

Features

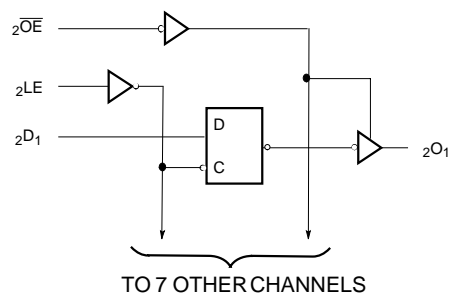
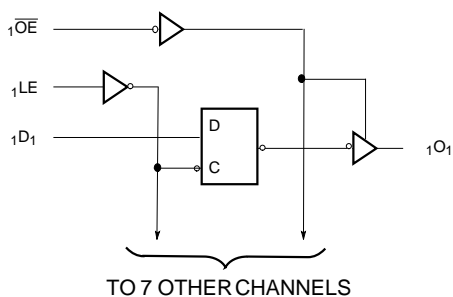
- Low power, pin-compatible replacement for LCX and LPT families
- 5V tolerant inputs and outputs
- 24 mA balanced drive outputs
- Power-off disable outputs permits live insertion
- Edge-rate control circuitry for reduced noise
- FCT-C speed at 4.2 ns
- Latch-up performance exceeds JEDEC standard no. 17
- Typical output skew < 250 ps
- Industrial temperature range of -40°C to $+85^{\circ}\text{C}$
- TSSOP (19.6-mil pitch) or SSOP (25-mil pitch)
- Typical V_{olp} (ground bounce) performance exceeds Mil Std 883D
- $V_{CC} = 2.7\text{V}$ to 3.6V
- ESD (HBM) > 2000V

Functional Description

This device is a 16-bit, D-type latch, designed for use in bus applications requiring high speed and low power. It can either 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. The outputs are 24-mA balanced output drivers with current limiting resistors to reduce the need for external terminating resistors and provide for minimal undershoot and reduced ground bounce. Flow-through pinout and small shrink packaging aid in simplifying board layout.

The CY74FCT163373 is designed with inputs and outputs capable of being driven by 5.0V buses, allowing its use in mixed voltage systems as a translator. The outputs are also designed with a power off disable feature enabling its use in applications requiring live insertion.

Logic Block Diagrams CY74FCT163373



Pin Configuration

SSOP/TSSOP
Top View

| | | | |
|------------------|----|----|------------------|
| $\overline{1OE}$ | 1 | 48 | $\overline{1LE}$ |
| $\overline{1O1}$ | 2 | 47 | $\overline{1D1}$ |
| $\overline{1O2}$ | 3 | 46 | $\overline{1D2}$ |
| GND | 4 | 45 | GND |
| $\overline{1O3}$ | 5 | 44 | $\overline{1D3}$ |
| $\overline{1O4}$ | 6 | 43 | $\overline{1D4}$ |
| V_{CC} | 7 | 42 | V_{CC} |
| $\overline{1O5}$ | 8 | 41 | $\overline{1D5}$ |
| $\overline{1O6}$ | 9 | 40 | $\overline{1D6}$ |
| GND | 10 | 39 | GND |
| $\overline{1O7}$ | 11 | 38 | $\overline{1D7}$ |
| $\overline{1O8}$ | 12 | 37 | $\overline{1D8}$ |
| $\overline{2O1}$ | 13 | 36 | $\overline{2D1}$ |
| $\overline{2O2}$ | 14 | 35 | $\overline{2D2}$ |
| GND | 15 | 34 | GND |
| $\overline{2O3}$ | 16 | 33 | $\overline{2D3}$ |
| $\overline{2O4}$ | 17 | 32 | $\overline{2D4}$ |
| V_{CC} | 18 | 31 | V_{CC} |
| $\overline{2O5}$ | 19 | 30 | $\overline{2D5}$ |
| $\overline{2O6}$ | 20 | 29 | $\overline{2D6}$ |
| GND | 21 | 28 | GND |
| $\overline{2O7}$ | 22 | 27 | $\overline{2D7}$ |
| $\overline{2O8}$ | 23 | 26 | $\overline{2D8}$ |
| $\overline{2OE}$ | 24 | 25 | $\overline{2LE}$ |

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 -55°C to +125°C

Ambient Temperature with

Power Applied -55°C to +125°C

Supply Voltage Range 0.5V to +4.6V

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

Operating Range

| Range | Ambient Temperature | V _{CC} |
|------------|---------------------|-----------------|
| Industrial | -40°C to +85°C | 2.7V to 3.6V |

Electrical Characteristics for Non Bus Hold Devices Over the Operating Range V_{CC}=2.7V to 3.6V

| Parameter | Description | Test Conditions | Min. | Typ. ^[4] | Max. | Unit | |
|------------------|---|--|------|---------------------|------|------|----|
| V _{IH} | Input HIGH Voltage | All Inputs | 2.0 | | 5.5 | 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 =5.5 | | | ±1 | μA | |
| I _{IL} | Input LOW Current | V _{CC} =Max., V _I =GND | | | ±1 | μA | |
| I _{OZH} | High Impedance Output Current (Three-State Output pins) | V _{CC} =Max., V _{OUT} =5.5V | | | ±1 | μA | |
| I _{OZL} | High Impedance Output Current (Three-State Output pins) | V _{CC} =Max., V _{OUT} =GND | | | ±1 | μA | |
| I _{OS} | Short Circuit Current ^[6] | V _{CC} =Max., V _{OUT} =GND | -60 | -135 | -240 | mA | |
| I _{OFF} | Power-Off Disable | V _{CC} =0V, V _{OUT} ≤4.5V | | | ±100 | μA | |
| I _{CC} | Quiescent Power Supply Current | V _{IN} ≤0.2V, V _{IN} ≥V _{CC} -0.2V | | | 0.1 | 10 | μA |
| ΔI _{CC} | Quiescent Power Supply Current (TTL inputs HIGH) | V _{IN} =V _{CC} -0.6V ^[7] | | | 2.0 | 30 | μA |

Note:

- 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.
- With the exception of inputs with bus hold, unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
- Typical values are at V_{CC}=3.3V, 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.
- Per TTL driven input; all other inputs at V_{CC} or GND.

Electrical Characteristics For Balanced Drive Devices Over the Operating Range $V_{CC}=2.7V$ to $3.6V$

| Parameter | Description | Test Conditions | Min. | Typ. ^[4] | Max. | Unit |
|-----------|--|--|--------------------|---------------------|------|------|
| I_{ODL} | Output LOW Dynamic Current ^[6] | $V_{CC}=3.3V$, $V_{IN}=V_{IH}$ or V_{IL} , $V_{OUT}=1.5V$ | 45 | | 180 | mA |
| I_{ODH} | Output HIGH Dynamic Current ^[6] | $V_{CC}=3.3V$, $V_{IN}=V_{IH}$ or V_{IL} , $V_{OUT}=1.5V$ | -45 | - | -180 | mA |
| V_{OH} | Output HIGH Voltage | $V_{CC}=\text{Min.}$, $I_{OH}=-0.1$ mA | $V_{CC}-0.2$ | | | V |
| | | $V_{CC}=\text{Min.}$, $I_{OH}=-8$ mA | 2.4 ^[8] | 3.0 | | V |
| | | $V_{CC}=3.0V$, $I_{OH}=-24$ mA | 2.0 | 3.0 | | V |
| V_{OL} | Output LOW Voltage | $V_{CC}=\text{Min.}$, $I_{OL}=0.1$ mA | | | 0.2 | V |
| | | $V_{CC}=\text{Min.}$, $I_{OL}=24$ mA | | 0.3 | 0.55 | |

Note:

8. $V_{OH}=V_{CC}-0.6$ V at rated current.

Capacitance^[5] ($T_A = +25^\circ\text{C}$, $f = 1.0$ 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_{CCD} | Dynamic Power Supply Current ^[9] | $V_{CC}=\text{Max.}$, One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE}=\text{GND}$ | 50 | 75 | $\mu\text{A}/\text{MHz}$ | |
| I_C | Total Power Supply Current ^[10] | $V_{CC}=\text{Max.}$, $f_1=10$ MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling, $\overline{OE}=\text{GND}$ | $V_{IN}=V_{CC}$ or $V_{IN}=\text{GND}$ | 0.5 | 0.8 | mA |
| | | $V_{IN}=V_{CC}-0.6V$ or $V_{IN}=\text{GND}$ | 0.5 | 0.8 | mA | |
| | | $V_{CC}=\text{Max.}$, $f_1=2.5$ MHz, 50% Duty Cycle, Outputs Open, Sixteen Bits Toggling, $\overline{OE}=\text{GND}$ | $V_{IN}=V_{CC}$ or $V_{IN}=\text{GND}$ | 2.0 | 3.0 ^[11] | mA |
| | | $V_{IN}=V_{CC}-0.6V$ or $V_{IN}=\text{GND}$ | 2.0 | 3.3 ^[11] | mA | |

Switching Characteristics Over the Operating Range $V_{CC}=3.0V$ to $3.6V$ ^[12,13]

| Parameter | Description | CY74FCT163373C | | Unit | Fig. No. ^[14] |
|------------------------|----------------------------------|----------------|------|------|--------------------------|
| | | Min. | Max. | | |
| t_{PLH} t_{PHL} | Propagation Delay D to Q Output | 1.5 | 4.1 | ns | 1, 3 |
| t_{PLH} t_{PHL} | Propagation Delay LE to Q Output | 2.0 | 5.5 | ns | 1, 5 |
| t_{PZH} t_{PZL} | Output Enable Time | 1.5 | 5.8 | ns | 1, 7, 8 |
| t_{PHZ} t_{PLZ} | Output Disable Time | 1.5 | 5.2 | ns | 1, 7, 8 |
| t_{SU} | Input Setup time | 2.0 | - | ns | 1, 4 |
| t_H | Input Hold time | 1.5 | - | ns | 1, 4 |
| $t_{SK(O)}$ | Output Skew ^[15] | | 0.5 | ns | — |

Notes:

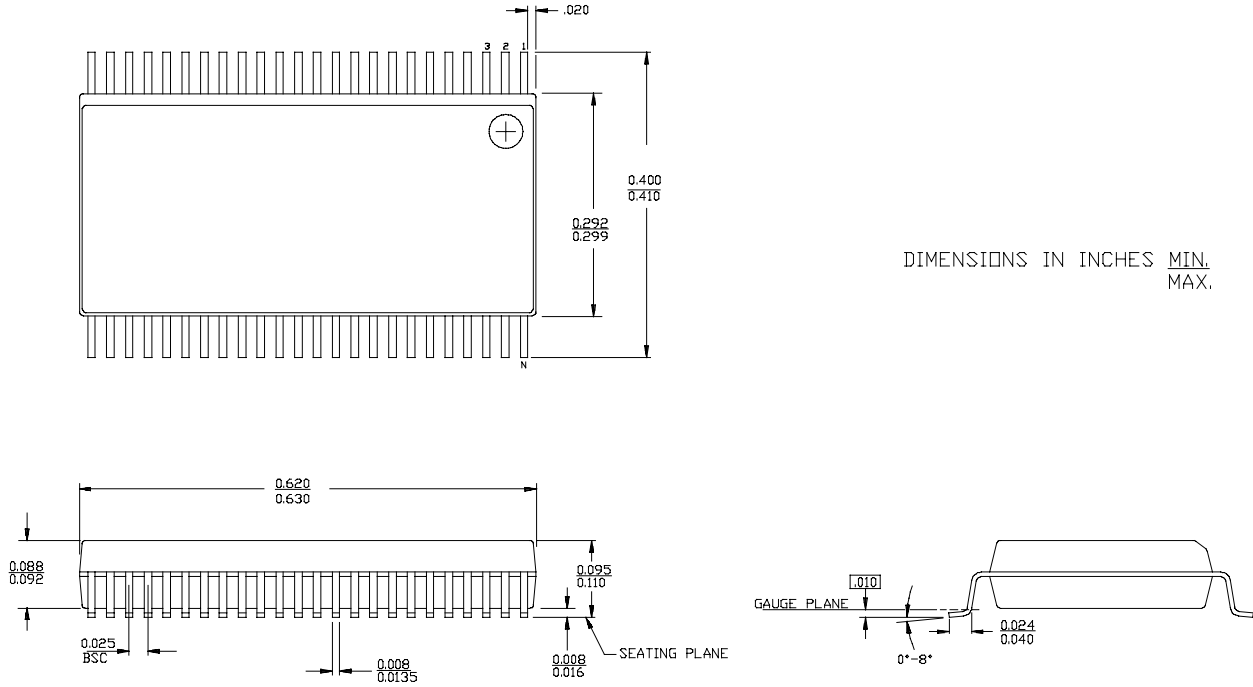
9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
10. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$
 I_{CC} = Quiescent Current with CMOS input levels
 ΔI_{CC} = Power Supply Current 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)
 f_0 = Clock frequency for registered devices, otherwise zero
 f_1 = Input signal frequency
 N_1 = Number of inputs changing at f_1
 All currents are in milliamps 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.
12. Minimum limits are specified but not tested on Propagation Delays.
13. For $V_{CC}=2.7$, propagation delay, output enable and output disable times should be degraded by 20%.
14. See "Parameter Measurement Information" in the General Information section.
15. Skew between any two outputs of the same package switching in the same direction. This parameter is ensured by design.

Ordering Information CY74FCT163373

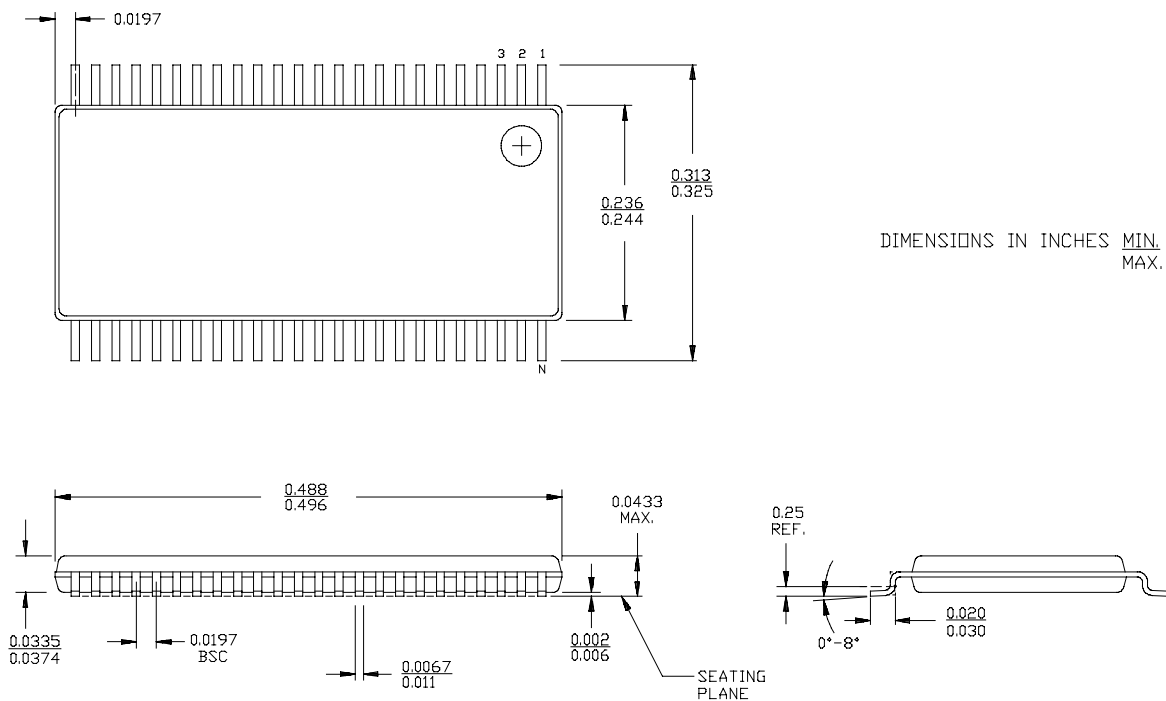
| Speed (ns) | Ordering Code | Package Name | Package Type | Operating Range |
|------------|------------------------|--------------|-------------------------|-----------------|
| 4.2 | CY74FCT163373CPACT | Z48 | 48-Lead (240-Mil) TSSOP | Industrial |
| | CY74FCT163373CPVC/PVCT | O48 | 48-Lead (300-Mil) SSOP | |

Package Diagrams

48-Lead Shrunken Small Outline Package O48



48-Lead Thin Shrunken Small Outline Package Z48



PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|--------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| CY74FCT163373CPAC | OBSOLETE | TSSOP | DGG | 48 | | TBD | Call TI | Call TI |
| CY74FCT163373CPACT | OBSOLETE | TSSOP | DGG | 48 | | TBD | Call TI | Call TI |
| CY74FCT163373CPVC | OBSOLETE | SSOP | DL | 48 | | TBD | Call TI | Call TI |
| CY74FCT163373CPVCT | OBSOLETE | SSOP | DL | 48 | | TBD | Call TI | Call TI |

⁽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.

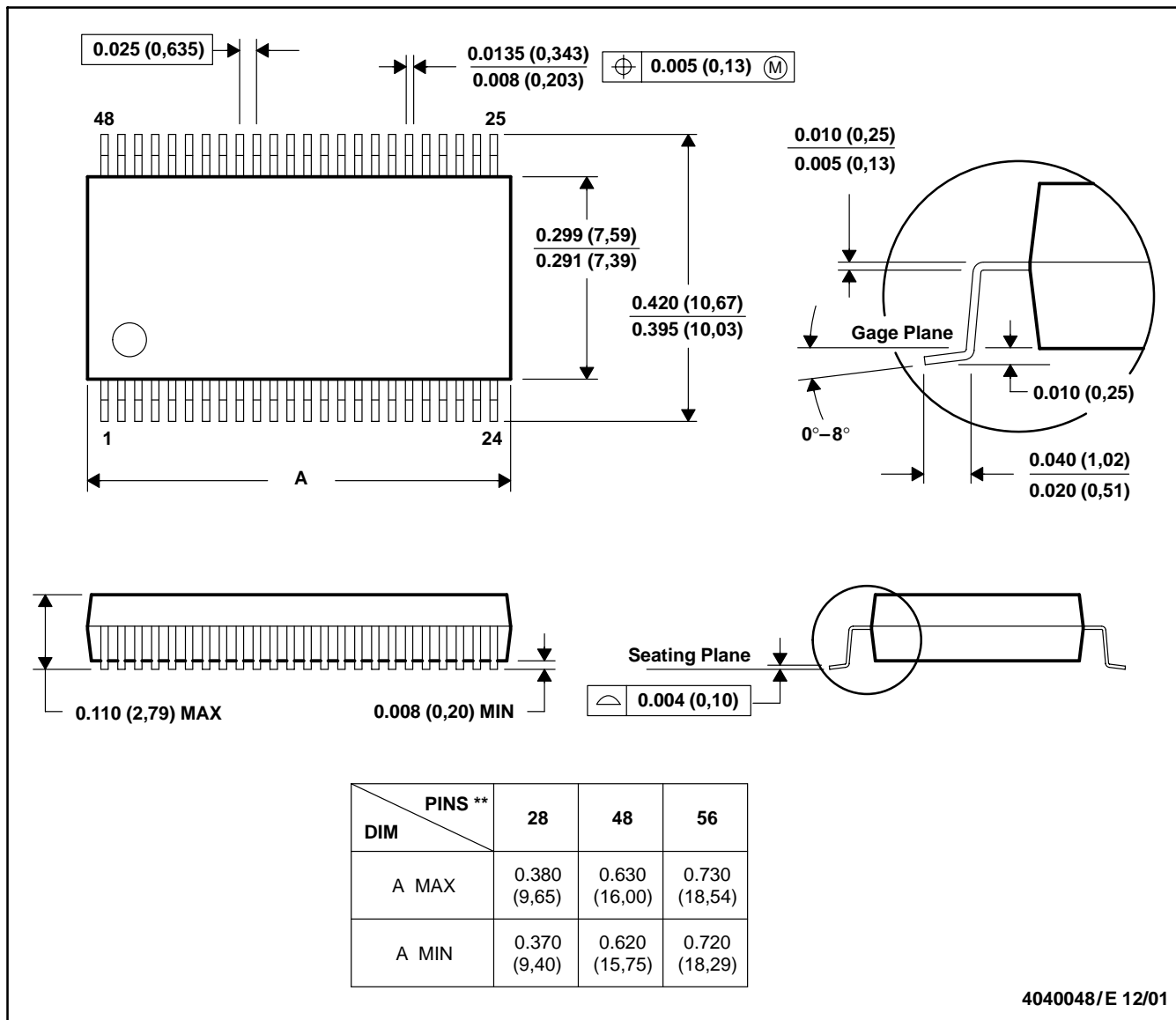
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DL (R-PDSO-G**)

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



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