ARM® Cortex®-M
32-bit Microcontroller

KM1M0GF0/1 Series
Datasheet

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1. Overview

1.1 Overview

KM1M0GF series is a 32-bit microcontroller with a simple, high-performance architecture that pursues ease of use and cost performance for the program development in C language.

This LSI uses Arm Cortex-M0+ CPU core and integrates standard peripherals such as internal memory for instructions/data, DMA controller, clock generator, bus controller, interrupt controller, and timer/serial interface. And this also integrates high-precision and high-speed analog circuits. As system safety design, this LSI has the various safety mechanisms (memory protection, clock error detection, power supply voltage detection, watchdog timer etc.).

1.2 Product Summary

The LSIs shown in Table 1.2-1 are described in this manual.

Table 1.2-1 Product Summary

Series	LSI Part Number	Number of Pins	APROM [KB]	RAM [KB]	CRYPTO Function	APROM Swap Function	Package
KM1M0GF0 Series	KM1M0GF01K (*2)	128	256 + 2	16	-	-	LQFP 14 mm × 14 mm 0.4 mm pitch
	KM1M0GF02K (*1)	100					LQFP 14 mm × 14 mm 0.5 mm pitch
	KM1M0GF03K (*2)	80					LQFP 12 mm × 12 mm 0.5 mm pitch
	KM1M0GF04K (*2)	64					LQFP 10 mm × 10 mm 0.5 mm pitch
	KM1M0GF01Z (*2)	128		24		-	LQFP 14 mm × 14 mm 0.4 mm pitch
	KM1M0GF02Z (*2)	100					LQFP 14 mm × 14 mm 0.5 mm pitch
	KM1M0GF03Z (*2)	80					LQFP 12 mm × 12 mm 0.5 mm pitch
	KM1M0GF04Z (*2)	64					LQFP 10 mm × 10 mm 0.5 mm pitch
	KM1M0GF01Y (*2)	128				✓	LQFP 14 mm × 14 mm 0.4 mm pitch
	KM1M0GF02Y (*2)	100					LQFP 14 mm × 14 mm 0.5 mm pitch
	KM1M0GF03Y (*2)	80					LQFP 12 mm × 12 mm 0.5 mm pitch
	KM1M0GF04Y (*2)	64					LQFP 10 mm × 10 mm 0.5 mm pitch
KM1M0GF1 Series	KM1M0GF11Z (*2)	128			✓	-	LQFP 14 mm × 14 mm 0.4 mm pitch
	KM1M0GF12Z (*1)	100					LQFP 14 mm × 14 mm 0.5 mm pitch
	KM1M0GF13Z (*2)	80					LQFP 12 mm × 12 mm 0.5 mm pitch
	KM1M0GF14Z (*2)	64					LQFP 10 mm × 10 mm 0.5 mm pitch
	KM1M0GF11Y (*2)	128				✓	LQFP 14 mm × 14 mm 0.4 mm pitch
	KM1M0GF12Y (*2)	100					LQFP 14 mm × 14 mm 0.5 mm pitch
	KM1M0GF13Y (*2)	80					LQFP 12 mm × 12 mm 0.5 mm pitch
	KM1M0GF14Y (*2)	64					LQFP 10 mm × 10 mm 0.5 mm pitch

*1 Under development
*2 Planned

1.2.1 Function Summary

Table 1.2-2 shows the functions of each product.

Table 1.2-2 List of Functions

Function		128-pin (KM1M0GFx1x)	100-pin (KM1M0GFx2x)	80-pin (KM1M0GFx3x)	64-pin (KM1M0GFx4x)
CPU		Arm Cortex-M0+			
General purpose pin		115	87	67	51
Operation mode	Active mode	NORMAL mode, SLOW mode			
	Standby mode	SLEEP mode, DEEPSLEEP mode, STOP mode			
Debugger I/F	Interface	SWD			
DMA	Number of channels	2			
Interrupt	External interrupt	20			
Timer	8-bit timer	5			
	16-bit timer	10			
	Motor control PWM	1			
	RTC (24h Timer)	1			
Noise filter	Target	External interrupt			
Communication I/F	Clock-synchro-nous/UART	3			
	IIC	2			
	LIN/UART	1			
	CAN FD	1			
12-bit A/D	AD0 CH number	16		15	10
8-bit D/A	Module number/CH number	2/4			1/1
Comparator	Module number/CH number	2/4		2/3	2/2
CRC calculation	Number of channels	1			
Safety function	Flash memory	ECC, Data protection			
	RAM	1-bit error detection			
	Access area	MPU (Area management / protection), Register Protection			
	System	Window watchdog timer			
	Clock	Clock monitoring (External oscillation, PLL error detection)			
	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			
	CAN message RAM	ECC 1-bit / 2-bit error detection			
	Boot status	Boot status detection			
CRYPTO function		AES Encryption, Random number generator (PRNG)			

1.3 Features

The features of this LSI are described.

Functions	Features
CPU	- Arm Cortex-M0+ ・MPU, configurable 8 areas ・MTB
Memory	- ROM access ・40MHz: 1 wait access - RAM access ・40MHz: No wait access
Clock	- HXOCLK (External high-speed oscillation) frequency: 4 to 20 MHz - HRCCLK (Internal high-speed oscillation) frequency: 20 MHz ± 10 % - LXOCLK (External low-speed oscillation) frequency: 32.768Hz - LRCCLK (Internal low-speed oscillation) frequency: 30 kHz ± 10 % - PLLCLK (PLL) t frequency: 120 MHz to 192 MHz - BASECLK ・Selectable from HXOCLK, HRCCLK, LXOCLK, LRCCLK, PLLCLK ・ Start from HRCCLK after reset release ・Switchable to LRCCLK when a clock error is detected - SYSCLK ・Clock frequency: Selectable from BASECLK divided by 1 to 16 - CPUCLK ・Clock frequency: Selectable from SYSCLK divided by 1 to 128 - HPCLK ・Selectable from HXOCLK, HRCCLK, PLLCLK - LPCLK ・Selectable from LXOCLK, LRCCLK
Reset	- Hardware reset ・Power-on reset - System reset ・NRST pin input ・Register setting ・Error detection (WDT overflow, Clock error detection) - Software reset factor can be monitored
Low power consumption	- SLOW mode: Select LXOCLK or LRCCLK for BASECLK - SLEEP mode: CPUCLK only - DEEP SLEEP mode: Clocks can be stopped including BASECLK - STOP mode: All oscillation stopped
Interrupt	- External interrupt: High/Low-level, Rising/Falling/Both edge
DMA	- Transfer mode: One-word transfer mode, burst transfer mode - Transfer unit: 8-bit/16-bit/32-bit - Maximum transfer words: (2^{16}-1) words - Transfer factor: Software, External interrupt, Peripheral module factor - Maximum register reload: (2^{16}-1) counts - Interrupt: DMA completion, reload count completion, bus error, transfer request overflow, invalid DMA transfer request
Noise filter	- Sampling type noise filter can be inserted to external interrupt. - Sampling clock is selectable
8-bit timer (TM00 to 04)	- Timer pulse output, Additional pulse PWM output - Event count, Simple pulse width measurement - Clock source: SYSCLK, SYSCLK/4, SYSCLK/16, SYSCLK/32, SYSCLK/64, SYSCLK/128, CPUCLK/2, CPUCLK/4, CPUCLK/8, LPCLK, external clock

Functions	Features
16-bit timer (TM07 to 16)	- Timer pulse output, PWM output (cycle/duty can be continuously changed) - Event count, Input capture (rising edge/falling edge) - Start by start trigger - Clock source: SYSCLK, SYSCLK/2, SYSCLK/4, SYSCLK/16, CPUCLK, CPUCLK/2, CPUCLK/4, CPUCLK/16, external clock
Motor control PWM	- Complementary 3-phase PWM output (wave mode: triangular wave, saw-tooth wave) - Dead time insert, Output shift, High/Low-level output - Synchronous A/D conversion trigger - Interrupt output control - Output protection: High/Low/Hi-z outputs - Clock source: SYSCLK, CPUCLK
RTC (24h Timer)	- Calendar (second, minute, hour, date, day of week, month, year) - Periodic interrupt - Alarm
Clock-synchronous (Serial 1 to 3)	- 2-wire/3-wire/4-wire - 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 3.3 Mbps
UART (Serial 1 to 3)	- 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
IIC (Serial 6 to 7)	- Master/Slave communication - Start condition selection: Enabled/Disabled - MSB/LSB transfer selection - Transfer format: 7-bit address format - Maximum transfer rate: Standard mode: 100 kbps, Fast mode: 400 kbps
LIN (Serial 0)	- Master/Slave communication - Wake-Up signal transmission/reception - Break field transmission/reception - Sync field transmission/reception - PID field transmission/reception - Error detection: Checksum error, Bit error, ID parity error, Sync field error, Timeout error - Timeout detection: Bus idle timeout - Baud rate correction
CAN FD	- CAN FD controller mode ・CAN 2.0B and CAN FD mixed mode ・CAN 2.0B mode - ISO11898 compliant
12-bit A/D	- Synchronous start with motor control PWM
Comparator	- Set reference voltage by 8-bit DAC - Sampling type noise filter can be inserted to comparator output - Detection mode can be selected from 1 level, 2 levels or window detection mode
8-bit D/A	- Comparator reference voltage can be generated
CRC calculation	- CRC-32, CRC-16-CCITT, CRC-16-IBM, CRC-8-ATM symbol can be generated

Functions	Features
Safety function	- ECC function ・Check area: APROM, CAN Message RAM ・2-bit random error detection - Parity function ・Check area: RAM ・1-bit random error detection - MPU area management and protection - Flash Erase/Program protection function - Write access protection for main registers - Clock monitor function - Window watchdog timer (internal oscillation count) - Power supply voltage detection - ADC fault diagnosis function using internal power supply - Boot Status detection
CRYPTO function (*1)	- AES encryption - Random number generator (PRNG)

Note:

*1 Only KM1M0GF1 Series has the CRYPTO function.

1.4 Pins

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

- Pin Configuration
- Pin Functions

1.4.1 Pin Configuration

Figure 1.4-1 shows the pin configuration of 128-pin (KM1M0GFx1x).

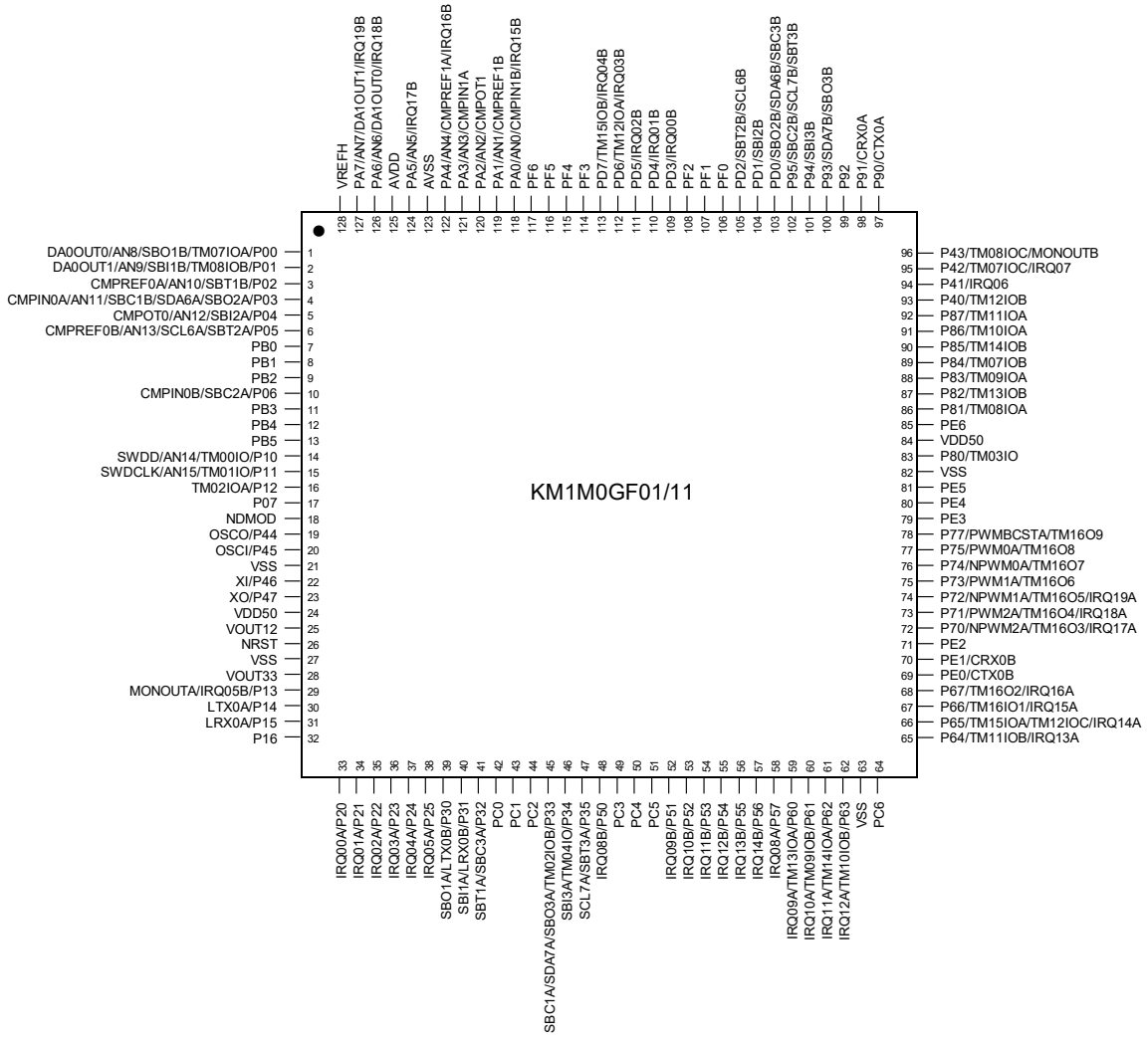


Figure 1.4-1 Pin Configuration 128-pin (KM1M0GFx1x)

Figure 1.4-2 shows the pin configuration of 100-pin (KM1M0GFx2x).

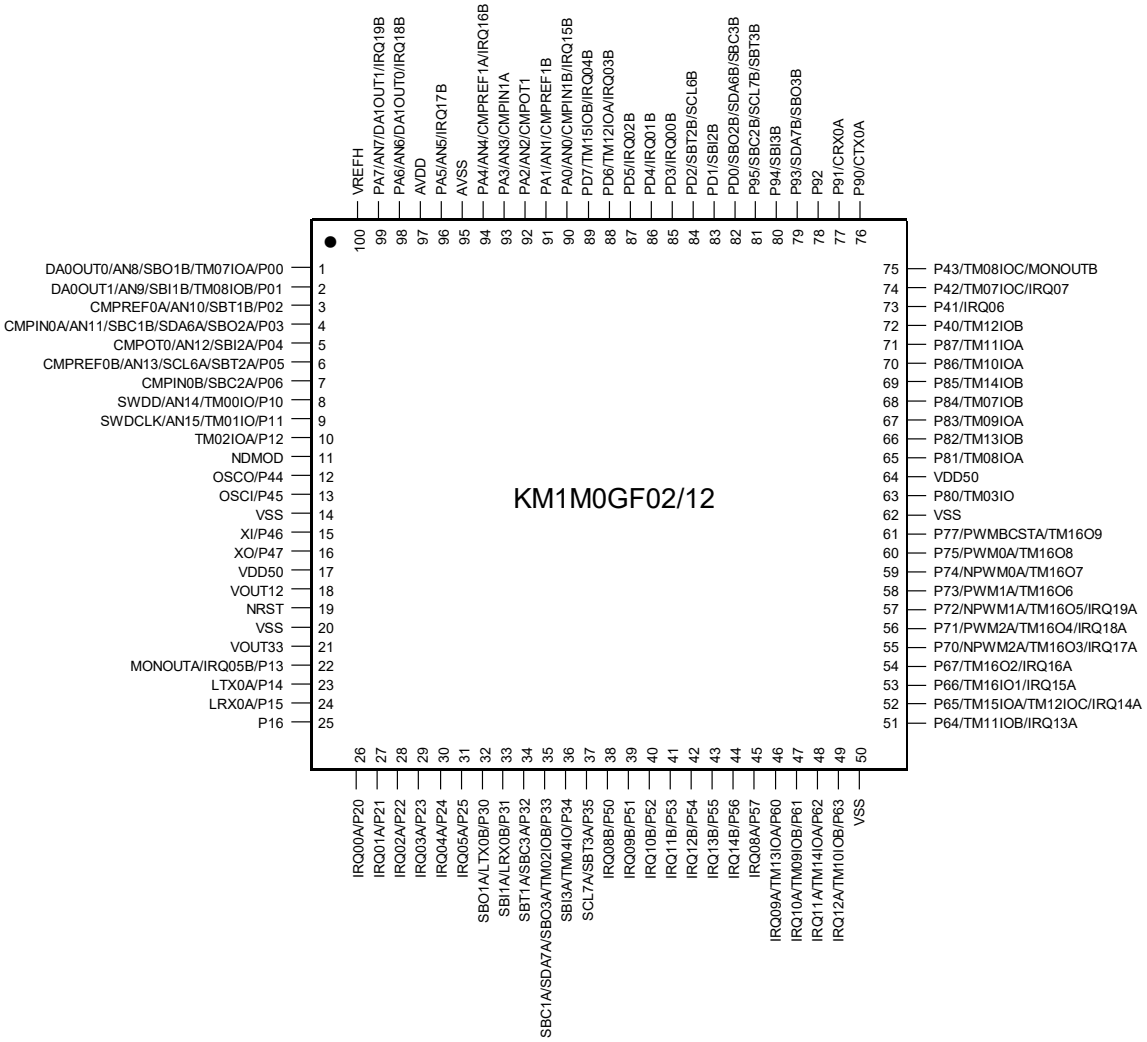


Figure 1.4-2 Pin Configuration 100-pin (KM1M0GFx2x)

Figure 1.4-3 shows the pin configuration of 80-pin (KM1M0GFx3x).

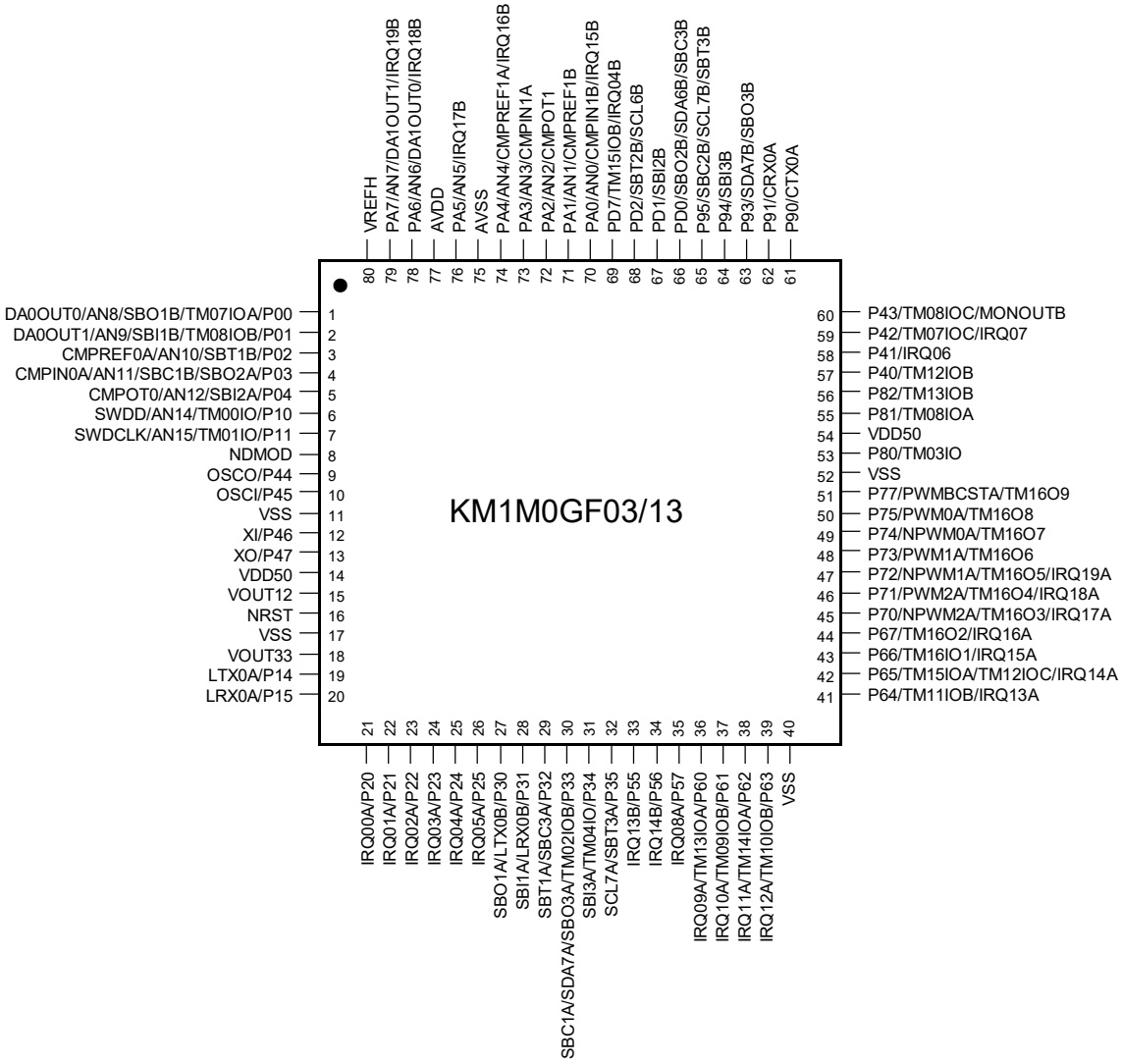


Figure 1.4-3 Pin Configuration 80-pin (KM1M0GFx3x)

Figure 1.4-4 shows the pin configuration of 64-pin (KM1M0GFx4x).

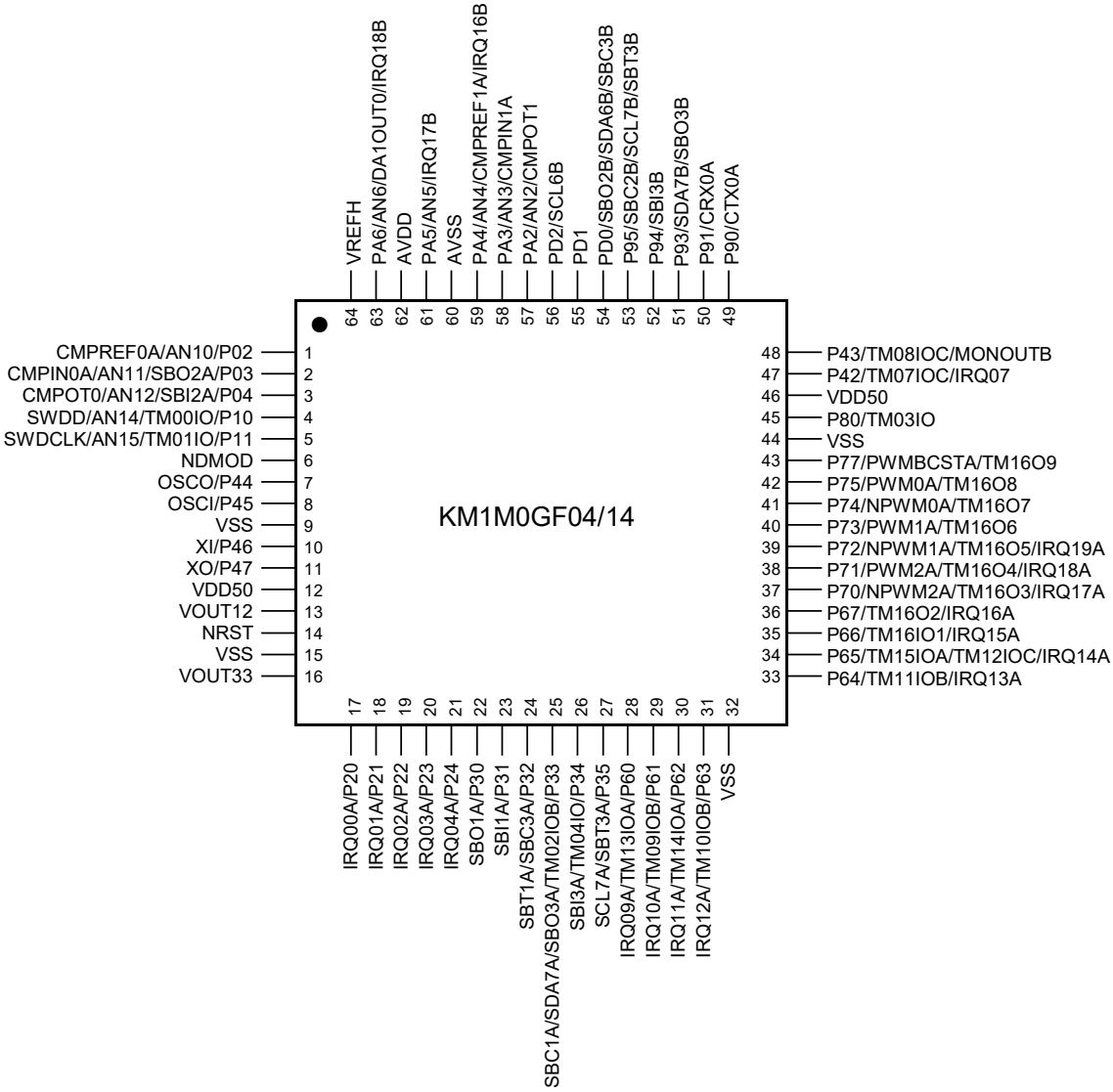


Figure 1.4-4 Pin Configuration 64-pin (KM1M0GFx4x)

1.4.2 128-pin (KM1M0GFx1x) Pin Functions

128-pin (KM1M0GFx1x) pin functions are listed in Table 1.4-1 .

Table 1.4-1 Pin Functions (128-pin(KM1M0GFx1x))

128-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
1	-	P00	TM07IOA	SBO1B	AN8 DA0OUT0	-	-
2	-	P01	TM08IOB	SBI1B	AN9 DA0OUT1	-	-
3	-	P02	-	SBT1B	AN10 CMPREF0A	-	-
4	-	P03	-	SBO2A SDA6A SBC1B	AN11 CMPIN0A	-	-
5	-	P04	-	SBI2A	AN12 CMPOT0	-	-
6	-	P05	-	SBT2A SCL6A	AN13 CMPREF0B	-	-
7	-	PB0	-	-	-	-	-
8	-	PB1	-	-	-	-	-
9	-	PB2	-	-	-	-	-
10	-	P06	-	SBC2A	CMPIN0B	-	-
11	-	PB3	-	-	-	-	-
12	-	PB4	-	-	-	-	-
13	-	PB5	-	-	-	-	-
14	-	P10	TM00IO	-	AN14	-	SWDD
15	-	P11	TM01IO	-	AN15	-	SWDCLK
16	-	P12	TM02IOA	-	-	-	-
17	-	P07	-	-	-	-	-
18	NDMOD	-	-	-	-	-	-
19	OSCO	P44	-	-	-	-	-
20	OSCI	P45	-	-	-	-	-
21	VSS	-	-	-	-	-	-
22	XI	P46	-	-	-	-	-
23	XO	P47	-	-	-	-	-
24	VDD50	-	-	-	-	-	-
25	VOUT12	-	-	-	-	-	-
26	NRST	-	-	-	-	-	-
27	VSS	-	-	-	-	-	-
28	VOUT33	-	-	-	-	-	-
29	-	P13	-	-	-	IRQ05B	MONOUTA
30	-	P14	-	LTX0A	-	-	-
31	-	P15	-	LRX0A	-	-	-
32	-	P16	-	-	-	-	-
33	-	P20	-	-	-	IRQ00A	-

128-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
34	-	P21	-	-	-	IRQ01A	-
35	-	P22	-	-	-	IRQ02A	-
36	-	P23	-	-	-	IRQ03A	-
37	-	P24	-	-	-	IRQ04A	-
38	-	P25	-	-	-	IRQ05A	-
39	-	P30	-	SBO1A LTX0B	-	-	-
40	-	P31	-	SBI1A LRX0B	-	-	-
41	-	P32	-	SBC3A SBT1A	-	-	-
42	-	PC0	-	-	-	-	-
43	-	PC1	-	-	-	-	-
44	-	PC2	-	-	-	-	-
45	-	P33	TM02IOB	SBO3A SDA7A SBC1A	-	-	-
46	-	P34	TM04IO	SBI3A	-	-	-
47	-	P35	-	SBT3A SCL7A	-	-	-
48	-	P50	-	-	-	IRQ08B	-
49	-	PC3	-	-	-	-	-
50	-	PC4	-	-	-	-	-
51	-	PC5	-	-	-	-	-
52	-	P51	-	-	-	IRQ09B	-
53	-	P52	-	-	-	IRQ10B	-
54	-	P53	-	-	-	IRQ11B	-
55	-	P54	-	-	-	IRQ12B	-
56	-	P55	-	-	-	IRQ13B	-
57	-	P56	-	-	-	IRQ14B	-
58	-	P57	-	-	-	IRQ08A	-
59	-	P60	TM13IOA	-	-	IRQ09A	-
60	-	P61	TM09IOB	-	-	IRQ10A	-
61	-	P62	TM14IOA	-	-	IRQ11A	-
62	-	P63	TM10IOB	-	-	IRQ12A	-
63	VSS	-	-	-	-	-	-
64	-	PC6	-	-	-	-	-
65	-	P64	TM11IOB	-	-	IRQ13A	-
66	-	P65	TM15IOA TM12IOC	-	-	IRQ14A	-
67	-	P66	TM16IO1	-	-	IRQ15A	-
68	-	P67	TM16O2	-	-	IRQ16A	-
69	-	PE0	-	-	-	-	CTX0B
70	-	PE1	-	-	-	-	CRX0B

128-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
71	-	PE2	-	-	-	-	-
72	-	P70	NPWM2A TM16O3	-	-	IRQ17A	-
73	-	P71	PWM2A TM16O4	-	-	IRQ18A	-
74	-	P72	NPWM1A TM16O5	-	-	IRQ19A	-
75	-	P73	PWM1A TM16O6	-	-	-	-
76	-	P74	NPWM0A TM16O7	-	-	-	-
77	-	P75	PWM0A TM16O8	-	-	-	-
78	-	P77	PWMBCSTA TM16O9	-	-	-	-
79	-	PE3	-	-	-	-	-
80	-	PE4	-	-	-	-	-
81	-	PE5	-	-	-	-	-
82	VSS	-	-	-	-	-	-
83	-	P80	TM03IO	-	-	-	-
84	VDD50	-	-	-	-	-	-
85	-	PE6	-	-	-	-	-
86	-	P81	TM08IOA	-	-	-	-
87	-	P82	TM13IOB	-	-	-	-
88	-	P83	TM09IOA	-	-	-	-
89	-	P84	TM07IOB	-	-	-	-
90	-	P85	TM14IOB	-	-	-	-
91	-	P86	TM10IOA	-	-	-	-
92	-	P87	TM11IOA	-	-	-	-
93	-	P40	TM12IOB	-	-	-	-
94	-	P41	-	-	-	IRQ06	-
95	-	P42	TM07IOC	-	-	IRQ07	-
96	-	P43	TM08IOC	-	-	-	MONOUTB
97	-	P90	-	-	-	-	CTX0A
98	-	P91	-	-	-	-	CRX0A
99	-	P92	-	-	-	-	-
100	-	P93	-	SDA7B SBO3B	-	-	-
101	-	P94	-	SBI3B	-	-	-
102	-	P95	-	SBC2B SCL7B SBT3B	-	-	-
103	-	PD0	-	SBO2B SDA6B SBC3B	-	-	-

128-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
104	-	PD1	-	SBI2B	-	-	-
105	-	PD2	-	SBT2B SCL6B	-	-	-
106	-	PF0	-	-	-	-	-
107	-	PF1	-	-	-	-	-
108	-	PF2	-	-	-	-	-
109	-	PD3	-	-	-	IRQ00B	-
110	-	PD4	-	-	-	IRQ01B	-
111	-	PD5	-	-	-	IRQ02B	-
112	-	PD6	TM12IOA	-	-	IRQ03B	-
113	-	PD7	TM15IOB	-	-	IRQ04B	-
114	-	PF3	-	-	-	-	-
115	-	PF4	-	-	-	-	-
116	-	PF5	-	-	-	-	-
117	-	PF6	-	-	-	-	-
118	-	PA0	-	-	AN0 CMPIN1B	IRQ15B	-
119	-	PA1	-	-	AN1 CMPREF1B	-	-
120	-	PA2	-	-	AN2 CMPOT1	-	-
121	-	PA3	-	-	AN3 CMPIN1A	-	-
122	-	PA4	-	-	AN4 CMPREF1A	IRQ16B	-
123	AVSS	-	-	-	-	-	-
124	-	PA5	-	-	AN5	IRQ17B	-
125	AVDD	-	-	-	-	-	-
126	-	PA6	-	-	AN6 DA1OUT0	IRQ18B	-
127	-	PA7	-	-	AN7 DA1OUT1	IRQ19B	-
128	VREFH	-	-	-	-	-	-

1.4.3 100-pin (KM1M0GFx2x) Pin Functions

100-pin (KM1M0GFx2x) pin functions are listed in Table 1.4-2 .

Table 1.4-2 Pin Functions (100-pin(KM1M0GFx2x))

100-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
1	-	P00	TM07IOA	SBO1B	AN8 DA0OUT0	-	-
2	-	P01	TM08IOB	SBI1B	AN9 DA0OUT1	-	-
3	-	P02	-	SBT1B	AN10 CMPREF0A	-	-
4	-	P03	-	SBO2A SDA6A SBC1B	AN11 CMPIN0A	-	-
5	-	P04	-	SBI2A	AN12 CMPOT0	-	-
6	-	P05	-	SBT2A SCL6A	AN13 CMPREF0B	-	-
7	-	P06	-	SBC2A	CMPIN0B	-	-
8	-	P10	TM00IO	-	AN14	-	SWDD
9	-	P11	TM01IO	-	AN15	-	SWDCLK
10	-	P12	TM02IOA	-	-	-	-
11	NDMOD	-	-	-	-	-	-
12	OSCO	P44	-	-	-	-	-
13	OSCI	P45	-	-	-	-	-
14	VSS	-	-	-	-	-	-
15	XI	P46	-	-	-	-	-
16	XO	P47	-	-	-	-	-
17	VDD50	-	-	-	-	-	-
18	VOUT12	-	-	-	-	-	-
19	NRST	-	-	-	-	-	-
20	VSS	-	-	-	-	-	-
21	VOUT33	-	-	-	-	-	-
22	-	P13	-	-	-	IRQ05B	MONOUTA
23	-	P14	-	LTX0A	-	-	-
24	-	P15	-	LRX0A	-	-	-
25	-	P16	-	-	-	-	-
26	-	P20	-	-	-	IRQ00A	-
27	-	P21	-	-	-	IRQ01A	-
28	-	P22	-	-	-	IRQ02A	-
29	-	P23	-	-	-	IRQ03A	-
30	-	P24	-	-	-	IRQ04A	-
31	-	P25	-	-	-	IRQ05A	-
32	-	P30	-	SBO1A LTX0B	-	-	-

100-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
33	-	P31	-	SBI1A LRX0B	-	-	-
34	-	P32	-	SBC3A SBT1A	-	-	-
35	-	P33	TM02IOB	SBO3A SDA7A SBC1A	-	-	-
36	-	P34	TM04IO	SBI3A	-	-	-
37	-	P35	-	SBT3A SCL7A	-	-	-
38	-	P50	-	-	-	IRQ08B	-
39	-	P51	-	-	-	IRQ09B	-
40	-	P52	-	-	-	IRQ10B	-
41	-	P53	-	-	-	IRQ11B	-
42	-	P54	-	-	-	IRQ12B	-
43	-	P55	-	-	-	IRQ13B	-
44	-	P56	-	-	-	IRQ14B	-
45	-	P57	-	-	-	IRQ08A	-
46	-	P60	TM13IOA	-	-	IRQ09A	-
47	-	P61	TM09IOB	-	-	IRQ10A	-
48	-	P62	TM14IOA	-	-	IRQ11A	-
49	-	P63	TM10IOB	-	-	IRQ12A	-
50	VSS	-	-	-	-	-	-
51	-	P64	TM11IOB	-	-	IRQ13A	-
52	-	P65	TM15IOA TM12IOC	-	-	IRQ14A	-
53	-	P66	TM16IO1	-	-	IRQ15A	-
54	-	P67	TM16O2	-	-	IRQ16A	-
55	-	P70	NPWM2A TM16O3	-	-	IRQ17A	-
56	-	P71	PWM2A TM16O4	-	-	IRQ18A	-
57	-	P72	NPWM1A TM16O5	-	-	IRQ19A	-
58	-	P73	PWM1A TM16O6	-	-	-	-
59	-	P74	NPWM0A TM16O7	-	-	-	-
60	-	P75	PWM0A TM16O8	-	-	-	-
61	-	P77	PWMBCSTA TM16O9	-	-	-	-
62	VSS	-	-	-	-	-	-
63	-	P80	TM03IO	-	-	-	-
64	VDD50	-	-	-	-	-	-

100-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
65	-	P81	TM08IOA	-	-	-	-
66	-	P82	TM13IOB	-	-	-	-
67	-	P83	TM09IOA	-	-	-	-
68	-	P84	TM07IOB	-	-	-	-
69	-	P85	TM14IOB	-	-	-	-
70	-	P86	TM10IOA	-	-	-	-
71	-	P87	TM11IOA	-	-	-	-
72	-	P40	TM12IOB	-	-	-	-
73	-	P41	-	-	-	IRQ06	-
74	-	P42	TM07IOC	-	-	IRQ07	-
75	-	P43	TM08IOC	-	-	-	MONOUTB
76	-	P90	-	-	-	-	CTX0A
77	-	P91	-	-	-	-	CRX0A
78	-	P92	-	-	-	-	-
79	-	P93	-	SDA7B SBO3B	-	-	-
80	-	P94	-	SBI3B	-	-	-
81	-	P95	-	SBC2B SCL7B SBT3B	-	-	-
82	-	PD0	-	SBO2B SDA6B SBC3B	-	-	-
83	-	PD1	-	SBI2B	-	-	-
84	-	PD2	-	SBT2B SCL6B	-	-	-
85	-	PD3	-	-	-	IRQ00B	-
86	-	PD4	-	-	-	IRQ01B	-
87	-	PD5	-	-	-	IRQ02B	-
88	-	PD6	TM12IOA	-	-	IRQ03B	-
89	-	PD7	TM15IOB	-	-	IRQ04B	-
90	-	PA0	-	-	AN0 CMPIN1B	IRQ15B	-
91	-	PA1	-	-	AN1 CMPREF1B	-	-
92	-	PA2	-	-	AN2 CMPOT1	-	-
93	-	PA3	-	-	AN3 CMPIN1A	-	-
94	-	PA4	-	-	AN4 CMPREF1A	IRQ16B	-
95	AVSS	-	-	-	-	-	-
96	-	PA5	-	-	AN5	IRQ17B	-
97	AVDD	-	-	-	-	-	-

100-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
98	-	PA6	-	-	AN6 DA1OUT0	IRQ18B	-
99	-	PA7	-	-	AN7 DA1OUT1	IRQ19B	-
100	VREFH	-	-	-	-	-	-

1.4.4 80-pin (KM1M0GFx3x) Pin Functions

80-pin (KM1M0GFx3x) pin functions are listed in Table 1.4-3 .

Table 1.4-3 Pin Functions (80-pin(KM1M0GFx3x))

80-pin Pin No.	Power supply / Clock / Sys-tem	Port	Timer	Serial	Analog	Interrupt	Others
1	-	P00	TM07IOA	SBO1B	AN8 DA0OUT0	-	-
2	-	P01	TM08IOB	SBI1B	AN9 DA0OUT1	-	-
3	-	P02	-	SBT1B	AN10 CMPREF0A	-	-
4	-	P03	-	SBO2A SBC1B	AN11 CMPIN0A	-	-
5	-	P04	-	SBI2A	AN12 CMPOT0	-	-
6	-	P10	TM00IO	-	AN14	-	SWDD
7	-	P11	TM01IO	-	AN15	-	SWDCLK
8	NDMOD	-	-	-	-	-	-
9	OSCO	P44	-	-	-	-	-
10	OSCI	P45	-	-	-	-	-
11	VSS	-	-	-	-	-	-
12	XI	P46	-	-	-	-	-
13	XO	P47	-	-	-	-	-
14	VDD50	-	-	-	-	-	-
15	VOUT12	-	-	-	-	-	-
16	NRST	-	-	-	-	-	-
17	VSS	-	-	-	-	-	-
18	VOUT33	-	-	-	-	-	-
19	-	P14	-	LTX0A	-	-	-
20	-	P15	-	LRX0A	-	-	-
21	-	P20	-	-	-	IRQ00A	-
22	-	P21	-	-	-	IRQ01A	-
23	-	P22	-	-	-	IRQ02A	-
24	-	P23	-	-	-	IRQ03A	-
25	-	P24	-	-	-	IRQ04A	-
26	-	P25	-	-	-	IRQ05A	-
27	-	P30	-	SBO1A LTX0B	-	-	-
28	-	P31	-	SBI1A LRX0B	-	-	-
29	-	P32	-	SBC3A SBT1A	-	-	-
30	-	P33	TM02IOB	SBO3A SDA7A SBC1A	-	-	-

80-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
31	-	P34	TM04IO	SBI3A	-	-	-
32	-	P35	-	SBT3A SCL7A	-	-	-
33	-	P55	-	-	-	IRQ13B	-
34	-	P56	-	-	-	IRQ14B	-
35	-	P57	-	-	-	IRQ08A	-
36	-	P60	TM13IOA	-	-	IRQ09A	-
37	-	P61	TM09IOB	-	-	IRQ10A	-
38	-	P62	TM14IOA	-	-	IRQ11A	-
39	-	P63	TM10IOB	-	-	IRQ12A	-
40	VSS	-	-	-	-	-	-
41	-	P64	TM11IOB	-	-	IRQ13A	-
42	-	P65	TM15IOA TM12IOC	-	-	IRQ14A	-
43	-	P66	TM16IO1	-	-	IRQ15A	-
44	-	P67	TM16O2	-	-	IRQ16A	-
45	-	P70	NPWM2A TM16O3	-	-	IRQ17A	-
46	-	P71	PWM2A TM16O4	-	-	IRQ18A	-
47	-	P72	NPWM1A TM16O5	-	-	IRQ19A	-
48	-	P73	PWM1A TM16O6	-	-	-	-
49	-	P74	NPWM0A TM16O7	-	-	-	-
50	-	P75	PWM0A TM16O8	-	-	-	-
51	-	P77	PWMBCSTA TM16O9	-	-	-	-
52	VSS	-	-	-	-	-	-
53	-	P80	TM03IO	-	-	-	-
54	VDD50	-	-	-	-	-	-
55	-	P81	TM08IOA	-	-	-	-
56	-	P82	TM13IOB	-	-	-	-
57	-	P40	TM12IOB	-	-	-	-
58	-	P41	-	-	-	IRQ06	-
59	-	P42	TM07IOC	-	-	IRQ07	-
60	-	P43	TM08IOC	-	-	-	MONOUTB
61	-	P90	-	-	-	-	CTX0A
62	-	P91	-	-	-	-	CRX0A
63	-	P93	-	SDA7B SBO3B	-	-	-
64	-	P94	-	SBI3B	-	-	-

80-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
65	-	P95	-	SBC2B SCL7B SBT3B	-	-	-
66	-	PD0	-	SBO2B SDA6B SBC3B	-	-	-
67	-	PD1	-	SBI2B	-	-	-
68	-	PD2	-	SBT2B SCL6B	-	-	-
69	-	PD7	TM15IOB	-	-	IRQ04B	-
70	-	PA0	-	-	AN0 CMPIN1B	IRQ15B	-
71	-	PA1	-	-	AN1 CMPREF1B	-	-
72	-	PA2	-	-	AN2 CMPOT1	-	-
73	-	PA3	-	-	AN3 CMPIN1A	-	-
74	-	PA4	-	-	AN4 CMPREF1A	IRQ16B	-
75	AVSS	-	-	-	-	-	-
76	-	PA5	-	-	AN5	IRQ17B	-
77	AVDD	-	-	-	-	-	-
78	-	PA6	-	-	AN6 DA1OUT0	IRQ18B	-
79	-	PA7	-	-	AN7 DA1OUT1	IRQ19B	-
80	VREFH	-	-	-	-	-	-

1.4.5 64-pin (KM1M0GFx3x) Pin Functions

64-pin (KM1M0GFx3x) pin functions are listed in Table 1.4-4 .

Table 1.4-4 Pin Functions (64-pin(KM1M0GFx4x))

64-pin Pin No.	Power supply / Clock / Sys-tem	Port	Timer	Serial	Analog	Interrupt	Others
1	-	P02	-	-	AN10 CMPREF0A	-	-
2	-	P03	-	SBO2A	AN11 CMPIN0A	-	-
3	-	P04	-	SBI2A	AN12 CMPOT0	-	-
4	-	P10	TM00IO	-	AN14	-	SWDD
5	-	P11	TM01IO	-	AN15	-	SWDCLK
6	NDMOD	-	-	-	-	-	-
7	OSCO	P44	-	-	-	-	-
8	OSCI	P45	-	-	-	-	-
9	VSS	-	-	-	-	-	-
10	XI	P46	-	-	-	-	-
11	XO	P47	-	-	-	-	-
12	VDD50	-	-	-	-	-	-
13	VOUT12	-	-	-	-	-	-
14	NRST	-	-	-	-	-	-
15	VSS	-	-	-	-	-	-
16	VOUT33	-	-	-	-	-	-
17	-	P20	-	-	-	IRQ00A	-
18	-	P21	-	-	-	IRQ01A	-
19	-	P22	-	-	-	IRQ02A	-
20	-	P23	-	-	-	IRQ03A	-
21	-	P24	-	-	-	IRQ04A	-
22	-	P30	-	SBO1A LTX0B	-	-	-
23	-	P31	-	SBI1A LRX0B	-	-	-
24	-	P32	-	SBC3A SBT1A	-	-	-
25	-	P33	TM02IOB	SBO3A SDA7A SBC1A	-	-	-
26	-	P34	TM04IO	SBI3A	-	-	-
27	-	P35	-	SBT3A SCL7A	-	-	-
28	-	P60	TM13IOA	-	-	IRQ09A	-
29	-	P61	TM09IOB	-	-	IRQ10A	-
30	-	P62	TM14IOA	-	-	IRQ11A	-
31	-	P63	TM10IOB	-	-	IRQ12A	-

64-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
32	VSS	-	-	-	-	-	-
33	-	P64	TM11IOB	-	-	IRQ13A	-
34	-	P65	TM15IOA TM12IOC	-	-	IRQ14A	-
35	-	P66	TM16IO1	-	-	IRQ15A	-
36	-	P67	TM16O2	-	-	IRQ16A	-
37	-	P70	NPWM2A TM16O3	-	-	IRQ17A	-
38	-	P71	PWM2A TM16O4	-	-	IRQ18A	-
39	-	P72	NPWM1A TM16O5	-	-	IRQ19A	-
40	-	P73	PWM1A TM16O6	-	-	-	-
41	-	P74	NPWM0A TM16O7	-	-	-	-
42	-	P75	PWM0A TM16O8	-	-	-	-
43	-	P77	PWMBCSTA TM16O9	-	-	-	-
44	VSS	-	-	-	-	-	-
45	-	P80	TM03IO	-	-	-	-
46	VDD50	-	-	-	-	-	-
47	-	P42	TM07IOC	-	-	IRQ07	-
48	-	P43	TM08IOC	-	-	-	MONOUTB
49	-	P90	-	-	-	-	CTX0A
50	-	P91	-	-	-	-	CRX0A
51	-	P93	-	SDA7B SBO3B	-	-	-
52	-	P94	-	SBI3B	-	-	-
53	-	P95	-	SBC2B SCL7B SBT3B	-	-	-
54	-	PD0	-	SBO2B SDA6B SBC3B	-	-	-
55	-	PD1	-	SBI2B	-	-	-
56	-	PD2	-	SBT2B SCL6B	-	-	-
57	-	PA2	-	-	AN2 CMPOT1	-	-
58	-	PA3	-	-	AN3 CMPIN1A	-	-
59	-	PA4	-	-	AN4 CMPREF1A	IRQ16B	-
60	AVSS	-	-	-	-	-	-

64-pin Pin No.	Power supply / Clock / System	Port	Timer	Serial	Analog	Interrupt	Others
61	-	PA5	-	-	AN5	IRQ17B	-
62	AVDD	-	-	-	-	-	-
63	-	PA6	-	-	AN6 DA1OUT0	IRQ18B	-
64	VREFH	-	-	-	-	-	-

1.4.6 Pin Functions (Sorted by Function).

Table 1.4-5 shows the pin functions grouped by function.

Table 1.4-5 Pin Functions (by function)

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
External power supply	VDD50	24, 84	17, 64	14, 54	12, 46	Input
	AVDD	125	97	77	62	Input
Power pin for internal circuit	VOUT12	25	18	15	13	Output
	VOUT33	28	21	18	16	Output
A/D converter reference power supply	VREFH	128	100	80	64	Input
GND	VSS	21, 27, 63, 82	14, 20, 50, 62	11, 17, 40, 52	9, 15, 32, 44	Input
	AVSS	123	95	75	60	Input
Debugger	SWDCLK	15	9	7	5	Input
	SWDD	14	8	6	4	Input/Output
External oscil-lation	XI	22	15	12	10	Input
	XO	23	16	13	11	Output
	OSCI	20	13	10	8	Input
	OSCO	19	12	9	7	Output
Reset	NRST	26	19	16	14	Input
Mode	NDMOD	18	11	8	6	Input

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
External interrupt	IRQ00A	33	26	21	17	Input
	IRQ01A	34	27	22	18	Input
	IRQ02A	35	28	23	19	Input
	IRQ03A	36	29	24	20	Input
	IRQ04A	37	30	25	21	Input
	IRQ05A	38	31	26	-	Input
	IRQ06	94	73	58	-	Input
	IRQ07	95	74	59	47	Input
	IRQ08A	58	45	35	-	Input
	IRQ09A	59	46	36	28	Input
	IRQ10A	60	47	37	29	Input
	IRQ11A	61	48	38	30	Input
	IRQ12A	62	49	39	31	Input
	IRQ13A	65	51	41	33	Input
	IRQ14A	66	52	42	34	Input
	IRQ15A	67	53	43	35	Input
	IRQ16A	68	54	44	36	Input
	IRQ17A	72	55	45	37	Input
	IRQ18A	73	56	46	38	Input
	IRQ19A	74	57	47	39	Input
	IRQ00B	109	85	-	-	Input
	IRQ01B	110	86	-	-	Input
	IRQ02B	111	87	-	-	Input
	IRQ03B	112	88	-	-	Input
	IRQ04B	113	89	69	-	Input
	IRQ05B	29	22	-	-	Input
	IRQ08B	48	38	-	-	Input
	IRQ09B	52	39	-	-	Input
	IRQ10B	53	40	-	-	Input
	IRQ11B	54	41	-	-	Input
	IRQ12B	55	42	-	-	Input
	IRQ13B	56	43	33	-	Input
	IRQ14B	57	44	34	-	Input
	IRQ15B	118	90	70	-	Input
	IRQ16B	122	94	74	59	Input
	IRQ17B	124	96	76	61	Input
	IRQ18B	126	98	78	63	Input
	IRQ19B	127	99	79	-	Input

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
Timer	TM00IO	14	8	6	4	Input/Output
	TM01IO	15	9	7	5	Input/Output
	TM02IOA	16	10	-	-	Input/Output
	TM02IOB	45	35	30	25	Input/Output
	TM03IO	83	63	53	45	Input/Output
	TM04IO	46	36	31	26	Input/Output
	TM07IOA	1	1	1	-	Input/Output
	TM07IOB	89	68	-	-	Input/Output
	TM07IOC	95	74	59	47	Input/Output
	TM08IOA	86	65	55	-	Input/Output
	TM08IOB	2	2	2	-	Input/Output
	TM08IOC	96	75	60	48	Input/Output
	TM09IOA	88	67	-	-	Input/Output
	TM09IOB	60	47	37	29	Input/Output
	TM10IOA	91	70	-	-	Input/Output
	TM10IOB	62	49	39	31	Input/Output
	TM11IOA	92	71	-	-	Input/Output
	TM11IOB	65	51	41	33	Input/Output
	TM12IOA	112	88	-	-	Input/Output
	TM12IOB	93	72	57	-	Input/Output
	TM12IOC	66	52	42	34	Input/Output
	TM13IOA	59	46	36	28	Input/Output
	TM13IOB	87	66	56	-	Input/Output
	TM14IOA	61	48	38	30	Input/Output
	TM14IOB	90	69	-	-	Input/Output
	TM15IOA	66	52	42	34	Input/Output
	TM15IOB	113	89	69	-	Input/Output
	TM16IO1	67	53	43	35	Input/Output
	TM16O2	68	54	44	36	Output
	TM16O3	72	55	45	37	Output
	TM16O4	73	56	46	38	Output
	TM16O5	74	57	47	39	Output
	TM16O6	75	58	48	40	Output
	TM16O7	76	59	49	41	Output
	TM16O8	77	60	50	42	Output
	TM16O9	78	61	51	43	Output
	NPWM2A	72	55	45	37	Output
	PWM2A	73	56	46	38	Output
	NPWM1A	74	57	47	39	Output
	PWM1A	75	58	48	40	Output
	NPWM0A	76	59	49	41	Output
	PWM0A	77	60	50	42	Output
	PWMBCSTA	78	61	51	43	Output

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
Serial	SBO1A	39	32	27	22	Input/Output
	SBI1A	40	33	28	23	Input
	SBT1A	41	34	29	24	Input/Output
	SBC1A	45	35	30	25	Input/Output
	SBO1B	1	1	1	-	Input/Output
	SBI1B	2	2	2	-	Input
	SBT1B	3	3	3	-	Input/Output
	SBC1B	4	4	4	-	Input/Output
	SBO2A	4	4	4	2	Input/Output
	SBI2A	5	5	5	3	Input
	SBT2A	6	6	-	-	Input/Output
	SBC2A	10	7	-	-	Input/Output
	SBO2B	103	82	66	54	Input/Output
	SBI2B	104	83	67	55	Input
	SBT2B	105	84	68	56	Input/Output
	SBC2B	102	81	65	53	Input/Output
	SBO3A	45	35	30	25	Input/Output
	SBI3A	46	36	31	26	Input
	SBT3A	47	37	32	27	Input/Output
	SBC3A	41	34	29	24	Input/Output
	SBO3B	100	79	63	51	Input/Output
	SBI3B	101	80	64	52	Input
	SBT3B	102	81	65	53	Input/Output
	SBC3B	103	82	66	54	Input/Output
IIC	SDA6A	4	4	-	-	Input/Output
	SDA6B	103	82	66	54	Input/Output
	SCL6A	6	6	-	-	Input/Output
	SCL6B	105	84	68	56	Input/Output
	SDA7A	45	35	30	25	Input/Output
	SDA7B	100	79	63	51	Input/Output
	SCL7A	47	37	32	27	Input/Output
	SCL7B	102	81	65	53	Input/Output
LIN	LTX0A	30	23	19	-	Output
	LTX0B	39	32	27	22	Output
	LRX0A	31	24	20	-	Input
	LRX0B	40	33	28	23	Input
CAN FD	CTX0A	69	-	-	-	Output
	CRX0A	70	-	-	-	Input
	CTX0B	97	76	61	49	Output
	CRX0B	98	77	62	50	Input

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
AD input	AN0	118	90	70	-	Input
	AN1	119	91	71	-	Input
	AN2	120	90	72	57	Input
	AN3	121	93	73	58	Input
	AN4	122	94	74	59	Input
	AN5	124	96	76	61	Input
	AN6	126	98	78	63	Input
	AN7	127	99	79	-	Input
	AN8	1	1	1	-	Input
	AN9	2	2	2	-	Input
	AN10	3	3	3	1	Input
	AN11	4	4	4	2	Input
	AN12	5	5	5	3	Input
	AN13	6	6	-	-	Input
	AN14	14	8	6	4	Input
	AN15	15	9	7	5	Input
Comparator input	CMPREF0A	3	3	3	1	Input
	CMPREF0B	6	6	-	-	Input
	CMPIN0A	4	4	4	2	Input
	CMPIN0B	10	7	-	-	Input
	CMPREF1A	122	94	74	59	Input
	CMPREF1B	119	91	71	-	Input
	CMPIN1A	121	93	73	58	Input
	CMPIN1B	118	90	70	-	Input
Comparator output	CMPOT0	5	5	5	3	Output
	CMPOT1	120	92	72	57	Output
D/A output	DA0OUT0	1	1	1	-	Output
	DA0OUT1	2	2	2	-	Output
	DA1OUT0	126	98	78	63	Output
	DA1OUT1	127	99	79	-	Output
Monitor output	MONOUTA	29	22	-	-	Output
	MONOUTB	96	75	60	48	Output

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
IO port	P00	1	1	1	-	Input/Output
	P01	2	2	2	-	Input/Output
	P02	3	3	3	1	Input/Output
	P03	4	4	4	2	Input/Output
	P04	5	5	5	3	Input/Output
	P05	6	6	-	-	Input/Output
	P06	10	7	-	-	Input/Output
	P07	17	-	-	-	Input/Output
	P10	14	8	6	4	Input/Output
	P11	15	9	7	5	Input/Output
	P12	16	10	-	-	Input/Output
	P13	29	22	-	-	Input/Output
	P14	30	23	19	-	Input/Output
	P15	31	24	20	-	Input/Output
	P16	32	25	-	-	Input/Output
	P20	33	26	21	17	Input/Output
	P21	34	27	22	18	Input/Output
	P22	35	28	23	19	Input/Output
	P23	36	29	24	20	Input/Output
	P24	37	30	25	21	Input/Output
	P25	38	31	26	-	Input/Output
	P30	39	32	27	22	Input/Output
	P31	40	33	28	23	Input/Output
	P32	41	34	29	24	Input/Output
	P33	45	35	30	25	Input/Output
	P34	46	36	31	26	Input/Output
	P35	47	37	32	27	Input/Output
	P40	93	72	57	-	Input/Output
	P41	94	73	58	-	Input/Output
	P42	95	74	59	47	Input/Output
	P43	96	75	60	48	Input/Output
	P44	19	12	9	7	Input
	P45	20	13	10	8	Input
	P46	22	15	12	10	Input
	P47	23	16	13	11	Input
	P50	48	38	-	-	Input/Output
	P51	52	39	-	-	Input/Output
	P52	53	40	-	-	Input/Output
	P53	54	41	-	-	Input/Output
	P54	55	42	-	-	Input/Output
	P55	56	43	33	-	Input/Output
	P56	57	44	34	-	Input/Output
	P57	58	45	35	-	Input/Output

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
IO port	P60	59	46	36	28	Input/Output
	P61	60	47	37	29	Input/Output
	P62	61	48	38	30	Input/Output
	P63	62	49	39	31	Input/Output
	P64	65	51	41	33	Input/Output
	P65	66	52	42	34	Input/Output
	P66	67	53	43	35	Input/Output
	P67	68	54	44	36	Input/Output
	P70	72	55	45	37	Input/Output
	P71	73	56	46	38	Input/Output
	P72	74	57	47	39	Input/Output
	P73	75	58	48	40	Input/Output
	P74	76	59	49	41	Input/Output
	P75	77	60	50	42	Input/Output
	P77	78	61	51	43	Input/Output
	P80	83	63	53	45	Input/Output
	P81	86	65	55	-	Input/Output
	P82	87	66	56	-	Input/Output
	P83	88	67	-	-	Input/Output
	P84	89	68	-	-	Input/Output
	P85	90	69	-	-	Input/Output
	P86	91	70	-	-	Input/Output
	P87	92	71	-	-	Input/Output
	P90	97	76	61	49	Input/Output
	P91	98	77	62	50	Input/Output
	P92	99	78	-	-	Input/Output
	P93	100	79	63	51	Input/Output
	P94	101	80	64	52	Input/Output
	P95	102	81	65	53	Input/Output
	PA0	118	90	70	-	Input/Output
	PA1	119	91	71	-	Input/Output
	PA2	120	92	72	57	Input/Output
	PA3	121	93	73	58	Input/Output
	PA4	122	94	74	59	Input/Output
	PA5	124	96	76	61	Input/Output
	PA6	126	98	78	63	Input/Output
	PA7	127	99	79	-	Input/Output
	PB0	7	-	-	-	Input/Output
	PB1	8	-	-	-	Input/Output
	PB2	9	-	-	-	Input/Output
	PB3	11	-	-	-	Input/Output
	PB4	12	-	-	-	Input/Output
	PB5	13	-	-	-	Input/Output

Functions	Pin Name	128-pin (KM1M0GFx1x) Pin No.	100-pin (KM1M0GFx2x) Pin No.	80-pin (KM1M0GFx3x) Pin No.	64-pin (KM1M0GFx4x) Pin No.	I/O
IO port	PC0	42	-	-	-	Input/Output
	PC1	43	-	-	-	Input/Output
	PC2	44	-	-	-	Input/Output
	PC3	49	-	-	-	Input/Output
	PC4	50	-	-	-	Input/Output
	PC5	51	-	-	-	Input/Output
	PC6	64	-	-	-	Input/Output
	PD0	103	82	66	54	Input/Output
	PD1	104	83	67	55	Input/Output
	PD2	105	84	68	56	Input/Output
	PD3	109	85	-	-	Input/Output
	PD4	110	86	-	-	Input/Output
	PD5	111	87	-	-	Input/Output
	PD6	112	88	-	-	Input/Output
	PD7	113	89	69	-	Input/Output
	PE0	69	-	-	-	Input/Output
	PE1	70	-	-	-	Input/Output
	PE2	71	-	-	-	Input/Output
	PE3	79	-	-	-	Input/Output
	PE4	80	-	-	-	Input/Output
	PE5	81	-	-	-	Input/Output
	PE6	85	-	-	-	Input/Output
	PF0	106	-	-	-	Input/Output
	PF1	107	-	-	-	Input/Output
	PF2	108	-	-	-	Input/Output
	PF3	114	-	-	-	Input/Output
	PF4	115	-	-	-	Input/Output
	PF5	116	-	-	-	Input/Output
	PF6	117	-	-	-	Input/Output

Note:

Use conditions : VDD50=AVDD=VREFH, VSS=AVSS.

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.

1.5.1 Absolute Maximum Ratings

	CMOS Integrated Circuit
Application	General purpose
Feature	CMOS 32-bit 1-chip microcomputer

Parameter			Symbol	Rating	Unit
A1	Power supply voltage 1 (VDD50, AVDD, VREFH pin)		V_{DD50A}	-0.3 to 6.5	V
A2	Internal power supply voltage 1 (VOUT33 pin)		V_{OUT33A}	-0.3 to 4.6	
A3	Internal power supply voltage 2 (VOUT12 pin)		V_{OUT12A}	-0.3 to 1.6	
A4	Input pin voltage		V_{I1}	-0.3 to VDD50 +0.3 (Upper limit: 6.5)	
A5	I/O pin voltage		V_{I2}	-0.3 to VDD50 +0.3 (Upper limit: 6.5)	
A6	Average output current High-level	I/O pin	I_{OH1}(avg)	±6	mA
A7		Total of all pins	I_{OH2}	±60	
A8	Average output current Low-level	I/O pin	I_{OL1}(avg)	±6	
A9		Total of all pins	I_{OL2}	±60	
A10	Average injection current	I/O pin	I_{INJ1}	±2	
A11		Total of all pins	I_{INJ2}	±20	
A12	Power dissipation *1 T_a = 105℃		P_D	230	mW
A13	Operating case temperature		T_a	-40 to 105	℃
A14	Storage temperature		T_{stg}	-55 to 125	

*1 Calculated using a 4-layer printed circuit board (75 mm x 75 mm x 0.8 mm).

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 LSI operating at this range is not guaranteed as it is higher than our stated recommended operating range.

1.5.2 Operation Conditions

Power supply voltage during operation			V_{SS} = 0.0 V Ta = -40 ℃ to 105 ℃			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B1	External power supply voltage 1 (VDD50, AVDD, VREFH pin)	V_{DD50}	V_{RST5N}	5.0	5.5	V
B2	Internal power supply voltage 1 (VOUT33 pin)	V_{OUT33}	-	2.5	-	
B3	Internal power supply voltage 2 (VOUT12 pin)	V_{OUT12}	-	1.25	-	

Note:

Multiple external power supply pins of VDD50 must be supplied from the same one external power supply. Internal regulator output (V_{OUT33}, V_{OUT12}) cannot be supplied to other LSI.

External oscillation 1, 2			VDD50 = VRST5N to 5.5 V, VSS = 0.0 V Ta = -40 ℃ to 105 ℃			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B4	External high-speed oscillation frequency (Ceramic/Crystal)	F_{OSC}	4.0	-	20.0	MHz
B5	External low-speed oscillation frequency (Ceramic/Crystal)	F_{SOSC}	-	32.768	-	kHz

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.

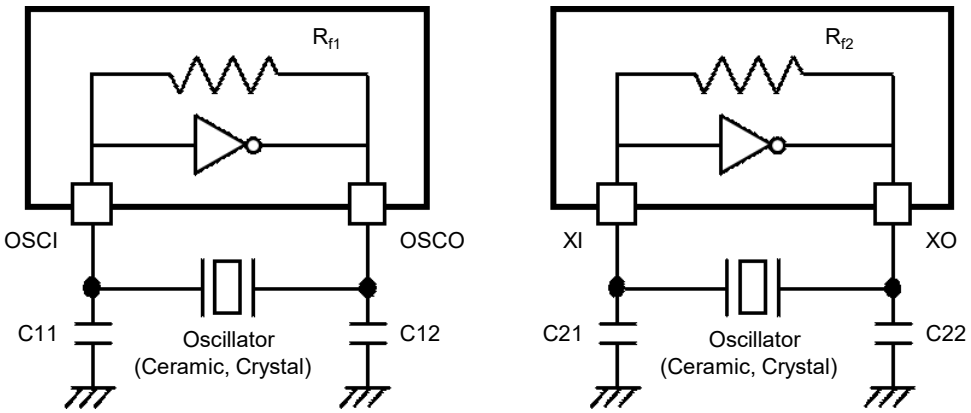


Figure 1.5-1 Example of Oscillator Connection

External clock input OSCI (OSCO left open)			VDD50 = VRST5N to 5.5 V, VSS = 0.0 V Ta = -40 ℃ to 105 ℃			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B6	Clock frequency	F_{CP1}	4.0	-	20.0	MHz
B7	High-level pulse width	t_{wh1}	22.5	-	-	ns
B8	Low-level pulse width	t_{wl1}	22.5	-	-	
B9	Rising time	t_{wr1}	-	-	2.5	
B10	Falling time	t_{wf1}	-	-	2.5	

Note:

It is necessary to set clock duty ratio from 45 % to 55 %.

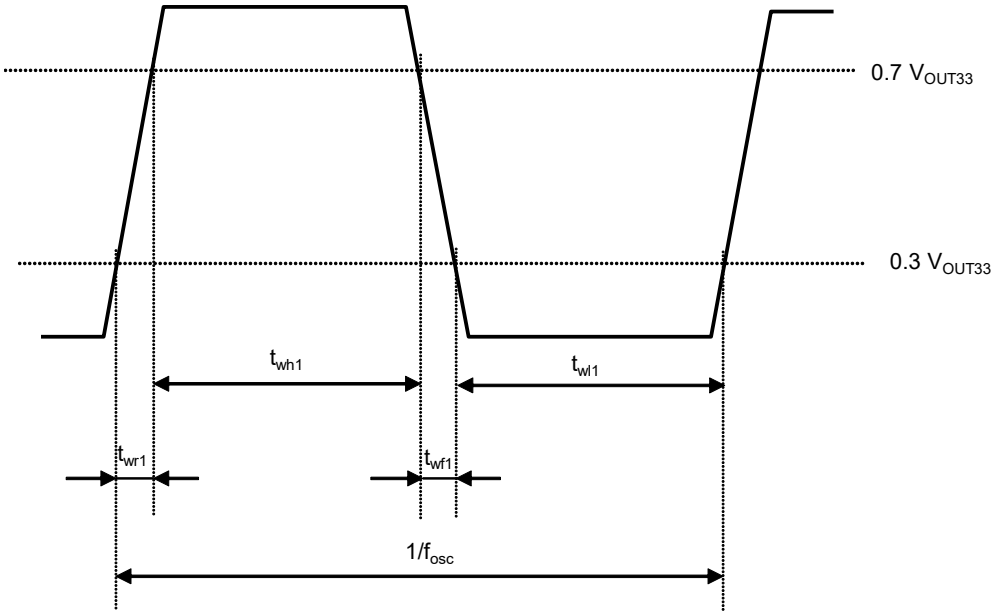


Figure 1.5-2 OSCI Timing Chart

External clock input XI (XO left open)			VDD50 = VRST5N to 5.5 V, VSS = 0.0 V Ta = -40 ℃ to 105 ℃			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B11	Clock frequency	F_{CP2}	-	32.768	-	kHz
B12	High-level pulse width	t_{wh2}	-	4.5	-	µs
B13	Low-level pulse width	t_{wl2}	-	4.5	-	
B14	Rising time	t_{wr2}	-	-	20	ns
B15	Falling time	t_{wf2}	-	-	20	

Note:

It is necessary to set clock duty ratio from 45 % to 55 %.

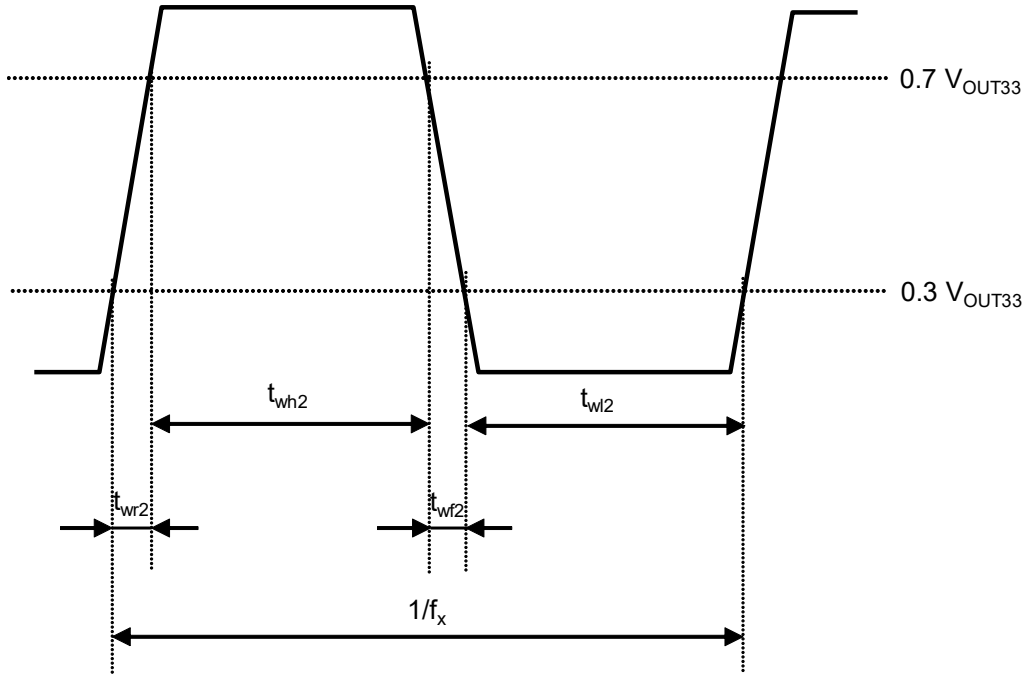


Figure 1.5-3 XI Timing Chart

1.5.3 DC Characteristics

Power supply current during operation					V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Sym-bol	Condition		Rating			Unit
					MIN	TYP	MAX	
C1	NORMAL	IDD1	CPUCLK = 10 MHz HXOCLK = 10 MHz HRCCLK = stopped V_{DD50} = 5 V (when PLL is not used)		-	4.5	9.5	mA
C2		IDD2	CPUCLK = 40 MHz[40 times/divided by 4] HXOCLK = 4 MHz HRCCLK = stopped V_{DD50} = 5 V (when PLL is used)		-	11	16	
C3	SLEEP0	IDD3	CPUCLK = 10 MHz HXOCLK = 10 MHz HRCCLK = stopped V_{DD50} = 5 V (when PLL is not used)		-	4	9	
C4	DEEPSLEEP0	IDD4	CPUCLK = 10 MHz HXOCLK = 10 MHz HRCCLK = stopped V_{DD50} = 5 V (when PLL is not used)		-	2	7	
C5		IDD5	CPUCLK = 40MHz [40 times/divided by 4] HXOCLK = 4 MHz HRCCLK = stopped V_{DD50} = 5 V (when PLL is used)		-	6)	11	
C6	SLOW2	IDD6	CPUCLK = 32.768 kHz LXOCLK = 32.768 kHz LRCCLK = 30 kHz V_{DD50} = 5 V	T_a = 25 ℃	-	35	-	µA
				T_a = 105 ℃	-	-	280	
C7	DEEPSLEEP2	IDD7	HXOCLK = HRCCLK = PLLCLK = SYSCLK = stopped LXOCLK = 32.768 kHz LRCCLK = 30 kHz VDD50 = 5 V		-	20	260	
C8	STOP0/STOP2	IDD8	HXOCLK = HRCCLK = PLLCLK = SYSCLK = LXOCLK = LRCCLK = stopped V_{DD50} = 5 V POWSWCNT.MCAN_PWEN = 1	T_a = 25 ℃	-	15	-	
				T_a = 105 ℃	-	-	250	

Note:

The measurement condition:

- No load (Pull-up resistor/Pull-down resistor unconnected)
- All I/O pins are open.
- A/D converter, D/A converter, Comparator are stopped

Input pin 1 NDMOD				V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
C9	Input voltage High-level	V_{IH1}	-	V_{DD50} × 0.7	-	V_{DD50}	V
C10	Input voltage Low-level	V_{IH1}	-	V_{SS}	-	V_{DD50} × 0.3	
C11	Input leakage current	I_{LK1}	V_{IN} = 0 V to V_{DD50}	-	-	±1	µA

Input pin 2 P44, P45, P46, P47				V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
C12	Input voltage High-level	V_{IH2}	-	V_{DD50} × 0.7	-	V_{DD50}	V
C13	Input voltage Low-level 1	V_{IL2-1}	-	V_{SS}	-	V_{DD50} × 0.3	
C14	Input voltage Low-level 2	V_{IL2-2}	Extended input level V_{DD50} = 4.5 V to 5.5 V	V_{SS}	-	V_{DD50} × 0.45	
C15	Input leakage current	I_{LK2}	V_{IN} = 0 V to V_{DD50}	-	-	±1	µA
C16	Internal pull-up resistor	R_{IO2}	V_{IN} = 0 V	15	30	60	kΩ

Input pin 3 NRST				V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
C17	Input voltage High-level	V_{IH3}	-	V_{DD50} × 0.7	-	V_{DD50}	V
C18	Input voltage Low-level	V_{IH3}	-	V_{SS}	-	V_{DD50} × 0.3	
C19	Internal pull-up resistor	R_{IO3}	V_{IN} = 0 V	15	30	60	kΩ

I/O pin 1 P00 to P07, P10 to P16, P20 to P25, P30 to P35, P40 to P43, P50 to P57, P60 to P67, P70 to P75, P77, P80 to P87, P90 to P95, PA0 to PA7, PB0 to PB5, PC0 to PC6, PD0 to PD7, PE0 to PE6, PF0 to PF6				V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
C20	Input voltage High-level	V_{IH4}	-	V_{DD50} × 0.7	-	V_{DD50}	V
C21	Input voltage Low-level 1	V_{IL4-1}	-	V_{SS}	-	V_{DD50} × 0.3	
C22	Input voltage Low-level 2	V_{IL4-2}	Extended input level V_{DD50} = 4.5 V to 5.5 V	V_{SS}	-	V_{DD50} × 0.45	
C23	Input leakage current	I_{LK4}	V_{IN} = 0 V to V_{DD50}	-	-	±1	µA
C24	Internal pull-up resistor	R_{IO4}	V_{IN} = 0 V	15	30	60	kΩ
C25	Output voltage High-level	V_{OH4}	V_{DD50} = 5.0 V, I_{OH} = -3 mA	4.5	-	-	V
C26	Output voltage Low-level	V_{OL4}	V_{DD50} = 5.0 V, I_{OL} = 3 mA	-	-	0.5	

1.5.4 Analog Characteristics

This Manual shows the electrical characteristics of analog.

1.5.4.1 12-bit A/D Converter

12-bit A/D converter ADC				V_{DD50} = 2.7 to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
D1	Resolution	-	-	10	-	12	Bit
D2	Conversion clock	-	-	2	-	10	Bit
D3	Integral non-linearity error	$INLE_{AD}$	Sampling time ≥ 300 ns Conversion clock = 10 MHz V_{DD50} = 5.0 V	-	-	±3	LSB
D4	Differential non-linearity error	$DNLE_{AD}$		-	-	±3	
D5	Zero transition voltage	-		-	10	20	mV
D6	Full-scale transition voltage	-		V_{DD50} - 20	V_{DD50} - 10	-	
D7	A/D conversion time	T_{CONV1}	12-bit conversion, ADCK = 10 MHz, S/H = 3 cycles	1.6	-	-	µs
		T_{CONV2}	10-bit conversion, ADCK = 10 MHz, S/H = 3 cycles	1.4	-	-	
D8	Input dynamic range	V_{IA}	-	V_{SS}	-	V_{DD50}	V
D9	Power supply current during operation	I_{AD}	-	-	1	-	mA

1.5.4.2 D/A Converter

8-bit D/A converter DAC0, DAC1				V_{DD50} = 2.7 to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
D10	Resolution	-	-	-	-	8	Bit
D11	Zero scale voltage	V_{ZS}	V_{DD50} = 5.0 V	-1	-	+1	LSB
D12	Full scale voltage	V_{FS}		V_{DD50} - 2	-	V_{DD50}	
D13	Integral non-linearity error	$INLE_{DA}$	R_{IO} = 4 MΩ V_{DD50} = 5.0 V	-	-	±3	
D14	Differential non-linearity error	$DNLE_{DA}$		-	-	±3	
D15	Settling time	T_{SET}	External load CL = 15 pF Settling accuracy: ±1LSB	-	-	5.5	µs
D16	Power supply current during operation	I_{DA}	-	-	150	-	µA/unit

1.5.4.3 Comparator

Comparator CMP0, CMP1				V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
D17	Input Offset voltage	V_{OFFC}	V_{DD50} = 5.0 V	-	-	±25	mV
D18	Input dynamic range	V_{IC}	V_{DD50} = 5.0 V	0.1	-	V_{DD50}-0.1	V
D19	Output delay	-	Low-speed mode Input slew rate > 1 V/μs V_{DD50} = 5.0 V	-	-	3.0	μs
D20		-	High-speed mode Input slew rate > 1 V/μs V_{DD50} = 5.0 V	-	-	2.0	μs
D21	Operation stabilization wait time	-	-	30	-	-	μs
D22	Power supply current during operation	I_{CMP}	-	-	10	-	μA/unit

1.5.4.4 Internal Oscillation

			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
D23	Internal high-speed oscillation circuit Output frequency	F_{RC}	-	18	20	22	MHz
D24	Internal low-speed oscillation circuit Output frequency	F_{RCX}	-	27	30	33	kHz

1.5.4.5 Power-on Reset

				V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D25	Power supply voltage detection level	V_{RST5P}	At rising	2.4	2.7	3.0	V
D26		V_{RST5N}	At falling	2.25	2.40	2.55	
D27	Hysteresis width (*1)	V_{RSTHYS}	V_{RST5P} - V_{RST5N}	80	-	-	mV
D28	Change rate of power supply voltage	ΔV_{DD50}	-	-	-	50	V/ms

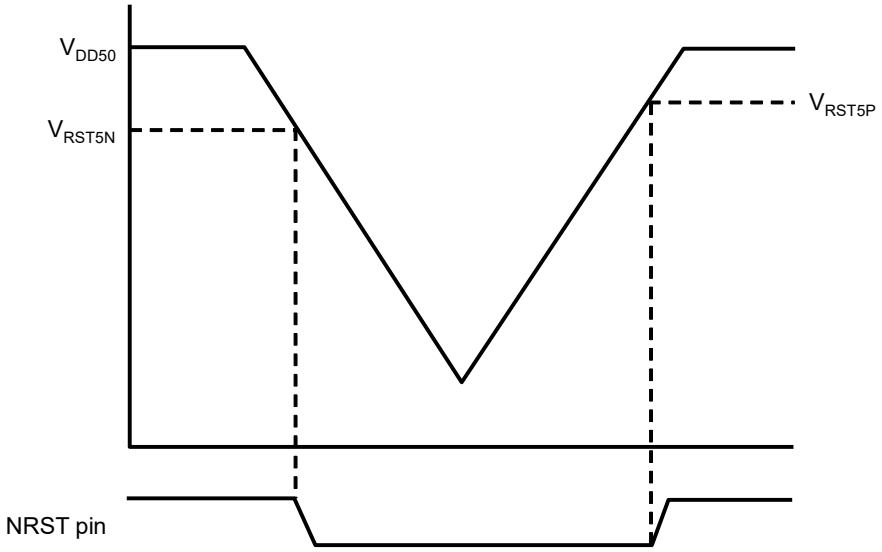


Figure 1.5-4 Characteristics of Power-on Reset Circuit

Note:

*1 The characteristics are a design guarantee.

1.5.4.6 Power Supply Voltage Detection (LVD)

				V_{SS} = 0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
D29	Power supply detection level 1-1	V_{LVD11}	At rising	2.4	2.6	2.8	V
D30	Power supply detection level 1-2	V_{LVD12}	At falling	2.3	2.5	2.7	
D31	Power supply detection level 2-1	V_{LVD21}	At rising	2.6	2.8	3.0	
D32	Power supply detection level 2-2	V_{LVD22}	At falling	2.5	2.7	2.9	
D33	Power supply detection level 3-1	V_{LVD31}	At rising	2.8	3.0	3.2	
D34	Power supply detection level 3-2	V_{LVD32}	At falling	2.7	2.9	3.1	
D35	Power supply detection level 4-1	V_{LVD41}	At rising	3.0	3.2	3.4	
D36	Power supply detection level 4-2	V_{LVD42}	At falling	2.9	3.1	3.3	
D37	Power supply detection level 5-1	V_{LVD51}	At rising	3.2	3.4	3.6	
D38	Power supply detection level 5-2	V_{LVD52}	At falling	3.1	3.3	3.5	
D39	Power supply detection level 6-1	V_{LVD61}	At rising	3.4	3.6	3.8	
D40	Power supply detection level 6-2	V_{LVD62}	At falling	3.3	3.5	3.7	
D41	Power supply detection level 7-1	V_{LVD71}	At rising	3.575	3.8	4.025	
D42	Power supply detection level 7-2	V_{LVD72}	At falling	3.475	3.7	3.925	
D43	Power supply detection level 8-1	V_{LVD81}	At rising	3.775	4.0	4.225	
D44	Power supply detection level 8-2	V_{LVD82}	At falling	3.675	3.9	4.125	
D45	Change rate of power supply voltage	Δt/ΔV				50	V/ms

1.5.5 AC Characteristics

1.5.5.1 Reset

			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
E1	Reset signal L pulse width	t_{NRSTW}	-	2	-	-	μs

1.5.5.2 Serial Interface

Serial interface 1 to 3 Clock-Synchronous I/O timing 1 Master (SBT polarity High-level)			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V C_L = 30 pF, T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
E2	Cycle time	t_{S_CYCLE1}	-	300	-	-	ns
E3	SBT High-level width	t_{S_HIGH1}	-	(t_{S_CYCLE1}/2)-17	-	-	
E4	SBT Low-level width	t_{S_LOW1}	-	(t_{S_CYCLE1}/2)-17	-	-	
E5	SBI/SBO setup time	t_{S_SET1}	-	11	-	-	
E6	SBI/SBO hold time	t_{S_HOLD1}	-	11	-	-	
E7	SBO output delay	t_{S_OPD1}	-	-	-	86	

Serial interface 1 to 3 Clock-Synchronous I/O timing 2 Slave (SBT polarity High-level)			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V C_L = 30 pF, T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
E8	Cycle time	t_{S_CYCLE1}	-	300	-	-	ns
E9	SBT High-level width	t_{S_HIGH1}	-	133	-	-	
E10	SBT Low-level width	t_{S_LOW1}	-	133	-	-	
E11	SBI/SBO setup time	t_{S_SET1}	-	11	-	-	
E12	SBI/SBO hold time	t_{S_HOLD1}	-	11	-	-	
E13	SBO output delay	t_{S_OPD1}	-	-	-	86	

Serial interface 1 to 3 Clock-Synchronous I/O timing 3 Master (SBT polarity Low-level)			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V C_L = 30 pF, T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
E14	Cycle time	t_{S_CYCLE2}	-	300	-	-	ns
E15	SBT High-level width	t_{S_HIGH2}	-	(t_{S_CYCLE2}/2)-17	-	-	
E16	SBT Low-level width	t_{S_LOW2}	-	(t_{S_CYCLE2}/2)-17	-	-	
E17	SBI/SBO setup time	t_{S_SET2}	-	11	-	-	
E18	SBI/SBO hold time	t_{S_HOLD2}	-	11	-	-	
E19	SBO output delay	t_{S_OPD2}	-	-	-	86	

Serial interface 1 to 3 Clock-Synchronous I/O timing 4 Slave (SBT polarity Low-level)			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V C_L = 30 pF, T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
E20	Cycle time	t_{S_CYCLE2}	-	300	-	-	ns
E21	SBT High-level width	t_{S_HIGH2}	-	133	-	-	
E22	SBT Low-level width	t_{S_LOW2}	-	133	-	-	
E23	SBI/SBO setup time	t_{S_SET2}	-	11	-	-	
E24	SBI/SBO hold time	t_{S_HOLD2}	-	11	-	-	
E25	SBO output delay	t_{S_OPD2}	-	-	-	86	

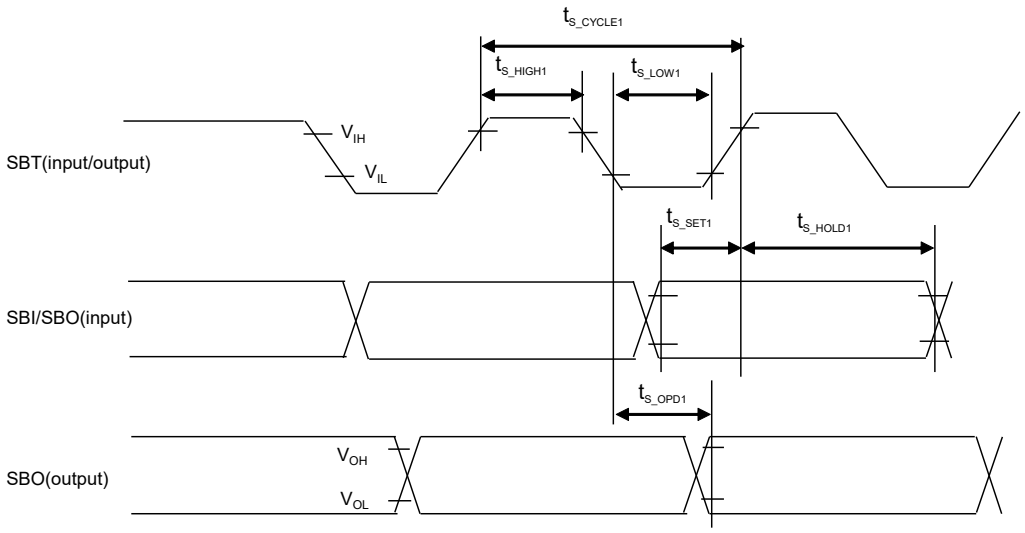


Figure 1.5-5 Serial Interface signal timing 1 (SBT polarity High-level)

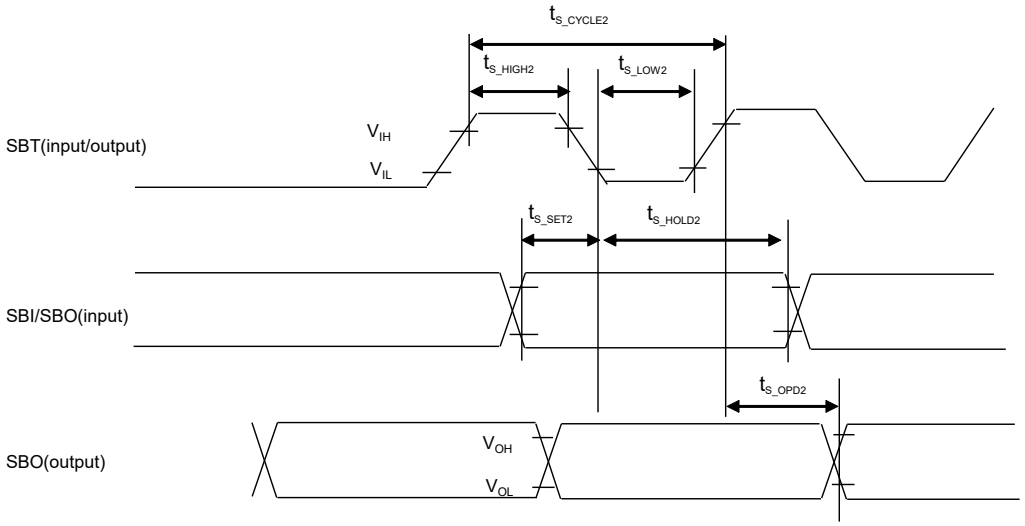


Figure 1.5-6 Serial Interface signal timing 2 (SBT polarity Low-level)

Serial interface 6 and 7 IIC signal I/O timing 1 (SCL clock frequency: max 100 kHz)			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V C_L = 30 pF, T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
E26	Bus free time	t_{BUF}	-	4.7	-	-	µs
E27	Hold time of start condition	$t_{HD;STA}$	-	4.0	-	-	
E28	Clock Low-level pulse width	t_{LOW}	-	4.7	-	-	
E29	Clock High-level pulse width	t_{HIGH}	-	4.0	-	-	
E30	Setup time of repeat start condition	$t_{SU;STA}$	-	4.7	-	-	
E31	Hold time of data	$t_{HD;DAT}$	At SDA output	300	-	-	ns
			At SDA input	0	-	-	
E32	Setup time of data	$t_{SU;DAT}$	-	250	-	-	
E33	Setup time of stop condition	$t_{SU;STO}$	-	4.0	-	-	µs

Serial interface 6 and 7 IIC signal I/O timing 2 (SCL clock frequency: max 400 kHz)			V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V C_L = 30 pF, T_a = -40 ℃ to 105 ℃				
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
E34	Bus free time	t_{BUF}	-	1.3	-	-	µs
E35	Hold time of start condition	$t_{HD;STA}$	-	0.6	-	-	
E36	Clock Low-level pulse width	t_{LOW}	-	1.3	-	-	
E37	Clock High-level pulse width	t_{HIGH}	-	0.6	-	-	
E38	Setup time of repeat start condition	$t_{SU;STA}$	-	0.6	-	-	
E39	Hold time of data	$t_{HD;DAT}$	At SDA output	300	-	-	ns
			At SDA input	0	-	-	
E40	Setup time of data	$t_{SU;DAT}$	-	100	-	-	
E41	Setup time of stop condition	$t_{SU;STO}$	-	0.6	-	-	µs

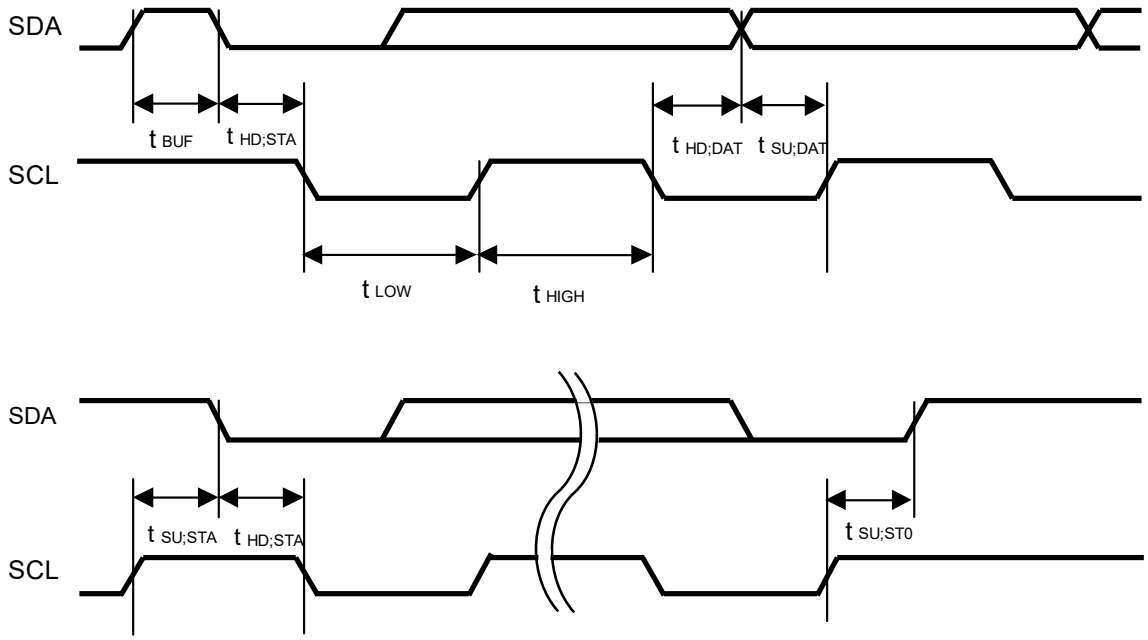


Figure 1.5-7 IIC Signal Timing

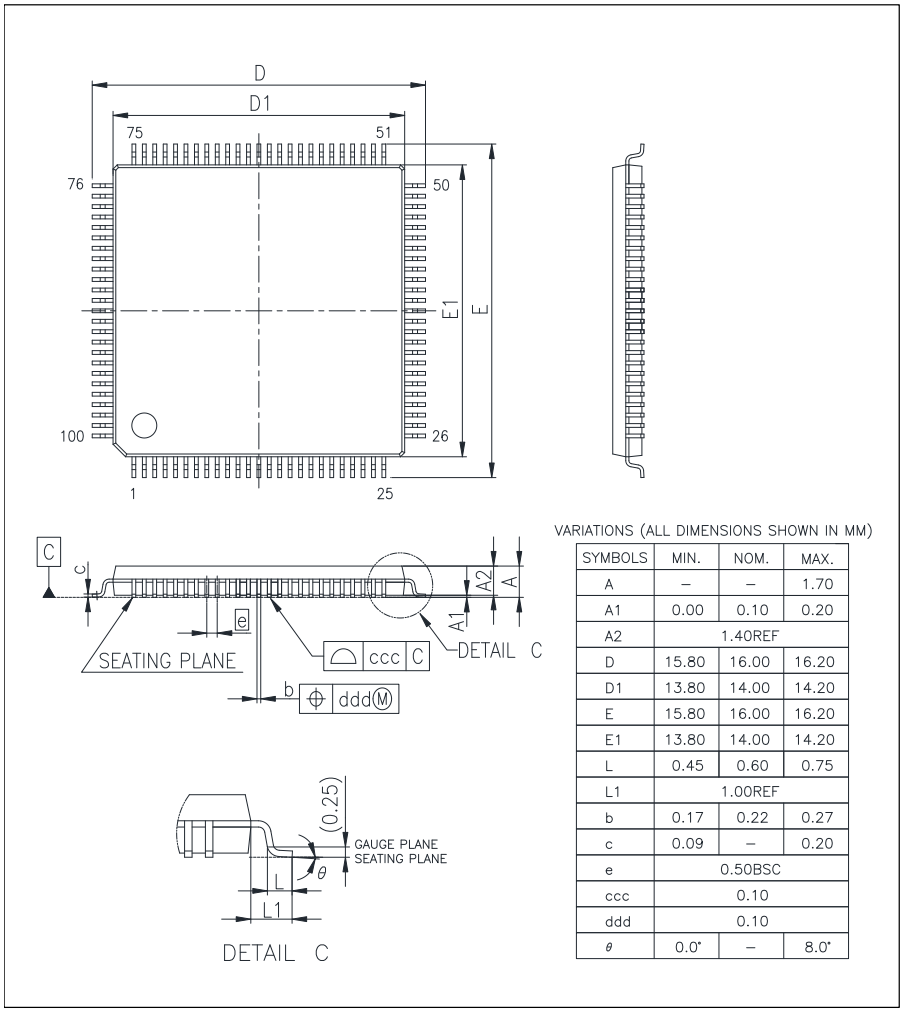
1.5.6 Flash EEPROM Characteristics

				V_{DD50} = V_{RST5N} to 5.5 V, V_{SS} = 0.0 V T_a = -40 ℃ to 105 ℃			
Parameter		Symbol	Condition	Rating			Unit
				MIN	TYP	MAX	
F1	E/W power supply voltage	V_{DD50EW}	-	2.2	-	5.5	V
F2	E/W counts	T_{EW}	-	100	-	-	times
F3	Data retention period	T_{HLD}	-	15	-	-	years
F4	Write time	T_{WRITE}	Per 8 bytes	-	120	150	μs
F5	Erase time	T_{ERASE}	Per 1 sector	-	25	30	ms
F6	Write current	I_{WRITE}	-	-	-	3.1	mA
F7	Erase current	I_{ERASE}	-	-	-	3.1	mA

1.6 Package Dimension

The package dimension is shown below.

- LQFP100-pin 14 mm□, 0.5 mm pitch Figure 1.6-1



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.70
A1	0.00	0.10	0.20
A2		1.40REF	
D	15.80	16.00	16.20
D1	13.80	14.00	14.20
E	15.80	16.00	16.20
E1	13.80	14.00	14.20
L	0.45	0.60	0.75
L1		1.00REF	
b	0.17	0.22	0.27
c	0.09	–	0.20
e		0.50BSC	
ccc		0.10	
ddd		0.10	
θ	0.0°	–	8.0°

Figure 1.6-1 Package Dimension of LQFP100-pin 14 mm□

1.7 Cautions for Circuit Setup

The cautions for circuit setup are described as follows.

- Cautions of Usage
- Pin Connections
- Unused Pin Connection
- Cautions on Power Supply
- Example of Oscillator Connection

1.7.1 Cautions of Usage

When using this LSI, obey the following cautions.

1. Operation temperature should be well considered. If the operation temperature is over the condition, improper operation can occur.
2. Operation voltage should be also well considered.

   - If the operation voltage is over the operating range, the life of the product can be shortened (e.g., the lifetime warranty of a transistor due to the change over time).

   - If the operation voltage is below the operating range, it may operate improperly.
3. If you install the product close to high electrical fields (such as just below the cathode ray tube, etc.), shield the package surface to ensure normal performance.

1.7.2 Pin Connections

Each pin connection is listed in Table 1.7-1 .

Table 1.7-1 Pin Connections

Pin Name	Input/Output	Connection Details
VDD50	Input	Connect to 5 V external power supply. Connect the high-frequency nose filtering bypass capacitor (0.1 μF) between each pin and VSS pins. Also, connect the decoupling capacitor (2 μF or more) between the VDD50 pin, which is adjacent to the VOUT12 pin, and VSS pins. (Put the capacitor near the pins) Before branching to the VDD50, AVDD, and VREFH pins near the 5V power supply, connect the electrolytic capacitor (10 μF or more) for low-frequency noise filtering.
AVDD	Input	Connect to 5 V external power supply. Connect the high-frequency nose filtering bypass capacitor (0.1 μF) between AVDD and AVSS. (Put the capacitor near the pins)
VREFH	Input	Connect to 5 V external power supply.
VSS	Input	Short circuit with common GND.
AVSS	Input	Short circuit with common GND.
VOUT12	Output	Connect the high-frequency nose filtering bypass capacitor (0.1 μF) and the capacitor (1 μF) for stabilization between VOUT12 pin and VSS pins. (Put the capacitor near the pins)
VOUT33	Output	Connect the high-frequency nose filtering bypass capacitor (0.1 μF) and the capacitor (1 μF) for stabilization between VOUT33 pin and VSS pins. (Put the capacitor near the pins)
OSCI, OSCO	I/O	HXOCLK is generated by connecting the oscillator to OSCI and OSCO pins and starting external high-speed oscillation (HXO).
XI, XO	I/O	LXOCLK is generated by connecting the oscillator to XI and XO pins and starting external low-speed oscillation (LXO).
SWDCLK, SWDD	I/O	Insert a 100 Ω limit resistor between this pin and the external connector. Pull-up connect to V_{DD50} with the 10 kΩ resistor.
NDMOD	Input	Insert a 100 Ω limit resistor between this pin and the external connector. Pull-up connect to V_{DD50} with the 2 kΩ resistor.
NRST	I/O	Insert a 100 Ω limit resistor between this pin and the external connector. Connect the capacitor (1.0 μF or more) between NRST pin and VSS pin, and the discharge diode between NRST pin and V_{DD50}. (Put the capacitor near the pins)
Others	I/O	For pins where external noise is a concern, it is recommended to insert a limiting resistor of about 100 Ω.

Note:
Determine the processing method of each pin by evaluating enough in consideration of the effect of external noise.

Note:
VOUT33 and VOUT12 are the pins to connect capacity for the internal power supply stabilization.

Note:
The wiring for power supply and GND lines should be as thick and short as possible.

Note:

Capacitors other than electrolytic capacitors of 10 μF or more must be placed as close to the pins as possible. When placing them in parallel, place the one with excellent frequency response closer to the pins.

Figure 1.7-1 shows the MCU peripheral recommended circuit. Table 1.7-2 shows the recommended external circuit constants.

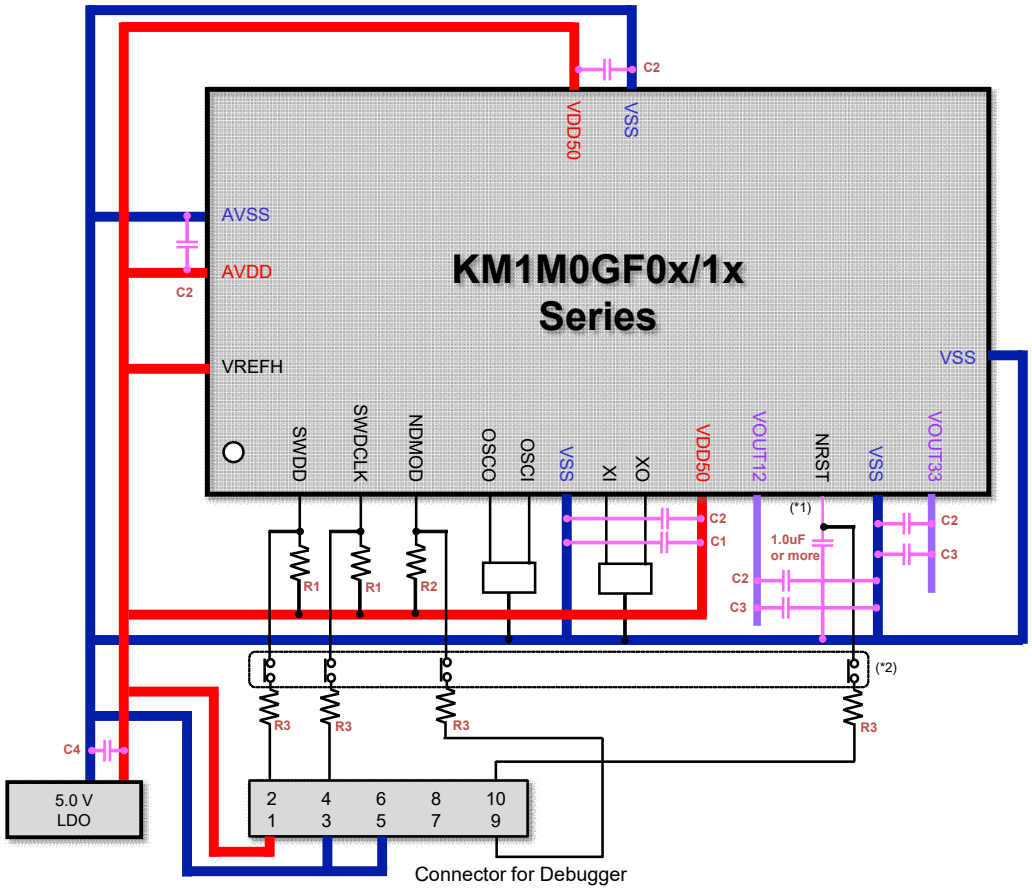


Figure 1.7-1 MCU Peripheral Recommended Circuit

Table 1.7-2 Recommended External Circuit Constants

Symbol	Recommended Value	Objective
C1	2 μF or more	For stabilization of internal regulator
C2	0.1 μF	For high-frequency noise filtering
C3	1 μF	For stabilization of internal regulator
C4	10 μF or more	For low-frequency noise filtering
R1	10 kΩ	For setting mode pin
R2	2 kΩ	
R3	100 Ω	For preventing noise of communication line

Note:

*1 When an external reset IC is unused, do not add a pull-up resistor to NRST pin.

Note:

*2 By attaching a jumper etc. near the microcontroller, it is possible to prevent noise coming from the connector and the wiring on the PCB.

1.7.3 Unused Pins

It is recommended that unused pins be set to open. To set the general-purpose port function to an unused pin, set it to the I/O disabled state (both input and output disabled) or the output state (input disabled and output enabled). It is recommended that the input-only pin with general-purpose port function be disabled as well. For more details, refer to Figure 1.7-2 and Table 1.7-3 .

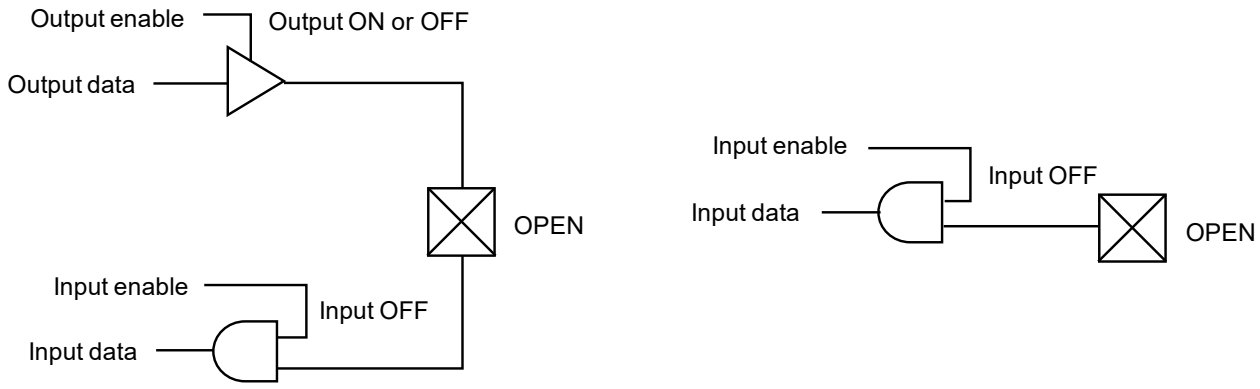


Figure 1.7-2 Unused I/O Pins

Table 1.7-3 Recommended Processing of Unused Pins

Pin	Input/ Output	Recommended Processing for Unused Pins
P44, P45, P46, P47	Input pin	Set it as general-purpose port function and perform one of the following processing. - Set pins to open in the state of Input prohibition with port control. - Connect the resistor for pull-down in V_{SS} in the state of input with port control. - Connect the resistor for pull-up in V_{DD50} in the state of input with port control.
Other I/O pins	I/O pin	Set it as general-purpose port function and perform one of the following processing. - Set pins to open in the state of Input/Output prohibition with port control. - Set pins to open in the state of High-level Output or Low-level Output with port control. - Connect the resistor for pull-down in V_{SS} in the state of input with port control. - Connect the resistor for pull-up in V_{DD50} in the state of input with port control.

Note:
Determine the processing method of each pin by evaluating enough in consideration of the effect of external noise.

1.7.4 Cautions on Power Supply

The cautions on power supply are described as follows.

- Relations between Power Supply and Input Pin Voltage
- Restriction at Power-on
- Power Supply Circuit

1.7.4.1 Relations between Power Supply and Input Pin Voltage

Input pin voltage should be supplied only after power supply is turned on. If this order is reversed, a latch up occurs inside the LSI and the destruction of the LSI by a large current flow can occur.

Relations between the power supply and input pin voltage are shown in Figure 1.7-3 .

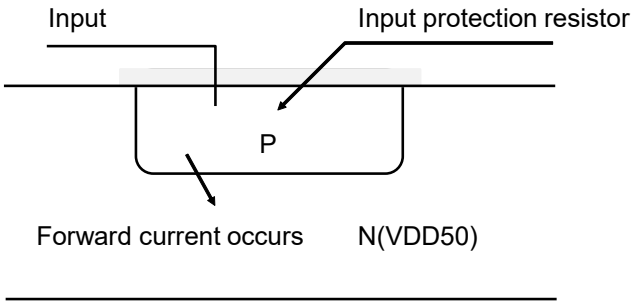


Figure 1.7-3 Relations between Power Supply and Input Pin Voltage

1.7.4.2 Power Supply Circuit for LSI

The power supply circuit should be designed with sufficient margin, after checking AC line noise evaluation, and confirming the ripple when driving an LED and considering the power supply system.

Figure 1.7-4 shows an example for a power supply circuit. (Emitter follower type).

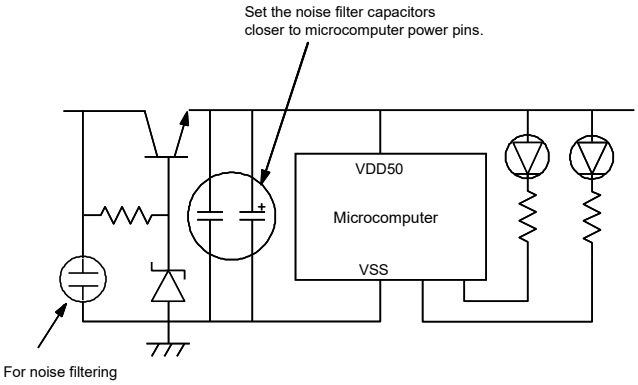


Figure 1.7-4 Power Supply Circuit Example (Emitter Follower Type)

1.7.5 Example of Oscillator Connection

Figure 1.7-5 shows the example of oscillator connection, and Table 1.7-4 shows recommended oscillators and the circuit constants.

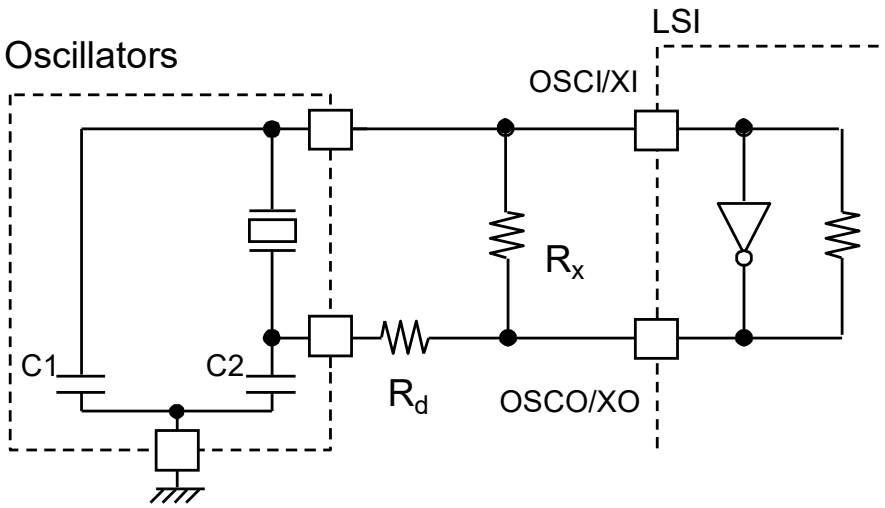


Figure 1.7-5 Example of Oscillator Connection

Table 1.7-4 Recommended Oscillators and Circuit Constants

Oscillator Manufacturer	frequency	Oscillator Product Number	Recommended Circuit Constant		
			Load capacity C1 = C2 [pF]	External feed-back resistor R_X [Ω]	Dumping re-sistor R_d [Ω]
Murata	20 MHz	CSTNE20M0VH3C000R0	15	Open	0
	10 MHz	CSTNE10M0GH5C000R0	33	Open	0
	4 MHz	CSTNR4M00GH5C000R0	39	Open	0
NDK	32.768 kHz	NX3215SA	9	Open	0

The recommended values above are based on the evaluation result of oscillator for a single unit of this LSI.

Note:

Consult the oscillator manufacturer for the appropriate circuit constant since the circuit constant of each oscillator, which is connected to OSCI/OSCO and XI/XO, depends on stray capacitance of the oscillator or on the mounting circuit.

Inquiries

If you have questions regarding technical information on this manual, please visit the following URL.

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KM1M0GF0/1 Series
Datasheet

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