

Features

- I_{off} supports partial-power-down mode operation
- Edge-rate control circuitry for significantly improved noise characteristics
- Typical output skew < 250 ps
- ESD > 2000V
- TSSOP (19.6-mil pitch) and SSOP (25-mil pitch) packages
- Industrial temperature range of -40°C to $+85^{\circ}\text{C}$
- $V_{CC} = 5\text{V} \pm 10\%$

CY74FCT16373T Features:

- 64 mA sink current, 32 mA source current
- Typical V_{OLP} (ground bounce) < 1.0V at $V_{CC} = 5\text{V}$, $T_A = 25^{\circ}\text{C}$

CY74FCT162373T Features:

- Balanced 24 mA output drivers
- Reduced system switching noise
- Typical V_{OLP} (ground bounce) < 0.6V at $V_{CC} = 5\text{V}$, $T_A = 25^{\circ}\text{C}$

Functional Description

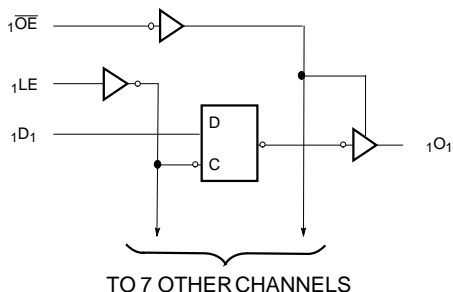
CY74FCT16373T and CY74FCT162373T are 16-bit D-type latches designed for use in bus applications requiring high speed and low power. These devices can be used as two independent 8-bit latches or as a single 16-bit latch by connecting the Output Enable (\overline{OE}) and Latch (LE) inputs. Flow-through pinout and small shrink packaging aid in simplifying board layout.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

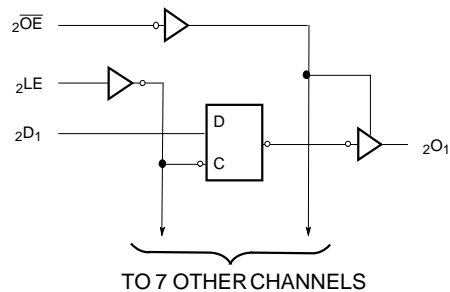
The CY74FCT16373T is ideally suited for driving high-capacitance loads and low-impedance backplanes.

The CY74FCT162373T has 24-mA balanced output drivers with current limiting resistors in the outputs. This reduces the need for external terminating resistors and provides for minimal undershoot and reduced ground bounce. The CY74FCT162373T is ideal for driving transmission lines.

Logic Block Diagrams



FCT162373-1

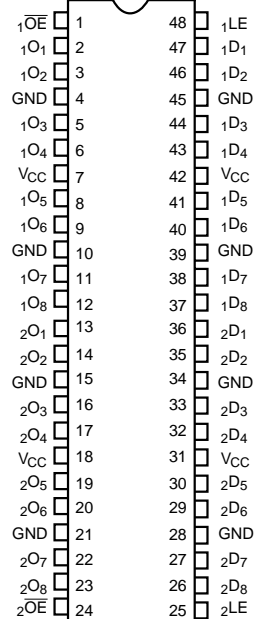


FCT162373-2

Pin Configuration

SSOP/TSSOP/TVSOP

Top View



FCT162373-3

Pin Description

| Name | Description |
|-----------------|-----------------------------------|
| D | Data Inputs |
| LE | Latch Enable Inputs (Active HIGH) |
| \overline{OE} | Output Enable Inputs (Active LOW) |
| O | Three-State Outputs |

Function Table^[1]

| Inputs | | | Outputs |
|--------|----|-----------------|----------------|
| D | LE | \overline{OE} | O |
| H | H | L | H |
| L | H | L | L |
| X | L | L | Q ₀ |
| X | X | H | Z |

Maximum Ratings^[2, 3]

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature..... Com'l -55°C to +125°C

Ambient Temperature with Power Applied..... Com'l -55°C to +125°C

DC Input Voltage -0.5V to +7.0V

DC Output Voltage -0.5V to +7.0V

DC Output Current (Maximum Sink Current/Pin) -60 to +120 mA

Power Dissipation 1.0W

Static Discharge Voltage..... >2001V (per MIL-STD-883, Method 3015)

Operating Range

| Range | Ambient Temperature | V _{CC} |
|------------|---------------------|-----------------|
| Industrial | -40°C to +85°C | 5V ± 10% |

Electrical Characteristics Over the Operating Range

| Parameter | Description | Test Conditions | Min. | Typ. ^[4] | Max. | Unit |
|------------------|---|--|------|---------------------|------|------|
| V _{IH} | Input HIGH Voltage | | 2.0 | | | V |
| V _{IL} | Input LOW Voltage | | | | 0.8 | V |
| V _H | Input Hysteresis ^[5] | | | 100 | | mV |
| V _{IK} | Input Clamp Diode Voltage | V _{CC} =Min., I _{IN} =-18 mA | | -0.7 | -1.2 | V |
| I _{IH} | Input HIGH Current | V _{CC} =Max., V _I =V _{CC} | | | ±1 | ∞A |
| I _{IL} | Input LOW Current | V _{CC} =Max., V _I =GND | | | ±1 | ∞A |
| I _{OZH} | High Impedance Output Current (Three-State Output pins) | V _{CC} =Max., V _{OUT} =2.7V | | | ±1 | ∞A |
| I _{OZL} | High Impedance Output Current (Three-State Output pins) | V _{CC} =Max., V _{OUT} =0.5V | | | ±1 | ∞A |
| I _{OS} | Short Circuit Current ^[6] | V _{CC} =Max., V _{OUT} =GND | -80 | -140 | -200 | mA |
| I _O | Output Drive Current ^[6] | V _{CC} =Max., V _{OUT} =2.5V | -50 | | -180 | mA |
| I _{OFF} | Power-Off Disable | V _{CC} =0V, V _{OUT} ≤4.5V ^[7] | | | ±1 | ∞A |

Output Drive Characteristics for CY74FCT16373T

| Parameter | Description | Test Conditions | Min. | Typ. ^[4] | Max. | Unit |
|-----------------|---------------------|--|------|---------------------|------|------|
| V _{OH} | Output HIGH Voltage | V _{CC} =Min., I _{OH} =-3 mA | 2.5 | 3.5 | | V |
| | | V _{CC} =Min., I _{OH} =-15 mA | 2.4 | 3.5 | | V |
| | | V _{CC} =Min., I _{OH} =-32 mA | 2.0 | 3.0 | | V |
| V _{OL} | Output LOW Voltage | V _{CC} =Min., I _{OL} =64 mA | | 0.2 | 0.55 | V |

Notes:

- H = HIGH Voltage Level. L = LOW Voltage Level. X = Don't Care. Z = High Impedance. Q₀=Previous state of flip-flop.
- Operation beyond the limits set forth may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.
- Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
- Typical values are at V_{CC}=5.0V, T_A= +25°C ambient.
- This parameter is specified but not tested.
- Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample and hold techniques are preferable in order to minimize internal chip heating and more accurately reflect operational values. Otherwise prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parametric tests. In any sequence of parameter tests, I_{OS} tests should be performed last.
- Tested at +25°C.

Output Drive Characteristics for CY74FCT162373T

| Parameter | Description | Test Conditions | Min. | Typ. ^[4] | Max. | Unit |
|------------------|------------------------------------|---|------|---------------------|------|------|
| I _{ODL} | Output LOW Current ^[6] | V _{CC} =5V, V _{IN} =V _{IH} or V _{IL} , V _{OUT} =1.5V | 60 | 115 | 150 | mA |
| I _{ODH} | Output HIGH Current ^[6] | V _{CC} =5V, V _{IN} =V _{IH} or V _{IL} , V _{OUT} =1.5V | -60 | -115 | -150 | mA |
| V _{OH} | Output HIGH Voltage | V _{CC} =Min., I _{OH} =-24 mA | 2.4 | 3.3 | | V |
| V _{OL} | Output LOW Voltage | V _{CC} =Min., I _{OL} =24 mA | | 0.3 | 0.55 | V |

Capacitance^[5] (T_A = +25°C, f = 1.0 MHz)

| Parameter | Description | Test Conditions | Typ. ^[4] | Max. | Unit |
|------------------|--------------------|-----------------------|---------------------|------|------|
| C _{IN} | Input Capacitance | V _{IN} = 0V | 4.5 | 6.0 | pF |
| C _{OUT} | Output Capacitance | V _{OUT} = 0V | 5.5 | 8.0 | pF |

Power Supply Characteristics

| Parameter | Description | Test Conditions | Typ. ^[4] | Max. | Unit |
|------------------|--|---|---------------------|----------------------|--------|
| I _{CC} | Quiescent Power Supply Current | V _{CC} =Max. V _{IN} ≤0.2V, V _{IN} ≥V _{CC} -0.2V | 5 | 500 | ∞A |
| ΔI _{CC} | Quiescent Power Supply Current (TTL inputs HIGH) | V _{CC} =Max. V _{IN} =3.4V ^[8] | 0.5 | 1.5 | mA |
| I _{CCD} | Dynamic Power Supply Current ^[9] | V _{CC} =Max., One Input Toggling, 50% Duty Cycle, Outputs Open, OE=GND V _{IN} =V _{CC} or V _{IN} =GND | 60 | 100 | ∞A/MHz |
| I _C | Total Power Supply Current ^[10] | V _{CC} =Max., f ₁ =10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling, OE=GND, LE=V _{CC} V _{IN} =V _{CC} or V _{IN} =GND | 0.6 | 1.5 | mA |
| | | V _{CC} =Max., f ₁ =10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling, OE=GND, LE=V _{CC} V _{IN} =3.4V or V _{IN} =GND | 0.9 | 2.3 | mA |
| | | V _{CC} =Max., f ₁ =2.5 MHz, 50% Duty Cycle, Outputs Open, Sixteen Bits Toggling, OE=GND, LE=V _{CC} V _{IN} =V _{CC} or V _{IN} =GND | 2.4 | 4.5 ^[11] | mA |
| | | V _{CC} =Max., f ₁ =2.5 MHz, 50% Duty Cycle, Outputs Open, Sixteen Bits Toggling, OE=GND, LE=V _{CC} V _{IN} =3.4V or V _{IN} =GND | 6.4 | 16.5 ^[11] | mA |

Notes:

8. Per TTL driven input (V_{IN}=3.4V); all other inputs at V_{CC} or GND.
9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
10. $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$
 I_{CC} = Quiescent Current with CMOS input levels
 ΔI_{CC} = Power Supply Current for a TTL HIGH input (V_{IN}=3.4V)
 D_H = Duty Cycle for TTL inputs HIGH
 N_T = Number of TTL inputs at D_H
 I_{CCD} = Dynamic Current caused by an input transition pair (HLH or LHL)
 f₀ = Clock frequency for registered devices, otherwise zero
 f₁ = Input signal frequency
 N₁ = Number of inputs changing at f₁
 All currents are in milliamperes and all frequencies are in megahertz.
11. Values for these conditions are examples of the I_{CC} formula. These limits are specified but not tested.

Switching Characteristics Over the Operating Range^[12]

| Parameter | Description | CY74FCT16373AT CY74FCT162373AT | | Unit | Fig. No. ^[13] |
|--------------------------------------|----------------------------------|-----------------------------------|------|------|--------------------------|
| | | Min. | Max. | | |
| t _{PLH} t _{PHL} | Propagation Delay D to O | 1.5 | 5.2 | ns | 1, 3 |
| t _{PLH} t _{PHL} | Propagation Delay LE to O | 2.0 | 6.7 | ns | 1, 5 |
| t _{PZH} t _{PZL} | Output Enable Time | 1.5 | 6.1 | ns | 1, 7, 8 |
| t _{PHZ} t _{PLZ} | Output Disable Time | 1.5 | 5.5 | ns | 1, 7, 8 |
| t _{SU} | Set-Up Time HIGH or LOW, D to LE | 2.0 | | ns | 9 |
| t _H | Hold Time HIGH or LOW, D to LE | 1.5 | | ns | 9 |
| t _W | LE Pulse Width HIGH | 3.3 | | ns | 5 |
| t _{SK(O)} | Output Skew ^[14] | | 0.5 | ns | — |

| Parameter | Description | CY74FCT16373CT CY74FCT162373CT | | Unit | Fig. No. ^[13] |
|--------------------------------------|-----------------------------------|-----------------------------------|------|------|--------------------------|
| | | Min. | Max. | | |
| t _{PLH} t _{PHL} | Propagation Delay D to O | 1.5 | 4.2 | ns | 1, 3 |
| t _{PLH} t _{PHL} | Propagation Delay LE to O | 2.0 | 5.5 | ns | 1, 5 |
| t _{PZH} t _{PZL} | Output Enable Time | 1.5 | 5.5 | ns | 1, 7, 8 |
| t _{PHZ} t _{PLZ} | Output Disable Time | 1.5 | 5.0 | ns | 1, 7, 8 |
| t _{SU} | Set-Up Time HIGH or LOW, D to LE | 2.0 | | ns | 9 |
| t _H | Hold Time HIGH or LOW, D to LE | 1.5 | | ns | 9 |
| t _W | LE Pulse Width HIGH | 3.3 | | ns | 5 |
| t _{SK(O)} | Output Skew ^[14] | | 0.5 | ns | — |

Notes:

12. Minimum limits are specified but not tested on Propagation Delays.
13. See "Parameter Measurement Information" in the General Information section.
14. Skew between any two outputs of the same package switching in the same direction. This parameter is ensured by design.

Ordering Information CY74FCT16373

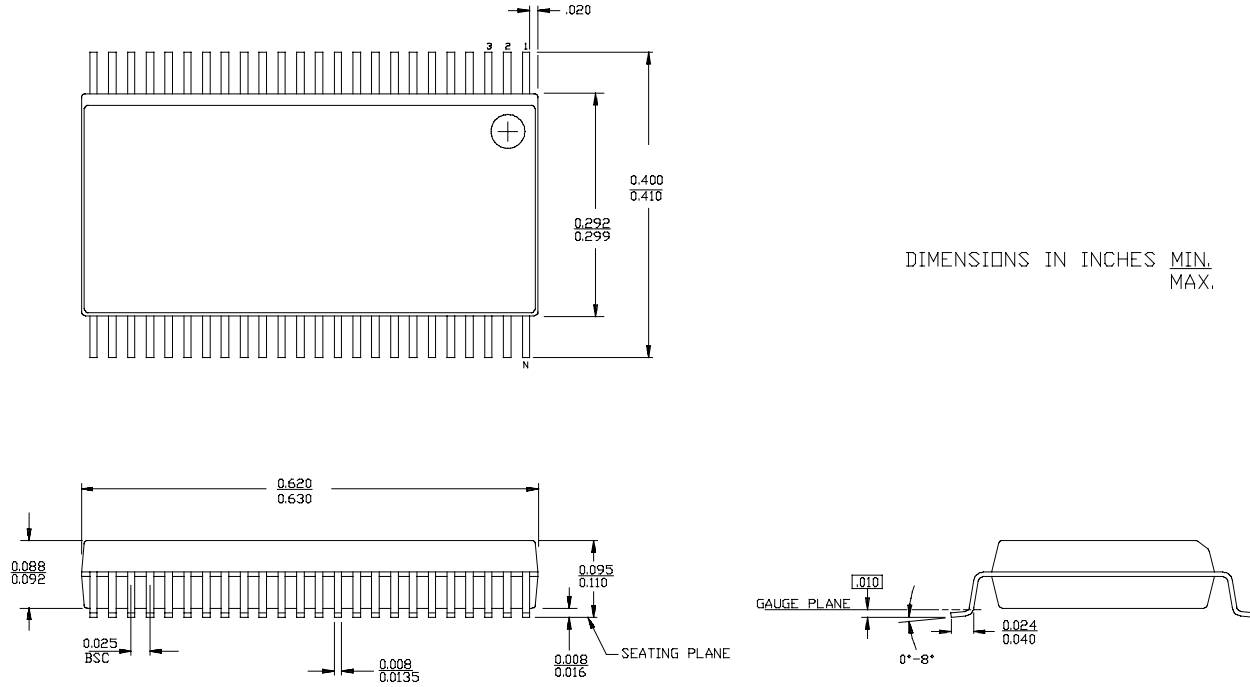
| Speed (ns) | Ordering Code | Package Name | Package Type | Operating Range |
|------------|------------------------|--------------|-------------------------|-----------------|
| 4.2 | CY74FCT16373CTPACT | Z48 | 48-Lead (240-Mil) TSSOP | Industrial |
| | CY74FCT16373CTPVC/PVCT | O48 | 48-Lead (300-Mil) SSOP | |
| | CY74FCT16373CTVR | - | 48-Lead (173-Mil) TVSOP | |
| 5.2 | CY74FCT16373ATPACT | Z48 | 48-Lead (240-Mil) TSSOP | Industrial |
| | CY74FCT16373ATPVC/PVCT | O48 | 48-Lead (300-Mil) SSOP | |
| | CY74FCT16373ATVR | - | 48-Lead (173-Mil) TVSOP | |

Ordering Information CY74FCT162373

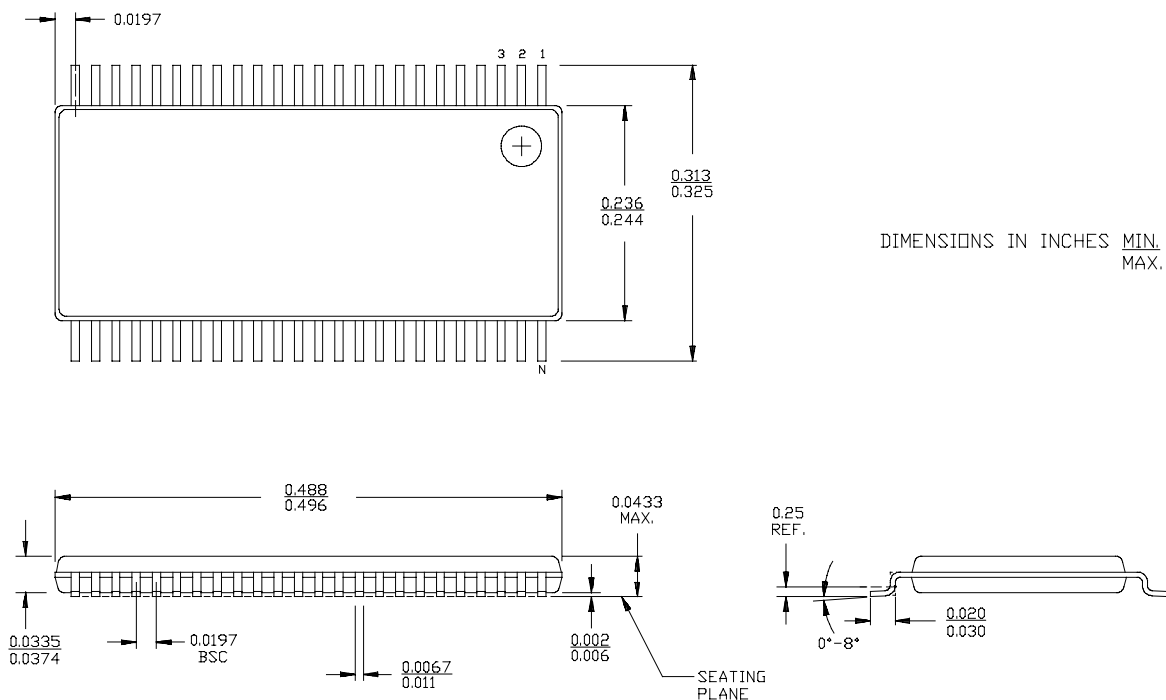
| Speed (ns) | Ordering Code | Package Name | Package Type | Operating Range |
|------------|--------------------|--------------|-------------------------|-----------------|
| 4.2 | 74FCT162373CTPACT | Z48 | 48-Lead (240-Mil) TSSOP | Industrial |
| | CY74FCT162373CTPVC | O48 | 48-Lead (300-Mil) SSOP | |
| | 74FCT162373CTPVCT | O48 | 48-Lead (300-Mil) SSOP | |
| 5.2 | 74FCT162373ATPACT | Z48 | 48-Lead (240-Mil) TSSOP | Industrial |
| | CY74FCT162373ATPVC | O48 | 48-Lead (300-Mil) SSOP | |
| | 74FCT162373ATPVCT | O48 | 48-Lead (300-Mil) SSOP | |

Package Diagrams

48-Lead Shrunk Small Outline Package O48



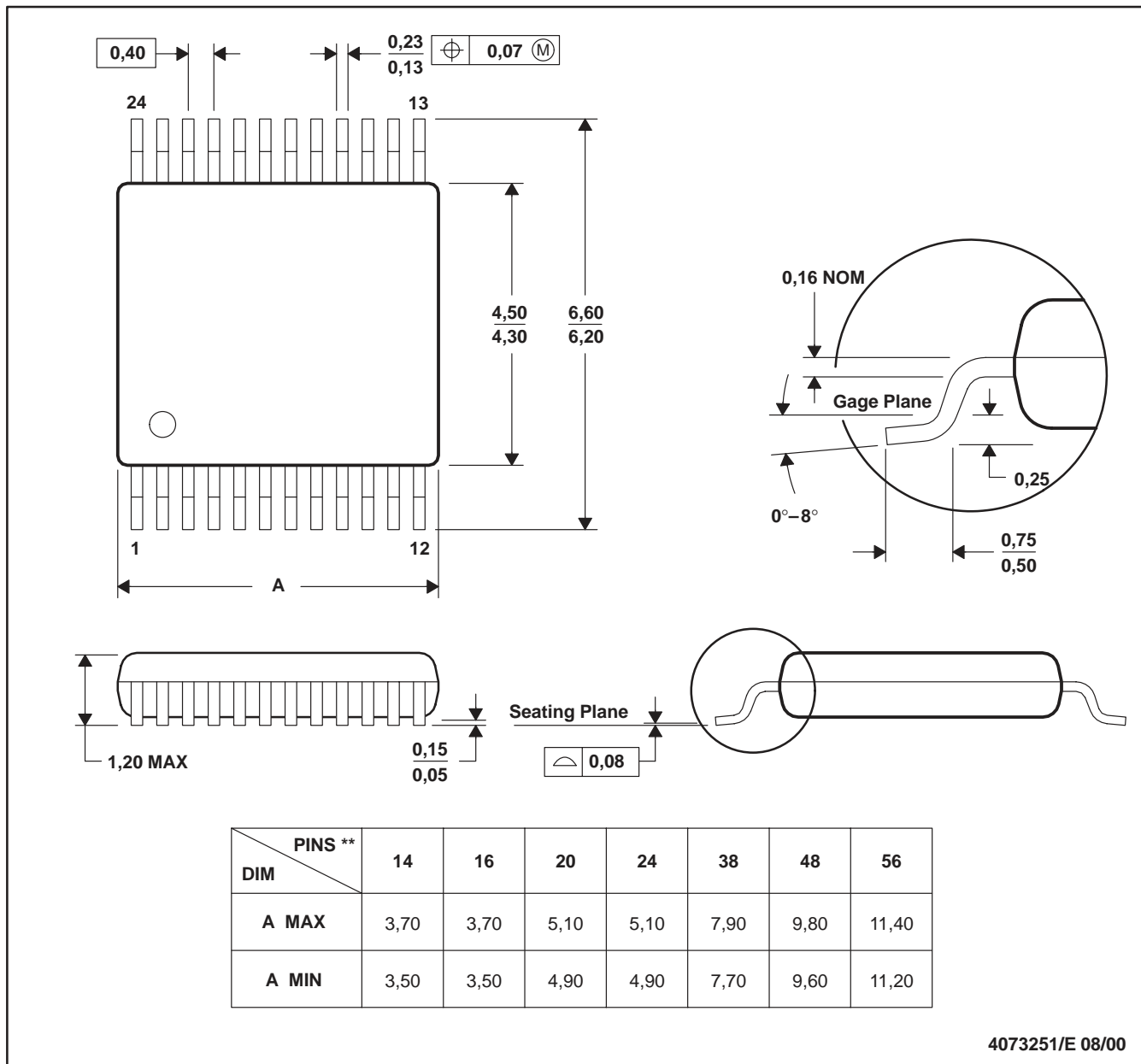
48-Lead Thin Shrunk Small Outline Package Z48



DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



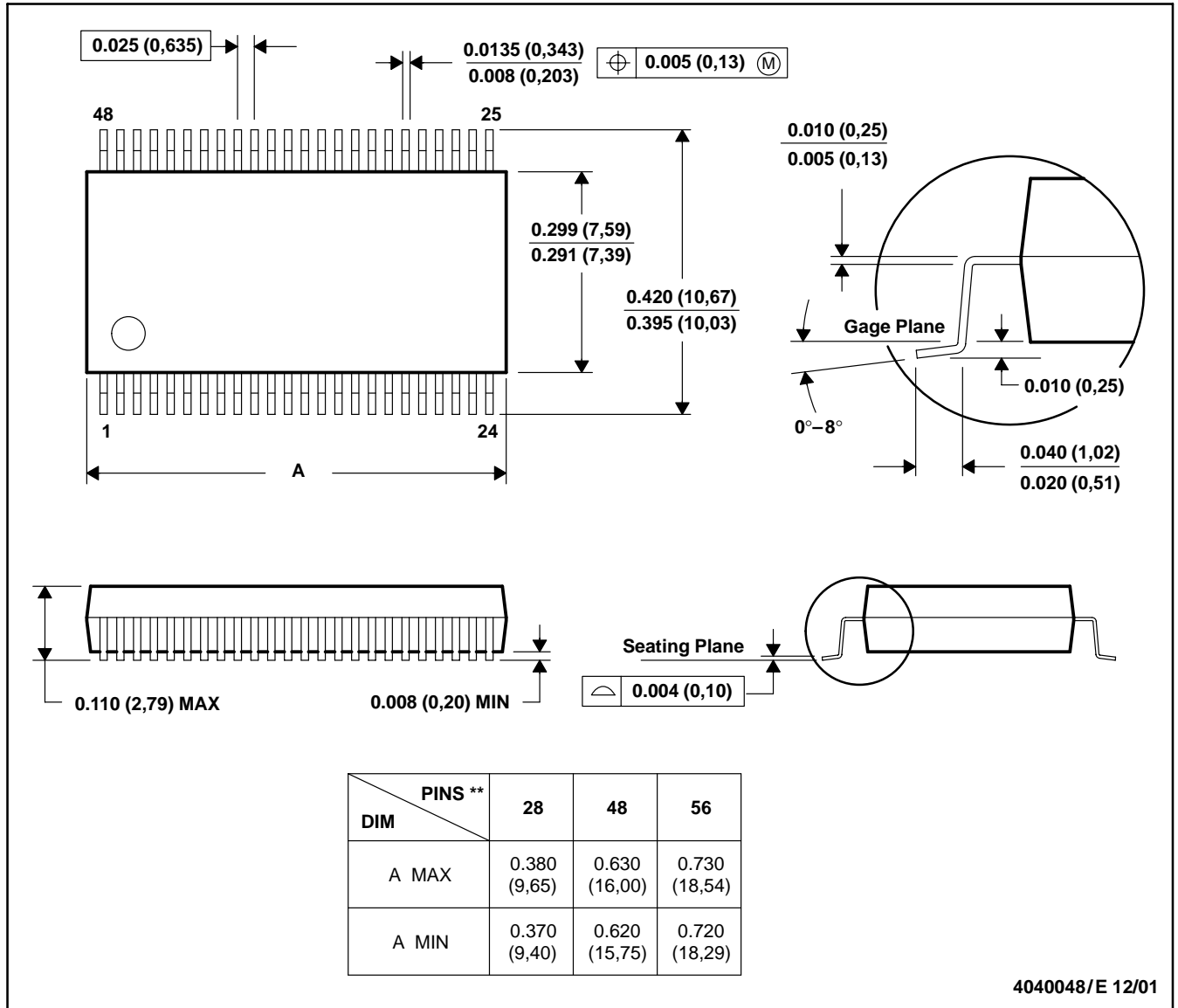
4073251/E 08/00

- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

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

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| Products | | Applications | |
|------------------|--|---------------------|--|
| Amplifiers | amplifier.ti.com | Audio | www.ti.com/audio |
| Data Converters | dataconverter.ti.com | Automotive | www.ti.com/automotive |
| DSP | dsp.ti.com | Broadband | www.ti.com/broadband |
| Interface | interface.ti.com | Digital Control | www.ti.com/digitalcontrol |
| Logic | logic.ti.com | Military | www.ti.com/military |
| Power Mgmt | power.ti.com | Optical Networking | www.ti.com/opticalnetwork |
| Microcontrollers | microcontroller.ti.com | Security | www.ti.com/security |
| | | Telephony | www.ti.com/telephony |
| | | Video & Imaging | www.ti.com/video |
| | | Wireless | www.ti.com/wireless |

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2003, Texas Instruments Incorporated