

**32M-BIT MASK-PROGRAMMABLE ROM  
4M-WORD BY 8-BIT (BYTE MODE)/2M-WORD BY 16-BIT (WORD MODE)****Description**

The  $\mu$ PD23C32000A is a 33,554,432 bits mask-programmable ROM. The word organization is selectable (BYTE mode: 4,194,304 words by 8 bits, WORD mode: 2,097,152 words by 16 bits).

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

The  $\mu$ PD23C32000A is packed in 44-pin plastic SOP, 48-pin plastic TSOP (I), and 44-pin plastic TSOP (II).

**Features**

- Word organization
  - 4,194,304 words by 8 bits (BYTE mode)
  - 2,097,152 words by 16 bits (WORD mode)
- Access time 120 ns (MAX.)
- Low current consumption
  - Active ..... 70 mA (MAX.)
  - Standby ..... 100  $\mu$ A (MAX.) (CMOS level input)

★ **Ordering Information**

Part Number	Package
$\mu$ PD23C32000AGX-xxx	44-pin Plastic SOP (600 mil)
$\mu$ PD23C32000AGY-xxx-MJH	48-pin Plastic TSOP (I) (12 × 18 mm) (Normal bent)
$\mu$ PD23C32000AGY-xxx-MKH	48-pin Plastic TSOP (I) (12 × 18 mm) (Reverse bent)
$\mu$ PD23C32000AG5-xxx-7JF <sup>Note</sup>	44-pin Plastic TSOP (II) (400 mil) (Normal bent)

(xxx: ROM code suffix No.)

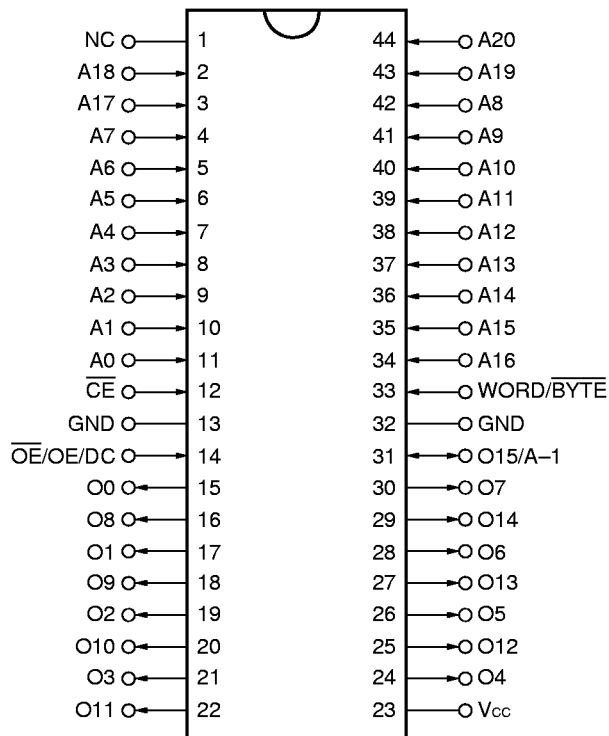
**Note** Under development

The information in this document is subject to change without notice.

★ Pin Configuration (Marking Side)

44-pin Plastic SOP (600 mil)

[μPD23C32000AGX]

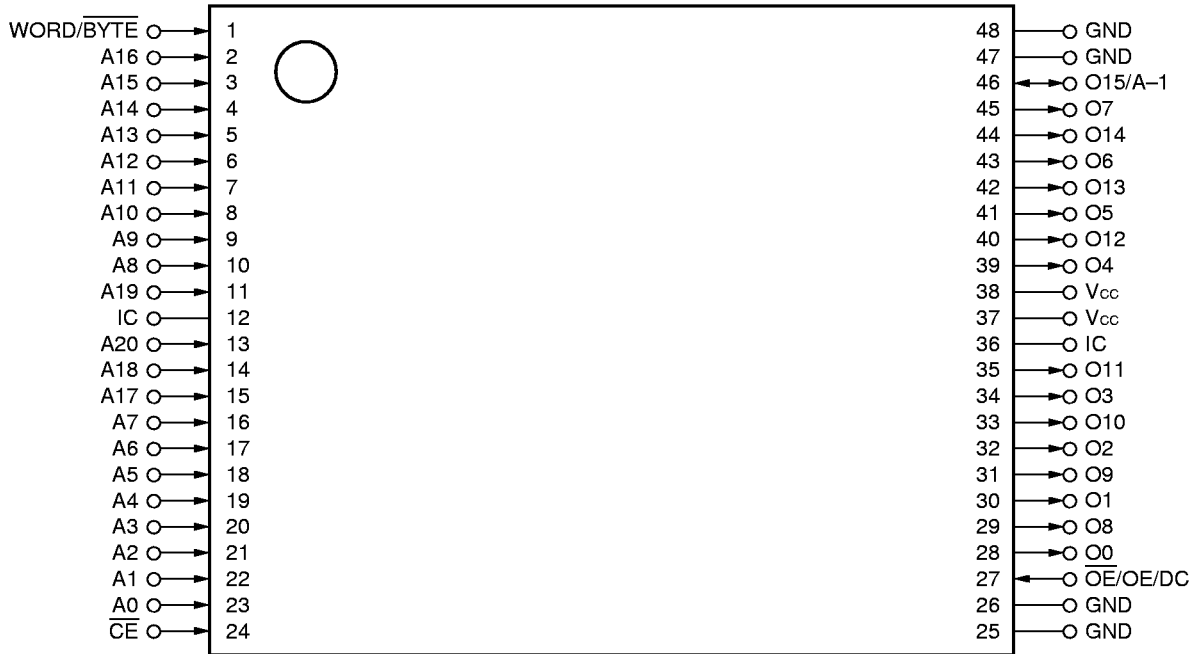


- A0 - A20 : Address inputs
- O0 - 07, O8 - O14 : Data outputs
- O15/A-1 : Data 15 output (WORD mode)/LSB address input (BYTE mode)
- WORD/BYTE : Mode select
- CE : Chip enable
- OE/OE : Output enable
- V<sub>cc</sub> : Supply voltage
- GND : Ground
- NC<sup>Note 1</sup> : No connection
- IC<sup>Note 2</sup> : Internal connection
- DC : Don't care

**Notes 1.** Some signals can be applied because this pin is not connected to the inside of the chip.  
**2.** Leave this pin unconnected or connect to GND.

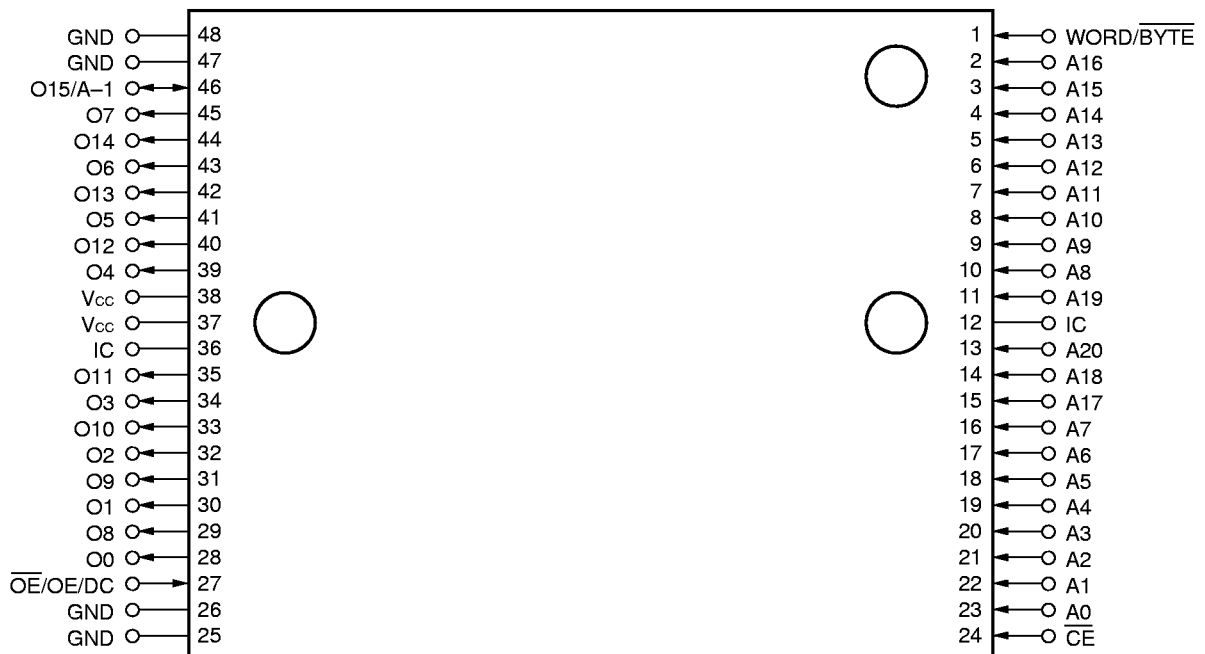
48-pin Plastic TSOP (I) (12 × 18 mm) (Normal bent)

[μPD23C32000AGY-MJH]



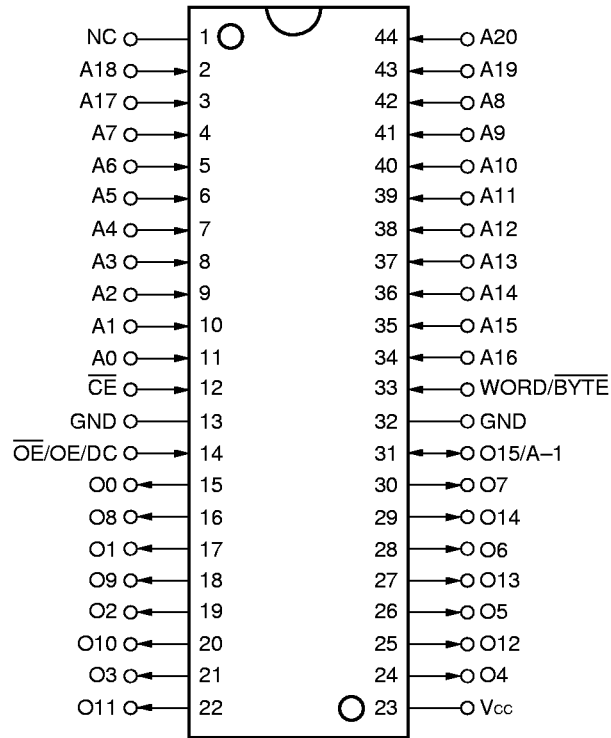
48-pin Plastic TSOP (I) (12 × 18 mm) (Reverse bent)

[μPD23C32000AGY-MKH]



44-pin Plastic TSOP (II) (400 mil) (Normal bent)

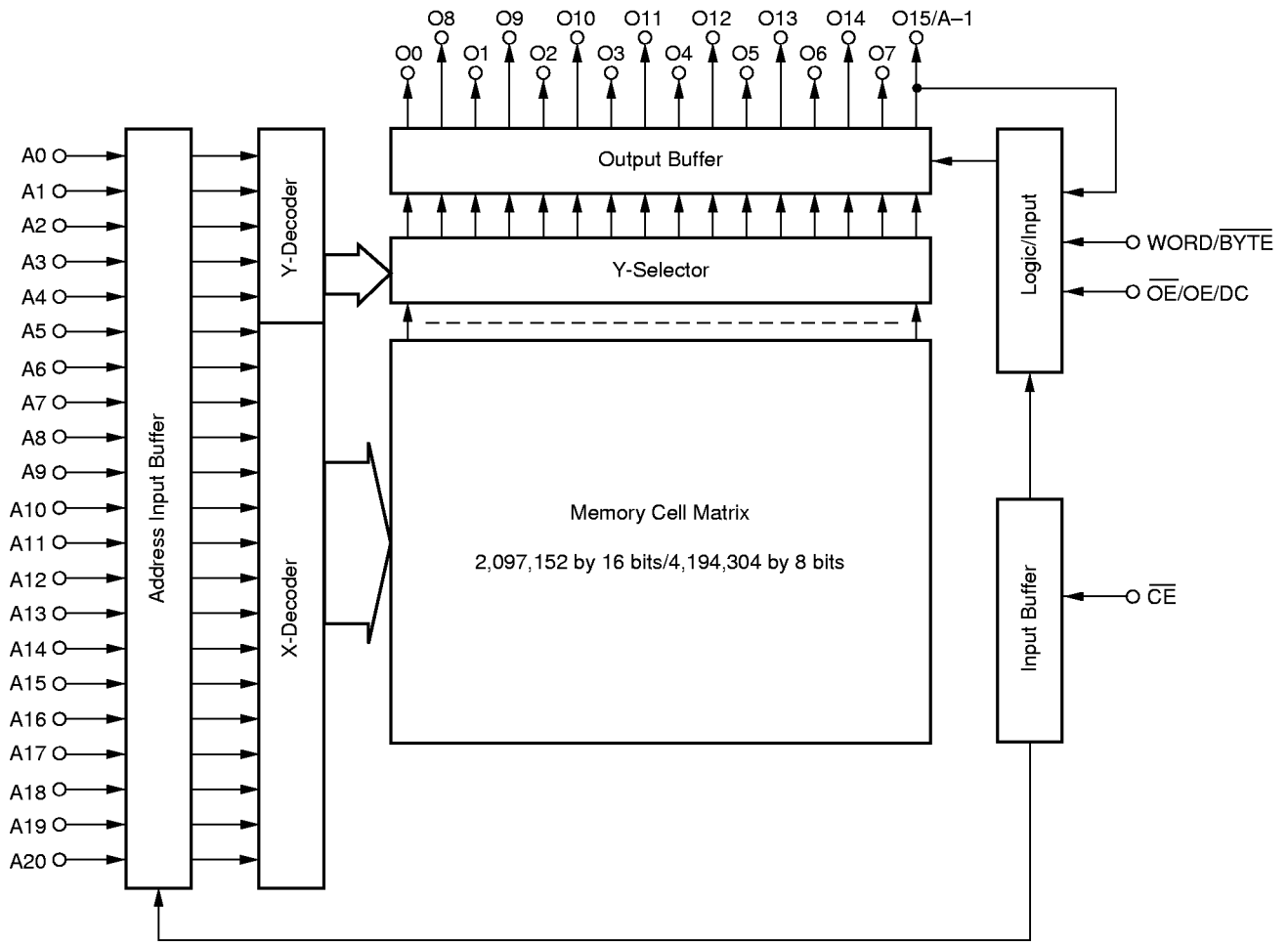
[μPD23C32000AG5-7JF]



Input/Output Pin Functions

Pin name	Input/Output	Function
WORD/ $\overline{\text{BYTE}}$	Input	The pin for switching word mode and byte mode. High level ..... Word mode (2M-word by 16 bits) Low level ..... Byte mode (4M-word by 8 bits)
A0 to A20 (Address input)		Address bus. A0 to A20 are used differently in the word mode (2M-word by 16 bits) and the byte mode (4M-word by 8 bits). Word mode ..... A0 to A20 are used as 21 bits address signals. Byte mode ..... A0 to A20 are used as the upper 21 bits of total 22 bits of address signal. (The least significant bit (A-1) is combined to O15.)
O0 to O7, O8 to O14 (Data output)	Output	Output data bus. O0 to O7, O8 to O14 are used differently in the word (2M-word by 16 bits) and the byte mode (4M-word by 8 bits). Word mode ..... The lower 15 bits of 16 bits data outputs to O0 to O14. (The most significant bit (O15) combined to A-1.) Byte mode ..... 8 bits data outputs to O0 to O7 and also O8 to O14 is high impedance.
O15/A-1 (Data output 15)/ (LSB Address input)	Output/ Input	O15/A-1 are used differently in the word (2M-word by 16 bits) and the byte mode (4M-word by 8 bits). Word mode ..... The most significant output data bus (O15). Byte mode ..... The least significant address bus (A-1).
$\overline{\text{CE}}$ (Chip Enable)	Input	Chip activating signal. When the OE is active, output states are following. High level ..... High impedance Low level ..... Data out
$\overline{\text{OE/OE/DC}}$ (Output Enable/Don't care)		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.
V <sub>cc</sub>	—	Supply voltage
GND	—	Ground
NC	—	Not internally connected. (The signal can be connected.)
IC	—	Internally connected. (Leave this pin unconnected or connect to GND.)

Block Diagram



**Mask Option**

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

Option	$\overline{OE}/OE/DC$	OE active level
0	$\overline{OE}$	L
1	OE	H
x	DC	Don't care

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

Operation mode (Option: 0)

$\overline{CE}$	$\overline{OE}$	Mode	Output state
L	L	Active	Data out
	H		High impedance
H	H or L	Standby	High impedance

Operation mode (Option: 1)

$\overline{CE}$	OE	Mode	Output state
L	L	Active	High impedance
	H		Data out
H	H or L	Standby	High impedance

Operation mode (Option: x)

$\overline{CE}$	DC	Mode	Output state
L	H or L	Active	Data out
H	H or L	Standby	High impedance

**Remark** L: Low level input  
 H: High level input

**Electrical Specifications**

**Absolute Maximum Ratings**

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	$V_{CC}$		-0.3 to +7.0	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 sections 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 conditions	MIN.	TYP.	MAX.	Unit
Input capacitance	$C_I$	f = 1 MHz			10	pF
Output capacitance	$C_O$				12	pF

**DC Characteristics ( $T_A = -10\text{ to }+70\text{ °C}$ ,  $V_{CC} = 5.0\text{ V} \pm 10\%$ )**

Parameter	Symbol	Test conditions	MIN.	TYP.	MAX.	Unit
High level input voltage	$V_{IH}$		2.2		$V_{CC} + 0.3$	V
Low level input voltage	$V_{IL}$		-0.3		+0.8	V
High level output voltage	$V_{OH1}$	$I_{OH} = -400\ \mu A$	2.4			V
	$V_{OH2}$	$I_{OH} = -100\ \mu A$	$V_{CC} - 0.5$			
Low level output voltage	$V_{OL}$	$I_{OL} = 2.1\text{ mA}$			0.4	V
Input leakage current	$I_{LI}$	$V_I = 0\text{ to }V_{CC}$	-10		+10	μA
Output leakage current	$I_{LO}$	$V_O = 0\text{ to }V_{CC}$ , Chip deselected	-10		+10	μA
Power supply current	$I_{CC1}$	$\overline{CE} = V_{IL}$ (Active mode), $I_O = 0\text{ mA}$			70	mA
Standby current	$I_{CC2}$	$\overline{CE} = V_{IH}$ (Standby mode)			1.5	mA
	$I_{CC3}$	$\overline{CE} = V_{CC} - 0.2\text{ V}$ (Standby mode)			100	



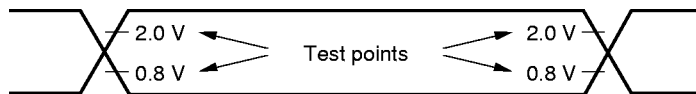
**AC Characteristics (T<sub>A</sub> = -10 to +70 °C, V<sub>CC</sub> = 5.0 V ±10 %)**

Parameter	Symbol	Test conditions	MIN.	TYP.	MAX.	Unit
Address access time	t <sub>ACC</sub>				120	ns
Chip enable access time	t <sub>CE</sub>				120	ns
Output enable access time	t <sub>OE</sub>				50	ns
Output hold time	t <sub>OH</sub>		0			ns
Output disable time	t <sub>DF</sub>		0		25	ns
WORD/ $\overline{\text{BYTE}}$ access time	t <sub>WB</sub>				120	ns

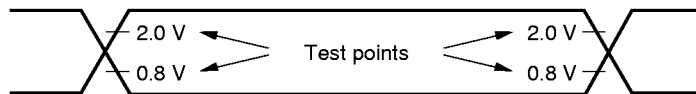
**Remark** t<sub>DF</sub> is the time from inactivation of  $\overline{\text{CE}}$  or  $\overline{\text{OE/OE}}$  to high-impedance state output.

**AC Test Conditions**

Input waveform (Rise/Fall time ≤ 5 ns)



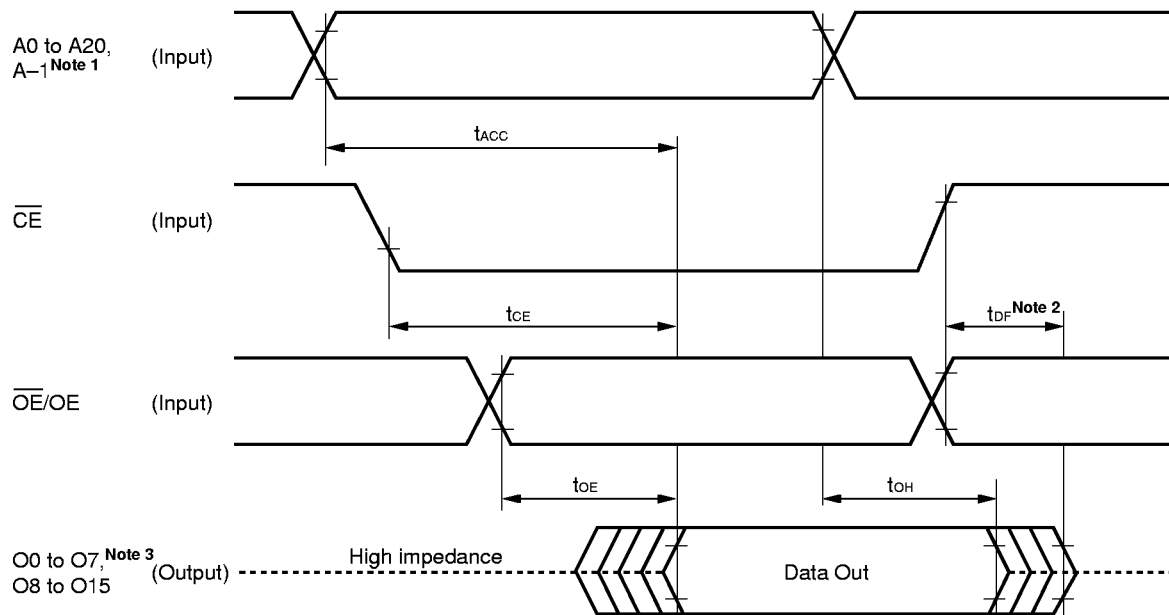
Output waveform



Output load

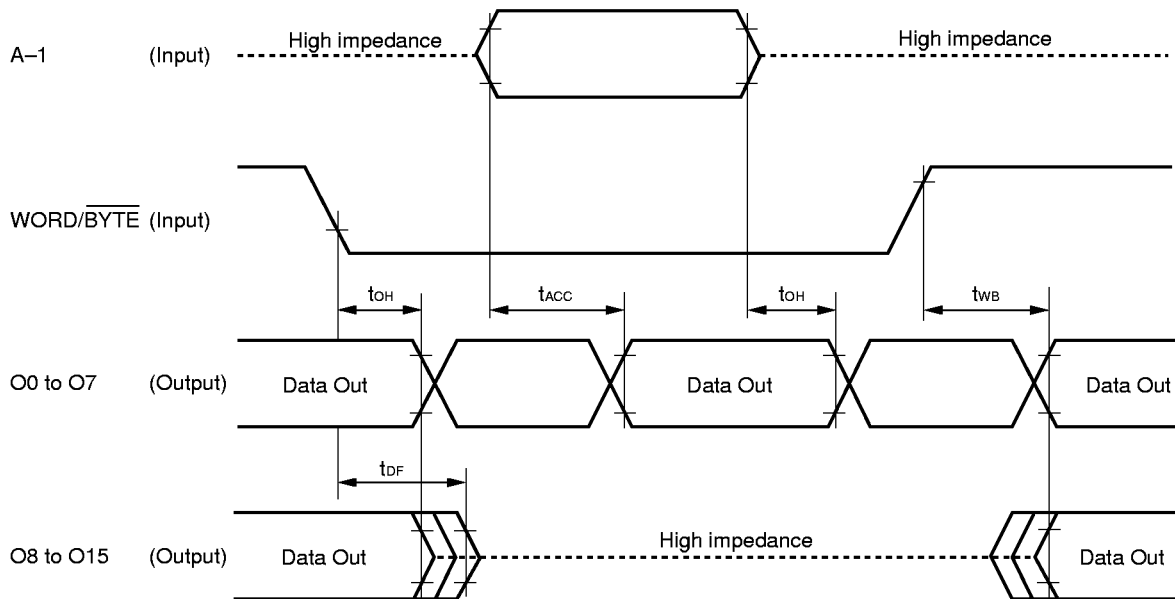
1TTL + 100 pF

Read Cycle Timing Chart



- Notes**
1. During WORD mode, A-1 is O15.
  2.  $t_{DF}$  is specified when the one of  $\overline{CE}$ ,  $\overline{OE}$  or OE is inactivated.
  3. During BYTE mode, O8 to O14 are high impedance and O15 is A-1.

WORD/BYTE Switch Timing Chart



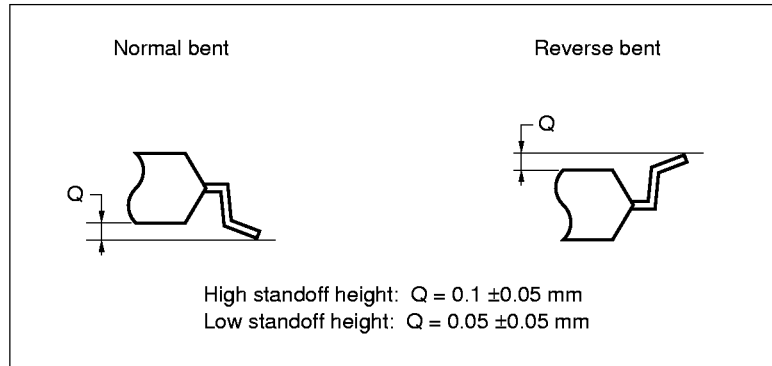
**Remark**  $\overline{OE/OE}$ ,  $\overline{CE}$ : Active.

★ **Notice of change in 48-pin TSOP (I) standoff height**

We are changing the 48-pin TSOP (I) standoff height  $0.05 \pm 0.05$  mm (low standoff height) to  $0.1 \pm 0.05$  mm (high standoff height). Each lot version is identified by the fifth character of the lot number.

**Difference between high standoff height and low standoff height**

**Detail of lead end**

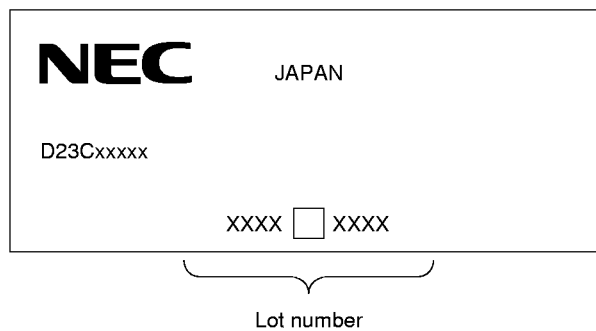


**Identification of each lot version**

Each lot version is identified by the fifth character of the lot number.

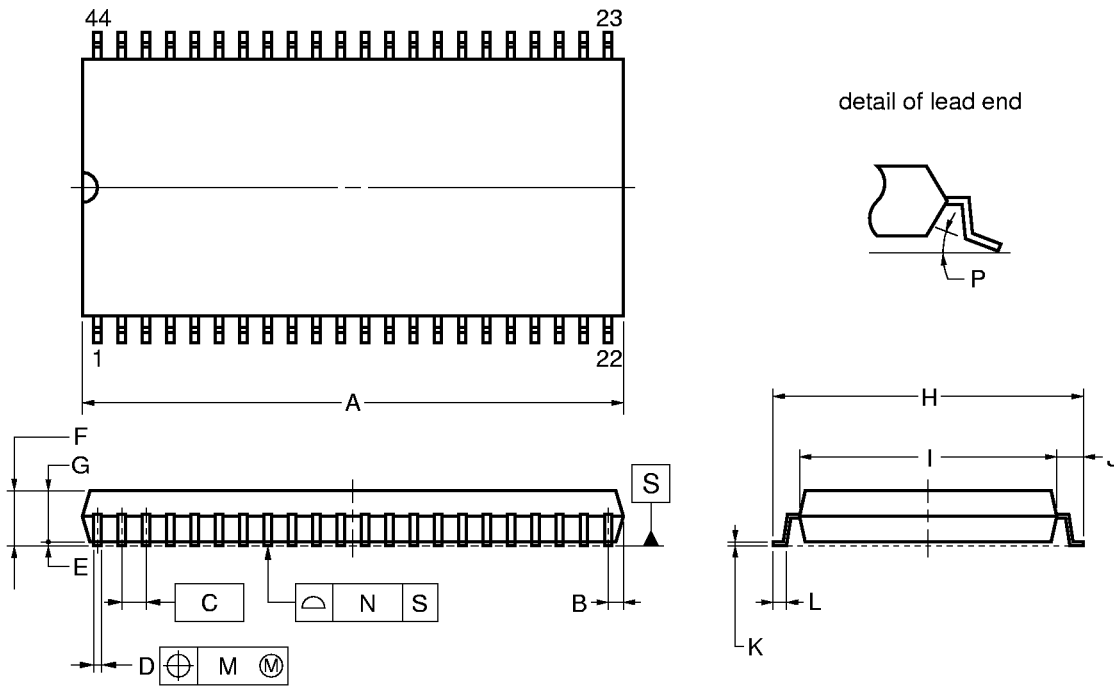
Fifth character of the lot number	Lot version	Standoff height
L	L version	$0.1 \pm 0.05$ mm (High standoff height)
K	K version	$0.05 \pm 0.05$ mm (Low standoff height)

**Marking Example**



★ Package Drawings

44 PIN PLASTIC SOP (600 mil)



NOTE

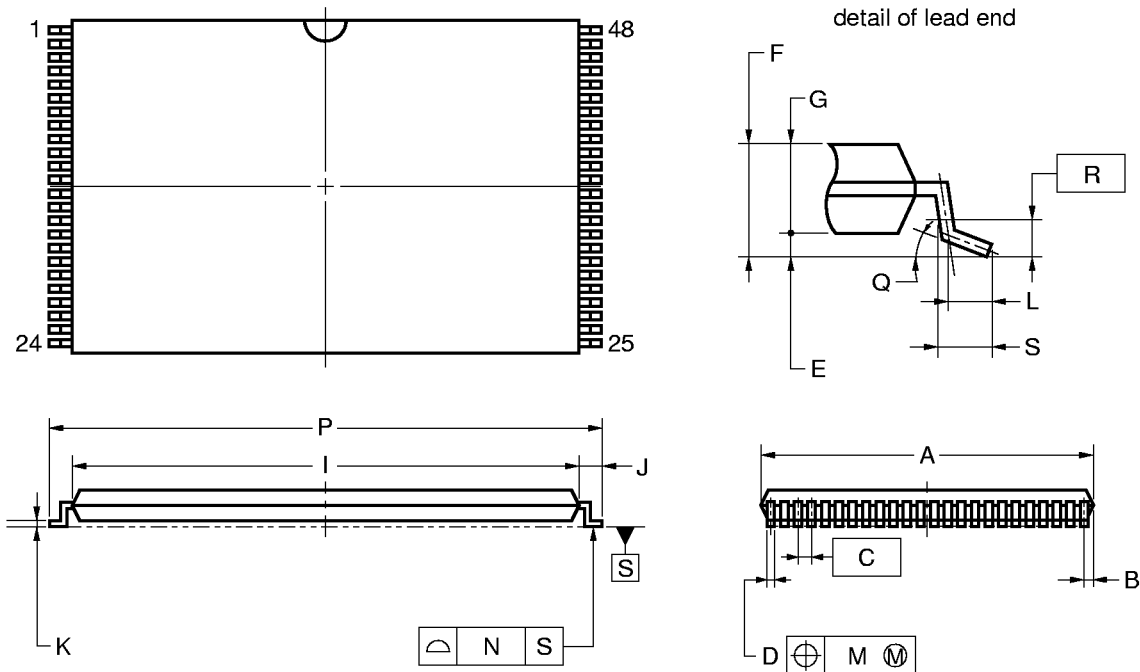
1. Controlling dimension — millimeter.
2. Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	27.83 <sup>+0.4</sup> <sub>-0.05</sub>	1.096 <sup>+0.016</sup> <sub>-0.003</sub>
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.42 <sup>+0.08</sup> <sub>-0.07</sub>	0.017 <sup>+0.003</sup> <sub>-0.004</sub>
E	0.15±0.1	0.006±0.004
F	3.0 MAX.	0.119 MAX.
G	2.7±0.05	0.106 <sup>+0.003</sup> <sub>-0.002</sub>
H	16.04±0.3	0.631 <sup>+0.013</sup> <sub>-0.012</sub>
I	13.24±0.1	0.521 <sup>+0.005</sup> <sub>-0.004</sub>
J	1.4±0.2	0.055±0.008
K	0.22 <sup>+0.08</sup> <sub>-0.07</sub>	0.009 <sup>+0.003</sup> <sub>-0.004</sub>
L	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
M	0.12	0.005
N	0.10	0.004
P	3° <sup>+7°</sup> <sub>-3°</sub>	3° <sup>+7°</sup> <sub>-3°</sub>

P44GX-50-600A-3

L Version: High standoff height

48 PIN PLASTIC TSOP (I) (12×18)



NOTES

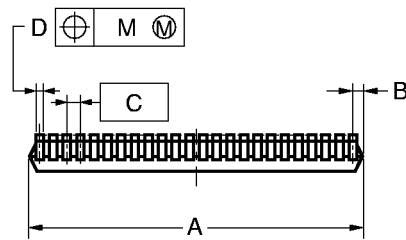
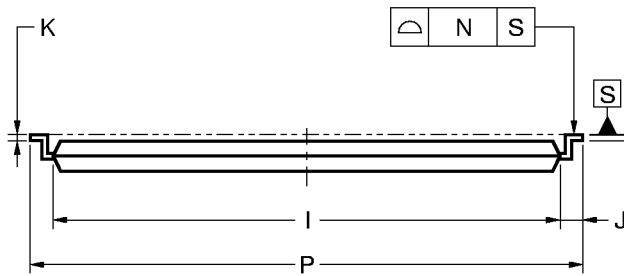
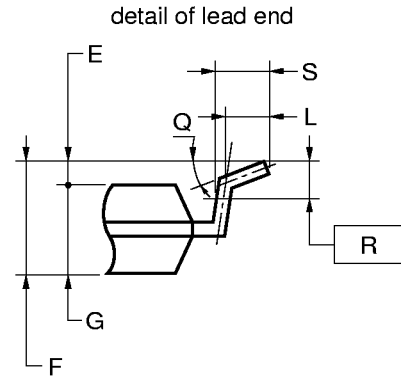
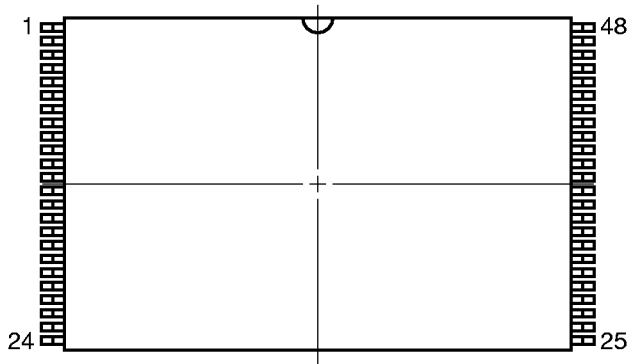
1. Controlling dimension — Millimeter.
2. Each lead centerline is located within 0.10 mm (0.004 inch) of its true position (T.P.) at maximum material condition.
3. "A" excludes mold flash. (Includes mold flash : 12.4 mm MAX. <0.489 inch MAX.>)

ITEM	MILLIMETERS	INCHES
A	12.0±0.1	0.472 <sup>+0.005</sup> <sub>-0.004</sub>
B	0.45 MAX.	0.018 MAX.
C	0.5 (T.P.)	0.020 (T.P.)
D	0.22±0.05	0.009 <sup>+0.002</sup> <sub>-0.003</sub>
E	0.1±0.05	0.004±0.002
F	1.2 MAX.	0.048 MAX.
G	1.0±0.05	0.039 <sup>+0.003</sup> <sub>-0.002</sub>
I	16.4±0.1	0.646 <sup>+0.004</sup> <sub>-0.005</sub>
J	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.145±0.05	0.006 <sup>+0.002</sup> <sub>-0.003</sub>
L	0.5	0.020
M	0.10	0.004
N	0.10	0.004
P	18.0±0.2	0.709 <sup>+0.008</sup> <sub>-0.009</sub>
Q	3 <sup>+5°</sup> <sub>-3°</sub>	3 <sup>+5°</sup> <sub>-3°</sub>
R	0.25	0.010
S	0.60±0.15	0.024 <sup>+0.006</sup> <sub>-0.007</sub>

S48GY-50-MJH1

L Version: High standoff height

48 PIN PLASTIC TSOP (I) (12×18)



NOTES

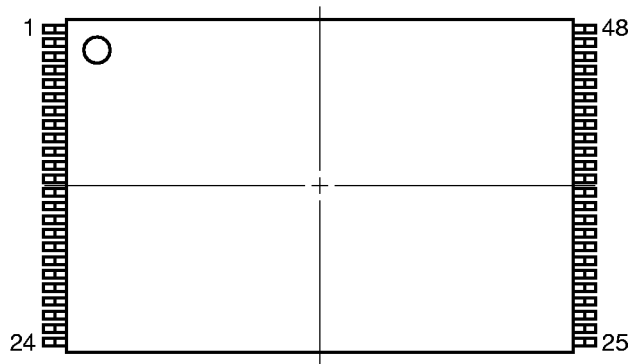
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E	0.1±0.05	0.004±0.002
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G	1.0±0.05	0.039 <sup>+0.003</sup> <sub>-0.002</sub>
I	16.4±0.1	0.646 <sup>+0.004</sup> <sub>-0.005</sub>
J	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.145±0.05	0.006 <sup>+0.002</sup> <sub>-0.003</sub>
L	0.5	0.020
M	0.10	0.004
N	0.10	0.004
P	18.0±0.2	0.709 <sup>+0.008</sup> <sub>-0.009</sub>
Q	3° <sup>+5°</sup> <sub>-3°</sub>	3° <sup>+5°</sup> <sub>-3°</sub>
R	0.25	0.010
S	0.60±0.15	0.024 <sup>+0.006</sup> <sub>-0.007</sub>

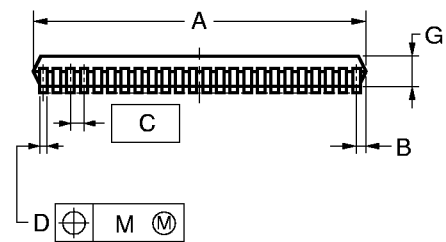
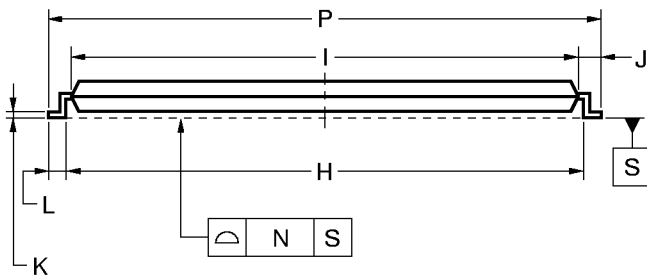
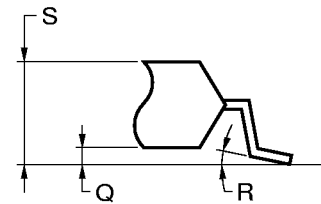
S48GY-50-MKH1

K Version: Low standoff height

48 PIN PLASTIC TSOP (I) (12x18)



detail of lead end



NOTES

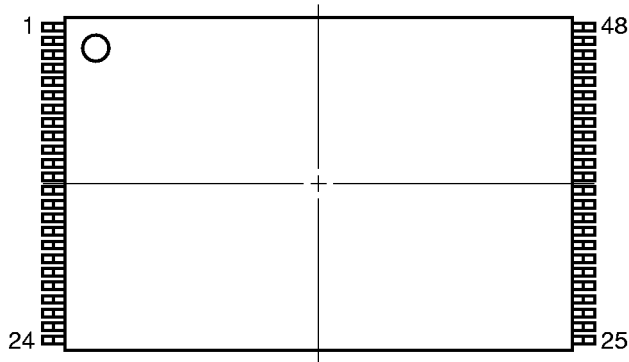
1. Controlling dimension — millimeter.
2. Each lead centerline is located within 0.08 mm (0.003 inch) of its true position (T.P.) at maximum material condition.
3. "A" excludes mold flash. (Includes mold flash : 12.4 mm MAX. <0.489 inch MAX.>)

ITEM	MILLIMETERS	INCHES
A	12.0±0.1	0.472 <sup>+0.005</sup> <sub>-0.004</sub>
B	0.45 MAX.	0.018 MAX.
C	0.5 (T.P.)	0.020 (T.P.)
D	0.22 <sup>+0.08</sup> <sub>-0.07</sub>	0.009 <sup>+0.003</sup> <sub>-0.004</sub>
G	0.97	0.038
H	17.0±0.2	0.669 <sup>+0.009</sup> <sub>-0.008</sub>
I	16.4±0.1	0.646 <sup>+0.004</sup> <sub>-0.005</sub>
J	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.145 <sup>+0.03</sup> <sub>-0.055</sub>	0.006 <sup>+0.001</sup> <sub>-0.003</sub>
L	0.5±0.1	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
M	0.08	0.003
N	0.10	0.004
P	18.0±0.2	0.709 <sup>+0.008</sup> <sub>-0.009</sub>
Q	0.05±0.05	0.002±0.002
R	2° <sup>+4°</sup> <sub>-2°</sub>	2° <sup>+4°</sup> <sub>-2°</sub>
S	1.02±0.08	0.040 <sup>+0.004</sup> <sub>-0.003</sub>

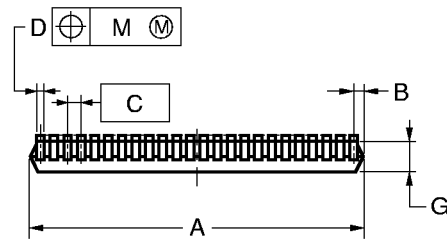
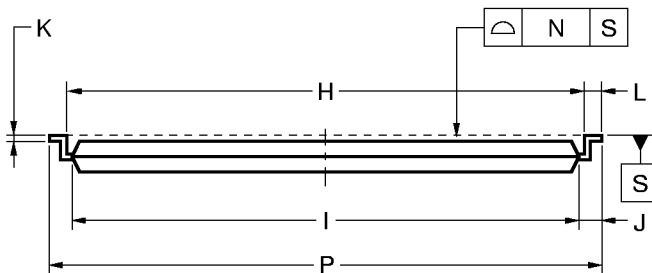
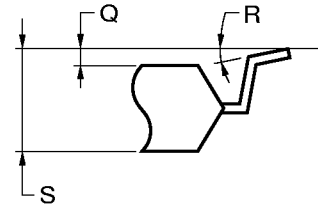
S48GY-50-MJH-3

K Version: Low standoff height

48 PIN PLASTIC TSOP (I) (12x18)



detail of lead end



NOTES

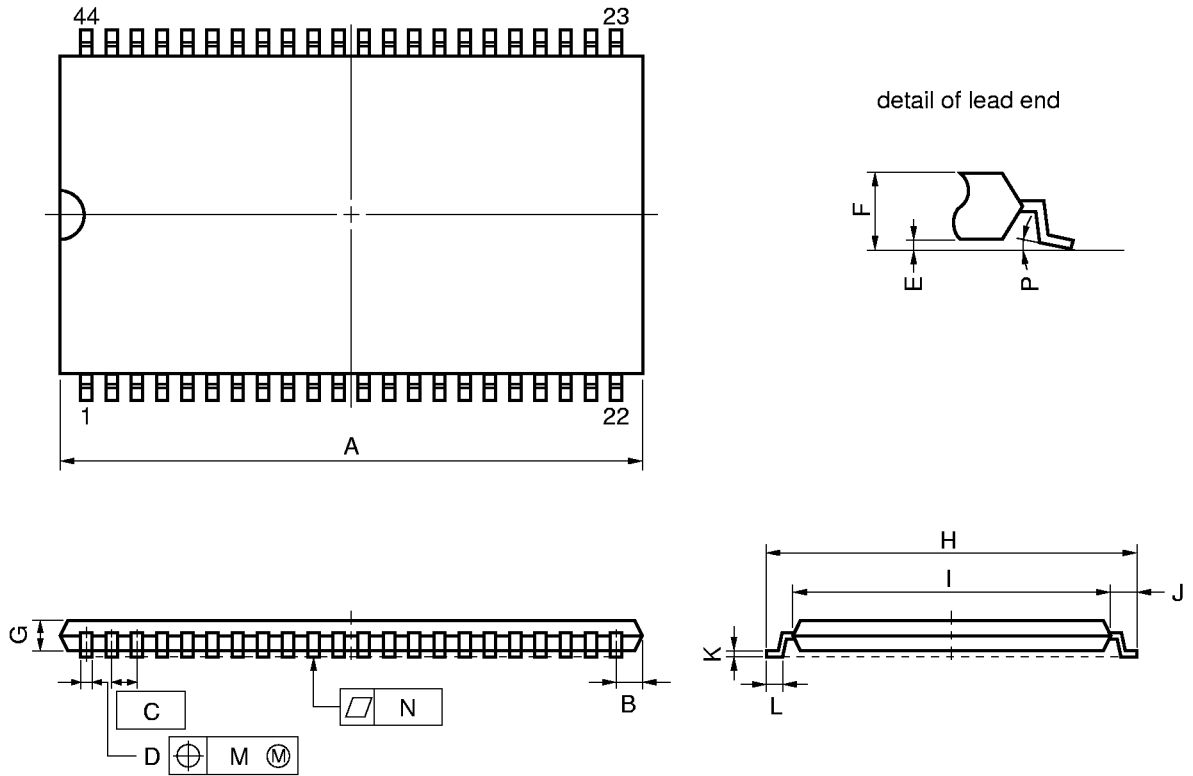
- Controlling dimension — millimeter.
- Each lead centerline is located within 0.08 mm (0.003 inch) of its true position (T.P.) at maximum material condition.
- "A" excludes mold flash. (Includes mold flash : 12.4 mm MAX. <0.489 inch MAX.>)

ITEM	MILLIMETERS	INCHES
A	12.0±0.1	0.472 <sup>+0.005</sup> <sub>-0.004</sub>
B	0.45 MAX.	0.018 MAX.
C	0.5 (T.P.)	0.020 (T.P.)
D	0.22 <sup>+0.08</sup> <sub>-0.07</sub>	0.009 <sup>+0.003</sup> <sub>-0.004</sub>
G	0.97	0.038
H	17.0±0.2	0.669 <sup>+0.009</sup> <sub>-0.008</sub>
I	16.4±0.1	0.646 <sup>+0.004</sup> <sub>-0.005</sub>
J	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.145 <sup>+0.03</sup> <sub>-0.055</sub>	0.006 <sup>+0.001</sup> <sub>-0.003</sub>
L	0.5±0.1	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
M	0.08	0.003
N	0.10	0.004
P	18.0±0.2	0.709 <sup>+0.008</sup> <sub>-0.009</sub>
Q	0.05±0.05	0.002±0.002
R	2° <sup>+4°</sup> <sub>-2°</sub>	2° <sup>+4°</sup> <sub>-2°</sub>
S	1.02±0.08	0.040 <sup>+0.004</sup> <sub>-0.003</sub>

S48GY-50-MKH-3



44 PIN PLASTIC TSOP(II) (400 mil)



NOTE

Each lead centerline is located within 0.13 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	18.63 MAX.	0.734 MAX.
B	0.93 MAX.	0.037 MAX.
C	0.8 (T.P.)	0.031 (T.P.)
D	0.32 <sup>+0.08</sup> <sub>-0.07</sub>	0.013±0.003
E	0.1±0.05	0.004±0.002
F	1.2 MAX.	0.048 MAX.
G	0.97	0.038
H	11.76±0.2	0.463±0.008
I	10.16±0.1	0.400±0.004
J	0.8±0.2	0.031 <sup>+0.009</sup> <sub>-0.008</sub>
K	0.145 <sup>+0.025</sup> <sub>-0.015</sub>	0.006±0.001
L	0.5±0.1	0.020 <sup>+0.004</sup> <sub>-0.005</sub>
M	0.13	0.005
N	0.10	0.004
P	3° <sup>+7°</sup> <sub>-3°</sub>	3° <sup>+7°</sup> <sub>-3°</sub>

S44G5-80-7JF5

## Recommended Soldering Conditions

Please consult with our sales offices for soldering conditions of the  $\mu$ PD23C32000A.

### Types of Surface Mount Device

- $\mu$ PD23C32000AGX : 44-pin Plastic SOP (600 mil)
- $\mu$ PD23C32000AGY-MJH : 48-pin Plastic TSOP (I) (12 × 18 mm) (Normal bent)
- $\mu$ PD23C32000AGY-MKH : 48-pin Plastic TSOP (I) (12 × 18 mm) (Reverse bent)
- $\mu$ PD23C32000AG5-7JF : 44-pin Plastic TSOP (II) (400 mil) (Normal bent)