

## 32-bit Microcontroller

# KM103HFB3/B4/B5/B6/B7 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, extended 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 List

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]	VGA	Package
		Instruction	Data	Data		
KM103HFB7K	128	264	32	20	○	128 pins LQFP 18 mm x 18 mm
KM103HFB6K	100	264	32	20	○	100 pins LQFP 14 mm x 14 mm
KM103HFB5K	80	264	32	20	○	80 pins TQFP 12 mm x 12 mm
KM103HFB4K	64	264	32	20	○	64 pins TQFP 10 mm x 10 mm
KM103HFB4G		132	16	16	○	
KM103HFB3K	48	264	32	20	○	48 pins TQFP 7 mm x 7 mm
KM103HFB3G		132	16	16	○	

### Hint:

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

KM103HFByz ( y=3,4,5,6,7 z=K,G )

## 1.2.1 Function Summary

Table 1.2-2 shows the functions of each product.

Table 1.2-2 The List of Function

Function		KM103HFB 7z	KM103HFB 6z	KM103HFB 5z	KM103HFB 4z	KM103HFB 3z
Pins		128 pins	100 pins	80 pins	64 pins	48 pins
CPU		AM32R Extended arithmetic unit				
General purpose pin	I/O	92	74	54	41	25
	Input	8	8	8	6	6
Operation mode	Active mode	NORMAL				
	Standby mode	SLEEP, HALT, STOP				
DMA		2 ch.				
External interrupt		10			7	4
8-bit timer (Timer 0 to 7, 14 to 17)		12 ch.				
16-bit timer	General purpose Timer 8 to 13)	6 ch.			5 ch.	
	Motor control (PWM0,1)	2 ch.				1 ch.
	Power control (GPWM0 to 5)	6 ch.				3 ch.
Communication I/F	Clock-synchronous/UART/IIC (Serial 0)	1 ch.				
	Clock-synchronous/SPI/ UART/LIN (Serial 3)	1 ch.				
	Clock-synchronous/SPI/UART (Serial 4,5)	2 ch.	-			
	Clock-synchronous/UART (Serial 1,2)	2 ch.			1 ch.	-
12-bit A/D	AD0	14 ch.		12 ch.	10 ch.	8 ch.
	AD1	12 ch.		12 ch.	10 ch.	8 ch.
	AD2	16 ch.		10 ch.	-	-
	Total	20 ch.		16 ch.	10 ch.	8 ch.
Programmable gain amplifier (VGA)		2 units / 6 ch.	2 units / 6 ch.	2 units / 6 ch.	2 units / 4 ch.	2 units / 4 ch.
Comparator		4 units / 2 ch.				4 units / 2 ch.
8-bit D/A	For comparator reference volt- age	4 units				4 units
	For VGA reference voltage	2 units	2 units	2 units	2 units	2 units
10-bit D/A		2 units / 2 ch.				

Function		KM103HFB 7z	KM103HFB 6z	KM103HFB 5z	KM103HFB 4z	KM103HFB 3z
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 80 MHz 2 cycles (Min), selectable from 2 to 7 - D-Flash: at 80 MHz 5 cycles (Min), selectable from 2 to 7 - RAM access - D-RAM: at 80MHz 1 cycle (Data access timing), 2 cycles (Instruction access timing) - 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 $\pm$ 10 % - PLL clock - PLL Input: Selectable from External high-speed oscillation or Internal high-speed oscillation - PLL Input frequency: 4 MHz to 20 MHz - PLL Output frequency: 120 MHz to 240MHz - CPU clock (MCLK) - Start with External high-speed oscillation when reset is released - Clock frequency: Selectable from External/Internal/PLL divided by 2, 4 - Peripheral module clock (IOCLK) - Clock frequency: Selectable from External/Internal/PLL 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 sources 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 edges
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 - Sampling clock is selectable

Functions	Features
Watchdog timer	<ul style="list-style-type: none"> <li>- Overflow detect cycle: External high-speed oscillation cycle<math>\times 2^{16}</math> to <math>2^{24}</math></li> <li>- Operation at the time of overflow detection:               <ul style="list-style-type: none"> <li>- First overflow: Generate non-maskable interrupt</li> <li>- Second overflow: Generate overflow error detection reset</li> </ul> </li> </ul>
Watchdog timer 2	<ul style="list-style-type: none"> <li>- Overflow detect cycle: <math>4.20 \mu\text{s}</math>(Internal oscillation)<math>\times 2^7</math> to <math>2^{20}</math></li> <li>- Operation at the time of overflow detection:               <ul style="list-style-type: none"> <li>- First overflow: Generate non-maskable interrupt</li> <li>- Second overflow: Generate overflow error detection reset</li> </ul> </li> </ul>
8-bit timer (Timer 0 to 7, 14 to 17)	<ul style="list-style-type: none"> <li>- Interval timer count, Event count</li> <li>- Timer Output</li> <li>- Cascade connection</li> </ul>
16-bit timer (Timer 8 to 13)	<ul style="list-style-type: none"> <li>- Interval timer count, Event count,</li> <li>- Up-down pulse count, Phase difference pulse count</li> <li>- Timer output, PWM output, 1-shot output</li> <li>- Input capture by external input</li> <li>- Timer count start by start trigger</li> <li>- A/D conversion start trigger output</li> </ul>
Motor control PWM (PWM0,1)	<ul style="list-style-type: none"> <li>- Min. resolution: 12.5ns</li> <li>- Triangular and saw-tooth waves output</li> <li>- Dead time insertion, Output shift</li> <li>- A/D conversion start trigger output</li> <li>- Output protection: H/L/Hi-z output can be selected</li> </ul>
Power control PWM (GPWM0 to 5)	<ul style="list-style-type: none"> <li>- Complementary PWM output (waveform mode: saw-tooth wave, triangular wave)</li> <li>- Dead time insertion, output shift, H/L level output can be set</li> <li>- Synchronous A/D conversion start</li> <li>- Interrupt output control</li> <li>- Output protection: H/L/Hi-z output can be selected</li> <li>- Duty cut, period cut possible</li> <li>- Double buffer update enable function</li> </ul>
Multi Feedback Assist	<ul style="list-style-type: none"> <li>- GPWM0 to 5 start timing can be set individually</li> <li>- Competition detection and automatic avoidance between PWM0 to 1, GPWM0 to 5 output and A/D conversion start</li> <li>- External interrupt and comparator detection mask (blanking) possible for PWM0 to 1 and GPWM0 to 5 output</li> </ul>
Synchronous SIF (Serial 0 to 1)	<ul style="list-style-type: none"> <li>- 3-wire</li> <li>- Transfer bits (2-bit to 8-bit)</li> <li>- MSB/LSB transfer selection</li> </ul>
Synchronous SIF/SPI (Serial 2 to 5)	<ul style="list-style-type: none"> <li>- 2-wire/3-wire/4-wire (Serial 3 to 5 only)</li> <li>- Transfer bits (2-bit to 8-bit)</li> <li>- MSB/LSB transfer selection</li> <li>- Clock polarity selection</li> <li>- Continuous communication</li> <li>- Output level after the final bit transmission(H/L/final data)</li> <li>- Maximum transfer rate 5.0 Mbps</li> </ul>
UART (Serial 0 to 5)	<ul style="list-style-type: none"> <li>- 1-wire (Serial 2 to 5 only)/ 2-wire</li> <li>- Character bits (7-bit/8-bit)</li> <li>- Stop bits (1-bit/2-bit)</li> <li>- Parity bit: Enabled/Disabled, Parity bit type: 0/1/Even parity/Odd parity</li> <li>- MSB/LSB transfer selection</li> </ul>

Functions	Features
IIC (Serial 0)	<ul style="list-style-type: none"> <li>- Master/Slave communication</li> <li>- Start condition select: Enable/Disable</li> <li>- MSB/LSB transfer selection</li> <li>- Transfer format: 7-bit address format</li> <li>- Maximum transfer rate: Standard Mode: 100 kbps, Fast Mode: 400 kbps</li> </ul>
LIN (Serial 3)	<ul style="list-style-type: none"> <li>- Master/Slave communication</li> <li>- Wake-up signal transmission/reception</li> <li>- Synch Break field transmission/reception</li> <li>- Synch field transmission/reception</li> <li>- ID field transmission/reception</li> <li>- Error detection: Check sum error, Bit error, Timeout</li> </ul>
12-bit A/D	<ul style="list-style-type: none"> <li>- Timer 12 to 13, PWM0 to 1, GPWM0 to 5 can be started synchronously</li> <li>- Sample / hold time can be set for each channel</li> <li>- Conversion channel order during continuous conversion can be set arbitrarily</li> <li>- Conversion error detection</li> <li>- Conversion state output</li> <li>- Start trigger reduction function</li> </ul>
VGA	<ul style="list-style-type: none"> <li>- 1unit / 3ch (VGA0 to 1) configuration</li> <li>- Gain selection (2,3,4,5,6,8,10,20 times)</li> <li>- Set Output offset voltage by 8-bit DAC</li> <li>- Offset cancellation by input short-circuit</li> </ul>
Comparator	<ul style="list-style-type: none"> <li>- Hysteresis ON/OFF</li> <li>- Set reference voltage by 8-bit DAC or pin input</li> <li>- Sampling type noise filter is inserted to comparator output</li> <li>- Detection mode can be selected from 1 level / 2 levels or window detection mode</li> </ul>
8-bit D/A	<ul style="list-style-type: none"> <li>- VGA output offset voltage can be generated</li> <li>- Comparator reference voltage can be generated</li> </ul>
10-bit D/A	<ul style="list-style-type: none"> <li>- Output the set DC voltage from a pin</li> </ul>
Safety function	<ul style="list-style-type: none"> <li>- Flash data protection function</li> <li>- Flash-ECC function <ul style="list-style-type: none"> <li>- Check area: I-Flash, D-Flash</li> <li>- 2-bit or more error detection</li> </ul> </li> <li>- RAM-ECC function <ul style="list-style-type: none"> <li>- Check area: Data RAM,</li> <li>- 2-bit or more error detection</li> </ul> </li> <li>- Memory access control function <ul style="list-style-type: none"> <li>Write enable/disable to Data RAM</li> </ul> </li> <li>- Register protection function</li> <li>- WDT function</li> <li>- Clock monitor function</li> <li>- CRC calculation function <ul style="list-style-type: none"> <li>CRC-8-ATM, CRC-16-CCITT, CRC-16, CRC-32/MPEG symbol can be generated</li> </ul> </li> <li>- ADC fault diagnosis function using internal power supply</li> <li>- Power supply voltage fall detection function <ul style="list-style-type: none"> <li>Falling detection level: 3.9 V</li> </ul> </li> <li>- Identifying reset factor</li> </ul>

## 1.4 Pins

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

- Pin Configuration
- Pin Functions

### 1.4.1 Pin Configuration

The pin configuration diagram of each series is shown in the following order.

- Pin Configuration Figure of KM103HFB7 Series (128 pins) (Figure 1.4-1 )
- Pin Configuration Figure of KM103HFB6 Series (100 pins) (Figure 1.4-2 )
- Pin Configuration Figure of KM103HFB5 Series (80 pins) (Figure 1.4-3 )
- Pin Configuration Figure of KM103HFB4 Series (64 pins) (Figure 1.4-4 )
- Pin Configuration Figure of KM103HFB3 Series (48 pins) (Figure 1.4-5 )



### 1.4.1.1 Pin Configuration Figure of KM103HFB7 Series (128 pins)

Figure 1.4-1 shows pin configuration figure of KM103HFB7 series (128 pins).

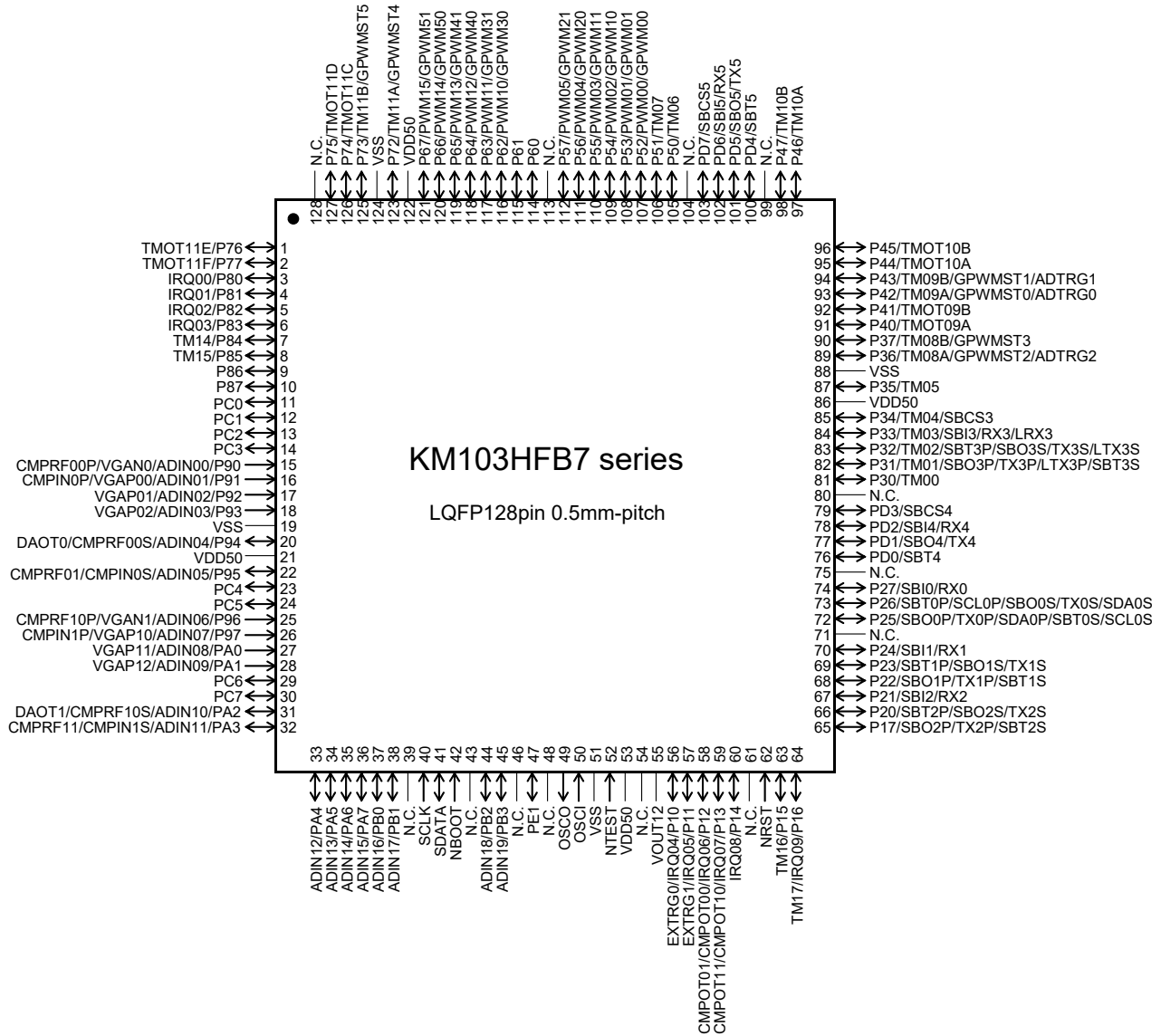


Figure 1.4-1 Pin Configuration Figure of KM103HFB7 Series (128 pins)

### 1.4.1.2 Pin Configuration Figure of KM103HFB6 Series (100 pins)

Figure 1.4-2 shows pin configuration figure of KM103HFB6 series (100 pins).

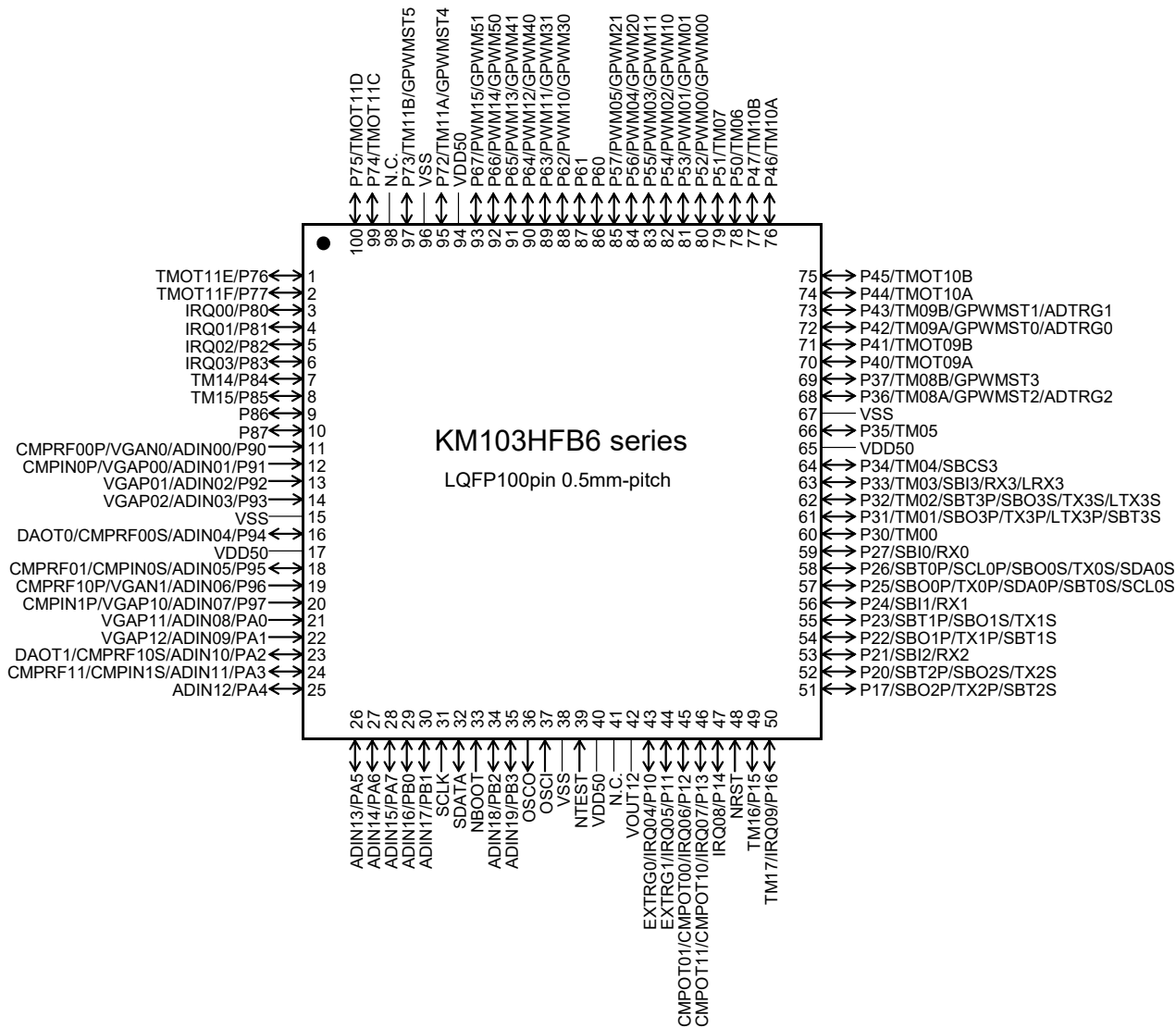


Figure 1.4-2 Pin Configuration Figure of KM103HFB6 Series (100 pins)

### 1.4.1.3 Pin Configuration Figure of KM103HFB5 Series (80 pins)

Figure 1.4-3 shows pin configuration figure of KM103HFB5 series (80 pins).

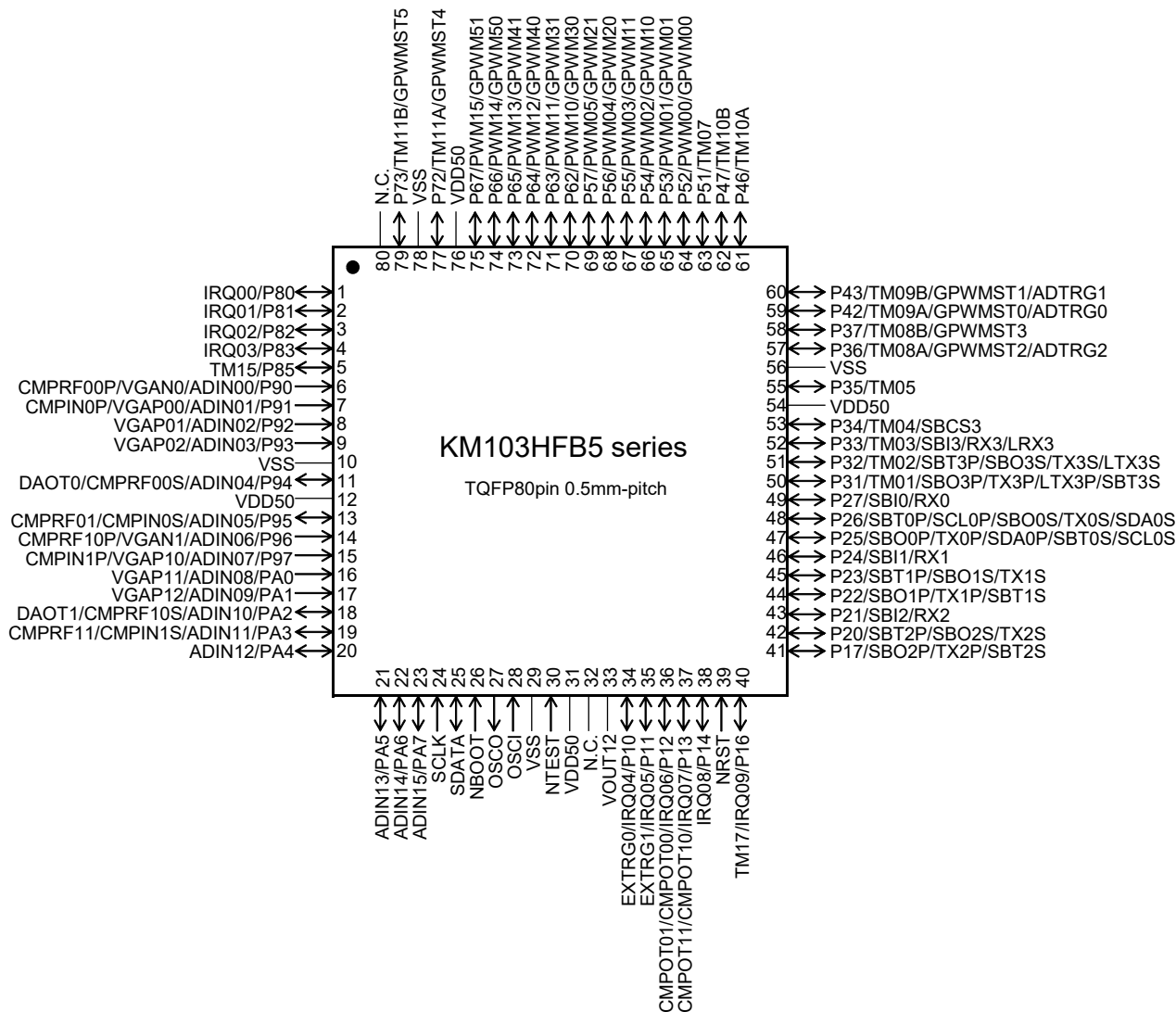


Figure 1.4-3 Pin Configuration Figure of KM103HFB5 Series (80 pins)

### 1.4.1.4 Pin Configuration Figure of KM103HFB4 Series (64 pins)

Figure 1.4-4 shows Pin Configuration Figure of KM103HFB4 Series (64 pins).

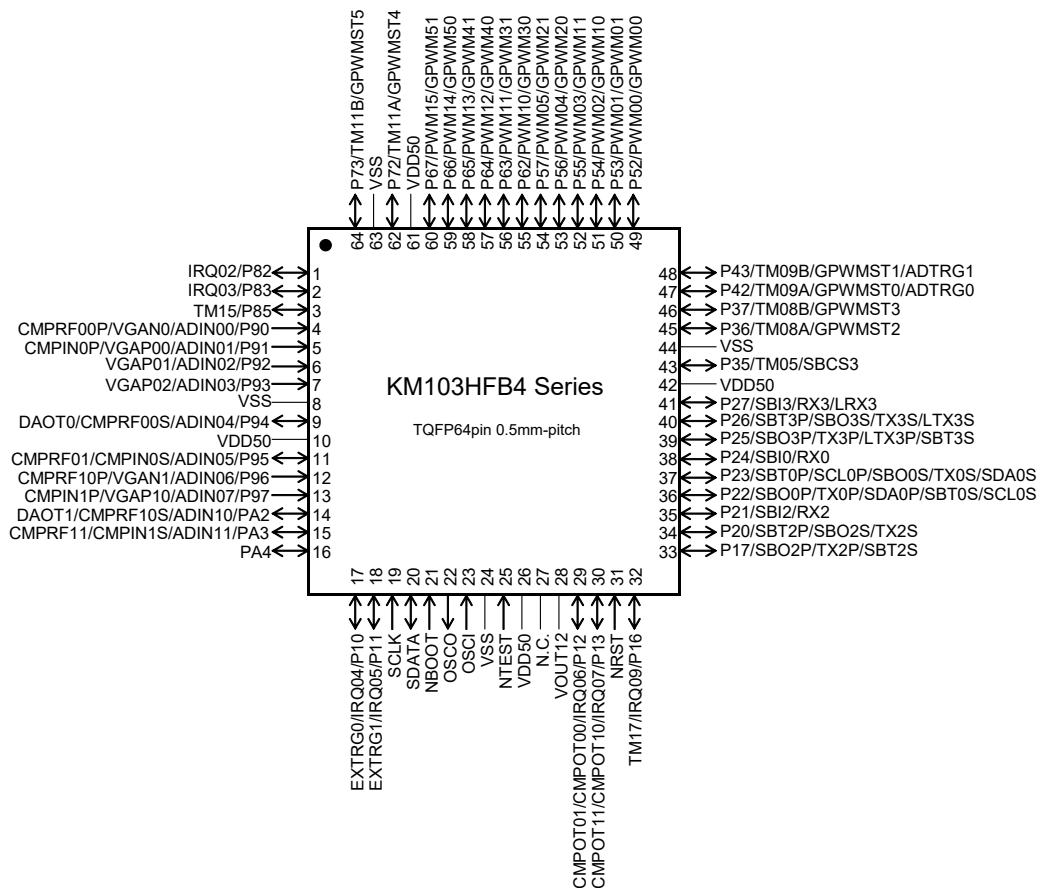


Figure 1.4-4 Pin Configuration Figure of KM103HFB4 Series (64 pins)

### 1.4.1.5 Pin Configuration Figure of KM103HFB3 Series (48 pins)

Figure 1.4-5 shows pin configuration figure of KM103HFB3 series (48 pins).

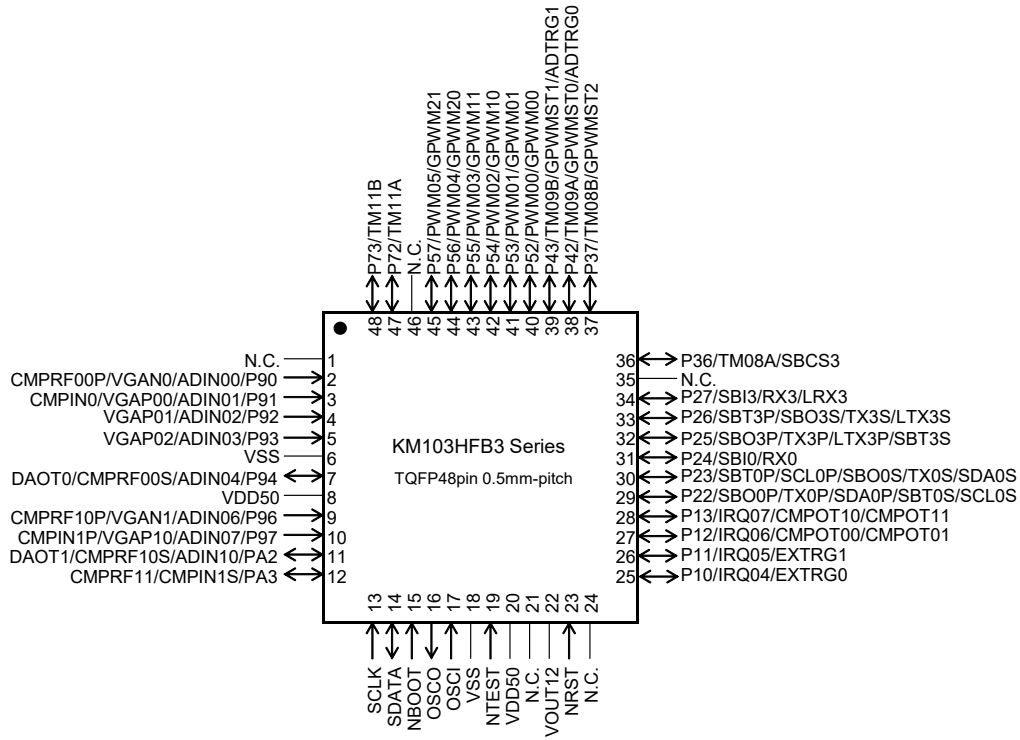


Figure 1.4-5 Pin Configuration Figure of KM103HFB3 Series (48 pins)

## 1.4.2 Pin Functions

The pin function table of each series is shown in the following order.

- Pin Functions of KM103HFB7 Series ([Table 1.4-1](#))
- Pin Functions of KM103HFB6 Series ([Table 1.4-2](#))
- Pin Functions of KM103HFB5 Series ([Table 1.4-3](#))
- Pin Functions of KM103HFB4 Series ([Table 1.4-4](#))
- Pin Functions of KM103HFB3 Series ([Table 1.4-5](#))

### 1.4.2.1 Pin Functions of KM103HFB7 Series

The pin functions are listed in [Table 1.4-1](#).

Table 1.4-1 Pin Functions (KM103HFB7)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	21	Input	-
		53		
		86		
		122		
Power pin for internal circuit	VOUT12	55	Output	-
GND	VSS	19	Input	-
		51		
		88		
		124		
External oscillation input pin	OSCI	50	Input	-
External oscillation output pin	OSCO	49	Output	-
Reset	NRST	62	Input	-
Mode	NTEST	52	Input	-
	NBOOT	42	Input	-
External interrupt	IRQ00	3	Input	P80
	IRQ01	4	Input	P81
	IRQ02	5	Input	P82
	IRQ03	6	Input	P83
	IRQ04	56	Input	P10/EXTRG0
	IRQ05	57	Input	P11/EXTRG1
	IRQ06	58	Input	P12/CMPOT00/CMPOT01
	IRQ07	59	Input	P13/CMPOT10/CMPOT11
	IRQ08	60	Input	P14
	IRQ09	64	Input	P16/TM17
8-bit timer	TM00	81	I/O	P30
	TM01	82	I/O	P31/SBO3P/TX3P/LTX3P/SBT3S
	TM02	83	I/O	P32/SBT3P/SBO3S/TX3S/LTX3S
	TM03	84	I/O	P33/TM03/SBI3/RX3/LRX3
	TM04	85	I/O	P34/SBCS3
	TM05	87	I/O	P35
	TM06	105	I/O	P50
	TM07	106	I/O	P51
	TM14	7	I/O	P84
	TM15	8	I/O	P85
	TM16	63	I/O	P15
	TM17	64	I/O	P16/IRQ09

Functions	Pin name	Pin No.	I/O	Other Pins
16-bit timer	TM08A	89	I/O	P36/GPWMST2/ADTRG2
	TM08B	90	I/O	P37/GPWMST3
	TM09A	93	I/O	P42/GPWMST0/ADTRG0
	TM09B	94	I/O	P43/GPWMST1/ADTRG1
	TMOT09A	91	Output	P40
	TMOT09B	92	Output	P41
	TM10A	97	I/O	P46
	TM10B	98	I/O	P47
	TMOT10A	95	Output	P44
	TMOT10B	96	Output	P45
	TM11A	123	I/O	P72/GPWMST4
	TM11B	125	I/O	P73/GPWMST5
	TMOT11C	126	Output	P74
	TMOT11D	127	Output	P75
	TMOT11E	1	Output	P76
	TMOT11F	2	Output	P77
Motor control PWM	PWM00	107	Output	P52/GPWM00
	PWM01	108	Output	P53/GPWM01
	PWM02	109	Output	P54/GPWM10
	PWM03	110	Output	P55/GPWM11
	PWM04	111	Output	P56/GPWM20
	PWM05	112	Output	P57/GPWM21
	PWM10	116	Output	P62/GPWM30
	PWM11	117	Output	P63/GPWM31
	PWM12	118	Output	P64/GPWM40
	PWM13	119	Output	P65/GPWM41
	PWM14	120	Output	P66/GPWM50
	PWM15	121	Output	P67/GPWM51



Functions	Pin name	Pin No.	I/O	Other Pins
Power control PWM	GPWM00	107	Output	P52/PWM00
	GPWM01	108	Output	P53/PWM01
	GPWM10	109	Output	P54/PWM02
	GPWM11	110	Output	P55/PWM03
	GPWM20	111	Output	P56/PWM04
	GPWM21	112	Output	P57/PWM05
	GPWM30	116	Output	P62/PWM10
	GPWM31	117	Output	P63/PWM11
	GPWM40	118	Output	P64/PWM12
	GPWM41	119	Output	P65/PWM13
	GPWM50	120	Output	P66/PWM14
	GPWM51	121	Output	P67/PWM15
	GPWMST0	93	Output	P42/TM09A/ADTRG0
	GPWMST1	94	Output	P43/TM09B/ADTRG1
	GPWMST2	89	Output	P36/TM08A/ADTRG2
	GPWMST3	90	Output	P37/TM08B
	GPWMST4	123	Output	P72/TM11A
	GPWMST5	125	Output	P73/TM11B

Functions	Pin name	Pin No.	I/O	Other Pins
Clock-synchronous SIF/SPI	SBO0P	72	I/O	P25/TX0P/SDA0P/SBT0S/SCL0S
	SBT0P	73	I/O	P26/SCL0P/SBO0S/TX0S/SDA0S
	SBO0S	73	I/O	P26/SBT0P/SCL0P/TX0S/SDA0S
	SBT0S	72	I/O	P25/SBO0P/TX0P/SDA0P/SCL0S
	SBI0	74	Input	P27/RX0
	SBO1P	68	I/O	P22/TX1P/SBT1S
	SBT1P	69	I/O	P23/SBO1S/TX1S
	SBO1S	69	I/O	P23/SBT1P/TX1S
	SBT1S	68	I/O	P22/SBO1P/TX1P
	SBI1	70	Input	P24/RX1
	SBO2P	65	I/O	P17/TX2P/SBT2S
	SBT2P	66	I/O	P20/SBO2S/TX2S
	SBO2S	66	I/O	P20/SBT2P/TX2S
	SBT2S	65	I/O	P17/SBO2P/TX2P
	SBI2	67	Input	P21/RX2
	SBCS3	85	I/O	P34/TM04
	SBO3P	82	I/O	P31/TM01/TX3P/LTX3P/SBT3S
	SBT3P	83	I/O	P32/TM02/SBO3S/TX3S/LTX3S
	SBO3S	83	I/O	P32/TM02/SBT3P/TX3S/LTX3S
	SBT3S	82	I/O	P31/TM01/SBO3P/TX3P/LTX3P
	SBI3	84	Input	P33/TM03/RX3/LRX3
	SBCS4	79	I/O	PD3
	SBO4	77	I/O	PD1/TX4
	SBT4	76	I/O	PD0
	SBI4	78	Input	PD2/RX4
	SBCS5	103	I/O	PD7
SBO5	101	I/O	PD5/TX5	
SBT5	100	I/O	PD4	
SBI5	102	Input	PD6/RX5	
UART	TX0P	72	I/O	P25/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	73	I/O	P26/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	74	Input	P27/SBI0
	TX1P	68	I/O	P22/SBO1P/SBT1S
	TX1S	69	I/O	P23/SBT1P/SBO1S
	RX1	70	Input	P24/SBI1
	TX2P	65	I/O	P17/SBO2P/SBT2S
	TX2S	66	I/O	P20/SBT2P/SBO2S
	RX2	67	Input	P21/SBI2

Functions	Pin name	Pin No.	I/O	Other Pins
UART	TX3P	82	I/O	P31/TM01/SBO3P/LTX3P/SBT3S
	TX3S	83	I/O	P32/TM02/SBT3P/SBO3S/LTX3S
	RX3	84	Input	P33/TM03/SBI3/LRX3
	TX4	77	I/O	PD1/SBO4
	RX4	78	Input	PD2/SBI4
	TX5	101	I/O	PD5/SBO5
	RX5	102	Input	PD6/SBI5
LIN	LTX3P	82	Output	P31/TM01/SBO3P/TX3P/SBT3S
	LTX3S	83	Output	P32/TM02/SBT3P/SBO3S/TX3S
	LRX3	84	Input	P33/TM03/SBI3/RX3
IIC	SDA0P	72	I/O	P25/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	73	I/O	P26/SBT0P/SBO0S/TX0S/SDA0S
	SDA0S	73	I/O	P26/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	72	I/O	P25/SBO0P/TX0P/SDA0P/SBT0S
A/D input	ADIN00	15	Input	P90/VGAN0/CMPRF00P
	ADIN01	16	Input	P91/VGAP00/CMPIN0P
	ADIN02	17	Input	P92/VGAP01
	ADIN03	18	Input	P93/VGAP02
	ADIN04	20	Input	P94/CMPRF00S/DAOT0
	ADIN05	22	Input	P95/CMPIN0S/CMPRF01
	ADIN06	25	Input	P96/VGAN1/CMPRF10P
	ADIN07	26	Input	P97/VGAP10/CMPIN1P
	ADIN08	27	Input	PA0/VGAP11
	ADIN09	28	Input	PA1/VGAP12
	ADIN10	31	Input	PA2/CMPRF10S/DAOT1
	ADIN11	32	Input	PA3/CMPIN1S/CMPRF11
	ADIN12	33	Input	PA4
	ADIN13	34	Input	PA5
	ADIN14	35	Input	PA6
	ADIN15	36	Input	PA7
	ADIN16	37	Input	PB0
	ADIN17	38	Input	PB1
	ADIN18	44	Input	PB2
ADIN19	45	Input	PB3	
A/D monitor	ADTRG0	93	Output	P42/TM09A/GPWMST0
	ADTRG1	94	Output	P43/TM09B/GPWMST1
	ADTRG2	89	Output	P36/TM08A/GPWMST2
VGA input	VGAN0	15	Input	P90/ADIN00/CMPRF00P
	VGAP00	16	Input	P91/ADIN01/CMPIN0P
	VGAP01	17	Input	P92/ADIN02
	VGAP02	18	Input	P93/ADIN03

Functions	Pin name	Pin No.	I/O	Other Pins
VGA input	VGAN1	25	Input	P96/ADIN06/CMPRF10P
	VGAP10	26	Input	P97/ADIN07/CMPIN1P
	VGAP11	27	Input	PA0/ADIN08
	VGAP12	28	Input	PA1/ADIN09
Comparator input	CMPIN0P	16	Input	P91/ADIN01/VGAP00
	CMPIN0S	22	Input	P95/ADIN05/CMPRF01
	CMPIN1P	26	Input	P97/ADIN07/VGAP10
	CMPIN1S	32	Input	PA3/ADIN11/CMPRF11
	CMPRF00P	15	Input	P90/ADIN00/VGAN0
	CMPRF00S	20	Input	P94/ADIN04/DAOT0
	CMPRF01	22	Input	P95/ADIN05/CMPIN0S
	CMPRF10P	25	Input	P96/ADIN06/VGAN1
	CMPRF10S	31	Input	PA2/ADIN10/DAOT1
	CMPRF11	32	Input	PA3/ADIN11/CMPIN1S
Comparator output	CMPOT00	58	Output	P12/IRQ06/CMPOT01
	CMPOT01	58	Output	P12/IRQ06/CMPOT00
	CMPOT10	59	Output	P13/IRQ07/CMPOT11
	CMPOT11	59	Output	P13/IRQ07/CMPOT10
D/A output	DAOT0	20	Output	P94/ADIN04/CMPRF00S
	DAOT1	31	Output	PA2/ADIN10/CMPRF10S
I/O port	P10	56	I/O	IRQ04/EXTRG0
	P11	57	I/O	IRQ05/EXTRG1
	P12	58	I/O	IRQ06/CMPOT00/CMPOT01
	P13	59	I/O	IRQ07/CMPOT10/CMPOT11
	P14	60	I/O	IRQ08
	P15	63	I/O	TM16
	P16	64	I/O	IRQ09/TM17
	P17	65	I/O	SBO2P/TX2P/SBT2S
	P20	66	I/O	SBT2P/SBO2S/TX2S
	P21	67	I/O	SBI2/RX2
	P22	68	I/O	SBO1P/TX1P/SBT1S
	P23	69	I/O	SBT1P/SBO1S/TX1S
	P24	70	I/O	SBI1/RX1
	P25	72	I/O	SBO0P/TX0P/SDA0P/SBT0S/SCL0S
	P26	73	I/O	SBT0P/SCL0P/SBO0S/TX0S/SDA0S
	P27	74	I/O	SBI0/RX0
	P30	81	I/O	TM00
	P31	82	I/O	TM01/SBO3P/TX3P/LTX3P/SBT3S
	P32	83	I/O	TM02/SBT3P/SBO3S/TX3S/LTX3S
	P33	84	I/O	TM03/SBI3/RX3/LRX3
P34	85	I/O	TM04/SBCS3	

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P35	87	I/O	TM05
	P36	89	I/O	TM08A/GPWMST2/ADTRG2
	P37	90	I/O	TM08B/GPWMST3
	P40	91	I/O	TMOT09A
	P41	92	I/O	TMOT09B
	P42	93	I/O	TM09A/GPWMST0/ADTRG0
	P43	94	I/O	TM09B/GPWMST1/ADTRG1
	P44	95	I/O	TMOT10A
	P45	96	I/O	TMOT10B
	P46	97	I/O	TM10A
	P47	98	I/O	TM10B
	P50	105	I/O	TM06
	P51	106	I/O	TM07
	P52	107	I/O	PWM00/GPWM00
	P53	108	I/O	PWM01/GPWM01
	P54	109	I/O	PWM02/GPWM10
	P55	110	I/O	PWM03/GPWM11
	P56	111	I/O	PWM04/GPWM20
	P57	112	I/O	PWM05/GPWM21
	P60	114	I/O	-
	P61	115	I/O	-
	P62	116	I/O	PWM10/GPWM30
	P63	117	I/O	PWM11/GPWM31
	P64	118	I/O	PWM12/GPWM40
	P65	119	I/O	PWM13/GPWM41
	P66	120	I/O	PWM14/GPWM50
	P67	121	I/O	PWM15/GPWM51
	P72	123	I/O	TM11A/GPWMST4
	P73	125	I/O	TM11B/GPWMST5
	P74	126	I/O	TMOT11C
	P75	127	I/O	TMOT11D
	P76	1	I/O	TMOT11E
	P77	2	I/O	TMOT11F
	P80	3	I/O	IRQ00
	P81	4	I/O	IRQ01
	P82	5	I/O	IRQ02
	P83	6	I/O	IRQ03
P84	7	I/O	TM14	
P85	8	I/O	TM15	
P86	9	I/O	-	
P87	10	I/O	-	

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P90	15	Input	ADIN00/VGAN0/CMPRF00P
	P91	16	Input	ADIN01/VGAP00/CMPIN0P
	P92	17	Input	ADIN02/VGAP01
	P93	18	Input	ADIN03/VGAP02
	P94	20	I/O	ADIN04/CMPRF00S/DAOT0
	P95	22	I/O	ADIN05/CMPIN0S/CMPRF01
	P96	25	Input	ADIN06/VGAN1/CMPRF10P
	P97	26	Input	ADIN07/VGAP10/CMPIN1P
	PA0	27	Input	ADIN08/VGAP11
	PA1	28	Input	ADIN09/VGAP12
	PA2	31	I/O	ADIN10/CMPRF10S/DAOT1
	PA3	32	I/O	ADIN11/CMPIN1S/CMPRF11
	PA4	33	I/O	ADIN12
	PA5	34	I/O	ADIN13
	PA6	35	I/O	ADIN14
	PA7	36	I/O	ADIN15
	PB0	37	I/O	ADIN16
	PB1	38	I/O	ADIN17
	PB2	44	I/O	ADIN18
	PB3	45	I/O	ADIN19
	PC0	11	I/O	-
	PC1	12	I/O	-
	PC2	13	I/O	-
	PC3	14	I/O	-
	PC4	23	I/O	-
	PC5	24	I/O	-
	PC6	29	I/O	-
	PC7	30	I/O	-
	PD0	76	I/O	SBT4
	PD1	77	I/O	SBO4/TX4
	PD2	78	I/O	SBI4/RX4
	PD3	79	I/O	SBCS4
	PD4	100	I/O	SBT5
	PD5	101	I/O	SBO5/TX5
PD6	102	I/O	SBI5/RX5	
PD7	103	I/O	SBCS5	
PE1	47	I/O	-	
Onboard debugger	SCLK	40	Input	-
	SDATA	41	I/O	-
	EXTRG1	57	I/O	P11/IRQ05
	EXTRG0	56	I/O	P10/IRQ04

### 1.4.2.2 Pin Functions of KM103HFB6 Series

The pin functions are listed in [Table 1.4-2](#).

Table 1.4-2 Pin Functions (KM103HFB6)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	17	Input	-
		40		
		65		
		94		
Power pin for internal circuit	VOUT12	42	Output	-
GND	VSS	15	Input	-
		38		
		67		
		96		
External oscillation input pin	OSCI	37	Input	-
External oscillation output pin	OSCO	36	Output	-
Reset	NRST	48	Input	-
Mode	NTEST	39	Input	-
	NBOOT	33	Input	-
External interrupt	IRQ00	3	Input	P80
	IRQ01	4	Input	P81
	IRQ02	5	Input	P82
	IRQ03	6	Input	P83
	IRQ04	43	Input	P10/EXTRG0
	IRQ05	44	Input	P11/EXTRG1
	IRQ06	45	Input	P12/CMPOT00/CMPOT01
	IRQ07	46	Input	P13/CMPOT10/CMPOT11
	IRQ08	47	Input	P14
	IRQ09	50	Input	P16/TM17
8-bit timer	TM00	60	I/O	P30
	TM01	61	I/O	P31/SBO3P/TX3P/LTX3P/SBT3S
	TM02	62	I/O	P32/SBT3P/SBO3S/TX3S/LTX3S
	TM03	63	I/O	P33/TM03/SBI3/RX3/LRX3
	TM04	64	I/O	P34/SBCS3
	TM05	66	I/O	P35
	TM06	78	I/O	P50
	TM07	79	I/O	P51
	TM14	7	I/O	P84
	TM15	8	I/O	P85
	TM16	49	I/O	P15
	TM17	50	I/O	P16/IRQ09

Functions	Pin name	Pin No.	I/O	Other Pins
16-bit timer	TM08A	68	I/O	P36/GPWMST2/ADTRG2
	TM08B	69	I/O	P37/GPWMST3
	TM09A	72	I/O	P42/GPWMST0/ADTRG0
	TM09B	73	I/O	P43/GPWMST1/ADTRG1
	TMOT09A	70	Output	P40
	TMOT09B	71	Output	P41
	TM10A	76	I/O	P46
	TM10B	77	I/O	P47
	TMOT10A	74	Output	P44
	TMOT10B	75	Output	P45
	TM11A	95	I/O	P72/GPWMST4
	TM11B	97	I/O	P73/GPWMST5
	TMOT11C	99	Output	P74
	TMOT11D	100	Output	P75
	TMOT11E	1	Output	P76
	TMOT11F	2	Output	P77
Motor control PWM	PWM00	80	Output	P52/GPWM00
	PWM01	81	Output	P53/GPWM01
	PWM02	82	Output	P54/GPWM10
	PWM03	83	Output	P55/GPWM11
	PWM04	84	Output	P56/GPWM20
	PWM05	85	Output	P57/GPWM21
	PWM10	88	Output	P62/GPWM30
	PWM11	89	Output	P63/GPWM31
	PWM12	90	Output	P64/GPWM40
	PWM13	91	Output	P65/GPWM41
	PWM14	92	Output	P66/GPWM50
	PWM15	93	Output	P67/GPWM51



Functions	Pin name	Pin No.	I/O	Other Pins
Power control PWM	GPWM00	80	Output	P52/PWM00
	GPWM01	81	Output	P53/PWM01
	GPWM10	82	Output	P54/PWM02
	GPWM11	83	Output	P55/PWM03
	GPWM20	84	Output	P56/PWM04
	GPWM21	85	Output	P57/PWM05
	GPWM30	88	Output	P62/PWM10
	GPWM31	89	Output	P63/PWM11
	GPWM40	90	Output	P64/PWM12
	GPWM41	91	Output	P65/PWM13
	GPWM50	92	Output	P66/PWM14
	GPWM51	93	Output	P67/PWM15
	GPWMST0	72	Output	P42/TM09A/ADTRG0
	GPWMST1	73	Output	P43/TM09B/ADTRG1
	GPWMST2	68	Output	P36/TM08A/ADTRG2
	GPWMST3	69	Output	P37/TM08B
	GPWMST4	95	Output	P72/TM11A
	GPWMST5	97	Output	P73/TM11B
Clock-synchronous SIF/SPI	SBO0P	57	I/O	P25/TX0P/SDA0P/SBT0S/SCL0S
	SBT0P	58	I/O	P26/SCL0P/SBO0S/TX0S/SDA0S
	SBO0S	58	I/O	P26/SBT0P/SCL0P/TX0S/SDA0S
	SBT0S	57	I/O	P25/SBO0P/TX0P/SDA0P/SCL0S
	SBI0	59	Input	P27/RX0
	SBO1P	54	I/O	P22/TX1P/SBT1S
	SBT1P	55	I/O	P23/SBO1S/TX1S
	SBO1S	55	I/O	P23/SBT1P/TX1S
	SBT1S	54	I/O	P22/SBO1P/TX1P
	SBI1	56	Input	P24/RX1
	SBO2P	51	I/O	P17/TX2P/SBT2S
	SBT2P	52	I/O	P20/SBO2S/TX2S
	SBO2S	52	I/O	P20/SBT2P/TX2S
	SBT2S	51	I/O	P17/SBO2P/TX2P
	SBI2	53	Input	P21/RX2
	SBCS3	64	I/O	P34/TM04
	SBO3P	61	I/O	P31/TM01/TX3P/LTX3P/SBT3S
	SBT3P	62	I/O	P32/TM02/SBO3S/TX3S/LTX3S
	SBO3S	62	I/O	P32/TM02/SBT3P/TX3S/LTX3S
	SBT3S	61	I/O	P31/TM01/SBO3P/TX3P/LTX3P
SBI3	63	Input	P33/TM03/RX3/LRX3	

Functions	Pin name	Pin No.	I/O	Other Pins
UART	TX0P	57	I/O	P25/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	58	I/O	P26/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	59	Input	P27/SBI0
	TX1P	54	I/O	P22/SBO1P/SBT1S
	TX1S	55	I/O	P23/SBT1P/SBO1S
	RX1	56	Input	P24/SBI1
	TX2P	51	I/O	P17/SBO2P/SBT2S
	TX2S	52	I/O	P20/SBT2P/SBO2S
	RX2	53	Input	P21/SBI2
	TX3P	61	I/O	P31/TM01/SBO3P/LTX3P/SBT3S
	TX3S	62	I/O	P32/TM02/SBT3P/SBO3S/LTX3S
	RX3	63	Input	P33/TM03/SBI3/LRX3
LIN	LTX3P	61	Output	P31/TM01/SBO3P/TX3P/SBT3S
	LTX3S	62	Output	P32/TM02/SBT3P/SBO3S/TX3S
	LRX3	63	Input	P33/TM03/SBI3/RX3
IIC	SDA0P	57	I/O	P25/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	58	I/O	P26/SBT0P/SBO0S/TX0S/SDA0S
	SDA0S	58	I/O	P26/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	57	I/O	P25/SBO0P/TX0P/SDA0P/SBT0S
A/D input	ADIN00	11	Input	P90/VGAN0/CMPRF00P
	ADIN01	12	Input	P91/VGAP00/CMPIN0P
	ADIN02	13	Input	P92/VGAP01
	ADIN03	14	Input	P93/VGAP02
	ADIN04	16	Input	P94/CMPRF00S/DAOT0
	ADIN05	18	Input	P95/CMPIN0S/CMPRF01
	ADIN06	19	Input	P96/VGAN1/CMPRF10P
	ADIN07	20	Input	P97/VGAP10/CMPIN1P
	ADIN08	21	Input	PA0/VGAP11
	ADIN09	22	Input	PA1/VGAP12
	ADIN10	23	Input	PA2/CMPRF10S/DAOT1
	ADIN11	24	Input	PA3/CMPIN1S/CMPRF11
	ADIN12	25	Input	PA4
	ADIN13	26	Input	PA5
	ADIN14	27	Input	PA6
	ADIN15	28	Input	PA7
	ADIN16	29	Input	PB0
	ADIN17	30	Input	PB1
	ADIN18	34	Input	PB2
ADIN19	35	Input	PB3	

Functions	Pin name	Pin No.	I/O	Other Pins
A/D monitor	ADTRG0	72	Output	P42/TM09A/GPWMST0
	ADTRG1	73	Output	P43/TM09B/GPWMST1
	ADTRG2	68	Output	P36/TM08A/GPWMST2
VGA input	VGAN0	11	Input	P90/ADIN00/CMPRF00P
	VGAP00	12	Input	P91/ADIN01/CMPIN0P
	VGAP01	13	Input	P92/ADIN02
	VGAP02	14	Input	P93/ADIN03
	VGAN1	19	Input	P96/ADIN06/CMPRF10P
	VGAP10	20	Input	P97/ADIN07/CMPIN1P
	VGAP11	21	Input	PA0/ADIN08
	VGAP12	22	Input	PA1/ADIN09
Comparator input	CMPIN0P	12	Input	P91/ADIN01/VGAP00
	CMPIN0S	18	Input	P95/ADIN05/CMPRF01
	CMPIN1P	20	Input	P97/ADIN07/VGAP10
	CMPIN1S	24	Input	PA3/ADIN11/CMPRF11
	CMPRF00P	11	Input	P90/ADIN00/VGAN0
	CMPRF00S	16	Input	P94/ADIN04/DAOT0
	CMPRF01	18	Input	P95/ADIN05/CMPIN0S
	CMPRF10P	19	Input	P96/ADIN06/VGAN1
	CMPRF10S	23	Input	PA2/ADIN10/DAOT1
	CMPRF11	24	Input	PA3/ADIN11/CMPIN1S
Comparator output	COMPOT00	45	Output	P12/IRQ06/COMPOT01
	COMPOT01	45	Output	P12/IRQ06/COMPOT00
	COMPOT10	46	Output	P13/IRQ07/COMPOT11
	COMPOT11	46	Output	P13/IRQ07/COMPOT10
D/A output	DAOT0	16	Output	P94/ADIN04/CMPRF00S
	DAOT1	23	Output	PA2/ADIN10/CMPRF10S

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P10	43	I/O	IRQ04/EXTRG0
	P11	44	I/O	IRQ05/EXTRG1
	P12	45	I/O	IRQ06/CMPOT00/CMPOT01
	P13	46	I/O	IRQ07/CMPOT10/CMPOT11
	P14	47	I/O	IRQ08
	P15	49	I/O	TM16
	P16	50	I/O	IRQ09/TM17
	P17	51	I/O	SBO2P/TX2P/SBT2S
	P20	52	I/O	SBT2P/SBO2S/TX2S
	P21	53	I/O	SBI2/RX2
	P22	54	I/O	SBO1P/TX1P/SBT1S
	P23	55	I/O	SBT1P/SBO1S/TX1S
	P24	56	I/O	SBI1/RX1
	P25	57	I/O	SBO0P/TX0P/SDA0P/SBT0S/SCL0S
	P26	58	I/O	SBT0P/SCL0P/SBO0S/TX0S/SDA0S
	P27	59	I/O	SBI0/RX0
	P30	60	I/O	TM00
	P31	61	I/O	TM01/SBO3P/TX3P/LTX3P/SBT3S
	P32	62	I/O	TM02/SBT3P/SBO3S/TX3S/LTX3S
	P33	63	I/O	TM03/SBI3/RX3/LRX3
	P34	64	I/O	TM04/SBCS3
	P35	66	I/O	TM05
	P36	68	I/O	TM08A/GPWMST2/ADTRG2
	P37	69	I/O	TM08B/GPWMST3
	P40	70	I/O	TMOT09A
	P41	71	I/O	TMOT09B
	P42	72	I/O	TM09A/GPWMST0/ADTRG0
	P43	73	I/O	TM09B/GPWMST1/ADTRG1
	P44	74	I/O	TMOT10A
	P45	75	I/O	TMOT10B
P46	76	I/O	TM10A	

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P47	77	I/O	TM10B
	P50	78	I/O	TM06
	P51	79	I/O	TM07
	P52	80	I/O	PWM00/GPWM00
	P53	81	I/O	PWM01/GPWM01
	P54	82	I/O	PWM02/GPWM10
	P55	83	I/O	PWM03/GPWM11
	P56	84	I/O	PWM04/GPWM20
	P57	85	I/O	PWM05/GPWM21
	P60	86	I/O	-
	P61	87	I/O	-
	P62	88	I/O	PWM10/GPWM30
	P63	89	I/O	PWM11/GPWM31
	P64	90	I/O	PWM12/GPWM40
	P65	91	I/O	PWM13/GPWM41
	P66	92	I/O	PWM14/GPWM50
	P67	93	I/O	PWM15/GPWM51
	P72	95	I/O	TM11A/GPWMST4
	P73	97	I/O	TM11B/GPWMST5
	P74	99	I/O	TMOT11C
	P75	100	I/O	TMOT11D
	P76	1	I/O	TMOT11E
	P77	2	I/O	TMOT11F
	P80	3	I/O	IRQ00
	P81	4	I/O	IRQ01
	P82	5	I/O	IRQ02
	P83	6	I/O	IRQ03
	P84	7	I/O	TM14
	P85	8	I/O	TM15
	P86	9	I/O	-
	P87	10	I/O	-
	P90	11	Input	ADIN00/VGAN0/CMPRF00P
	P91	12	Input	ADIN01/VGAP00/CMPIN0P
	P92	13	Input	ADIN02/VGAP01
	P93	14	Input	ADIN03/VGAP02
	P94	16	I/O	ADIN04/CMPRF00S/DAOT0
	P95	18	I/O	ADIN05/CMPIN0S/CMPRF01
	P96	19	Input	ADIN06/VGAN1/CMPRF10P
	P97	20	Input	ADIN07/VGAP10/CMPIN1P
	PA0	21	Input	ADIN08/VGAP11
	PA1	22	Input	ADIN09/VGAP12

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	PA2	23	I/O	ADIN10/CMPRF10S/DAOT1
	PA3	24	I/O	ADIN11/CMPIN1S/CMPRF11
	PA4	25	I/O	ADIN12
	PA5	26	I/O	ADIN13
	PA6	27	I/O	ADIN14
	PA7	28	I/O	ADIN15
	PB0	29	I/O	ADIN16
	PB1	30	I/O	ADIN17
	PB2	34	I/O	ADIN18
	PB3	35	I/O	ADIN19
Onboard debugger	SCLK	31	Input	-
	SDATA	32	I/O	-
	EXTRG1	44	I/O	P11/IRQ05
	EXTRG0	43	I/O	P10/IRQ04

### 1.4.2.3 Pin Functions of KM103HFB5 Series

The pin functions are listed in [Table 1.4-3](#).

Table 1.4-3 Pin Functions (KM103HFB5)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	12 31 54 76	Input	-
Power pin for internal circuit	VOUT12	33	Output	-
GND	VSS	10 29 56 78	Input	-
External oscillation input pin	OSCI	28	Input	-
External oscillation output pin	OSCO	27	Output	-
Reset	NRST	39	Input	-
Mode	NTEST	30	Input	-
	NBOOT	26	Input	-
External interrupt	IRQ00	1	Input	P80
	IRQ01	2	Input	P81
	IRQ02	3	Input	P82
	IRQ03	4	Input	P83
	IRQ04	34	Input	P10/EXTRG0
	IRQ05	35	Input	P11/EXTRG1
	IRQ06	36	Input	P12/CMPOT00/CMPOT01
	IRQ07	37	Input	P13/CMPOT10/CMPOT11
	IRQ08	38	Input	P14
	IRQ09	40	Input	P16/TM17
8-bit timer	TM01	50	I/O	P31/SBO3P/TX3P/LTX3P/SBT3S
	TM02	51	I/O	P32/SBT3P/SBO3S/TX3S/LTX3S
	TM03	52	I/O	P33/TM03/SBI3/RX3/LRX3
	TM04	53	I/O	P34/SBCS3
	TM05	55	I/O	P35
	TM07	63	I/O	P51
	TM15	5	I/O	P85
	TM17	40	I/O	P16/IRQ09

Functions	Pin name	Pin No.	I/O	Other Pins
16-bit timer	TM08A	57	I/O	P36/GPWMST2/ADTRG2
	TM08B	58	I/O	P37/GPWMST3
	TM09A	59	I/O	P42/GPWMST0/ADTRG0
	TM09B	60	I/O	P43/GPWMST1/ADTRG1
	TM10A	61	I/O	P46
	TM10B	62	I/O	P47
	TM11A	77	I/O	P72/GPWMST4
	TM11B	79	I/O	P73/GPWMST5
VGA input	PWM00	64	Output	P52/GPWM00
	PWM01	65	Output	P53/GPWM01
	PWM02	66	Output	P54/GPWM10
	PWM03	67	Output	P55/GPWM11
	PWM04	68	Output	P56/GPWM20
	PWM05	69	Output	P57/GPWM21
	PWM10	70	Output	P62/GPWM30
	PWM11	71	Output	P63/GPWM31
	PWM12	72	Output	P64/GPWM40
	PWM13	73	Output	P65/GPWM41
	PWM14	74	Output	P66/GPWM50
	PWM15	75	Output	P67/GPWM51
Power control PWM	GPWM00	64	Output	P52/PWM00
	GPWM01	65	Output	P53/PWM01
	GPWM10	66	Output	P54/PWM02
	GPWM11	67	Output	P55/PWM03
	GPWM20	68	Output	P56/PWM04
	GPWM21	69	Output	P57/PWM05
	GPWM30	70	Output	P62/PWM10
	GPWM31	71	Output	P63/PWM11
	GPWM40	72	Output	P64/PWM12
	GPWM41	73	Output	P65/PWM13
	GPWM50	74	Output	P66/PWM14
	GPWM51	75	Output	P67/PWM15
	GPWMST0	59	Output	P42/TM09A/ADTRG0
	GPWMST1	60	Output	P43/TM09B/ADTRG1
	GPWMST2	57	Output	P36/TM08A/ADTRG2
	GPWMST3	58	Output	P37/TM08B
	GPWMST4	77	Output	P72/TM11A
	GPWMST5	79	Output	P73/TM11B



Functions	Pin name	Pin No.	I/O	Other Pins
Clock-synchronous SIF/SPI	SBO0P	47	I/O	P25/TX0P/SDA0P/SBT0S/SCL0S
	SBT0P	48	I/O	P26/SCL0P/SBO0S/TX0S/SDA0S
	SBO0S	48	I/O	P26/SBT0P/SCL0P/TX0S/SDA0S
	SBT0S	47	I/O	P25/SBO0P/TX0P/SDA0P/SCL0S
	SBI0	49	Input	P27/RX0
	SBO1P	44	I/O	P22/TX1P/SBT1S
	SBT1P	45	I/O	P23/SBO1S/TX1S
	SBO1S	45	I/O	P23/SBT1P/TX1S
	SBT1S	44	I/O	P22/SBO1P/TX1P
	SBI1	46	Input	P24/RX1
	SBO2P	41	I/O	P17/TX2P/SBT2S
	SBT2P	42	I/O	P20/SBO2S/TX2S
	SBO2S	42	I/O	P20/SBT2P/TX2S
	SBT2S	41	I/O	P17/SBO2P/TX2P
	SBI2	43	Input	P21/RX2
	SBCS3	53	I/O	P34/TM04
	SBO3P	50	I/O	P31/TM01/TX3P/LTX3P/SBT3S
	SBT3P	51	I/O	P32/TM02/SBO3S/TX3S/LTX3S
	SBO3S	51	I/O	P32/TM02/SBT3P/TX3S/LTX3S
	SBT3S	50	I/O	P31/TM01/SBO3P/TX3P/LTX3P
SBI3	52	Input	P33/TM03/RX3/LRX3	
UART	TX0P	47	I/O	P25/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	48	I/O	P26/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	49	Input	P27/SBI0
	TX1P	44	I/O	P22/SBO1P/SBT1S
	TX1S	45	I/O	P23/SBT1P/SBO1S
	RX1	46	Input	P24/SBI1
	TX2P	41	I/O	P17/SBO2P/SBT2S
	TX2S	42	I/O	P20/SBT2P/SBO2S
	RX2	43	Input	P21/SBI2
	TX3P	50	I/O	P31/TM01/SBO3P/LTX3P/SBT3S
	TX3S	51	I/O	P32/TM02/SBT3P/SBO3S/LTX3S
	RX3	52	Input	P33/TM03/SBI3/LRX3
LIN	LTX3P	50	Output	P31/TM01/SBO3P/TX3P/SBT3S
	LTX3S	51	Output	P32/TM02/SBT3P/SBO3S/TX3S
	LRX3	52	Input	P33/TM03/SBI3/RX3
IIC	SDA0P	47	I/O	P25/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	48	I/O	P26/SBT0P/SBO0S/TX0S/SDA0S
	SDA0S	48	I/O	P26/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	47	I/O	P25/SBO0P/TX0P/SDA0P/SBT0S

Functions	Pin name	Pin No.	I/O	Other Pins
A/D input	ADIN00	6	Input	P90/VGAN0/CMPRF00P
	ADIN01	7	Input	P91/VGAP00/CMPIN0P
	ADIN02	8	Input	P92/VGAP01
	ADIN03	9	Input	P93/VGAP02
	ADIN04	11	Input	P94/CMPRF00S/DAOT0
	ADIN05	13	Input	P95/CMPIN0S/CMPRF01
	ADIN06	14	Input	P96/VGAN1/CMPRF10P
	ADIN07	15	Input	P97/VGAP10/CMPIN1P
	ADIN08	16	Input	PA0/VGAP11
	ADIN09	17	Input	PA1/VGAP12
	ADIN10	18	Input	PA2/CMPRF10S/DAOT1
	ADIN11	19	Input	PA3/CMPIN1S/CMPRF11
	ADIN12	20	Input	PA4
	ADIN13	21	Input	PA5
	ADIN14	22	Input	PA6
ADIN15	23	Input	PA7	
A/D monitor	ADTRG0	59	Output	P42/TM09A/GPWMST0
	ADTRG1	60	Output	P43/TM09B/GPWMST1
	ADTRG2	57	Output	P36/TM08A/GPWMST2
VGA input	VGAN0	6	Input	P90/ADIN00/CMPRF00P
	VGAP00	7	Input	P91/ADIN01/CMPIN0P
	VGAP01	8	Input	P92/ADIN02
	VGAP02	9	Input	P93/ADIN03
	VGAN1	14	Input	P96/ADIN06/CMPRF10P
	VGAP10	15	Input	P97/ADIN07/CMPIN1P
	VGAP11	16	Input	PA0/ADIN08
	VGAP12	17	Input	PA1/ADIN09
Comparator input	CMPIN0P	7	Input	P91/ADIN01/VGAP00
	CMPIN0S	13	Input	P95/ADIN05/CMPRF01
	CMPIN1P	15	Input	P97/ADIN07/VGAP10
	CMPIN1S	19	Input	PA3/ADIN11/CMPRF11
	CMPRF00P	6	Input	P90/ADIN00/VGAN0
	CMPRF00S	11	Input	P94/ADIN04/DAOT0
	CMPRF01	13	Input	P95/ADIN05/CMPIN0S
	CMPRF10P	14	Input	P96/ADIN06/VGAN1
	CMPRF10S	18	Input	PA2/ADIN10/DAOT1
	CMPRF11	19	Input	PA3/ADIN11/CMPIN1S
Comparator output	COMPOT00	36	Output	P12/IRQ06/COMPOT01
	COMPOT01	36	Output	P12/IRQ06/COMPOT00
	COMPOT10	37	Output	P13/IRQ07/COMPOT11
	COMPOT11	37	Output	P13/IRQ07/COMPOT10

Functions	Pin name	Pin No.	I/O	Other Pins
D/A output	DAOT0	11	Output	P94/ADIN04/CMPRF00S
	DAOT1	18	Output	PA2/ADIN10/CMPRF10S
I/O port	P10	34	I/O	IRQ04/EXTRG0
	P11	35	I/O	IRQ05/EXTRG1
	P12	36	I/O	IRQ06/CMPOT00/CMPOT01
	P13	37	I/O	IRQ07/CMPOT10/CMPOT11
	P14	38	I/O	IRQ08
	P16	40	I/O	IRQ09/TM17
	P17	41	I/O	SBO2P/TX2P/SBT2S
	P20	42	I/O	SBT2P/SBO2S/TX2S

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P21	43	I/O	SBI2/RX2
	P22	44	I/O	SBO1P/TX1P/SBT1S
	P23	45	I/O	SBT1P/SBO1S/TX1S
	P24	46	I/O	SBI1/RX1
	P25	47	I/O	SBO0P/TX0P/SDA0P/SBT0S/SCL0S
	P26	48	I/O	SBT0P/SCL0P/SBO0S/TX0S/SDA0S
	P27	49	I/O	SBI0/RX0
	P31	50	I/O	TM01/SBO3P/TX3P/LTX3P/SBT3S
	P32	51	I/O	TM02/SBT3P/SBO3S/TX3S/LTX3S
	P33	52	I/O	TM03/SBI3/RX3/LRX3
	P34	53	I/O	TM04/SBCS3
	P35	55	I/O	TM05
	P36	57	I/O	TM08A/GPWMST2/ADTRG2
	P37	58	I/O	TM08B/GPWMST3
	P42	59	I/O	TM09A/GPWMST0/ADTRG0
	P43	60	I/O	TM09B/GPWMST1/ADTRG1
	P46	61	I/O	TM10A
	P47	62	I/O	TM10B
	P51	63	I/O	TM07
	P52	64	I/O	PWM00/GPWM00
	P53	65	I/O	PWM01/GPWM01
	P54	66	I/O	PWM02/GPWM10
	P55	67	I/O	PWM03/GPWM11
	P56	68	I/O	PWM04/GPWM20
	P57	69	I/O	PWM05/GPWM21
	P62	70	I/O	PWM10/GPWM30
	P63	71	I/O	PWM11/GPWM31
	P64	72	I/O	PWM12/GPWM40
	P65	73	I/O	PWM13/GPWM41
	P66	74	I/O	PWM14/GPWM50
	P67	75	I/O	PWM15/GPWM51
	P72	77	I/O	TM11A/GPWMST4
	P73	79	I/O	TM11B/GPWMST5
	P80	1	I/O	IRQ00
	P81	2	I/O	IRQ01
	P82	3	I/O	IRQ02
	P83	4	I/O	IRQ03
	P85	5	I/O	TM15
	P90	6	Input	ADIN00/VGAN0/CMPRF00P
	P91	7	Input	ADIN01/VGAP00/CMPIN0P
P92	8	Input	ADIN02/VGAP01	

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P93	9	Input	ADIN03/VGAP02
	P94	11	I/O	ADIN04/CMPRF00S/DAOT0
	P95	13	I/O	ADIN05/CMPIN0S/CMPRF01
	P96	14	Input	ADIN06/VGAN1/CMPRF10P
	P97	15	Input	ADIN07/VGAP10/CMPIN1P
	PA0	16	Input	ADIN08/VGAP11
	PA1	17	Input	ADIN09/VGAP12
	PA2	18	I/O	ADIN10/CMPRF10S/DAOT1
	PA3	19	I/O	ADIN11/CMPIN1S/CMPRF11
	PA4	20	I/O	ADIN12
	PA5	21	I/O	ADIN13
	PA6	22	I/O	ADIN14
	PA7	23	I/O	ADIN15
Onboard debugger	SCLK	24	Input	-
	SDATA	25	I/O	-
	EXTRG1	35	I/O	P11/IRQ05
	EXTRG0	34	I/O	P10/IRQ04

### 1.4.2.4 Pin Functions of KM103HFB4 Series

The pin functions are listed in [Table 1.4-4](#).

Table 1.4-4 Pin Functions (KM103HFB4)

Functions	Pin name	Pin No.	I/O	Other Pins
External power pin	VDD50	10 26 42 61	Input	-
Power pin for internal circuit	VOUT12	28	Output	-
GND	VSS	8 24 44 63	Input	-
External oscillation input pin	OSCI	23	Input	-
External oscillation output pin	OSCO	22	Output	-
Reset	NRST	31	Input	-
Mode	NTEST	25	Input	-
	NBOOT	21	Input	-
External interrupt	IRQ02	1	Input	P82
	IRQ03	2	Input	P83
	IRQ04	17	Input	P10/EXTRG0
	IRQ05	18	Input	P11/EXTRG1
	IRQ06	29	Input	P12/CMPOT00/CMPOT01
	IRQ07	30	Input	P13/CMPOT10/CMPOT11
	IRQ09	32	Input	P16/TM17
8-bit timer	TM05	43	I/O	P35
	TM15	3	I/O	P85
	TM17	32	I/O	P16/IRQ09
16-bit timer	TM08A	45	I/O	P36/GPWMST2
	TM08B	46	I/O	P37/GPWMST3
	TM09A	47	I/O	P42/GPWMST0/ADTRG0
	TM09B	48	I/O	P43/GPWMST1/ADTRG1
	TM11A	62	I/O	P72/GPWMST4
	TM11B	64	I/O	P73/GPWMST5

Functions	Pin name	Pin No.	I/O	Other Pins
Motor control PWM	PWM00	49	Output	P52/GPWM00
	PWM01	50	Output	P53/GPWM01
	PWM02	51	Output	P54/GPWM10
	PWM03	52	Output	P55/GPWM11
	PWM04	53	Output	P56/GPWM20
	PWM05	54	Output	P57/GPWM21
	PWM10	55	Output	P62/GPWM30
	PWM11	56	Output	P63/GPWM31
	PWM12	57	Output	P64/GPWM40
	PWM13	58	Output	P65/GPWM41
	PWM14	59	Output	P66/GPWM50
	PWM15	60	Output	P67/GPWM51
Power control PWM	GPWM00	49	Output	P52/PWM00
	GPWM01	50	Output	P53/PWM01
	GPWM10	51	Output	P54/PWM02
	GPWM11	52	Output	P55/PWM03
	GPWM20	53	Output	P56/PWM04
	GPWM21	54	Output	P57/PWM05
	GPWM30	55	Output	P62/PWM10
	GPWM31	56	Output	P63/PWM11
	GPWM40	57	Output	P64/PWM12
	GPWM41	58	Output	P65/PWM13
	GPWM50	59	Output	P66/PWM14
	GPWM51	60	Output	P67/PWM15
	GPWMST0	47	Output	P42/TM09A/ADTRG0
	GPWMST1	48	Output	P43/TM09B/ADTRG1
	GPWMST2	45	Output	P36/TM08A
	GPWMST3	46	Output	P37/TM08B
	GPWMST4	62	Output	P72/TM11A
GPWMST5	64	Output	P73/TM11B	

Functions	Pin name	Pin No.	I/O	Other Pins
Clock-synchronous SIF/SPI	SBO0P	36	I/O	P22/TX0P/SDA0P/SBT0S/SCL0S
	SBT0P	37	I/O	P23/SCL0P/SBO0S/TX0S/SDA0S
	SBO0S	37	I/O	P23/SBT0P/SCL0P/TX0S/SDA0S
	SBT0S	36	I/O	P22/SBO0P/TX0P/SDA0P/SCL0S
	SBI0	38	Input	P24/RX0
	SBO2P	33	I/O	P17/TX2P/SBT2S
	SBT2P	34	I/O	P20/SBO2S/TX2S
	SBO2S	34	I/O	P20/SBT2P/TX2S
	SBT2S	33	I/O	P17/SBO2P/TX2P
	SBI2	35	Input	P21/RX2
	SBCS3	43	I/O	P35/TM05
	SBO3P	39	I/O	P25/TX3P/LTX3P/SBT3S
	SBT3P	40	I/O	P26/SBO3S/TX3S/LTX3S
	SBO3S	40	I/O	P26/SBT3P/TX3S/LTX3S
	SBT3S	39	I/O	P25/SBO3P/TX3P/LTX3P
SBI3	41	Input	P27/RX3/LRX3	
UART	TX0P	36	I/O	P22/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	37	I/O	P23/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	38	Input	P24/SBI0
	TX2P	33	I/O	P17/SBO2P/SBT2S
	TX2S	34	I/O	P20/SBT2P/SBO2S
	RX2	35	Input	P21/SBI2
	TX3P	39	I/O	P25/SBO3P/LTX3P/SBT3S
	TX3S	40	I/O	P26/SBT3P/SBO3S/LTX3S
	RX3	41	Input	P27/SBI3/LRX3
LIN	LTX3P	39	Output	P25/SBO3P/TX3P/SBT3S
	LTX3S	40	Output	P26/SBT3P/SBO3S/TX3S
	LRX3	41	Input	P27/SBI3/RX3
IIC	SDA0P	36	I/O	P22/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	37	I/O	P23/SBT0P/SBO0S/TX0S/SDA0S
	SDA0S	37	I/O	P23/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	36	I/O	P22/SBO0P/TX0P/SDA0P/SBT0S



Functions	Pin name	Pin No.	I/O	Other Pins
A/D input	ADIN00	4	Input	P90/VGAN0/CMPRF00P
	ADIN01	5	Input	P91/VGAP00/CMPIN0P
	ADIN02	6	Input	P92/VGAP01
	ADIN03	7	Input	P93/VGAP02
	ADIN04	9	Input	P94/CMPRF00S/DAOT0
	ADIN05	11	Input	P95/CMPIN0S/CMPRF01
	ADIN06	12	Input	P96/VGAN1/CMPRF10P
	ADIN07	13	Input	P97/VGAP10/CMPIN1P
	ADIN10	14	Input	PA2/CMPRF10S/DAOT1
	ADIN11	15	Input	PA3/CMPIN1S/CMPRF11
A/D monitor	ADTRG0	47	Output	P42/TM09A/GPWMST0
	ADTRG1	48	Output	P43/TM09B/GPWMST1
VGA input	VGAN0	4	Input	P90/ADIN00/CMPRF00P
	VGAP00	5	Input	P91/ADIN01/CMPIN0P
	VGAP01	6	Input	P92/ADIN02
	VGAP02	7	Input	P93/ADIN03
	VGAN1	12	Input	P96/ADIN06/CMPRF10P
	VGAP10	13	Input	P97/ADIN07/CMPIN1P
Comparator input	CMPIN0P	5	Input	P91/ADIN01/VGAP00
	CMPIN0S	11	Input	P95/ADIN05/CMPRF01
	CMPIN1P	13	Input	P97/ADIN07/VGAP10
	CMPIN1S	15	Input	PA3/ADIN11/CMPRF11
	CMPRF00P	4	Input	P90/ADIN00/VGAN0
	CMPRF00S	9	Input	P94/ADIN04/DAOT0
	CMPRF01	11	Input	P95/ADIN05/CMPIN0S
	CMPRF10P	12	Input	P96/ADIN06/VGAN1
	CMPRF10S	14	Input	PA2/ADIN10/DAOT1
	CMPRF11	15	Input	PA3/ADIN11
Comparator output	COMPOT00	29	Output	P12/IRQ06/COMPOT01
	COMPOT01	29	Output	P12/IRQ06/COMPOT00
	COMPOT10	30	Output	P13/IRQ07/COMPOT11
	COMPOT11	30	Output	P13/IRQ07/COMPOT10
D/A output	DAOT0	9	Output	P94/ADIN04/CMPRF00S
	DAOT1	14	Output	PA2/ADIN10/CMPRF10S

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P10	17	I/O	IRQ04/EXTRG0
	P11	18	I/O	IRQ05/EXTRG1
	P12	29	I/O	IRQ06/CMPOT00/CMPOT01
	P13	30	I/O	IRQ07/CMPOT10/CMPOT11
	P16	32	I/O	IRQ09/TM17
	P17	33	I/O	SBO2P/TX2P/SBT2S
	P20	34	I/O	SBT2P/SBO2S/TX2S
	P21	35	I/O	SBI2/RX2
	P22	36	I/O	SBO0P/TX0P/SDA0P/SBT0S/SCL0S
	P23	37	I/O	SBT0P/SCL0P/SBO0S/TX0S/SDA0S
	P24	38	I/O	SBI0/RX0
	P25	39	I/O	SBO3P/TX3P/LTX3P/SBT3S
	P26	40	I/O	SBT3P/SBO3S/TX3S/LTX3S
	P27	41	I/O	SBI3/RX3/LRX3
	P35	43	I/O	TM05/SBCS3
	P36	45	I/O	TM08A/GPWMST2
	P37	46	I/O	TM08B/GPWMST3
	P42	47	I/O	TM09A/GPWMST0/ADTRG0
	P43	48	I/O	TM09B/GPWMST1/ADTRG1
	P52	49	I/O	PWM00/GPWM00
	P53	50	I/O	PWM01/GPWM01
	P54	51	I/O	PWM02/GPWM10
	P55	52	I/O	PWM03/GPWM11
	P56	53	I/O	PWM04/GPWM20
	P57	54	I/O	PWM05/GPWM21
	P62	55	I/O	PWM10/GPWM30
	P63	56	I/O	PWM11/GPWM31
	P64	57	I/O	PWM12/GPWM40
	P65	58	I/O	PWM13/GPWM41
	P66	59	I/O	PWM14/GPWM50
	P67	60	I/O	PWM15/GPWM51
P72	62	I/O	TM11A/GPWMST4	

Functions	Pin name	Pin No.	I/O	Other Pins
I/O port	P73	64	I/O	TM11B/GPWMST5
	P82	1	I/O	IRQ02
	P83	2	I/O	IRQ03
	P85	3	I/O	TM15
	P90	4	Input	ADIN00/VGAN0/CMPRF00P
	P91	5	Input	ADIN01/VGAP00/CMPIN0P
	P92	6	Input	ADIN02/VGAP01
	P93	7	Input	ADIN03/VGAP02
	P94	9	I/O	ADIN04/CMPRF00S/DAOT0
	P95	11	I/O	ADIN05/CMPIN0S/CMPRF01
	P96	12	Input	ADIN06/VGAN1/CMPRF10P
	P97	13	Input	ADIN07/VGAP10/CMPIN1P
	PA2	14	I/O	ADIN10/CMPRF10S/DAOT1
	PA3	15	I/O	ADIN11/CMPIN1S/CMPRF11
	PA4	16	I/O	
Onboard debugger	SCLK	19	Input	-
	SDATA	20	I/O	-
	EXTRG1	18	I/O	P11/IRQ05
	EXTRG0	17	I/O	P10/IRQ04

### 1.4.2.5 Pin Functions of KM103HFB3 Series

The pin functions are listed in [Table 1.4-5](#).

Table 1.4-5 Pin Functions (KM103HFB3)

Functions	Pin name	Pin No.		I/O	Other Pins
		(48 pins)	(44 pins)		
External power pin	VDD50	8 20	7 19	Input	-
Power pin for internal circuit	VOOUT12	22	21	Output	-
GND	VSS	6 18	5 17	Input	-
External oscillation input pin	OSCI	17	16	Input	-
External oscillation output pin	OSCO	16	15	Output	-
Reset	NRST	23	22	Input	-
Mode	NTEST	19	18	Input	-
	NBOOT	15	15	Input	-
External interrupt	IRQ04	25	23	Input	P10/EXTRG0
	IRQ05	26	24	Input	P11/EXTRG1
	IRQ06	27	25	Input	P12/CMPOT00/CMPOT01
	IRQ07	28	26	Input	P13/CMPOT10/CMPOT11
16-bit timer	TM08A	36	33	I/O	P36/SBCS3
	TM08B	37	34	I/O	P37/GPWMST2
	TM09A	38	35	I/O	P42/GPWMST0/ADTRG0
	TM09B	39	36	I/O	P43/GPWMST1/ADTRG1
	TM11A	47	43	I/O	P72
	TM11B	48	44	I/O	P73
Motor control PWM	PWM00	40	37	Output	P52/GPWM00
	PWM01	41	38	Output	P53/GPWM01
	PWM02	42	39	Output	P54/GPWM10
	PWM03	43	40	Output	P55/GPWM11
	PWM04	44	41	Output	P56/GPWM20
	PWM05	45	42	Output	P57/GPWM21
Power control PWM	GPWM00	40	37	Output	P52/PWM00
	GPWM01	41	38	Output	P53/PWM01
	GPWM10	42	39	Output	P54/PWM02
	GPWM11	43	40	Output	P55/PWM03
	GPWM20	44	41	Output	P56/PWM04
	GPWM21	45	42	Output	P57/PWM05
	GPWMST0	38	35	Output	P42/TM09A/ADTRG0
	GPWMST1	39	36	Output	P43/TM09B/ADTRG1
	GPWMST2	37	34	Output	P37/TM08B

Functions	Pin name	Pin No.		I/O	Other Pins
		(48 pins)	(44 pins)		
Clock-synchronous SIF/SPI	SBO0P	29	27	I/O	P22/TX0P/SDA0P/SBT0S/SCL0S
	SBT0P	30	28	I/O	P23/SCL0P/SBO0S/TX0S/SDA0S
	SBO0S	30	28	I/O	P23/SBT0P/SCL0P/TX0S/SDA0S
	SBT0S	29	27	I/O	P22/SBO0P/TX0P/SDA0P/SCL0S
	SBI0	31	29	Input	P24/RX0
	SBCS3	36	33	I/O	P36/TM08A
	SBO3P	32	30	I/O	P25/TX3P/LTX3P/SBT3S
	SBT3P	33	31	I/O	P26/SBO3S/TX3S/LTX3S
	SBO3S	33	31	I/O	P26/SBT3P/TX3S/LTX3S
	SBT3S	32	30	I/O	P25/SBO3P/TX3P/LTX3P
	SBI3	34	32	Input	P27/RX3/LRX3
UART	TX0P	29	27	I/O	P22/SBO0P/SDA0P/SBT0S/SCL0S
	TX0S	30	28	I/O	P23/SBT0P/SCL0P/SBO0S/SDA0S
	RX0	31	29	Input	P24/SBI0
	TX3P	32	30	I/O	P25/SBO3P/LTX3P/SBT3S
	TX3S	33	31	I/O	P26/SBT3P/SBO3S/LTX3S
	RX3	34	32	Input	P27/SBI3/LRX3
LIN	LTX3P	32	30	Output	P25/SBO3P/TX3P/SBT3S
	LTX3S	33	31	Output	P26/SBT3P/SBO3S/TX3S
	LRX3	34	32	Input	P27/SBI3/RX3
IIC	SDA0P	29	27	I/O	P22/SBO0P/TX0P/SBT0S/SCL0S
	SCL0P	30	28	I/O	P23/SBT0P/SBO0S/TX0S/SDA0S
	SDA0S	30	28	I/O	P23/SBT0P/SCL0P/SBO0S/TX0S
	SCL0S	29	27	I/O	P22/SBO0P/TX0P/SDA0P/SBT0S
A/D input	ADIN00	2	1	Input	P90/VGAN0/CMPRF00P
	ADIN01	3	2	Input	P91/VGAP00/CMPIN0
	ADIN02	4	3	Input	P92/VGAP01
	ADIN03	5	4	Input	P93/VGAP02
	ADIN04	7	6	Input	P94/CMPRF00S/DAOT0
	ADIN06	9	8	Input	P96/VGAN1/CMPRF10P
	ADIN07	10	9	Input	P97/VGAP10/CMPIN1P
	ADIN10	11	10	Input	PA2/CMPRF10S/DAOT1
A/D monitor	ADTRG0	38	35	Output	P42/TM09A/GPWMST0
	ADTRG1	39	36	Output	P43/TM09B/GPWMST1
VGA input	VGAN0	2	1	Input	P90/ADIN00/CMPRF00P
	VGAP00	3	2	Input	P91/ADIN01/CMPIN0
	VGAP01	4	3	Input	P92/ADIN02
	VGAP02	5	4	Input	P93/ADIN03
	VGAN1	9	8	Input	P96/ADIN06/CMPRF10P
	VGAP10	10	9	Input	P97/ADIN07/CMPIN1P

Functions	Pin name	Pin No.		I/O	Other Pins
		(48 pins)	(44 pins)		
Comparator input	CMPIN0	3	2	Input	P91/ADIN01/VGAP00
	CMPIN1P	10	9	Input	P97/ADIN07/VGAP10
	CMPIN1S	12	11	Input	PA3/CMPRF11
	CMPRF00P	2	1	Input	P90/ADIN00/VGAN0
	CMPRF00S	7	6	Input	P94/ADIN04/DAOT0
	CMPRF10P	9	8	Input	P96/ADIN06/VGAN1
	CMPRF10S	11	10	Input	PA2/ADIN10/DAOT1
	CMPRF11	12	11	Input	PA3/CMPIN1S
Comparator output	CMPOT00	27	25	Output	P12/IRQ06/CMPOT01
	CMPOT01	27	25	Output	P12/IRQ06/CMPOT00
	CMPOT10	28	26	Output	P13/IRQ07/CMPOT11
	CMPOT11	28	26	Output	P13/IRQ07/CMPOT10
D/A output	DAOT0	7	6	Output	P94/ADIN04/CMPRF00S
	DAOT1	11	10	Output	PA2/ADIN10/CMPRF10S
I/O port	P10	25	23	I/O	IRQ04/EXTRG0
	P11	26	24	I/O	IRQ05/EXTRG1
	P12	27	25	I/O	IRQ06/CMPOT00/CMPOT01
	P13	28	26	I/O	IRQ07/CMPOT10/CMPOT11
	P22	29	27	I/O	SBO0P/TX0P/SDA0P/SBT0S/SCL0S
	P23	30	28	I/O	SBT0P/SCL0P/SBO0S/TX0S/SDA0S
	P24	31	29	I/O	SBI0/RX0
	P25	32	30	I/O	SBO3P/TX3P/LTX3P/SBT3S
	P26	33	31	I/O	SBT3P/SBO3S/TX3S/LTX3S
	P27	34	32	I/O	SBI3/RX3/LRX3
	P36	36	33	I/O	TM08A/SBCS3
	P37	37	34	I/O	TM08B/GPWMST2
	P42	38	35	I/O	TM09A/GPWMST0/ADTRG0
	P43	39	36	I/O	TM09B/GPWMST1/ADTRG1
	P52	40	37	I/O	PWM00/GPWM00
	P53	41	38	I/O	PWM01/GPWM01
	P54	42	39	I/O	PWM02/GPWM10
	P55	43	40	I/O	PWM03/GPWM11
	P56	44	41	I/O	PWM04/GPWM20
	P57	45	42	I/O	PWM05/GPWM21
	P72	47	43	I/O	TM11A
	P73	48	44	I/O	TM11B
	P90	2	1	Input	ADIN00/VGAN0/CMPRF00P
P91	3	2	Input	ADIN01/VGAP00/CMPIN0	

Functions	Pin name	Pin No.		I/O	Other Pins
		(48 pins)	(44 pins)		
I/O port	P92	4	3	Input	ADIN02/VGAP01
	P93	5	4	Input	ADIN03/VGAP02
	P94	7	6	I/O	ADIN04/CMPRF00S/DAOT0
	P96	9	8	Input	ADIN06/VGAN1/CMPRF10P
	P97	10	9	Input	ADIN07/VGAP10/CMPIN1P
	PA2	11	10	I/O	ADIN10/CMPRF10S/DAOT1
	PA3	12	11	I/O	CMPIN1S/CMPRF11
Onboard debugger	SCLK	13	12	Input	-
	SDATA	14	13	I/O	-
	EXTRG1	26	24	I/O	P11/IRQ05
	EXTRG0	25	23	I/O	P10/IRQ04

## 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.

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### Hint:

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

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### 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 $V_{DD50A} + 0.3$ (upper limit: 7.0)	V	
A4	VGA input pin voltage	$V_{I2}$	-2.0 to $V_{DD50A} + 0.3$ (upper limit: 7.0)	V	
A5	I/O pin voltage	$V_{I3}$	-0.3 to $V_{DD50A} + 0.3$ (upper limit: 7.0)	V	
A6	Average output current	I/O pin 1, 3 (*1)	$I_{O1(avg)}$	$\pm 12$	mA
A7		I/O pin 2 (*2)	$I_{O2(avg)}$	$\pm 24$	mA
A8		Total of all pins	$I_{O3}$	$\pm 70$	mA
A9	Power dissipation	$P_T$	700	mW	
A10	Operating case temperature	$T_{COPR}$	-40 to 115	°C	
A11	Storage temperature	$T_{STG}$	-40 to 125	°C	

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### 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.

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### Note:

\*1 I/O pins 1 and 3 are I/O pins 1 and 3 described in [1.5.3 DC Characteristics](#).

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### Note:

\*2 I/O pin 2 is I/O pin 2 described in [1.5.3 DC Characteristics](#).

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## 1.5.2 Operation Conditions

Power supply voltage during operation		$V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C to } 115\text{ }^\circ\text{C}$				
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 $5.5\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C to } 115\text{ }^\circ\text{C}$				
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	-	$M\Omega$

**Note:**

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

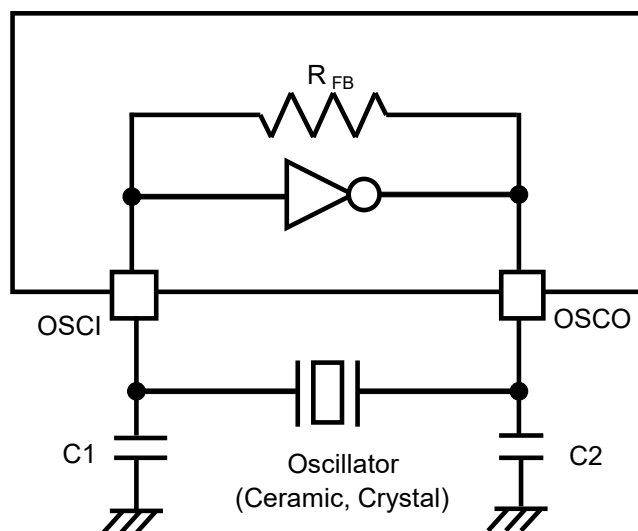


Figure 1.5-1 Oscillation Circuit

External clock input OSCI (OSCO left open)			$V_{DD50} = V_{RST5N}$ to 5.5 V, $V_{SS} = 0.0$ V $T_c = -40$ °C to 115 °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 %.

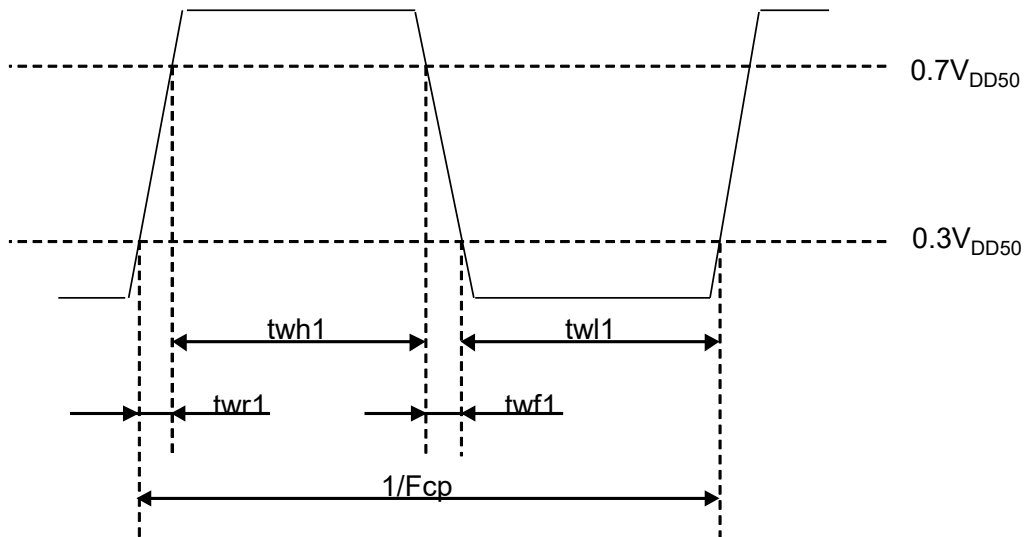


Figure 1.5-2 OSCI Timing Chart

### 1.5.3 DC Characteristics

Power supply current during operation		$V_{DD50} = 5.0\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C}$ to $115\text{ }^\circ\text{C}$ Output pins left open				
Parameter		Sym- bol	Conditions	Rating		Unit
				TYP	MAX	
C1	NORMAL mode	$I_{DD1}$	HXOCLK= 10 MHz, using PLL, MCLK = 80 MHz, IOCLK = 40 MHz CPU and peripheral circuits are operating, Analog circuits are stopped	80 (T.B.D)	100 (T.B.D)	mA
C2	SLEEP mode	$I_{DD2}$	HXOCLK= 10 MHz, using PLL, MCLK = 80 MHz, IOCLK = 40 MHz CPU is stopped, peripheral circuits are oper- ating, Analog circuits are stopped	20 (T.B.D)	70 (T.B.D)	
C3	HALT mode	$I_{DD3}$	HXOCLK = 10 MHz, PLLCLK is stopped, MCLK, IOCLK are stopped, CPU and peripheral circuits are stopped, Analog circuits are stopped	10 (T.B.D)	50 (T.B.D)	
C4	STOP mode	$I_{DD4}$	HXOCLK, PLLCLK, MCLK, IOCLK = stopped	2 (T.B.D)	40 (T.B.D)	

**Note:**

- The measurement conditions are as follows.
- All I/O pins are output state. (No load)

Input pin 1 NBOOT		$V_{DD50} = 5.0\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C}$ to $115\text{ }^\circ\text{C}$					
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	$I_{LK1}$	$V_{IN} = 0\text{ V}$ to $V_{DD50}$	-	-	$\pm 5$	$\mu\text{A}$

Input pin 2 SCLK, NTEST		$V_{DD50} = 5.0\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C}$ to $115\text{ }^\circ\text{C}$					
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"	$V_{IL2}$		$V_{SS}$	-	$V_{DD50} \times 0.3$	
C10	Internal pull-up resistor	$R_{IO2}$	$V_{IN} = 0\text{ V}$	15	30	60	$\text{k}\Omega$

Input pin 3 <MN103HFB7z, MN103HFB6z, MN103HFB5z> P90 to P93, P96, P97, PA0, PA1 <MN103HFB4z, MN103HFB3z> P90 to P93, P96, P97		$V_{DD50} = 5.0\text{ V}, V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C to }115\text{ }^\circ\text{C}$					
Parameter		Sym- bol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C11	Input voltage "High level"	$V_{IH3}$	When VGA is not used	$V_{DD50} \times 0.7$	-	$V_{DD50}$	V
C12	Input voltage "Low level"	$V_{IL3}$	When VGA is not used	$V_{SS}$	-	$V_{DD50} \times 0.3$	
C13	Input leakage current	$I_{LK3}$	$V_{IN} = 0\text{ V to }V_{DD50}$	-	-	$\pm 10$	$\mu\text{A}$
C14	Input voltage range	$V_{IN3}$	When VGA is used	-1.5	-	$V_{DD50}$	V

I/O pin 1 NRST		$V_{DD50} = 5.0\text{ V}, V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C to }115\text{ }^\circ\text{C}$					
Parameter		Sym- bol	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	$R_{IO4}$	$V_{IN} = 0\text{ V}$	15	30	60	$\text{k}\Omega$
C18	Output voltage "Low level"	$V_{OL4}$	$V_{DD50} = V_{RST5P}$ $I_{OL} = 3.0\text{ mA}$	-	-	0.5	V

I/O pin 2 SDATA		$V_{DD50} = 5.0\text{ V}, V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C to }115\text{ }^\circ\text{C}$					
Parameter		Sym- bol	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	Output voltage "High level"	$V_{OH5}$	$I_{OH} = -6.0\text{ mA}$	4.5	-	-	
C22	Output voltage "Low level"	$V_{OL5}$	$I_{OL} = 6.0\text{ mA}$	-	-	0.5	

I/O pin 3 <KM103HFB7z> P10 to P17, P20 to P27, P30 to P37, P40 to P47, P50 to P57, P60 to P67, P72 to P77, P80 to P87, P94, P95, PA2 to PA7, PB0 to PB3, PC0 to PC7, PD0 to PD7, PE1 <KM103HFB6z> P10 to P17, P20 to P27, P30 to P37, P40 to P47, P50 to P57, P60 to P67, P72 to P77, P80 to P87, P94, P95, PA2 to PA7, PB0 to PB3 <KM103HFB5z> P10 to P14, P16, P17, P20 to P27, P31 to P37, P42, P43, P46, P47, P51 to P57, P62 to P67, P72, P73, P80 to P83, P85, P94, P95, PA2 to PA7 <KM103HFB4z> P10 to P13, P16, P17, P20 to P27, P35 to P37, P42, P43, P52 to P57, P62 to P67, P72, P73, P82, P83, P85, P94, P95, PA2 to PA4 <KM103HFB3z> P10 to P13, P22 to P27, P36 to P37, P42, P43, P52 to P57, P72, P73, P94, PA2, PA3				$V_{DD50} = 5.0\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C}$ to $115\text{ }^\circ\text{C}$			
Parameter	Symbol	Conditions	Rating			Unit	
			MIN	TYP	MAX		
C23	Input voltage "High level"	$V_{IH6}$	$V_{DD50} \times 0.7$	-	$V_{DD50}$	V	
C24	Input voltage "Low level"	$V_{IL6}$	$V_{SS}$	-	$V_{DD50} \times 0.3$		
C25	Input leakage current	$I_{LK6}$	$V_{IN} = 0\text{ V}$ to $V_{DD50}$	-	$\pm 5$	$\mu\text{A}$	
C26	Internal pull-up resistor	$R_{IO6}$	$V_{IN} = 0\text{ V}$	15	30	60	k $\Omega$
C27	Output voltage "High level"	$V_{OH6}$	$I_{OH} = -3.0\text{ mA}$	4.5	-	-	V
C28	Output voltage "Low level"	$V_{OL6}$	$I_{OL} = 3.0\text{ mA}$	-	-	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 <sub>DD50</sub> = 5.0 V, V <sub>SS</sub> = 0.0 V T <sub>c</sub> = -40 °C to 115 °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 <sub>AD</sub>	Sampling time ≥ 150 ns Conversion clock = 40 MHz	-	-	±3	LSB
D4	Differential non-linearity error	DNLE <sub>AD</sub>		-	-	±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 <sub>IA</sub>		V <sub>SS</sub>	-	V <sub>DD50</sub>	V
D9	Power supply current during operation	I <sub>AD</sub>	Conversion clock = 40 MHz	-	2.5	-	mA/unit

### 1.5.4.2 Programmable Gain Amplifier (VGA)

VGA0, VGA1		V <sub>DD50</sub> = 5.0 V, V <sub>SS</sub> = 0.0 V T <sub>c</sub> = -40 °C to 115 °C					
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D10	Gain	G <sub>VGA</sub>		2	-	20	times
D11	Gain error	G <sub>ERR1</sub>	G <sub>VGA</sub> = 2 to 10 times	-	±0.7	1.5 (T.B.D)	%
		G <sub>ERR2</sub>	G <sub>VGA</sub> = 20 times	-	±1.2	2.0 (T.B.D)	
D12	Output offset voltage	V <sub>OFFG1</sub>	G <sub>VGA</sub> = 2 to 10 times	-	±80	±120	mV
		V <sub>OFFG2</sub>	G <sub>VGA</sub> = 20 times	-	±130	±180	
D13	Output reference voltage range	V <sub>REFG</sub>		1.0	-	4.0	V
D14	Output dynamic range	V <sub>OG</sub>		1.0	-	4.0	
D15	Input dynamic range	V <sub>IG1</sub>	G <sub>VGA</sub> =2 times	-1.5	-	1.5	
		V <sub>IG2</sub>	G <sub>VGA</sub> =3 times	-1.0	-	1.0	
		V <sub>IG3</sub>	G <sub>VGA</sub> =4 times	-0.75	-	0.75	
		V <sub>IG4</sub>	G <sub>VGA</sub> =5 times	-0.6	-	0.6	
		V <sub>IG5</sub>	G <sub>VGA</sub> =6 times	-0.5	-	0.5	
		V <sub>IG6</sub>	G <sub>VGA</sub> =8 times	-0.375	-	0.375	
		V <sub>IG7</sub>	G <sub>VGA</sub> =10 times	-0.3	-	0.3	
		V <sub>IG8</sub>	G <sub>VGA</sub> =20 times	-0.15	-	0.15	
D16	Power supply current during operation	I <sub>G</sub>	G <sub>VGA</sub> =10 times, V <sub>INP</sub> =V <sub>INN</sub> =0.0 V	-	2.6	-	mA/ Unit

### 1.5.4.3 Comparator

CMP00 to CMP11			$V_{DD50} = 5.0\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C}$ to $115\text{ }^\circ\text{C}$				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D17	Input offset voltage	$V_{OFFC}$		-	-	$\pm 20$	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 DACI11, DACV0, DACV1			$V_{DD50} = 5.0\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C}$ to $115\text{ }^\circ\text{C}$				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D22	Resolution	-		-	-	8	Bits
D23	Integral non-linearity error	$INLE_{DA1}$		-	-	$\pm 1$	LSB
D24	Differential linearity error	$DNLE_{DA1}$		-	-	$\pm 1$	
D25	Zero scale voltage	-		-20	-	80 (T.B.D)	mV
D26	Full scale voltage	-		4900 (T.B.D)	-	5020	
D27	Power supply current during operation	$I_{DA1}$		-	0.5	-	mA/ Unit

10-bit D/A Converter DACP0, DACP1			$V_{DD50} = 5.0\text{ V}$ , $V_{SS} = 0.0\text{ V}$ $T_c = -40\text{ }^\circ\text{C}$ to $115\text{ }^\circ\text{C}$				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D28	Resolution	-		-	-	10	Bits
D29	Integral non-linearity error	$INLE_{DA2}$		-	-	$\pm 3$	LSB
D30	Differential linearity error	$DNLE_{DA2}$		-	-	$\pm 3$	
D31	Zero scale voltage	-		-20	-	80 (T.B.D)	mV
D32	Full scale voltage	-		4950 (T.B.D)	-	5020	
D33	Power supply current during operation	$I_{DA2}$		-	0.5	-	mA/ Unit



### 1.5.4.5 Power Supply Voltage Detection (LVD)

Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
$V_{DD50} = V_{RST5N}$ to 5.5 V, $V_{SS} = 0.0$ V $T_c = -40$ °C to 115 °C							
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	$\Delta V_{DD50P}$	At rising	-	-	5	V/ms
D37		$\Delta V_{DD50N}$	At falling	-	-	1	

### 1.5.4.6 Power-on Reset

Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
$V_{SS} = 0.0$ V $T_c = -40$ °C to 115 °C							
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	$\Delta V_{DD50P}$	At rising	-	-	5	V/ms
D41		$\Delta V_{DD50N}$	At falling	-	-	1	

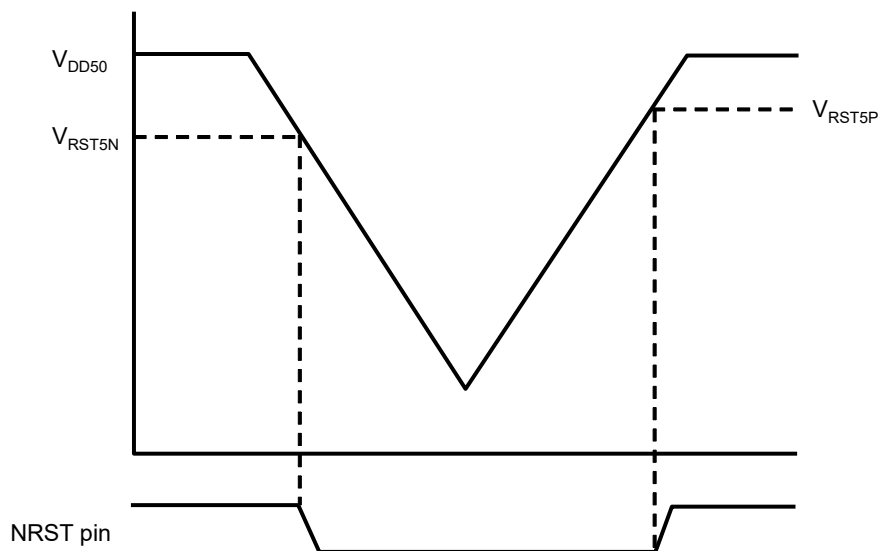


Figure 1.5-3 Characteristics of Power-on Reset Circuit

### 1.5.4.7 Internal Oscillation

Parameter		Sym- bol	Conditions	Rating			Unit
				MIN	TYP	MAX	
$V_{DD50} = V_{RST5N}$ to 5.5 V, $V_{SS} = 0.0$ V $T_c = -40$ °C to 115 °C							
D42	Oscillation frequency	$F_{RC}$		9	10	11	MHz

### 1.5.5 AC Characteristics

Parameter		Sym- bol	Conditions	Rating			Unit
				MIN	TYP	MAX	
$V_{DD50} = V_{RST5N}$ to 5.5 V, $V_{SS} = 0.0$ V $T_c = -40$ °C to 115 °C							
E1	Reset signal pulse width	$t_{NRSTW}$		1	-	-	µs

### 1.5.6 Flash EEPROM Characteristics

Parameter		Sym- bol	Conditions	Rating			Unit
				MIN	TYP	MAX	
$V_{DD50} = V_{RST5N}$ to 5.5 V, $V_{SS} = 0.0$ V $T_c = -40$ °C to 115 °C							
F1	Allowable time of re-writing: 1	$E_{MAX1}$	I-Flash, when the ECC function is enabled	T.B.D	-	-	times
F2	Allowable time of re-writing: 2	$E_{MAX2}$	D-Flash, when the ECC function is enabled	T.B.D	-	-	
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 of each series are shown in the following order.

- LQFP128-18□

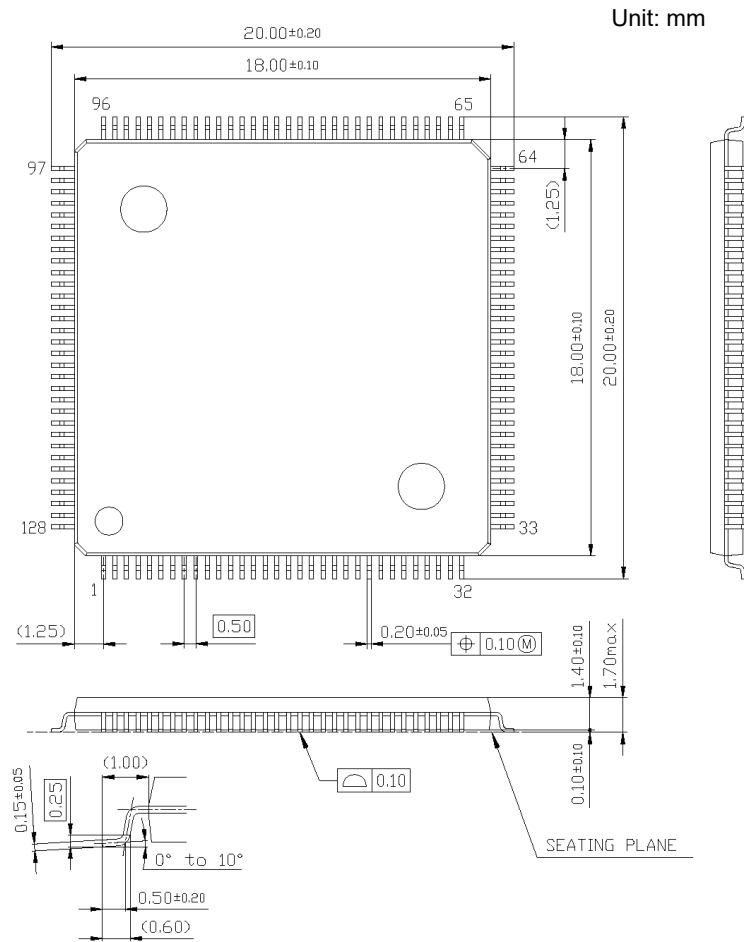


Figure 1.6-1 Package Dimension of LQFP128-18□

- LQFP100-14□

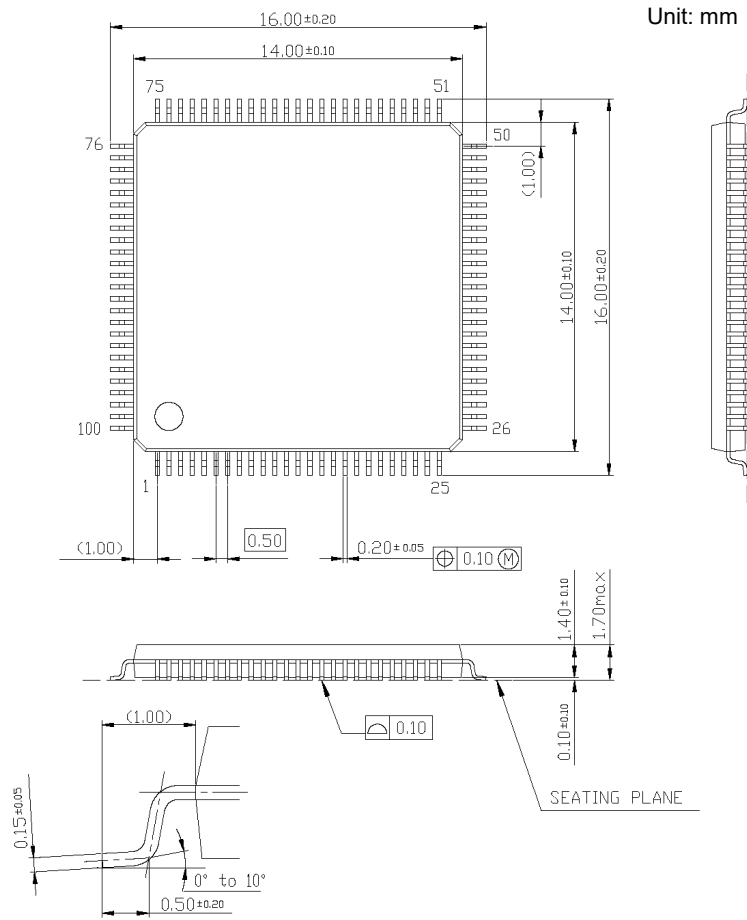
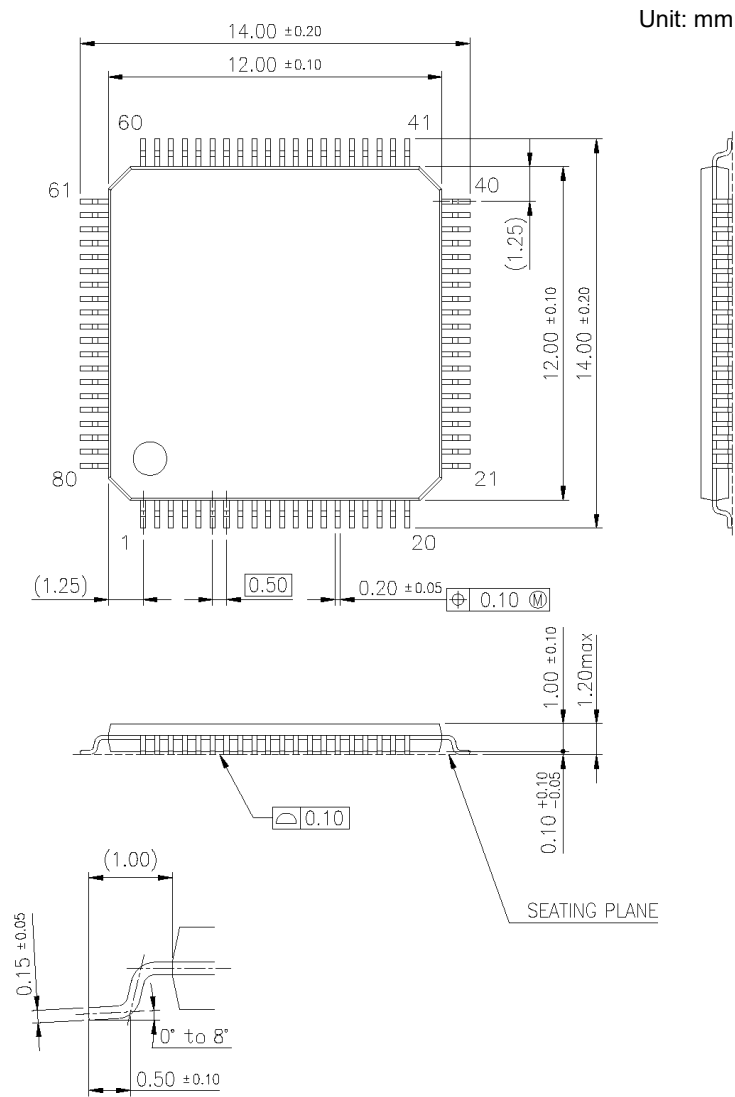


Figure 1.6-2 Package Dimension of LQFP100-14□

- TQFP080-12□



- TQFP064-10□

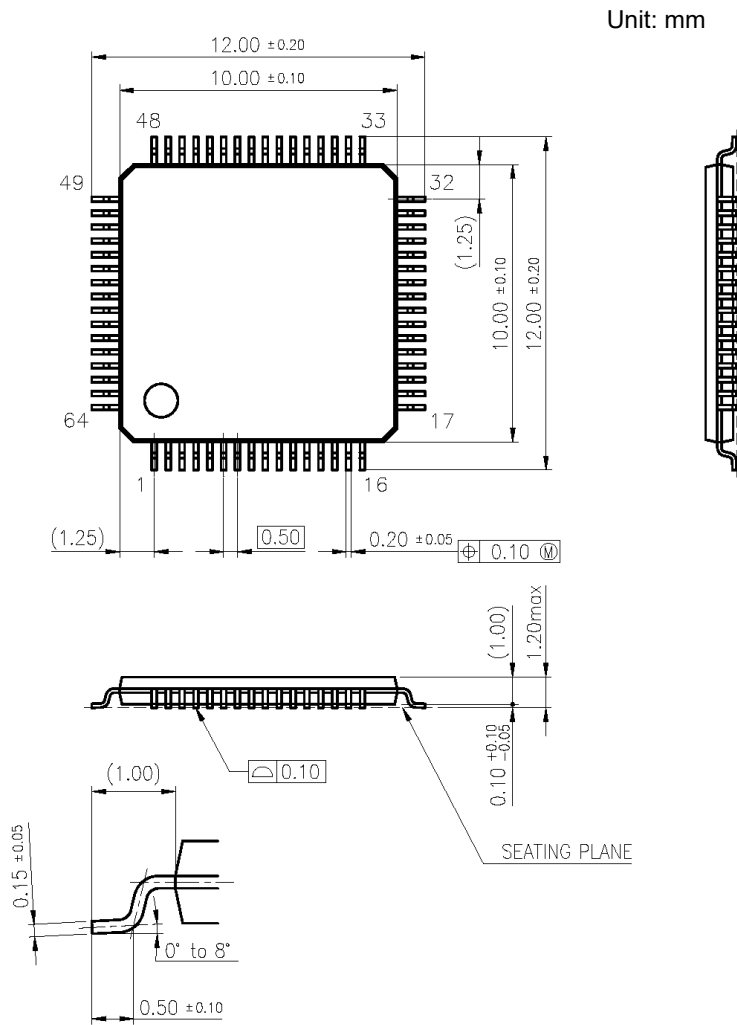


Figure 1.6-6 Package Dimension of TQFP064-10□

- TQFP048-7□

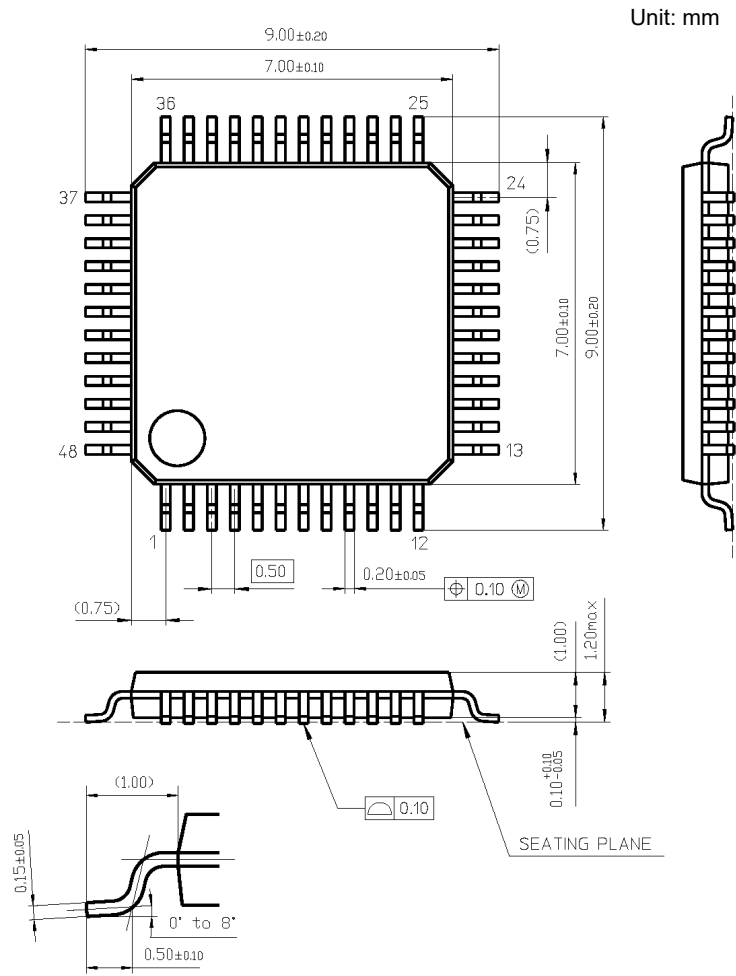


Figure 1.6-8 Package Dimension of TQFP048-7□

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**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.**

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