

MOS INTEGRATED CIRCUIT

μ PD780031A(A), 780032A(A), 780033A(A), 780034A(A),
 μ PD780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A)

8-BIT SINGLE-CHIP MICROCONTROLLERS

DESCRIPTION

The μ PD780031A(A), 780032A(A), 780033A(A), 780034A(A), 780031AY(A), 780032AY(A), 780033AY(A) and 780034AY(A) are products to which a quality assurance program more stringent than that used for the μ PD780031A, 780032A, 780033A, 780034A, 780031AY, 780032AY, 780033AY and 780034AY (standard models) is applied (NEC classifies these products as "special" quality grade models).

The μ PD780031A(A), 780032A(A), 780033A(A), and 780034A(A) are members of the μ PD780034A Subseries of the 78K/0 Series. Only selected functions of the existing μ PD78054 Subseries are provided, and the serial interface is enhanced.

The μ PD780031AY(A), 780032AY(A), 780033AY(A), and 780034AY(A) are the μ PD780034A Subseries with multimaster supporting I²C bus interface, which makes them suitable for AV equipment.

Flash memory versions, the μ PD78F0034A and 78F0034AY, that can operate in the same power supply voltage range as the mask ROM version, and various development tools, are available.

Detailed function descriptions are provided in the following user's manuals. Be sure to read them before designing.

μ PD780024A, 780034A, 780024AY, 780034AY

Subseries User's Manual: U14046E

78K/0 Series User's Manual Instructions: U12326E

FEATURES

- Internal ROM and RAM

Part Number \ Item	Program Memory (Internal ROM)	Data Memory (Internal High-Speed RAM)	Package
μ PD780031A(A), 780031AY(A)	8 KB	512 bytes	• 64-pin plastic SDIP (19.05 mm (750)) • 64-pin plastic QFP (14 × 14)
μ PD780032A(A), 780032AY(A)	16 KB		
μ PD780033A(A), 780033AY(A)	24 KB	1024 bytes	• 64-pin plastic TQFP (12 × 12)
μ PD780034A(A), 780034AY(A)	32 KB		

- External memory expansion space: 64 KB
- Minimum instruction execution time: 0.24 μ s (@ $f_x = 8.38$ MHz operation)
- I/O ports: 51 (5 V-tolerant N-ch open-drain: 4)
- 10-bit resolution A/D converter: 8 channels ($AV_{DD} = 1.8$ to 5.5 V)
- Serial interfaces: 3 channels
 - μ PD780031A(A), 780032A(A), 780033A(A), 780034A(A): UART mode, 3-wire serial I/O mode (2 channels)
 - μ PD780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A): UART mode, 3-wire serial I/O mode, I²C bus mode
- Timer: 5 channels
- Power supply voltage: $V_{DD} = 1.8$ to 5.5 V

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
 Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

APPLICATIONS

Telephones, household electrical appliances, pagers, AV equipment, car audios, office automation equipment, etc.

ORDERING INFORMATION

Part Number	Package
μPD780031ACW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780031AGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780031AGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)
μPD780032ACW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780032AGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780032AGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)
μPD780033ACW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780033AGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780033AGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)
μPD780034ACW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780034AGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780034AGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)
μPD780031AYCW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780031AYGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780031AYGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)
μPD780032AYCW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780032AYGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780032AYGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)
μPD780033AYCW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780033AYGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780033AYGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)
μPD780034AYCW(A)-xxx	64-pin plastic SDIP (19.05 mm (750))
μPD780034AYGC(A)-xxx-AB8	64-pin plastic QFP (14 × 14)
μPD780034AYGK(A)-xxx-9ET	64-pin plastic TQFP (12 × 12)

Remark xxx indicates ROM code suffix.

QUALITY GRADE

Special

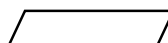
Please refer to "Quality Grades on NEC Semiconductor Devices" (Document No. C11531E) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

DIFFERENCES BETWEEN μPD780031A(A), 780032A(A), 780033A(A), 780034A(A), 780031AY(A), 780032AY(A), 780033AY(A) AND 780034AY(A), AND μPD780031A, 780032A, 780033A, 780034A, 780031AY, 780032AY, 780033AY AND 780034AY

Product name Item	μPD780031A(A), 780032A(A), 780033A(A), 780034A(A), 780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A)	μPD780031A, 780032A, 780033A, 780034A, 780031AY, 780032AY, 780033AY, 780034AY
Quality grade	Special	Standard

78K/0 SERIES LINEUP

The products in the 78K/0 Series are listed below. The names enclosed in boxes are subseries names.

 Products in mass production

 Products under development

Y subseries products are compatible with I²C bus.

78K/0 Series	Control		
	100-pin		EMI-noise reduced version of the μPD78078
	100-pin		μPD78054 with added timer and enhanced external interface
	100-pin		ROM-less version of the μPD78078
	100-pin		μPD78078Y with enhanced serial I/O and limited function
	100-pin		μPD78078Y with enhanced serial I/O and limited function
	80-pin		μPD78054 with enhanced serial I/O
	80-pin		μPD78054 with enhanced serial I/O
	80-pin		EMI-noise reduced version of the μPD78054
	80-pin		EMI-noise reduced version of the μPD78054
	80-pin		μPD78018F with added UART and D/A converter and enhanced I/O
	80-pin		μPD78018F with added UART and D/A converter and enhanced I/O
	80-pin		RAM capacity of the μPD780024A increased
	64-pin		μPD780034A with added timer and enhanced serial I/O
	64-pin		μPD780034A with added timer and enhanced serial I/O
	64-pin		μPD780024A with enhanced A/D converter
	64-pin		μPD780024A with enhanced A/D converter
	64-pin		μPD78018F with enhanced serial I/O
	64-pin		μPD78018F with enhanced serial I/O
	64-pin		EMI-noise reduced version of the μPD78018F
	64-pin		Basic subseries for control
64-pin		Basic subseries for control	
42-/44-pin		On-chip UART, capable of operating at low voltage (1.8 V)	
64-pin	Inverter control		
		On-chip inverter controller and UART. EMI-noise reduced.	
	VFD drive		
100-pin		μPD78044F with enhanced I/O and VFD C/D. Display output total: 53	
80-pin		For panel control. On-chip VFD and C/D. Display output total: 53	
80-pin		μPD78044F with added N-ch open-drain I/O. Display output total: 34	
80-pin		Basic subseries for VFD drive. Display output total: 34	
	LCD drive		
120-pin		μPD780308 with enhanced display function and timer. Segment signal output: 40 pins max.	
120-pin		μPD780308 with enhanced display function and timer. Segment signal output: 32 pins max.	
120-pin		μPD780308 with enhanced display function and timer. Segment signal output: 24 pins max.	
100-pin		μPD78064 with enhanced SIO, and increased ROM, RAM capacity	
100-pin		EMI-noise reduced version of the μPD78064	
100-pin		Basic subseries for LCD drive, on-chip UART	
		Basic subseries for LCD drive, on-chip UART	
	Bus interface supported		
100-pin		On-chip D-CAN controller	
80-pin		μPD78054 with added IEBus™ controller. EMI-noise reduced.	
80-pin		On-chip D-CAN/IEBus controller	
80-pin		On-chip controller compliant with J1850 (Class 2)	
	Meter control		
100-pin		For industrial meter control	
80-pin		On-chip automobile meter controller/driver	
80-pin		For automobile meter driver. On-chip D-CAN controller	

Remark VFD (Vacuum Fluorescent Display) is referred to as FIP™ (Fluorescent Indicator Panel) in some documents, but the functions of the two are the same.

The major functional differences among the subseries are shown below.

• Non Y subseries

Function Subseries Name		ROM Capacity	Timer				8-Bit A/D	10-Bit A/D	8-Bit D/A	Serial Interface	I/O	V _{DD} MIN. Value	External Expansion					
			8-Bit	16-Bit	Watch	WDT												
Control	μPD78075B	32 K to 40 K	4 ch	1 ch	1 ch	1 ch	8 ch	—	2 ch	3 ch (UART: 1 ch)	88	1.8 V	√					
	μPD78078	48 K to 60 K									61	2.7 V						
	μPD78070A	—																
	μPD780058	24 K to 60 K	2 ch								3 ch (Time-division UART: 1 ch)	68		1.8 V				
	μPD78058F	48 K to 60 K									3 ch (UART: 1ch)	69		2.7 V				
	μPD78054	16 K to 60 K										2.0 V						
	μPD780065	40 K to 48 K									4 ch (UART: 1 ch)	60		2.7 V				
	μPD780078	48 K to 60 K										2 ch		—	8 ch	3 ch (UART: 2 ch)	52	1.8 V
	μPD780034A	8 K to 32 K										1 ch		8 ch	—	3 ch (UART: 1 ch, time-division 3-wire: 1 ch)	51	
	μPD780024A											2 ch				53		
	μPD78014H																	
	μPD78018F										8 K to 60 K							
	μPD78083	8 K to 16 K									—	—				1 ch (UART: 1 ch)	33	—
Inverter control	μPD780988	16 K to 60 K	3 ch	Note	—	1 ch	—	8 ch	—	3 ch (UART: 2 ch)	47	4.0 V	√					
VFD drive	μPD780208	32 K to 60 K	2 ch	1 ch	1 ch	1 ch	8 ch	—	—	2 ch	74	2.7 V	—					
	μPD780232	16 K to 24 K	3 ch	—	—	4 ch	40				4.5 V							
	μPD78044H	32 K to 48 K	2 ch	1 ch	1 ch	8 ch	1 ch				68	2.7 V						
	μPD78044F	16 K to 40 K				2 ch												
LCD drive	μPD780338	48 K to 60 K	3 ch	2 ch	1 ch	1 ch	—	10 ch	1 ch	2 ch (UART: 1 ch)	54	1.8 V	—					
	μPD780328													62				
	μPD780318													70				
	μPD780308	48 K to 60 K	2 ch	1 ch		8 ch	—	—	3 ch (Time-division UART: 1 ch)	57	2.0 V							
	μPD78064B	32 K										2 ch (UART: 1 ch)						
	μPD78064	16 K to 32 K																
Bus interface supported	μPD780948	60 K	2 ch	2 ch	1 ch	1 ch	8 ch	—	—	3 ch (UART: 1 ch)	79	4.0 V	√					
	μPD78098B	40 K to 60 K		1 ch								2 ch	69	2.7 V	—			
Meter control	μPD780958	48 K to 60 K	4 ch	2 ch	—	1 ch	—	—	—	2 ch (UART: 1 ch)	69	2.2 V	—					
Dash board control	μPD780852	32 K to 40 K	3 ch	1 ch	1 ch	1 ch	5 ch	—	—	3 ch (UART: 1 ch)	56	4.0 V	—					
	μPD780824	32 K to 60 K								2 ch (UART: 1 ch)	59							

Note 16-bit timer: 2 channels
10-bit timer: 1 channel

• Y subseries

Function Subseries Name		ROM Capacity	Timer				8-Bit	10-Bit	8-Bit	Serial Interface	I/O	V _{DD} MIN. Value	External Expansion
			8-Bit	16-Bit	Watch	WDT							
Control	μPD78078Y	48 K to 60 K	4 ch	1 ch	1 ch	1 ch	8 ch	–	2 ch	3 ch (UART: 1 ch, I ² C: 1 ch)	88	1.8 V	√
	μPD78070AY	–									61	2.7 V	
	μPD780018AY	48 K to 60 K							–	3 ch (I ² C: 1 ch)	88		
	μPD780058Y	24 K to 60 K	2 ch						2 ch	3 ch (Time division UART: 1 ch, I ² C: 1 ch)	68	1.8 V	
	μPD78058FY	48 K to 60 K								3 ch (UART: 1 ch, I ² C: 1 ch)	69	2.7 V	
	μPD78054Y	16 K to 60 K										2.0 V	
	μPD780078Y	48 K to 60 K		2 ch			–	8 ch	–	4 ch (UART: 2 ch, I ² C: 1 ch)	52	1.8 V	
	μPD780034AY	8 K to 32 K		1 ch						3 ch (UART: 1 ch, I ² C: 1 ch)	51		
	μPD780024AY						8 ch	–					
	μPD78018FY	8 K to 60 K								2 ch (I ² C: 1 ch)	53		
LCD drive	μPD780308Y	48 K to 60 K	2 ch	1 ch	1 ch	1 ch	8 ch	–	–	3 ch (Time division UART: 1 ch, I ² C: 1 ch)	57	2.0 V	–
	μPD78064Y	16 K to 32 K								2 ch (UART: 1 ch, I ² C: 1 ch)			
For bus interface	μPD780701Y	60 K	3 ch	2 ch	1 ch	1 ch	16 ch	–	–	4 ch (UART: 1 ch, I ² C: 1 ch)	67	3.5 V	–
	μPD780833Y										65	4.5 V	

Remark The functions of non Y subseries and Y subseries products are the same, except for the serial interface.

OVERVIEW OF FUNCTIONS

Part Number		μ PD780031A(A) μ PD780031AY(A)	μ PD780032A(A) μ PD780032AY(A)	μ PD780033A(A) μ PD780033AY(A)	μ PD780034A(A) μ PD780034AY(A)
Internal memory	ROM	8 KB	16 KB	24 KB	32 KB
	High-speed RAM	512 bytes		1024 bytes	
Memory space		64 KB			
General-purpose registers		8 bits $\times$ 32 registers (8 bits $\times$ 8 registers $\times$ 4 banks)			
Minimum instruction execution time		On-chip minimum instruction execution time cycle variable function			
	When main system clock selected	0.24 μ s/0.48 μ s/0.95 μ s/1.91 μ s/3.81 μ s (@ 8.38 MHz operation)			
	When subsystem clock selected	122 μ s (@ 32.768 kHz operation)			
Instruction set		• 16-bit operation • Multiply/divide (8 bits $\times$ 8 bits, 16 bits $\div$ 8 bits) • Bit manipulation (set, reset, test, Boolean operation) • BCD adjust, etc.			
I/O ports		Total: 51 • CMOS input: 8 • CMOS I/O: 39 • 5 V-tolerant N-ch open-drain I/O : 4			
A/D converter		• 10-bit resolution $\times$ 8 channels • Low-voltage operation available: AV_{DD} = 1.8 to 5.5 V			
Serial interfaces		• μPD780031A(A), 780032A(A), 780033A(A), 780034A(A) UART mode: 1 channel 3-wire serial I/O mode: 2 channels • μPD780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A) UART mode: 1 channel 3-wire serial I/O mode: 1 channel I²C bus mode (multimaster supporting): 1 channel			
Timers		• 16-bit timer/event counter: 1 channel • 8-bit timer/event counter: 2 channels • Watch timer: 1 channel • Watchdog timer: 1 channel			
Timer outputs		3 (8-bit PWM output capable: 2)			
Clock output		• 65.5 kHz, 131 kHz, 262 kHz, 524 kHz, 1.05 MHz, 2.10 MHz, 4.19 MHz, 8.38 MHz (@ 8.38 MHz operation with main system clock) • 32.768 kHz (@ 32.768 kHz operation with subsystem clock)			
Buzzer output		1.02 kHz, 2.05 kHz, 4.10 kHz, 8.19 kHz (@ 8.38 MHz operation with main system clock)			
Vectored interrupt sources	Maskable	Internal: 13, external: 5			
	Non-maskable	Internal: 1			
	Software	1			
Power supply voltage		V _{DD} = 1.8 to 5.5 V			
Operating ambient temperature		T _A = -40 to +85°C			
Package		• 64-pin plastic SDIP (19.05 mm (750)) • 64-pin plastic QFP (14 $\times$ 14) • 64-pin plastic TQFP (12 $\times$ 12)			

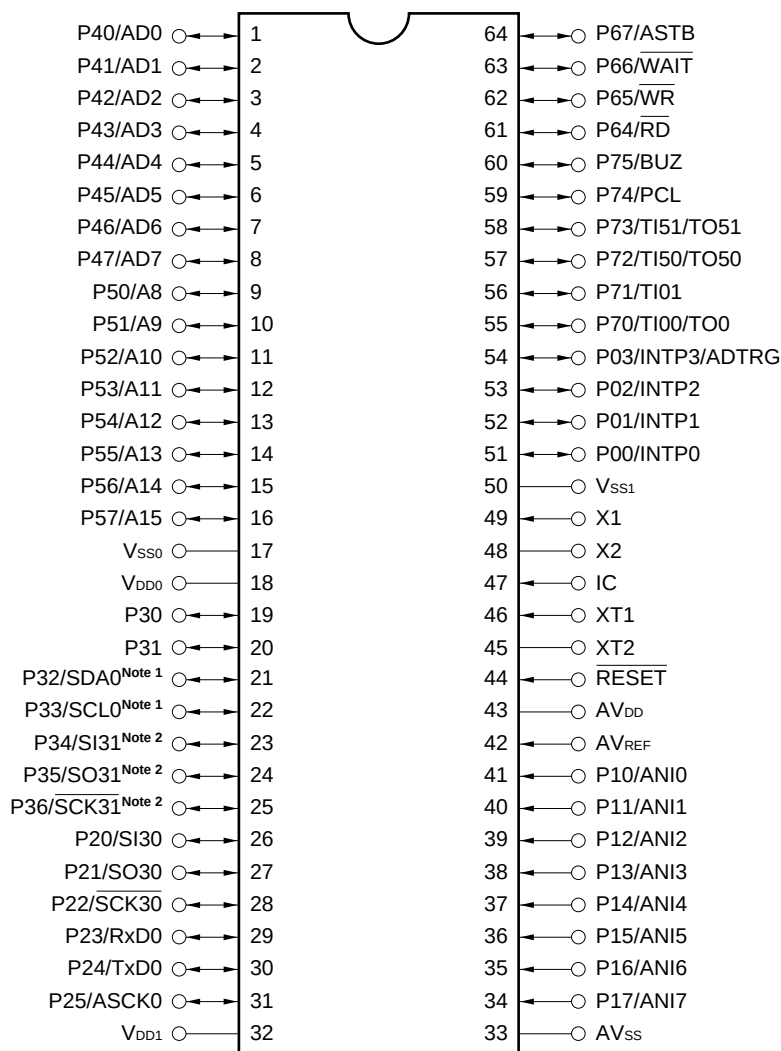
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1. PIN CONFIGURATION (TOP VIEW)

• 64-pin plastic SDIP (19.05 mm (750))

μ PD780031ACW(A)-xxx, 780032ACW(A)-xxx, 780033ACW(A)-xxx, 780034ACW(A)-xxx,
 μ PD780031AYCW(A)-xxx, 780032AYCW(A)-xxx, 780033AYCW(A)-xxx, 780034AYCW(A)-xxx



- Notes**
1. SDA0 and SCL0 are incorporated only in the μ PD780034AY Subseries.
 2. SI31, SO31, and SCK31 are incorporated only in the μ PD780034A Subseries.

- Cautions**
1. Connect the IC (Internally Connected) pin directly to V_{SS0} or V_{SS1}.
 2. Connect the AV_{SS} pin to V_{SS0}.

Remark When the μ PD780031A(A), 780032A(A), 780033A(A), 780034A(A), 780031AY(A), 780032AY(A), 780033AY(A), and 780034AY(A) are used in applications where the noise generated inside the microcontroller needs to be reduced, the implementation of noise reduction measures, such as supplying voltage to V_{DD0} and V_{DD1} individually and connecting V_{SS0} and V_{SS1} to different ground lines, is recommended.

• 64-pin plastic QFP (14 × 14)

μPD780031AGC(A)-xxx-AB8, 780032AGC(A)-xxx-AB8, 780033AGC(A)-xxx-AB8, 780034AGC(A)-xxx-AB8,

μPD780031AYGC(A)-xxx-AB8, 780032AYGC(A)-xxx-AB8, 780033AYGC(A)-xxx-AB8,

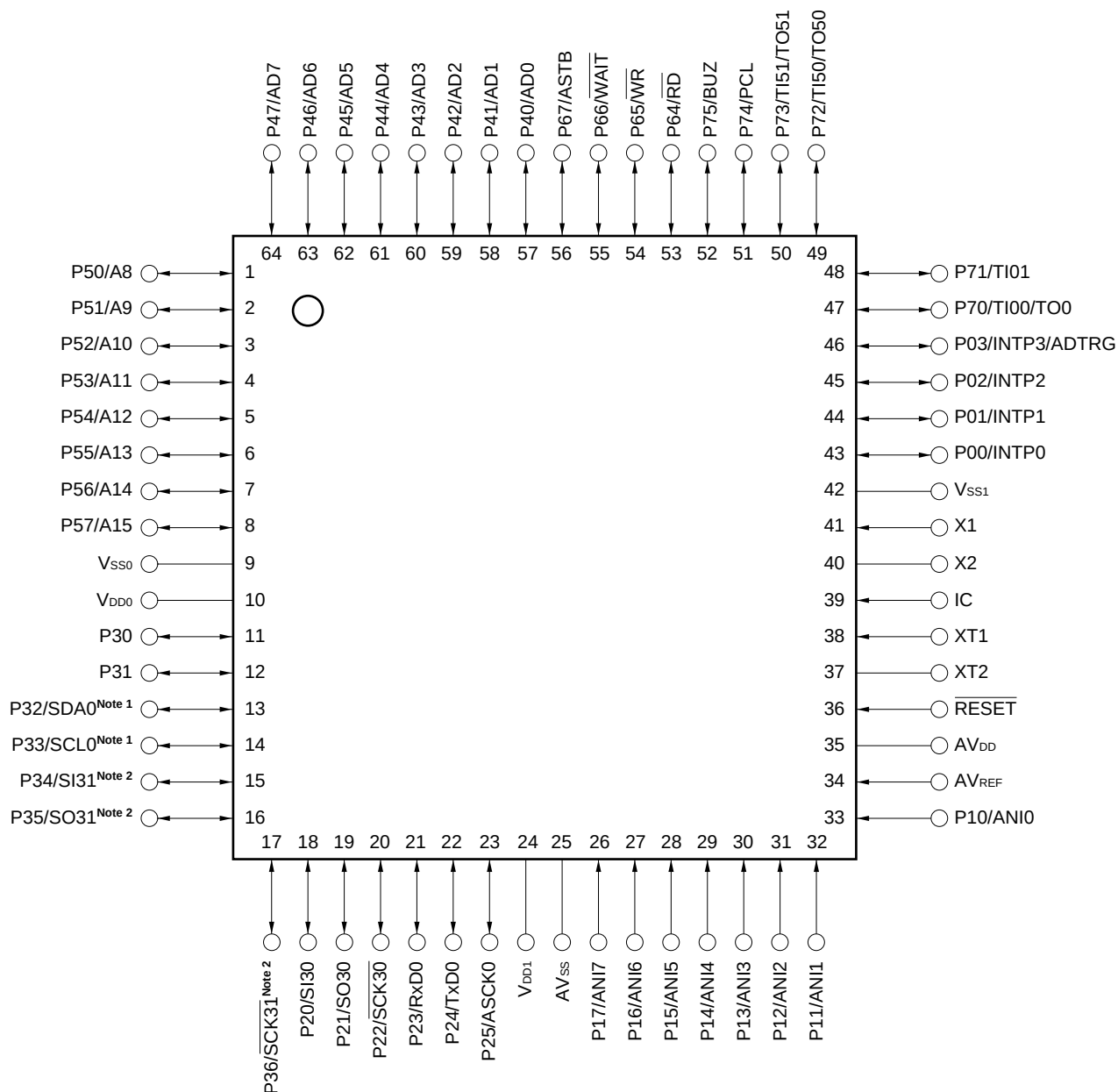
μPD780034AYGC(A)-xxx-AB8

• 64-pin plastic TQFP (12 × 12)

μPD780031AGK(A)-xxx-9ET, 780032AGK(A)-xxx-9ET, 780033AGK(A)-xxx-9ET, 780034AGK(A)-xxx-9ET,

μPD780031AYGK(A)-xxx-9ET, 780032AYGK(A)-xxx-9ET, 780033AYGK(A)-xxx-9ET,

μPD780034AYGK(A)-xxx-9ET



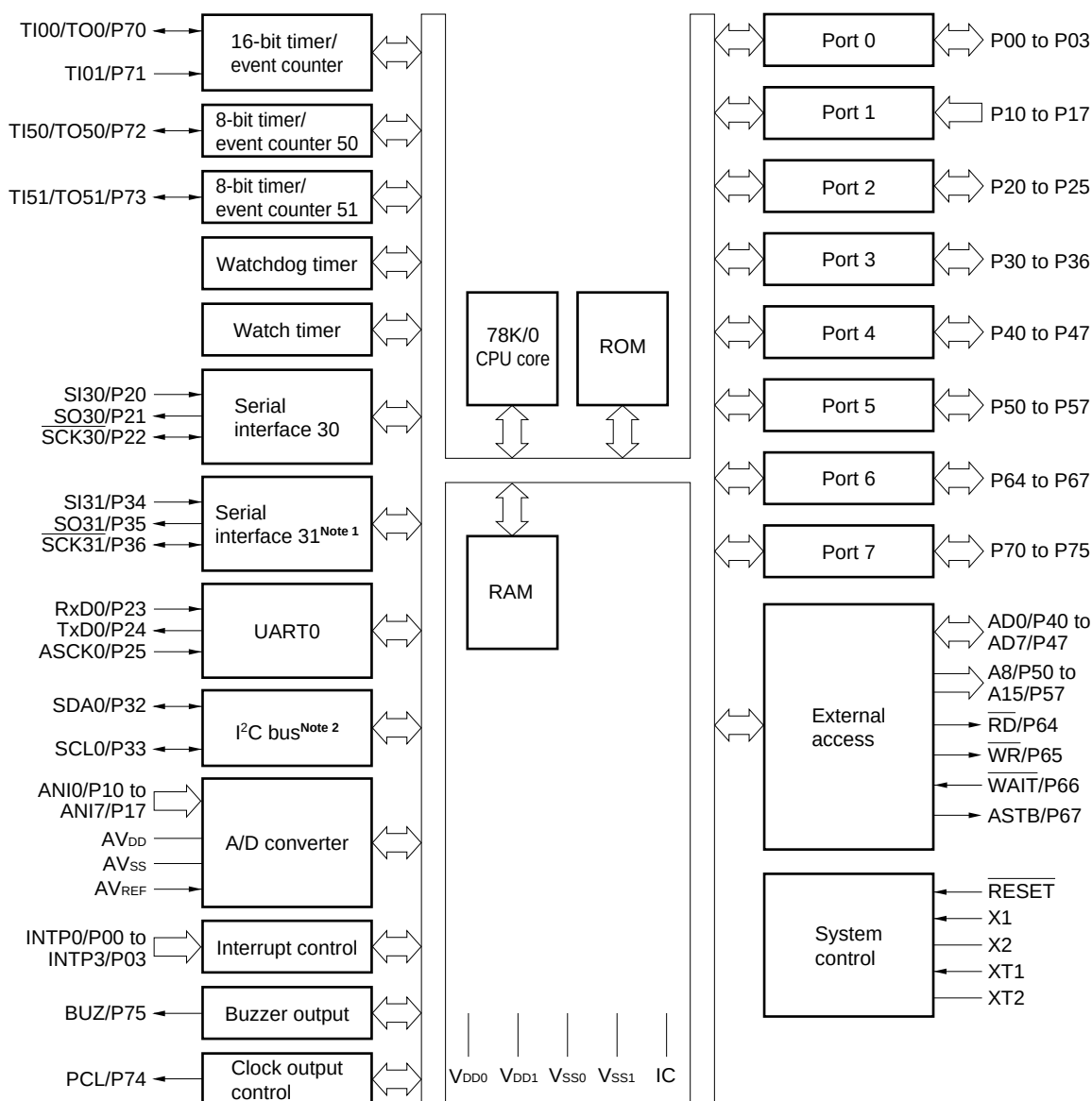
- Notes**
1. SDA0 and SCL0 are incorporated only in the μPD780034AY Subseries.
 2. SI31, SO31, and SCK31 are incorporated only in the μPD780034A Subseries.

- Cautions**
1. Connect the IC (Internally Connected) pin directly to V_{SS0} or V_{SS1}.
 2. Connect the AV_{SS} pin to V_{SS0}.

Remark When the μPD780031A(A), 780032A(A), 780033A(A), 780034A(A), 780031AY(A), 780032AY(A), 780033AY(A), and 780034AY(A) are used in applications where the noise generated inside the microcontroller needs to be reduced, the implementation of noise reduction measures, such as supplying voltage to V_{DD0} and V_{DD1} individually and connecting V_{SS0} and V_{SS1} to different ground lines, is recommended.

A8 to A15:	Address Bus	P70 to P75:	Port 7
AD0 to AD7:	Address/Data Bus	PCL:	Programmable Clock
ADTRG:	AD Trigger Input	RD:	Read Strobe
ANI0 to ANI7:	Analog Input	RESET:	Reset
ASCK0:	Asynchronous Serial Clock	RxD0:	Receive Data
ASTB:	Address Strobe	SCK30, SCK31, SCL0:	Serial Clock
AV _{DD} :	Analog Power Supply	SDA0:	Serial Data
AV _{REF} :	Analog Reference Voltage	SI30, SI31:	Serial Input
AV _{SS} :	Analog Ground	SO30, SO31:	Serial Output
BUZ:	Buzzer Clock	TI00, TI01, TI50, TI51:	Timer Input
IC:	Internally Connected	TO0, TO50, TO51:	Timer Output
INTP0 to INTP3:	External Interrupt Input	TxD0:	Transmit Data
P00 to P03:	Port 0	V _{DD0} , V _{DD1} :	Power Supply
P10 to P17:	Port 1	V _{SS0} , V _{SS1} :	Ground
P20 to P25:	Port 2	WAIT:	Wait
P30 to P36:	Port 3	WR:	Write Strobe
P40 to P47:	Port 4	X1, X2:	Crystal (Main System Clock)
P50 to P57:	Port 5	XT1, XT2:	Crystal (Subsystem Clock)
P64 to P67:	Port 6		

2. BLOCK DIAGRAM



- Notes**
1. Incorporated only in the μPD780034A Subseries.
 2. Incorporated only in the μPD780034AY Subseries.

Remark The internal ROM and RAM capacities vary depending on the product.

3. PIN FUNCTIONS

3.1 Port Pins (1/2)

Pin Name	I/O	Function		After Reset	Alternate Function
P00	I/O	Port 0 4-bit I/O port Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.		Input	INTP0
P01					INTP1
P02					INTP2
P03					INTP3/ADTRG
P10 to P17	Input	Port 1 8-bit input-only port		Input	ANI0 to ANI7
P20	I/O	Port 2 6-bit I/O port Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.		Input	SI30
P21					SO30
P22					SCK30
P23					RxD0
P24					TxD0
P25					ASCK0
P30	I/O	Port 3 7-bit I/O port Input/output can be specified in 1-bit units.	N-ch open-drain I/O port An on-chip pull-up resistor can be specified by the mask option. LEDs can be driven directly.	Input	—
P31					
P32					
P33					SDA0 ^{Note 1}
P34		An on-chip pull-up resistor can be specified by means of software.			SI31 ^{Note 2}
P35					SO31 ^{Note 2}
P36					SCK31 ^{Note 2}
P40 to P47	I/O	Port 4 8-bit I/O port Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software. The interrupt request flag (KRIF) is set to 1 by falling edge detection.		Input	AD0 to AD7
P50 to P57	I/O	Port 5 8-bit I/O port LEDs can be driven directly. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.		Input	A8 to A15
P64	I/O	Port 6 4-bit I/O port Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.		Input	$\overline{\text{RD}}$
P65					$\overline{\text{WR}}$
P66					$\overline{\text{WAIT}}$
P67					ASTB

Notes 1. SDA0 and SCL0 are incorporated only in the μPD780034AY Subseries.

2. SI31, SO31, and SCK31 are incorporated only in the μPD780034A Subseries.

3.1 Port Pins (2/2)

Pin Name	I/O	Function	After Reset	Alternate Function
P70	I/O	Port 7 6-bit I/O port Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.	Input	TI00/TO0
P71				TI01
P72				TI50/TO50
P73				TI51/TO51
P74				PCL
P75				BUZ

3.2 Non-Port Pins (1/2)

Pin Name	I/O	Function	After Reset	Alternate Function
INTP0	Input	External interrupt request input for which the valid edge (rising edge, falling edge, or both rising and falling edges) can be specified	Input	P00
INTP1				P01
INTP2				P02
INTP3				P03/ADTRG
SI30	Input	Serial interface serial data input	Input	P20
SI31 ^{Note 1}				P34
SO30	Output	Serial interface serial data output	Input	P21
SO31 ^{Note 1}			Input	P35
SDA0 ^{Note 2}	I/O	Serial interface serial data input/output		P32
SCK30	I/O	Serial interface serial clock input/output	Input	P22
SCK31 ^{Note 1}				P36
SCL0 ^{Note 2}				P33
RxD0	Input	Serial data input for asynchronous serial interface	Input	P23
TxD0	Output	Serial data output for asynchronous serial interface	Input	P24
ASCK0	Input	Serial clock input for asynchronous serial interface		P25

Notes 1. SI31, SO31, and SCK31 are incorporated only in the μPD780034A Subseries.

2. SDA0 and SCL0 are incorporated only in the μPD780034AY Subseries.

3.2 Non-Port Pins (2/2)

Pin Name	I/O	Function	After Reset	Alternate Function
TI00	Input	External count clock input to 16-bit timer/event counter 0 Capture trigger input to capture register 01 (CR01) of 16-bit timer/event counter 0	Input	P70/TO0
TI01		Capture trigger input to capture register 00 (CR00) of 16-bit timer/event counter 0		P71
TI50		External count clock input to 8-bit timer/event counter 50		P72/TO50
TI51		External count clock input to 8-bit timer/event counter 51		P73/TO51
TO0	Output	16-bit timer/event counter 0 output	Input	P70/TI00
TO50		8-bit timer/event counter 50 output (also used for 8-bit PWM output)		P72/TI50
TO51		8-bit timer/event counter 51 output (also used for 8-bit PWM output)		P73/TI51
PCL	Output	Clock output (for trimming of main system clock and subsystem clock)	Input	P74
BUZ	Output	Buzzer output	Input	P75
AD0 to AD7	I/O	Lower address/data bus for expanding memory externally	Input	P40 to P47
A8 to A15	Output	Higher address bus for expanding memory externally	Input	P50 to P57
$\overline{\text{RD}}$	Output	Strobe signal output for reading from external memory	Input	P64
$\overline{\text{WR}}$		Strobe signal output for writing to external memory		P65
$\overline{\text{WAIT}}$	Input	Wait insertion at external memory access	Input	P66
ASTB	Output	Strobe output that externally latches address information output to ports 4 and 5 to access external memory	Input	P67
ANI0 to ANI7	Input	A/D converter analog input	Input	P10 to P17
ADTRG	Input	A/D converter trigger signal input	Input	P03/INTP3
AV _{REF}	Input	A/D converter reference voltage input	—	—
AV _{DD}	—	A/D converter analog power supply. Set potential to that of V _{DD0} or V _{DD1}	—	—
AV _{SS}	—	A/D converter ground potential. Set potential to that of V _{SS0} or V _{SS1}	—	—
$\overline{\text{RESET}}$	Input	System reset input	—	—
X1	Input	Connecting crystal resonator for main system clock oscillation	—	—
X2	—		—	—
XT1	Input	Connecting crystal resonator for subsystem clock oscillation	—	—
XT2	—		—	—
V _{DD0}	—	Positive power supply for ports	—	—
V _{SS0}	—	Ground potential of ports	—	—
V _{DD1}	—	Positive power supply (except ports)	—	—
V _{SS1}	—	Ground potential (except ports)	—	—
IC	—	Internally connected. Connect directly to V _{SS0} or V _{SS1} .	—	—

3.3 Pin I/O Circuits and Recommended Connection of Unused Pins

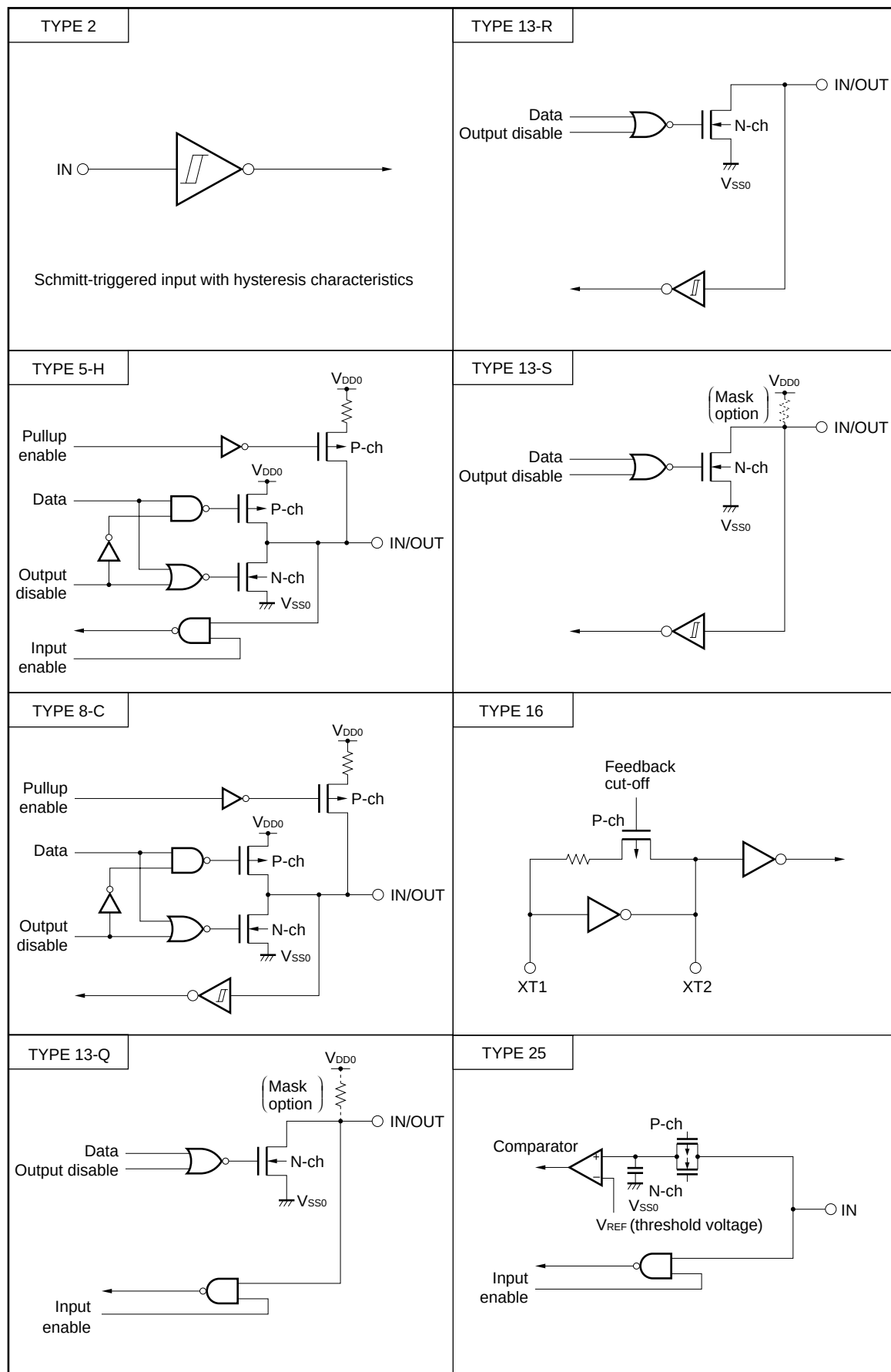
The input/output circuit type of each pin and recommended connection of unused pins are shown in Table 3-1.
For the input/output circuit configuration of each type, see Figure 3-1.

Table 3-1. Types of Pin I/O Circuits

Pin Name	Input/Output Circuit Type	I/O	Recommended Connection of Unused Pins
P00/INTP0	8-C	Input	Input: Independently connect to V _{SS0} via a resistor. Output: Leave open.
P01/INTP1			
P02/INTP2			
P03/INTP3/ADTRG			
P10/ANI0 to P17/ANI7	25	Input	Connect to V _{DD0} or V _{SS0} .
P20/SI30	8-C	I/O	Input: Independently connect to V _{DD0} or V _{SS0} via a resistor. Output: Leave open.
P21/SO30	5-H		
P22/SCK30	8-C		
P23/RxD0			
P24/TxD0	5-H		
P25/ASCK0	8-C		
P30, P31	13-Q	I/O	Input: Independently connect to V _{DD0} via a resistor. Output: Leave open.
P32, P33 (μPD780034A Subseries only)	13-S		
P32/SDA0 (μPD780034AY Subseries only)	13-R		
P33/SCL0 (μPD780034AY Subseries only)			
P34/SI31 ^{Note}			8-C
P35/SO31 ^{Note}	5-H		Input: Independently connect to V _{DD0} or V _{SS0} via a resistor. Output: Leave open.
P36/SCK31 ^{Note}	8-C		
P40/AD0 to P47/AD7	5-H	I/O	Input: Independently connect to V _{DD0} via a resistor. Output: Leave open.
P50/A8 to P57/A15		I/O	Input: Independently connect to V _{DD0} or V _{SS0} via a resistor.
P64/RD		I/O	Output: Leave open.
P65/WR			
P66/WAIT			
P67/ASTB			
P70/TI00/TO0	8-C		
P71/TI01			
P72/TI50/TO50			
P73/TI51/TO51			
P74/PCL	5-H		
P75/BUZ			
RESET	2	Input	—
XT1	16		
XT2			—
AV _{DD}	—		Connect to V _{DD0} or V _{DD1} .
AV _{REF}			Connect to V _{SS0} or V _{SS1} .
AV _{SS}			
IC			Connect directly to V _{SS0} or V _{SS1} .

Note SI31, SO31, and SCK31 are incorporated only in the μPD780034A Subseries.

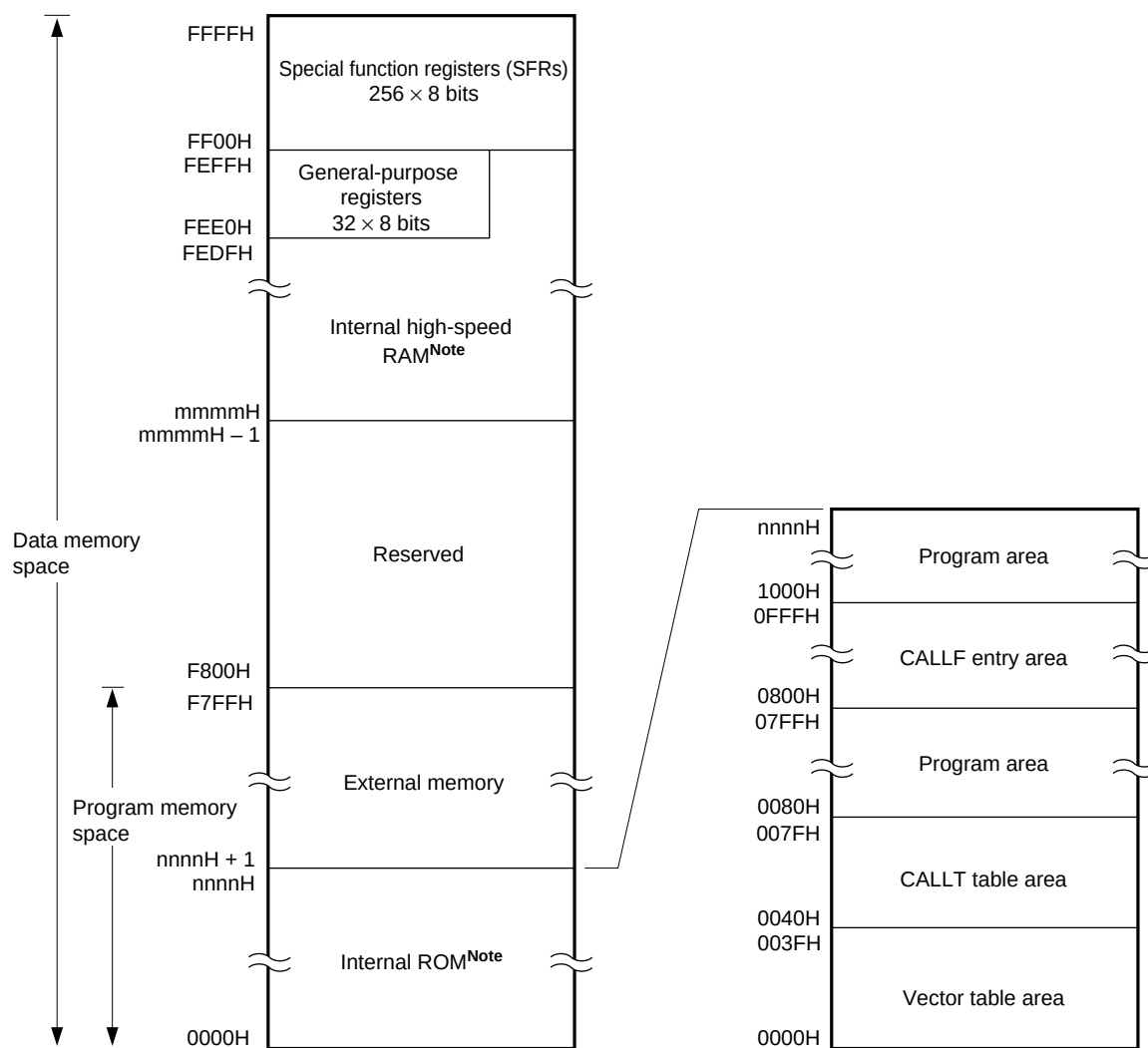
Figure 3-1. Pin I/O Circuits



4. MEMORY SPACE

Figure 4-1 shows the memory map of the μPD780031A(A), 780032A(A), 780033A(A), 780034A(A), 780031AY(A), 780032AY(A), 780033AY(A), and 780034AY(A).

Figure 4-1. Memory Map



Note The internal ROM and internal high-speed RAM capacities vary depending on the product (see the following table).

Part Number	Last Address of Internal ROM nnnnH	Start Address of Internal High-Speed RAM mmmmH
μPD780031A(A), 780031AY(A)	1FFFH	FD00H
μPD780032A(A), 780032AY(A)	3FFFH	
μPD780033A(A), 780033AY(A)	5FFFH	FB00H
μPD780034A(A), 780034AY(A)	7FFFH	

5. PERIPHERAL HARDWARE FUNCTION FEATURES

5.1 Ports

The following 3 types of I/O ports are available.

- CMOS input (Port 1): 8
- CMOS I/O (Ports 0, 2, 4 to 7, P34 to P36): 39
- N-ch open-drain I/O (P30 to P33): 4

Total: 51

Table 5-1. Port Functions

Name	Pin Name	Function
Port 0	P00 to P03	I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.
Port 1	P10 to P17	Input-only port.
Port 2	P20 to P25	I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.
Port 3	P30 to P33	N-ch open-drain I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by mask option. LEDs can be driven directly.
	P34 to P36	I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.
Port 4	P40 to P47	I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software. The interrupt request flag (KRIF) is set to 1 by falling edge detection.
Port 5	P50 to P57	I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software. LEDs can be driven directly.
Port 6	P64 to P67	I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.
Port 7	P70 to P75	I/O port. Input/output can be specified in 1-bit units. An on-chip pull-up resistor can be specified by means of software.

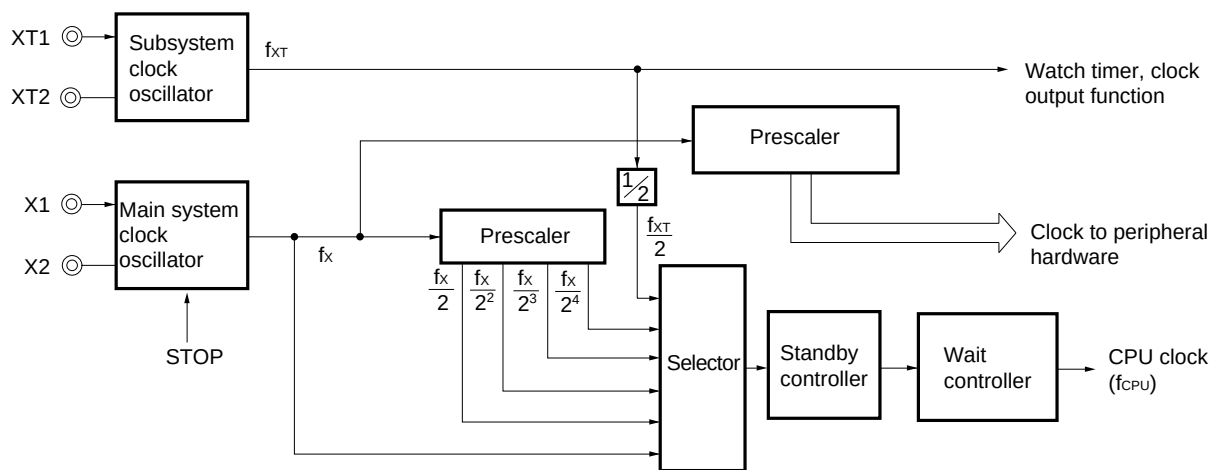
5.2 Clock Generator

A system clock generator is incorporated.

The minimum instruction execution time can be changed.

- 0.24 μs/0.48 μs/0.95 μs/1.91 μs/3.81 μs (@ 8.38 MHz operation with main system clock)
- 122 μs (@ 32.768 kHz operation with subsystem clock)

Figure 5-1. Clock Generator Block Diagram



5.3 Timer/Counter

Five timer/counter channels are incorporated.

- 16-bit timer/event counter: 1 channel
- 8-bit timer/event counter: 2 channels
- Watch timer: 1 channel
- Watchdog timer: 1 channel

Table 5-2. Operations of Timer/Event Counter

	16-Bit Timer/ Event Counter 0	8-Bit Timer/ Event Counters 50, 51	Watch Timer	Watchdog Timer
Operation mode				
Interval timer	1 channel	2 channels	1 channel ^{Note 1}	1 channel ^{Note 2}
External event counter	1 channel	2 channels	—	—
Function				
Timer output	1	2	—	—
PPG output	1	—	—	—
PWM output	—	2	—	—
Pulse width measurement	2 inputs	—	—	—
Square wave output	1	2	—	—
Interrupt source	2	2	2	1

- Notes**
1. The watch timer can perform both watch timer and interval timer functions at the same time.
 2. The watchdog timer has the watchdog timer and interval timer functions. However, use the watchdog timer by selecting either the watchdog timer function or the interval timer function.

Figure 5-2. Block Diagram of 16-Bit Timer/Event Counter 0

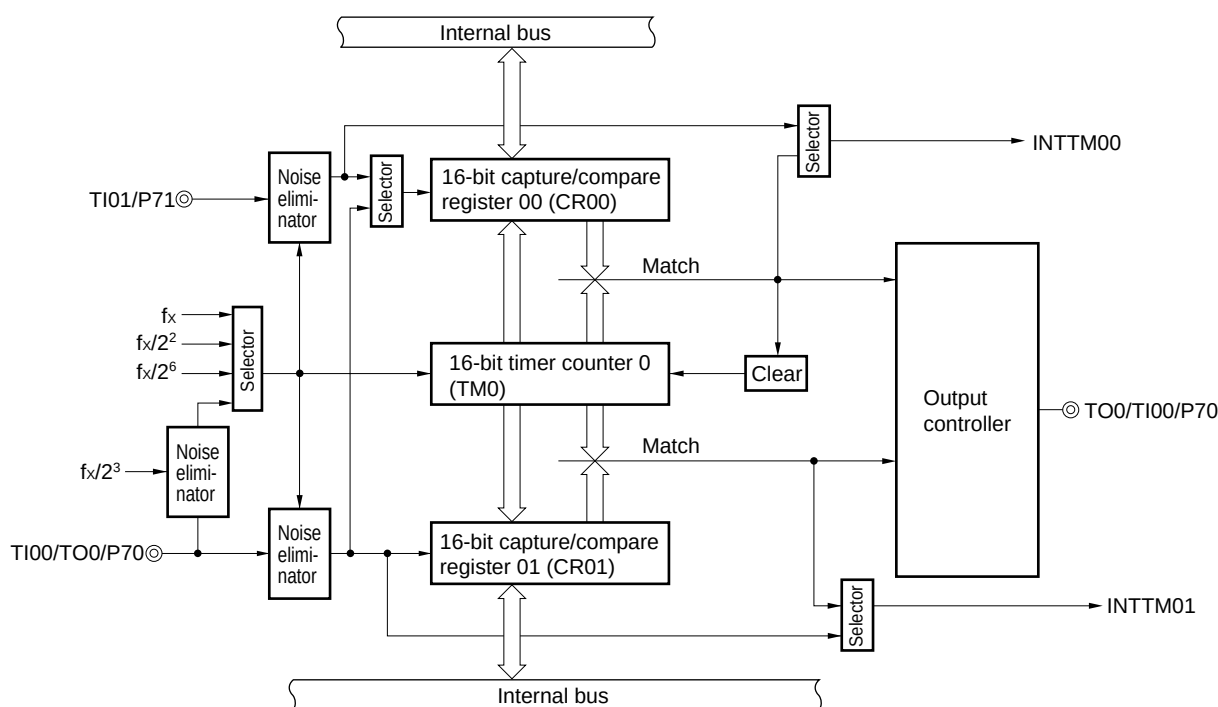


Figure 5-3. Block Diagram of 8-Bit Timer/Event Counter 50

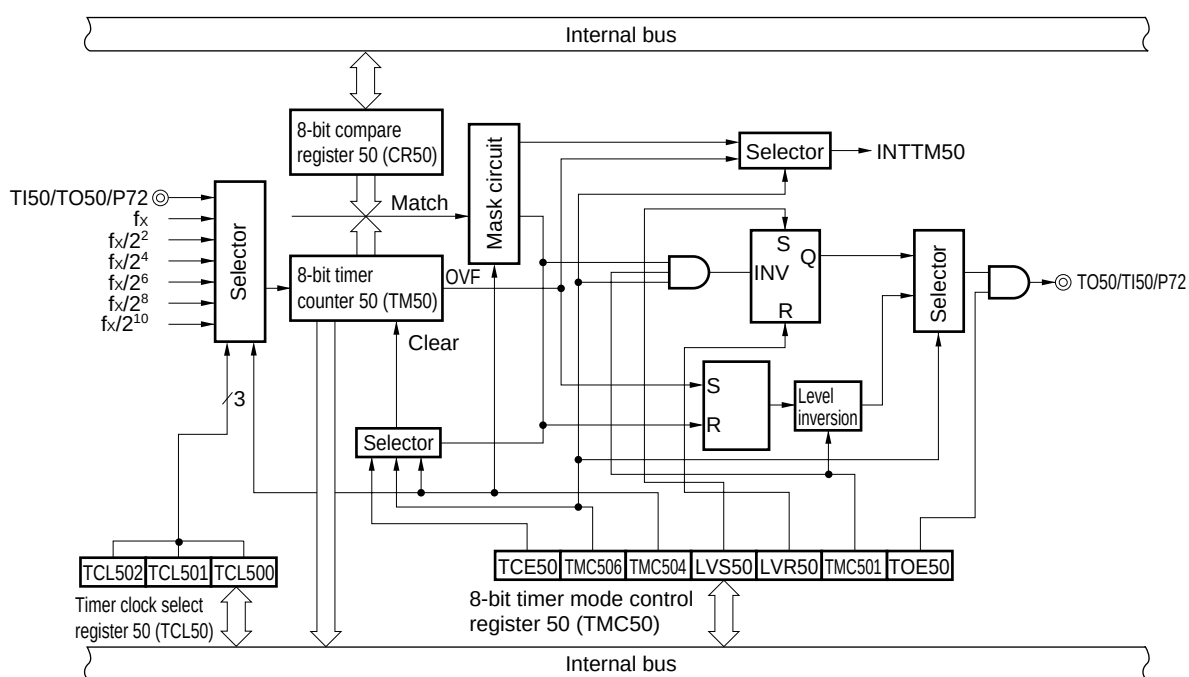


Figure 5-4. Block Diagram of 8-Bit Timer/Event Counter 51

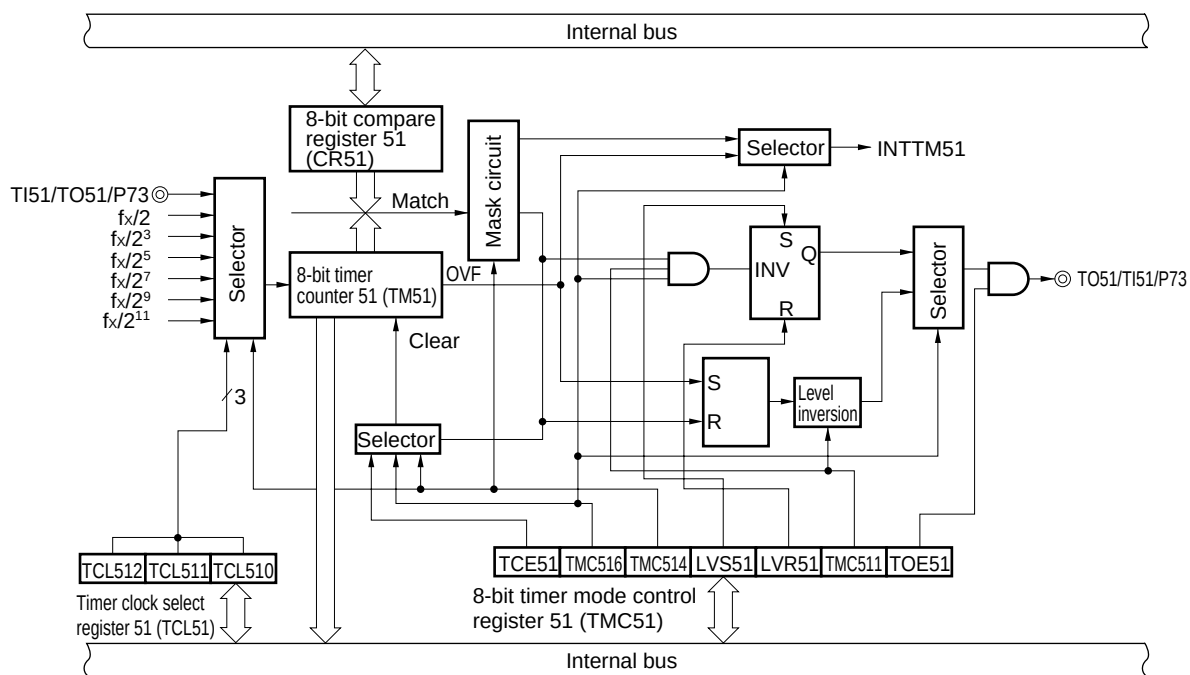


Figure 5-5. Watch Timer Block Diagram

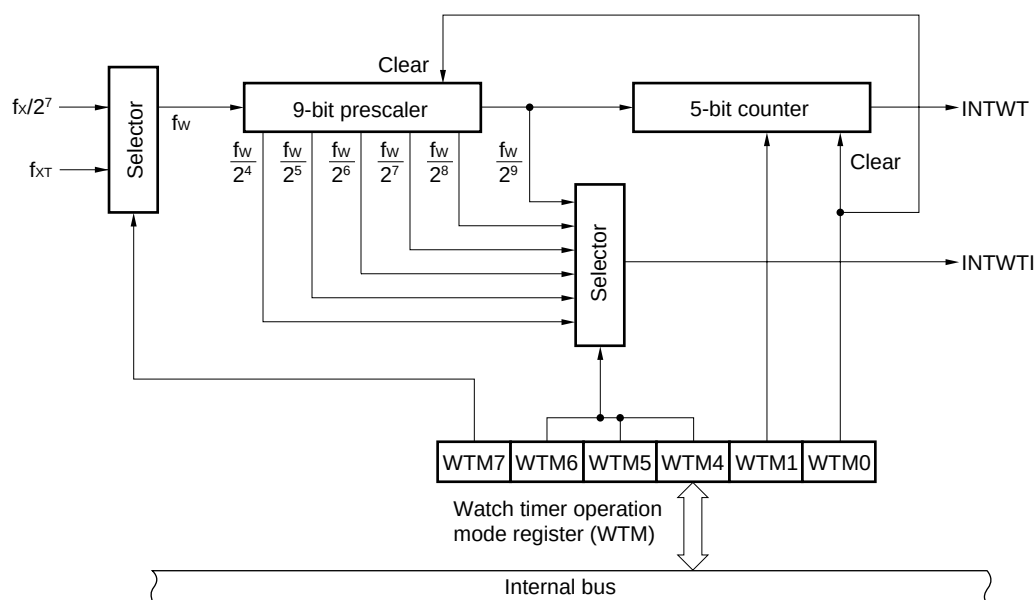
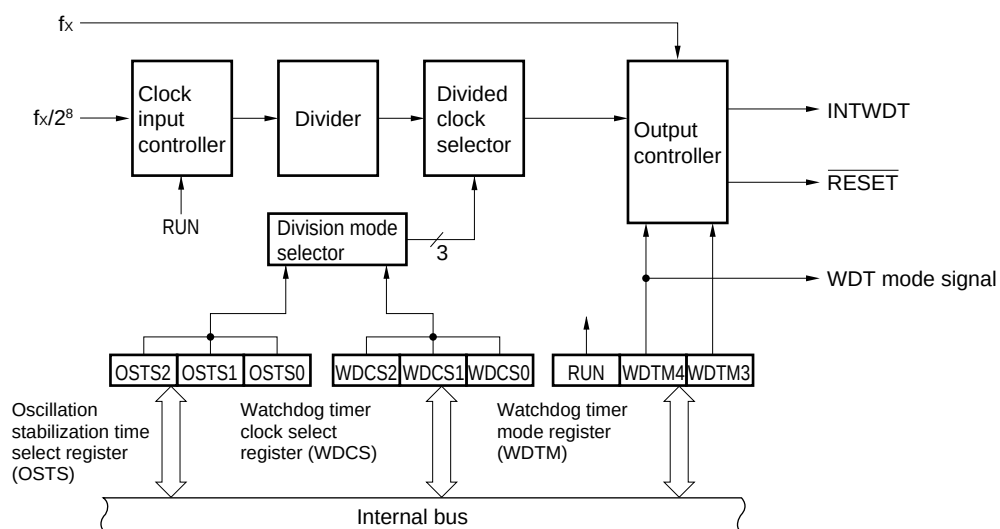


Figure 5-6. Watchdog Timer Block Diagram



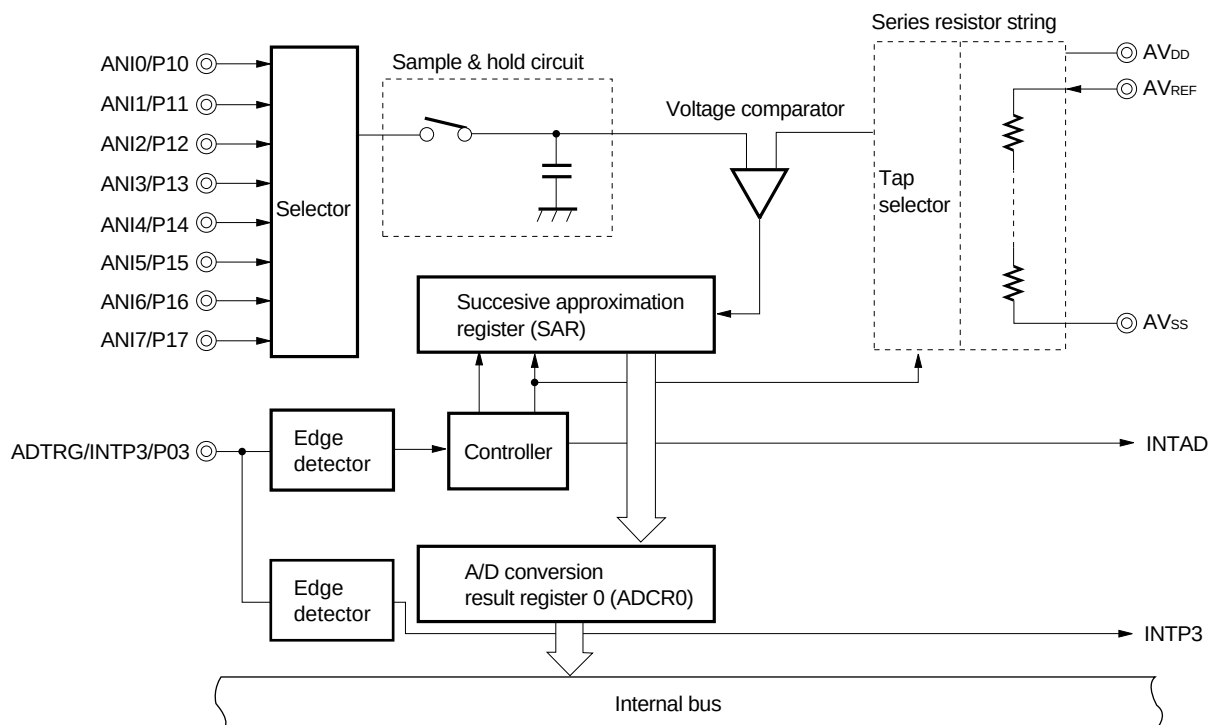
5.5 A/D Converter

An A/D converter consisting of eight 10-bit resolution channels is incorporated.

The following two A/D conversion operation startup methods are available.

- Hardware start
- Software start

Figure 5-8. A/D Converter Block Diagram



5.6 Serial Interface

Three serial interface channels are incorporated.

- μPD780034A Subseries
Serial interface UART0: 1 channel
Serial interface 30, 31: 2 channels
- μPD780034AY Subseries
Serial interface UART0: 1 channel
Serial interface 30: 1 channel
Serial interface IIC0: 1 channel

(1) Serial interface UART0

Serial interface UART0 has two modes: asynchronous serial interface (UART) mode and infrared data transfer mode.

- **Asynchronous serial interface (UART) mode**

This mode enables full-duplex operation wherein one byte of data starting from the start bit is transmitted and received.

The on-chip UART-dedicated baud-rate generator enables communication using a wide range of selectable baud rates. In addition, a baud rate can be also defined by dividing the clock input to the ASCK0 pin.

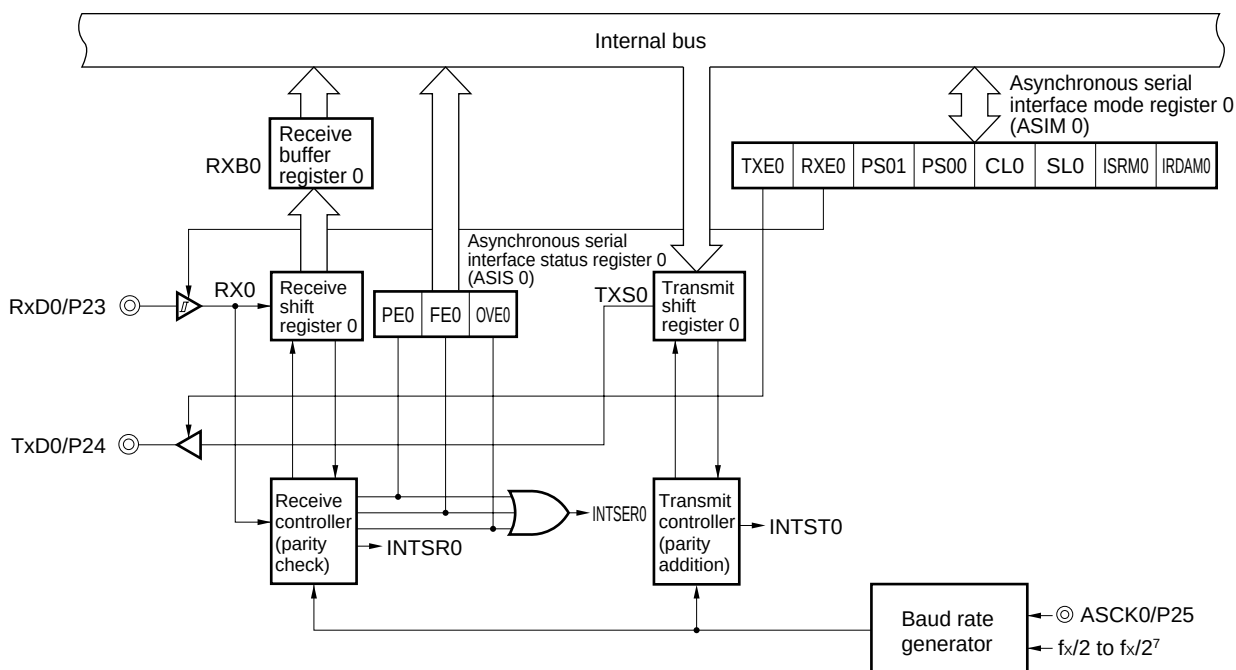
The UART-dedicated baud-rate generator can also be used to generate a MIDI-standard baud rate (31.25 kbps).

- **Infrared data transfer mode**

This mode enables pulse output and pulse reception in data format.

This mode can be used for office equipment applications such as personal computers.

Figure 5-9. Block Diagram of Serial Interface UART0



(2) Serial interface 3n^{Note}

Serial interface 3n has one mode: 3-wire serial I/O mode.

• 3-wire serial I/O mode (fixed as MSB first)

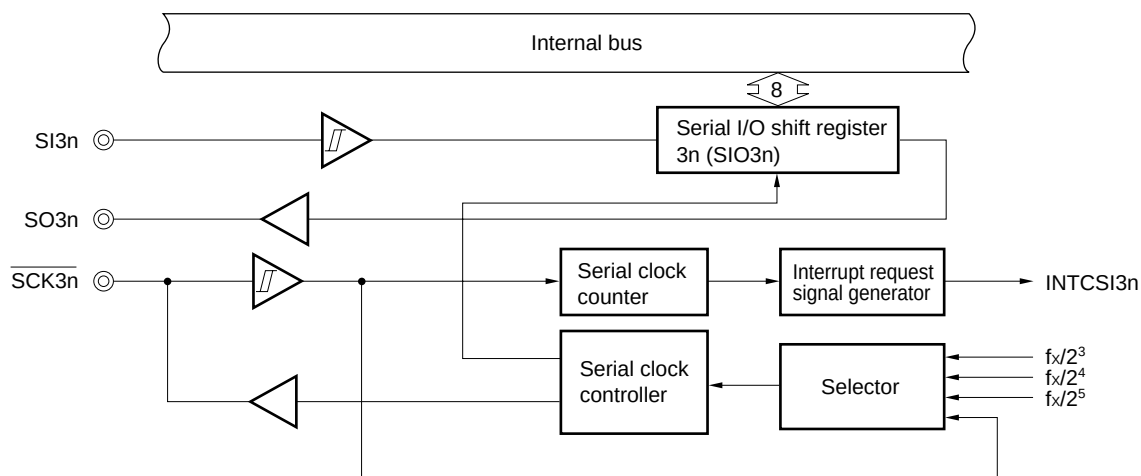
This is an 8-bit data transfer mode using three lines: a serial clock line ($\overline{\text{SCK3n}}$), serial output line (SO3n), and serial input line (SI3n).

Since simultaneous transmit and receive operations are enabled in the 3-wire serial I/O mode, the processing time for data transfer is reduced.

The first bit in 8-bit data in the serial transfer is fixed as MSB.

The 3-wire serial I/O mode is useful for connection to peripheral I/O devices, and display controllers, etc., that include a clocked serial interface.

Figure 5-10. Block Diagram of Serial Interface 3n



Remark μPD780034A Subseries: n = 0, 1

μPD780034AY Subseries: n = 0

(3) Serial interface IIC0 (μPD780034AY Subseries only)

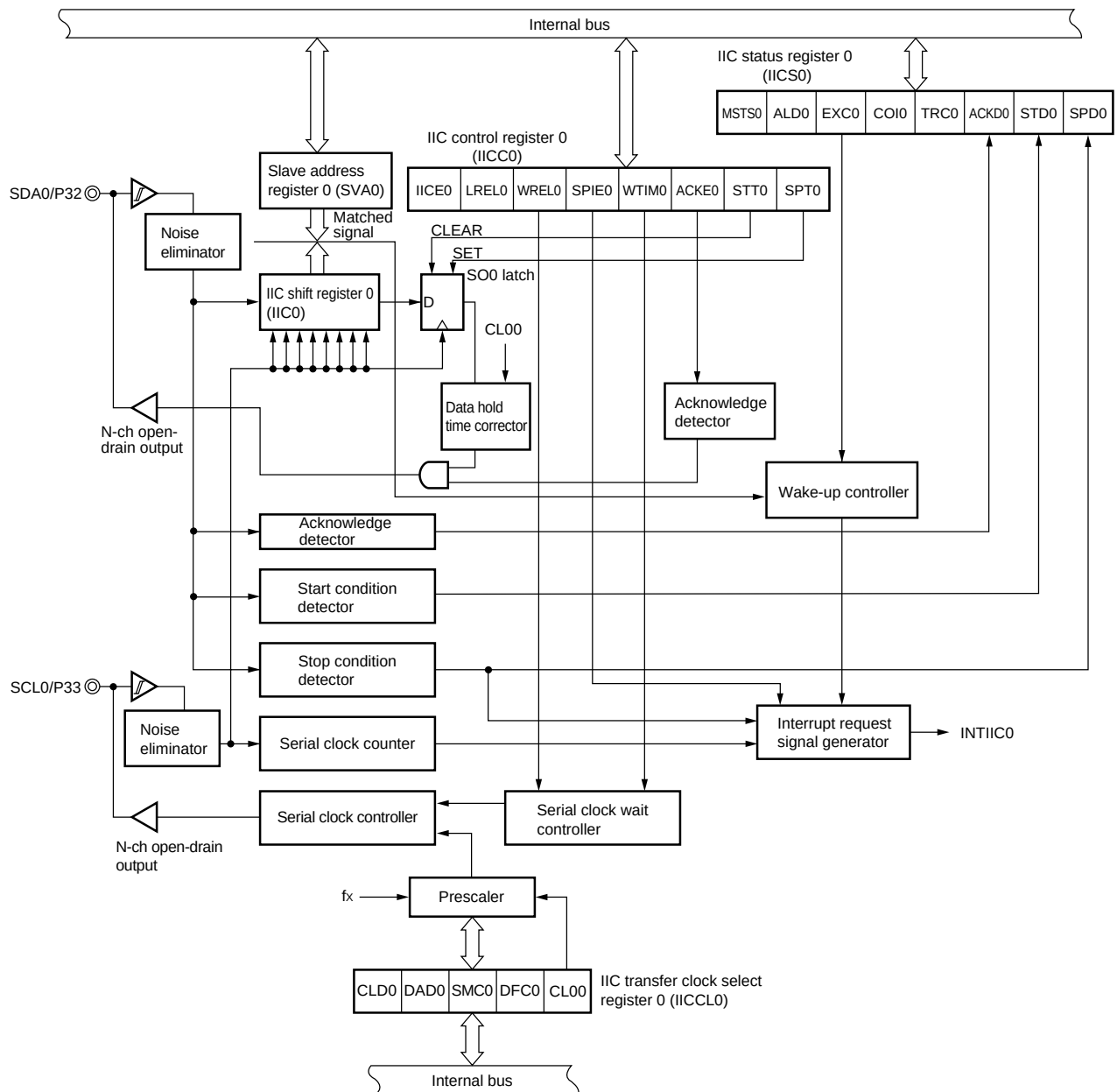
The serial interface IIC0 has the I²C (Inter IC) bus mode (multimaster supported).

- **I²C bus mode (multimaster supported)**

This is an 8-bit data transfer mode using two lines: a serial clock line (SCL0) and serial data bus line (SDA0). This mode complies with the I²C bus format, and can output “start condition”, “data”, and “stop condition” during transmission via the serial data bus. This data is automatically detected by hardware during reception.

Since the SCL0 and SDA0 are open-drain outputs in IIC0, pull-up resistors for the serial clock line and the serial data bus line are required.

Figure 5-11. Block Diagram of Serial Interface IIC0



6. INTERRUPT FUNCTIONS

A total of 20 interrupt sources are provided, divided into the following three types.

- Non-maskable: 1
- Maskable: 18
- Software: 1

Table 6-1. Interrupt Source List

Interrupt Type	Default Priority ^{Note 1}	Interrupt Source		Internal/ External	Vector Table Address	Basic Configuration Type ^{Note 2}
		Name	Trigger			
Non-maskable	—	INTWDT	Watchdog timer overflow (with watchdog timer mode 1 selected)	Internal	0004H	(A)
Maskable	0	INTWDT	Watchdog timer overflow (with interval timer mode selected)			(B)
	1	INTP0	Pin input edge detection	External	0006H	(C)
	2	INTP1			0008H	
	3	INTP2			000AH	
	4	INTP3			000CH	
	5	INTSER0	Serial interface UART0 reception error generation	Internal	000EH	(B)
	6	INTSR0	End of serial interface UART0 reception		0010H	
	7	INTST0	End of serial interface UART0 transmission		0012H	
	8	INTCSI30	End of serial interface SIO3 (SIO30) transfer		0014H	
	9	INTCSI31	End of serial interface SIO3 (SIO31) transfer [Only for μPD780034A Subseries]		0016H	
	10	INTIIC0	End of serial interface IIC0 transfer [Only for μPD780034AY Subseries]		0018H	
	11	INTWTI	Reference time interval signal from watch timer		001AH	
	12	INTTM00	Match between TM0 and CR00 (when CR00 is specified as compare register) Detection of TI01 valid edge (when CR00 is specified as capture register)		001CH	
	13	INTTM01	Match between TM0 and CR01 (when CR01 is specified as compare register) Detection of TI00 valid edge (when CR01 is specified as capture register)		001EH	
	14	INTTM50	Match between TM50 and CR50		0020H	
	15	INTTM51	Match between TM51 and CR51		0022H	
	16	INTAD0	End of A/D conversion		0024H	
	17	INTWT	Watch timer overflow		0026H	
	18	INTKR	Port 4 falling edge detection	External	0028H	(D)
Software	—	BRK	BRK instruction execution	—	003EH	(E)

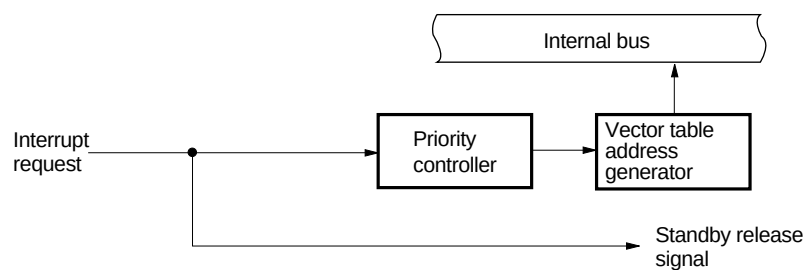
Notes 1. The default priority is the priority order when several maskable interrupt requests are generated at the same time. 0 is the highest, and 18 is the lowest.

2. Basic configuration types (A) to (E) correspond to (A) to (E) in Figure 6-1.

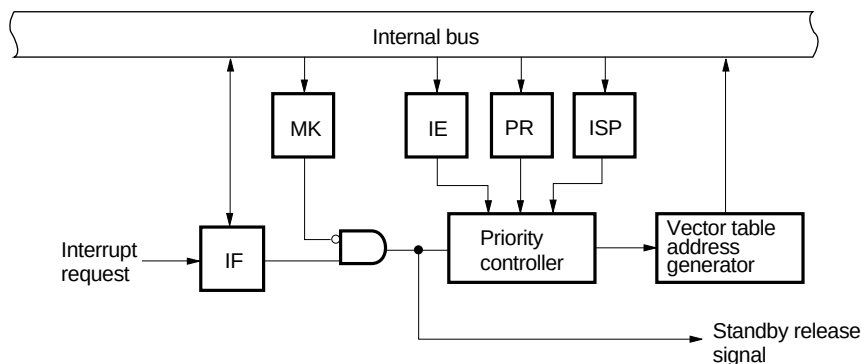
Remark Two watchdog timer interrupt sources (INTWDT): a non-maskable interrupt and a mask interrupt (internal), are available, either of which can be selected.

Figure 6-1. Basic Configuration of Interrupt Function (1/2)

(A) Internal non-maskable interrupt



(B) Internal maskable interrupt



(C) External maskable interrupt (INTP0 to INTP3)

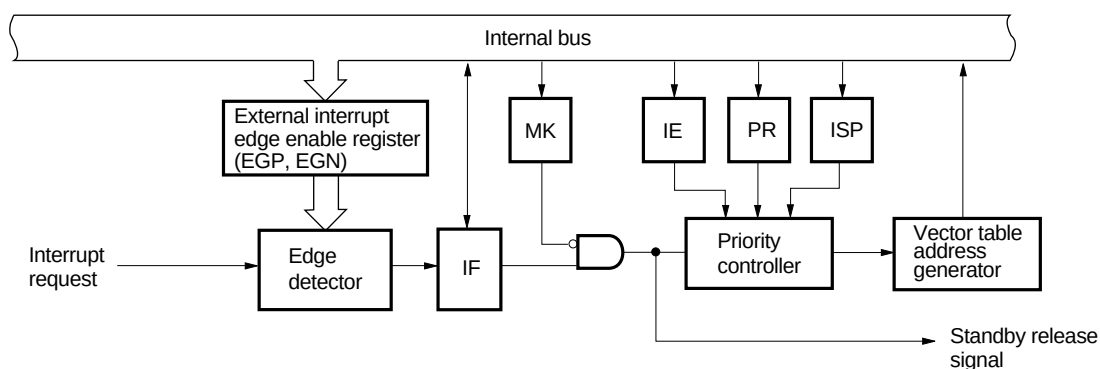
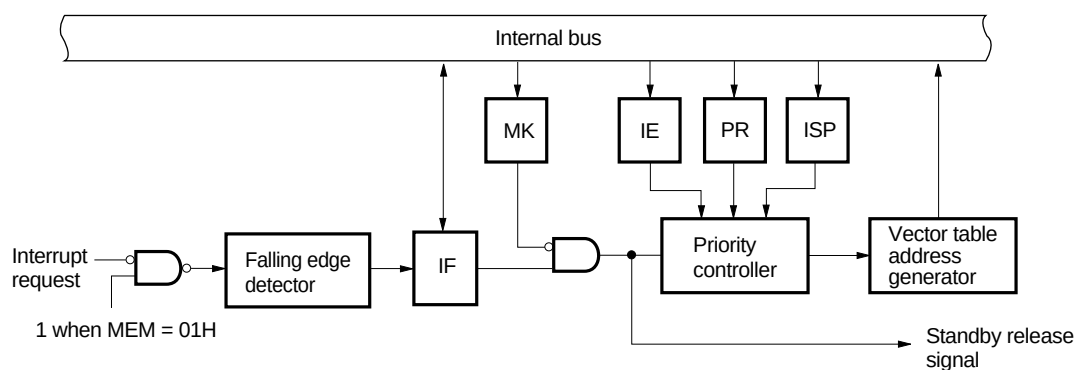
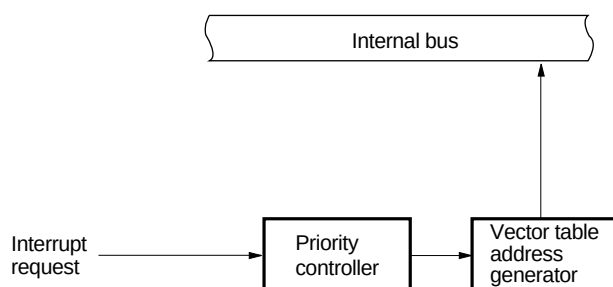


Figure 6-1. Basic Configuration of Interrupt Function (2/2)

(D) External maskable interrupt (INTKR)



(E) Software interrupt



IF: Interrupt request flag
 IE: Interrupt enable flag
 ISP: In-service priority flag
 MK: Interrupt mask flag
 PR: Priority specification flag
 MEM: Memory expansion mode register

7. EXTERNAL DEVICE EXPANSION FUNCTION

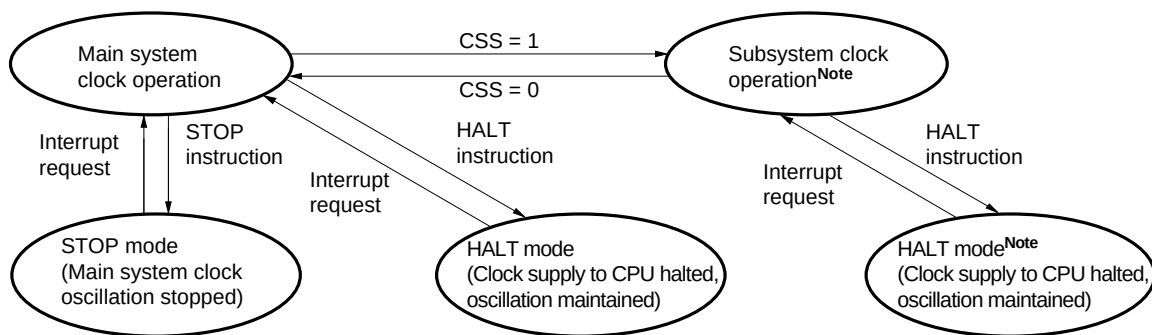
The external device expansion function is for connecting external devices to areas other than the internal ROM, RAM, and SFR. Ports 4 to 6 are used for external device connection.

8. STANDBY FUNCTION

The following two standby modes are available for further reduction of system current consumption.

- **HALT mode:** In this mode, the CPU operation clock is stopped. The average current consumption can be reduced by intermittent operation by combining this mode with the normal operation mode.
- **STOP mode:** In this mode, oscillation of the main system clock is stopped. All the operations performed on the main system clock are suspended, and only the subsystem clock is used, resulting in extremely small power consumption. This can be used only when the main system clock is operating (the subsystem clock oscillation cannot be stopped).

Figure 8-1. Standby Function



Note The current consumption can be reduced by stopping the main system clock. When the CPU is operating on the subsystem clock, set bit 7 (MCC) of the processor clock control register (PCC) to stop the main system clock. The STOP instruction cannot be used.

Caution When the main system clock is stopped and the device is operating on the subsystem clock, wait until the oscillation stabilization time has been secured by the program before switching back to the main system clock.

9. RESET FUNCTION

The following two reset methods are available.

- External reset by $\overline{\text{RESET}}$ signal input
- Internal reset by watchdog timer runaway time detection

10. MASK OPTION

Table 10.1 Pin Mask Option Selection

Subseries Name	Pins	Mask Option
μ PD780034A Subseries	P30 to P33	An on-chip pull-up resistor can be specified in 1-bit units.
μ PD780034AY Subseries	P30, P31	

The mask option can be used to specify the connection of an on-chip pull-up resistor to P30 to P33^{Note}, in 1-bit units.

Note The μ PD780034AY Subseries has P30 and P31 only.

11. INSTRUCTION SET

(1) 8-bit instructions

MOV, XCH, ADD, ADDC, SUB, SUBC, AND, OR, XOR, CMP, MULU, DIVUW, INC, DEC, ROR, ROL, RORC, ROLC, ROR4, ROL4, PUSH, POP, DBNZ

2nd Operand	#byte	A	r ^{Note}	sfr	saddr	!addr16	PSW	[DE]	[HL]	[HL + byte] [HL + B] [HL + C]	\$addr16	1	None
A	ADD ADDC SUB SUBC AND OR XOR CMP		MOV XCH ADD ADDC SUB SUBC AND OR XOR CMP	MOV XCH	MOV XCH ADD ADDC SUB SUBC AND OR XOR CMP	MOV XCH ADD ADDC SUB SUBC AND OR XOR CMP	MOV	MOV XCH	MOV XCH ADD ADDC SUB SUBC AND OR XOR CMP			ROR ROL RORC ROLC	
r	MOV	MOV ADD ADDC SUB SUBC AND OR XOR CMP											INC DEC
B, C											DBNZ		
sfr	MOV	MOV											
saddr	MOV ADD ADDC SUB SUBC AND OR XOR CMP	MOV									DBNZ		INC DEC
!addr16		MOV											
PSW	MOV	MOV											PUSH POP
[DE]		MOV											
[HL]		MOV											ROR4 ROL4
[HL + byte] [HL + B] [HL + C]		MOV											
X													MULU
C													DIVUW

Note Except r = A

(2) 16-bit instructions

MOVW, XCHW, ADDW, SUBW, CMPW, PUSH, POP, INCW, DECW

2nd Operand 1st Operand	#word	AX	rp ^{Note}	sfrp	saddrp	!addr16	SP	None
AX	ADDW SUBW CMPW		MOVW XCHW	MOVW	MOVW	MOVW	MOVW	
rp	MOVW	MOVW ^{Note}						INCW, DECW PUSH, POP
sfrp	MOVW	MOVW						
saddrp	MOVW	MOVW						
!addr16		MOVW						
SP	MOVW	MOVW						

Note Only when rp = BC, DE or HL**(3) Bit manipulation instructions**

MOV1, AND1, OR1, XOR1, SET1, CLR1, NOT1, BT, BF, BTCLR

2nd Operand 1st Operand	A.bit	sfr.bit	saddr.bit	PSW.bit	[HL].bit	CY	\$addr16	None
A.bit						MOV1	BT BF BTCLR	SET1 CLR1
sfr.bit						MOV1	BT BF BTCLR	SET1 CLR1
saddr.bit						MOV1	BT BF BTCLR	SET1 CLR1
PSW.bit						MOV1	BT BF BTCLR	SET1 CLR1
[HL].bit						MOV1	BT BF BTCLR	SET1 CLR1
CY	MOV1 AND1 OR1 XOR1	MOV1 AND1 OR1 XOR1	MOV1 AND1 OR1 XOR1	MOV1 AND1 OR1 XOR1	MOV1 AND1 OR1 XOR1			SET1 CLR1 NOT1

(4) Call instructions/branch instructions

CALL, CALLF, CALLT, BR, BC, BNC, BZ, BNZ, BT, BF, BTCLR, DBNZ

2nd Operand 1st Operand	AX	!addr16	!addr11	[addr5]	\$addr16
Basic instruction	BR	CALL BR	CALLF	CALLT	BR, BC, BNC BZ, BNZ
Compound instruction					BT, BF BTCLR DBNZ

(5) Other instructions

ADJBA, ADJBS, BRK, RET, RETI, RETB, SEL, NOP, EI, DI, HALT, STOP

12. ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings (T_A = 25°C)

Parameter	Symbol	Conditions			Ratings	Unit
Supply voltage	V _{DD}				−0.3 to +6.5	V
	AV _{DD}				−0.3 to V _{DD} + 0.3 ^{Note}	V
	AV _{REF}				−0.3 to V _{DD} + 0.3 ^{Note}	V
	AV _{SS}				−0.3 to +0.3	V
Input voltage	V _{I1}	P00 to P03, P10 to P17, P20 to P25, P34 to P36, P40 to P47, P50 to P57, P64 to P67, P70 to P75, X1, X2, XT1, XT2, RESET			−0.3 to V _{DD} + 0.3 ^{Note}	V
	V _{I2}	P30 to P33	N-ch open-drain	Without pull-up resistor	−0.3 to +6.5	V
				With pull-up resistor	−0.3 to V _{DD} + 0.3 ^{Note}	V
Output voltage	V _O				−0.3 to V _{DD} + 0.3 ^{Note}	V
Analog input voltage	V _{AN}	P10 to P17		Analog input pin	AV _{SS} − 0.3 to AV _{REF} + 0.3 ^{Note} and −0.3 to V _{DD} + 0.3 ^{Note}	V
Output current, high	I _{OH}	Per pin			−10	mA
		Total for P00 to P03, P40 to P47, P50 to P57, P64 to P67, P70 to P75			−15	mA
		Total for P20 to P25, P30 to P36			−15	mA
Output current, low	I _{OL}	Per pin for P00 to P03, P20 to P25, P34 to P36, P40 to P47, P64 to P67, P70 to P75			20	mA
		Per pin for P30 to P33, P50 to P57			30	mA
		Total for P00 to P03, P40 to P47, P64 to P67, P70 to P75			50	mA
		Total for P20 to P25			20	mA
		Total for P30 to P36			100	mA
		Total for P50 to P57			100	mA
Operating ambient temperature	T _A				−40 to +85	°C
Storage temperature	T _{stg}				−65 to +150	°C

Note 6.5 V or below

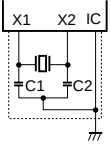
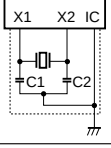
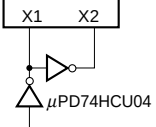
Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

Capacitance ($T_A = 25^\circ\text{C}$, $V_{DD} = V_{SS} = 0\text{ V}$)

Parameter	Symbol	Conditions		MIN.	TYP.	MAX.	Unit
Input capacitance	C_{IN}	$f = 1\text{ MHz}$ Unmeasured pins returned to 0 V.				15	pF
I/O capacitance	C_{IO}	$f = 1\text{ MHz}$ Unmeasured pins returned to 0 V.	P00 to P03, P20 to P25, P34 to P36, P40 to P47, P50 to P57, P64 to P67, P70 to P75			15	pF
			P30 to P33			20	pF

Remark Unless otherwise specified, the characteristics of alternate-function pins are the same as those of port pins.

Main System Clock Oscillator Characteristics ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 1.8$ to 5.5 V)

Resonator	Recommended Circuit	Parameter	Conditions	MIN.	TYP.	MAX.	Unit
Ceramic resonator		Oscillation frequency (f_x) ^{Note 1}	$V_{DD} = 4.0$ to 5.5 V	1.0		8.38	MHz
				1.0		5.0	
		Oscillation stabilization time ^{Note 2}	After V_{DD} reaches oscillation voltage range MIN.			4	ms
Crystal resonator		Oscillation frequency (f_x) ^{Note 1}	$V_{DD} = 4.0$ to 5.5 V	1.0		8.38	MHz
				1.0		5.0	
		Oscillation stabilization time ^{Note 2}	$V_{DD} = 4.0$ to 5.5 V			10	ms
External clock		X1 input frequency (f_x) ^{Note 1}	$V_{DD} = 4.0$ to 5.5 V	1.0		8.38	MHz
				1.0		5.0	
		X1 input high-/low-level width (t_{xH} , t_{xL})	$V_{DD} = 4.0$ to 5.5 V	50		500	ns
				85		500	

Notes 1. Indicates only oscillator characteristics. Refer to **AC Characteristics** for instruction execution time.

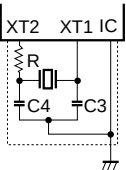
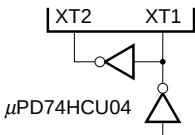
2. Time required to stabilize oscillation after reset or STOP mode release.

Cautions 1. When using the main system clock oscillator, wire as follows in the area enclosed by the broken lines in the above figures to avoid an adverse effect from wiring capacitance.

- Keep the wiring length as short as possible.
- Do not cross the wiring with the other signal lines.
- Do not route the wiring near a signal line through which a high fluctuating current flows.
- Always make the ground point of the oscillator capacitor the same potential as V_{SS1} .
- Do not ground the capacitor to a ground pattern through which a high current flows.
- Do not fetch signals from the oscillator.

2. When the main system clock is stopped and the system is operating on the subsystem clock, wait until the oscillation stabilization time has been secured by the program before switching back to the main system clock.

Subsystem Clock Oscillator Characteristics (T_A = -40 to +85°C, V_{DD} = 1.8 to 5.5 V)

Resonator	Recommended Circuit	Parameter	Conditions	MIN.	TYP.	MAX.	Unit
Crystal resonator		Oscillation frequency (f _{XT}) ^{Note 1}		32	32.768	35	kHz
		Oscillation stabilization time ^{Note 2}	V _{DD} = 4.0 to 5.5 V		1.2	2	s
						10	
External clock		XT1 input frequency (f _{XT}) ^{Note 1}		32		38.5	kHz
		XT1 input high-/low-level width (t _{XTH} , t _{XTL})		5		15	μs

Notes 1. Indicates only oscillator characteristics. Refer to **AC Characteristics** for instruction execution time.

2. Time required to stabilize oscillation after V_{DD} reaches oscillation voltage range MIN.

Cautions 1. When using the subsystem clock oscillator, wire as follows in the area enclosed by the broken lines in the above figures to avoid an adverse effect from wiring capacitance.

- Keep the wiring length as short as possible.
- Do not cross the wiring with the other signal lines.
- Do not route the wiring near a signal line through which a high fluctuating current flows.
- Always make the ground point of the oscillator capacitor the same potential as V_{SS1}.
- Do not ground the capacitor to a ground pattern through which a high current flows.
- Do not fetch signals from the oscillator.

2. The subsystem clock oscillator is designed as a low-amplitude circuit for reducing current consumption, and is more prone to malfunction due to noise than the main system clock oscillator. Particular care is therefore required with the wiring method when the subsystem clock is used.

Recommended Oscillator Constant

Main system clock: Ceramic resonator (T_A = -40 to +85°C)

Manufacturer	Part Number	Frequency (MHz)	Recommended Circuit Constant		Oscillation Voltage Range	
			C1 (pF)	C2 (pF)	MIN. (V)	MAX. (V)
Murata Mfg. Co., Ltd.	CSB1000J	1.00	100	100	1.8	5.5
	CSA2.00MG040	2.00	100	100	1.8	5.5
	CST2.00MG040	2.00	On-chip	On-chip	1.8	5.5
	CSA3.58MG	3.58	30	30	1.8	5.5
	CST3.58MGW	3.58	On-chip	On-chip	1.8	5.5
	CSA4.19MG	4.19	30	30	1.8	5.5
	CST4.19MGW	4.19	On-chip	On-chip	1.8	5.5
	CSA5.00MG	5.00	30	30	1.8	5.5
	CST5.00MGW	5.00	On-chip	On-chip	1.8	5.5
	CSA8.00MTZ	8.00	30	30	4.0	5.5
	CST8.00MTW	8.00	On-chip	On-chip	4.0	5.5
	CSA8.00MTZ093	8.00	30	30	4.0	5.5
	CST8.00MTW093	8.00	On-chip	On-chip	4.0	5.5
	CSA8.38MTZ	8.38	30	30	4.0	5.5
	CST8.38MTW	8.38	On-chip	On-chip	4.0	5.5
	CSA8.38MTZ093	8.38	30	30	4.0	5.5
	CST8.38MTW093	8.38	On-chip	On-chip	4.0	5.5
TDK	CCR3.58MC3	3.58	On-chip	On-chip	1.8	5.5
	CCR4.19MC3	4.19	On-chip	On-chip	1.8	5.5
	CCR5.0MC3	5.00	On-chip	On-chip	1.8	5.5
	CCR8.0MC5	8.00	On-chip	On-chip	2.0	5.5
	CCR8.38MC5	8.38	On-chip	On-chip	2.0	5.5

Caution The oscillator constant and oscillation voltage range indicate conditions of stable oscillation. Oscillation frequency precision is not guaranteed. For applications requiring oscillation frequency precision, the oscillation frequency must be adjusted on the implementation circuit. For details, contact directly the manufacturer of the resonator used.

DC Characteristics ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 1.8$ to 5.5 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output current, high	I_{OH}	Per pin			-1	mA
		All pins			-15	mA
Output current, low	I_{OL}	Per pin for P00 to P03, P20 to P25, P34 to P36, P40 to P47, P64 to P67, P70 to P75			10	mA
		Per pin for P30 to P33, P50 to P57			15	mA
		Total for P00 to P03, P40 to P47, P64 to P67, P70 to P75			20	mA
		Total for P20 to P25			10	mA
		Total for P30 to P36			70	mA
		Total for P50 to P57			70	mA
Input voltage, high	V_{IH1}	P10 to P17, P21, P24, P35, P40 to P47, P50 to P57, P64 to P67, P74, P75	$V_{DD} = 2.7$ to 5.5 V	$0.7V_{DD}$	V_{DD}	V
				$0.8V_{DD}$	V_{DD}	V
	V_{IH2}	P00 to P03, P20, P22, P23, P25, P34, P36, P70 to P73, RESET	$V_{DD} = 2.7$ to 5.5 V	$0.8V_{DD}$	V_{DD}	V
				$0.85V_{DD}$	V_{DD}	V
	V_{IH3}	P30 to P33 (N-ch open-drain)	$V_{DD} = 2.7$ to 5.5 V	$0.7V_{DD}$	5.5	V
				$0.8V_{DD}$	5.5	V
	V_{IH4}	X1, X2	$V_{DD} = 2.7$ to 5.5 V	$V_{DD} - 0.5$	V_{DD}	V
				$V_{DD} - 0.2$	V_{DD}	V
	V_{IH5}	XT1, XT2	$V_{DD} = 4.0$ to 5.5 V	$0.8V_{DD}$	V_{DD}	V
				$0.9V_{DD}$	V_{DD}	V
Input voltage, low	V_{IL1}	P10 to P17, P21, P24, P35, P40 to P47, P50 to P57, P64 to P67, P74, P75	$V_{DD} = 2.7$ to 5.5 V	0	$0.3V_{DD}$	V
				0	$0.2V_{DD}$	V
	V_{IL2}	P00 to P03, P20, P22, P23, P25, P34, P36, P70 to P73, RESET	$V_{DD} = 2.7$ to 5.5 V	0	$0.2V_{DD}$	V
				0	$0.15V_{DD}$	V
	V_{IL3}	P30 to P33	$4.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$	0	$0.3V_{DD}$	V
			$2.7\text{ V} \leq V_{DD} < 4.0\text{ V}$	0	$0.2V_{DD}$	V
			$1.8\text{ V} \leq V_{DD} < 2.7\text{ V}$	0	$0.1V_{DD}$	V
	V_{IL4}	X1, X2	$V_{DD} = 2.7$ to 5.5 V	0	0.4	V
				0	0.2	V
	V_{IL5}	XT1, XT2	$V_{DD} = 4.0$ to 5.5 V	0	$0.2V_{DD}$	V
				0	$0.1V_{DD}$	V
Output voltage, high	V_{OH1}	$V_{DD} = 4.0$ to 5.5 V, $I_{OH} = -1$ mA	$V_{DD} - 1.0$		V_{DD}	V
		$I_{OH} = -100\text{ }\mu\text{A}$	$V_{DD} - 0.5$		V_{DD}	V
Output voltage, low	V_{OL1}	P30 to P33	$V_{DD} = 4.0$ to 5.5 V,		2.0	V
		P50 to P57	$I_{OL} = 15$ mA	0.4	2.0	V
		P00 to P03, P20 to P25, P34 to P36, P40 to P47, P64 to P67, P70 to P75	$V_{DD} = 4.0$ to 5.5 V, $I_{OL} = 1.6$ mA		0.4	V
	V_{OL2}	$I_{OL} = 400\text{ }\mu\text{A}$			0.5	V

Remark Unless otherwise specified, the characteristics of alternate-function pins are the same as those of port pins.

DC Characteristics ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 1.8$ to 5.5 V)

Parameter	Symbol	Conditions		MIN.	TYP.	MAX.	Unit
Input leakage current, high	I_{LIH1}	$V_{IN} = V_{DD}$	P00 to P03, P10 to P17, P20 to P25, P34 to P36, P40 to P47, P50 to P57, P64 to P67, P70 to P75, $\overline{\text{RESET}}$			3	μA
	I_{LIH2}		X1, X2, XT1, XT2			20	μA
	I_{LIH3}	$V_{IN} = 5.5$ V	P30 to P33 ^{Note 1}			3	μA
Input leakage current, low	I_{LIL1}	$V_{IN} = 0$ V	P00 to P03, P10 to P17, P20 to P25, P34 to P36, P40 to P47, P50 to P57, P64 to P67, P70 to P75, $\overline{\text{RESET}}$			-3	μA
	I_{LIL2}		X1, X2, XT1, XT2			-20	μA
	I_{LIL3}		P30 to P33 ^{Note 1}			-3	μA
Output leakage current, high	I_{LOH}	$V_{OUT} = V_{DD}$				3	μA
Output leakage current, low	I_{LOL}	$V_{OUT} = 0$ V				-3	μA
Mask option pull-up resistance	R_1	$V_{IN} = 0$ V, P30, P31, P32 ^{Note 2} , P33 ^{Note 2}		15	30	90	$\text{k}\Omega$
Software pull-up resistance	R_2	$V_{IN} = 0$ V, P00 to P03, P20 to P25, P34 to P36, P40 to P47, P50 to P57, P64 to P67, P70 to P75		15	30	90	$\text{k}\Omega$

Notes 1. μ PD780031A(A), 780032A(A),: When pull-up resistors are not connected to P30 to P33
780033A(A), 780034A(A) (specified by the mask option).

μ PD780031AY(A), 780032AY(A),: When pull-up resistors are not connected to P30 and P31
780033AY(A), 780034AY(A) (specified by the mask option).

2. Only for the μ PD780031A(A), 780032A(A), 780033A(A), and 780034A(A)

Remark Unless otherwise specified, the characteristics of alternate-function pins are the same as those of port pins.

DC Characteristics ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 1.8$ to 5.5 V)

Parameter	Symbol	Conditions			MIN.	TYP.	MAX.	Unit
Power supply current ^{Note 1}	I _{DD1}	8.38 MHz crystal oscillation operating mode	V _{DD} = 5.0 V ±10% ^{Note 2}	When A/D converter is stopped		5.5	11	mA
				When A/D converter is operating		6.5	13	mA
		5.00 MHz crystal oscillation operating mode	V _{DD} = 3.0 V ±10% ^{Note 2}	When A/D converter is stopped		2	4	mA
				When A/D converter is operating		3	6	mA
			V _{DD} = 2.0 V ±10% ^{Note 3}	When A/D converter is stopped		0.4	1.5	mA
				When A/D converter is operating		1.4	4.2	mA
	I _{DD2}	8.38 MHz crystal oscillation HALT mode	V _{DD} = 5.0 V ±10% ^{Note 2}	When peripheral functions are stopped		1.1	2.2	mA
				When peripheral functions are operating			4.7	mA
		5.00 MHz crystal oscillation HALT mode	V _{DD} = 3.0 V ±10% ^{Note 2}	When peripheral functions are stopped		0.35	0.7	mA
				When peripheral functions are operating			1.7	mA
			V _{DD} = 2.0 V ±10% ^{Note 3}	When peripheral functions are stopped		0.15	0.4	mA
				When peripheral functions are operating			1.1	mA
	I _{DD3}	32.768 kHz crystal oscillation operating mode ^{Note 4}	V _{DD} = 5.0 V ±10%		40	80	μA	
			V _{DD} = 3.0 V ±10%		20	40	μA	
			V _{DD} = 2.0 V ±10%		10	20	μA	
	I _{DD4}	32.768 kHz crystal oscillation HALT mode ^{Note 4}	V _{DD} = 5.0 V ±10%		30	60	μA	
			V _{DD} = 3.0 V ±10%		6	18	μA	
			V _{DD} = 2.0 V ±10%		2	10	μA	
	I _{DD5}	XT1 = V _{DD} STOP mode When feedback resistor is not used	V _{DD} = 5.0 V ±10%		0.1	30	μA	
			V _{DD} = 3.0 V ±10%		0.05	10	μA	
			V _{DD} = 2.0 V ±10%		0.05	10	μA	

Notes 1. Total current through the internal power supply (V_{DD0} , V_{DD1}), including the peripheral operation current (except the current through pull-up resistors of ports and the AV_{REF} pin).

2. When the processor clock control register (PCC) is set to 00H.

3. When PCC is set to 02H.

4. When main system clock operation is stopped.

AC Characteristics

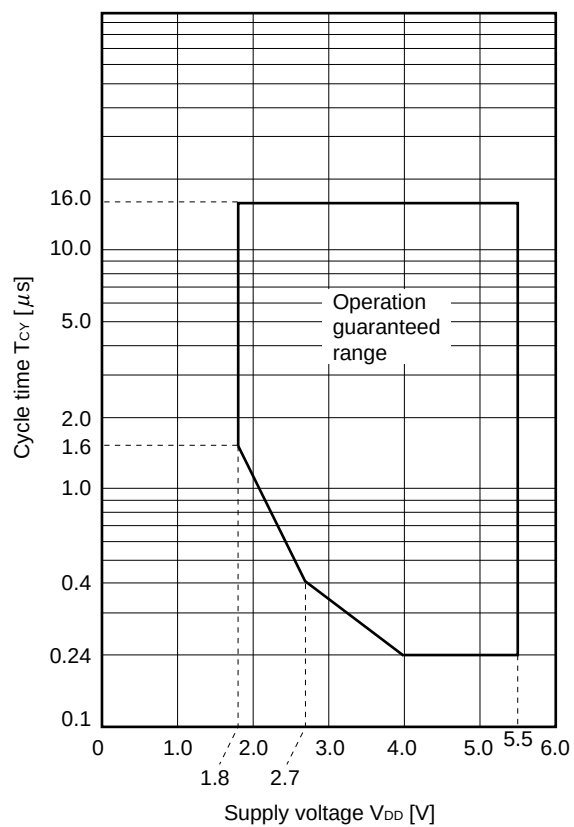
(1) Basic Operation ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 1.8$ to 5.5 V)

Parameter	Symbol	Conditions		MIN.	TYP.	MAX.	Unit
Cycle time (Min. instruction execution time)	T_{CY}	Operating with main system clock	$4.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$	0.24		16	μs
			$2.7\text{ V} \leq V_{DD} < 4.0\text{ V}$	0.4		16	μs
				1.6		16	μs
		Operating with subsystem clock		103.9 ^{Note 1}	122	125	μs
TI00, TI01 input high-/low-level width	t_{TIH0}, t_{TIL0}	$4.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$		$2/f_{sam} + 0.1$ ^{Note 2}			μs
		$2.7\text{ V} \leq V_{DD} < 4.0\text{ V}$		$2/f_{sam} + 0.2$ ^{Note 2}			μs
				$2/f_{sam} + 0.5$ ^{Note 2}			μs
TI50, TI51 input frequency	f_{TI5}	$V_{DD} = 2.7$ to 5.5 V		0		4	MHz
				0		275	kHz
TI50, TI51 input high-/low-level width	t_{TIH5}, t_{TIL5}	$V_{DD} = 2.7$ to 5.5 V		100			ns
				1.8			ns
Interrupt request input high-/low -level width	t_{INTH}, t_{INTL}	INTP0 to INTP3, P40 to P47	$V_{DD} = 2.7$ to 5.5 V	1			μs
				2			μs
$\overline{\text{RESET}}$ low-level width	t_{RSL}	$V_{DD} = 2.7$ to 5.5 V		10			μs
				20			μs

Notes 1. Value when an external clock is used. When a crystal resonator is used, it is $114\text{ }\mu\text{s}$ (MIN.).

2. Selection of $f_{sam} = f_x, f_x/4, f_x/64$ is possible using bits 0 and 1 (PRM00, PRM01) of prescaler mode register 0 (PRM0). However, if the TI00 valid edge is selected as the count clock, the value becomes $f_{sam} = f_x/8$.

T_{CY} vs. V_{DD} (Main system clock operation)



(2) Read/Write Operation ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 4.0$ to 5.5 V)

(1/3)

Parameter	Symbol	Conditions	MIN.	MAX.	Unit
ASTB high-level width	t_{ASTH}		$0.3t_{CY}$		ns
Address setup time	t_{ADS}		20		ns
Address hold time	t_{ADH}		6		ns
Input time from address to data	t_{ADD1}			$(2 + 2n)t_{CY} - 54$	ns
	t_{ADD2}			$(3 + 2n)t_{CY} - 60$	ns
Output time from $\overline{RD}\downarrow$ to address	t_{RDAD}		0	100	ns
Input time from $\overline{RD}\downarrow$ to data	t_{RDD1}			$(2 + 2n)t_{CY} - 87$	ns
	t_{RDD2}			$(3 + 2n)t_{CY} - 93$	ns
Read data hold time	t_{RDH}		0		ns
$\overline{RD}$ low-level width	t_{RDL1}		$(1.5 + 2n)t_{CY} - 33$		ns
	t_{RDL2}		$(2.5 + 2n)t_{CY} - 33$		ns
Input time from $\overline{RD}\downarrow$ to $\overline{WAIT}\downarrow$	t_{RDWT1}			$t_{CY} - 43$	ns
	t_{RDWT2}			$t_{CY} - 43$	ns
Input time from $\overline{WR}\downarrow$ to $\overline{WAIT}\downarrow$	t_{WRWT}			$t_{CY} - 25$	ns
$\overline{WAIT}$ low-level width	t_{WTL}		$(0.5 + n)t_{CY} + 10$	$(2 + 2n)t_{CY}$	ns
Write data setup time	t_{WDS}		60		ns
Write data hold time	t_{WDH}		6		ns
$\overline{WR}$ low-level width	t_{WRL1}		$(1.5 + 2n)t_{CY} - 15$		ns
Delay time from $ASTB\downarrow$ to $\overline{RD}\downarrow$	t_{ASTRD}		6		ns
Delay time from $ASTB\downarrow$ to $\overline{WR}\downarrow$	t_{ASTWR}		$2t_{CY} - 15$		ns
Delay time from $\overline{RD}\uparrow$ to $ASTB\uparrow$ at external fetch	t_{RDAST}		$0.8t_{CY} - 15$	$1.2t_{CY}$	ns
Hold time from $\overline{RD}\uparrow$ to address at external fetch	t_{RDADH}		$0.8t_{CY} - 15$	$1.2t_{CY} + 30$	ns
Write data output time from $\overline{RD}\uparrow$	t_{RDWD}		40		ns
Write data output time from $\overline{WR}\downarrow$	t_{WRWD}		10	60	ns
Hold time from $\overline{WR}\uparrow$ to address	t_{WRADH}		$0.8t_{CY} - 15$	$1.2t_{CY} + 30$	ns
Delay time from $\overline{WAIT}\uparrow$ to $\overline{RD}\uparrow$	t_{WTRD}		$0.8t_{CY}$	$2.5t_{CY} + 25$	ns
Delay time from $\overline{WAIT}\uparrow$ to $\overline{WR}\uparrow$	t_{WTWR}		$0.8t_{CY}$	$2.5t_{CY} + 25$	ns

Remarks 1. $t_{CY} = T_{CY}/4$ 2. n indicates the number of waits.3. $C_L = 100$ pF (C_L indicates the load capacitance of the AD0 to AD7, A8 to A15, $\overline{RD}$, $\overline{WR}$, $\overline{WAIT}$, and $ASTB$ pins.)

(2) Read/Write Operation ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 2.7$ to 4.0 V)

(2/3)

Parameter	Symbol	Conditions	MIN.	MAX.	Unit
ASTB high-level width	t_{ASTH}		$0.3t_{CY}$		ns
Address setup time	t_{ADS}		30		ns
Address hold time	t_{ADH}		10		ns
Input time from address to data	t_{ADD1}			$(2 + 2n)t_{CY} - 108$	ns
	t_{ADD2}			$(3 + 2n)t_{CY} - 120$	ns
Output time from $\overline{RD}\downarrow$ to address	t_{RDAD}		0	200	ns
Input time from $\overline{RD}\downarrow$ to data	t_{RDD1}			$(2 + 2n)t_{CY} - 148$	ns
	t_{RDD2}			$(3 + 2n)t_{CY} - 162$	ns
Read data hold time	t_{RDH}		0		ns
$\overline{RD}$ low-level width	t_{RDL1}		$(1.5 + 2n)t_{CY} - 40$		ns
	t_{RDL2}		$(2.5 + 2n)t_{CY} - 40$		ns
Input time from $\overline{RD}\downarrow$ to $\overline{WAIT}\downarrow$	t_{RDWT1}			$t_{CY} - 75$	ns
	t_{RDWT2}			$t_{CY} - 60$	ns
Input time from $\overline{WR}\downarrow$ to $\overline{WAIT}\downarrow$	t_{WRWT}			$t_{CY} - 50$	ns
$\overline{WAIT}$ low-level width	t_{WTL}		$(0.5 + 2n)t_{CY} + 10$	$(2 + 2n)t_{CY}$	ns
Write data setup time	t_{WDS}		60		ns
Write data hold time	t_{WDH}		10		ns
$\overline{WR}$ low-level width	t_{WRL1}		$(1.5 + 2n)t_{CY} - 30$		ns
Delay time from $\overline{ASTB}\downarrow$ to $\overline{RD}\downarrow$	t_{ASTRD}		10		ns
Delay time from $\overline{ASTB}\downarrow$ to $\overline{WR}\downarrow$	t_{ASTWR}		$2t_{CY} - 30$		ns
Delay time from $\overline{RD}\uparrow$ to $\overline{ASTB}\uparrow$ at external fetch	t_{RDAST}		$0.8t_{CY} - 30$	$1.2t_{CY}$	ns
Hold time from $\overline{RD}\uparrow$ to address at external fetch	t_{RDADH}		$0.8t_{CY} - 30$	$1.2t_{CY} + 60$	ns
Write data output time from $\overline{RD}\uparrow$	t_{RDWD}		40		ns
Write data output time from $\overline{WR}\downarrow$	t_{WRWD}		20	120	ns
Hold time from $\overline{WR}\uparrow$ to address	t_{WRADH}		$0.8t_{CY} - 30$	$1.2t_{CY} + 60$	ns
Delay time from $\overline{WAIT}\uparrow$ to $\overline{RD}\uparrow$	t_{WTRD}		$0.5t_{CY}$	$2.5t_{CY} + 50$	ns
Delay time from $\overline{WAIT}\uparrow$ to $\overline{WR}\uparrow$	t_{WTWR}		$0.5t_{CY}$	$2.5t_{CY} + 50$	ns

Remarks 1. $t_{CY} = T_{CY}/4$ 2. n indicates the number of waits.3. $C_L = 100$ pF (C_L indicates the load capacitance of the AD0 to AD7, AD8 to AD15, $\overline{RD}$, $\overline{WR}$, $\overline{WAIT}$, and $\overline{ASTB}$ pins.)

(2) Read/Write Operation ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 1.8$ to 2.7 V)

(3/3)

Parameter	Symbol	Conditions	MIN.	MAX.	Unit
ASTB high-level width	t_{ASTH}		$0.3t_{CY}$		ns
Address setup time	t_{ADS}		120		ns
Address hold time	t_{ADH}		20		ns
Input time from address to data	t_{ADD1}			$(2 + 2n)t_{CY} - 233$	ns
	t_{ADD2}			$(3 + 2n)t_{CY} - 240$	ns
Output time from $\overline{RD}\downarrow$ to address	t_{RDAD}		0	400	ns
Input time from $\overline{RD}\downarrow$ to data	t_{RDD1}			$(2 + 2n)t_{CY} - 325$	ns
	t_{RDD2}			$(3 + 2n)t_{CY} - 332$	ns
Read data hold time	t_{RDH}		0		ns
$\overline{RD}$ low-level width	t_{RDL1}		$(1.5 + 2n)t_{CY} - 92$		ns
	t_{RDL2}		$(2.5 + 2n)t_{CY} - 92$		ns
Input time from $\overline{RD}\downarrow$ to $\overline{WAIT}\downarrow$	t_{RDWT1}			$t_{CY} - 350$	ns
	t_{RDWT2}			$t_{CY} - 132$	ns
Input time from $\overline{WR}\downarrow$ to $\overline{WAIT}\downarrow$	t_{WRWT}			$t_{CY} - 100$	ns
$\overline{WAIT}$ low-level width	t_{WTL}		$(0.5 + 2n)t_{CY} + 10$	$(2 + 2n)t_{CY}$	ns
Write data setup time	t_{WDS}		60		ns
Write data hold time	t_{WDH}		20		ns
$\overline{WR}$ low-level width	t_{WRL1}		$(1.5 + 2n)t_{CY} - 60$		ns
Delay time from $\overline{ASTB}\downarrow$ to $\overline{RD}\downarrow$	t_{ASTRD}		20		ns
Delay time from $\overline{ASTB}\downarrow$ to $\overline{WR}\downarrow$	t_{ASTWR}		$2t_{CY} - 60$		ns
Delay time from $\overline{RD}\uparrow$ to $\overline{ASTB}\uparrow$ at external fetch	t_{RDAST}		$0.8t_{CY} - 60$	$1.2t_{CY}$	ns
Hold time from $\overline{RD}\uparrow$ to address at external fetch	t_{RDADH}		$0.8t_{CY} - 60$	$1.2t_{CY} + 120$	ns
Write data output time from $\overline{RD}\uparrow$	t_{RDWD}		40		ns
Write data output time from $\overline{WR}\downarrow$	t_{WRWD}		40	240	ns
Hold time from $\overline{WR}\uparrow$ to address	t_{WRADH}		$0.8t_{CY} - 60$	$1.2t_{CY} + 120$	ns
Delay time from $\overline{WAIT}\uparrow$ to $\overline{RD}\uparrow$	t_{WTRD}		$0.5t_{CY}$	$2.5t_{CY} + 100$	ns
Delay time from $\overline{WAIT}\uparrow$ to $\overline{WR}\uparrow$	t_{WTWR}		$0.5t_{CY}$	$2.5t_{CY} + 100$	ns

Remarks 1. $t_{CY} = T_{CY}/4$ 2. n indicates the number of waits.3. $C_L = 100\text{pF}$ (C_L indicates the load capacitance of the AD0 to AD7, AD8 to AD15, $\overline{RD}$, $\overline{WR}$, $\overline{WAIT}$, and $\overline{ASTB}$ pins.)

(3) Serial Interface ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = 1.8$ to 5.5 V)

(a) 3-wire serial I/O mode ($\overline{\text{SCK3n}}$... Internal clock output)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
$\overline{\text{SCK3n}}$ cycle time	t_{KCY1}	$4.0 \text{ V} \leq V_{DD} \leq 5.5 \text{ V}$	954			ns
		$2.7 \text{ V} \leq V_{DD} < 4.0 \text{ V}$	1600			ns
			3200			ns
$\overline{\text{SCK3n}}$ high-/low-level width	$t_{\text{KH1}}, t_{\text{KL1}}$	$V_{DD} = 4.0$ to 5.5 V	$t_{\text{KCY1}}/2 - 50$			ns
			$t_{\text{KCY1}}/2 - 100$			ns
SI3n setup time (to $\overline{\text{SCK3n}}\uparrow$)	t_{SIK1}	$4.0 \text{ V} \leq V_{DD} \leq 5.5\text{V}$	100			ns
		$2.7 \text{ V} \leq V_{DD} < 4.0\text{V}$	150			ns
			300			ns
SI3n hold time (from $\overline{\text{SCK3n}}\uparrow$)	t_{KSI1}		400			ns
Delay time from $\overline{\text{SCK3n}}\downarrow$ to SO3n output	t_{KSO1}	$C = 100 \text{ pF}$ ^{Note}			300	ns

Note C is the load capacitance of the $\overline{\text{SCK3n}}$, and SO3n output lines.

(b) 3-wire serial I/O mode ($\overline{\text{SCK3n}}$... External clock input)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
$\overline{\text{SCK3n}}$ cycle time	t_{KCY2}	$4.0 \text{ V} \leq V_{DD} \leq 5.5 \text{ V}$	800			ns
		$2.7 \text{ V} \leq V_{DD} < 4.0 \text{ V}$	1600			ns
			3200			ns
$\overline{\text{SCK3n}}$ high-/low-level width	$t_{\text{KH2}}, t_{\text{KL2}}$	$4.0 \text{ V} \leq V_{DD} \leq 5.5 \text{ V}$	400			ns
		$2.7 \text{ V} \leq V_{DD} < 4.0 \text{ V}$	800			ns
			1600			ns
SI3n setup time (to $\overline{\text{SCK3n}}\uparrow$)	t_{SIK2}		100			ns
SI3n hold time (from $\overline{\text{SCK3n}}\uparrow$)	t_{KSI2}		400			ns
Delay time from $\overline{\text{SCK3n}}\downarrow$ to SO3n output	t_{KSO2}	$C = 100 \text{ pF}$ ^{Note}			300	ns

Note C is the load capacitance of the SO3n output line.

Remark μPD780031A(A), 780032A(A), 780033A(A), 780034A(A): $n = 0,1$
μPD780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A): $n = 0$

(c) UART mode (dedicated baud-rate generator output)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Transfer rate		$4.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$			131031	bps
		$2.7\text{ V} \leq V_{DD} < 4.0\text{ V}$			78125	bps
					39063	bps

(d) UART mode (external clock input)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
ASCK0 cycle time	t_{KCY3}	$4.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$	800			ns
		$2.7\text{ V} \leq V_{DD} < 4.0\text{ V}$	1600			ns
			3200			ns
ASCK0 high-/low-level width	$t_{KH3},$ t_{KL3}	$4.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$	400			ns
		$2.7\text{ V} \leq V_{DD} < 4.0\text{ V}$	800			ns
			1600			ns
Transfer rate		$4.0\text{ V} \leq V_{DD} \leq 5.5\text{ V}$			39063	bps
		$2.7\text{ V} \leq V_{DD} < 4.0\text{ V}$			19531	bps
					9766	bps

(e) UART mode (infrared data transfer mode)

Parameter	Symbol	Conditions	MIN.	MAX.	Unit
Transfer rate		$V_{DD} = 4.0\text{ to }5.5\text{ V}$		131031	bps
Bit rate allowable error		$V_{DD} = 4.0\text{ to }5.5\text{ V}$		± 0.87	%
Output pulse width		$V_{DD} = 4.0\text{ to }5.5\text{ V}$	1.2	$0.24/f_{br}$ ^{Note}	μs
Input pulse width		$V_{DD} = 4.0\text{ to }5.5\text{ V}$	$4/f_x$		μs

Note fbr: Specified baud rate

(f) I²C bus mode (μPD780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A) only)

Parameter	Symbol	Standard Mode		High-Speed Mode		Unit
		MIN.	MAX.	MIN.	MAX.	
SCL0 clock frequency	f _{CLK}	0	100	0	400	kHz
Bus-free time (between stop and start conditions)	t _{BUF}	4.7	—	1.3	—	μs
Hold time ^{Note 1}	t _{HD:STA}	4.0	—	0.6	—	μs
SCL0 clock low-level width	t _{LOW}	4.7	—	1.3	—	μs
SCL0 clock high-level width	t _{HIGH}	4.0	—	0.6	—	μs
Start/restart condition setup time	t _{SU:STA}	4.7	—	0.6	—	μs
Data hold time	CBUS-compatible master	t _{HD:DAT}	5.0	—	—	μs
	I ² C bus		0 ^{Note 2}	—	0 ^{Note 2}	0.9 ^{Note 3} μs
Data setup time	t _{SU:DAT}	250	—	100 ^{Note 4}	—	ns
SDA0 and SCL0 signal rise time	t _R	—	1000	20 + 0.1Cb ^{Note 5}	300	ns
SDA0 and SCL0 signal fall time	t _F	—	300	20 + 0.1Cb ^{Note 5}	300	ns
Stop condition setup time	t _{SU:STO}	4.0	—	0.6	—	μs
Spike pulse width controlled by input filter	t _{SP}	—	—	0	50	ns
Capacitive load per bus line	Cb	—	400	—	400	pF

Notes 1. In the start condition, the first clock pulse is generated after this hold time.

2. To fill in the undefined area of the SCL0 falling edge, it is necessary for the device to internally provide at least 300 ns of hold time for the SDA0 signal (which is V_{IHmin.} of the SCL0 signal).

3. If the device does not extend the SCL0 signal low hold time (t_{LOW}), only the maximum data hold time t_{HD:DAT} needs to be fulfilled.

4. The high-speed mode I²C bus is available in a standard mode I²C bus system. At this time, the conditions described below must be satisfied.

- If the device does not extend the SCL0 signal low state hold time

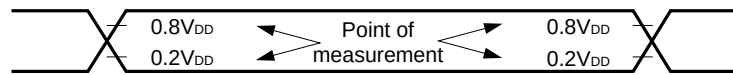
$$t_{SU:DAT} \geq 250 \text{ ns}$$

- If the device extends the SCL0 signal low state hold time

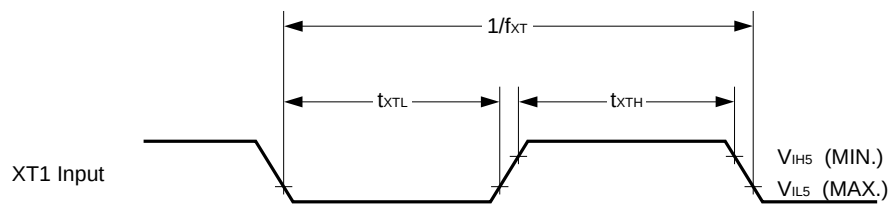
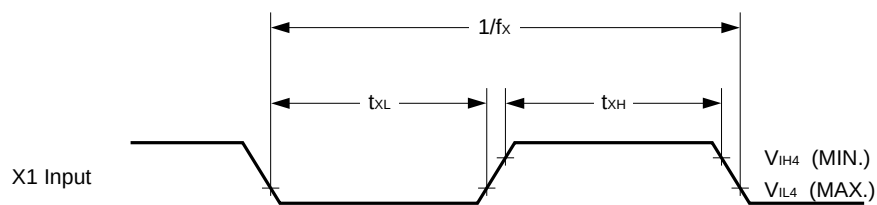
Be sure to transmit the next data bit to the SDA0 line before the SCL0 line is released (t_{Rmax.} + t_{SU:DAT} = 1000 + 250 = 1250 ns by standard mode I²C bus specification).

5. Cb: Total capacitance per bus line (unit: pF)

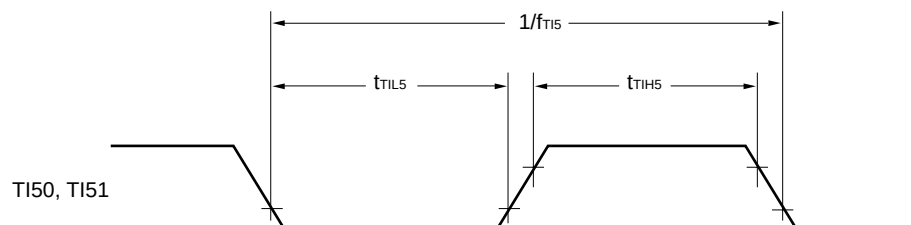
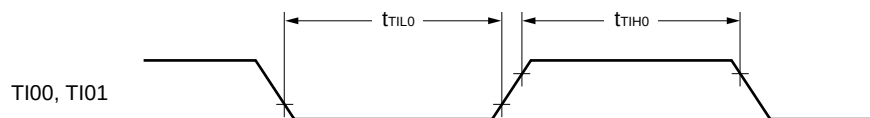
AC Timing Measurement Points (Excluding X1, XT1 inputs)



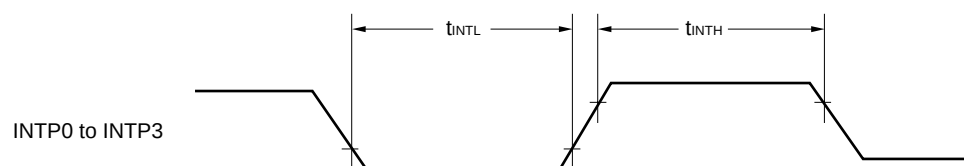
Clock Timing



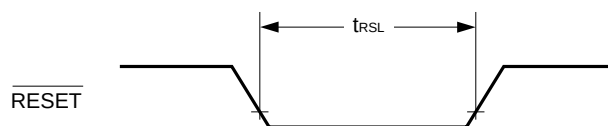
TI Timing



Interrupt Request Input Timing

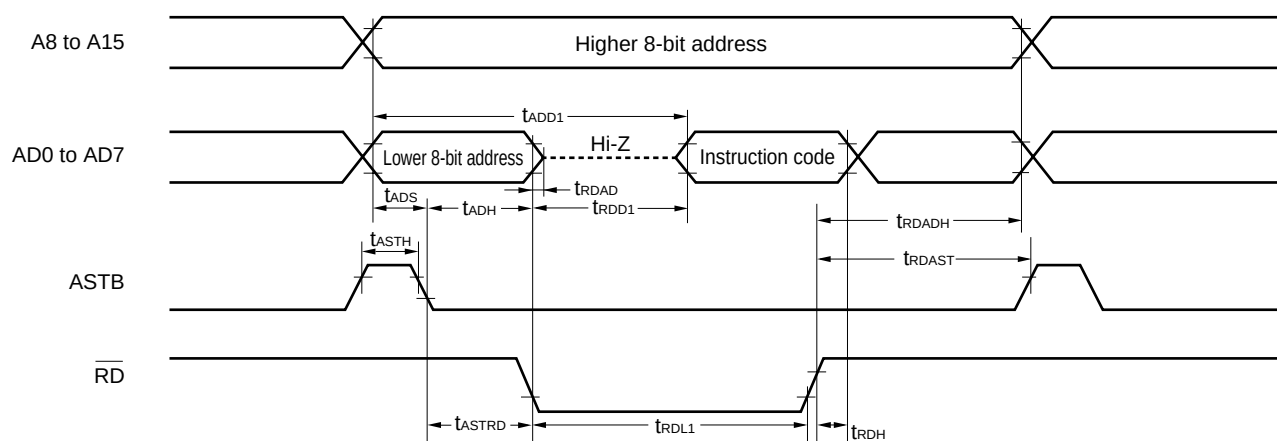


$\overline{\text{RESET}}$ Input Timing

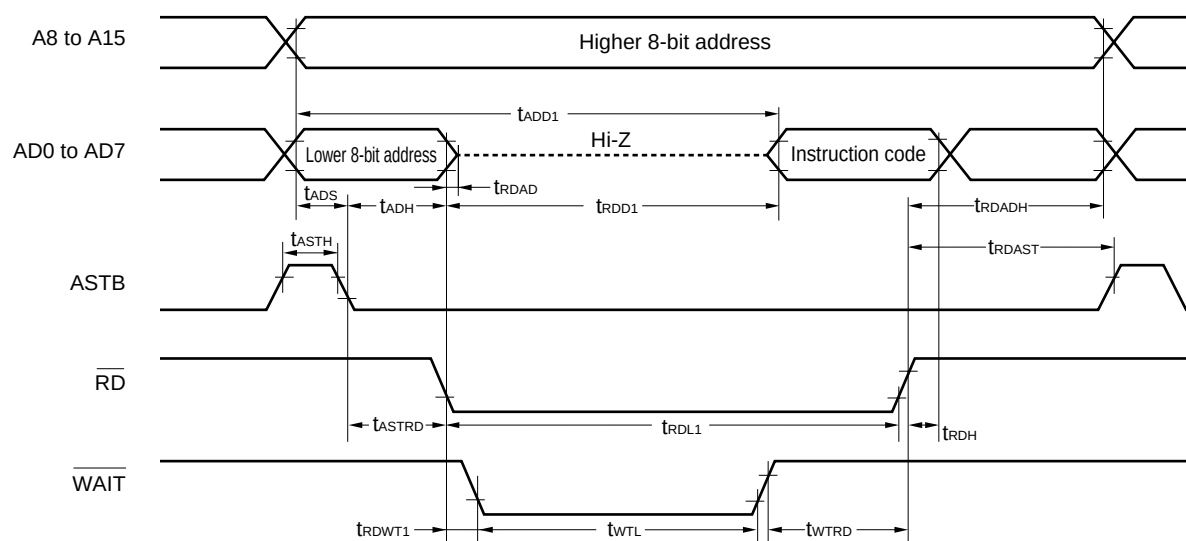


Read/Write Operation

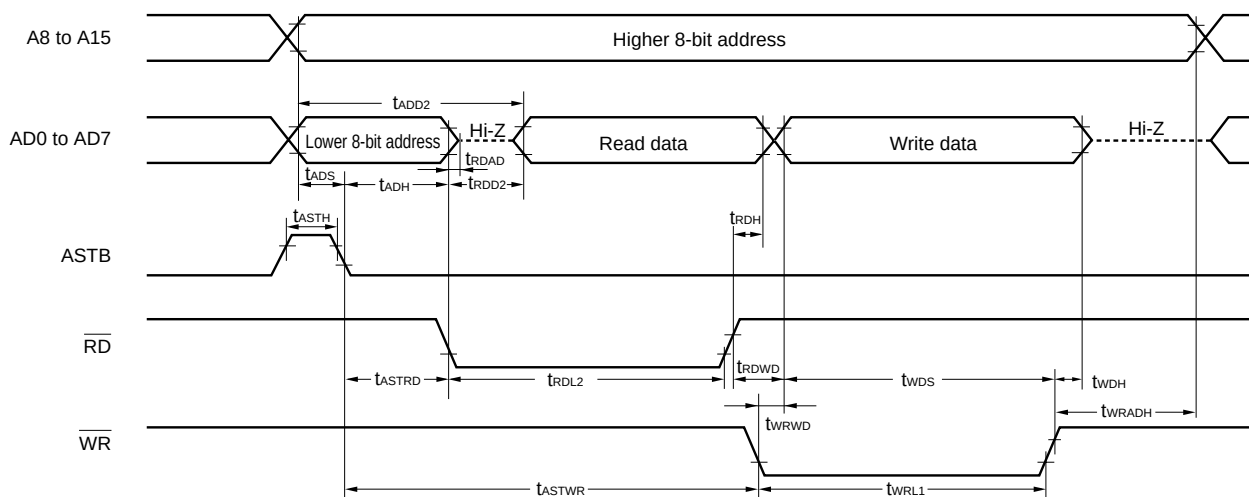
External fetch (no wait):



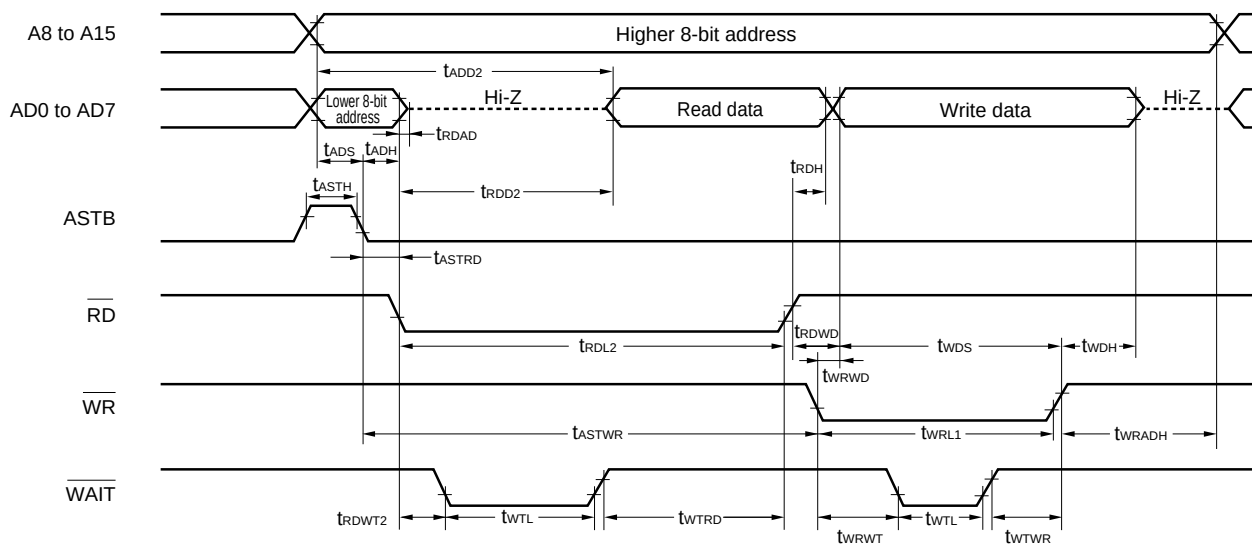
External fetch (wait insertion):



External data access (no wait):

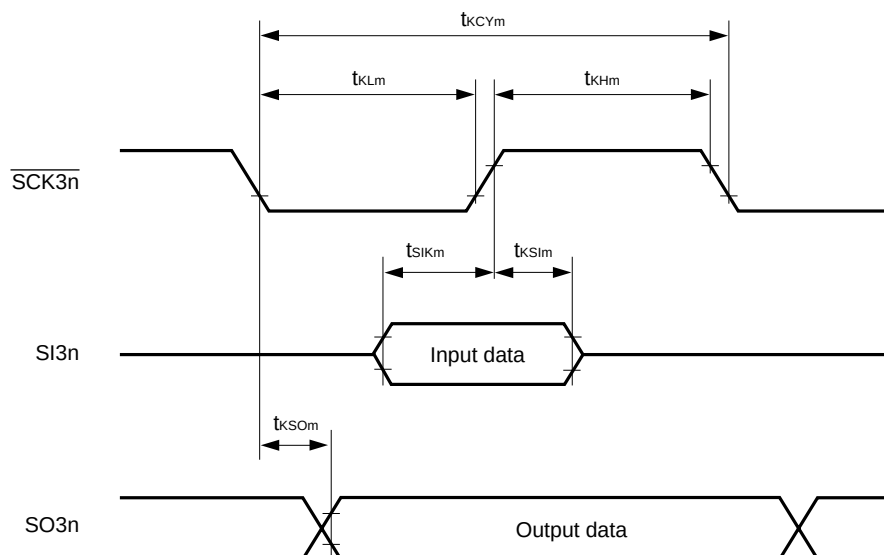


External data access (wait insertion):



Serial Transfer Timing

3-wire serial I/O mode:

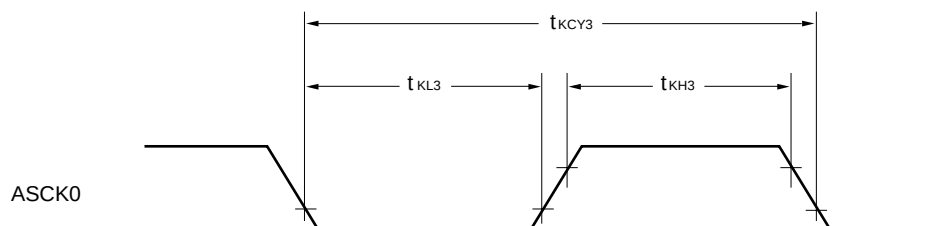


Remarks 1. $m = 1, 2$

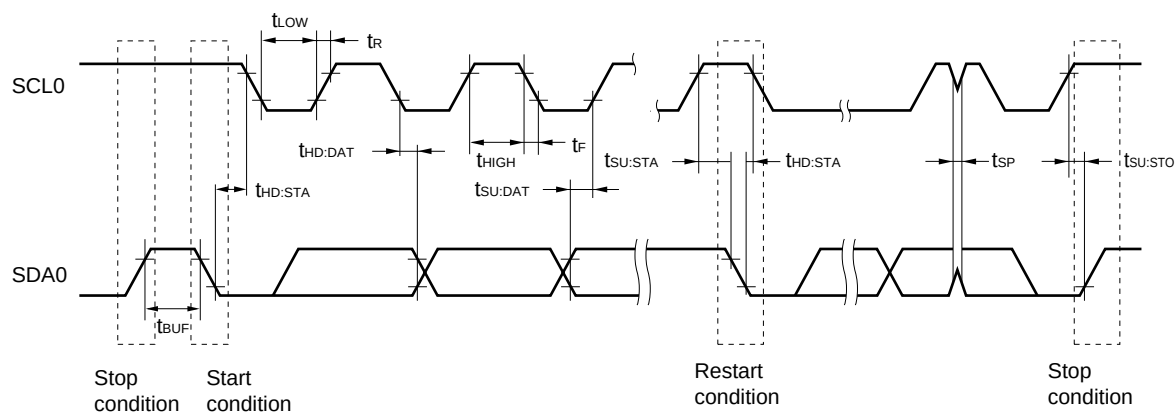
2. $\mu\text{PD780031A(A), 780032A(A), 780033A(A), 780034A(A):}$ $n = 0, 1$

$\mu\text{PD780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A):}$ $n = 0$

UART mode (external clock input):



I²C bus mode ($\mu\text{PD780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A)}$ only):



A/D Converter Characteristics ($T_A = -40$ to $+85^\circ\text{C}$, $V_{DD} = AV_{DD} = AV_{REF} = 1.8$ to 5.5 V, $AV_{SS} = V_{SS} = 0$ V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Resolution			10	10	10	bit
Overall error ^{Notes 1, 2}		$4.0\text{ V} \leq AV_{REF} \leq 5.5\text{ V}$		± 0.2	± 0.4	%FSR
		$2.7\text{ V} \leq AV_{REF} < 4.0\text{ V}$		± 0.3	± 0.6	%FSR
		$1.8\text{ V} \leq AV_{REF} < 2.7\text{ V}$		± 0.6	± 1.2	%FSR
Conversion time	t_{CONV}	$4.0\text{ V} \leq AV_{REF} \leq 5.5\text{ V}$	14		96	μs
		$2.7\text{ V} \leq AV_{REF} < 4.0\text{ V}$	19		96	μs
		$1.8\text{ V} \leq AV_{REF} < 2.7\text{ V}$	28		96	μs
Zero-scale error ^{Notes 1, 2}		$4.0\text{ V} \leq AV_{REF} \leq 5.5\text{ V}$			± 0.4	%FSR
		$2.7\text{ V} \leq AV_{REF} < 4.0\text{ V}$			± 0.6	%FSR
		$1.8\text{ V} \leq AV_{REF} < 2.7\text{ V}$			± 1.2	%FSR
Full-scale error ^{Notes 1, 2}		$4.0\text{ V} \leq AV_{REF} \leq 5.5\text{ V}$			± 0.4	%FSR
		$2.7\text{ V} \leq AV_{REF} < 4.0\text{ V}$			± 0.6	%FSR
		$1.8\text{ V} \leq AV_{REF} < 2.7\text{ V}$			± 1.2	%FSR
Integral linearity error ^{Note 1}		$4.0\text{ V} \leq AV_{REF} \leq 5.5\text{ V}$			± 2.5	LSB
		$2.7\text{ V} \leq AV_{REF} < 4.0\text{ V}$			± 4.5	LSB
		$1.8\text{ V} \leq AV_{REF} < 2.7\text{ V}$			± 8.5	LSB
Differential linearity error		$4.0\text{ V} \leq AV_{REF} \leq 5.5\text{ V}$			± 1.5	LSB
		$2.7\text{ V} \leq AV_{REF} < 4.0\text{ V}$			± 2.0	LSB
		$1.8\text{ V} \leq AV_{REF} < 2.7\text{ V}$			± 3.5	LSB
Analog input voltage	V_{IAN}		0		AV_{REF}	V
Reference voltage	AV_{REF}		1.8		AV_{DD}	V
Resistance between AV_{REF} and AV_{SS}	R_{REF}	When A/D conversion is not performed.	20	40		k Ω

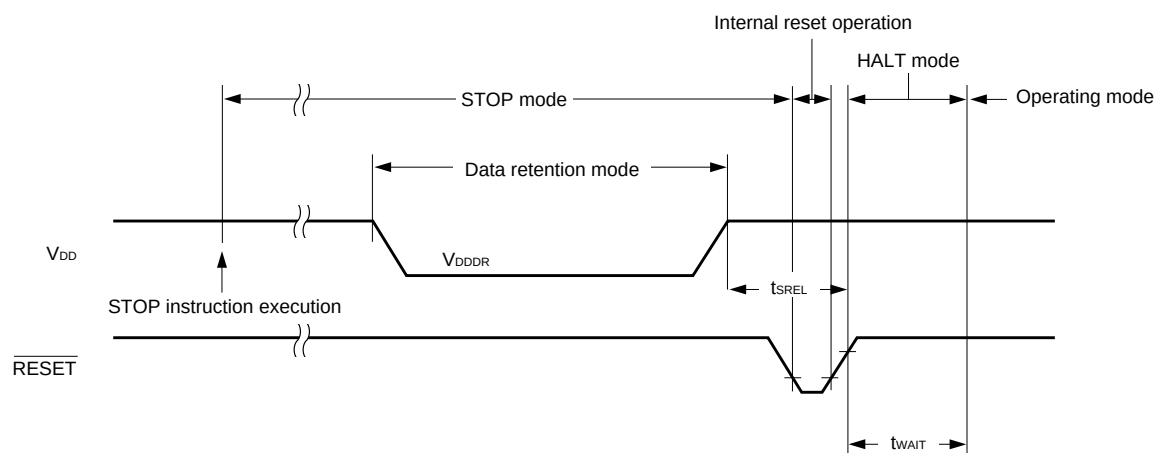
- Notes**
1. Excludes quantization error ($\pm 1/2$ LSB).
 2. This value is indicated as a ratio to the full-scale value.

Data Memory STOP Mode Low Supply Voltage Data Retention Characteristics ($T_A = -40$ to $+85^\circ\text{C}$)

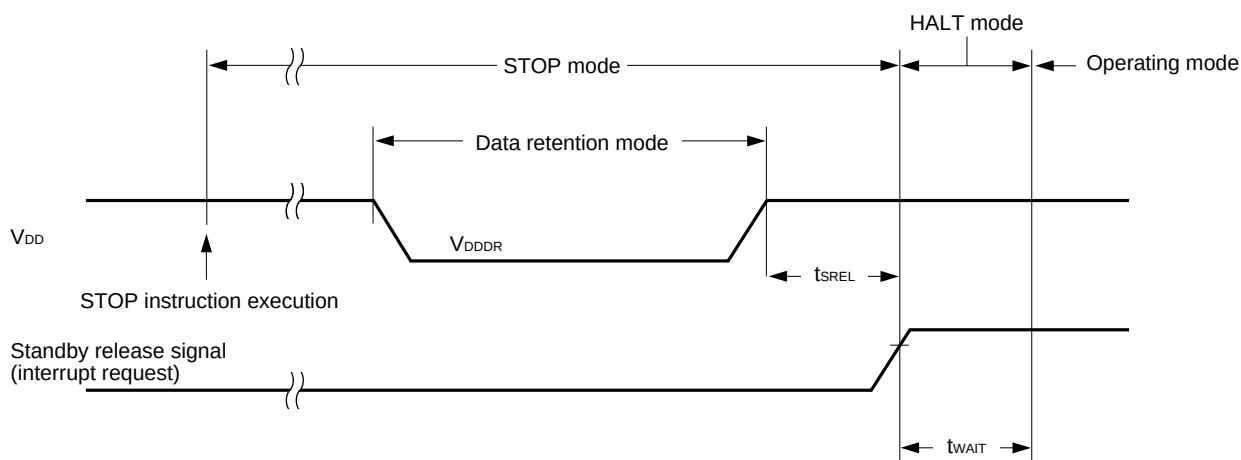
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Data retention power supply voltage	V_{DDDR}		1.6		5.5	V
Data retention power supply current	I_{DDDR}	Subsystem clock stop ($XT1 = V_{DD}$) and feed-back resistor disconnected		0.1	30	μA
Release signal set time	t_{SREL}		0			μs
Oscillation stabilization wait time	t_{WAIT}	Release by $\overline{\text{RESET}}$		$2^{17}/f_x$		s
		Release by interrupt request		Note		s

Note Selection of $2^{12}/f_x$ and $2^{14}/f_x$ to $2^{17}/f_x$ is possible using bits 0 to 2 (OSTS0 to OSTS2) of the oscillation stabilization time select register (OSTS).

Data Retention Timing (STOP Mode Release by $\overline{\text{RESET}}$)

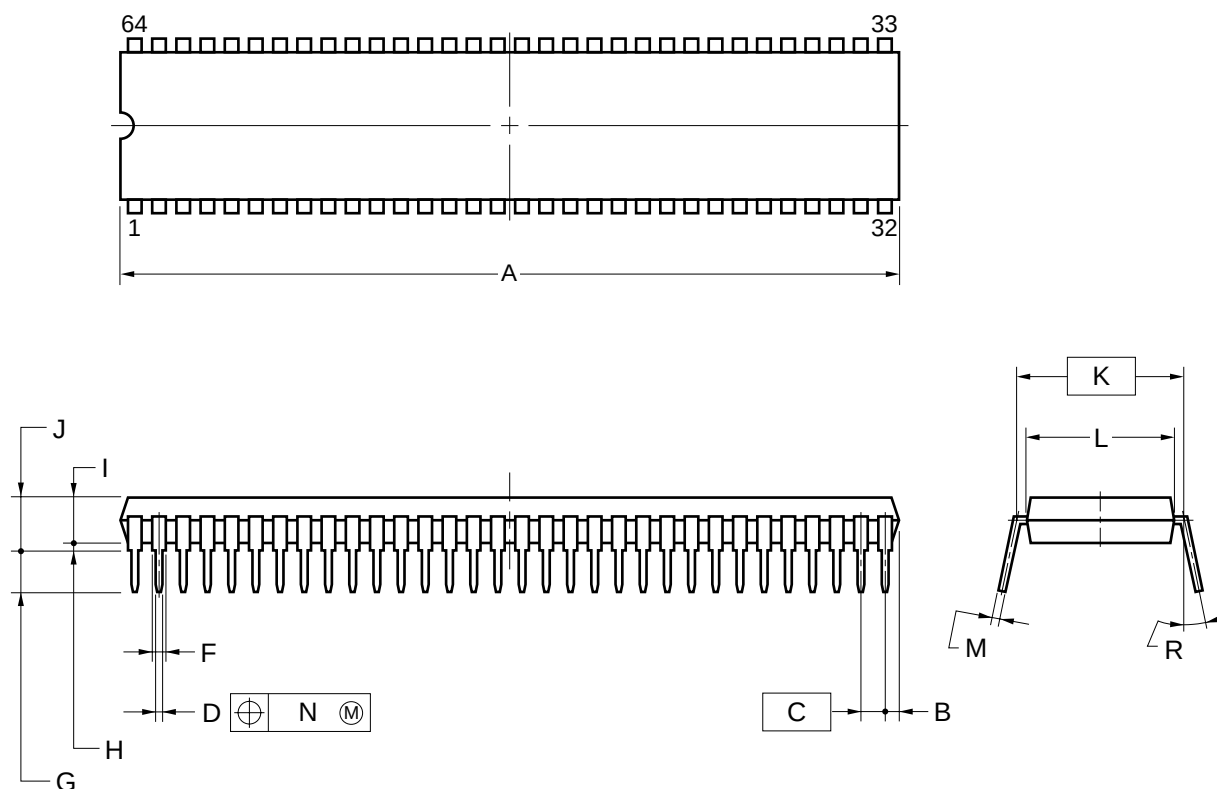


Data Retention Timing (Standby Release Signal: STOP Mode Release by Interrupt Request Signal)



13. PACKAGE DRAWINGS

64-PIN PLASTIC SDIP (19.05mm(750))



NOTES

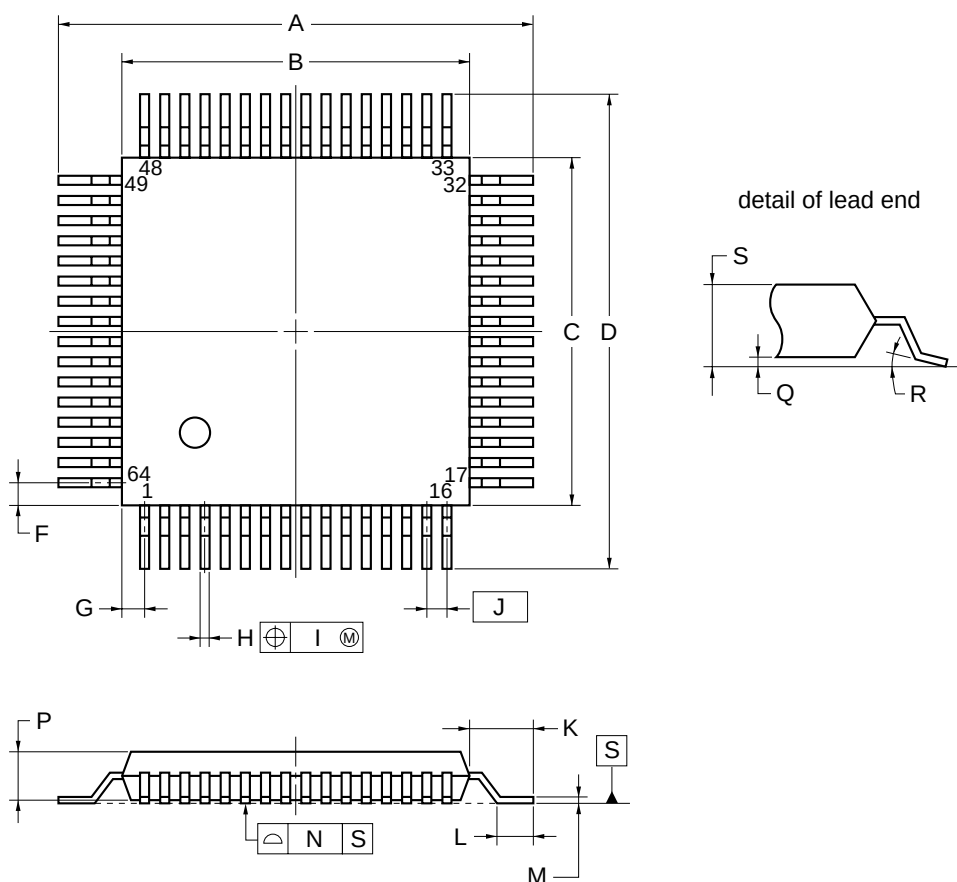
- Each lead centerline is located within 0.17 mm of its true position (T.P.) at maximum material condition.
- Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS
A	58.0 ^{+0.68} _{-0.20}
B	1.78 MAX.
C	1.778 (T.P.)
D	0.50±0.10
F	0.9 MIN.
G	3.2±0.3
H	0.51 MIN.
I	4.05 ^{+0.26} _{-0.20}
J	5.08 MAX.
K	19.05 (T.P.)
L	17.0±0.2
M	0.25 ^{+0.10} _{-0.05}
N	0.17
R	0 ~ 15°

P64C-70-750A,C-4

Remark The external dimensions and materials of the ES version are the same as those of the mass-produced version.

64-PIN PLASTIC QFP (14x14)



NOTE

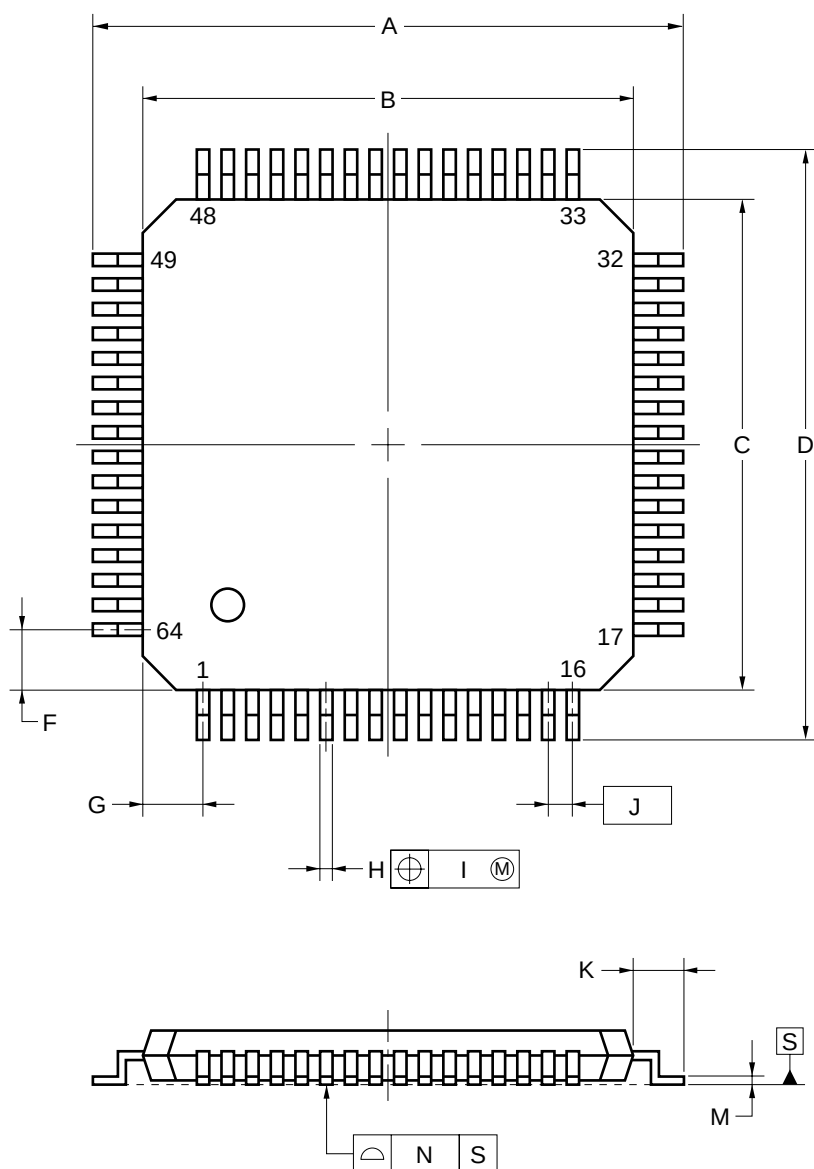
Each lead centerline is located within 0.15 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	17.6±0.4
B	14.0±0.2
C	14.0±0.2
D	17.6±0.4
F	1.0
G	1.0
H	0.37 ^{+0.08} _{-0.07}
I	0.15
J	0.8 (T.P.)
K	1.8±0.2
L	0.8±0.2
M	0.17 ^{+0.08} _{-0.07}
N	0.10
P	2.55±0.1
Q	0.1±0.1
R	5°±5°
S	2.85 MAX.

P64GC-80-AB8-5

Remark The external dimensions and materials of the ES version are the same as those of the mass-produced version.

64-PIN PLASTIC TQFP (12x12)



NOTE

Each lead centerline is located within 0.13 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	14.0±0.2
B	12.0±0.2
C	12.0±0.2
D	14.0±0.2
F	1.125
G	1.125
H	0.32 ^{+0.06} _{-0.10}
I	0.13
J	0.65 (T.P.)
K	1.0±0.2
L	0.5
M	0.17 ^{+0.03} _{-0.07}
N	0.10
P	1.0
Q	0.1±0.05
R	3° ^{+4°} _{-3°}
S	1.1±0.1
T	0.25
U	0.6±0.15

P64GK-65-9ET-3

Remark The external dimensions and materials of the ES version are the same as those of the mass-produced version.

14. RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions.

For details of the recommended soldering conditions, refer to the document **Semiconductor Device Mounting Technology Manual (C10535E)**.

For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

Table 14-1. Surface Mounting Type Soldering Conditions (1/2)

- (1) μPD780031AGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)
 μPD780032AGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)
 μPD780033AGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)
 μPD780034AGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)
 μPD780031AYGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)
 μPD780032AYGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)
 μPD780033AYGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)
 μPD780034AYGC(A)-xxx-AB8: 64-pin plastic QFP (14 × 14)

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared reflow	Package peak temperature: 235°C, Time: 30 seconds max. (at 210°C or higher), Count: Three times or less	IR35-00-3
VPS	Package peak temperature: 215°C, Time: 40 seconds max. (at 200°C or higher), Count: Three times or less	VP15-00-3
Wave soldering	Solder bath temperature: 260°C max., Time: 10 seconds max., Count: Once, Preheating temperature: 120°C max. (package surface temperature)	WS60-00-1
Partial heating	Pin temperature: 300°C max., Time: 3 seconds max. (per pin row)	—

Caution Do not use different soldering methods together (except for partial heating).

Table 14-1. Surface Mounting Type Soldering Conditions (2/2)

- (2) μPD780031AGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)
 μPD780032AGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)
 μPD780033AGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)
 μPD780034AGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)
 μPD780031AYGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)
 μPD780032AYGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)
 μPD780033AYGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)
 μPD780034AYGK(A)-xxx-9ET: 64-pin plastic TQFP (12 × 12)

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared reflow	Package peak temperature: 235°C, Time: 30 seconds max. (at 210°C or higher), Count: Two times or less, Exposure limit: 7 days ^{Note} (after that, prebake at 125°C for 10 hours)	IR35-107-2
VPS	Package peak temperature: 215°C, Time: 40 seconds max. (at 200°C or higher), Count: Two times or less, Exposure limit: 7 days ^{Note} (after that, prebake at 125°C for 10 hours)	VP15-107-2
Partial heating	Pin temperature: 300°C max., Time: 3 seconds max. (per pin row)	—

Note After opening the dry pack, store it at 25°C or less and 65%RH or less for the allowable storage period.

Caution Do not use different soldering methods together (except for partial heating).

Table 14-2. Insertion Type Soldering Conditions

- μPD780031ACW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))
 μPD780032ACW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))
 μPD780033ACW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))
 μPD780034ACW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))
 μPD780031AYCW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))
 μPD780032AYCW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))
 μPD780033AYCW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))
 μPD780034AYCW(A)-xxx: 64-pin plastic SDIP (19.05 mm (750))

Soldering Method	Soldering Condition
Wave soldering (only for pins)	Solder bath temperature: 260°C max., Time: 10 seconds max.
Partial heating	Pin temperature: 300°C max., Time: 3 seconds max. (per pin row)

Caution Apply wave soldering only to the pins and be careful not to bring solder into direct contact with the package.

APPENDIX A. DEVELOPMENT TOOLS

The following development tools are available for system development using the μPD780034A, 780034AY Subseries.

Also refer to **(5) Cautions on Using Development Tools**.

(1) Language Processing Software

RA78K0	Assembler package common to 78K/0 Series
CC78K0	C compiler package common to 78K/0 Series
DF780034	Device file for μPD780034A, 780034AY Subseries
CC78K0-L	C compiler library source file common to 78K/0 Series

(2) Flash Memory Writing Tools

Flashpro II (FL-PR2) Flashpro III (FL-PR3, PG-FP3)	Flash programmer dedicated to microcontrollers with on-chip flash memory
FA-64CW FA-64GC FA-64GK-9ET	Adapter for flash memory writing

(3) Debugging Tools

• When using in-circuit emulator IE-78K0-NS

IE-78K0-NS	In-circuit emulator common to 78K/0 Series
IE-70000-MC-PS-B	Power supply unit for IE-78K0-NS
IE-78K0-NS-PA	Performance board to enhance and expand the functions of IE-78K0-NS
IE-70000-98-IF-C	Adapter required when using PC-9800 series as host machine (excluding notebook PCs) (C bus supported)
IE-70000-CD-IF-A	PC card and interface cable when using notebook PC as host machine (PCMCIA socket supported)
IE-70000-PC-IF-C	Adapter required when using IBM PC/AT™ or compatible as host machine (ISA bus supported)
IE-70000-PCI-IF-A	Adapter required when using PC in which PCI bus is incorporated as host machine
IE-780034-NS-EM1	Emulation board to emulate μPD780034A, 780034AY Subseries
NP-64CW	Emulation probe for 64-pin plastic SDIP (CW type)
NP-64GC NP-64GC-TQ	Emulation probe for 64-pin plastic QFP (GC-AB8 type)
NP-64GK	Emulation probe for 64-pin plastic TQFP (GK-9ET type)
EV-9200GC-64	Conversion socket to connect the NP-64GC and a target system board on which a 64-pin plastic QFP (GC-AB8 type) can be mounted
TGC-064SAP	Conversion adapter to connect the NP-64GC-TQ and a target system board on which a 64-pin plastic QFP (GC-AB8 type) can be mounted
TGK-064SBP	Conversion adapter to connect the NP-64GK and a target system board on which a 64-pin plastic TQFP (GK-9ET type) can be mounted
ID78K0-NS	Integrated debugger for IE-78K0-NS
SM78K0	System simulator common to 78K/0 Series
DF780034	Device file for μPD780034A, 780034AY Subseries

• When using in-circuit emulator IE-78001-R-A

IE-78001-R-A	In-circuit emulator common to 78K/0 Series
IE-70000-98-IF-C	Adapter required when using PC-9800 series as host machine (excluding notebook PCs) (C bus supported)
IE-70000-PC-IF-C	Adapter required when using IBM PC/AT or compatible as host machine (ISA bus supported)
IE-70000-PCI-IF-A	Adapter required when using PC in which PCI bus is incorporated as host machine
IE-78000-R-SV3	Interface adapter and cable when using EWS as host machine
IE-780034-NS-EM1	Emulation board to emulate μ PD780034A, 780034AY Subseries
IE-78K0-R-EX1	Emulation probe conversion board necessary when using IE-780034-NS-EM1 on IE-78001-R-A
EP-78240CW-R	Emulation probe for 64-pin plastic SDIP (CW type)
EP-78240GC-R	Emulation probe for 64-pin plastic QFP (GC-AB8 type)
EP-78012GK-R	Emulation probe for 64-pin plastic TQFP (GK-9ET type)
EV-9200GC-64	Conversion socket to connect the EP-78240GC-R and a target system board on which a 64-pin plastic QFP (GC-AB8 type) can be mounted
TGK-064SBP	Conversion adapter to connect the EP-78012GK-R and a target system board on which a 64-pin plastic TQFP (GK-9ET type) can be mounted
ID78K0	Integrated debugger for IE-78001-R-A
SM78K0	System simulator common to 78K/0 Series
DF780034	Device file for μ PD780034A, 780034AY Subseries

(4) Real-Time OS

RX78K0	Real-time OS for 78K/0 Series
MX78K0	OS for 78K/0 Series

(5) Cautions on Using Development Tools

- The ID78K0-NS, ID78K0, and SM78K0 are used in combination with the DF780034.
- The CC78K0 and RX78K0 are used in combination with the RA78K0 and the DF780034.
- FL-PR2, FL-PR3, FA-64CW, FA-64GC, FA-64GK-9ET, NP-64CW, NP-64GC, NP-64GC-TQ, and NP-64GK are products made by Naito Densai Machida Mfg. Co., Ltd. (+81-44-822-3813).
- The TGC-064SAP, and TGC-064SBP are products made by TOKYO ELETECH CORPORATION.

Refer to: Daimaru Kogyo, Ltd.

Tokyo Electronic Division (+81-3-3820-7112)

Osaka Electronic Division (+81-6-6244-6672)

- For third-party development tools, see the **Single-chip Microcontroller Development Tool Selection Guide (U11069E)**.
- The host machines and OSs supporting each software are as follows.

Software	Host Machine [OS]	PC	EWS
		PC-9800 series [Japanese Windows™] IBM PC/AT and compatibles [Japanese/English Windows]	HP9000 series 700™ [HP-UX™] SPARCstation™ [SunOS™, Solaris™] NEWS™ (RISC) [NEWS-OS™]
RA78K0		√ Note	√
CC78K0		√ Note	√
ID78K0-NS		√	—
ID78K0		√	√
SM78K0		√	—
RX78K0		√ Note	√
MX78K0		√ Note	√

Note DOS-based software

APPENDIX B. RELATED DOCUMENTS

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Documents Related to Devices

Document Name	Document No.
μPD780024A, 780034A, 780024AY, 780034AY Subseries User's Manual	U14046E
μPD780031A(A), 780032A(A), 780033A(A), 780034A(A), 780031AY(A), 780032AY(A), 780033AY(A), 780034AY(A) Data Sheet	This document
μPD780031A, 780032A, 780033A, 780034A, 780031AY, 780032AY, 780033AY, 780034AY Data Sheet	U14044E
μPD78F0034A, 78F0034AY Data Sheet	U14040E
78K/0 Series User's Manual Instructions	U12326E

Documents Related to Development Tools (User's Manuals)

Document Name		Document No.
RA78K0 Assembler Package	Operation	U11802E
	Assembly Language	U11801E
	Structured Assembly Language	U11789E
CC78K0 C Compiler	Operation	U11517E
	Language	U11518E
IE-78K0-NS In-circuit Emulator		—
IE-78001-R-A In-circuit Emulator		—
IE-780034-NS-EM1 Emulation Board		To be prepared
EP-78240 Emulation Probe		U10332E
EP-78012GK-R Emulation Probe		—
SM78K0S, SM78K0 System Simulator Ver. 2.10 or Later Windows based	Operation	U14611E
SM78K Series System Simulator Ver. 2.10 or Later Windows based	External Part User Open Interface Specifications	To be prepared
ID78K0-NS Integrated Debugger Ver. 2.00 or Later Windows based	Operation	U14379E
ID78K0-NS, ID78K0S-NS Integrated Debugger Ver. 2.20 or Later Windows based	Operation	To be prepared
ID78K0 Integrated Debugger EWS based	Reference	—
ID78K0 Integrated Debugger Windows based	Reference	U11539E
	Guide	U11649E

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Documents Related to Embedded Software (User's Manuals)

Document Name		Document No.
78K/0 Series Real-time OS	Fundamentals	U11537E
	Installation	U11536E
78K/0 Series OS MX78K0	Fundamental	U12257E

Other Related Documents

Document Name	Document No.
SEMICONDUCTOR SELECTION GUIDE Products & Packages (CD-ROM)	X13769X
Semiconductor Device Mounting Technology Manual	C10535E
Quality Grades on NEC Semiconductor Devices	C11531E
NEC Semiconductor Device Reliability/Quality Control System	C10983E
Guide to Prevent Damage for Semiconductor Devices by Electrostatic Discharge (ESD)	C11892E
Guide to Microcomputer-Related Products by Third Party	—

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NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note:

Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note:

No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note:

Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

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- Availability of related technical literature
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