Panasonic

'97 Microcomputer Family Selection Guide

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Microcomputer Family '97
Selection Guide

Selection Guide

MN1500 Series
MN1700 Series
MN1870 Series
MN1880 Series
MN1860 Series
MN10100 Series
MN10200 Series
DSP Series
ASP Series

Request for your special attention and precautions in using the technical information and semiconductors described in this book

(1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technologies described in this book and controlled under the "Foreign Exchange and Foreign Trade Control Law" is to be exported or taken out of Japan.

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(3) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household applications).
Consult our sales staff in advance for information on the following applications:

- Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
- Any applications other than the standard applications intended.

(4) The products and product specifications described in this book are subject to change without notice for reasons of modification and/or improvement. At the final stage of your design, purchasing or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.

(5) When designing your equipment, comply with the guaranteed values, in particular those of maximum rating, the range of operating power supply voltage and heat radiation characteristics. Otherwise, we will not be liable for any defect which may arise later in your equipment.
Even when the products are used within the guaranteed values, redundant design is recommended, so that such equipment may not violate relevant laws or regulations because of the function of our products.

(6) When using products for which vacuum packing is required, observe the conditions (including shelf life and after-unpacking stand-by time) agreed upon when specification sheets are individually exchanged.

If you have any inquiries or questions about this book or our semiconductors, please contact one of our sales offices listed at the back of this book or Matsushita Electronics Corporation's Sales Department.

1997 Microcomputer Family

DATA BOOK

Contents

How to Read This Manual

■ Performing Searches

This manual offers three methods to find the information you need quickly.

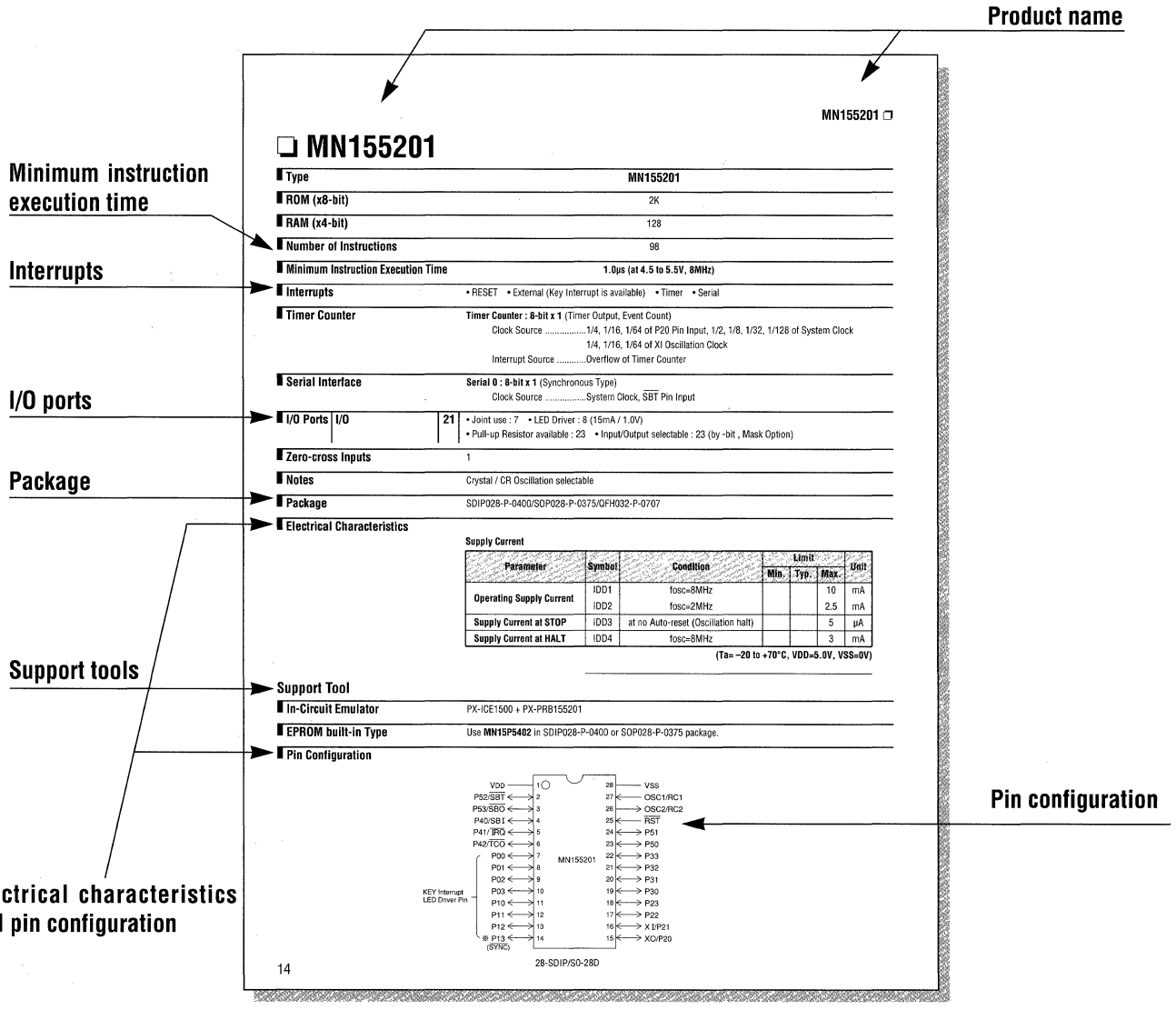
(1) To search for the start of a series, refer to the index at the beginning of the volume.

(2) To look for a particular listed product, refer to the chart of listed products at the beginning of the volume.

(3) The names of the listed products are located at the top right corner of every page. This makes it possible to leaf through the pages and stop at the place where the desired product name appears.

■ Format of this Manual

This manual is divided by lists, specifications for the various series, package lists, and the glossary. The page layout for the series specifications is composed of the product name, the specification support tools, and the pin configuration. Shown below is a sample of page layout and the meaning of each section.



■ Description

● Type

Development status may be either "in production" (no indication), "ES (Engineering Sample) available," or "Under Development".

Please indicate the values in square brackets ("[ ]") when you order ROM.

● Minimum instruction execution time

If it is possible to select the microcontroller operation clock (OSC or X), execution times are given separately for the main clock and the sub-clock.

When two types of minimum instruction execution time are given with no special description, the values are given as variations in the operating voltage range or oscillation frequency.

● Interrupts

Interrupts are listed by source.

When jointly used, values are separated by a slash ("/").

The number of sources indicated in the list is the total number except RESET.

● I/O ports

The number stated is the number of ports available for general use.

The detailed description provides an explanation of each pin. "P" is an abbreviation for "port".

● Electrical characteristics

The values listed under electrical characteristics are all reference values.

● Piggyback

Development status is either "available" (no indication) or "Under Development".

● EPROM built-in type

Development status may be either "in production" (no indication), "ES (Engineering Sample) available", or "Under Development".

Specifications may vary slightly from the chip described. Please consult our sales staffs.

■ Note!

For information regarding chip development status, package, piggyback, and availability of an EPROM built-in version, please consult our sales staffs (contact points are listed at the end of this manual).

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■ 4-bit 1-chip Microcomputer MN1500 Series Family

Category	Type	ROM (x 8-bit)	RAM (x 4-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
Standard Port	MN155201	2K	128	23	1.0 4.0	4.5~5.5 2.0~5.5	3	8-bit x 1	8-bit x 1	–	–	–		SDIP028-P-0400 SOP028-P-0375 QFH032-P-0707	16
	MN150401	4K	320	54	1.9 4.0 244	2.6~5.5 2.2~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	–	–	–		QFP064-P-1414	18
	MN150202	2K	128	32	1.9 4.0 244	2.6~5.5 2.2~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	–	–	–		QFP044-P-1010	20
	MN150402	4K	320	32	1.9 4.0 244	2.6~5.5 2.2~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	–	–	–		QFP044-P-1010	20
	MN150602	6K	320	32	1.9 4.0 244	2.6~5.5 2.2~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	–	–	–		SDIP042-P-0600	20
	MN150837	8K	512	33	0.95 1.91 122	2.7~5.5 1.8~5.5 1.8~5.5	4	8-bit x 2	8-bit x 1	–	–	–		QFP044-P-1010	22
	MN151233	12K	512	54	0.95 1.91 122	2.7~5.5 1.8~5.5 1.8~5.5	4	8-bit x 2	8-bit x 1	–	–	–		QFP064-P-1414	24
A/D • FLP • LCD	MN155202	2K	128	21	1.0 4.0	4.5~5.5 2.0~5.5	3	8-bit x 1	8-bit x 1	○	–	–		SDIP028-P-0400 SOP028-P-0375	26
	MN155402	4K	192	21	1.0 4.0	4.5~5.5 2.0~5.5	3	8-bit x 1	8-bit x 1	○	–	–		SDIP028-P-0400 SOP028-P-0375 QFH032-P-0707	26
	MN158418	4K	256	56	2.0	4.5~5.5	3	8-bit x 1	8-bit x 1	–	○	–		SDIIP064-P-0750	28
	MN150413	4K	256	26	2 0.94	1.8~5.5 2.7~5.5	3	8-bit x 2	8-bit x 1	–	–	○	Remote Control Transmission	QFP044-P-1414	30
	MN150813	8K	432	26	2 0.94	1.8~5.5 2.7~5.5	3	8-bit x 2	8-bit x 1	–	–	○	Remote Control Transmission	QFP044-P-1414	30
	MN158851A1 [High Speed Version]	8K	432	32	1 8	4.5~5.5 2.5~5.5	4	8-bit x 1 16-bit x 1	8-bit x 1	–	–	○		QFP084-P-1818	32
	MN150810	8K	512	40	0.95 1.91 122	4.5~5.5 2.6~5.5 2.2~5.5	3	8-bit x 2	8-bit x 1	–	–	○		QFP064-P-1414	34
Telephone	MN150409	4K	256	33	1.1 2.2 17.6	4.5~5.5 3.0~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	–	–	–	DTMF Output	SDIP042-P-0600 QFP044-P-1010	36
	MN150609	6K	512	33	1.1 2.2 17.6	4.5~5.5 3.0~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	–	–	–	DTMF Output	SDIP042-P-0600 QFP044-P-1010	36
	MN150832	8K	512	55	1.1 2.2 17.6	4.5~5.5 3.0~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	–	–	–	DTMF Output	QFP064-P-1414 SDIIP064-P-0750	38
Television Tuning	MN152810	8K	320	20	2	4.5~5.5	3	8-bit x 1	8-bit x 1	○	–	–	Remote Control Reception	SDIP052-P-0600	40
	MN152811	8K	256	17	2	4.5~5.5	3	8-bit x 1	8-bit x 1	○	–	–	Remote Control Reception	SDIP042-P-0600	42
Remote Control	MN150414	4K	256	22	2.0 4.0 8.0	1.8~3.6	3	8-bit x 2	8-bit x 1	–	–	–	Remote Control Transmission	SOP028-P-0375	44
	MN150814	8K	320	22	2.0 4.0 8.0	1.8~3.6	3	8-bit x 2	8-bit x 1	–	–	–	Remote Control Transmission	SOP028-P-0375	44
	MN151614	8K + Table ROM 8K	320	22	2.0 4.0 8.0	1.8~3.6	3	8-bit x 2	8-bit x 1	–	–	–	Remote Control Transmission	SOP028-P-0375	44
Electrical Home Appliance	MN150404	4K	256	32	1.91 4.0 244	2.6~5.5 2.2~5.5 2.2~5.5	3	8-bit x 2	8-bit x 1	○	–	○		QFP064-P-1414	46
	MN150804	8K	384	32	1.91 4.0 244	2.6~5.5 2.2~5.5 2.2~5.5	3	8-bit x 2	8-bit x 1	○	–	○		QFP064-P-1414	46
	MN150120*1	1K	64	15	1.0 4.0 8.0	4.5~5.5 2.0~5.5 1.8~5.5	3	–	–	–	–	–		SOP020-P-0300 SDIP022-P-0300	48
	MN150222	2K	96	15	1.0 4.0 8.0	4.5~5.5 2.0~5.5 1.8~5.5	4	8-bit x 1	–	○	–	–		SOP020-P-0300 SDIP022-P-0300	50
	MN150831	8K	512	33	1.0 1.91 244	4.5~5.5 1.8~5.5 1.8~5.5	4	8-bit x 2	8-bit x 1	○	–	–		QFP044-P-1010	52
	MN151630	16K	512	54	1.0 1.91 15.28	4.5~5.5 2.6~5.5 2.2~5.5	4	8-bit x 2	8-bit x 1	○	–	○		QFP084-P-1818	54

*1 under development

■ 4-bit 1-chip Microcomputer MN1700 Series Family

Category	Type	ROM (x 10-bit)	RAM (x 4-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
Standard Port	MN170401	4K	256 + Stack 96	57	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	–	–	–		SDIP064-P-0750 QFP064-P-1818	58
	MN170801	8K	512 + Stack 96	57	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	–	–	–		SDIIP064-P-0750 QFP064-P-1818	58
	MN171601A	16K	896 + Stack 96	57	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	–	–	–		SDIP064-P-0750 QFP064-P-1818	58
A/D • FLP • LCD	MN171202	12K	896 + Stack 96	56	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	–	○	–		SDIP064-P-0750	60
	MN171602	16K	896 + Stack 96	56	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	–	○	–		SDIP064-P-0750	60
	MN170803A	8K	512 + Stack 96	52	0.5 1.0 91.6	4.5~5.5 3.0~5.5 2.2~5.5	9	8-bit x 2	8-bit x 2	○	–	○	Remote Control Transmission/ Reception	QFP084-P-1818	62
	MN171603	16K	896 + Stack 96	52	0.5 1.0 91.6	4.5~5.5 3.0~5.5 2.2~5.5	9	8-bit x 2	8-bit x 2	○	–	○	Remote Control Transmission/ Reception	QFP084-P-1818	62
	MN170804	8K	512 + Stack 96	55	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	○	–	–		SDIP064-P-0750 QFP064-P-1818 QFH064-P-1212	64
	MN171604	16K	896 + Stack 96	55	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	○	–	–		SDIP064-P-0750 QFH064-P-1212	64
	MN171608	16K	896 + Stack 96	34	0.5 3.0 91.6	4.5~5.5 2.5~5.5 2.5~5.5	7	8-bit x 2	8-bit x 1	–	–	○	Remote Control Transmission/ Reception	QFP064-P-1414	66
	MN171609	16K + Table ROM 4K	896 + Stack 96	52	2.27 91.6	2.0~3.6 2.0~3.6	9	8-bit x 2	8-bit x 2	–	–	○	Remote Control Transmission/ Reception	QFP084-P-1818	68
	MN172412	16K + Table ROM 8K	896 + Stack 96	76	0.5 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	–	○	–		QFP084-P-1818	70
	MN173222	32K	1408+ Stack	76	0.35 91.6	4.5~5.5 2.7~5.5	9	8-bit x 2	8-bit x 2	–	○	–		QFP084-P-1818	72
Telephone	MN170805	8K	1536 + Stack 96	73	0.84 1.68 91.6	3.6~5.5 2.5~5.5 2.5~5.5	9	8-bit x 2	8-bit x 2	○	–	–	TONE Output DTMF Output	QFP084-P-1818	74
	MN171605	16K	1920 + Stack 96	73	0.84 1.68 91.6	3.6~5.5 2.5~5.5 2.5~5.5	9	8-bit x 2	8-bit x 2	○	–	–	TONE Output DTMF Output	QFP084-P-1818	74

■ 8-bit 1-chip Microcomputer MN1870 Series Family

Category	Type	ROM (x 8-bit)	RAM (x 8-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
A/D • FLP • LCD	MN187124	12K	384	54	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	–	○	–	Remote Control Reception Simple A/D	SDIP064-P-0750 QFP064-P-1818	78
	MN187164	16K	512	54	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	–	○	–	Remote Control Reception Simple A/D	SDIP064-P-0750 QFP064-P-1818	78
	MN187204	20K	640	54	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	–	○	–	Remote Control Reception Simple A/D	SDIP064-P-0750 QFP064-P-1818	78
	MN187244	24K	768	54	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	–	○	–	Remote Control Reception Simple A/D	SDIP064-P-0750 QFP064-P-1818	78
	MN187324	32K	960	54	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	–	○	–	Remote Control Reception Simple A/D	SDIP064-P-0750 QFP064-P-1818	78
	MN1871610	16K	1024	56	0.667 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	○	–	○	Remote Control Transmission/ Reception	QFP100-P-1818	80
	MN1872410	24K	1536	56	0.667 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	○	–	○	Remote Control Transmission/ Reception	QFP100-P-1818	80
	MN1873210	32K	1536	56	0.667 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	○	–	○	Remote Control Transmission/ Reception	QFP100-P-1818	80
	MN1872456	24K	1536	56	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	○		○	Remote Control Transmission/ Reception	QFP100-P-1818	80
	MN1873256	32K	1152	56	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	○	–	○	Remote Control Transmission/ Reception	QFP100-P-1818	80
	MN1871215	12K	384	56	0.477 122	4.5~5.5 2.7~5.5	10	8-bit x 4	8-bit x 2	○	–	○	Remote Control Transmission/ Reception	QFP084-P-1818	82
	MN1872423	24K	512	73	0.477 122	4.3~5.5 2.2~5.5	16	8-bit x 6	8-bit x 3	○	○	–	Remote Control Transmission	QFP084-P-1818E	84
	MN1873223	32K	1024	73	0.477 122	4.3~5.5 2.2~5.5	16	8-bit x 6	8-bit x 3	○	○	–	Remote Control Transmission	QFP084-P-1818E	84
	MN1874023	40K	1024	73	0.477 122	4.3~5.5 2.2~5.5	16	8-bit x 6	8-bit x 3	○	○	–	Remote Control Transmission	QFP084-P-1818E	84
	MN1874823	48K	1024	73	0.477 122	4.3~5.5 2.2~5.5	16	8-bit x 6	8-bit x 3	○	○	–	Remote Control Transmission	QFP084-P-1818E	84
	MN1872457	24K	768	57	0.475 122	3.5~5.5 2.2~5.5	13	8-bti x 4	8-bit x 2	○	○	–	Remote Control Reception	QFH064-P-1414B	88
	MN1873260	32K	1152	53	0.475 122	2.7~5.5 2.2~5.5	15	8-bti x 1	8-bit x 2 I²C/UART selectable x 1	○	–	–		QFS064-P-1414A	90
OSD Built-in	MN1871274*2	12K	256	21	0.5	4.5~5.5	7	8-bit x 2	–	○	–	–	Remote Control Reception	SDIP042-P-0600	92
	MN1871681*1	16K	320	21	0.5	4.5~5.5	8	8-bit x 2	I²C x 1	○	–	–	Remote Control Reception	SDIP042-P-0600	94
	MN1873284*1	32K	640	21	0.5	4.5~5.5	8	8-bit x 2	I²C x 1	○	–	–	Remote Control Reception	SDIP042-P-0600	96
Caption Decoder	MN1871675	16K	320	29	0.5	4.5~5.5	8	8-bit x 2	–	○	–	–	Remote Control Reception	SDIP064-P-0750	98
	MN1873265	32K	480	29	0.5	4.5~5.5	8	8-bit x 2	–	○	–	–	Remote Control Reception	SDIP064-P-0750	100
	MN1874083*1	40K	640	29	0.5	4.5~5.5	9	8-bit x 2	I²C x 1	○	–	–	Remote Control Reception	SDIP064-P-0750	102
	MN1874085*1	40K	640	29	0.5	4.5~5.5	8	8-bit x 2	–	○	–	–	Remote Control Reception	SDIP064-P-0750	104
	MN1874876	48K	928	46	0.5	4.5~5.5	13	8-bit x 2	8-bit x 1 I²C x 1	○	–	–	Remote Control Reception	SDIP064-P-0750	106
	MN1874878	48K	928	46	0.5	4.5~5.5	13	8-bit x 2	8-bit x 1 I²C x 1	○	–	–	Remote Control Reception	SDIP064-P-0750	108
	MN1876476	64K	928	46	0.5	4.5~5.5	13	8-bit x 2	8-bit x 1 I²C x 1	○	–	–	Remote Control Reception	SDIP064-P-0750	110
	MN1876478	64K	928	46	0.5	4.5~5.5	13	8-bit x 2	8-bit x 1 I²C x 1	○	–	–	Remote Control Reception	SDIP064-P-0750	112
	MN1879682	96K	1248	50	0.333	4.5~5.5	13	8-bit x 2	8-bit x 1 I²C x 1	○	–	–	Remote Control Reception	SDIP064-P-0750	114
General purpose I²C platform	MN1870877*2	8K	256	46	0.5	4.5~5.5	7	8-bit x 2	I²C x 1	○	–	–	Remote Control Reception	QFP064-P-1414	116
Remote Control	MN187818	8K	1536	59	1.0 122	3.3~5.5 2.2~5.5	10	8-bit x 2 16-bit x 2	8-bit x 2	–	–	–	Remote Control Transmission/ Reception	QFP064-P-1414	118
	MN1871618	16K	768	59	1.0 122	3.3~5.5 2.2~5.5	10	8-bit x 2 16-bit x 2	8-bit x 2	–	–	–	Remote Control Transmission/ Reception	QFP064-P-1414	118

*1 under development

*2 ES (Engineering Sample) available

■ 8-bit 1-chip Microcomputer MN1880 Series Family

Category	Type	ROM (x 8-bit)	RAM (x 8-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
Standard Port	MN188161	16K	640	56	0.5 122	4.5~5.5 3.0~5.5	10	16-bit x 5	8-bit x 1 UART x 1	–	–	–		SDIP064-P-0750 QFP064-P-1414 QFP064-P-1818	122
	MN188321	32K	448	56	0.5 122	4.5~5.5 3.0~5.5	10	16-bit x 5	8-bit x 1 UART x 1	–	–	–		SDIP064-P-0750 QFP064-P-1414 QFP064-P-1818	122
A/D	MN188166	16K	384	69 66	0.5 122	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818 QFH080-P-1414	124
	MN1882010	20K	512	66	0.5 122	3.3~3.6 3.0~3.6	11	16-bit x 6	8-bit x 2	○	–	–		QFH080-P-1212	128
	MN1883210 [5-Voltage Version]	32K	528	69	0.5 122	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	128
	MN1883210A [3.3-Voltage Version]	32K	688	69	0.5 122	3.3~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFH080-P-1414	128
	MN1882414	24K	448	70	0.5 122	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2 UART x 1	○	–	–		QFP084-P-1818	132
	MN1883214	32K	928	70	0.5 122	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2 UART x 1	○	–	–		QFP084-P-1818	132
	MN1882417	24K	800	66	0.5 122	4.5~5.5 3.5~5.5	11	16-bit x 6	8-bit x 2 UART x 1	○	–	–		QFH080-P-1414	136
	MN1883220	32K	2592	66	0.5 122	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2 UART x 1	○	–	–		QFH080-P-1414	140
	MN1884820	48K	2720	66	0.5 122	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2 UART x 1	○	–	–		QFH080-P-1414	140
	MN1880023	External	704	73	0.200 0.400 122	4.5~5.5 3.0~5.5 2.7~4.0	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818 QFH084-P-1212	144
	MN1884824	48K	928	73	0.200 0.333 122	4.5~5.5 3.0~5.5 2.7~4.0	11	16-bit x 6	8-bit x 2 UART x 1	○	–	–		QFP084-P-1818 QFH084-P-1212	144
	MN1880024	External	928	73	0.200 122	4.5~5.5 2.7~4.0	11	16-bit x 6	8-bit x 2 UART x 1	○	–	–		QFP084-P-1818 QFH084-P-1212	144
Microcomputer Servo	MN6750165	16K	384	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	146
	MN6750245	24K	512	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	146
	MN6750325	32K	640	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	146
	MN6750405	40K	768	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	146
	MN6750326	32K	640	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	148
	MN6750406	40K	768	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	148
	MN6750566	56K	896	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	148
	MN6750646	64K	1024	52	0.5 128	4.5~5.5 3.0~5.5	11	16-bit x 6	8-bit x 2	○	–	–		QFP084-P-1818	148
	MN6750487	48K	896	70	0.279 143 122	4.5~5.5 2.7~5.5 2.7~5.5	13	8-bit x 1 16-bit x 6 30-bit x 1	8-bit x 2	○	–	–	Remote Control Reception	QFP100-P-1818	150
	MN6750647	64K	1024	70	0.279 143 122	4.5~5.5 2.7~5.5 2.7~5.5	13	8-bit x 1 16-bit x 6 30-bit x 1	8-bit x 2	○	–	–	Remote Control Reception	QFP100-P-1818	150
	MN675048	64K	1024	75	0.279 143 122	4.5~5.5 2.7~5.5 2.7~5.5	13	8-bit x 1 16-bit x 6 30-bit x 1	8-bit x 2	○	–	–	Remote Control Reception	QFP100-P-1818	154
	MN675058	80K	1280	75	0.279 143 122	4.5~5.5 2.7~5.5 2.7~5.5	13	8-bit x 1 16-bit x 6 30-bit x 1	8-bit x 2	○	–	–	Remote Control Reception	QFP100-P-1818	154
	MN675029	32K	768	61	0.250 122	4.5~5.5 2.7~5.5	13	16-bit x 7	8-bit x 2	○	–	–		QFP084-P-1818	158
	MN675039	40K	1024	61	0.250 122	4.5~5.5 2.7~5.5	13	16-bit x 7	8-bit x 2	○	–	–		QFP084-P-1818	158
	MN675049	56K	1280	61	0.250 122	4.5~5.5 2.7~5.5	13	16-bit x 7	8-bit x 2	○	–	–		QFP084-P-1818	158

■ 8-bit 1-chip Microcomputer MN1860 Series Family

Category	Type	ROM (x 8-bit)	RAM (x 8-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
A/D	MN1860003	External	1088	85	0.20 122	4.5~5.5 4.5~5.5	23	8-bit x 4 16-bit x 2	8-bit x 2 UART x 1	○	–	–		QFP100-P-1818	162
	MN1860004	External	1088	85	0.16 0.20 122	4.5~5.5 3.0~5.5 3.0~5.5	24	8-bit x 4 16-bit x 2	8-bit x 2 UART x 1	○	–	–		QFH100-P-1414	166
	MN1866405	64K	1856	85	0.16 0.20 122	4.5~5.5 3.0~5.5 3.0~5.5	25	8-bit x 4 16-bit x 2	8-bit x 3 UART x 1	○	–	–		QFH100-P-1414	170
	MN1866406	64K	1856	85	0.16 0.25 122	4.5~5.5 3.0~5.5 3.0~5.5	25	8-bit x 4 16-bit x 2	8-bit x 3 UART x 1	○	–	–		QFH100-P-1414 QFP100-P-1818	170
Microcomputer Servo	MN6755240	24K	704	93	0.333 0.25 122	3.3~5.5 4.2~5.5 3.3~5.5	24	16-bit x 5	8-bit x 2	○	–	–		QFP124-P-2828 QFP128-P-1818	174
	MN6755320	32K	1024	93	0.333 0.25 122	3.3~5.5 4.2~5.5 2.2~5.5	24	16-bit x 5	8-bit x 2	○	–	–		QFP124-P-2828 QFP128-P-1818	174
	MN6755486	48K	1024	95	0.25 122	3.0~5.5 2.2~5.5	25	16-bit x 5 30-bit x 1	8-bit x 3	○	–	–		QFP124-P-2828 QFP128-P-1818	178
	MN675556	64K	1536	95	0.25 122	3.0~5.5 2.2~5.5	25	16-bit x 5 30-bit x 1	8-bit x 3	○	–	–		QFP128-P-1818	178
	MN675567	72K	2048	95	0.25 122	4.0~5.5 2.7~5.5	28	16-bit x 5 30-bit x 1	8-bit x 2	○	–	–		QFP100-P-1818	182
	MN675547	56K	1536	95	0.25 122	4.0~5.5 2.7~5.5	28	16-bit x 5 30-bit x 1	8-bit x 2	○	–	–		QFP100-P-1818	182

■ 8-bit 1-chip Microcomputer MN10100 Series Family

Category	Type	ROM (x 8-bit)	RAM (x 8-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
A/D	MN101C01D	64K*3	2K*3	70*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	–	–		QFS080-P-1414	186
	MN101C01C*1	48K*3	2K*3	70*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	–	–		QFS080-P-1414	186
	MN101C01A*4	32K*3	1.5K*3	70*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	–	–		QFS080-P-1414	–
	MN101C15F*1	96K*3	4K*3	70*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	–	–		LQFP080-P-1414A	–
	MN101C15A*4	32K*3	1.5K*3	70*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	–	–		LQFP080-P-1414A	–
	MN101C027	16K*3	0.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 UART selectable	○	–	–		LQFP064-P-1414	188
	MN101C25*1	8K*3	0.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 UART selectable	○	–	–		LQFP064-P-1414	–
	MN101C14A*1	32K*3	1.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 UART selectable	○	–	–		LQFP064-P-1414	–
	MN101C149*4	24K*3	1.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 UART selectable	○	–	–		LQFP064-P-1414	–
	MN101C147*1	16K*3	0.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 UART selectable	○	–	–		LQFP064-P-1414	–
	MN101C145*4	8K*3	0.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 UART selectable	○	–	–		LQFP064-P-1414	–
	MN101C10A*1	32K*3	1.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	17	8-bit x 5 16-bit x 1	8-bit x 2 One UART selectable	○	–	–		LQFP064-P-1414	–
	MN101C109*4	24K*3	1.5K*3	54*3	0.1 122	4.5~5.5 2.0~5.5	17	8-bit x 5 16-bit x 1	8-bit x 2 One UART selectable	○	–	–		LQFP064-P-1414	–
	MN101C117*1	16K*3	0.5K*3	34*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 One UART selectable	○	–	–		QFP044-P-1010	–
	MN101C115*4	8K*3	0.5K*3	34*3	0.1 122	4.5~5.5 2.0~5.5	14	8-bit x 3 16-bit x 1	8-bit x 1 UART selectable	○	–	–		QFP044-P-1010	–

*1 under development
*3 at single chip mode
*4 under planning

■ 8-bit 1-chip Microcomputer MN10100 Series Family (Continue)

Category	Type	ROM (x 8-bit)	RAM (x 8-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
A/D • D/A	MN101C08C*1	48K*3	1.5K*3	68*3	0.1 122	4.5~5.5 2.0~5.5	17	8-bit x 5 16-bit x 1	8-bit x 2 One UART selectable	○	–	–		LQFP080-P-1414A	–
	MN101C08A*4	32K*3	1.5K*3	68*3	0.1 122	4.5~5.5 2.0~5.5	17	8-bit x 5 16-bit x 1	8-bit x 2 One UART selectable	○	–	–		LQFP080-P-1414A	–
	MN101C12G*4	128K*3	4K*3	88*3	0.1 122	4.5~5.5 2.0~5.5	19	8-bit x 5 16-bit x 2	8-bit x 3 One I²C selectable One UART selectable	○	○	–		LQFP100-P-1414	–
	MN101C12F*4	96K*3	4K*3	88*3	0.1 122	4.5~5.5 2.0~5.5	19	8-bit x 5 16-bit x 2	8-bit x 3 One I²C selectable One UART selectable	○	○	–		LQFP100-P-1414	–
	MN101C12D*4	64K*3	4K*3	88*3	0.1 122	4.5~5.5 2.0~5.5	19	8-bit x 5 16-bit x 2	8-bit x 3 One I²C selectable One UART selectable	○	○	–		LQFP100-P-1414	–
A/D • FLP	MN101C04C*1	48K*3	1.5K*3	89*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	○	–		LQFP100-P-1414	–
	MN101C049*4	24K*3	1K*3	89*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	○	–		LQFP100-P-1414	–
	MN101C06D*1	64K*3	1.5K*3	69*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	○	–		LQFP080-P-1414A	–
	MN101C06A*1	32K*3	1K*3	69*3	0.1 122	4.5~5.5 2.0~5.5	18	8-bit x 5 16-bit x 1	8-bit x 3 One I²C selectable One UART selectable	○	○	–		LQFP080-P-1414A	–
	MN101C077*4	16K*3	0.5K*3	53*3	0.1 122	4.5~5.5 2.0~5.5	15	8-bit x 3 16-bit x 1	8-bit x 2 One UART selectable	○	○	–		LQFP064-P-1414	–
	MN101C075*4	8K*3	0.25K*3	53*3	0.1 122	4.5~5.5 2.0~5.5	15	8-bit x 3 16-bit x 1	8-bit x 2 One UART selectable	○	○	–		LQFP064-P-1414	–
A/D • LCD	MN101C039	24K*3	1.5K*3	57*3	0.1 122	4.5~5.5 2.0~5.5	13	8-bit x 3 16-bit x 1	8-bit x 2 One UART selectable	○	–	○		QFP100-P-1818B	190
	MN101C03A	32K*3	1.5K*3	57*3	0.1 122	4.5~5.5 2.0~5.5	13	8-bit x 3 16-bit x 1	8-bit x 2 One UART selectable	○	–	○		QFP100-P-1818B	190
	MN101C037*1	16K*3	1K*3	57*3	0.1 122	4.5~5.5 2.0~5.5	13	8-bit x 3 16-bit x 1	8-bit x 2 One UART selectable	○	–	○		OFP100-P-1818B	–
	MN101C16A*1	32K*3	1.5K*3	57*3	0.1 122	4.5~5.5 2.0~5.5	13	8-bit x 3 16-bit x 1	8-bit x 2 One UART selectable	○	–	○		QFP100-P-1818B	–
	MN101C167*4	16K*3	1K*3	57*3	0.1 122	4.5~5.5 2.0~5.5	13	8-bit x 3 16-bit x 1	8-bit x 2 One UART selectable	○	–	○		QFP100-P-1818B	–
	MN101C097*1	16K*3	0.5K*3	32*3	0.1 122	4.5~5.5 2.0~5.5	13	8-bit x 3 16-bit x 1	8-bit x 1	○	–	○		LQFP064-P-1414	–
	MN101C095*4	5K*3	0.5K*3	32*3	0.1 122	4.5~5.5 2.0~5.5	13	8-bit x 3 16-bit x 1	8-bit x 1	○	–	○		LQFP064-P-1414	–
VTR • Servo	MN101D01G*1	128K*3	2.5K*3	70*3	0.12 122	4.0~5.5 2.5~5.5	28	16-bit x 7	8-bit x 3 One I²C selectable One UART selectable	○	–	–		QFP100-P-1818B	–
	MN101D01D*1	64K*3	1.5K*3	70*3	0.1 122	4.5~5.5 2.5~5.5	28	16-bit x 7	8-bit x 3 One I²C selectable One UART selectable	○	–	–		QFP100-P-1818B	–

*1 under development
*3 at single chip mode
*4 under planning

■ 16-bit 1-chip Microcomputer MN10200 Series Family

Category	Type	ROM (x 8-bit)	RAM (x 8-bit)	I/O (Lines)	Speed (µs)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D	FLP	LCD	Special Ports	Package	Page
A/D	MN1020003	External	1K	35	0.122	4.75~5.25	21	8-bit x 5 16-bit x 2	7,8-bit x 1 UART selectable	○	–	–		QFS080-P-1414	194
	MN1020004A	External	External	49	0.122	4.5~5.5	29	8-bit x 6 16-bit x 3	7,8-bit x 2 UART selectable	○	–	–		QFH100-P-1414 TQFP100-P-1414	196
	MN1020407*2	32K	1K	68	0.122	4.5~5.5	18	8-bit x 4 16-bit x 2	7,8,9-bit x 2 UART selectable	○	–	–		QFP084-P-1818	200
	MN1021213	90K	3K	50	0.2 0.125	2.7~3.6	38	8-bit x 10 16-bit x 3	8-bit x 4 UART selectable	○	–	–		LQFP128-P-1818B	202
	MN1020015-1	External	3K	49	0.122 62.5	4.5~5.5	29	8-bit x 6 16-bit x 3	7,8-bit x 2 UART selectable	○	–	–		QFH100-P-1414 LQFP100-P-1414	206
	MN1020415*1	32K	2K	84	0.122 62.5	4.5~5.5	29	8-bit x 6 16-bit x 3	7,8-bit x 2 UART selectable	○	–	–		QFH100-P-1414	206
	MN102B3203*2	External	3K	48	0.122 62.5	4.5~5.5	29	8-bit x 6 16-bit x 3	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	206
	MN1020012A	External	External	29	0.1	4.5~5.5	38	8-bit x 10 16-bit x 3	7,8-bit x 2 UART selectable	○	–	–	4-state Synchronous Output	QFP128-P-1818	210
	MN1020012AFA	External	External	29	0.1	4.5~5.5	38	8-bit x 10 16-bit x 3	7,8-bit x 2 UART selectable	○	–	–	4-state Synchronous Output	LQFP128-P-1818B	210
	MN1020019	External	3K	22	0.1, 62.5 0.2, 62.5	4.5~5.5 2.7~3.3	15	8-bit x 4	7,8-bit x 2 UART selectable	○	–	–		QFH064-P-1414B	212
	MN1020219	16K	1K	52	0.1, 62.5 0.2, 62.5	4.5~5.5 2.7~3.3	15	8-bit x 4	7,8-bit x 2 UART selectable	○	–	–		QFH064-P-1414B	212
	MN1020419	32K	2K	52	0.1, 62.5 0.2, 62.5	4.5~5.5 2.7~3.3	15	8-bit x 4	7,8-bit x 2 UART selectable	○	–	–		QFH064-P-1414B	212
	MN1020819	64K	3K	52	0.1 62.5	4.5~5.5	15	8-bit x 4	7,8-bit x 2 UART selectable	○	–	–		QFH064-P-1414B	212
	MN1021617*2	128K	4K	108	0.05 0.1	3.0~3.6 2.0~3.6	54	8-bit x 16 16-bit x 5 24-bit x 1	7,8-bit x 4 UART selectable	○	–	–		LQFP128-P-1818B	214
	MN1020017*1	0K	4K	108	0.05 0.1	3.0~3.6 2.0~3.6	54	8-bit x 16 16-bit x 5 24-bit x 1	7,8-bit x 4 UART selectable	○	–	–		LQFP128-P-1818B	214
	MN1020817*2	64K	3K	108	0.05 0.1	3.0~3.6 2.0~3.6	54	8-bit x 16 16-bit x 5 24-bit x 1	7,8-bit x 4 UART selectable	○	–	–		LQFP128-P-1818B	214
	MN102L2403*2	External	3K	66	0.1 62.5	4.5~5.5	42	8-bit x 8 16-bit x 3	7,8-bit x 3 UART selectable	○	–	–	4-state or 8-state Synchronous Output	LQFP128-P-1818B	222
	MN102H3104*1	0K	4K	108	0.05	4.5~5.5	54	8-bit x 16 16-bit x 5 24-bit x 1	7,8-bit x 4 UART selectable	○	–	–		LQFP128-P-1818B	218
	MN102LP25G*1	128K (OTP)	5K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		QFH100-P-1414	224
	MN102L25G*1	128K	5K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102LP25Z	128K (OTP)	3K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102LF25Z*1	128K (Flash)	3K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102L25Z	128K	3K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102LP25D*1	64K (OTP)	3K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102L25D*1	64K	3K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102LP25A*1	32K (OTP)	2K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102L25A*1	32K (OTP)	2K	80	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
	MN102L2503*2	External	3K	48	0.1 62.5	4.5~5.5	26	8-bit x 6 16-bit x 2	7,8-bit x 2 UART selectable	○	–	–		LQFP100-P-1414	224
Microcomputer Servo	MN1020705	56K	1536	88	0.167 62.5	4.5~5.5 2.7~5.5	25	16-bit x 5 47-bit x 1	8-bit x 3	○	–	–		QFP128-P-1818	226
TV channel selector	MN102L230	External	2K	24	0.1	4.75~5.25	10	16-bit x 2	8-bit x 1	○	–	–		QFP160-P-2828B	228

*1 under development
*2 ES (Engineering Sample) available

■ Digital Signal Processor (DSP) MN1900/10/20 Series Family

Category	Type	ROM (x 32-bit)	RAM1 (x 16-bit)	RAM2 (x 16-bit)	Speed (ns)	Supply (V)	Interrupts (Factors)	Package	Page
1900Series	MN19041A [High Speed Version]	4K	258	Internal512 External4K	100	4.75~5.25	4	QFP084-P-1818	232
	MN19091A [High Speed Version]	External8K	258	Internal512 External4K	100	4.75~5.25	5	PGA144-C-S15U	234
	MN1900402	4K	514	Internal1K, External4K	100	4.75~5.25	4	QFP084-P-1818	236
	MN1900403	4K	258	Internal512	200	3.5~5.5	4	TQFP080-P-1212	238
	MN1900003	External64K	514	Internal2K, External64K	100	4.75~5.25	5	PGA144-C-S15U	240
	MN1900011	External64K	1026	Internal3K,External64K	100	4.75~5.25	5	PGA181-C-S15U	242
	MN1901012	10K	450	Internal1792, External64K (ROM 3.5K)	83	4.75~5.5	4	QFP100-P-1818	244
	MN1901611	16K	514	Internal2.5K, External64K	90.9	4.75~5.5	4	QFH128-P-1818 QFP128-P-1818	246
1920Series	MN1920802A [High Speed Version]	*2 8K	*3 514	*3 Internal2K, External16M	80 125 x 10₃	4.75~5.25 3.5~5.25	7	QFP124-P-2828	250
	MN1920001C [High Speed Version]	*2 External64K	*3 514	*3 Internal2.5K, External16M	80 125 x 10₃	4.75~5.25 3.5~5.25	7	QFP208-P-2828	252
	MN1921003A [High Speed Version]	*2 10K	*3 514	Internal1K*3,1K External16M*3	70	4.75~5.25	7	QFP144-P-2020	254
Low Power Series	MN1920811	8K	2K*1 (ROM 2.5K*1)	Intenal512*1	93	3.5~3.9	4	LQFP128-P-1818	256
	MN1920813	8K	2K (ROM 2.5K)	Intenal512	92 68	3.5~3.9 4.5~5.5	4	TQFP100-P-1414	258
	MN1921814	18K	2.75K (ROM 2.5K)	Intenal512	92 68	3.5~3.9 4.5~5.5	4	TQFP-100-P-1414	260
	MN1921816	18K	2.75K (ROM 2.5K)	Internal512	92	2.7~3.3	4	TQFP100-P-1414	262
	MN1932801	28K*3	6K (ROM 30K)		27 25	2.7~3.3 3.0~3.6	6	TQFP100-P-1414	264
	MN1933211	32K*3	6K + 32 (ROM 30K)		21.7 20	2.7~3.3 3.0~3.6	6	TQFP100-P-1212 TQFP100-P-1414	266
	MN1931712	17K*3	3.5K (ROM 5K)		20	3.0~3.6	6	QFP100-P-1818B	268

*1 (x 16-bit) *2 (x 40-bit) *3 (x 24-bit)

■ Audio Signal Processor (ASP) MN1940 Series Family

Category	Type	ROM (x 32-bit)	RAM1 (x 16-bit)	RAM2 (x 24-bit)	Speed (ns)	Supply Voltage (V)	Interrupts (Factors)	Package	Page
1940Series	MN19411	192	128	Internal128	80	4.5~5.5	0	64-QFP (18 x 18 mm)	272
	MN19412A	512	256	Internal256	50	4.75~5.25	2	84-QFP (18 x 18 mm)	274
	MN19413	512	256	Internal256	50	4.75~5.25	2	100-QFP (18 x 18 mm)	276

■ 32-bit 1-chip Microcomputer MN10300 Series

Type	CPU Performance*2	Built-in Memory	Extended Arithmetic Functions	I/O (lines)	Supply Voltage (V)	Interrupts (Factors)	Timer Counter	Serial Interfaces	A/D Converter	DMA Controller	Bus Interface	Package
MN103000	60MIPS (60MHz)	Instruction RAM: 16 kB Data RAM: 16 KB	Multiplier built-in	89	3.3V±5%	48	32-bit x 2 16-bit x 5 WDT x 1	UART/CSI x 2	10-bit x 8ch	4ch	Data: 8-/16-/32-bit Selectable DRAM Interface	QFP160-P-2828B
MN103001G*1	60MIPS (60MHz)	Instruction ROM: 128 kB Data RAM: 8 KB	On-chip sum-and-accumulate function	72	3.3V±5%	38	32-bit x 3 16-bit x 4 WDT x 1	UART/CSI x 1 UART x 1, CSI x 2	10-bit x 4ch	–	Data: 8-/16-bit Selectable DRAM Interface	LQFP100-P-1414
MN103002*1	100MIPS (100MHz)	Instruction cache: 4 kB Data cache: 4 KB	On-chip sum-and-accumulate function	26	3.3V±5%	30	32-bit x 1 16-bit x 3 WDT x 1	UART/CSI x 2 UART x 1	–	4ch	Data: 16-/32-bit Selectable DRAM Interface	QFP160-P-2828B

*1 under development
*2 Dhrystone2.1

1500 4-bit SERIES

MN1500 Series

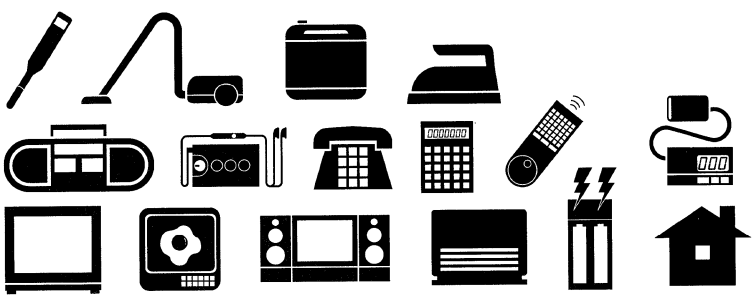
MN1500 Series

The MN1500 Series could be called the standard for 4-bit microcomputers. In addition to the general purpose I/O ports, this series also provides numerous peripheral functions for analog interface such as LCD drive, fluorescent display, telephone, etc., and meets to wider range of applications.

Features

- **4-bit Standard Microcomputer**
  Execution speed: 1 µs to 2 µs (4MHz)
  Maximum ROM capacity: 12k bytes
  RAM: 16 to 512 nibbles
  Package: 18 pins to 84 pins
- **Large Family Line-up**
  For remote control, telephone, TV channel selection, FLP display, LCD driver. Analog interface included.
- **Application in ASICs**
  The standard CMOS core is now being applied in ASICs.

■ Applications



❑ MN155201

Type	MN155201
ROM (x8-bit)	2K
RAM (x4-bit)	128
Number of Instructions	98
Minimum Instruction Execution Time	**1.0μs (at 4.5 to 5.5V, 8MHz)** **4.0μs (at 2.0 to 5.5V, 2MHz)**
Interrupts	• RESET • External (Key Interrupt is available) • Timer • Serial
Timer Counter	**Timer Counter : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/4, 1/16, 1/64 of P20 Pin Input, 1/2, 1/8, 1/32, 1/128 of System Clock 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock **Watchdog**
Serial Interface	**Serial 0 : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports I/O 21	• Joint use : 7 • LED Driver : 8 (15mA / 1.0V) • Pull-up Resistor available : 23 • Input/Output selectable : 23 (by -bit, Mask Option)
Zero-cross Inputs	1
Notes	Crystal / CR Oscillation selectable
Package	SDIP028-P-0400, SOP028-P-0375, QFH032-P-0707

Electrical Characteristics

Supply Current

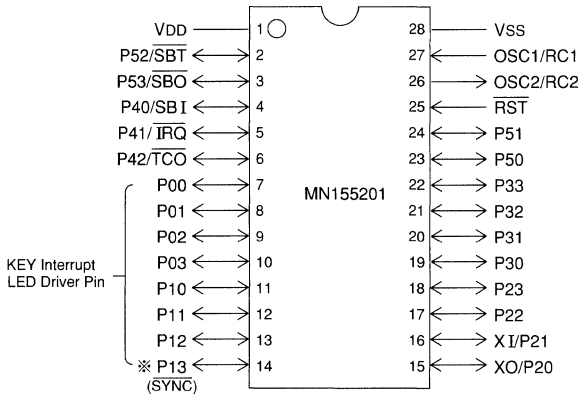
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8MHz			10	mA
	IDD2	fosc=2MHz			2.5	mA
Supply Current at STOP	IDD3	at no Auto-reset (Oscillation halt)			5	μA
Supply Current at HALT	IDD4	fosc=8MHz			3	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

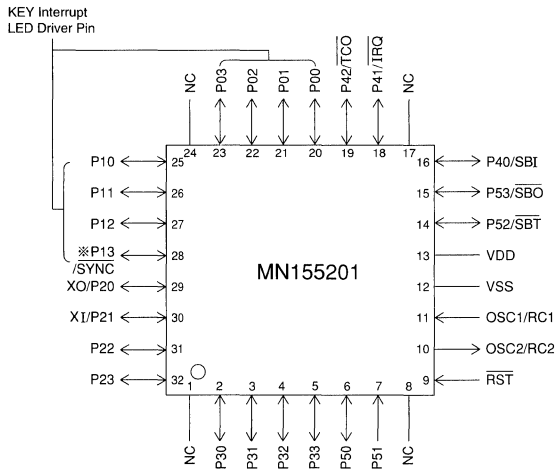
Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB155201
EPROM built-in Type	Use **MN15P5402** in SDIP028-P-0400 or SOP028-P-0375 package.

Pin Configuration



SDIP028-P-0400/SOP028-P-0375



QFH032-P-0707

※ $\overline{\text{SYNC}}$ signal will be outputted from this terminal during RESET.
After RESET, this terminal will function as P13.
NC : Nothing connected with terminal.

❑ MN150401

Type			MN150401
ROM (x8-bit)			4K
RAM (x4-bit)			320
Number of Instructions			104
Minimum Instruction Execution Time		With Main Clock operated	**1/8 dividing 1.9μs (at 2.6 to 5.5V, 4.19MHz)** **1/8 dividing 4.0μs (at 2.2 to 5.5V, 2MHz)**
		With Sub-clock operated	**1/8 dividing 244μs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts			• RESET • Top Priority • External (Key Interrupt is available) / Timer 2 • Timer • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** (Event Count) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of System Clock, 1/16384 of OSC Oscillation Clock 1/1, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	I/O	46	• Pull-up Resistor available : 46 (Software Programmable) • Input/Output selectable : 46 (P0 to A : by 4-bit, PD : by 2-bit)
	Input	8	• Joint use : 4 • Pull-up Resistor available : 8 (Software Programmable)
Special Ports			Buzzer Output
Package			QFP064-P-1414

Electrical Characteristics

Supply Current

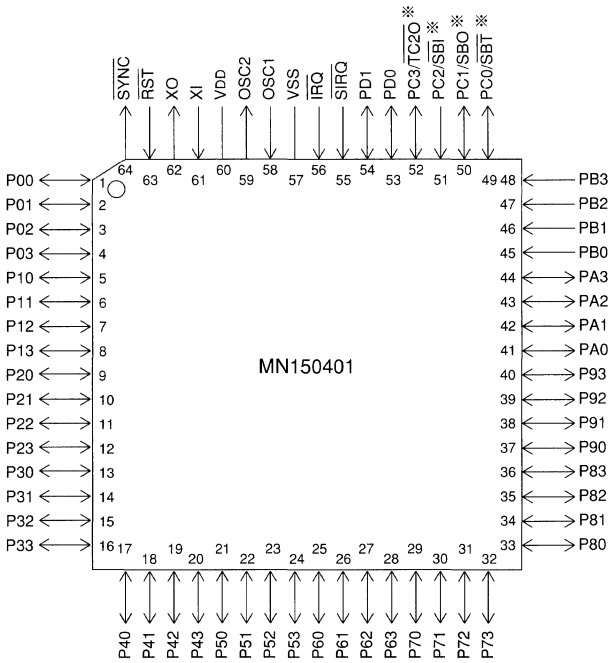
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Current at RESET	IDD1	VDD=5V, at 4.0MHz Operation		2.0	5.0	mA
Operating Supply Current	IDD2	VDD=3V, at 32.768kHz Operation		80	200	μA
Supply Current at STOP	IDD5	VDD=3V, Oscillation halt			10	μA
Supply Current at HALT	IDD3	VDD=5V, at 4.0MHz Operation		0.5	1.2	mA
	IDD4	VDD=3V, at 32.768kHz Operation		40	100	μA

(Ta= –10 to +70°C, VSS=0V, Oscillation waveform is a square wave)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB150401
Piggyback	Use **EP150801** as piggy in SDIP064-P-0750 package.
EPROM built-in Type	Use **MN15P0801** (ES (Engineering Sample) available) in QFP064-P-1414 package.

Pin Configuration



QFP064-P-1414

※ Input only when used as the port C.

❑ MN150202 / 0402 / 0602

Type			**MN150202 / 0402 / 0602**
ROM (x8-bit)			2K / 4K / 6K
RAM (x4-bit)			128 / 320 / 320
Number of Instructions			104
Minimum Instruction Execution Time		With Main Clock operated	**1/8 dividing 1.9µs (at 2.6 to 5.5V, 4.19MHz)** **1/8 dividing 4.0µs (at 2.2 to 5.5V, 2MHz)**
		With Sub-clock operated	**1/8 dividing 244µs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts			• RESET • NMI • External (Key Interrupt is available) / Timer 2 • Timer • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** (Event Count) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of System Clock, 1/16384 of OSC Oscillation Clock 1/1, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**24**	• Pull-up Resistor available : 24 (Software Programmable) • Input/Output selectable : 24 (P0 to 5 : by 4-bit)
	Input	**8**	• Joint use : 4 • Pull-up Resistor available : 8 (Software Programmable)
Special Ports			Buzzer Output
Package			MN150202 : QFP044-P-1010 MN150402 : QFP044-P-1010 MN150602 : SDIP042-P-0600

Electrical Characteristics

Supply Current

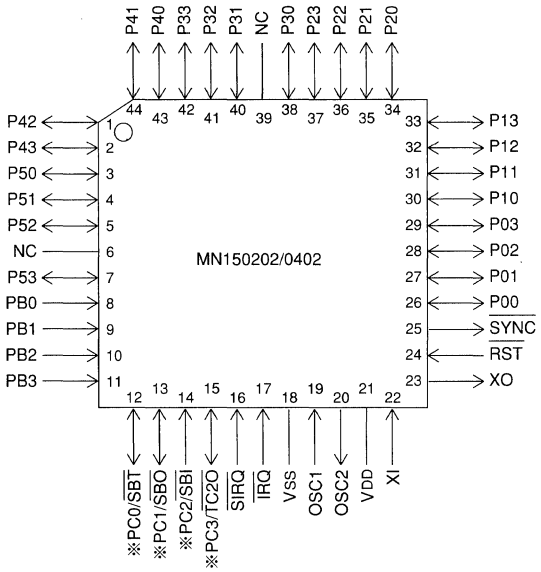
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Current at RESET	IDD1	VDD=5V, at 4.0MHz Operation		2.0	5.0	mA
Operating Supply Current	IDD2	VDD=3V, at 32.768kHz Operation		80	200	µA
Supply Current at STOP	IDD5	VDD=3V, Oscillation halt			10	µA
Supply Current at HALT	IDD3	VDD=5V, at 4.0MHz Operation		0.5	1.2	mA
	IDD4	VDD=3V, at 32.768kHz Operation		40	100	µA

(Ta= −10 to +70°C, VSS=0V, Oscillation waveform is a square wave)

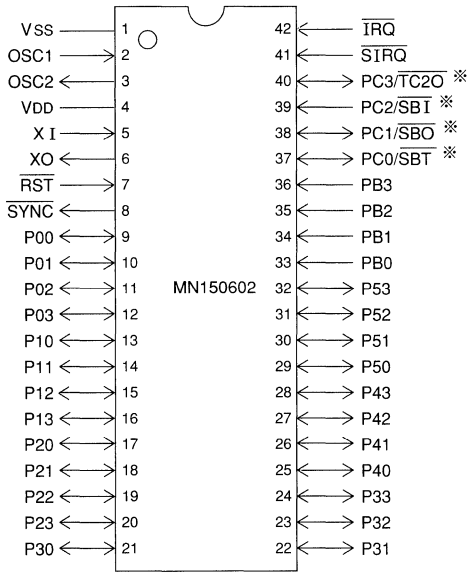
Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB150402
Piggyback	Use **EP150801** as piggy in SDIP064-P-0750. (Available in SDIP042-P-0600 with converter adaptor.)
EPROM built-in Type	Use **MN15P0802** in QFP044-P-1010/SDIP042-P-0600 (ES (Engineering Sample)available) package.

Pin Configuration



QFP044-P-1010



SDIP042-P-0600

※ Input only when used as the port C.
NC : Nothing connected with terminal.

❑ MN150837

Type			**MN150837**
ROM (x8-bit)			8K
RAM (x8-bit)			512
Minimum Instruction Execution Time		With Main Clock operated	**1/4 dividing 0.95μs (at 2.7 to 5.5V, 4.19MHz)** **1/8 dividing 1.91μs (at 1.8 to 5.5V, 4.19MHz)**
		With Sub-clock operated	**122μs (at 1.8 to 5.5V, 32.768KHz)**
Interrupts			• RESET • External / Timer 2 • External • Timer • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** (Event Count) Clock Source .....System Clock, 1/2, 1/8, 1/32, 1/128 **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of System Clock, $1/2^{14}$ of OSC Oscillation Clock, 1/1, $1/2^{6}$ of XI Oscillation Clock (Connectable) Timer Counter 1/2
Serial Interface			**Serial : 8-bit x 1** Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**20**	• Joint use : 3 • Input/output selectable : 20 (P2 : by-bit P3, 4, 8, 9 : by-port) • Pull-up Resistor available : 20 (Software Programmable)
	Input	**5**	• Joint use : 2 • Pull-up Resistor available : 4 (Software Programmable)
	Output	**8**	• Nch Open-drain : 8
Package			QFP044-P-1010

Electrical Characteristics

Supply Current

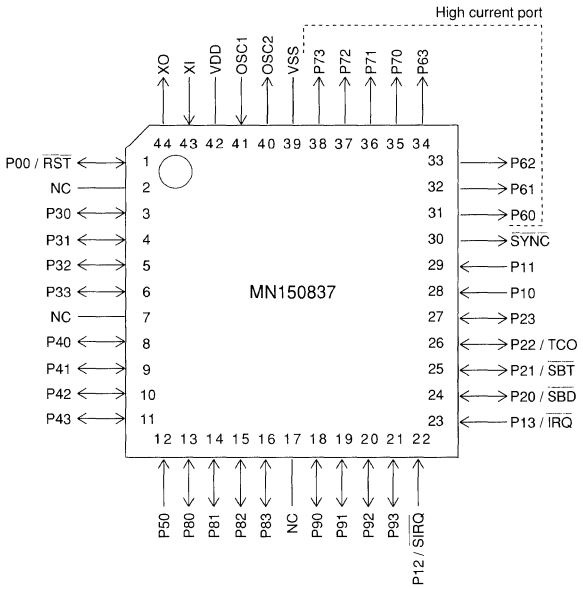
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD2	1/8fosc, 4.00MHz			5.0	mA
	IDD3	1/4fosc, 4.00MHz			9.0	mA
	IDD4	1/4fx, 32.7kHz			0.5	mA
Supply Current at STOP	IDD6	XI=open, VDD=5V			10.0	μA
	IDD7	XI=32.7kHz, VDD=3V			10.0	μA
Supply Current at HALT	IDD5	fosc=4.0MHz			1.2	mA

(Ta= −40 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB151637
EPROM built-in Type	Use **MN15P1631** (ES (Engineering Sample) available) in QFP044-P-1010 package.

Pin Configuration



QFP044-P-1010

NC : Nothing connected with terminal.

❑ MN151233

Type			**MN151233**
ROM (x8-bit)			12K
RAM (x8-bit)			512
Minimum Instruction Execution Time		With Main Clock operated	**1/4 dividing 0.95µs (at 2.7 to 5.5V, 4.19MHz)** **1/8 dividing 1.91µs (at 1.8 to 5.5V, 4.19MHz)**
		With Sub-clock operated	**122µs (at 1.8 to 5.5V, 32.768kHz)**
Interrupts			• RESET • External / Timer 2 • External • Timer • Serial
Timer Counter			**Timer Counter : 8-bit x 1** (Event Count) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of System Clock, $1/2^{14}$ of OSC Oscillation Clock, 1/1, $1/2^{6}$ of XI Oscillation Clock (Connectable) Timer Counter 1/2
Serial Interface			**Serial : 8-bit x 1** Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**32**	• Joint use : 3 • Input/output selectable : 32 (P2 : by-bit P3, 4, 8 to B, D : by-port) • Pull-up Resistor available : 32 (Software Programmable)
	Input	**8**	• Joint use : 2 • Pull-up Resistor available : 8 (Software Programmable)
	Output	**14**	• Nch Open-drain : 14
Package			QFP064-P-1414

Electrical Characteristics

Supply Current

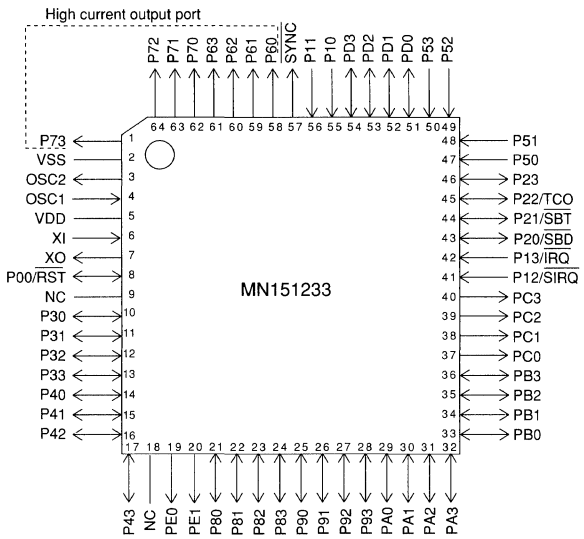
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD2	1/8fosc, 4.00MHz			5.0	mA
	IDD3	1/4fosc, 4.00MHz			9.0	mA
	IDD4	1/4fx, 32.7kHz			0.5	mA
Supply Current at STOP	IDD6	XI=open, VDD=5V			10.0	µA
	IDD7	XI=32.7kHz, VDD=3V			10.0	µA
Supply Current at HALT	IDD5	fosc=4.0MHz			1.2	mA

(Ta= –40 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB151633
EPROM built-in Type	Use **MN15P1618** (ES (Engineering Sample) available) in QFH064-P-1414 package.

Pin Configuration



QFP064-P-1414

NC : Nothing connected with terminal

❑ MN155202 / 402

Type			**MN155202 / 402**
ROM (x8-bit)			2K / 4K
RAM (x4-bit)			128 / 192
Number of Instructions			98
Minimum Instruction Execution Time			**1.0μs (at 4.5 to 5.5V, 8MHz)** **4.0μs (at 2.0 to 5.5V, 2MHz)**
Interrupts			• RESET • External (Key Interrupt is available) • Timer • Serial
Timer Counter			**Timer Counter : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/4, 1/16, 1/64, of P20 Pin Input, 1/2, 1/8, 1/32, 1/128 of System Clock 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock **Watchdog Timer**
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**21**	• Joint use : 13 • LED Driver : 8 (15mA / 1.0V) • Pull-up Resistor available, Input selectable : 21 (by -bit, Mask Option)
Zero-cross Inputs			1
A/D Inputs			10-bit x 6ch (with S/H)
Notes			Crystal / CR Oscillation selectable
Package			MN155202 : SDIP028-P-0400, SOP028-P-0375 MN155402 : SDIP028-P-0400, SOP028-P-0375, QFH032-P-0707

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8MHz, VDD=5V			10	mA
	IDD2	fosc=2MHz, VDD=5V			2.5	mA
Supply Current at STOP	IDD3	at no Auto-reset (Oscillation halt)			5	μA
Supply Current at HALT	IDD4	fosc=8MHz			3	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Relative Error	DF LNTY	AVDD=VDD=5.0V, AVSS=VSS=0V			※±3	LSB
A/D Conversion Time	VCNV	fosc=8MHz		12		μs
Analog Input Voltage			AVSS		AVDD	V

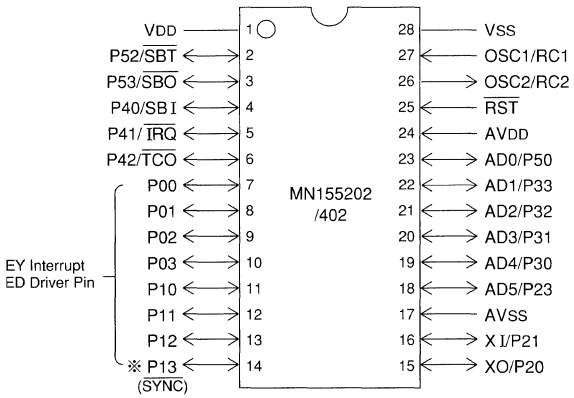
(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

※±3 LSB relative error is a design-assured value.

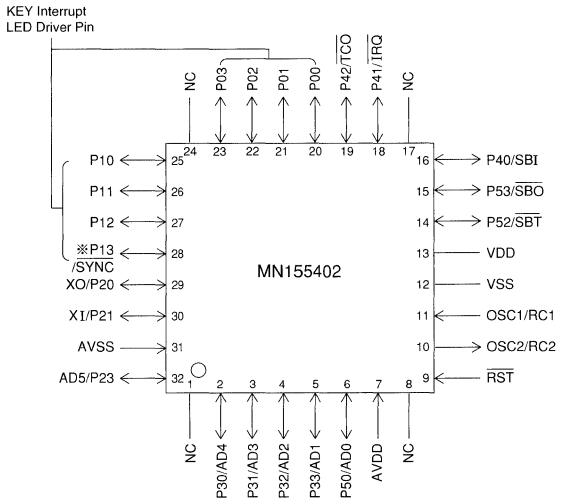
Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB155202
EPROM built-in Type	Use **MN15P5402** in SDIP028-P-0400 / SOP028-P-0375 package.

Pin Configuration



SDIP028-P-0400 / SOP028-P-0375



QFH032-P-0707

※ $\overline{\text{SYNC}}$ signal will be output from this terminal during internal RESET.
After RESET, this terminal will function as P13.
NC : Nothing connected with terminal.

❑ MN158418

Type			**MN158418**
ROM (x8-bit)			4K
RAM (x4-bit)			256
Number of Instructions			94
Minimum Instruction Execution Time			**2.0μs (at 4.5 to 5.5V, 4MHz)**
Interrupts			• RESET • External • Timer • Serial
Timer Counter			**Timer Counter : 8-bit x 1** Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock Interrupt Source .....Overflow of Timer Counter
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**High Voltage I/O**	**12**	• Pch Open-drain (Breakdown Voltage -30V) : 12 • Pull-down Resistor available : 12 (Mask Option)
	Input	**7**	• Joint use : 4 Pull-up Resistor available : 2 • Pull-down Resistor available : 2 • Pull-up Resistor available : 3 (Software Programmable)
	High Voltage Output	**29**	• Pch Open-drain available (Breakdown Voltage -30V) : 29 • Pull-down Resistor available : 29 (Mask Option)
	Output	**8**	
FLP			41
Notes			Crystal / CR Oscillation selectable
Package			SDIP064-P-0750

Electrical Characteristics

Supply Current

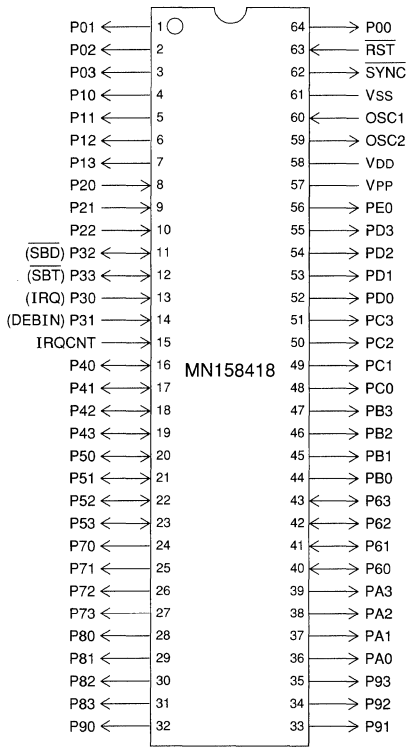
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=4.0MHz		2.5	6.0	mA
Supply Current at STOP	IDD3	VPP=0V			20	μA
Supply Current at HALT	IDD2	fosc=4.0MHz, VPP=0V		0.6	1.5	mA

(Ta= −10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB158418
Piggyback	Use **EP158418** as piggy in SDIP064-P-0750 package.

Pin Configuration



SDIP064-P-0750

❑ MN150413 / 0813

Type	**MN150413 / 0813**
ROM (x8-bit)	4K/8K
RAM (x4-bit)	256/432
Number of Instructions	103
Minimum Instruction Execution Time	**At 1/4 frequency dividing 2μs (at 1.8 to 5.5V, 2MHz)** **At 1/4 frequency dividing 0.94μs (at 2.7 to 5.5V, 4.24MHz)** **At 1/8 frequency dividing 2μs (at 1.8 to 5.5V, 4MHz)**
Interrupts	• RESET • External (Key Interrupt is available) • Timer • Serial
Timer Counter	**Timer Counter 1 : 8-bit x 1** (Event Count) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock, XI Oscillation Clock Remote Control Carrier Output 1/1, 1/4, 1/16, 1/64 of Time Base 8Hz Dividing Signal Interrupt Source .....Overflow of Timer Counter 1 **Time Counter 2 : 8-bit x 1** Clock Source.....1/1, 1/16, 1/32, 1/64 of OSC Oscillation Clock, 1/1, 1/16, 1/32, 1/64 of XI Oscillation Clock, 1/1, 1/16, 1/32, 1/64 of TC12 Pin Input Interrupt Source.....Overflow of Timer Counter 2 **Time Base Counter** Clock Source .....1/8 of XI Oscillation Clock **Watchdog Timer** (Connectable) Timer Counter 1 + Timer Counter 2
Serial Interface	**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....$\overline{SBT}$ Pin Input, System Clock

I/O Ports	**I/O**	**16**	• Joint use : 10 • Pull-up Resistor available : 16 (Software Programmable) • SEG output selectable : 8 (Software Programmable)
	Input	**9**	• Joint use : 5 • Pull-up Resistor available : 9 (Software Programmable)
	Output	**1**	• Joint use : 1

LCD	33 Segments • 2 Common • 1/2 Duty, 33 Segments • 3 Common • 1/3 Duty, 32 Segments • 4 Common • 1/4 Duty
Special Ports	Buzzer Output, Remote Control Transmission
Notes	Built-in Carrier Generator Circuit for Remote Controller
Package	QFP064-P-1414

Electrical Characteristics

Supply Current

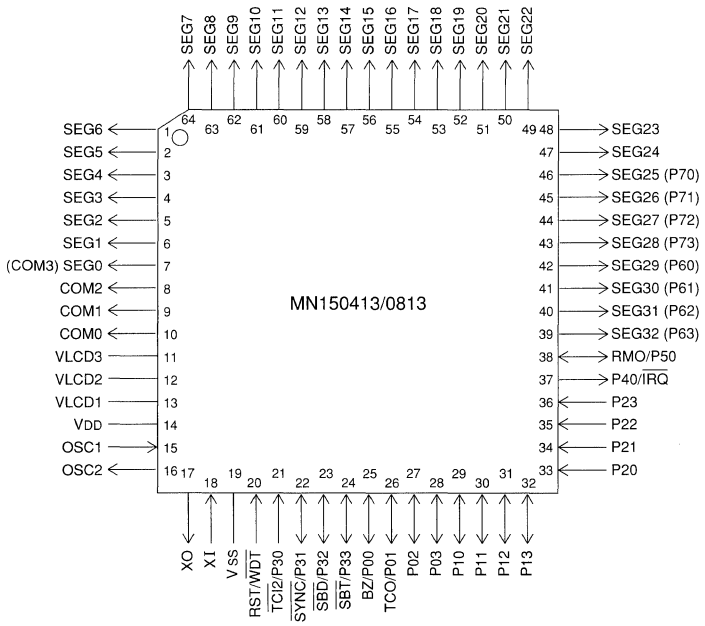
Parameter	Symbol	Condition	Limit Min.	Limit Typ.	Limit Max.	Unit
Operating Supply Current	IDD1	fosc=4MHz, 1/8 diving		1.0	3.0	μA
Supply Current at STOP	IDD8	fxi=32.768kHz		4.0	10	μA
	IDD9	Oscillation halt			2.0	μA
Supply Current at HALT	IDD4	fosc=4MHz		0.6	1.2	mA

(Ta= −40 to +85°C, VDD=3.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB150413/0813
EPROM built-in Type	Use **MN15P0813** in QFP064-P-1414 package.

Pin Configuration



QFP064-P-1414

※ P30 to P33 : Input only when used as the port 3.
P60 to P63, P70 to P73 : I/O when used as the port 6 or 7.

❑ MN158851A1 [High Speed Version]

Type	**MN158851A1 [High Speed Version]**
ROM (x8-bit)	8K
RAM (x4-bit)	432
Number of Instructions	99
Minimum Instruction Execution Time	**1µs (at 4.5 to 5.5V, 8MHz)** **8µs (at 2.5 to 5.5V, 1MHz)**
Interrupts	• RESET • External 0 • External 1 • Timer • Serial
Timer Counter	**Timer Counter 1 : 8-bit x 1** (Event Count, Timer Output) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter **Timer Counter 2 : 16-bit x 1** (Event Count) Clock Source .....CKI Pin Input **Time Base Counter** (Time Base) Clock Source .....XI Oscillation Clock, OSC Oscillation Clock
Serial Interface	Serial : 8-bit x 1 (Synchronous Type) Clock Source .....$\overline{\text{SBT}}$ Pin Input, System Clock

I/O Ports	**I/O**	**12**	
	Input	**12**	• Joint use : 2 • Pull-up Resistor available : 10 (Software Programmable)
	Output	**8**	

LCD	29 Segments • 4 Common • 1/3, 1/4 Duty
Special Ports	Buzzer Output
Package	QFP084-P-1818

Electrical Characteristics

Supply Current

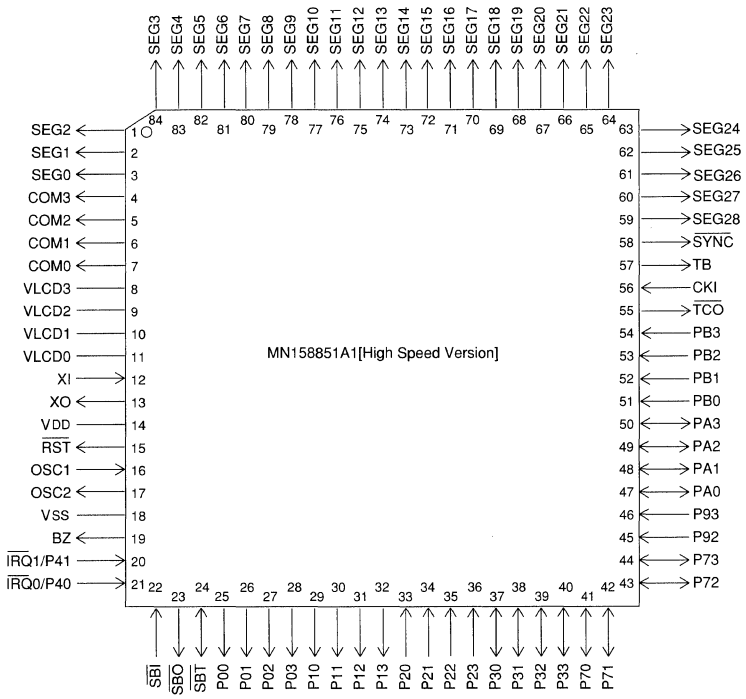
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	VDD1	fosc=8MHz, tc=1µs		6	12	mA
Supply Current at STOP	IDD3	XI=0V, VDD=5V			40	µA
Supply Current at HALT	IDD2	fosc=8MHz, tc=1µs		3	6	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB158851
Piggyback	Use **EP158851** as piggy in QFP084-P-1818 package.

Pin Configuration



QFP084-P-1818

❑ MN150810

Type			**MN150810**
ROM (x8-bit)			8K
RAM (x4-bit)			512
Number of Instructions			104
Minimum Instruction Execution Time		With Main Clock operated	**1/4 dividing 0.95μs (at 4.5 to 5.5V, 4.19MHz)** **1/8 dividing 1.91μs (at 2.6 to 5.5V, 4.19MHz)**
		With Sub-clock operated	**122μs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts			• RESET • External (Key Interrupt is available) • Timer • Serial/Timer 2
Timer Counter			**Timer Counter : 8-bit x 1** (Event Count) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of System Clock, 1/16384 of OSC Oscillation Clock, 1/1, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**20**	• Joint use : 6 • Pull-up Resistor available : 20 (Software Programmable)
	Input	**5**	• Joint use : 4 • Pull-up Resistor available : 5 (Software Programmable)
	High Voltage Output	**4**	• Nch Open-drain available (Breakdown Voltage 10V) : 4
	Output	**11**	• Joint use : 8
LCD			16 Segment • 2, 3, 4 Common • 1/2, 1/3, 1/4 Duty
Package			QFP064-P-1414

Electrical Characteristics

Supply Current

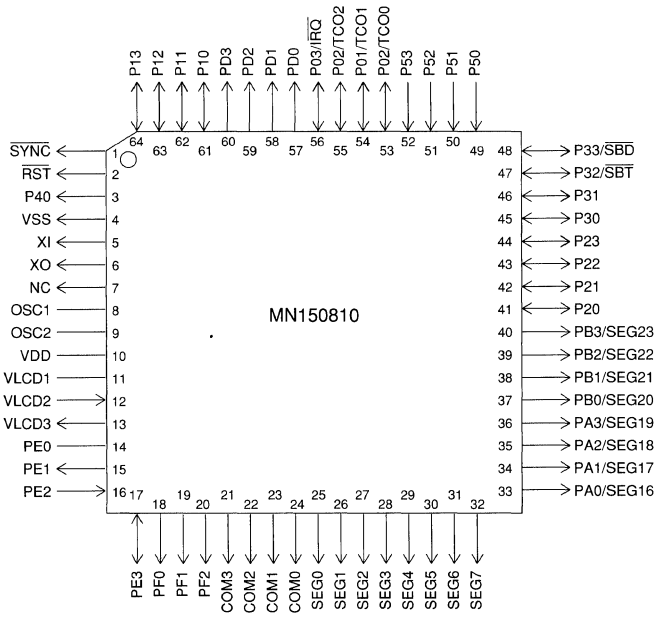
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=4MHz, VDD=5V			5.0	mA
	IDD2	fosc=32.768kHz, VDD=5V			0.5	mA
Supply Current at STOP	IDD5	XI=32kHz, VDD=5V			10	μA
	IDD6	XI=OPEN, VDD=5V			5	μA
Supply Current at HALT	IDD3	fosc=4MHz, VDD=5V			1.2	mA

(Ta= −40 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB150810

Pin Configuration



QFP064-P-1414

※ P10 to P13 : High current output port
PD0 to PD3 : Output port (10V withstanding)
NC : Nothing connected with terminal.

❑ MN150409 / 0609

Type			**MN150409 / 0609**
ROM (x8-bit)			4K / 6K
RAM (x4-bit)			256 / 512
Number of Instructions			104
Minimum Instruction Execution Time			**1/4 dividing 1.1µs (at 4.5 to 5.5V, 3.58MHz)** **1/8 dividing 2.2µs (at 3.0 to 5.5V, 3.58MHz)** **1/64 dividing 17.6µs (at 2.2 to 5.5V, 3.58MHz)**
Interrupts			• RESET • Top Priority (External) • External / Timer 2 • Timer • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output) Clock Source .....System Clock Interrupt Source .....Overflow of Timer Counter 2
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**29**	• Joint use : 5 (LED Driver (10mA / 1V)) • Pull-up Resistor available : 29 (Software Programmable) • Output Structure specified by Mask Option : 29 (P0, 1 : by -bit P2 to A, D : by -byte)
	Input	**4**	• Joint use • Pull-up Resistor available : 4 (Software Programmable)
Special Ports			DTMF Output, Buzzer Output
Package			SDIP042-P-0600, QFP044-P-1010

Electrical Characteristics

Supply Current

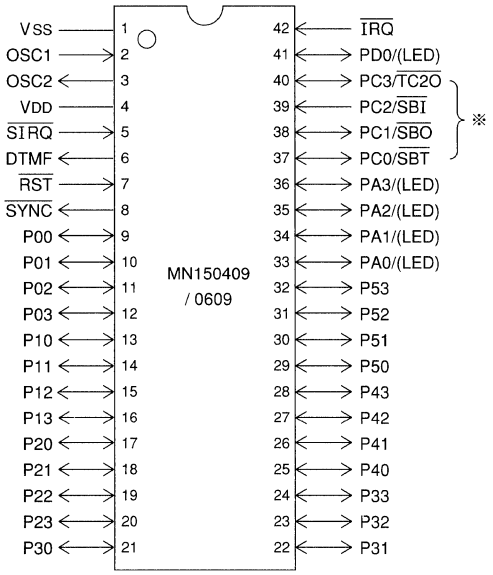
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD2	1/4fosc, 3.58MHz		2.5	5.0	mA
	IDD3	1/8fosc, 3.58MHz		1.5	4.0	mA
Supply Current at STOP	IDD5				10	µA
Supply Current at HALT	IDD4	fosc=3.58MHz		0.5	1.2	mA

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

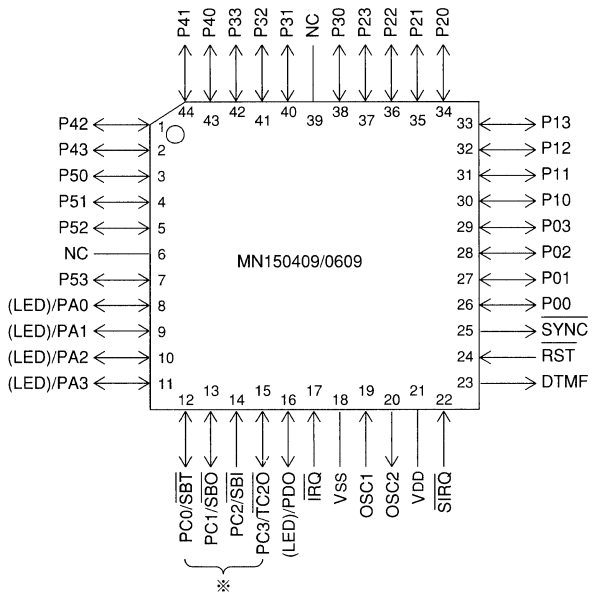
Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB150609
EPROM built-in Type	Use **MN15P0809** (ES (Engineering Sample) available) in SDIP042-P-0600 / QFP044-P-1010 package.

Pin Configuration



SDIP042-P-0600



QFP044-P-1010

※ Input only when used as the port C.
NC : Nothing connected with terminal

❑ MN150832

Type			**MN150832**
ROM (x8-bit)			8K
RAM (x4-bit)			512
Number of Instructions			104
Minimum Instruction Execution Time			**1/4 dividing 1.1µs (at 4.5 to 5.5V, 3.58MHz)** **1/8 dividing 2.2µs (at 3.0 to 5.5V, 3.58MHz)** **1/64 dividing 17.6µs (at 2.2 to 5.5V, 3.58MHz)**
Interrupts			• RESET • Top Priority (External) • External / Timer 2 • Timer • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output) Clock Source .....System Clock Interrupt Source .....Overflow of Timer Counter 2
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**47**	• Joint use : 7 (LED Driver (10mA / 1V)) • Pull-up Resistor available : 47 (Software Programmable) • Output Structure specified by Mask Option : 47 (P0, 1 : by -bit P2 to A, D : by -byte)
	Input	**8**	• Joint use : 8 • Pull-up Resistor available : 8 (Software Programmable)
Special Ports			DTMF Output, Buzzer Output
Package			QFP064-P-1414, SDIP064-P-0750

Electrical Characteristics

Supply Current

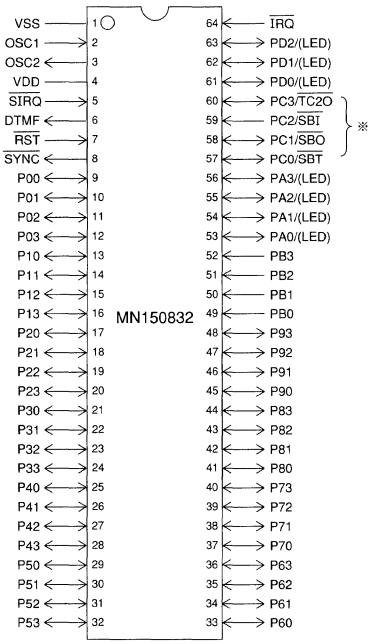
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD2	1/4fosc, 3.58MHz		2.5	5.0	mA
	IDD3	1/8fosc, 3.58MHz		1.5	4.0	mA
Supply Current at STOP	IDD5				10	µA
Supply Current at HALT	IDD4	fosc=3.58MHz		0.5	1.2	mA

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

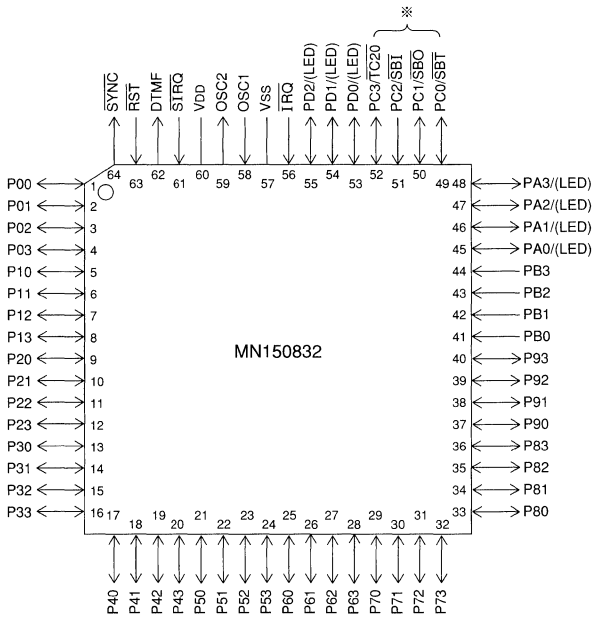
Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB150808
EPROM built-in Type	Use **MN15P0808** (ES (Engineering Sample) available) in QFP064-P-1414 / SDIP064-P-0750 (under development) package.

Pin Configuration



SDIP064-P-0750



QFP064-P-1414

※ Input only when used as C-port

❑ MN152810

Type			MN152810
ROM (x8-bit)			8K
RAM (x4-bit)			320
Number of Instructions			115
Minimum Instruction Execution Time			**At 1/12 frequency dividing 2μs (at 4.5 to 5.5V, 6MHz)**
Interrupts			• RESET • SIRQ • Remote Control Input • Timer • Serial (Only when choosing Mask Option)
Timer Counter			**Timer Counter : 8-bit x 1** Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock Interrupt Source .....Overflow of Timer Counter
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	I/O	6	• Joint use : 2 • Pull-up Resistor available (Mask Option) • Nch Open-drain available (Output) : 4
	Input	4	• Joint use : 1 • Pull-up Resistor available : 4 (Mask Option) • Output selectable : 3 (Software Programmable)
	High Voltage Output	5	• Nch Open-drain (Breakdown Voltage 12V) : 5 • Push-pull Output selectable : 4 (Mask Option)
	Output	5	
A/D Inputs			5-bit x 4ch (Conversion by Software)
D/A Outputs			6-bit x 5ch
PWM			7-bit x 4ch (Repetition Cycle 256μs, at 6MHz), 14-bit x 1ch (Repetition Cycle 32.8ms, at 6MHz)
Special Ports			Tri-state Output (PTO), Remote Control Reception
CRTC			5 x 7 dots, 16 characters, 6 lines, 7 colors, 120 patterns, Rounding function, Framing function
Notes			Remote Control Data Detection Circuit built-in, For Voltage Synthesizer, Stand-by
Package			SDIP052-P-0600

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=6MHz, VDD=VDDC=AVDD=5V VSSC=2V, Ta=25°C		28	50	mA
	IDD2	fosc=6MHz, VDD=VDDC=AVDD=5V VSSC=2V, Ta=25°C		4.0	8.0	mA
Supply Current at STOP	IDD3	VDD=VDDC=AVDD=3V, VSSC=0V fosc=0Hz, Ta=25°C			2.0	μA

(Ta=25, 80°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		VDD=5V, VSS=0V			±1	LSB
D/A Conversion Absolute Error		VDD=5V, VSS=0V			±1/2	LSB
Analog Input Voltage			VSS		VDD	V

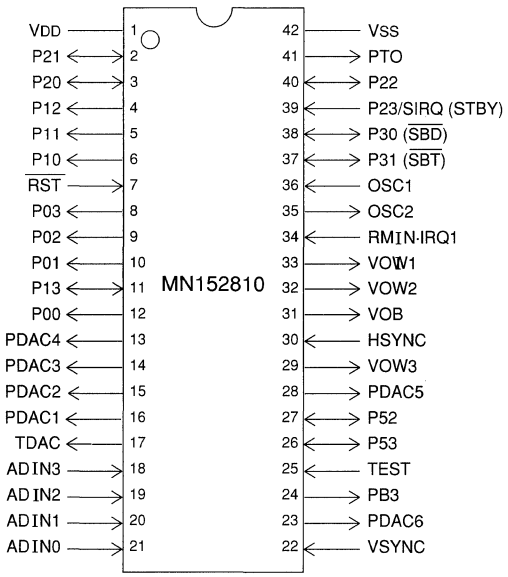
(Ta=25, 80°C, VDD=5.0V, VSS=0V, VSSC=0V, VDDC=AVDD=5V)

Support Tool

In-Circuit Emulator PX-ICE1500 + PX-PRB152810

Piggyback Use **EP152810** as piggy in SDIP052-P-0600 package.

Pin Configuration



SDIP052-P-0600

NC : Nothing connected with terminal

❑ MN152811

Type			**MN152811**
ROM (x8-bit)			8K
RAM (x4-bit)			256
Number of Instructions			115
Minimum Instruction Execution Time			**2μs (at 4.5 to 5.5V, 6MHz)**
Interrupts			• RESET • SIRQ • Remote Control Input • Timer • Serial (Only when choosing Mask Option)
Timer Counter			**Timer Counter : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock Interrupt Source .....Overflow of Timer Counter
Serial Interface			**Serial : 8-bit x 1** Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**5**	• Joint use : 2 • Specified pull-up Resistor available (Mask Option) : 2 • Nch Open-drain available (Output) : 5
	Input	**4**	• Joint use : 1 • Specified pull-up Resistor available (Mask Option) : 1 • Output selectable (Software Programmable) : 3
	High Voltage Output	**5**	• Nch Open-drain (Breakdown Voltage 12V) : 5 • Push-pull Output selectable (Mask Option) : 4
	Output	**3**	
A/D Inputs			5-bit x 4ch (Conversion by Software)
PWM			7-bit x 6ch (Repetition Cycle 256μs, at 6MHz), 14-bit x 1ch (Repetition Cycle 32.8ms, at 6MHz)
Special Ports			Tri-state Output (PTO), Remote Control Reception
CRTC			5 x 7 dots, 16 characters, 2 lines, 7 colors, 56 patterns, Rounding function, Framing function
Notes			Remote Control Data Detection Circuit built-in, For Voltage Synthesizer
Package			SDIP042-P-0600

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=6MHz, VDD=5V Ta=25°C		5.0	10	mA
Supply Current at STOP	IDD3	fosc=0Hz, VDD=5V Ta=25°C			2.0	µA

(VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		VDD=5V, VSS=0V			±1	LSB
Analog Input Voltage			VSS		VDD	

(VDD=5.0V, VSS=0V, Ta=25.8°C)

Support Tool

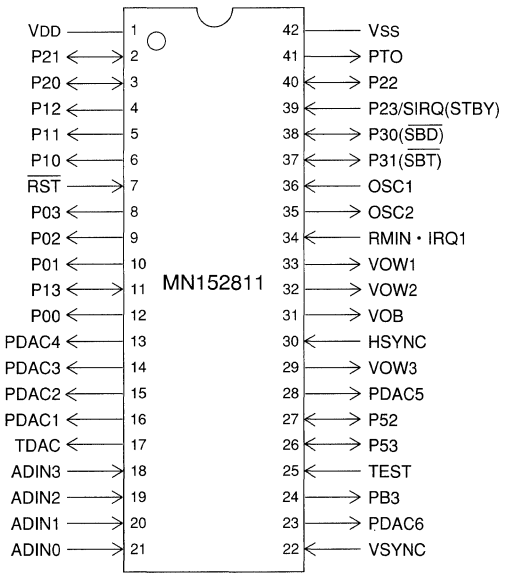
In-Circuit Emulator

PX-ICE1500 + PX-PRB152811

Piggyback

Use **EP152811**.

Pin Configuration



SDIP042-P-0600

❑ MN150414 / 0814 / 1614

Type	**MN150414 / 0814 / 1614**
ROM (x8-bit)	4K / 8K / 8K (Table ROM 8K)
RAM (x4-bit)	256 / 320 / 320
Number of Instructions	103
Minimum Instruction Execution Time	**At 1/8 frequency dividing 2.0µs (at 1.8 to 3.6V, 4MHz)** **At 1/16 frequency dividing 4.0µs (at 1.8 to 3.6V, 4MHz)** **At 1/32 frequency dividing 8.0µs (at 1.8 to 3.6V, 4MHz)**
Interrupts	• RESET • External (Key Interrupt is available) • Timer • Serial
Timer Counter	**Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock, Remote Control Carrier Output Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** Clock Source .....1/1, 1/16, 1/32, 1/64 of OSC Oscillation Clock 1/1, 1/16, 1/32, 1/64 of TC12 Pin Input, Remote Control Carrier Output Interrupt Source .....Overflow of Timer Counter 2 **Watchdog Timer** Connectable Timer Counter 1 + Timer Counter 2
Serial Interface	**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input

I/O Ports	**I/O**	**12 (13)**	• Joint use : 1 • Specified pull-up Resistor available : 13 (Software Programmable) (WOT Output by $\overline{RST}$ Pin Output)
	Input	**9**	• Joint use : 5 • Specified pull-up Resistor available : 9 (Software Programmable)
	Output	**1**	• Joint use : 1

Special Ports	Remote Control Transmission
Notes	Carrier Generator Circuit for Remote Controller built-in and Auto Reset Circuit built-in
Package	SOP028-P-0375

Electrical Characteristics

Supply Current

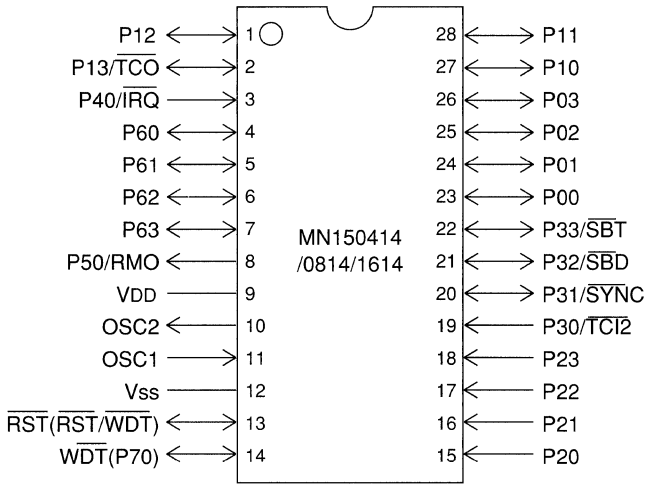
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=4MHz, 1/8 dividing		1.0	3.0	mA
Supply Current at STOP	IDD3	Auto Reset Circuit built-in		1.0	5	µA
Supply Current at HALT	IDD2	fosc=4MHz, 1/8 dividing		0.6	1.2	mA

(Ta= –20 to +85°C, VDD=3V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1500 + PX-PRB150414 / 0814 / 1614
EPROM built-in Type	Use **MN15P1614** (ES (Engineering Sample) available) in SOP028-P-0375 package.

Pin Configuration



SOP028-P-0375

❑ MN150404 / 0804

Type			**MN150404 / 0804**
ROM (x8-bit)			4K / 8K
RAM (x4-bit)			256 / 384
Number of Instructions			101 / 104
Minimum Instruction Execution Time		With Main Clock operated	**1/8 dividing 1.91µs (at 2.6 to 5.5V, 4.19MHz)** **1/8 dividing 4.0µs (at 2.2 to 5.5V, 2MHz)**
		With Sub-clock operated	**1/8 dividing 244µs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts			• RESET • External • Timer • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** (Event Count) Clock Source .....1/2, 1/8, 1/32, 1/128 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of System Clock, 1/16384 of OSC Oscillation Clock, 1/1, 1/64 of XI Oscillation Clock
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**8**	• Joint use : 2 • Specified pull-up Resistor available : 8 (Software Programmable)
	Input	**8**	• Joint use : 7 • Specified pull-up Resistor available : 8 (Software Programmable)
	High Voltage Output	**4**	• Nch Open-drain (Breakdown Voltage 10V) : 4
	Output	**12**	• Joint use : 8
Zero-cross Inputs			1
A/D Inputs			8-bit x 8ch (with S/H)
LCD			24 Segment • 3 Common • 1/3 Duty
Special Ports			Comparator (2)
Package			QFP064-P-1414

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=4MHz, VDD=5V		2.0	5.0	mA
	IDD2	fosc=32.768kHz, VDD=3V		80	200	µA
Supply Current at STOP	IDD5	XI=32kHz, VDD=3V		7	13	µA
	IDD6	XI=OPEN, VDD=3V		4	8	µA
Supply Current at HALT	IDD3	fosc=4MHz, VDD=3V		0.5	1.2	mA
	IDD4	fosc=32.768kHz, VDD=3V		40	100	µA

(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		VDD=5.0V, VSS=0V, VREF+=VDD			±3	LSB
A/D Conversion Relative Error					±2	LSB
A/D Conversion Time		fosc=4MHz	18		18	µs
Reference Input Voltage	Vref+		VSS		VDD	V
Analog Input Voltage	VAD		VSS		Vref+	V

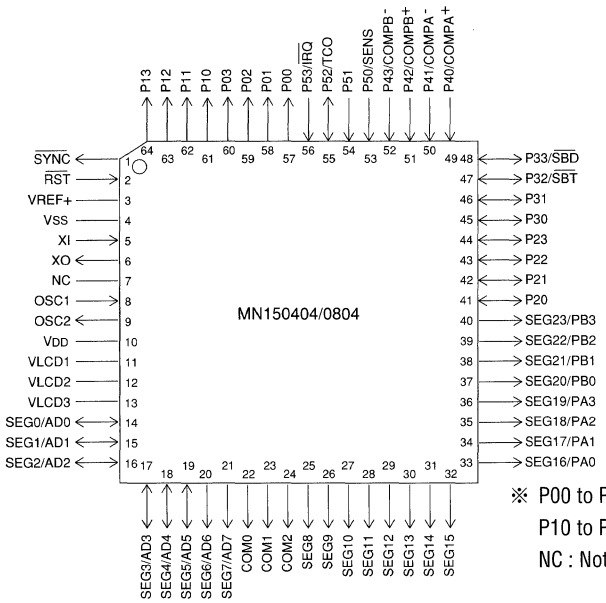
(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1500 + PX-PRB150404 / 0804

EPROM built-in Type Use **MN15P0804** in QFP064-P-1414 package.

Pin Configuration



※ P00 to P03 : Output port (10V Breakdown Voltage)
P10 to P13 : High current output port
NC : Nothing connected with terminal.

QFP064-P-1414

Note : Use with on-chip MN15P0804 pull-up resistor open.

❑ MN150120

Type			**MN150120 (under development)**
ROM (x8-bit)			1K
RAM (x4-bit)			64
Number of Instructions			51
Minimum Instruction Execution Time			**1/8 dividing 1.0μs (at 4.5 to 5.5V, 8MHz)** **1/8 dividing 4.0μs (at 2.0 to 5.5V, 2MHz)** **1/8 dividing 8.0μs (at 1.8 to 5.5V, 1MHz)** **1/8 dividing 8.0μs (at 3.0 to 5.5V, selecting CR Oscillation)**
Interrupts			• Time Base • External • AC Zero-cross
Timer Counter			**Time Base Counter : 1** Clock Source .....1/1 of OSC Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Watchdog Timer (Mask Option)**
I/O Ports	**I/O**	**15 (16)**	• Joint use : 7 (8) • Specified pull-up Resistor available : 11 (12) (Mask Option) • Specified output architecture available : Nch Open-drain / Push-pull : 11 (12) (Mask Option) • 4ch LED direct drive available (20mA / 2.0V) • When CR oscillation mode is selected, OSC2 terminal may be used as P33 terminal
Comparator			2
Zero-cross Inputs			1
Special Ports			Buzzer Output (1kHz, 2kHz, 4kHz : fosc=at 4MHz)
Notes			CR / crystal Oscillation selectable, Auto-reset circuit selectable (Mask Option)
Package			SOP020-P-0300, SDIP022-P-0300

	Time Base Output			
fosc=8MHz	2kHz	4kHz	8kHz	16kHz
fosc=1MHz	0.25kHz	0.5kHz	1kHz	2kHz

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8MHz		4.0	8.0	mA
	IDD2	fosc=32.768kHz		30	60	μA
Supply Current at HALT	IDD3	fosc=32.768kHz		15	30	μA
Supply Current at STOP	IDD4			0.5	50	μA
Auto reset current consumption	IDD5			30	80	μA

(Ta= –40 to +85°C, VDD=5.0V, VSS=0V)

Comparator Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Input offset voltage	VIOF	Vin=1.5 to 3.5V		20	100	m
In-phase input voltage range	VISP		1.5		3.5	V

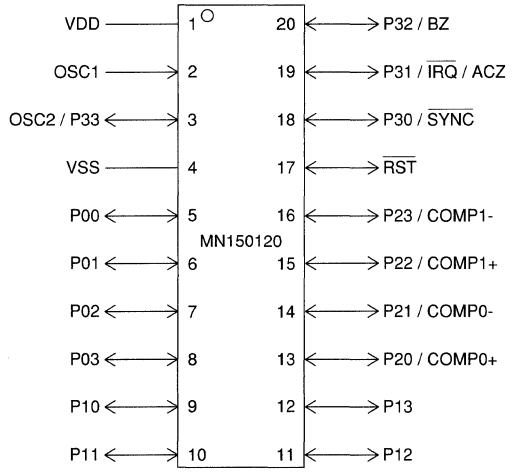
(Ta= –40 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

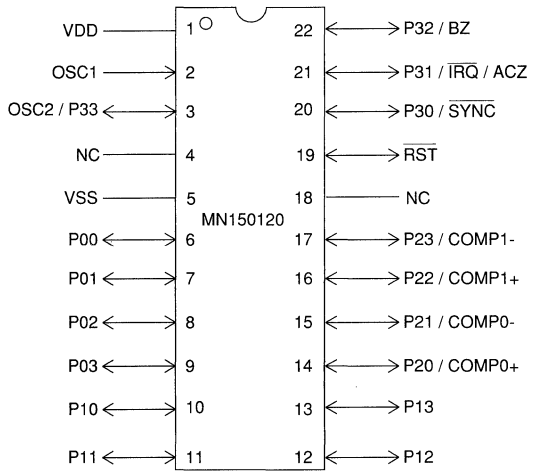
In-Circuit Emulator PX-ICE1500 + PX-PRB150120

EPROM built-in Type Use **MN15P0222** (ES (Engineering Sample) available) in SOP020-P-0300 / SDIP022-P-0300 package.

Pin Configuration



SOP020-P-0300



SDIP022-P-0300

※ P00 to P03 : High current output port
NC : Nothing connected with terminal.

❑ MN150222

Type			**MN150222**
ROM (x8-bit)			2K
RAM (x4-bit)			96
Number of Instructions			51
Minimum Instruction Execution Time			**1/8 dividing 1.0μs (at 4.5 to 5.5V, 8MHz)** **1/8 dividing 4.0μs (at 2.2 to 5.5V, 2MHz)** **1/8 dividing 8.0μs (at 1.8 to 5.5V, 1MHz)** **1/8 dividing 8.0μs (at 3.0 to 5.5V, selecting CR Oscillation)**
Interrupts			• Timer • Time Base • EXternal • AC Zero-cross
Timer Counter			**Timer Counter : 8-bit x 1** (Event Count : Timer Output) Clock Source .....System Clock, 1/16384 of OSC Oscillation Clock, TCI Input Interrupt Source .....Overflow of Timer Counter **Time Base Counter : 1** Clock Source .....1/1 of OSC Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Watchdog Timer (Mask Option)**
I/O Ports	**I/O**	**15 (16)**	• Joint use : 7 (8) • Specified pull-up Resistor available : 11 (12) (Mask Option) • Specified output architecture available : Nch Open drain / Push-pull : 11 (12) (Mask Option) • 4ch LED direct drive OK (20mA / 2.0V) • When CR oscillation mode is selected, OSC2 terminal may be used as P33 terminal
A/D Inputs			10-bit x 4ch (with S/H)
Zero-cross Inputs			1
Special Ports			Buzzer Output (1kHz, 2kHz, 4kHz : fosc=at 4MHz)
Notes			CR/crystal oscillation selectable, Auto-reset circuit selectable (Mask option)
Package			SOP020-P-0300, SDIP022-P-0300

	Time Base Output			
fosc=8MHz	2kHz	4kHz	8kHz	16kHz
fosc=1MHz	0.25kHz	0.5kHz	1kHz	2kHz

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8MHz		4.0	8.0	mA
	IDD2	fosc=32.768kHz		30	60	µA
Supply Current at HALT	IDD3	fosc=32.768kHz		15	30	µA
Supply Current at STOP	IDD4			0.5	5.0	µA
Auto reset current consumption	IDD5			30	80	µA

(Ta= –40 to +85°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=8MHz		15	27	µs
Analog Input Voltage	VIA		VSS		VDD	V

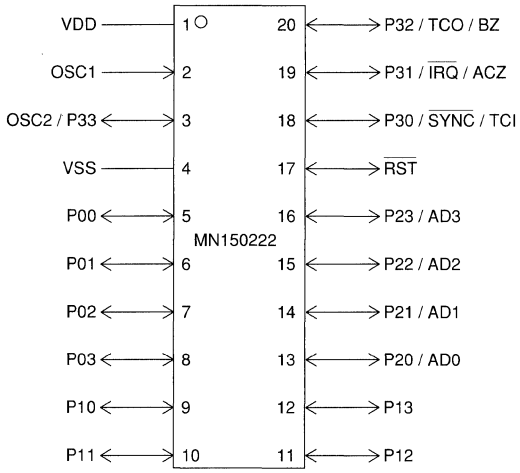
(Ta= –40 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

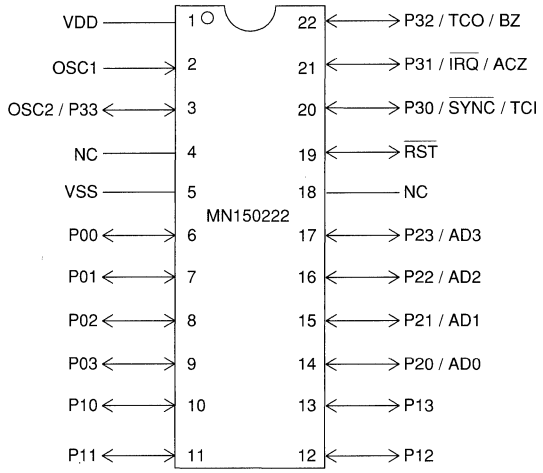
In-Circuit Emulator PX-ICE1500 + PX-PRB150222

EPROM built-in Type Use **MN15P0222** (ES (Engineering Sample) available) in SOP020-P-0300 / SDIP022-P-0300 package.

Pin Configuration



SOP020-P-0300



SDIP022-P-0300

※ P00 to P03 : High current output port
NC : Nothing connected with terminal.

❑ MN150831

Type			**MN150831**
ROM (x8-bit)			8K
RAM (x4-bit)			512
Number of Instructions			106
Minimum Instruction Execution Time			**1/4 dividing 1.0μs (at 4.5 to 5.5V, 4MHz)** **1/8 dividing 1.91μs (at 1.8 to 5.5V, 4.19MHz)** **1/8 dividing 244μs (at 1.8 to 5.5V, 32.768kHz)**
Interrupts			• Timer • External • AC Zero cross • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** (Event Count) Clock Source .....System Clock, XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....System Clock, XI Oscillation Clock, TCI Input Interrupt Source .....Overflow of Timer Counter 2 Cascade connection to timer counter 1 possible **Watchdog Timer**
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{\text{SBT}}$ Pin Input
I/O Ports	**I/O**	**20**	• Joint use : 12 • Specified pull-up Resistor available : 12 (Software Programmable) • Specified output architecture available : Nch Open drain / Push-pull : 20 (Software Programmable)
	Input	**5**	• Joint use : 4 • Specified pull-up Resistor available : 4 (Software Programmable)
	Output	**8**	• 8ch LED direct drive OK (20mA / 1.3V)
A/D Inputs			10-bit x 8ch (with S/H)
Zero-cross Inputs			1
Special Ports			Buzzer Output (1kHz, 2kHz, 4kHz : fosc=at 4MHz)
Package			QFP044-P-1010

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=4MHz		2.0	5.0	mA
Supply Current at HALT	IDD2	fosc=4MHz		0.6	1.2	mA
Supply Current at STOP	IDD3	fxi=32.768kHz		80	16.0	μA
	IDD4			1.0	5.0	μA

(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Relative Error		Vref+=5V			±3	LSB
A/D Conversion Time		fosc=4MHz			54	μs
Analog Input Voltage	VIA		VSS		Vref+	V

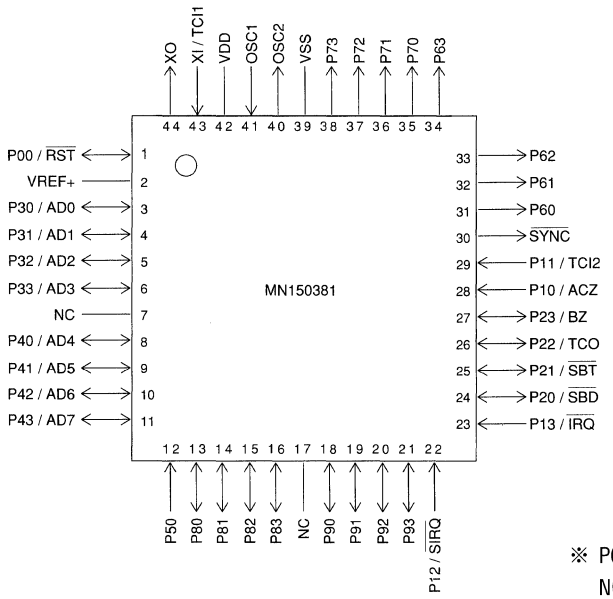
(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1500 + PX-PRB151631

EPROM built-in Type Use **MN15P1631** (ES (Engineering Sample) available) in QFP044-P-1010 package.

Pin Configuration



※ P60 to P73 : High current output port
NC : Nothing connected with terminal.

QFP044-P-1010

❑ MN151630

Type			**MN151630**
ROM (x8-bit)			16K
RAM (x4-bit)			512
Number of Instructions			106
Minimum Instruction Execution Time			**1/4 dividing 1.0μs (at 4.5 to 5.5V, 4MHz)** **1/8 dividing 1.91μs (at 2.6 to 5.5V, 4.19MHz)** **1/64 dividing 15.28μs (at 2.2 to 5.5V, 4.19MHz)**
Interrupts			• Timer • External • AC Zero cross • Serial
Timer Counter			**Timer Counter 1 : 8-bit x 1** (Event Count) Clock Source .....System Clock, XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....System Clock, XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2 Cascade connection to timer counter 1 possible **Watchdog Timer**
Serial Interface			**Serial : 8-bit x 1** (Synchronous Type) Clock Source .....System Clock, $\overline{SBT}$ Pin Input
I/O Ports	**I/O**	**32**	• Joint use : 28 • Specified pull-up Resistor available : 24 (Software Programmable) • Specified output architecture available : Nch Open drain / Push-pull : 32 (Software Programmable)
	Input	**8**	• Joint use : 3 • Specified pull-up Resistor available : 8 (Software Programmable)
	Output	**4**	• Joint use : 6 • 8ch LED direct drive OK (20mA / 1.3V)
A/D Inputs			10-bit x 8ch (with S/H)
LCD			31-Segment x 4-Common • 1/2, 1/3, 1/4 Duty 32-Segment x 3-Common • 1/2, 1/3 Duty
Special Ports			Buzzer Output (1kHz, 2kHz, 4kHz : fosc=at 4MHz) AC Zero-cross Input
Package			QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=4MHz		2.0	5.0	mA
Supply Current at HALT	IDD2	fosc=4MHz		0.6	1.2	mA
Supply Current at STOP	IDD3	fxi=32.768kHz		8.0	16.0	μA
	IDD4			1.0	5.0	μA

(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Relative Error		Vref+=5V, Vref–=0V			±3	LSB
A/D Conversion Time		fosc=4MHz			54	μs
Analog Input Voltage	VIA		Vref–		Vref+	V

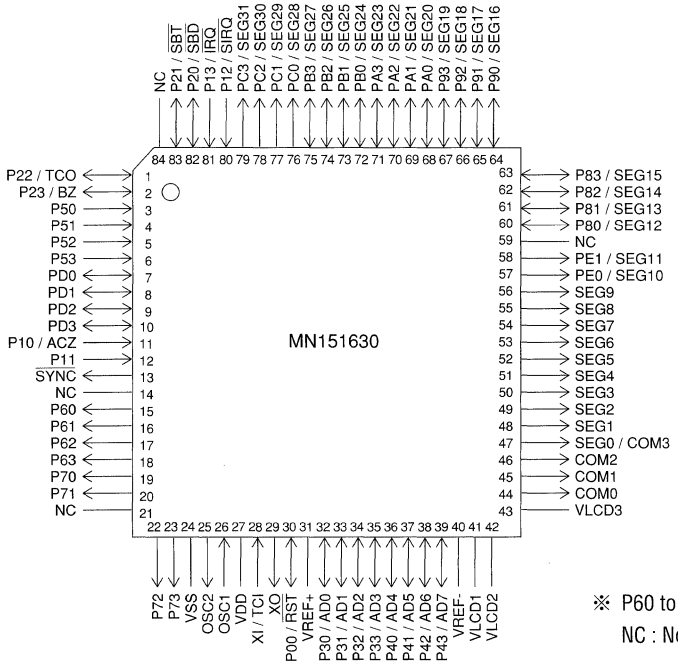
(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1500 + PX-PRB151630

EPROM built-in Type Use **MN15P1630** (ES (Engineering Sample) available) in QFP084-P-1818 package.

Pin Configuration



※ P60 to P73 : High current output port
NC : Nothing connected with terminal.

QFP084-P-1818

1700 4-bit SERIES

MN1700 Series

MN1700 Series

The MN1700 Series includes the finest 4-bit microcomputers and provides functions and speeds that come close to those of 8-bit microcomputers.

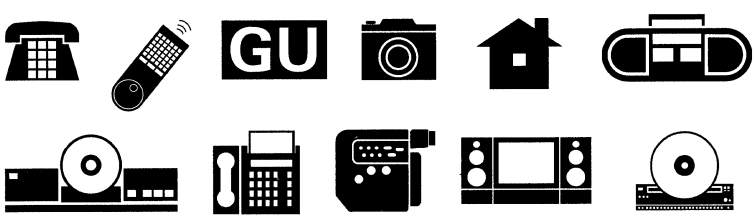
As for hardware, this series has the features of high-speed instruction execution time, large memory size, enhanced- interrupts, -timer, and-serial ports.

And also, instruction execution efficiency is enhanced, especially for frequently used instruction sets.

Features

- **The highest Class 4-bit Controller**
  High-speed 0.5 µs (6MHz) instruction execution
  Maximum ROM size: 16k-words (linear space)
  Maximum RAM size: 4k-nibbles
- **10-bit ROM for Higher Instruction Efficiency**
  10 bits per instruction assures that 80% of the instructions can be executed in one machine cycle
- **Numerous General-purpose Registers**
  Eight general-purpose registers
  Register stack: 96 nibbles
- **Built-in EPROM Type**
  Testing is surely available for all types with internal EPROMs.
- **High-level Language Support**
  The high-level language CL/1 is used for software development.

■ **Applications**



❑ MN170401 / 0801 / 1601A

Type			**MN170401 / 0801 / 1601A**
ROM (x10-bit)			4K / 8K / 16K
RAM (x4-bit)			256 + Stack 96 / 512 + Stack 96 / 896 + Stack 96
Minimum Instruction Execution Time	With Main Clock operated		**0.5µs (at 4.5 to 5.5V, 6.0MHz)**
	With Sub-clock operated		**91.6 µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Connectable Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input **Serial B : 8-bit x 1** (Synchronous Type) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTB}}$ Pin Input Connectable Serial A + Serial B
I/O Ports	**I/O**	**50**	• Joint use : 26 • Specified pull-up Resistor available : 50 (Mask Option) • Input/Output selectable : 50 (P0, P1, PE : by -bit, P4~D : by -port)
	Input	**7**	• Joint use : 6 • Specified pull-up Resistor available : 7 (Mask Option)
Special Ports			Buzzer Output
Package			SDIP064-P-0750, QFP064-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	VDD=5V, fosc=6MHz		10	20	mA
Operating Supply Current	IDD2	VDD=3V, fx=32kHz		50	100	µA
Supply Current at STOP	IDD4			0.1	10	µA
Supply Current at HALT	IDD3	VDD=5V, fosc=6MHz		2	5	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

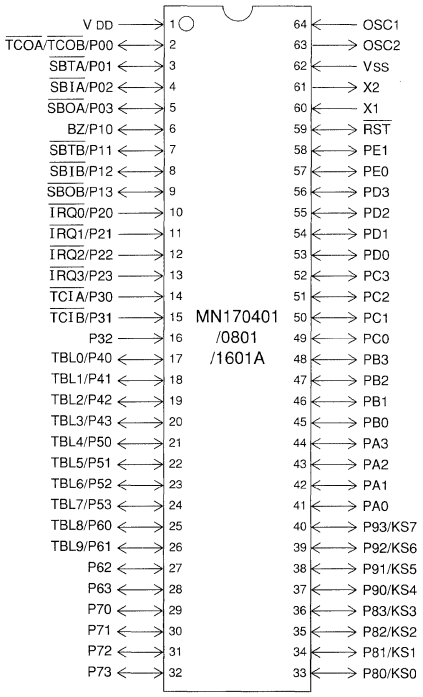
In-Circuit Emulator

PX-ICE1700 + PX-PRB173201

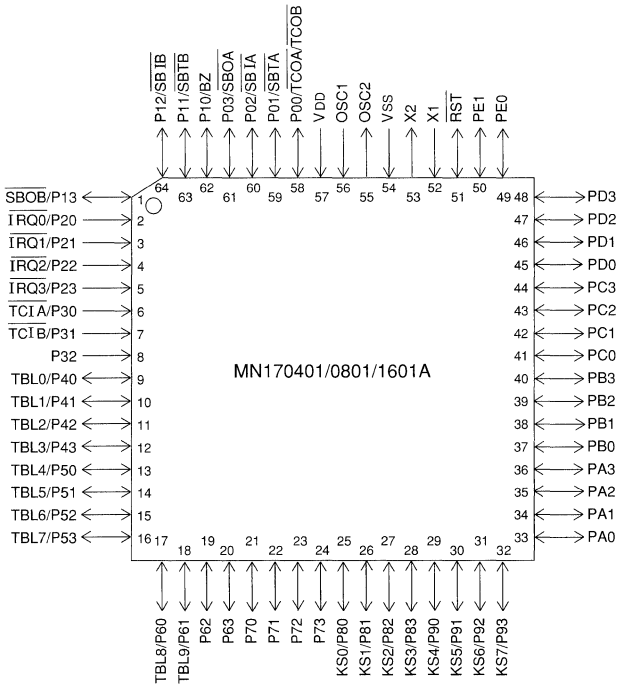
EPROM built-in Type

Use **MN17P1601** in SDIP064-P-0750 or QFP064-P-1818 package.

Pin Configuration



SDIP064-P-0750



QFP064-P-1818

❑ MN171202 / 1602

Type			**MN171202 / 1602**
ROM (x10-bit)			12K / 16K
RAM (x4-bit)			896 + Stack 96
Minimum Instruction Execution Time			With Main Clock operated **0.5µs (at 4.5 to 5.5V, 6.0MHz)** With Sub-clock operated **91.6µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Connectable Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input **Serial B : 8-bit x 1** (Synchronous Type) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTB}}$ Pin Input Connectable Serial A + Serial B
I/O Ports	**High Voltage I/O**	**16**	• Pch Open-drain (Breakdown Voltage -30V) : FLP Driver : 16 • Specified pull-down Resistor available : 16 (Mask Option) • Input/Output selectable : 16 (by -bit)
	I/O	**20**	• Joint use, Specified pull-up Resistor available : 20 (Mask Option) • Input/Output selectable : 20 (by -bit)
	Input	**4**	• Joint use, Specified pull-up Resistor available : 4 (Mask Option)
	High Voltage Output	**16**	• Pch Open-drain (Breakdown Voltage -30V) : FLP Driver : 16 • Specified pull-down Resistor available : 16 (Mask Option)
FPL			16 Segments x 16 Columns
Special Ports			Buzzer Output
Package			SDIP064-P-0750

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	VDD=5V, fosc=6MHz		10	20	mA
	IDD2	VDD=3V, fx=32kHz		50	100	µA
Supply Current at STOP	IDD4			0.1	10	µA
Supply Current at HALT	IDD3	VDD=5V, fosc=6MHz		2	5	mA

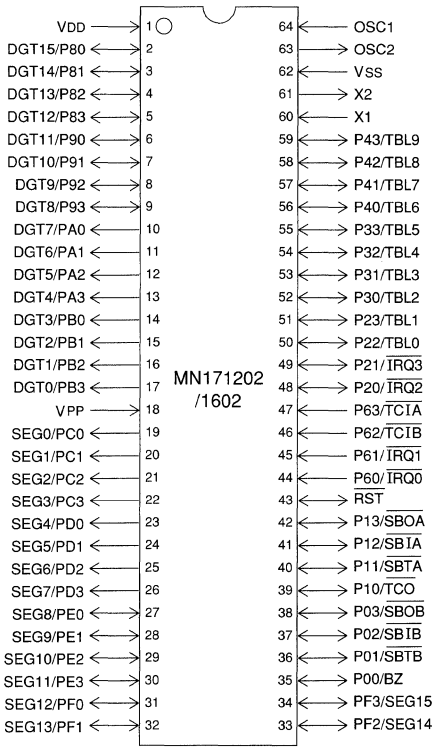
(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1700 + PX-PRB173202

EPROM built-in Type Use **MN17P1602** in SDIP064-P-0750 package.

Pin Configuration



SDIP064-P-0750

❑ MN170803A / 1603

Type			**MN170803A / 1603**
ROM (x10-bit)			8K / 16K
RAM (x4-bit)			512 + Stack 96 / 896 + Stack 96
Minimum Instruction Execution Time	With Main Clock operated		**Without frequency dividing 0.5µs (at 4.5 to 5.5V, 6.0MHz)** **At 1/2 frequency dividing 1.0µs (at 3.0 to 5.5V, 6.0MHz)**
	With Sub-clock operated		**91.6µs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Connectable Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission /Reception of variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input **Serial B : 8-bit x 1** (Synchronous Type) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTB}}$ Pin Input Connectable Serial A + Serial B
I/O Ports	**I/O**	**48**	• Joint use : 47 • Specified pull-up Resistor available : 48 (Mask Option) • Input/Output selectable : 48 (P0, P1 : by -bit, P4~PD : by -port)
	Input	**4**	• Joint use : 4 • Specified pull-up Resistor available : 4 (Mask Option)
A/D Inputs			8-bit x 8ch (with S/H)
LCD			36 Segment • 4 Common • Static, 1/2, 1/3, 1/4 Duty
Special Ports			Buzzer Output, Remote Control Transmission/Reception
Notes			Carrier Generator Circuit for Remote Controller built-in, Remote Control Input Noise Filter built-in LCD Driver Circuit, A/D built-in Type
Package			QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=6MHz		10	20	mA
	IDD2	VDD=3V, fx=32kHz		50	100	µA
Supply Current at STOP	IDD4			0.1	10	µA
Supply Current at HALT	IDD3	fosc=6MHz		2	5	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Asolute Error		AVDD=5V, AVSS=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=6MHz		4.5		µs
Analog Input Voltage	VADIN		V_{AVSS}		V_{AVDD}	V

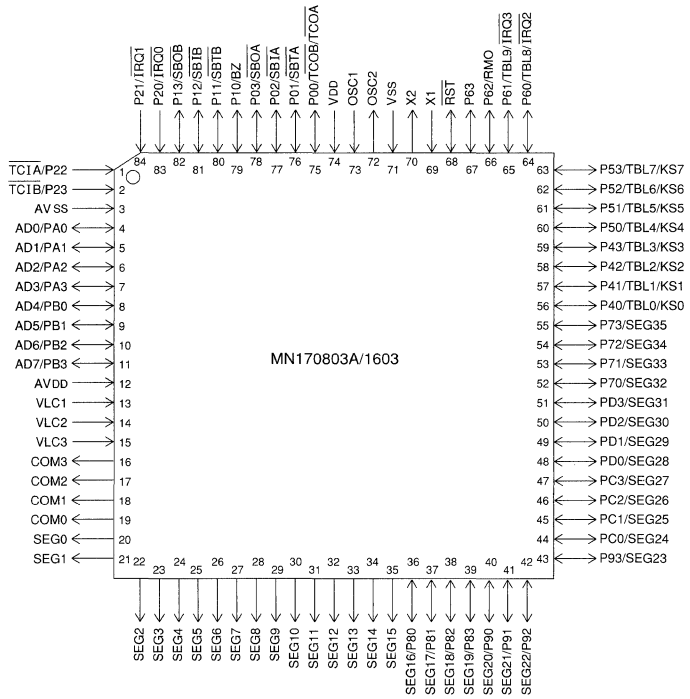
(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1700 + PX-PRB173203

EPROM built-in Type Use **MN17P1603** (ES (Engineering Sample) available) in QFP084-P-1818 package.

Pin Configuration



QFP084-P-1818

❑ MN170804 / 1604

Type			**MN170804 / 1604**
ROM (x10-bit)			8K / 16K
RAM (x4-bit)			512 + Stack 96 / 896 + Stack 96
Minimum Instruction Execution Time			With Main Clock operated **0.5µs (at 4.5 to 5.5V, 6.0MHz)** With Sub-clock operated **91.6µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Cloc Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock (Connectable) Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input **Serial B : 8-bit x 1** (Synchronous Type) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTB}}$ Pin Input (Connectable) Serial A + Serial B
I/O Ports	**I/O**	**48**	• Joint use : 34 • Specified pull-up Resistor available : 48 (Mask Option) • Input/Output selectable : 48 (P0, 1 : by -bit, P4~PD : by -port)
	Input	**7**	• Joint use : 6 • Specified pull-up Resistor available : 7 (Mask Option)
A/D Inputs			8-bit x 8ch (with S/H)
Special Ports			Buzzer Output
Notes			A/D Add-on Type of MN17XX01
Package			MN170804 : SDIP064-P-0750, QFH064-1212, QFP064-P-1818 MN171604 : SDIP064-P-0750, QFH064-1212

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	VDD=5V, fosc=6MHz		10	20	mA
	IDD2	VDD=3V, fx=32kHz		50	100	µA
Supply Current at STOP	IDD3			0.1	10	µA
Supply Current at HALT	IDD4	VDD=5V, fosc=6MHz		2	5	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		AVDD=5V, AVSS=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=6MHz			4.5	µs
Analog Input Voltage	VADIN		VAVSS		VAVDD	V

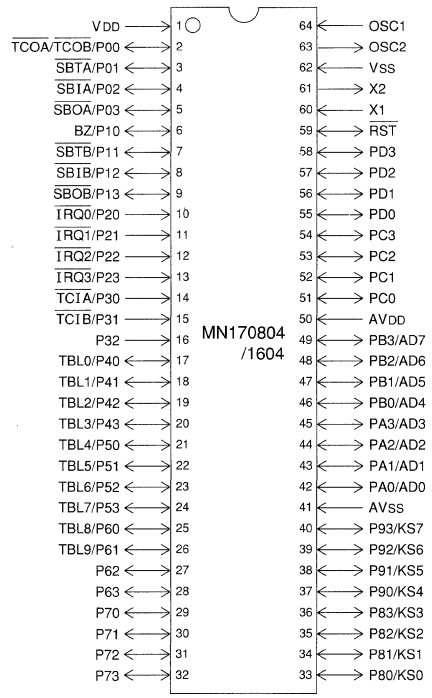
(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

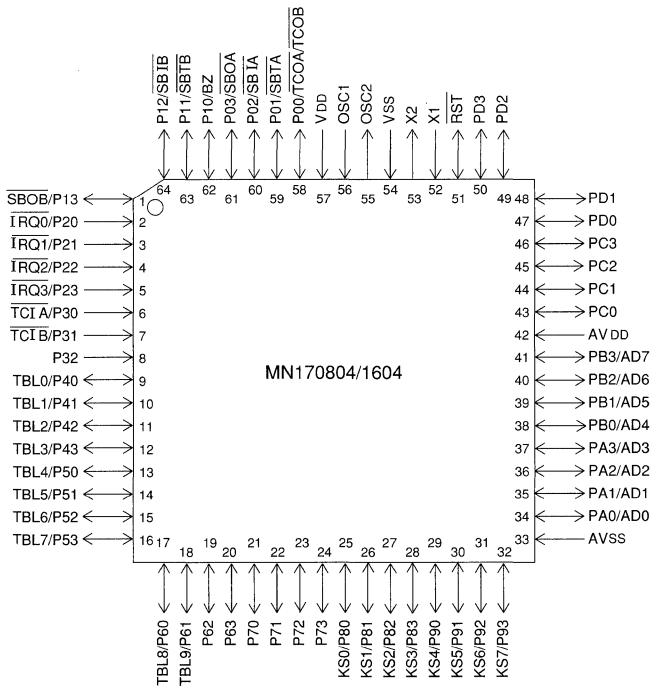
In-Circuit Emulator PX-ICE1700 + PX-PRB173204

EPROM built-in Type Use **MN17P1604** (ES (Engineering Sample) available) in SDIP064-P-0750 / QFP064-P-1818 package.

Pin Configuration



SDIP064-P-0750



QFH064-P-1212 (MN170804 / 1604)
QFP064-P-1818 (MN170804)

❑ MN171608

Type			**MN171608**
ROM (x10-bit)			16K
RAM (x4-bit)			896 + Stack 96
Minimum Instruction Execution Time		With Main Clock operated	**0.5µs (at 4.5 to 5.5V, 6.0MHz)** **3µs (at 2.5 to 5.5V, 1MHz)**
		With Sub-clock operated	**91.6µs (2.5 to 5.5V, at 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • Timer A • Serial A • External 2 / SBIA • Key • Timer B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock (Connectable) Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input 16-bit Transmission/Reception possible
I/O Ports	**I/O**	**26**	• Joint use : 26 • Specified pull-up Resistor available : 26 (Mask Option) • Input/Output selectable : 26 (P0, 1 : by -bit, P6, 8, 9, C, D : by -port)
	Input	**8**	• Joint use : 8 • Specified pull-up Resistor available : 8 (Mask Option)
LCD			32 Segment • 4 Common • Static, 1/2, 1/3, 1/4 Duty
Special Ports			Buzzer Output, Remote Control Transmission/Reception
Notes			Carrier Generator Circuit for Remote Controller built-in, Remote Control Input Noise Filter built-in LCD Driver Circuit
Package			QFP064-P-1414

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	VDD=5V, fosc=6MHz			20	mA
	IDD2	VDD=3V, fx=32kHz			100	µA
Supply Current at STOP	IDD4			0.1	10	µA
Supply Current at HALT	IDD3	VDD=5V, fosc=6MHz			5	mA

(Ta= −10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

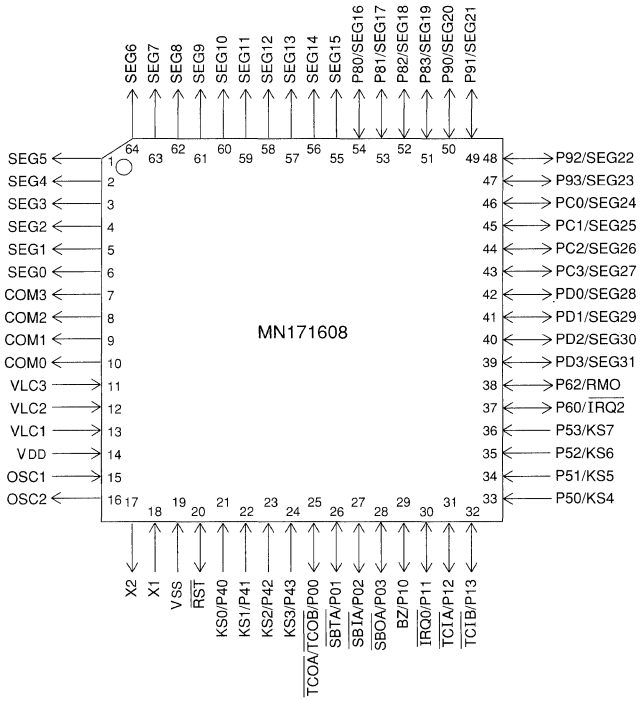
In-Circuit Emulator

PX-ICE1700 + PX-PRB173208 (under development)

EPROM built-in Type

Use **MN17P1608** (ES (Engineering Sample) available) in QFP064-P-1414 package.

Pin Configuration



QFP064-P-1414

❑ MN171609

Type			**MN171609**
ROM (x10-bit)			16K + Table ROM 4K
RAM (x4-bit)			896 + Stack 96
Minimum Instruction Execution Time			With Main Clock operated **At 1/2 frequency dividing 2.27µs (at 2.0 to 3.6v, 2.64MHz)** With Sub-clock operated **91.6µs (at 2.0 to 3.6V, 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count) Clock Source .....System Clock, OSC Oscillation Clock, XI Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count) Clock Source .....System Clock, OSC Oscillation Clock, XI Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock (Connectable) Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Receive of variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Output Clock, $\overline{\text{SBTA}}$ Pin Input **Serial B : 8-bit x 1** (Synchronous Type) Clock Source .....OSC Oscillation Clock 1/8, Timer Output Clock, $\overline{\text{SBTB}}$ Pin Input (Connectable) Serial A + Serial B
I/O Ports	**I/O**	**48**	• Joint use : 40 • Specified pull-up Resistor available : 48 (Mask Option) • Input/Output selectable : 48 (P0, 1 : by -bit, P4~D : by -port)
	Input	**4**	• Joint use : 4 • Specified pull-up Resistor available : 4 (Mask Option)
LCD			Static, 36 Segment / 1/2 Duty, 36 Segment / 1/3 Duty, 36 Segment / 1/4 Duty
Special Ports			Buzzer Output, Remote Control Transmission/Reception
Notes			Carrier Generator Circuit for Remote Controller built-in, Remote Control Input Noise Filter built-in LCD Driver Circuit
Package			QFP084-p-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	VDD=3V, fosc=2.64MHz		1.8	5.4	mA
	IDD2	VDD=3V, FX=32kHz			100	μA
Supply Current at STOP	IDD4	Oscillation halt (OSC, X)		0.1	10	μA
Supply Current at HALT	IDD3	VDD=3V, fosc=2.64MHz			1.0	mA

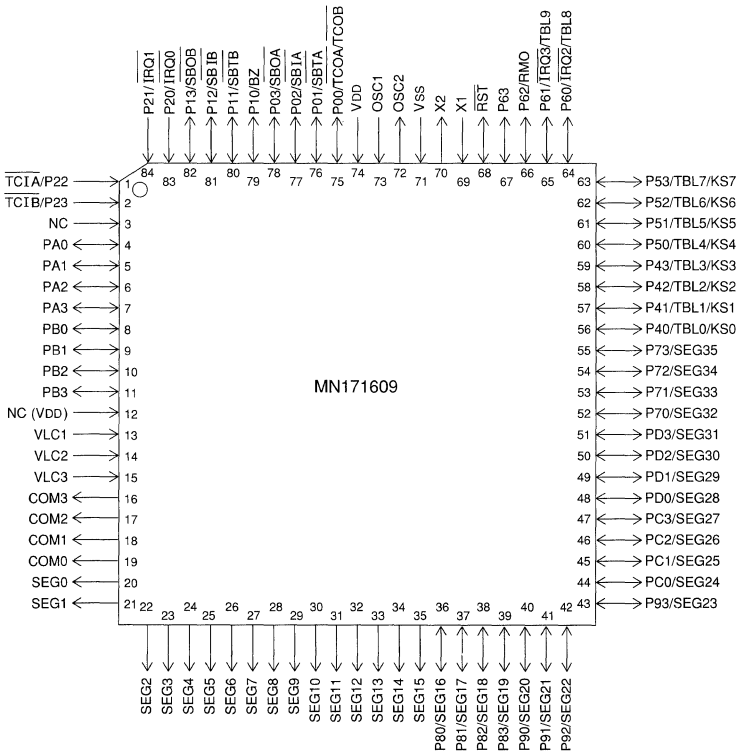
(Ta= –20 to +70°C, VDD=3.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1700 + PX-PRB173209 (under development)

EPROM built-in Type Use **MN17P1609** (ES (Engineering Sample) available).

Pin Configuration



QFP084-p-1818

NC : Nothing connected with terminal

❑ MN172412

Type			**MN172412**
ROM (x10-bit)			16K + Table ROM 4K
RAM (x4-bit)			896 + Stack 96
Minimum Instruction Execution Time			With Main Clock operated **0.5µs (at 4.5 to 5.5V,6.0MHz)** With Sub-clock operated **91.6µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock (Connectable) Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Receptionof variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input **Serial B : 8-bit x 1** (Synchronous Type) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTB}}$ Pin Input (Connectable) Serial A + Serial B
I/O Ports	**High Voltage I/O**	**32**	• Specified pull-down Resistor available : 32 (Mask Option) • FLP Breakdown Voltage (-30V) : 32 • Input/Output selectable : 32 (by -bit)
	I/O	**24**	• Joint use : 24 • Specified pull-up Resistor available : 24 (Mask Option) • Input/Output selectable : 24 (by -bit) • LED Driver : 4 (15mA, 2V)
	Input	**4**	• Joint use : 4 • Specifited pull-up Resistor available : 4 (Mask Option)
	High Voltage Output	**16**	• Specifited pull-down Resistor available : 16 (Mask Option) • FLP Breakdown Voltage (-30V) : 16
FLP			16 Segments x 32 Digits
Special Ports			Buzzer Output
Notes			High Voltage Pin of MN171602, Table ROM Add-on Type
Package			QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=6MHz		10	20	mA
	IDD2	VDD=3V, fx=32kHz		50	100	µA
Supply Current at STOP	IDD4			0.1	10	µA
Supply Current at HALT	IDD3	fosc=6MHz		2	5	mA

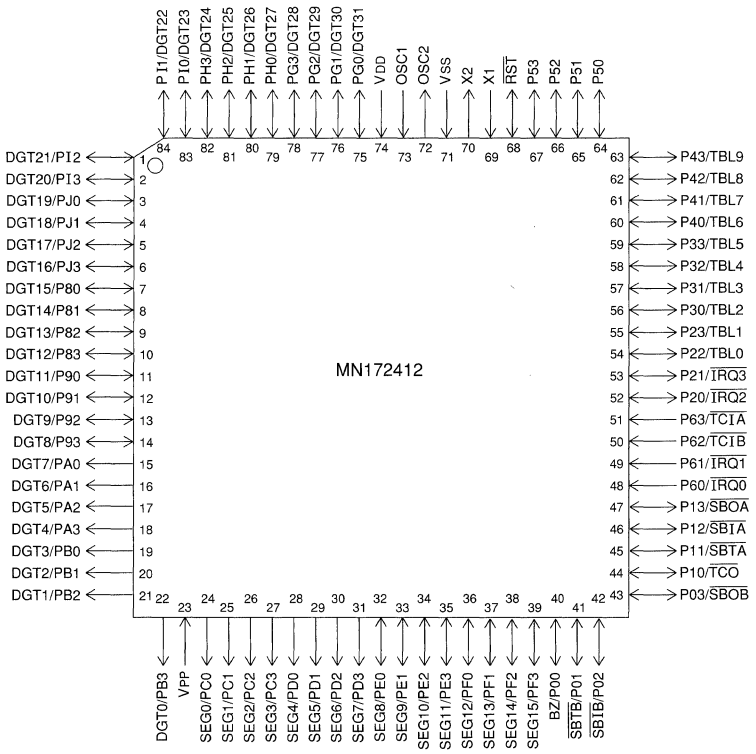
(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1700 + PX-PRB173212

EPROM built-in Type Use **MN17P3212**.

Pin Configuration



QFP084-P-1818

❑ MN173222

Type		**MN173222**
ROM (x10-bit)		32K
RAM (x4-bit)		1408 + Stack 128
Minimum Instruction Execution Time	With Main Clock operated	**0.5µs (at 4.5 to 5.5V,6MHz)**
	With Sub-clock operated	**91.6µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts	• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B	
Timer Counter	**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator)	
	Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input	
	Interrupt Source .....Overflow of Timer Counter A	
	Timer Counter B : 8-bit x 1 (Timer Output, Event Count, Synchronous Serial Clock Generator)	
	Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input	
	Interrupt Source .....Overflow of Timer Counter B	
	Time Base Counter (Time Base)	
	Clock Source .....OSC Oscillation Clock, X Oscillation Clock	
	Interrupt Source .....Overflow of Time Base Counter	
	Counter for Clock (Clock function)	
	Clock Source .....OSC Oscillation Clock, X Oscillation Clock	
	(Connectable) Timer Counter A + Timer Counter B	
Serial Interface	**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Receptionof variable bit length, Start Condition function)	
	Clock Source .....OSC Oscillation Clock 1/8*, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input	
	Serial B : 8-bit x 1 (Synchronous Type)	
	Clock Source .....OSC Oscillation Clock 1/8*, Timer Counter Output, $\overline{\text{SBTB}}$ Pin Input	
	(Connectable) Serial A + Serial B	
	*1/2 prescaler minimum	

I/O Ports	**High Voltage I/O**	**32**	• Specified pull-down Resistor available : 32 (Mask Option) • FLP Breakdown Voltage (-30V) : 32 • Input/Output selectable : 32 (by -bit)
	I/O	**24**	• Joint use : 24 • Specified pull-up Resistor available : 24 (Mask Option) • Input/Output selectable : 24 (by -bit) • LED Driver : 4 (15mA, 2V)
	Input	**4**	• Joint use : 4 • Specified pull-up Resistor available : 4 (Mask Option)
	High Voltage Output	**16**	• Specifited pull-down Resistor available : 16 (Mask Option) • FLP Breakdown Voltage (-30V) : 16

FLP	16 Segments x 32 Digits
Special Ports	Buzzer Output
Notes	MN172412 and PIN compatible parts, expanded program area
Package	QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8.5MHz		9	18	mA
	IDD2	VDD=3V, fx=32kHz		40	80	µA
Supply Current at STOP	IDD4			0.1	10	µA
Supply Current at HALT	IDD3	fosc=6.0MHz		2	5	mA

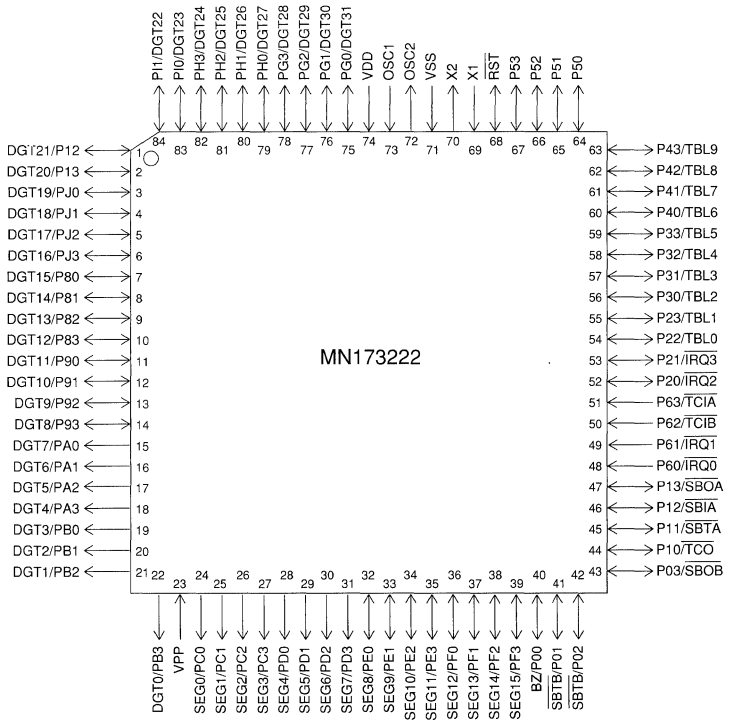
(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1700 + PX-PRB173222 (under development)

EPROM built-in Type Use **MN17P3222**.

Pin Configuration



QFP084-P-1818

❑ MN170805 / 1605

Type			**MN170805 / 1605**
ROM (x10-bit)			8K / 16K
RAM (x4-bit)			1536 + Stack 96 / 1920 + Stack 96
Minimum Instruction Execution Time		With Main Clock operated	**At 1/1 frequency dividing 0.84µs (at 3.6 to 5.5V, 3.58MHz)** **At 1/2 frequency dividing 1.68µs (at 2.5 to 5.5V, 3.58MHz)**
		With Sub-clock operated	**91.6µs (at 2.5 to 5.5V, 32.768kHz)**
Interrupts			• RESET • Time Base • External 0 • External 1 • Timer A • Serial A • External 2 / SBIA • External 3 / Key • Timer B • Serial B
Timer Counter			**Timer Counter A : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter A **Timer Counter B : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....System Clock, OSC Oscillation Clock, X Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter B **Time Base Counter** (Time Base) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Interrupt Source .....Overflow of Time Base Counter **Counter for Clock** (Clock function) Clock Source .....OSC Oscillation Clock, X Oscillation Clock Connectable Timer Counter A + Timer Counter B
Serial Interface			**Serial A : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, Start Condition function) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTA}}$ Pin Input **Serial B : 8-bit x 1** (Synchronous Type) Clock Source .....OSC Oscillation Clock 1/8, Timer Counter Output, $\overline{\text{SBTB}}$ Pin Input Connectable Serial A + Serial B
I/O Ports	**High Voltage I/O**	**13**	• Nch Open-drain (Breakdown Voltage 10V) : 13 • Specifi ed pull-up Resistor available : 13 (Mask Option) • Input/Output selectable : 13 (PF~I by -port)
	I/O	**52**	• Joint use : 32 • Specified pull-up Resistor available (Mask Option) • Input/Output selectable : 52 (P4~E : by -port, P0, 1 : by -bit)
	Input	**8**	• Joint use : 6 • Specified pull-up Resistor available : 8 (Mask Option)
A/D Inputs			8-bit x 8ch (with S/H)
Special Ports			TONE Output, DTMF Output, Buzzer Output
Notes			DTMF, A/D built-in Type, Large RAM Capacity Version
Package			QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=3.58MHz		8	16	mA
	IDD2	VDD=3V, fx=32kHz		50	100	µA
Supply Current at STOP	IDD4			0.1	10	µA
Supply Current at HALT	IDD3	fosc=3.58MHz		2	4	mA

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		AVDD=5V, AVSS=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=3.58MHz		7.54		µs
Analog Inpout Voltage	VADIN		V_{AVSS}		V_{AVDD}	V

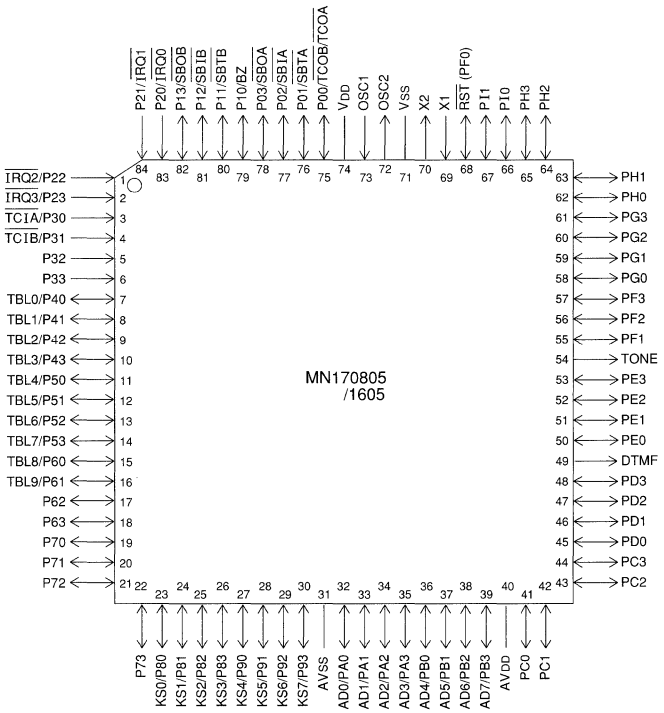
(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1700 + PX-PRB173205

EPROM built-in Type Use **MN17P1605** (ES(Engineering Sample) available in QFP084-P-1818 package.

Pin Configuration



QFP084-P-1818

1870 8-bit SERIES

MN1870 Series

MN1870 Series

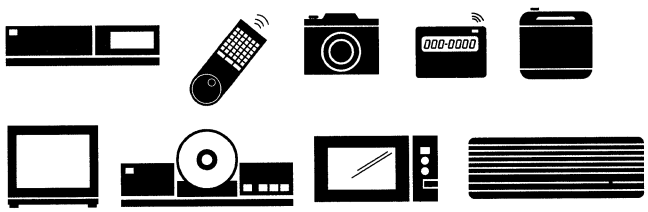
The MN1870 Series 8-bit microcomputers are ideal for applications ranging from increasingly high-tech consumer electronics to industrial field.

Based on the MN1880 Series, these microcomputers are compact enough for consumer electronics. This series provides an abundance of the peripheral functions required for each field of application in consumer electronics.

Features

- **High-speed, High-performance 8-bit Controllers Optimized for Consumer Applications**
  - High execution speed of 0.5 µs (8MHz)
  - Maximum ROM capacity of 64kbytes
- **Numerous and Powerful Peripheral Functions**
  - Timer, serial, remote control, A/D convertor, D/A convertor, channel selection, FLP display, LCD display, OSD.
- **Memory-oriented Architecture**
  - Operations can be performed directly between memories. The results of operations can also be written directly into memory.
- **Further Line-up of Internal EPROM Types**
  - Testing is surely assured by using the internal EPROM type before mask ROM products.
- **High-level Language Support**
  - The high-level language CL/1 is used for software development.

■ **Applications**



❑ MN187124 / 164 / 204 / 244 / 324

Type		**MN187124 / 164 / 204 / 244 / 324**
ROM (x8-bit)		12K / 16K / 20K / 24K / 32K
RAM (x8-bit)		384 / 512 / 640 / 768 / 960
Minimum Instruction Execution Time	With Main Clock operated	**0.477µs (at 4.5 to 5.5V, 8.38MHz)**
	With Sub-clock operated	**122µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts	• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Serial 0 • Serial 1 • Key Scan • Auto RAM Data Transmission	

Timer Counter

Timer Counter 0 : 8-bit x 1 (Event Count, Synchronous Serial Clock Generator, Pulse Width Measurement)
- Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock
  1/1, 1/4, 1/16, 1/64 of External Clock Input
- Interrupt Source .....Overflow of Timer Counter 0

Timer Counter 1 : 8-bit x 1 (Timer Output)
- Clock Source .....1/16, 1/64, 1/256, 1/512 of System Clock, OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 8-bit x 1 (Clock function, Time Base)
- Clock Source .....1/4096 of System Clock, 1/128 of XI Oscillation Clock
- Interrupt Source .....1/1, 1/2, 1/4, 1/8 dividing

Timer Counter 3 : 8-bit x 1 (Event Count)
- Clock Source .....1/1, 1/4, 1/16 of System Clock, External Clock Input
- Interrupt Source .....Overflow of Timer Counter 3

Watchdog Timer : 2-bit x 1 (Watchdog)
- Clock Source .....1/16384 of System Clock
- Interrupt Source .....Reset at Overflow

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Transmission/Reception of variable bit length, MSB/LSB selectable, Clock Polarity selectable, Start Condition function)
- Clock Source .....1/1, 1/8, 1/16 of System Clock, Timer 0 Output Clock, $\overline{\text{SBTO}}$ Pin Input, P20 Pin Input

Serial 1 : 8-bit x 1 (Synchronous Type) (Transmssion/Reception of variable bit length, MSB/LSB selectable, Start Condition function)
- Clock Source .....1/1, 1/8, 1/16 of System Clock, $\overline{\text{SBT1}}$ Pin Input, Timer 0 Output Clock

(Connectable) Serial 0 + Serial 1

I/O Ports	**High Voltage I/O**	**18**	• Pch Open-drain (Breakdown Voltage -30V) : FL Driver : 18 • Specified pull-down Resistor available : 16 (Mask Option) • Specified pull-up Resistor available : 2 (Mask Option)
	I/O	**18**	• Joint use : 13 • Specified pull-up Resistor available : 13 (Mask Option) • Input/Output selectable : 18 (by -bit)
	Input	**2**	• Joint use : 2 • Specified pull-up Resistor available : 2 (Mask Option)
	High Voltage Output	**16**	• Pch Open-drain (Breakdown Voltage -30V) : FL Driver : 16

FLP	16 to 10 Segments x 10 to 16 Columns
PWM	14-bit x 1ch (Repetition Cycle 15.6ms, at 4.19MHz)
Special Ports	Buzzer Output, Hsync detection, Remote Control Receive, Simple A/D (4-bit x 3ch), DMA
Package	SDIP064-P-0750, QFP064-P-1818

Electrical Characteristics

Supply Current

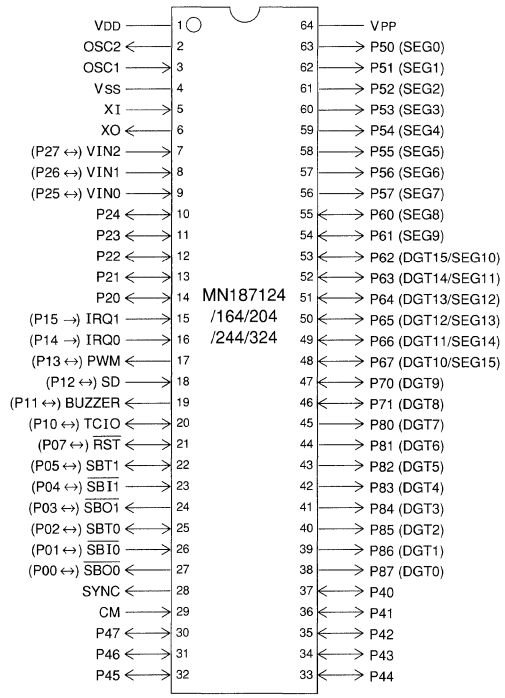
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8.38MHz			30	mA
	IDD2	fosc=32kHz, VDD=3V			200	µA
Supply Current at STOP	IDD3	VDD=3V			20	µA

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

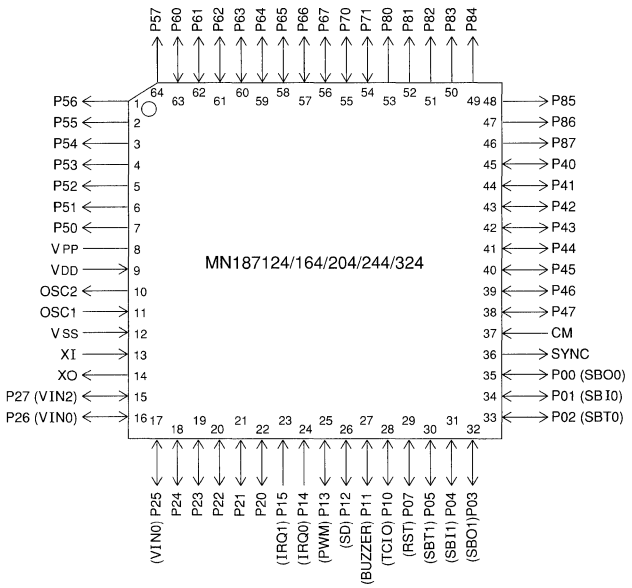
Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB187324
Piggyback	Use **EP187324** as piggy in SDIP064-P-0750 / QFP064-P-1818 package. EP187324 is corresponded to MN187124/164/204.
EPROM built-in Type	Use **MN18P7324** in SDIP064-P-0750 / QFP064-P-1818 package.

Pin Configuration



SDIP064-P-0750



QFP064-P-1818

P40 to P47, P60 to P67, P70, P71 : High Voltage I/O
P50 to P57, P84 to P87 : High Voltage Input

❑ MN1871610 / 2410 / 3210 / 2456 / 3256

Type			**MN1871610 / 2410 / 3210 / 2456 / 3256**
ROM (x8-bit)			16K / 24K / 32K / 24K / 32K
RAM (x8-bit)			1024 / 1536 / 1536 / 1536 / 1152
Minimum Instruction Execution Time			With Main Clock operated **0.667µs (at 4.5 to 5.5V, 6.00MHz)***1 With Sub-clock operated **122µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts			• RESET • External 0 • External 1 / Remote Control Input • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Serial 0 • Serial 1 • Key Input • Auto RAM Data Transmission
Timer Counter			**Timer Counter 0 : 8-bit x 1** (Event Count, Synchronous Serial Clock Generator, Pulse Width Measurement) Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock, 1/1, 1/4, 1/16, 1/64 of External Clock Input Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Timer Output) Clock Source .....1/16, 1/64, 1/256, 1/512 of System Clock, OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Clock function, Time Base) Clock Source .....1/4096 of System Clock, 1/128 of XI Oscillation Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Event Count) Clock Source .....1/1, 1/4, 1/16 of System Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 3 **Watchdog Timer : 2-bit x 1** (Watchdog) Clock Source .....1/16384 of System Clock Interrupt Source .....Reset at Overflow
Serial Interface			**Serial 0 : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, MSB/LSB selectable, Clock Polarity selectable, Start Condition function) Clock Source .....1/1, 1/8, 1/16 of System Clock, Timer 0 Output Clock, $\overline{\text{SBT0}}$ Pin Input, P30 Pin Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transmission/Recetion of variable bit length, MSB/LSB selectable, Start Condition function) Clock Source .....1/1, 1/8, 1/16 of System Clock, $\overline{\text{SBT1}}$ Pin Input, Timer 0 Output Clock (Connectable) Serial 0 + Serial 1
I/O Ports	**I/O**	**54**	• Joint use : 52 • Specified pull-up Resistor available : 14 (Mask Option) • Input/Output selectable (P0 to 4 : by 1-bit P5 to 7 : by 8-bit)
	Input	**2**	• Joint use : Pull-up Resistor available : 2 (Mask Option)
A/D Inputs			8-bit x 8ch (with S/H)
LCD			50 Segment • 4 Common • 1/2, 1/3, 1/4 Duty
PWM			14-bit x 1ch (Repetition Cycle 15.6ms, at 4.19MHz)
Special Ports			Buzzer Output, Remote Control Transmission/Reception

Notes

Carrier Generator Circuit for Remote Controller built-in, Remote Control Data Detection Circuit built-in

*1 8.38 MHz operation is possible only for the mask ROM version of the MN1871610, MN1872456, MN1873256.

The built-in EPROM version of the MN1872410/3210 operates at up to 6 MHz.

Package

QFP100-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8.38 / 6.00MHz			30	mA
	IDD2	fxi=32kHz, VDD=2.7V			200	µA
Supply Current at STOP	IDD3	VDD=3.0V			20	µA
Supply Current at HALT	IDD4	VDD=2.7V			50	µA

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=5V, Vref–=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=4.19MHz	8.59			µs
Reference Input Voltage	Vref+		Vref–		VDD	V
	Vref–		VSS		Vref+	V
Analog Input Voltage	VADIN		Vref–		Vref+	V

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator

PX-ICE1870 / 80 + PX-PRB1873210

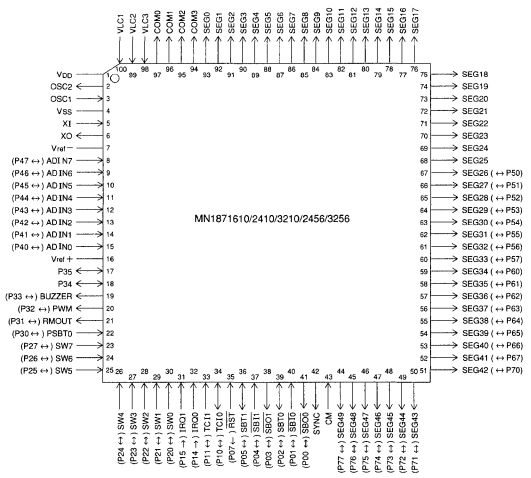
Piggyback

Use **EP1873210** as piggy in QFP100-P-1818 package.

EPROM built-in Type

Use **MN18P73210** (under development) in QFP100-P-1818 package.

Pin Configuration



QFP100-P-1818

❑ MN1871215

Type			MN1871215
ROM (x8-bit)			12K
RAM (x8-bit)			384
Minimum Instruction Execution Time			With Main Clock operated **0.477µs (at 4.5 to 5.5V, 8.38MHz)** With Sub-clock operated **122µs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts			• RESET • External 0 • External 1 / Remote Control Input • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Serial 0 • Serial 1 • Key Input • Auto RAM Data Transmission
Timer Counter			**Timer Counter 0 : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator) Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock, 1/1, 1/4, 1/16, 1/64 of External Clock Input Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Timer Output) Clock Source .....1/16, 1/64, 1/256, 1/512 of System Clock, OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Clock function, Time Base) Clock Source .....1/4096 of System Clock, 1/128 of XI Oscillation Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Event Count) Clock Source .....1/1, 1/4, 1/16 of System Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 3 **Watchdog Timer** Clock Source .....1/16384 of System Clock Interrupt Source .....Overflow
Serial Interface			**Serial 0 : 8-bit x 1** (Synchronous Type) (MSB/LSB selectable, Clock Polarity selectable, Start Condition function, Transmission/Reception of variable bit length) Clock Source .....1/1, 1/8, 1/16 of System Clock, 1/2 of Timer 0, $\overline{\text{SBT0}}$ Pin Input **Serial 1 : 8-bit x 1** (Synchronous Type) (MSB/LSB selectable, Start Condition function, Transmission /Reception of variable bit length) Clock Source .....1/1, 1/8, 1/16 of System Clock, 1/2 of Timer 0, $\overline{\text{SBT1}}$ Pin Input (Connectable) Serial 0 + Serial 1
I/O Ports	I/O	54	• Joint use : 52 • Specified pull-up Resistor available : 14 (Mask Option)
	Input	2	• Joint use : 2 • Specified pull-up Resistor available : 2 (Mask Option)
A/D Inputs			8-bit x 8ch (with S/H)
LCD			34 Segment • 4 Common • 1/2, 1/3, 1/4 Duty
PWM			14-bit x 1ch (Repetition Cycle 15.6ms, at 4.19MHz)
Special Ports			Buzzer Output, Remote Control Transmission/Reception
Notes			Carrier Generator Circuit for Remote Controller built-in, Remote Control Data Detection Circuit built-in
Package			QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8.38MHz			30	mA
	IDD2	fx=32kHz, VDD=3V			200	µA
Supply Current at STOP	IDD3	VDD=3V			20	µA
Supply Current at HALT	IDD4	VDD=3V			50	µA

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=5.0V, Vref–=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=4.19 / 8.38MHz			8.82	µs
Reference Input Voltage	Vref+		Vref–		VDD	V
Analog Input Voltage			Vref–		Vref+	V

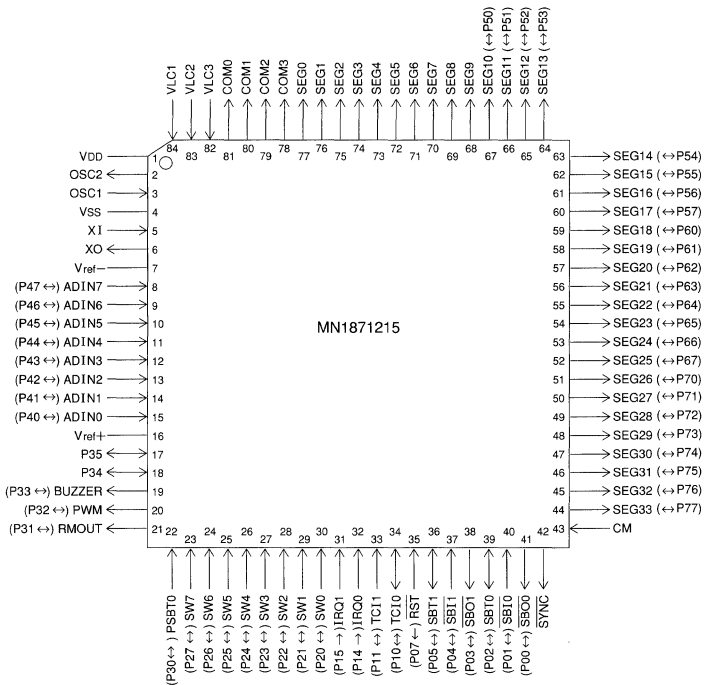
(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1870 / 80 + PX-PRB1873215

Piggyback Use **EP1873215** as piggy in QFP084-P-1818 package.

Pin Configuration



QFP084-P-1818

❑ MN1872423 / 3223 / 4023 / 4823

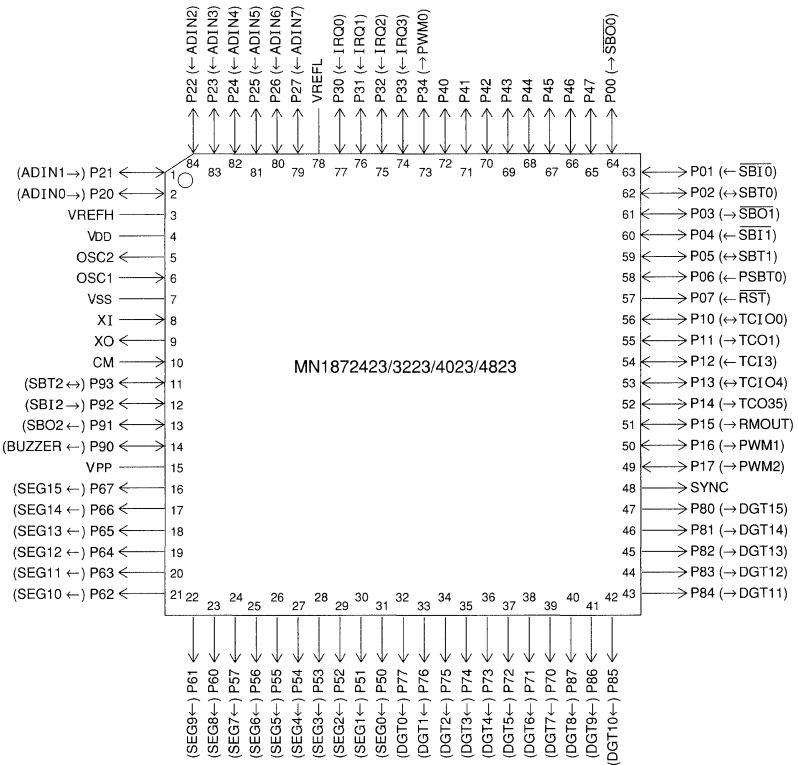
Type	**MN1872423 / 3223 / 4023 / 4823**
ROM (x8-bit)	24K / 32K / 40K / 48k
RAM (x8-bit)	512 / 1024 / 1024 / 1024
Minimum Instruction Execution Time	With Main Clock operated **0.477µs (at 4.3 to 5.5V, 8.38MHz)** With Sub-clock operated **122µs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts	• RESET • External 0 • External 1 • External 2 • External 3 • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Timer 5 • Serial 0 • Serial 1 • Serial 2 • Key Scan • Auto RAM Data Transmission • Reserve
Timer Counter	**Timer Counter 0 : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator, Pulse Width Measurement) Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock, 1/1, 1/4, 1/16, 1/64 of Timer 2 (Clock Flag), 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock, 1/1, 1/4, 1/16, 1/64 of External Clock Input Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Timer Output) Clock Source .....1/16, 1/64, 1/256 of System Clock, OSC Oscillation Clock, Overflow of Timer 0 Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Clock function, Time Base) Clock Source .....1/4096 of System Clock, 1/128 of XI Oscillation Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Timer Output, Event Count, PWM Output, Synchronous Output (1-bit x 1ch)) Clock Source .....1/4, 1/16 of System Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 3 **Timer Counter 4 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/4, 1/16 of System Clock, OSC Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 4 **Timer Counter 5 : 8-bit x 1** (Timer Output, Synchronous Output (1-bit x 1ch)) Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock, 1/1, 1/4, 1/16, 1/64 of Overflow of Timer Counter 4 Interrupt Source .....Overflow of Timer Counter 5 **Watchdog** (Connectable) Timer Counter 0 + Timer Counter 2, Timer Counter 4 + Timer Counter 5
Serial Interface	**Serial 0 : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, MSB/LSB selectable, Clock Polarity selectable, Start Condition function, DMA function) Clock Source .....1/1, 1/8, 1/16 of System Clock, Timer Output Clock, $\overline{\text{SBT0}}$ Pin Input, PSBT0 Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, MSB/LSB selectable, Start Condition function, DMA function) Clock Source .....1/1, 1/8, 1/16 of System Clock, Timer Output Clock, $\overline{\text{SBT1}}$ Pin Input **Serial 2 : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, MSB/LSB selectable, Clock Polarity selectable, Start Condition function, DMA function) Clock Source .....1/1, 1/8, 1/16 of System Clock, Timer Output Clock, $\overline{\text{SBT2}}$ Pin Input (Connectable) Serial 0 + Serial 1

I/O Ports	**I/O**	**41**	• Joint use : 33 • Specified pull-up Resistor available : 33 (Software Programmable) • Specified pull-down Resistor available : 8 (Software Programmable)
	High Voltage Output	**32**	• Pch Open-drain (Breakdown Voltage -30V) : FL Driver : 32 • Specified pull-down Resistor available : 16 (Mask Option)
A/D Inputs			8-bit x 8ch (with S/H)
FLP			16 Segments x 16 Columns
PWM			14-bit x 1ch (Repetition Cycle 15.6ms, at 4.19MHz), 8-bit x 2ch (Repetition Cycle 244µs, at 4.19MHz)
Special Ports			Buzzer Output, 1 (Synchronous Output), Remote Control Transmission
Notes			Carrier Generator Circuit for Remote Controller built-in
Package			QFP084-P-1818

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1876423
Piggyback	Use **EP1876423** as piggy in QFP084-P-1818 package. **EP1876423** is corresponded to **MN1872423**.
EPROM built-in Type	Use **MN18P76423** (under development) in QFP084-P-1818 package.

Pin Configuration



QFP084-P-1818E

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8.38MHz, VDD=5V			20	mA
	IDD2	fxi=32kHz, VDD=3V		50	100	µA
Supply Current at STOP	IDD3	fxi=32kHz, VDD=3V			10	µA

(Ta= –20 to +70°C, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		VrefH=5V, VrefL=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=4.19 / 8.38MHz			8.82	µs
Reference Input Voltage	VrefH		VrefL		VDD	V
	VrefL		VSS		VrefH	V
Analog Input Voltage	VADIN		VrefL		VrefH	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

❑ MN1872457

Type			**MN1872457**
ROM (x8-bit)			24K
RAM (x8-bit)			768
Minimum Instruction Execution Time			With Main Clock operated **0.475µs (at 3.5 to 5.5V, 8.4MHz)** With Sub-clock operated **122µs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts			• RESET • External 0 • External 1 • External 2 • External 3 • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Serial 0 • Serial 1 • Key Scan • Auto RAM Data Transmission • Reserve
Timer Counter			**Timer Counter 0 : 8-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator, Pulse Width Measurement) Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock, 1/1, 1/4, 1/16, 1/64 of Timer 2 (Clock Flag), 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock, 1/1, 1/4, 1/16, 1/64 of External Clock Input Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Timer Output) Clock Source .....1/16, 1/64, 1/256, of System Clock, OSC Oscillation Clock, Overflow of Timer Counter 0 Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Clock function, Time Base) Clock Source .....1/4096 of System Clock, 1/128 of XI Oscillation Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Event Count) Clock Source .....1/1, 1/4, 1/16 of System Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 3 **Watchdog**
Serial Interface			**Serial 0 : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length MSB/LSB selectable,Clock Polarity selectable, Start Condition function) Clock Source .....1/8, 1/16, 1/32 of System Clock, Timer Clock, $\overline{\text{SBT0}}$ Pin Input, PSBT0 Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, MSB/LSB selectable, Start Condition function) Clock Source .....1/1, 1/8, 1/16 of System Clock, $\overline{\text{SBT1}}$ Pin Input, Timer Clock (Connectable) Serial 0 + Serial 1
I/O Ports	**I/O**	**30**	• Joint use : 22 • Specified pull-up Resistor available : 18 (Software Programmable) • Specified pull-down Resistor available : 8 (Software Programmable)
	Input	**1**	• Joint use : 1
	High Voltage Output	**26**	• Pch Open-drain (Breakdown Voltage -30V) : FL Driver : 26 • Specified pull-down Resistor available : 16 (Mask Option)
A/D Inputs			8-bit x 4ch (with S/H)
FLP			8 to 16 Segments x 10 to 18 Columns
PWM			14-bit x 1ch (Repetition Cycle 15.6ms, at 4.19MHz), 8-bit x 1ch (Repetition Cycle 244µs, at 4.19MHz)
Special Ports			Buzzer Output, Remote Control Reception
Package			QFH064-P-1414B

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8.4MHz			20	mA
	IDD2	fx=32kHz, VDD=3V		50	200	µA
Supply Current at STOP	IDD3	VDD=3V			10	µA

(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		VrefH=5V, VrefL=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=4.19 / 8.38MHz			8.82	µs
Analog Input Voltage	VADIN		VSS		VDD	V

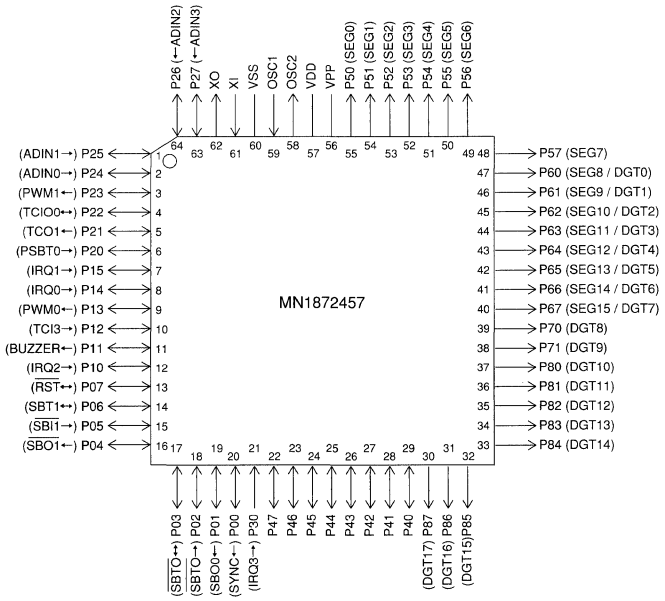
(Ta= –10 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE 1870 / 80 + PX-PRB1876457

EPROM built-in Type Use **MN18P73257** QFP064-P-1414B package.

Pin Configuration



QFH064-P-1414B

❑ MN1873260

Type	MN1873260
ROM (x8-bit)	32K
RAM (x8-bit)	1152
Minimum Instruction Execution Time	With Main Clock operated **0.475µs (at 2.7 to 5.5V, 8.38MHz)** With Sub-clock operated **122µs (at 2.2 to 5.5V, 32kHz)**
Interrupts	• RESET • External • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Serial 0 • Serial 1 • Serial 2 • Auto RAM Data Transmission • Reserve
Timer Counter	**Timer Counter 0 : 8-bit x 1** (Reload Function, Counter Halt) Clock Source .....1/1, 1/8, 1/16 of System Clock, 1/8192 of XI Oscillation Clock Interrupt Source .....Underflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Reload Function, Counter Halt) Clock Source .....1/1, 1/32, of System Clock, OSC Oscillation Clock,1/1 of XI Oscillation Clock Interrupt Source .....Underflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Reload Function, Timer Output, Counter Halt) Clock Source .....1/4, 1/16, 1/64 of System Clock, 1/2 of External Clock Input Interrupt Source .....Underflow of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Reload Function, Event Count, Timer Output, Counter Halt) Clock Source .....1/1, 1/32 of System Clock, 1/1 of XI Oscillation Clock, 1/2 of External Clock Input Interrupt Source .....Underflow of Timer Counter 3 **Timer Counter 4 : 8-bit x 1** (Reload Function, Event Count, Timer Output, Counter Halt, PWM Output) Clock Source .....1/1, 1/4 of System Clock, 1/16 of XI Oscillation Clock, 1/2 of External Clock Input Interrupt Source .....Underflow of Timer Counter 4 **Wathdog : 14-bit x 1** (Watchdog) Clock Source .....1/32768 of System Clock Interrupt Source .....Reset at 1/216 of System Clock
Serial Interface	**Serial 0, 1 : 8-bit x 1** (Synchronous Type, Transmission/Reception of variable bit length, MSB/LSB selectable,Clock Polarity selectable, Start Condition function) Clock Source .....1/1, 1/8, 1/16 of System Clock, 1/2 of Timer 3 Output Clock Serial 0 : $\overline{SBT0}$ Pin Input, $\overline{PSBT0}$ Pin Input Serial 1 : $\overline{SBT1}$ Pin Input **Serial 2 : 8-bit x 1** (Synchronous Type, I²C, UART selectable) Simple I²C : Dedicated single master, 8-bit+ACK bit length transmission / reception, start state, stop state Simple UART : Start + 5- to 8-bit + 1- or 2- step timer setting transmission rate Clock Source .....1/8, 1/32, 1/128 of System Clock, 1/8 of Timer 4 Output Clock Connectable Serial 0 + Serial 1 Upward compatible with MN1500 series MN1500 / MN1700 / MN1860 / MN1870 / MN1880 series
I/O Ports | I/O	**53** • Joint use : 53 • Input/Output selectable (by 1-bit)
A/D Inputs	10-bit x 8ch (with S/H)
PWM	8-bit x 2ch (Repetition Cycle 244µs, at 4.19MHz)
Special Ports	Buzzer Output
Notes	AC Zero-cross Function
Package	QFS064-P-1414A

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8.38			20	mA
	IDD2	fxI=32kHz, VDD=3V			100	µA
Supply Current at STOP	IDD3	VDD=3V			10	µA
Supply Current at HALT	IDD4	VDD=3V			20	µA

(Ta= –30 to +85°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=5V, Vref-=0V			±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=4.19MHz	8.6			µs
Reference Input Voltage			Vref-		VDD	V
			VSS		Vref+	V
Analog Input Voltage	VIA		Vref-		Vref+	V

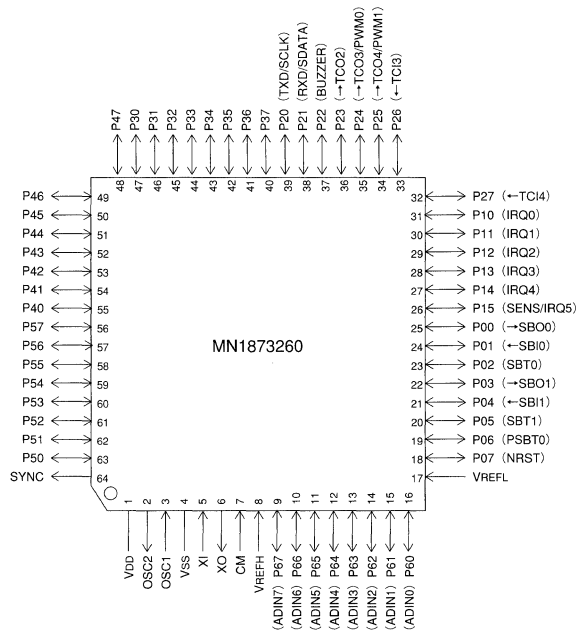
(Ta= –30 to +85°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE 1870 / 80 + PX-PRB1873260

EPROM built-in Type Use **MN18P76460** QFS064-P-1414 package.

Pin Configuration



QFS064-P-1414

❑ MN1871274

Type			**MN1871274 (ES (Engineering Sample) available)**
ROM (x8-bit)			12K
RAM (x8-bit)			256
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • Remote Control •MOSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8, Timer Counter 2 **Watchdog**
I/O Ports	**I/O**	**20**	• Joint use : 10 • General use : 10
	Input	**1**	• Joint use : 1
A/D Inputs			5-bit x 10ch (without S/H)
PWM			14-bit x 1ch, 8-bit x 5ch
Special Ports			Hsync detection, Remote Control Reception
CRTC			Single OSD built-in (Menu OSD : 12 x 18, 128 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP042-P-0600

Electrical Characteristics

A/D Converter Characteristics

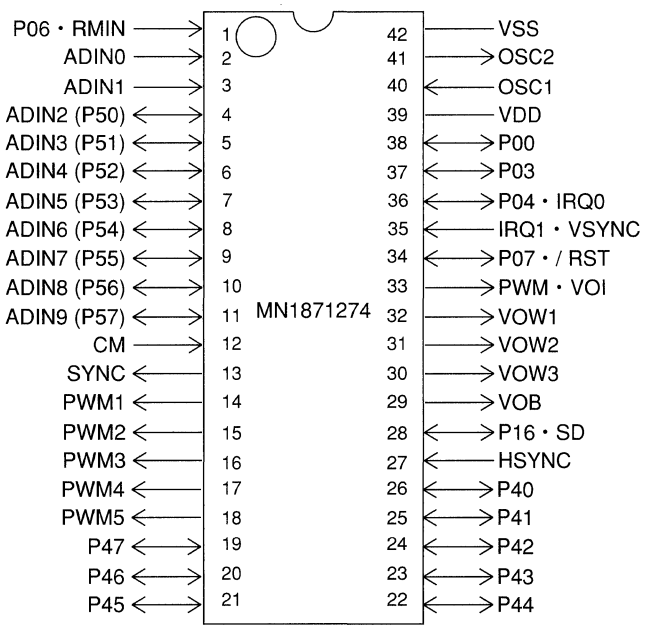
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error	TDA	fosc=12MHz	9			us
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870/80+PX-PRB1876476
EPROM built-in Type	Use **EP18P76476** with converting P-board from SDIP064-P-0750 to SDIP042-P-0600. Use **MN18P73284** (under development).

Pin Configuration



SDIP042-P-0600

❑ MN1871681

Type			**MN1871681 (under development)**
ROM (x8-bit)			16K
RAM (x8-bit)			320
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • I²C • Remote Control • MOSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog Timer**
Serial Interface			**I²C x 1** (Two bus line system)
I/O Ports	**I/O**	**20**	• Joint use : 12 • General use : 8
	Input	**1**	• Joint use : 1
A/D Inputs			5-bit x 10ch (without S/H)
PWM			14-bit x 1ch, 8-bit x 5ch (All PWM are 5V ; not connectable to 12V systems)
Special Ports			Hsync detection, Remote Control Reception
CRTC			Single OSD built-in (Menu OSD : 12 x 18, 256 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP042-P-0600

Electrical Characteristics

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9			μs
Analog Input Voltage	VAD		VSS		VDD	V

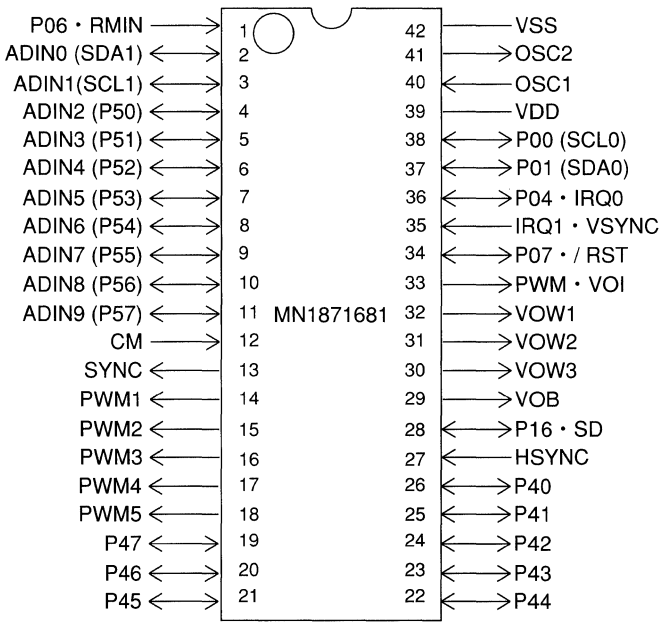
(Ta= –20 to+70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1870 / 80+PX-PRB1876476

EPROM built-in Type Use **MN18P76476** with converting P-board from SDIP064-P-0750 to SDIP042-P-0600.
Use **MN18P73284** (under development).

Pin Configuration



SDIP064-P-0750

❑ MN1873284

Type			**MN1873284 (under development)**
ROM (x8-bit)			32K
RAM (x8-bit)			640
Minimum Instruction Execution Time			**2/3 dividing 0.5µs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • I²C • Remote Control • MOSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog Timer**
Serial Interface			**I²C x 1** (Two bus line system)
I/O Ports	**I/O**	**20**	• Joint use : 12 • General use : 8
	Input	**1**	• Joint use : 1
A/D Inputs			5-bit x 10ch (without S/H)
PWM			14-bit x 1ch, 8-bit x 5ch (All PWM are 5V ; not connectable to 12V systems)
Special Ports			Hsync detection, Remote Control Reception
CRTC			Single OSD built-in (Caption Menu : 12 x 18, 320 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP042-P-0600

Electrical Characteristics

A/D Converter Characteristics

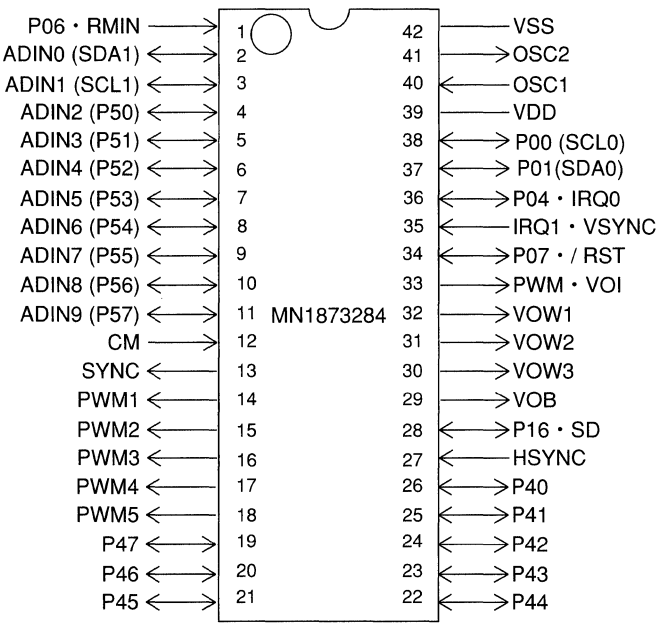
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9			µs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to+70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80+PX-PRB1876476
EPROM built-in Type	Use **MN18P76476** witn converting P-board from SDIP064-P-0750 to SDIP042-P-0600. Use **MN18P73284** (under development).

Pin Configuration



SDIP042-P-0600

❑ MN1871675

Type			**MN1871675**
ROM (x8-bit)			16K
RAM (x8-bit)			320
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • Remote Control • Line 21 • COSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog**
I/O Ports	**I/O**	**21**	• Joint use : 3
	Input	**1**	• Joint use : 1
	High Voltage Output	**7**	• Nch Open-drain (Breakdown Voltage 12V) : 7
A/D Inputs			5-bit x 10ch (without S/H)
PWM			14-bit x 1ch (Repetition Cycle 16μs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32μs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16μs, at 12MHz)
Special Ports			Remote Control Reception
CRTC			Single OSD built-in (Caption OSD : 12 x 26, 144 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

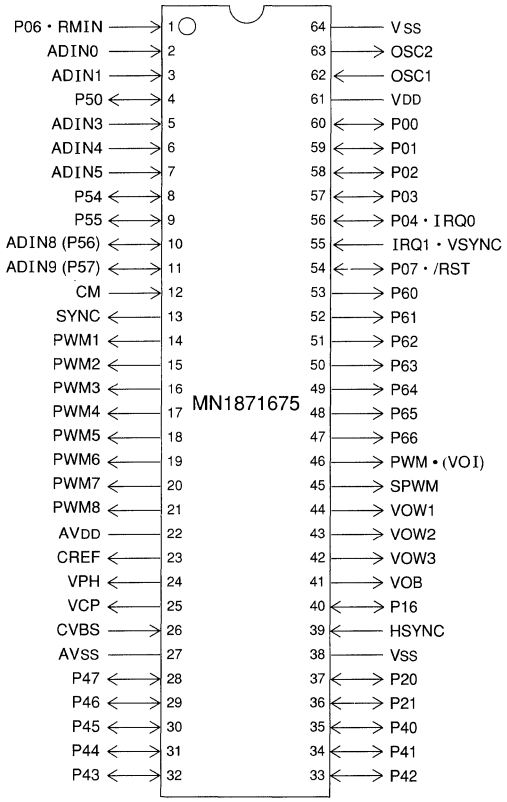
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9			μs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to+70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80, PX-PRB1876476 (under development)
EPROM built-in Type	Use **MN18P76476** in SDIP064-P-0750.

Pin Configuration



SDIP064-P-0750

❑ MN1873265

Type			**MN1873265**
ROM (x8-bit)			32K
RAM (x8-bit)			480
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • Remote Control • Line 21 • COSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog**
I/O Ports	**I/O**	**21**	• Joint use : 3
	Input	**1**	• Joint use : 1
	High Voltage Output	**7**	• Nch Open-drain (Breakdown Voltage 12V) : 7
A/D Inputs			5-bit x 7ch (without S/H)
PWM			14-bit x 1ch (Repetition Cycle 16μs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32μs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16μs, at 12MHz)
Special Ports			Remote Control Reception
CRTC			Single OSD built-in (Caption OSD : 12 x 26, 176 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

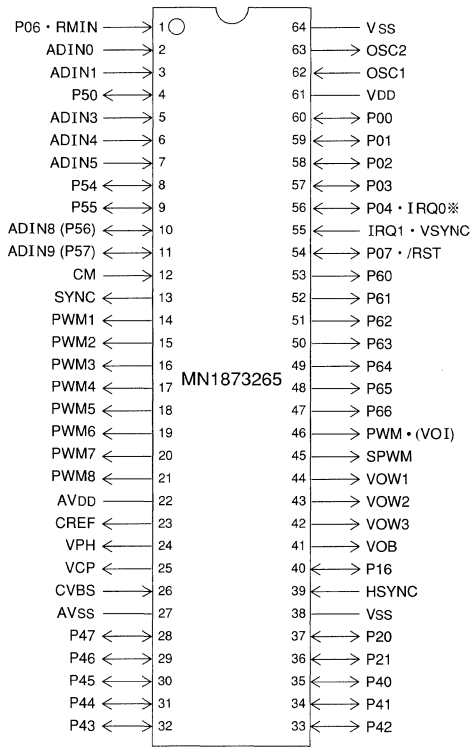
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9			μs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1876462, PX-PRB1876476 (under development)
EPROM built-in Type	Use **MN18P73213** in SDIP064-P-0750 package.

Pin Configuration



SDIP064-P-0750

❑ MN1874083

Type			**MN1874083 (under development)**
ROM (x8-bit)			40K
RAM (x8-bit)			640
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • I²C • Remote Control • Line 21 • COSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog**
Serial Interface			**I²C x 1** (Two bus line system)
I/O Ports	**I/O**	**21**	• Joint use : 5
	Input	**1**	• Joint use : 1
	Output	**7**	• Nch Open-drain : 7
A/D Inputs			5-bit x 7ch (without S/H)
PWM			14-bit x 1ch (Repetition Cycle 16μs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32μs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16μs, at 12MHz) (All PWM are 5V ; not connectable to 12V systems)
Special Ports			Remote Control Reception
CRTC			Single OSD built-in (Caption OSD : 12 x 26, 256 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

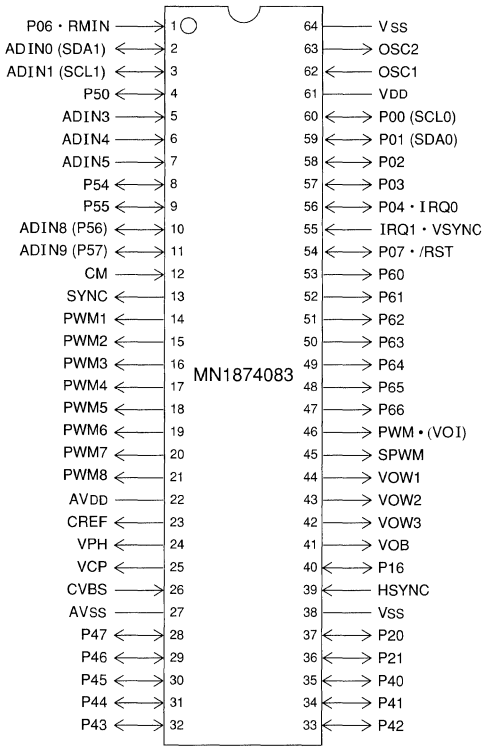
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9			μs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1879682, PX-PRB1879682 (under development)
EPROM built-in Type	Use **MN18P79682** in SDIP064-P-0750 package.

Pin Configuration



SDIP064-P-0750

❑ MN1874085

Type	**MN1874085 (under development)**
ROM (x8-bit)	40K
RAM (x8-bit)	640
Minimum Instruction Execution Time	**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts	• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • Remote Control • Line 21 • COSD
Timer Counter	**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog**

I/O Ports	**I/O**	**21**	• Joint use : 3
	Input	**1**	• Joint use : 1
	Output	**7**	• Nch Open-drain : 7

A/D Inputs	5-bit x 7ch (without S/H)
PWM	14-bit x 1ch (Repetition Cycle 16μs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32μs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16μs, at 12MHz) (All PWM are 5V ; not connectable to 12V systems)
Special Ports	Remote Control Reception
CRTC	Single OSD built-in (Caption OSD : 12 x 26, 256 letters)
Notes	Remote Control Data Detection Circuit built-in
Package	SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

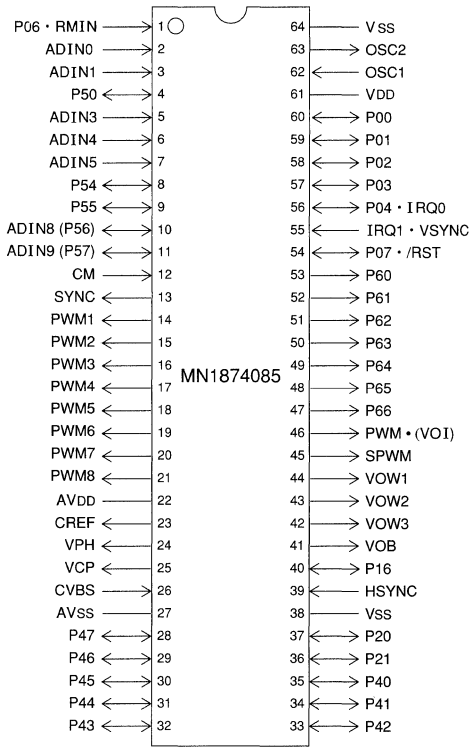
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9			μs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1879682, PX-PRB1879682 (under development)
EPROM built-in Type	Use **MN18P79682** in SDIP064-P-0750 package.

Pin Configuration



SDIP064-P-0750

❑ MN1874876

Type			**MN1874876**
ROM (x8-bit)			48K
RAM (x8-bit)			928
Minimum Instruction Execution Time			**2/3 dividing 0.5µs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • External 2 • External 3 • Timer 0 • Timer 1 • Timer 2 • I²C • Serial • Remote Control • Line 21 • MOSD • COSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog** **Counter for Clock (Clock function)** **AC Counter**
Serial Interface			**Serial 0 : 8-bit x 1** (Transmission/Reception of variable bit length, Transfer direction of MSB/LSB selectable, Clock Polarity selectable, Start Condition function) Clock Source .....System Clock **I²C x 1** (Two bus line system)
I/O Ports	**I/O**	**36**	• Joint use : 28
	Input	**3**	• Joint use : 3
	High Voltage Output	**7**	• Nch Open-drain (Breakdown Voltage 12V) : 7
A/D Inputs			5/7-bit x 10ch (without S/H)
PWM			14-bit x 1ch (Repetition Cycle 16µs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32µs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16µs, at 12MHz)
Special Ports			Hsync Detection, Remote Control Reception
CRTC			Double OSD built-in (Menu OSD : 12 x 18, 256 letters, Caption OSD : 12 x 26, 176 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9/12			µs
Analog Input Voltage	VAD		VSS		VDD	V

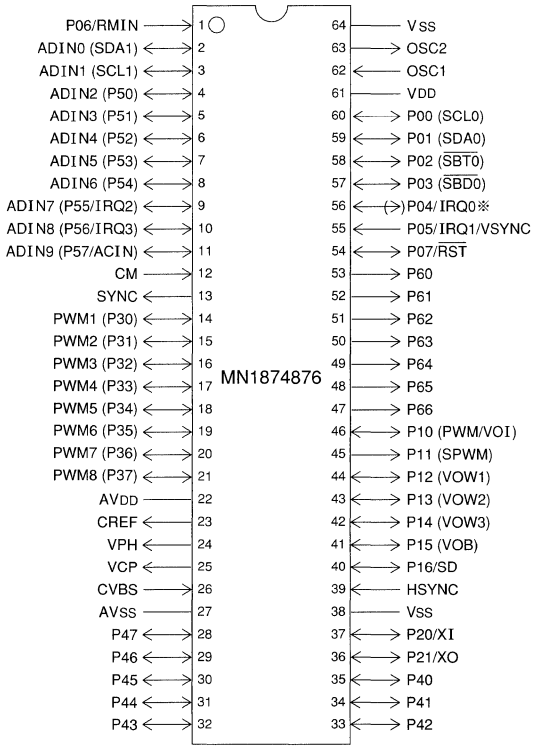
(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1870 / 80 + PX-PRB1876462, PX-PRB1876476 (under development)

EPROM built-in Type Use **MN18P76476** in SDIP064-P-0750

Pin Configuration



SDIP064-P-0750

※P04 • IRQ0 terminal

TYPE A	Stand-by function is availabe	Input terminal
TYPE B	Stand-by function is not available	I/O terminal

❑ MN1874878

Type	**MN1874878**
ROM (x8-bit)	48K
RAM (x8-bit)	928
Minimum Instruction Execution Time	**2/3 dividing 0.5µs (at 4.5 to 5.5V, 12MHz)**
Interrupts	• RESET • External 0 • External 1 • External 2 • External 3 • Timer 0 • Timer 1 • Timer 2 • I²C • Serial • Remote Control • Line 21 • MOSD • COSD
Timer Counter	**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog** Counter for Clock (Clock function) AC Counter
Serial Interface	**Serial 0 : 8-bit x 1** (Transmission / Reception of variable length, Transfer direction of MSB/LSB selectable, Colck Polarity selectable, Start Condition function) Clock Source .....System Clock **I²C x 1** (Two bus line system)

I/O Ports			
	I/O	**36**	• Joint use : 29
	Input	**3**	• Joint use : 3
	High Voltage Output	**7**	• Nch Open-drain (Breakdown Voltage 12V) : 7

A/D Inputs	5/7-bit x 10ch (without S/H)
PWM	14-bit x 1ch (Repetition Cycle 16µs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32µs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16µs, at 12MHz)
Special Ports	Hsync Detection, Remote Control Reception
CRTC	Double OSD built-in (Menu OSD : 12 x 18, 256 letters, Caption OSD : 12 x 26, 176 letters)
Notes	Remote Control Data Detection Circuit built-in, On-chip synchronous separator for caption decoder
Package	SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

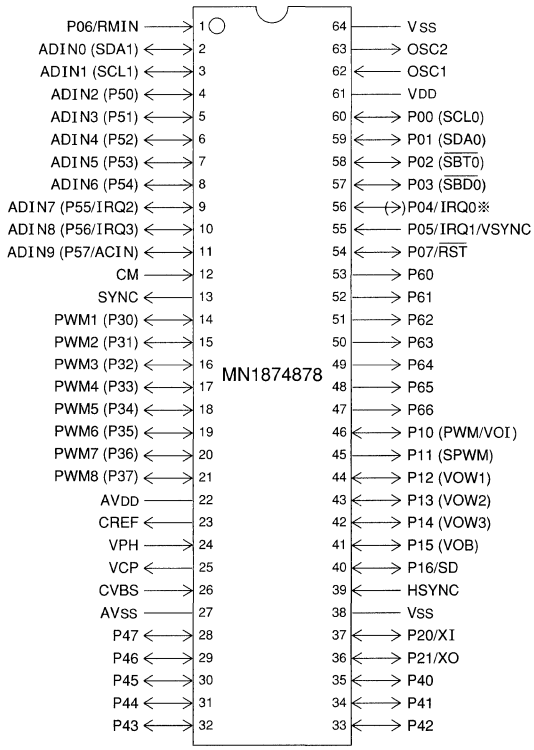
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9/12			µs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1876462, PX-PRB1876476, PX-PRB1879682
EPROM built-in Type	Use **MN18P79682** in SDIP064-P-0750 package. (PWM are 5V ; not connectable to 12V systems)

Pin Configuration



SDIP064-P-0750

※P04 • IRQ0 terminal

TYPE A	Stand-by function is availabe	Input terminal
TYPE B	Stand-by function is not available	I/O terminal

❑ MN1876476

Type			**MN1876476**
ROM (x8-bit)			64K
RAM (x8-bit)			928
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • External 2 • External 3 • Timer 0 • Timer 1 • Timer 2 • I²C • Serial • Remote Control • Line 21 • MOSD • COSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog** **Counter for Clock (Clock function)** **AC Counter**
Serial Interface			**Serial 0 : 8-bit x 1** (Transmission/Reception of variable bit length, Transfer direction of MSB/LSB selectable, Clock Polarity selectable, Start Condition function) Clock Source .....System Clock **I²C x 1** (Two bus line system)
I/O Ports	**I/O**	**36**	• Joint use : 28
	Input	**3**	• Joint use : 3
	High Voltage Output	**7**	• Nch Open-drain (Breakdown Voltage 12V) : 7
A/D Inputs			5/7-bit x 10ch (without S/H)
PWM			14-bit x 1ch (Repetition Cycle 16μs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32μs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16μs, at 12MHz)
Special Ports			Hsync Detection, Remote Control Reception
CRTC			Double OSD built-in (Menu OSD : 12 x 18, 512 letters, Caption OSD : 12 x 26, 176 letters)
Notes			Remote Control Data Detection Circuit built-in
Package			SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9/12			µs
Analog Input Voltage	VAD		VSS		VDD	V

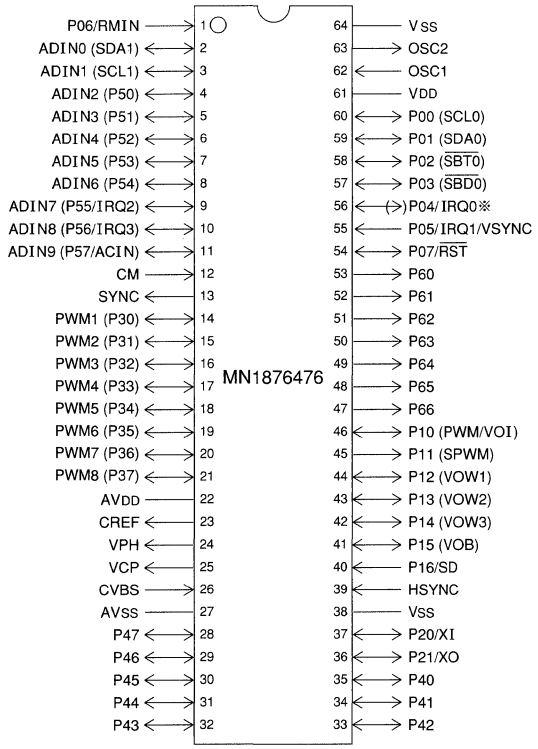
(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1870 / 80 + PX-PRB1876462, PX-PRB1876476 (under development)

EPROM built-in Type Use **MN18P76476** in SDIP064-P-0750 package.

Pin Configuration



SDIP064-P-0750

※ P04 • IRQ0 terminal

TYPE A	Stand-by function is availabe	Input terminal
TYPE B	Stand-by function is not available	I/O terminal

❑ MN1876478

Type			**MN1876478**
ROM (x8-bit)			64K
RAM (x8-bit)			928
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • External 2 • External 3 • Timer 0 • Timer 1 • Timer 2 • I²C • Serial • Remote Control • Line 21 • MOSD • COSD
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog** **Counter for Clock (Clock function)** **AC Counter**
Serial Interface			**Serial 0 : 8-bit x 1** (Transmission/Reception of variable bit length, Transfer direction of MSB/LSB selectable, Clock Polarity selectable, Start Condition function) Clock Source .....System Clock **I²C x 1** (Two bus line system)
I/O Ports	**I/O**	**36**	• Joint use : 29
	Input	**3**	• Joint use : 3
	High Voltage Output	**7**	• Nch Open-drain (Breakdown Voltage 12V) : 7
A/D Inputs			5/7-bit x 10ch (without S/H)
PWM			14-bit x 1ch (Repetition Cycle 16μs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32μs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16μs, at 12MHz)
Special Ports			Hsync Detection, Remote Control Reception
CRTC			Double OSD built-in (Menu OSD : 12 x 18, 512 letters, Caption OSD : 12 x 26, 176 letters)
Notes			Remote Control Data Detection Circuit built-in, On-chip synchronous separator for caption decoder
Package			SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9/12			µs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

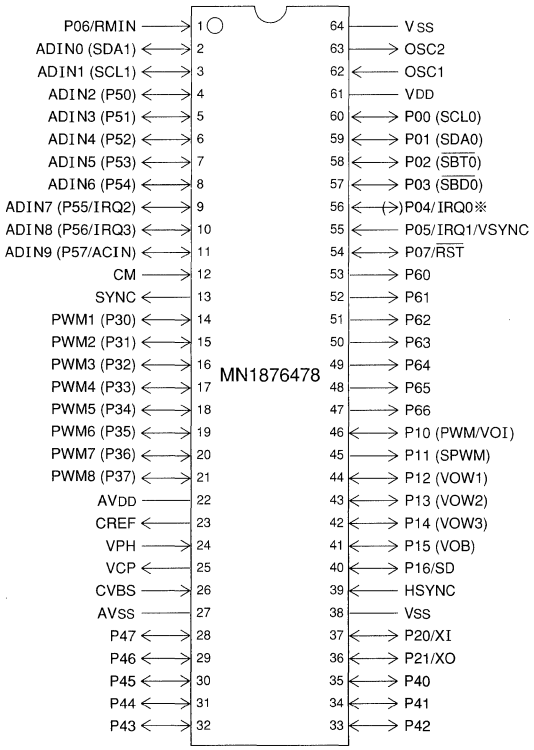
In-Circuit Emulator

PX-ICE1870 / 80 + PX-PRB1876462, PX-PRB1876476, PX-PRB1879682

EPROM built-in Type

Use **MN18P79682** in SDIP064-P-0750 package.
(PWM are 5V ; not connectable to 12V systems)

Pin Configuration



SDIP064-P-0750

※ P04 • IRQ0 terminal

TYPE A	Stand-by function is availabe	Input terminal
TYPE B	Stand-by function is not available	I/O terminal

❑ MN1879682

Type	**MN1879682**
ROM (x8-bit)	96K
RAM (x8-bit)	1248
Minimum Instruction Execution Time	**0.5µs / 0.333µs (at 4.5 to 5.5V, 12MHz) selectable**
Interrupts	• RESET • External 0 • External 1 • External 2 • External 3 • Timer 0 • Timer 1 • Timer 2 • I²C • Serial • Remote Control • Line 21 • MOSD • COSD
Timer Counter	**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock, Counts external input (P54 input) Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog** **Counter for Clock (Clock function)** **AC Counter**
Serial Interface	**Serial 0 : 8-bit x 1** (Transmission/Reception of variable bit length, Transfer direction of MSB/LSB selectable, Clock Polarity selectable, Start Condition function, Data flow undirectional / bidirectional selectable) Clock Source .....System Clock **I²C x 1** (Two bus line system)

I/O Ports	**I/O**	**40**	• Joint use : 33
	Input	**3**	• Joint use : 3
	Output	**7**	• Nch Open-drain : 7

A/D Inputs	5/7-bit x 10ch (without S/H)
PWM	14-bit x 1ch (Repetition Cycle 16µs, at 12MHz), 8-bit x 8ch (Repetition Cycle 32µs, at 12MHz), 7-bit x 1ch (Repetition Cycle 16µs, at 12MHz) (All PWM are 5V ; not connectable to 12V systems)
Special Ports	Hsync Detection, Remote Control Reception
CRTC	Double OSD built-in (Menu OSD : 12 x 18, 512 letters, Caption OSD : 12 x 26, 176 letters)
Notes	Remote Control Data Detection Circuit built-in, On-chip synchronous separator for caption decoder
Package	SDIP064-P-0750

Electrical Characteristics

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9/12			µs
Analog Input Voltage	VAD		VSS		VDD	V

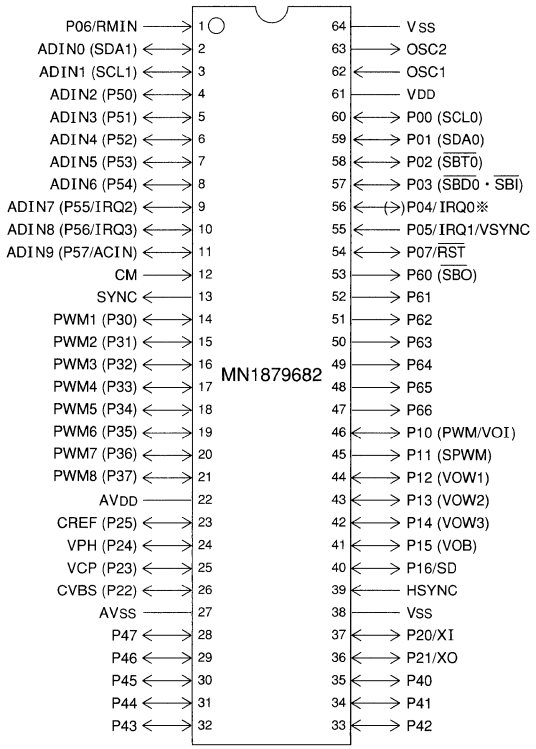
(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1870 / 80 + PX-PRB1879682

EPROM built-in Type Use **MN18P79682** in SDIP064-P-0750 package.

Pin Configuration



SDIP064-P-0750

※ P04 • IRQ0 terminal

TYPE A	Stand-by function is availabe	Input terminal
TYPE B	Stand-by function is not available	I/O terminal

❑ MN1870877

Type			**MN1870877 [ES (Engineering Sample) available]**
ROM (x8-bit)			8K
RAM (x8-bit)			256
Minimum Instruction Execution Time			**2/3 dividing 0.5μs (at 4.5 to 5.5V, 12MHz)**
Interrupts			• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 • Remote Control • I²C
Timer Counter			**Timer Counter 0 : 8-bit x 1** Clock Source .....1/1, 1/4, 1/16, 1/64 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** Clock Source .....1/2, 1/16, 1/64, 1/256, 1/512 of System Clock Interrupt Source .....Overflow of Timer Counter 1 **Time Base Counter** Clock Source .....1/4096 of System Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 2 **Watchdog Timer**
Serial Interface			**I²C x 1** (Two bus line system)
I/O Ports	**I/O**	**36**	• Joint use : 12 • General use : 24
	Input	**2**	• Joint use : 2
	Output	**7**	• Dedicated : 7
A/D Inputs			5-bit x 10ch (without S/H)
PWM			14-bit x 1ch, 7-bit x 1ch
Special Ports			Remote Control Reception
Notes			Remote Control Data Detection Circuit built-in
Package			QFP064-P-1414

Electrical Characteristics

A/D Converter Characteristics

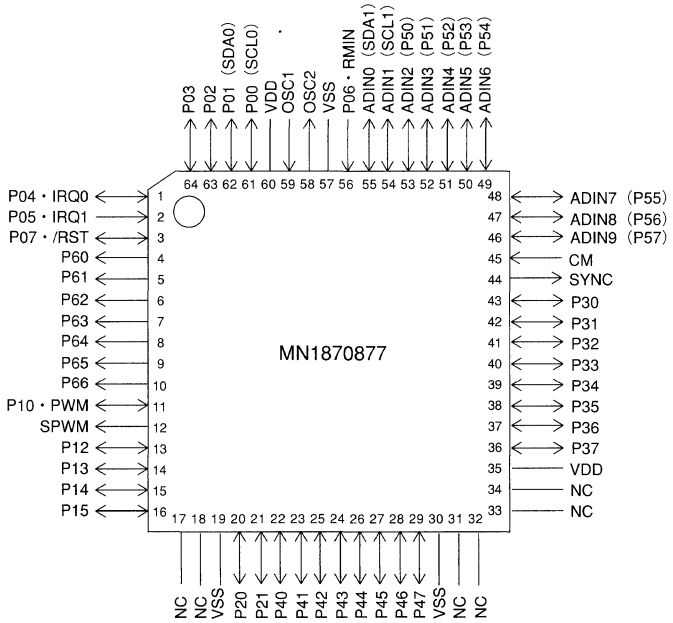
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Time	TAD	fosc=12MHz	9			μs
Analog Input Voltage	VAD		VSS		VDD	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	MN18EV76476
EPROM built-in Type	Use **EP18P76476** in QFP064-P-1414

Pin Configuration



QFP064-P-1414

NC : Nothing connected with terminal.

❑ MN187818 / 1618

Type			**MN187818 / 1618**
ROM (x8-bit)			8K / 16K
RAM (x8-bit)			1536 / 768
Minimum Instruction Execution Time	With Main Clock operated		**1/8 dividing 1.0μs (at 3.3 to 5.5V, 8MHz)**
	With Sub-clock operated		**122μs (at 2.2 to 5.5V, 32.768kHz)**
Interrupts	• RESET • External 0 • External 1 • Timer 0 • Timer 1 • Timer 2 stop • Timer 3 • Serial 0 • Serial 1 • Key Scan • Timer 2		
Timer Counter	**Timer Counter 0 : 8-bit x 1** (Timer Output, Event Count, Pulse Width Measurement) Clock Source .....1/1, 1/4, 1/16, 1/64 of External Clock Input, 1/1, 1/4, 1/16, 1/64 of System Clock, 1/1, 1/4, 1/16, 1/64 of XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 16-bit x 1** (Event Count, Pulse Width Measurement) Clock Source .....External Clock Input, System Clock, OSC Oscillation Clock Interrupt Source .....Pulse Width Measurement finished or Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Input Capture, Synchronous Serial Clock Generator, Pulse Width Measurement) Clock Source .....1/1 to 1/16 of External Clock Input, 1/1 to 1/16 of OSC Oscillation Clock, 1/1 to 1/16 of System Clock Interrupt Source .....Overflow of Timer Counter 2, Pulse Width Measurement finish **Timer Counter 3 : 8-bit x 1** (Clock function, Time Base) Clock Source .....1/4096 of System Clock, 1/128 of XI Oscillation Clock Interrupt Source .....1/1, 1/2, 1/4, 1/8 of Timer Counter 3 **Watchdog**		
Serial Interface	**Serial 0 : 8-bit x 1** (Synchronous Type) (Transmission/Reception of variable bit length, Transfer direction of MSB/LSB selectable,Clock Polarity selectable, Start Condition function) Clock Source .....1/1, 1/8, 1/16 of System Clock, 1/2 of Timer Counter 2, $\overline{SBT0}$ Pin Input, P20 Pin Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transmissio/Reception of variable bit length, MSB/LSB selectable, Start Condition function Clock Source .....1/1, 1/8, 1/16 of System Clock, 1/2 of Timer Counter 2, $\overline{SBT1}$ Pin Input (Connectable) Serial 0 + Serial 1		
I/O Ports	**I/O**	**54**	• Joint use : 11 • Specified pull-up Resistor available : 17 (Software Programmable)
	Input	**2**	• Joint use
	Output	**3**	—
Special Ports	Buzzer Output, Remote Control Transmission/Reception		
Notes	Carrier Generator Circuit for Remote Controller built-in, Remote Controller Reception Amp built-in, Learning function of Remote Control		
Package	QFP064-P-1414		

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8MHz			20	mA
	IDD2	fosc=32kHz, VDD=3V			200	µA
Supply Current at STOP	IDD3	VDD=3V			10	µA
	IDD4	VDD=2V			3	

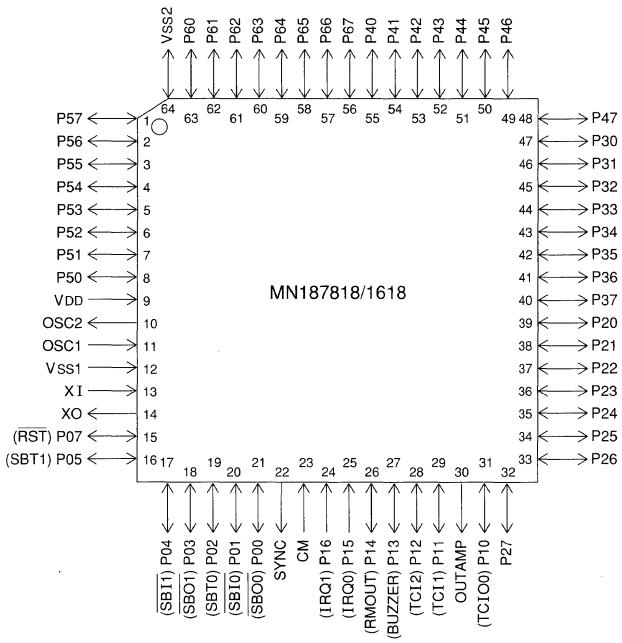
(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE1870 / 80 + PX-PRB1873218

Piggyback Use **EP187818** (EP1873218) as piggy in QFP064-P-1818 package.

Pin Configuration



QFP064-P-1414

1880 8-bit SERIES

MN1880 Series

MN1880 Series

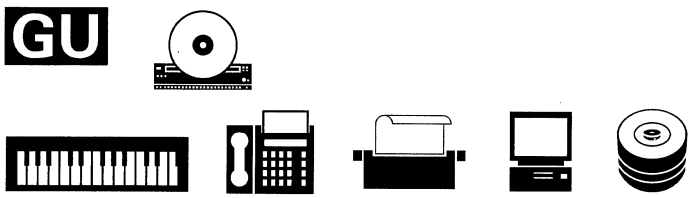
The MN1880 Series features hardware-implemented high-speed context-switching. Designed for control purposes, these microcomputers are ideal for parallel processing.

The instruction set also enables high-speed control processing by means of an instruction repeat function and powerful bit operation functions. This series is suitable for a wide range of applications from industrial consumer electronics.

Features

- **8-bit Controller Optimized for High-speed Parallel Processing**
  High execution speed of 0.33 µs (12MHz) to 0.5 µs (8MHz)
  Maximum internal ROM capacity of 64kbytes (2Mbytes external)
- **Context-switching by Hardware**
  Two internal register sets eliminate task-switching time-loss
- **Memory-oriented Architecture**
  Operations can be performed directly between memories and registers. Operation results can also be written directly to memory.
- **Strong Line-up of built-in EPROM Types**
  Testing is surely assured by using the internal EPROM type before mask ROM products.
- **High-level Language Support**
  The high-level language CL/1 which is available to describe parallel prpcessing program is used for software development.

■ **Applications**



❑ MN188161 / 321

Type			**MN188161 / 321**
ROM (x8-bit)			16K / 32K
RAM (x8-bit)			640 / 448
Minimum Instruction Execution Time	With Main Clock operated		**0.5µs (at 4.5 to 5.5V, 8MHz)**
	With Sub-clock operated		**122µs (at 3.0 to5.5V, 32.768kHz)**
Interrupts	• RESET • Runaway • External 0 • External 1 • External 2 • External 3 / Timer 3 • Timer 0 • Timer 1 • Timer 2 • Serial Reception • Serial Transmission		
I/O Ports	**I/O**	**48**	• Joint use : 3 • Input/Output selectable : 48 (P1 : by -bit, P3~7 : by -byte)
	Input	**8**	• Joint use : 6
Package			SDIP064-P-0750, SDIP064-P-1414, SDIP064-P-1818

Timer Counter

Timer Counter 0 : 16-bit x 1 (Timer Output, Event Count)
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Overflow of Timer Counter 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count)
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1
Clock Source .....1/32 of XI Oscillation Clock, 1/16 of OSC Oscillation Clock, System Clock
Interrupt Source .....Overflow of Timer Counter 2

Timer Counter 3 : 16-bit x 1 (UART Baud Rate Generator)
Clock Source .....1/16 of OSC Oscillation Clock, System Clock
Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Watchdog, Time Base)
Clock Source .....XI Oscillation Clock, System Clock
Interrupt Source .....Overflow of Timer Counter 4 (Watchdog)

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function)
Clock Source .....1/4, 1/16, 1/32 of Machine Cycle, External Clock

UART x 1

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 8MHz Operation			35	mA
	IDD2	At 32kHz Operation			5	mA
Supply Current at STOP	IDD3	Oscillation halt			50	µA
Supply Current at HALT	IDD4	8MHz Oscillation halt			500	µA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

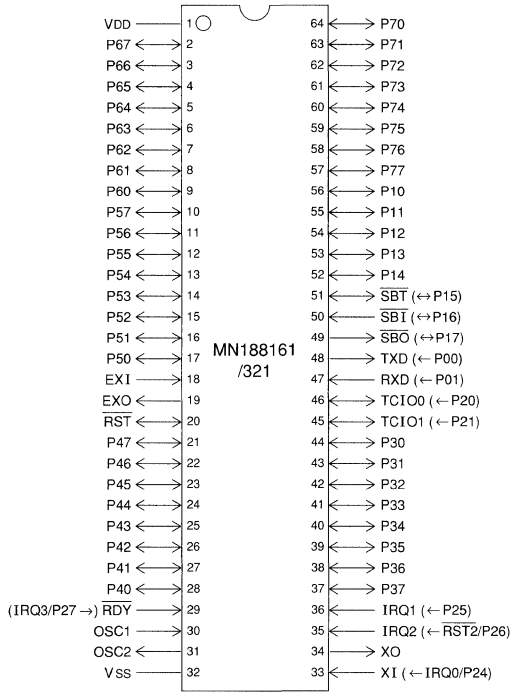
Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB188321
Piggyback	Use **EP188321** as piggy in SDIP064-P-0750 package.

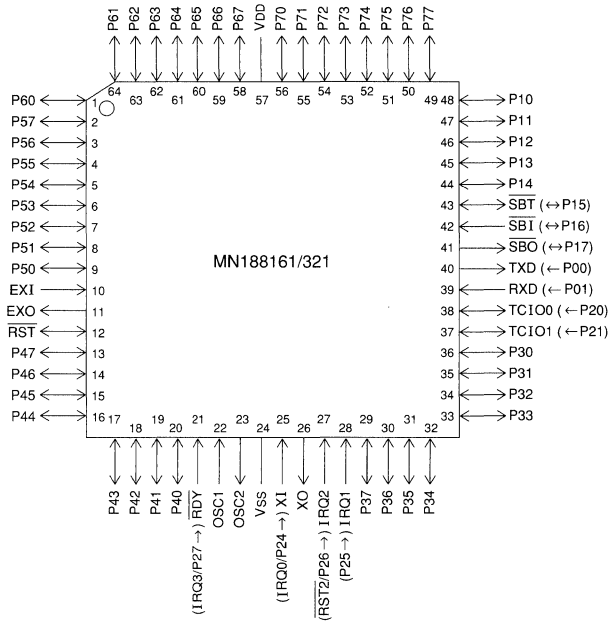
EPROM built-in Type

Use **MN18P8321** in SDIP064-P-0750 or QFP064-P-1818 package.
Use **MN18P8161** in QFH064-P-1010 package.

Pin Configuration



SDIP064-P-0750



QFP-P-1414 / QFP064-P-1818

❑ MN188166

Type		**MN188166**
ROM (x8-bit)		16K
RAM (x8-bit)		384
Minimum Instruction Execution Time	With Main Clock operated	**0.5µs (at 4.5 to 5.5V, 8MHz)**
	With Sub-clock operated	**122µs (at 3.0 to 5.5V, 32.768kHz)**
Interrupts	• RESET • Runaway • External 0 • External 1 • External 2 • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Serial 0 • Serial 1 / A/D	

Timer Counter

Timer Counter 0 : 16-bit x 1 (Synchronous Output (1-bit x 4ch, 1-bit x 1ch))
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 0, Compare to Timer Counter 0 and Output Compare Register 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count, Synchronous Serial Clock Generator)
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Input Capture, PWM Output)
Clock Source .....System Clock, 1/16, 1/24 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 2, Specified Edge Input of TCIO2, Bit Counter Underflow of Shift Register, Compare of Shift Registor 2 and Compare Register 2

Timer Counter 3 : 16-bit x 1 (Serial Index Search)
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Event Count)
Clock Source .....1/16 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Overflow of Timer Counter 4 (Switch to Timer Counter 5)

Timer Counter 5 : 16-bit x 1 (Watchdog, Time Base)
Clock Source .....System Clock, XI Oscillation Clock
Interrupt Source .....1/2048, 1/4096, 1/8192 of Timer Counter 5 (Switch to Timer Counter 4)

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start, Condition function, Index Search function)
Clock Source .....1/4, 1/16, 1/32 of System Clock, External Clock Input, 1/2 of Timer Counter 1, $\overline{SBT0}$ Pin Input

Serial 1 : 8-bit x 1 (Synchronous Type) (Start Condition function, Transfer direction of MSB/LSB selectable)
Clock Source .....1/4, 1/16, 1/32 of System Clock, External Clock Input, 1/2 of Timer Counter 1, $\overline{SBT1}$ Pin Input

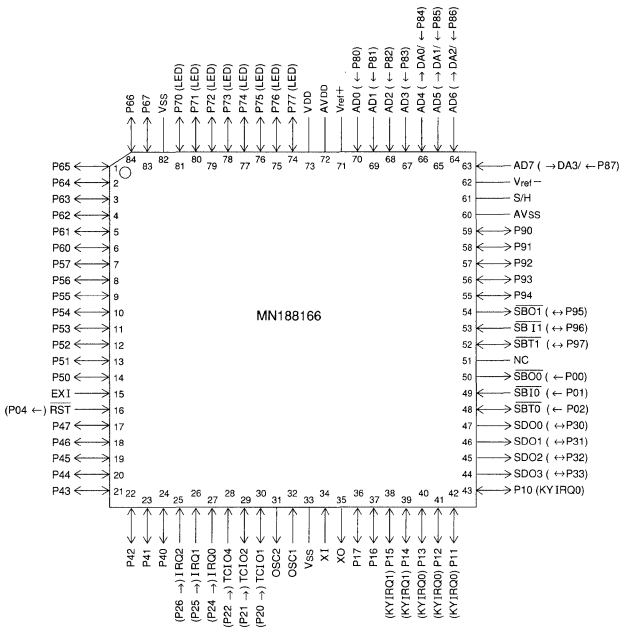
I/O Ports	**I/O**	**52**	• Joint use : 13 (QFP084-P-1818) • Input/Output selectable : 52 (P1, P4 to 6, P9 : by -bit, P7 : by 8-bit, P3 : by 4-bit)
		49	• Joint use : 12 (QFH080-P-1414)
	Input	**17**	• Joint use : 17
A/D Inputs			8-bit x 8ch (with S/H)
D/A (Analog) Outputs			8-bit x 4ch (Shared with A/D)
PWM			16-bit x 1ch (Repetition Cycle 1µs to 32.8ms, at 8MHz)

ICR	16-bit x 1ch
OCR	16-bit x 1ch
Notes	VISS/VASS Detector function
Package	QFP084-P-1818, QFH080-P-1414

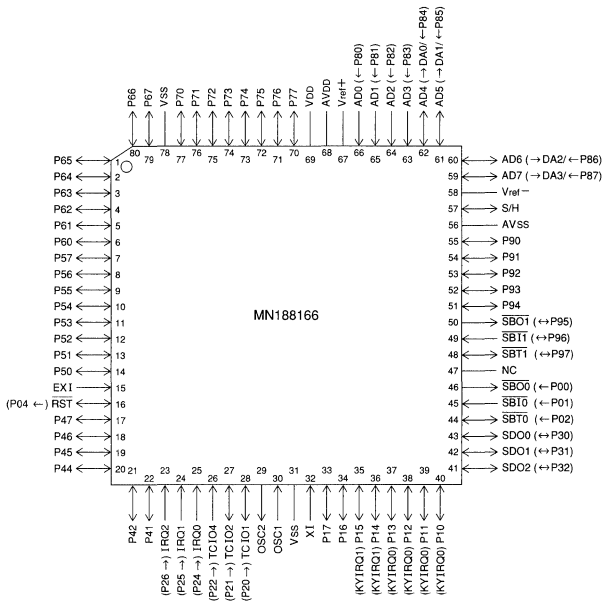
Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB188326
Piggyback	Use **EP188326** as piggy in QFP084-P-1818 package.
EPROM built-in Type	Use **MN18P8326** in QFP084-P-1818 package.

Pin Configuration



QFP054-P-1818



QFH080-P-1414

NC : Nothing connected with terminal.

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=8MHz			50	mA
Operating Supply Current	IDD2	fosc=32kHz			5	mA
Supply Current at STOP	IDD3	Oscillation halt			50	μA
Supply Current at HALT	IDD4	8MHz Oscillation halt			500	μA

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=4V, Vref–=1V,			±3	LSB
A/D Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
D/A Conversion Absolute Error		Vref+=4V, Vref–=1V,			±3	LSB
D/A Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
A/D Conversion Time		fosc=8MHz		32		μs
D/A Conversion Time		fosc=8MHz		4		μs
Reference Input Voltage	Vref+				0.8VDD	V
	Vref–		0.2VDD			V
Analog Input Voltage			Vref–		Vref+	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN1882010 / 3210 / 3210A

Type — **MN1882010 / 3210 [5-Voltage Version] / 3210A [3.3-Voltage Version]**

ROM (x8-bit) — 20K / 32K / 32K

RAM (x8-bit) — 512 / 528 / 688

Minimum Instruction Execution Time

With Main Clock operated	**0.5µs (at 3.3 to 3.6V, 8MHz)**	**MN1882010**
	0.5µs (at 4.5 to 5.5V, 8MHz)	**MN1883210 [5-Voltage Version]**
	0.5µs (at 3.3 to 5.5V, 8MHz)	**MN1883210A [3.3-Voltage Version]**
With Sub-clock operated	**122µs (at 3.0 to 3.6V, 32.768kHz)**	**MN1882010**
	122µs (at 3.0 to 5.5V, 32.768kHz)	**Except MN1882010**

Interrupts

• RESET • External 0/Key Input • External 1 • External 2 • Timer 0 • Timer 1 • Timer 2
• Timer 3 • Timer 4 • Serial 0 • Serial 1 Interrupt / A/D • Runaway

Timer Counter

Timer Counter 0 : 16-bit x 1 (Synchronous Output (4-bit x 1 ch))
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Output Compare Register 0 and timer 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count, Synchronous Serial Clock Generator)
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Input Capture, PWM Output)
Clock Source .....System Clock, 1/16, 1/24 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 2, Specified Edge of TCIO2, Bit Counter Underflow of Shift Register, Coincidence of Shift Register and Compare Register

Timer Counter 3 : 16-bit x 1 (Serial Index Search)
Clock Source .....System Clock, 1/16 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Event Count)
Clock Source .....1/16 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Overflow of Timer Counter 4 (Switch to Timer Counter 5)

Timer Counter 5 : 16-bit x 1 (Watchdog, Time Base, Clock function)
Clock Source .....1/4 of OSC Oscillation Clock, XI Oscillation Clock
Interrupt Source .....1/2048, 1/4096, 1/8192 of Timer Counter 5 (Switch to Timer Counter 4)

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function)
Clock Source 1/2 of Timer Counter 1, 1/4, 1/16, 1/32 of System Clock, External Clock Input

Serial 1 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function)
Clock Source .....1/2 of Timer Counter 1, 1/4, 1/16, 1/32 of System Clock, External Clock Input

I/O Ports

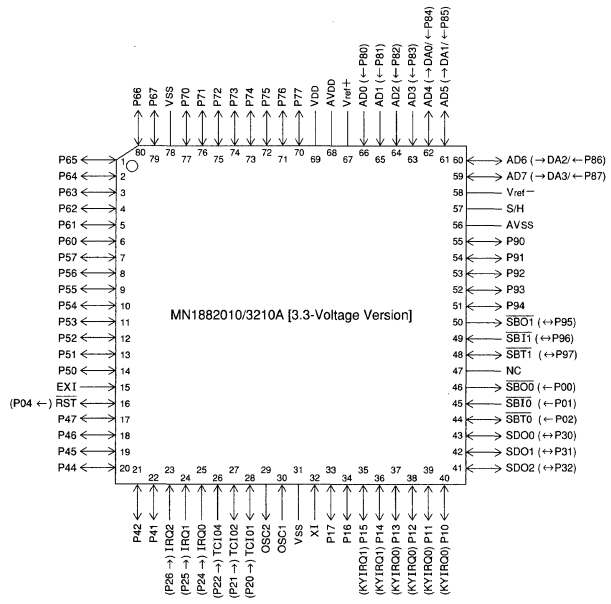
I/O	**49**	• Joint use : 12 • Input/Output selectable : 49 (P1, P5 to 7, P9, P41 to 42, P44 to 47 : by -bit P7, P30 to 32 : by -byte) (MN1882010)
	52	• Joint use : 13 • Input/Output selectable : 52 (P1, P4 to 6, P9 : by -bit P7, P30 to 33 : by -byte) (MN1882410 / 3210)
Input	**17**	• Joint use : 17

A/D Inputs	8-bit x 8ch (without S/H)
D/A (Analog) Outputs	8-bit x 4ch (Shared with A/D)
PWM	16-bit x 1ch (Repetition Cycle 1µs to 32.8ms, at 8MHz)
ICR	16-bit x 1ch
OCR	16-bit x 1ch
Special Ports	Synchronous Output (4-bit x 1ch)
Notes	VISS/VASS Detector function, Low Power Consumption Type
Package	MN1882010 : QFH080-P-1212 MN1883210 [5-Voltage Version] : QFP084-P-1818 MN1883210A [3.3-Voltage Version] : QFH080-P-1414,QFP084-P-1818

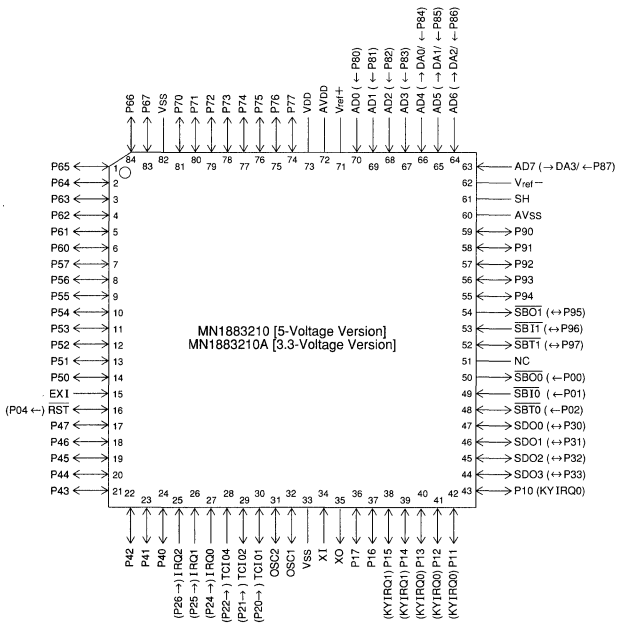
Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1883210
Piggyback	Use **EP1883210** as piggy in QFP084-P-1818 package.
EPROM built-in Type	Use **MN1882010 or MN18P82410** [ES (Engineering Sample) available] in QFH080-P-1212 package. Use **MN1882410 / 3210 or MN18P83210** [ES (Engineering Sample) available] in QFH080-P-1414or QFP084-P-1818 package.

Pin Configuration



QFH080-P-1212 (MN1882010)
QFH080-P-1414 (MN1883210A [3.3-Voltage Version]



QFP080-P-1818 (MN1883210 [5-Voltage Version]
/3210A [3.3-Voltage Version])

See the next page for electrical characteristics.

NC : Nothing connected connected with pin.

Electrical Characteristics

Supply Current (MN1882010)

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 8MHz Operation		12	24	mA
	IDD2	At 32kHz Operation		0.2	0.4	mA
Supply Current at STOP	IDD3	Oscillation halt			10	µA
Supply Current at HALT	IDD4	8MHz Oscillation halt		40	80	µA

(Ta= –20 to +70°C, VDD=3.5V, VSS=0V)

A/D, D/A Converter Characteristics (MN1882010)

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=3.5V, Vref–=0V			±5	LSB
A/D Conersion Relative Error		VDD=3.5V			±2	LSB
D/A Conversion Absolute Error		Vref+=3.5V, Vref–=0V,			±5	LSB
D/A Conersion Relative Error		VDD=3.5V			±2	LSB
A/D Conversion Time		fosc=8MHz	32			µs
D/A Conversion Time		fosc=8MHz	4			µs
A/D • D/A Conversion Time		fosc=8MHz	40			µs
Reference Input Voltage	Vref+				VDD	V
	Vref–		VSS			V
Analog Input Voltage	VIA		Vref–		Vref+	V

(Ta= –20 to +70°C, VDD=3.5V, VSS=0V)

Supply Current (MN1883210 / 3210A)

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 8MHz Operation			50	mA
	IDD2	At 32kHz Operation			5	mA
Supply Current at STOP	IDD3	Oscillation halt			500	µA
Supply Current at HALT	IDD4	8MHz Oscillation halt			50	µA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics (MN1883210 / 3210A)

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=5V, Vref–=0V			±3	LSB
A/D Conersion Relative Error		VDD=5V			±1	LSB
D/A Conversion Absolute Error		Vref+=5V, Vref–=0V,			±3	LSB
D/A Conersion Relative Error		VDD=5V			±1	LSB
A/D Conversion Time		fosc=8MHz	32			µs
D/A Conversion Time		fosc=8MHz	4			µs
A/D • D/A Conversion Time		fosc=8MHz	40			µs
Reference Input Voltage	Vref+				VDD	V
	Vref–		VSS			V
Analog Input Voltage	VIA		Vref–		Vref+	V

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

❑ MN1882414 / 3214

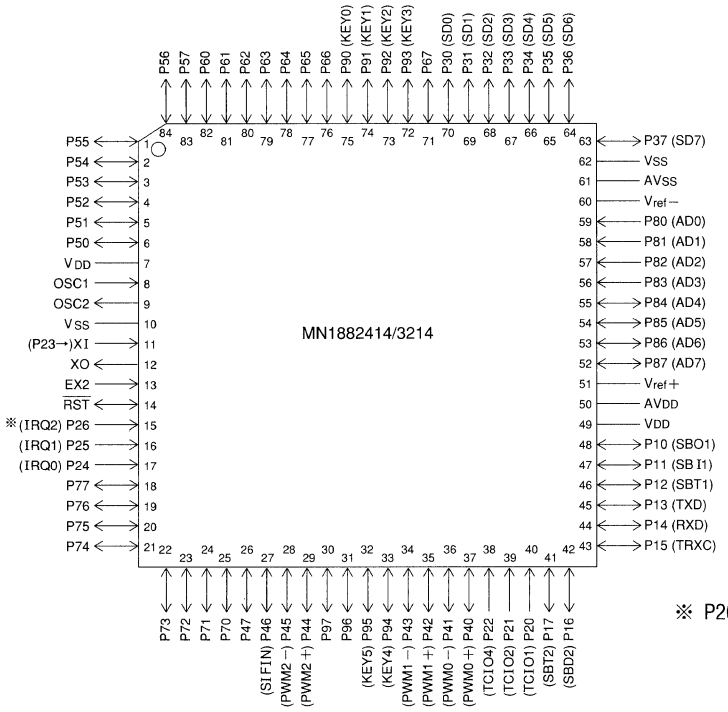
Type			MN1882414 / 3214
ROM (x8-bit)			24K / 32K
RAM (x8-bit)			448 / 928
Minimum Instruction Execution Time	With Main Clock operated		**0.5µs (at 4.5 to 5.5V, 8MHz)**
	With Sub-clock operated		**122µs (at 3.0 to 5.5V, 32.768kHz)**
Interrupts	• RESET • Runaway • External 0 / Key Input • External 1 • External 2/Zero-cross • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Serial Receive • Serial Transmit / A/D		
Timer Counter	**Timer Counter 0 : 16-bit x 1** (Synchronous Output (4-bit x 1ch)) Clock Source .....1/16 of OSC Oscillation Clock, System Clock Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Output Compare Register and Timer Counter 0 **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator) Clock Source .....P20 Input, System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Input Capture, PWM Output) Clock Source .....System Clock, 1/16, 1/24 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2, Specified Edge of TCIO2, Bit Counter Underflow Coincidence of Shift Register and Compare Register **Timer Counter 3 : 16-bit x 1** (Serial Index Search) Clock Source .....System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 3 **Timer Counter 4 : 16-bit x 1** (Event Count, Synchronous Output (4-bit x 1ch)) Clock Source .....1/16 of OSC Oscillation Clock, P22 Input Interrupt Source .....Overflow of Timer Counter 4 (Switch to Timer Counter 5) **Timer Counter 5 : 16-bit x 1** (Watchdog, Time Base, Clock function) Clock Source .....XI Pin Input, 1/4 of OSC Oscillation Clock Interrupt Source .....1/2048, 1/4096, 1/8192 of Timer Counter 5 (Switch to Timer Counter 4)		
Serial Interface	**Serial 0 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function, Serial Transfer Index Search) Clock Source .....1/4, 1/16, 1/32 of System Clock, External Clock, 1/2 of Timer Counter 4 **Serial 1 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function) Clock Source .....1/4, 1/16, 1/32 of System Clock, External Clock, 1/2 of Timer Counter 4 UART x 1		
I/O Ports	I/O	56	• Joint use : 29 • Input/Output selectable : 56 (P1, P4~6, P9 : by -bit P3, P7 : by -byte)
	Input	14	• Joint use : 14
Zero-cross Inputs			1
A/D Inputs			8-bit x 8ch (without S/H)
D/A (Analog) Outputs			8-bit x 4ch (Shared with A/D)
PWM			16-bit x 1ch (Repetition Cycle 1µs~32.8ms, at 8MHz), 8-bit x 3ch (Repetition Cycle Minimum 128µs, 8MHz)
ICR			16-bit x 1ch
OCR			16-bit x 1ch

Special Ports	Synchronous Output (4-bit x 2ch)
Notes	VISS/VASS Detector function
Package	QFP 084-P-1818

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1883214
Piggyback	Use **EP1883214** as piggy in QFP084-P1818 package.
EPROM built-in Type	Use **MN18P83214** in QFP084-P1818 package.

Pin Configuration



※ P26 / IRQ2 : (Zero-cross available)

QFP084-P1818

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 8MHz Operation			50	mA
	IDD2	At 32kHz Operation			5	mA
Supply Current at STOP	IDD3	Oscillation halt			50	μA
Supply Current at HALT	IDD4	At 32kHz Oscillation, 8MHz halt			500	μA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=5V, Vref–=0V			±3	LSB
A/D Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
D/A Conversion Absolute Error		Vref+=5V, Vref–=0V			±3	LSB
D/A Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
A/D Conversion Time		At 8MHz Operation			32	μs
D/A Conversion Time		At 8MHz Operation			4	μs
A/D • D/A Conversion Time		At 8MHz Operation			48	μs
Reference Input Voltage	Vref+		VSS		VDD	V
Analog Input Voltage	ADin		Vref–		Vref+	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN1882417

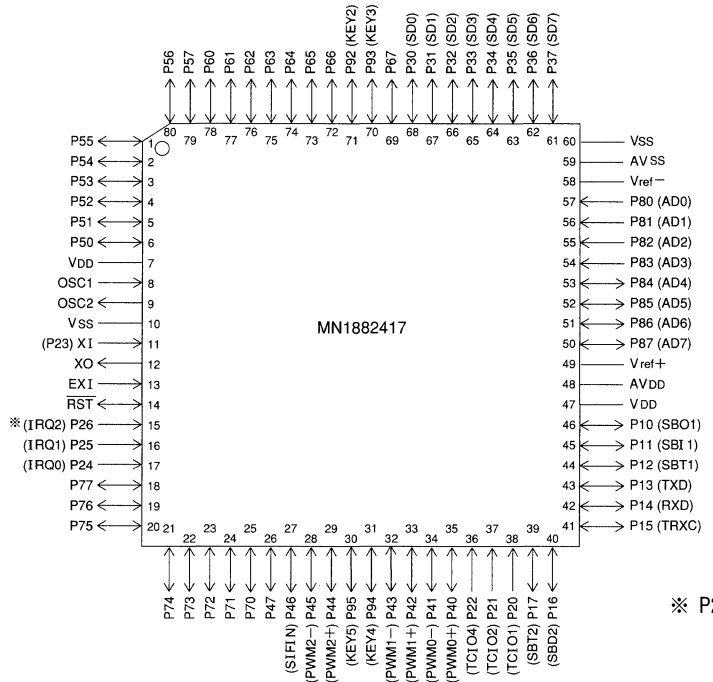
Type			**MN1882417**
ROM (x8-bit)			24K
RAM (x8-bit)			800
Minimum Instruction Execution Time			With Main Clock operated **0.5µs (at 4.5 to 5.5V, 8MHz)** With Sub-clock operated **122µs (at 3.5 to 5.5V, 32.768kHz)**
Interrupts			• RESET • External 0 / Key Input • External 1 • External 2 / Zero-cross • Serial Receive • Serial Transmit / A/D • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Runaway
Timer Counter			**Timer Counter 0 : 16-bit x 1** (Synchronous Output (4-bit x 1ch)) Clock Source .....System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Timer Counter 0 and Output Compare Register 0 **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator) Clock Source .....1/16 of OSC Oscillation Clock, System Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Input Capture, PWM Output) Clock Source .....System Clock, 1/16, 1/24 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2, Specified Edge Input of TCIO2, Bit Counter Underflow of Shift Register, Concidfnce of Compare Register and Shift Register **Timer Counter 3 : 16-bit x 1** (Serial Index Search) Clock Source .....1/16 of OSC Oscillation Clock, System Clock Interrupt Source .....Overflow of Timer Counter 3 **Timer Counter 4 : 16-bit x 1** (Event Count, Synchronous Serial Clock Generator, Synchronous Output (4-bit x 1ch)) Clock Source .....1/16 of OSC Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 4 (Switch to Timer Counter 5) **Timer Counter 5 : 16-bit x 1** (Watchdog, Time Base, Clock function) Clock Source .....1/4 of OSC Oscillation Clock, XI Pin Input Interrupt Source .....1/2048, 1/4096, 1/8192 of Timer Counter 5 (Switch to Timer Counter 4)
Serial Interface			**Serial 0 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function, Serial Transfer Index Search) Clock Source .....1/2 of Timer Counter 4, 1/4, 1/16, 1/32 of System Clock, External Clock **Serial 1 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function) Clock Source .....1/2 of Timer Counter 4, 1/4, 1/16, 1/32 of System Clock, External Clock UART x 1
I/O Ports	**I/O**	**52**	• Joint use : 27 • Input/Output selectable : 52 (P1, P4 to P6, P92 to 95 : by -bit P3, P7 : by -byte)
	Input	**14**	• Joint use : 14
Zero-cross Inputs			1
A/D Inputs			8-bit x 8ch (without S/H)
D/A (Analog) Outputs			8-bit x 4ch (Shared with A/D)
PWM			16-bit x 1ch (Repetition Cycle 0.99µs to 32.4ms, at 8MHz), 8-bit x 3ch (at Repetition Cycle 128µs, 8MHz)
ICR			16-bit x 1ch

OCR	16-bit x 1ch
Special Ports	Synchronous Output (4-bit x 2ch)
Notes	VISS/VASS Detector function, MN1882414 derivative with P90P91P96P97 deleted
Package	QFH080-P-1414

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1883217
EPROM built-in Type	Use **MN18P83217** in QFH080-P-1414 package.

Pin Configuration



※ P26 / IRQ2 : (Zero-cross available)

QFH080-P-1414

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 8MHz Operation			25	mA
	IDD2	At 32kHz Operation			3	mA
Supply Current at STOP	IDD3	Oscillation halt			20	µA
Supply Current at HALT	IDD4	At 32kHz Oscillation, 8MHz Oscillation halt			2	mA

(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=5.0V, Vref–=0V			±3	LSB
A/D Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
D/A Conversion Absolute Error		Vref+=5.0V, Vref–=0V			±3	LSB
D/A Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
A/D Conversion Time		For 1ch		32		µs
D/A Conversion Time		For 1ch		4		µs
A/D • D/A Conversion Time		For A/D 1ch, D/A 4ch		48		µs
Reference Input Voltage	Vref+				VDD	V
	Vref–		VSS			V
Analog Input Voltage	ADin		Vref–		Vref+	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN1883220 / 4820

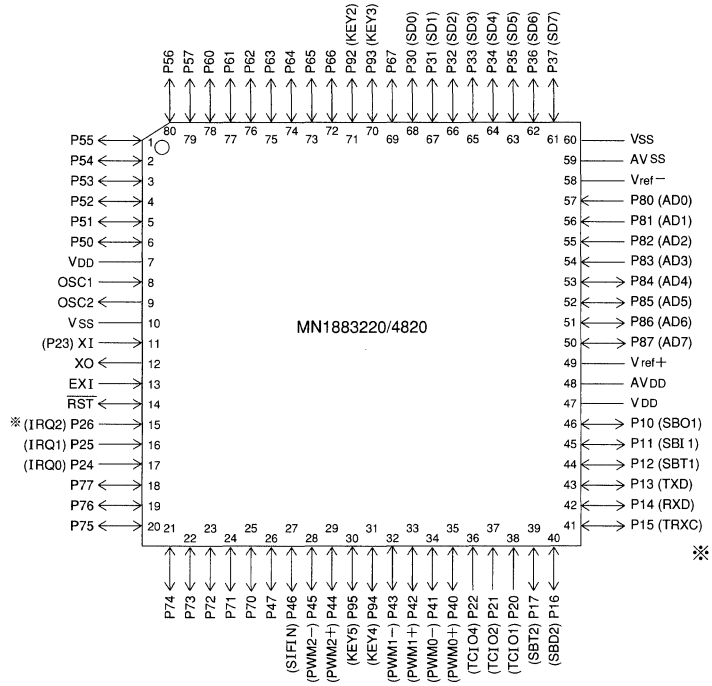
Type			**MN1883220 / 4820**
ROM (x8-bit)			32K / 48K
RAM (x8-bit)			2592 / 2720
Minimum Instruction Execution Time	With Main Clock operated		**0.5µs (at 4.5 to 5.5V, 8MHz)**
	With Sub-clock operated		**122µs (at 3.0 to 5.5V, 32.768kHz)**
Interrupts	• RESET • External 0 / Key Input • External 1 • External 2 / Zero-cross • Serial Receive • Serial Transmit / A/D • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Runaway		
Timer Counter	**Timer Counter 0 : 16-bit x 1** (Synchronous Output (4-bit x 1ch)) Clock Source .....System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Timer Counter 0 and Output Compare 0 **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator) Clock Source .....1/16 of OSC Oscillation Clock, System Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Input Capture, PWM Output, Timer Output, Synchronous Output (1-bit x 1ch)) Clock Source .....System Clock, 1/16, 1/24 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2, Specified Edge Input of TCIO2, Bit Counter Underflow of Shift Register, Coincidence of Compare Register and Shift Register **Timer Counter 3 : 16-bit x 1** (Serial Index Search) Clock Source .....1/16 of OSC Oscillation Clock, System Clock Interrupt Source .....Overflow of Timer Counter 3 **Timer Counter 4 : 16-bit x 1** (Event Count, Synchronous Serial Clock Generator, Synchronous Output (4-bit x 1ch)) Clock Source .....1/16 of OSC Oscillation Clock, External Clock Input Interrupt Source .....Overflow of Timer Counter 4 (Switch to Timer Counter 5) **Timer Counter 5 : 16-bit x 1** (Watchdog, Time Base, Clock function) Clock Source .....1/4 of OSC Oscillation Clock, XI Input Interrupt Source .....1/2048, 1/4096, 1/8192 of Clock Source (Switch to Timer Counter 4)		
Serial Interface	**Serial 1 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function,Serial transfer Index Search) Clock Source .....1/2 of Timer Counter 4, 1/4, 1/16, 1/32 of System Clock **Serial 2 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function) Clock Source .....1/2 of Timer Counter 4, 1/4, 1/16, 1/32 of System Clock, External Clock UART x 1		
I/O Ports	**I/O**	**52**	• Joint use : 27 • Input/Output selectable : 52 (P1, P4~P6, P92~95 : by -bit P3, P7 : by -byte)
	Input	**14**	• Joint use : 14
Zero-cross Inputs	1		
A/D Inputs	8-bit x 8ch (without S/H)		
D/A (Analog) Outputs	8-bit x 4ch (Shared with A/D)		
PWM	16-bit x 1ch (Repetition Cycle 0.99µs to 32.4ms, at 8MHz), 8-bit x 3ch (at Repetition Cycle 128µs, 8MHz)		

ICR	16-bit x 1ch
OCR	16-bit x 1ch
Special Ports	Synchronous Output (4-bit x 2ch)
Notes	VISS/VASS Detector function. The function of specifiting channel numberof A/D, serial transmission, A/D interrpt mask, external two-edge-interrupt, and so on that are added to the MN188xx17.
Package	QFH080-P-1414

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB1883220
EPROM built-in Type	Use **MN18P86420** in QFH080-P-1414 package.

Pin Configuration



※ P26 / IRQ2 : (Zero-cross available)

QFH080-P-1414

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	8MHz			25	mA
	IDD2	32kHz			3	mA
Supply Current at STOP	IDD3	Oscillation halt			20	μA
Supply Current at HALT	IDD4	At 32kHz Oscillation, 8MHz Oscillation halt			2	mA

(Ta= –20 to +85°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		Vref+=5.0V, Vref–=0V			±3	LSB
A/D Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
D/A Conversion Absolute Error		Vref+=5.0V, Vref–=0V			±3	LSB
D/A Conersion Relative Error		AVDD=5V, AVSS=0V			±1	LSB
A/D Conversion Time		For 1ch		32		μs
D/A Conversion Time		For 1ch		4		μs
A/D • D/A Conversion Time		For A/D 1ch, D/A 4ch		48		μs
Reference Input Voltage	Vref+				VDD	V
	Vref–		VSS			V
Analog Input Voltage	ADin		Vref–		Vref+	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN1880023 / 4824 / 0024

Type			**MN1880023 / 4824 / 0024**
ROM (x8-bit)			External / 48K / External
RAM (x8-bit)			704 / 928 / 928
Minimum Instruction Execution Time		With Main Clock operated	**0.200µs (at 4.5 to 5.5V, 20MHz)** **0.400µs (at 3.0 to 5.5V, 10MHz) : MN1884824 only**
		With Sub- clock operated	**122µs (at 2.7 to 4.0V, 32.768kHz)**
Interrupts			• RESET • External 0 / Key Input • External 1 • External 2 / External 3 / External 4 / External 5 • Timer 0 • Timer 1 / PWM • Timer 2 • Timer 3 / A/D • Timer 4 • Serial 0 • Serial 1 / UART • Runaway
Timer Counter			**Timer Counter 0 : 16-bit x 1** (Synchronous Output (4-bit x 1ch)) Clock Source .....1/2 of System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 0, Condcidence of Output Compare Register 0 and Timer Counter 0 **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of System Clock, 1/16 of OSC Oscillation Clock, External Clock Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Input Capture, PWM Output) Clock Source .....1/2 of System Clock, 1/16, 1/24 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2, Specified Edge of TC102 **Timer Counter 3 : 16-bit x 1** (Generation of A/D converter trigger, Serial Index Search) Clock Source .....1/2 of System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 3 **Timer Counter 4 : 16-bit x 1** (Event Count, Synchronous Serial Clock Generator) Clock Source .....1/16 of OSC Oscillation , External Clock Input Interrupt Source .....Overflow of Timer Counter 4 (Switch to Timer Counter 5) **Timer Counter 5 : 16-bit x 1** (Watchdog, Time Base, Clock function) Clock Source .....1/4 of OSC Oscillation Clock, XI Oscillation Clock Interrupt Source .....1/2048, 1/4096, 1/8192 of Timer Counter 5 (Switch to Timer Counter 4)
Serial Interface			**Serial : 8-bit x 2** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function, Serial transfer Index Search) Clock Source .....1/4, 1/16, 1/32 of System Clock, External Clock, 1/2 of Timer Counter 4 **UART x 1** (8-bit Baud Rate Timer built-in)
I/O Ports	**I/O**	**58**	• Joint use : 27 • Input/Output selectable (P0, P1, P4 to 6 : by-bit, P3, P7 : by-byte)
	Input	**15**	• Joint use : 15 • A/D Input selectable (P8 : by-bit)
A/D Inputs			8-bit x 8ch (without S/H)
PWM			16-bit x 1ch (at Repetition Cycle 0.80µs to 26.2ms, 20MHz), 10-bit x 1ch (at Repetition Cycle 0.4 to 204.8µs, 20MHz)
ICR			16-bit x 1ch
OCR			16-bit x 1ch

Special Ports

Synchronous Output (4-bit x 1ch)

Expanded Memory Access Mode

High-speed bus mode/standard bus mode function

* A memory-wait addition function is available during the high-speed mode on the MN1884824 / MN18P86424 only.

Package

QFP084-P-1818, QFP084-P-1212

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 20MHz Opeation			70	mA
	IDD2	At 32kHz Operation			5	mA
Supply Current at STOP	IDD3	Oscillation halt			50	μA
Supply Current at HALT	IDD4	20MHz Oscillaiton halt			500	μA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Linearity Error					±2	LSB
Zero Transition Voltage	VOT			100	200	mV
Full-scale Transition Voltage	VFT		4850	4950		mV
A/D Conversion Time		fosc=20MHz, at High Speed A/D Conversion			2.60	μs
Analog Input Voltage	VIA		Vref–		Vref+	V

(Ta=25°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator

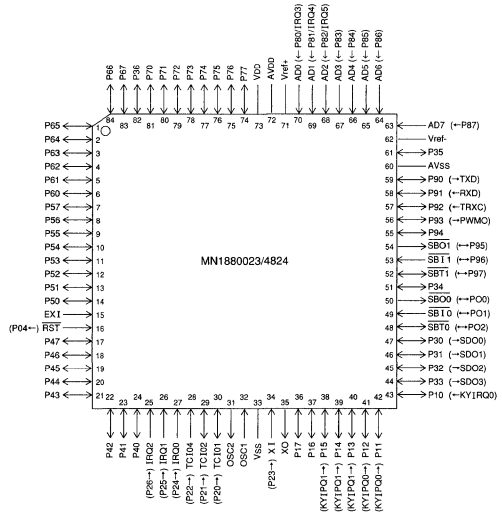
Mr. ICE / 1880 (made by Computex Co. Ltd.) For 18mm x 18mm package only

PX-ICE1880-2

EPROM built-in Type

Use **MN18P86424** (under development)

Pin Configuration



QFP084-P-1818 / QFH084-P-1212

❑ MN6750165 / 245 / 325 / 405

Type	**MN6750165 / 245 / 325 / 405**
ROM (x8-bit)	16K / 24K / 32K / 40K
RAM (x8-bit)	384 / 512 / 640 / 768
Minimum Instruction Execution Time	**0.5µs (at4.5 to 5.5V, 8MHz)** **128µs (at 3.0 to 5.5V, 8MHz, operates in fosc/256)** **(Operation with 32.768kHz by Mask Option)**
Interrupts	• RESET • Runaway • External • Input Capture 0 • Input Capture 1 • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Serial Transmission/Reception • Serial Transmission/Reception / A/D
Timer Counter	**Timer Counter 0 : 16-bit x 1** (Synchronous Interrupt function) Clock Source .....System Clock, 1/16, 1/256 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Output Compare Register 0 compare to Timer Counter 0 **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator, Linear Time Counter (Counter for Control Signal Pulse)) Clock Source .....System Clock, 1/16 of OSC Oscillation Clock, Control (CTL) Signal Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Timer Output, Input Capture) Clock Source .....System Clock, 1/16, 1/24 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 2, DCTL Signal Edge, Shift Register 4 Bit Counter Underflow, Coincidence of Compare Register and Shift Register **Timer Counter 3 : 16-bit x 1** (Timer Output, Serial Index Search) Clock Source .....System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer Counter 3 **Timer Counter 4 : 16-bit x 1** (Timer Output, Event Count, Time Base) Clock Source .....1/4, 1/16, 1/256 of OSC Oscillation Clock, XI Oscillation Clock, External Clock Input Interrupt Source .....SPGIRQ, HOCRIRQ, Overflow of Timer Counter 4 **Timer Counter 5 : 16-bit x 1** (Timer Output, Watchdog) Clock Source .....1/4 of OSC Oscillation Clock
Serial Interface	**Serial 0 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function) Clock Source .....1/2 1/4, 1/8 of Timer Counter 1, 1/2 of Timer 4, $\overline{SBT0}$ Pin Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function, Simple Remote Control Reception) Clock Source .....1/2, 1/4, 1/8 of Timer Counter 2, 1/2 of Timer 4, $\overline{SBT1}$ Pin Input

I/O Ports	**I/O**	**39**	• Joint use : 23 • Clock / HSW Synchronous Output Port selectable (Mask Option)
	Input	**12**	• Joint use
	Output	**1**	• Joint use

A/D Inputs	8-bit x 8ch (without S/H)
PWM	11-bit x 2ch (at Repetition Cycle 256µs, 8MHz), 10-bit x 2ch (at Repetition Cycle 128µs, 8MHz), 14-bit x 1ch (at Repetition Cycle 8.192ms, 8MHz)
ICR	16-bit x 5ch

OCR	16-bit x 7ch, 8-bit x 1ch
Special Ports	Tri-state Output : VLP, Synchronous Output : 7, Tri-state Synchronous Output : 4, CTL Amp, FG Amp etc. built-in
Notes	VISS/VASS Detector function, 14-bit PWM, Digital PGMM, XI/XO Terminal, added to MN675201
Package	QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current		At 8MHz Operation, No load STBH (ANACNT; bp0)=1		25	50	mA
Supply Current at STOP		Oscillation halt, No load STBH (ANACNT; bp0)=0			50	µA

(Ta=25°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

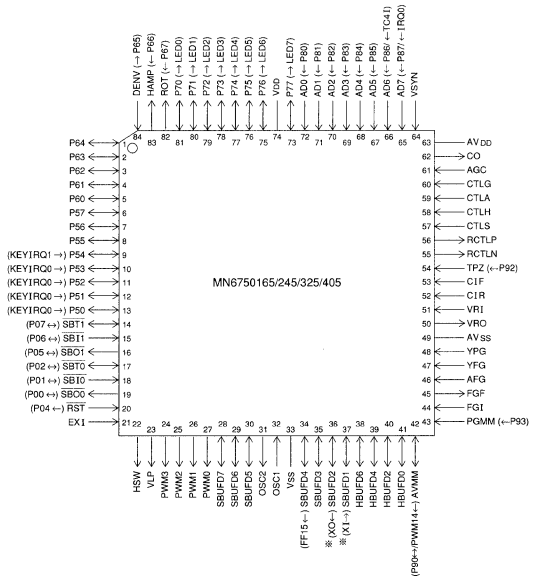
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Differential Nonlinearity	ΔNLad	8MHz			±3	LSB
A/D Conversion Time	Tad			32		µs

(Ta=25°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB6750325
Piggyback	Use **EP6750325** as piggy in QFP084-P-1818 package.
EPROM built-in Type	Use **MN67P50645** (ES (Engineering Sample) available) in QFP084-P-1818 package. Use **MN67P5325** (ES (Engineering Sample) available) in QFP084-P-1818 package.

Pin Configuration



※ XI, XO : Mask Option

QFP084-P-1818

❑ MN6750326 / 406 / 566 / 646

Type	**MN6750326 / 406 / 566 / 646**
ROM (x8-bit)	32K / 40K / 56k / 64k
RAM (x8-bit)	640 / 768 / 896 / 1024
Minimum Instruction Execution Time	**0.5µs (at 4.5 to 5.5V, 8MHz)** **128µs (at 3.0 to 5.5V, 8MHz, operates in fosc/256)** **(Operation with 32.768kHz by Mask Option)**
Interrupts	• RESET • Runaway • External • Input Capture 0 • Input Capture 1 • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Serial Transmission/Reception • Serial Transmission/Reception / AD
Timer Counter	**Timer Counter 0 : 16-bit x 1** (Synchronous Interrupt function) Clock Source .....System Clock, 1/16, 1/256 of OSC Oscillation Clock, XI Oscillation Interrupt Source .....Overflow of Timer Counter 0, Coincidence Output Compare Register 0 and Timer Counter 0 **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count, Synchronous Serial Clock Generator, Linear Time Counter (Counter for Control Signal Pulse) Clock Source .....System Clock, 1/16 of OSC Oscillation Clock, Control (CTL) Signal Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Timer Output, Input Capture) Clock Source .....System Clock, 1/16, 1/24 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer/Counter 2, DCTL Signal Edge, Shift Register 4-bit Counter Underflow, Coincidence of Shift Register and compare-register **Timer Counter 3 : 16-bit x 1** (Timer Output, Serial Index Search) Clock Source .....System Clock, 1/16 of OSC Oscillation Clock Interrupt Source .....Overflow of Timer/Counter 3 **Timer Counter 4 : 16-bit x 1** (Timer Output, Event Count, Time Base) Clock Source .....1/4, 1/16, 1/256 of OSC Oscillation Clock, XI Oscillation Clock, External Clock Input Interrupt Source .....SPGIRQ, HOCRIRQ, Overflow of Timer/Counter 4 **Timer Counter 5 : 16-bit x 1** (Timer Output, Watchdog) Clock Source .....1/4 of OSC Oscillation Clock
Serial Interface	**Serial 0 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function) Clock Source .....1/2 1/4, 1/8 of Timer Counter 1, 1/2 of Timer 4, $\overline{\text{SBT0}}$ Pin Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transfer direction MSB/LSB selectable, Start Condition function, Simple Remote Control Receive) Clock Source .....1/2, 1/4, 1/8 of Timer Counter 2, 1/2 of Timer 4, $\overline{\text{SBT1}}$ Pin Input

I/O Ports	**I/O**	**39**	• Joint use : 23 • Clock / HSW Synchronous Output Port selectable (Mask Option)
	Input	**12**	• Joint use
	Output	**1**	• Joint use

A/D Inputs	8-bit x 8ch (without S/H)
PWM	11-bit x 2ch (at Repetition Cycle 256µs, 8MHz), 10-bit x 2ch (at Repetition Cycle 128µs, 8MHz), 14-bit x 1ch (at Repetition Cycle 8.192ms, 8MHz)
ICR	16-bit x 5ch
OCR	16-bit x 7ch, 8-bit x 1ch

Special Ports

Tri-state Output : VLP, Synchronous Output : 7, Tri-state Synchronous Output : 4,
CTL Amp, FG Amp etc. built-in

Notes

VISS/VASS Detector function, 14-bit PWM, Digital PGMM, XI/CO Terminal, added to MN675201

Package

QFP084-P-1818

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current		At 8MHz Operation, No load STBH (ANACNT; bp0)=1		25	50	mA
Supply Current at STOP		Oscillation halt, No load STBH (ANACNT; bp0)=0			50	µA

(Ta=25°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Differential Nonlinearity	ΔNLad				±3	LSB
A/D Conversion Time	Tad	8MHz		32		µs

(Ta=25°C, VDD=5.0V, VSS=0V)

Support Tool

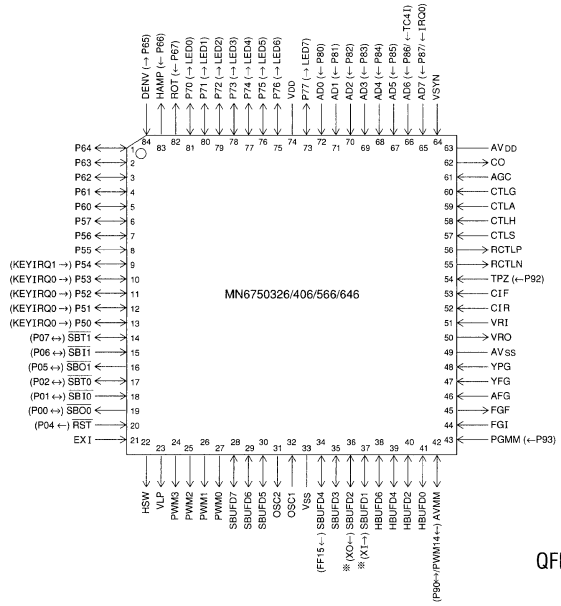
In-Circuit Emulator

PX-ICE1870 / 80 + PX-PRB6750325

EPROM built-in Type

Use **MN67P50646** (ES (Engineering Sample) available) in QFP084-P-1818 package.

Pin Configuration



※ XI, XO : Mask Option

QFP084-P-1818E

❑ MN6750487 / 647

Type		**MN6750487 /647**
ROM (x8-bit)		48K / 64K
RAM (x8-bit)		896 / 1024
Minimum Instruction Execution Time	With Main Clock operated	**0.279µs (at 4.5 to 5.5V, 14.32MHz)**
	With Sub-clock operated	**143µs (at 2.7 to 5.5V, 14.32MHz internal dividing)**
		122µs (2.7 to 5.5V, at 32.768kHz)
Interrupts		• RESET • Runaway • External 0, 1, 2 / Key Input (P50~54) • Input Capture 0, 1 • Timer 0 / Timer 6 • Timer 1 • Timer 2 • Timer 3 / Cylinder FG • Timer 4 / Synchronous Output / Continuous Synchronous Output • Serial 0 • Serial 1 / A/D Conversion / Remote Control Reception

Timer Counter

Timer Counter 0 : 16-bit x 1 (Timer Output, Output Compare)
- Clock Source .....1/1, 1/2, of System Clock, 1/16, 1/32 of OSC Oscillation Clock, 1/256, 1/512 of XI Oscillation Clock or OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Output Compare Register 0 and Timer Counter 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count (CTL Signal), Synchronous Serial Clock Generator)
- Clock Source .....1/1, 1/2, of System Clock, 1/16, 1/32 of OSC Oscillation Clock, CTL Signal
- Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Timer Output, Input Capture, (DCTL Specified Edge), DCTL Signal Duty Judge)
- Clock Source .....1/1, 1/2 of System Clock, 1/16, 1/24, 1/32, 1/48 of OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer/Counter 2, DCTL Specified Edge Input, Timer 2 Shift Register 4-bit Counter Underflow, Concidence of Timer 2 Shift Register and Timer 2 Shift Register compare-register

Timer Counter 3 : 16-bit x 1 (Timer Output, Serial Index Search)
- Clock Source .....1/1, 1/2 of System Clock, 1/16, 1/32 of OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Timer Output, Event Count (PC0 Input))
- Clock Source .....1/16, 1/32 of OSC Oscillation Clock, External Clock Input
- Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 16-bit x 1 (Timer Output, Watchdog)
- Clock Source .....1/16 of OSC Oscillation Clock, XI Oscillation Clock
- Interrupt Source .....$1/2^{11}$, $1/2^{12}$, $1/2^{13}$ of Timer Counter 5, Overflow (PI)

Timer Counter 6 : 30-bit x 1 (Timer Output, Clock function (Maximum 4 hours), Buzzer Output)
- Clock Source .....1/32, 1/64, 1/256,1/512 of OSC Oscillation Clock, XI Oscillation Clock, 1/2 of System Clock
- Interrupt Source .....1 second Output, 1 minute Output, 1 hour Output, 4 hour Output

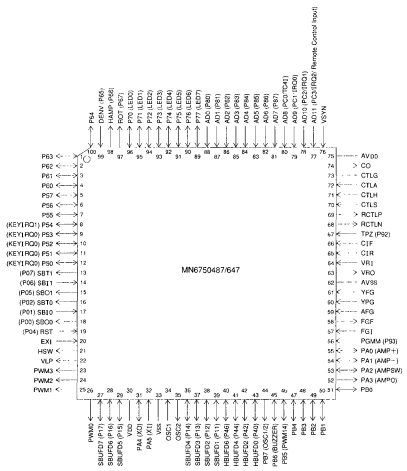
Timer Counter 7 : 8-bit x 1 (Simple Remote Control Reception)
- Clock Source .....1/8, 1/16, 1/32, 1/64 of System Clock
- Interrupt Source .....8th Overflow of Timer Counter 7

Serial Interface			**Serial 0 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function,FIFO • 8 or 16-bit length Transmit/Reception (8bits by 8 stages)) Clock Source .....1/16, 1/64, 1/128 of System Clock, Timer 4 Output 2 dividing, $\overline{\text{SBT0}}$ Pin Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function,Simple Remote Control Reception) Clock Source .....1/16, 1/64, 1/128 of System Clock, Timer 4 Output 2 dividing, $\overline{\text{SBT1}}$ Pin Input
I/O Ports	**I/O**	**53**	• Joint use : 33 Port 0, 1, 4, 5, 6, 7, A, B, by -bit
	Input	**15**	• Joint use
	Output	**2**	• Joint use
A/D Inputs			8-bit x 12ch (without S/H)
PWM			10-bit x 2ch (at Repetition Cycle 143µs, 14.32MHz), 11-bit x 2ch (at Repetition Cycle 286µs, 14.32MHz), 14-bit x 1ch (at Repetition Cycle 2288µs, 14.32MHz)
ICR			16-bit x 5ch
OCR			16-bit x 7ch, 8-bit x 1ch
Special Ports			Buzzer Output, Tri-state Output (PTO) VLP Pin, Synchronous Output : 7, Tri-state Synchronous Output : 4 Remote Control Reception, CTL Amp, FG Amp built-in, 1/2 Output of OSC Oscillation Clock (1 Vpp), Error Amp etc. built-in
Notes			VISS/VASS Detector function
Package			QFP100-P-1818

Support Tool

In-Circuit Emulator	PX-ICE1870 / 80 + PX-PRB6750647
EPROM built-in Type	Use **MN67P50647** (ES (Enginnering Sample) available).

Pin Configuration



QFP100-P-1818

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 14.32MHz Opration No load STBH (ANACNT0, #80)=1		25	60	mA
	IDD2	16MHz Oscillation SLOW Mode, No load STBH=1		2	5	mA
Supply Current at STOP	IDSP	Oscillaiton halt, No load STBH (ANACNT; BP0)=0			20	μA
Supply Current at HALT	IDHT	14.32MHz Oscillation, No load STBH=0			5	mA

(Ta=25±2°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Differential Nonlinearity	ΔNLad				±3	LSB
A/D Conversion Time	Tab	fosc=14.32MHz		3.91		μs
Analog Input Voltage			0.5		4.5	V

(Ta=25±2°C, VDD=5.0V, VSS=0V)

❑ MN675048 / 58

Type		**MN6750487 /58**
ROM (x8-bit)		64K / 80K
RAM (x8-bit)		1024 / 1280
Minimum Instruction Execution Time	With Main Clock operated	**0.279µs (at 4.5 to 5.5V, 14.32MHz)**
	With Sub-clock operated	**143µs (at 2.7 to 5.5V, 14.32MHz internal dividing)**
		122µs (2.7 to 5.5V, at 32.768kHz)
Interrupts		• RESET • Runaway • External 0, 1, 2 / Key Input (P50~54) • Input Capture 0, 1 • Timer 0 / Timer 6 • Timer 1 • Timer 2 • Timer 3 / Cylinder FG • Timer 4 / Synchronous Output / Continuous Synchronous Output • Serial 0 • Serial 1 / A/D Conversion / Remote Control Receive

Timer Counter

Timer Counter 0 : 16-bit x 1 (Timer Output, Output Compare)
- Clock Source .....1/1, 1/2, of System Clock, 1/16, 1/32 of OSC Oscillation Clock, 1/512 of XI Oscillation Clock or OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Output Compare Register 0 and Timer Counter 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count (CTL Signal), Synchronous Serial Clock Generator)
- Clock Source .....1/1, 1/2, of System Clock, 1/16, 1/32 of OSC Oscillation Clock, CTL Signal
- Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Timer Output, Input Capture, (DCTL Specified Edge), DCTL Signal Duty Judge)
- Clock Source .....1/1, 1/2 of System Clock, 1/16, 1/24, 1/32, 1/48 of OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer/Counter 2, DCTL Specified Edge Input, Timer-2 Shift Register 4-bit Counter Underflow, Concidence of Timer-2 Shift Register and Timer-2 Shift Register compare-register

Timer Counter 3 : 16-bit x 1 (Timer Output, Serial Index Search)
- Clock Source .....1/1, 1/2 of System Clock, 1/16, 1/32 of OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Timer Output, Event Count (P92 Input))
- Clock Source .....1/16, 1/32 of OSC Oscillation Clock, External Clock Input
- Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 16-bit x 1 (Timer Output, Watchdog)
- Clock Source .....1/8 of OSC Oscillation Clock, XI Oscillation Clock
- Interrupt Source .....$1/2^{11}$, $1/2^{12}$, $1/2^{13}$ of Timer Counter 5, Overflow (PI)

Timer Counter 6 : 30-bit x 1 (Timer Output, Clock function (Maximum 4 hours), Buzzer Output)
- Clock Source .....1/32, 1/64, 1/256,1/512 of OSC Oscillation Clock, XI Oscillation Clock, 1/2 of System Clock
- Interrupt Source .....1 second Output, 1 minute Output, 1 hour Output, 4 hour Output

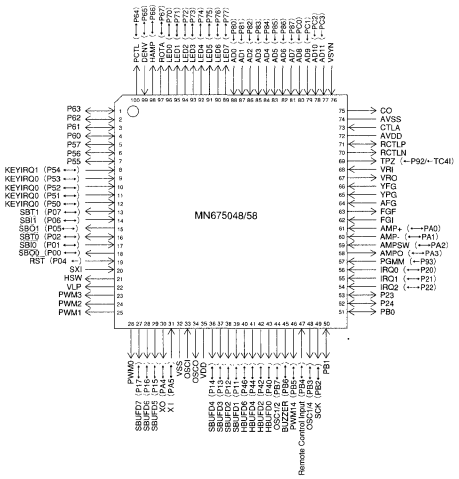
Timer Counter 7 : 8-bit x 1 (Simple Remote Control Reception)
- Clock Source .....1/8, 1/16, 1/32, 1/64 of System Clock
- Interrupt Source .....8th Overflow of Timer Counter 7

Serial Interface			**Serial 0 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function, FIFO • 8 or 16-bit length Transmit/Receive(8bits by 8 stages)) Clock Source .....1/2, 1/4, 1/18, 1/32, 1/64, 1/128, of System Clock, Timer 4 Output 2 dividing, $\overline{SBT0}$ Pin Input **Serial 1 : 8-bit x 1** (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function, Simple I²C function) Clock Source .....11/2, 1/4, 1/18, 1/32, 1/64, 1/128, of System Clock, Timer 4 Output 2 dividing, $\overline{SBT0}$ pin Input
I/O Ports	**I/O**	**60**	• Joint use : 41 Port 0, 1, 4, 5, 6, 7, A, B, by -bit
	Input	**14**	• Joint use : 14
	Output	**1**	• Joint use : 1
A/D Inputs			8-bit x 12ch (without S/H)
PWM			10-bit x 2ch (Repetition Cycle 143µs, at 14.32MHz), 11-bit x 2ch (Repetition Cycle 286µs, at 14.32MHz), 14-bit x 1ch (Repetition Cycle 2288µs, at 14.32MHz)
ICR			16-bit x 5ch
OCR			16-bit x 7ch, 8-bit x 1ch
Special Ports			Buzzer Output, Tri-state Output (PTO) VLP Pin, Synchronous Output : 7, Tri-state Synchronous Output : 4 Remote Control Receive, CTL Amp, FG Amp built-in, 1/2 Output of OSC Oscillation Clock (1 Vpp), Error Amp etc. built-in
Notes			VISS/VASS Detector function
Package			QFP100-P-1818

Support Tool

In-Circuit Emulator	PX-ICE1880-2 + PX-PRB6750647
EPROM built-in Type	Use **MN67P50647** (ES (Enginnering Sample) available).

Pin Configuration



QFP100-P-1818

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 14.32MHz Opration, No load STBH (ANACNT0, #80)=1		30	60	mA
	IDD2	16MHz Oscillation, SLOW Mode, No load STBH=1		2	5	mA
Supply Current at STOP	IDSP	Oscillaiton halt, No load STBH (ANACNT; BP0)=0			20	μA
Supply Current at HALT	IDHT	14.32MHz Oscillation, No load STBH=0			5	mA

(Ta=25±2°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Differential Nonlinearity	ΔNLad				±3	LSB
A/D Conversion Time	Tad	fosc=14.32MHz		8		μs
Analog Input Voltage			0.5		4.5	V

(Ta=25±2°C, VDD=5.0V, VSS=0V)

❑ MN675029 / 39 / 49

Type		**MN675029 / 39 / 49**
ROM (x8-bit)		32K / 40K / 56 /
RAM (x8-bit)		768 / 1024 / 1280
Minimum Instruction Execution Time	With Main Clock operated	**0.250μs (at 4.5 to 5.5V, 16.0MHz)**
	With Sub-clock operated	**122μs (at 2.7 to 5.5V, 32.768kHz)**
Interrupts	• RESET • Runaway • External 0, 1, 2 / Key Input (P50~54) • Input Capture 0, 1 • Timer 0 / Timer 6 • Timer 1 • Timer 2 • Timer 3 • Capstan FG • Cylinder FG • Timer 4 / Synchronous Output / Continuous Synchronous Output • Serial 0 • Serial 1 / A/D Conversion	

Timer Counter

Timer Counter 0 : 16-bit x 1 (Timer Output, Output Compare)
- Clock Source .....1/1, 1/2, of System Clock, 1/16, 1/32 of OSC Oscillation Clock, 1/256 1/512 of XI Oscillation Clock
- Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Output Compare Register 0 compare to Timer Counter 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count (CTL Signal), Synchronous Serial Clock Generator)
- Clock Source .....1/1, 1/2, of System Clock, 1/16, 1/32 of OSC Oscillation Clock, CTL Signal
- Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Timer Output, Input Capture, (DCTL Specified Edge), DCTL Signal Duty Judgement)
- Clock Source .....1/1, 1/2 of System Clock, 1/16, 1/24, 1/32, 1/48 of OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer/Counter 2, DCTL Specified Edge Input, Timer-2 Shift Register 4-bit Counter Underflow, Concidence of Timer-2 Shift Register and Timer-2 Shift Register compare-register

Timer Counter 3 : 16-bit x 1 (Timer Output, Serial Index Search)
- Clock Source .....1/1, 1/2 of System Clock, 1/16, 1/32 of OSC Oscillation Clock
- Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Timer Output, Event Count (P92 Input))
- Clock Source .....1/16, 1/32 of OSC Oscillation Clock, External Clock Input
- Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 16-bit x 1 (Timer Output, Watchdog)
- Clock Source .....1/16 of OSC Oscillation Clock, XI Oscillation Clock
- Interrupt Source .....$1/2^{11}$, $1/2^{12}$, $1/2^{13}$ of Timer Counter 5, Overflow (PI)

Timer Counter 6 : 30-bit x 1 (Timer Output, Clock function (Maximum 2 seconds), Buzzer Output)
- Clock Source .....1/32, 1/64, 1/256,1/512 of OSC Oscillation Clock, XI Oscillation Clock, 1/2 of System Clock
- Interrupt Source .....0.25 second Output, 0.5. second Output, 1 second Output, 2 second Output

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function)
- Clock Source .....1/2, 1/4, 1/18, 1/32, 1/64, 1/128, of System Clock, Timer 4 Output 2 dividing, $\overline{SBT0}$ Pin Input

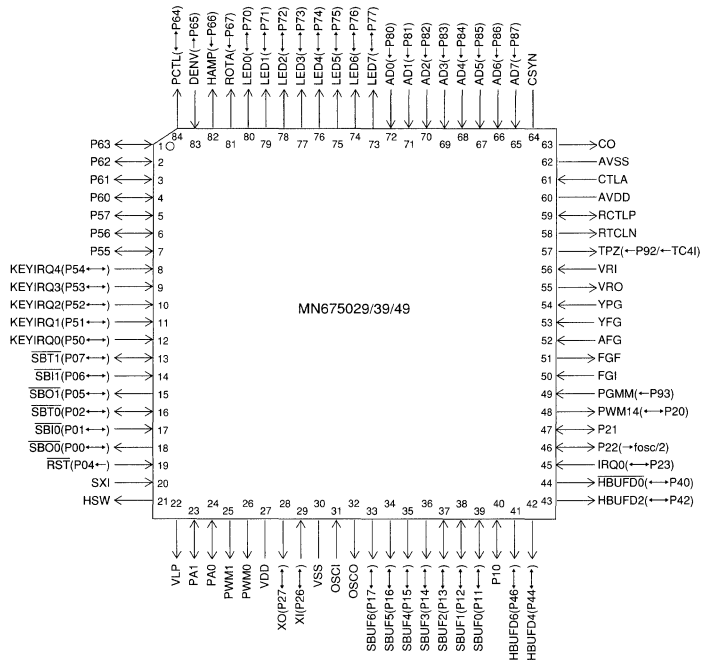
Serial 1 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function, Simple Remote Control Reception)
- Clock Source .....11/2, 1/4, 1/18, 1/32, 1/64, 1/128, of System Clock, Timer 4 Output 2 dividing, $\overline{SBT1}$ point Input

I/O Ports	**I/O**	**47**	• Joint use : 31 Port 0, 1, 4, 5, 6, 7, A, by -bit
	Input	**12**	• Joint use : 12
	Output	**2**	• Joint use : 2
A/D Inputs			8-bit x 8ch (without S/H)
PWM			12-bit x 2ch (at Repetition Cycle 512µs, 16.0MHz), 14-bit x 1ch (at Repetition Cycle 2048µs, 16.0MHz),
ICR			17-bit x 6ch
OCR			16-bit x 7ch, 8-bit x 1ch
Special Ports			Tri-state Output (PTO) VPL Pin, Synchronous Output : 7,Tri-stassse Synchronous Output : 4, CTL Amp FG Amp built-in. 1/2 Output of OSC Oscillation Clock (1 Vpp)
Notes			VISS/VASS Detector function
Package			QFP084-P-1818

Support Tool

In-Circuit Emulator	PX-ICE1870-2 + PX-PRB675069
EPROM built-in Type	Use **MN67P5069** (ES (Enginnering Sample) available).

Pin Configuration



QFP084-P-1818

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 14.32MHz Opration No load STBH (ANACNT0, #80)=1		30	60	mA
	IDD2	16MHz Oscillation SLOW Mode, No load STBH=1		2	5	mA
Supply Current at STOP	IDSP	Oscillaiton halt, No load STBH (ANACNT; BP0)=0			20	μA
Supply Current at HALT	IDHT	16MHz Oscillation, No load STBH=0			5	mA

(Ta=25±2°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Differential Nonlinearity	ΔNLad				±3	LSB
A/D Conversion Time	Tad	fosc=14.32MHz		39.1		μs
Analog Input Voltage			0.5		4.5	V

(Ta=25±2°C, VDD=5.0V, VSS=0V)

1860 8-bit SERIES

MN1860 Series

The MN1860 Series eliminates context-switching time loss through hardware implementation, and is ideal for parallel processing. The capabilities of these microcomputers are effective in multitasking applications, with four sets of internal registers.

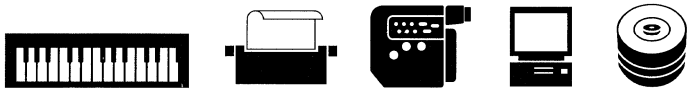
The instruction set also has upward compatibility with that of the MN1880 Series at the source code and machine language levels. The 16-bit ALU (Arithmetic Logic Unit) increases the speed of operation processing, making this series suitable for a wide range of applications in the consumer and industrial sectors.

Features

- **High-speed 8-bit Controller**
  High-speed 0.25 µs (16MHz) instruction execution 64kbytes maximum ROM size
- **Context-Switching by Hardware**
  Task-switching time loss is reduced with four internal register sets.
- **Instruction Upward Compatibility with MN1880 Series**
  MN1880 software can be used and 16-bit operation instructions are enhanced.
- **High-level Language Support**
  The high-level language CL/1 utilized for software development can be used to write programs that make 4-task parallel processing possible.

■ Applications

GU



MN1860 Series

❑ MN1860003

Type		**MN1860003**
ROM (x8-bit)		External
RAM (x8-bit)		1088
Minimum Instruction Execution Time	With Main Clock operated	**0.20µs (at 4.5 to 5.5V, 20MHz)**
	With Sub-clock operated	**122µs (at 4.5 to 5.5V, 32.768kHz)**
Interrupts	• RESET • Runaway • External 0 to 5 • Timer 0 to 5 Overflow • Timer 0, 1 Capture / Compare • Timer 0, 1 Compare • Mail • SIF 0, 1 • UART Reception • UART Transmission • A/D	

Timer Counter

Timer Counter 0 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Synchronous Output (4-bit x 2ch))

Clock Source .....1/16, 1/32 of OSC Oscillation Clock, 1/16, 1/32 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Compare to Register 0 and Timer Counter 0 Coincidence of Capture / Compare Register 0 and Timer Counter 0 , Coincidence of the Capture / Compare Register

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Synchronous Output (4-bit x 2ch))

Clock Source .....1/16, 1/32 of OSC Oscillation Clock, 1/32 of XI Oscillation Clock, Overflow of Timer Counter 0, External Clock Input

Interrupt Source .....Overflow of Timer Counter 1, Coincidence of Compare Register 1and Timer Counter 1, Coincidence of Capture / Compare Register 1 and Timer Counter 1, Capture of the Capture / Compare Register

Timer Counter 2 : 8-bit x 1 (Timer Output, Event Count, UART Baud Rate Generator, PWM Output)

Clock Source .....1/8 of System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 2

Timer Counter 3 : 8-bit x 1 (Timer Output, PWM Output, Synchronous Serial Clock Generator, Synchronous Output (4-bit x 2ch), Event Count)

Clock Source .....1/8 of System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, Overflow of Timer Counter 1, Overflow of Timer Counter 2

Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 8-bit x 1 (Timer Output, Event Count, PWM Output, A/D Conversion Trigger Generation)

Clock Source .....1/8 of System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 8-bit x 1 (Timer Output, PWM Output, Serial Index Search, Synchronous Output (4-bit x 2ch), Event Count)

Clock Source .....1/8 of System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, Overflow of Timer Counter 3, Overflow of Timer Counter 4

Interrupt Source .....Overflow of Timer Counter 5

Watchdog

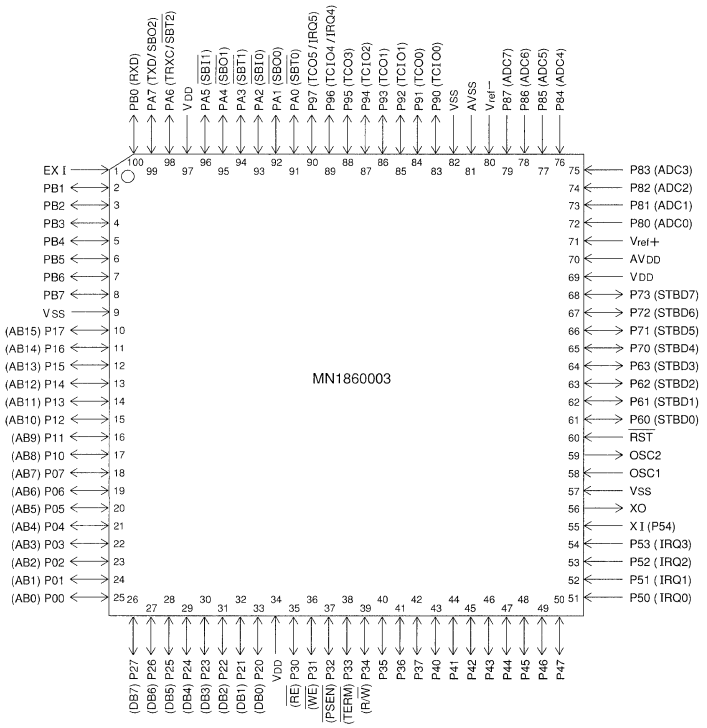
(Connectable) Timer Counter 0 + Timer Counter 1, Timer Counter 1 + Timer Counter 3
Timer Counter 2 + Timer Counter 3, Timer Counter 3 + Timer Counter 5
Timer Counter 4 + Timer Counter 5

Serial Interface			Serial : 8-bit x 2 (Synchronous Type) Clock Source .....1/4, 1/16, 1/32 of Machine Cycle, External Clock, Overflow of Timer Counter 3 UART x 1
I/O Ports	**I/O**	**72**	• Joint use : 54 • Specified pull-up Resistor available : 17 (Software Programmable)
	Input	**13**	• Joint use : 13
A/D Inputs			8-bit x 8ch (with S/H)
PWM			16-bit x 4ch (at Repetition Cycle 1.0µs to 131ms, 16MHz)
ICR			16-bit x 2ch (Possible to set to OCR)
OCR			16-bit x 2ch
Special Ports			4-bit x 2ch (Synchronous Output)
Package			QFP100-P-1818

Support Tool

In-Circuit Emulator	Mr. ICE / 1860 (made by Computex Co. Ltd.)

Pin Configuration



QFH100-P-1818

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 20MHz Opeation			70	mA
	IDD2	At 32kHz Operation			5	mA
Supply Current at STOP	IDD3	Oscillation halt			50	µA
Supply Current at HALT	IDD4	20MHz Oscillaiton halt			500	µA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Linearity Error					±2	LSB
Zero Transition Voltage	VOT			100	200	mV
Full-scale Transition Voltage	VFT		4850	4950		mV
A/D Conversion Time		fosc=20MHz, at No Wait			2.6	µS
Analog Input Voltage	VIA		Vref–		Vref+	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN1860004

Type	MN1860004
ROM (x8-bit)	External (Maximum 256K)
RAM (x8-bit)	1088
Minimum Instruction Execution Time	With Main Clock operated **0.16µs (at 4.5 to 5.5V, 25MHz)** **0.20µs (at 3.0 to 5.5V, 20MHz)** With Sub-clock operated **122µs (at 3.0 to 5.5V, 32.768kHz)**
Interrupts	• RESET • Runaway • External 0 to 5 • Timer 0 to 5 • Timer 0, 1 Capture / Compare • Timer 0, 1 Compare • Mail • SIF 0, 1 • UART Reception • UART Transmission • A/D • bank

Timer Counter

Timer Counter 0 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Synchronous Output (4-bit x 2ch))

Clock Source .....1/16, 1/32 of OSC Oscillation Clock, 1/16, 1/32 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Compare Register 0 and Timer Counter 1, Coincidence of Capture / Compare Register 0 and Timer Counter 0, At the capture mode of the Capture / Compare Register 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Synchronous Output (4-bit x 2ch))

Clock Source .....1/16, 1/32 of OSC Oscillation Clock, 1/16 1/32 of XI Oscillation Clock, Overflow of Timer Counter 0, External Clock Input

Interrupt Source .....Overflow of Timer Counter 1, Coincidence of Compare Register 1 and Timer Counter 1, Coincidence of Capture / Compare Register 1 and Timer Counter 1, Capture of the Capture / Compare Register 1

Timer Counter 2 : 8-bit x 1 (Timer Output, Event Count, PWM Output)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 2

Timer Counter 3 : 8-bit x 1 (Timer Output, PWM Output, Synchronous Serial Clock Generator, Synchronous Output (4-bit x 2ch), Event Count)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, Overflow of Timer Counter 1

Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 8-bit x 1 (Timer Output, Event Count, PWM Output, A/D Conversion Trigger Generation)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 8-bit x 1 (Timer Output, PWM Output, Serial Index Search, Synchronous Output (4-bit x 2ch), Event Count)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, Overflow of Timer Counter 3

Interrupt Source .....Overflow of Timer Counter 5

Watchdog

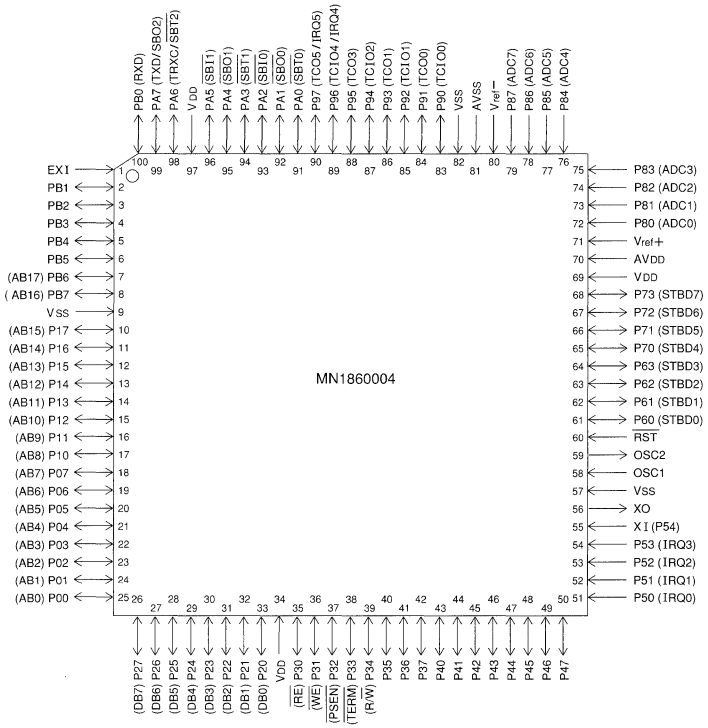
(Connectable) Timer Counter 2 + Timer Counter 3, Timer Counter 4 + Timer Counter 5, Timer Counter 0 + Timer Counter 1, Timer Counter 3 + Timer Counter 5

Serial Interface			Serial : 8-bit x 2 (Synchronous Type) Clock Source .....Machine Cycle, External Clock, Overflow of Timer Counter 3 UART x 1
I/O Ports	**I/O**	**72**	• Joint use : 56 • Pull-up Resistor available : 20 (Software Programmable)
	Input	**13**	• Joint use : 13
A/D Inputs			8-bit x 8ch (with S/H)
PWM			16-bit x 4ch (Repetition Cycle 0.8µs to 104.8ms, at 20MHz)
ICR			16-bit x 2ch (Possible to set to OCR)
OCR			16-bit x 2ch
Package			QFH100-P-1414

Support Tool

In-Circuit Emulator	Mr. ICE / 1860 (made by Computex Co. Ltd.)

Pin Configuration



QFH100-P-1414

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 25MHz Opeation			60	mA
	IDD2	At 32kHz Operation			5	mA
Supply Current at STOP	IDD3	Oscillation halt			20	μA
Supply Current at HALT	IDD4	25MHz Oscillaiton halt			500	μA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Linearity Error					±2	LSB
Zero Transition Voltage	VOT			100	200	mV
Full-scale Transition Voltage	VFT		4850	4950		mV
A/D Conversion Time		at a high-speed A/D conversion			2.08	μS
Analog Input Voltage	VIA		Vref–		Vref+	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN1866405 / 06

Type		**MN1866405 / 06**
ROM (x8-bit)		64K
RAM (x8-bit)		1856
Minimum Instruction Execution Time	With Main Clock operated	**0.16µs (at 4.5 to 5.5V, 25MHz) : MN1866405 / 06** **0.20µs (at 3.0 to 5.5V, 20MHz) : MN1866405** **0.25µs (at 3.0 to 5.5V, 16MHz) : MN1866406**
	With Sub-clock operated	**122µs (at 3.0 to 5.5V, 32.768kHz)**
Interrupts		• RESET • Runaway • External 0 to 5 • Timer 0 to 5 • Timer 0, 1 Capture / Compare • Timer 0, 1 Compare • Mail • SIF 0, 1, 3 • UART Receiption • UART Transmission • A/D • Bank

Timer Counter

Timer Counter 0 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Synchronous Output (4-bit x 2ch))

Clock Source .....1/16, 1/32 of OSC Oscillation Clock, 1/16, 1/32 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Compare Register 0 and Timer Counter 0 Coincidence of Capture / Compare Register 0 and Timer Counter 0 , Capture of the Capture / Compare Register 0

Timer Counter 1 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Pulse Width Measurement, Synchronous Output (4-bit x 2ch))

Clock Source .....1/16, 1/32 of OSC Oscillation Clock, 1/16 1/32 of XI Oscillation Clock, Overflow of Timer Counter 0, External Clock Input

Interrupt Source .....Overflow of Timer Counter 1, Coincidence of Compare Register 1 and Timer Counter 1 Coincidence of Capture / Compare Register 1 and Timer Counter 1 , Capture of the Capture / Compare Register 1

Timer Counter 2 : 8-bit x 1 (Timer Output, Event Count, PWM Output)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 2

Timer Counter 3 : 8-bit x 1 (Timer Output, PWM Output, Synchronous Serial Clock Generator, Synchronous Output (4-bit x 2ch), Event Count)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, Overflow of Timer Counter 1

Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 8-bit x 1 (Timer Output, Event Count, PWM Output, A/D Conversion Trigger Generation)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, External Clock Input

Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 8-bit x 1 (Timer Output, PWM Output, Serial Index Search, Synchronous Output (4-bit x 2ch), Event Count)

Clock Source .....1/8 System Clock, 1/256, 1/4096 of OSC Oscillation Clock, 1/256, 1/4096 of XI Oscillation Clock, Overflow of Timer Counter 3

Interrupt Source .....Overflow of Timer Counter 5

Watchdog

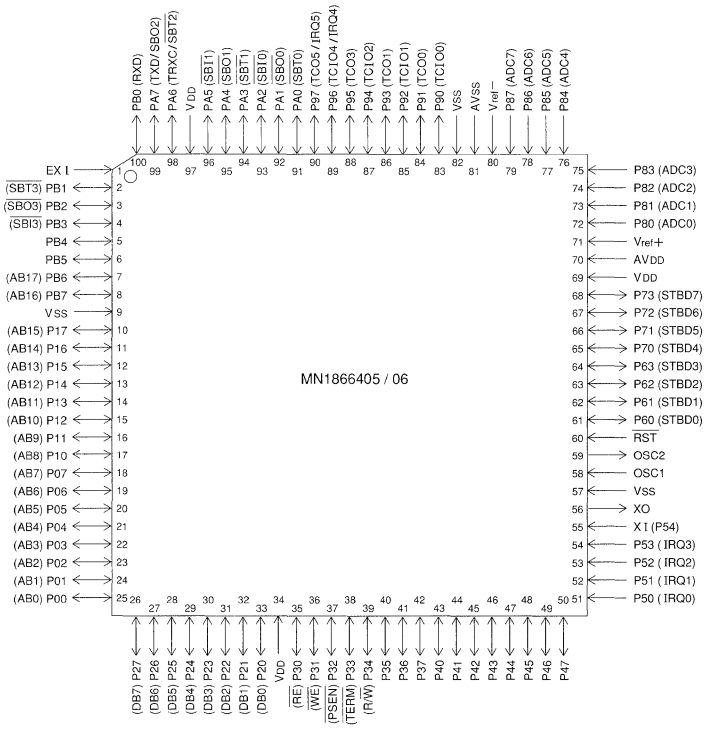
(Connectable) Timer Counter 2 + Timer Counter 3, Timer Counter 4 + Timer Counter 5
Timer Counter 0 + Timer Counter 1, Timer Counter 3 + Timer Counter 5

Serial Interface			Serial : 8-bit x 3 (Synchronous Type) Clock Source .....Machine Cycle, External Clock, Overflow of Timer Counter 3 UART x 1
I/O Ports	**I/O**	**72**	• Joint use : 59 • Specified pull-up Resistor available : 20 (Software Programmable)
	Input	**13**	• Joint use : 13
A/D Inputs			8-bit x 8ch (with S/H)
PWM			16-bit x 4ch (at Repetition Cycle 0.8µs to 104.8ms, 20MHz)
ICR			16-bit x 2ch (Possible to set to OCR)
OCR			16-bit x 2ch
Package			MN1866405 : QFH100-P-1414 MN1866406 : QFH100-P-1414, QFP100-P-1818

Support Tool

In-Circuit Emulator	Mr. ICE / 1860 (made by Computex Co. Ltd.)
EPROM built-in Type	Use **MN18P66405** (ES (Engineering Sample) available) in QFH100-P-1414 / QFP100-P-1818 package.

Pin Configuration



QFH100-P-1414 (MN1866405 / 06)
QFP100-P-1818 (MN1866406)

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	At 20MHz Opeation			50	mA
	IDD2	At 32kHz Operation			5	mA
Supply Current at STOP	IDD3	Oscillation halt			50	μA
Supply Current at HALT	IDD4	20MHz Oscillaiton halt			500	μA

(Ta= –20 to +70°C, VDD=3.5V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Linearity Error					±2	LSB
Zero Transition Voltage	VOT			100	200	mV
Full-scale Transition Voltage	VFT		2800	2900		mV
A/D Conversion Time		at High Speed A/D Conversion			2.60	μS
Analog Input Voltage	VIA		Vref–		Vref+	V

(Ta=25°C, VDD=3.0V, VSS=0V)

❑ MN6755240 / 320

Type		**MN6755240 / 320**
ROM (x8-bit)		24K / 32K
RAM (x8-bit)		704 / 1024
Minimum Instruction Execution Time	With Main Clock operated	**0.33µs (at 3.3 to 5.5V, 12MHz)** **0.25µs (at 4.2 to 5.5V, 16MHz)**
	With Sub-clock operated	**122µs (at 3.3 to 5.5V, 32.768kHz)**

Interrupts

• RESET • Runaway • External 0 • External 1 • Cylinder FG • Capstan FG • HSW
• VSYNC • General-use Capture • Free Running Counter • CTL • Unreeling Reel FG
• Feeding Reel FG • Timer 0 to 4 • Synchronous Output • Continuous Synchronous Output • DMA
• Direction Detection • Serial 0, 1 • A/D

Timer Counter

Timer Counter 0 : 16-bit x 1 (Synchronous Interrupt function)
Clock Source .....System Clock, XI Oscillation Clock, 1/32 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 0, Compare to Output Compare Register

Timer Counter 1 : 16-bit x 1 (Event Count, Synchronous Serial Clock Generator)
Clock Source .....System Clock, 1/32 of OSC Oscillation Clock, AFG Frequency Dividing Signal
Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Event Count, Input Capture, Synchronous Interrupt function)
Clock Source .....System Clock, 1/32, 1/48 OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 2, DCTL Signal Edge,
Bit Counter Underflow for Shift Register,
Coincidence of Compare Register and Shift Register

Timer Counter 3 : 16-bit x 1 (Timer Output (Possible by Mask Option), Event Count, Serial Index Search)
Clock Source .....System Clock, 1/32 of OSC Oscillation Clock, TC13 Input
Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Event Count, Linear Time Count)
Clock Source .....1/32 of OSC Oscillation Clock, CTL Signal
Interrupt Source .....Overflow of Timer Counter 4

Watchdog Timer : 19-bit x 1 (Watchdog)
Clock Source .....OSC Oscillation Clock, XI Oscillation Clock,
Interrupt Source .....Watchdog Timer period 32.7ms (fosc=at 16MHz), 43.7ms (fosc=at 12MHz),
64ms (XI=at 32kHz)

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function)
Clock Source .....1/2, 1/4, 1/8 of System Clock, 1/2 of Timer Counter, $\overline{\text{SBT0}}$ Pin Input

Serial 1 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function)
Clock Source .....1/2, 1/4, 1/8 of System Clock, 1/2 of Timer Counter, $\overline{\text{SBT1}}$ Pin Input

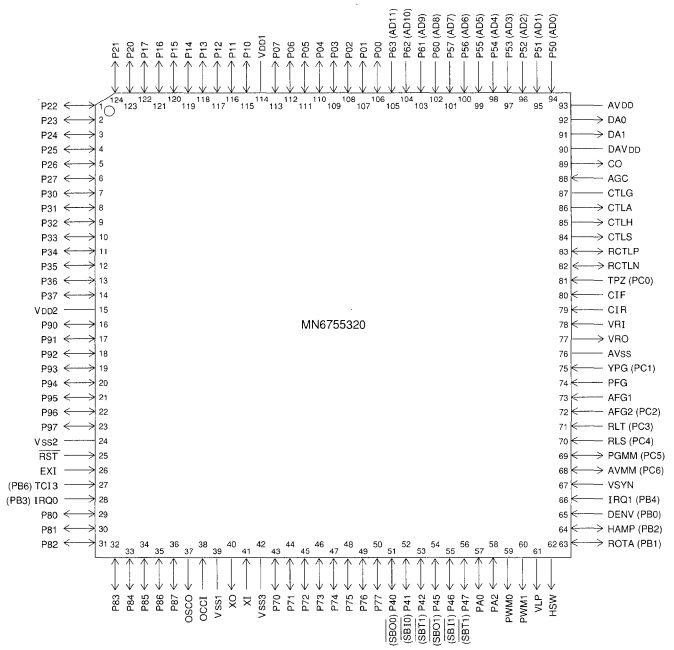
I/O Ports	**I/O**	**64**	• Joint use : 32
	Input	**25**	• Joint use
	Output	**4**	
A/D Inputs			8-bit x 12ch (without S/H)
D/A (Analog) Outputs			13-bit x 2ch
PWM			8-bit x 2ch (at Repetition Cycle 32µs, 6MHz), 14-bit x 1ch (at Repetitio Cycle 1.024ms, 16MHz)
ICR			18-bit x 3ch, 16-bit x 5ch

OCR	16-bit x 2ch
FGICR	9-bit x 1ch, 11-bit x 3ch
Special Ports	Real Time Output (16 (with DMA function), 2 (4-state Synchronous Output), 8 (2-state Synchronous Output)), CTL Amp, DMA, Reel FG Input
Notes	VISS/VASS Detector function
Package	QFP124-P-2828, QFP128-P-1818

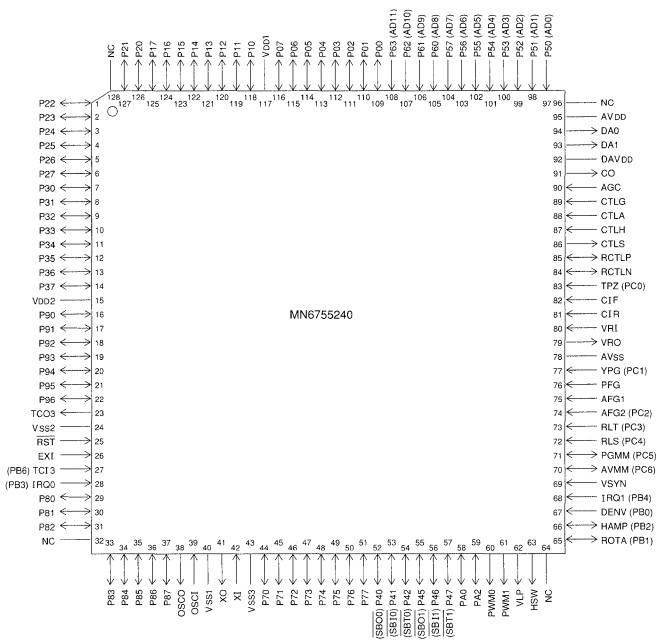
Support Tool

In-Circuit Emulator	Mr. ICE / 1860 (made by Computex Co. Ltd.)
Piggyback	Use **EP67550** as piggy in QFP124-P-2828 / QFP128-P-1818 package.
EPROM built-in Type	Use **MN67P55320** (ES (Engineering Sample) available) in QFP124-P-2828 / QFP128-P-1818 package.

Pin Configuration



QFP124-P-2828



QFP128-P-1818

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=12M, STBH (ANACNT, #A9)='01'		30	50	mA
Supply Current at STOP	IDD2	Oscillation halt, No load STBH (ANACNT, #A9)='00'			50	μA

(Ta=25°C, VDD=5.0V, VSS=0V)

A/D, D/A Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error					±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=16MHz		3.25		μs
Analog Input Voltage			0.5		4.5	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN6755486 / 675556

Type		**MN6755486 / 675556**
ROM (x8-bit)		48K / 64K
RAM (x8-bit)		1024 / 1536
Minimum Instruction Execution Time	With Main Clock operated	**0.25µs (at 3.0 to 5.5V, 16MHz)**
	With Sub-clock operated	**122µs (at 2.2 to 5.5V, 32.768kHz)**

Interrupts

• RESET • Runaway • External 0 • External 1 (4 Input Expandable) • Cylinder FG • Capstan FG • HSW • VSYNC • General-use Capture • Free Running Counter • CTL • Winding Reel FG • Feeding Reel FG • Timer 0 to 5 • Synchronous Output • Continuous Synchronous Output • DMA • Direction Detection • Serial 0, 1, 2 • A/D

Timer Counter

Timer Counter 0 : 16-bit x 1 (Synchronous Interrupt function)
Clock Source .....System Clock, XI Oscillation Clock, 1/32 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 0, Coincidence of Output Compare Register

Timer Counter 1 : 16-bit x 1 (Event Count, Synchronous Serial Clock Generator)
Clock Source .....System Clock, 1/32 of OSC Oscillation Clock, AFG Frequency Dividing Signal
Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Event Count, Input Capture, Synchronous Interrupt function)
Clock Source .....System Clock, 1/32, 1/48 OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 2, DCTL Signal Edge,
Bit Counter Underflow for Shift Register,
Coincidence of Compare Register and Shift Register

Timer Counter 3 : 16-bit x 1 (Timer Output (Possible at Mask Option), Event Count, Serial Index Search)
Clock Source .....System Clock, 1/32 of OSC Oscillation Clock, TC13 Input
Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Event Count, Linear Time Count)
Clock Source .....1/32 of OSC Oscillation Clock, CTL Signal
Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 30-bit x 1 (Clock, Buzzer Output)
Clock Source .....System Clock, XI Oscillation Clock, 1/256, 1/32 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter (Interrupts for second, minutes, and hours can be created.)

Watchdog Timer : 19-bit x 1 (Watchdog)
Clock Source .....OSC Oscillation Clock, XI Oscillation Clock,
Interrupt Source .....Watchdog Timer period 65.6ms (fosc=at 16MHz), 84.7ms (fosc=at 12MHz), 128ms (XI=at 32kHz)

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Transfer direction of MSB/LSB selectable, Start Condition function)
Clock Source .....1/2, 1/4, 1/8 of System Clock, 1/256 of OSC Oscillation Clock,
1/2 of Timer Counter, $\overline{\text{SBT0}}$ Pin Input

Serial 1 : 8-bit x 1 (Synchronous Type) (Transfer direction MSB/LSB selectable, Start Condition function)
Clock Source .....1/2, 1/4, 1/8 of System Clock, 1/256 of OSC Oscillation Clock,
1/2 of Timer Counter, $\overline{\text{SBT1}}$ Pin Input

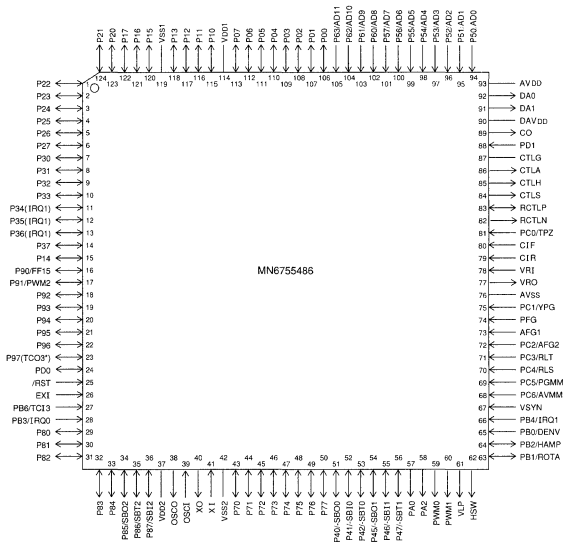
Serial 2 : 8-bit x 1 (Synchronous Type) (Transfer direction MSB/LSB selectable, Start Condition function)
Clock Source .....1/2, 1/4, 1/8 of System Clock, 1/256 of OSC Oscillation Clock,
1/2 of Timer Counter, $\overline{\text{SBT0}}$ Pin Input

I/O Ports	**I/O**	**64**	• Joint use : 32
	Input	**27**	• Joint use
	Output	**4**	
A/D			8-bit x 12ch (without S/H)
D/A			13-bit x 2ch
PWM			8-bit x 2ch (at Repetition Cycle 32µs, 16MHz), 14-bit x 1ch (at Repetitio Cycle 1.024ms, 16MHz)
ICR			18-bit x 3ch, 16-bit x 5ch
OCR			16-bit x 2ch
FGICR			9-bit x 1ch, 11-bit x 3ch
Simple Remote-control Reception Function			On-chip 4:3 majority-verdict circuit and general-use capture circuit (IRQ 0 input)
Special Ports			Real Time Output (16 (with DMA function), 4 (4-state Synchronous Output), 8 (2-state Synchronous Output)), CTL Amp, DMA, Reel FG Input
Notes			VISS/VASS Detector function
Package			MN6755486 : QFP124-P-2828, QFP128-P-1818 MN675556 : QFP128-P-1818

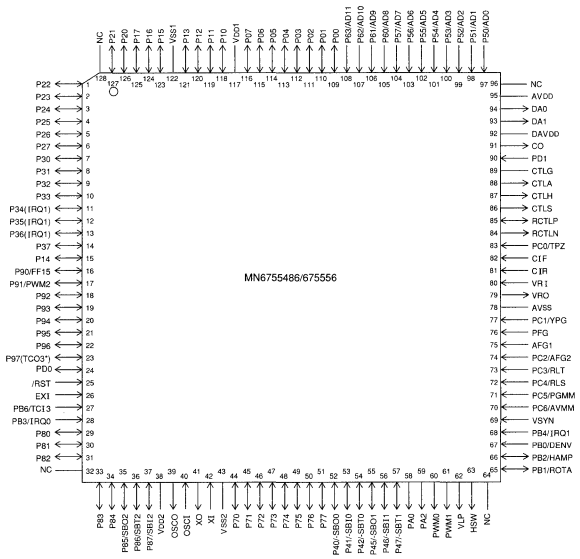
Support Tool

In-Circuit Emulator	Mr. ICE / 1860 (made by Computex Co. Ltd.)
Piggyback	Use **EP67556** as piggy in QFP124-P-2828 / QFP128-P-1818 package.
EPROM built-in Type	Use **MN67P55646** (ES (Engineering Sample) available) in QFP124-P-2828 / QFP128-P-1818 package.

Pin Configuration



QFP124-P-2828



QFP128-P-1818

NC : Nothing connected with terminal.

See the next page for electrical characteristics.

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=16M, STBH (ANACNT, #A9)='01'		30	50	mA
Supply Current at STOP	IDD2	Oscillation halt, No load STBH (ANACNT, #A9)='00'			10	μA
Supply Current at SLOW	IDD3	VDD=3V, XI=32kHz, STBH=0, No load		250	500	μA
Supply Current at HALT	IDD4	VDD=3V, XI=32kHz, STBH=0, No load		5	10	μA

(Ta=25±2°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error					±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=16MHz		3.25		μs
Analog Input Voltage			0.5		4.5	V

(Ta=25°C, VDD=5.0V, VSS=0V)

❑ MN675567 / 47

Type		**MN675567 / 47**
ROM (x8-bit)		72K / 56K
RAM (x8-bit)		2048 / 1536
Minimum Instruction Execution Time	With Main Clock operated	**0.25µs (at 4.0 to 5.5V, 16MHz)**
	With Sub-clock operated	**122µs (at 2.7 to 5.5V, 32.768kHz)**

Interrupts

• RESET • Runaway • External 0, 1, 2, 3 • Cylinder FG • Capstan FG • HSW • VSYNC
• General-use Capture • Free Running Counter • CTL, JOG, AVBUS • Winding Reel FG
• Feeding Reel FG • Timer 0 to 5 • Synchronous Output • Continuous Synchronous Output • DMA
• Direction Detection • Serial 0, 1D

Timer Counter

Timer Counter 0 : 16-bit x 1
Clock Source .....System Clock, 1/32 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 0

Timer Counter 1 : 16-bit x 1 (Event Count, Synchronous Serial Clock Generator)
Clock Source .....System Clock, 1/12, 1/16 of OSC Oscillation Clock, AFG Frequency Dividing Signal
Interrupt Source .....Overflow of Timer Counter 1

Timer Counter 2 : 16-bit x 1 (Event Count, Input Capture, Synchronous Interrupt function)
Clock Source .....System Clock, 1/32, 1/48 OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter 2, DCTL Signal Edge, Bit Counter Underflow for Shift Register, Coincidence of Compare Register and Shift Register

Timer Counter 3 : 16-bit x 1 (Timer Output, Event Count, Serial Index Search)
Clock Source .....System Clock, 1/32 of OSC Oscillation Clock, TC13 Input
Interrupt Source .....Overflow of Timer Counter 3

Timer Counter 4 : 16-bit x 1 (Linear Time Count)
Clock Source .....1/32 of OSC Oscillation Clock, CTL Signal
Interrupt Source .....Overflow of Timer Counter 4

Timer Counter 5 : 30-bit x 1 (Clock, Buzzer Output)
Clock Source .....System Clock, XI Oscillation Clock 1/768, 1/256, 1/96, 1/32 of OSC Oscillation Clock
Interrupt Source .....Overflow of Timer Counter (Interrupts for second, minutes, and hours are available.)

Watchdog Timer : 19-bit x 1 (Watchdog)
Clock Source .....OSC Oscillation Clock, XI Oscillation Clock,
Interrupt Source .....Watchdog Timer period 65.6ms (fosc=at 16MHz), 128ms (XI=at 32kHz)

Serial Interface

Serial 0 : 8-bit x 1 (Synchronous Type) (Simple I^2C function)
Clock Source .....1/4, 1/32, 1/64 of System Clock, 1/2 of Timer Counter 1, $\overline{SBT0}$ Pin Input

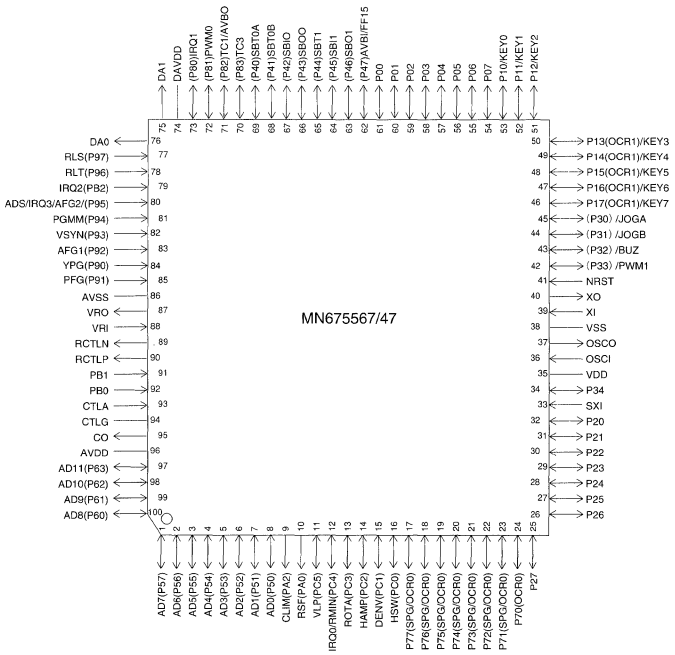
Serial 1 : 8-bit x 1 (Synchronous Type) (Simple I^2C function)
Clock Source .....1/4, 1/32, 1/64 of System Clock, 1/2 of Timer Counter 1, $\overline{SBT1}$ Pin Input

I/O Ports	**I/O**	**64**	• Joint use : 32
	Input	**27**	• Joint use : 9
	Output	**4**	
A/D			8-bit x 12ch (without S/H)
D/A			13-bit x 2ch
PWM			8-bit x 2ch (Repetition Cycle 32µs, at 16MHz), 14-bit x 1ch (Repetition Cycle 1.024ms, at 16MHz)
ICR			18-bit x 4ch, 16-bit x 4ch
OCR			16-bit x 3ch
FGICR			11-bit x 3ch
Simple Remote-control Reception Function			General-use capture circuit (IRQ 0 input)
Special Ports			Real Time Output (8 (with DMA function), 4 (4-state Synchronous Output), 8 (2-state Synchronous Output)), CTL Amp, FG Amp etc. built-in, DMA, Reel FG Input
Notes			VISS/VASS Detector function
Package			QFP100-P-1818

Support Tool

In-Circuit Emulator	Mr. ICE / 1860 (made by Computex Co. Ltd.)
Piggyback	Use **EP67557** as piggy in QFP100-P-1818 package.
EPROM built-in Type	Use **MN67P5577** [ES (Engineering Sample) available] in QFP100-P-1818 package.

Pin Configuration



QFP128-P-1818

See the next page for electrical characteristics.182

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc=16M, STBH (ANACNT, #A9)='01'		30	50	mA
Supply Current at STOP	IDD2	Oscillation halt, No load STBH (ANACNT, #A9)='00'			10	μA
Supply Current at SLOW	IDD3	VDD=3V, XI=32kHz, STBH=0, No load		250	500	μA
Supply Current at HALT	IDD4	VDD=3V, XI=32kHz, STBH=0, No load		5	10	μA

(Ta=25±2°C, VDD=5.0V, VSS=0V)

A/D Converter Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error					±3	LSB
A/D Conversion Relative Error					±3	LSB
A/D Conversion Time		fosc=16MHz		3.25		μs
Analog Input Voltage			0.5		4.5	V

(Ta=25°C, VDD=5.0V, VSS=0V)

10100 16-bit SERIES

MN10100 Series

The MN10100 Series of 8-bit microcomputers is the realization of developments in C programming.

Because of the 8-bit architecture, which allows half-byte instruction sets and offers other advantages, assembler ROM code size can be reduced.

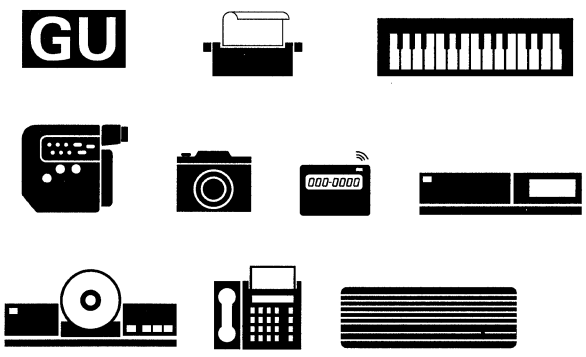
They are compact and consume little power, but feature a shortest instruction processing time of 100 ns (5 V).

They can be used in a wide variety of applications where cost performance is a demand.

Features

- **Efficiency of C-based ROM code:** Assembler rate 1 or less
- **High-speed instruction processing:** 100 ns
- **Linear address space:** 256 kB
- **Identical architecture for 32- and 16-bit microcomputers**
- **D option functions**
  - Hardware task switching (Max. 4 task)
  - 16-bit multiplication
  - ROM collection
  - Etc.

■ Applications



MN10100 Series

❑ MN101C01C / 01D

Type	**MN101C01C (under development) / 01D**
ROM (x8-bit)	48K/64K (External memory can be expanded)
RAM (x8-bit)	2048/2048 (External memory can be expanded)
Minimum Instruction Execution Time	**0.10 µs (at 4.5 to 5.5V, 20MHz)** **0.25 µs (at 2.7 to 5.5V, 8MHz)** **1.00 µs (at 2.0 to 5.5V, 2MHz)** **125 µs (at 2.0 to 5.5V, 32kHz)**
Interrupts	• RESET • Watchdog • External 0 • External 1 • External 2 • External 3 • External 4 • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Timer 5 • Clock Timer • Serial 0 • Serial 1 • Serial 2 • Automatic Transfer finish • A/D Conversion finish

Timer Counter

Timer Counter 0 : 8-bit x 1 (Square-wave/8-bit PWM Output, Event Count, Generation of Remote Control Carrier)
Clock Source .....1/1, 1/4 of System Clock, 1/1 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Register 0

Timer Counter 1 : 8-bit x 1 (Square-wave Output, Event Count, Synchronous Output Event)
Clock Source .....1/16, 1/64 of System Clock, 1/1 of XI Oscillation Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Register 1

Timer Counter 0, 1 can be cascade-connected.

Timer Counter 2 : 8-bit x 1 (Square-wave/8-bit PWM Output, Event Count, Synchronous Output Event)
Clock Source .....1/1, 1/4 of System Clock, 1/1 of XI Oscillation Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Register 2

Timer Counter 3 : 8-bit x 1 (Square-wave Output, Event Count, Generation of Remote Control Carrier, Serial 0 Baud Rate Timer)
Clock Source .....1/4, 1/16 of System Clock, 1/1 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Register 3

Timer Counter 2, 3 can be cascade-connected.

Timer Counter 4 : 16-bit x 1 (Square-wave/16-bit PWM Output, Event Count, Synchronous Output Event, Input Capture)
Clock Source .....1/4, 1/16 of System Clock, 1/1 of OSC Oscillation Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Register 4

Time Base Timer (One-minute Count Setting, Five independently operable 8-bit Timer Counter)
Clock Source .....1/4 of System Clock, 1/1, 1/8192 of OSC Oscillation Clock, 1/1, 1/8192 of XI Oscillation Clock
Interrupt Source .....Coincidence with Compare Register 5, 1/8192 Prescaler Overflow

Watchdog Timer
Clock Source .....1/131072, 1/524288, 1/2097152 of System Clock (Mask Option)

Serial Interface

Serial 0 : 8-bit x 1 [Synchronous Type/Simple UART(Half-duplex)]
Clock Source .....1/2, 1/4, 1/16 of System Clock
1/2 of Timer Counter 3

Serial 1 : 8-bit x 1 (Synchronous Type)
Clock Source .....1/2, 1/8, 1/64 of System Clock
1/2 of Timer Counter 3

Serial 2 : 8-bit x 1 (Synchronous Type/Simple I^2C)
Clock Source .....1/1, 1/2, 1/4 of System Clock
1/2 of Timer Counter 0

I/O Ports	**I/O**	**57**	• Joint use • Pull-up Resistor available • Input/Output selectable (bit unit)
	Input	**13**	• Joint use • Pull-up Resistor available

A/D Inputs

10-bit x 8ch (with S/H)

Special Ports

Buzzer Output, Remote Control Carrier Signal Output, High-current Drive Port

Package

QFS080-P-1414

Electrical Characteristics

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc = 20MHz, VDD = 5V			60	mA
	IDD2	fx = 32kHz, VDD = 3V			100	µA
Supply Current at HALT	IDD3	fx = 32kHz, VDD = 3V			8	µA
Supply Current at STOP	IDD4	VDD = 5V			2	µA

Support Tool

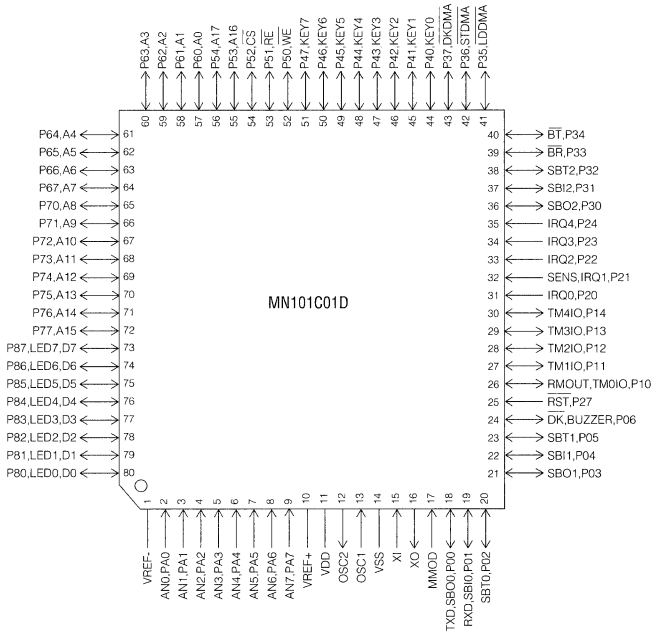
In-Circuit Emulator

PX-ICE101C + PX-PRB101C01D

EPROM built-in Type

Use **MN101CP01D** [ES (Engineering Sample) available] in QFS080-P-1414 package.

Pin Configuration



QFS080-P-1414

❑ MN101C027

Type			**MN101C027**
ROM (x8-bit)			16K (External memory can be expanded)
RAM (x8-bit)			512 (External memory can be expanded)
Minimum Instruction Execution Time			**0.10 µs (at 4.5 to 5.5V, 20MHz)** **0.25 µs (at 2.7 to 5.5V, 8MHz)** **1.00 µs (at 2.0 to 5.5V, 2MHz)** **125 µs (at 2.0 to 5.5V, 32kHz)**
Interrupts			• RESET • Watchdog • External 0 • External 1 • External 2 • External 3 • External 4 • Timer 2 • Timer 3 • Timer 4 • Timer 5 • Clock Timer • Serial 0 • Automatic Transfer finish • A/D Conversion finish
Timer Counter			**Timer Counter 2 : 8-bit x 1** (Square-wave/8-bit PWM Output, Event Count, Synchronous Output Event) Clock Source .....1/1, 1/4 of System Clock, 1/1 of XI Oscillation Clock, External Clock Input Interrupt Source .....Coincidence with Compare Register 2 **Timer Counter 3 : 8-bit x 1** (Square-wave Output, Event Count, Generation of Remote Control Carrier, Serial 0 Baud Rate Timer) Clock Source .....1/4, 1/16 of System Clock, 1/1 of OSC Oscillation Clock, External Clock Input Interrupt Source .....Coincidence with Compare Register 3 **Timer Counter 2, 3 can be cascade-connected.** **Timer Counter 4 : 16-bit x 1** (Square-wave/16-bit PWM Output, Event Count, Synchronous Output Event, Input Capture) Clock Source .....1/4, 1/16 of System Clock, 1/1 of OSC Oscillation Clock, External Clock Input Interrupt Source .....Coincidence with Compare Register 4 **Time Base Timer** (One-minute Count Setting, Five independently operable 8-bit Timer Counter) Clock Source .....1/4 of System Clock, 1/1, 1/8192 of OSC Oscillation Clock, 1/1, 1/8192 of XI Oscillation Clock Interrupt Source .....Coincidence with Compare Register 5, 1/8192 Prescaler Overflow **Watchdog Timer** Clock Source .....1/131072, 1/524288, 1/2097152 of System Clock (Mask Option)
Serial Interface			**Serial 0 : 8-bit x 1** [Synchronous Type/Simple UART(Half-duplex)] Clock Source .....1/2, 1/4, 1/16 of System Clock 1/2 of Timer Counter 3
I/O Ports	**I/O**	**41**	• Joint use : 37 • Pull-up Resistor available • Input/Output selectable (bit unit)
	Input	**13**	• Joint use • Pull-up Resistor available
A/D Inputs			10-bit x 8ch (with S/H)
Special Ports			Buzzer Output, Remote Control Carrier Signal Output, High-current Drive Port
Package			LQFP064-P-1414

Electrical Characteristics

Supply Current

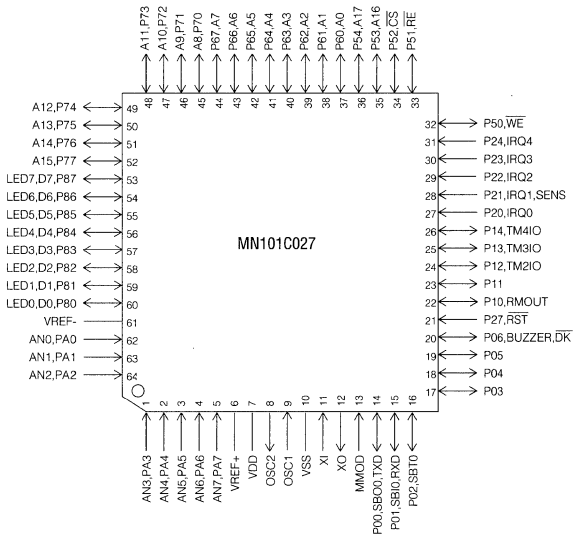
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc = 20MHz, VDD = 5V			60	mA
	IDD2	fx = 32kHz, VDD = 3V			100	µA
Supply Current at HALT	IDD3	fx = 32kHz, VDD = 3V			8	µA
Supply Current at STOP	IDD4	VDD = 5V			2	µA

Support Tool

In-Circuit Emulator PX-ICE101C + PX-PRB101C027

EPROM built-in Type Use **MN101CP02D** [ES (Engineering Sample) available] in LQFP064-P-1414 package.

Pin Configuration



LQFP064-P-1414

❑ MN101C039 / 03A

Type			**MN101C039 / 03A**
ROM (x8-bit)			24K/32K (External memory can be expanded)
RAM (x8-bit)			1536/1536 (External memory can be expanded)
Minimum Instruction Execution Time			**0.10 µs (at 4.5 to 5.5V, 20MHz)** **0.25 µs (at 2.7 to 5.5V, 8MHz)** **125 µs (at 2.0 to 5.5V, 32kHz)**
Interrupts			• RESET • Watchdog • External 0 • External 1 • External 2 • External 3 • External 4 • Timer 2 • Timer 3 • Timer 4 • Timer 5 • Clock Timer • Serial 0 • Serial 1 • A/D Conversion finish
Timer Counter			**Timer Counter 2 : 8-bit x 1** (Square-wave/8-bit PWM Output, Event Count, Synchronous Output Event) Clock Source .....1/1, 1/4 of System Clock, 1/1 of XI Oscillation Clock, External Clock Input Interrupt Source .....Coincidence with Compare Register 2 **Timer Counter 3 : 8-bit x 1** (Square-wave Output, Event Count, Generation of Remote Control Carrier, Serial 0 Baud Rate Timer) Clock Source .....1/4, 1/16 of System Clock, 1/1 of OSC Oscillation Clock, External Clock Input Interrupt Source .....Coincidence with Compare Register 3 **Timer Counter 2, 3 can be cascade-connected.** **Timer Counter 4 : 16-bit x 1** (Square-wave/16-bit PWM Output, Event Count, Synchronous Output Event, Input Capture) Clock Source .....1/4, 1/16 of System Clock, 1/1 of OSC Oscillation Clock, External Clock Input Interrupt Source .....Coincidence with Compare Register 4 **Time Base Timer** (One-minute Count Setting, Five independently operable 8-bit Timer Counter) Clock Source .....1/4 of System Clock, 1/1, 1/8192 of OSC Oscillation Clock, 1/1, 1/8192 of XI Oscillation Clock Interrupt Source .....Coincidence with Compare Register 5, 1/8192 Prescaler Overflow **Watchdog Timer** Clock Source .....1/131072, 1/524288, 1/2097152 of System Clock (Mask Option)
Serial Interface			**Serial 0 : 8-bit x 1** [Synchronous Type/Simple UART(Half-duplex)] Clock Source .....1/2, 1/4, 1/16 of System Clock 1/2 of Timer Counter 3 **Serial 1 : 8-bit x 1** (Synchronous Type) Clock Source .....1/2, 1/8, 1/64 of System Clock 1/2 of Timer Counter 3
I/O Ports	**I/O**	**57**	• Joint use • Pull-up Resistor available • Input/Output selectable (bit unit) • Pull-down Resistor partially available
	Input	**13**	• Joint use • Pull-up Resistor available • Pull-down Resistor partially available
A/D Inputs			10-bit x 8ch (with S/H)
LCD			52 Segment • 4 Common • Static, 1/2, 1/3, 1/4 Duty
Special Ports			Buzzer Output, Remote Control Carrier Signal Output, High-current Drive Port
Package			QFP100-P-1818B

Electrical Characteristics

Supply Current

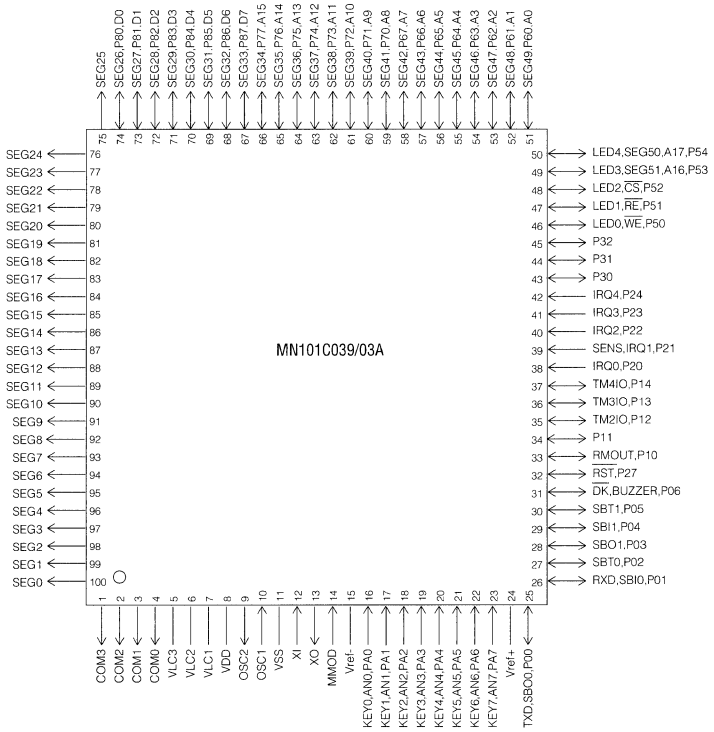
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	fosc = 8MHz, VDD = 5V			25	mA
	IDD2	fx = 32kHz, VDD = 3V			100	µA
Supply Current at HALT	IDD3	fx = 32kHz, VDD = 3V			8	µA
Supply Current at STOP	IDD4	VDD = 5V			2	µA

Support Tool

In-Circuit Emulator PX-ICE101C + PX-PRB101C01D

EPROM built-in Type Use **MN101CP03D** [ES (Engineering Sample) available] in QFP100-P-1818B package.

Pin Configuration



QFP100-P-1818B

16-bit 10200 SERIES

MN10200 Series

The MN10200 series uses a simple and elegant architecture that executes basic instructions at a rate of 1 byte per cycle to achieve high-speed operation with a minimum instruction execution time of 100 nsec at 20 MHz. These are 16-bit microcontrollers with an ASIC expansion bus to allow the customers to incorporate peripheral circuitry of their original design in them with ease. These equipment-oriented microcontrollers demonstrate high realtime performance.

Features

- **16-bit architecture**

  1-bit minimum instruction code -- 100 nsec minimum instruction execution time (at 20 MHz)

- **Elegant architecture**

  High-efficiency 1 byte per cycle instructions

  Achievement of higher speeds for load/store transfer and branch instructions, etc.

- **Flexible expansion of functions**

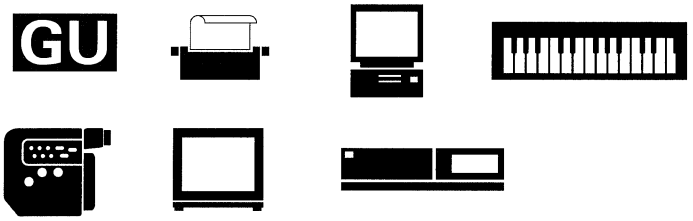
  Achievement of a microcontroller that supports customization through an ASIC expansion bus

- **Software support**

  ANSI C language -- <μ>ITRON*-specification realtime OS

  * ITRON is an abbreviation of "Industrial TRON."

■ Applications



MN10200 Series

❑ MN1020003

Type			MN1020003
ROM (x8-bit) **RAM (x8-bit)**			Maximum 16M in total (In-built RAM 1K, Special Register 1K Reserve Space 2K included) External ROM, RAM
Minimum Instruction Execution Time			With Main Clock operated **122ns (at 4.75 to 5.25V, 16.39MHz)**
Interrupts			• RESET • NMI • External 1 to 5 • Timer 0 to 6 (12 factors) • A/D • Serial Reception • Serial Transmission
Timer Counter			**Timer Counter 0 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input Interrupt Source .....Underflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input Interrupt Source .....Underflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input Interrupt Source .....Underflow of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input Interrupt Source .....Underflow of Timer Counter 3 **Timer Counter 4 : 16-bit x 1** (Timer Output, Event Count, Input Capture (3), Synchronous Output (1-bit x 1ch), PWM Output) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input (2) Interrupt Source .....Capture/Compare x 2 **Timer Counter 5 : 16-bit x 1** (Timer Output, Event Count, Input Capture (2), Synchronous Output (1-bit x 1ch), PWM Output) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input Interrupt Source .....Capture/Compare x 2 **Timer Counter 6 : 8-bit x 1** (Timer Output, Event Count, Input Capture (2), Synchronous Output (1-bit x 1ch), PWM Output) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input Interrupt Source .....Capture/Compare x 2 **Prescaler Counter x 2** **Timer Counter 0,1,2,3 can be cascade-connected every 8-bit. (Max. 32-bit)**
Serial Interface			**Serial : 7,8-bit x 1** (Synchronous Type) (Joint use with UART) Clock Source .....Receive : $\overline{\text{SBT0}}$ Pin Input, Transmission : Timer 2,3 **UART x 1** (Joint use with Serial)
I/O Ports	**High Voltage I/O**	**35**	• Joint use : 35 Input, Output selectable : 35 (by-bit), • Specifited pull-up Resistor available (Software Programmable) : 27
A/D Inputs			8-bit x 8ch (with S/H)
PWM			16-bit x 2ch, 8-bit x 1ch (Number of PWM, ICR and OCR channels depends on combination type)
ICR			(16-bit x 2ch)
OCR			(16-bit x 2ch)
Package			QFS080-P-1414

Electrical Characteristics

A/D D/A Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		VREFH=5V, VREFL=0V			±3	LSB
A/D Conversion Time		fosc1=16.39MHz	4.88			µs
Reference Input Voltage	VREFH	VREFH>VREFL			AVDD	2
	VREFL		AVSS			V
Analog Input Voltage	VIA		VREFL		VREFH	V

(Ta= +25°C, VDD=5.0V, VSS=0V)

Supply Current

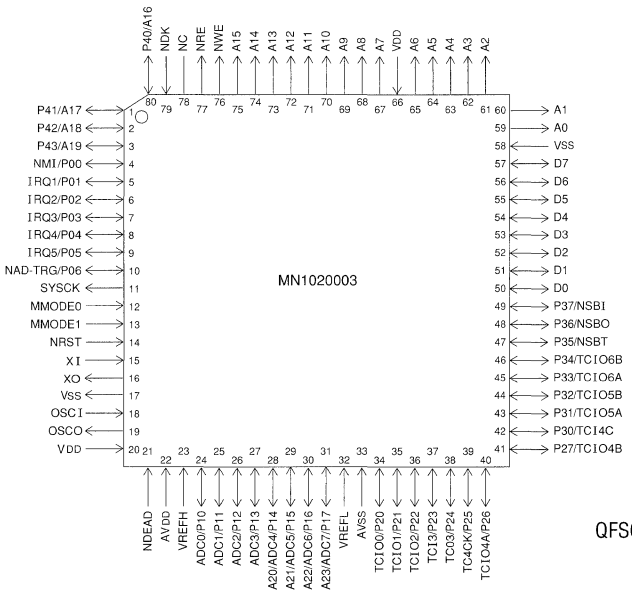
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	Input voltage level VDD or VSS fosc1 = 16.39 MHz output release			75	mA
Supply Current at STOP	IDD3	Pin with pull-up resistor is open All other input pins and Hi-z state input/output pins are apply simultaneously VDD or VSS level			30	µA
Supply Current at HALT	IDD4	fosc1 = 16.39 kHz Pin with pull-up resistor is open All other input pins and Hi-z state input/output pin are simultaneously applied VDD or VSS levell			30	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE102B00 + PX-PRB1020003

Pin Configuration



QFS080-P-1414

❑ MN1020004A

Type	MN1020004A
ROM (x8-bit / x16-bit) **RAM (x8-bit / x16-bit)**	Maximum 16M in total (Special Register 1K, Reserve Space 3K included) External ROM, RAM
Minimum Instruction Execution Time	With Main Clock operated **122µs (at 4.5 to 5.5V, 16.39MHz)**
Interrupts	• RESET • Watchdog • Timer Counter 0 to 5 • Timer Counter 6 to 7 • Timer Counter 6 to 8 Compare Capture A • Timer Counter 6 to 8 Compare Capture B • ATC ch 0 to 3 Transfer finished • External 0 to 3 • Serial ch 0, 1 Transmission • Serial ch 0, 1 Reception • Key Input (OR) • A/D Conversion finish
Timer Counter	**Timer Counter 0 : 8-bit x 1** (Timer Output, Event Count, Two 8-bit Prescalers built-in) Clock Source .....1/ (1 to 256) of System Clock, 1/4 of XI Oscillation Clock, External Clock Input Interrupt Source .....Underflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Timer Output, Event Count, Synchronous Output (4-bit x 2ch), Two 8-bit Prescalers built-in, ATC Start up) Clock Source .....1/ (1 to 256) of System Clock. External Clock Input Interrupt Source .....Underflow of Timer Counter 1 **Timer Counter 2 : 8-bit x 1** (Timer Output, Event count, Two 8-bit Prescalers built-in, A/D Conversion Start up) Clock Source .....1/ (1 to 256) of System Clock. External Clock Input Interrupt Source .....Underflow of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Timer Output, Event count, UART Baud Rate Generator (2ch), Synchronous Serial Clock Generator (2ch), Two 8-bit Prescalers built-in) Clock Source .....1/ (1 to 256) of System Clock, External Clock Input Interrupt Source .....Underflow of Timer Counter 3 **Timer Counter 4 : 8-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator (2ch), Synchronous Serial Clock Generator (2ch), Two 8-bit Prescalers built-in, Self Reflesh Start up) Clock Source .....1/ (1 to 256) of System Clock Interrupt Source .....Underlow of Timer Counter 4 **Timer Counter 5 : 8-bit x 1** (Event count, Two 8-bit Prescalers built-in, Reflesh Start up) Clock Source .....1/ (1 to 256) of System Clock, 1/4 XI Oscillation Clock Interrupt Source .....Underflow of Timer Counter 5 **Timer Counter 6 : 16-bit x 1** (Timer Output, Event count, Input Capture, PWM Output, Up Down function, 2-Phase Encoder Input, ATC Start up) Clock Source .....1/ (1 to 256) of System Clock. External Clock Input Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 6 **Timer Counter 7 : 16-bit x 1** (Timer Output, Event count, Input Capture, PWM Output, Up Down function, 2-Phase Encoder Input) Clock Source .....1/ (1 to 256) of System Clock. External Clock Input Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 7 **Timer Counter 8 : 16-bit x 1** (Timer Output, Event count, Input Capture, PWM Output, Synchronous Output (4-bit x 2ch), ATC Start up) Clock Source .....1/ (1 to 256) of System Clock. External Clock Input Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture **Timer 0, 1, 2, 3, 4, 5 can be cascade-connected every 8-bit unit. (maximum 48-bit)**

Serial Interface

Serial 0 : 7,8-bit x 1 (Joint use with UART, ATC Start up possible, Transmission finish, Reception finish)
Clock Source .....1/8 of Timer Counter 3, 1/8 of Timer Counter 4

Serial 1 : 7,8-bit x 1 (Joint use with UART, ATC Start up possible, Transmission finish, Reception finish)
Clock Source .....1/8 of Timer Counter 3, 1/8 of Timer Counter 4

UART x 2 (Joint use with Serial)

I/O Ports

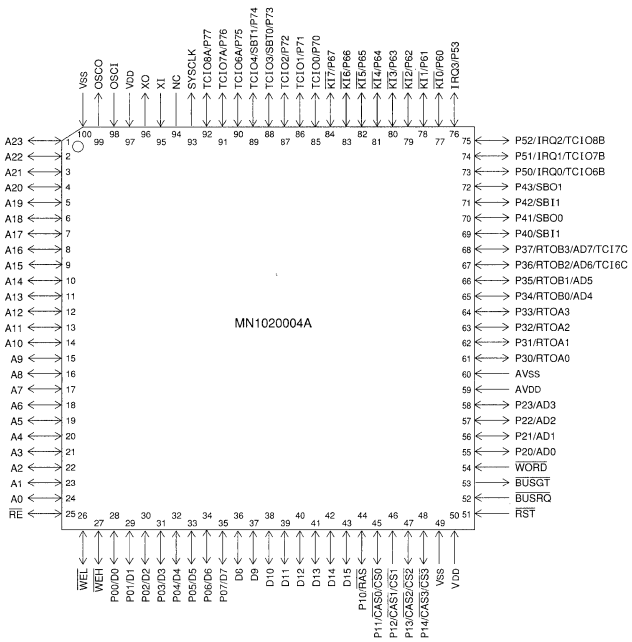
I/O	49	• Joint use : 49 • Input/Output selectable : 49 (by-bit) • Specifited pull- up Resistor available : 24 (Software Programable)

Support Tool

In-Circuit Emulator

PX-ICE102B00 + PX-PRB1020004

Pin Configuration



QFH100-P-1414 / TQFP100-P-1414

NC : Nothing connected with pin.

See the next page for peripheral function, Package and electrical characteristics.

A/D	8-bit x 8ch (with S/H)
PWM	16-bit x 3ch (Number of PWM, ICR and OCR channels depends on combination type)
ICR	(16-bit x 3ch)
OCR	(16-bit x 3ch)
Special Ports	4 (Synchronous) x 2ch Usable as 8-bit
Notes	DRAM Refresh Controller built-in, Data Bus Width ; 8 or 16-bit selectable
Package	QFH100-P-1414 / TQFP100-P-1414

Electrical Characteristics

A/D Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		AVDD=5V, AVSS=0V			±3	LSB
A/D Conversion Time			4.0			µs
Analog Input Voltage	VIA		AVSS		AVDD	V

(Ta= –20 to +70°C, VDD=4.5 to 5.5V, VSS=0V)

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	Input voltage level VDD or VSS fosc1 = 16.39 MHz output release			60	mA
Supply Current at STOP	IDD3	Pin with pull-up resistor is open All other pins and Hi-z state input/output pin are simultaneously applied VDD or VSS level			30	µA
Supply Current at HALT	IDD4	fosc1 = 16.39 kHz Pin with pull-up resistor is open All other input pins and Hi-z state input/output pin are simultaneously applied VDD or VSS level			30	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

❑ MN1020407

Type	**MN1020407 [ES (Engineering Sample) is available]**
ROM (x8-bit)	32K (External memory cannot be expanded)
RAM (x8-bit)	1K (External memory cannot be expanded)
Minimum Instruction Execution Time	**122ns (at 4.5 to 5.5V, 16.39MHz)**
Interrupts	• RESET • Watchdog • Timer Counter 2 to 5 • Underflow of Timer Counter 0 • Timer Counter 1 Compare Capture A • Timer Counter 1 Compare Capture B • External 0 to 3 • Serial ch 0.1 Transmission • Serial ch 0, 1 Reception • A/D Conversion finish • Coincidence with Timer Counter 0, Base Register
Timer Counter	**Timer Counter 0 : 16-bit x 1** (Inverter control, PWM Output) Clock Source .....1/1, 1/2, of System Clock Interrupt Source .....Coincidence with Base Register or Underflow **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count, Input Capture, PWM Output, Up Down function, 2-Phase Encorder Input) Clock Source .....1/2 of OSCI Oscillation Clock, TCIO1B Pin Input Interrupt Source .....Coincidence with Compare Capture A or at Capture Coincidence with Compare Capture B or at Capture **Timer Counter 2 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/2 of OSCI Oscillation Clock, TCIO2 Pin Input Interrupt Source .....Underflow of Timer Counter 2 **Timer Counter 3 : 8-bit x 1** (Timer Output, Event Count, AD Conversion Startup) Clock Source .....TCIO3 Pin Input, 1/2 of OSCI Oscillation Clock Interrupt Source .....Underflow of Timer Counter 3 **Timer Counter 4 : 8-bit x 1** (UART Baud Rate Generator(2ch), Synchronous Serial Clock Generator (2ch)) Clock Source .....1/2 of OSCI Oscillation Clock, Timer 2 Output, Timer 3 Output Interrupt Source .....Underflow of Timer Counter 4 **Timer Counter 5 : 8-bit x 1** (UART Baud Rate Generator (2ch), Synchronous Serial Clock Generator (2ch)) Clock Source .....1/2 of OSCI Oscillation Clock, Timer 2 Output, Timer 4 Output Interrupt Source .....Underflow of Timer Counter 5 **Timer 2, 3, 4, 5 can be cascade-connected by 8-bit unit. (Maximum 32-bit)**
Serial Interface	**Serial 0 : 7, 8, 9-bit x 1** (Joint use with UART, Only at 8-bit Trasfer direction of MSB/LSB selectable, Start Condition function) Clock Source .....1/8 of Timer Counter 4, 1/8, of Timer Counter 5, 1/1, 1/2, 1/8, 1/32, 1/128, 1/256 of System Clock **Serial 1 : 7, 8, 9-bit x 1** (Joint use with UART, Only at 8-bit Trasfer direction of MSB/LSB selectable, Start Condition function) Clock Source .....1/8 of Timer Counter 4, 1/8, of Timer Counter 5, 1/1, 1/2, 1/8, 1/32, 1/128, 1/256 of System Clock **UART x 2** (Joint use with Serial)

I/O Ports	**I/O**	**52**	• Joint use : 20 • Input/Output selectable : 52 (by -bit) • Pull-up Resistor available (Software Programable) : 38 • LED Driver : 6 (10mA) • Photo Coupler Driver : 6 (15mA)
	Input	**16**	• Joint use: 8 Dedicated : 8

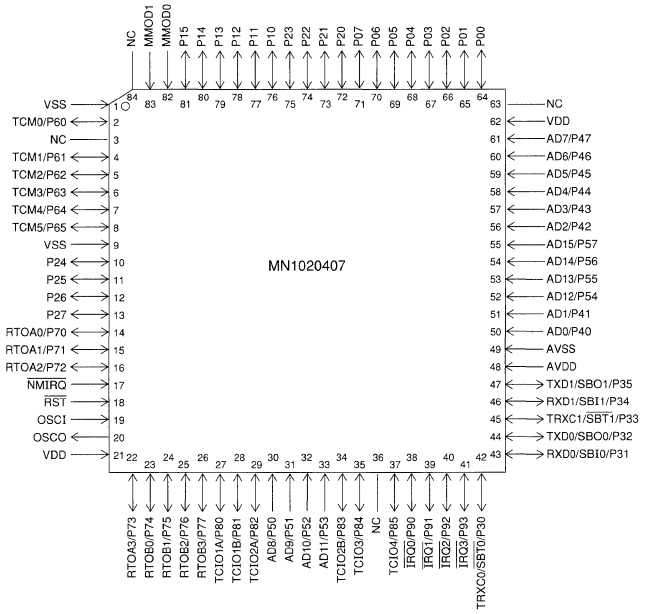
A/D Inputs	8-bit x 8ch (with S/H)
PWM	16-bit x 2ch

ICR	(16-bit x 1ch)
OCR	(16-bit x 1ch)
Notes	Inverter control circuit, three phase 6 outputs, triangular wave modulation, built-in power transistor short-prevention circuit (three 8-bit deadlock timers), function of the force output off by hardware when an abnormality is detected
Package	QFP084-P-1818

Support Tool

In-Circuit Emulator	PX-ICE102B00 + PX-PRB1020407
EPROM built-in Type	Use **MN102P0707** (under development) in QFP084-P-1818 package.

Pin Configuration



QFP084-P-1818

NC : Nothing connected with pin.

❑ MN1021213

Type		MN1021213
ROM (x8-bit)		90K
RAM (x8-bit)		3K
Minimum Instruction Execution Time	Processor Mode	**200ns (at 2.7 to 3.6V, 10MHz)** (However, a wait setting of 1 wait or more is required for peripheral-function register access and external memory space access.)
	External Expansion Mode	**125ns (at 2.7 to 3.6V, 16MHz)** (However, a wait setting of 1 wait or more is required for peripheral-function register access and external memory space access.)
Interrupts		• RESET • Watchdog • Timer Counter 0 to 9 • Timer Counter 10 to 11 • Timer Counter 10 to 12 Compare Capture A • Timer Counter 10 to 12 Compare Capture B • ATCch 0 to 3 • External 0 to 3 • Serial ch 0 to 3 Transmission • Serial ch 0 to 3 Reception • KI Pin (OR) • A/D Conversion finish

Timer Counter

Timer Counter 0,2 to 4 : 8-bit x 1 (Timer Output, Event Count)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 0,2 to 4

Timer Counter 1 : 8-bit x 1 (Timer Output, Event Count, Synchronous Output (4-bit x 1ch))
Clock Source .....1/(1 to 256) of System Clock, External Clock Input
Interrupt Source .....Underflow of Timer Counter 1

Timer Counter 5, 6, 8, 9 : 8-bit x 1 (Timer Output, Event Count, UART Baud Rate Generator, Synchronous Serial Clock Generator)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 5, 6, 8, 9

Timer Counter 7 : 8-bit x 1 (Timer Output, Event Count, A/D Conversion Start up)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 7

Timer Counter 10,11 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encoder Input)
Clock Source .....1/(1 to 256) of System Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 10,11

Timer Counter 12 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture

(Connectable) Timer Counter 0 to 9

Serial Interface

Serial 0, 1 : 8-bit x 1 (Transfer direction of MSB/LSB selectable, Transmission / Reception of 8-bit length)
Clock Source .....1/8 Timer Counter 8, 1/8 of Timer Counter 9

Serial 2, 3 : 8-bit x 1 (Transfer direction of MSB/LSB selectable, Transmit/ Receive of 8-bit length)
Clock Source .....1/8 Timer Counter 5, 1/8 of Timer Counter 6

UART x 4 (Joint use with Serial 0 to 3)

I/O Ports	**I/O**	**46***	• Dedicated : 23 • Joint use : 23 (External Expansion Mode) • Input / Output selectable (by-bit) *at External Expansion Mode
			• Dedicated : 3 • Joint use : 23 (Processor Mode) • Input/Output selectable (by-bit)
	Input	**4**	• Joint use : 4
A/D			8-bit x 8ch (Maximum input is 12) (with S/H)
PWM			16-bit x 3ch
ICR			16-bit x 3ch
OCR			16-bit x 3ch
Special Ports			1 (4-state Synchronous Output)
Notes			Address / Data Multiplex Bus Interface
Package			LQFP128-P-1818B

Electrical Characteristics

A/D Characteristics

Parameter	Symbol	Condition	Limit			Unit	Notes
			Min.	Typ.	Max.		
A/D Conversion Relative Error					±2	LSB	ch0 to 3
					±3	LSB	ch4 to 11
A/D Conversion Time		16MHz	5.0			µs	
Analog Input Voltage	VIA		VSS		VDD	V	

(Ta= +25°C, VDD=AVDD=3.0V, VSS=AVSS=0V)

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDDopr	VI = VDD or VSS, Output open f = 16 MHz, VDD = 3.6V			60	mA
Supply Current at STOP	IDDS	Pin with pull-up resistor is open All other input pins and Hi-z state input/output pins are simultaaneously applied VDD or Vss level f = 16 MHz, VDD = 3.6V Output release			50	µA
Supply Current at HALT	IDDH				15	mA

(Ta= –20 to +70°C, VDD=AVDD=2.7 to 3.6V, VSS=AVSS=0V)

Support Tool

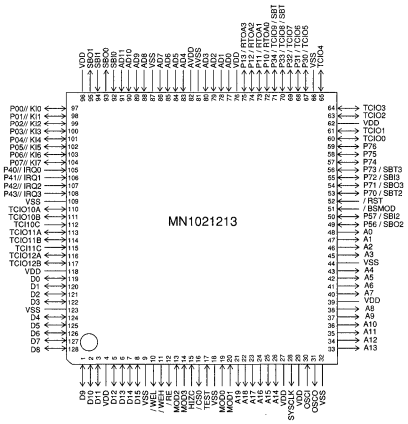
In-Circuit Emulator

PX-ICE10200 + PX-PRB1020013
PARTNER • EX1020013

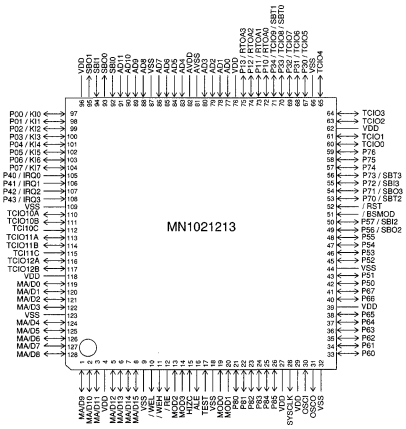
EPROM built-in Type

Use MN102P1213LH in LQFP128-P-1818B package.

Pin Configuration



LQFP128-P-1818B (Processor Mode)



LQFP128-P-1818B (External Expansion Mode)

❑ MN1020015-1 / 0415 / B3203

Type — **MN1020015-1 / 0415 (under development) / B3203 [ES (Enginerring Sample) is available]**

ROM (x8-bit / 16-bit) — Maximum 16M in total (Special Register 1K, Reserve Space 1K included)

RAM (x8-bit / 16-bit) — External / 32K / External (External Memory Expandable)
3K / 2K / 3K (External Memory Expandable)

Minimum Instruction Execution Time — With Main Clock operated **122ns (at 4.5 to 5.5V, 16.39MHz)**

Interrupts

- RESET • Watchdog • Timer Counter 0 to 5
- Timer Counter 6 to 7 • Timer Counter 6 to 8 Compare Capture A
- Timer Counter 6 to 8 Compare Capture B • ATC ch 0 to 3 Transfer finish • External 0 to 3
- Serial ch 0.1 Transmission • Serial ch 0, 1 Reception • Key Input (OR) • A/D Conversion finish

Timer Counter

Timer Counter 0 : 8-bit x 1 (Timer Output, Event Count, Two 8-bit Prescalers built-in)
Clock Source .....1/ (1 to 256) of System Clock, 1/4 of XI Oscillation Clock, External Clock Input
Interrupt Source .....Underflow of Timer Counter 0

Timer Counter 1 : 8-bit x 1 (Timer Output, Event Count, Synchronous Output (4-bit x 2ch), Two 8-bit Prescalers built-in, ATC Start up)
Clock Source .....1/ (1 to 256) of System Clock External, Clock Input
Interrupt Source .....Underflow of Timer Counter 1

Timer Counter 2 : 8-bit x 1 (Timer Output, Event count, Two 8-bit Prescalers built-in, A/D Conversion Start up)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Underflow of Timer Counter 2

Timer Counter 3 : 8-bit x 1 (Timer Output, Event count, UART Baud Rate Generator (2ch), Synchronous Serial Clock Generator (2ch), Two 8-bit Prescalers built-in)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Underflow of Timer Counter 3

Timer Counter 4 : 8-bit x 1 (Timer Output, Event Count, UART Baud Rate Generator (2ch), Synchronous Serial Clock Generator (2ch), Two 8-bit Prescalers built-in, Self Reflesh Start up)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Underlow of Timer Counter 4

Timer Counter 5 : 8-bit x 1 (Event count, Two 8-bit Prescalers built-in, Reflesh Start up)
Clock Source .....1/ (1 to 256) of System Clock, 1/4 XI Oscillation Clock, External Clock Input
Interrupt Source .....Underflow of Timer Counter 5

Timer Counter 6 : 16-bit x 1 (Timer Output, Event count, Input Capture, PWM Output, Up Down function, 2-Phase Encoder Input, ATC Start up)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 6

Timer Counter 7 : 16-bit x 1 (Timer Output, Event count, Input Capture, PWM Output, Up Down function, 2-Phase Encoder Input)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 7

Timer Counter 8 : 16-bit x 1 (Timer Output, Event count, Input Capture, PWM Output, Synchronous Output (4-bit x 2ch), ATC Start up)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture

Timer 0, 1, 2, 3, 4, 5 can be cascade-connected every 8-bit. (maximum 48-bit)

Serial Interface

Serial 0 : 7,8-bit x 1 (Joint use with UART, ATC Start up possible, Transmission finish, Reception finish)
Clock Source .....1/8 of Timer Counter 3, 1/8 of Timer Counter 4

Serial 1 : 7,8-bit x 1 (Joint use with UART, ATC Start up possible, Transmission finish, Reception finish)
Clock Source .....1/8 of Timer Counter 3, 1/8 of Timer Counter 4

UART x 2 (Joint use with Serial)

I/O Ports | I/O | 84 |

- Joint use : 84 (MN1020415), 49 (MN1020015-1), 48 (MN102B3203)
- Specified pull- up Resistor available : 24 (Software Programable)

A/D Inputs

-bit x 8ch (with S/H)

PWM

16-bit x 3ch (Number of PWM, ICR and OCR channels depends on combination type)

ICR

(16-bit x 3ch)

OCR

(16-bit x 3ch)

Special Ports

4 (Synchronous) x 2ch Usable as 8-bit

Notes

DRAM Refresh Controller built-in, Data Bus Width ; 8 or 16-bit selectable

Package

MN1020015-1 : QFH100-P-1414, LQFP100-P-1414
MN1020415 : QFH100-P-1414
MN102B3203 : LQFP100-P-1414

Electrical Characteristics

A/D Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		AVDD=5V, AVSS=0V			±3	LSB
A/D Conversion Time			4.0			µs
Reference Input Voltage	VREFH	VREFH>VREFL			AVDD	V
	VREFL		AVSS			V
Analog Input Voltage	VIA		VREFL		VREFH	V

(Ta= –20 to +70°C, VDD=4.5 to 5.5V, VSS=0V)

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDD1	Input voltage level VDD or VSS fosc1 = 16.39 MHz output release			60	mA
Supply Current at STOP	IDD3	Pin with pull-up resistor is open All other input pins and Hi-z state input/output pins are simultaaneously applied VDD or Vss level			30	µA
Supply Current at HALT	IDD4	fosc1 = 16.39 MHz Pin with pull-up resistor is open All other input pins and Hi-z state input/output pins are simultaaneously applied VDD or Vss level			30	mA

(Ta= –20 to +70°C, VDD=5.0V, VSS=0V)

Support Tool

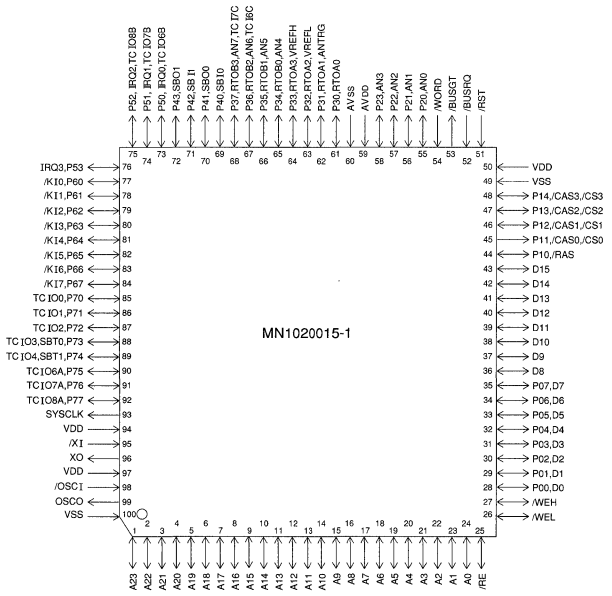
In-Circuit Emulator

PX-ICE10200 + PX-PRB1020415 (MN102B0415)
PX-ICE102B00 + PX-PRB102B32 (MN102B3203)

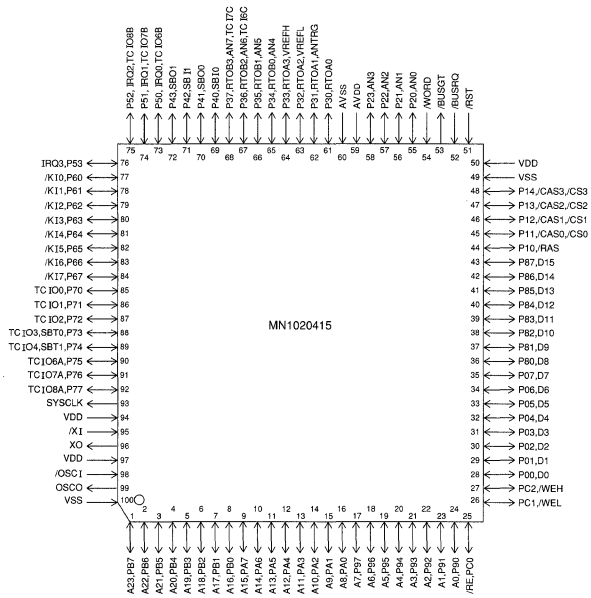
EPROM built-in Type

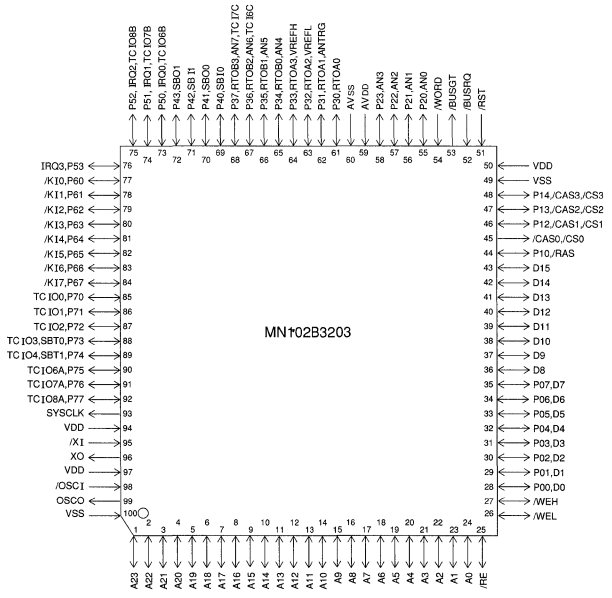
Use **MN102F0715** (for software development) in QFH100-P-1414 package.

Pin Configuration



QFH100-P-1414
LQFP100-P-1414





LQFP100-P-1414

* The MN102B3203 has the MN1020015-1 TTL, with certain terminals excepted.
* The MN102B203 does not have P11 functions.

❑ MN1020012A / 0012AFA

Type	MN1020012A / 0012AFA
ROM (x8-bit / 16-bit) RAM (x8-bit / 16-bit)	Maximum 16M in total (Special Register 1K, Reserve Space 3K included) External ROM, RAM
Minimum Instruction Execution Time	**100ns (at 4.5 to 5.5V, 20MHz)**
Interrupts	• RESET • Watchdog • Timer Counter 0 to 9 • Timer Counter 10 to 11 • Timer Counter 10 to 12 Compare Capture A • Timer Counter 10 to 12 Compare Capture B • DMA 0 to 7 Transfer finish • External 0 to 3 • Serial ch 0, 1 Transmit • Serial ch 0, 1Reception • $\overline{KI}$ Pin (OR) • A/D Conversion finish
Timer Counter	**Timer Counter 0,2 to 6 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/(1 to 256) of System Clock, External Clock Interrupt Source .....Underflow of Timer Counter 0,2 to 6 **Timer Counter 7 : 8-bit x 1** (Timer Output, Event Count, A/D Conversion Start up) Clock Source .....1/(1 to 256) of System Clock, External Clock Interrupt Source .....Underflow of Timer Counter 7 **Timer Counter 1 : 8-bit x 1** (Timer Output, Event Count, Synchronous Output (4-bit x 2ch)) Clock Source .....1/(1 to 256) of System Clock, External Clock Interrupt Source .....Underflow of Timer Counter 1 **Timer Counter 8,9 : 8-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator, Synchronous Serial Clock Generator) Clock Source .....1/(1 to 256) of System Clock, External Clock Interrupt Source .....Underflow of Timer Counter 8,9 **Timer Counter 10,11 : 16-bit x 1** (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encoder Input) Clock Source .....1/(1 to 256) of System Clock, External Clock Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 10,11 **Timer Counter 12 : 16-bit x 1** (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Synchronous Output (4-bit x 2ch)) Clock Source .....1/(1 to 256) of System Clock, External Clock Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture (Connectable) Timer Counter 0 to 9
Serial Interface	**Serial 0 : 7,8-bit x 1** (Joint use with UART, Transfer direction of MSB/LSB selectable) Clock Source .....1/8 Timer Counter 8, 1/8 of Timer Counter 9, External Clock **Serial 1 : 7,8-bit x 1** (Joint use with UART, Transfer direction of MSB/LSB selectable) Clock Source .....1/8 Timer Counter 8, 1/8 of Timer Counter 9, External Clock **UART x 2** (Joint use with Serial 0, 1)

I/O Ports			
	I/O	25	• Joint use : 25 (by -bit)
	Input	4	• Joint use : 4

A/D Inputs	8-bit x 8ch (with S/H)
PWM	16-bit x 3ch
Special Ports	2 (4-state Synchronous Output)
Notes	DRAM Reflesh Controler, DMA Controller, DRAM High Speed Page Mode Support

Package

MN1020012A : QFP128-P-1818
MN1020012FA : LQFP128-P-1818B

Electrical Characteristics

A/D, D/A Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		AVDD=5V, AVSS=0V			±3	LSB
A/D Conversion Time			4.0			µs
Analog Input Voltage	VIA		VSS		VDD	V

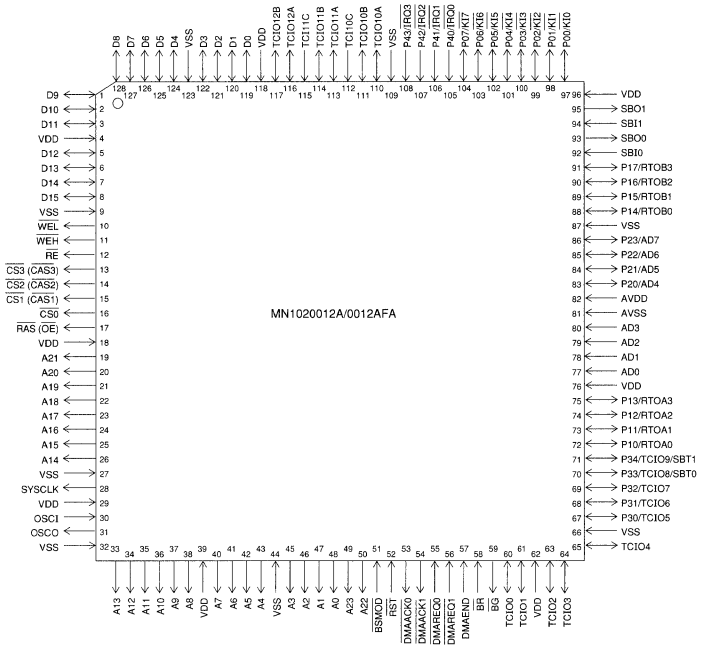
(Ta=+25°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator

PX-ICE10200SL + PX-PRB1020012
PARTNER • EX1020012

Pin Configuration



QFP128-P-1818 (MN1020012A)
LQFP128-P-1818B (MN1020012AFA)

❑ MN1020019 / 0219 / 0419 / 0819

Type — **MN1020019 / 0219 / 0419 / 0819**

ROM (x8-bit) — External / 16K / 32K / 64K (External Memory Expandable)

RAM (x8-bit) — 3K / 1K / 2K / 3K (External Memory Expandable)

Minimum Instruction Execution Time — **MN1020019 / 0219 / 0419 / 0819 : 100ns (at 4.5 to 5.5V, 20MHz)**
MN1020019 / 0219 / 0419 : 200ns (at 2.7 to 3.3V, 10MHz)

Interrupts
- RESET • Watchdog • Timer Counter 0 to 3
- External 0 to 3 • NMI • Serial ch 0, 1 Transmission • Serial ch 0, 1Reception
- A/D Conversion finish

Timer Counter

Timer Counter 0,1 : 8-bit x 1 (Timer Output, Event Count)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 0, 1

Timer Counter 2 : 8-bit x 1 (Timer Output, Event Count, UART Baud Rate Generator, Synchronous Serial Clock Generator, DRAM Reflesh Timing Generator)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 2

Timer Counter 3 : 8-bit x 1 (Timer Output, Event Count, UART Baud Rate Generator, Synchronous Serial Clock Generator)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 3

(Connectable) Timer Counter 0, 1

Serial Interface

Serial 0 : 7,8-bit x 1 (Joint use with UART, Transfer direction of MSB/LSB selectable)
Clock Source .....1/8 Timer Counter 2, 1/8 of Timer Counter 3, External Clock

Serial 1 : 7,8-bit x 1 (Joint use with UART, Transfer direction of MSB/LSB selectable)
Clock Source .....1/8 Timer Counter 2, 1/8 of Timer Counter 3, External Clock

UART x 2 (Joint use with Serial 0, 1)

I/O Ports		
I/O	**51**	• Joint use : 51 (35 : by-bit, 16 : by-byte) (MN1020219 / 0419 / 0819), 21 (All individual bit control) (MN1020019)
Input	**1**	• Joint use : 1

A/D Inputs — 8-bit x 4ch (with S/H)

Notes — DRAM Reflesh Controller

Package — QFH064-P-1414B

Electrical Characteristics

A/D, D/A Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Relative Error		VDD=5V, VSS=0V			±3	LSB
A/D Conversion Time		fosc=20MHz	4.8			µs
Analog Input Voltage	VIA		VSS		VDD	V

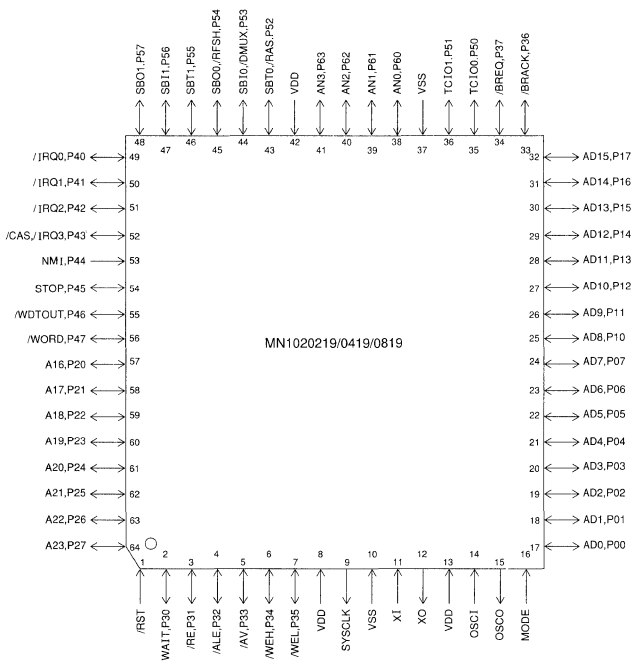
(Ta=25°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator

PX-ICE102LOO + PX-PRB1020019

Pin Configuration



QFH064-P-1414B

❑ MN1021617 / 0017 / 0817

Type		**MN1021617 [ES (Engineering Sample) available] / 0017 (under development) / 0817 (under development)**
ROM (x8 / 16-bit)		128K / 0K / 64K
RAM (x8 / 16-bit)		4K / 4K / 3K
Minimum Instruction Execution Time	With Main Clock operated	**50ns (at 3.0 to 3.6V, 40MHz)** **100ns (at 2.0 to 3.6V, 20MHz)**
Interrupts		• $\overline{\text{RST}}$ Pin • Watchdog • NMI Pin • Timer Counter 4 to15 • Timer Counter 16, 17, 21 • Timer Counter 16 to 20 Compare Capture A • Timer Counter 16 to 20 Compare Capture B • Timer Counter 21 Capture A • Timer Counter 21 Capture B • Timer Counter 21 Capture D • Timer Counter 21 Capture E • Timer Counter 21 Capture F • ATC ch 0 to 3 Transfer finish • External 0 to 7 • Serial ch 0 to 3 Transmission • Serial ch 0 to 3 Reception • KI Pin (OR) • A/D Conversion finish

Timer Counter

Timer Counter 0, 1 : 8-bit x 1 (Prescalers)
Clock Source .....1/ (1 to 256) of System Clock

Timer Counter 2, 3 : 8-bit x 1 (UART Baud Rate Generator)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output

Timer Counter 5, 9 : 8-bit x 1 (UART Baud Rate Generator)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 5, 9

Timer Counter 4 : 8-bit x 1 (Timer Output, A/D Conversion Start up)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 4

Timer Counter 7 : 8-bit x 1
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output
Interrupt Source .....Underlow of Timer Counter 7

Timer Counter 6, 10, 11 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output
Interrupt Source .....Underflow of Timer Counter 6, 10, 11

Timer Counter 8 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 8

Timer Counter 12 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input with Edge, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 12

Timer Counter 13 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 13

Timer Counter 14 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input with Edge, Timer Counter 0 Output
Interrupt Source .....Underflow of Timer Counter 14

Timer Counter

Timer Counter 15 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input with Edge, Timer Counter 0 Output
Interrupt Source .....Underflow of Timer Counter 15

Timer Counter 16, 17 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encorder Input)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input (with Edge, Timer Counter 17 only)
Interrupt Source .....Coincidence with Compare Capture A or at Capture
Coincidence with Compare Capture B or at Capture
Underflow of Timer Counter 16, 17

Timer Counter 18, 19, 20: 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encorder Input)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Capture A or at Capture
Coincidence with Compare Capture B or at Capture

(Connectable) Timer Counter 0 to 3, 4 to 7, 8 to 11, 12 to 15

Timer Counter 21 : 24-bit x 1 (Servo Control)
Clock Source .....1 / (1 to 256) of System Clock
Interrupt Source .....When capturing to Capture A
When capturing to Capture B
When capturing to Capture D
When coinciding to Compare E
When coinciding to Compare F

Serial Interface

Serial 0, 1 : 8-bit x 1 (The transfer direction of MSB / LSB selectable, Transmission / Reception of 8-bit length)
Clock Source .....1/8 of Timer Counter 2, 1/8, 1/2 of Timer Counter 5, External Clock

Serial 2, 3 : 8-bit x 1 (The transfer direction of MSB / LSB selectable, Transmission / Reception of 8-bit length)
Clock Source .....1/8 of Timer Counter 3, 1/8, 1/2 of Timer Counter 9, External Clock

UART x 4 (Joint use with Serial 0 to 3)
I^2C x 2 (Joint use with Serial 1, 3, Single Master only)

I/O Ports

I/O	100	• Joint use : 56 (Address Data Separate 8-bit Mode) • Joint use : 73 (Address Data Multiplex 8-bit Mode)
Input	8	• Joint use : 8

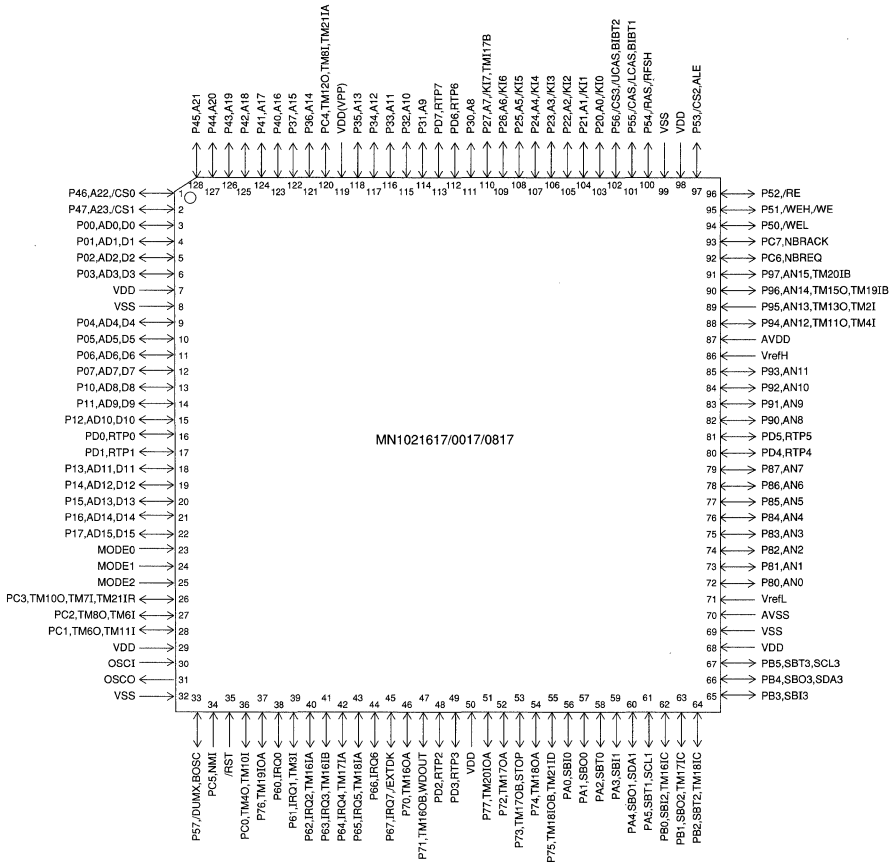
See the next page for support tool, peripheral function, Package and electrical characteristics.

Support Tool

In Circuit Emulator

PX-ICE102H1617

Pin Configuration



LQFP128-P-1818B

A/D	10-bit x 12ch (Maximum input is 16) (with S/H)
PWM	16-bit x 5ch
ICR	16-bit x 5ch, 24-bit x 1ch
OCR	16-bit x 5ch, 24-bit x 1ch
Notes	Address / Data Multiplex Bus Interface, Address / Data Separate Bus Interface, 8-bit / 16-bit Bus Width selectable, DRAM Refresh Controller built-in
Package	LQFP128-P-1818B

Electrical Characteristics

A/D Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Non-linear Error		10 bit			±4	LSB
A/D Conversion Time		at 40Mhz	2.8			µs
Analog Input Voltage	VIA		VSS		VDD	V

(Ta= +25°C, VDD=AVDD=3.3V, VSS=AVSS=0V)

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDDopr	VI = VDD or VSS, Output release f = 40MHz, VDD=3.3V			50	mA
Supply Current at STOP	IDDS	Pin with pull-up resistor is open All other input pins and Hi-z state input/output pins are simultaneously applied VDD or VSS level			30	µA
Supply Current at HALT	IDDH	f = 40MHz, VDD = 3.3V Output release			25	mA

(Ta= –20 to +70°C, VDD=AVVD=3.3V, VSS=AVSS=0V)

❑ MN102H3104

Type		**MN102H3104 (under development)**
ROM (x8-bit)		0K
RAM (x8-bit)		4K
Minimum Instruction Execution Time	With Main Clock operated	**50ns (at 4.5 to 5.5V, 30MHz)**
Interrupts	• $\overline{\text{RST}}$ Pin • Watchdog • NMI Pin • Timer Counter 4 to15 • Timer Counter 16, 17, 21 • Timer Counter 16 to 20 Compare Capture A • Timer Counter 16 to 20 Compare Capture B • Timer Counter 21 Capture A • Timer Counter 21 Capture B • Timer Counter 21 Capture D • Timer Counter 21 Compare E • Timer Counter 21 Compare F • ATC ch 0 to 3 Transfer finish • External 0 to 7 • Serial ch 0 to 3 Transmission • Serial ch 0 to 3 Reception • $\overline{\text{KI}}$ Pin (OR) • A/D Conversion finish	

Timer Counter

Timer Counter 0, 1 : 8-bit x 1 (Prescalers)
Clock Source .....1/ (1 to 256) of System Clock

Timer Counter 2, 3 : 8-bit x 1 (UART Baud Rate Generator)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output

Timer Counter 5, 9 : 8-bit x 1 (UART Baud Rate Generator)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 5, 9

Timer Counter 4 : 8-bit x 1 (Timer Output, A/D Conversion Start up)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 4

Timer Counter 7 : 8-bit x 1
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output
Interrupt Source .....Underlow of Timer Counter 7

Timer Counter 6, 10, 11 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output
Interrupt Source .....Underflow of Timer Counter 6, 10, 11

Timer Counter 8 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 8

Timer Counter 12 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input with Edge, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 12

Timer Counter 13 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, Timer Counter 0 Output, Timer Counter 1 Output
Interrupt Source .....Underflow of Timer Counter 13

Timer Counter 14 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input with Edge, Timer Counter 0 Output
Interrupt Source .....Underflow of Timer Counter 14

Timer Counter

Timer Counter 15 : 8-bit x 1 (Timer Output)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input with Edge, Timer Counter 0 Output
Interrupt Source .....Underflow of Timer Counter 15

Timer Counter 16, 17 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encorder Input)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input (with Edge, Timer Counter 17 only)
Interrupt Source .....Coincidence with Compare Capture A or at Capture
Coincidence with Compare Capture B or at Capture
Underflow of Timer Counter 16, 17

Timer Counter 18, 19, 20 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encorder Input)
Clock Source .....1/ (1 to 256) of System Clock, External Clock Input
Interrupt Source .....Coincidence with Compare Capture A or at Capture
Coincidence with Compare Capture B or at Capture

(Connectable) Timer Counter 0 to 3, 4 to 7, 8 to 11, 12 to 15

Timer Counter 21 : 24-bit x 1 (Servo Control)
Clock Source .....1 / (1 to 256) of System Clock
Interrupt Source .....When capturing to Capture A
When capturing to Capture B
When capturing to Capture D
When coinciding to Compare E
When coinciding to Compare F

Serial Interface

Serial 0, 1 : 8-bit x 1 (The transfer direction of MSB / LSB selectable, Transmission / Reception of 8-bit length)
Clock Source .....1/8 of Timer Counter 2, 1/8, 1/2 of Timer Counter 5, External Clock

Serial 2, 3 : 8-bit x 1 (The transfer direction of MSB / LSB selectable, Transmission / Reception of 8-bit length)
Clock Source .....1/8 of Timer Counter 3, 1/8, 1/2 of Timer Counter 9, External Clock

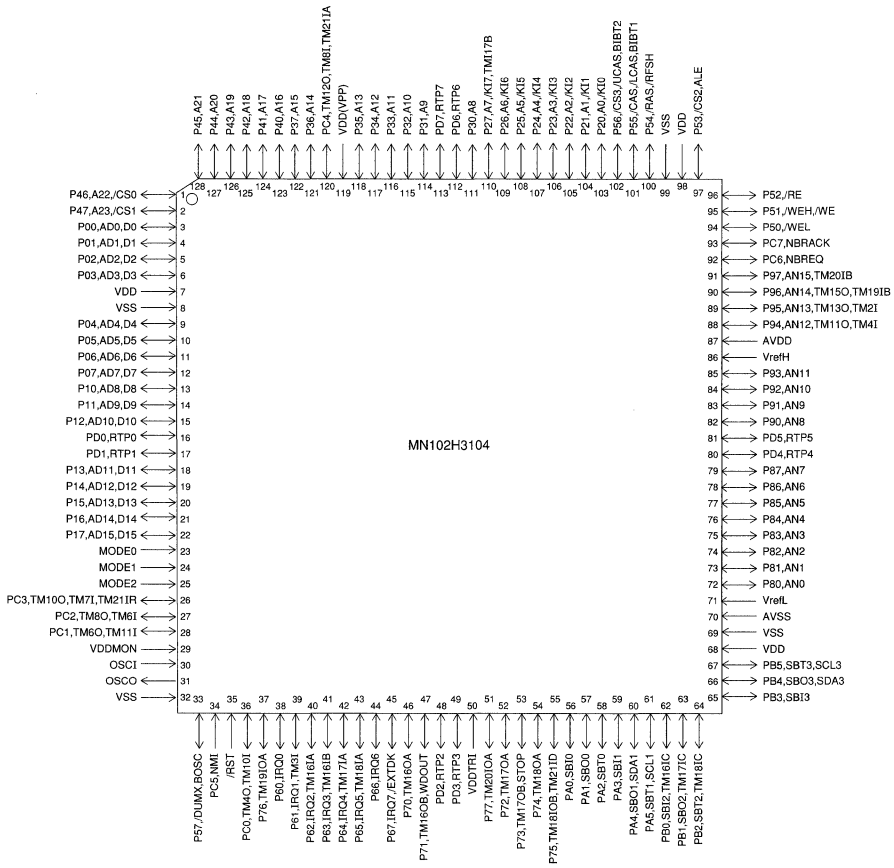
UART x 4 (Joint use with Serial 0 to 3)
I^2C x 2 (Joint use with Serial 1, 3, Single Master only)

I/O Ports			
	I/O	100	• Joint use : 56 (Address Data Separate 8-bit Mode) • Joint use : 73 (Address Data Multiplex 8-bit Mode)
	Input	8	• Joint use : 8

See the next page for support tool, peripheral function, Package and electrical characteristics.

Support Tool

Pin Configuration



LQFP128-1818B

A/D	10-bit x 12ch (Maximum input is 16) (with S/H)
PWM	16-bit x 5ch
ICR	16-bit x 5ch, 24-bit x 1ch
OCR	16-bit x 5ch, 24-bit x 1ch
Notes	Address / Data Multiplex Bus Interface, Address / Data Separate Bus Interface, 8-bit / 16-bit Bus Width selectable, DRAM Refresh Controller built-in
Package	LQFP128-P-1818B

Electrical Characteristics

A/D Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Non-linear Error		10 bit			±4	LSB
A/D Conversion Time		at 30Mhz	2.8			µs
Analog Input Voltage	VIA		VSS		VDD	V

(Ta= +25°C, VDD=AVDD=5.0V, VSS=AVSS=0V)

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	IDDopr	VI = VDD or VSS, Output release f = 40MHz, VDD=5.0V			50	mA
Supply Current at STOP	IDDS	Pin with pull-up resistor is open All other input pins and Hi-z state input/output pins are simultaneously applied VDD or VSS level			150	µA
Supply Current at HALT	IDDH	f = 40MHz, VDD = 5.0V Output release			25	mA

(Ta= –20 to +70°C, VDD=AVVD=5.0V, VSS=AVSS=0V)

❑ MN102L2403

Type	**MN102L2403 [ES (Engineering Sample) available]**
ROM (x8-bit / 16-bit)	Maximum 16M in total (Special Register 1K included)
RAM (x8-bit / 16-bit)	External ROM, RAM 3K
Minimum Instruction Execution Time	**100ns (at 4.5 to 5.5V, 20MHz)**
Interrupts	• RESET • Watchdog • Timer Counter 0 to 7 • Timer Counter 8 to 10 • Timer Counter 8 to 10 Compare Capture A • Timer Counter 8 to 10 Compare Capture B • DMA 0 to 5 Transfer finish • External 0 to 7 • Serial ch 0 to 2, 1 Transmission • Serial ch 0 to 2 Reception • $\overline{KI}$ Pin (OR) • A/D Conversion finish • NMI Pin • Address coincidence

Timer Counter

Timer Counter 0 : 8-bit x 1 (Timer Output, Event Count)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 0

Timer Counter 1 : 8-bit x 1 (Timer Output, Event Count, DMA Start up)
Clock Source 1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 1

Timer Counter 2 : 8-bit x 1 (Timer Output, Event Count, Synchronous Output (4-bit x 2ch))
Clock Source .....1/(1 to 256) of System Clock, External Clock, 1/4 of Low Speed Clock
Interrupt Source .....Underflow of Timer Counter 2. 4

Timer Counter 3 : 8-bit x 1 (Timer Output, Event Count, A/D Conversion Start up)
Clock Source .....1/(1 to 256) of System Clock, External Clock, 1/4 of Low Speed Clock
Interrupt Source .....Underflow of Timer Counter 3

Timer Counter 4 : 8-bit x 1 (Time Output, Event Count, DMA start up)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 4

Timer Counter 5 to 7 : 8-bit x 1 (Timer Output, Event Count, UART Baud Rate Generator, Synchronous Serial Clock Generator)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Underflow of Timer Counter 5 to 7

Timer Counter 8, 9 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encoder Input)
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 8, 9

Timer Counter 10 : 16-bit x 1 (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, Synchronous Output (4-bit x 2ch))
Clock Source .....1/(1 to 256) of System Clock, External Clock
Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture

(Connectable) Timer Counter 0 to 7

Serial Interface

Serial 0 : 7,8-bit x 1 (Joint use with UART, Transfer direction of MSB/LSB selectable)
Clock Source .....1/2 Timer Counter 5, 1/16 of Timer Counter 5, External Clock, Automatic Baud Rate

Serial 1 : 7,8-bit x 1 (Joint use with UART, Transfer direction of MSB/LSB selectable)
Clock Source .....1/2 Timer Counter 6, 1/16 of Timer Counter 6, 7, External Clock

Serial 2 : 7,8-bit x 1 (Joint use with UART, Transfer direction of MSB/LSB selectable)
Clock Source .....1/2 of Timer Counter 7, 1/16 of Timer Counter 5, 7, External Clock

UART x 3 (Joint use with Serial 0, 1, 2)

I/O Ports	**I/O**	**39**	• Joint use : 39 (by -bit)
	Input	**13**	• Joint use : 13 (by-bit)
	Output	**14**	• Joint use : 6 (by-bit), 8 (by 4-bit)
A/D Inputs			10-bit x 8ch (with S/H)
PWM			16-bit x 3ch
Notes			Burst ROM Interface, DMA Controller, DRAM Reflesh Controller, DRAM High Speed Page Mode, EDO Mode, Support
Package			QFP128-P-1818

Electrical Characteristics

A/D Characteristics

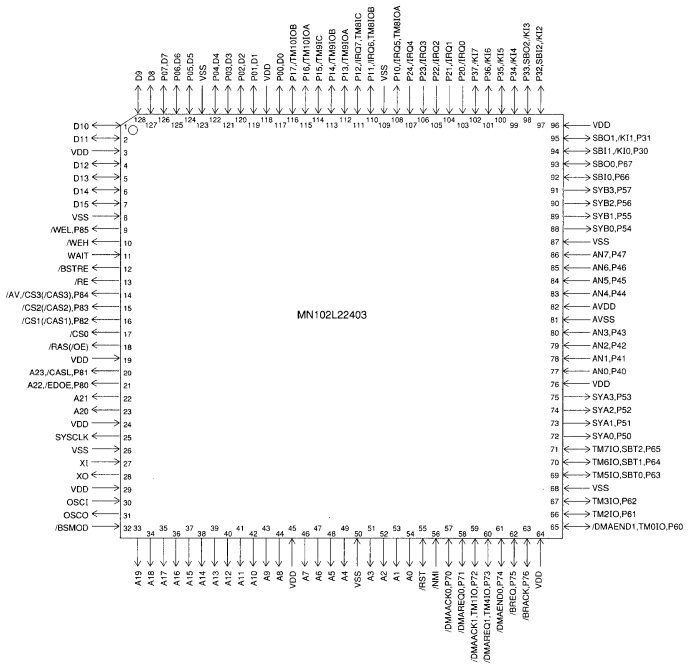
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		AVDD=5V, AVSS=0V			±4	LSB
A/D Conversion Time			4.0			µs
Analog Input Voltage	VIA		VSS		VDD	V

(Ta=25°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator PX-ICE102L00 + PX-PRB102L24

Pin Configuration



LQFP128-P-1818B

❑ MN102LP25G / L25G / LP25Z / LF25Z / L25Z / LP25D / L25D / LP25A / L25A / L2503

Type	**MN102LP25G / L25G / LP25Z / LF25Z / L25Z / LP25D / L25D / LP25A / L25A / L2503** **LP25Z, L25Z, L2503 : ES (Engineering Sample) available** **Other than the above : under development**
ROM (x8-bit / x16-bit)	128K (OTP) / 128K / 128K (OTP) / 128K (Flash) / 128K / 64K (OTP) / 64K / 32K (OTP) / 32K / External
RAM (x8-bit / x16-bit)	5K / 5K / 3K / 3K / 3K / 3K / 3K / 2K / 2K / 3K
Minimum Instruction Execution Time	**100ns (at 4.5 to 5.5V, 20MHz)**
Interrupts	• RESET • Watchdog • Timer Counter 0 to 5 • Timer Counter 6 to 7 • Timer Counter 6 to 7 Compare Capture A • Timer Counter 6 to7 Compare Capture B • ATC Transfer finish • External 0 to 4 • Serial ch 0, 1 Transmission • Serial ch 0, 1Reception • NMI Pin • A/D Conversion finish
Timer Counter	**Timer Counter 0 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/1, 1/128 of System Clock, 1/4 Low Speed Clock, External Clock Interrupt Source .....Underflow of Timer Counter 0 **Timer Counter 1 : 8-bit x 1** (Timer Output, Event Count, A/D Conversion Start up) Clock Source .....System Clock, 1/4 Low Speed Clock, External Clock, Timer Counter 0 Output Interrupt Source .....Underflow of Timer Counter 1 **Timer Counter 2 to 3 : 8-bit x 1** (Timer Output, Event Count, UART Baud Rate Generator) Clock Source .....System Clock, External Clock, Timer Counter 0 Output, Timer Counter 1, 2 Output Interrupt Source .....Underflow of Timer Counter 2, 3 **Timer Counter 4, 5 : 8-bit x 1** (Timer Output, Event Count) Clock Source .....1/4 Low Speed Clock, External Clock, Timer Counter 0 Output, Timer Counter 3, 4 Output Interrupt Source .....Underflow of Timer Counter 4, 5 **Timer Counter 6, 7 : 16-bit x 1** (Timer Output, Event Count, Input Capture, Output Compare, PWM Output, 2-Phase Encoder Input) Clock Source .....System Clock, External Clock, Timer Counter 4, 5 Output Interrupt Source .....Coincidence with Compare Capture A or at Capture, Coincidence with Compare Capture B or at Capture, Underflow of Timer Counter 6, 7 (Connectable) Timer Counter 0 to 5
Serial Interface	**Serial 0 : 7, 8-bit x 1** (Joint use with UART, Transfer direction of MSB/LSB selectable) Clock Source .....1/16 Timer Counter 2, 1/16 of Timer Counter 3, 1/2 of Timer Counter 2 **Serial 1 : 7, 8-bit x 1** (Joint use with UART, Transfer direction of MSB/LSB selectable) Clock Source .....1/16 Timer Counter 2, 1/16 of Timer Counter 3, 1/2 of Timer Counter 3 **UART x 2** (Joint use with Serial 0, 1) **I^2C mode** (Single master system master transmission / reception possible)
I/O Ports | **I/O** | **80**	• Joint use : 16 (by 8-bit), 8 (by 4-bit), 60 (by-bit)
A/D Inputs	8-bit x 8ch (with S/H)
PWM	16-bit x 2ch
Notes	Burst ROM inferface support, ATC (between serial 0ch and internal RAM) support
Package	LQFP100-P-1414

Electrical Characteristics

A/D Characteristics

Parameter	Symbol	Condition		Limit			Unit
				Min.	Typ.	Max.	
A/D Conversion Relative Error		VDD=5V, VSS=0V	ch0 to 3			±3	LSB
			ch4 to 7			+4	
A/D Conversion Time				4.8			µs
Analog Input Voltage	VIA			VSS		VDD	V

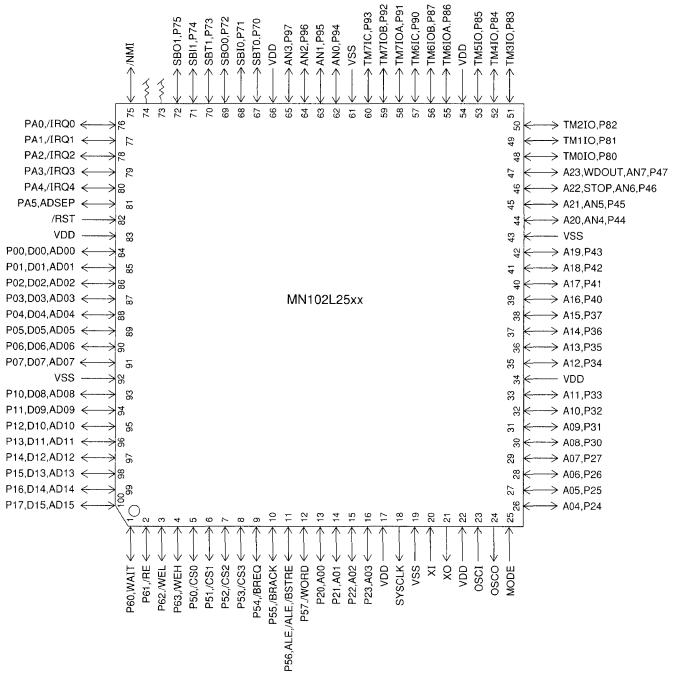
(Ta= +25°C, VDD=5.0V, VSS=0V)

Support Tool

In-Circuit Emulator

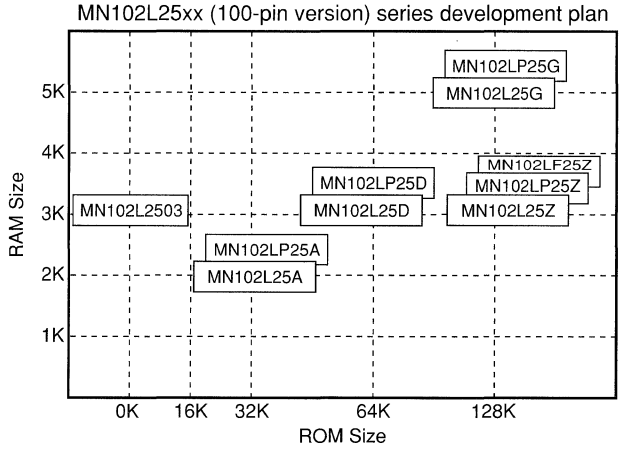
PX-ICE102L00 + PX-PRB102L25

Pin Configuration



LQFP100-P-1414

MN102L25xx (100-pin version) series development plan



❑ MN1020705

Type			**MN1020705**
ROM (x8-bit)			56K
RAM (x8-bit)			1536
Minimum Instruction Execution Time		With Main Clock operated	**167ns (at 4.5 to 5.5V, 11.9MHz)**
		With Sub-clock operated	**62.5µs (at 2.7 to 5.5V, 32kHz)**
Interrupts			• RESET • Overflow of Timer Counter 0 to 5 • A/D x 2 • Runaway Search x 1 • Drum Servo x 1 • External x 3 / Key Scan x 1 • Serial x 3 • Capstan Servo x 1 • DMA x 2 • VSYNC x 1 • Remote Control Reception x 1 • Reel FG x 2 • Synchronous Output x 2
Timer Counter			**Timer Counter 0 : 16-bit x 1** (Timer Output) Clock Source .....1/4, 1/8, 1/16, 1/32 of System Clock Interrupt Source .....Overflow of Timer Counter 0 **Timer Counter 1 : 16-bit x 1** (Timer Output, Event Count) Clock Source .....1/8, 1/16, 1/32 of System Clock, Capstan FG Interrupt Source .....Overflow of Timer Counter 1 **Timer Counter 2 : 16-bit x 1** (Timer Output) Clock Source .....1/4, 1/8, 1/16, 1/32 of System Clock Interrupt Source .....Overflow of Timer Counter 2 **Timer Counter 3 : 16-bit x 1** (Timer Output, Synchronous Serial Clock Generator) Clock Source .....1/4, 1/8, 1/16, 1/32 of System Clock Interrupt Source .....Overflow of Timer Counter 3 **Timer Counter 4 : 16-bit x 1** (Timer Output, Serial Index Search) Clock Source .....1/4, 1/8, 1/16, 1/32 of System Clock Interrupt Source .....Overflow of Timer Counter 4 **Timer Counter 5 : 47-bit x 1** (Timer Output, Clock Function) Clock Source .....XI Oscillation Clock Interrupt Source .....Overflow of Timer Counter 50, 51, 52 **Freerun Counter**
Serial Interface			**Serial 0 to 2 : 8-bit x 1** (Transfer direction of MSB/LSB selectable, Start Condition function, DMA function) Clock Source .....1/4, 1/16, 1/32, 1/64 of System Clock, External Clock, 1/2 of Timer Counter 3
I/O Ports	**I/O**	**74**	• Joint use : 40 Input/Output selectable : 74 (by-bit) • Nch Open-drain : 8
	Input	**14**	• Joint use : 14
A/D Inputs			8-bit x 12ch (without S/H)
D/A			13-bit x 1, 12-bit x 1, 6-bit x 2
PWM			14-bit x 1ch (Standard Cycle 21.3µs, at 12MHz), 10-bit x 2ch (Standard Cycle 5.3µs, at 12MHz), 12-bit x 2ch (Standard Cycle 21.3µs, at 12MHz)
ICR			25-bit x 1ch, 19-bit x 2ch, 16-bit x 3ch
OCR			16-bit x 2ch, 40 (Internal : 16)
Special Ports			Real Time Output, 16 (Synchronous Output with DMA function), 8 (Synchronous output), 2 (Tri-State Synchronous output), Remote Control Reception
Notes			Tape Residual Detecting, DMA Controller, Tape Head Dust Detecting, SP/LP Detecting, AFT

Package

QFP128-P-1818

Electrical Characteristics

A/D, D/A Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D-converter differential nonlinearity	Lad	Vin=0~VDD			±3	LSB
D/A-converter differential nonlinearity	Lad	VDD=5.0V, Vout=0.9 to 4.1V			±0.5	LSB
A/D Conversion Time	Yad	fosc=12MHz		4.66		µs

(Ta=25°C, VDD=5.0V, VSS=0V)

Supply Current

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Operating Supply Current	Ipd	At12MHz Operation, No load		75	150	mA
Supply Current at STOP	Ipdst	Oscillation halt, No load			20	µA
Supply Current at RESET	Ipdhl	32kHz Oscillation, No load			50	µA

(Ta=25°C, VDD=5.0V, VSS=0V)

Support Tool

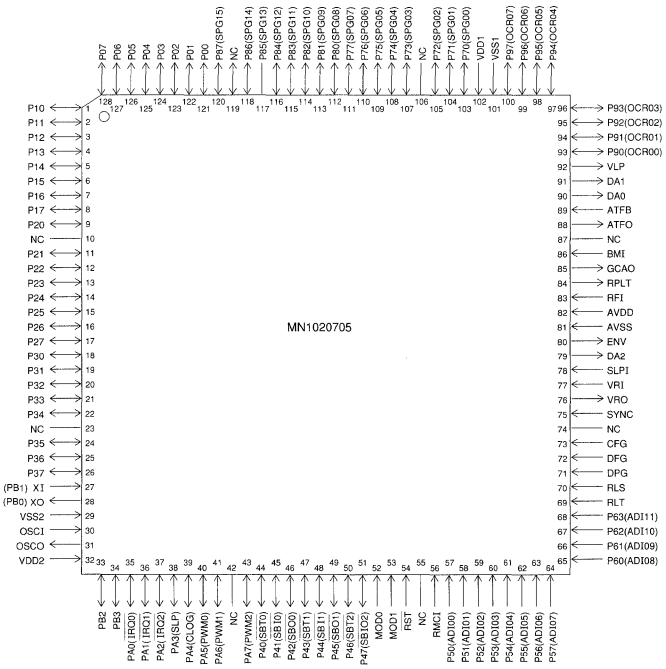
In-Circuit Emulator

PX-ICE10200 + PX-PRB1020705

EPROM built-in Type

Use **MN102P0705FH** [ES (Engineering Sample) available] in QFP128-P-1818 Package.

Pin Configuration



QFP128-P-1818

NC : Nothing connected with pin.

❑ MN102L230

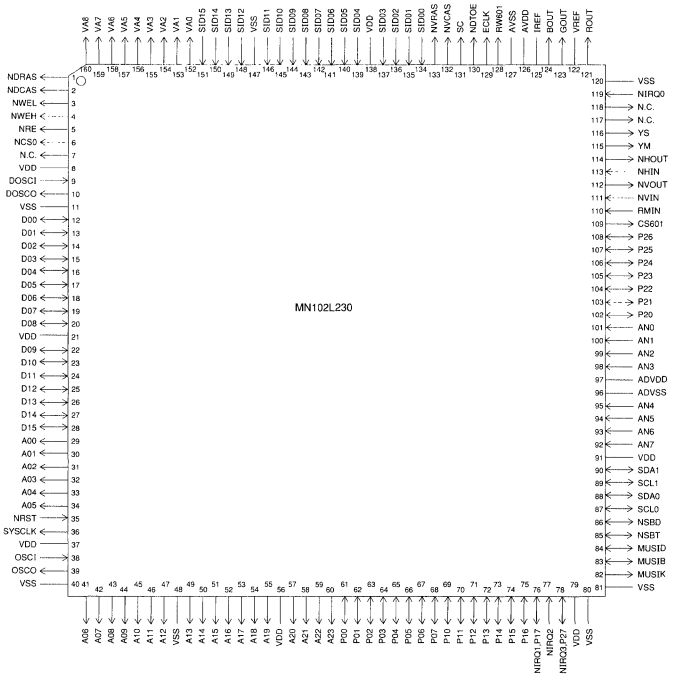
Type			**MN102L230**
ROM (x8-bit / x16-bit)			Maximum 16M in external total (Control register, Inbuilt RAM, Character multiplex I/F space, VRAM, DRAM, Reserve Space included)
RAM (x16-bit)			2K
Minimum Instruction Execution Time			**100ns (at 4.5 to 5.5V, 20MHz)**
Interrupts			External 4 Internal 6 : Timer x 2, A/D x 1, TV peripheral block x 1, Watchdog x 1, NMI x 1 TV peripheral block internal interrupt : OSD x 4, Serial x 2, I^2C x 1, MUSE x 4, Remote Control x 5
Timer Counter			**Timer Counter 10, 11 : 16-bit x 2** (1000-division down counter) Clock Source .....1/ (1 to 256) of System Clock Interrupt Source .....Underflow of Timer Counter 10, 11 Watchdog : 17-bit x 1
Serial Interface			**Serial 0 : 8-bit x 1** (Transmission / Reception of arbitrary bit length, Transfer direction of MSB / LSB selectable, Clock Polarity selectable, Start Condition function) Clock Source .....625K, 312.5K, 156.3K, 104.2K, 52.1K, 39.1K, 26.0KHz (OSC=at 20MHz) **I^2C x 1** : For multi master mode, Bus line (output) has 2 systems Clock Source .....89.3K, 78.1K, 62.5K, 52.1K, 44.6K, 39.1K (OSC=at 20MHz) **MUSE Serial Bus** : Responds to arbitrary byte-length transfer, Parity Error, Acknowledge error detection function Clock Source 156.3K, 104.2K, 78.1K, 52.1K, 39.1K, 26.6KHz
I/O Ports	**I/O**	**49**	• Joint use : 2

Support Tool

In-Circuit Emulator

PX-ICE102L00 + PX-PRB102L23
PARTNER-EX1020023

Pin Configuration



QFP160-P-2828B

NC : Nothing connected with pin.

See the next page for peripheral function, Package and electrical characteristics.

A/D Inputs	8-bit x 8ch (with S/H)
D/A	4-bit x 3ch (Analog R, G, B Output)
Special Ports	Remote Control Reception, Character multiplex LSI (MN83601 I/F)
CRTC	**Bit map OSD** : Packed pixel (4 bit / pixels) method, internal 32 color pallet, 16 colors simultaneously displayed per field, horizontal pixel width 512 to 840 pixels (when display covers entire screen within 28 µs / 32 µs
Notes	VRAM, DRAM Refresh Controller, Remote control input discriminant circuit built-in
Package	QFP160-P-2828B

Electrical Characteristics

A/D Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
A/D Conversion Absolute Error		ADVDD=5V, ADVSS=0V			±5	LSB
A/D Conversion Time		f = 16MHz	5.0			µs
Analog Input Voltage	VIA		VSS		VDD	V
Full-scale Output Current	IFS	VREF =1.2, VRIREF=1.2kΩ	4	5	6	mA
Output Voltage Setting Range	VO	RL=200Ω, VREF=1.2V, RIREF=1.2kΩ	0		1.2	V
Non-linear Error	NLE	RL=200Ω, VREF=1.2V, RIREF=1.2kΩ			±0.5	LSB
Differential Non-linear Error	DNLE	RL=200Ω, VREF=1.2V, RIREF=1.2kΩ			±0.5	LSB
Channel Interval Error	IFS	VREF=1.2V, RIREF=1.2kΩ Error from 3-channel average IFS			±3	%

(Ta=25°C, VDD=AVDD=ADVDD=5.0V, VSS=AVSS=ADVSS=0V, fosc=20MHz)

DSP SERIES

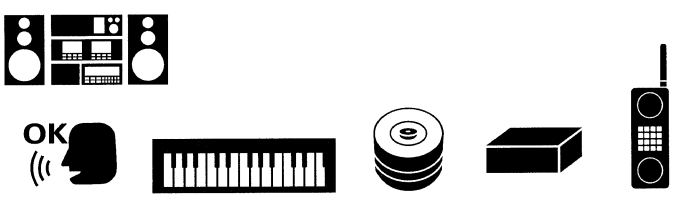
MN1900/10/20 Series

The MN1900/10/20 series of program-control type CMOS high-performance digital signal processors, and incorporate multipliers, ALU, RAM, serial and parallel interfaces, DMA and so on, on a single chip. The MN1900 series supports pseudo 24-bit fixed-point arithmetic. The MN1920 series is an upwardly compatible version of the MN1900 series and offering complete 24-bit implementation for precise arithmetic as well as high speeds.

Features

- **Digital signal processing**
  - 80 ns to 200 ns execution time -- large (4 k to 16 M word) data RAM space
  - Parallel processing with extended-word long instructions (MN1900/20)
- **MN1900 series**
  - Pseudo 24-bit fixed-point arithmetic
  - 20 x 20 → 32-bit parallel multipliers
  - 24-bit ALU
- **MN1910 series**
  - 16-bit fixed-point arithmetic
  - 16 x 16 → 32-bit parallel multipliers
  - 32-bit ALU
- **MN1920 series**
  - 24-bit fixed-point arithmetic
  - 24 x 24 → 48-bit parallel multipliers
  - 56-bit ALU
  - Advanced-function version of the MN1900 series offering upward compatibility for instructions

■ Applications



DSP Series

❑ MN19041A [High Speed Version]

Type		**MN19041A [High Speed Version]**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	4K (32-bit)
Data	**Data RAM1 (word)**	258 (16-bit)
	Data RAM2 (word)	Internal 512, External 4K (16-bit) • For external **Memory Access Time 30ns** **Wait 1 Wait 20ns (at 100ns Operation)**
	RAM Pointer 1	9-bit x 1, Indirect addressing
	RAM Pointer 2	12-bit x 6, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **100ns (at 4.75 to 5.25V, 50MHz)** Low Speed Operation **160μs (at 3.5 to 5.25V, 32kHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		QFP084-P-1818
In-Circuit Emulator		ICE19091A
Evaluation Chip		MN19091A

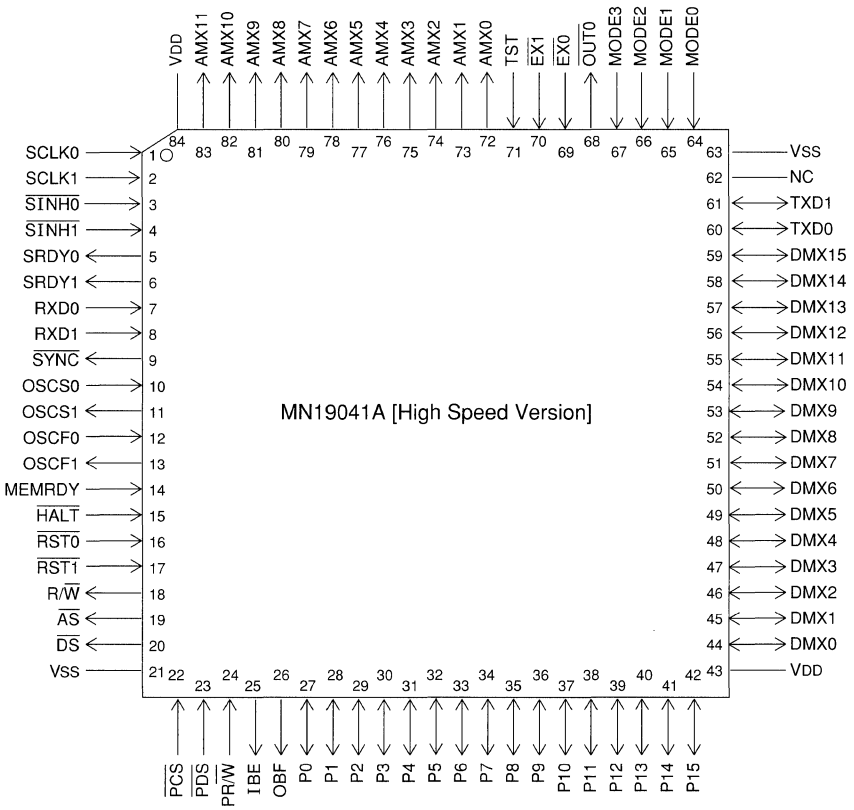
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	4.75	5.0	5.25	V
	VSS					
Oscillation Frequency	fF				50	MHz
Machine Cycle	Tcyc		100		160x10³	ns
Supply Current	IDD			60	100	mA
Power Consumption	Pt			300	525	mW

(Ta= –20 to +70°C)

Pin Configuration



QFP084-P-1818

NC : Nothing connected with pin.

❑ MN19091A [High Speed Version]

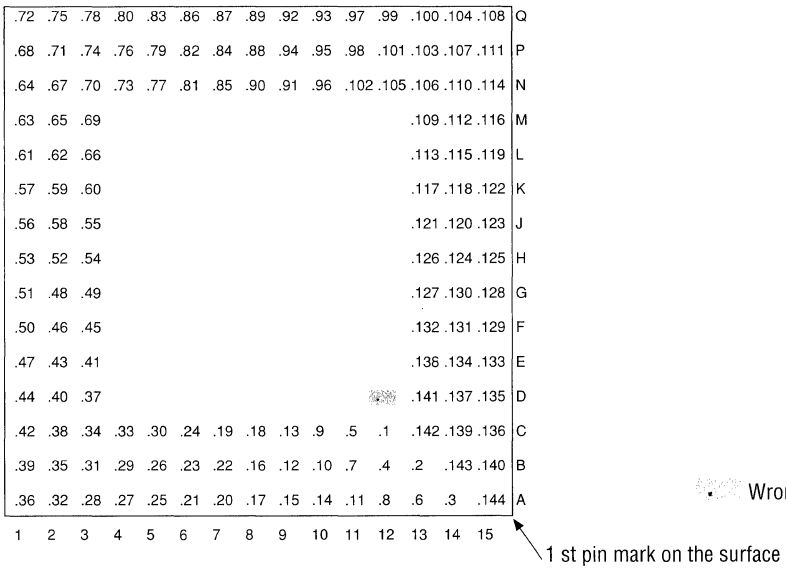
Type		**MN19091A [High Speed Version]**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	External 8K (32-bit)
Data	**Data RAM1 (word)**	258 (16-bit)
	Data RAM2 (word)	Internal 512, External 4K (16-bit) • For external **Memory Access Time 30ns** **Wait 1 Wait 20ns (at 100ns Operation)**
	RAM Pointer 1	9-bit x 1, Indirect addressing
	RAM Pointer 2	12-bit x 6, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **100ns (at 4.75 to 5.25V, 50MHz)** Low Speed Operation **160µs (at 3.5 to 5.25V, 32kHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA • NMI (For ICE) Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total (+NMI Interrupt 1 level)
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		PGA144-C-S15U
In-Circuit Emulator		ICE19091A
Electrical Characteristics		

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	4.75	5.0	5.25	V
	VSS					
Oscillation Frequency	fF				50	MHz
Machine Cycle	Tcyc		100		$160x10^3$	ns
Supply Current	IDD			80	150	mA
Power Consumption	Pt			400	788	mW

(Ta= –20 to +70°C)

Pin Configuration



(Bottom View)
PGA144-C-S15U

Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name
1	C12	VDD	37	D3	VSS	73	N4	VDD	109	M13	VSS
2	B13	VDD	38	C2	—	74	P3	—	110	N14	—
3	A14	SRDY0	39	B1	DMX6	75	Q2	$\overline{OUT0}$	111	P15	DMI16
4	B12	SRDY1	40	D2	DMX7	76	P4	$\overline{EX1}$	112	M14	DMI17
5	C11	RXD0	41	E3	DMX8	77	N5	$\overline{EX0}$	113	L13	DMI18
6	A13	RXD1	42	C1	DMX9	78	Q3	$\overline{NMI}$	114	N15	DMI19
7	B11	$\overline{PCS}$	43	E2	DMX10	79	P5	AMI0	115	L14	DMI20
8	A12	$\overline{PDS}$	44	D1	DMX11	80	Q4	AMI1	116	M15	DMI21
9	C10	PR/$\overline{W}$	45	F3	DMX12	81	N6	AMI2	117	K13	DMI22
10	B10	IBE	46	F2	DMX13	82	P6	AMI3	118	K14	DMI23
11	A11	OBF	47	E1	DMX14	83	Q5	AMI4	119	L15	DMI24
12	B9	P0	48	G2	DMX15	84	P7	AMI5	120	J14	DMI25
13	C9	P1	49	G3	TEST3	85	N7	AMI6	121	J13	DMI26
14	A10	P2	50	F1	TEST2	86	Q6	AMI7	122	K15	DMI27
15	A9	P3	51	G1	TEST1	87	Q7	AMI8	123	J15	DMI28
16	B8	P4	52	H2	TEST0	88	P8	AMI9	124	H14	DMI29
17	A8	P5	53	H1	MODE3	89	Q8	AMI10	125	H15	DMI30
18	C8	P6	54	H3	MODE2	90	N8	AMI11	126	H13	DMI31
19	C7	P7	55	J3	MODE1	91	N9	AMI12	127	G13	$\overline{SYNC}$
20	A7	P8	56	J1	MODE0	92	Q9	DMI0	128	G15	OSCS0
21	A6	P9	57	K1	S2	93	Q10	DMI1	129	F15	OSCS1
22	B7	P10	58	J2	S1	94	P9	DMI2	130	G14	OSCF0
23	B6	P11	59	K2	S0	95	P10	DMI3	131	F14	OSCF1
24	C6	P12	60	K3	AMX0	96	N10	DMI4	132	F13	MEMRDY
25	A5	P13	61	L1	AMX1	97	Q11	DMI5	133	E15	$\overline{HALT}$
26	B5	P14	62	L2	AMX2	98	P11	DMI6	134	E14	$\overline{RST0}$
27	A4	P15	63	M1	AMX3	99	Q12	DMI7	135	D15	$\overline{RST1}$
28	A3	TXD1	64	N1	AMX4	100	Q13	DMI8	136	C15	R/$\overline{W}$
29	B4	TXD0	65	M2	AMX5	101	P12	DMI9	137	D14	$\overline{AS}$
30	C5	DMX0	66	L3	AMX6	102	N11	DMI10	138	E13	$\overline{DS}$
31	B3	DMX1	67	N2	AMX7	103	P13	DMI11	139	C14	SCLK0
32	A2	DMX2	68	P1	AMX8	104	Q14	DMI12	140	B15	$\overline{SINH0}$
33	C4	DMX3	69	M3	AMX9	105	N12	DMI13	141	D13	SCLK1
34	C3	DMX4	70	N3	AMX10	106	N13	DMI14	142	C13	—
35	B2	—	71	P2	—	107	P14	—	143	B14	—
36	A1	DMX5	72	Q1	AMX11	108	Q15	DMI15	144	A15	$\overline{SINH1}$

❑ MN1900402

Type		**MN1900402**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	4K (32-bit)
Data	**Data RAM1 (word)**	514 (16-bit)
	Data RAM2 (word)	Internal 1K, External 4K (16-bit) • For external **Memory Access Time 30ns** **Wait 1 Wait 20ns (at 100ns Operation)**
	RAM Pointer 1	10-bit x 1, Indirect addressing
	RAM Pointer 2	12-bit x 6, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **100ns (at 4.75 to 5.25V, 50MHz)** Low Speed Operation **160µs (at 3.5 to 5.25V, 32kHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		QFP084-P-1818
In-Circuit Emulator		ICE1900402
Evaluation Chip		MN1900003

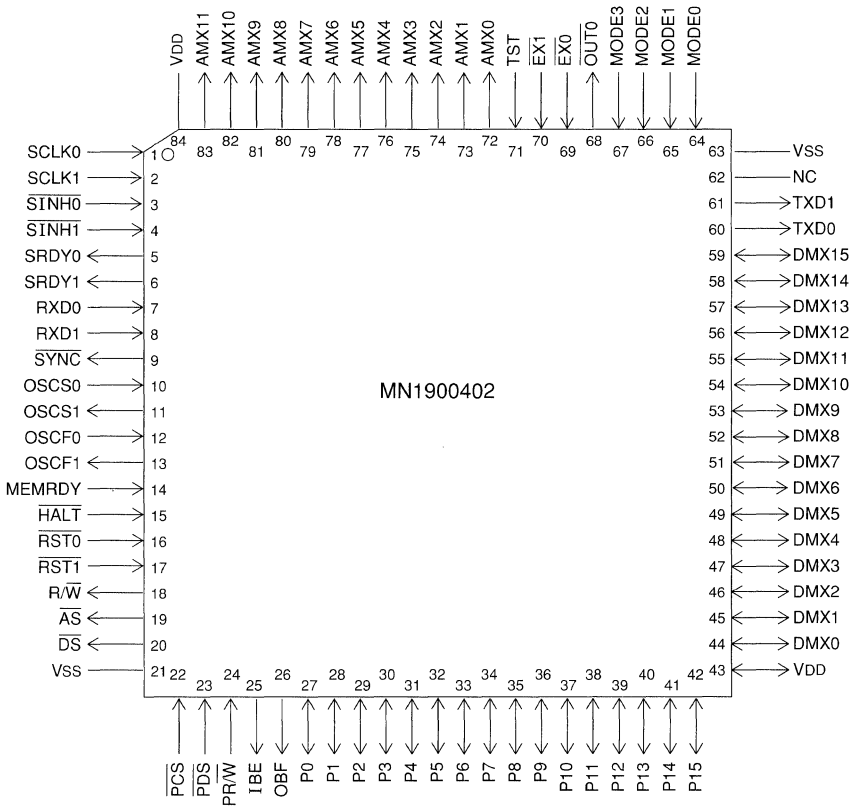
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	4.75	5.0	5.25	V
	VSS					
Oscillation Frequency	fF				50	MHz
Machine Cycle	Tcyc		100		$160x10^3$	ns
Supply Current	IDD			60	100	mA
Power Consumption	Pt			300	525	mW

(Ta= –20 to +70°C)

Pin Configuration



QFP084-P-1818

NC : Nothing connected with pin.

❑ MN1900403

Type		**MN1900403**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	4K (32-bit)
Data	**Data RAM1 (word)**	258 (16-bit)
	Data RAM2 (word)	Internal 512
	RAM Pointer 1	9-bit x 1, Indirect addressing
	RAM Pointer 2	12-bit x 6 Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **200ns (at 3.5 to 5.5V, 25MHz)** Low Speed Operation **160µs (at 3.5 to 5.5V, 32kHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		TQFP080-P-1212
In-Circuit Emulator		ICE19091A
Evaluation Chip		MN19091A

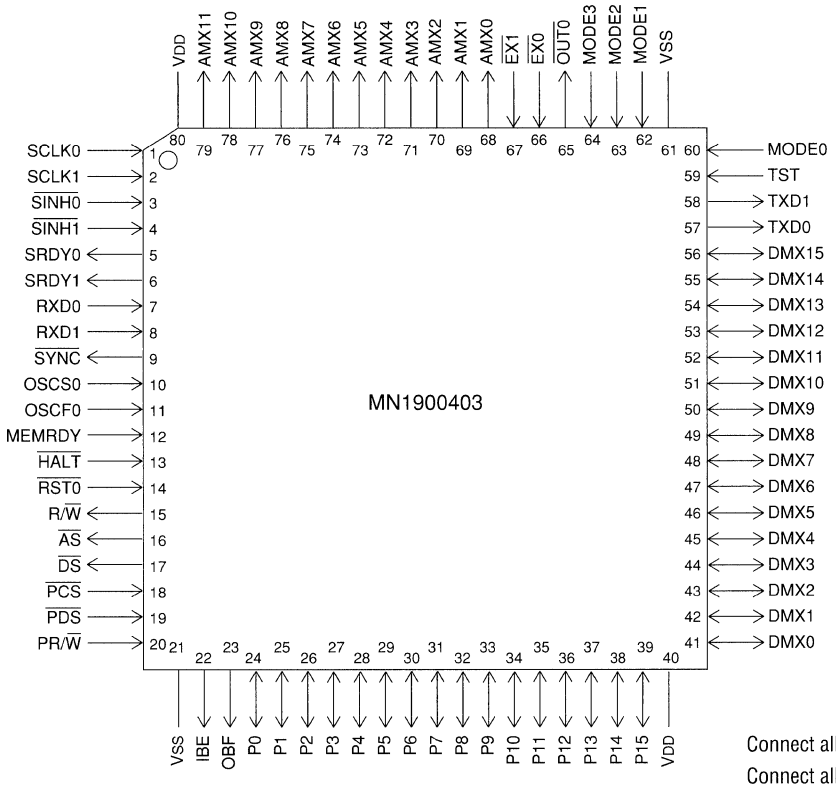
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	3.5	5.0	5.5	V
	VSS					
Oscillation Frequency	fF				25	MHz
Machine Cycle	Tcyc		200		$160x10^3$	ns
Supply Current	IDD			20	60	mA
Power Consumption	Pt			100	330	mW

(Ta= – 20 to +70°C)

Pin Configuration



Connect all VDD externally.
Connect all VSS externally.

TQFP080-P-1212

❑ MN1900003

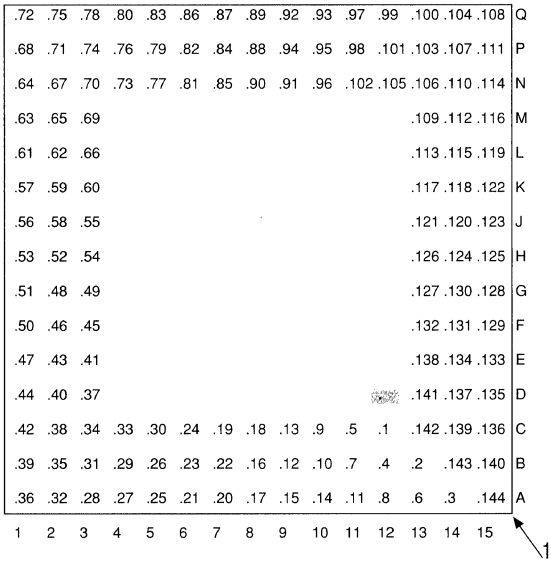
Type		**MN1900003**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	External 64K (32-bit)
Data	**Data RAM1 (word)**	514 (16-bit)
	Data RAM2 (word)	Internal 2K, External 64K (16-bit) • For external **Memory Access Time 30ns** **Wait 1 Wait 20ns (at 100ns Operation)**
	RAM Pointer 1	10-bit x 1, Indirect addressing
	RAM Pointer 2	16-bit x 6, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **100ns (at 4.75 to 5.25V, 50MHz)** Low Speed Operation **160µs (at 3.5 to 5.25V, 32kHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA • NMI (For ICE) Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total (+NMI Interrupt 1 level)
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		PGA144-C-S15U
In-Circuit Emulator		MN1900003
Electrical Characteristics		

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	4.75	5.0	5.25	V
	VSS					
Oscillation Frequency	fF				50	MHz
Machine Cycle	Tcyc		100		$160x10^3$	ns
Supply Current	IDD			80	150	mA
Power Consumption	Pt			400	788	mW

(Ta= –20 to +70°C)

Pin Configuration



(Bottom View)
PGA144-C-S15U

Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name
1	C12	VDD	37	D3	VSS	73	N4	AMX15	109	M13	DMI14
2	B13	SRDY0	38	C2	DMX8	74	P3	$\overline{OUT0}$	110	N14	DMI15
3	A14	SRDY1	39	B1	DMX9	75	Q2	$\overline{EX1}$	111	P15	DMI16
4	B12	RXD0	40	D2	DMX10	76	P4	$\overline{EX0}$	112	M14	DMI17
5	C11	RXD1	41	E3	DMX11	77	N5	$\overline{NMI}$	113	L13	DMI18
6	A13	$\overline{PCS}$	42	C1	DMX12	78	Q3	VSS	114	N15	DMI19
7	B11	$\overline{PDS}$	43	E2	DMX13	79	P5	AMI0	115	L14	DMI20
8	A12	PR/$\overline{W}$	44	D1	DMX14	80	Q4	AMI1	116	M15	DMI21
9	C10	IBE	45	F3	DMX15	81	N6	AMI2	117	K13	DMI22
10	B10	0BF	46	F2	TEST3	82	P6	AMI3	118	K14	DMI23
11	A11	P0	47	E1	TEST2	83	Q5	AMI4	119	L15	DMI24
12	B9	P1	48	G2	TEST1	84	P7	AMI5	120	J14	DMI25
13	C9	P2	49	G3	TEST0	85	N7	AMI6	121	J13	DMI26
14	A10	P3	50	F1	MODE3	86	Q6	AMI7	122	K15	DMI27
15	A9	P4	51	G1	MODE2	87	Q7	AMI8	123	J15	DMI28
16	B8	P5	52	H2	MODE1	88	P8	AMI9	124	H14	DMI29
17	A8	P6	53	H1	MODE0	89	Q8	AMI10	125	H15	DMI30
18	C8	P7	54	H3	S2	90	N8	AMI11	126	H13	DMI31
19	C7	P8	55	J3	S1	91	N9	AMI12	127	G13	$\overline{SYNC}$
20	A7	P9	56	J1	S0	92	Q9	AMI13	128	G15	OSCS0
21	A6	P10	57	K1	AMX0	93	Q10	AMI14	129	F15	OSCS1
22	B7	P11	58	J2	AMX1	94	P9	AMI15	130	G14	VDD
23	B6	P12	59	K2	AMX2	95	P10	DMI0	131	F14	OSCF0
24	C6	P13	60	K3	AMX3	96	N10	DMI1	132	F13	OSCF1
25	A5	P14	61	L1	AMX4	97	Q11	DMI2	133	E15	VSS
26	B5	P15	62	L2	AMX5	98	P11	DMI3	134	E14	MEMRDY
27	A4	TXD1	63	M1	AMX6	99	Q12	DMI4	135	D15	$\overline{HALT}$
28	A3	TXD0	64	N1	AMX7	100	Q13	DMI5	136	C15	$\overline{RST0}$
29	B4	DMX0	65	M2	VDD	101	P12	DMI6	137	D14	$\overline{RST1}$
30	C5	DMX1	66	L3	AMX8	102	N11	DMI7	138	E13	R/$\overline{W}$
31	B3	DMX2	67	N2	AMX9	103	P13	DMI8	139	C14	$\overline{AS}$
32	A2	DMX3	68	P1	AMX10	104	Q14	DMI9	140	B15	$\overline{DS}$
33	C4	DMX4	69	M3	AMX11	105	N12	DMI10	141	D13	$\overline{SCLK0}$
34	C3	DMX5	70	N3	AMX12	106	N13	DMI11	142	C13	$\overline{SINH0}$
35	B2	DMX6	71	P2	AMX13	107	P14	DMI12	143	B14	$\overline{SCLK1}$
36	A1	DMX7	72	Q1	AMX14	108	Q15	DMI13	144	A15	$\overline{SINH1}$

❑ MN1900011

Type		**MN1900011**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	External 64K (32-bit)
Data	**Data RAM1 (word)**	1026 (16-bit)
	Data RAM2 (word)	Internal 3K, External 64K (16-bit) • For external **Memory Access Time 30ns** **Wait 1 to 7 Wait 20 to 140ns (at 100ns Operation)**
	RAM Pointer 1	10-bit x 1, Indirect addressing
	RAM Pointer 2	16-bit x 6, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **100ns (at 4.75 to 5.25V, 50MHz)** Low Speed Operation **160µs (at 3.5 to 5.25V, 32kHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA • NMI (For ICE) Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total (+NMI Interrupt 1 level)
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1 (I/O port joint use)
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		PGA181-C-S15U
In-Circuit Emulator		PARTNER-ET1900011

Electrical Characteristics

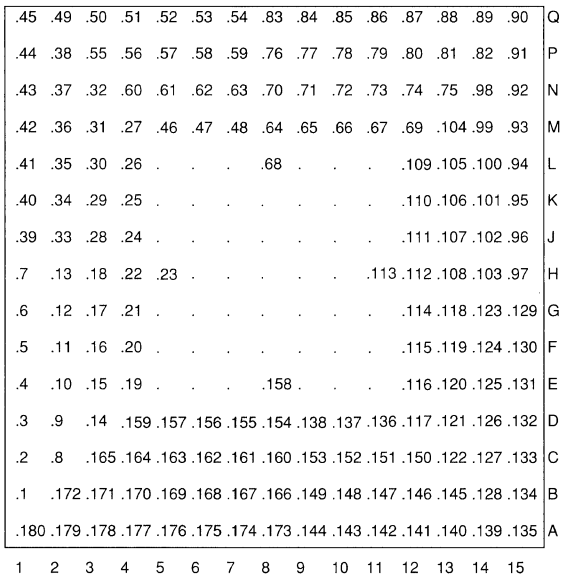
Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	4.75	5.0	5.25	V
	VSS					
Oscillation Frequency	fF				50	MHz
Machine Cycle	Tcyc		100		$160x10^3$	ns
Supply Current	IDD			80	150	mA
Power Consumption	Pt			400	788	mW

(Ta= –20 to +70°C)

※Self-oscillation is up to 30MHz. (Pay attention to the effect of substrate capacitance.)

Pin Configuration



(Bottom View)
PGA181-C-S15U

Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name	Pin No.	Pin Assignment	Pin name
1	B1	VDD	37	N2	TXD0	73	N11	AMX6	109	L12	AMI12	145	B13	DMI22
2	C1	CLKOUT	38	P2	DMX0	74	N12	AMX7	110	K12	AMI13	146	B12	DMI23
3	D1	W/$\overline{R}$	39	J1	DMX1	75	N13	—	111	J12	AMI14	147	B11	DMI24
4	E1	$\overline{AS1}$	40	K1	DMX2	76	P8	VSS	112	H12	AMI15	148	B10	DMI25
5	F1	$\overline{AS2}$	41	L1	DMX3	77	P9	AMX8	113	H11	—	149	B9	DMI26
6	G1	SSYNC0	42	M1	DMX4	78	P10	AMX9	114	G12	BMX2	150	C12	DMI27
7	H1	SSYNC1	43	N1	DMX5	79	P11	AMX10	115	F12	BMX1	151	C11	DMI28
8	C2	SRDY0	44	P1	DMX6	80	P12	AMX11	116	E12	BMX0	152	C10	DMI29
9	D2	SRDY1	45	Q1	DMX7	81	P13	AMX12	117	D12	OUT2	153	C9	DMI30
10	E2	RXD0	46	M5	VSS	82	P14	AMX13	118	G13	OUT1	154	D8	DMI31
11	F2	RXD1	47	M6	DMX8	83	Q8	AMX14	119	F13	—	155	D7	$\overline{SYNC}$
12	G2	$\overline{PCS}$	48	M7	DMX9	84	Q9	AMX15	120	E13	VDD	156	D6	OSCS0
13	H2	$\overline{PDS}$	49	Q2	DMX10	85	Q10	$\overline{READY}$	121	D13	DMI0	157	D5	OSCS1
14	D3	PR/$\overline{W}$	50	Q3	DMX11	86	Q11	$\overline{MON}$	122	C13	DMI1	158	E8	VSS
15	E3	IBE	51	Q4	DMX12	87	Q12	$\overline{RST2}$	123	G14	DMI2	159	D4	OSCF0
16	F3	OBF	52	Q5	DMX13	88	Q13	$\overline{RDYACK}$	124	F14	DMI3	160	C8	OSCF1
17	G3	—	53	Q6	DMX14	89	Q14	$\overline{RSTOUT}$	125	E14	DMI4	161	C7	VDD
18	H3	P0	54	Q7	DMX15	90	Q15	VDD	126	D14	DMI5	162	C6	MEMRDY
19	E4	P1	55	P3	VDD	91	P15	$\overline{OUT0}$	127	C14	DMI6	163	C5	$\overline{HALT}$
20	F4	P2	56	P4	TEST3	92	N15	$\overline{EX1}$	128	B14	DMI7	164	C4	$\overline{RST0}$
21	G4	P3	57	P5	TEST2	93	M15	$\overline{EX0}$	129	G15	DMI8	165	C3	—
22	H4	P4	58	P6	TEST1	94	L15	NMI	130	F15	DMI9	166	B8	$\overline{RST1}$
23	H5	—	59	P7	TEST0	95	K15	VSS	131	E15	DMI10	167	B7	R/$\overline{W}$
24	J4	P5	60	N4	MODE3	96	J15	AMI0	132	D15	DMI11	168	B6	$\overline{AS}$
25	K4	P6	61	N5	MODE2	97	H15	AMI1	133	C15	DMI12	169	B5	$\overline{DS}$
26	L4	P7	62	N6	MODE1	98	N14	AMI2	134	B15	DMI13	170	B4	SCLK0
27	M4	P8	63	N7	MODE0	99	M14	AMI3	135	A15	VSS	171	B3	$\overline{SINH0}$
28	J3	P9	64	M8	S2	100	L14	AMI4	136	D11	VDD	172	B2	SCLK1
29	K3	—	65	M9	S1	101	K14	AMI5	137	D10	DMI14	173	A8	$\overline{SINH1}$
30	L3	P10	66	M10	S0	102	J14	AMI6	138	D9	DMI15	174	A7	$\overline{T12}$
31	M3	P11	67	M11	AMX0	103	H14	AMI7	139	A14	DMI16	175	A6	$\overline{T23}$
32	N2	P12	68	L8	AMX1	104	M13	AMI8	140	A13	DMI17	176	A5	$\overline{T34}$
33	J2	P13	69	M12	AMX2	105	L13	AMI9	141	A12	DMI18	177	A4	$\overline{T40}$
34	K2	P14	70	N8	AMX3	106	K13	AMI10	142	A11	DMI19	178	A3	$\overline{MRAMEN}$
35	L2	P15	71	N9	AMX4	107	J13	—	143	A10	DMI20	179	A2	$\overline{MONRDY}$
36	M2	TXD1	72	N10	AMX5	108	H13	AMI11	144	A9	DMI21	180	A1	VSS

❑ MN1901012

Type		**MN1901012**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	10K (32-bit)
Data	**Data RAM1 (word)**	450 (16-bit)
	Data RAM2 (word)	Internal 1792, External 64K (16-bit) • For external **Memory Access Time 19.8ns** **Wait 1 to 7 Wait 16.6 to 116.2ns (at 83ns Operation)**
	Data ROM (word)	3.5K (16-bit) • Data ROM is mapped on the Address of RAM 2.
	RAM Pointer 1	10-bit x 1, Indirect addressing
	RAM Pointer 2	16-bit x 6, Indirect, Direct, Cyclic Addressing
	RAM Pointer	16-bit x 6, Indirect, Direct, Cyclic Addressing (common with RAM Pointer 2)
Instruction Execution Time		High Speed Operation **83ns (at 4.75 to 5.5V, 60MHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1 (I/O port joint use)
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		QFP100-P-1818
In-Circuit Emulator		PARTNER-ET 1900011
Evaluation Chip		MN1900011

Electrical Characteristics

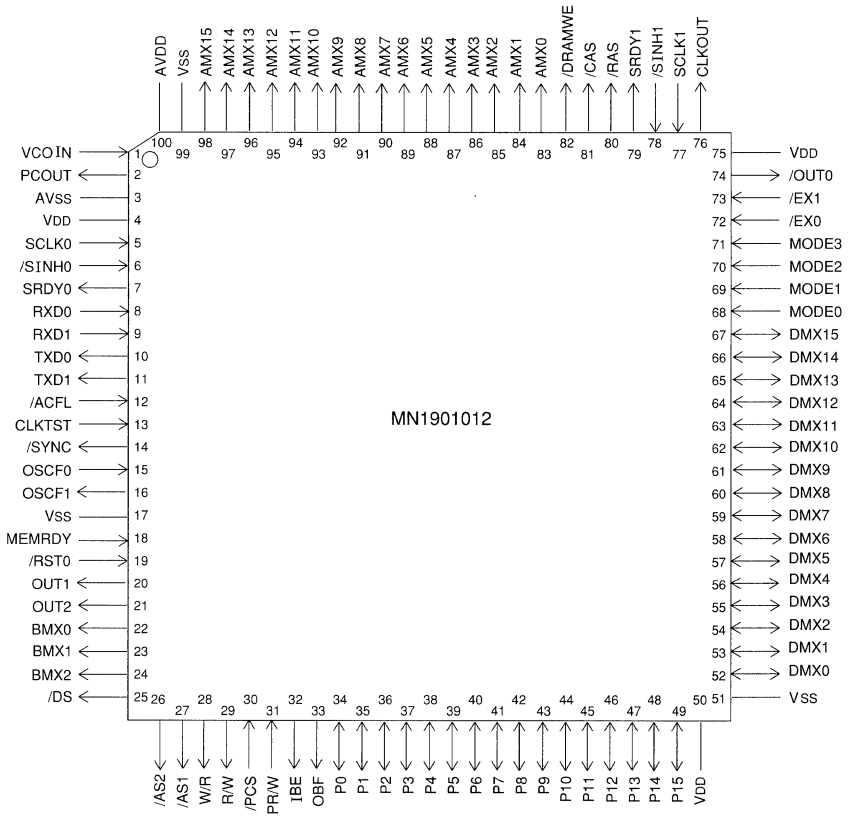
Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	4.75	5.0	5.5	V
	VSS					
Oscillation Frequency	fF		4		60	MHz
Machine Cycle	Tcyc		83		1250	ns
Supply Current	IDD			85	160	mA
Power Consumption	Pt			425	880	mW

(Ta= –20 to +70°C)

※Self-oscillation is up to 30MHz. (Pay attention to the effect of substrate capacitance.)

Pin Configuration



QFP100-P-1818

❑ MN1901611

Type		**MN1901611**
Data Type		Pseudo 24-bit Fixed Point
Instruction	**Instruction ROM (word)**	16K (32-bit)
Data	**Data RAM1 (word)**	514 (16-bit)
	Data RAM2 (word)	Internal 2.5K, External 64K (16-bit) • For external **Memory Access Time 24.5ns** **Wait 1 to 7 Wait 18.1 to 127.3ns (at 90.9ns Operation)**
	RAM Pointer 1	10-bit x 1, Indirect addressing
	RAM Pointer 2	16-bit x 6, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **90.9ns (at 4.75 to 5.5V, 55MHz)** Low Speed Operation **160µs (at 3.5 to 5.5V, 32kHz)**
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 7 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1 (I/O port joint use)
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	20 x 20 → 32-bit
	Calculation Accuracy ALU	24-bit
	Barrel Shifter	32 → 24-bit (–16 to +15 Shift)
	General-use Register	24-bit x 4
	Max/min Value Set	Available
Package		QFH128-P-1818, QFP128-P-1818
In-Circuit Emulator		PARTNER-ET1900011
Evaluation Chip		MN1900011

Electrical Characteristics

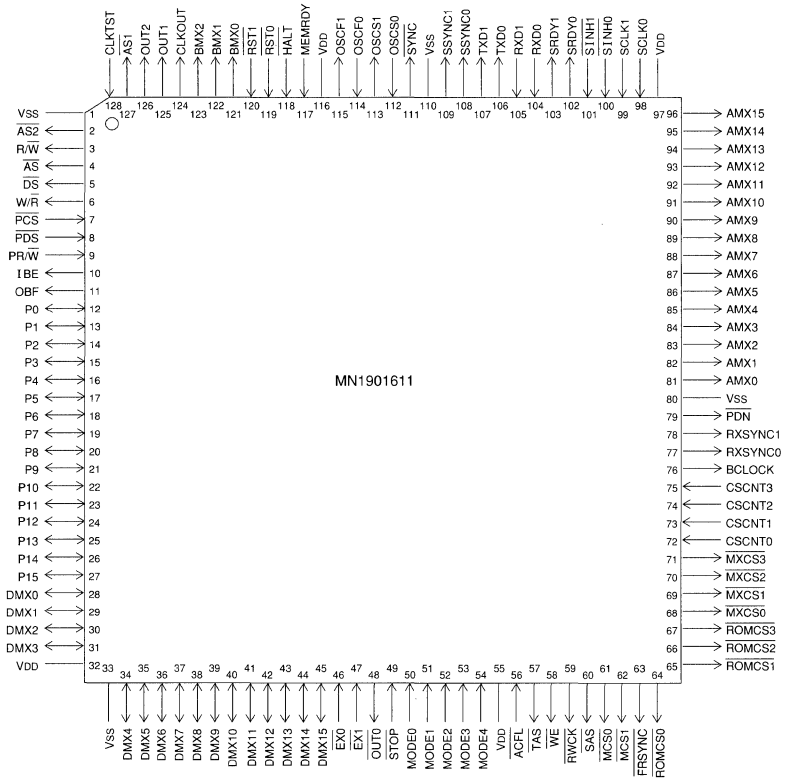
Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD and VSS Pins externally	4.75	5.0	5.5	V
	VSS					
Oscillation Frequency	fF				55	MHz
Machine Cycle	Tcyc		90.9		$160x10^3$	ns
Supply Current	IDD			80	150	mA
Power Consumption	Pt			400	825	mW

(Ta= –20 to +70°C)

※Self-oscillation is up to 30MHz. (Pay attention to the effect of substrate capacitance.)

Pin Configuration



QFH128-P-1818 / QFP128-P-1818

❑ MN199001

Type		**MN199001**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	2K, External 64K (32-bit)
Data	**Data RAM1 (word)**	96 (16-bit)
	Data RAM2 (word)	Internal 64, External 64K (16-bit) • For external **Memory Access Time 25ns** **Wait 2 Wait 50ns (at 100ns Operation)**
	RAM Pointer 1	RAM1, RAM2 joint use
	RAM Pointer 2	16-bit x 7, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **100ns (at 4.75 to 5.25V, 40MHz)** Low Speed Operation —
Interrupts		• RESET • External EX0 Interrupt • External INT Interrupt • Overflow Interrupt • I/O Interrupt • DMA Multiplex Loop, Multiplex Sub-routine, Multiplex Interrupts Max 31 levels in total
I/O	**Serial Interfaces**	8/12/16-bit x 2
	Parallel Interfaces	16-bit x 1 (I/O port joint use)
	Special function	Pseudo SRAM Interface
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	32-bit
	Barrel Shifter	32 → 32-bit (–16 to +15 Shift)
	General-use Register	32-bit x 2
	Max/min Value Set	Available
Package		QFP100-P-1818
In-Circuit Emulator		ICE199001 (For 20MHz)
Evaluation Chip		MN199001
Notes		A/D, D/A Conversion built-in

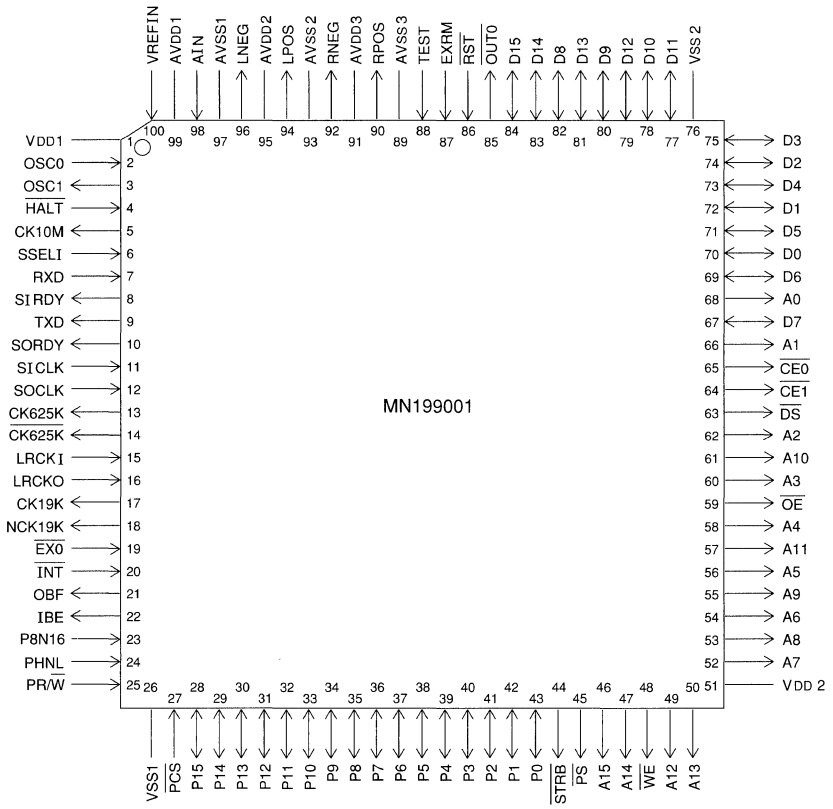
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		4.75	5.0	5.25	V
Oscillation Frequency	foscF				40	MHz
Machine Cycle	Tcyc		100			ns
Supply Current	IDD	fosc=40MHz		50	100	mA
Power Consumption	Pt	fosc=40MHz		250	525	mW

(Ta=25°C)

Pin Configuration



QFP100-P-1818

❑ MN1920802A [High Speed Version]

Type		**MN1920802A [High Speed Version]**
Data Type		24-bit Fixed Point
Instruction	**Instruction ROM (word)**	8K (40-bit)
Data	**Data RAM1 (word)**	514 (24-bit)
	Data RAM2 (word)	Internal 2K, External 16M (24-bit) • For external **Memory Access Time 23ns: 1 Wait** **Wait 1 to 7 Wait 20 to 140ns (at 80ns Operation)**
	RAM Pointer 1	10-bit x 3, Indirect addressing
	RAM Pointer 2	24-bit x 9, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **80ns (at 4.75 to 5.25V, 50MHz)** Low Speed Operation **125µs (at 3.5 to 5.25V, 32kHz)**
Interrupts		• RESET • External Pin Interrupt; 3 kinds (EX0, EX1, UNMI) • Overflow • I/O • DMA • NMI (For ICE) Multiplex Loop, Multiplex Sub-routine, Multiplex Interrupts. 15 levels in total
I/O	**Serial Interfaces**	1 to 24-bit x 2
	Parallel Interfaces	24-bit x 1 (I/O port joint use)
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	24 x 24 → 48-bit
	Calculation Accuracy ALU	56-bit
	Barrel Shifter	56 → 56-bit (–32 to +31 Shift)
	General-use Register	56-bit x 4 x 2 Bank
	Max/min Value Set	Available
Package		QFP124-P-2828
In-Circuit Emulator		ICE1920802
Evaluation Chip		MN1920001

Electrical Characteristics

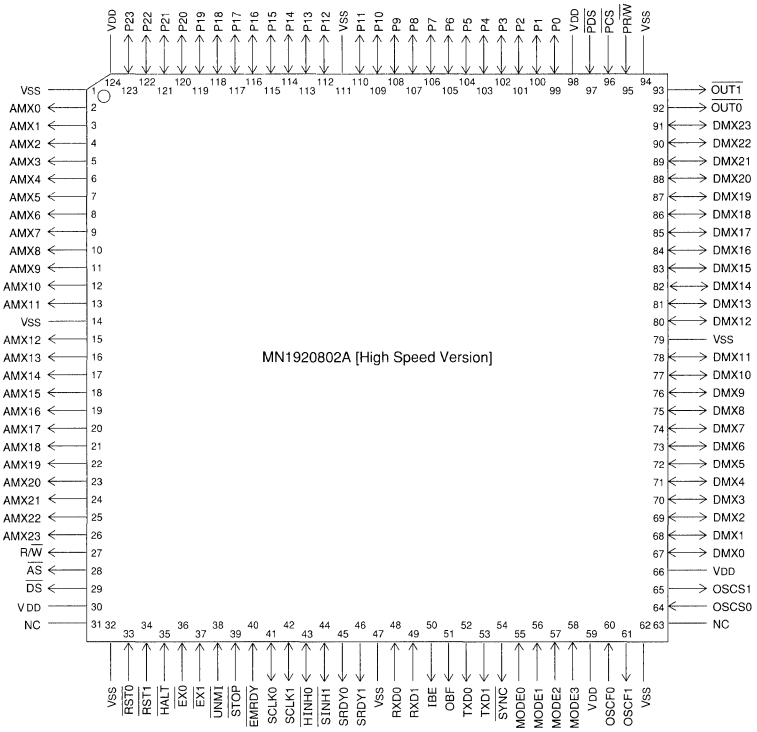
Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD externally	4.75	5.0	5.25	V
Oscillation Frequency	fF		4		50	MHz
Machine Cycle	Tcyc		80		$125x10^3$	ns
Supply Current	IDD	foscF=50MHz, Without External Load		80	140	mA
Power Consumption	Pt			400	735	mW

(Ta= –20 to +70°C)

※Self-oscillation is up to 30MHz. (Pay attention to the effect of substrate capacitance.)

Pin Configuration



QFP124-P-2828

NC : Nothing connected with pin.

❑ MN1920001C [High Speed Version]

Type		**MN1920001C [High Speed Version] [ES (Engineering Sample) available]**
Data Type		24-bit Fixed Point
Instruction	**Instruction ROM (word)**	External 64K (40-bit)
Data	**Data RAM1 (word)**	514 (24-bit)
	Data RAM2 (word)	Internal 2.5K, External 16K (24-bit) • For external **Memory Access Time 15ns** **Wait 1 to 7 Wait 20 to 140ns (at 80ns Operation)**
	RAM Pointer 1	10-bit x 3, Indirect addressing
	RAM Pointer 2	24-bit x 9, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **80ns (at 4.75 to 5.25V, 50MHz)** Low Speed Operation **125μs (at 3.5 to 5.25V, 32kHz)**
Interrupts		• RESET • External Pin Interrupt 3 kinds (EX0, EX1, UNMI) • Overflow • I/O • DMA • NMI (For ICE) Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total (+NMI Interrupt 1 level)
I/O	**Serial Interfaces**	1 to 24-bit x 2
	Parallel Interfaces	24-bit x 1 (I/O Pin joint use)
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	24 x 24 → 48-bit
	Calculation Accuracy ALU	56-bit
	Barrel Shifter	56 → 56-bit (-32 to +31 Shift)
	General-use Register	56-bit x 4 x 2 Bank
	Max/min Value Set	Available
Package		QFP208-P-2828
In-Circuit Emulator		ICE1920001

Electrical Characteristics

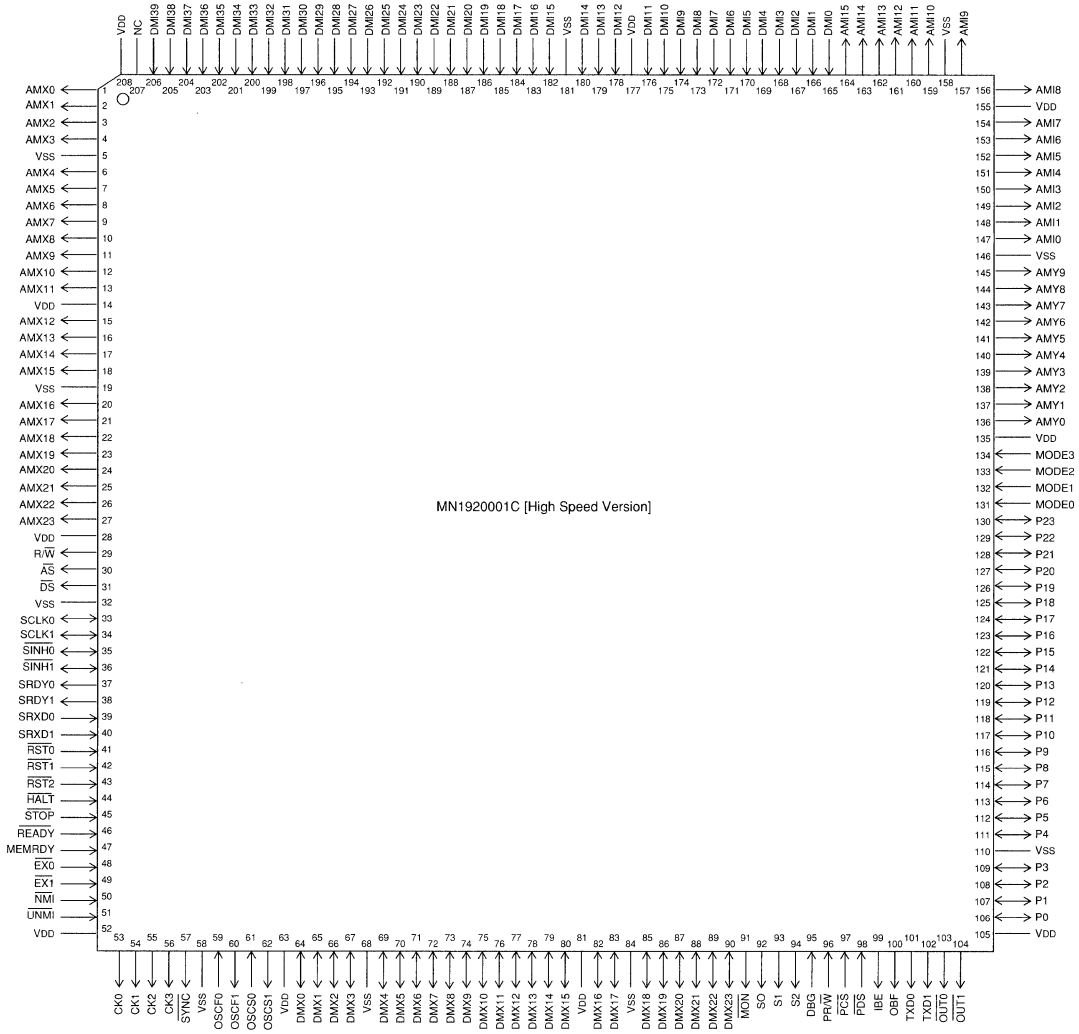
Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD externally	4.75	5.0	5.25	V
Oscillation Frequency	fF		4		50	MHz
Machine Cycle	Tcyc		80		$125x10^3$	ns
Supply Current	IDD	foscF=50MHz Without External Load		80	140	mA
Power Consumption	Pt			400	735	mW

(Ta= –20 to +70°C)

※Self-oscillation is up to 30MHz. (Pay attention to the effect of substrate capacitance.)

Pin Configuration



QFP208-P-2828

NC : Nothing connected with pin.

❑ MN1921003A [High Speed Version]

Type		**MN1921003A [High Speed Version]**
Data Type		24-bit Fixed Point
Instruction	**Instruction ROM (word)**	10K (40-bit)
Data	**Data RAM1 (word)**	514 (24-bit)
	Data RAM2 (word)	Internal 1K (24-bit), 1K (16-bit), External 16M (24-bit) • For external **Memory Access Time 10ns: 1 Wait** **Wait 1 to 7 Wait 17.5 to 122.5ns (at 70ns Operation)**
	RAM Pointer 1	10-bit x 3, Indirect addressing
	RAM Pointer 2	24-bit x 9, Indirect, Direct, Cyclic Addressing
Instruction Execution Time		High Speed Operation **70ns (at 4.75 to 5.25V, 57.1MHz)** Low Speed Operation —
Interrupts		• RESET • External Pin Interrupt 3 kinds (EX0, EX1, UNMI) • Overflow • I/O • DMA • NMI (For ICE) Multiplex Loop, Multiplex Sub-routine, Interrupts. 15 levels in total (+NMI Interrupt 1 level)
I/O	**Serial Interfaces**	1 to 24-bit x 2
	Parallel Interfaces	24-bit x 1 (I/O Port joint use)
	Special function	DMA 2ch, 64 multiplication PLL built-in
Calculation function	**Calculation Accuracy MUL**	24 x 24 → 48-bit
	Calculation Accuracy ALU	56-bit
	Barrel Shifter	56 → 56-bit (–32 to +31 Shift)
	General-use Register	56-bit x 4 x 2 Bank
	Max/min Value Set	Available
Package		QFP144-P-2020
In-Circuit Emulator		ICE1920802 (Used for the limited function)
Evaluation Chip		MN1920001

Electrical Characteristics

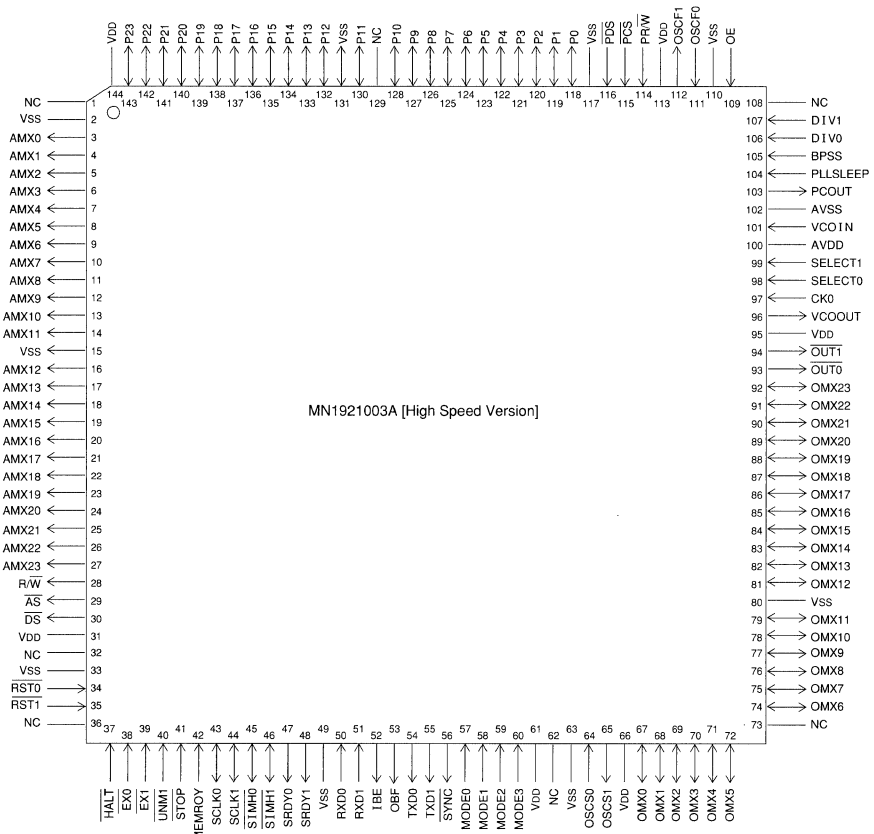
Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect all VDD externally	4.75	5.0	5.25	V
Oscillation Frequency	fF		4		57.1	MHz
Machine Cycle	Tcyc	foscF=892.8kHz (With PLL)	70		$1x10^3$	ns
Supply Current	IDD	Without External Load		100	140	mA
Power Consumption	Pt			500	735	mW

(Ta= –20 to +70°C)

※Self-oscillation is up to 30MHz. (Pay attention to the effect of substrate capacitance.)

Pin Configuration



QFP144-P-2020

NC : Nothing connected with pin.

❑ MN1920811

Type		**MN1920811**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	8K (32-bit)
Data	**Data RAM1 (word)**	2K (16-bit), Data ROM: 2.5K (16-bit)
	Data RAM2 (word)	512 (16-bit)
	RAM Pointer 1	13-bit x 9, Indirect, Direct, Initial Value Pointer increment
	RAM Pointer 2	9-bit x 6, Indirect, Initial Value Pointer increment
Instruction Execution Time		High Speed Operation **93ns (at 3.5 to 3.9V, 21.504MHz)** Low Speed Operation —
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	17-bit
	Barrel Shifter	32 → 17-bit (–32 to +31 Shift)
	General-use Register	16-bit x 8
	Max/min Value Set	Available
Package		LQFP128-P-1818
In-Circuit Emulator		ICE1920811
Evaluation Chip		MN1920811
Notes		Double Speed MAC (16 x 16 → 32, 32+40 → 40), Low Power Consumption

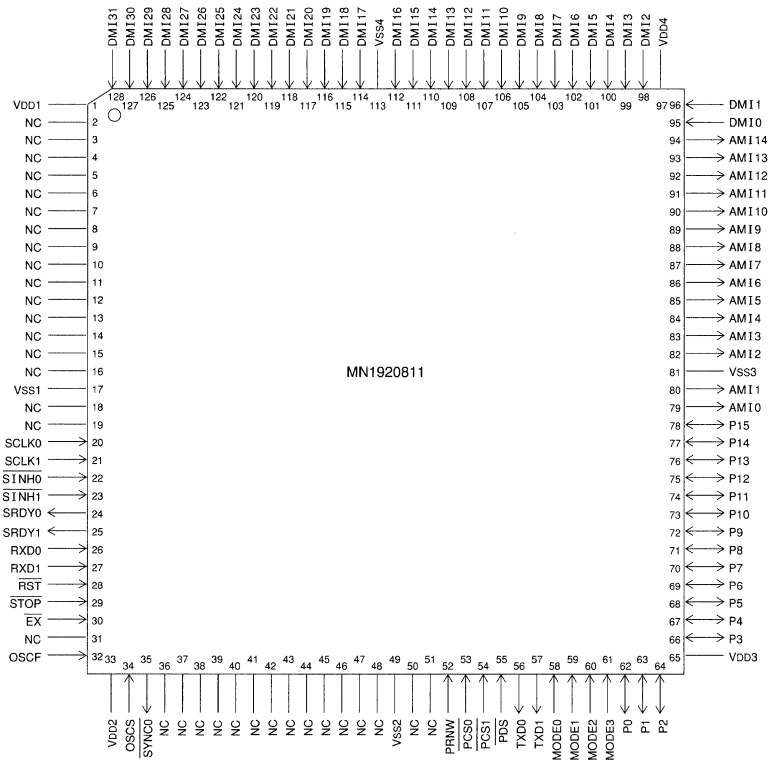
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		3.5	3.7	3.9	V
Oscillation Frequency	foscf		4		21.739	MHz
Machine Cycle	Tcyc		92			ns
Supply Current	IDD	foscF=21.504MHz		25	50	mA
Power Consumption	Pt	At execution of VSELP, Without External Load		90	195	mW

(Ta= –20 to +70°C)

Pin Configuration



LQFP128-P-1818

NC : Nothing connected with pin.

❑ MN1920813

Type		**MN1920813**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	8K (32-bit)
Data	**Data RAM1 (word)**	2K (16-bit) Data ROM: 2.5K (16-bit)
	Data RAM2 (word)	512 (16-bit)
	RAM Pointer 1	13-bit x 9, Indirect, Direct, Initial Value Pointer increment
	RAM Pointer 2	9-bit x 6, Indirect, Initial Value Pointer increment
Instruction Execution Time		High Speed Operation **92ns (at 3.5 to 3.9V, 21.739MHz), 68ns (at 4.5 to 5.5V, 29.4MHz)** Low Speed Operation —
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	17-bit
	Barrel Shifter	32 → 17-bit (–32 to +31 Shift)
	General-use Register	16-bit x 8
	Max/min Value Set	Available
Package		TQFP100-P-1414
In-Circuit Emulator		ICE1920811
Evaluation Chip		MN1920811
Notes		Double Speed MAC (16 x 16 → 32, 32+40 → 40), Low Power Consumption

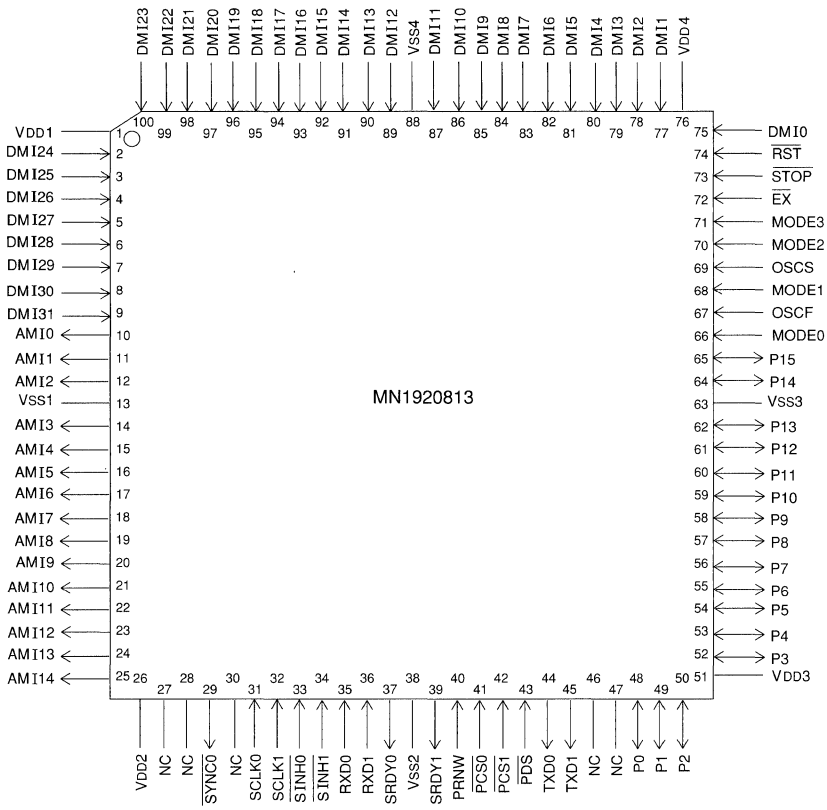
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		3.5	3.7	3.9	V
			4.5	5.0	5.5	
Oscillation Frequency	foscf	VDD=3.5 to 3.9V	4		21.739	MHz
		VDD=4.5 to 5.5V	4		29.4	
Machine Cycle	Tcyc	VDD=3.5 to 3.9V, 21.739MHz	92			ns
		VDD=4.5 to 5.5V, 29.4MHz	68			
Supply Current	IDD	foscF=21.504MHz		25	50	mA
Power Consumption	Pt	At execution of VSELP, Without External Load		90	195	mW
Supply Current	IDD	foscF=28.57MHz		40	80	mA
Power Consumption	Pt	Without External Load		200	440	mW

(Ta= –20 to +70°C)

Pin Configuration



TQFP100-P-1414

NC : Nothing connected with pin.

❑ MN1921814

Type		**MN1921814**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	8K (32-bit)
Data	**Data RAM1 (word)**	2.75K (16-bit), Data ROM: 2.5K (16-bit)
	Data RAM2 (word)	512 (16-bit)
	RAM Pointer 1	13-bit x 9, Indirect, Direct, Initial Value Pointer increment
	RAM Pointer 2	9-bit x 6, Indirect, Initial Value Pointer increment
Instruction Execution Time		High Speed Operation **92ns (at 3.5 to 3.9V, 21.739MHz), 68ns (at 4.5 to 5.5V, 29.4MHz)** Low Speed Operation —
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	17-bit
	Barrel Shifter	32 → 17-bit (–32 to +31 Shift)
	General-use Register	16-bit x 8
	Max/min Value Set	Available
Package		TQFP100-P-1414
In-Circuit Emulator		ICE1920811
Evaluation Chip		MN1920811
Notes		Double Speed MAC (16 x 16 → 32, 32+40 → 40), Low Power Consumption

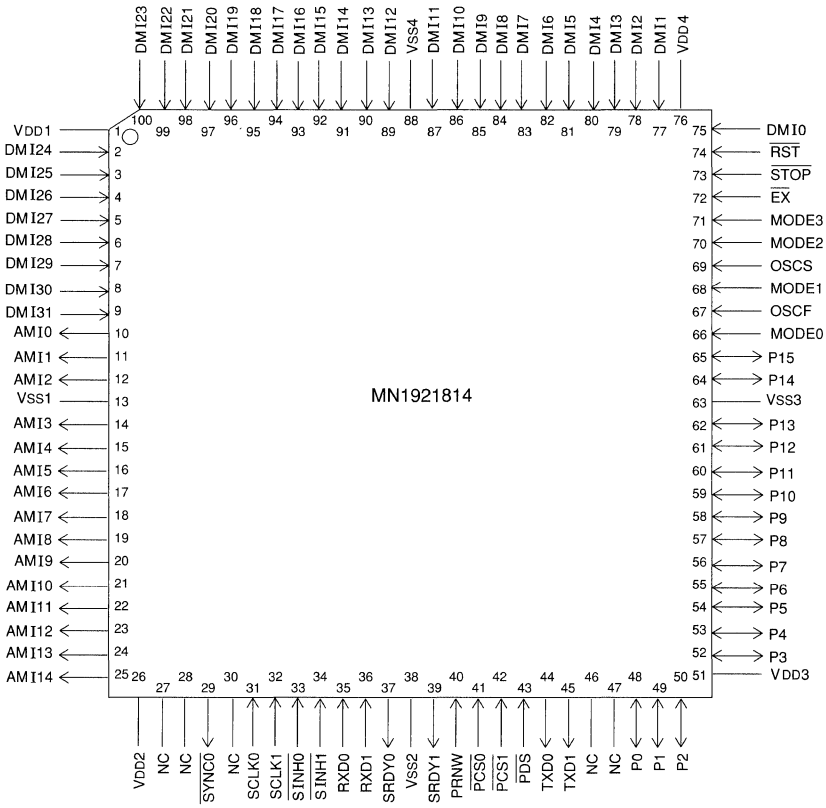
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		3.5	3.7	3.9	V
			4.5	5.0	5.5	
Oscillation Frequency	foscF	VDD=3.5 to 3.9V	4		21.739	MHz
		VDD=4.5 to 5.5V	4		29.4	
Machine Cycle	Tcyc	VDD=3.5 to 3.9V, 21.739MHz	92			ns
		VDD=4.5 to 5.5V, 29.4MHz	68			
Supply Current	IDD	foscf=21.504MHz		25	50	mA
Power Consumption	Pt	At execution of VSELP, Without External Load		90	195	mW
Supply Current	IDD	foscF=28.57MHz		40	80	mA
Power Consumption	Pt	Without External Load		200	440	mW

(Ta= –20 to +70°C)

Pin Configuration



TQFP100-P-1414

NC : Nothing connected with pin.

❑ MN1921816

Type		**MN1921816**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	18K (32-bit)
Data	**Data RAM1 (word)**	2.75K (16-bit) Data ROM: 2.5K (16-bit)
	Data RAM2 (word)	512 (16-bit)
	RAM Pointer 1	13-bit x 9, Indirect, Direct, Initial Value Pointer increment
	RAM Pointer 2	9-bit x 6, Indirect, Initial Value Pointer increment
Instruction Execution Time		High Speed Operation **92ns (at 2.7 to 3.3V, 21.739MHz)** Low Speed Operation —
Interrupts		• RESET • External • Overflow • I/O • DMA Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	17-bit
	Barrel Shifter	32 → 17-bit (–32 to +31 Shift)
	General-use Register	16-bit x 8
	Max/min Value Set	Available
Package		TQFP100-P-1414
In-Circuit Emulator		ICE1920811
Evaluation Chip		MN1920811
Notes		Double Speed MAC (16 x 16 → 32, 32+40 → 40), Low Power Consumption

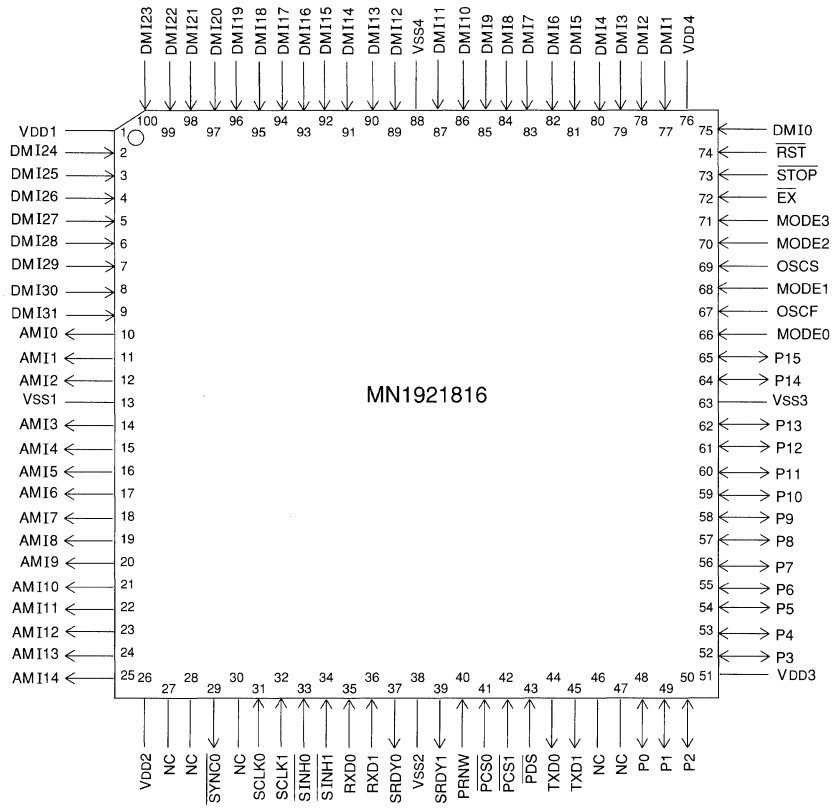
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		2.7	3.0	3.3	V
Oscillation Frequency	foscF	VDD=2.7 to 3.3V	4		21.739	MHz
Machine Cycle	Tcyc	VDD=2.7 to 3.3V, 21.739MHz	92			ns
Supply Current	IDD	foscF=21.504MHz At execution of VSELP, Without External Load		13.3	30	mA
Power Consumption	Pt			40	100	mW

(Ta= –20 to +70°C)

Pin Configuration



TQFP100-P-1414

NC : Nothing connected with pin.

❑ MN1932801

Type		**MN1932801**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	28K (24-bit)
Data	**Data RAM (word)**	6K (16-bit), Data ROM: 30K (16-bit)
	RAM Pointer	16-bit x 10, Indirect, Direct, Initial Value Pointer increment, Cyclic Addressing • Bit Reverse
Instruction Execution Time		High Speed Operation **27ns (at 2.7 to 3.3V), 25ns (at 3.0 to 3.6V)** Low Speed Operation —
Interrupts		• RESET • External • Overflow • I/O • DMA • Timer Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1 General-use Output 16-bit General-use Input 4-bit
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	16-bit
	Barrel Shifter	40 → 17-bit (–32 to +31 Shift)
	General-use Register	16-bit x 4
	Max/min Value Set	Available
Package		TQFP100-P-1414
In-Circuit Emulator		ICE1932801
Evaluation Chip		MN1932801
Notes		Double Speed MAC (16 x 16 → 32, 32+40 → 40), Low Power Consumption

Electrical Characteristics

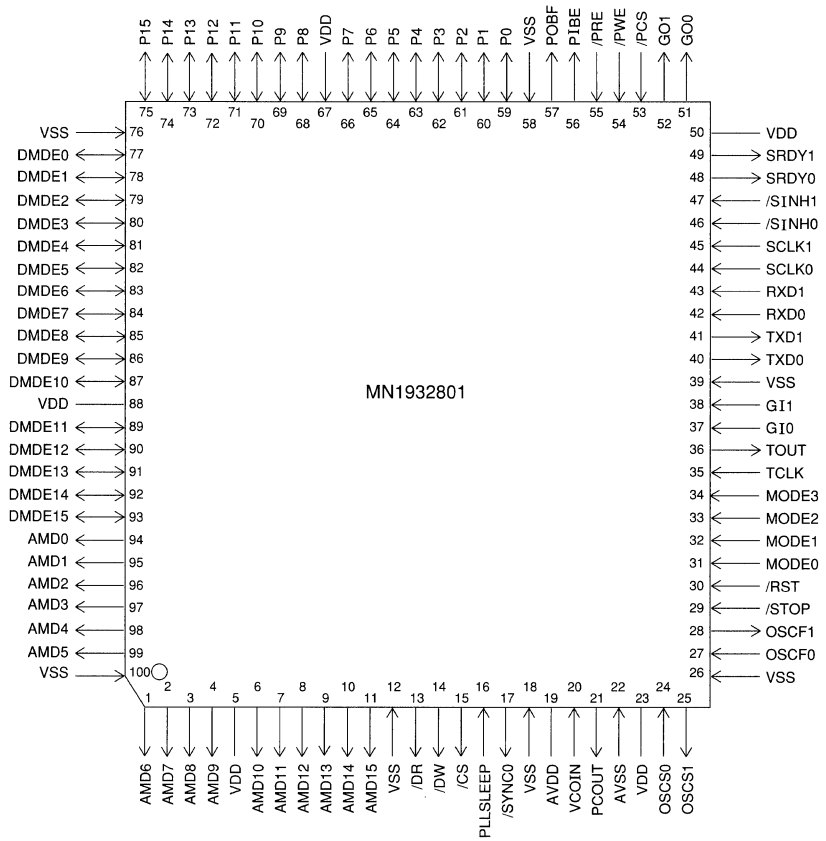
Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		2.7	3.0	3.6	V
Input Clock Frequency*	fF	VDD=3.0 to 3.6V	65/N		80/N	MHz
		VDD=2.7 to 3.3V	60/N		74/N	MHz
Machine Cycle	tcyc	VDD=3.0 to 3.6V	25			ns
		VDD=2.7 to 3.3V	27			ns
Supply Current	IDD	tcyc=30.0ns		40	130	mA
Power Consumption	Pt	Without External Load		120	429	mW

(Ta= –20 to +70°C)

*N: PLL multiplication factor

Pin Configuration



TQFP100-P-1414

❑ MN1933211

Type		**MN1933211**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	32K (24-bit)
Data	**Data RAM (word)**	6K + 32 (16-bit) Data ROM: 30K (16-bit)
	RAM Pointer	16-bit x 10, Indirect, Direct, Initial Value Pointer increment, Cyclic Addressing • Bit Reverse
Instruction Execution Time		High Speed Operation **21.7ns (at 2.7 to 3.3V), 20ns (at 3.0 to 3.6V)** Low Speed Operation —
Interrupts		• RESET • External • Overflow • I/O • DMA • Timer Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1 General-use Output 16-bit General-use Input 4-bit
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	16-bit
	Barrel Shifter	40 → 17-bit (–32 to +31 Shift)
	General-use Register	16-bit x 4
	Max/min Value Set	Available
Package		TQFP100-P-1212, TQFP100-P-1414
In-Circuit Emulator		ICE1933211
Evaluation Chip		MN1933211
Notes		Double Speed MAC (16 x 16 → 32, 32+40 → 40), Low Power Consumption

Electrical Characteristics

Electrical Characteristics

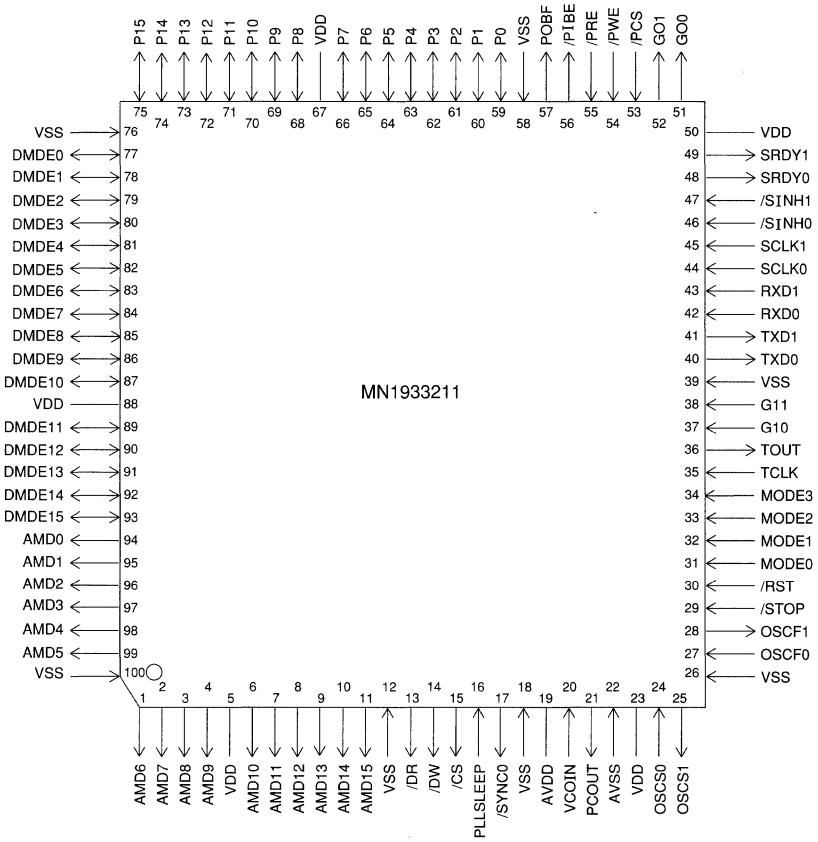
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		2.7	3.0	3.6	V
Input Clock Frequency*1	fF	VDD=3.0 to 3.5V	72/N		100/N	MHz
		VDD=2.7 to 3.3V	64/N		92/N	MHz
Machine Cycle	tcyc	VDD ≥ 3.0V	20			ns
		VDD ≥ 2.7V	21.7			ns
Supply Current 1	IDD1	VDD=2.7 to 3.3V, tcyc=21.7ns		30*2	175	mA
Power Consumption1	Pt1	Without External Load			630	mW
Supply Current 2	IDD2	VDD=3.0 to 3.6V, tcyc=20ns			240	mA
Power Consumption2	Pt2	Without External Load			864	mW

(Ta= –20 to +70°C)

*1 N : PLL multiplication factor

*2 Values given are for machine cycle of 27ns at PSI-CELP voice coding execution

Pin Configuration



TQFP100-P-1212 / TQFP100-P-1414

❑ MN1931712

Type		**MN1931712**
Data Type		16-bit Fixed Point
Instruction	**Instruction ROM (word)**	17K (24-bit)
Data	**Data RAM (word)**	3.5K (16-bit) Data ROM: 5K (16-bit)
	RAM Pointer	16-bit x 10, Indirect, Direct, Initial Value Pointer increment, Cyclic Addressing • Bit Reverse
Instruction Execution Time		High Speed Operation **20ns (at 3.0 to 3.6V, 100MHz)** Low Speed Operation —
Interrupts		• RESET • External • Overflow • I/O • DMA • Timer Multiplex Loop, Multiplex Sub-routine, Interrupts 15 levels in total
I/O	**Serial Interfaces**	1 to 16-bit x 2
	Parallel Interfaces	16-bit x 1 General-use Output 16-bit General-use Input 4-bit
	Special function	DMA 2ch
Calculation function	**Calculation Accuracy MUL**	16 x 16 → 32-bit
	Calculation Accuracy ALU	16-bit
	Barrel Shifter	40 → 17-bit (–32 to +31 Shift)
	General-use Register	16-bit x 4
	Max/min Value Set	Available
Package		QFP100-P-1818B
In-Circuit Emulator		ICE1933211
Evaluation Chip		MN1933211
Notes		Double Speed MAC (16 x 16 → 32, 32+40 → 40), Low Power Consumption PCM-CODEC I/F, ADPCM I/F, Flash Memory I/F

Electrical Characteristics

Electrical Characteristics

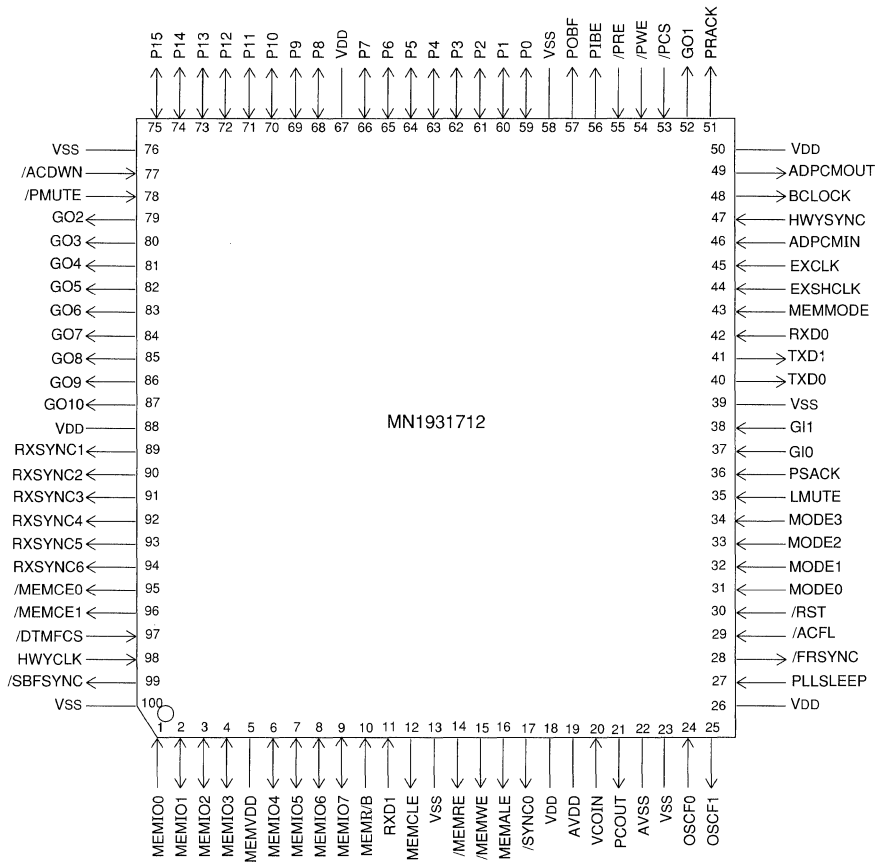
Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD		3.0	3.3	3.6	V
Input Clock Frequency*1	fF	VDD=3.0 to 3.6V	72/N		100/N	MHz
Machine Cycle	tcyc	VDD ≥ 3.0V	20			ns
Supply Current 1	IDD1	VDD=3.3V, tcyc=20ns Without External Load, Double-speed MAC 10% or less		45	128	mA
Power Consumption 1	Pt1			149*2	422	mW

(Ta= –20 to +70°C)

*1 N : PLL multiplication factor

*2 Values when using ADPCM at Ta=25°C, echo cancellation, DTMF

Pin Configuration



TQFP100-P-1212 / TQFP100-P-1414

ASP SERIES

MN1940 Series

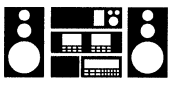
The MN1940 Series includes program-controlled CMOS high-performance digital signal processors with optimum architecture for audio signal processing.

A multiplier, ALU, RAM, audio serial interface, and program RAM are integrated into a single chip.

Features

- **Audio Signal Processing Architecture**
  - 80 ns maximum execution speed.
  - Direct coupling to digital delay DRAM available.
  - Program loading to instruction RAM.
  - Setting of filter coefficient and digital delay time.
- **High-accuracy Operation Functions**
  - 24 x 16 → 40-bit multiplier 44-bit ALU
- **Audio Serial Interface**
  - Input: 2 ports (2 channels/port)
  - Output: 3 ports (2 channels/port)
  - I^2S/CD format switching for individual ports
  - Full 16/24 bit switching

■ **Applications**



ASP Series

❑ MN19411

Type		MN19411
Data Type		24-bit Fixed Point
Instruction	Instruction ROM (word)	192 (32-bit, On-chip RAM)
Data	Data RAM1 (word)	128 (16-bit)
	Data RAM2 (word)	Internal 128 (24-bit) / External 256K or 1M DRAM x 1 to 2 pieces • For external **Memory Access Time 80ns (f_{CLK}=25MHz)**
	RAM Pointer 1	7-bit x 1
	RAM Pointer 2	7-bit x 1 (Internal) 1 (External), Cyclic Addressing
Instruction Execution Time		High Speed Operation **80ns (at 4.5 to 5.5V, 25MHz)** Low Speed Operation
Interrupts		• RESET Multiplex Loop, Multiplex Sub-routine 2 levels in total
I/O	Serial Interfaces	16/24-bit (L, R) input x 2, output x 3
	Special function	Direct connection of DRAM for Digital Delay is available, I²C Interface built-in
Calculation function	Calculation Accuracy MUL	24 x 16 → 40-bit
	Calculation Accuracy ALU	44
	Barrel Shifter	40 → 40-bit / –4, 0, +1, +4 Shift
	Max/min Value Set	Available
Package		QFP064-P-1818
In-Circuit Emulator		Evaluation Board

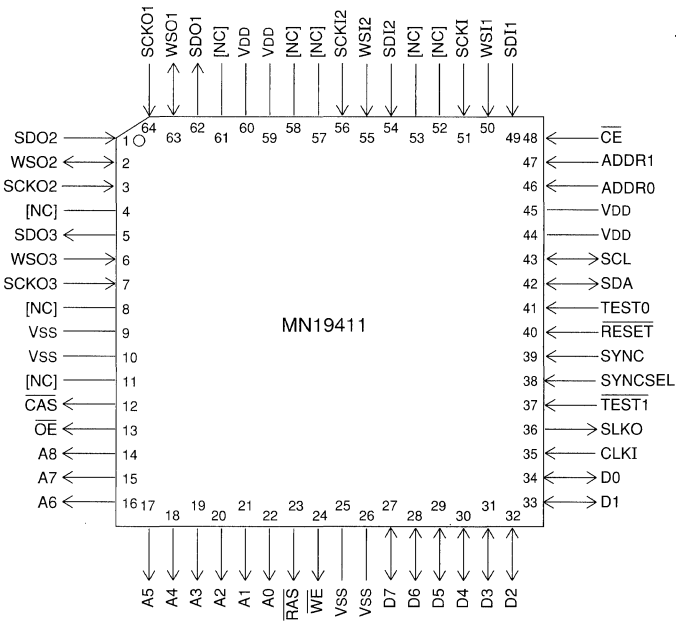
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	Connect respectively all VDD and VSS terminals externally	4.5	5.0	5.5	V
Oscillation Frequency	f_{CLK}		4		25	MHz
Machine Cycle	Tcyc		80		500	ns
Supply Current	IDD	f_{CLK}=24.5MHz, Ta=25°C		65	100	mA
Power Consumption	P_D				550	mW

(Ta= –20 to +70°C, VSS=0V)

Pin Configuration



QFP064-P-1818

NC : Nothing connected with pin.

❑ MN19412A

Type		MN19412A
Data Type		24-bit Fixed Point
Instruction	Instruction ROM (word)	512 (32-bit, On-chip RAM)
Data	Data RAM1 (word)	256 (16-bit)
	Data RAM2 (word)	Internal 256 (24-bit) / External 256K or 1M DRAM x 1 to 2 pieces, 256K SRAM x 1 to 2 pieces • For external **Memory Access Time DRAM 80ns, SRAM 100ns (f_{OSC}=40MHz)**
	RAM Pointer 1	8-bit x 2
	RAM Pointer 2	8-bit x 2 (Internal), 2 (External), Cyclic Addressing
Instruction Execution Time		High Speed Operation **50ns (at 4.75 to 5.25V, 40MHz)** Low Speed Operation —
Interrupts		• RESET • INT0 Interrupts • INT1 Interrupts Multiplex Loop, Multiplex Sub-routine, Interrupts 3 levels in total
I/O	Serial Interfaces	16/24-bit (L, R) input x 2, output x 3
	Parallel Interfaces	8-bit x 1
	Special function	Direct connection to DRAM, SRAM for Digital Delay is available, I²C Interface built-in
Calculation function	Calculation Accuracy MUL	24 x 16 → 40-bit
	Calculation Accuracy ALU	44
	Barrel Shifter	40 → 40-bit / 0, +1, +4 Shift, −32 to +31 Shift
	Max/min Value Set	Available
Package		QFP084-P-1818
In-Circuit Emulator		Evaluation Board

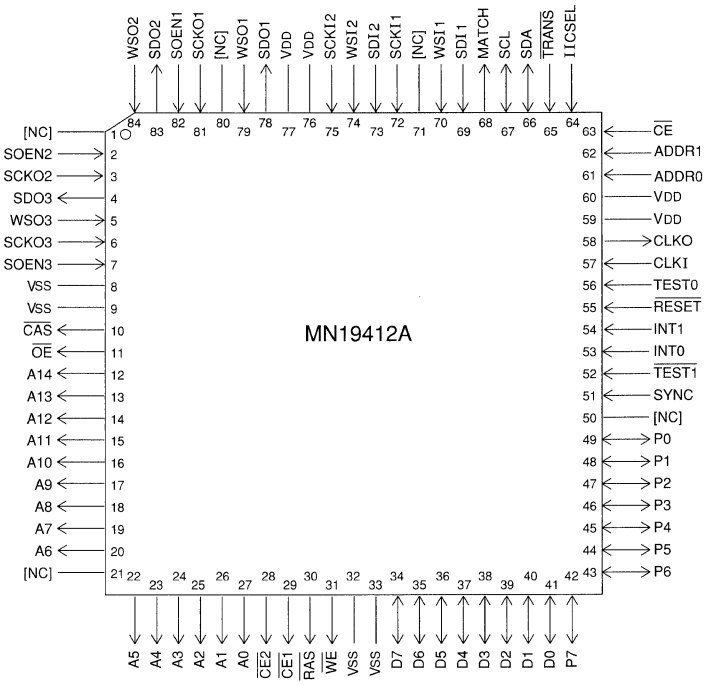
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	fosc=4 to 40MHz	4.75	5.0	5.25	V
	VSS	Connect respectively all VDD and VSS terminals externally				
Oscillation Frequency	fosc	VDD=4.75 to 5.25V	4		40	MHz
Machine Cycle	Tcyc		50		500	ns
Supply Current	IDD	f_{CLK}=40MHz, Ta=25°C		110	150	mA
Power Consumption	P_D				787.5	mW

(Ta= −20 to +70°C, VSS=0V)

Pin Configuration



QFP084-P-1818

NC : Nothing connected with pin.

❑ MN19413

Type		**MN19413**
Data Type		24-bit Fixed Point
Instruction	**Instruction ROM (word)**	512 (32-bit, On-chip RAM)
Data	**Data RAM1 (word)**	256 (16-bit)
	Data RAM2 (word)	Internal 256 (24-bit) / External 256K or 1M or 4M DRAM x 1 to 2 pieces, 256K or 1M SRAM x 1 to 2 pieces • For external **Memory Access Time DRAM 80ns, SRAM 100ns (f_{OSC}=20MHz)**
	RAM Pointer 1	8-bit x 2
	RAM Pointer 2	8-bit x 2 (Internal), 2 (External), Cyclic Addressing
Instruction Execution Time		High Speed Operation **50ns (at 4.75 to 5.25V, 20MHz)** Low Speed Operation —
Interrupts		• RESET • INT0 Interrupts • INT1 Interrupts Multiplex Loop, Multiplex Sub-routine, Interrupts 3 levels in total
I/O	**Serial Interfaces**	16/24-bit (L, R) input x 1, output x 2
	Parallel Interfaces	4-bit x 1
	Special function	Direct connection to DRAM, SRAM for Digital Delay is available, I²C Interface built-in
Calculation function	**Calculation Accuracy MUL**	24 x 16 → 40-bit
	Calculation Accuracy ALU	44
	Barrel Shifter	40 → 40-bit / 0, +1, +4 Shift, −32 to +31 Shift
	Max/min Value Set	Available
Package		QFP100-P-1818
In-Circuit Emulator		Evaluation Board

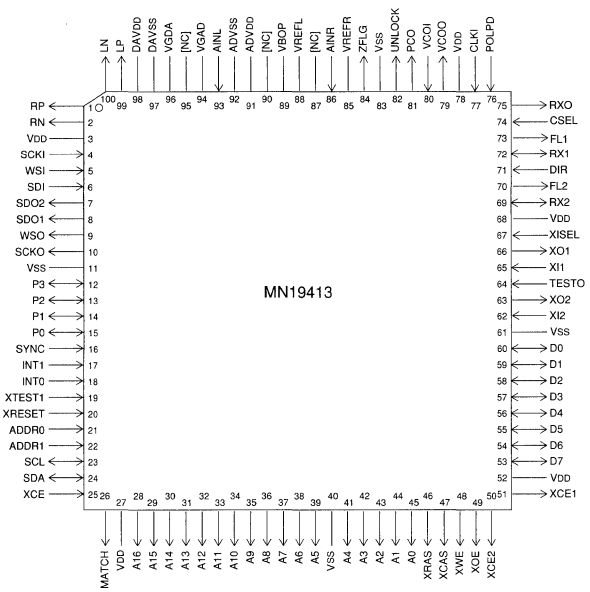
Electrical Characteristics

Electrical Characteristics

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Supply Voltage	VDD	f_{OSC}=2 to 20MHz	4.75	5.0	5.25	V
	VSS	Connect respectively all VDD and VSS terminals externally				
Oscillation Frequency	f_{OSC}	VDD=4.75 to 5.25V	2		20	MHz
Machine Cycle	Tcyc		50		500	ns
Supply Current	IDD	f_{CLK}=20MHz, Ta=25°C		120	190	mA
Power Consumption	P_D				990	mW

(Ta= −20 to +70°C, VSS=0V)

Pin Configuration



QFP100-P-1818

NC : Nothing connected with pin.

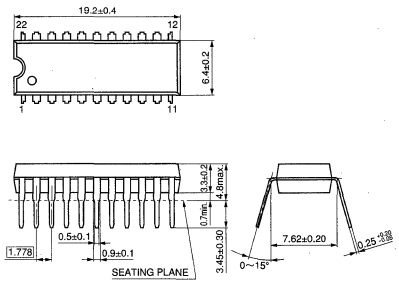
PACKAGE

Package

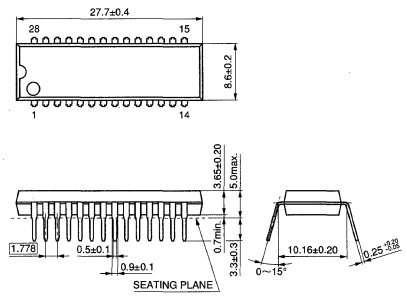
DIL Packages

Unit : mm

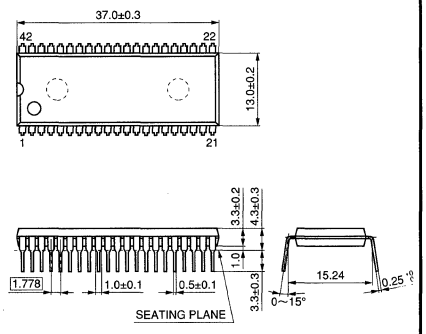
SDIP-022-P-0300



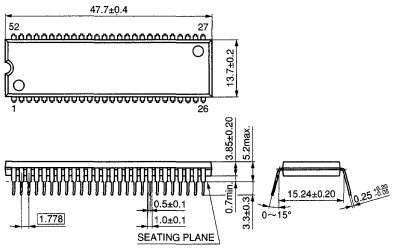
SDIP028-P-0400



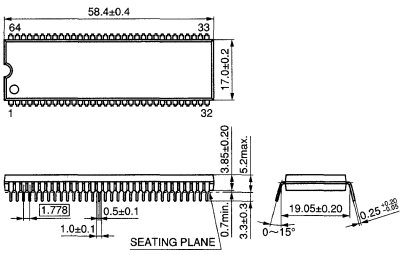
SDIP042-P-0600



SDIP052-P-0600



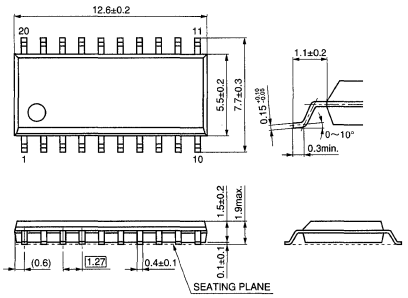
SDIP064-P-0750



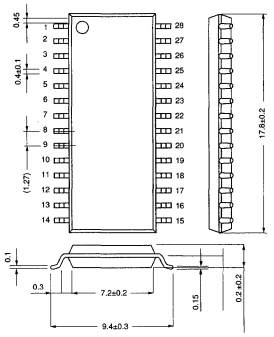
SO Packages

Unit : mm

SOP020-P-0300



SOP028-P-0375



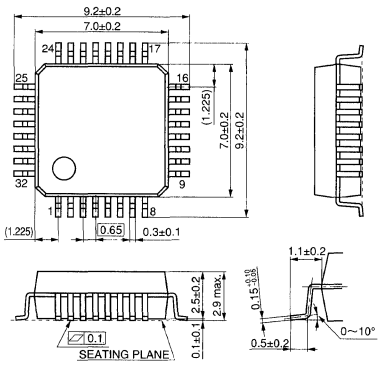
• Package Symbol : SDIP = Shrink Dual - In - Line Plastic Package
SOP = Small Out Line Package

About Package Symbol : The name conformed to EIAJ.

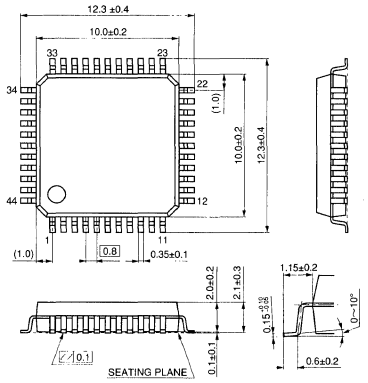
QFP / QFH / QFS / TQFP / LQFP Packages

Unit : mm

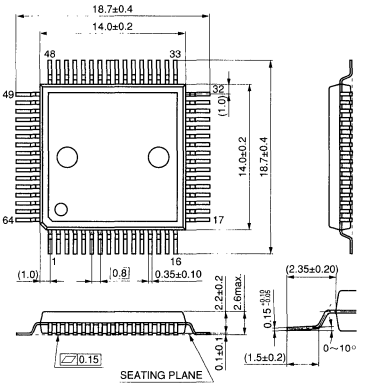
QFH032-P-0707



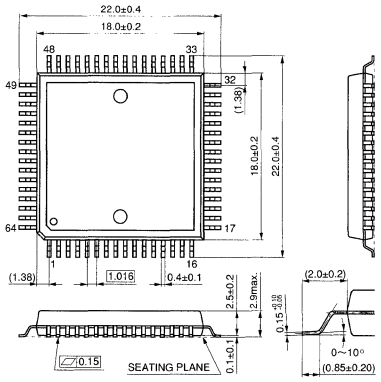
QFP044-P-1010



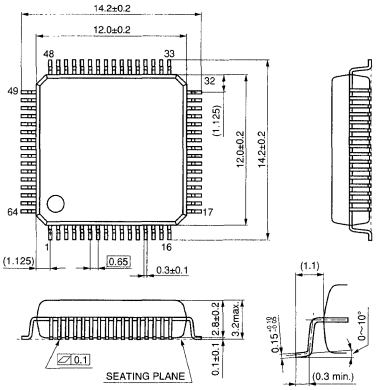
QFP064-P-1414



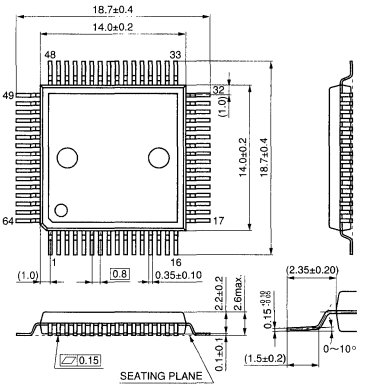
QFH064-P-1818



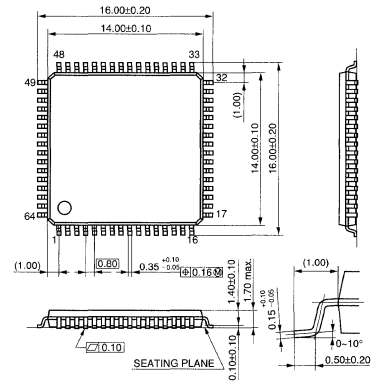
QFH064-P-1212



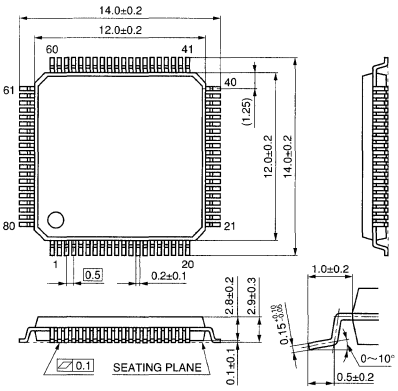
QFH064-P-1414B



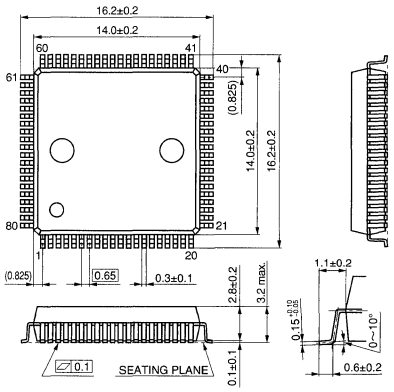
LQFP064-P-1414



QFH080-P-1212



QFH080-P-1414



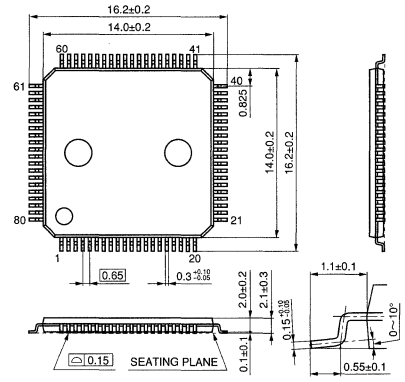
• Package Symbol : QFP = Quad Flat Package
QFH = Quad Flat High Package
LQFP = Low Profile Quad Flat Package

About Package Symbol : The name conformed to EIAJ.

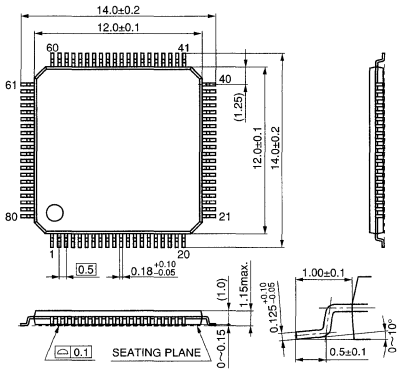
QFP / QFS / TQFP / LQFP Packages

Unit : mm

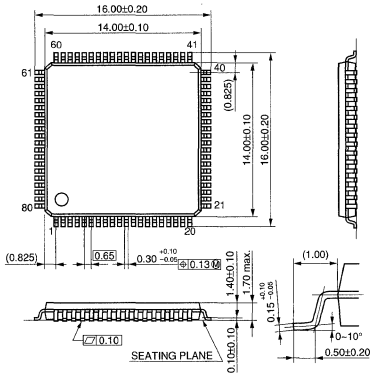
QFS080-P-1414



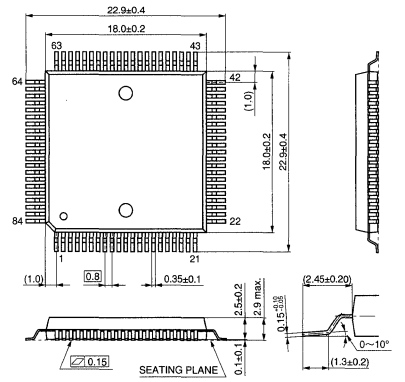
TQFP080-P-1212



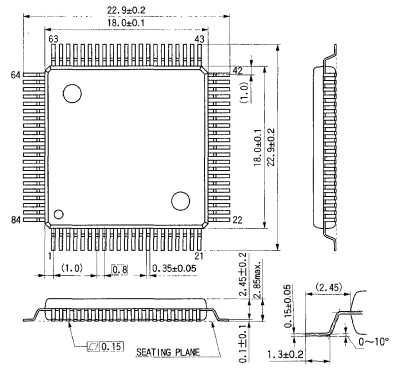
LQFP080-P-1414A



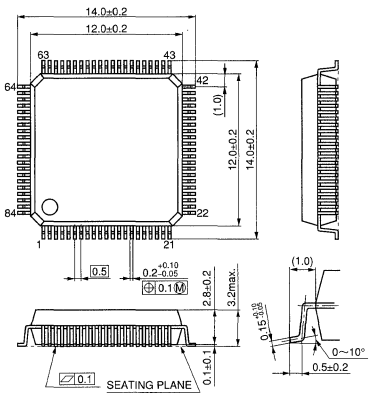
QFP084-P-1818



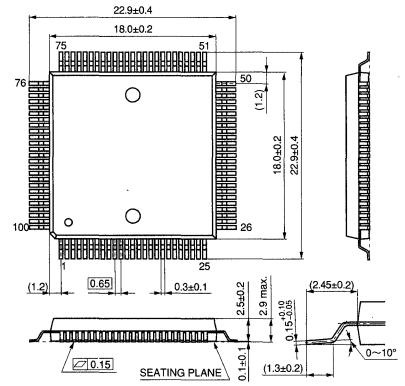
QFP084-P-1818E



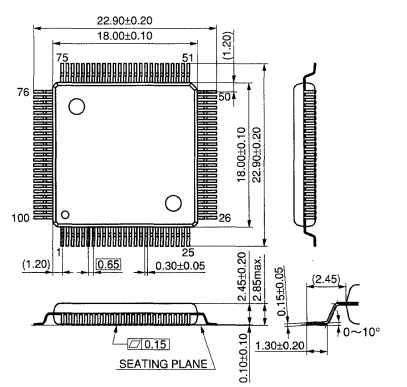
QFH084-P-1212



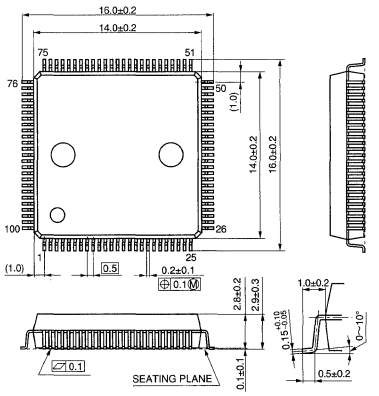
QFP100-P-1818



QFP100-P-1818B



QFH100-P-1414



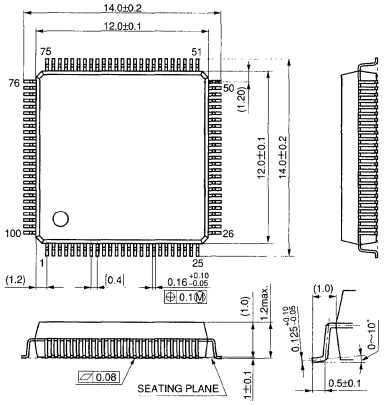
• Package Symbol : QFP = Quad Flat Package
QFH = Quad Flat High Package
QFS = Quad Flat L - Leaded Package, Small Package
TQFP=Thin Quad Flat Package
LQFP = Low Profile Quad Flat Package

About Package Symbol : The name conformed to EIAJ.

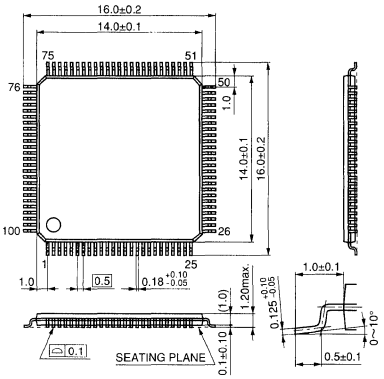
QFP / QFH / QFS / TQFP / LQFP Packages

Unit : mm

TQFP100-P-1212



TQFP100-P-1414



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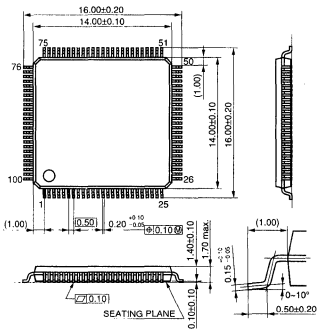
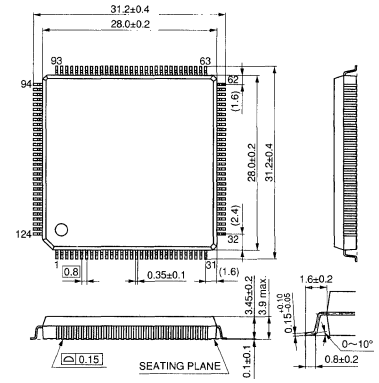
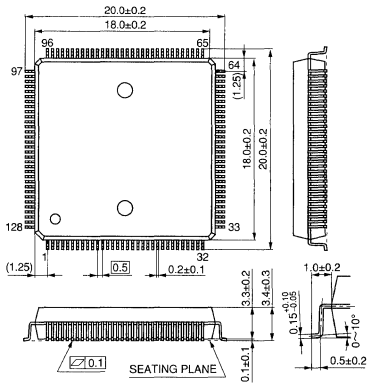


QFP124-P-2828



QFH128-P-1818



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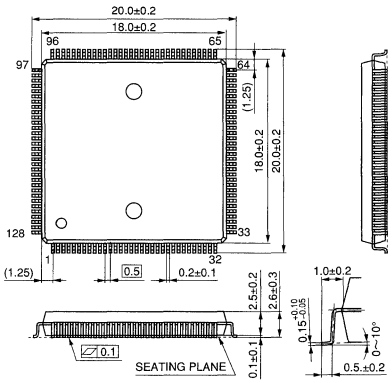

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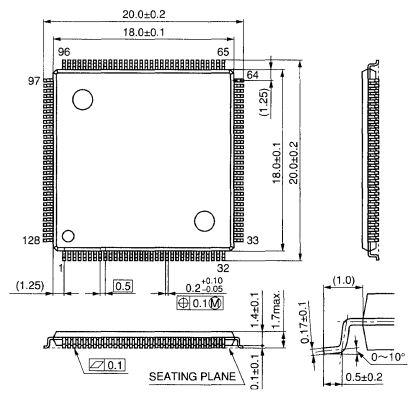

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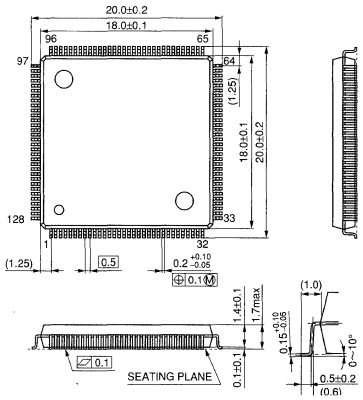
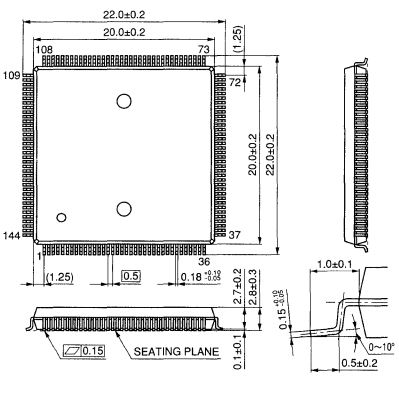


QFP144-P-2020

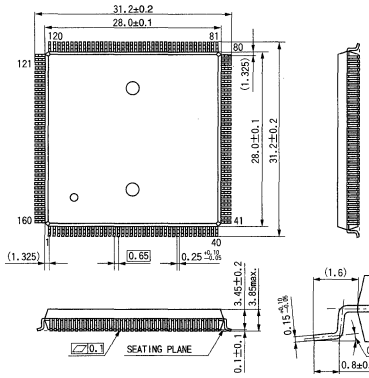


- Package Symbol : QFP = Quad Flat Package
  QFH = Quad Flat High Package
  TQFP =Thin Quad Flat Package
  LQFP=Low Profile Quad Flat Package

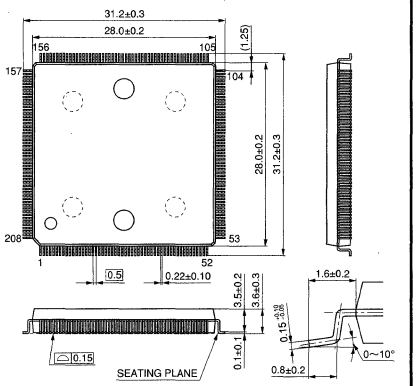
About Package Symbol : The name conformed to EIAJ.

QFP / QFH / QFS / TQFP / LQFP Packages Unit : mm

QFP160-P-2828B



QFP208-P-2828

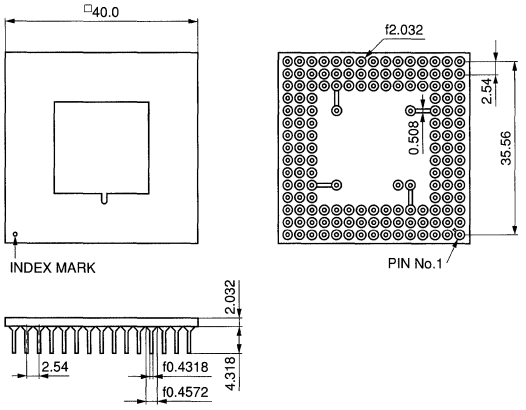


• Package Symbol : QFP = Quad Flat Package
About Package Symbol : The name conformed to EIAJ.

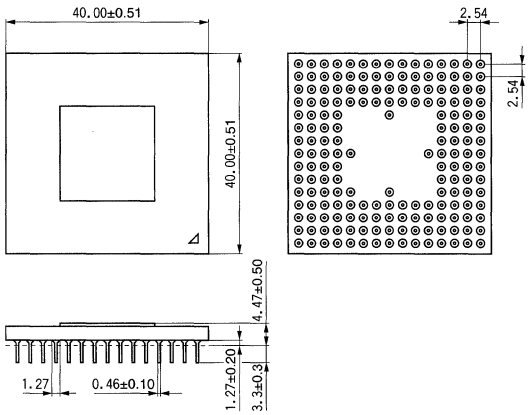
PGA Packages

Unit : mm

PGA144-C-S15U



PGA181-C-S15U



• Package Symbol : PGA = Pin Grid Array
About Package Symbol : The name conformed to EIAJ.

GLOSSARY

Glossary

— C —

■ CRTC

CRT Controller

— D —

■ DTMF

Dual Tone Multiple Frequency

— F —

■ FGICR

Frequency Generator ICR

■ FLP

Fluorescent Light Panel

■ FS

Frequency Synthesizer

— H —

■ HBS

Home Bus System

— I —

■ ICR

Input Capture Register

— L —

■ LCD

Liquid Crystal Display

■ LED

Light Emitting Diode

— O —

■ OCR

Output Compare Register

— P —

■ PLL

Phase Locked Loop

■ PWM

Pulse Width Modulaiton

— S —

■ S/H

Sample Hold

— U —

■ UART

Universal Asynchronous Receiver Transmitter

— V —

■ VF

Vacuum Fluorescent

■ VS

Voltage Synthesizer

Matsushita Electronics Corporation
Semiconductor Group

Nagaokakyo, Kyoto, 617 Japan
Tel: (075) 951-8151

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