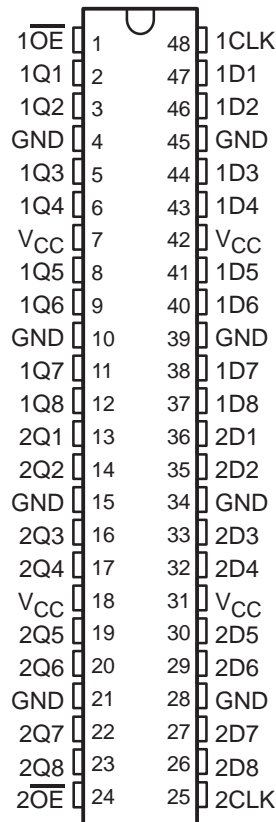


54AC16374, 74AC16374 16-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

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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_{CC} 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**

54AC16374 . . . WD PACKAGE
74AC16374 . . . DL PACKAGE
(TOP VIEW)



description

The 'AC16374 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.

The 'AC16374 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.

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.

\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 74AC16374 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 54AC16374 is characterized for operation over the full military temperature range of -55°C to 125°C . The 74AC16374 is characterized for operation from -40°C to 85°C .



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 **TEXAS
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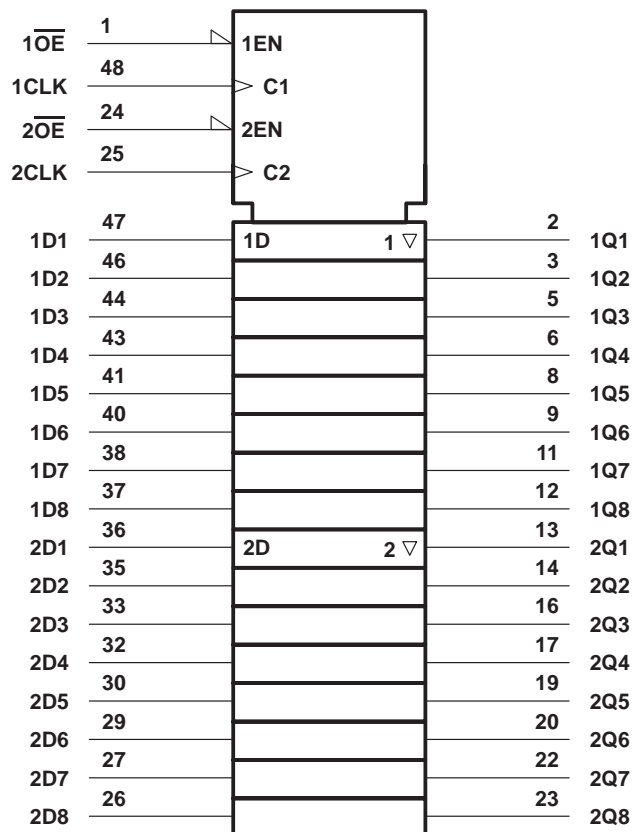
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FUNCTION TABLE

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

logic symbol†

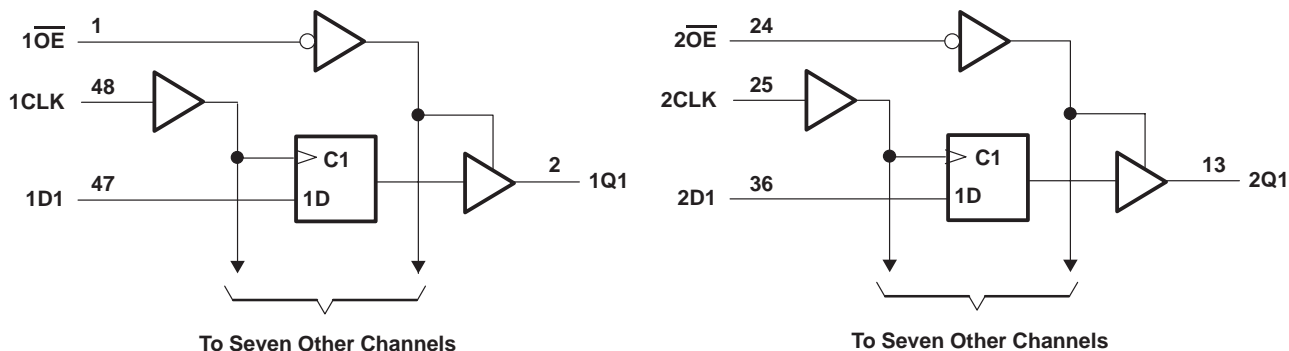


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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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 $V_I > V_{CC}$)	± 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 package 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.

54AC16374, 74AC16374

16-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

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recommended operating conditions (see Note 3)

		54AC16374			74AC16374			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	3	5	5.5	3	5	5.5	V
V _{IH}	High-level input voltage	V _{CC} = 3 V		2.1	2.1		V	
		V _{CC} = 4.5 V		3.15	3.15			
		V _{CC} = 5.5 V		3.85	3.85			
V _{IL}	Low-level input voltage	V _{CC} = 3 V			0.9		V	
		V _{CC} = 4.5 V			1.35			
		V _{CC} = 5.5 V			1.65			
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	V _{CC} = 3 V			-4		mA	
		V _{CC} = 4.5 V			-24			
		V _{CC} = 5.5 V			-24			
I _{OL}	Low-level output current	V _{CC} = 3 V			12		mA	
		V _{CC} = 4.5 V			24			
		V _{CC} = 5.5 V			24			
Δt/Δv	Input transition rise or fall rate	0		10	0		10	ns/V
T _A	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 _{CC}	T _A = 25°C			54AC16374		74AC16374		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = -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 _{OH} = -4 mA	3 V	2.58			2.48		2.48		
		I _{OL} = -24 mA	4.5 V	3.94			3.8			3.8
			5.5 V	4.94			4.8			4.8
I _{OH} = -75 mA†	5.5 V				3.85		3.85			
V _{OL}	I _{OL} = 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 _{OL} = 12 mA	3 V			0.36		0.44	0.44		
		I _{OL} = 24 mA	4.5 V			0.36		0.44		0.44
			5.5 V			0.36		0.44		0.44
I _{OL} = 75 mA†	5.5 V				1.65		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		±5	±5	μA	
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V			8		80	80	μA	
C _i	V _I = V _{CC} or GND	5 V			3				pF	
C _o	V _O = V _{CC} or GND	5 V			11				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)

		$T_A = 25^\circ\text{C}$		54AC16374		74AC16374		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency	0	60	0	60	0	60	MHz
t_w	Pulse duration	CLK high or low		8.3		8.3		ns
t_{su}	Setup time, data before CLK \uparrow			7.5		7.5		ns
t_h	Hold time, data after CLK \uparrow			0		0		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)

		$T_A = 25^\circ\text{C}$		54AC16374		74AC16374		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency	0	100	0	100	0	100	MHz
t_w	Pulse duration	CLK high or low		5		5		ns
t_{su}	Setup time, data before CLK \uparrow			5		5		ns
t_h	Hold time, data after CLK \uparrow			0		0		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)	$T_A = 25^\circ\text{C}$			54AC16374		74AC16374		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			60			60		60	MHz	
t_{PLH}	CLK	Q	4.9	12.2	15	4.9	17	4.9	17	ns
t_{PHL}			4.8	11.9	14.3	4.8	15.7	4.8	15.7	
t_{PZH}	$\overline{\text{OE}}$	Q	4.3	11.9	14.7	4.3	16.8	4.3	16.8	ns
t_{PZL}			5.3	15.5	18.7	5.3	21.2	5.3	21.2	
t_{PHZ}	$\overline{\text{OE}}$	Q	4	7.3	9	4	9.8	4	9.8	ns
t_{PLZ}			3.8	7.1	8.8	3.8	9.4	3.8	9.4	

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)	$T_A = 25^\circ\text{C}$			54AC16374		74AC16374		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			100			100		100	MHz	
t_{PLH}	CLK	Q	3.8	7.6	9.5	3.8	10.8	3.8	10.8	ns
t_{PHL}			3.8	7.6	9.5	3.8	10.6	3.8	10.6	
t_{PZH}	$\overline{\text{OE}}$	Q	3.2	7.2	9	3.2	10.2	3.2	10.2	ns
t_{PZL}			3.8	8.7	10.7	3.8	12.1	3.8	12.1	
t_{PHZ}	$\overline{\text{OE}}$	Q	3.7	6	7.5	3.7	8.2	3.7	8.2	ns
t_{PLZ}			3.5	5.8	7.3	3.5	7.9	3.5	7.9	

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

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance per flip-flop	Outputs enabled	$C_L = 50\text{ pF}$, $f = 1\text{ MHz}$	49	pF
	Outputs disabled	32			

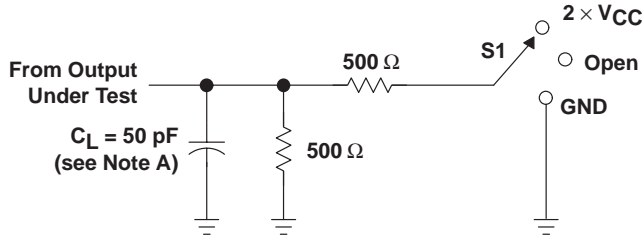
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 WITH 3-STATE OUTPUTS

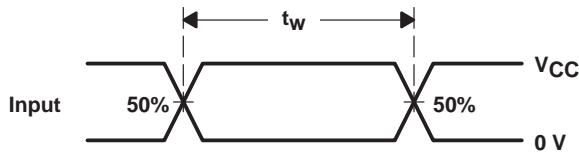
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PARAMETER MEASUREMENT INFORMATION

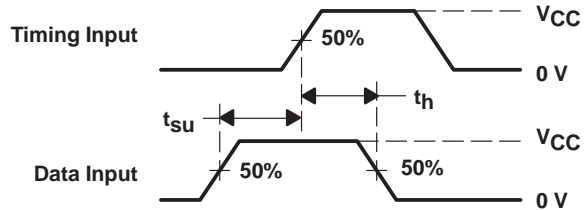


LOAD CIRCUIT

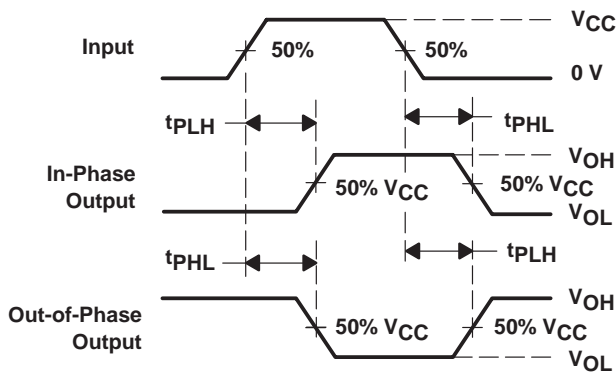
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND



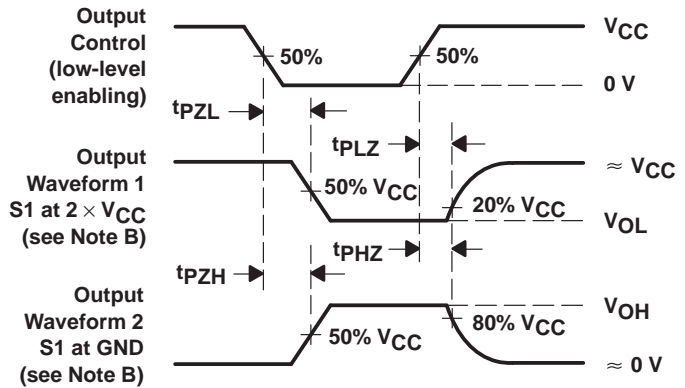
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

- 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: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.
 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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
74AC16374DL	OBSOLETE	SSOP	DL	48		TBD	Call TI	Call TI	-40 to 85	AC16374	
74AC16374DLR	ACTIVE	SSOP	DL	48	1000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC16374	Samples

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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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
74AC16374DLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS

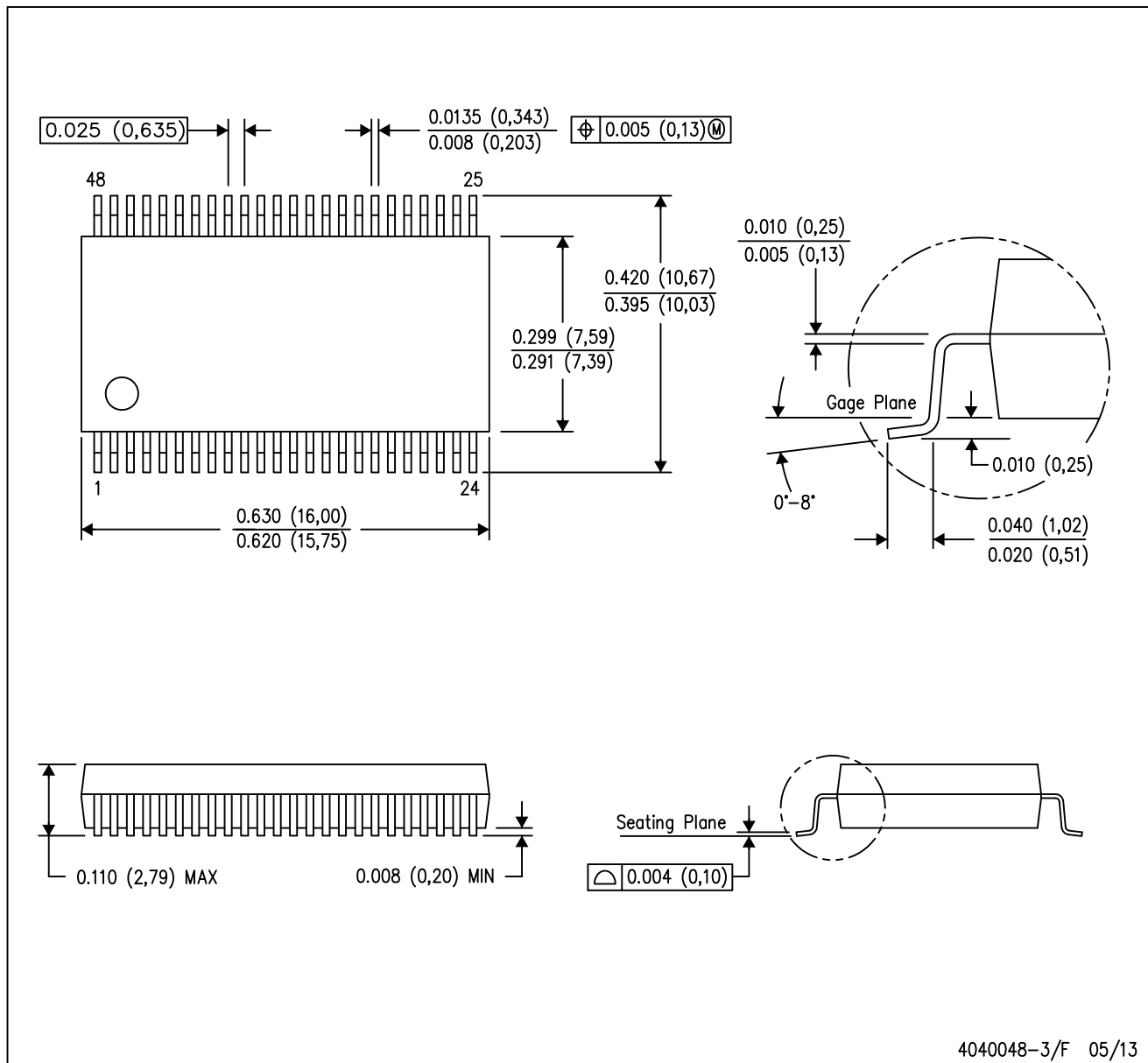

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74AC16374DLR	SSOP	DL	48	1000	367.0	367.0	55.0

MECHANICAL DATA

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



- 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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