32-bit Microcontroller

KM103HFD4/D5/D6/D7/D8 Series
Datasheet

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1.1 Overview

The KM103H is a 32-bit microcontroller designed for fast feedback processing mainly required for motor control, pursuing ease of use and cost performance intended for program development in C language.

Built around a compact 32-bit CPU with a basic instruction word length of 1 byte, this LSI includes internal memory for instructions and data, DMA controller, a clock generator, bus controller, interrupt controller, standard peripheral circuitry such as timers and serial interfaces, PWM circuit best suited to motor control, arithmetic unit for speed-up of inverter / converter control and high accuracy / high speed analog circuit.

As system safety design, this LSI has the various safety mechanisms (Memory-ECC, clock error detection, power supply voltage detection, window watchdog timer, etc.).

1.2 Product Summary

The LSI shown in Table 1.2-1 is described in this manual.

Table 1.2-1 Product Summary

LSI	Pins	ROM [KB]		RAM [KB]		Package
		Instruction	Data	Instruction	Data	
KM103HFD8N	144	512	64	32	32	144 pins LQFP 20 mm x 20 mm
KM103HFD8M		408		20	20	
KM103HFD7N	128	512	64	32	32	128 pins LQFP 18 mm x 18 mm
KM103HFD7M		408		20	20	
KM103HFD7K		264	32	16	12	
KM103HFD6N	100	512	64	32	32	100 pins LQFP 14 mm x 14 mm
KM103HFD6M		408		20	20	
KM103HFD6K		264	32	16	12	
KM103HFD5N	80	512	64	32	32	80 pins TQFP 12 mm x 12 mm
KM103HFD5M		408		20	20	
KM103HFD5K		264	32	16	12	
KM103HFD4M	64	408	64	20	20	64 pins TQFP 10 mm x 10 mm
KM103HFD4K		264	32	16	12	

Hint:

In this manual, the product names are classified as follows.

KM103HFDyz (y=4,5,6,7,8 z=N,M,K)

1.2.1 Function Summary

Table 1.2-2 shows the functions of each product.

Table 1.2-2 The List of Function

Function		KM103HFD8z	KM103HFD7z	KM103HFD6z	KM103HFD5y	KM103HFD4z
Pins		144 pins	128 pins	100 pins	80 pins	64 pins
CPU		AM32R Extended Arithmetic unit				
General purpose pin	I/O	112	100	74	54	44
	Input	12		10		6
Operation mode	Active mode	NORMAL				
	Standby mode	SLEEP, HALT, STOP				
DMA		3				
External interrupt		16			12	10
8-bit timer (Timer 0 to 15, 26 to 29)		20		16		12
16-bit timer	General purpose (Timer 20 to 23)	4				2
	Complementary PWM (Timer 16 to 19, 24,25)	6		4		
	Motor control (PWM0 to 2)	3		2		
Communication I/F	Clock synchronous/UART/IIC (Serial 0)	1				
	Clock synchronous/UART/LIN (Serial 1)	1				
	Clock synchronous/SPI/UART (Serial 3)	1				
	Clock synchronous/UART (Serial 2,4,5,6)	4		2		-
12-bit A/D	AD0	20 ch		16 ch	14 ch	10 ch
	AD1	20 ch		14 ch	12 ch	
	AD2	20 ch		12 ch	8 ch	6 ch
	Total	28 ch		20 ch	16 ch	12 ch
Programmable gain amplifier (VGA)		3 units / 9 ch		3 units / 7 ch		2 units / 4 ch
Comparator		6 units / 3 ch				4 units / 2 ch
8-bit D/A	For comparator reference voltage	6 units				4 units
	For VGA reference voltage	3 units				2 units
10-bit D/A		2 units / 2 ch				

Function		KM103HFD8z	KM103HFD7z	KM103HFD6z	KM103HFD5y	KM103HFD4z
Safety function	Flash memory	ECC, Data protection				
	RAM	ECC				
	Access area	Memory Access Restriction Function, Register protect (Protection)				
	System	Window watchdog timer				
	Clock	Clock monitoring (External oscillation, PLL error detection)				
	Communication	CRC Calculation Function				
	A/D converter	A/D converter error detection				
	Power supply voltage	POR, Power supply voltage detection				
	Reset	Detection of reset factor immediately before by reset factor register				
Power-on reset function		Rising: 2.90 V Falling: 2.80 V				

1.3   Features

The features of this LSI are described.

Functions	Features
CPU	KM103S core made by Nuvoton Technology Corporation Japan - LOAD/STORE architecture with 5-stage pipeline - Instruction set of 1 byte in word length
Extended arithmetic unit	High-speed multiplication, High-speed division, Square root, Trigonometric function, Absolute value, Saturate calculation, Multiply-accumulate operation 3-phase/2-phase conversion, 2-phase/3-phase conversion, Low-pass filter, PI control operation

Memory	- ROM access
	    - I-Flash: at 120 MHz 4 cycles (Min), selectable from 2 to 7 cycles
	    - D-Flash: at 120 MHz 7 cycles (Min), selectable from 2 to 7 cycles
	 - RAM access
	    - I-RAM: 120MHz: 2 cycles
	    - D-RAM: 120MHz 1 cycle (Data access timing), 2 cycles (instruction access timing)
	 - Cache access
	    - Cache area: 4 KB
	    - Cache hit timing: 2 cycles
	 - Swap Function
	    - I-Flash: Supports swap function of Boot area and Program area

Clock	- HXOCLK (External oscillation) frequency: 4 to 20 MHz
	 - HRCCLK (Internal high-speed oscillation) frequency: 10 MHz ± 10 %
	 - PLLCLK (PLL)
	    - PLL Input: External high-speed oscillation
	    - PLL Input frequency: 4 MHz to 20 MHz
	    - PLL Output frequency: 120 MHz to 240 MHz
	 - BASECLK
	    - Selectable from HXOCLK, PLLCLK
	    - Switchable to HRCCLK when a clock error is detected
	 - CPU clock (MCLK)
	    - Start with HXOCLK divided by 2 when reset is released
	    - Clock frequency: Selectable from BASECLK divided by 2, 4
	 - Peripheral module clock (IOCLK)
	    - Clock frequency: Selectable from BASECLK divided by 4, 8, 16
	    - Clock operation/stop can be selected for each peripheral module (initial value: operation)

Reset	- Hardware reset
	    - Power-on reset (falling detection level: 2.80 V)
	    - NRST pin input
	 - Software reset
	    - Reset by register setting
	    - Reset by error detection (WDT/WDT2 2 times overflow, Clock error detection, Power supply voltage detection)
	 - Software reset factor can be monitored

Operation Modes	- NORMAL mode: All clock source operation – SLEEP mode: Only CPU clock stops – HALT mode: All clocks stop except source oscillation(external, internal), PLL – STOP mode: All clocks stop except internal oscillation
Interrupt	- Interrupt level: 7 levels - External interrupt: High/Low level, Rising/Falling/Both edge

Functions	Features
DMA	- Transfer mode: Single word transfer mode, Burst transfer mode, Intermittent transfer mode - Transfer unit: 8-bit/16-bit/32-bit - Maximum transfer count: 65535 words - Transfer factor: Software start, External interrupt, Peripheral module factor - Interrupt: DMA Transfer end, DMA Post-transfer end request, DMA transfer request overflow
Noise filter	- Sampling type noise filter can be inserted to external interrupt, 8-bit timer input, 16-bit timer input - Sampling clock is selectable

Watchdog timer	- Overflow detect cycle: External high-speed oscillation cycle$\times 2^{16}$ to 2^{24}
	- Operation at the time of overflow detection:
	  - First overflow: Generate non-maskable interrupt
	  - Second overflow: Generate overflow error detection reset

Watchdog timer 2	- Overflow detect cycle: 4.20 μs (Internal oscillation)$\times 2^{7}$ to 2^{20}
	- Operation at the time of overflow detection:
	  - First overflow: Generate non-maskable interrupt
	  - Second overflow: Generate overflow error detection reset

16-bit timer (Timer 0 to 15, 26 to 29)	- Interval timer count, Event count - Timer Output - Cascade connection
16-bit timer (Timer 20 to 23)	- Interval timer count, Event count, Up-down pulse count, Phase difference pulse count - Timer output, PWM output, 1-shot output - Input capture by external input - Timer count start by start trigger - A/D conversion start trigger output - 32-bit cascade connection - Output protection: H/L/Hi-z output can be selected - Timer interrupt output control
16-bit timer (Timer 16 to 19,24,25)	- Interval timer count, Event count, Up-down pulse count, Phase difference pulse count - Timer output, PWM/Complementary PWM output (Wave mode: saw-tooth waves only), 1-shot output - Input capture by external input - Timer count start by start trigger - A/D conversion start trigger output - 32-bit cascade connection - Output protection: H/L/Hi-z output can be selected, reading edge blanking can be set - Timer interrupt output control - PWM output: Dead time insert, output shift, Duty cut, Period cut
Motor control PWM (PWM0 to 2)	- Min. resolution: 8.33 ns - Triangular and saw-tooth waves output - Dead time insertion, Output shift - A/D conversion start trigger output - Output protection: H/L/Hi-z Output can be select
Multi Feedback Assist	- Timer 16 to 19, 24 to 25, PWM0 to 2 start timing can be set individually - Competition detection and automatic avoidance between Timer 16 to 19, 24 to 25, PWM0 to 2 output and A/D conversion start - External interrupt and comparator detection mask (blanking) possible for timer 16 to 19, 24 to 25, PWM0 to 2 output

Functions	Features
Synchronous SIF/SPI (Serial 0 to 6)	- 2-wire/3-wire/4-wire (Serial 3 only) - Transfer bits (2-bit to 8-bit) - MSB/LSB transfer - Clock polarity selection - Continuous communication - Output level after the final bit transmission(H/L/final data) - Maximum transfer rate 5.0 Mbps
UART (Serial 0 to 6)	- 1-wire/2-wire - Character bits(7-bit/8-bit) - Stop bits(1-bit/2-bit) - Parity bit: Enabled/Disabled, Parity bit type: 0/1/Even parity/Odd parity - MSB/LSB transfer - Input/output UART communication waveform data which corresponding AMI driver IC (Serial 2 only)
IIC (Serial 0)	- Master/Slave communication - Start condition select: Enable/Disable - MSB/LSB transfer selection - Transfer format: 7-bit address format - Maximum transfer rate: Standard Mode: 100 kbps, Fast Mode: 400 kbps
LIN (Serial 1)	- Master/Slave communication - Wake Up signal transmission/reception - Synch Break field transmission/reception - Synch field transmission/reception - ID field transmission/reception - Error detection: Check sum error, Bit error, Timeout
12-bit A/D	- Timer 16 to 19, 24 to 25, PWM0 to 2 can be started synchronously - Sample / hold time can be set for each channel - Conversion channel order during continuous conversion can be set arbitrarily - Conversion error detection - Conversion state Output - Start trigger reduction function - Conversion time: 0.5 μs(Min)
VGA	- 1unit / 3ch (VGA0 to 2) configuration - Gain selection (2,3,4,5,6,8,10,20 times) - Set Output offset voltage by 8-bit DAC - Offset cancellation by input Short-circuit - Switchable between 1-phase input and 3-phase input
Comparator	- Hysteresis ON/OFF - Set reference voltage by 8-bit DAC or pin input - Sampling type noise filter is inserted to comparator Output - Detection mode can be selected from 1 level / 2 levels or window detection mode
8-bit D/A	- VGA Output offset voltage can be generated - Comparator reference voltage can be generated
10-bit D/A	- Output the set DC voltage from a pin

Functions	Features

Safety function	- Flash Data Protection Function
	- Flash-ECC function
	  -Check area: I-Flash, D-Flash
	  -2-bit or more error detection
	- RAM-ECC function
	  -Check area: Instruction RAM, Data RAM
	  -2-bit or more error detection
	- Memory access control function
	  Write enable/disable to Instruction RAM, Data RAM
	- Register protection function
	- WDT function
	- Clock monitor function
	- CRC Calculation Function
	  CRC-8-ATM, CRC-16-CCITT, CRC-16, CRC-32/MPEG symbol can be generated
	- ADC fault diagnosis function using internal power supply
	- Power supply voltage fall detection function
	  Falling detection level: 3.9 V
	- Identifying Reset Factor

1.4 Pins

The specifications of pins in this LSI are described as follows.

- Pin Configuration
- Pin Function

1.4.1 Pin Configuration

Figure 1.4-1 shows the pin configuration of KM103HFD8z (144 pins).
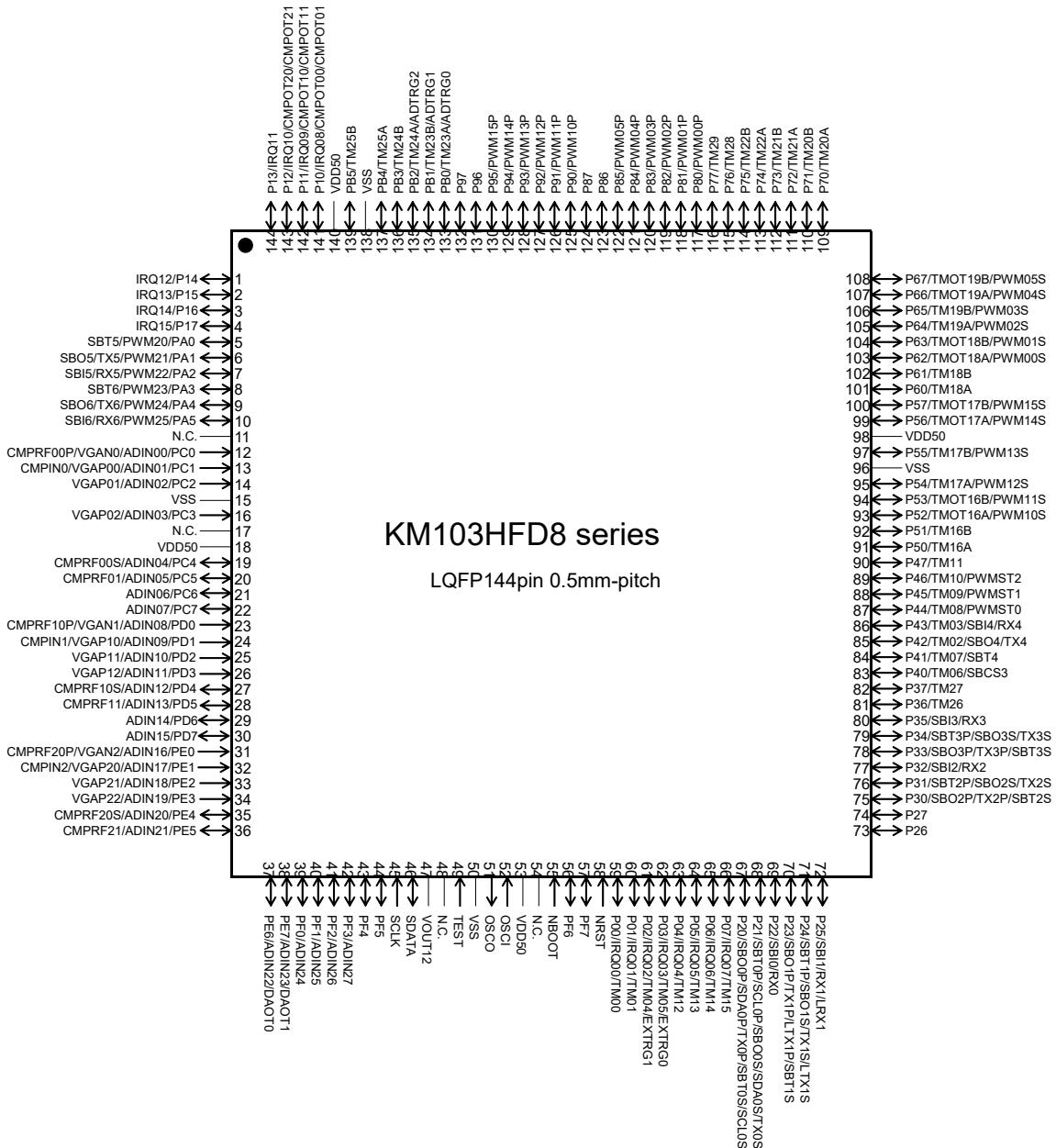
Figure 1.4-1 Pin Configuration Figure of KM103HFD8z (144 pins)

Figure 1.4-2 shows pin configuration figure of KM103HFD7z (128 pins).
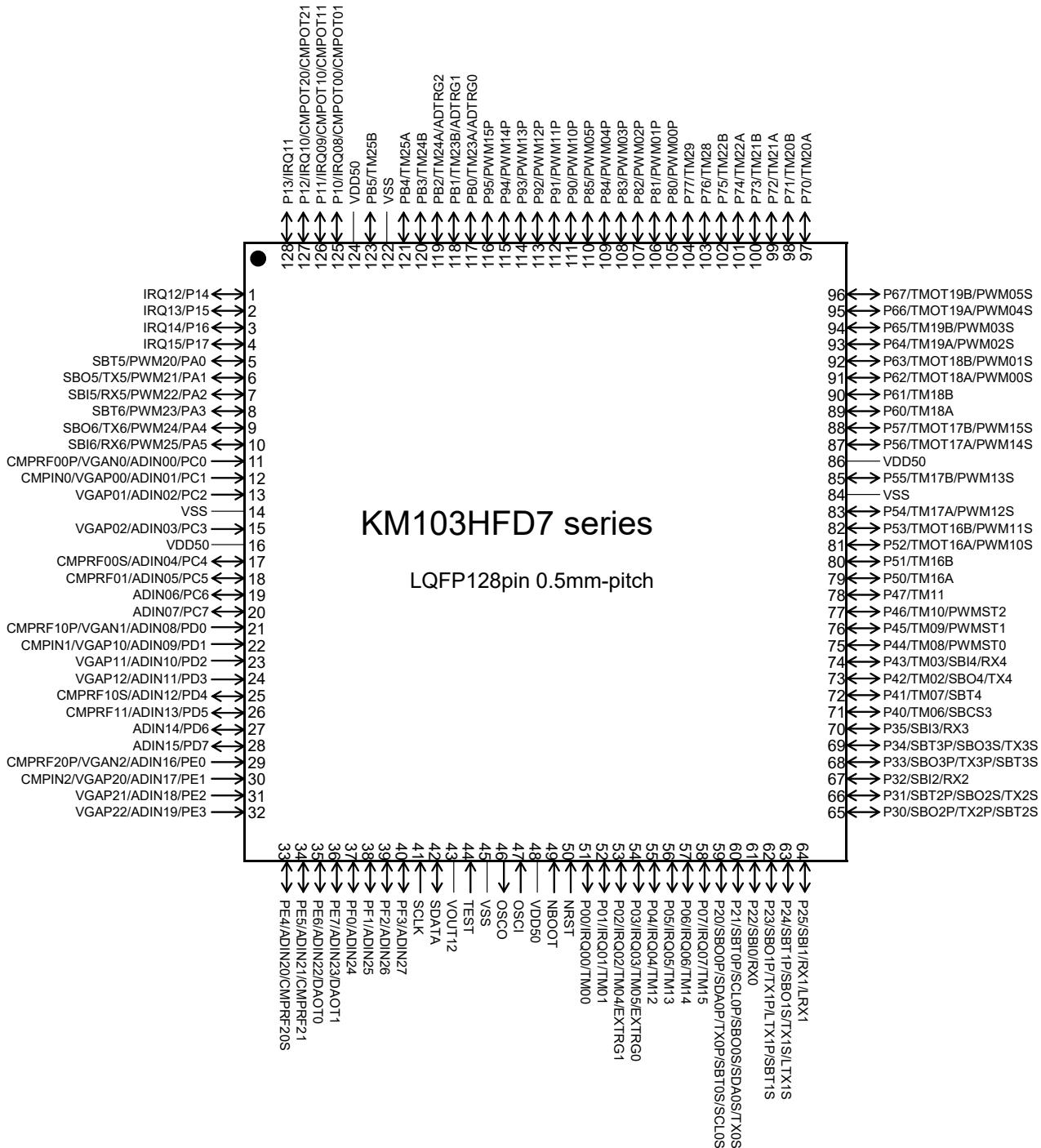
Figure 1.4-2 Pin Configuration Figure of KM103HFD7z (128 pins)

Figure 1.4-3 shows the pin configuration of KM103HFD6z (100 pins).
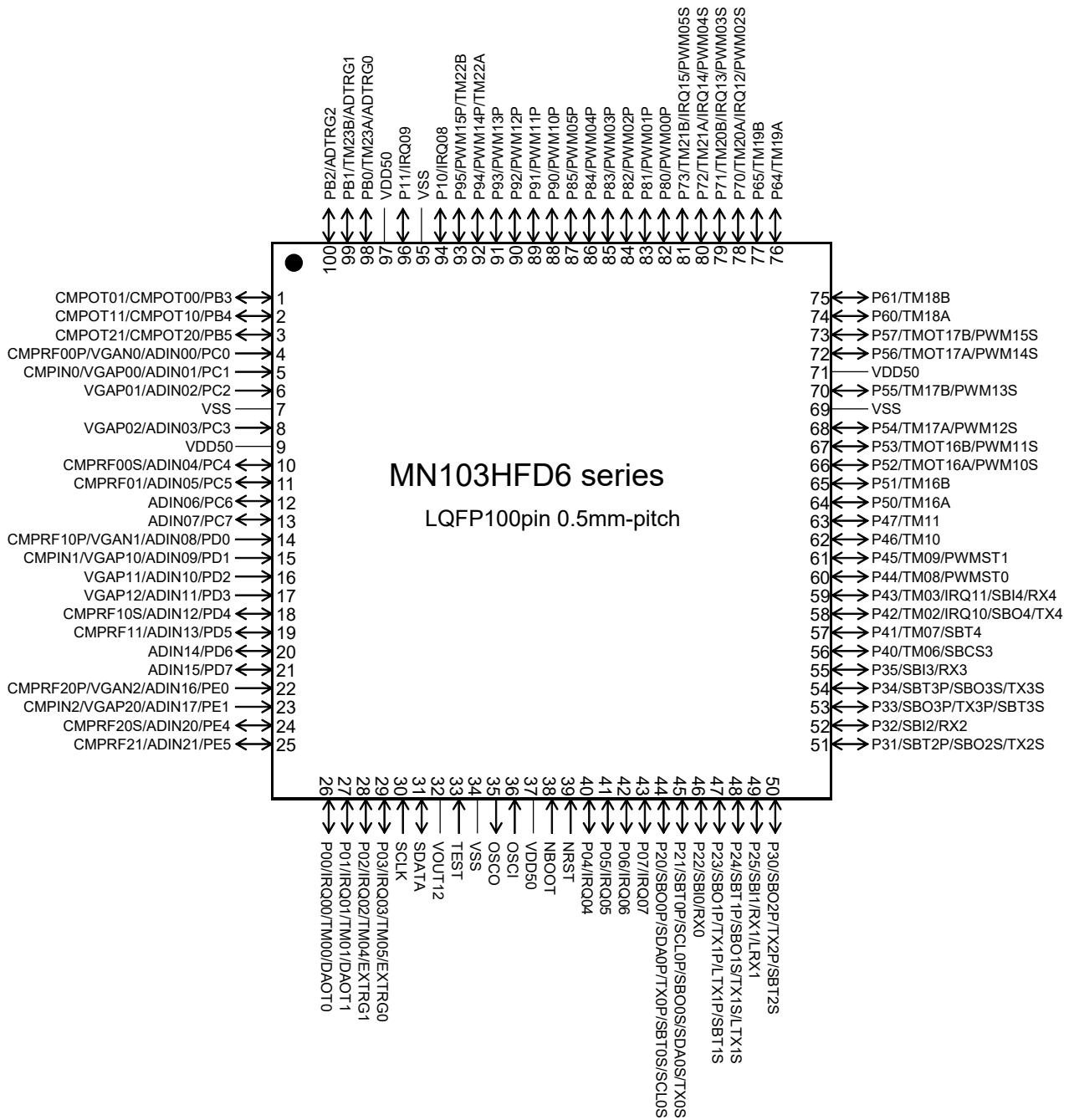
Figure 1.4-3 Pin Configuration Figure of KM103HFD6z (100pins)

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Figure 1.4-4 shows the pin configuration of KM103HFD5z (80 pins).
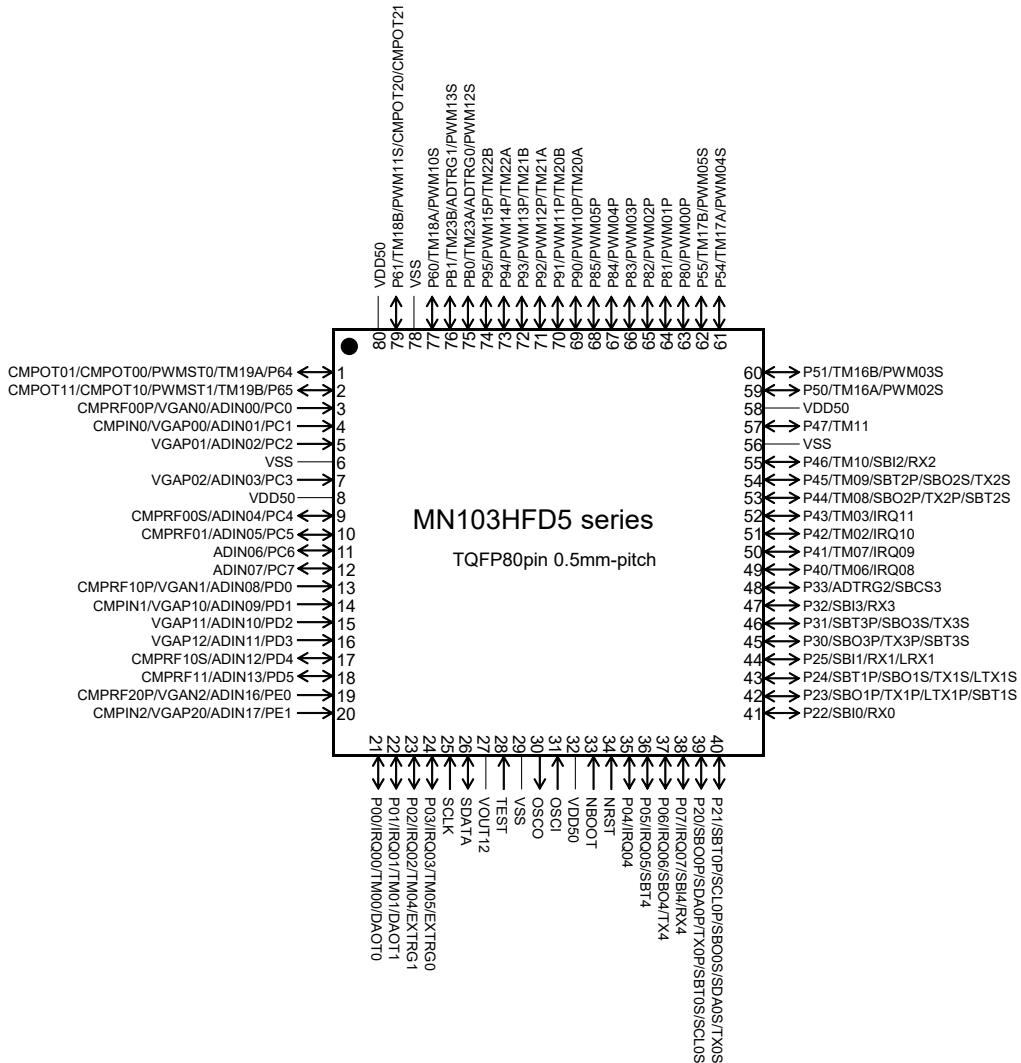
Figure 1.4-4 Pin Configuration Figure of KM103HFD5z (80 pins)

Figure 1.4-5 shows the pin configuration of KM103HFD4z (64 pins).
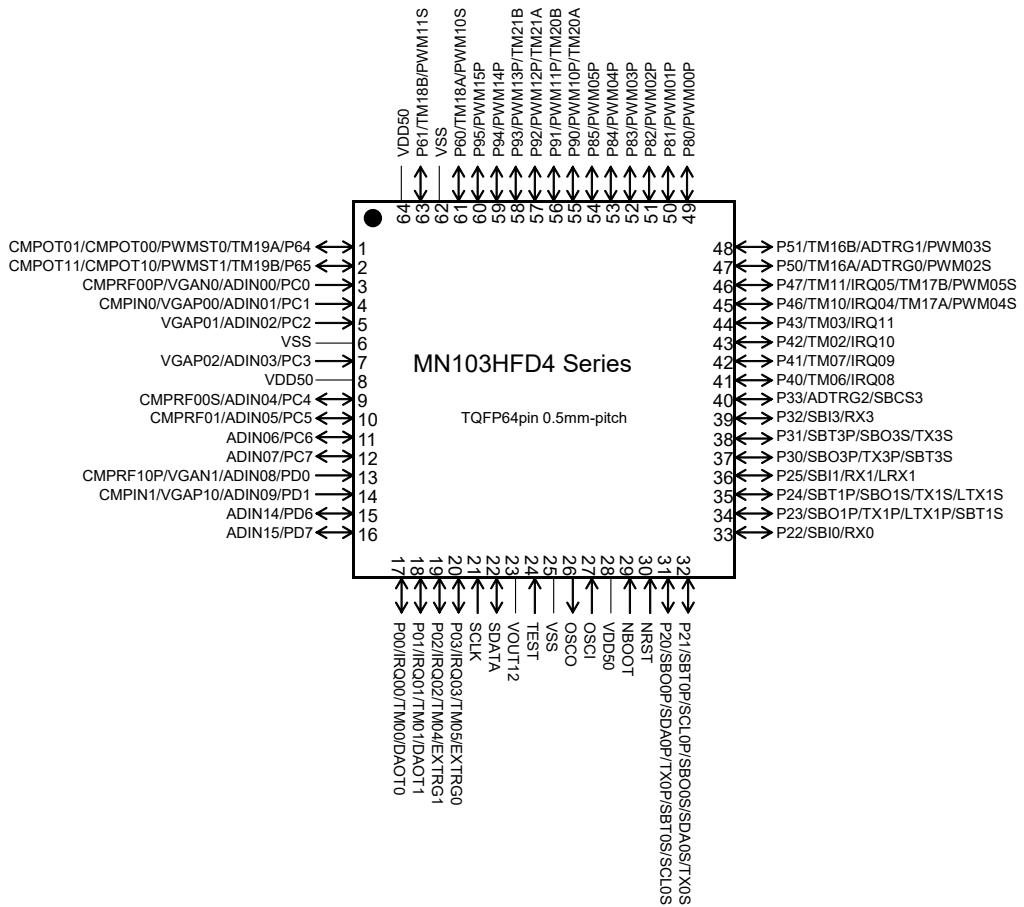
Figure 1.4-5 Pin Configuration Figure of KM103HFD4z (64 pins)

1.4.2 Pin Functions

The pin functions are listed in Table 1.4-1 to Table 1.4-5 .

Table 1.4-1 Pin Functions (KM103HFD8z)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	18 53 98 140	Input	-
Power pin for internal circuit	VOUT12	47	Output	-
GND	VSS	15 50 96 138	Input	-
External oscillation input pin	OSCI	52	Input	-
External oscillation output pin	OSCO	51	Output	-
Reset	NRST	58	Input	-
Mode	TEST	49	Input	-
	NBOOT	55	Input	-
External interrupt	IRQ00	59	Input	P00/TM00
	IRQ01	60	Input	P01/TM01
	IRQ02	61	Input	P02/TM04/EXTRG1
	IRQ03	62	Input	P03/TM05/EXTRG0
	IRQ04	63	Input	P04/TM12
	IRQ05	64	Input	P05/TM13
	IRQ06	65	Input	P06/TM14
	IRQ07	66	Input	P07/TM15
	IRQ08	141	Input	P10/CMPOT00/CMPOT01
	IRQ09	142	Input	P11/CMPOT10/CMPOT11
	IRQ10	143	Input	P12/CMPOT20/CMPOT21
	IRQ11	144	Input	P13
	IRQ12	1	Input	P14
	IRQ13	2	Input	P15
	IRQ14	3	Input	P16
	IRQ15	4	Input	P17

Functions	Pin name	Pin No.	I/O	Other Pins
8-bit timer	TM00	59	I/O	P00/IRQ00
	TM01	60	I/O	P01/IRQ01
	TM02	85	I/O	P42/SBO4/TX4
	TM03	86	I/O	P43/SBI4/RX4
	TM04	61	I/O	P02/IRQ02/EXTRG1
	TM05	62	I/O	P03/IRQ03/EXTRG0
	TM06	83	I/O	P40/SBCS3
	TM07	84	I/O	P41/SBT4
	TM08	87	I/O	P44/PWMST0
	TM09	88	I/O	P45/PWMST1
	TM10	89	I/O	P46/PWMST2
	TM11	90	I/O	P47
	TM12	63	I/O	P04/IRQ04
	TM13	64	I/O	P05/IRQ05
	TM14	65	I/O	P06/IRQ06
	TM15	66	I/O	P07/IRQ07
	TM26	81	I/O	P36
	TM27	82	I/O	P37
	TM28	115	I/O	P76
	TM29	116	I/O	P77
16-bit timer	TM16A	91	I/O	P50
	TMOT16A	93	Output	P52/PWM10S
	TM16B	92	I/O	P51
	TMOT16B	94	Output	P53/PWM11S
	TM17A	95	I/O	P54/PWM12S
	TMOT17A	99	Output	P56/PWM14S
	TM17B	97	I/O	P55/PWM13S
	TMOT17B	100	Output	P57/PWM15S
	TM18A	101	I/O	P60
	TMOT18A	103	Output	P62/PWM00S
	TM18B	102	I/O	P61
	TMOT18B	104	Output	P63/PWM01S
	TM19A	105	I/O	P64/PWM02S
	TMOT19A	107	Output	P66/PWM04S
	TM19B	106	I/O	P65/PWM03S
	TMOT19B	108	Output	P67/PWM05S
	TM20A	109	I/O	P70
	TM20B	110	I/O	P71
	TM21A	111	I/O	P72
	TM21B	112	I/O	P73

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Functions	Pin name	Pin No.	I/O	Other Pins
16-bit timer	TM22A	113	I/O	P74
	TM22B	114	I/O	P75
	TM23A	133	I/O	PB0/ADTRG0
	TM23B	134	I/O	PB1/ADTRG1
	TM24A	135	I/O	PB2/ADTRG2
	TM24B	136	I/O	PB3
	TM25A	137	I/O	PB4
	TM25B	139	I/O	PB5
Motor control PWM	PWM00P	117	Output	P80
	PWM01P	118	Output	P81
	PWM02P	119	Output	P82
	PWM03P	120	Output	P83
	PWM04P	121	Output	P84
	PWM05P	122	Output	P85
	PWM00S	103	Output	P62/TMOT18A
	PWM01S	104	Output	P63/TMOT18B
	PWM02S	105	Output	P64/TM19A
	PWM03S	106	Output	P65/TM19B
	PWM04S	107	Output	P66/TMOT19A
	PWM05S	108	Output	P67/TMOT19B
	PWM10P	125	Output	P90
	PWM11P	126	Output	P91
	PWM12P	127	Output	P92
	PWM13P	128	Output	P93
	PWM14P	129	Output	P94
	PWM15P	130	Output	P95
	PWM10S	93	Output	P52/TMOT16A
	PWM11S	94	Output	P53/TMOT16B
	PWM12S	95	Output	P54/TM17A
	PWM13S	97	Output	P55/TM17B
	PWM14S	99	Output	P56/TMOT17A
	PWM15S	100	Output	P57/TMOT17B
	PWM20	5	Output	PA0/SBT5
	PWM21	6	Output	PA1/SBO5/TX5
	PWM22	7	Output	PA2/SBI5/RX5
	PWM23	8	Output	PA3/SBT6
	PWM24	9	Output	PA4/SBO6/TX6
	PWM25	10	Output	PA5/SBI6/RX6
	PWMST0	87	Output	P44/TM08
	PWMST1	88	Output	P45/TM09
	PWMST2	89	Output	P46/TM10

Functions	Pin name	Pin No.	I/O	Other Pins
Clock synchronous SIF/SPI	SBO0P	67	I/O	P20/SDA0P/TX0P/SBT0S/SCL0S
	SBT0P	68	I/O	P21/SCL0P/SBO0S/SDA0S/TX0S
	SBO0S	68	I/O	P21/SBT0P/SCL0P/SDA0S/TX0S
	SBT0S	67	I/O	P20/SBO0P/SDA0P/TX0P/SCL0S
	SBI0	69	Input	P22/RX0
	SBO1P	70	I/O	P23/TX1P/LTX1P/SBT1S
	SBT1P	71	I/O	P24/SBO1S/TX1S/LTX1S
	SBO1S	71	I/O	P24/SBT1P/TX1S/LTX1S
	SBT1S	70	I/O	P23/SBO1P/TX1P/LTX1P
	SBI1	72	Input	P25/RX1/LRX1
	SBO2P	75	I/O	P30/TX2P/SBT2S
	SBT2P	76	I/O	P31/SBO2S/TX2S
	SBO2S	76	I/O	P31/SBT2P/TX2S
	SBT2S	75	I/O	P30/SBO2P/TX2P
	SBI2	77	Input	P32/RX2
	SBCS3	83	I/O	P40/TM06
	SBO3P	78	I/O	P33/TX3P/SBT3S
	SBT3P	79	I/O	P34/SBO3S/TX3S
	SBO3S	79	I/O	P34/SBT3P/TX3S
	SBT3S	78	I/O	P33/SBO3P/TX3P
	SBI3	80	Input	P35/RX3
	SBO4	85	I/O	P42/TM02/TX4
	SBT4	84	I/O	P41/TM07
	SBI4	86	Input	P43/TM03/RX4
	SBO5	6	I/O	PA1/PWM21/TX5
	SBT5	5	I/O	PA0/PWM20
	SBI5	7	Input	PA2/PWM22/RX5
	SBO6	9	I/O	PA4/PWM24/TX6
	SBT6	8	I/O	PA3/PWM23
	SBI6	10	Input	PA5/PWM25/RX6

Functions	Pin name	Pin No.	I/O	Other Pins
UART	TX0P	67	I/O	P20/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	68	I/O	P21/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	69	Input	P22/SBI0
	TX1P	70	I/O	P23/SBO1P/LTX1P/SBT1S
	TX1S	71	I/O	P24/SBT1P/SBO1S/LTX1S
	RX1	72	Input	P25/SBI1/LRX1
	TX2P	75	I/O	P30/SBO2P/SBT2S
	TX2S	76	I/O	P31/SBT2P/SBO2S
	RX2	77	Input	P32/SBI2
	TX3P	78	I/O	P33/SBO3P/SBT3S
	TX3S	79	I/O	P34/SBT3P/SBO3S
	RX3	80	Input	P35/SBI3
	TX4	85	I/O	P42/TM02/SBO4
	RX4	86	Input	P43/TM03/SBI4
	TX5	6	I/O	PA1/PWM21/SBO5
	RX5	7	Input	PA2/PWM22/SBI5
	TX6	9	I/O	PA4/PWM24/SBO6
	RX6	10	Input	PA5/PWM25/SBI6
LIN	LTX1P	70	Output	P23/SBO1P/TX1P/SBT1S
	LTX1S	71	Output	P24/SBT1P/SBO1S/TX1S
	LRX1	72	Input	P25/SBI1/RX1
IIC	SDA0P	67	I/O	P20/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	68	I/O	P21/SBT0P/SBO0S/SDA0S/TX0S
	SDA0S	68	I/O	P21/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	67	I/O	P20/SBO0P/SDA0P/TX0P/SBT0S

Functions	Pin name	Pin No.	I/O	Other Pins
A/D input	ADIN00	12	Input	PC0/VGAN0/CMPRF00P
	ADIN01	13	Input	PC1/VGAP00/CMPIN0
	ADIN02	14	Input	PC2/VGAP01
	ADIN03	16	Input	PC3/VGAP02
	ADIN04	19	Input	PC4/CMPRF00S
	ADIN05	20	Input	PC5/CMPRF01
	ADIN06	21	Input	PC6
	ADIN07	22	Input	PC7
	ADIN08	23	Input	PD0/VGAN1/CMPRF10P
	ADIN09	24	Input	PD1/VGAP10/CMPIN1
	ADIN10	25	Input	PD2/VGAP11
	ADIN11	26	Input	PD3/VGAP12
	ADIN12	27	Input	PD4/CMPRF10S
	ADIN13	28	Input	PD5/CMPRF11
	ADIN14	29	Input	PD6
	ADIN15	30	Input	PD7
	ADIN16	31	Input	PE0/VGAN2/CMPRF20P
	ADIN17	32	Input	PE1/VGAP20/CMPIN2
	ADIN18	33	Input	PE2/VGAP21
	ADIN19	34	Input	PE3/VGAP22
	ADIN20	35	Input	PE4/CMPRF20S
	ADIN21	36	Input	PE5/CMPRF21
	ADIN22	37	Input	PE6/DAOT0
	ADIN23	38	Input	PE7/DAOT1
	ADIN24	39	Input	PF0
	ADIN25	40	Input	PF1
	ADIN26	41	Input	PF2
	ADIN27	42	Input	PF3
A/D monitor	ADTRG0	133	Output	PB0/TM23A
	ADTRG1	134	Output	PB1/TM23B
	ADTRG2	135	Output	PB2/TM24A

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Functions	Pin name	Pin No.	I/O	Other Pins
VGA input	VGAN0	12	Input	PC0/ADIN00/CMPRF00P
	VGAP00	13	Input	PC1/ADIN01/CMPIN0
	VGAP01	14	Input	PC2/ADIN02
	VGAP02	16	Input	PC3/ADIN03
	VGAN1	23	Input	PD0/ADIN08/CMPRF10P
	VGAP10	24	Input	PD1/ADIN09/CMPIN1
	VGAP11	25	Input	PD2/ADIN10
	VGAP12	26	Input	PD3/ADIN11
	VGAN2	31	Input	PE0/ADIN16/CMPRF20P
	VGAP20	32	Input	PE1/ADIN17/CMPIN2
	VGAP21	33	Input	PE2/ADIN18
	VGAP22	34	Input	PE3/ADIN19
Comparator input	CMPIN0	13	Input	PC1/ADIN01/VGAP00
	CMPIN1	24	Input	PD1/ADIN09/VGAP10
	CMPIN2	32	Input	PE1/ADIN17/VGAP20
	CMPRF00P	12	Input	PC0/ADIN00/VGAN0
	CMPRF00S	19	Input	PC4/ADIN04
	CMPRF01	20	Input	PC5/ADIN05
	CMPRF10P	23	Input	PD0/ADIN08/VGAN1
	CMPRF10S	27	Input	PD4/ADIN12
	CMPRF11	28	Input	PD5/ADIN13
	CMPRF20P	31	Input	PE0/ADIN16/VGAN2
	CMPRF20S	35	Input	PE4/ADIN20
	CMPRF21	36	Input	PE5/ADIN21
Comparator output	CMPOT00	141	Output	P10/IRQ08/CMPOT01
	CMPOT01	141	Output	P10/IRQ08/CMPOT00
	CMPOT10	142	Output	P11/IRQ09/CMPOT11
	CMPOT11	142	Output	P11/IRQ09/CMPOT10
	CMPOT20	143	Output	P12/IRQ10/CMPOT21
	CMPOT21	143	Output	P12/IRQ10/CMPOT20
D/A output	DAOT0	37	Output	PE6/ADIN22
	DAOT1	38	Output	PE7/ADIN23

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P00	59	I/O	IRQ00/TM00
	P01	60	I/O	IRQ01/TM01
	P02	61	I/O	IRQ02/TM04/EXTRG1
	P03	62	I/O	IRQ03/TM05/EXTRG0
	P04	63	I/O	IRQ04/TM12
	P05	64	I/O	IRQ05/TM13
	P06	65	I/O	IRQ06/TM14
	P07	66	I/O	IRQ07/TM15
	P10	141	I/O	IRQ08/CMPOT00/CMPOT01
	P11	142	I/O	IRQ09/CMPOT10/CMPOT11
	P12	143	I/O	IRQ10/CMPOT20/CMPOT21
	P13	144	I/O	IRQ11
	P14	1	I/O	IRQ12
	P15	2	I/O	IRQ13
	P16	3	I/O	IRQ14
	P17	4	I/O	IRQ15
	P20	67	I/O	SBO0P/SDA0P/TX0P/SBT0S/SCL0S
	P21	68	I/O	SBT0P/SCL0P/SBO0S/SDA0S/TX0S
	P22	69	I/O	SBI0/RX0
	P23	70	I/O	SBO1P/TX1P/LTX1P/SBT1S
	P24	71	I/O	SBT1P/SBO1S/TX1S/LTX1S
	P25	72	I/O	SBI1/RX1/LRX1
	P26	73	I/O	-
	P27	74	I/O	-
	P30	75	I/O	SBO2P/TX2P/SBT2S
	P31	76	I/O	SBT2P/SBO2S/TX2S
	P32	77	I/O	SBI2/RX2
	P33	78	I/O	SBO3P/TX3P/SBT3S
	P34	79	I/O	SBT3P/SBO3S/TX3S
	P35	80	I/O	SBI3/RX3
	P36	81	I/O	TM26
	P37	82	I/O	TM27
	P40	83	I/O	TM06/SBCS3
	P41	84	I/O	TM07/SBT4
	P42	85	I/O	TM02/SBO4/TX4
	P43	86	I/O	TM03/SBI4/RX4
	P44	87	I/O	TM08/PWMST0
	P45	88	I/O	TM09/PWMST1
	P46	89	I/O	TM10/PWMST2
	P47	90	I/O	TM11

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P50	91	I/O	TM16A
	P51	92	I/O	TM16B
	P52	93	I/O	TMOT16A/PWM10S
	P53	94	I/O	TMOT16B/PWM11S
	P54	95	I/O	TM17A/PWM12S
	P55	97	I/O	TM17B/PWM13S
	P56	99	I/O	TMOT17A/PWM14S
	P57	100	I/O	TMOT17B/PWM15S
	P60	101	I/O	TM18A
	P61	102	I/O	TM18B
	P62	103	I/O	TMOT18A/PWM00S
	P63	104	I/O	TMOT18B/PWM01S
	P64	105	I/O	TM19A/PWM02S
	P65	106	I/O	TM19B/PWM03S
	P66	107	I/O	TMOT19A/PWM04S
	P67	108	I/O	TMOT19B/PWM05S
	P70	109	I/O	TM20A
	P71	110	I/O	TM20B
	P72	111	I/O	TM21A
	P73	112	I/O	TM21B
	P74	113	I/O	TM22A
	P75	114	I/O	TM22B
	P76	115	I/O	TM28
	P77	116	I/O	TM29
	P80	117	I/O	PWM00P
	P81	118	I/O	PWM01P
	P82	119	I/O	PWM02P
	P83	120	I/O	PWM03P
	P84	121	I/O	PWM04P
	P85	122	I/O	PWM05P
	P86	123	I/O	-
	P87	124	I/O	-
	P90	125	I/O	PWM10P
	P91	126	I/O	PWM11P
	P92	127	I/O	PWM12P
	P93	128	I/O	PWM13P
	P94	129	I/O	PWM14P
	P95	130	I/O	PWM15P
	P96	131	I/O	-
	P97	132	I/O	-

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	PA0	5	I/O	PWM20/SBT5
	PA1	6	I/O	PWM21/SBO5/TX5
	PA2	7	I/O	PWM22/SBI5/RX5
	PA3	8	I/O	PWM23/SBT6
	PA4	9	I/O	PWM24/SBO6/TX6
	PA5	10	I/O	PWM25/SBI6/RX6
	PB0	133	I/O	TM23A/ADTRG0
	PB1	134	I/O	TM23B/ADTRG1
	PB2	135	I/O	TM24A/ADTRG2
	PB3	136	I/O	TM24B
	PB4	137	I/O	TM25A
	PB5	139	I/O	TM25B
	PC0	12	Input	ADIN00/VGAN0/CMPRF00P
	PC1	13	Input	ADIN01/VGAP00/CMPIN0
	PC2	14	Input	ADIN02/VGAP01
	PC3	16	Input	ADIN03/VGAP02
	PC4	19	I/O	ADIN04/CMPRF00S
	PC5	20	I/O	ADIN05/CMPRF01
	PC6	21	I/O	ADIN06
	PC7	22	I/O	ADIN07
	PD0	23	Input	ADIN08/VGAN1/CMPRF10P
	PD1	24	Input	ADIN09/VGAP10/CMPIN1
	PD2	25	Input	ADIN10/VGAP11
	PD3	26	Input	ADIN11/VGAP12
	PD4	27	I/O	ADIN12/CMPRF10S
	PD5	28	I/O	ADIN13/CMPRF11
	PD6	29	I/O	ADIN14
	PD7	30	I/O	ADIN15
	PE0	31	Input	ADIN16/VGAN2/CMPRF20P
	PE1	32	Input	ADIN17/VGAP20/CMPIN2
	PE2	33	Input	ADIN18/VGAP21
	PE3	34	Input	ADIN19/VGAP22
	PE4	35	I/O	ADIN20/CMPRF20S
	PE5	36	I/O	ADIN21/CMPRF21
	PE6	37	I/O	ADIN22/DAOT0
	PE7	38	I/O	ADIN23/DAOT1

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	PF0	39	I/O	ADIN24
	PF1	40	I/O	ADIN25
	PF2	41	I/O	ADIN26
	PF3	42	I/O	ADIN27
	PF4	43	I/O	-
	PF5	44	I/O	-
	PF6	56	I/O	-
	PF7	57	I/O	-
Onboard debugger	SCLK	45	Input	-
	SDATA	46	I/O	-
	EXTRG1	61	I/O	P02/IRQ02/TM04
	EXTRG0	62	I/O	P03/IRQ03/TM05

Table 1.4-2 Pin Functions (KM103HFD7z)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	16 48 86 124	Input	-
Power pin for internal circuit	VOUT12	43	Output	-
GND	VSS	14 45 84 122	Input	-
External oscillation input pin	OSCI	47	Input	-
External oscillation output pin	OSCO	46	Output	-
Reset	NRST	50	Input	-
Mode	TEST	44	Input	-
	NBOOT	49	Input	-
External interrupt	IRQ00	51	Input	P00/TM00
	IRQ01	52	Input	P01/TM01
	IRQ02	53	Input	P02/TM04/EXTRG1
	IRQ03	54	Input	P03/TM05/EXTRG0
	IRQ04	55	Input	P04/TM12
	IRQ05	56	Input	P05/TM13
	IRQ06	57	Input	P06/TM14
	IRQ07	58	Input	P07/TM15
	IRQ08	125	Input	P10/CMPOT00/CMPOT01
	IRQ09	126	Input	P11/CMPOT10/CMPOT11
	IRQ10	127	Input	P12/CMPOT20/CMPOT21
	IRQ11	128	Input	P13
	IRQ12	1	Input	P14
	IRQ13	2	Input	P15
	IRQ14	3	Input	P16
	IRQ15	4	Input	P17

Functions	Pin name	Pin No.	I/O	Other Pins
8-bit timer	TM00	51	I/O	P00/IRQ00
	TM01	52	I/O	P01/IRQ01
	TM02	73	I/O	P42/SBO4/TX4
	TM03	74	I/O	P43/SBI4/RX4
	TM04	53	I/O	P02/IRQ02/EXTRG1
	TM05	54	I/O	P03/IRQ03/EXTRG0
	TM06	71	I/O	P40/SBCS3
	TM07	72	I/O	P41/SBT4
	TM08	75	I/O	P44/PWMST0
	TM09	76	I/O	P45/PWMST1
	TM10	77	I/O	P46/PWMST2
	TM11	78	I/O	P47
	TM12	55	I/O	P04/IRQ04
	TM13	56	I/O	P05/IRQ05
	TM14	57	I/O	P06/IRQ06
	TM15	58	I/O	P07/IRQ07
	TM28	103	I/O	P76
	TM29	104	I/O	P77

Functions	Pin name	Pin No.	I/O	Other Pins
16-bit timer	TM16A	79	I/O	P50
	TMOT16A	81	Output	P52/PWM10S
	TM16B	80	I/O	P51
	TMOT16B	82	Output	P53/PWM11S
	TM17A	83	I/O	P54/PWM12S
	TMOT17A	87	Output	P56/PWM14S
	TM17B	85	I/O	P55/PWM13S
	TMOT17B	88	Output	P57/PWM15S
	TM18A	89	I/O	P60
	TMOT18A	91	Output	P62/PWM00S
	TM18B	90	I/O	P61
	TMOT18B	92	Output	P63/PWM01S
	TM19A	93	I/O	P64/PWM02S
	TMOT19A	95	Output	P66/PWM04S
	TM19B	94	I/O	P65/PWM03S
	TMOT19B	96	Output	P67/PWM05S
	TM20A	97	I/O	P70
	TM20B	98	I/O	P71
	TM21A	99	I/O	P72
	TM21B	100	I/O	P73
	TM22A	101	I/O	P74
	TM22B	102	I/O	P75
	TM23A	117	I/O	PB0/ADTRG0
	TM23B	118	I/O	PB1/ADTRG1
	TM24A	119	I/O	PB2/ADTRG2
	TM24B	120	I/O	PB3
	TM25A	121	I/O	PB4
	TM25B	123	I/O	PB5

Functions	Pin name	Pin No.	I/O	Other Pins
Motor control PWM	PWM00P	105	Output	P80
	PWM01P	106	Output	P81
	PWM02P	107	Output	P82
	PWM03P	108	Output	P83
	PWM04P	109	Output	P84
	PWM05P	110	Output	P85
	PWM00S	91	Output	P62/TMOT18A
	PWM01S	92	Output	P63/TMOT18B
	PWM02S	93	Output	P64/TM19A
	PWM03S	94	Output	P65/TM19B
	PWM04S	95	Output	P66/TMOT19A
	PWM05S	96	Output	P67/TMOT19B
	PWM10P	111	Output	P90
	PWM11P	112	Output	P91
	PWM12P	113	Output	P92
	PWM13P	114	Output	P93
	PWM14P	115	Output	P94
	PWM15P	116	Output	P95
	PWM10S	81	Output	P52/TMOT16A
	PWM11S	82	Output	P53/TMOT16B
	PWM12S	83	Output	P54/TM17A
	PWM13S	85	Output	P55/TM17B
	PWM14S	87	Output	P56/TMOT17A
	PWM15S	88	Output	P57/TMOT17B
	PWM20	5	Output	PA0/SBT5
	PWM21	6	Output	PA1/SBO5/TX5
	PWM22	7	Output	PA2/SBI5/RX5
	PWM23	8	Output	PA3/SBT6
	PWM24	9	Output	PA4/SBO6/TX6
	PWM25	10	Output	PA5/SBI6/RX6
	PWMST0	75	Output	P44/TM08
	PWMST1	76	Output	P45/TM09
	PWMST2	77	Output	P46/TM10

Functions	Pin name	Pin No.	I/O	Other Pins
Clock synchronous SIF/SPI	SBO0P	59	I/O	P20/SDA0P/TX0P/SBT0S/SCL0S
	SBT0P	60	I/O	P21/SCL0P/SBO0S/SDA0S/TX0S
	SBO0S	60	I/O	P21/SBT0P/SCL0P/SDA0S/TX0S
	SBT0S	59	I/O	P20/SBO0P/SDA0P/TX0P/SCL0S
	SBI0	61	Input	P22/RX0
	SBO1P	62	I/O	P23/TX1P/LTX1P/SBT1S
	SBT1P	63	I/O	P24/SBO1S/TX1S/LTX1S
	SBO1S	63	I/O	P24/SBT1P/TX1S/LTX1S
	SBT1S	62	I/O	P23/SBO1P/TX1P/LTX1P
	SBI1	64	Input	P25/RX1/LRX1
	SBO2P	65	I/O	P30/TX2P/SBT2S
	SBT2P	66	I/O	P31/SBO2S/TX2S
	SBO2S	66	I/O	P31/SBT2P/TX2S
	SBT2S	65	I/O	P30/SBO2P/TX2P
	SBI2	67	Input	P32/RX2
	SBCS3	71	I/O	P40/TM06
	SBO3P	68	I/O	P33/TX3P/SBT3S
	SBT3P	69	I/O	P34/SBO3S/TX3S
	SBO3S	69	I/O	P34/SBT3P/TX3S
	SBT3S	68	I/O	P33/SBO3P/TX3P
	SBI3	70	Input	P35/RX3
	SBO4	73	I/O	P42/TM02/TX4
	SBT4	72	I/O	P41/TM07
	SBI4	74	Input	P43/TM03/RX4
	SBO5	6	I/O	PA1/PWM21/TX5
	SBT5	5	I/O	PA0/PWM20
	SBI5	7	Input	PA2/PWM22/RX5
	SBO6	9	I/O	PA4/PWM24/TX6
	SBT6	8	I/O	PA3/PWM23
	SBI6	10	Input	PA5/PWM25/RX6

Functions	Pin name	Pin No.	I/O	Other Pins
UART	TX0P	59	I/O	P20/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	60	I/O	P21/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	61	Input	P22/SBI0
	TX1P	62	I/O	P23/SBO1P/LTX1P/SBT1S
	TX1S	63	I/O	P24/SBT1P/SBO1S/LTX1S
	RX1	64	Input	P25/SBI1/LRX1
	TX2P	65	I/O	P30/SBO2P/SBT2S
	TX2S	66	I/O	P31/SBT2P/SBO2S
	RX2	67	Input	P32/SBI2
	TX3P	68	I/O	P33/SBO3P/SBT3S
	TX3S	69	I/O	P34/SBT3P/SBO3S
	RX3	70	Input	P35/SBI3
	TX4	73	I/O	P42/TM02/SBO4
	RX4	74	Input	P43/TM03/SBI4
	TX5	6	I/O	PA1/PWM21/SBO5
	RX5	7	Input	PA2/PWM22/SBI5
	TX6	9	I/O	PA4/PWM24/SBO6
	RX6	10	Input	PA5/PWM25/SBI6
LIN	LTX1P	62	Output	P23/SBO1P/TX1P/SBT1S
	LTX1S	63	Output	P24/SBT1P/SBO1S/TX1S
	LRX1	64	Input	P25/SBI1/RX1
IIC	SDA0P	59	I/O	P20/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	60	I/O	P21/SBT0P/SBO0S/SDA0S/TX0S
	SDA0S	60	I/O	P21/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	59	I/O	P20/SBO0P/SDA0P/TX0P/SBT0S

Functions	Pin name	Pin No.	I/O	Other Pins
A/D input	ADIN00	11	Input	PC0/VGAN0/CMPRF00P
	ADIN01	12	Input	PC1/VGAP00/CMPIN0
	ADIN02	13	Input	PC2/VGAP01
	ADIN03	15	Input	PC3/VGAP02
	ADIN04	17	Input	PC4/CMPRF00S
	ADIN05	18	Input	PC5/CMPRF01
	ADIN06	19	Input	PC6
	ADIN07	20	Input	PC7
	ADIN08	21	Input	PD0/VGAN1/CMPRF10P
	ADIN09	22	Input	PD1/VGAP10/CMPIN1
	ADIN10	23	Input	PD2/VGAP11
	ADIN11	24	Input	PD3/VGAP12
	ADIN12	25	Input	PD4/CMPRF10S
	ADIN13	26	Input	PD5/CMPRF11
	ADIN14	27	Input	PD6
	ADIN15	28	Input	PD7
	ADIN16	29	Input	PE0/VGAN2/CMPRF20P
	ADIN17	30	Input	PE1/VGAP20/CMPIN2
	ADIN18	31	Input	PE2/VGAP21
	ADIN19	32	Input	PE3/VGAP22
	ADIN20	33	Input	PE4/CMPRF20S
	ADIN21	34	Input	PE5/CMPRF21
	ADIN22	35	Input	PE6/DAOT0
	ADIN23	36	Input	PE7/DAOT1
	ADIN24	37	Input	PF0
	ADIN25	38	Input	PF1
	ADIN26	39	Input	PF2
	ADIN27	40	Input	PF3
A/D monitor	ADTRG0	117	Output	PB0/TM23A
	ADTRG1	118	Output	PB1/TM23B
	ADTRG2	119	Output	PB2/TM24A

Functions	Pin name	Pin No.	I/O	Other Pins
VGA input	VGAN0	11	Input	PC0/ADIN00/CMPRF00P
	VGAP00	12	Input	PC1/ADIN01/CMPIN0
	VGAP01	13	Input	PC2/ADIN02
	VGAP02	15	Input	PC3/ADIN03
	VGAN1	21	Input	PD0/ADIN08/CMPRF10P
	VGAP10	22	Input	PD1/ADIN09/CMPIN1
	VGAP11	23	Input	PD2/ADIN10
	VGAP12	24	Input	PD3/ADIN11
	VGAN2	29	Input	PE0/ADIN16/CMPRF20P
	VGAP20	30	Input	PE1/ADIN17/CMPIN2
	VGAP21	31	Input	PE2/ADIN18
	VGAP22	32	Input	PE3/ADIN19
Comparator input	CMPIN0	12	Input	PC1/ADIN01/VGAP00
	CMPIN1	22	Input	PD1/ADIN09/VGAP10
	CMPIN2	30	Input	PE1/ADIN17/VGAP20
	CMPRF00P	11	Input	PC0/ADIN00/VGAN0
	CMPRF00S	17	Input	PC4/ADIN04
	CMPRF01	18	Input	PC5/ADIN05
	CMPRF10P	21	Input	PD0/ADIN08/VGAN1
	CMPRF10S	25	Input	PD4/ADIN12
	CMPRF11	26	Input	PD5/ADIN13
	CMPRF20P	29	Input	PE0/ADIN16/VGAN2
	CMPRF20S	33	Input	PE4/ADIN20
	CMPRF21	34	Input	PE5/ADIN21
Comparator output	CMPOT00	125	Output	P10/IRQ08/CMPOT01
	CMPOT01	125	Output	P10/IRQ08/CMPOT00
	CMPOT10	126	Output	P11/IRQ09/CMPOT11
	CMPOT11	126	Output	P11/IRQ09/CMPOT10
	CMPOT20	127	Output	P12/IRQ10/CMPOT21
	CMPOT21	127	Output	P12/IRQ10/CMPOT20
D/A output	DAOT0	35	Output	PE6/ADIN22
	DAOT1	36	Output	PE7/ADIN23

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P00	51	I/O	IRQ00/TM00
	P01	52	I/O	IRQ01/TM01
	P02	53	I/O	IRQ02/TM04/EXTRG1
	P03	54	I/O	IRQ03/TM05/EXTRG0
	P04	55	I/O	IRQ04/TM12
	P05	56	I/O	IRQ05/TM13
	P06	57	I/O	IRQ06/TM14
	P07	58	I/O	IRQ07/TM15
	P10	125	I/O	IRQ08/CMPOT00/CMPOT01
	P11	126	I/O	IRQ09/CMPOT10/CMPOT11
	P12	127	I/O	IRQ10/CMPOT20/CMPOT21
	P13	128	I/O	IRQ11
	P14	1	I/O	IRQ12
	P15	2	I/O	IRQ13
	P16	3	I/O	IRQ14
	P17	4	I/O	IRQ15
	P20	59	I/O	SBO0P/SDA0P/TX0P/SBT0S/SCL0S
	P21	60	I/O	SBT0P/SCL0P/SBO0S/SDA0S/TX0S
	P22	61	I/O	SBI0/RX0
	P23	62	I/O	SBO1P/TX1P/LTX1P/SBT1S
	P24	63	I/O	SBT1P/SBO1S/TX1S/LTX1S
	P25	64	I/O	SBI1/RX1/LRX1
	P30	65	I/O	SBO2P/TX2P/SBT2S
	P31	66	I/O	SBT2P/SBO2S/TX2S
	P32	67	I/O	SBI2/RX2
	P33	68	I/O	SBO3P/TX3P/SBT3S
	P34	69	I/O	SBT3P/SBO3S/TX3S
	P35	70	I/O	SBI3/RX3
	P40	71	I/O	TM06/SBCS3
	P41	72	I/O	TM07/SBT4
	P42	73	I/O	TM02/SBO4/TX4
	P43	74	I/O	TM03/SBI4/RX4
	P44	75	I/O	TM08/PWMST0
	P45	76	I/O	TM09/PWMST1
	P46	77	I/O	TM10/PWMST2
	P47	78	I/O	TM11

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P50	79	I/O	TM16A
	P51	80	I/O	TM16B
	P52	81	I/O	TMOT16A/PWM10S
	P53	82	I/O	TMOT16B/PWM11S
	P54	83	I/O	TM17A/PWM12S
	P55	85	I/O	TM17B/PWM13S
	P56	87	I/O	TMOT17A/PWM14S
	P57	88	I/O	TMOT17B/PWM15S
	P60	89	I/O	TM18A
	P61	90	I/O	TM18B
	P62	91	I/O	TMOT18A/PWM00S
	P63	92	I/O	TMOT18B/PWM01S
	P64	93	I/O	TM19A/PWM02S
	P65	94	I/O	TM19B/PWM03S
	P66	95	I/O	TMOT19A/PWM04S
	P67	96	I/O	TMOT19B/PWM05S
	P70	97	I/O	TM20A
	P71	98	I/O	TM20B
	P72	99	I/O	TM21A
	P73	100	I/O	TM21B
	P74	101	I/O	TM22A
	P75	102	I/O	TM22B
	P76	103	I/O	TM28
	P77	104	I/O	TM29
	P80	105	I/O	PWM00P
	P81	106	I/O	PWM01P
	P82	107	I/O	PWM02P
	P83	108	I/O	PWM03P
	P84	109	I/O	PWM04P
	P85	110	I/O	PWM05P
	P90	111	I/O	PWM10P
	P91	112	I/O	PWM11P
	P92	113	I/O	PWM12P
	P93	114	I/O	PWM13P
	P94	115	I/O	PWM14P
	P95	116	I/O	PWM15P

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	PA0	5	I/O	PWM20/SBT5
	PA1	6	I/O	PWM21/SBO5/TX5
	PA2	7	I/O	PWM22/SBI5/RX5
	PA3	8	I/O	PWM23/SBT6
	PA4	9	I/O	PWM24/SBO6/TX6
	PA5	10	I/O	PWM25/SBI6/RX6
	PB0	117	I/O	TM23A/ADTRG0
	PB1	118	I/O	TM23B/ADTRG1
	PB2	119	I/O	TM24A/ADTRG2
	PB3	120	I/O	TM24B
	PB4	121	I/O	TM25A
	PB5	123	I/O	TM25B
	PC0	11	Input	ADIN00/VGAN0/CMPRF00P
	PC1	12	Input	ADIN01/VGAP00/CMPIN0
	PC2	13	Input	ADIN02/VGAP01
	PC3	15	Input	ADIN03/VGAP02
	PC4	17	I/O	ADIN04/CMPRF00S
	PC5	18	I/O	ADIN05/CMPRF01
	PC6	19	I/O	ADIN06
	PC7	20	I/O	ADIN07
	PD0	21	Input	ADIN08/VGAN1/CMPRF10P
	PD1	22	Input	ADIN09/VGAP10/CMPIN1
	PD2	23	Input	ADIN10/VGAP11
	PD3	24	Input	ADIN11/VGAP12
	PD4	25	I/O	ADIN12/CMPRF10S
	PD5	26	I/O	ADIN13/CMPRF11
	PD6	27	I/O	ADIN14
	PD7	28	I/O	ADIN15
	PE0	29	Input	ADIN16/VGAN2/CMPRF20P
	PE1	30	Input	ADIN17/VGAP20/CMPIN2
	PE2	31	Input	ADIN18/VGAP21
	PE3	32	Input	ADIN19/VGAP22
	PE4	33	I/O	ADIN20/CMPRF20S
	PE5	34	I/O	ADIN21/CMPRF21
	PE6	35	I/O	ADIN22/DAOT0
	PE7	36	I/O	ADIN23/DAOT1
	PF0	37	I/O	ADIN24
	PF1	38	I/O	ADIN25
	PF2	39	I/O	ADIN26
	PF3	40	I/O	ADIN27

Functions	Pin name	Pin No.	I/O	Other Pins
Onboard debugger	SCLK	41	Input	-
	SDATA	42	I/O	-
	EXTRG1	53	I/O	P02/IRQ02/TM04
	EXTRG0	54	I/O	P03/IRQ03/TM05

Table 1.4-3 Pin Functions (KM103HFD6z)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	9 37 71 97	Input	-
Power pin for internal circuit	VOUT12	32	Output	-
GND	VSS	7 34 69 95	Input	-
External oscillation input pin	OSCI	36	Input	-
External oscillation output pin	OSCO	35	Output	-
Reset	NRST	39	Input	-
Mode	TEST	33	Input	-
	NBOOT	38	Input	-
External interrupt	IRQ00	26	Input	P00/TM00/DAOT0
	IRQ01	27	Input	P01/TM01/DAOT1
	IRQ02	28	Input	P02/TM04/EXTRG1
	IRQ03	29	Input	P03/TM05/EXTRG0
	IRQ04	40	Input	P04
	IRQ05	41	Input	P05
	IRQ06	42	Input	P06
	IRQ07	43	Input	P07
	IRQ08	94	Input	P10
	IRQ09	96	Input	P11
	IRQ10	58	Input	P42/TM02/SBO4/TX4
	IRQ11	59	Input	P43/TM03/SBI4/RX4
	IRQ12	78	Input	P70/TM20A/PWM02S
	IRQ13	79	Input	P71/TM20B/PWM03S
	IRQ14	80	Input	P72/TM21A/PWM04S
	IRQ15	81	Input	P73/TM21B/PWM05S

Functions	Pin name	Pin No.	I/O	Other Pins
8-bit timer	TM00	26	I/O	P00/IRQ00/DAOT0
	TM01	27	I/O	P01/IRQ01/DAOT1
	TM02	58	I/O	P42/IRQ10/SBO4/TX4
	TM03	59	I/O	P43/IRQ11/SBI4/RX4
	TM04	28	I/O	P02/IRQ02/EXTRG1
	TM05	29	I/O	P03/IRQ03/EXTRG0
	TM06	56	I/O	P40/SBCS3
	TM07	57	I/O	P41/SBT4
	TM08	60	I/O	P44/PWMST0
	TM09	61	I/O	P45/PWMST1
	TM10	62	I/O	P46
	TM11	63	I/O	P47
16-bit timer	TM16A	64	I/O	P50
	TMOT16A	66	Output	P52/PWM10S
	TM16B	65	I/O	P51
	TMOT16B	67	Output	P53/PWM11S
	TM17A	68	I/O	P54/PWM12S
	TMOT17A	72	Output	P56/PWM14S
	TM17B	70	I/O	P55/PWM13S
	TMOT17B	73	Output	P57/PWM15S
	TM18A	74	I/O	P60
	TM18B	75	I/O	P61
	TM19A	76	I/O	P64
	TM19B	77	I/O	P65
	TM20A	78	I/O	P70/IRQ12/PWM02S
	TM20B	79	I/O	P71/IRQ13/PWM03S
	TM21A	80	I/O	P72/IRQ14/PWM04S
	TM21B	81	I/O	P73/IRQ15/PWM05S
	TM22A	92	I/O	P94/PWM14P
	TM22B	93	I/O	P95/PWM15P
	TM23A	98	I/O	PB0/ADTRG0
	TM23B	99	I/O	PB1/ADTRG1

Functions	Pin name	Pin No.	I/O	Other Pins
Motor control PWM	PWM00P	82	Output	P80
	PWM01P	83	Output	P81
	PWM02P	84	Output	P82
	PWM03P	85	Output	P83
	PWM04P	86	Output	P84
	PWM05P	87	Output	P85
	PWM02S	78	Output	P70/TM20A/IRQ12
	PWM03S	79	Output	P71/TM20B/IRQ13
	PWM04S	80	Output	P72/TM21A/IRQ14
	PWM05S	81	Output	P73/TM21B/IRQ15
	PWM10P	88	Output	P90
	PWM11P	89	Output	P91
	PWM12P	90	Output	P92
	PWM13P	91	Output	P93
	PWM14P	92	Output	P94/TM22A
	PWM15P	93	Output	P95/TM22B
	PWM10S	66	Output	P52/TMOT16A
	PWM11S	67	Output	P53/TMOT16B
	PWM12S	68	Output	P54/TM17A
	PWM13S	70	Output	P55/TM17B
	PWM14S	72	Output	P56/TMOT17A
	PWM15S	73	Output	P57/TMOT17B
	PWMST0	60	Output	P44/TM08
	PWMST1	61	Output	P45/TM09

Functions	Pin name	Pin No.	I/O	Other Pins
Clock synchronous SIF/SPI	SBO0P	44	I/O	P20/SDA0P/TX0P/SBT0S/SCL0S
	SBT0P	45	I/O	P21/SCL0P/SBO0S/SDA0S/TX0S
	SBO0S	45	I/O	P21/SBT0P/SCL0P/SDA0S/TX0S
	SBT0S	44	I/O	P20/SBO0P/SDA0P/TX0P/SCL0S
	SBI0	46	Input	P22/RX0
	SBO1P	47	I/O	P23/TX1P/LTX1P/SBT1S
	SBT1P	48	I/O	P24/SBO1S/TX1S/LTX1S
	SBO1S	48	I/O	P24/SBT1P/TX1S/LTX1S
	SBT1S	47	I/O	P23/SBO1P/TX1P/LTX1P
	SBI1	49	Input	P25/RX1/LRX1
	SBO2P	50	I/O	P30/TX2P/SBT2S
	SBT2P	51	I/O	P31/SBO2S/TX2S
	SBO2S	51	I/O	P31/SBT2P/TX2S
	SBT2S	50	I/O	P30/SBO2P/TX2P
	SBI2	52	Input	P32/RX2
	SBCS3	56	I/O	P40/TM06
	SBO3P	53	I/O	P33/TX3P/SBT3S
	SBT3P	54	I/O	P34/SBO3S/TX3S
	SBO3S	54	I/O	P34/SBT3P/TX3S
	SBT3S	53	I/O	P33/SBO3P/TX3P
	SBI3	55	Input	P35/RX3
	SBO4	58	I/O	P42/TM02/IRQ10/TX4
	SBT4	57	I/O	P41/TM07
	SBI4	59	Input	P43/TM03/IRQ11/RX4
UART	TX0P	44	I/O	P20/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	45	I/O	P21/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	46	Input	P22/SBI0
	TX1P	47	I/O	P23/SBO1P/LTX1P/SBT1S
	TX1S	48	I/O	P24/SBT1P/SBO1S/LTX1S
	RX1	49	Input	P25/SBI1/LRX1
	TX2P	50	I/O	P30/SBO2P/SBT2S
	TX2S	51	I/O	P31/SBT2P/SBO2S
	RX2	52	Input	P32/SBI2
	TX3P	53	I/O	P33/SBO3P/SBT3S
	TX3S	54	I/O	P34/SBT3P/SBO3S
	RX3	55	Input	P35/SBI3
	TX4	58	I/O	P42/TM02/IRQ10/SBO4
	RX4	59	Input	P43/TM03/IRQ11/SBI4
LIN	LTX1P	47	Output	P23/SBO1P/TX1P/SBT1S
	LTX1S	48	Output	P24/SBT1P/SBO1S/TX1S
	LRX1	49	Input	P25/SBI1/RX1

Functions	Pin name	Pin No.	I/O	Other Pins
IIC	SDA0P	44	I/O	P20/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	45	I/O	P21/SBT0P/SBO0S/SDA0S/TX0S
	SDA0S	45	I/O	P21/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	44	I/O	P20/SBO0P/SDA0P/TX0P/SBT0S
A/D input	ADIN00	4	Input	PC0/VGAN0/CMPRF00P
	ADIN01	5	Input	PC1/VGAP00/CMPIN0
	ADIN02	6	Input	PC2/VGAP01
	ADIN03	8	Input	PC3/VGAP02
	ADIN04	10	Input	PC4/CMPRF00S
	ADIN05	11	Input	PC5/CMPRF01
	ADIN06	12	Input	PC6
	ADIN07	13	Input	PC7
	ADIN08	14	Input	PD0/VGAN1/CMPRF10P
	ADIN09	15	Input	PD1/VGAP10/CMPIN1
	ADIN10	16	Input	PD2/VGAP11
	ADIN11	17	Input	PD3/VGAP12
	ADIN12	18	Input	PD4/CMPRF10S
	ADIN13	19	Input	PD5/CMPRF11
	ADIN14	20	Input	PD6
	ADIN15	21	Input	PD7
	ADIN16	22	Input	PE0/VGAN2/CMPRF20P
	ADIN17	23	Input	PE1/VGAP20/CMPIN2
	ADIN20	24	Input	PE4/CMPRF20S
	ADIN21	25	Input	PE5/CMPRF21
A/D monitor	ADTRG0	98	Output	PB0/TM23A
	ADTRG1	99	Output	PB1/TM23B
	ADTRG2	100	Output	PB2
VGA input	VGAN0	4	Input	PC0/ADIN00/CMPRF00P
	VGAP00	5	Input	PC1/ADIN01/CMPIN0
	VGAP01	6	Input	PC2/ADIN02
	VGAP02	8	Input	PC3/ADIN03
	VGAN1	14	Input	PD0/ADIN08/CMPRF10P
	VGAP10	15	Input	PD1/ADIN09/CMPIN1
	VGAP11	16	Input	PD2/ADIN10
	VGAP12	17	Input	PD3/ADIN11
	VGAN2	22	Input	PE0/ADIN16/CMPRF20P
	VGAP20	23	Input	PE1/ADIN17/CMPIN2

Functions	Pin name	Pin No.	I/O	Other Pins
Comparator input	CMPIN0	5	Input	PC1/ADIN01/VGAP00
	CMPIN1	15	Input	PD1/ADIN09/VGAP10
	CMPIN2	23	Input	PE1/ADIN17/VGAP20
	CMPRF00P	4	Input	PC0/ADIN00/VGAN0
	CMPRF00S	10	Input	PC4/ADIN04
	CMPRF01	11	Input	PC5/ADIN05
	CMPRF10P	14	Input	PD0/ADIN08/VGAN1
	CMPRF10S	18	Input	PD4/ADIN12
	CMPRF11	19	Input	PD5/ADIN13
	CMPRF20P	22	Input	PE0/ADIN16/VGAN2
	CMPRF20S	24	Input	PE4/ADIN20
	CMPRF21	25	Input	PE5/ADIN21
Comparator output	CMPOT00	1	Output	PB3/CMPOT01
	CMPOT01	1	Output	PB3/CMPOT00
	CMPOT10	2	Output	PB4/CMPOT11
	CMPOT11	2	Output	PB4/CMPOT10
	CMPOT20	3	Output	PB5/CMPOT21
	CMPOT21	3	Output	PB5/CMPOT20
D/A output	DAOT0	26	Output	P00/IRQ00
	DAOT1	27	Output	P01/IRQ01

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P00	26	I/O	IRQ00/TM00/DAOT0
	P01	27	I/O	IRQ01/TM01/DAOT1
	P02	28	I/O	IRQ02/TM04/EXTRG1
	P03	29	I/O	IRQ03/TM05/EXTRG0
	P04	40	I/O	IRQ04
	P05	41	I/O	IRQ05
	P06	42	I/O	IRQ06
	P07	43	I/O	IRQ07
	P10	94	I/O	IRQ08
	P11	96	I/O	IRQ09
	P20	44	I/O	SBO0P/SDA0P/TX0P/SBT0S/SCL0S
	P21	45	I/O	SBT0P/SCL0P/SBO0S/SDA0S/TX0S
	P22	46	I/O	SBI0/RX0
	P23	47	I/O	SBO1P/TX1P/LTX1P/SBT1S
	P24	48	I/O	SBT1P/SBO1S/TX1S/LTX1S
	P25	49	I/O	SBI1/RX1/LRX1
	P30	50	I/O	SBO2P/TX2P/SBT2S
	P31	51	I/O	SBT2P/SBO2S/TX2S
	P32	52	I/O	SBI2/RX2
	P33	53	I/O	SBO3P/TX3P/SBT3S
	P34	54	I/O	SBT3P/SBO3S/TX3S
	P35	55	I/O	SBI3/RX3
	P40	56	I/O	TM06/SBCS3
	P41	57	I/O	TM07/SBT4
	P42	58	I/O	TM02/IRQ10/SBO4/TX4
	P43	59	I/O	TM03/IRQ11/SBI4/RX4
	P44	60	I/O	TM08/PWMST0
	P45	61	I/O	TM09/PWMST1
	P46	62	I/O	TM10
	P47	63	I/O	TM11
	P50	64	I/O	TM16A
	P51	65	I/O	TM16B
	P52	66	I/O	TMOT16A/PWM10S
	P53	67	I/O	TMOT16B/PWM11S
	P54	68	I/O	TM17A/PWM12S
	P55	70	I/O	TM17B/PWM13S
	P56	72	I/O	TMOT17A/PWM14S
	P57	73	I/O	TMOT17B/PWM15S

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P60	74	I/O	TM18A
	P61	75	I/O	TM18B
	P64	76	I/O	TM19A
	P65	77	I/O	TM19B
	P70	78	I/O	TM20A/IRQ12/PWM02S
	P71	79	I/O	TM20B/IRQ13/PWM03S
	P72	80	I/O	TM21A/IRQ14/PWM04S
	P73	81	I/O	TM21B/IRQ15/PWM05S
	P80	82	I/O	PWM00P
	P81	83	I/O	PWM01P
	P82	84	I/O	PWM02P
	P83	85	I/O	PWM03P
	P84	86	I/O	PWM04P
	P85	87	I/O	PWM05P
	P90	88	I/O	PWM10P
	P91	89	I/O	PWM11P
	P92	90	I/O	PWM12P
	P93	91	I/O	PWM13P
	P94	92	I/O	PWM14P/TM22A
	P95	93	I/O	PWM15P/TM22B
	PB0	98	I/O	TM23A/ADTRG0
	PB1	99	I/O	TM23B/ADTRG1
	PB2	100	I/O	ADTRG2
	PB3	1	I/O	CMPOT00/CMPOT01
	PB4	2	I/O	CMPOT10/CMPOT11
	PB5	3	I/O	CMPOT20/CMPOT21
	PC0	4	Input	ADIN00/VGAN0/CMPRF00P
	PC1	5	Input	ADIN01/VGAP00/CMPIN0
	PC2	6	Input	ADIN02/VGAP01
	PC3	8	Input	ADIN03/VGAP02
	PC4	10	I/O	ADIN04/CMPRF00S
	PC5	11	I/O	ADIN05/CMPRF01
	PC6	12	I/O	ADIN06
	PC7	13	I/O	ADIN07

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	PD0	14	Input	ADIN08/VGAN1/CMPRF10P
	PD1	15	Input	ADIN09/VGAP10/CMPIN1
	PD2	16	Input	ADIN10/VGAP11
	PD3	17	Input	ADIN11/VGAP12
	PD4	18	I/O	ADIN12/CMPRF10S
	PD5	19	I/O	ADIN13/CMPRF11
	PD6	20	I/O	ADIN14
	PD7	21	I/O	ADIN15
	PE0	22	Input	ADIN16/VGAN2/CMPRF20P
	PE1	23	Input	ADIN17/VGAP20/CMPIN2
	PE4	24	I/O	ADIN20/CMPRF20S
	PE5	25	I/O	ADIN21/CMPRF21
Onboard debugger	SCLK	30	Input	-
	SDATA	31	I/O	-
	EXTRG1	28	I/O	P02/IRQ02/TM04
	EXTRG0	29	I/O	P03/IRQ03/TM05

Table 1.4-4 Pin Functions (KM103HFD5z)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	8 32 58 80	Input	-
Power pin for internal circuit	VOUT12	27	Output	-
GND	VSS	6 29 56 78	Input	-
External oscillation input pin	OSCI	31	Input	-
External oscillation output pin	OSCO	30	Output	-
Reset	NRST	34	Input	-
Mode	TEST	28	Input	-
	NBOOT	33	Input	-
External interrupt	IRQ00	21	Input	P00/TM00/DAOT0
	IRQ01	22	Input	P01/TM01/DAOT1
	IRQ02	23	Input	P02/TM04/EXTRG1
	IRQ03	24	Input	P03/TM05/EXTRG0
	IRQ04	35	Input	P04
	IRQ05	36	Input	P05/SBT4
	IRQ06	37	Input	P06/SBO4/TX4
	IRQ07	38	Input	P07/SBI4/RX4
	IRQ08	49	Input	P40/TM06
	IRQ09	50	Input	P41/TM07
	IRQ10	51	Input	P42/TM02
	IRQ11	52	Input	P43/TM03
8-bit timer	TM00	21	I/O	P00/IRQ00/DAOT0
	TM01	22	I/O	P01/IRQ01/DAOT1
	TM02	51	I/O	P42/IRQ10
	TM03	52	I/O	P43/IRQ11
	TM04	23	I/O	P02/IRQ02/EXTRG1
	TM05	24	I/O	P03/IRQ03/EXTRG0
	TM06	49	I/O	P40/IRQ08
	TM07	50	I/O	P41/IRQ09
	TM08	53	I/O	P44/SBO2P/TX2P/SBT2S
	TM09	54	I/O	P45/SBT2P/SBO2S/TX2S
	TM10	55	I/O	P46/SBI2/RX2
	TM11	57	I/O	P47

Functions	Pin name	Pin No.	I/O	Other Pins
16-bit timer	TM16A	59	I/O	P50/PWM02S
	TM16B	60	I/O	P51/PWM03S
	TM17A	61	I/O	P54/PWM04S
	TM17B	62	I/O	P55/PWM05S
	TM18A	77	I/O	P60/PWM10S
	TM18B	79	I/O	P61/CMPOT20/PWM11S/CMPOT21
	TM19A	1	I/O	P64/PWMST0/CMPOT00/CMPOT01
	TM19B	2	I/O	P65/PWMST1/CMPOT10/CMPOT11
	TM20A	69	I/O	P90/PWM10P
	TM20B	70	I/O	P91/PWM11P
	TM21A	71	I/O	P92/PWM12P
	TM21B	72	I/O	P93/PWM13P
	TM22A	73	I/O	P94/PWM14P
	TM22B	74	I/O	P95/PWM15P
	TM23A	75	I/O	PB0/ADTRG0/PWM12S
	TM23B	76	I/O	PB1/ADTRG1/PWM13S
Motor control PWM	PWM00P	63	Output	P80
	PWM01P	64	Output	P81
	PWM02P	65	Output	P82
	PWM03P	66	Output	P83
	PWM04P	67	Output	P84
	PWM05P	68	Output	P85
	PWM02S	59	Output	P50/TM16A
	PWM03S	60	Output	P51/TM16B
	PWM04S	61	Output	P54/TM17A
	PWM05S	62	Output	P55/TM17B
	PWM10P	69	Output	P90/TM20A
	PWM11P	70	Output	P91/TM20B
	PWM12P	71	Output	P92/TM21A
	PWM13P	72	Output	P93/TM21B
	PWM14P	73	Output	P94/TM22A
	PWM15P	74	Output	P95/TM22B
	PWM10S	77	Output	P60/TM18A
	PWM11S	79	Output	P61/TM18B/CMPOT20/CMPOT21
	PWM12S	75	Output	PB0/TM23A/ADTRG0
	PWM13S	76	Output	PB1/TM23B/ADTRG1
	PWMST0	1	Output	P64/TM19A/CMPOT00/CMPOT01
	PWMST1	2	Output	P65/TM19B/CMPOT10/CMPOT11

Functions	Pin name	Pin No.	I/O	Other Pins
Clock synchronous SIF/SPI	SBO0P	39	I/O	P20/SDA0P/TX0P/SBT0S/SCL0S
	SBT0P	40	I/O	P21/SCL0P/SBO0S/SDA0S/TX0S
	SBO0S	40	I/O	P21/SBT0P/SCL0P/SDA0S/TX0S
	SBT0S	39	I/O	P20/SBO0P/SDA0P/TX0P/SCL0S
	SBI0	41	Input	P22/RX0
	SBO1P	42	I/O	P23/TX1P/LTX1P/SBT1S
	SBT1P	43	I/O	P24/SBO1S/TX1S/LTX1S
	SBO1S	43	I/O	P24/SBT1P/TX1S/LTX1S
	SBT1S	42	I/O	P23/SBO1P/TX1P/LTX1P
	SBI1	44	Input	P25/RX1/LRX1
	SBO2P	53	I/O	P44/TM08/TX2P/SBT2S
	SBT2P	54	I/O	P45/TM09/SBO2S/TX2S
	SBO2S	54	I/O	P45/TM09/SBT2P/TX2S
	SBT2S	53	I/O	P44/TM08/SBO2P/TX2P
	SBI2	55	Input	P46/TM10/RX2
	SBCS3	48	I/O	P33/ADTRG2
	SBO3P	45	I/O	P30/TX3P/SBT3S
	SBT3P	45	I/O	P31/SBO3S/TX3S
	SBO3S	46	I/O	P31/SBT3P/TX3S
	SBT3S	46	I/O	P30/SBO3P/TX3P
	SBI3	47	Input	P32/RX3
	SBO4	37	I/O	P06/IRQ06/TX4
	SBT4	36	I/O	P05/IRQ05
	SBI4	38	Input	P07/IRQ07/RX4
UART	TX0P	39	I/O	P20/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	40	I/O	P21/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	41	Input	P22/SBI0
	TX1P	42	I/O	P23/SBO1P/LTX1P/SBT1S
	TX1S	43	I/O	P24/SBT1P/SBO1S/LTX1S
	RX1	44	Input	P25/SBI1/LRX1
	TX2P	53	I/O	P44/TM08/SBO2P/SBT2S
	TX2S	54	I/O	P45/TM09/SBT2P/SBO2S
	RX2	55	Input	P46/TM10/SBI2
	TX3P	45	I/O	P30/SBO3P/SBT3S
	TX3S	46	I/O	P31/SBT3P/SBO3S
	RX3	47	Input	P32/SBI3
	TX4	37	I/O	P06/IRQ06/SBO4
	RX4	38	Input	P07/IRQ07/SBI4
LIN	LTX1P	42	Output	P23/SBO1P/TX1P/SBT1S
	LTX1S	43	Output	P24/SBT1P/SBO1S/TX1S
	LRX1	44	Input	P25/SBI1/RX1

Functions	Pin name	Pin No.	I/O	Other Pins
IIC	SDA0P	39	I/O	P20/SBO0P/TX0P/SCL0S/SBT0S
	SCL0P	40	I/O	P21/SBT0P/SBO0S/SDA0S/TX0S
	SDA0S	40	I/O	P21/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	39	I/O	P20/SBO0P/SDA0P/TX0P/SBT0S
A/D input	ADIN00	3	Input	PC0/VGAN0/CMPRF00P
	ADIN01	4	Input	PC1/VGAP00/CMPIN0
	ADIN02	5	Input	PC2/VGAP01
	ADIN03	7	Input	PC3/VGAP02
	ADIN04	9	Input	PC4/CMPRF00S
	ADIN05	10	Input	PC5/CMPRF01
	ADIN06	11	Input	PC6
	ADIN07	12	Input	PC7
	ADIN08	13	Input	PD0/VGAN1/CMPRF10P
	ADIN09	14	Input	PD1/VGAP10/CMPIN1
	ADIN10	15	Input	PD2/VGAP11
	ADIN11	16	Input	PD3/VGAP12
	ADIN12	17	Input	PD4/CMPRF10S
	ADIN13	18	Input	PD5/CMPRF11
	ADIN16	19	Input	PE0/VGAN2/CMPRF20P
	ADIN17	20	Input	PE1/VGAP20/CMPIN2
A/D monitor	ADTRG0	75	Output	PB0/TM23A/PWM12S
	ADTRG1	76	Output	PB1/TM23B/PWM13S
	ADTRG2	48	Output	P33/SBCS3
VGA input	VGAN0	3	Input	PC0/ADIN00/CMPRF00P
	VGAP00	4	Input	PC1/ADIN01/CMPIN0
	VGAP01	5	Input	PC2/ADIN02
	VGAP02	7	Input	PC3/ADIN03
	VGAN1	13	Input	PD0/ADIN08/CMPRF10P
	VGAP10	14	Input	PD1/ADIN09/CMPIN1
	VGAP11	15	Input	PD2/ADIN10
	VGAP12	16	Input	PD3/ADIN11
	VGAN2	19	Input	PE0/ADIN16/CMPRF20P
	VGAP20	20	Input	PE1/ADIN17/CMPIN2

Functions	Pin name	Pin No.	I/O	Other Pins
Comparator input	CMPIN0	4	Input	PC1/ADIN01/VGAP00
	CMPIN1	14	Input	PD1/ADIN09/VGAP10
	CMPIN2	20	Input	PE1/ADIN17/VGAP20
	CMPRF00P	3	Input	PC0/ADIN00/VGAN0
	CMPRF00S	9	Input	PC4/ADIN04
	CMPRF01	10	Input	PC5/ADIN05
	CMPRF10P	13	Input	PD0/ADIN08/VGAN1
	CMPRF10S	17	Input	PD4/ADIN12
	CMPRF11	18	Input	PD5/ADIN13
	CMPRF20P	19	Input	PE0/ADIN16/VGAN2
Comparator output	CMPOT00	1	Output	P64/TM19A/PWMST0/CMPOT01
	CMPOT01	1	Output	P64/TM19A/PWMST0/CMPOT00
	CMPOT10	2	Output	P65/TM19B/PWMST1/CMPOT11
	CMPOT11	2	Output	P65/TM19B/PWMST1/CMPOT10
	CMPOT20	79	Output	P61/TM18B/PWM11S/CMPOT21
	CMPOT21	79	Output	P61/TM18B/CMPOT20/PWM11S
D/A output	DAOT0	21	Output	P00/IRQ00/TM00
	DAOT1	22	Output	P01/IRQ01/TM01
I/O port	P00	21	I/O	IRQ00/TM00/DAOT0
	P01	22	I/O	IRQ01/TM01/DAOT1
	P02	23	I/O	IRQ02/TM04/EXTRG1
	P03	24	I/O	IRQ03/TM05/EXTRG0
	P04	35	I/O	IRQ04
	P05	36	I/O	IRQ05/SBT4
	P06	37	I/O	IRQ06/SBO4/TX4
	P07	38	I/O	IRQ07/SBI4/RX4
	P20	39	I/O	SBO0P/SDA0P/TX0P/SBT0S/SCL0S
	P21	40	I/O	SBT0P/SCL0P/SBO0S/SDA0S/TX0S
	P22	41	I/O	SBI0/RX0
	P23	42	I/O	SBO1P/TX1P/LTX1P/SBT1S
	P24	43	I/O	SBT1P/SBO1S/TX1S/LTX1S
	P25	44	I/O	SBI1/RX1/LRX1
	P30	45	I/O	SBO3P/TX3P/SBT3S
	P31	46	I/O	SBT3P/SBO3S/TX3S
	P32	47	I/O	SBI3/RX3
	P33	48	I/O	ADTRG2/SBCS3

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P40	49	I/O	TM06/IRQ08
	P41	50	I/O	TM07/IRQ09
	P42	51	I/O	TM02/IRQ10
	P43	52	I/O	TM03/IRQ11
	P44	53	I/O	TM08/SBO2P/TX2P/SBT2S
	P45	54	I/O	TM09/SBT2P/SBO2S/TX2S
	P46	55	I/O	TM10/SBI2/RX2
	P47	57	I/O	TM11
	P50	59	I/O	TM16A/PWM02S
	P51	60	I/O	TM16B/PWM03S
	P54	61	I/O	TM17A/PWM04S
	P55	62	I/O	TM17B/PWM05S
	P60	77	I/O	TM18A/PWM10S
	P61	79	I/O	TM18B/CMPOT20/PWM11S/CMPOT21
	P64	1	I/O	TM19A/PWMST0/CMPOT00/CMPOT01
	P65	2	I/O	TM19B/PWMST1/CMPOT10/CMPOT11
	P80	63	I/O	PWM00P
	P81	64	I/O	PWM01P
	P82	65	I/O	PWM02P
	P83	66	I/O	PWM03P
	P84	67	I/O	PWM04P
	P85	68	I/O	PWM05P
	P90	69	I/O	PWM10P/TM20A
	P91	70	I/O	PWM11P/TM20B
	P92	71	I/O	PWM12P/TM21A
	P93	72	I/O	PWM13P/TM21B
	P94	73	I/O	PWM14P/TM22A
	P95	74	I/O	PWM15P/TM22B
	PB0	75	I/O	TM23A/ADTRG0/PWM12S
	PB1	76	I/O	TM23B/ADTRG1/PWM13S
	PC0	3	Input	ADIN00/VGAN0/CMPRF00P
	PC1	4	Input	ADIN01/VGAP00/CMPIN0
	PC2	5	Input	ADIN02/VGAP01
	PC3	7	Input	ADIN03/VGAP02
	PC4	9	I/O	ADIN04/CMPRF00S
	PC5	10	I/O	ADIN05/CMPRF01
	PC6	11	I/O	ADIN06
	PC7	12	I/O	ADIN07

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	PD0	13	Input	ADIN08/VGAN1/CMPRF10P
	PD1	14	Input	ADIN09/VGAP10/CMPIN1
	PD2	15	Input	ADIN10/VGAP11
	PD3	16	Input	ADIN11/VGAP12
	PD4	17	I/O	ADIN12/CMPRF10S
	PD5	18	I/O	ADIN13/CMPRF11
	PE0	19	Input	ADIN16/VGAN2/CMPRF20P
	PE1	20	Input	ADIN17/VGAP20/CMPIN2
Onboard debugger	SCLK	25	Input	-
	SDATA	26	I/O	-
	EXTRG1	23	I/O	P02/IRQ02/TM04
	EXTRG0	24	I/O	P03/IRQ03/TM05

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Table 1.4-5 Pin Functions (KM103HFD4z)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	8 28 64	Input	-
Power pin for internal circuit	VOUT12	23	Output	-
GND	VSS	6 25 62	Input	-
External oscillation input pin	OSCI	27	Input	-
External oscillation output pin	OSCO	26	Output	-
Reset	NRST	30	Input	-
Mode	TEST	24	Input	-
	NBOOT	29	Input	-
External interrupt	IRQ00	17	Input	P00/TM00/DAOT0
	IRQ01	18	Input	P01/TM01/DAOT1
	IRQ02	19	Input	P02/TM04/EXTRG1
	IRQ03	20	Input	P03/TM05/EXTRG0
	IRQ04	45	Input	P46/TM10/TM17A/PWM04S
	IRQ05	46	Input	P47/TM11/TM17B/PWM05S
	IRQ08	41	Input	P40/TM06
	IRQ09	42	Input	P41/TM07
	IRQ10	43	Input	P42/TM02
	IRQ11	44	Input	P43/TM03
8-bit timer	TM00	17	I/O	P00/IRQ00/DAOT0
	TM01	18	I/O	P01/IRQ01/DAOT1
	TM02	43	I/O	P42/IRQ10
	TM03	44	I/O	P43/IRQ11
	TM04	19	I/O	P02/IRQ02/EXTRG1
	TM05	20	I/O	P03/IRQ03/EXTRG0
	TM06	41	I/O	P40/IRQ08
	TM07	42	I/O	P41/IRQ09
	TM10	45	I/O	P46/IRQ04/TM17A/PWM04S
	TM11	46	I/O	P47/IRQ05/TM17B/PWM05S

Functions	Pin name	Pin No.	I/O	Other Pins
16-bit timer	TM16A	47	I/O	P50/ADTRG0/PWM02S
	TM16B	48	I/O	P51/ADTRG1/PWM03S
	TM17A	45	I/O	P46/TM10/IRQ04/PWM04S
	TM17B	46	I/O	P47/TM11/IRQ05/PWM05S
	TM18A	61	I/O	P60/PWM10S
	TM18B	63	I/O	P61/PWM11S
	TM19A	1	I/O	P64/PWMST0/CMPOT00/CMPOT01
	TM19B	2	I/O	P65/PWMST1/CMPOT10/CMPOT11
	TM20A	55	I/O	P90/PWM10P
	TM20B	56	I/O	P91/PWM11P
	TM21A	57	I/O	P92/PWM12P
	TM21B	58	I/O	P93/PWM13P
Motor control PWM	PWM00P	49	Output	P80
	PWM01P	50	Output	P81
	PWM02P	51	Output	P82
	PWM03P	52	Output	P83
	PWM04P	53	Output	P84
	PWM05P	54	Output	P85
	PWM02S	47	Output	P50/TM16A/ADTRG0
	PWM03S	48	Output	P51/TM16B/ADTRG1
	PWM04S	45	Output	P46/TM10/IRQ04/TM17A
	PWM05S	46	Output	P47/TM11/IRQ05/TM17B
	PWM10P	55	Output	P90/TM20A
	PWM11P	56	Output	P91/TM20B
	PWM12P	57	Output	P92/TM21A
	PWM13P	58	Output	P93/TM21B
	PWM14P	59	Output	P94
	PWM15P	60	Output	P95
	PWM10S	61	Output	P60/TM18A
	PWM11S	63	Output	P61/TM18B
	PWMST0	1	Output	P64/TM19A/CMPOT00/CMPOT01
	PWMST1	2	Output	P65/TM19B/CMPOT10/CMPOT11

Functions	Pin name	Pin No.	I/O	Other Pins
Clock synchronous SIF/SPI	SBO0P	31	I/O	P20/SDA0P/TX0P/SBT0S/SCL0S
	SBT0P	32	I/O	P21/SCL0P/SBO0S/SDA0S/TX0S
	SBO0S	32	I/O	P21/SBT0P/SCL0P/SDA0S/TX0S
	SBT0S	31	I/O	P20/SBO0P/SDA0P/TX0P/SCL0S
	SBI0	33	Input	P22/RX0
	SBO1P	34	I/O	P23/TX1P/LTX1P/SBT1S
	SBT1P	35	I/O	P24/SBO1S/TX1S/LTX1S
	SBO1S	35	I/O	P24/SBT1P/TX1S/LTX1S
	SBT1S	34	I/O	P23/SBO1P/TX1P/LTX1P
	SBI1	36	Input	P25/RX1/LRX1
	SBCS3	40	I/O	P33/ADTRG2
	SBO3P	37	I/O	P30/TX3P/SBT3S
	SBT3P	38	I/O	P31/SBO3S/TX3S
	SBO3S	38	I/O	P31/SBT3P/TX3S
	SBT3S	37	I/O	P30/SBO3P/TX3P
	SBI3	39	Input	P32/RX3
UART	TX0P	31	I/O	P20/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	32	I/O	P21/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	33	Input	P22/SBI0
	TX1P	34	I/O	P23/SBO1P/LTX1P/SBT1S
	TX1S	35	I/O	P24/SBT1P/SBO1S/LTX1S
	RX1	36	Input	P25/SBI1/LRX1
	TX3P	37	I/O	P30/SBO3P/SBT3S
	TX3S	38	I/O	P31/SBT3P/SBO3S
	RX3	39	Input	P32/SBI3
LIN	LTX1P	34	Output	P23/SBO1P/TX1P/SBT1S
	LTX1S	35	Output	P24/SBT1P/SBO1S/TX1S
	LRX1	36	Input	P25/SBI1/RX1
IIC	SDA0P	31	I/O	P20/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	32	I/O	P21/SBT0P/SBO0S/SDA0S/TX0S
	SDA0S	32	I/O	P21/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	31	I/O	P20/SBO0P/SDA0P/TX0P/SBT0S

Functions	Pin name	Pin No.	I/O	Other Pins
A/D input	ADIN00	3	Input	PC0/VGAN0/CMPRF00P
	ADIN01	4	Input	PC1/VGAP00/CMPIN0
	ADIN02	5	Input	PC2/VGAP01
	ADIN03	7	Input	PC3/VGAP02
	ADIN04	9	Input	PC4/CMPRF00S
	ADIN05	10	Input	PC5/CMPRF01
	ADIN06	11	Input	PC6
	ADIN07	12	Input	PC7
	ADIN08	13	Input	PD0/VGAN1/CMPRF10P
	ADIN09	14	Input	PD1/VGAP10/CMPIN1
	ADIN14	15	Input	PD6
	ADIN15	16	Input	PD7
A/D monitor	ADTRG0	47	Output	P50/TM16A/PWM02S
	ADTRG1	48	Output	P51/TM16B/PWM03S
	ADTRG2	40	Output	P33/SBCS3
VGA input	VGAN0	3	Input	PC0/ADIN00/CMPRF00P
	VGAP00	4	Input	PC1/ADIN01/CMPIN0
	VGAP01	5	Input	PC2/ADIN02
	VGAP02	7	Input	PC3/ADIN03
	VGAN1	13	Input	PD0/ADIN08/CMPRF10P
	VGAP10	14	Input	PD1/ADIN09/CMPIN1
Comparator input	CMPIN0	4	Input	PC1/ADIN01/VGAP00
	CMPIN1	14	Input	PD1/ADIN09/VGAP10
	CMPRF00P	3	Input	PC0/ADIN00/VGAN0
	CMPRF00S	9	Input	PC4/ADIN04
	CMPRF01	10	Input	PC5/ADIN05
	CMPRF10P	13	Input	PD0/ADIN08/VGAN1
Comparator output	CMPOT00	1	Output	P64/TM19A/PWMST0/CMPOT01
	CMPOT01	1	Output	P64/TM19A/PWMST0/CMPOT00
	CMPOT10	2	Output	P65/TM19B/PWMST1/CMPOT11
	CMPOT11	2	Output	P65/TM19B/PWMST1/CMPOT10
D/A output	DAOT0	17	Output	P00/IRQ00/TM00
	DAOT1	18	Output	P01/IRQ01/TM01

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Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P00	17	I/O	IRQ00/TM00/DAOT0
	P01	18	I/O	IRQ01/TM01/DAOT1
	P02	19	I/O	IRQ02/TM04/EXTRG1
	P03	20	I/O	IRQ03/TM05/EXTRG0
	P20	31	I/O	SBO0P/SDA0P/TX0P/SBT0S/SCL0S
	P21	32	I/O	SBT0P/SCL0P/SBO0S/SDA0S/TX0S
	P22	33	I/O	SBI0/RX0
	P23	34	I/O	SBO1P/TX1P/LTX1P/SBT1S
	P24	35	I/O	SBT1P/SBO1S/TX1S/LTX1S
	P25	36	I/O	SBI1/RX1/LRX1
	P30	37	I/O	SBO3P/TX3P/SBT3S
	P31	38	I/O	SBT3P/SBO3S/TX3S
	P32	39	I/O	SBI3/RX3
	P33	40	I/O	ADTRG2/SBCS3
	P40	41	I/O	TM06/IRQ08
	P41	42	I/O	TM07/IRQ09
	P42	43	I/O	TM02/IRQ10
	P43	44	I/O	TM03/IRQ11
	P46	45	I/O	TM10/IRQ04/TM17A/PWM04S
	P47	46	I/O	TM11/IRQ05/TM17B/PWM05S
	P50	47	I/O	TM16A/ADTRG0/PWM02S
	P51	48	I/O	TM16B/ADTRG1/PWM03S
	P60	61	I/O	TM18A/PWM10S
	P61	63	I/O	TM18B/PWM11S
	P64	1	I/O	TM19A/PWMST0/CMPOT00/CMPOT01
	P65	2	I/O	TM19B/PWMST1/CMPOT10/CMPOT11
	P80	49	I/O	PWM00P
	P81	50	I/O	PWM01P
	P82	51	I/O	PWM02P
	P83	52	I/O	PWM03P
	P84	53	I/O	PWM04P
	P85	54	I/O	PWM05P
	P90	55	I/O	PWM10P/TM20A
	P91	56	I/O	PWM11P/TM20B
	P92	57	I/O	PWM12P/TM21A
	P93	58	I/O	PWM13P/TM21B
	P94	59	I/O	PWM14P
	P95	60	I/O	PWM15P

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	PC0	3	Input	ADIN00/VGAN0/CMPRF00P
	PC1	4	Input	ADIN01/VGAP00/CMPIN0
	PC2	5	Input	ADIN02/VGAP01
	PC3	7	Input	ADIN03/VGAP02
	PC4	9	I/O	ADIN04/CMPRF00S
	PC5	10	I/O	ADIN05/CMPRF01
	PC6	11	I/O	ADIN06
	PC7	12	I/O	ADIN07
	PD0	13	Input	ADIN08/VGAN1/CMPRF10P
	PD1	14	Input	ADIN09/VGAP10/CMPIN1
	PD6	15	I/O	ADIN14
	PD7	16	I/O	ADIN15
Onboard debugger	SCLK	21	Input	-
	SDATA	22	I/O	-
	EXTRG1	19	I/O	P02/IRQ02/TM04
	EXTRG0	20	I/O	P03/IRQ03/TM05

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1.5 Electrical Characteristics

About electrical specification, a standard specification is described in the manual of this LSI. When using this LSI, consult the staff in our sales offices for the product specifications.

Hint:

T.B.D. items will be updated when the manual is revised.

1.5.1 Absolute Maximum Ratings

	Parameter		Symbol	Rating	Unit
A1	Power supply voltage 1		V_{DD50A}	-0.3 to 7.0	V
A2	Internal power supply voltage 2		V_{OUT12A}	-0.3 to 1.6	V
A3	Input pin voltage		V_{I1}	-0.3 to V_{DD50} +0.3 (upper limit: 7.0)	V
A4	VGA input pin voltage		V_{I2}	-2.0 to V_{DD50} +0.3 (upper limit: 7.0)	V
A5	I/O pin voltage		V_{I3}	-0.3 to V_{DD50} +0.3 (upper limit: 7.0)	V
A6	Average output current	I/O pin 1, 3 (*1)	$I_{O1}(avg)$	±12	mA
A7		I/O pin 2, 4 (*2)	$I_{O2}(avg)$	±24	mA
A8		Total of all pins	I_{O3}	±70	mA
A9	Power dissipation		P_T	800	mW
A10	Operating case temperature		T_{COPR}	-40 to 110	°C
A11	Storage temperature		T_{STG}	-40 to 125	°C

Note:

Although this LSI has internal ESD protection circuit, it may still sustain permanent damage if not handled properly.

Therefore, proper ESD precautions are recommended to avoid electrostatic damage to the MOS gate.

This product may sustain permanent damage if it gets stress which is higher than the above stated absolute maximum rating even only for a second.

This rating is the maximum rating and device operating at this range is not guaranteed as it is higher than our stated recommended operating range.

Note:

*1 I/O pins 1 and 3 are I/O pins 1 and 3 described in 1.5.3 DC Characteristics.

Note:

*2 I/O pins 2 and 4 are I/O pins 2 and 4 described in 1.5.3 DC Characteristics.

1.5.2   Operation Conditions

Power supply voltage during operation						$V_{SS} = 0.0$ V
						Tc = -40 °C to 110 °C
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B1	External power supply voltage	V_{DD50}	V_{RST5N}	5.0	5.5	V
B2	Internal power supply voltage	V_{OUT12}	-	1.25	-	

Note:

For the power supply voltage detection level V_{RST5N}, refer to 1.5.4.6 Power-on Reset.

Note:

Internal regulator output (V_{OUT12}) can not be used for supply to other LSI.

Oscillation pin						$V_{DD50} = V_{RST5N}$ to 5.5 V, $V_{SS} = 0.0$ V
						Tc= -40 °C to 110 °C
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B3	Input frequency	F_{OSC}	4.0	-	20.0	MHz
B4	Internal feedback resistance	R_{FB}	-	1.0	-	MΩ

Note:

Oscillation circuit characteristics and peripheral parts (load capacity, damping resister, and feedback resister) are different by each oscillator and substrate. To decide appropriate capacity value for circuit constant, please consult the oscillator manufacturer.
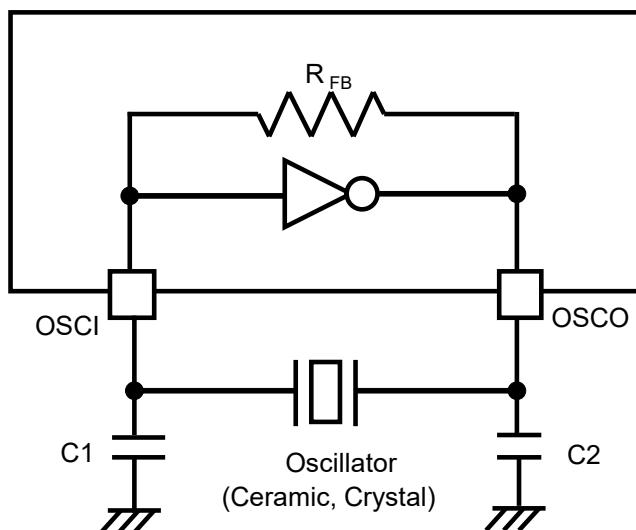
Figure 1.5-1 Oscillation Circuit

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External clock input OSCI (OSCO left open)			$V_{DD50} = V_{RST5N}$ to 5.5 V, $V_{SS} = 0.0$ V			
			Tc = -40 °C to 110 °C			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B5	Clock frequency	F_{CP}	4.0	-	20.0	MHz
B6	High level pulse width	t_{wh1}	20	-	-	ns
B7	Low level pulse width	t_{wl1}	20	-	-	
B8	Rising time	t_{wr1}	-	-	5	
B9	Falling time	t_{wf1}	-	-	5	

Note:

It is necessary to set clock duty ratio from 45 % to 55 %.
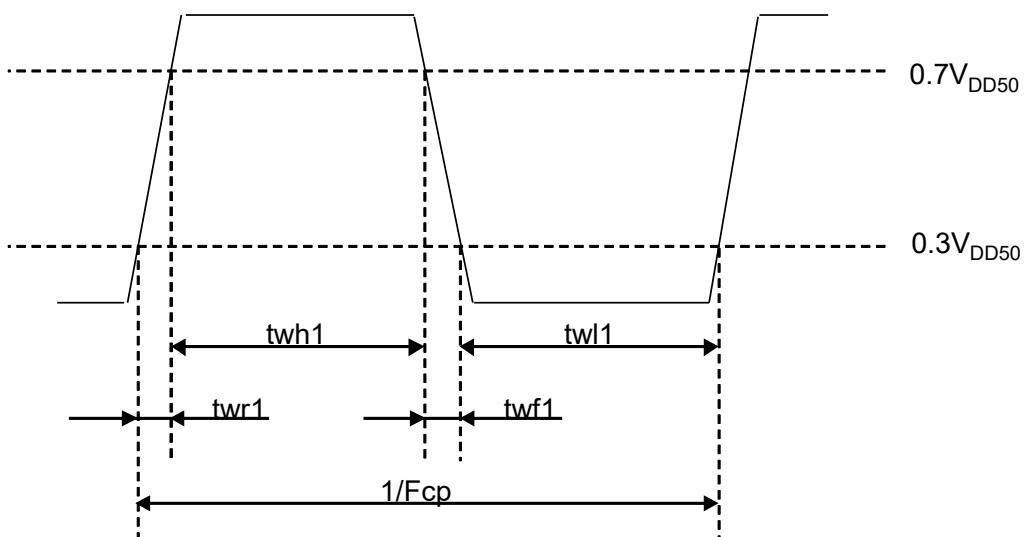
Figure 1.5-2 OSCI Timing Chart

1.5.3   DC Characteristics

Power supply current during operation				V_{DD50} = 5.0 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C Output pins left open			
	Parameter	Sym-bol	Conditions	Rating		Unit	
				TYP	MAX		
C1	NORMAL mode	I_{DD1}	HXOCLK= 10 MHz, PLLCLK = 240MHz, MCLK = 120 MHz, IOCLK = 60 MHz CPU and Peripheral circuits are operating. Analog circuits are stopped.	75	130	mA	
C2	SLEEP mode	I_{DD2}	HXOCLK= 10 MHz, PLLCLK = 240MHz MCLK = 120 MHz, IOCLK = 60 MHz CPU is stopped, Peripheral circuits are operating. Analog circuits are stopped.	60	115		
C3	HALT mode	I_{DD3}	HXOCLK = 10 MHz, PLLCLK stopped, MCLK, IOCLK stopped, CPU and Peripheral circuits are stopped. Analog circuits are stopped.	15	75		
C4	STOP mode	I_{DD4}	HXOCLK, PLLCLK, MCLK, IOCLK = stopped	8	55		

Note:

The measurement conditions are as follows.

- All I/O pins are output state. (No load)

Input pin 1 NBOOT, SCLK				V_{DD50} = 5.0 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C			
	Parameter	Sym-bol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C5	Input voltage "High level"	V_{IH1}		$V_{DD50} \times 0.7$	-	V_{DD50}	V
C6	Input voltage "Low level"	V_{IL1}		V_{SS}	-	$V_{DD50} \times 0.3$	
C7	Input leakage current	I_{LK1}	V_{IN} = 0 V to V_{DD50}	-	-	±5	µA

Input pin 2 TEST				V_{DD50} = 5.0 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C			
	Parameter	Sym-bol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C8	Input voltage "High level"	V_{IH2}		$V_{DD50} \times 0.7$	-	V_{DD50}	V
C9	Input voltage "Low level"	V_{IH2}		V_{SS}	-	$V_{DD50} \times 0.3$	
C10	Internal pull-up resistor	R_{IO2}	V_{IN} = 0 V	15	30	60	kΩ

Input pin 3
PC0 to PC3, PD0 to PD3, PE0 to PE3 — V_{DD50} = 5.0 V, V_{SS} = 0.0 V; Tc = -40 °C to 110 °C

	Parameter	Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C11	Input voltage "High level"	V_{IH3}		$V_{DD50} \times 0.7$	-	V_{DD50}	V
C12	Input voltage "Low level"	V_{IL3}		V_{SS}	-	$V_{DD50} \times 0.3$	
C13	Input leakage current	I_{LK3}	V_{IN} = 0 V to V_{DD50}	-	-	±10	µA
C14	Input voltage range	V_{IN3}	VGA is used	-1.5	-	V_{DD50}	V

I/O pin 1
NRST — V_{DD50} = 5.0 V, V_{SS} = 0.0 V; Tc = -40 °C to 110 °C

	Parameter	Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C15	Input voltage "High level"	V_{IH4}		$V_{DD50} \times 0.7$	-	V_{DD50}	V
C16	Input voltage "Low level"	V_{IL4}		V_{SS}	-	$V_{DD50} \times 0.3$	
C17	Internal pull-up resistor	R_{IO4}	V_{IN} = 0 V	15	30	60	kΩ
C18	Output voltage "Low level"	V_{OL4}	$V_{DD50} = V_{RST5P}$, I_{OL} = 3.0 mA	-	-	0.5	V

I/O pin 2
SDATA — V_{DD50} = 5.0 V, V_{SS} = 0.0 V; Tc = -40 °C to 110 °C

	Parameter	Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C19	Input voltage "High level"	V_{IH5}		$V_{DD50} \times 0.7$	-	V_{DD50}	V
C20	Input voltage "Low level"	V_{IL5}		V_{SS}	-	$V_{DD50} \times 0.3$	
C21	Input leakage current	I_{LK5}	V_{IN} = 0 V to V_{DD50}	-	-	±5	µA
C22	Output voltage "High level"	V_{OH5}	I_{OH} = -6.0 mA	4.5	-	-	V
C23	Output voltage "Low level"	V_{OL5}	I_{OL} = 6.0 mA	-	-	0.5	

I/O pin 3							

I/O pin 3

<KM103HFD8z>

P00 to P07, P12 to P17, P20 to P27, P30 to P37, P40 to P45, P76, P77, P86, P87, P96, P97, PC4 to PC7, PD4 to PD7, PE4 to PE7, PF0 to PF7

<KM103HFD7z>

P00 to P07, P12 to P17, P20 to P25, P30 to P35, P40 to P45, P76, P77, PC4 to PC7, PD4 to PD7, PE4 to PE7, PF0 to PF3

<KM103HFD6z>

P00 to P07, P20 to P25, P30 to P35, P40 to P45, PB2 to PB5, PC4 to PC7, PD4 to PD7, PE4,PE5

<KM103HFD5z>

P00 to P07, P20 to P25, P30 to P33, PC4 to PC7, PD4, PD5

<KM103HFD4z>

P00 to P03, P20 to P25, P30 to P33, PC4 to PC7, PD6, PD7

V_{DD50} = 5.0 V, V_{SS} = 0.0 V
Tc = -40 °C to 110°C

	Parameter	Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C24	Input voltage "High level"	V_{IH6}		$V_{DD50} \times 0.7$	-	V_{DD50}	V
C25	Input voltage "Low level"	V_{IL6}		V_{SS}	-	$V_{DD50} \times 0.3$	
C26	Input leakage current	I_{LK6}	V_{IN} = 0 V to V_{DD50}	-	-	±5	µA
C27	Internal pull-up resistor	R_{IO6}	V_{IN} = 0 V	15	30	60	kΩ
C28	Output voltage "High level"	V_{OH6}	I_{OH} = -3.0 mA	4.5	-	-	V
C29	Output voltage "Low level"	V_{OL6}	I_{OL} = 3.0 mA	-	-	0.5	

I/O pin 4
<KM103HFD8z>
P10, P11, P46, P47, P50 to P57, P60 to P67, P70 to P75, P80 to P85, P90 to P95, PA0 to PA5, PB0 to PB5
<KM103HFD7z>
P10, P11, P46, P47, P50 to P57, P60 to P67, P70 to P75, P80 to P85, P90 to P95, PA0 to PA5, PB0 to PB5
<KM103HFD6z>
P10,P11,P46,P47,P50 to P57, P60, P61, P64, P65, P70 to P73, P80 to P85, P90 to P95, PB0, PB1
<KM103HFD5z>
P40 to P47, P50, P51, P54, P55, P60, P61, P64, P65, P80 to P85, P90 to P95, PB0,PB1
<KM103HFD4z>
P40 to P43, P46, P47, P50, P51, P60, P61, P64, P65, P80 to P85, P90 to P95

$V_{DD50} = 5.0$ V, $V_{SS} = 0.0$ V
Tc = -40 °C to 110 °C

	Parameter	Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C30	Input voltage "High level"	V_{IH7}		$V_{DD50} \times 0.7$	-	V_{DD50}	V
C31	Input voltage "Low level"	V_{IL7}		V_{SS}	-	$V_{DD50} \times 0.3$	
C32	Input leakage current	I_{LK7}	$V_{IN} = 0$ V to V_{DD50}	-	-	±5	µA
C33	Internal pull-up resistor	R_{IO7}	$V_{IN} = 0$ V	15	30	60	kΩ
C34	Output voltage "High level"	V_{OH7}	$I_{OH} = -6.0$ mA	4.5	-	-	V
C35	Output voltage "Low level"	V_{OL7}	$I_{OL} = 6.0$ mA	-	-	0.5	

1.5.4 Analog Characteristics

This LSI Manual shows the electrical characteristics of analog.

1.5.4.1 12-bit A/D Converter

ADC0, ADC1, ADC2						V_{DD50} = 5.0 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C	
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D1	Resolution	-		-	-	12	Bits
D2	Conversion clock	-		10	-	40	MHz
D3	Integral non-linearity error	$INLE_{AD}$	Sampling time ≥ 150 ns Conversion clock = 40 MHz	-	-	±3	LSB
D4	Differential non-linearity error	$DNLE_{AD}$		-	-	±3	LSB
D5	Zero transition voltage	-		-20	-	20	mV
D6	Full-scale transition voltage	-		4980	-	5020	mV
D7	A/D conversion time	-		0.5	-	-	μs
D8	Input dynamic range	V_{IA}		V_{SS}	-	V_{DD50}	V
D9	Power supply current during operation	I_{AD}	Conversion clock = 40 MHz	-	2.5	-	mA/unit

1.5.4.2 Programmable Gain Amplifier (VGA)

VGA0, VGA1, VGA2							$V_{DD50} = 5.0$ V, $V_{SS} = 0.0$ V Tc = -40 °C to 110 °C
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D10	Gain	G_{VGA}		2	-	20	times
D11	Gain error	G_{ERR1}	G_{VGA} = 2 to 10 times	-	±0.7	±1.5	%
		G_{ERR2}	G_{VGA} = 20 times	-	±1.2	±2.0	
D12	Output offset voltage	V_{OFFG1}	G_{VGA} = 2 to 10 times	-	±80	±120	mV
		V_{OFFG2}	GVGA = 20 times	-	±130	±180	
D13	Output reference voltage range	V_{REFG}		1.0	-	4.0	V
D14	Output dynamic range	V_{OG}		1.0	-	4.0	
D15	Input dynamic range	V_{IG1}	G_{VGA}=2 times	-1.5	-	1.5	
		V_{IG2}	G_{VGA}=3 times	-1.0	-	1.0	
		V_{IG3}	G_{VGA}=4 times	-0.75	-	0.75	
		V_{IG4}	G_{VGA}=5 times	-0.6	-	0.6	
		V_{IG5}	G_{VGA}=6 times	-0.5	-	0.5	
		V_{IG6}	G_{VGA}=8 times	-0.375	-	0.375	
		V_{IG7}	G_{VGA}=10 times	-0.3	-	0.3	
		V_{IG8}	G_{VGA}=20 times	-0.15	-	0.15	
D16	Power supply current during operation	I_G	G_{VGA}=10 times, $V_{INP}=V_{INN}$=0.0 V	-	2.6	-	mA/ Unit

1.5.4.3   Comparator

CMP00 to CMP21						V_{DD50} = 5.0 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C	
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D17	Input offset voltage	V_{OFFC}		-	-	±20	mV
D18	Input dynamic range	V_{IC}		50	-	4950	
D19	Input hysteresis width	V_{HYSC}	Reference voltage = 2.5 V	-	30	50	
D20	Minimum comparison voltage	V_{MINC}		20	-	-	
D21	Power supply current during operation	I_C		-	0.3	-	mA/Unit

1.5.4.4   D/A Converter

8-bit D/A Converter DACI00 to DACI21, DACV0 to DACV2						V_{DD50} = 5.0 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C	
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D22	Resolution	-		-	-	8	Bits
D23	Integral non-linearity error	$INLE_{DA1}$		-	-	±1	LSB
D24	Differential linearity error	$DNLE_{DA1}$		-	-	±1	
D25	Zero scale voltage	-		-20	-	20	mV
D26	Full scale voltage	-		4960	-	5020	
D27	Power supply current during operation	I_{DA1}		-	0.5	-	mA/Unit

10-bit D/A Converter DACP0, DACP1						V_{DD50} = 5.0 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C	
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D28	Resolution	-		-	-	10	Bits
D29	Integral non-linearity error	$INLE_{DA2}$		-	-	±3	LSB
D30	Differential linearity error	$DNLE_{DA2}$		-	-	±3	
D31	Zero scale voltage	-		-20	-	20	mV
D32	Full scale voltage	-		4980	-	5020	
D33	Power supply current during operation	I_{DA2}		-	0.5	-	mA/Unit

1.5.4.5 Power Supply Voltage Detection (LVD)

				V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V Tc= -40 °C to 110 °C			
	Parameter	Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D34	Power supply voltage detection level	V_{LVDP}	At rising	4.0	4.2	4.4	V
D35		V_{LVDN}	At falling	3.9	4.1	4.3	
D36	Change rate of power supply voltage	ΔV_{DD50P}	At rising	-	-	5	V/ms
D37		ΔV_{DD50N}	At falling	-	-	1	

1.5.4.6 Power-on Reset

				V_{SS} = 0.0 V Tc= -40 °C to 110 °C			
	Parameter	Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D38	Power supply voltage detection level	V_{RST5P}	At rising	2.90	2.95	3.00	V
D39		V_{RST5N}	At falling	2.80	2.85	2.90	
D40	Change rate of power supply voltage	ΔV_{DD50P}	At rising	-	-	5	V/ms
D41		ΔV_{DD50N}	At falling	-	-	1	
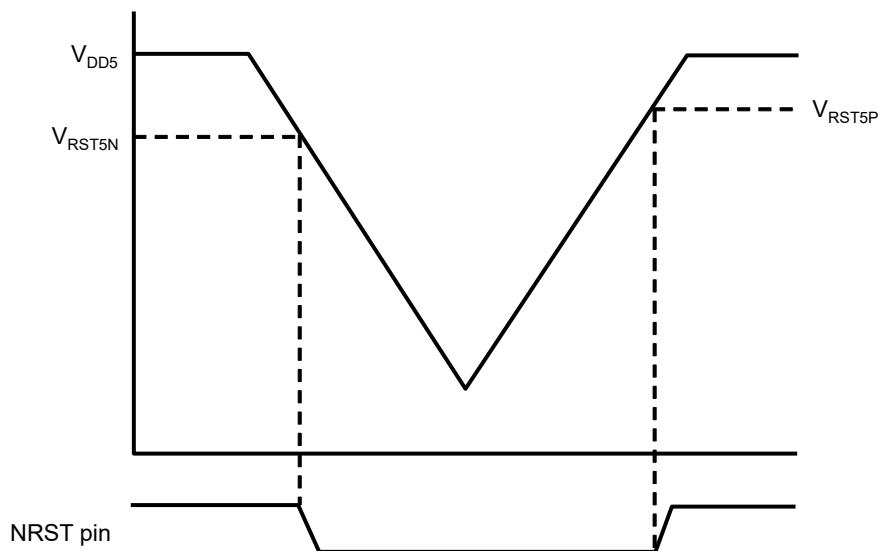
Figure 1.5-3 Characteristics of Power-on Reset Circuit

1.5.4.7 Internal Oscillation

				$V_{DD50} = V_{RST5N}$ to 5.5 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D42	Oscillation frequency	F_{RC}		9	10	11	MHz

1.5.5 AC Characteristics

				$V_{DD50} = V_{RST5N}$ to 5.5 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
E1	Reset signal pulse width	t_{NRSTW}		1	-	-	μs

1.5.6 Flash EEPROM Characteristics

				$V_{DD50} = V_{RST5N}$ to 5.5 V, V_{SS} = 0.0 V Tc = -40 °C to 110 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
F1	Allowable time of re-writing: 1	E_{MAX1}	I-Flash, when the ECC function is enabled	10,000	-	-	times
F2	Allowable time of re-writing: 2	E_{MAX2}	D-Flash, when the ECC function is enabled	100,000	-	-	
F3	Data retention period 1 (*1)	T_{HLD1}	I-Flash After rewriting E_{MAX1} (MIN) times	20	-	-	years
F4	Data retention period 2 (*1)	T_{HLD2}	D-Flash After rewriting E_{MAX2} (MIN) times	5	-	-	

Note:

*1 This includes the time when the power is off.

1.6 Package Dimension

The package dimension is shown in the following order.

- LQFP144-20□

Unit: mm
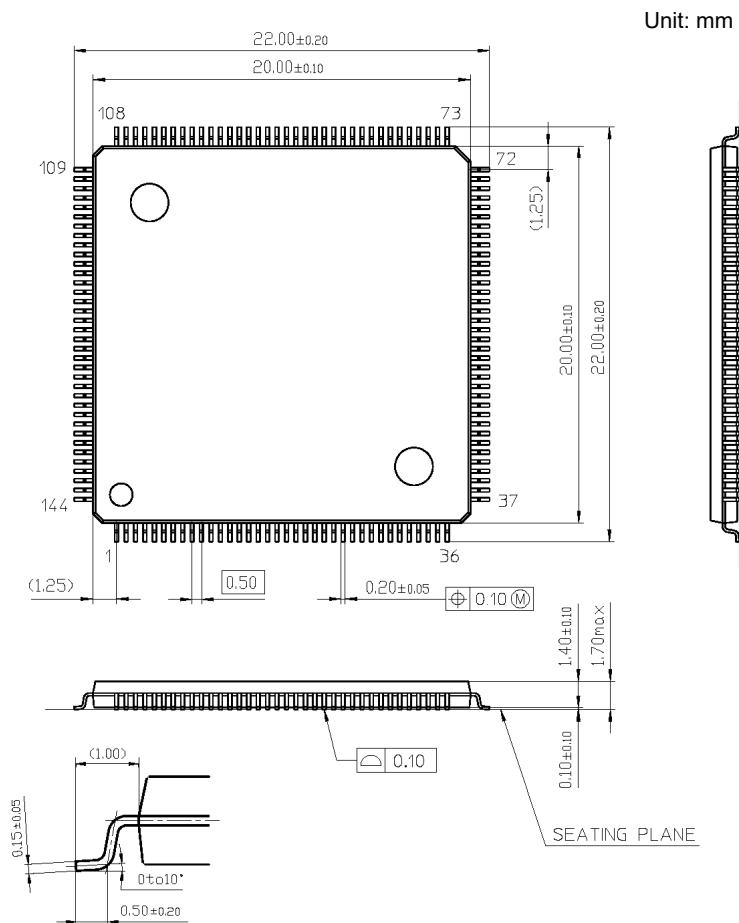

Figure 1.6-1 Package Dimension of LQFP144-20□

- LQFP128-18□

Unit: mm
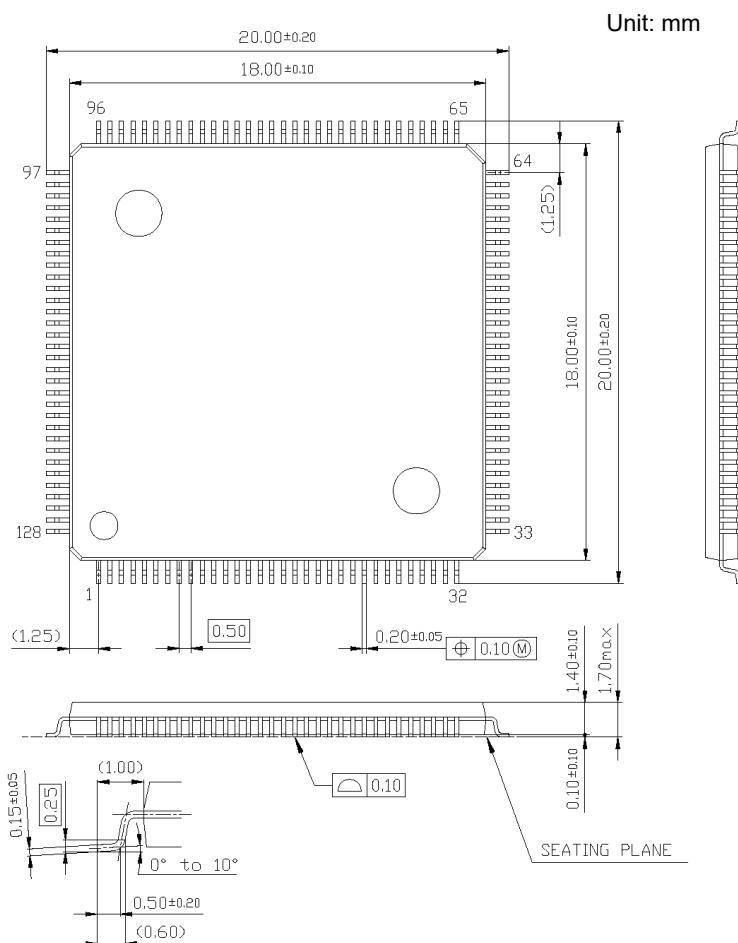
Figure 1.6-2 Package Dimension of LQFP128-18□

• LQFP100-14□
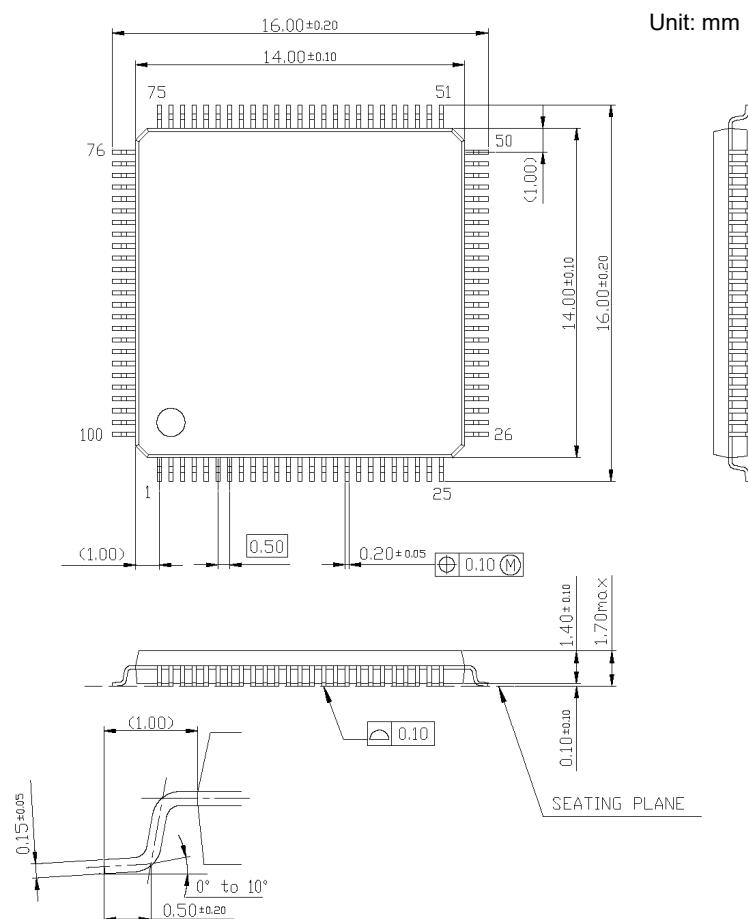
Figure 1.6-3 Package Dimension of LQFP100-14□

- TQFP080-12□

Unit: mm
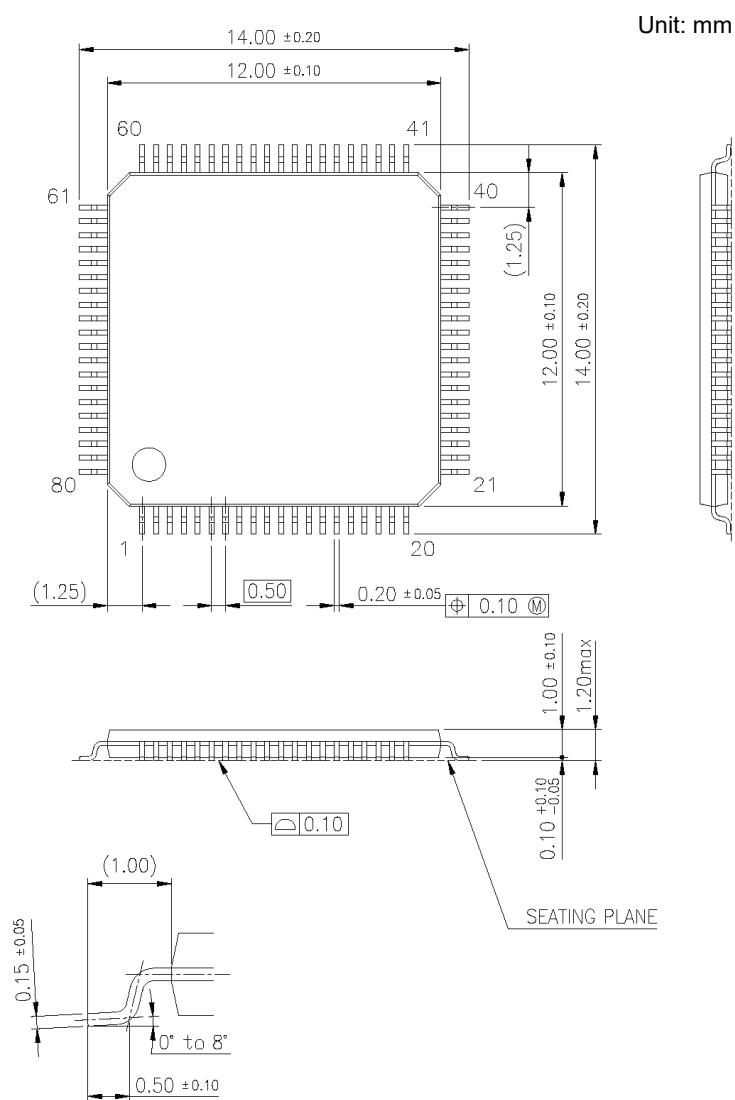
Figure 1.6-4 Package Dimension of TQFP080-12□

- TQFP064-10□

Unit: mm
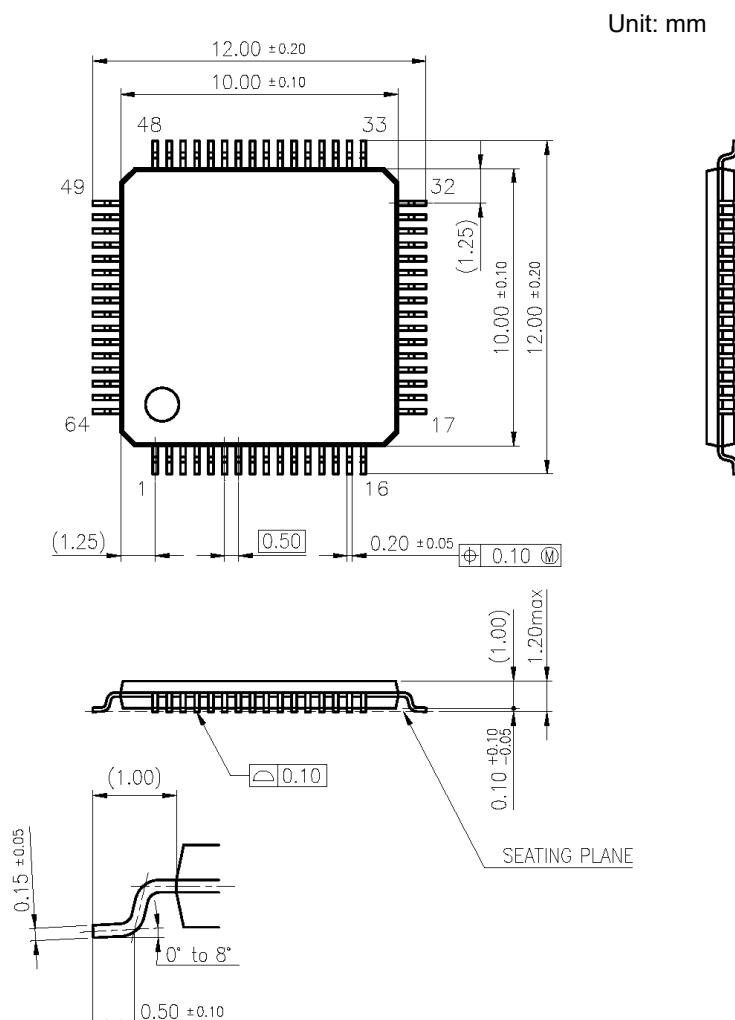
Figure 1.6-5 Package Dimension of TQFP064-10□

Note:

The external dimensions of the package are subject to change. Before using this product, please obtain product specifications from the sales offices.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.