

MN102H60G , MN102H60K

Type	MN102H60G	MN102H60K
ROM (×8-bit)	128 K	256 K
RAM (×8-bit)	4 K	8 K
Package	LQFP100-P-1414 *Lead-free , MLGA100-L-1010 *Lead-free	LQFP100-P-1414 *Lead-free
Minimum Instruction Execution Time	With main clock operated 58 ns (at 3.0 V to 3.6 V, 34 MHz)	
Interrupts	• $\overline{\text{RST}}$ pin • Watchdog • $\overline{\text{NMI}}$ pin • Timer counter 0 to 7 underflow • Timer counter 8 to 12 underflow • Timer counter 8 to 12 compare capture A • Timer counter 8 to 12 compare capture B • ATC ch.0 to 3 transfer finish • ETC ch.0 to 1 transfer finish • External 0 to 4 • Serial ch.0 to 4 transmission • Serial ch.0 to 4 reception • $\overline{\text{KI}}$ pin (OR) • A/D conversion finish	
Timer Counter	Timer counter 0 : 8-bit × 1 (prescaler, timer output, event count, clock supply for 16-bit timer, timer interrupts) Clock source 1/2 of system clock (BOSC) frequency; 1/4 of system clock (XI) frequency; system clock (BOSC); TM0IO pin Interrupt source underflow of timer counter 0 Timer counter 1 : 8-bit × 1 (serial clock generator, timer interrupts) Clock source 1/2 of system clock (BOSC) frequency; underflow of timer counter 0, 4 Interrupt source underflow of timer counter 1 Timer counter 2 : 8-bit × 1 (serial clock generator, timer interrupts) Clock source 1/2 of system clock (BOSC) frequency; underflow of timer counter 0, 4 Interrupt source underflow of timer counter 2 Timer counter 3 : 8-bit × 1 (A/D conversion start up, timer interrupts) Clock source 1/2 of system clock (BOSC) frequency; underflow of timer counter 0, 4 Interrupt source underflow of timer counter 3 Timer counter 4 : 8-bit × 1 (prescaler, serial clock generator, timer output, event count, clock supply for 16-bit timer, timer interrupts) Clock source 1/2 of system clock (BOSC) frequency; underflow of timer counter 0; TM4IO pin Interrupt source underflow of timer counter 4 Timer counter 5 : 8-bit × 1 (serial clock generator, timer interrupts) Clock source 1/2 of system clock (BOSC) frequency; underflow of timer counter 0; system clock (BOSC) Interrupt source underflow of timer counter 5 Timer counter 6 : 8-bit × 1 (timer interrupts) Clock source 1/4 of system clock (XI) frequency; underflow of timer counter 0, 4 Interrupt source underflow of timer counter 6 Timer counter 7 : 8-bit × 1 (timer output, event count, timer interrupts) Clock source 1/4 of system clock (XI) frequency; underflow of timer counter 0; TM7IO pin Interrupt source underflow of timer counter 7 Connectable timer counter 0 to 7 Timer counter 8 : 16-bit × 1 (timer output, event count, input capture, PWM output, 2-phase encoder input) Clock source underflow of timer counter 0, 4; TM8IOB pin; 1/2 of system clock (BOSC) frequency; 2-phase encode of TM8IOA pin/TM8IOB pin (1 ×, 4 ×); TM8IC pin Interrupt source underflow of timer counter 8; timer counter 8 compare capture A; timer counter 8 compare capture B	

Timer Counter (Continue)		Timer counter 9 : 16-bit × 1 (timer output, event count, input capture, PWM output, 2-phase encoder input) Clock source underflow of timer counter 0, 4; TM9IOB pin; 1/2 of system clock (BOSC) frequency; 2-phase encode of TM9IOA pin/TM9IOB pin (1 ×, 4 ×) Interrupt source underflow of timer counter 9; timer counter 9 compare capture A; timer counter 9 compare capture B Timer counter 10 : 16-bit × 1 (timer output, event count, input capture, PWM output, 2-phase encoder input) Clock source underflow of timer counter 0, 4; TM10IOB pin; 1/2 of system clock (BOSC) frequency; 2-phase encode of TM10IOA pin/TM10IOB pin (1 ×, 4 ×) Interrupt source underflow of timer counter 10; timer counter 10 compare capture A; timer counter 10 compare capture B Timer counter 11 : 16-bit × 1 (timer output, event count, input capture, PWM output, 2-phase encoder input) Clock source underflow of timer counter 0, 4; TM11IOB pin; 1/2 of system clock (BOSC) frequency; 2-phase encode of TM11IOA pin/TM11IOB pin (1 ×, 4 ×) Interrupt source underflow of timer counter 11; timer counter 11 compare capture A; timer counter 11 compare capture B Timer counter 12 : 16-bit × 1 (timer output, event count, input capture, PWM output, 2-phase encoder input) Clock source underflow of timer counter 0, 4; 1/2 of system clock (BOSC) frequency; 2-phase encode of TM12IOA pin/TM12IOB pin (1 ×, 4 ×), TM12IOB pin Interrupt source underflow of timer counter 12; timer counter 12 compare capture A; timer counter 12 compare capture B Timer counter 13, 14 : 8-bit × 1 (simple PWM output) Clock source 1/2 of system clock (BOSC) frequency; underflow of timer counter 0 Timer counter 15 : 16-bit × 1 (pulse width measurement) Clock source system clock (BOSC); 1/2 of system clock (BOSC) frequency; underflow of timer counter 0; TM15IB pin Connectable timer counter 13, 14	
Serial Interface		Serial 0, 1 : 8-bit × 1 (transfer direction of MSB / LSB selectable, transmission / reception of 7, 8-bit length) Clock source 1/8 of timer counter 1 underflow frequency; 1/8, 1/2 of timer counter 2 underflow frequency; external pin Serial 2, 3 : 8-bit × 1 (transfer direction of MSB / LSB selectable, transmission / reception of 7, 8-bit length) Clock source 1/8 of timer counter 4 underflow frequency; 1/8, 1/2 of timer counter 5 underflow frequency; external pin Serial 4 : 8-bit × 1 (transfer direction of MSB / LSB selectable, transmission / reception of 7, 8-bit length) Clock source 1/8 of timer counter 1 underflow frequency; 1/8, 1/2 of timer counter 5 underflow frequency; external pin UART × 2 (common use with serial 3, 4) I²C × 2 (common use with serial 3,4; single master)	
I/O Pins	I/O	82	• Common use : 46 (address data separate 8-bit mode) • Common use : 53 (address data multiplex 8-bit mode)
A/D Inputs		10-bit × 8-ch. (with S/H)	
PWM		16-bit × 5-ch. (timer counter 8 to 12)	
ICR		16-bit × 5-ch. (timer counter 8 to 12)	
OCR		16-bit × 5-ch. (timer counter 8 to 12)	
Notes		Address / data multiplex bus interface, address / data separate bus interface, 8-bit / 16-bit bus width selectable	

See the next page for electrical characteristics, pin assignment and support tool.

Electrical Characteristics

Supply current

Parameter	Symbol	Condition	Limit			Unit
			min	typ	max	
Operating supply current	IDDopr	VI = VDD or VSS, output open f = 34 MHz , VDD = 3.3 V			60+10 α *	mA
Supply current at STOP	IDDS	Pin with pull-up resistor is open All other input pins and Hi-Z state input/output			70	μ A
Supply current at HALT	IDDH	pins are simultaneously applied VDD or VSS level f = 34 MHz , VDD = 3.3 V, output open			30+10 α *	mA

(Ta = -40°C to +85°C , VDD = AVDD = 3.3 V , VSS = AVSS = 0 V)

* " α " depends on products.

MN102H60G, MN102H60K : α = 0

MN102HF60G : α = 1

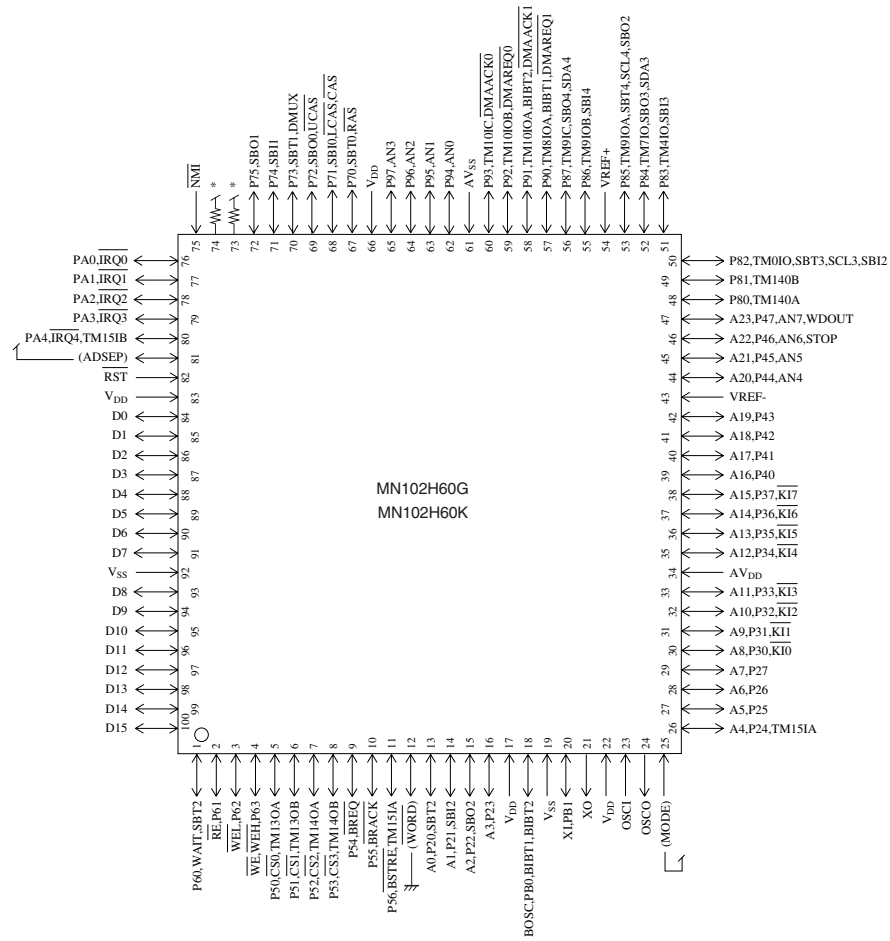
MN102HF60K : α = 2

A/D characteristics

Parameter	Symbol	Condition	Limit			Unit
			min	typ	max	
Non-linear error		10-bit			± 4	LSB
A/D conversion time		at 34 MHz	3.29			μ s
Analog input voltage	VIA		VSS		VDD	V

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

Pin Assignment



LQFP100-P-1414 *Lead-free

* Use 33 kΩ to 50 kΩ.

* Pin position in 16-bit bus width address data split memory extension mode.

Support Tool

In-circuit Emulator	PX-ICE102H60-LQFP100-P-1414	
Flash Memory Built-in Type	Type	MN102HF60G, MN102HF60K
	ROM (× 8-bit)	128 K / 256 K
	RAM (× 8-bit)	4 K / 10 K
	Minimum instruction execution time	58 ns (at 3.0 V to 3.6 V, 34 MHz)
	Package	LQFP100-P-1414 *Lead-free

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

- (1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technical information described in this material and controlled under the "Foreign Exchange and Foreign Trade Law" is to be exported or taken out of Japan.
- (2) The technical information described in this material is limited to showing representative characteristics and applied circuits examples of the products. It neither warrants non-infringement of intellectual property right or any other rights owned by our company or a third party, nor grants any license.
- (3) We are not liable for the infringement of rights owned by a third party arising out of the use of the technical information as described in this material.
- (4) The products described in this material are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).
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.
- (5) The products and product specifications described in this material are subject to change without notice for 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.
- (6) 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, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (7) When using products for which damp-proof packing is required, observe the conditions (including shelf life and amount of time let standing of unsealed items) agreed upon when specification sheets are individually exchanged.
- (8) This material may be not reprinted or reproduced whether wholly or partially, without the prior written permission of Matsushita Electric Industrial Co., Ltd.