

SN54ACT16373, 74ACT16373
16-BIT D-TYPE TRANSPARENT LATCHES
WITH 3-STATE OUTPUTS

SCAS122C – MARCH 1990 – REVISED SEPTEMBER 1996

- Members of the Texas Instruments **Widebus™ Family**
- Inputs Are TTL-Voltage Compatible
- 3-State Bus Driving 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- μ m Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Shrink Small-Outline (DL) 300-mil 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

description

The SN54ACT16373 and 74ACT16373 are 16-bit D-type transparent 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. These devices can be used as two 8-bit latches or one 16-bit latch. The Q outputs of the latches follow the data (D) inputs if enable C is taken high. When C 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 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 and the increased drive provide 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 latches. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The 74ACT16373 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 SN54ACT16373 is characterized for operation over the full military temperature range of -55°C to 125°C. The 74ACT16373 is characterized for operation from -40°C to 85°C.

SN54ACT16373 . . . WD PACKAGE
74ACT16373 . . . DL PACKAGE
(TOP VIEW)

1 \overline{OE}	1	48	1C
1Q1	2	47	1D1
1Q2	3	46	1D2
GND	4	45	GND
1Q3	5	44	1D3
1Q4	6	43	1D4
V_{CC}	7	42	V_{CC}
1Q5	8	41	1D5
1Q6	9	40	1D6
GND	10	39	GND
1Q7	11	38	1D7
1Q8	12	37	1D8
2Q1	13	36	2D1
2Q2	14	35	2D2
GND	15	34	GND
2Q3	16	33	2D3
2Q4	17	32	2D4
V_{CC}	18	31	V_{CC}
2Q5	19	30	2D5
2Q6	20	29	2D6
GND	21	28	GND
2Q7	22	27	2D7
2Q8	23	26	2D8
2 \overline{OE}	24	25	2C



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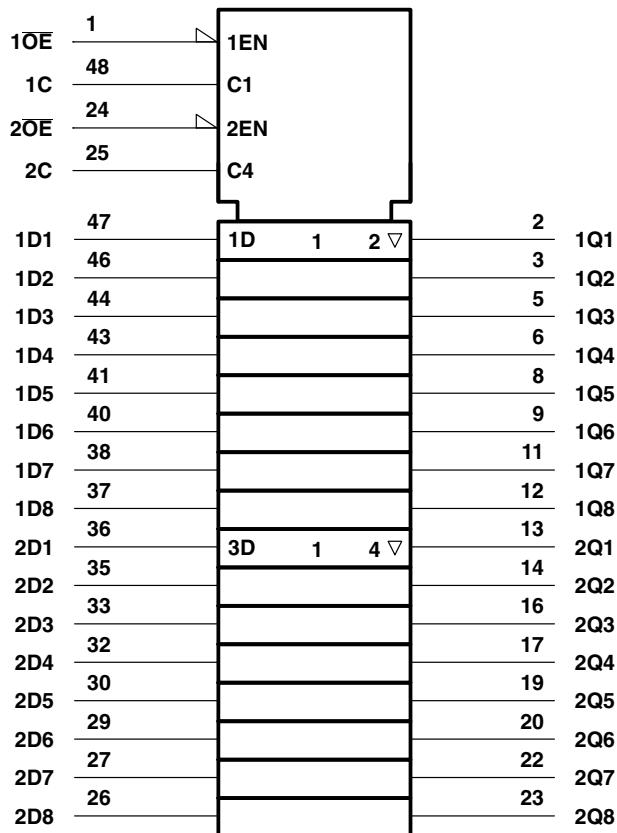
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FUNCTION TABLE

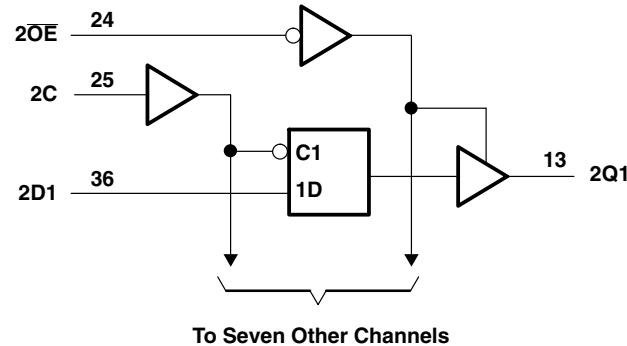
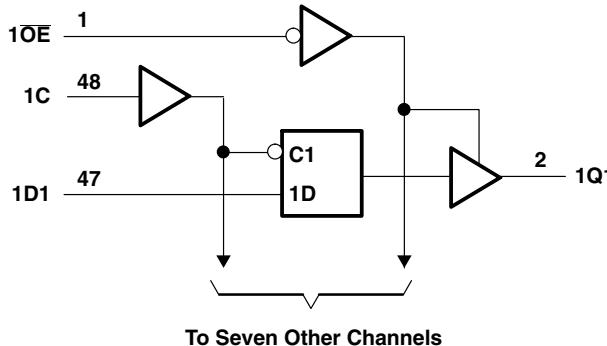
INPUTS			OUTPUT Q
OE	C	D	
L	H	H	H
L	H	L	L
L	L	X	Q ₀
H	X	X	Z

logic symbol[†]



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

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)

		SN54ACT16373		74ACT16373		UNIT
		MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage (see Note 4)	4.5	5.5	4.5	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	°C

NOTES: 3. Unused inputs should be tied to V_{CC} through a pullup resistor of approximately 5 kΩ or greater to prevent them from floating.
4. All V_{CC} and GND pins must be connected to the proper voltage supply.

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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			SN54ACT16373		74ACT16373		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				
V _{OL}	I _{OL} = 50 µA	4.5 V		0.1		0.1		0.1		V
		5.5 V		0.1		0.1		0.1		
	I _{OL} = 24 mA	4.5 V		0.36		0.5		0.44		
		5.5 V		0.36		0.5		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 _I = 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		SN54ACT16373		74ACT16373		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration, LE high		4		4		1		ns
t _{su}	Setup time, data before LE↓		1		1		1		ns
t _h	Hold time, data after LE↓		5		5		5		ns

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			SN54ACT16373		74ACT16373		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	D	Q	3.8	7.9	9.4	3.8	11.8	3.8	11.1	ns
t _{PHL}			3.1	8.2	9.7	3.1	13	3.1	12.3	
t _{PLH}	LE	Q	4.6	9.3	10.8	4.6	13.7	4.6	12.8	ns
t _{PHL}			4.5	9.1	10.5	4.5	13	4.5	12.2	
t _{PZH}	OE	Q	3.1	8	9.5	3.1	13	3.1	12.1	ns
t _{PZL}			3.8	9.4	11.1	3.8	15.1	3.8	14.2	
t _{PHZ}	OE	Q	5.3	8.6	9.9	5.3	11	5.3	10.7	ns
t _{PLZ}			4.3	7.4	8.7	4.3	9.8	4.3	9.4	

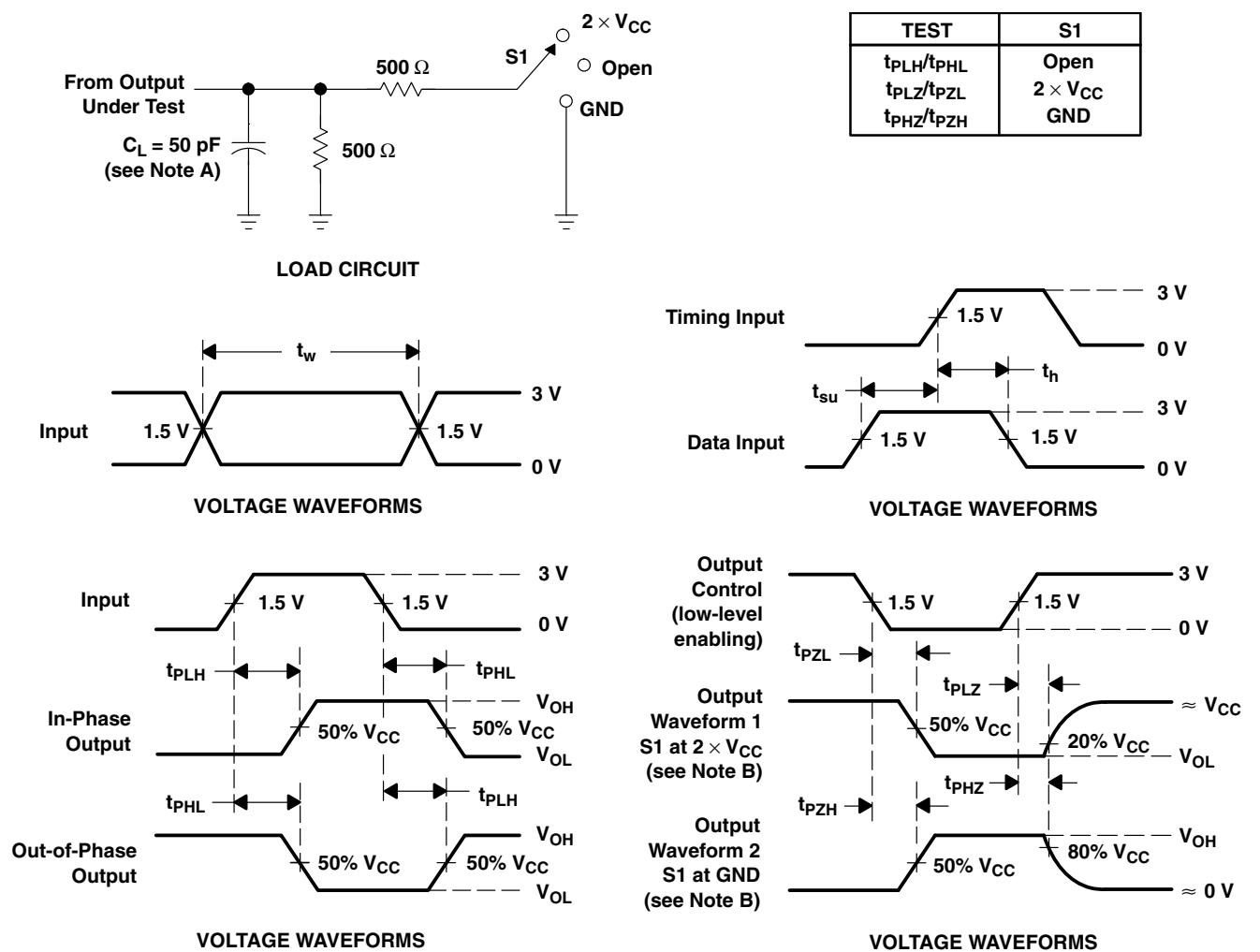


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operating characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per latch	Outputs enabled	43	
		Outputs disabled	4.5	pF

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 $\leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.
 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 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)
5962-9202401Mxa	Active	Production	CFP (WD) 48	15 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9202401MX A SNJ54ACT16373WD
74ACT16373DL	Obsolete	Production	SSOP (DL) 48	-	-	Call TI	Call TI	-40 to 85	ACT16373
74ACT16373DLR	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ACT16373
74ACT16373DLR.A	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ACT16373
74ACT16373DLRG4	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ACT16373
SNJ54ACT16373WD	Active	Production	CFP (WD) 48	15 TUBE	No	SNPB	N/A for Pkg Type	-	5962-9202401MX A SNJ54ACT16373WD
SNJ54ACT16373WD.A	Active	Production	CFP (WD) 48	15 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9202401MX A SNJ54ACT16373WD

⁽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.

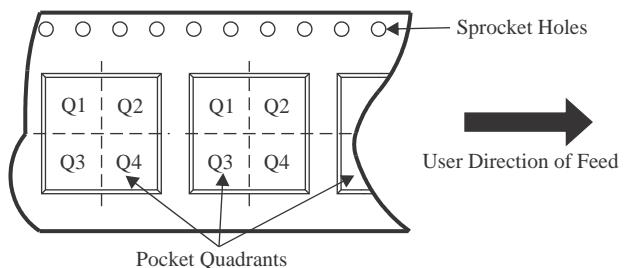
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TAPE AND REEL INFORMATION


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
74ACT16373DLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

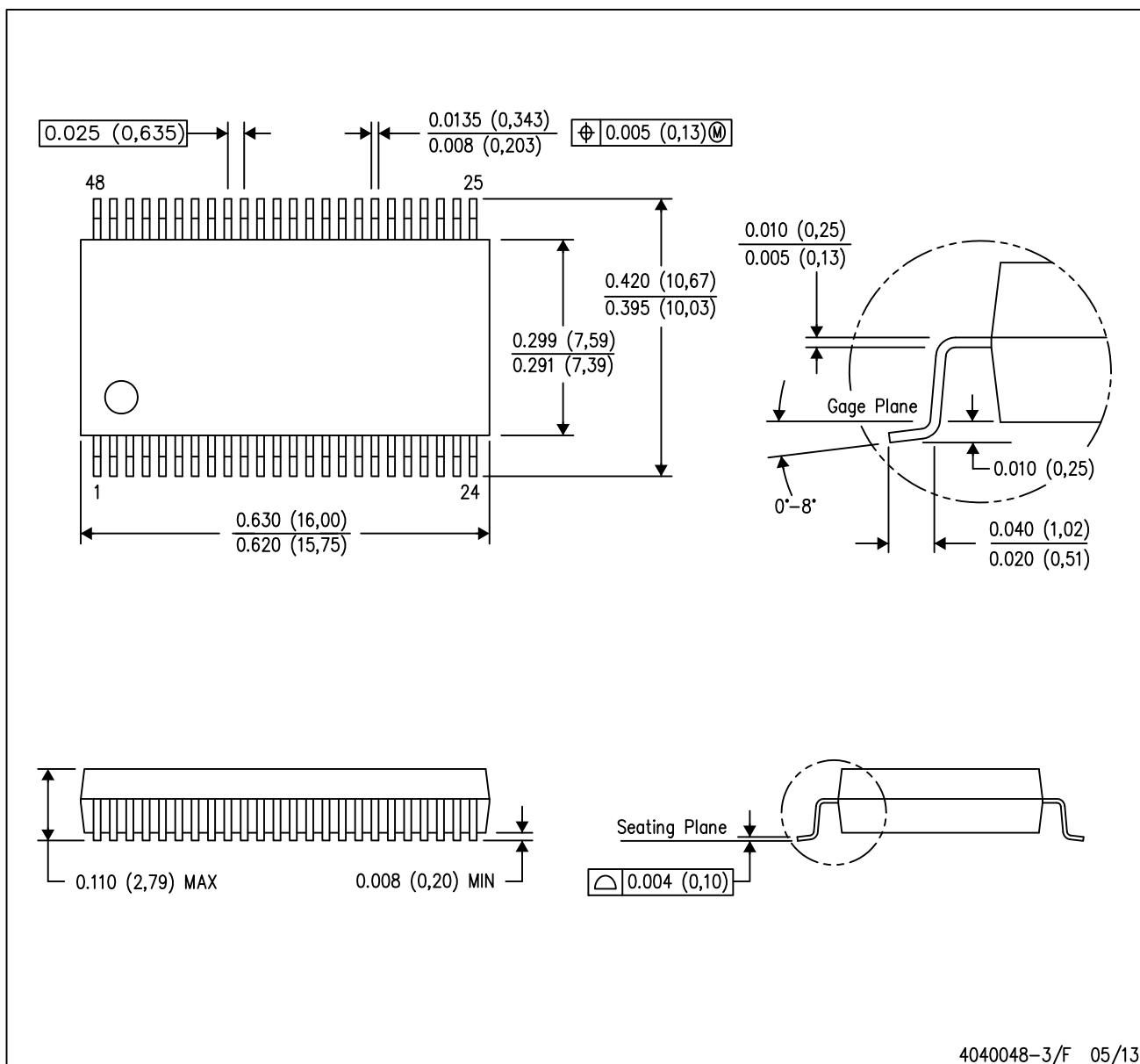
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74ACT16373DLR	SSOP	DL	48	1000	356.0	356.0	53.0

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



4040048-3/F 05/13

NOTES:

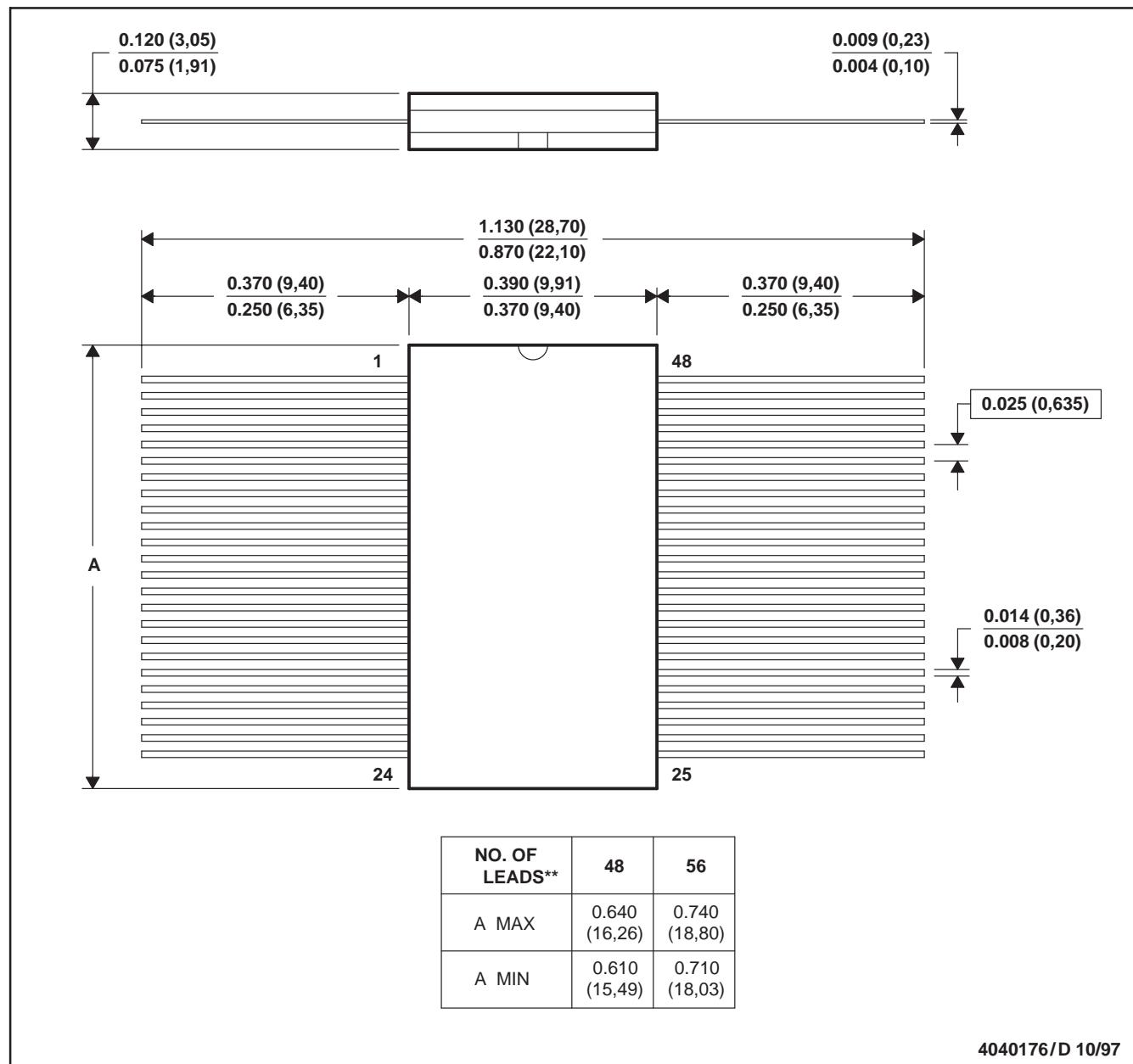
- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- Falls within JEDEC MO-118

PowerPAD is a trademark of Texas Instruments.

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

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