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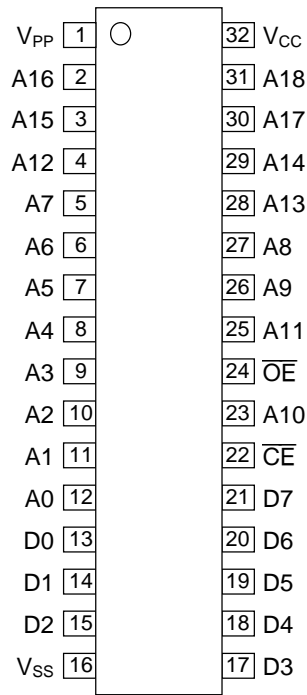# MR27V401E

524,288-Word × 8-Bit One Time PROM

GENERAL DESCRIPTION

The MR27V401E is a 4 Mbit electrically One Time Programmable Read-Only Memory organized as 524,288-word × 8-bit. The MR27V401E supports high speed asynchronous read operation using a single 3.3V power supply.
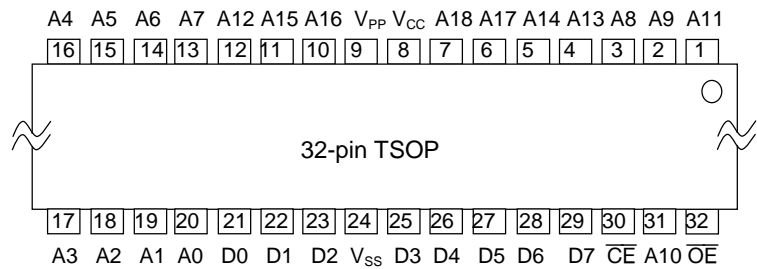
FEATURES

· 524,288-word × 8-bit
· +3.3 V power supply
· Access time   70 nS MAX
· Operating current   25 mA MAX
· Standby current   50 μA MAX
· Input/Output TTL compatible
· Three-state output
· Packages:

         32-pin plastic SOP   (SOP32-P-525-1.27-K)   (MR27V401EMA)
         32-pin plastic TSOP (TSOP(1)32-P-0814-0.50-1K)   (MR27V401ETA)
   32-pin plastic DIP   (DIP32-P-600-2.54)   (MR27V401ERA)

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PIN CONFIGURATION (TOP VIEW)

```
              V_PP  1   ◯    32  V_CC
              A16   2         31  A18
              A15   3         30  A17
              A12   4         29  A14
              A7    5         28  A13
              A6    6         27  A8
              A5    7         26  A9
              A4    8         25  A11
              A3    9         24  OE̅
              A2   10         23  A10
              A1   11         22  C̅E̅
              A0   12         21  D7
              D0   13         20  D6
              D1   14         19  D5
              D2   15         18  D4
              V_SS 16         17  D3
```

32-pin SOP/DIP

```
   A4  A5  A6  A7 A12 A15 A16 V_PP V_CC A18 A17 A14 A13 A8  A9 A11
   16  15  14  13  12  11  10   9   8    7   6   5   4   3   2   1
                                                            ◯
  ≈                        32-pin TSOP                      ≈

   17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32
   A3  A2  A1  A0  D0  D1  D2 V_SS D3  D4  D5  D6  D7  C̅E̅ A10 OE̅
```

Pin name	Functions
A0 to A18	Address input
D0 to D7	Data output
C̅E̅	Chip enable
O̅E̅	Output enable
V_CC	Power supply voltage
V_SS	GND
V_PP	Program power supply voltage

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BLOCK DIAGRAM
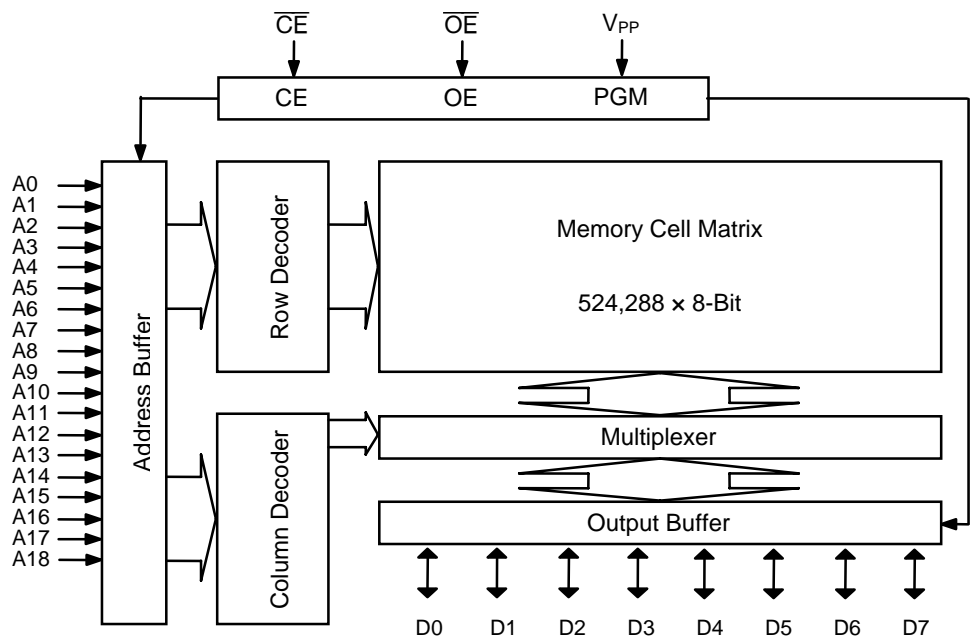
FUNCTION TABLE

Mode	$\overline{CE}$	$\overline{OE}$	DC	V_{CC}	D0 to D7
Read	L	L			D_{OUT}
Output disable	L	H	**	3.3 V	Hi–Z
Standby	H	*			Hi–Z
Program	L	H			D_{IN}
Program Inhibit	H	H	9.75V	4.0V	Hi–Z
Program verify	H	L			D_{OUT}

*: Don't Care (H or L)
**: Don't Care (H or L or OPEN)

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ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Value	Unit
Operating temperature under bias	Ta	—	0 to 70	°C
Storage temperature	Tstg		−55 to 125	°C
Input voltage	V_I		−0.5 to V_{CC}+0.5	V
Output voltage	V_O	relative to V_{SS}	−0.5 to V_{CC}+0.5	V
Power supply voltage	V_{CC}		−0.5 to 5	V
Program power supply voltage	V_{PP}		−0.5 to 11.5	V
Power dissipation per package	P_D	—	1.0	W

RECOMMENDED OPERATING CONDITIONS

(Ta = 0 to 70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
V_{CC} power supply voltage	V_{CC}		3.0	—	3.6	V
V_{PP} power supply voltage	V_{PP}	V_{CC} = 3.0 to 3.6 V	−0.5	—	V_{CC}+0.5∗	V
Input "H" level	V_{IH}		2.2	—	V_{CC}+0.5∗	V
Input "L" level	V_{IL}		−0.5∗∗	—	0.6	V

Voltage is relative to V_{SS}.

∗ : Vcc+1.5V(Max.) when pulse width of overshoot is less than 10ns.

∗∗ : -1.5V(Min.) when pulse width of undershoot is less than 10ns.

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ELECTRICAL CHARACTERISTICS

DC Characteristics

(V_{CC} = 3.3 V $\pm$ 0.3 V, Ta = 0 to 70°C)

parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I_{LI}	V_I = 0 to V_{CC}	—	—	10	μA
Output leakage current	I_{LO}	V_O = 0 to V_{CC}	—	—	10	μA
V_{CC} power supply current (Standby)	I_{CCSC}	$\overline{CE}$ = V_{CC}	—	—	50	μA
	I_{CCST}	$\overline{CE}$ = V_{IH}	—	—	1	mA
V_{CC} power supply current (Read)	I_{CCA}	$\overline{CE}$ = V_{IL}, $\overline{OE}$ = V_{IH} tc = 70 ns	—	—	25	mA
V_{PP} power supply current	I_{PP}	V_{PP} = V_{CC}	—	—	10	μA
Input "H" level	V_{IH}	—	2.2	—	V_{CC}+0.5∗	V
Input "L" level	V_{IL}	—	−0.5∗∗	—	0.6	V
Output "H" level	V_{OH}	I_{OH} = −400 μA	2.4	—	—	V
Output "L" level	V_{OL}	I_{OL} = 2.1 mA	—	—	0.4	V

Voltage is relative to V_{SS}.

∗ : Vcc+1.5V(Max.) when pulse width of overshoot is less than 10ns.

∗∗ : -1.5V(Min.) when pulse width of undershoot is less than 10ns.

AC Characteristics

(V_{CC} = 3.3 V $\pm$ 0.3 V, Ta = 0 to 70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Address cycle time	t_C	—	70	—	ns
Address access time	t_{ACC}	$\overline{CE}$ = $\overline{OE}$ = V_{IL}	—	70	ns
$\overline{CE}$ access time	t_{CE}	$\overline{OE}$ = V_{IL}	—	70	ns
30	t_{OE}	$\overline{CE}$ = V_{IL}	—	35	ns
Output disable time	t_{CHZ}	$\overline{OE}$ = V_{IL}	0	30	ns
	t_{OHZ}	$\overline{CE}$ = V_{IL}	0	25	ns
Output hold time	t_{OH}	$\overline{CE}$ = $\overline{OE}$ = V_{IL}	0	—	ns

Measurement conditions

Input signal level -------------------------------- 0 V/3 V

Input timing reference level ----------------- 0.8 V/2.0 V

Output load -------------------------------------- 50 pF

Output timing reference level --------------- 0.8 V/2.0 V

2.08 V

800 Ω

Output

50 pF
(Including scope and jig)

TIMING CHART (READ CYCLE)

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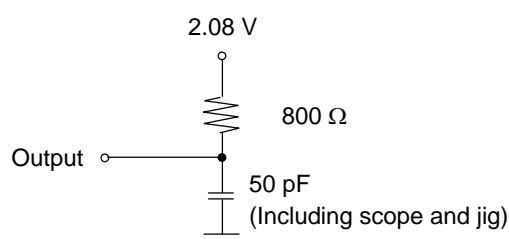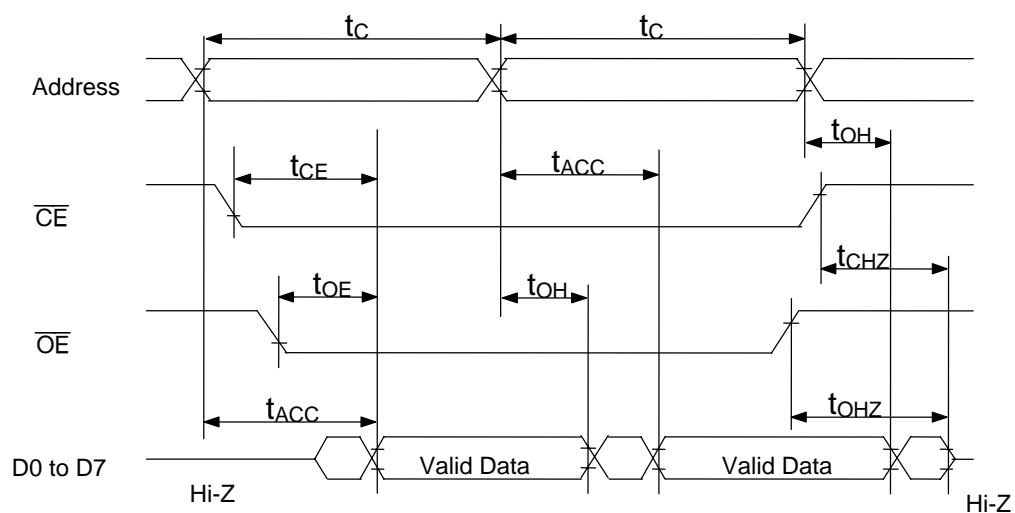
ELECTRICAL CHARACTERISTICS (PROGRAMMING OPERATION)

DC Characteristics

(Ta = 25°C ± 5°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input leakage current	I_{LI}	$V_I = V_{CC}$+0.5 V	—	—	10	μA
V_{PP} power supply current (Program)	I_{PP2}	$\overline{CE}$ = V_{IL}	—	—	50	mA
V_{CC} power supply current	I_{CC}	—	—	—	80	mA
Input "H" level	V_{IH}	—	3.0	—	V_{CC}+0.5	V
Input "L" level	V_{IL}	—	−0.5	—	0.8	V
Output "H" level	V_{OH}	I_{OH} = −400 μA	2.4	—	—	V
Output "L" level	V_{OL}	I_{OL} = 2.1 mA	—	—	0.45	V
Program voltage	V_{PP}	—	9.5	9.75	10.0	V
V_{CC} power supply voltage	V_{CC}	—	3.9	4.0	4.1	V

Voltage is relative to V_{SS}.

AC Characteristics

(V_{CC} = 4.0 V ± 0.1 V, V_{PP} = 9.75 V ± 0.25 V, Ta = 25°C ± 5°C)

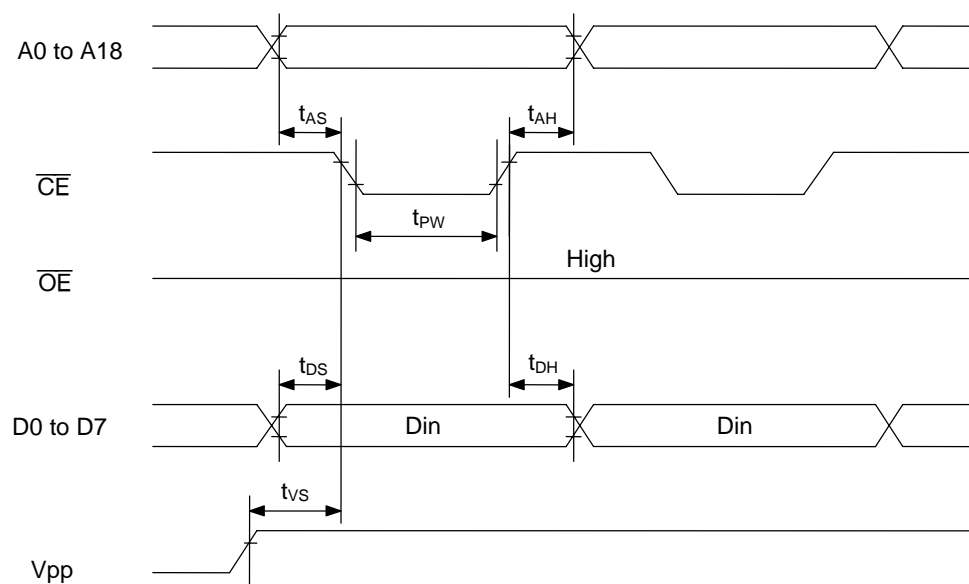| Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Address set-up time	t_{AS}	—	100	—	—	ns
$\overline{OE}$ set-up time	t_{OES}	—	2	—	—	μs
Data set-up time	t_{DS}	—	100	—	—	ns
Address hold time	t_{AH}	—	2	—	—	μs
Data hold time	t_{DH}	—	100	—	—	ns
Output float delay time from $\overline{OE}$	t_{OHZ}	—	0	—	100	ns
V_{PP} voltage set-up time	t_{VS}	—	2	—	—	μs
Program pulse width	t_{PW}	—	9	10	11	μs
Data valid from $\overline{OE}$	t_{OE}	—	—	—	100	ns
Address hold from $\overline{OE}$ high	t_{AOH}	—	0	—	—	ns

Pin Check Function

Pin Check Function is to check contact between each device-pin and each socket-lead with EPROM programmer. Setting up address as following condition call the preprogrammed codes on device outputs.

(V_{CC} = 3.3 V ± 0.3 V, $\overline{CE}$ = V_{IL}, $\overline{OE}$ = V_{IL}, Ta = 25°C ± 5°C)
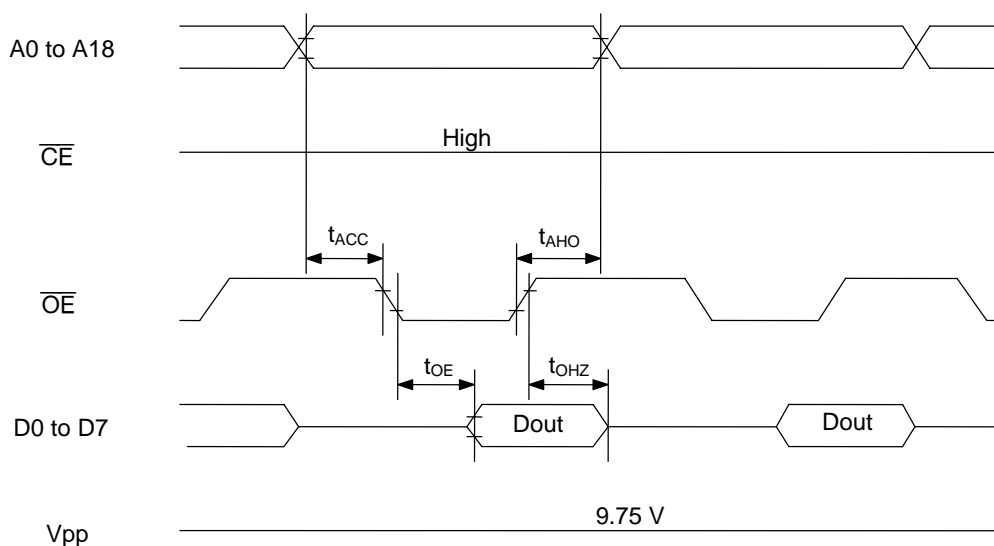
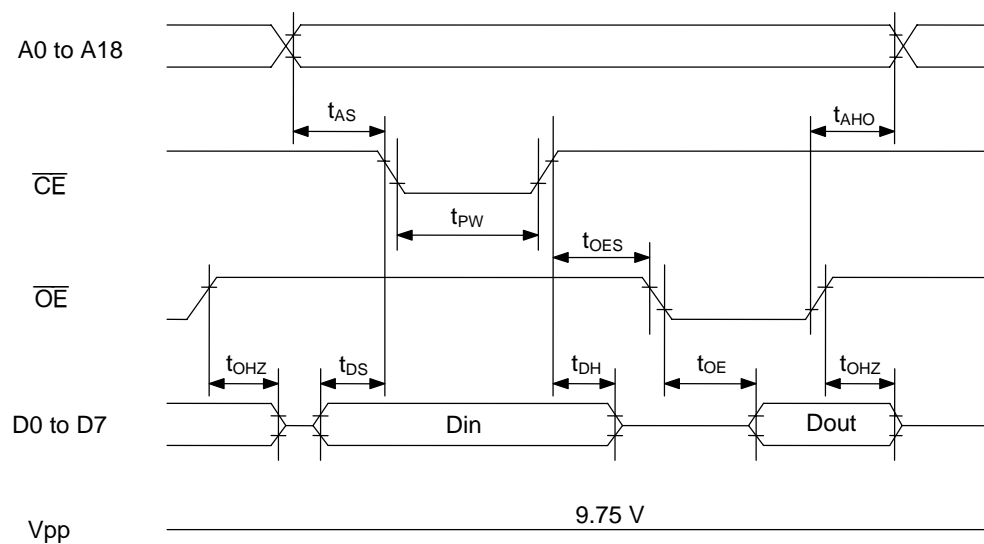| A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	DATA
0	1	0	1	0	1	0	1	0	VH*	1	1	0	1	0	1	0	1	0	AA
1	0	1	0	1	0	1	0	1	VH*	0	0	1	0	1	0	1	0	1	55
Other conditions																			FF

∗: VH = 8 V ± 0.25 V

Consecutive Programming Waveforms

Consecutive Program Verify Waveforms

Program and Program Verify Cycle Waveforms

Pin Capacitance

(V_{CC} = 3.3 V, Ta = 25°C, f = 1 MHz)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input	C_{IN1}	V_I = 0 V	—	—	8	pF
Output	C_{OUT}	V_O = 0 V	—	—	10	

Programming/Verify Flow Chart

Programming

```
                              ┌──────────┐
                              │  Start   │
                              └──────────┘
                                   │
         NG                      ◇ Pin Check ◇
  ┌──────────────┐◄────────────
  │ Bad Insertion│
  └──────────────┘               │ PASS
                         ┌────────────────────┐
                         │Address = First Location│
                         └────────────────────┘
                                   │
                         ┌──────────────┐
                         │ V_CC = 4.0 V │
                         └──────────────┘
                                   │
                         ┌──────────────┐
                         │ V_PP = 9.75 V│
                         └──────────────┘
                                   │
                         ┌──────────────┐
                    ┌───►│Program 10 μs │
                    │    └──────────────┘
                    │            │
  ┌──────────────┐ NO   ◇ Last Address? ◇
  │Increment Address│◄────
  └──────────────┘            │ YES
                         ┌────────────────────┐
                         │Address = First Location│
                         └────────────────────┘
```

$V_{CC} = 4.0$ V

$V_{PP} = 9.75$ V

Program 10 μs

Increment Address

Last Address?

Address = First Location

X = 0

Verify(One Byte) NG → X = X+1

X = 2? → YES

Program 10 μs NO

Increment Address NO Last Address? YES

$V_{CC} = 3.0$ V/$V_{PP} = 3.0$ V

Verify NG → Device Failed

PASS

Device Passed

Verify

Start

Pin Check NG → Bad Insertion

PASS

Address = First Location

$V_{CC} = 3.0$ V/$V_{PP} = 3.0$ V

Verify NG

PASS

$V_{CC} = 3.6$ V/$V_{PP} = 3.6$ V

Verify NG

PASS

Device Passed   Device Failed

PACKAGE DIMENSIONS

(Unit: mm)

SOP32-P-525-1.27-K

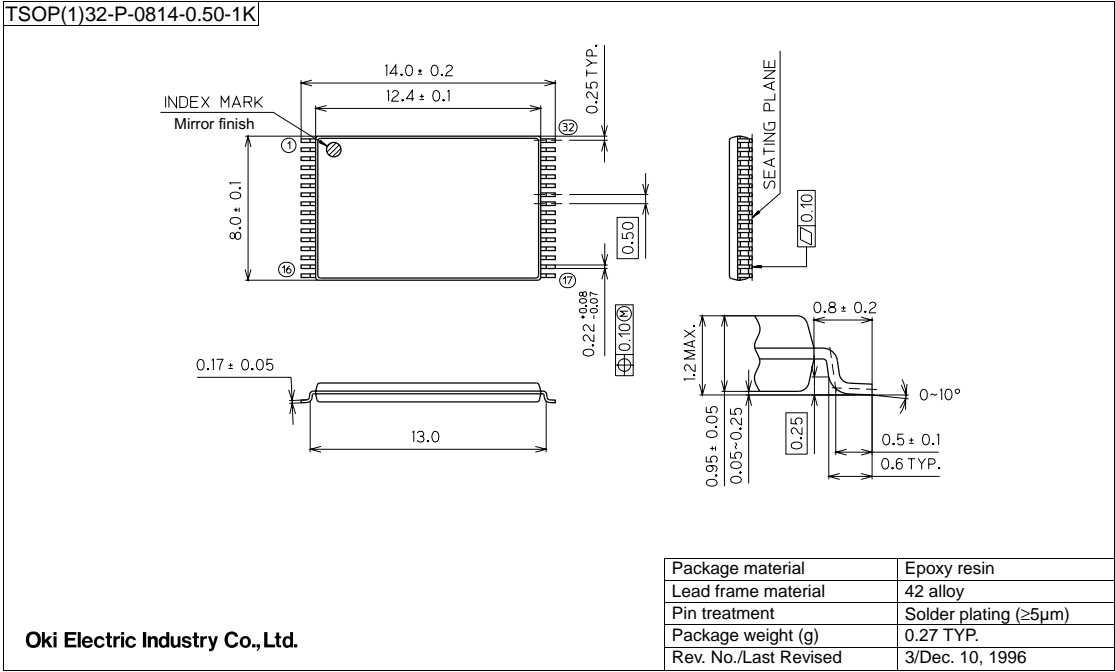| Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5μm)
Package weight (g)	1.32 TYP.
Rev. No./Last Revised	5/Fev. 10, 1997

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Notes for Mounting the Surface Mount Type Package

The surface mount type packages are very susceptible to heat in reflow mounting and humidity absorbed in storage. Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).
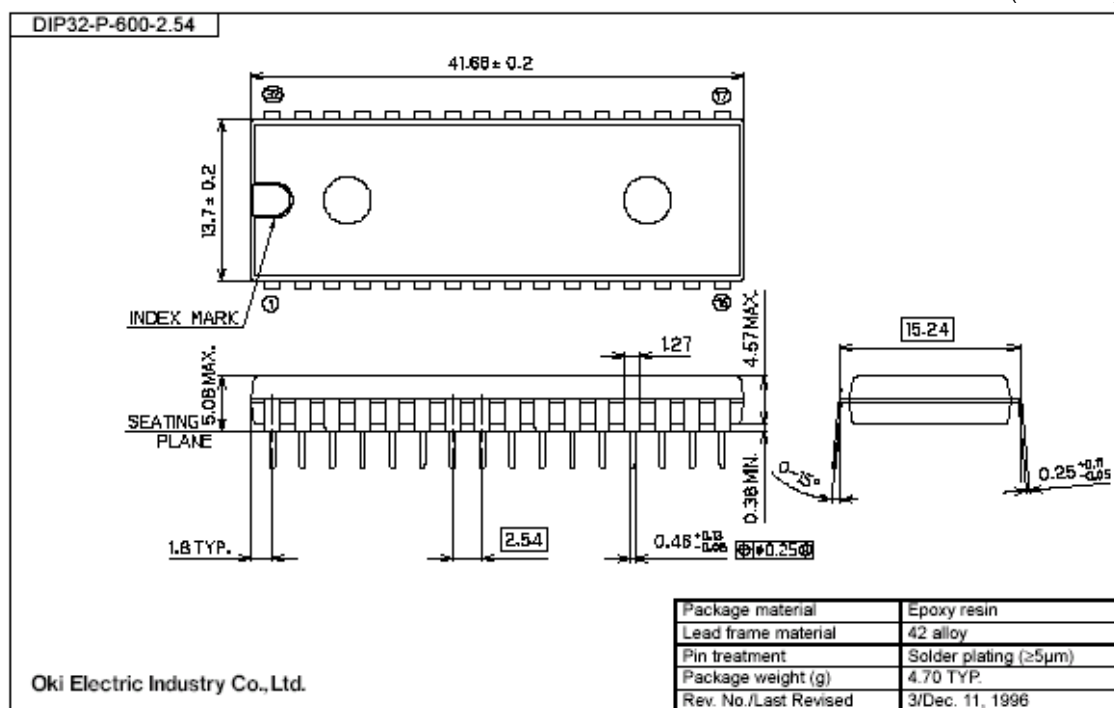
(Unit: mm)

TSOP(1)32-P-0814-0.50-1K

Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5µm)
Package weight (g)	0.27 TYP.
Rev. No./Last Revised	3/Dec. 10, 1996

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Notes for Mounting the Surface Mount Type Package

The surface mount type packages are very susceptible to heat in reflow mounting and humidity absorbed in storage. Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

(Unit: mm)

DIP32-P-600-2.54

Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5μm)
Package weight (g)	4.70 TYP.
Rev. No./Last Revised	3/Dec. 11, 1996

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REVISION HISTORY

Document No.	Date	Page		Description
		Previous Edition	Current Edition	
FEDR27V401E-01-02	Sep. 2001	–	–	Final edition 2
FEDR27V401E-01-03	Jan. 15, 2004	1, 2	1, 2, 13	Added 32DIP package.

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