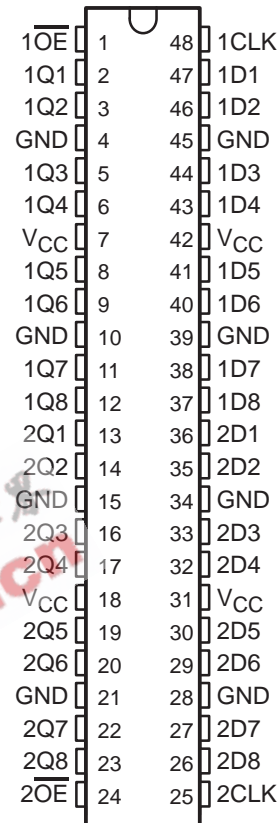


SN54ACT16374, 74ACT16374 16-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

SCAS124B – MARCH 1990 – REVISED APRIL 1996

- Members of the Texas Instruments *Widebus*™ Family
- Inputs Are TTL-Voltage Compatible
- 3-State Bus-Driving True Outputs
- Flow-Through Architecture Optimizes PCB Layout
- Distributed Center-Pin V_{CC} and GND Configurations Minimize High-Speed Switching Noise
- *EPIC*™ (Enhanced-Performance Implanted CMOS) 1- μ m Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) Packages Using 25-mil Center-to-Center Pin Spacings and 380-mil Fine-Pitch Ceramic Flat (WD) Packages Using 25-mil Center-to-Center Pin Spacings

SN54ACT16374 . . . WD PACKAGE
74ACT16374 . . . DL PACKAGE
(TOP VIEW)



description

The SN54ACT16374 and 74ACT16374 are 16-bit edge-triggered D-type flip-flops with 3-state outputs designed specifically for driving highly-capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

These devices can be used as two 8-bit flip-flops or one 16-bit flip-flop. On the positive transition of the clock (CLK) input, the Q outputs of the flip-flop take on the logic levels set up at the data (D) inputs.

An output-enable input (\overline{OE}) can be used to place the outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state provides the capability to drive bus lines in a bus-organized system without need for interface or pullup components. \overline{OE} does not affect the internal operations of the flip-flop. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The 74ACT16374 is packaged in TI's shrink small-outline package, which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit board area.

The SN54ACT16374 is characterized for operation over the full military temperature range of -55°C to 125°C . The 74ACT16374 is characterized for operation from -40°C to 85°C .



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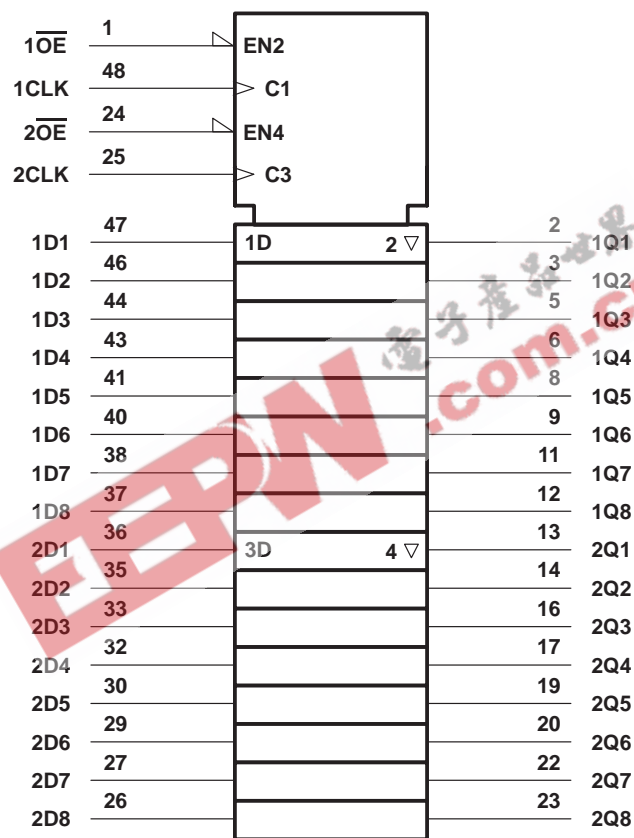
SN54ACT16374, 74ACT16374 16-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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FUNCTION TABLE
(each section)

| INPUTS | | | OUTPUT |
|-----------------|--------|---|--------|
| \overline{OE} | CLK | D | Q |
| L | ↑ | H | H |
| L | ↑ | L | L |
| L | H or L | X | Q_0 |
| H | X | X | Z |

logic symbol†

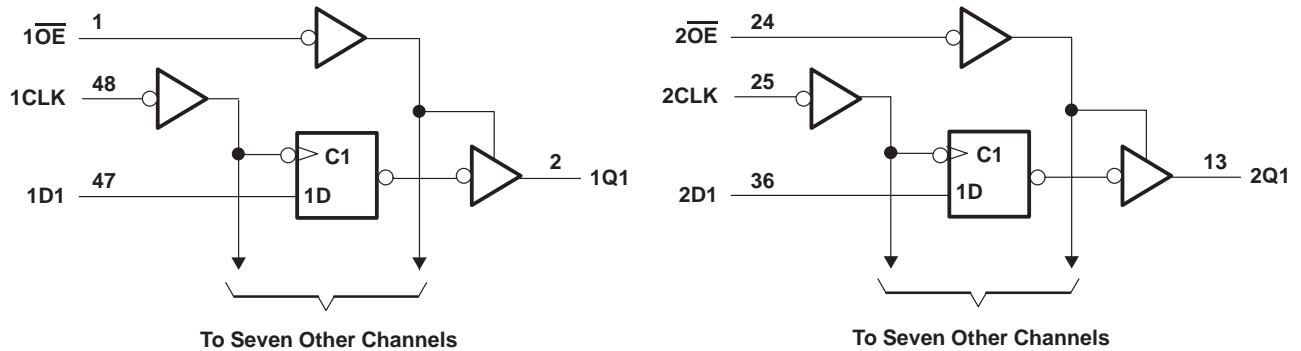


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

SN54ACT16374, 74ACT16374 16-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

| | |
|---|--|
| Supply voltage range, V_{CC} | -0.5 V to 7 V |
| Input voltage range, V_I (see Note 1) | -0.5 V to $V_{CC} + 0.5$ V |
| Output voltage range, V_O (see Note 1) | -0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) | ± 20 mA |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) | ± 50 mA |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ± 50 mA |
| Continuous current through V_{CC} or GND | ± 400 mA |
| Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): DL package | 1.2 W |
| Storage temperature range, T_{stg} | -65°C to 150°C |

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

recommended operating conditions (see Note 3)

| | SN54ACT16374 | | | 74ACT16374 | | | UNIT |
|--|--------------|-----|----------|------------|-----|----------|------------------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V_{CC} Supply voltage (see Note 4) | 4.5 | 5 | 5.5 | 4.5 | 5 | 5.5 | V |
| V_{IH} High-level input voltage | 2 | | | 2 | | | V |
| V_{IL} Low-level input voltage | | | 0.8 | | | 0.8 | V |
| V_I Input voltage | 0 | | V_{CC} | 0 | | V_{CC} | V |
| V_O Output voltage | 0 | | V_{CC} | 0 | | V_{CC} | V |
| I_{OH} High-level output current | | | -24 | | | -24 | mA |
| I_{OL} Low-level output current | | | 24 | | | 24 | mA |
| $\Delta t/\Delta v$ Input transition rise or fall rate | 0 | | 10 | 0 | | 10 | ns/V |
| T_A Operating free-air temperature | -55 | | 125 | -40 | | 85 | $^\circ\text{C}$ |

- NOTES: 3. Unused inputs must be held high or low to prevent them from floating.
4. All V_{CC} and GND pins must be connected to the proper voltage supply.

SN54ACT16374, 74ACT16374 16-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | SN54ACT16374 | | 74ACT16374 | | UNIT |
|---------------------------------------|---|-----------------|-----------------------|-----|------|--------------|------|------------|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = -50 μA | 4.5 V | 4.4 | | | 4.4 | | 4.4 | V | |
| | | 5.5 V | 5.4 | | | 5.4 | | 5.4 | | |
| | I _{OH} = -24 mA | 4.5 V | 3.94 | | | 3.7 | | 3.8 | | |
| | | 5.5 V | 4.94 | | | 4.7 | | 4.8 | | |
| | I _{OH} = -50 mA [†] | 5.5 V | | | | 3.85 | | | | |
| I _{OH} = -75 mA [†] | 5.5 V | | | | | | 3.85 | | | |
| V _{OL} | I _{OL} = 50 μA | 4.5 V | | | | 0.1 | | 0.1 | V | |
| | | 5.5 V | | | | 0.1 | | 0.1 | | |
| | I _{OL} = 24 mA | 4.5 V | | | | 0.36 | | 0.44 | | |
| | | 5.5 V | | | | 0.36 | | 0.44 | | |
| | I _{OL} = 50 mA [†] | 5.5 V | | | | | 1.65 | | | |
| I _{OL} = 75 mA [†] | 5.5 V | | | | | | 1.65 | | | |
| I _I | V _I = V _{CC} or GND | 5.5 V | | | ±0.1 | | ±1 | ±1 | μA | |
| I _{OZ} | V _O = V _{CC} or GND | 5.5 V | | | ±0.5 | | ±10 | ±5 | μA | |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | | | 8 | | 160 | 80 | μA | |
| ΔI _{CC} [‡] | One input at 3.4 V, Other inputs at GND or V _{CC} | 5.5 V | | | 0.9 | | 1 | 1 | mA | |
| C _i | V _I = V _{CC} or GND | 5 V | | | 4.5 | | | | pF | |
| C _o | V _O = V _{CC} or GND | 5 V | | | 12 | | | | pF | |

[†] Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

[‡] This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V to V_{CC}.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

| | | T _A = 25°C | | SN54ACT16374 | | 74ACT16374 | | UNIT |
|--------------------|--|-----------------------|-----|--------------|-----|------------|-----|------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| f _{clock} | Clock frequency | 0 | 65 | 0 | 65 | 0 | 65 | MHz |
| t _w | Pulse duration | CLK low | 7.5 | | 7.5 | | 7.5 | ns |
| | | CLK high | 4.5 | | 4.5 | | 4.5 | |
| t _{su} | Setup time, data before CLK [↑] | 6.5 | | 6.5 | | 6.5 | ns | |
| t _h | Hold time, data after CLK [↑] | 1 | | 1 | | 1 | ns | |

SN54ACT16374, 74ACT16374
16-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS
WITH 3-STATE OUTPUTS

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | T _A = 25°C | | | SN54ACT16374 | | 74ACT16374 | | UNIT |
|------------------|-----------------|-------------|-----------------------|-----|------|--------------|------|------------|------|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| f _{max} | | | 65 | | | 65 | | 65 | | MHz |
| t _{PLH} | CLK | Q | 5.1 | 8.8 | 10.9 | 5.1 | 13.2 | 5.1 | 12.4 | ns |
| t _{PHL} | | | 5.3 | 8.8 | 10.9 | 5.3 | 13.1 | 5.3 | 12.2 | |
| t _{PZH} | \overline{OE} | Q | 3.7 | 8.4 | 10.5 | 3.7 | 12.7 | 3.7 | 11.9 | ns |
| t _{PZL} | | | 4.4 | 9.7 | 11.9 | 4.4 | 14.3 | 4.4 | 13.4 | |
| t _{PHZ} | \overline{OE} | Q | 5.4 | 7.9 | 9.8 | 5.4 | 10.9 | 5.4 | 10.4 | ns |
| t _{PLZ} | | | 4.9 | 7.2 | 9.1 | 4.9 | 10.2 | 4.9 | 9.8 | |

operating characteristics, V_{CC} = 5 V, T_A = 25°C

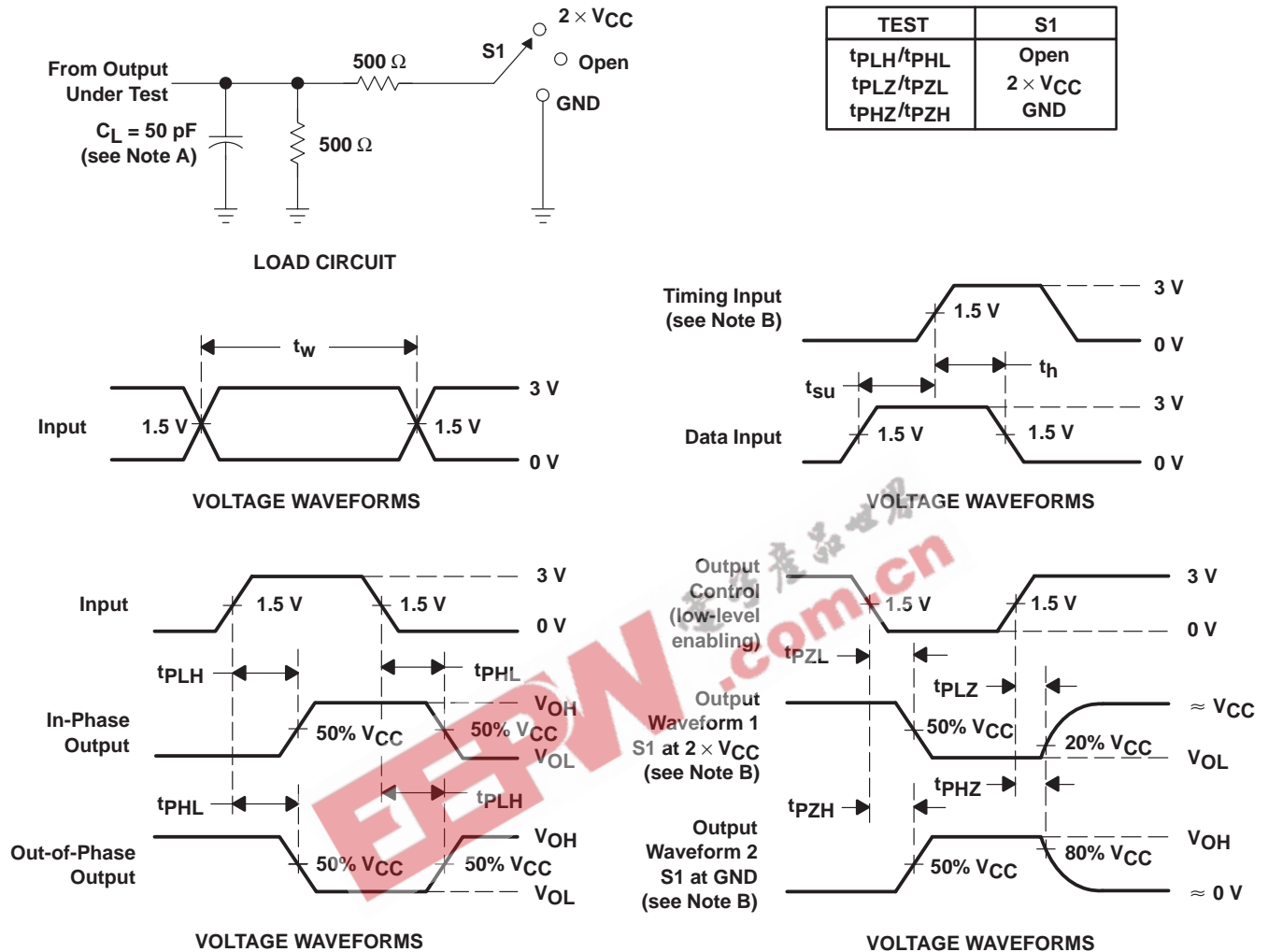
| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|-----------------|---|------------------|-----|------|
| C _{pd} | Power dissipation capacitance per flip-flop | Outputs enabled | 52 | pF |
| | | Outputs disabled | 38 | |

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SN54ACT16374, 74ACT16374 16-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS WITH 3-STATE OUTPUTS

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PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: PRR \leq 1 MHz, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9202501MXA | ACTIVE | CFP | WD | 48 | 1 | TBD | Call TI | Level-NC-NC-NC |
| 74ACT16374DL | ACTIVE | SSOP | DL | 48 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| 74ACT16374DLR | ACTIVE | SSOP | DL | 48 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| 74ACT16374DLRG4 | ACTIVE | SSOP | DL | 48 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SNJ54ACT16374WD | ACTIVE | CFP | WD | 48 | 1 | TBD | Call TI | Level-NC-NC-NC |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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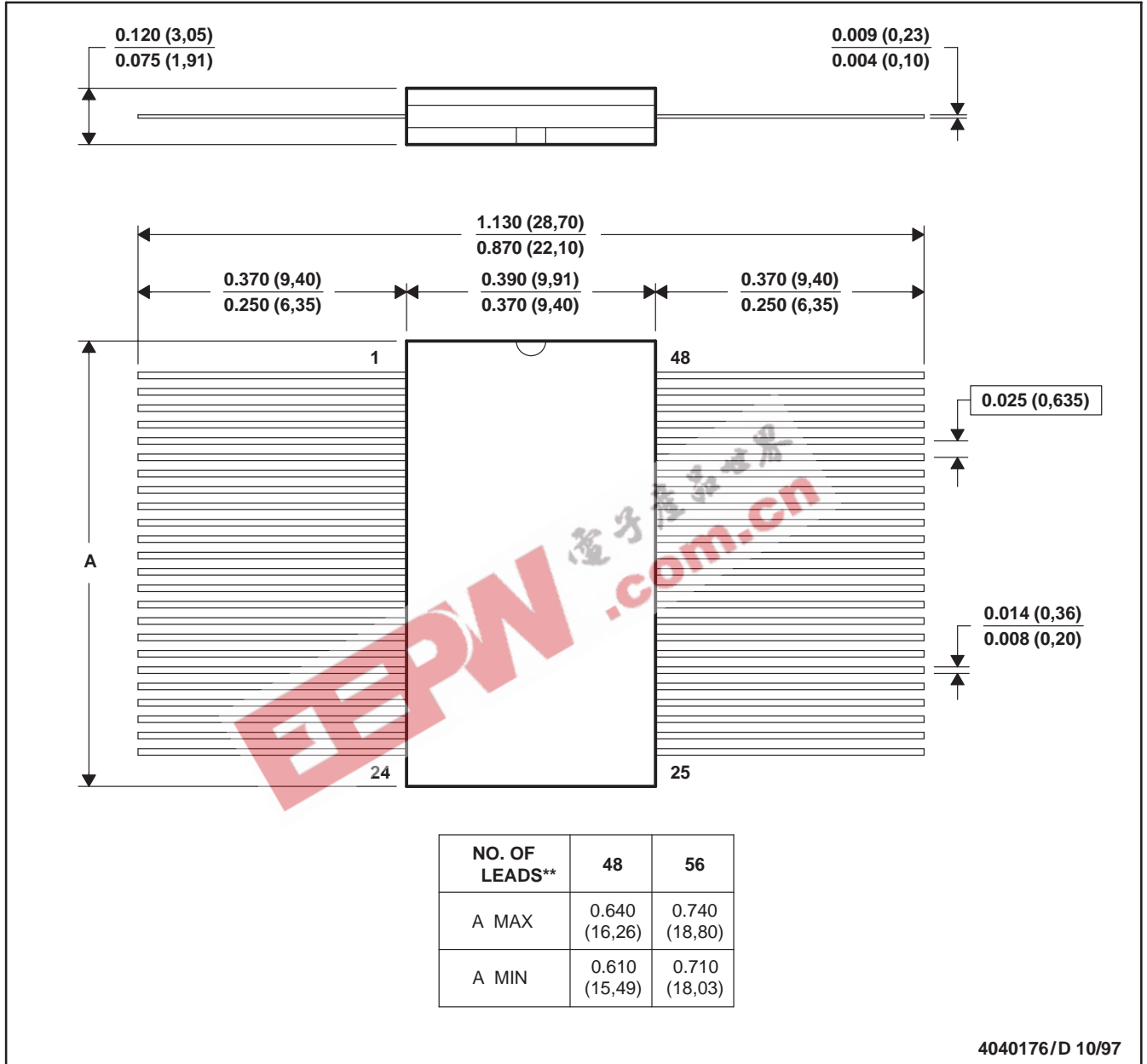
MECHANICAL DATA

MCFP010B – JANUARY 1995 – REVISED NOVEMBER 1997

WD (R-GDFP-F**)

CERAMIC DUAL FLATPACK

48 LEADS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. This package can be hermetically sealed with a ceramic lid using glass frit.
 D. Index point is provided on cap for terminal identification only
 E. Falls within MIL STD 1835: GDFP1-F48 and JEDEC MO-146AA
 GDFP1-F56 and JEDEC MO-146AB

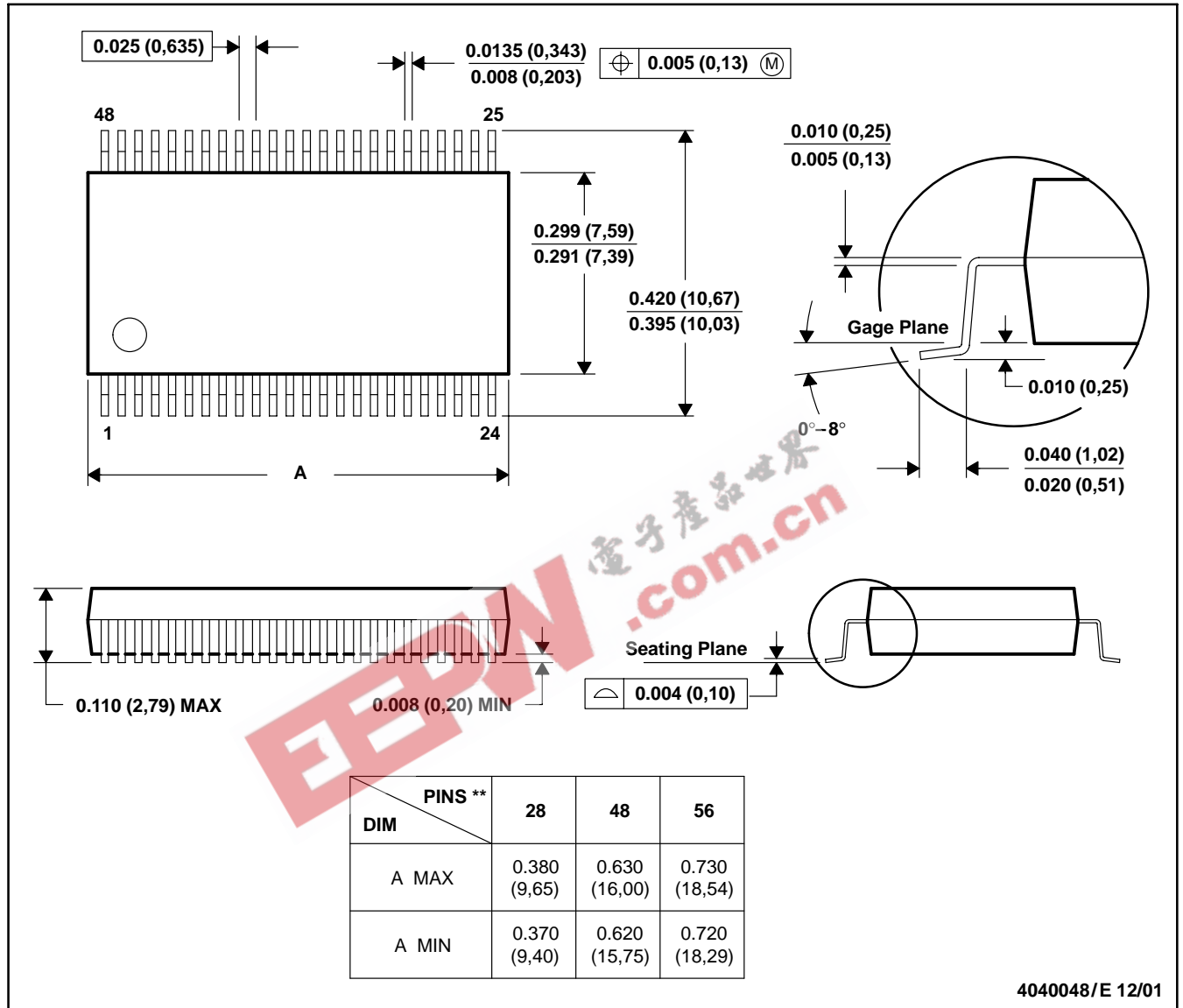
MECHANICAL DATA

MSS0001C – JANUARY 1995 – REVISED DECEMBER 2001

DL (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 D. Falls within JEDEC MO-118

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