

4M-BIT MASK-PROGRAMMABLE ROM

512K-WORD BY 8-BIT

Description

The μ PD23C4001EJ is a 4,194,304 bits (524,288 words by 8 bits) mask-programmable ROM.

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

The μ PD23C4001EJ is packed in 32-pin plastic DIP, 32-pin plastic SOP and 40-pin plastic TSOP (I).

Features

- Word organization : 524,288 words by 8 bits
- Wide voltage range: $V_{CC} = 2.7\text{ V}$ to 5.5 V

Operating supply voltage V_{CC}	Access time ns (MAX.)	Operating ambient temperature $^{\circ}\text{C}$	Power supply current (Active mode) mA (MAX.)	Standby current (CMOS level input) μA (MAX.)
$5.0\text{ V} \pm 10\%$	120	-10 to +70	35	100
$3.3\text{ V} \pm 0.3\text{ V}$	300	-10 to +70	15	25
	330	-20 to +85	20	150
$3.0\text{ V} \pm 0.3\text{ V}$	350	-10 to +70	10	20
	380	-20 to +85	15	100

Ordering Information

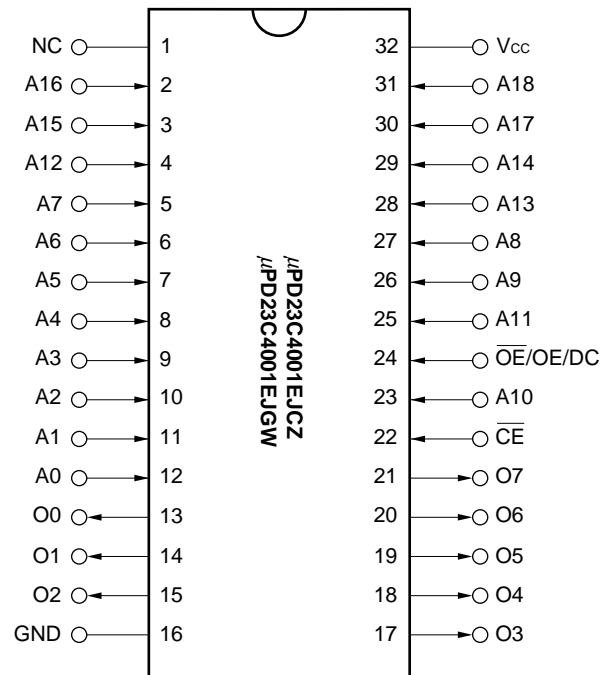
Part Number	Package
μ PD23C4001EJCZ-xxx	32-pin Plastic DIP (600 mil)
μ PD23C4001EJGW-xxx	32-pin Plastic SOP (525 mil)
μ PD23C4001EJGZ-xxx-LJH	40-pin Plastic TSOP (I) (10 × 20 mm) (Normal bent)
μ PD23C4001EJGZ-xxx-LKH	40-pin Plastic TSOP (I) (10 × 20 mm) (Reverse bent)

(xxx: ROM code suffix No.)

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

Pin Configuration (Marking Side)

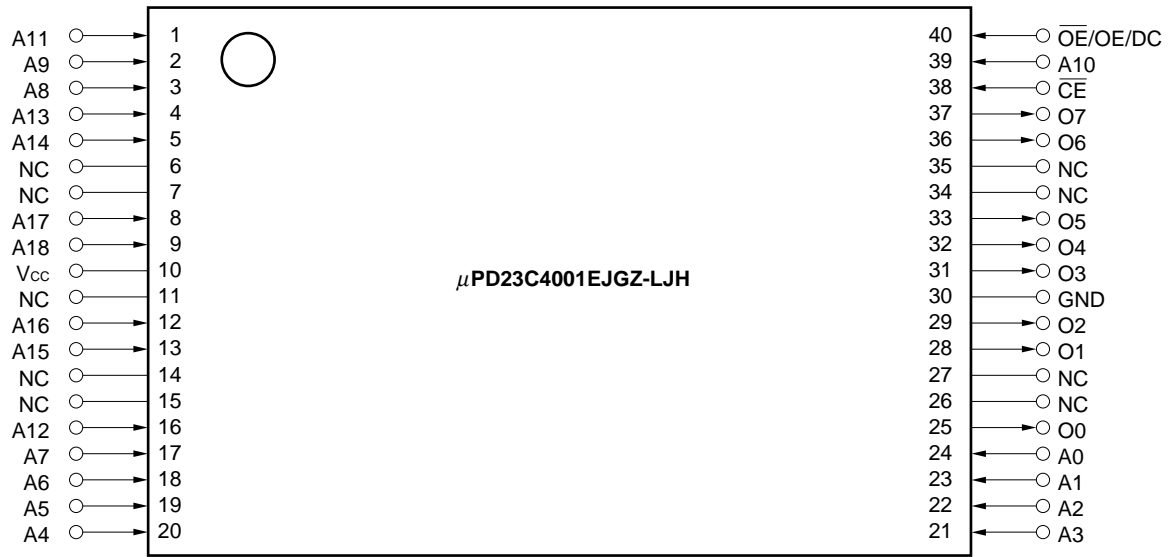
32-pin Plastic DIP (600 mil)
32-pin Plastic SOP (525 mil)



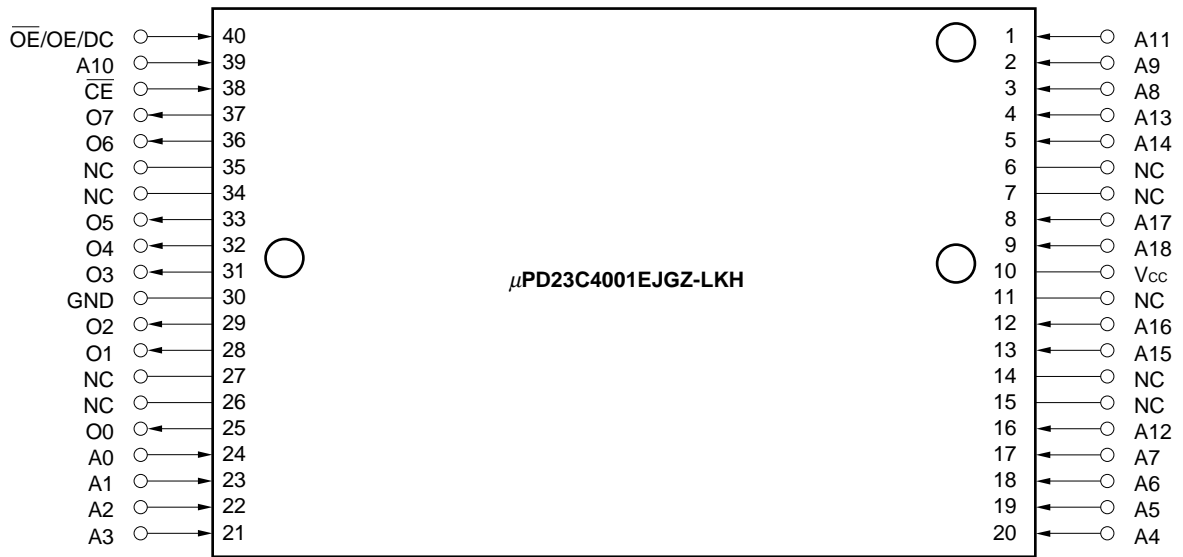
- A0 - A18 : Address inputs
- O0 - O7 : Data outputs
- \overline{CE} : Chip enable
- $\overline{OE/OE}$: Output enable
- V_{cc} : Supply voltage
- GND : Ground
- NC^{Note} : No connection
- DC : Don't care

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

40-pin Plastic TSOP (I) (10 × 20 mm) (Normal bent)



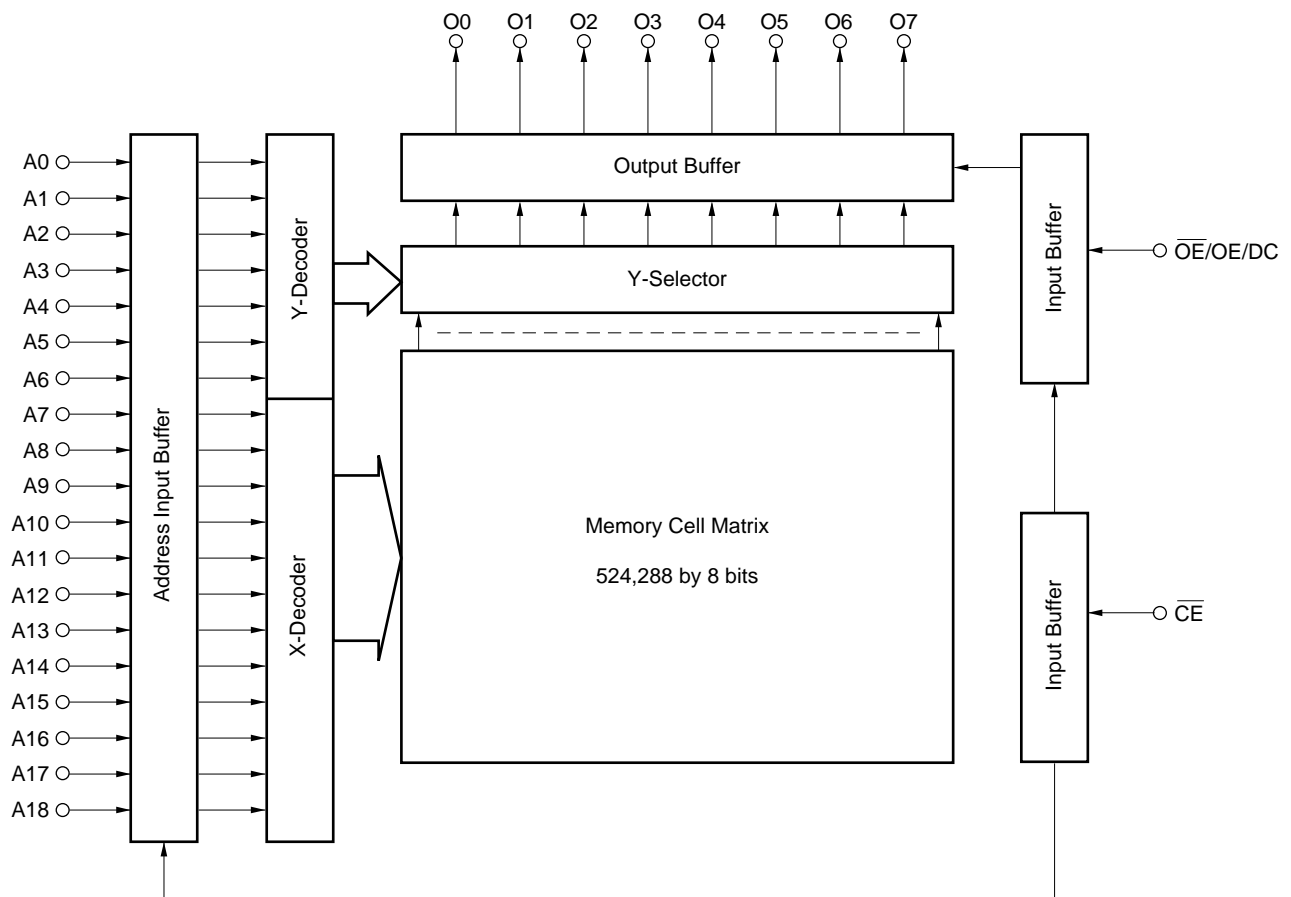
40-pin Plastic TSOP (I) (10 × 20 mm) (Reverse bent)



Input/Output Pin Functions

Pin name	Input/Output	Function
A0 to A18 (Address inputs)	Input	Address bus.
O0 to O7 (Data outputs)	Output	Output data bus.
\overline{CE} (Chip Enable)	Input	Chip activating signal. When the OE is active, output states are followings. High level High impedance Low level Data out
$\overline{OE/OE/DC}$ (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 _{cc}	—	Supply voltage
GND	—	Ground
NC	—	Not internally connected. (The signal can be connected.)

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 Characteristics

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	V _{CC} = 5.0 V ± 10 %	-10 to +70	°C
		V _{CC} = 2.7 V to 3.6 V	-20 to +85	
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 °C)

Parameter	Symbol	Test conditions	MIN.	TYP.	MAX.	Unit
Input capacitance	C _i	f = 1 MHz			15	pF
Output capacitance	C _o				15	pF

DC Characteristics 1 ($T_A = -10$ to $+70$ °C, $V_{CC} = +5.0$ 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}	$I_{OL} = 2.1$ mA			0.4	V
Input leakage current	I_{LI}	$V_I = 0$ to V_{CC}	-10		+10	μA
Output leakage current	I_{LO}	$V_O = 0$ to V_{CC} , Chip deselected	-10		+10	μA
Power supply current	I_{CC1}	$\overline{CE} = V_{IL}$ (Active mode), $I_O = 0$ mA			35	mA
Standby current	I_{CC2}	$\overline{CE} = V_{IH}$ (Standby mode)			1.5	mA
	I_{CC3}	$\overline{CE} = V_{CC}-0.2$ V (Standby mode)			100	μA

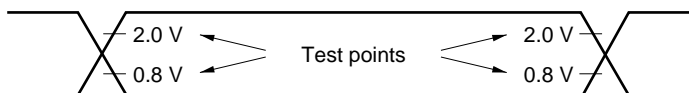
AC Characteristics 1 ($T_A = -10$ to $+70$ °C, $V_{CC} = +5.0$ V \pm 10 %)

Parameter	Symbol	Test conditions	MIN.	TYP.	MAX.	Unit
Address access time	t_{ACC}				120	ns
Chip enable access time	t_{CE}				120	ns
Output enable access time	t_{OE}				60	ns
Output hold time	t_{OH}		0			ns
Output disable time	t_{DF}		0		30	ns

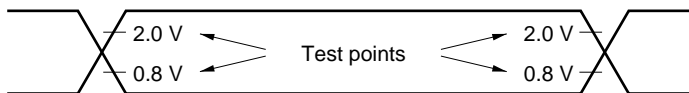
Remark t_{DF} is the time from inactivation of \overline{CE} or \overline{OE}/OE to high-impedance state output.

AC Test Conditions

Input waveform (Rise/Fall time \leq 5 ns)



Output waveform



Output load

1TTL + 100 pF

DC Characteristics 2 (T_A = -10 to +70 °C, V_{CC} = 2.7 V to 3.6 V)

Parameter	Symbol	Test conditions	MIN.	MAX.	Unit
High level input voltage	V _{IH}		0.7V _{CC}	V _{CC} +0.3	V
Low level input voltage	V _{IL}		-0.3	0.2V _{CC}	V
High level output voltage	V _{OH}	I _{OH} = -100 μA	0.8V _{CC}		V
Low level output voltage	V _{OL}	I _{OL} = 1.0 mA		0.4	V
High level input leakage current	I _{LIH}	V _I = V _{CC}		10	μA
Low level input leakage current	I _{LIL}	V _I = 0 V		-10	μA
High level output leakage current	I _{LOH}	V _O = V _{CC} Chip deselected		10	μA
Low level output leakage current	I _{LOL}	V _O = 0 V Chip deselected		-10	μA
Power supply current	I _{CC1}	$\overline{CE} = V_{IL}$ (Active mode), I _O = 0 mA	V _{CC} = 3.3 ± 0.3 V	15	mA
			V _{CC} = 3.0 ± 0.3 V	10	
Standby current	I _{CC3}	$\overline{CE} = V_{CC}-0.2$ V (Standby mode)	V _{CC} = 3.3 ± 0.3 V	25	μA
			V _{CC} = 3.0 ± 0.3 V	20	

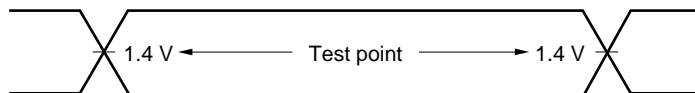
AC Characteristics 2 (T_A = -10 to +70 °C, V_{CC} = 2.7 V to 3.6 V)

Parameter	Symbol	V _{CC} = 3.0 ± 0.3 V		V _{CC} = 3.3 ± 0.3 V		Unit
		MIN.	MAX.	MIN.	MAX.	
Address access time	t _{ACC}		350		300	ns
Chip enable access time	t _{CE}		350		300	ns
Output enable access time	t _{OE}		150		120	ns
Output hold time	t _{OH}	0		0		ns
Output disable time	t _{DF}	0	50	0	40	ns

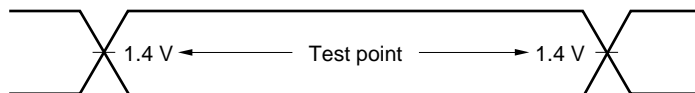
Remark t_{DF} is the time from inactivation of \overline{CE} or \overline{OE}/OE to high-impedance state output.

AC Test Conditions

Input waveform (Rise/Fall time ≤ 5 ns)



Output waveform



Output load

1TTL + 100 pF

DC Characteristics 3 (T_A = -20 to +85 °C, V_{CC} = 2.7 V to 3.6 V)

Parameter	Symbol	Test conditions	MIN.	MAX.	Unit
High level input voltage	V _{IH}		0.7V _{CC}	V _{CC} +0.3	V
Low level input voltage	V _{IL}		-0.3	0.17V _{CC}	V
High level output voltage	V _{OH}	I _{OH} = -100 μA	0.8V _{CC}		V
Low level output voltage	V _{OL}	I _{OL} = 1.0 mA		0.5	V
High level input leakage current	I _{LIH}	V _I = V _{CC}		20	μA
Low level input leakage current	I _{LIL}	V _I = 0 V		-20	μA
High level output leakage current	I _{LOH}	V _O = V _{CC} Chip deselected		20	μA
Low level output leakage current	I _{LOL}	V _O = 0 V Chip deselected		-20	μA
Power supply current	I _{CC1}	$\overline{CE} = V_{IL}$ (Active mode), I _O = 0 mA	V _{CC} = 3.3 ± 0.3 V	20	mA
			V _{CC} = 3.0 ± 0.3 V	15	
Standby current	I _{CC3}	$\overline{CE} = V_{CC}-0.2$ V (Standby mode)	V _{CC} = 3.3 ± 0.3 V	150	μA
			V _{CC} = 3.0 ± 0.3 V	100	

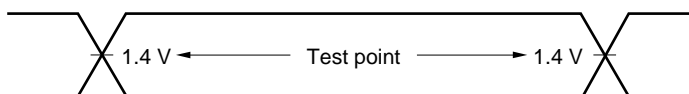
AC Characteristics 3 (T_A = -20 to +85 °C, V_{CC} = 2.7 V to 3.6 V)

Parameter	Symbol	V _{CC} = 3.0 ± 0.3 V		V _{CC} = 3.3 ± 0.3 V		Unit
		MIN.	MAX.	MIN.	MAX.	
Address access time	t _{ACC}		380		330	ns
Chip enable access time	t _{CE}		380		330	ns
Output enable access time	t _{OE}		170		140	ns
Output hold time	t _{OH}	0		0		ns
Output disable time	t _{DF}	0	50	0	40	ns

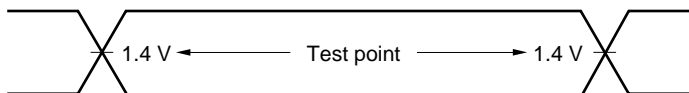
Remark t_{DF} is the time from inactivation of \overline{CE} or \overline{OE}/OE to high-impedance state output.

AC Test Conditions

Input waveform (Rise/Fall time ≤ 5 ns)



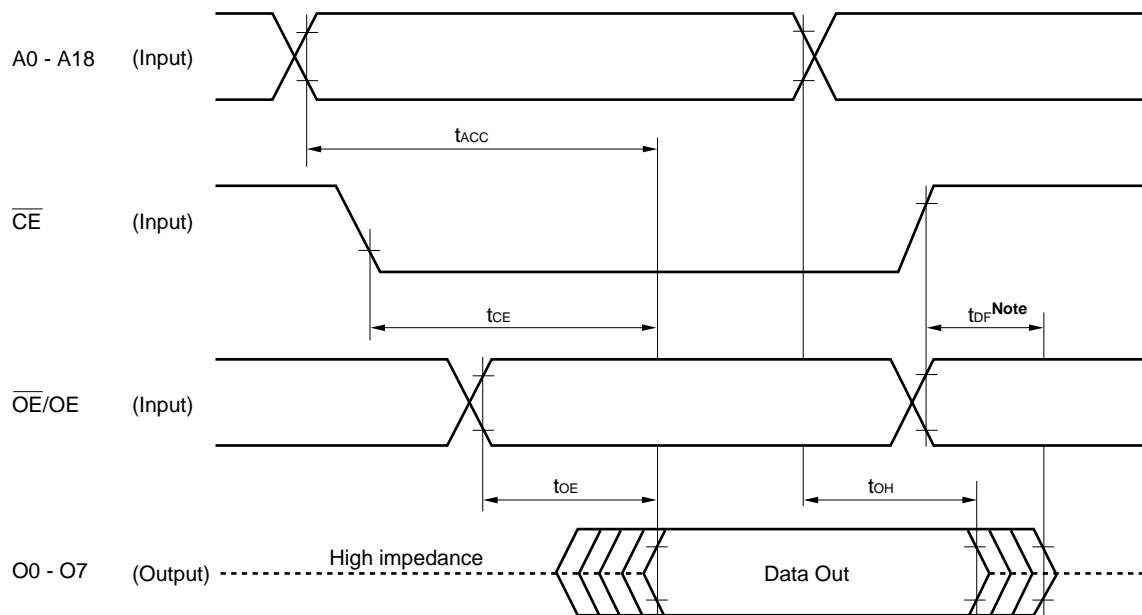
Output waveform



Output load

1TTL + 100 pF

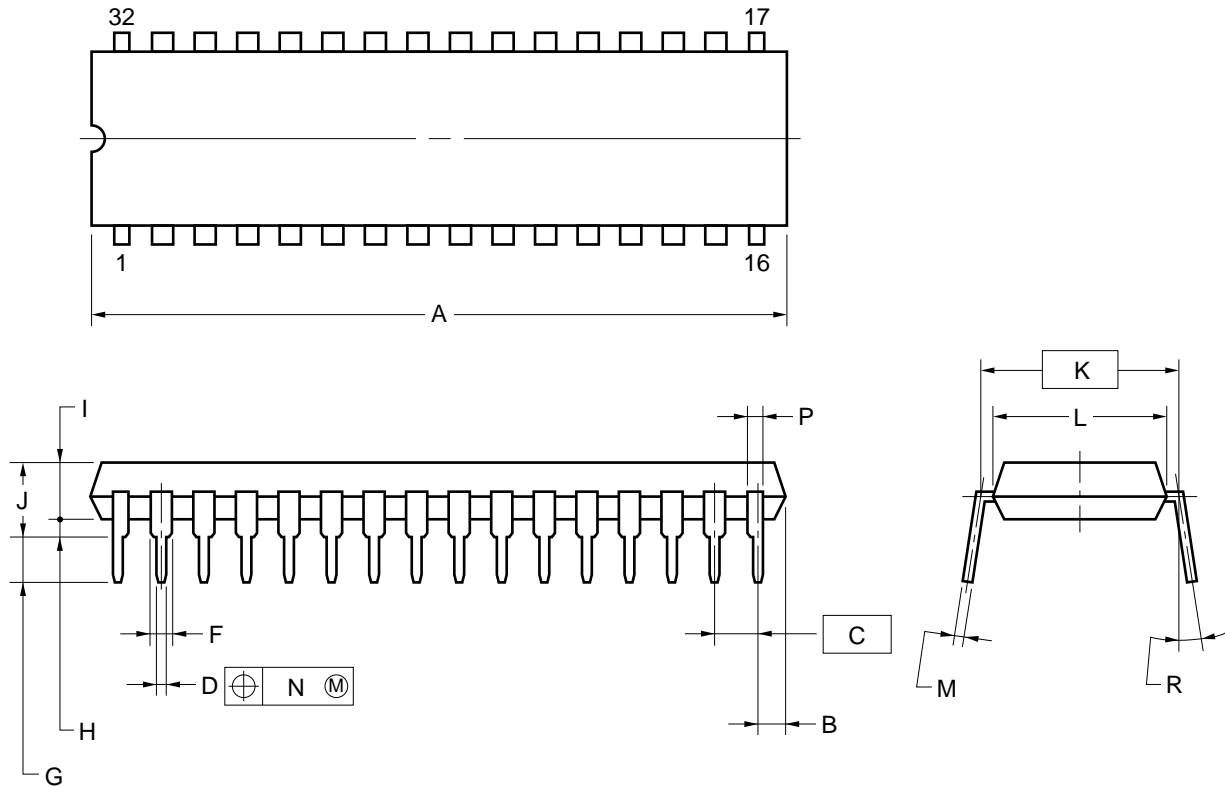
Read Cycle Timing Chart



Note t_{DF} is specified when the one of \overline{CE} , \overline{OE}/OE is inactivated.

Package Drawings

32PIN PLASTIC DIP (600 mil)



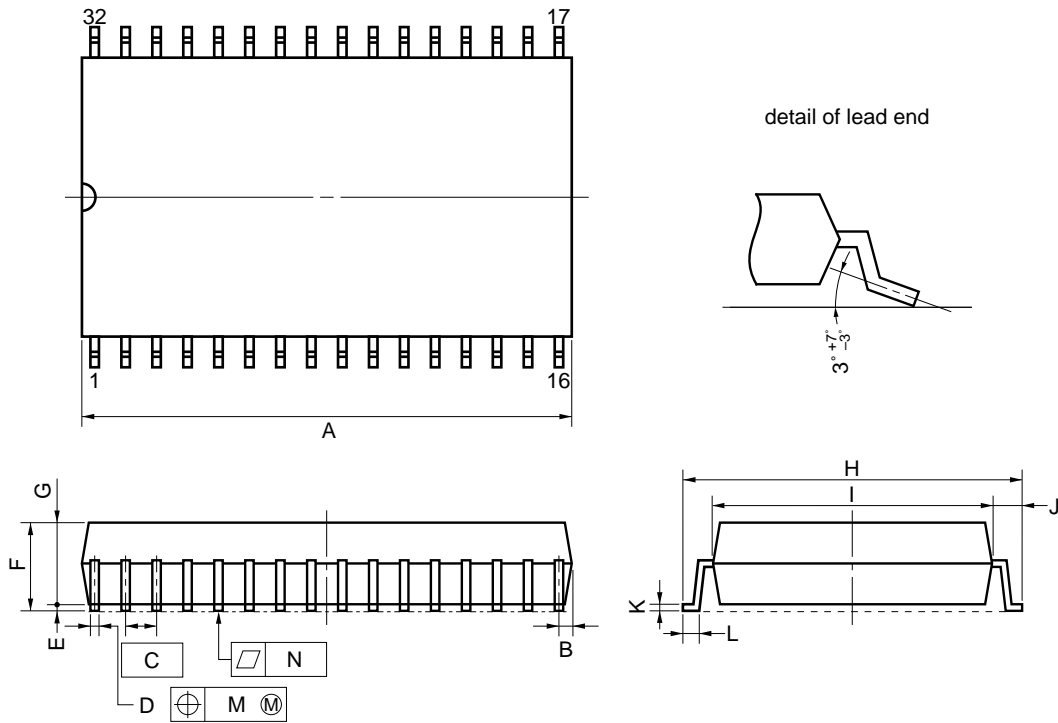
NOTES

- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	40.64 MAX.	1.600 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50±0.10	0.020 ^{+0.004} _{-0.005}
F	1.1 MIN.	0.043 MIN.
G	3.2±0.3	0.126±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	15.24 (T.P.)	0.600 (T.P.)
L	13.2	0.520
M	0.25 ^{+0.10} _{-0.05}	0.010 ^{+0.004} _{-0.003}
N	0.25	0.01
P	0.9 MIN.	0.035 MIN.
R	0~15°	0~15°

P32C-100-600A-1

32 PIN PLASTIC SOP (525 mil)



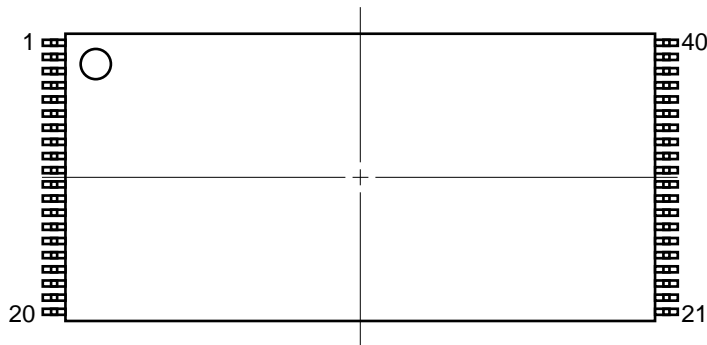
NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

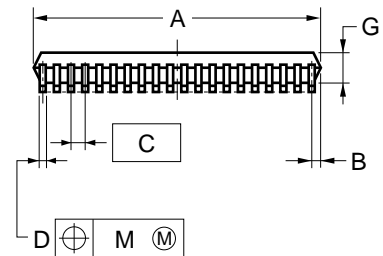
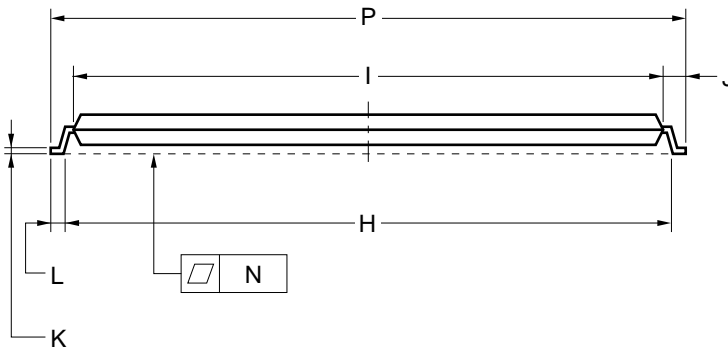
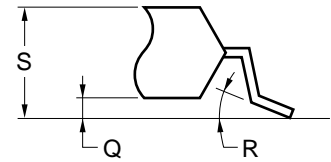
P32GW-50-525A

ITEM	MILLIMETERS	INCHES
A	20.61 MAX.	0.812 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	0.40 ^{+0.10} _{-0.05}	0.016 ^{+0.004} _{-0.003}
E	0.15±0.05	0.006
F	2.95 MAX.	0.117 MAX.
G	2.7	0.106
H	14.1±0.3	0.555±0.012
I	11.3	0.445
J	1.4±0.2	0.055±0.008
K	0.20 ^{+0.10} _{-0.05}	0.008 ^{+0.004} _{-0.002}
L	0.8±0.2	0.031 ^{+0.009} _{-0.008}
M	0.12	0.005
N	0.10	0.004

40 PIN PLASTIC TSOP (I) (10×20)



detail of lead end



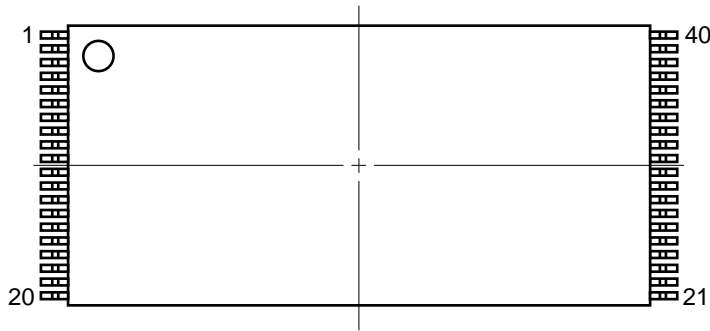
NOTES

- (1) Each lead centerline is located within 0.08 mm (0.003 inch) of its true position (T.P.) at maximum material condition.
- (2) "A" excludes mold flash. (Includes mold flash : 10.4 mm MAX. <0.410 inch MAX.>)

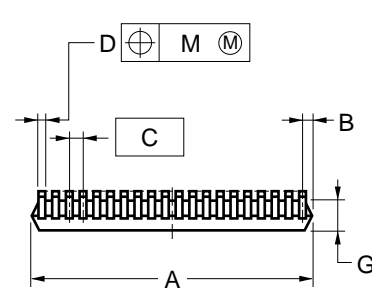
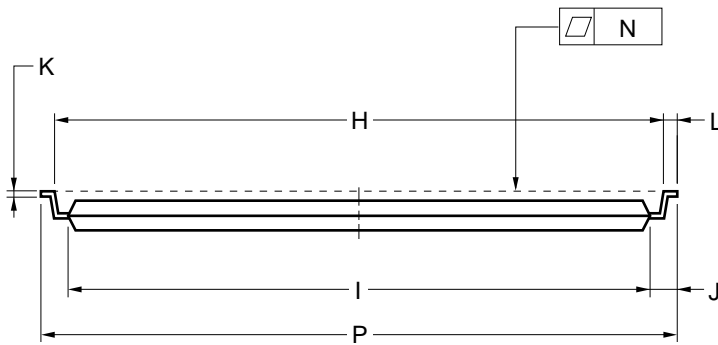
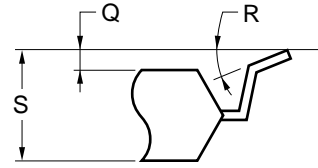
ITEM	MILLIMETERS	INCHES
A	10.0±0.1	0.394 ^{+0.004} _{-0.005}
B	0.45 MAX.	0.018 MAX.
C	0.5 (T.P.)	0.020 (T.P.)
D	0.20±0.10	0.008±0.004
G	1.02 MAX.	0.041 MAX.
H	19.0±0.2	0.748±0.008
I	18.4±0.2	0.724 ^{+0.009} _{-0.008}
J	0.8±0.2	0.031 ^{+0.009} _{-0.008}
K	0.125 ^{+0.10} _{-0.05}	0.005 ^{+0.004} _{-0.002}
L	0.5±0.1	0.020 ^{+0.004} _{-0.005}
M	0.08	0.003
N	0.10	0.004
P	20.0±0.2	0.787 ^{+0.009} _{-0.008}
Q	0.05±0.05	0.002±0.002
R	5°±5°	5°±5°
S	1.1 MAX.	0.044 MAX.

S40GZ-50-LJH-2

40 PIN PLASTIC TSOP (I) (10×20)



detail of lead end



NOTES

- (1) Each lead centerline is located within 0.08 mm (0.003 inch) of its true position (T.P.) at maximum material condition.
- (2) "A" excludes mold flash. (Includes mold flash : 10.4 mm MAX. <0.410 inch MAX.>)

ITEM	MILLIMETERS	INCHES
A	10.0±0.1	0.394 ^{+0.004} _{-0.005}
B	0.45 MAX.	0.018 MAX.
C	0.5 (T.P.)	0.020 (T.P.)
D	0.20±0.10	0.008±0.004
G	1.02 MAX.	0.041 MAX.
H	19.0±0.2	0.748±0.008
I	18.4±0.2	0.724 ^{+0.009} _{-0.008}
J	0.8±0.2	0.031 ^{+0.009} _{-0.008}
K	0.125 ^{+0.10} _{-0.05}	0.005 ^{+0.004} _{-0.002}
L	0.5±0.1	0.020 ^{+0.004} _{-0.005}
M	0.08	0.003
N	0.10	0.004
P	20.0±0.2	0.787 ^{+0.009} _{-0.008}
Q	0.05±0.05	0.002±0.002
R	5°±5°	5°±5°
S	1.1 MAX.	0.044 MAX.

S40GZ-50-LKH-2

Recommended Soldering Conditions

The following conditions (see table below) must be met when soldering the μPD23C4001EJ.

For more details, refer to our document “**SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL**” (C10535E).

Please consult our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

Types of Surface Mount Device

μPD23C4001EJGW : 32-pin Plastic SOP (525 mil)

μPD23C4001EJGZ-LJH : 40-pin Plastic TSOP (I) (10 × 20 mm) (Normal bent)

μPD23C4001EJGZ-LKH : 40-pin Plastic TSOP (I) (10 × 20 mm) (Reverse bent)

Please consult with our sales offices.

Type of Through Hole Mount Device

μPD23C4001EJCZ : 32-pin Plastic DIP (600 mil)

Soldering process	Soldering conditions
Wave soldering (Only to leads)	Solder temperature: 260 °C or below, Flow time: 10 seconds or below
Partial heating method	Terminal temperature: 300 °C or below, Time: 3 seconds or below (Per one lead)

Caution Do not jet molten solder on the surface of package.

[MEMO]

[MEMO]

[MEMO]

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 device 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.

[MEMO]

The export of this product from Japan is regulated by the Japanese government. To export this product may be prohibited without governmental license, the need for which must be judged by the customer. The export or re-export of this product from a country other than Japan may also be prohibited without a license from that country. Please call an NEC sales representative.

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.