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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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16M-BIT MASK-PROGRAMMABLE ROM

2M-WORD BY 8-BIT (BYTE MODE) / 1M-WORD BY 16-BIT (WORD MODE)

Description

The μ PD23C16000BL is a 16,777,216 bits mask-programmable ROM. The word organization is selectable (BYTE mode : 2,097,152 words by 8 bits, WORD mode : 1,048,576 words by 16 bits).

The active levels of OE (Output Enable Input) can be selected with mask-option.

The μ PD23C16000BL is packed in 48-pin PLASTIC TSOP(I) and 44-pin PLASTIC SOP.

Features

- Word organization
 - 2,097,152 words by 8 bits (BYTE mode)
 - 1,048,576 words by 16 bits (WORD mode)
- Operating supply voltage : $V_{CC} = 2.7\text{ V to }3.6\text{ V}$

Operating supply voltage V_{CC}	Access time ns (MAX.)	Power supply current (Active mode) mA(MAX.)	Standby current (CMOS level input) μ A(MAX.)
3.0 V \pm 0.3 V	90	30	30
3.3 V \pm 0.3 V	85		

Ordering Information

Part Number	Package
μ PD23C16000BLGY-xxx-MJH	48-pin PLASTIC TSOP(I) (12 x 18) (Normal bent)
μ PD23C16000BLGY-xxx-MKH	48-pin PLASTIC TSOP(I) (12 x 18) (Reverse bent)
μ PD23C16000BLGX-xxx ^{Note}	44-pin PLASTIC SOP (15.24 mm (600))
<R> μ PD23C16000BLGY-xxx-MJH-A	48-pin PLASTIC TSOP(I) (12 x 18) (Normal bent)
<R> μ PD23C16000BLGY-xxx-MKH-A	48-pin PLASTIC TSOP(I) (12 x 18) (Reverse bent)
<R> μ PD23C16000BLGX-xxx-A ^{Note}	44-pin PLASTIC SOP (15.24 mm (600))

Note Under development

Remarks 1. xxx : ROM code suffix No.

<R> **2.** Products with -A at the end of the part number are lead-free products.

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Pin Configurations

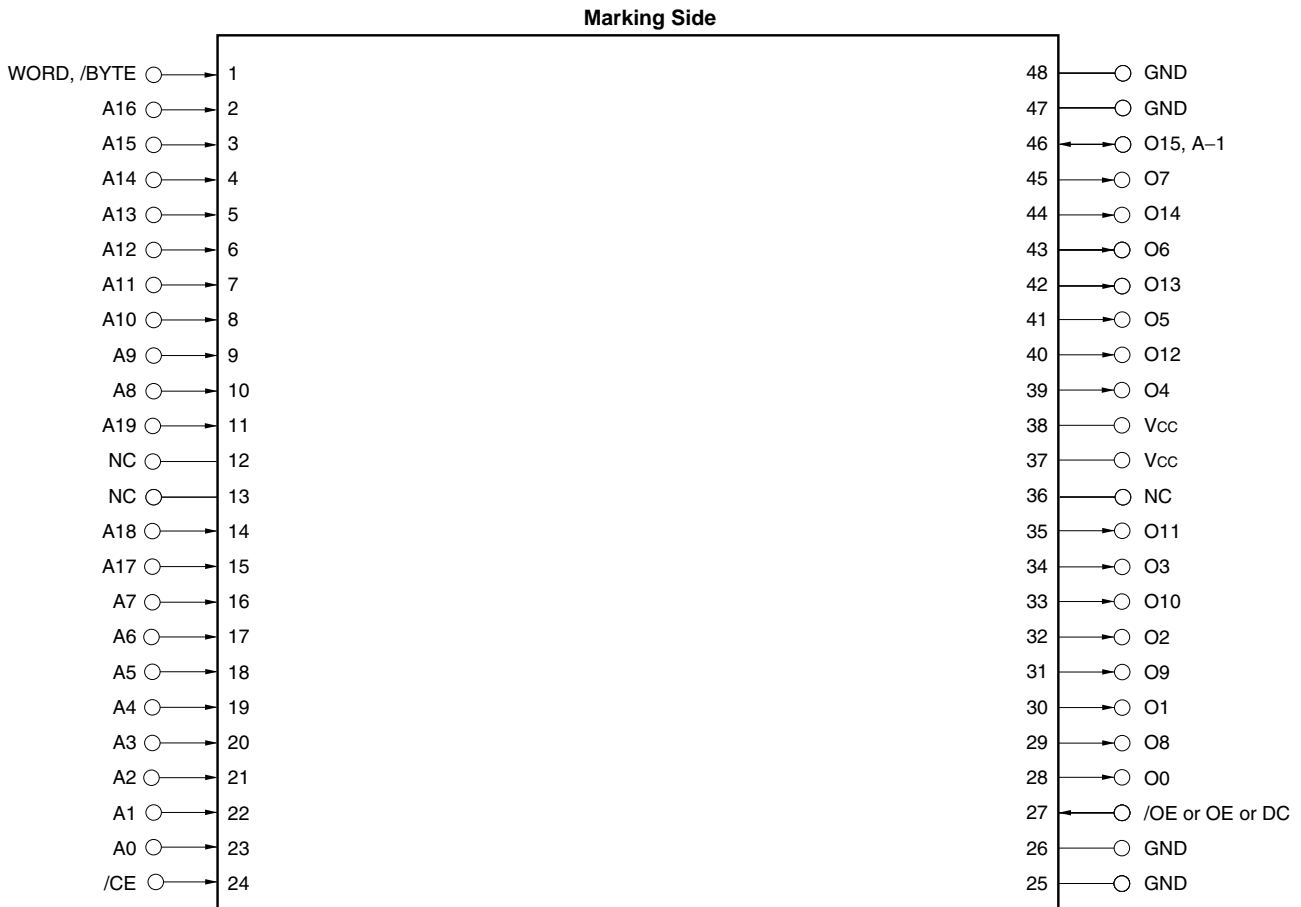
/xxx indicates active low signal.

48-pin PLASTIC TSOP(I) (12 x 18) (Normal bent)

[μPD23C16000BLGY-xxx-MJH]

[μPD23C16000BLGY-xxx-MJH-A]

<R>



- A0 to A19 : Address inputs
- O0 to O7, O8 to O14 : Data outputs
- O15, A-1 : Data output 15 (WORD mode),
LSB Address input (BYTE mode)
- WORD, /BYTE : Mode select
- /CE : Chip Enable
- /OE or OE : Output Enable
- Vcc : Supply voltage
- GND : Ground
- NC ^{Note} : No Connection
- DC : Don't Care

Note Some signals can be applied because this pin is not connected to the inside of the chip.

Remark Refer to **Package Drawings** for the 1-pin index mark.

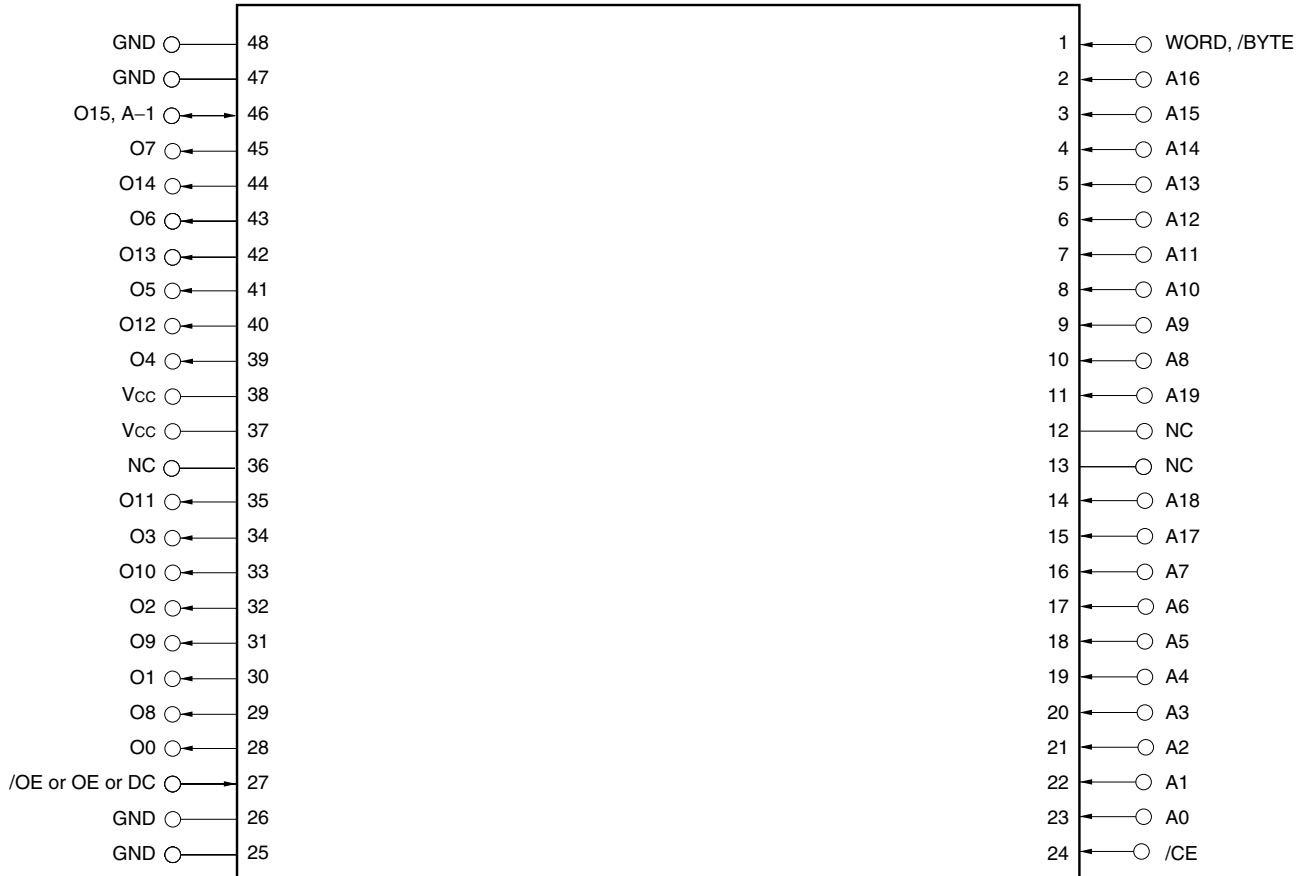
48-pin PLASTIC TSOP(I) (12 x 18) (Reverse bent)

[μPD23C16000BLGY-xxx-MKH]

<R>

[μPD23C16000BLGY-xxx-MKH-A]

Marking Side



- A0 to A19 : Address inputs
- O0 to O7, O8 to O14 : Data outputs
- O15, A-1 : Data output 15 (WORD mode),
LSB Address input (BYTE mode)
- WORD, /BYTE : Mode select
- /CE : Chip Enable
- /OE or OE : Output Enable
- Vcc : Supply voltage
- GND : Ground
- NC ^{Note} : No Connection
- DC : Don't Care

Note Some signals can be applied because this pin is not connected to the inside of the chip.

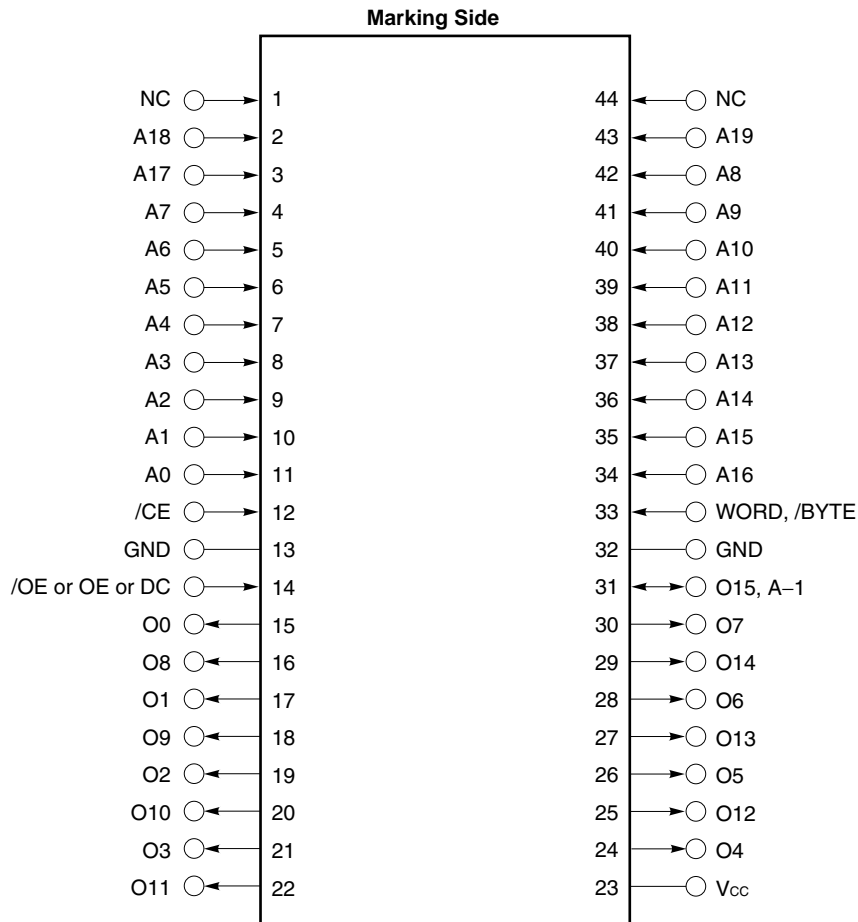
Remark Refer to **Package Drawings** for the 1-pin index mark.

44-pin PLASTIC SOP (15.24 mm (600))

[μPD23C16000BLGX-xxx]

<R>

[μPD23C16000BLGX-xxx-A]



- A0 to A19 : Address inputs
- O0 to O7, O8 to O14 : Data outputs
- O15, A-1 : Data output 15 (WORD mode),
LSB Address input (BYTE mode)
- WORD, /BYTE : Mode select
- /CE : Chip Enable
- /OE or OE : Output Enable
- V_{cc} : Supply voltage
- GND : Ground
- NC ^{Note} : No Connection
- DC : Don't Care

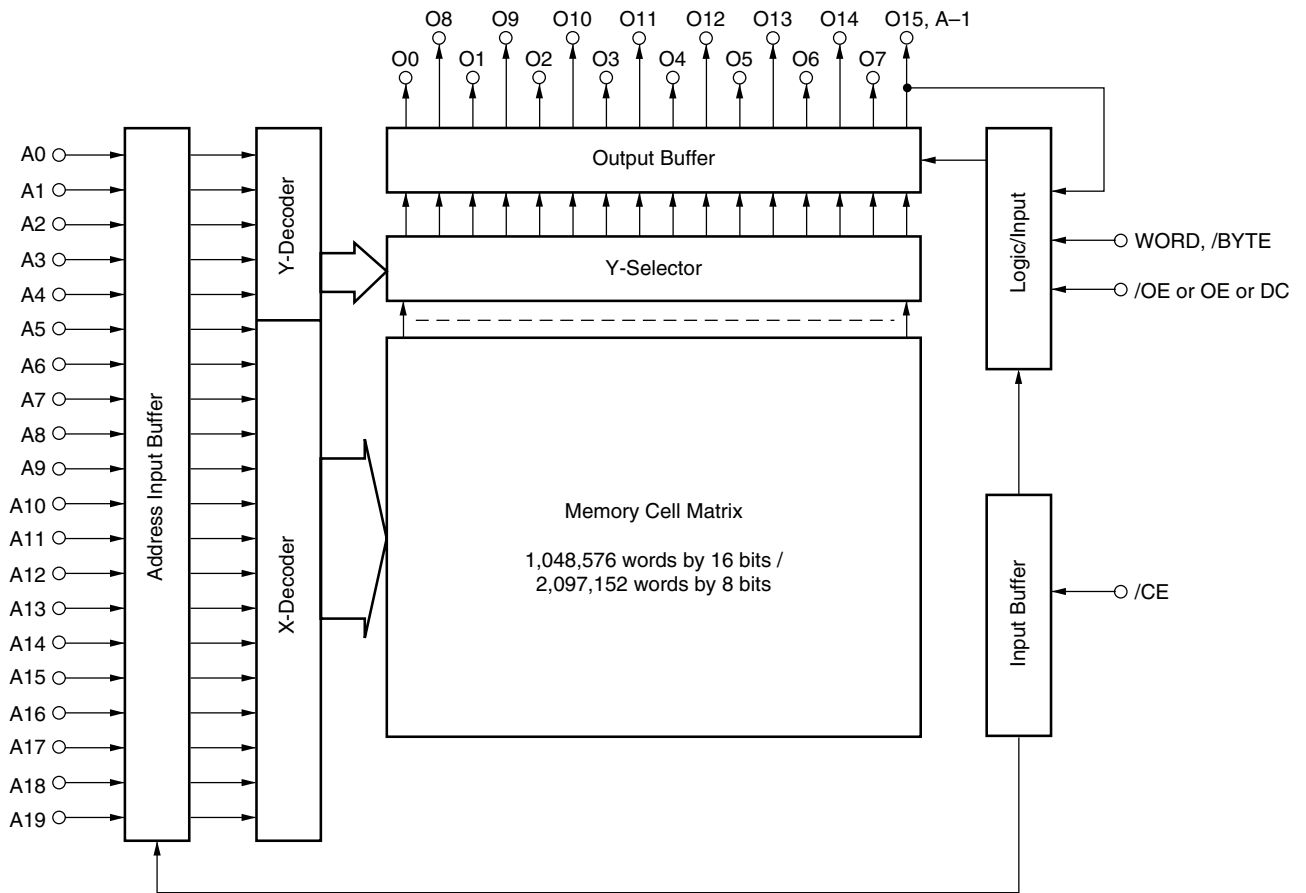
Note Some signals can be applied because this pin is not connected to the inside of the chip.

Remark Refer to **Package Drawings** for the 1-pin index mark.

Input / Output Pin Functions

Pin name	Input / Output	Function
WORD, /BYTE	Input	The pin for switching WORD mode and BYTE mode. High level : WORD mode (1M-word by 16-bit) Low level : BYTE mode (2M-word by 8-bit)
A0 to A19 (Address inputs)	Input	Address input pins. A0 to A19 are used differently in the WORD mode and the BYTE mode. WORD mode (1M-word by 16-bit) A0 to A19 are used as 20 bits address signals. BYTE mode (2M-word by 8-bit) A0 to A19 are used as the upper 20 bits of total 21 bits of address signal. (The least significant bit (A-1) is combined to O15.)
O0 to O7, O8 to O14 (Data outputs)	Output	Data output pins. O0 to O7, O8 to O14 are used differently in the WORD mode and the BYTE mode. WORD mode (1M-word by 16-bit) The lower 15 bits of 16 bits data outputs to O0 to O14. (The most significant bit (O15) combined to A-1.) BYTE mode (2M-word by 8-bit) 8 bits data outputs to O0 to O7 and also O8 to O14 are high impedance.
O15, A-1 (Data output 15, LSB Address input)	Output, Input	O15, A-1 are used differently in the WORD mode and the BYTE mode. WORD mode (1M-word by 16-bit) The most significant output data bus (O15). BYTE mode (2M-word by 8-bit) The least significant address bus (A-1).
/CE (Chip Enable)	Input	Chip activating signal. When the OE is active, output states are following. High level : High-Z Low level : Data out
/OE or OE or DC (Output Enable, Don't care)	Input	Output enable signal. The active level of OE is mask option. The active level of OE can be selected from high active, low active and Don't care at order.
Vcc	-	Supply voltage
GND	-	Ground
NC	-	Not internally connected. (The signal can be connected.)

Block Diagram



Mask Option

The active levels of output enable pin (/OE or OE or DC) are mask programmable and optional, and can be selected from among " 0 " " 1 " " x " shown in the table below.

Option	/OE or OE or DC	OE active level
0	/OE	L
1	OE	H
x	DC	Don't care

Operation modes for each option are shown in the tables below.

Operation mode (Option : 0)

/CE	/OE	Mode	Output state
L	L	Active	Data out
	H		High-Z
H	H or L	Standby	High-Z

Operation mode (Option : 1)

/CE	OE	Mode	Output state
L	L	Active	High-Z
	H		Data out
H	H or L	Standby	High-Z

Operation mode (Option : x)

/CE	DC	Mode	Output state
L	H or L	Active	Data out
H	H or L	Standby	High-Z

Remark L : Low level input
 H : High level input

Electrical Specifications

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V_{CC}		-0.3 to +4.6	V
Input voltage	V_I		-0.3 to $V_{CC}+0.3$	V
Output voltage	V_O		-0.3 to $V_{CC}+0.3$	V
Operating ambient temperature	T_A		-10 to +70	°C
Storage temperature	T_{stg}		-65 to +150	°C

Caution Exposing the device to stress above those listed in Absolute Maximum Ratings could cause permanent damage. The device is not meant to be operated under conditions outside the limits described in the operational section of this specification. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

Capacitance ($T_A = 25\text{ °C}$)

Parameter	Symbol	Test condition	MIN.	TYP.	MAX.	Unit
Input capacitance	C_I	$f = 1\text{ MHz}$			10	pF
Output capacitance	C_O				12	pF

DC Characteristics ($T_A = -10\text{ to }+70\text{ °C}$, $V_{CC} = 2.7\text{ to }3.6\text{ V}$)

Parameter	Symbol	Test conditions	MIN.	TYP.	MAX.	Unit
High level input voltage	V_{IH}		2.0		$V_{CC} + 0.3$	V
Low level input voltage	V_{IL}	$V_{CC} = 3.0\text{ V} \pm 0.3\text{ V}$	-0.3		+0.5	V
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	-0.3		+0.8	V
High level output voltage	V_{OH}	$I_{OH} = -100\ \mu\text{A}$	2.4			V
Low level output voltage	V_{OL}	$I_{OL} = 2.1\text{ mA}$			0.4	V
Input leakage current	I_{LI}	$V_I = 0\text{ V to }V_{CC}$	-10		+10	μA
Output leakage current	I_{LO}	$V_O = 0\text{ V to }V_{CC}$, Chip deselected	-10		+10	μA
Power supply current	I_{CC1}	/CE = V_{IL} (Active mode), $I_O = 0\text{ mA}$	$V_{CC} = 3.0\text{ V} \pm 0.3\text{ V}$		30	mA
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		30	
Standby current	I_{CC3}	/CE = $V_{CC} - 0.2\text{ V}$ (Standby mode)			30	μA

AC Characteristics (TA = -10 to +70 °C, Vcc = 2.7 to 3.6 V)

Parameter	Symbol	Test condition	Vcc = 3.0 V ± 0.3 V			Vcc = 3.3 V ± 0.3 V			Unit
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Address access time	t _{ACC}				90			85	ns
Address skew time	t _{SKEW}	Note			10			10	ns
Chip enable access time	t _{CE}				90			85	ns
Output enable access time	t _{OE}				25			25	ns
Output hold time	t _{OH}		0			0			ns
Output disable time	t _{DF}		0		25	0		25	ns
WORD, /BYTE access time	t _{WB}				90			85	ns

Note t_{SKEW} indicates the following three types of time depending on the condition.

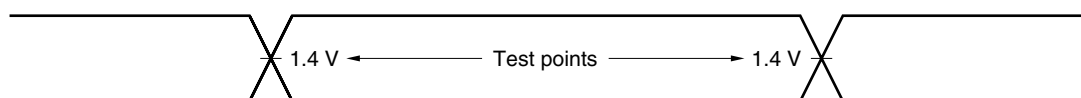
- 1) When switching /CE from high level to low level, t_{SKEW} is the time from the /CE low level input point until the next address is determined.
- 2) When switching /CE from low level to high level, t_{SKEW} is the time from the address change start point to the /CE high level input point.
- 3) When /CE is fixed to low level, t_{SKEW} is the time from the address change start point until the next address is determined.

Since specs are defined for t_{SKEW} only when /CE is active, t_{SKEW} is not subject to limitations when /CE is switched from high level to low level following address determination, or when the address is changed after /CE is switched from low level to high level.

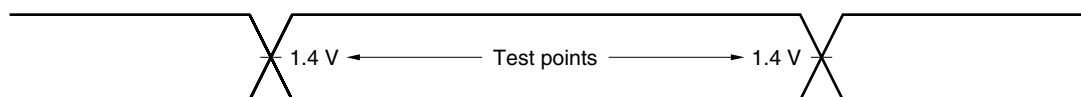
Remark t_{DF} is the time from inactivation of Chip Enable input (/CE) or Output Enable input (/OE or OE) to high impedance state output.

AC Test Conditions

Input waveform (Rise / Fall time ≤ 5 ns)



Output waveform



Output load

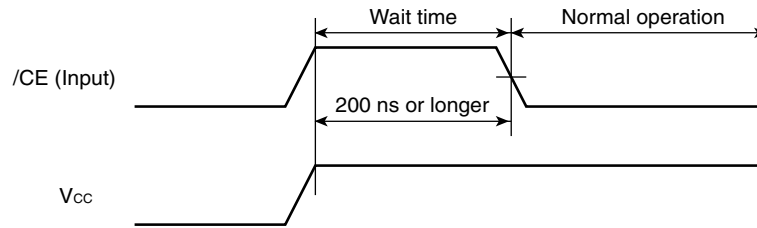
1TTL + 100 pF

Cautions on power application

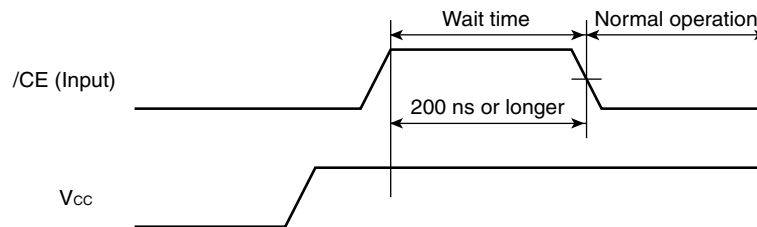
To ensure normal operation, always apply power using /CE following the procedure shown below.

- 1) Input a high level to /CE during and after power application.
- 2) Hold the high level input to /CE for 200 ns or longer (wait time).
- 3) Start normal operation after the wait time has elapsed.

Power Application Timing Chart 1 (When /CE is made high at power application)

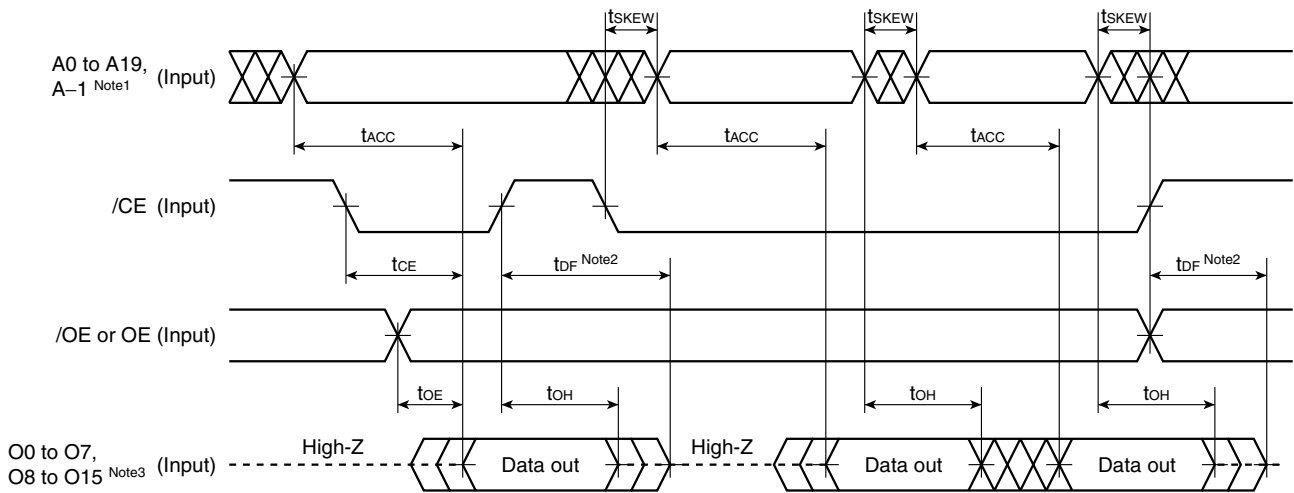


Power Application Timing Chart 2 (When /CE is made high after power application)



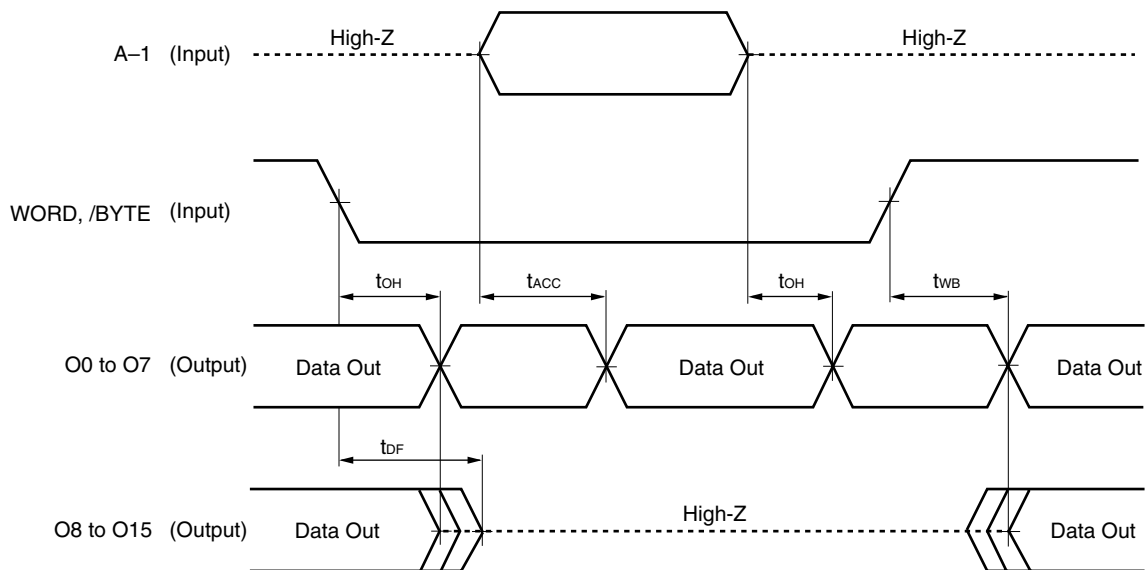
Caution Other signals can be either high or low during the wait time.

Read Cycle Timing Chart



- Notes**
1. During WORD mode, A-1 is O15.
 2. t_{DF} is the time from inactivation of Chip Enable input ($/CE$) or Output Enable input ($/OE$ or OE) to high impedance state output.
 3. During BYTE mode, O8 to O14 are high impedance and O15 is A-1.

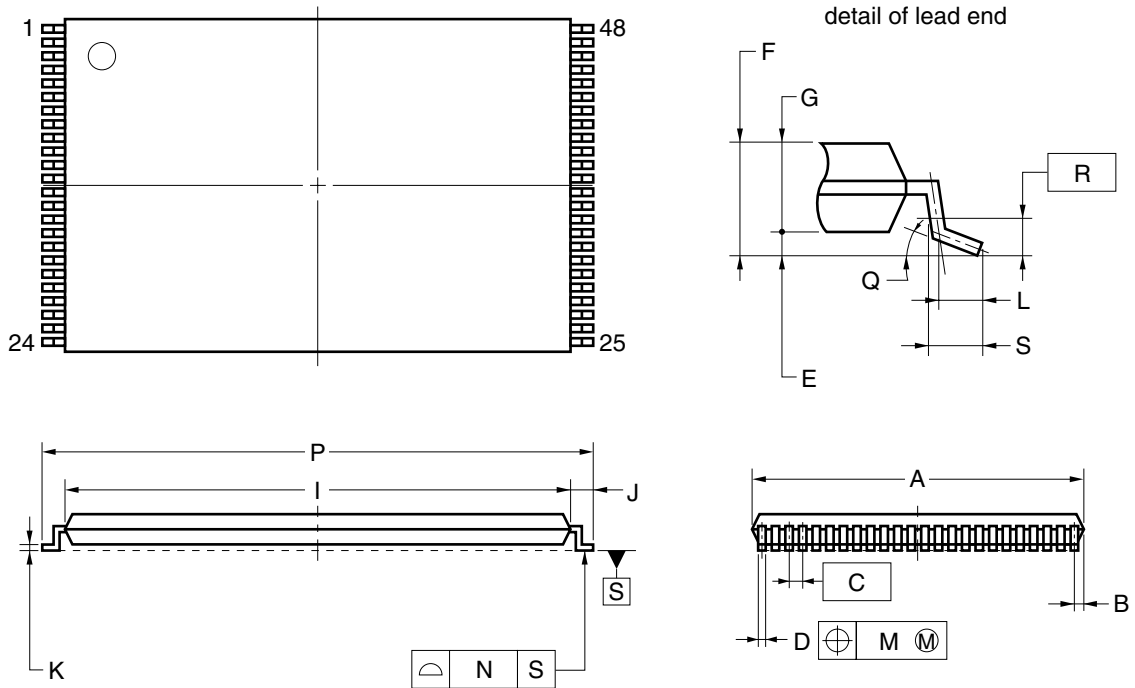
WORD, /BYTE Switch Timing Chart



Remark Chip Enable ($/CE$) and Output Enable ($/OE$ or OE) : Active.

Package Drawings

48-PIN PLASTIC TSOP(I) (12x18)



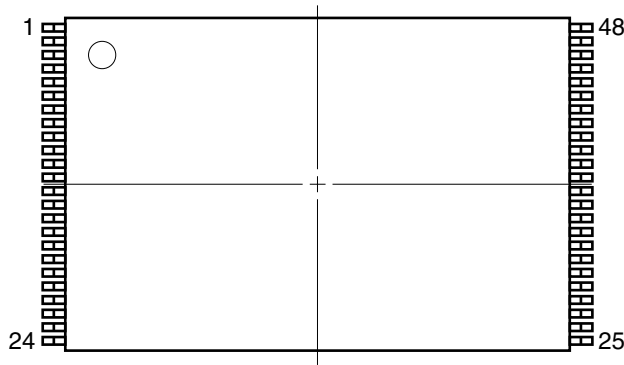
NOTES

1. Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.
2. "A" excludes mold flash. (Includes mold flash : 12.4 mm MAX.)

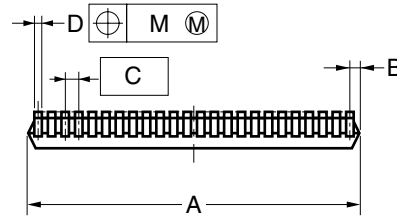
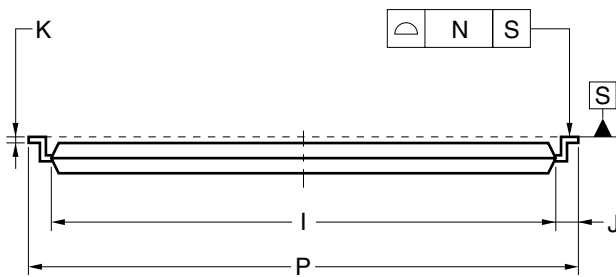
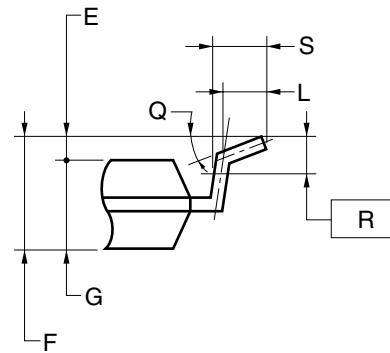
ITEM	MILLIMETERS
A	12.0±0.1
B	0.45 MAX.
C	0.5 (T.P.)
D	0.22±0.05
E	0.1±0.05
F	1.2 MAX.
G	1.0±0.05
I	16.4±0.1
J	0.8±0.2
K	0.145±0.05
L	0.5
M	0.10
N	0.10
P	18.0±0.2
Q	3° ^{+5°} _{-3°}
R	0.25
S	0.60±0.15

S48GY-50-MJH1-1

48-PIN PLASTIC TSOP(I) (12x18)



detail of lead end



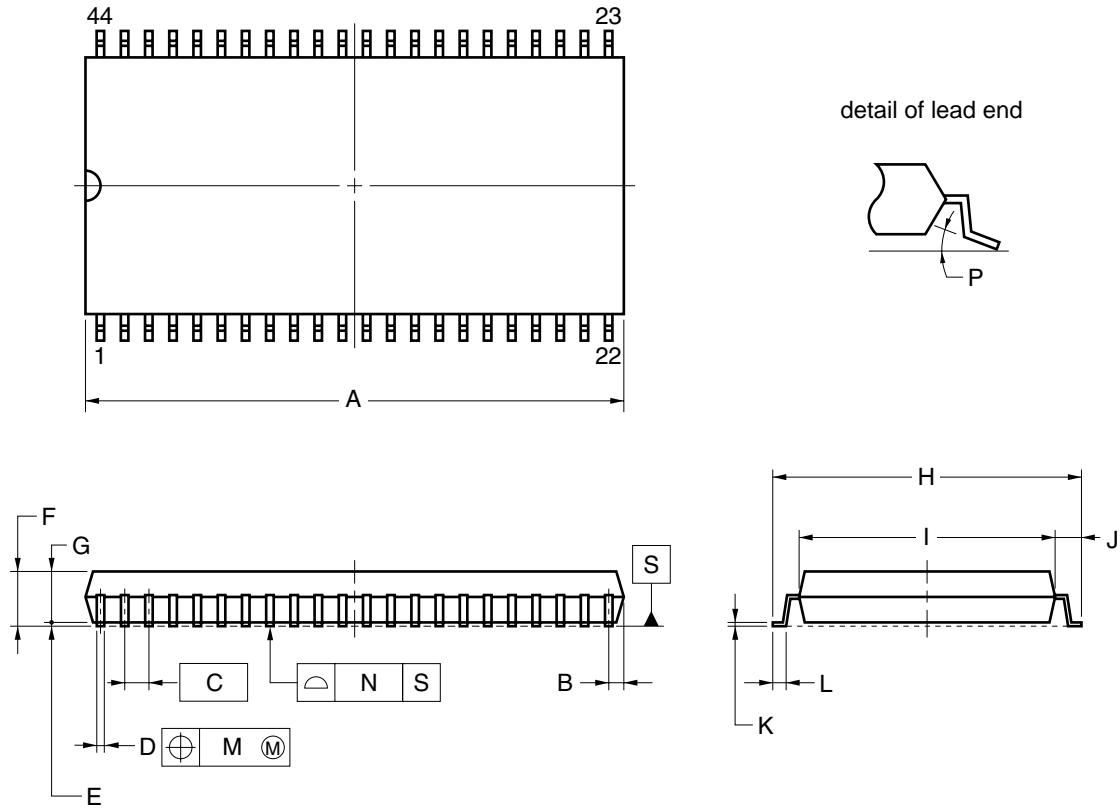
NOTES

1. Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.
2. "A" excludes mold flash. (Includes mold flash : 12.4 mm MAX.)

ITEM	MILLIMETERS
A	12.0±0.1
B	0.45 MAX.
C	0.5 (T.P.)
D	0.22±0.05
E	0.1±0.05
F	1.2 MAX.
G	1.0±0.05
I	16.4±0.1
J	0.8±0.2
K	0.145±0.05
L	0.5
M	0.10
N	0.10
P	18.0±0.2
Q	3° ^{+5°} -3°
R	0.25
S	0.60±0.15

S48GY-50-MKH1-1

44-PIN PLASTIC SOP (15.24 mm (600))



NOTE

Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS
A	27.83 ^{+0.4} _{-0.05}
B	0.78 MAX.
C	1.27 (T.P.)
D	0.42 ^{+0.08} _{-0.07}
E	0.15±0.1
F	3.0 MAX.
G	2.7±0.05
H	16.04±0.3
I	13.24±0.1
J	1.4±0.2
K	0.22 ^{+0.08} _{-0.07}
L	0.8±0.2
M	0.12
N	0.10
P	3° ^{+7°} _{-3°}

P44GX-50-600A-4

Recommended Soldering Conditions

Please consult with our sales offices for soldering conditions of the μ PD23C16000BL.

Types of Surface Mount Device

- μ PD23C16000BLGY-MJH : 48-pin PLASTIC TSOP(I) (12 x 18) (Normal bent)
- μ PD23C16000BLGY-MKH : 48-pin PLASTIC TSOP(I) (12 x 18) (Reverse bent)
- μ PD23C16000BLGX : 44-pin PLASTIC SOP (15.24 mm (600))
- <R> μ PD23C16000BLGY-MJH-A : 48-pin PLASTIC TSOP(I) (12 x 18) (Normal bent)
- <R> μ PD23C16000BLGY-MKH-A : 48-pin PLASTIC TSOP(I) (12 x 18) (Reverse bent)
- <R> μ PD23C16000BLGX-A : 44-pin PLASTIC SOP (15.24 mm (600))

Revision History

Edition/ Date	Page		Type of revision	Location	Description (Previous edition → This edition)
	This edition	Previous edition			
5th edition/ Feb. 2006	p.1	p.1	Addition	Ordering Information	Lead-free products have been added
	pp.2-4	pp.2-4	Addition	Pin Configuration	Lead-free products have been added
	p.15	p.15	Addition	Recommended Soldering Conditions	Lead-free products have been added

[MEMO]

[MEMO]

NOTES FOR CMOS DEVICES

① VOLTAGE APPLICATION WAVEFORM AT INPUT PIN

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (MAX) and V_{IH} (MIN) due to noise, etc., the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (MAX) and V_{IH} (MIN).

② HANDLING OF UNUSED INPUT PINS

Unconnected CMOS device inputs can be cause of malfunction. If an input pin is unconnected, it is possible that an internal input level may be generated due to noise, etc., causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND via a resistor if there is a possibility that it will be an output pin. All handling related to unused pins must be judged separately for each device and according to related specifications governing the device.

③ PRECAUTION AGAINST ESD

A 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 when it has occurred. Environmental control must be adequate. When it is dry, a humidifier should be used. It is recommended to avoid using insulators that easily build up 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 benches and floors should be grounded. The operator should be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with mounted semiconductor devices.

④ STATUS BEFORE INITIALIZATION

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

⑤ POWER ON/OFF SEQUENCE

In the case of a device that uses different power supplies for the internal operation and external interface, as a rule, switch on the external power supply after switching on the internal power supply. When switching the power supply off, as a rule, switch off the external power supply and then the internal power supply. Use of the reverse power on/off sequences may result in the application of an overvoltage to the internal elements of the device, causing malfunction and degradation of internal elements due to the passage of an abnormal current.

The correct power on/off sequence must be judged separately for each device and according to related specifications governing the device.

⑥ INPUT OF SIGNAL DURING POWER OFF STATE

Do not input signals or an I/O pull-up power supply while the device is not powered. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Input of signals during the power off state must be judged separately for each device and according to related specifications governing the device.

These commodities, technology or software, must be exported in accordance with the export administration regulations of the exporting country. Diversion contrary to the law of that country is prohibited.

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