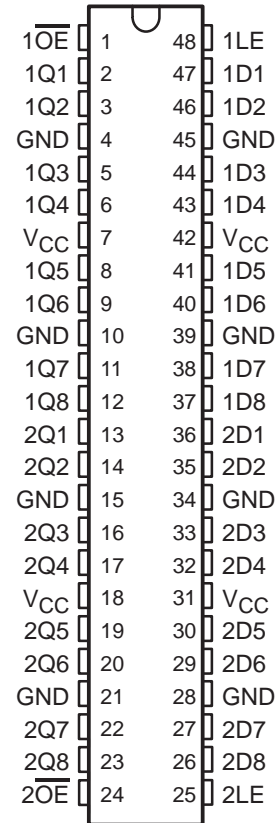


# 54AC16373, 74AC16373 16-BIT TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

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- Members of the Texas Instruments *Widebus*™ Family
- 3-State True Outputs
- Full Parallel Access for Loading
- Flow-Through Architecture Optimizes PCB Layout
- Distributed V<sub>CC</sub> and GND Pin Configuration Minimizes High-Speed Switching Noise
- EPIC™ (Enhanced-Performance Implanted CMOS) 1-μm 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

54AC16373 . . . WD PACKAGE  
74AC16373 . . . DL PACKAGE  
(TOP VIEW)



## description

The 'AC16373 are 16-bit transparent D-type latches 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. The device can be used as two 8-bit latches or one 16-bit latch. When the latch-enable (LE) input is high, the Q outputs follow the data (D) inputs. When LE is taken low, the Q outputs are latched at the levels set up at the D inputs.

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

The 74AC16373 is packaged in TI's shrink small-outline package (DL), which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The 54AC16373 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The 74AC16373 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .



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 **TEXAS  
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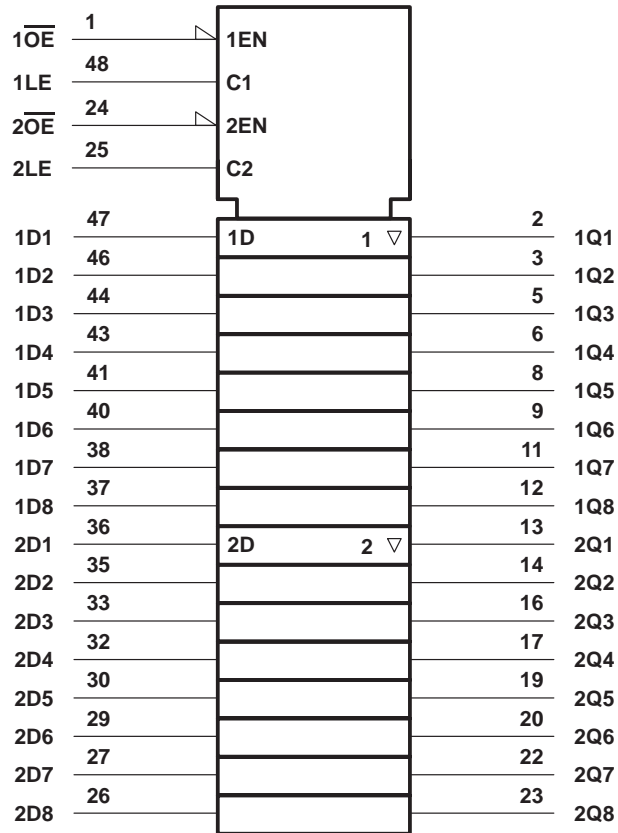
**54AC16373, 74AC16373**  
**16-BIT TRANSPARENT D-TYPE LATCHES**  
**WITH 3-STATE OUTPUTS**

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**FUNCTION TABLE**

INPUTS			OUTPUT
$\overline{OE}$	LE	D	Q
L	H	H	H
L	H	L	L
L	L	X	$Q_0$
H	X	X	Z

**logic symbol†**

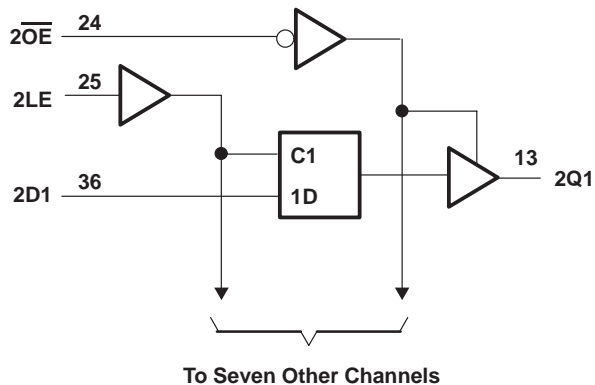
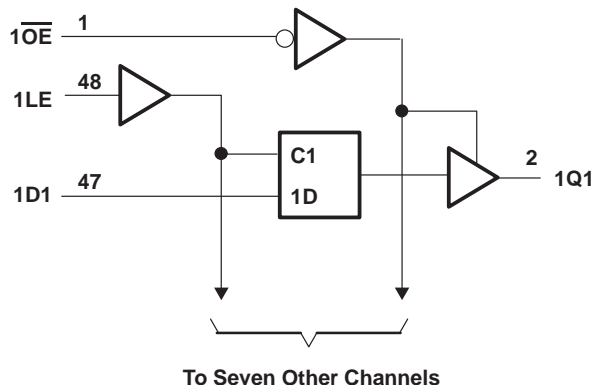


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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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 $V_I > V_{CC}$ ) .....	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	$\pm 50$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 50$ mA
Continuous current through $V_{CC}$ or GND .....	$\pm 400$ 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, $T_{stg}$ .....	$-65^\circ\text{C}$ to $150^\circ\text{C}$

† 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  $150^\circ\text{C}$  and a board trace length of 750 mils.

# 54AC16373, 74AC16373 16-BIT TRANSPARENT D-TYPE LATCHES WITH 3-STATE OUTPUTS

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## recommended operating conditions (see Note 3)

		54AC16373			74AC16373			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	3	5	5.5	3	5	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 3 V		2.1	2.1		V	
		V <sub>CC</sub> = 4.5 V		3.15	3.15			
		V <sub>CC</sub> = 5.5 V		3.85	3.85			
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 3 V			0.9		V	
		V <sub>CC</sub> = 4.5 V			1.35			
		V <sub>CC</sub> = 5.5 V			1.65			
V <sub>I</sub>	Input voltage	0		V <sub>CC</sub>	0		V <sub>CC</sub>	V
V <sub>O</sub>	Output voltage	0		V <sub>CC</sub>	0		V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 3 V			-4		mA	
		V <sub>CC</sub> = 4.5 V			-24			
		V <sub>CC</sub> = 5.5 V			-24			
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 3 V			12		mA	
		V <sub>CC</sub> = 4.5 V			24			
		V <sub>CC</sub> = 5.5 V			24			
Δt/Δv	Input transition rise or fall rate	0		10	0		10	ns/V
T <sub>A</sub>	Operating free-air temperature	-55		125	-40		85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			54AC16373		74AC16373		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	3 V	2.9			2.9		2.9	V	
		4.5 V	4.4			4.4		4.4		
		5.5 V	5.4			5.4		5.4		
	I <sub>OH</sub> = -4 mA	3 V	2.58			2.48		2.48		
		4.5 V	3.94			3.8		3.8		
		5.5 V	4.94			4.8		4.8		
I <sub>OH</sub> = -75 mA†	5.5 V				3.85		3.85			
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	3 V			0.1		0.1	0.1	V	
		4.5 V			0.1		0.1	0.1		
		5.5 V			0.1		0.1	0.1		
	I <sub>OL</sub> = 12 mA	3 V			0.36		0.44	0.44		
		4.5 V			0.36		0.44	0.44		
		5.5 V			0.36		0.44	0.44		
I <sub>OL</sub> = 75 mA†	5.5 V				1.65		1.65			
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V			±0.1		±1	±1	μA	
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	5.5 V			±0.5		±5	±5	μA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			8		80	80	μA	
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V			4.5				pF	
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> 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.

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**timing requirements over recommended operating free-air temperature range,  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 1)**

		$T_A = 25^\circ\text{C}$		54AC16373		74AC16373		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
$t_w$	Pulse duration, LE high	5		5		5		ns
$t_{su}$	Setup time, data before LE↓	1.5		1.5		1.5		ns
$t_h$	Hold time, data after LE↓	3		3		3		ns

**timing requirements over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)**

		$T_A = 25^\circ\text{C}$		54AC16373		74AC16373		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
$t_w$	Pulse duration, LE high	4		4		4		ns
$t_{su}$	Setup time, data before LE↓	1.5		1.5		1.5		ns
$t_h$	Hold time, data after LE↓	2.5		2.5		2.5		ns

**switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			54AC16373		74AC16373		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	D	Q	3.7	10.6	13.4	3.7	15.1	3.7	15.1	ns
$t_{PHL}$			4.3	11.3	14	4.3	14.8	4.3	14.8	
$t_{PLH}$	LE	Q	4.6	12.9	15.8	4.6	18.6	4.6	18.6	ns
$t_{PHL}$			4.5	12.1	14.6	4.5	16.4	4.5	16.4	
$t_{PZH}$	$\overline{OE}$	Q	4.2	11.8	14.8	4.2	17.5	4.2	17.5	ns
$t_{PZL}$			5.4	16.3	19.8	5.4	22.3	5.4	22.3	
$t_{PHZ}$	$\overline{OE}$	Q	4.2	7.9	9.5	4.2	10.2	4.2	10.2	ns
$t_{PLZ}$			3.8	7.1	8.9	3.8	9.8	3.8	9.8	

**switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			54AC16373		74AC16373		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	D	Q	3.1	6.7	8.5	3.1	9.7	3.1	9.7	ns
$t_{PHL}$			3.5	7.3	9.1	3.5	10.1	3.5	10.1	
$t_{PLH}$	LE	Q	3.8	8.2	10.2	3.8	11.9	3.8	11.9	ns
$t_{PHL}$			3.6	7.8	9.7	3.6	10.9	3.6	10.9	
$t_{PZH}$	$\overline{OE}$	Q	3.5	7.4	9.4	3.5	10.8	3.5	10.8	ns
$t_{PZL}$			4.3	9.1	11.3	4.3	12.8	4.3	12.8	
$t_{PHZ}$	$\overline{OE}$	Q	3.9	6.6	8	3.9	8.8	3.9	8.8	ns
$t_{PLZ}$			3.7	5.9	7.4	3.7	8.1	3.7	8.1	

**operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$**

PARAMETER		TEST CONDITIONS		TYP	UNIT
$C_{pd}$	Power dissipation capacitance per latch	Outputs enabled	$C_L = 50\text{ pF}$ , $f = 1\text{ MHz}$	43	pF
		Outputs disabled		5	

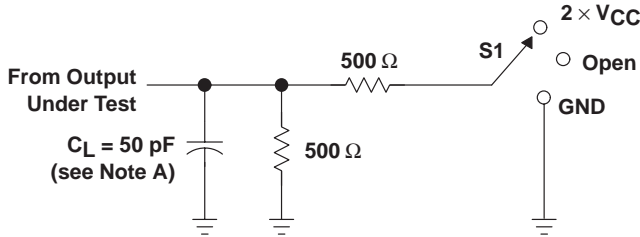
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 WITH 3-STATE OUTPUTS

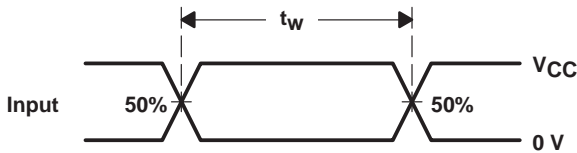
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PARAMETER MEASUREMENT INFORMATION

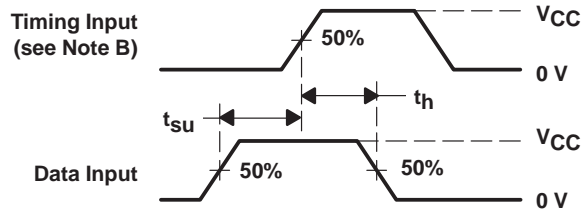


LOAD CIRCUIT

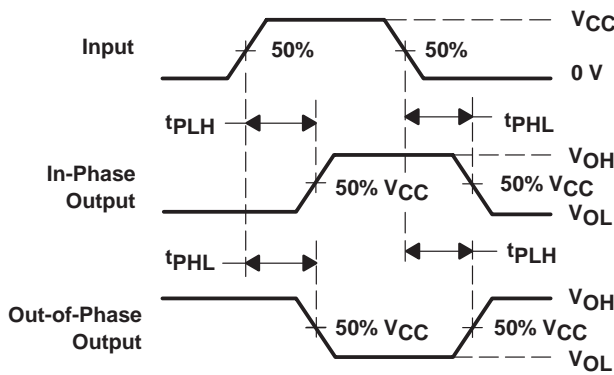
TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PLZ</sub> /t <sub>PZL</sub>	2 $\times$ V <sub>CC</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND



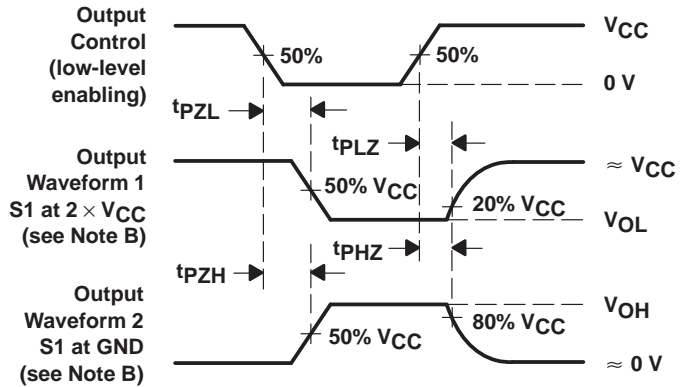
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

- NOTES: A. C<sub>L</sub> 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<sub>O</sub> = 50  $\Omega$ , t<sub>r</sub> = 3 ns, t<sub>f</sub> = 3 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 part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">74AC16373DL</a>	Obsolete	Production	SSOP (DL)   48	-	-	Call TI	Call TI	-40 to 85	AC16373
<a href="#">74AC16373DLR</a>	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC16373
74AC16373DLR.A	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC16373

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
74AC16373DLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1



## TAPE AND REEL BOX DIMENSIONS



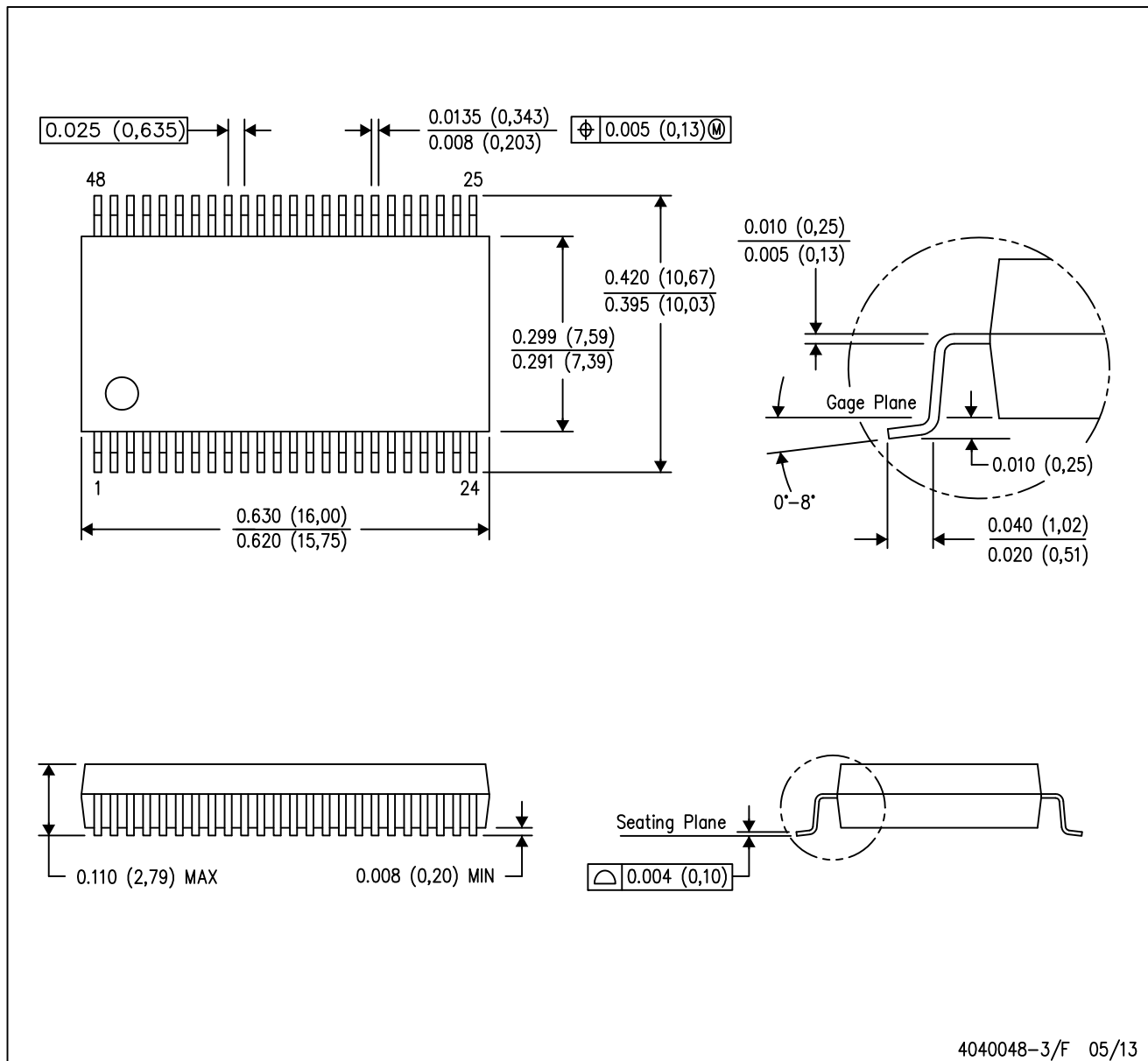
\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74AC16373DLR	SSOP	DL	48	1000	356.0	356.0	53.0

# MECHANICAL DATA

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



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

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