ARM® Cortex®-M
32-bit Microcontroller

KM1M7CF4/5 Series
Data Sheet

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1. Overview

1.1 Overview

The KM1M7 Series is a 32-bit microcontroller with internal Flash memory. It is intended for development of the C programming language with object-oriented program and is easy to use. It has fast feedback processing required for control of power supply and motor.

This LSI adopts the Arm Cortex-M7 to the 32-bit microcontroller part and is equipped with internal memory to instruction/data, DMA controller, clock generator, bus controller, interrupt controller, standard peripheral circuits (timer and serial interface and so on), PWM control circuit specialized for power supply and motor control, and high accuracy/high speed analog circuit.

This LSI has the various safety mechanisms (Memory-ECC, clock error detection, Low voltage level detection, window watchdog timer, etc.) and the system secure functions (Secure Boot, Crypto Accelerator (AES, SHA, ECC cryptography), random number generator, etc.).

1.2 Product Summary

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

Table 1.2-1 Product Summary

LSI series	LSI Product Number	Pins	Flash [KB]		RAM [KB]		Secure Function	Package
			Instruction	Data	Instruction	Data		
KM1M7CF4 Series	KM1M7CF41N (*)	128	512 (256+256)	32 (16+16)	64	64	-	LQFP128pin 14 mm□ 0.4 mm pitch
	KM1M7CF41K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF42N (*)	100	512 (256+256)	32 (16+16)				LQFP100pin 14 mm□ 0.5 mm pitch
	KM1M7CF42K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF43N (*)	80	512 (256+256)	32 (16+16)				LQFP80pin 12 mm□ 0.5 mm pitch
	KM1M7CF43K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF44N (*)	64	512 (256+256)	32 (16+16)				LQFP64pin 10 mm□ 0.5 mm pitch
	KM1M7CF44K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF45N (*)	48	512 (256+256)	32 (16+16)				LQFP48pin 7 mm□ 0.5 mm pitch
	KM1M7CF45K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF46N (*)	32	512 (256+256)	32 (16+16)				QFN32pin 4 mm□ 0.4 mm pitch
	KM1M7CF46K (*)		256 (128+128)	32 (16+16)				
KM1M7CF5 Series	KM1M7CF51N (*)	128	512 (256+256)	32 (16+16)	64	64	✓	LQFP128pin 14 mm□ 0.4 mm pitch
	KM1M7CF51K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF52N (*)	100	512 (256+256)	32 (16+16)				LQFP100pin 14 mm□ 0.5 mm pitch
	KM1M7CF52K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF53N (*)	80	512 (256+256)	32 (16+16)				LQFP80pin 12 mm□ 0.5 mm pitch
	KM1M7CF53K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF54N (*)	64	512 (256+256)	32 (16+16)				LQFP64pin 10 mm□ 0.5 mm pitch
	KM1M7CF54K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF55N (*)	48	512 (256+256)	32 (16+16)				LQFP48pin 7 mm□ 0.5 mm pitch
	KM1M7CF55K (*)		256 (128+128)	32 (16+16)				
	KM1M7CF56N (*)	32	512 (256+256)	32 (16+16)				QFN32pin 4 mm□ 0.4 mm pitch
	KM1M7CF56K (*)		256 (128+128)	32 (16+16)				

Note:

* Planned

1.2.1 Function Summary

Table 1.2-2 shows the functions for each product.

Table 1.2-2 List of Functions

Functions		128-Pin	100-Pin	80-Pin	64-Pin	48-Pin	32-Pin
CPU / Operating frequency		Arm Cortex-M7/160MHz					
General purpose pin		114	86	68	52	38	24
Operation mode	Active mode	NORMAL					
	Standby mode	SLEEP, DEEPSLEEP					
Debugger I/F	Interface	SWD					
DMA	CH number	16					
Interrupt	External interrupt	16 (channels)				10 (channels)	6 (channels)
Timer	16-bit timer	14 (units)					
	Power control PWM	13 (units)					
	RTC	1 (unit)					
Noise filter	Target pin	External interrupt, Timer input, comparator output					
Communication I/F	SPI(4-wire)/UART/IIC (Serial 0, 1)	2 (channels)					
	SPI(4-wire)/UART (Serial 2, 3, 4)	3 (channels)					
	SPI(3-wire)/UART/LIN (Serial 5)	1 (channel)					
	SPI(3-wire)/UART (Serial 6)	1 (channel)					
	CAN-FD	1 (channel)					
	SMBus	1 (channel)					
12-bit A/D	Quantity	5 (units)					
	AD0 CH number	8	8	6	4	4	3
	AD1 CH number	12	12	12	10	8	5
	AD2 CH number	9	9	6	2	2	2
	AD3 CH number	28	25	22	16	14	9
	AD4 CH number	28	24	22	16	14	9
	Total CH number	38	31	26	18	16	11
Comparator	Quantity	8 (units)					6 (units)
12-bit D/A	Quantity	8 (units)					7 (units)
	Buffer output	2 (channels)					1 (channel)
Temperature sensor	Quantity	1 (unit)					
Safety function	Flash Memory	Flash-ECC, Data protection					
	RAM	RAM-ECC					
	Access area	MPU (Area management/protection), Register protect					
	System	Window watchdog timer					
	Clock	Clock monitor (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	Reset factor detection by reset factor register					
Secure function (*1)		Secure Boot, Cryptographic Accelerator (AES, SHA, ECC-Algorithm) Random number generator					

Note:

*1 Secure functions are only embedded in KM1M7CF5 series.

1.3 Features

The features of this LSI are described.

Functions	Features
CPU	Arm Cortex-M7 (160MHz) - Equipped with FPU: Double precision floating point unit, IEEE754 compliant - Equipped with MPU: Memory protect unit, 16 area can be set Cache - Instruction: 4 KB, Data: 4 KB
Memory	Flash - Equipped with APROM and D-Flash - Dual bank 256 KB for Over-The-Air (OTA) upgrade - Support RWW: Read one bank of the flash While Write the other bank of the flash RAM - ITCM / DTCM area: No wait access
Clock	Base clock (BASECLK) - External oscillation (4 to 20 MHz), Internal oscillation (12 MHz(typ)) - Multiplication by PLL circuit Clock for safety function - Built-in low-speed oscillation (30 kHz(typ)) CPU clock (CPUCLK) - 1 to 8 dividing of base clock - Max Frequency：160 MHz(External oscillation)、156 MHz(Internal Oscillation) Peripheral clock (IOCLK) - 2 to 16 dividing of CPU clock - Clock operation/stop can be selected for each peripheral module - Max Frequency：80 MHz(External oscillation)、78 MHz(Internal Oscillation)
Reset	Hardware reset - Power-on reset System reset - Reset by external pin (NRST) - Reset by register setting - Reset by error detection (WDT overflow, Clock error detection) CPU generation reset - Reset by writing to AIRCR, Reset by CPU Lockup Reset factor can be monitored
Low power consumption	SLEEP mode (Stop CPU clock only) DEEPSLEEP mode (Stop clocks including BASECLK)
Interrupt	Interrupt level: 16 levels External interrupt: - High/Low level, Rising/Falling/Both edge
DMA	Transfer mode: Single word transfer mode, Burst transfer mode Transfer unit: 8 bits / 16 bits / 32 bits Maximum transfer count: 65535 words Transfer factor: External interrupt, Peripheral module factor Register reload count: Maximum 65535 times Interrupt: DMA completion, reload count completion, bus error, transfer request overflow, invalid DMA transfer request
Noise filter	Sampling type noise filter is inserted to external interrupt, timer input and comparator output. Sampling clock can be selected

Functions	Features
16-bit timer	Interval timer count, Event count, Up-down pulse count, Phase difference pulse count Timer Output, PWM/complement Output (wave mode: saw-tooth waves), 1-shot Output Input capture by external input Timer count start by start trigger 32-bit cascade connection Output protection: High/Low/Hi-z Output can be selected Timer interrupt Output control
Power control PWM	Complementary PWM output (Wave mode: Triangular and sawtooth waves) Dead time insert, Output shift, H/L level Output can be set Synchronous A/D conversion trigger Interrupt Output control Output protection: H/L/Hi-z Output can be selected Duty cut, period cut High resolution Output (duty, Output shift, cycle) Double buffer update
RTC	Calendar function (count seconds, minutes, hours, days, months, years) Periodic interrupt Alarm function
SPI (Clock-Synchronous) (Serial 0 to 6)	2-wire/3-wire/4-wire (Only serial 0 to 4 supports 4-wire system) Transfer bits (2 bits to 8 bits) MSB/LSB transfer Clock polarity selection Continuous communication Output level after the final bit transmission(H/L/final data)
UART (Serial 0 to 6)	1-wire/2-wire Character bits (7-bit/8-bit) Stop bits (1-bit/2-bit) Parity bit: Enabled/Disabled, Parity bit type: 0/1/Even parity/Odd parity MSB/LSB transfer
IIC(Serial 0,1)	Master/Slave communication Start condition selection: Enable/Disable MSB/LSB transfer selection Transfer format: 7/10 bit address format Maximum transfer speed Standard Mode: 100 kbps; Fast Mode: 400 kbps; Fast Mode Plus: 1 Mbps
SMBus interface	Conform to System Management Bus v3.0 Timeout detection, Packet error detection Return from CPU standby mode by detecting start condition
LIN controller (Serial 5)	Master/Slave communication Wake Up signal transmission/reception Synch Break field transmission/reception Synch field transmission/reception ID field transmission/reception Error detection: Check sum Error, Bit Error, Timeout
CAN FD interface	CAN FD Controller modes: - Mixed CAN 2.0B and CAN FD mode - CAN 2.0B mode Conforms to ISO11898-1
Function pin select (FPS)	External interrupts and serial I/F terminals can be freely assigned to multiple ports.
12-bit A/D	Power control PWM can be started synchronously Conversion error detection Conversion state Output Start trigger reduction function

Functions	Features
Comparator	Set reference voltage by 12-bit DAC Sampling type noise filter is inserted to comparator Output Detection mode can be selected from 1-level/2-level or window detection mode
12-bit D/A	Comparator reference voltage can be generated (Slope compensation operation) Buffered output the set DC voltage
Multi feedback assist	Start timing for 16-bit timers and power control PWM channels can be set individually Conflict detection/auto-avoidance function available between power control PWM output and A/D conversion start Comparator and external interrupt detection masking (blanking) available for power control PWM outputs
CRC calculation	CRC-32, CRC-16-CCITT, CRC-16, CRC-8-ATM symbol can be generated
Safety function	Flash-ECC function Flash Erase/Program protect function RAM-ECC function Function to protect write access to main register Clock monitor function Window watchdog timer(internal oscillation count) Power supply voltage detection ADC fault diagnosis function which is used for internal power supply
Secure function (*1)	Support Secure Boot Cryptographic Accelerator (AES, SHA, ECC-Algorithm) Random Number Generator (TRNG)

Note:

*1 Secure functions are only embedded in KM1M7CF5 series.

1.4 Pins

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

- Pin configuration
- Pin function

1.4.1 Pin Configuration

Figure 1.4-1 shows the pin configuration of KM1M7CF41/51 (128-pin).

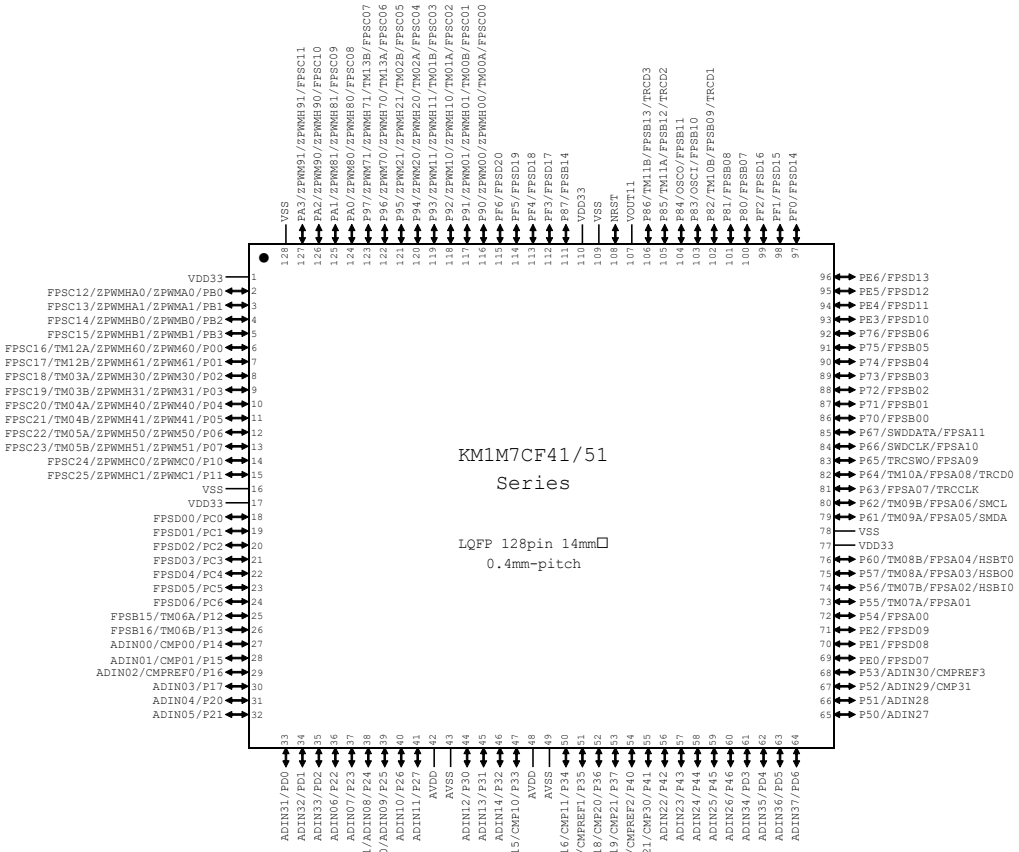


Figure 1.4-1 Pin Configuration of KM1M7CF41/51 (128-Pin)

Figure 1.4-2 shows the pin configuration of KM1M7CF42/52 (100-pin).

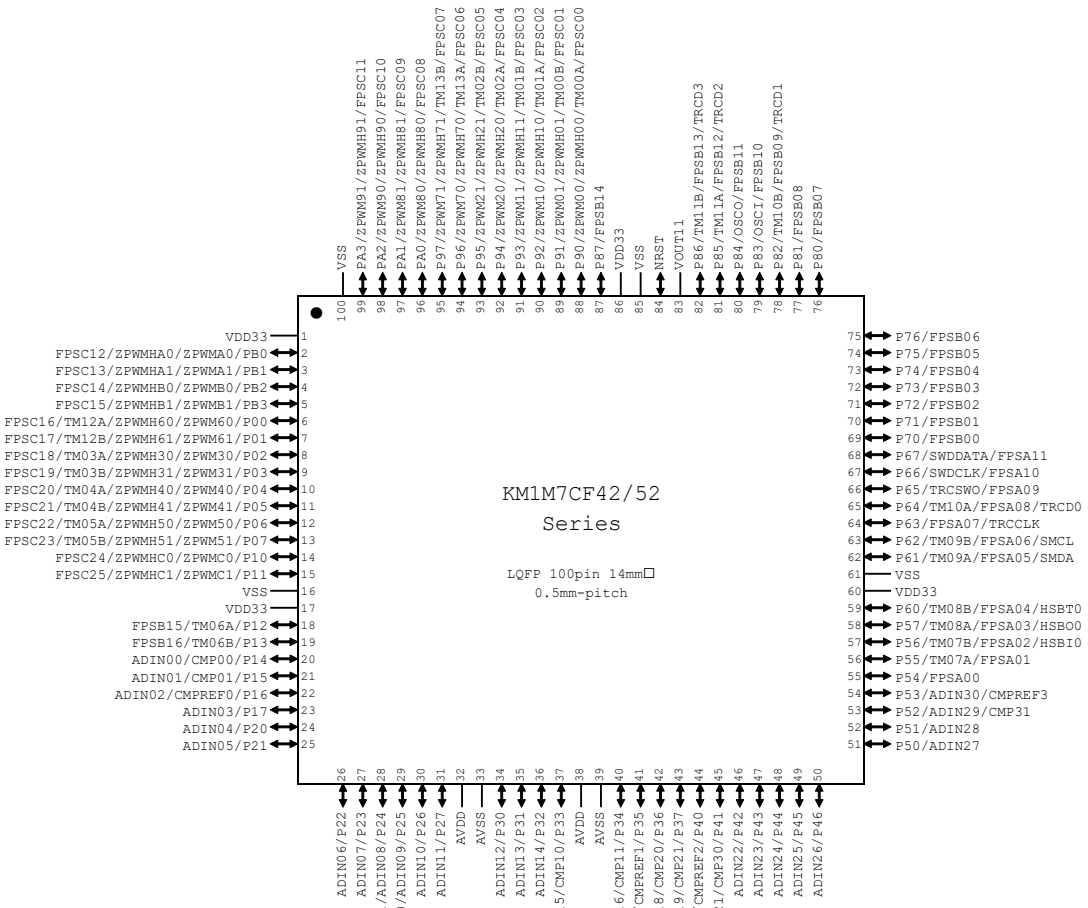


Figure 1.4-2 Pin Configuration of KM1M7CF42/52 (100-Pin)

Figure 1.4-3 shows the pin configuration of KM1M7CF43/53 (80-pin).

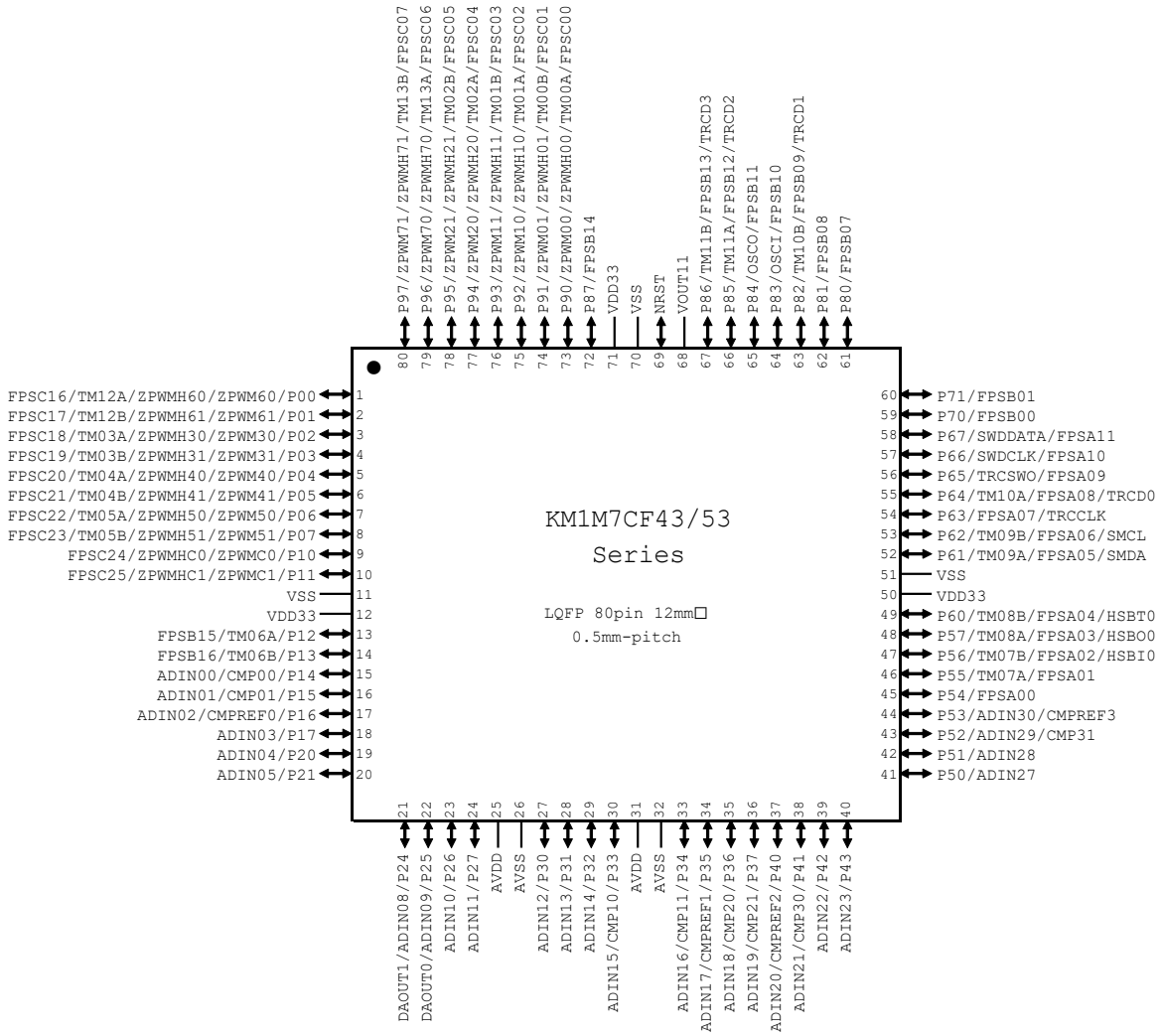


Figure 1.4-3 Pin Configuration of KM1M7CF43/53 (80-Pin)

Figure 1.4-4 shows the pin configuration of KM1M7CF44/54 (64-pin).

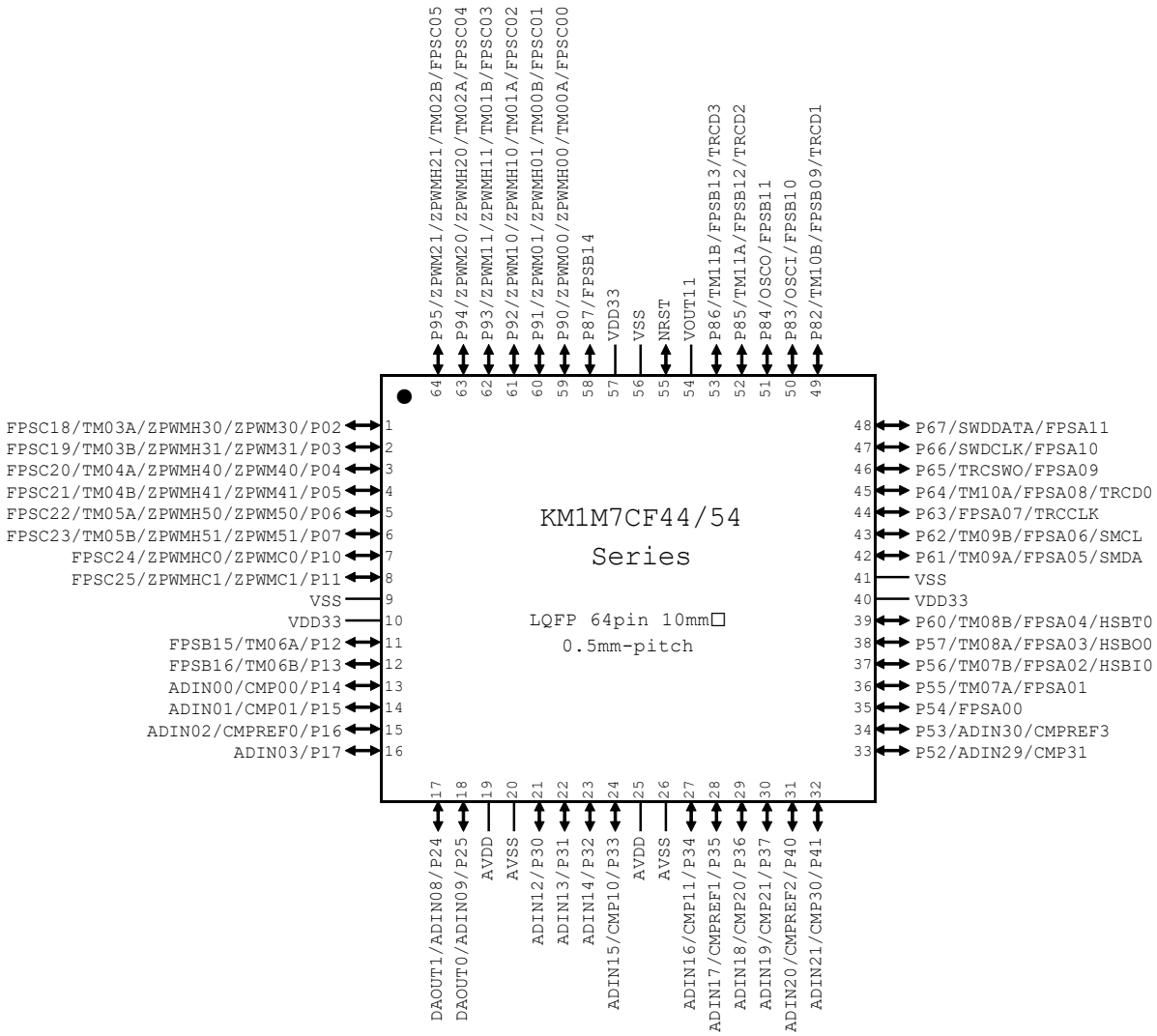


Figure 1.4-4 Pin Configuration of KM1M7CF44/54 (64-Pin)

Figure 1.4-5 shows the pin configuration of KM1M7CF45/55 (48-pin).

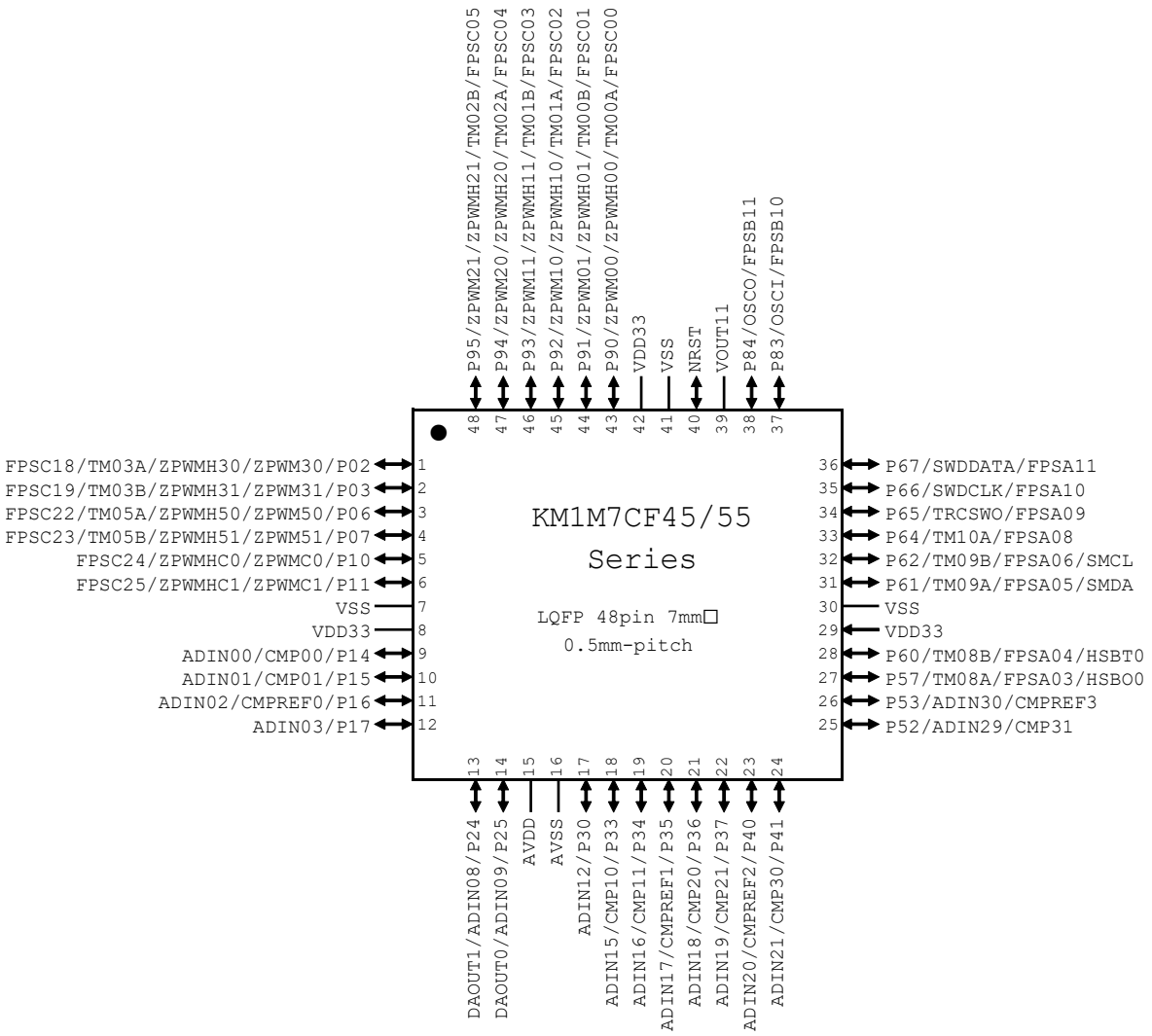


Figure 1.4-5 Pin Configuration of KM1M7CF45/55 (48-Pin)

Figure 1.4-6 shows the pin configuration of KM1M7CF46/56 (32-pin).

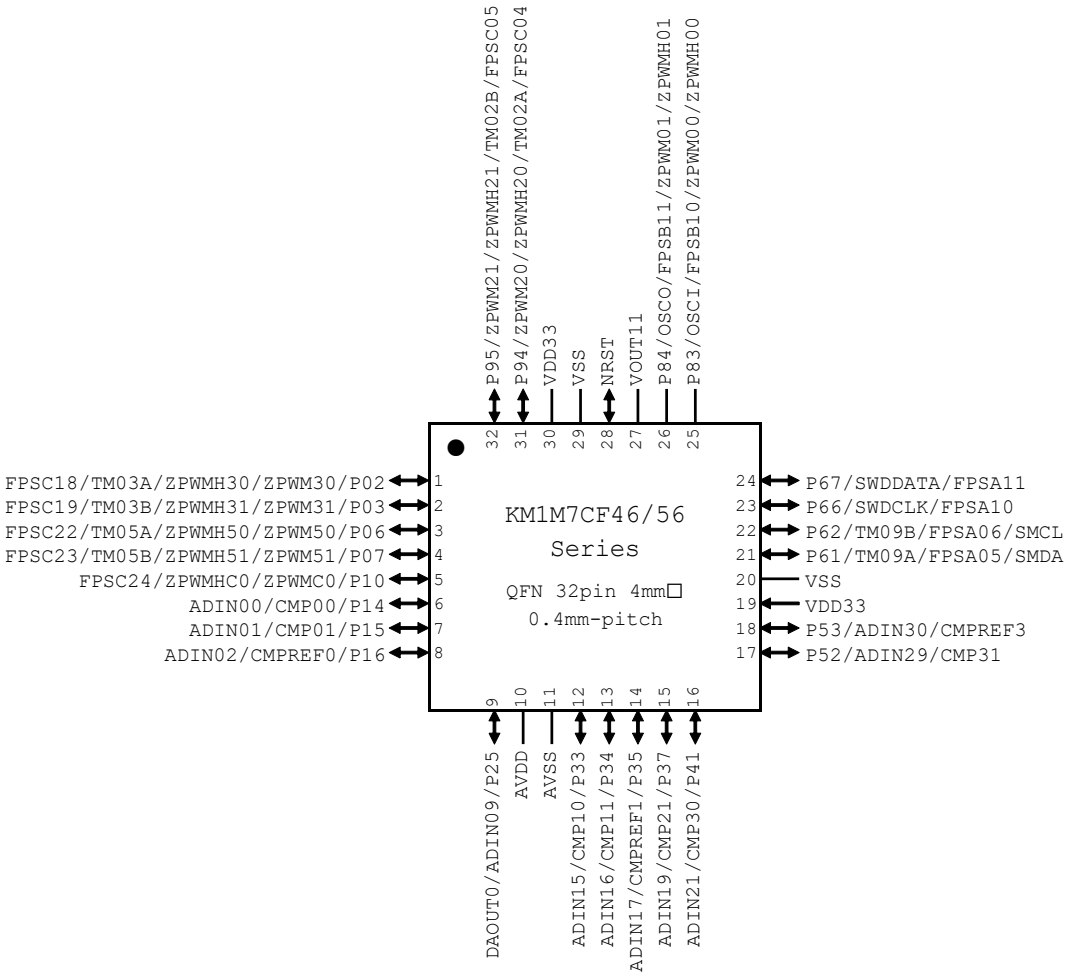


Figure 1.4-6 Pin Configuration of KM1M7CF46/56 (32-Pin)

1.4.2 Pin Functions

The pin functions are listed in Table 1.4-1 , Table 1.4-2 .

Table 1.4-1 Pin Functions

Pin No.				Function						PIN specification			5V tol-erant
128-Pin	100-Pin	80-Pin	64-Pin	48-Pin	32-Pin	Power / Special Features	Port	Timer PWM	Analog	Commu-nication	FPS	Current select	
1	1	-	-	-	-	VDD33	-	-	-	-	-	-	-
2	2	-	-	-	-	-	PB0	ZPWMA0	-	-	FPSC12	4/8 mA	-
3	3	-	-	-	-	-	PB1	ZPWMA1	-	-	FPSC13	4/8 mA	-
4	4	-	-	-	-	-	PB2	ZPUMB0	-	-	FPSC14	4/8 mA	-
5	5	-	-	-	-	-	PB3	ZPWMB1	-	-	FPSC15	4/8 mA	-
6	6	1	-	-	-	-	P00	ZPWM60/ TM12A	-	-	FPSC16	4/8 mA	-
7	7	2	-	-	-	-	P01	ZPWM61/ TM12B	-	-	FPSC17	4/8 mA	-
8	8	3	1	1	1	-	P02	ZPWM30/ TM03A	-	-	FPSC18	4/8 mA	-
9	9	4	2	2	2	-	P03	ZPWM31/ TM03B	-	-	FPSC19	4/8 mA	-
10	10	5	3	-	-	-	P04	ZPWM40/ TM04A	-	-	FPSC20	4/8 mA	-
11	11	6	4	-	-	-	P05	ZPWM41/ TM04B	-	-	FPSC21	4/8 mA	-
12	12	7	5	3	3	-	P06	ZPWM50/ TM05A	-	-	FPSC22	4/8 mA	-
13	13	8	6	4	4	-	P07	ZPWM51/ TM05B	-	-	FPSC23	4/8 mA	-
14	14	9	7	5	5	-	P10	ZPWMC0	-	-	FPSC24	4/8 mA	-
15	15	10	8	6	-	-	P11	ZPWMC1	-	-	FPSC25	4/8 mA	-
16	16	11	9	7	-	VSS	-	-	-	-	-	-	-
17	17	12	10	8	-	VDD33	-	-	-	-	-	-	-
18	-	-	-	-	-	-	PC0	-	-	-	FPSD00	2/4 mA	-
19	-	-	-	-	-	-	PC1	-	-	-	FPSD01	2/4 mA	-
20	-	-	-	-	-	-	PC2	-	-	-	FPSD02	2/4 mA	-
21	-	-	-	-	-	-	PC3	-	-	-	FPSD03	2/4 mA	-
22	-	-	-	-	-	-	PC4	-	-	-	FPSD04	2/4 mA	-
23	-	-	-	-	-	-	PC5	-	-	-	FPSD05	2/4 mA	-
24	-	-	-	-	-	-	PC6	-	-	-	FPSD06	2/4 mA	-
25	18	13	11	-	-	-	P12 (*3)	TM06A	-	-	FPSB15	4/8/20(*4) mA	✓
26	19	14	12	-	-	-	P13 (*3)	TM06B	-	-	FPSB16	4/8/20(*4) mA	✓
27	20	15	13	9	6	-	P14	-	ADIN00/ CMP00	-	-	2/4 mA	-
28	21	16	14	10	7	-	P15	-	ADIN01/ CMP01	-	-	2/4 mA	-
29	22	17	15	11	8	-	P16	-	ADIN02/ CMPREF0	-	-	2/4 mA	-
30	23	18	16	12	-	-	P17	-	ADIN03	-	-	2/4 mA	-
31	24	19	-	-	-	-	P20	-	ADIN04	-	-	2/4 mA	-
32	25	20	-	-	-	-	P21	-	ADIN05	-	-	2/4 mA	-
33	-	-	-	-	-		PD0	-	ADIN31	-	-	2/4 mA	-
34	-	-	-	-	-		PD1	-	ADIN32	-	-	2/4 mA	-
35	-	-	-	-	-		PD2	-	ADIN33	-	-	2/4 mA	-
36	26	-	-	-	-		P22	-	ADIN06	-	-	2/4 mA	-
37	27	-	-	-	-		P23	-	ADIN07	-	-	2/4 mA	-

Pin No.				Function						PIN specification			5V tol-erant
128-Pin	100-Pin	80-Pin	64-Pin	48-Pin	32-Pin	Power / Special Features	Port	Timer PWM	Analog	Commu-nication	FPS	Current select	
38	28	21	17	13	-	-	P24	-	ADIN08/ DAOUT1	-	-	2/4 mA	-
39	29	22	18	14	9	-	P25	-	ADIN09/ DAOUT0	-	-	2/4 mA	-
40	30	23	-	-	-	-	P26	-	ADIN10	-	-	2/4 mA	-
41	31	24	-	-	-	-	P27	-	ADIN11	-	-	2/4 mA	-
42	32	25	19	15	10	AVDD	-	-	-	-	-	-	-
43	33	26	20	16	11	AVSS	-	-	-	-	-	-	-
44	34	27	21	17	-	-	P30	-	ADIN12	-	-	2/4 mA	-
45	35	28	22	-	-	-	P31	-	ADIN13	-	-	2/4 mA	-
46	36	29	23	-	-	-	P32	-	ADIN14	-	-	2/4 mA	-
47	37	30	24	18	12	-	P33	-	ADIN15/ CMP10	-	-	2/4 mA	-
48	38	31	25	-	-	AVDD	-	-	-	-	-	-	-
49	39	32	26	-	-	AVSS	-	-	-	-	-	-	-
50	40	33	27	19	13	-	P34	-	ADIN16/ CMP11	-	-	2/4 mA	-
51	41	34	28	20	14	-	P35	-	ADIN17/ CMPREF1	-	-	2/4 mA	-
52	42	35	29	21	-	-	P36	-	ADIN18/ CMP20	-	-	2/4 mA	-
53	43	36	30	22	15	-	P37	-	ADIN19/ CMP21	-	-	2/4 mA	-
54	44	37	31	23	-	-	P40	-	ADIN20/ CMPREF2	-	-	2/4 mA	-
55	45	38	32	24	16	-	P41	-	ADIN21/ CMP30	-	-	2/4 mA	-
56	46	39	-	-	-	-	P42	-	ADIN22	-	-	2/4 mA	-
57	47	40	-	-	-	-	P43	-	ADIN23	-	-	2/4 mA	-
58	48	-	-	-	-		P44	-	ADIN24	-	-	2/4 mA	-
59	49	-	-	-	-		P45	-	ADIN25	-	-	2/4 mA	-
60	50	-	-	-	-		P46	-	ADIN26	-	-	2/4 mA	-
61	-	-	-	-	-		PD3	-	ADIN34	-	-	2/4 mA	-
62	-	-	-	-	-		PD4	-	ADIN35	-	-	2/4 mA	-
63	-	-	-	-	-		PD5	-	ADIN36	-	-	2/4 mA	-
64	-	-	-	-	-		PD6	-	ADIN37	-	-	2/4 mA	-
65	51	41	-	-	-	-	P50	-	ADIN27	-	-	2/4 mA	-
66	52	42	-	-	-	-	P51	-	ADIN28	-	-	2/4 mA	-
67	53	43	33	25	17	-	P52	-	ADIN29/ CMP31	-	-	2/4 mA	-
68	54	44	34	26	18	-	P53	-	ADIN30/ CMPREF3	-	-	2/4 mA	-
69	-	-	-	-	-		PE0	-	-	-	FPSD07	2/4 mA	-
70	-	-	-	-	-		PE1	-	-	-	FPSD08	2/4 mA	-
71	-	-	-	-	-		PE2	-	-	-	FPSD09	2/4 mA	-
72	55	45	35	-	-	-	P54	-	-	-	FPSA00	2/4 mA	-
73	56	46	36	-	-	-	P55	TM07A	-	-	FPSA01	2/4 mA	-
74	57	47	37	-	-	-	P56	TM07B	-	HSBI0	FPSA02	2/4 mA	-
75	58	48	38	27	-	-	P57 (*3)	TM08A	-	HSBO0	FPSA03	4/8/20(*4) mA	✓
76	59	49	39	28	-	-	P60 (*3)	TM08B	-	HSBT0	FPSA04	4/8/20(*4) mA	✓
77	60	50	40	29	19	VDD33	-	-	-	-	-	-	-
78	61	51	41	30	20	VSS	-	-	-	-	-	-	-
79	62	52	42	31	21	-	P61 (*3)	TM09A	-	SMDA	FPSA05	4/8/20(*4) mA	✓

Pin No.				Function						PIN specification			5V tol-erant
128-Pin	100-Pin	80-Pin	64-Pin	48-Pin	32-Pin	Power / Special Features	Port	Timer PWM	Analog	Commu-nication	FPS	Current select	
80	63	53	43	32	22	-	P62 (*3)	TM09B	-	SMCL	FPSA06	4/8/20(*4) mA	✓
81	64	54	44	-	-	TRCCLK	P63	-	-	-	FPSA07	2/4 mA	-
82	65	55	45	33	-	TRCD0 (*1)	P64	TM10A	-	-	FPSA08	2/4 mA	-
83	66	56	46	34	-	TRCSWO	P65	-	-	-	FPSA09	2/4 mA	-
84	67	57	47	35	23	SWDCLK	P66 (*3)	-	-	-	FPSA10	4/8/20(*4) mA	✓
85	68	58	48	36	24	SWDD	P67	-	-	-	FPSA11	4/8 mA	-
86	69	59	-	-	-	-	P70	-	-	-	FPSB00	2/4 mA	-
87	70	60	-	-	-	-	P71	-	-	-	FPSB01	2/4 mA	-
88	71	-	-	-	-	-	P72	-	-	-	FPSB02	2/4 mA	-
89	72	-	-	-	-	-	P73	-	-	-	FPSB03	2/4 mA	-
90	73	-	-	-	-	-	P74	-	-	-	FPSB04	2/4 mA	-
91	74	-	-	-	-	-	P75	-	-	-	FPSB05	2/4 mA	-
92	75	-	-	-	-	-	P76	-	-	-	FPSB06	2/4 mA	-
93	-	-	-	-	-	-	PE3	-	-	-	FPSD10	2/4 mA	-
94	-	-	-	-	-	-	PE4	-	-	-	FPSD11	2/4 mA	-
95	-	-	-	-	-	-	PE5	-	-	-	FPSD12	2/4 mA	-
96	-	-	-	-	-	-	PE6	-	-	-	FPSD13	2/4 mA	-
97	-	-	-	-	-	-	PF0	-	-	-	FPSD14	2/4 mA	-
98	-	-	-	-	-	-	PF1	-	-	-	FPSD15	2/4 mA	-
99	-	-	-	-	-	-	PF2	-	-	-	FPSD16	2/4 mA	-
100	76	61	-	-	-	-	P80	-	-	-	FPSB07	2/4 mA	-
101	77	62	-	-	-	-	P81	-	-	-	FPSB08	2/4 mA	-
102	78	63	49	-	-	TRCD1	P82	TM10B	-	-	FPSB09	4/8 mA	-
103	79	64	50	37	25	OSCI	P83	ZPWM00 (*2)	-	-	FPSB10	4/8 mA	-
104	80	65	51	38	26	OSCO	P84	ZPWM01 (*2)	-	-	FPSB11	4/8 mA	-
105	81	66	52	-	-	TRCD2	P85	TM11A	-	-	FPSB12	4/8 mA	-
106	82	67	53	-	-	TRCD3	P86	TM11B	-	-	FPSB13	4/8 mA	-
107	83	68	54	39	27	VOUT11	-	-	-	-	-	-	-
108	84	69	55	40	28	NRST	-	-	-	-	-	-	-
109	85	70	56	41	29	VSS	-	-	-	-	-	-	-
110	86	71	57	42	30	VDD33	-	-	-	-	-	-	-
111	87	72	58	-	-	-	P87	-	-	-	FPSB14	2/4 mA	-
112	-	-	-	-	-	-	PF3	-	-	-	FPSD17	2/4 mA	-
113	-	-	-	-	-	-	PF4	-	-	-	FPSD18	2/4 mA	-
114	-	-	-	-	-	-	PF5	-	-	-	FPSD19	2/4 mA	-
115	-	-	-	-	-	-	PF6	-	-	-	FPSD20	2/4 mA	-
116	88	73	59	43	-	-	P90	ZPWM00/ TM00A	-	-	FPSC00	4/8 mA	-
117	89	74	60	44	-	-	P91	ZPWM01/ TM00B	-	-	FPSC01	4/8 mA	-
118	90	75	61	45	-	-	P92	ZPWM10/ TM01A	-	-	FPSC02	4/8 mA	-
119	91	76	62	46	-	-	P93	ZPWM11/ TM01B	-	-	FPSC03	4/8 mA	-
120	92	77	63	47	31	-	P94	ZPWM20/ TM02A	-	-	FPSC04	4/8 mA	-
121	93	78	64	48	32	-	P95	ZPWM21/ TM02B	-	-	FPSC05	4/8 mA	-
122	94	79	-	-	-	-	P96	ZPWM70/ TM13A	-	-	FPSC06	4/8 mA	-

Pin No.				Function						PIN specification			5V tol-erant
128-Pin	100-Pin	80-Pin	64-Pin	48-Pin	32-Pin	Power / Special Features	Port	Timer PWM	Analog	Commu-nication	FPS	Current select	
123	95	80	-	-	-	-	P97	ZPWM71/ TM13B	-	-	FPSC07	4/8 mA	-
124	96	-	-	-	-	-	PA0	ZPWM80	-	-	FPSC08	4/8 mA	-
125	97	-	-	-	-	-	PA1	ZPWM81	-	-	FPSC09	4/8 mA	-
126	98	-	-	-	-	-	PA2	ZPWM90	-	-	FPSC10	4/8 mA	-
127	99	-	-	-	-	-	PA3	ZPWM91	-	-	FPSC11	4/8 mA	-
128	100	-	-	-	-	VSS	-	-	-	-	-	-	-

Note:

*1 128/100/80/64-Pin only

*2 32-Pin only

*4 Low output only

Note:

*3 When applying the input voltage higher than the external power supply voltage to the 5V tolerant pins, do not enable the pull-up resistor inside the microcontroller IO port.

Table 1.4-2 Pin Functions (by Function)

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
External power pin	VDD33	1, 17, 77, 110	1, 17, 60, 86	12, 50, 71	10, 40, 57	8, 29, 42	19, 30	Input
	AVDD	42, 48	32, 38	25, 31	19, 25	15	10	Input
Power pin for internal circuit	VOUT11	107	83	68	54	39	27	Output
GND	VSS	16, 78, 109	16, 61, 85	11, 51, 70	9, 41, 56	7, 30, 41	20, 29	Input
	AVSS	43, 49	33, 39	26, 32	20, 26	16	11	Input
Debugger	SWDCLK	84	67	57	47	35	23	Input
	SWDD	85	68	58	48	36	24	I/O
	TRCSWO	83	66	56	46	34	-	Output
	TRCCLK	81	64	54	44	-	-	Output
	TRCD0	82	65	55	45	-	-	Output
	TRCD1	102	78	63	49	-	-	Output
	TRCD2	105	81	66	52	-	-	Output
	TRCD3	106	82	67	53	-	-	Output
External oscilla-tion Input pin	OSCI	103	79	64	50	37	25	Input
	OSCO	104	80	65	51	38	26	Output
Reset	NRST	108	84	69	55	40	28	I/O
16-bit timer	TM00A	116	88	73	59	43	-	I/O
	TM00B	117	89	74	60	44	-	I/O
	TM01A	118	90	75	61	45	-	I/O
	TM01B	119	91	76	62	46	-	I/O
	TM02A	120	92	77	63	47	31	I/O
	TM02B	121	93	78	64	48	31	I/O
	TM03A	8	8	3	1	1	1	I/O
	TM03B	9	9	4	2	2	2	I/O
	TM04A	10	10	5	3	-	-	I/O
	TM04B	11	11	6	4	-	-	I/O
	TM05A	12	12	7	5	3	3	I/O
	TM05B	13	13	8	6	4	4	I/O
	TM06A	25	18	13	11	-	-	I/O
	TM06B	26	19	14	12	-	-	I/O
	TM07A	73	56	46	36	-	-	I/O
	TM07B	74	57	47	37	-	-	I/O
	TM08A	75	58	48	38	27	-	I/O
	TM08B	76	59	49	39	28	-	I/O
	TM09A	79	61	52	42	31	21	I/O
	TM09B	80	62	53	43	32	22	I/O
	TM10A	82	65	55	45	33	-	I/O
	TM10B	102	78	63	49	-	-	I/O
	TM11A	105	81	66	52	-	-	I/O
	TM11B	106	82	67	53	-	-	I/O
	TM12A	6	6	1	-	-	-	I/O
	TM12B	7	7	2	-	-	-	I/O
	TM13A	122	94	79	-	-	-	I/O
	TM13B	123	95	80	-	-	-	I/O

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
Power control PWM pin	ZPWM00	116	88	73	59	43	25	Output
	ZPWM01	117	89	74	60	44	26	Output
	ZPWM10	118	90	75	61	45	-	Output
	ZPWM11	119	91	76	62	46	-	Output
	ZPWM20	120	92	77	63	47	31	Output
	ZPWM21	121	93	78	64	48	32	Output
	ZPWM30	8	8	3	1	1	1	Output
	ZPWM31	9	9	4	2	2	2	Output
	ZPWM40	10	10	5	3	-	-	Output
	ZPWM41	11	11	6	4	-	-	Output
	ZPWM50	12	12	7	5	3	3	Output
	ZPWM51	13	13	8	6	4	4	Output
	ZPWM60	6	6	1	-	-	-	Output
	ZPWM61	7	7	2	-	-	-	Output
	ZPWM70	122	94	79	-	-	-	Output
	ZPWM71	123	95	80	-	-	-	Output
	ZPWM80	124	96	-	-	-	-	Output
	ZPWM81	125	97	-	-	-	-	Output
	ZPWM90	126	98	-	-	-	-	Output
	ZPWM91	127	99	-	-	-	-	Output
	ZPWMA0	2	2	-	-	-	-	Output
	ZPWMA1	3	3	-	-	-	-	Output
	ZPWMB0	4	4	-	-	-	-	Output
	ZPWMB1	5	5	-	-	-	-	Output
	ZPWMC0	14	14	9	7	5	5	Output
	ZPWMC1	15	15	10	8	6	-	Output
SMBus	SMDA	79	62	52	42	31	21	I/O
	SMCL	80	63	53	43	32	22	I/O
Serial I/F0	HSBI0	74	57	47	37	-	-	I/O
	HSBO0	75	58	48	38	27	-	I/O
	HSBT0	76	59	49	39	28	-	I/O

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
A/D Input	ADIN00	27	20	15	13	9	6	Input
	ADIN01	28	21	16	14	10	7	Input
	ADIN02	29	22	17	15	11	8	Input
	ADIN03	30	23	18	16	12	-	Input
	ADIN04	31	24	19	-	-	-	Input
	ADIN05	32	25	20	-	-	-	Input
	ADIN06	36	26	-	-	-	-	Input
	ADIN07	37	27	-	-	-	-	Input
	ADIN08	38	28	21	17	13	-	Input
	ADIN09	39	29	22	18	14	9	Input
	ADIN10	40	30	23	-	-	-	Input
	ADIN11	41	31	24	-	-	-	Input
	ADIN12	44	34	27	21	17	-	Input
	ADIN13	45	35	28	22	-	-	Input
	ADIN14	46	36	29	23	-	-	Input
	ADIN15	47	37	30	24	18	12	Input
	ADIN16	50	40	33	27	19	13	Input
	ADIN17	51	41	34	28	20	14	Input
	ADIN18	52	42	35	29	21	-	Input
	ADIN19	53	43	36	30	22	15	Input
	ADIN20	54	44	37	31	23	-	Input
	ADIN21	55	45	38	32	24	16	Input
	ADIN22	56	46	39	-	-	-	Input
	ADIN23	57	47	40	-	-	-	Input
	ADIN24	58	48	-	-	-	-	Input
	ADIN25	59	49	-	-	-	-	Input
	ADIN26	60	50	-	-	-	-	Input
	ADIN27	65	51	41	-	-	-	Input
	ADIN28	66	52	42	-	-	-	Input
	ADIN29	67	53	43	33	25	17	Input
	ADIN30	68	54	44	34	26	18	Input
	ADIN31	33	-	-	-	-	-	Input
	ADIN32	34	-	-	-	-	-	Input
	ADIN33	35	-	-	-	-	-	Input
	ADIN34	61	-	-	-	-	-	Input
	ADIN35	62	-	-	-	-	-	Input
	ADIN36	63	-	-	-	-	-	Input
	ADIN37	64	-	-	-	-	-	Input
Comparator Input	CMP00	27	20	15	13	9	6	Input
	CMP01	28	21	16	14	10	7	Input
	CMPREF0	29	22	17	15	11	8	Input
	CMP10	47	37	30	24	18	12	Input
	CMP11	50	40	33	27	19	13	Input
	CMPREF1	51	41	34	28	20	14	Input
	CMP20	52	42	35	29	21	-	Input
	CMP21	53	43	36	30	22	15	Input
	CMPREF2	54	44	37	31	23	-	Input
	CMP30	55	45	38	32	24	16	Input
	CMP31	67	53	43	33	25	17	Input
	CMPREF3	68	54	44	34	26	18	Input
D/A Output	DAOUT0	38	28	21	17	13	9	Output
	DAOUT1	39	29	22	18	14	-	Output

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
FPS (Function Pin Select)	FPSA00	72	55	45	35	-	-	I/O
	FPSA01	73	56	46	36	-	-	I/O
	FPSA02	74	57	47	37	-	-	I/O
	FPSA03	75	58	48	38	27	-	I/O
	FPSA04	76	59	49	39	28	-	I/O
	FPSA05	79	62	52	42	31	21	I/O
	FPSA06	80	63	53	43	32	22	I/O
	FPSA07	81	64	54	44	-	-	I/O
	FPSA08	82	65	55	45	33	-	I/O
	FPSA09	83	66	56	46	34	-	I/O
	FPSA10	84	67	57	47	35	23	I/O
	FPSA11	85	68	58	48	36	24	I/O
	FPSB00	86	69	59	-	-	-	I/O
	FPSB01	87	70	60	-	-	-	I/O
	FPSB02	88	71	-	-	-	-	I/O
	FPSB03	89	72	-	-	-	-	I/O
	FPSB04	90	73	-	-	-	-	I/O
	FPSB05	91	74	-	-	-	-	I/O
	FPSB06	92	75	-	-	-	-	I/O
	FPSB07	100	76	61	-	-	-	I/O
	FPSB08	101	77	62	-	-	-	I/O
	FPSB09	102	78	63	49	-	-	I/O
	FPSB10	103	79	64	50	37	25	I/O
	FPSB11	104	80	65	51	38	26	I/O
	FPSB12	105	81	66	52	-	-	I/O
	FPSB13	106	82	67	53	-	-	I/O
	FPSB14	111	87	72	58	-	-	I/O
	FPSB15	25	18	13	11	-	-	I/O
	FPSB16	26	19	14	12	-	-	I/O
	FPSC00	116	88	73	59	43	-	I/O
	FPSC01	117	89	74	60	44	-	I/O
	FPSC02	118	90	75	61	45	-	I/O
	FPSC03	119	91	76	62	46	-	I/O
	FPSC04	120	92	77	63	47	31	I/O
	FPSC05	121	93	78	64	48	32	I/O
	FPSC06	122	94	79	-	-	-	I/O
	FPSC07	123	95	80	-	-	-	I/O
	FPSC08	124	96	-	-	-	-	I/O
	FPSC09	125	97	-	-	-	-	I/O
	FPSC10	126	98	-	-	-	-	I/O
	FPSC11	127	99	-	-	-	-	I/O
	FPSC12	2	2	-	-	-	-	I/O
	FPSC13	3	3	-	-	-	-	I/O
	FPSC14	4	4	-	-	-	-	I/O
	FPSC15	5	5	-	-	-	-	I/O
	FPSC16	6	6	1	-	-	-	I/O
	FPSC17	7	7	2	-	-	-	I/O
	FPSC18	8	8	3	1	1	1	I/O
	FPSC19	9	9	4	2	2	2	I/O
	FPSC20	10	10	5	3	-	-	I/O

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
FPS (Function Pin Select)	FPSC21	11	11	6	4	-	-	I/O
	FPSC22	12	12	7	5	3	3	I/O
	FPSC23	13	13	8	6	4	4	I/O
	FPSC24	14	14	9	7	5	5	I/O
	FPSC25	15	15	10	8	6	-	I/O
	FPSD00	18	-	-	-	-	-	I/O
	FPSD01	19	-	-	-	-	-	I/O
	FPSD02	20	-	-	-	-	-	I/O
	FPSD03	21	-	-	-	-	-	I/O
	FPSD04	22	-	-	-	-	-	I/O
	FPSD05	23	-	-	-	-	-	I/O
	FPSD06	24	-	-	-	-	-	I/O
	FPSD07	69	-	-	-	-	-	I/O
	FPSD08	70	-	-	-	-	-	I/O
	FPSD09	71	-	-	-	-	-	I/O
	FPSD10	93	-	-	-	-	-	I/O
	FPSD11	94	-	-	-	-	-	I/O
	FPSD12	95	-	-	-	-	-	I/O
	FPSD13	96	-	-	-	-	-	I/O
	FPSD14	97	-	-	-	-	-	I/O
	FPSD15	98	-	-	-	-	-	I/O
	FPSD16	99	-	-	-	-	-	I/O
	FPSD17	112	-	-	-	-	-	I/O
	FPSD18	113	-	-	-	-	-	I/O
	FPSD19	114	-	-	-	-	-	I/O
	FPSD20	115	-	-	-	-	-	I/O

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
I/O Port	P00	6	6	1	-	-	-	I/O
	P01	7	7	2	-	-	-	I/O
	P02	8	8	3	1	1	1	I/O
	P03	9	9	4	2	2	2	I/O
	P04	10	10	5	3	-	-	I/O
	P05	11	11	6	4	-	-	I/O
	P06	12	12	7	5	3	3	I/O
	P07	13	13	8	6	4	4	I/O
	P10	14	14	9	7	5	5	I/O
	P11	15	15	10	8	6	-	I/O
	P12	25	18	13	11	-	-	I/O
	P13	26	19	14	12	-	-	I/O
	P14	27	20	15	13	9	6	I/O
	P15	28	21	16	14	10	7	I/O
	P16	29	22	17	15	11	8	I/O
	P17	30	23	18	16	12	-	I/O
	P20	31	24	19	-	-	-	I/O
	P21	32	25	20	-	-	-	I/O
	P22	36	26	-	-	-	-	I/O
	P23	37	27	-	-	-	-	I/O
	P24	38	28	21	17	13	-	I/O
	P25	39	29	22	18	14	9	I/O
	P26	40	30	23	-	-	-	I/O
	P27	41	31	24	-	-	-	I/O
	P30	44	34	27	21	17	-	I/O
	P31	45	35	28	22	-	-	I/O
	P32	46	36	29	23	-	-	I/O
	P33	47	37	30	24	18	12	I/O
	P34	50	40	33	27	19	13	I/O
	P35	51	41	34	28	20	14	I/O
	P36	52	42	35	29	21	-	I/O
	P37	53	43	36	30	22	15	I/O
	P40	54	44	37	31	23	-	I/O
	P41	55	45	38	32	24	16	I/O
	P42	56	46	39	-	-	-	I/O
	P43	57	47	40	-	-	-	I/O
	P44	58	48	-	-	-	-	I/O
	P45	59	49	-	-	-	-	I/O
	P46	60	50	-	-	-	-	I/O
	P50	65	51	41	-	-	-	I/O
	P51	66	52	42	-	-	-	I/O
	P52	67	53	43	33	25	17	I/O
	P53	68	54	44	34	26	18	I/O
	P54	72	55	45	35	-	-	I/O
	P55	73	56	46	36	-	-	I/O
	P56	74	57	47	37	-	-	I/O
	P57	75	58	48	38	27	-	I/O

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
I/O Port	P60	76	59	49	39	28	-	I/O
	P61	79	62	52	42	31	21	I/O
	P62	80	63	53	43	32	22	I/O
	P63	81	64	54	44	-	-	I/O
	P64	82	65	55	45	33	-	I/O
	P65	83	66	56	46	34	-	I/O
	P66	84	67	57	47	35	23	I/O
	P67	85	68	58	48	36	24	I/O
	P70	86	69	59	-	-	-	I/O
	P71	87	70	60	-	-	-	I/O
	P72	88	71	-	-	-	-	I/O
	P73	89	72	-	-	-	-	I/O
	P74	90	73	-	-	-	-	I/O
	P75	91	74	-	-	-	-	I/O
	P76	92	75	-	-	-	-	I/O
	P80	100	76	61	-	-	-	I/O
	P81	101	77	62	-	-	-	I/O
	P82	102	78	63	49	-	-	I/O
	P83	103	79	64	50	37	25	I/O
	P84	104	80	65	51	38	26	I/O
	P85	105	81	66	52	-	-	I/O
	P86	106	82	67	53	-	-	I/O
	P87	111	87	72	58	-	-	I/O
	P90	116	88	73	59	43	-	I/O
	P91	117	89	74	60	44	-	I/O
	P92	118	90	75	61	45	-	I/O
	P93	119	91	76	62	46	-	I/O
	P94	120	92	77	63	47	31	I/O
	P95	121	93	78	64	48	32	I/O
	P96	122	94	79	-	-	-	I/O
	P97	123	95	80	-	-	-	I/O
	PA0	124	96	-	-	-	-	I/O
	PA1	125	97	-	-	-	-	I/O
	PA2	126	98	-	-	-	-	I/O
	PA3	127	99	-	-	-	-	I/O
	PB0	2	2	-	-	-	-	I/O
	PB1	3	3	-	-	-	-	I/O
	PB2	4	4	-	-	-	-	I/O
	PB3	5	5	-	-	-	-	I/O
	PC0	18	-	-	-	-	-	I/O
	PC1	19	-	-	-	-	-	I/O
	PC2	20	-	-	-	-	-	I/O
	PC3	21	-	-	-	-	-	I/O
	PC4	22	-	-	-	-	-	I/O
	PC5	23	-	-	-	-	-	I/O
	PC6	24	-	-	-	-	-	I/O

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
I/O Port	PD0	33	-	-	-	-	-	I/O
	PD1	34	-	-	-	-	-	I/O
	PD2	35	-	-	-	-	-	I/O
	PD3	61	-	-	-	-	-	I/O
	PD4	62	-	-	-	-	-	I/O
	PD5	63	-	-	-	-	-	I/O
	PD6	64	-	-	-	-	-	I/O
	PE0	69	-	-	-	-	-	I/O
	PE1	70	-	-	-	-	-	I/O
	PE2	71	-	-	-	-	-	I/O
	PE3	93	-	-	-	-	-	I/O
	PE4	94	-	-	-	-	-	I/O
	PE5	95	-	-	-	-	-	I/O
	PE6	96	-	-	-	-	-	I/O
	PF0	97	-	-	-	-	-	I/O
	PF1	98	-	-	-	-	-	I/O
	PF2	99	-	-	-	-	-	I/O
	PF3	112	-	-	-	-	-	I/O
	PF4	113	-	-	-	-	-	I/O
	PF5	114	-	-	-	-	-	I/O
	PF6	115	-	-	-	-	-	I/O
External inter-rupt	IRQ00	Selectable for FPSA00 to 11 pins / FPSD00 to 20 pins						Input
	IRQ01							Input
	IRQ02							Input
	IRQ03							Input
	IRQ04	Selectable for FPSB00 to 16 pins / FPSD00 to 20 pins						Input
	IRQ05							Input
	IRQ06							Input
	IRQ07							Input
	IRQ08	Selectable for FPSA00 to 11 pins / FPSD00 to 20 pins						Input
	IRQ09							Input
	IRQ10							Input
	IRQ11							Input
	IRQ12	Selectable for FPSB00 to 16 pins / FPSD00 to 20 pins						Input
	IRQ13							Input
	IRQ14							Input
	IRQ15							Input
Serial I/F0	SIF00 (SBO0/TX0/ SDA0)	Selectable for FPSA00 to 11 pins						I/O
	SIF01(SBI0/ RX0)							Input
	SIF02(SBT0/ SCL0)							I/O
	SIF03(SBCS0)							I/O
Serial I/F1	SIF10 (SBO1/TX1/ SDA1)	Selectable for FPSB00 to 16 pins						I/O
	SIF11(SBI1/ RX1)							Input
	SIF12(SBT1/ SCL1)							I/O
	SIF13(SBCS1)							I/O

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
Serial I/F2	SIF20(SBO2/ TX2)	Selectable for FPSA00 to 11 pins						I/O
	SIF21(SBI2/ RX2)							Input
	SIF22(SBT2)							I/O
	SIF23(SBCS2)							I/O
Serial I/F3	SIF30(SBO3/ TX3)							I/O
	SIF31(SBI3/ RX3)							Input
	SIF32(SBT3)							I/O
	SIF33(SBCS3)							I/O
Serial I/F4	SIF40(SBO4/ TX4)	Selectable for FPSB00 to 16pins						I/O
	SIF41(SBI4/ RX4)							Input
	SIF42(SBT4)							I/O
	SIF43(SBCS4)							I/O
Serial I/F5	SIF50 (SBO5/TX5/LTX)							I/O
	SIF51 (SBI5/RX5/LRX)							Input
	SIF52(SBT5)							I/O
Serial I/F6	SIF60(SBO6/ TX6)							I/O
	SIF61(SBI6/ RX6)							Input
	SIF62(SBT6)							I/O
CAN-FD	CRX	Selectable for FPSA00 to 11 pins						Input
	CTX							Output

Function	Pin name	Pin No.						I/O
		128-pin	100-pin	80-Pin	64-Pin	48-Pin	32-Pin	
RTC	RTCOUT	Selectable for FPSA00 to 11pins / FPSB00 to 16pins / FPSC00 to 25pins / FPSD00 to 20pins						Output
ZPWM count state output	ZPWMBCST0							Output
	ZPWMBCST1							Output
	ZPWMBCST2							Output
	ZPWMBCST3							Output
	ZPWMBCST4							Output
	ZPWMBCST5							Output
	ZPWMBCST6							Output
	ZPWMBCST7							Output
	ZPWMBCST8							Output
	ZPWMBCST9							Output
	ZPWMBCSTA							Output
	ZPWMBCSTB							Output
	ZPWMBCSTC							Output
A/D conversion state output	ADSTATE0							Output
	ADSTATE1							Output
	ADSTATE2							Output
	ADSTATE3							Output
	ADSTATE4							Output
Comparator Output	CMPOT00							Output
	CMPOT01							Output
	CMPOT10							Output
	CMPOT11							Output
	CMPOT20							Output
	CMPOT21							Output
	CMPOT30							Output
	CMPOT31							Output
Clock Output	CLKOUT							Output

1.5 Electrical Characteristics

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

Hint:

T. B. D is planned to update at the time of revising the Technical Reference Manual.

1.5.1 Absolute Maximum Ratings

Parameter			Symbol	Rating	Unit
A1	Power supply voltage 1		V_{DD33A}	-0.3 to 4.6	V
A2	Power supply voltage 2		AV_{DDA}	-0.3 to 4.6	V
A3	Internal power supply voltage		V_{OUT11A}	-0.3 to 1.4	V
A4	I/O pin voltage 1		V_{I1}	-0.3 to V_{DD33} +0.3 (Up to: 4.6)	V
A5	I/O pin voltage 2 (5V Tolerant)		V_{I2}	-0.3 to 5.5	V
A6	Average Output current	I/O pin 1	I_{O1}(avg.)	±5	mA
A7		I/O pin 2, 4, 5	I_{O2}(avg.)	±20	mA
A8		I/O pin 3	I_{O3}(avg.)	±10	mA
A9		Total of all pins	I_{O4}	±50	mA
A10	Average Injection current	I/O pin	I_{INJ1}	±2	mA
A11		Total of all pins	I_{INJ2}	±20	mA
A12	Allowable loss		P_D	TBD	mW
A13	Operating Ambient temperature		T_a	-40 to 125	°C
A14	Operating Junction temperature		T_j	-40 to 150	°C
A15	Storage temperature		T_{stg}	-40 to 150	°C

Note:

Although this LSI has internal ESD protection circuit, it may still sustain permanent damage if not handled properly. Therefore, proper ESD precautions are recommended to avoid electrostatic damage to the MOS gate.

This product may sustain permanent damage if it gets stress which is higher than the above stated absolute maximum rating even only for a second. This rating is the maximum rating and device operating at this range is not guaranteed as it is higher than our stated recommended operating range.

1.5.2 Operation Conditions

Power supply voltage during operation			V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B1	External power supply voltage 1	V_{DD33}	V_{RST33N}	3.3	3.6	V
B2	External power supply voltage 2	AV_{DD}	-	V_{DD33}	-	
B3	Internal power supply voltage	V_{OUT11}	-	1.1	-	

Note:

Supply the external power supply pin VDD33 and the analog power supply pin AVDD from the same external power supply.

Oscillation pin			V_{DD33} = V_{RST33N} to 3.6 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B4	External oscillation frequency (Ceramic/Crystal)	F_{OSC}	4.0	-	20.0	MHz
B5	External oscillation Feedback resistor	R_{FB}	-	1.0	-	MΩ

Note:

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

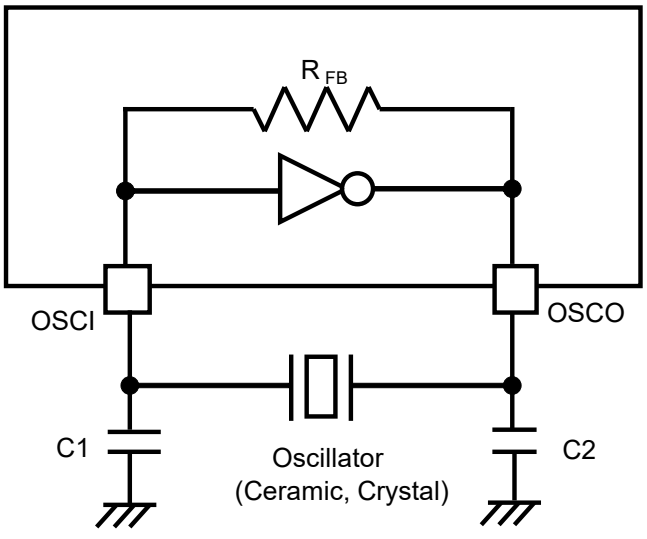


Figure 1.5-1 Oscillation Circuit

External clock input OSCI (OSCO left open)			V_{DD33} = V_{RST33N} to 3.6 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Rating			Unit
			MIN	TYP	MAX	
B6	Clock frequency	F_{CP}	4.0	-	20.0	MHz
B7	High level pulse width	t_{wh1}	20	-	-	ns
B8	Low level pulse width	t_{wl1}	20	-	-	
B9	Rising time	t_{wr1}	-	-	5	
B10	Falling time	t_{wf1}	-	-	5	

Note:

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

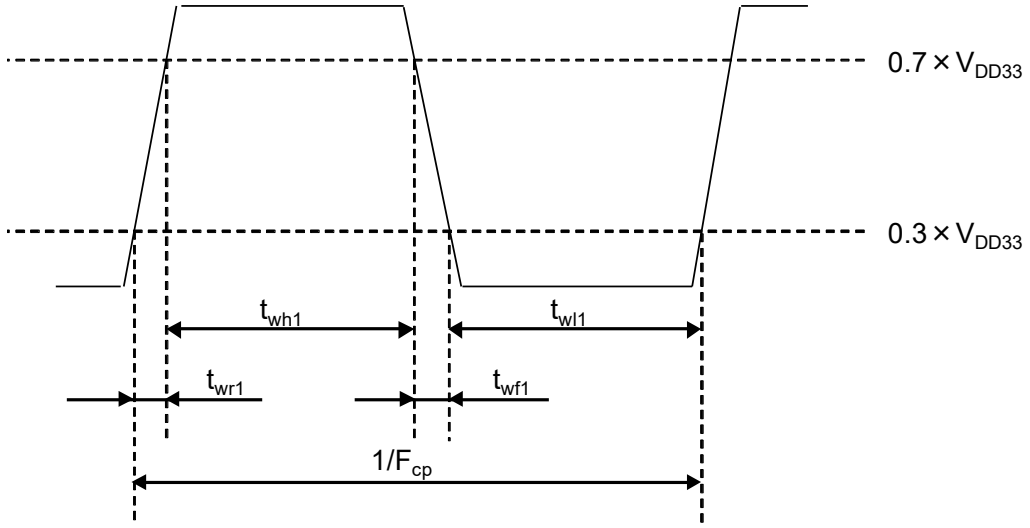


Figure 1.5-2 OSCI Timing Chart

1.5.3 DC Characteristics

Power supply current during operation			V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating		Unit
				TYP	MAX	
C1	NORMAL mode (KM1M7CF4 series)	I_{DD1}	F_{OSC} = 10 MHz, PLL is used CPUCLK = 160 MHz, IOCLK = 80 MHz CPU and Peripheral circuits are operating. Analog circuits are stopped.	60 T.B.D.	128 T.B.D.	mA
C2	NORMAL mode (KM1M7CF5 series)	I_{DD2}	F_{OSC} = 10 MHz, PLL is used CPUCLK = 160 MHz, IOCLK = 80 MHz CPU, Peripheral circuits and Secure function are operating. Analog circuits are stopped.	60.5 T.B.D.	129 T.B.D.	
C3	SLEEP mode (KM1M7CF4 series)	I_{DD3}	F_{OSC}= 10 MHz, PLL is used CPUCLK = 160 MHz, IOCLK = 80 MHz CPU is stopped, Peripheral circuits are operating. Analog circuits are stopped.	45 T.B.D.	112 T.B.D.	
C4	SLEEP mode (KM1M7CF5 series)	I_{DD4}	F_{OSC}= 10 MHz, PLL is used CPUCLK = 160 MHz, IOCLK = 80 MHz CPU is stopped, Peripheral circuits and Secure functions are operating. Analog circuits are stopped.	45.5 T.B.D.	113 T.B.D.	
C5	DEEPSLEEP mode	I_{DD5}	F_{OSC} is stopped, PLL is stopped CPUCLK = IOCLK = Stop, CPU and Peripheral circuits are stopped. Analog circuits are stopped.	1.5 T.B.D.	63.5 T.B.D.	

Note:

The measurement conditions are as follows.

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

I/O pin1 NRST				V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C6	Input voltage "High level"	V_{IH1}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V	V_{DD33} × 0.7	-	V_{DD33}	V
C7	Input voltage "Low level"	V_{IL1}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V	V_{SS}	-	V_{DD33} × 0.3	
C8	Internal pull-up resistor	R_{IO1}	V_{IN} = 0 V	15	30	60	kΩ
C9	Output voltage "Low level"	V_{OL1}	V_{DD33} = V_{RST33P} I_{OL} = 2.0 mA	-	-	0.4	V

I/O pin2 P00-P07, P10, P11, P67, P82-P86, P90-P97, PA0-PA3, PB0-PB3				V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C10	Input voltage "High level"	V_{IH2}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V	V_{DD33} × 0.7	-	V_{DD33}	V
C11	Input voltage "Low level"	V_{IL2}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V	V_{SS}	-	V_{DD33} × 0.3	
C12	Input Leakage Current	I_{LK2}	V_{IN} = 0 V to V_{DD33}	-	-	±5	μA
C13	Internal pull-up resistor	R_{IO2}	V_{IN} = 0 V	15	30	60	kΩ
C14	Output voltage "High level"1	V_{OH21}	IOPxDRV.PxxDRV = 0 I_{OH} = -4.0 mA	2.7	-	-	V
C15	Output voltage "High level"2	V_{OH22}	IOPxDRV.PxxDRV = 1 I_{OH} = -8.0 mA	2.7	-	-	
C16	Output voltage "Low level"1	V_{OL21}	IOPxDRV.PxxDRV = 0 I_{OL} = 4.0 mA	-	-	0.4	
C17	Output voltage "Low level"2	V_{OL22}	IOPxDRV.PxxDRV = 1 I_{OL} = 8.0 mA	-	-	0.4	

I/O pin3 P14-P17, P20-P27, P30-P37, P40-P46, P50-P56, P63-P65, P70-P76, P80, P81, P87, PC0-PC6 PD0-PD6, PE0-PE6, PF0-PF6			V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C18	Input voltage "High level"	V_{IH3}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V	V_{DD33} × 0.7	-	V_{DD33}	V
C19	Input voltage "Low level"	V_{IL3}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V	V_{SS}	-	V_{DD33} × 0.3	
C20	Input Leakage Current	I_{LK3}	V_{IN} = 0 V to V_{DD33}	-	-	±5	µA
C21	Internal pull-up resistor	R_{IO3}	V_{IN} = 0 V	15	30	60	kΩ
C22	Output voltage "High level"1	V_{OH31}	IOPxDRV.PxxDRV = 0 I_{OH} = -2.0 mA	2.7	-	-	V
C23	Output voltage "High level"2	V_{OH32}	IOPxDRV.PxxDRV = 1 I_{OH} = -4.0 mA	2.7	-	-	
C24	Output voltage "Low level"1	V_{OL31}	IOPxDRV.PxxDRV = 0 I_{OL} = 2.0 mA	-	-	0.4	
C25	Output voltage "Low level"2	V_{OL32}	IOPxDRV.PxxDRV = 1 I_{OL} = 4.0 mA	-	-	0.4	

I/O pin4 P12, P13, P57, P60, P61, P62, P66			V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
C26	Input voltage "High level"1	V_{IH41}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V IOPxILV.PxxILV = 0	V_{DD33} × 0.7	-	5.5	V
C27	Input voltage "High level"2	V_{IH42}	V_{DD33} = AV_{DD} = 3.0 V to 3.6 V IOPxILV.PxxILV = 1	1.35	-	5.5	
C28	Input voltage "Low level"1	V_{IL41}	V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V IOPxILV.PxxILV = 0	V_{SS}	-	V_{DD33} × 0.3	
C29	Input voltage "Low level"2	V_{IL42}	V_{DD33} = AV_{DD} = 3.0 V to 3.6 V IOPxILV.PxxILV = 1	V_{SS}	-	0.8	
C30	Input Leakage Current	I_{LK4}	V_{IN} = 0 V to V_{DD33}	-	-	±5	µA
C31	Internal pull-up resistor	R_{IO4}	V_{IN} = 0 V	15	30	60	kΩ
C32	Output voltage "High level"1	V_{OH41}	IOPxDRV.PxxDRV = 0 I_{OH} = -4.0 mA	2.7	-	-	V
C33	Output voltage "High level"2	V_{OH42}	IOPxDRV.PxxDRV = 1 I_{OH} = -8.0 mA	2.7	-	-	
C34	Output voltage "Low level"1	V_{OL41}	IOPxDRV.PxxDRV = 0 I_{OL} = 4.0 mA	-	-	0.4	
C35	Output voltage "Low level"2	V_{OL42}	IOPxDRV.PxxDRV = 1 I_{OL} = 8.0 mA	-	-	0.4	
C36	Output voltage "Low level"3	V_{OL43}	IOPxDRV20.PxxDRV20 = 1 I_{OL} = 20.0 mA	-	-	0.4	

1.5.4 Analog Characteristics

This LSI Manual shows the electrical characteristics of analog.

1.5.4.1 12bit A/D Converter

ADC0, ADC1, ADC2, ADC3, ADC4			V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D1	Resolution	-		-	-	12	Bit
D2	Conversion clock	-		10	-	80	MHz
D3	Integral non-linearity error	$INLE_{AD}$	Conversion clock = 40MHz	-	-	±3	LSB
D4	Differential non-linearity error	$DNLE_{AD}$	Conversion clock = 40MHz	-	-	±3	LSB
D5	Zero transition voltage	-		-10	-	10	mV
D6	Full-scale transition voltage	-		AV_{DD} - 10	-	A_{VDD} + 10	mV
D7	A/D conversion time	-		-	-	5	Msps
D8	Input voltage range	V_{IA}		AV_{SS}	-	AV_{DD}	V
D9	Power supply current during operation(*1)	I_{AD}		-	2.0	-	mA/unit

Note:

*1 Guaranteed by characterization, not tested in production

1.5.4.2 Comparator

CMP00–CMP31				V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D10	Input offset voltage	V_{OFFC}		-	-	±10	mV
D11	Input dynamic range	V_{IC}		50	-	A_{VDD} - 50	
D12	Input hysteresis width1(*1)	V_{HYSC1}	CMPnMD.HYSLVx = 0 CMPNn = 1.65 V	-	30	50	
	Input hysteresis width2(*1)	V_{HYSC2}	CMPnMD.HYSLVx = 1 CMPNn = 1.65 V	-	15	30	
D13	Minimum comparison voltage(*2)	V_{MINC}		20	-	-	
D14	Propagation delay(*2)	V_{DLY}	Filter OFF to CMP interrupt	-	30	-	ns
D15	Power supply current during operation(*1)	I_C		-	0.33	-	mA/ Unit

Note:

*1 Guaranteed by characterization, not tested in production

Note:

*2 Guaranteed by design, not tested in production

1.5.4.3 D/A Converter

DAC00–DAC31				V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D16	Resolution			-	-	12	Bit
D17	Integral non-linearity error(*1)	$INLE_{DA1}$		-	-	±5	LSB
D18	Differential linearity error(*1)	$DNLE_{DA1}$		-	-	±3	
D19	Zero scale voltage	-	DACnDR = 0x0000	-10	-	10	mV
D20	Full scale voltage	-	DACnDR = 0x0FFF	AV_{DD} - 10	-	AV_{DD} + 10	
D21	Settling Time(*1)	SET_{DA1}	±1LSB	-	0.77	-	us
D22	Power supply current during operation(*1)	I_{DA1}		-	0.12	-	mA/ Unit

DAC00,DAC31 Buffered ON				V_{DD33} = AV_{DD} = 3.3 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D23	Resolution			-	-	12	Bit
D24	Integral non-linearity error (*1)	$INLE_{DA2}$		-	-	±5	LSB
D25	Differential linearity error (*1)	$DNLE_{DA2}$		-	-	±3	
D26	Voltage on DAOUTn			0.2	-	A_{VDD} -0.2	V
D27	Offset Error (*1) (*2)	$OFSE_{DA2}$	DACnDR = 0x0800	-35	-	35	mV
D28	Gain Error (*1) (*2)	GE_{DA2}		-1.5	-	1.5	%
D29	Load Transient Settling Time (*1) (*2)	SET_{DA2}	±1LSB	-	1.6	-	us
D30	Power supply current during operation (*1)	I_{DA2}		-	0.52	-	mA/ Unit

Note:

*1 Guaranteed by characterization, not tested in production

Note:

*2 Connect the following load resistance and load capacitance between DAOUTn output and AVSS.

$R_{LOAD} \geq 7.5\ k\Omega$

$C_{LOAD} \leq 50\ pF$

1.5.4.4 Low Voltage Detection (LVD)

				V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D31	Low Voltage Detection level 1	V_{LVDP1}	At rising	2.8	2.9	3.0	V
D32		V_{LVDN1}	At falling	2.7	2.8	2.9	
D33	Low Voltage Detection level 2	V_{LVDP2}	At rising	2.9	3.0	3.1	V
D34		V_{LVDN2}	At falling	2.8	2.9	3.0	
D35	Low Voltage Detection level 3	V_{LVDP3}	At rising	3.0	3.1	3.2	V
D36		V_{LVDN3}	At falling	2.9	3.0	3.1	
D37	Change rate of power supply voltage (V_{DD33})	ΔV_{DD33P}		-	-	5	V/ms

1.5.4.5 Power-on Reset

				V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D38	Power supply voltage detection level	V_{RST33P}	At rising	2.6	2.8	3.0	V
D39		V_{RST33N}	At falling	2.45	2.55	2.65	
D40	Hysteresis width (*1)	V_{RSTHYS}	V_{RST33P}-V_{RST33N}	80	-	-	mV
D41	Change rate of power supply voltage(V_{DD33})	ΔV_{DD33P}		-	-	5	V/ms

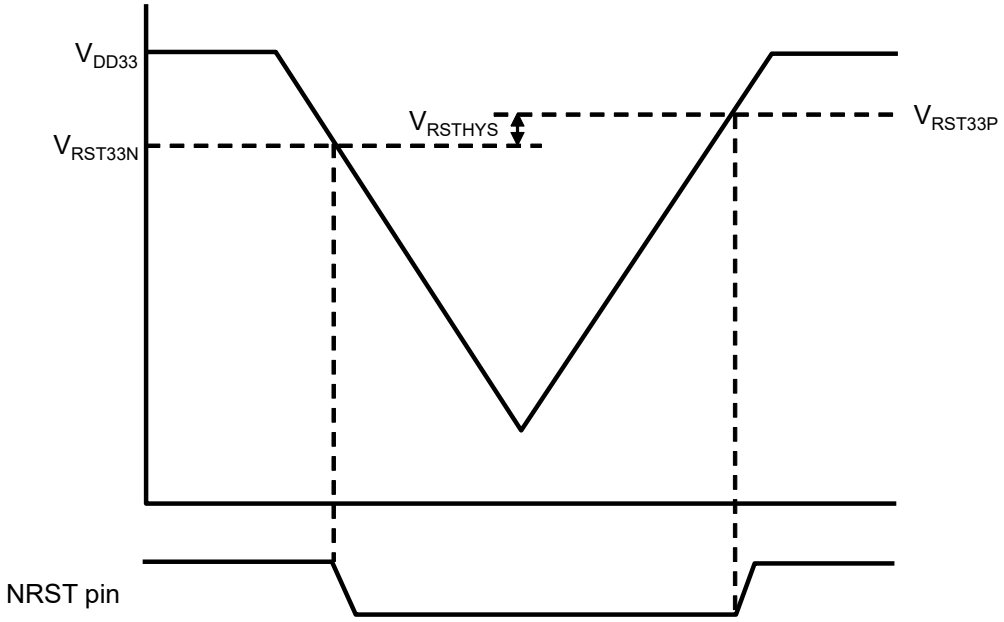


Figure 1.5-3 Characteristics of Power-on Reset Circuit

Note:

*1 Guaranteed by design, not tested in production

1.5.4.6 Internal Oscillation

HIRC				V_{DD33} = V_{RST33N} to 3.6 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D42	Oscillation frequency	F_{RC1}		-	12	-	MHz
	Frequency stability (*1,*2)		T.B.D.	T.B.D.	-	T.B.D.	%

LIRC				V_{DD33} = V_{RST33N} to 3.6 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D43	Oscillation frequency	F_{RC3}		-	30	-	kHz
	Frequency stability(*1, *2)			-10	-	10	%

Note:

*1 The frequencies listed in the tables represent the factory default values. The frequency values at low temperature are guaranteed based on characteristic evaluation.

Note:

*2 Oscillation accuracy may vary depending on factors such as mounting, reflow soldering, and aging.

1.5.4.7 Temperature sensor

			V_{DD33} = V_{RST33N} to 3.6 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D44	Temperature coefficient(*1)	Temp		-	3.76	-	mV/°C
D45	Temperature voltage(*1)	V_{Temp}	T_a = 25 °C	-	1.18	-	V
D46	Power supply current during operation(*1)	I_{Temp}		-	0.04	-	mA

Note:

*1 Guaranteed by characterization, not tested in productionn

1.5.4.8 True Random Number Generator

			V_{DD33} = V_{RST33N} to 3.6 V, V_{SS} = AV_{SS} = 0.0 V T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
D47	Power supply current during operation(*1)	I_{TRNG}		-	TBD	-	mA

Note:

True Random Number Generator (TRNG) is only embedded in KM1M7CF5 series.

Note:

*1 Guaranteed by characterization, not tested in production

1.5.5 AC Characteristics

1.5.5.1 Serial Interface

Clock-Synchronous I/O timing 1 master (SBT polarity "H", "L") I_{OH} = -4.0 mA, I_{OL} = 4.0 mA				V_{DD33} = AV_{DD} = 3.0 V to 3.6 V V_{SS} = AV_{SS} = 0.0 V, C_L = 30 pF T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
E1	Cycle time	t_{S_CYCLE1}		200	-	-	ns
E2	SBT High width	t_{S_HIGH1}		(t_{S_CYCLE1}/2)-10	-	-	
E3	SBT Low width	t_{S_LOW1}		(t_{S_CYCLE1}/2)-10	-	-	
E4	SBI/SBO setup time	t_{S_SET1}	Serial Interface 0,1	20	-	-	
			Serial Interface 2 to 6	15	-	-	
E5	SBI/SBO hold time	t_{S_HOLD1}		10	-	-	
E6	SBO output delay	t_{S_OPD1}		-	-	50 (T.B.D)	

Clock-Synchronous I/O timing 2 slave (SBT polarity "H", "L") I_{OH} = -4.0 mA, I_{OL} = 4.0 mA				V_{DD33} = AV_{DD} = 3.0 V to 3.6 V V_{SS} = AV_{SS} = 0.0 V, C_L = 30 pF T_a = -40 °C to 125 °C			
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
E7	Cycle time	t_{S_CYCLE2}		200	-	-	ns
E8	SBT High width	t_{S_HIGH2}		90	-	-	
E9	SBT Low width	t_{S_LOW2}		90	-	-	
E10	SBI/SBO setup time	t_{S_SET2}	Serial Interface 0,1	20	-	-	
			Serial Interface 2 to 6	15	-	-	
E11	SBI/SBO hold time	t_{S_HOLD2}		10	-	-	
E12	SBO output delay	t_{S_OPD2}		-	-	50 (T.B.D)	

Clock-Synchronous(When HS Pin Function is selected) I/O timing 3 master (SBT polarity "H", "L") I_{OH} = -8.0 mA, I_{OL} = 8.0 mA			V_{DD33} = AV_{DD} = 3.0 V to 3.6 V V_{SS} = AV_{SS} = 0.0 V, C_L = 30 pF T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
E13	Cycle time	t_{S_CYCLE3}		100 (T.B.D)	-	-	ns
E14	SBT High width	t_{S_HIGH3}		(t_{S_CYCLE3}/2)-5	-	-	
E15	SBT Low width	t_{S_LOW3}		(t_{S_CYCLE3}/2)-5	-	-	
E16	SBI/SBO setup time	t_{S_SET3}		5 (T.B.D)	-	-	
E17	SBI/SBO hold time	t_{S_HOLD3}		5 (T.B.D)	-	-	
E18	SBO output delay	t_{S_OPD3}		-	-	35 (T.B.D)	

Clock-Synchronous(When HS Pin Function is selected) I/O timing 4 slave (SBT polarity "H", "L") I_{OH} = -8.0 mA, I_{OL} = 8.0 mA			V_{DD33} = AV_{DD} = 3.0 V to 3.6 V V_{SS} = AV_{SS} = 0.0 V, C_L = 30 pF T_a = -40 °C to 125 °C				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
E19	Cycle time	t_{S_CYCLE4}		100 (T.B.D)	-	-	ns
E20	SBT High width	t_{S_HIGH4}		45	-	-	
E21	SBT Low width	t_{S_LOW4}		45	-	-	
E22	SBI/SBO setup time	t_{S_SET4}		5 (T.B.D)	-	-	
E23	SBI/SBO hold time	t_{S_HOLD4}		5 (T.B.D)	-	-	
E24	SBO output delay	t_{S_OPD4}		-	-	35 (T.B.D)	

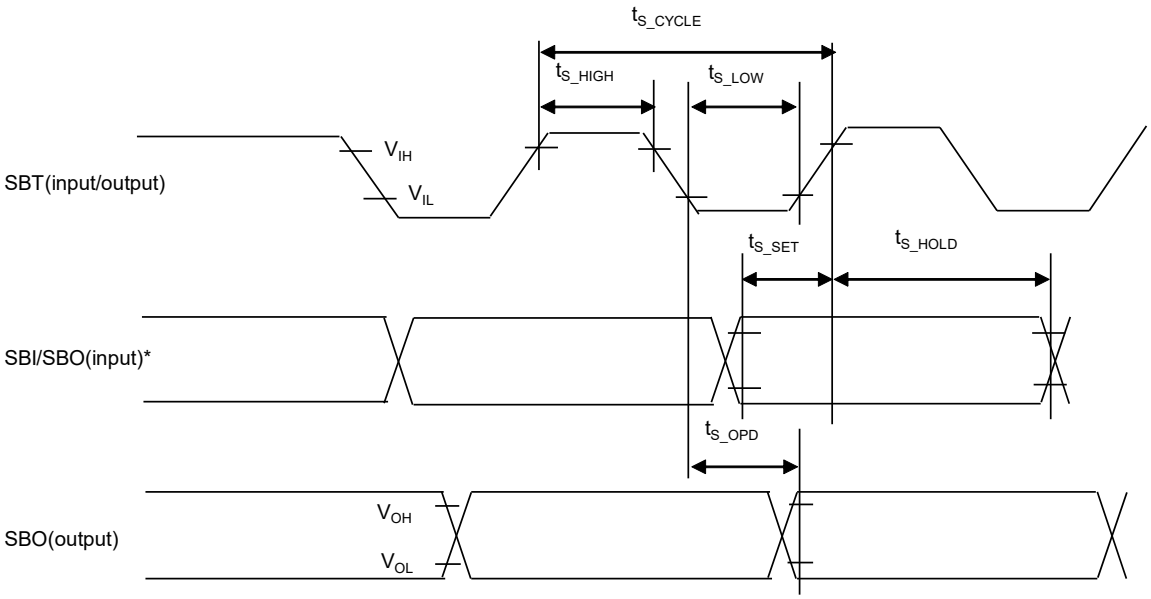


Figure 1.5-4 Serial Interface signal timing 1 (SBT polarity "H")

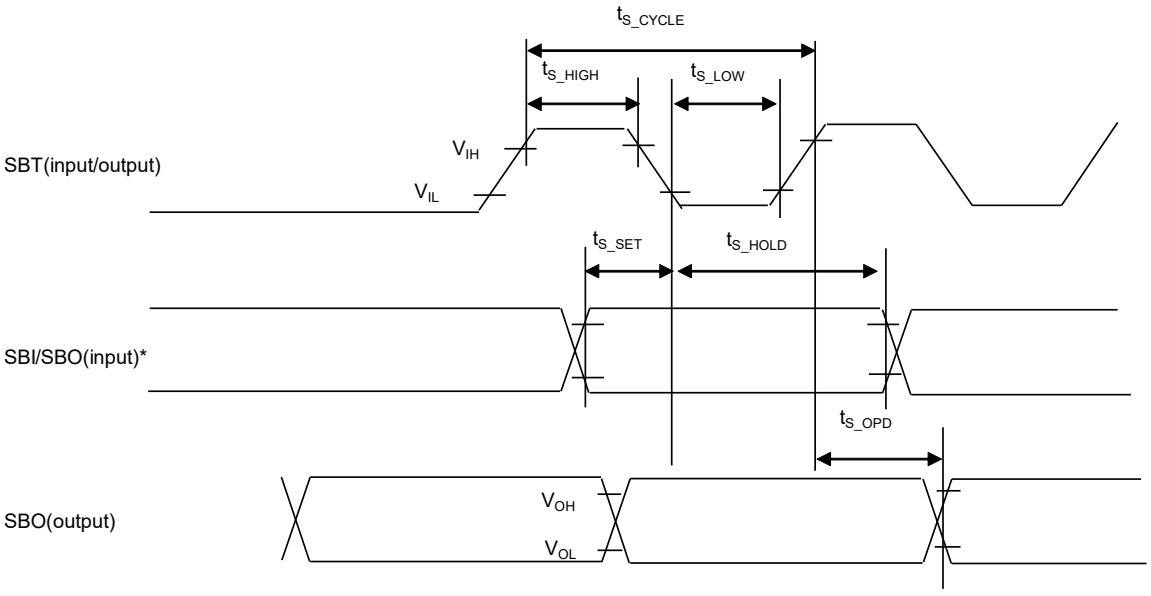


Figure 1.5-5 Serial Interface signal timing 2 (SBT polarity "L")

1.5.6 Flash EEPROM Characteristics

			V_{DD33} = AV_{DD} = V_{RST33N} to 3.6 V, V_{SS} = AV_{SS} = 0.0 V				
Parameter		Symbol	Conditions	Rating			Unit
				MIN	TYP	MAX	
F1	Allowable time of rewriting	E_{MAX}	T_j = -40℃ to 125℃	10,000	-	-	times
F2	Data retention period (*1)	T_{HLD}	After rewriting E_{MAX} times, T_j = 85℃	20	-	-	years
F3	Read current(*2)	I_{READ}	T_a = 25℃	-	3.5	-	mA
F4	Program current(*2)	I_{PROG}	T_a = 25℃	-	6.5	-	mA
F5	Erase current(*2)	I_{ERASE}	T_a = 25℃	-	4.5	-	mA
F6	Page (sector) erase time (*2)	T_{ERASE}	T_a = 25℃	-	-	120	ms
F7	Programming time (1 word) (*2)	T_{PROG}	T_a = 25℃	-	-	350	µs

Note:

*1 Including time when power is turned off.

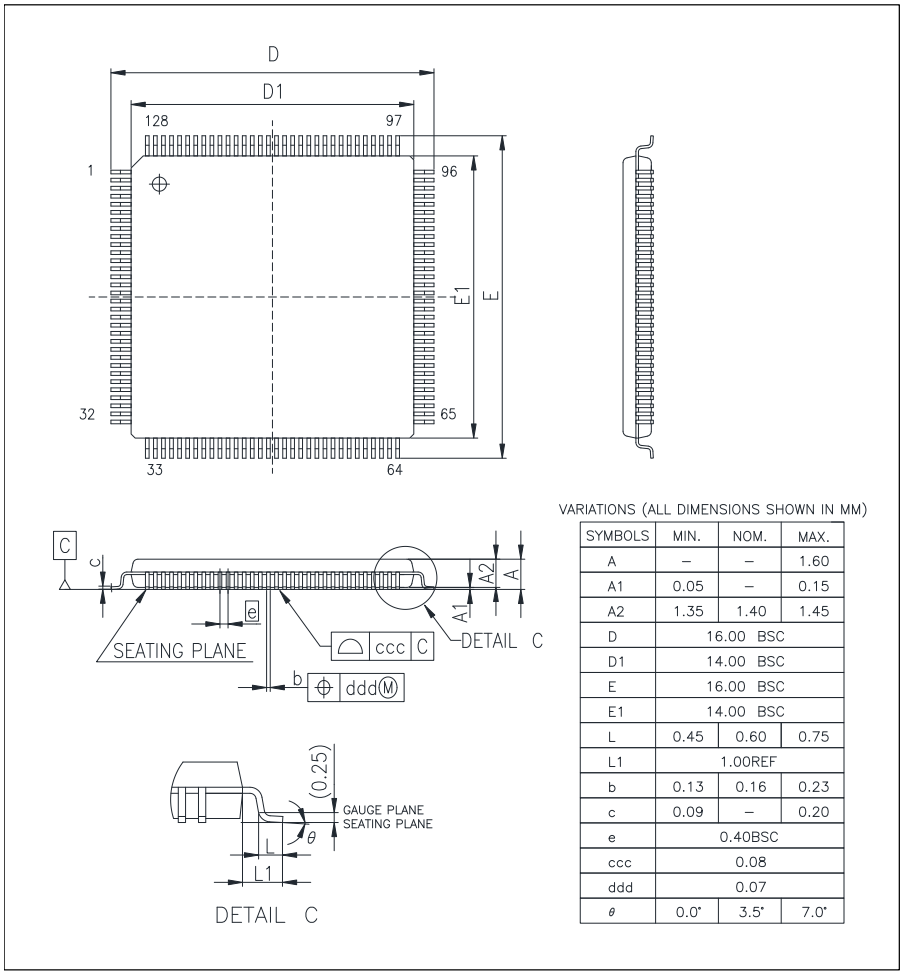
Note:

*2 Guaranteed by design, not tested in production

1.6 Package Dimensions

Package dimensions are shown as follows.

- LQFP128 14mm□ 0.4mm pitch Figure 1.6-1

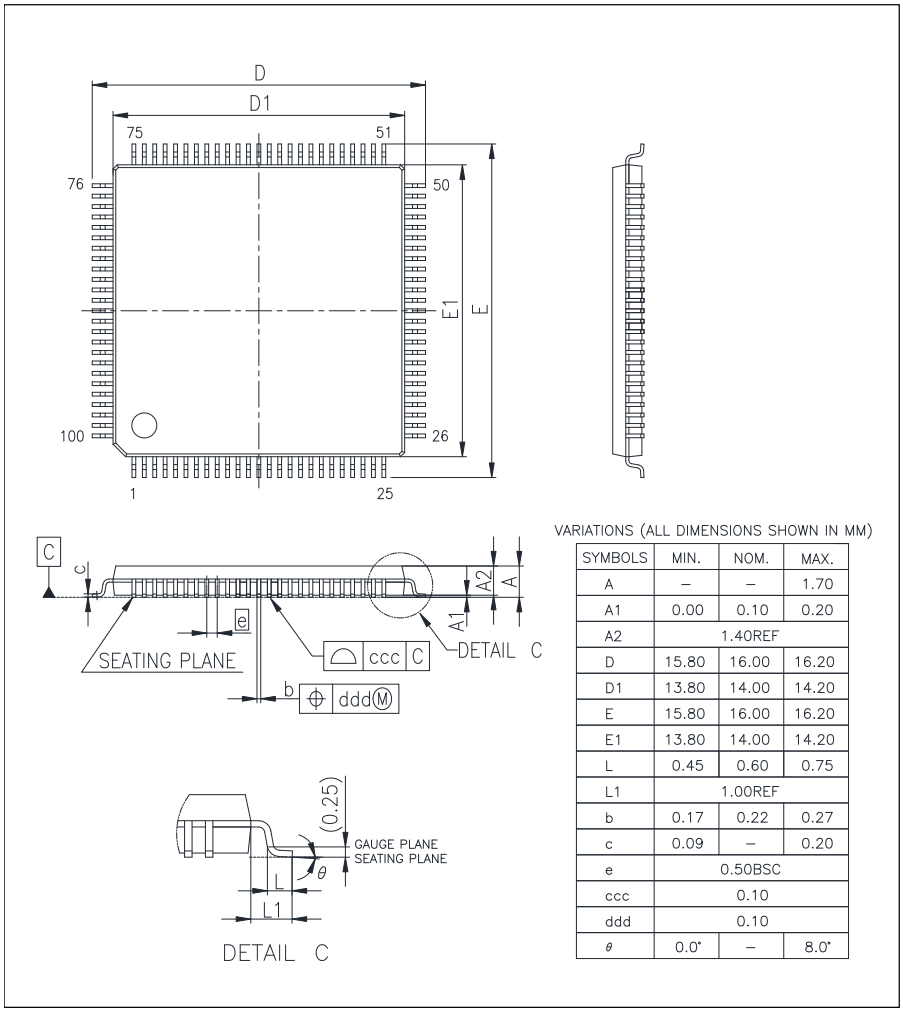


VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.60
A1	0.05	–	0.15
A2	1.35	1.40	1.45
D	16.00 BSC		
D1	14.00 BSC		
E	16.00 BSC		
E1	14.00 BSC		
L	0.45	0.60	0.75
L1	1.00REF		
b	0.13	0.16	0.23
c	0.09	–	0.20
e	0.40BSC		
ccc	0.08		
ddd	0.07		
θ	0.0°	3.5°	7.0°

Figure 1.6-1 LQFP128 14mm□ 0.4mm pitch Package Dimension (Unit: mm)

- LQFP100 14mm□ 0.5mm pitch Figure 1.6-2

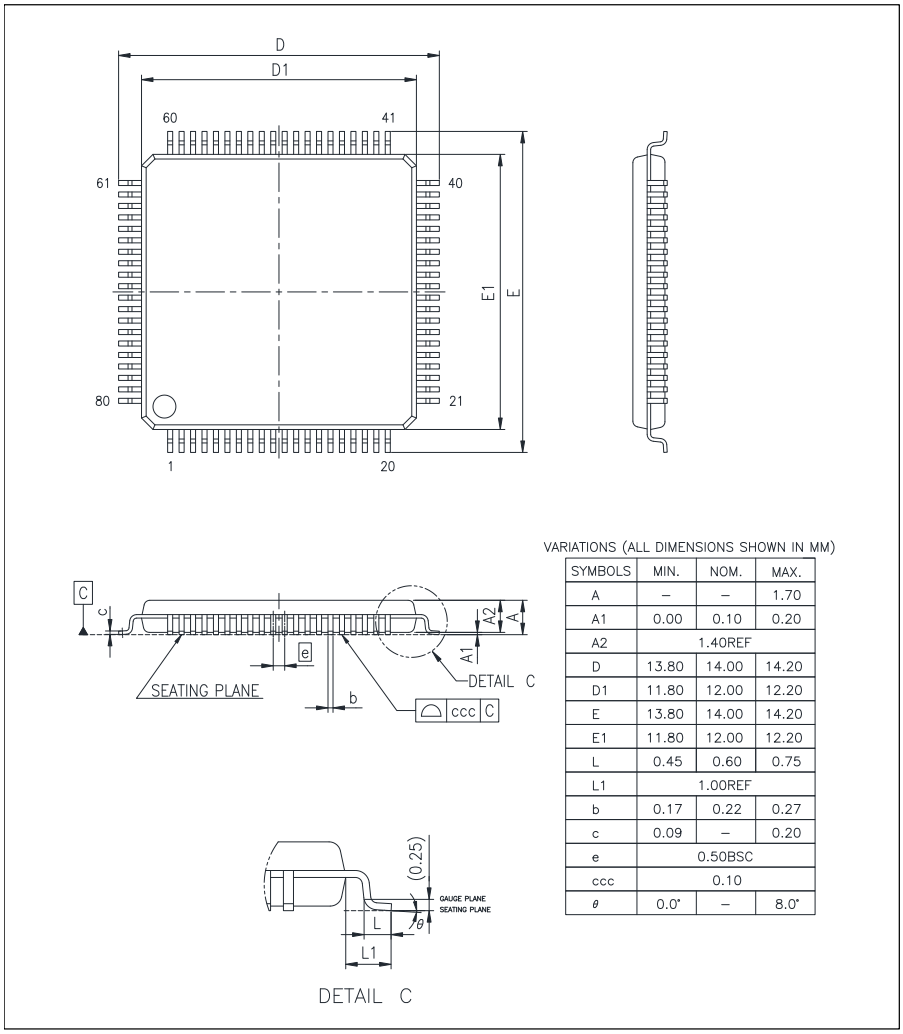


VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

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 1.6-2 LQFP100 14mm□ 0.5mm pitch Package Dimension (Unit: mm)

- LQFP80 12mm□ 0.5mm pitch Figure 1.6-3

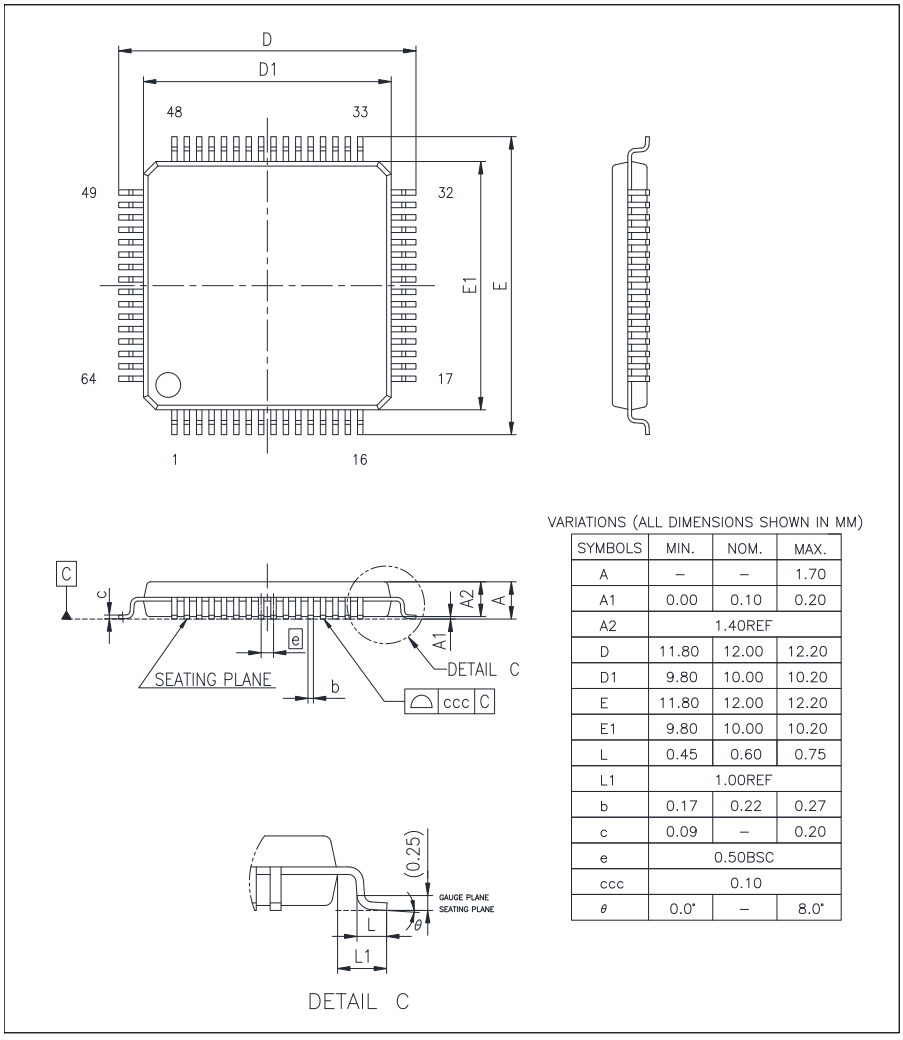


VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.70
A1	0.00	0.10	0.20
A2		1.40REF	
D	13.80	14.00	14.20
D1	11.80	12.00	12.20
E	13.80	14.00	14.20
E1	11.80	12.00	12.20
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	
θ	0.0°	–	8.0°

Figure 1.6-3 LQFP80 12mm□ 0.5mm pitch Package Dimension (Unit: mm)

- LQFP64 10mm□ 0.5mm pitch Figure 1.6-4

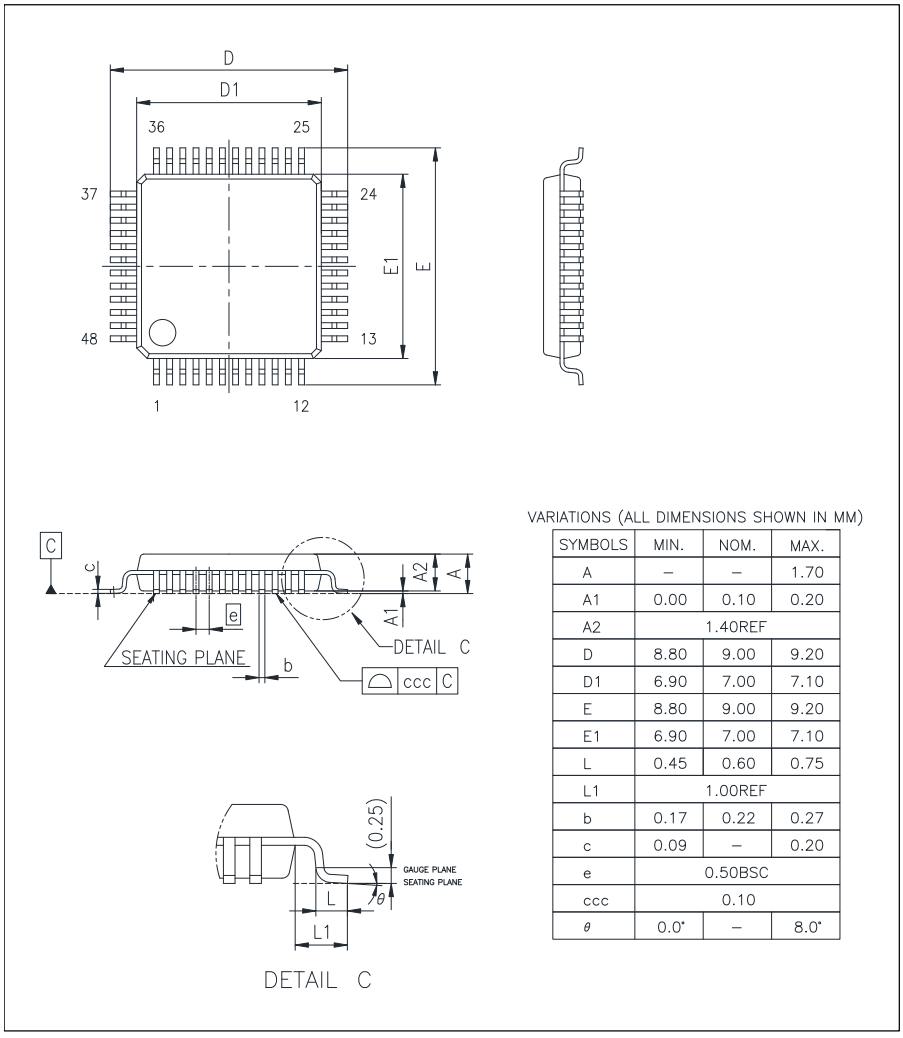


VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.70
A1	0.00	0.10	0.20
A2		1.40REF	
D	11.80	12.00	12.20
D1	9.80	10.00	10.20
E	11.80	12.00	12.20
E1	9.80	10.00	10.20
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	
θ	0.0°	–	8.0°

Figure 1.6-4 LQFP64 10mm□ 0.5mm pitch Package Dimension (Unit: mm)

- LQFP48 7mm□ 0.5mm pitch Figure 1.6-5

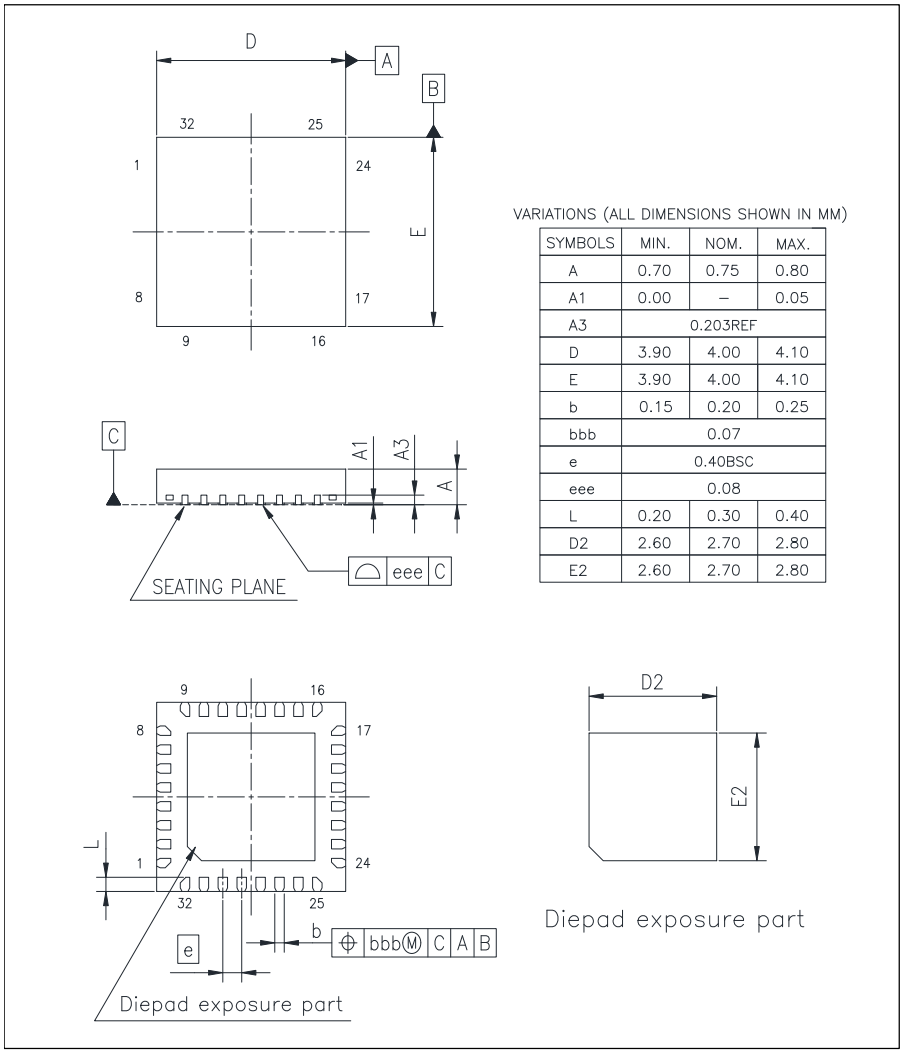


VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.70
A1	0.00	0.10	0.20
A2		1.40REF	
D	8.80	9.00	9.20
D1	6.90	7.00	7.10
E	8.80	9.00	9.20
E1	6.90	7.00	7.10
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	
θ	0.0°	–	8.0°

Figure 1.6-5 LQFP48 7mm□ 0.5mm pitch Package Dimension (Unit: mm)

- QFN32 4mm□ 0.4mm pitch Figure 1.6-6



VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	–	0.05
A3		0.203REF	
D	3.90	4.00	4.10
E	3.90	4.00	4.10
b	0.15	0.20	0.25
bbb		0.07	
e		0.40BSC	
eee		0.08	
L	0.20	0.30	0.40
D2	2.60	2.70	2.80
E2	2.60	2.70	2.80

Figure 1.6-6 QFN32 4mm□ 0.4mm pitch Package Dimension (Unit: mm)

Note:

Package dimensions are subject to change. Before using this product, please obtain product specifications from the sales offices.

1.7 Cautions for Circuit Setup

The cautions for circuit setup are described as follows.

- Cautions of Usage
- Pin Connection
- Unused Pin Connection
- Cautions of 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, duration 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 (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
VDD33, AVDD	Input	Connect to external power supply. Connect the decoupling capacitor between VDD33-VSS pin and AVDD-AVSS pin. The capacitance value should be equal to or greater than the stabilization capacitor of VOUT11. (Place it near the pin)
VSS, AVSS	Input	Short circuit with common GND.
VOUT11	Output	Connect the capacitor of 2.2 µF or more for stabilization between VOUT11- VSS pins. (Put near the pins)
NRST	I/O	When connecting a debugger, insert a 100 Ω limit resistor between this pin and the external connector. Connect the capacitor of 1.0 µF between NRST and VSS pins. (Put near the pins)
SWDCLK, SWDD	I/O	When connecting a debugger, insert 10k Ω pull-up resistor between each pins and VDD33, 100 Ω limit resistor between each pins and the external connector.
TRCSWO	Output	When connecting a debugger, insert 100 Ω limit resistor between each pins and the external connector.

Note:

The treatment of each pin should be determined after thorough evaluation, taking into account the effects of external noise and other factors. If external noise is a concern, it is recommended to insert a limiting resistor of about 100Ω to the relevant pin.

Note:

VOUT11 is the pin to connect a capacity for the internal power supply stabilization.

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

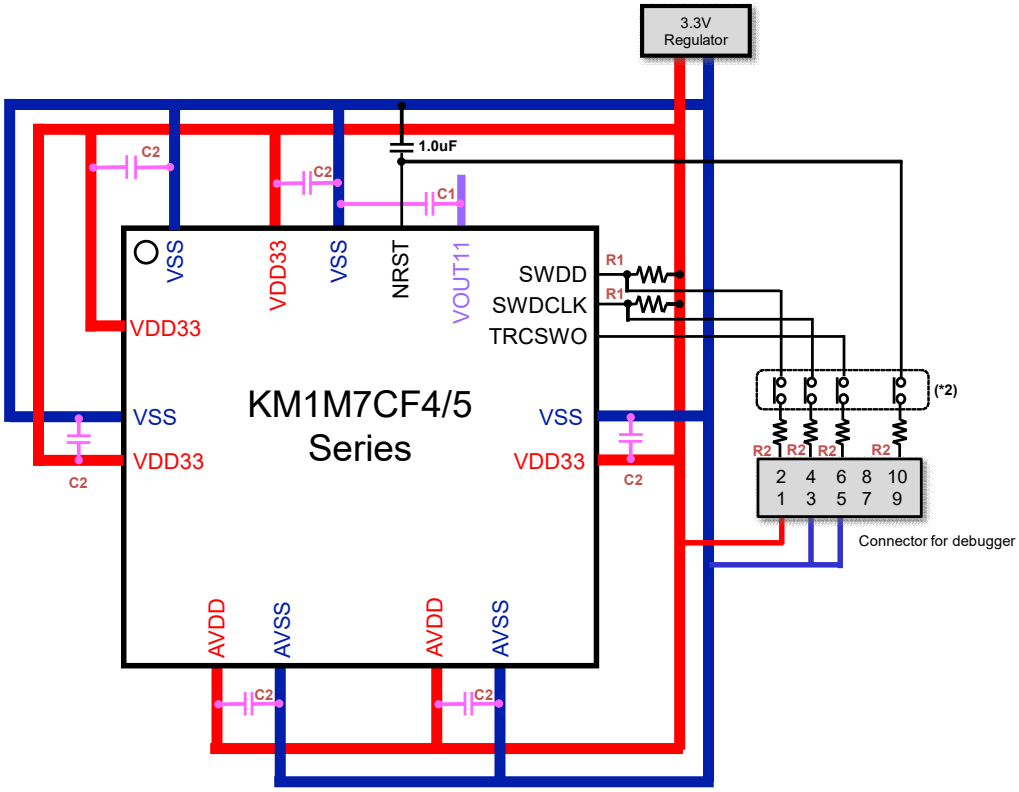


Figure 1.7-1 Recommended MCU Peripheral Circuit

Table 1.7-2 Recommended External Circuit Constants

Symbol	Recommended Value	Description
C1	More than 2.2 μF	For the stabilization of internal regulator
C2	More than C1	For noise filtering (*1)
R1	10 kΩ	For debug pin pull-up
R2	100 Ω	For preventing noise of communication line

Note:

* 1 Because the most suitable capacity value changes according to the frequency of noise, determine the value by the evaluation from your company.

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 Recommended PCB Design

The recommended guidelines for the microcontroller peripherals during PCB design are provided below for your reference when designing PCBs.

- Please keep the VDD33, VSS, AVDD, and AVSS lines from the power supply source to the microcontroller as low impedance as possible. (Example: Keep wiring lengths as short as possible and wiring widths as wide as possible.)
- Make sure that no phase shift occurs between each power terminal. (The wiring for the microcontroller's VDD33 and VSS from

  the power supply source should be shared and then separated near the microcontroller.)
- The capacitors connected to the VDD33 and VOUT11 terminals should be grounded to the pattern near the microcontroller's VSS terminal.

  The capacitors connected to the VOUT11 terminal should be grounded to the pattern near the microcontroller's VOUT11 terminal.

  The capacitors connected to the AVDD terminal should be grounded to the pattern near the microcontroller's AVSS terminal.
- The VOUT11 terminal is an internal power terminal, so please focus on noise care.

  Among the VDD33 and VSS terminals, the following terminals are supply terminals for internal logic circuits and Flash memory, so please prioritize noise care.

Table 1.7-3 VDD33, VSS terminals requiring special care

Number of Pins	VDD33 terminals requiring special care	VSS terminals requiring special care
128pn	Pin No.110	Pin No.109
100pin	Pin No.86	Pin No.85
80pin	Pin No.71	Pin No.70
64pin	Pin No.57	Pin No.56
48pin	Pin No.42	Pin No.41
32pin	Pin No.30	Pin No.29

- The power supply wiring to the AVDD terminal should be separated from the power supply wiring to the VDD33 terminal at the root.
- The GND wiring to the AVSS terminal should be separated from the GND wiring to the VSS terminal starting from the root.
- Do not share the wiring of VDD33, AVDD, VSS, and AVSS to the microcontroller with other ICs or components. (Power wiring to other blocks should be separated as close as possible to the power supply output source.)

1.7.4 Unused Pins

It is recommended to use the following procedure to set unused I/O pins to general purpose port function.

First, set unused I/O pins to general purpose port function. Then, set the pins either to I/O disabled state (both input enable and output enable are OFF) or to output state (input enable is OFF and output enable is ON). After that, open the pins. The details are shown in Figure 1.7-2 .

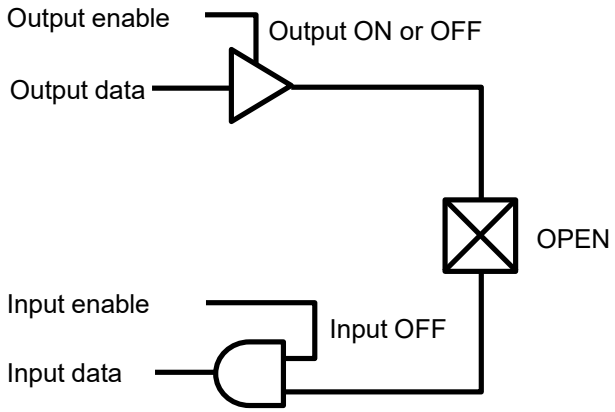


Figure 1.7-2 Unused I/O Pins

1.7.5 Cautions of Power Supply

The cautions of power supply are described as follows.

- Relation between Power Supply and Input Pin Voltage
- Restriction in Power-on
- Power Supply Circuit

1.7.5.1 Relation between Power Supply and Input Pin Voltage

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

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

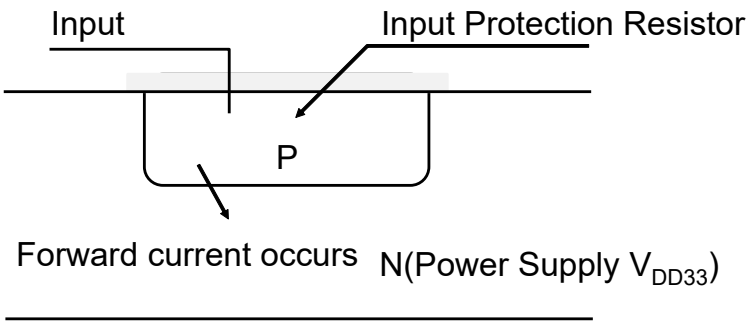


Figure 1.7-3 Relation between Power Supply and Input Pin Voltage

1.7.5.2 Restriction in Power-on

This LSI generates reset when power is applied by power-on reset and operates with the internal power supply generated by internal regulator. Therefore, design the circuit board so that the relation of NRST voltage, power supply voltage (V_{DD33}), and internal power supply voltage (V_{OUT11}) will comply with the following conditions.

- $\Delta V_{DD33} \leq 5$ V/ms
- $tV_{OUT11} < tV_{RST}$
- $t_{NRSTW} \geq 1$ µs

ΔV_{DD33}: The rate of power supply voltage (V_{DD33})

tV_{OUT11}: The time when power supply voltage reaches 0.99V

tV_{RST}: The time when power supply voltage reaches the lower limit of power supply voltage level (V_{RST33P})

t_{NRSTW}: The time that NRST pin maintains "L" level

Figure 1.7-4 shows the relation between power supply voltage and NRST voltage

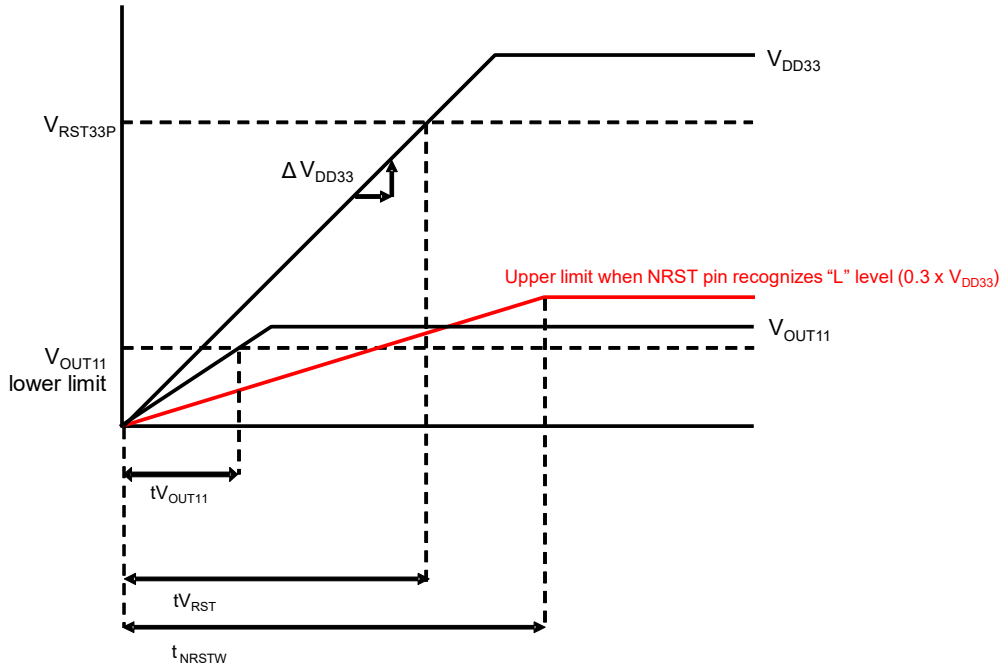


Figure 1.7-4 Relationship between LSI Power Supply and Reset Input Voltage

1.7.5.3 Power Supply Circuit for LSI

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

Figure 1.7-5 shows an example for a power supply circuit. (Emitter follower type).

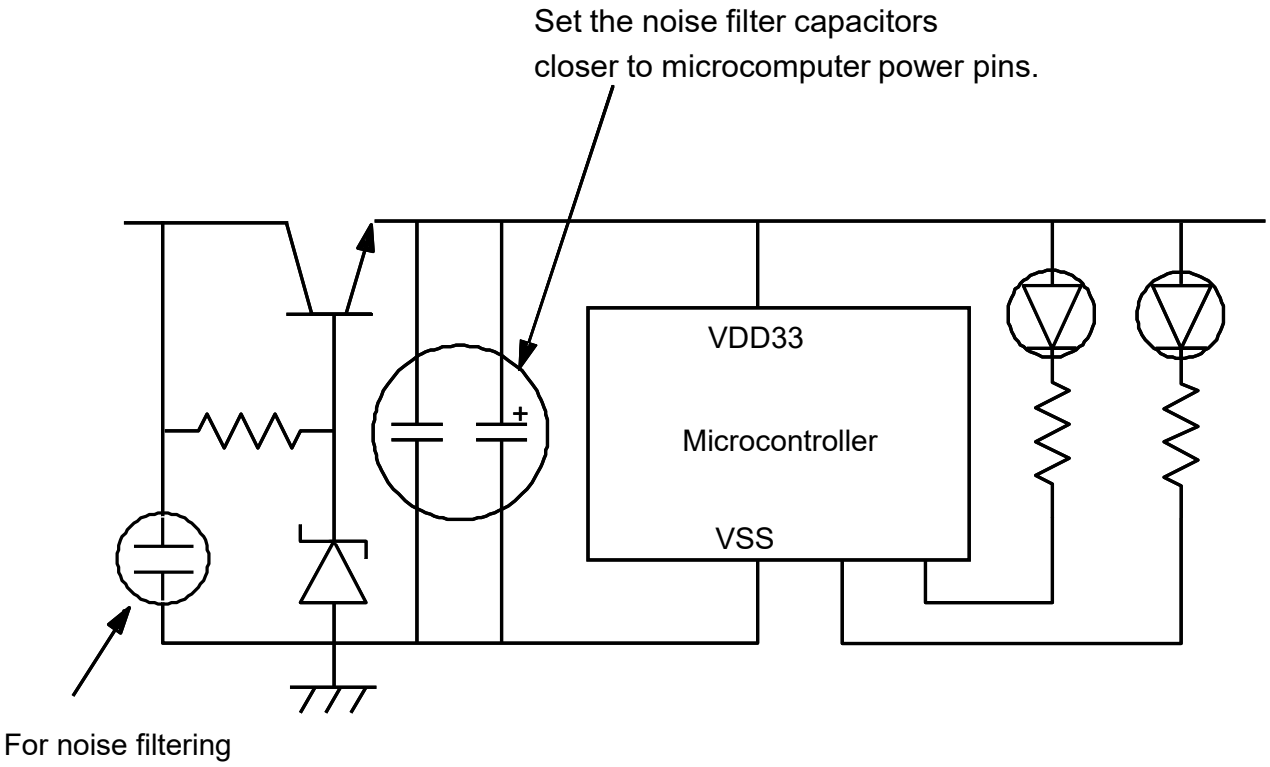


Figure 1.7-5 Power Supply Circuit Example (Emitter Follower Type)

Inquiries

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

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KM1M7CF4/5 Series
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