

FEATURES

- Member of the Texas Instruments Widebus™ Family
- EPIC™ (Enhanced-Performance Implanted CMOS) Submicron Process
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages

DESCRIPTION

This 16-bit buffer/driver is designed for 1.65-V to 3.6-V V_{CC} operation.

The SN74ALVCH16240 is designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. It provides inverting outputs and symmetrical active-low output-enable (\overline{OE}) inputs.

DGG OR DL PACKAGE
(TOP VIEW)

1	48	2	\overline{OE}
1Y1	47	1A1	
1Y2	46	1A2	
GND	45	GND	
1Y3	44	1A3	
1Y4	43	1A4	
V_{CC}	42	V_{CC}	
2Y1	41	2A1	
2Y2	40	2A2	
GND	39	GND	
2Y3	38	2A3	
2Y4	37	2A4	
3Y1	36	3A1	
3Y2	35	3A2	
GND	34	GND	
3Y3	33	3A3	
3Y4	32	3A4	
V_{CC}	31	V_{CC}	
4Y1	30	4A1	
4Y2	29	4A2	
GND	28	GND	
4Y3	27	4A3	
4Y4	26	4A4	
\overline{OE}	25	3	\overline{OE}

To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN74ALVCH16240 is characterized for operation from -40°C to 85°C.

FUNCTION TABLE
(each 4-bit buffer)

INPUTS		OUTPUT
\overline{OE}	A	Y
L	H	L
L	L	H
H	X	Z



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

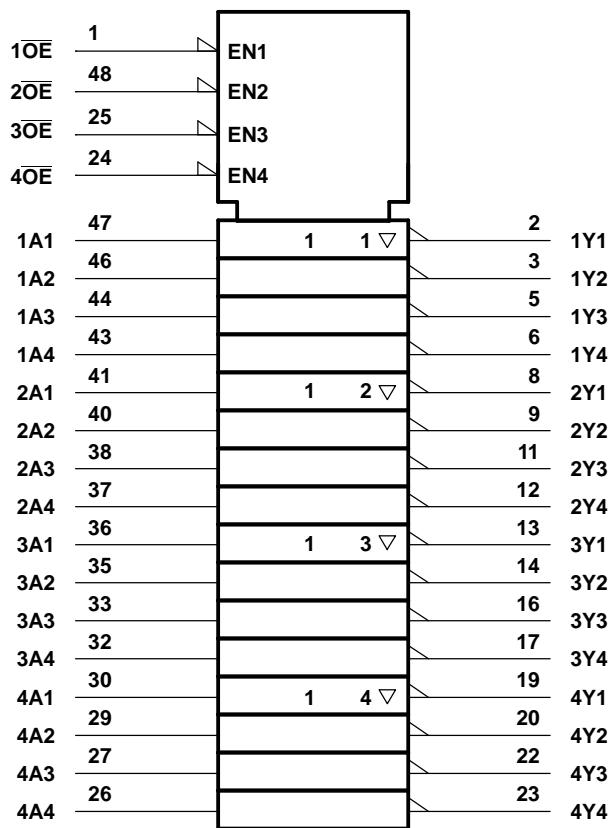
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**SN74ALVCH16240
16-BIT BUFFER/DRIVER
WITH 3-STATE OUTPUTS**

SCES045D—JULY 1995—REVISED AUGUST 2004

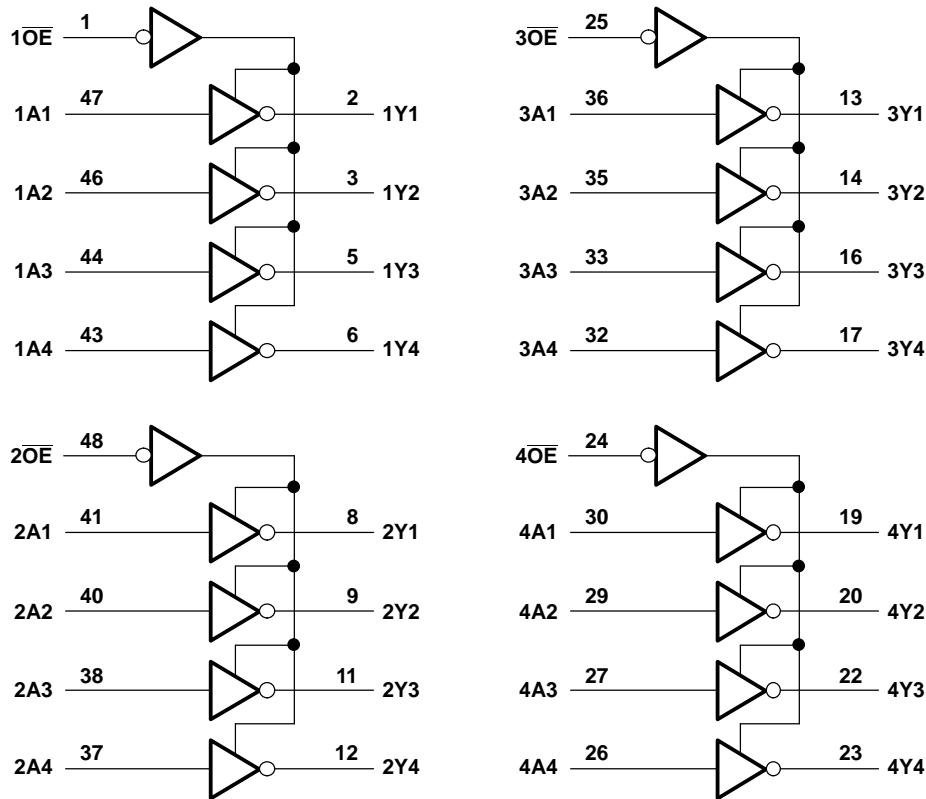
 **TEXAS
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LOGIC SYMBOL⁽¹⁾



⁽¹⁾This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

LOGIC DIAGRAM (POSITIVE LOGIC)



ABSOLUTE MAXIMUM RATINGS⁽¹⁾

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V_{CC}	Supply voltage range	-0.5	4.6	V
V_I	Input voltage range ⁽²⁾	-0.5	4.6	V
V_O	Output voltage range ⁽²⁾⁽³⁾	-0.5	$V_{CC} + 0.5$	V
I_{IK}	Input clamp current $V_I < 0$	-	-50	mA
I_{OK}	Output clamp current $V_O < 0$	-	-50	mA
I_O	Continuous output current	-	± 50	mA
	Continuous current through each V_{CC} or GND	-	± 100	mA
θ_{JA}	Package thermal impedance ⁽⁴⁾	DGG package		89
		DL package		94
T_{stg}	Storage temperature range	-65	150	°C

(1) 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.

(2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

(3) This value is limited to 4.6 V maximum.

(4) The package thermal impedance is calculated in accordance with JESD 51.

SN74ALVCH16240
16-BIT BUFFER/DRIVER
WITH 3-STATE OUTPUTS

SCES045D—JULY 1995—REVISED AUGUST 2004

 **TEXAS**
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RECOMMENDED OPERATING CONDITIONS⁽¹⁾

		MIN	MAX	UNIT
V_{CC}	Supply voltage	1.65	3.6	V
V_{IH}	High-level input voltage	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	$0.65 \times V_{CC}$	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7	
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2	
V_{IL}	Low-level input voltage	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0.7	
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	0.8	
V_I	Input voltage	0	V_{CC}	V
V_O	Output voltage	0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 1.65 \text{ V}$	-4	mA
		$V_{CC} = 2.3 \text{ V}$	-12	
		$V_{CC} = 2.7 \text{ V}$	-12	
		$V_{CC} = 3 \text{ V}$	-24	
I_{OL}	Low-level output current	$V_{CC} = 1.65 \text{ V}$	4	mA
		$V_{CC} = 2.3 \text{ V}$	12	
		$V_{CC} = 2.7 \text{ V}$	12	
		$V_{CC} = 3 \text{ V}$	24	
$\Delta t/\Delta v$	Input transition rise or fall rate		10	ns/V
T_A	Operating free-air temperature	-40	85	°C

(1) All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

ELECTRICAL CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	V _{CC}	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{OH}	I _{OH} = -100 μ A	1.65 V to 3.6 V	V _{CC}	- 0.2		V
	I _{OH} = -4 mA	1.65 V		1.2		
	I _{OH} = -6 mA	2.3 V		2		
	I _{OH} = -12 mA	2.3 V		1.7		
		2.7 V		2.2		
		3 V		2.4		
V _{OL}	I _{OL} = -24 mA	3 V		2		V
	I _{OL} = 100 μ A	1.65 V to 3.6 V		0.2		
	I _{OL} = 4 mA	1.65 V		0.45		
	I _{OL} = 6 mA	2.3 V		0.4		
	I _{OL} = 12 mA	2.3 V		0.7		
		2.7 V		0.4		
I _I	V _I = V _{CC} or GND	3.6 V		\pm 5	μ A	
I _{I(hold)}	V _I = 0.58 V	1.65 V		25		μ A
	V _I = 1.07 V	1.65 V		-25		
	V _I = 0.7 V	2.3 V		45		
	V _I = 1.7 V	2.3 V		-45		
	V _I = 0.8 V	3 V		75		
	V _I = 2 V	3 V		-75		
	V _I = 0 to 3.6 V ⁽²⁾	3.6 V		\pm 500	μ A	
I _{OZ}	V _O = V _{CC} or GND	3.6 V		\pm 10	μ A	
I _{CC}	V _I = V _{CC} or GND, I _O = 0	3.6 V		40	μ A	
Δ I _{CC}	One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	3 V to 3.6 V		750	μ A	
C _i	Control inputs	V _I = V _{CC} or GND	3.3 V	3		pF
	Data inputs			6		
C _o	Outputs	V _O = V _{CC} or GND	3.3 V	7		pF

(1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

(2) This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1 through Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 1.8 V	V _{CC} = 2.5 V \pm 0.2 V	V _{CC} = 2.7 V	V _{CC} = 3.3 V \pm 0.3 V	UNIT		
			TYP	MIN	MAX	MIN	MAX		
t _{pd}	A	Y	(1)	1	5.3	5.3	1	3.9	ns
t _{en}	\overline{OE}	Y	(1)	1	6.4	6.1	1	5	ns
t _{dis}	\overline{OE}	Y	(1)	1	5.4	4.8	1	4.4	ns

(1) This information was not available at the time of publication.

OPERATING CHARACTERISTICS

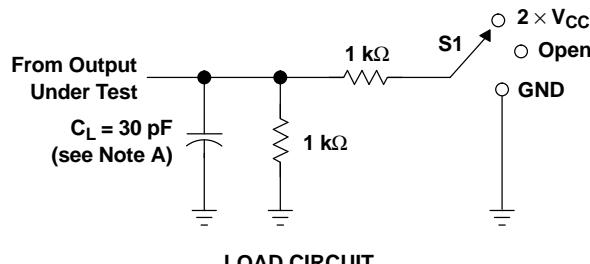
$T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	$V_{CC} = 1.8\text{ V}$	$V_{CC} = 2.5\text{ V}$	$V_{CC} = 3.3\text{ V}$	UNIT
		TYP	TYP	TYP	
C_{pd} Power dissipation capacitance	Outputs enabled	(1)	16	19	pF
	Outputs disabled	(1)	4	5	

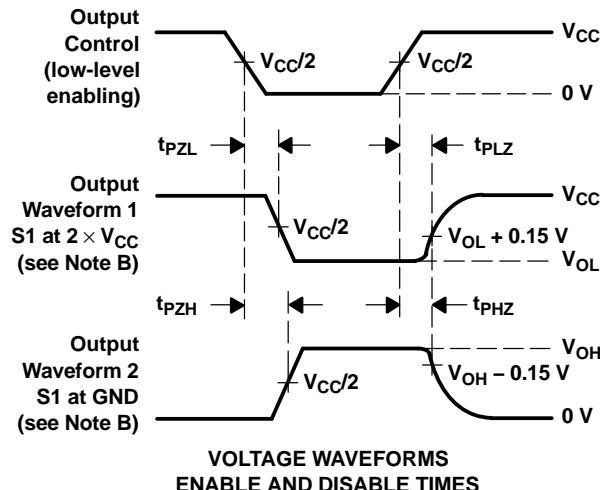
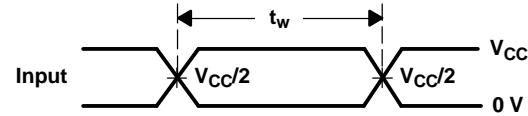
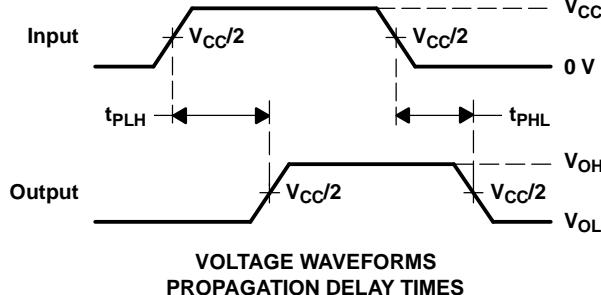
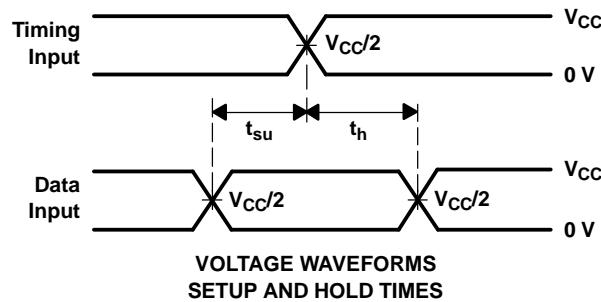
(1) This information was not available at the time of publication.

PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 1.8\text{ V}$



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



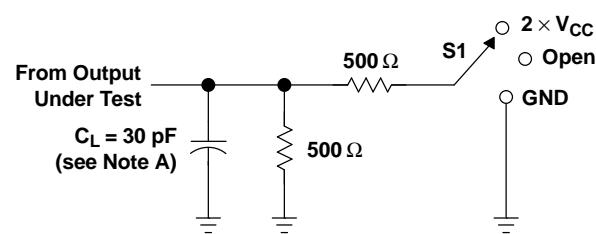
NOTES:

- C_L includes probe and jig capacitance.
- 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.
- All input pulses are supplied by generators having the following characteristics: PRR $\leq 10\text{ MHz}$, $Z_O = 50\text{ }\Omega$, $t_r \leq 2\text{ ns}$, $t_f \leq 2\text{ ns}$.
- The outputs are measured one at a time, with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- t_{PZL} and t_{PZH} are the same as t_{en} .
- t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

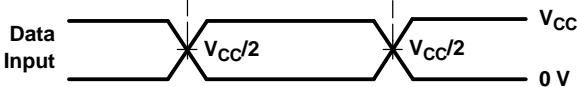
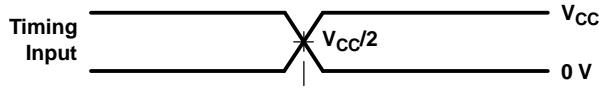
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$

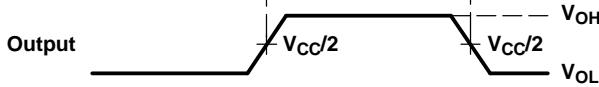
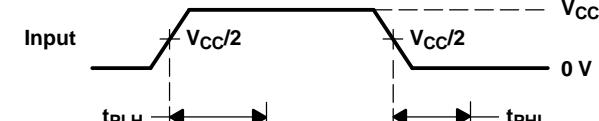


TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	2 \times V_{CC}
t_{PHZ}/t_{PZH}	GND

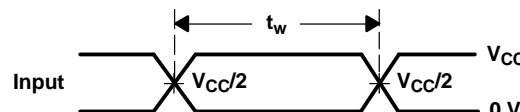
LOAD CIRCUIT



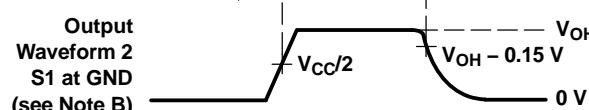
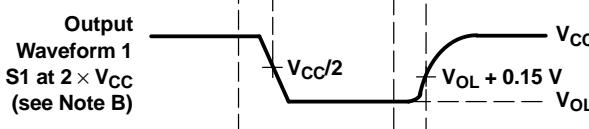
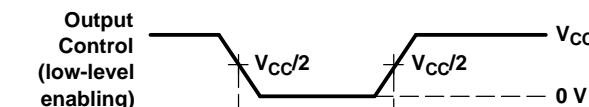
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



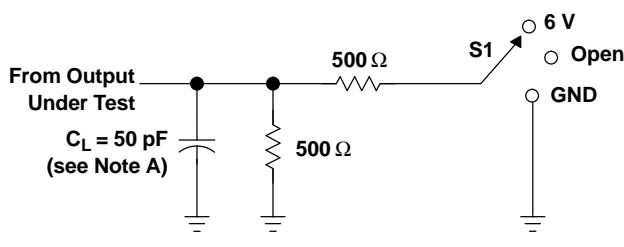
VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

NOTES:

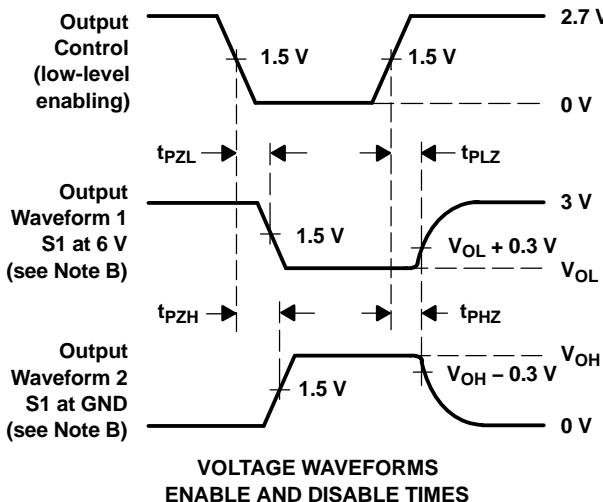
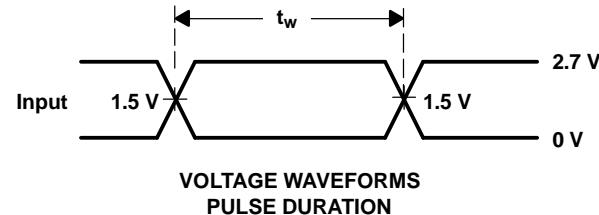
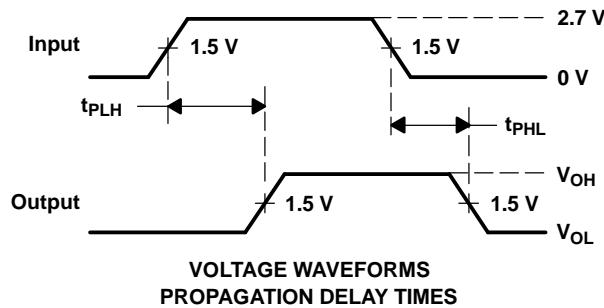
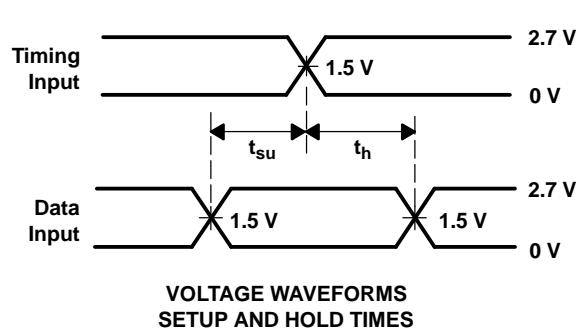
- C_L includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics: PRR $\leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2 \text{ ns}$, $t_f \leq 2 \text{ ns}$.
- The outputs are measured one at a time, with one transition per measurement.
- t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- t_{PZL} and t_{PZH} are the same as t_{en} .
- t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 2. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION
 $V_{CC} = 2.7 \text{ V AND } 3.3 \text{ V} \pm 0.3 \text{ V}$



TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



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 $\leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
- D. The outputs are measured one at a time, with one transition per measurement.
- E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- F. t_{PZL} and t_{PZH} are the same as t_{en} .
- G. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 3. 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)
SN74ALVCH16240DGGR	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ALVCH16240
SN74ALVCH16240DGGR.B	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ALVCH16240
SN74ALVCH16240DL	Active	Production	SSOP (DL) 48	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ALVCH16240
SN74ALVCH16240DL.B	Active	Production	SSOP (DL) 48	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ALVCH16240

⁽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.

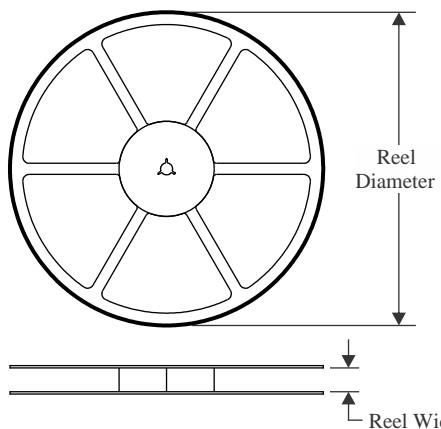
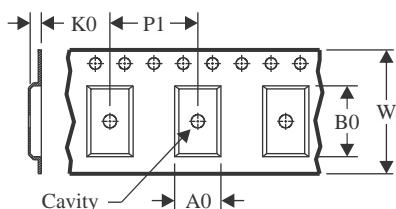
⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

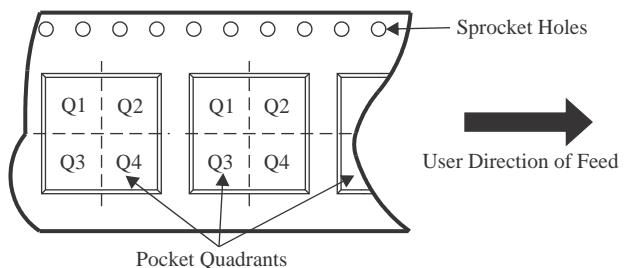
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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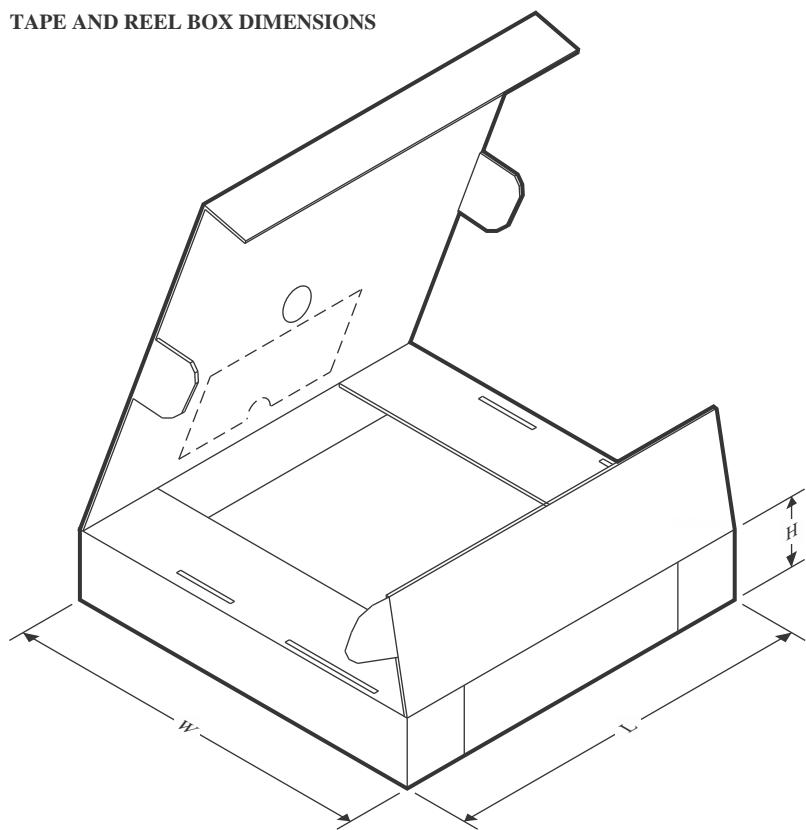
TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


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


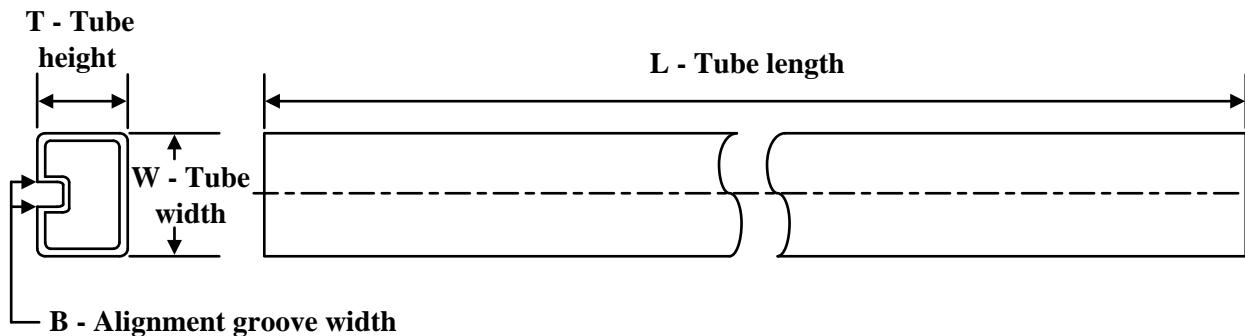
*All dimensions are nominal

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
SN74ALVCH16240DGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALVCH16240DGGR	TSSOP	DGG	48	2000	356.0	356.0	45.0

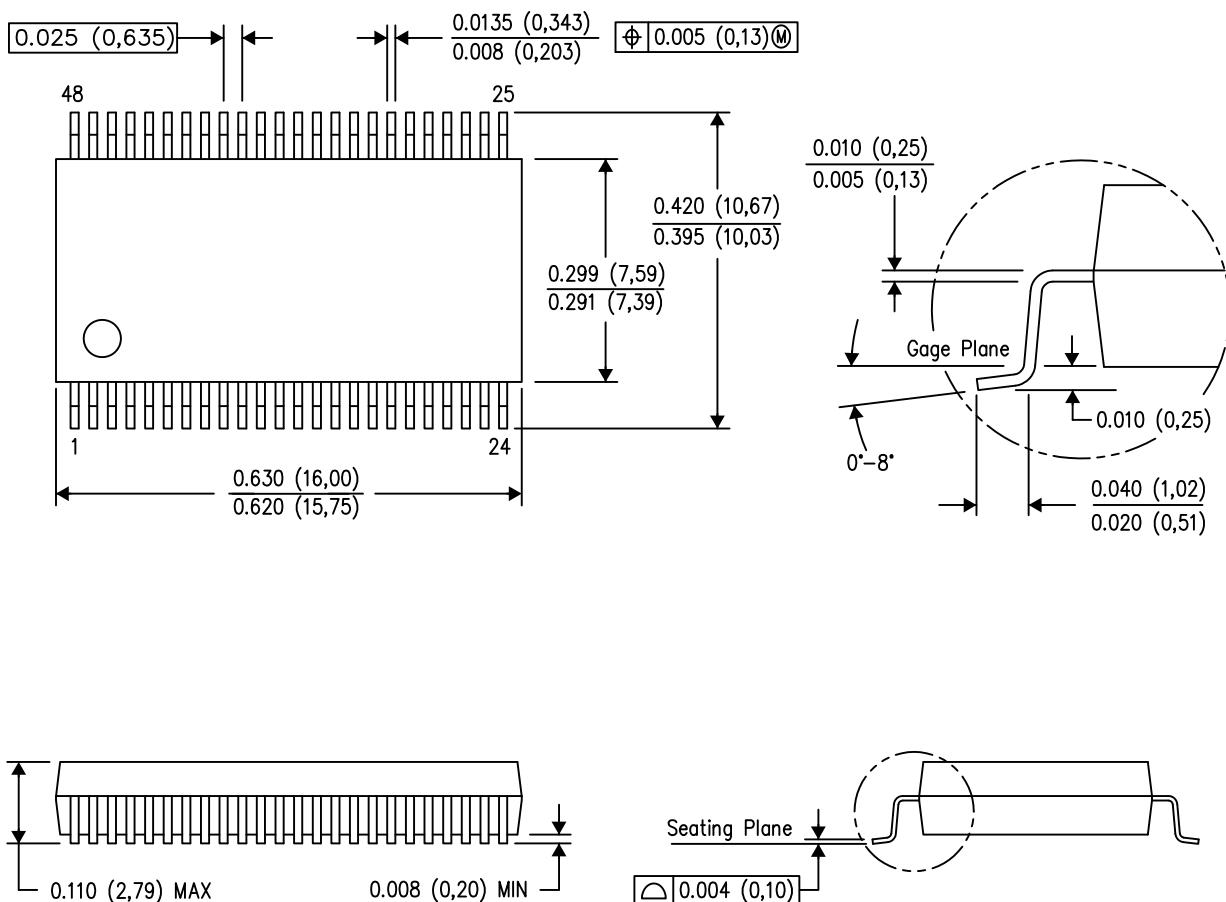
TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μ m)	B (mm)
SN74ALVCH16240DL	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74ALVCH16240DL.B	DL	SSOP	48	25	473.7	14.24	5110	7.87

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



4040048-3/F 05/13

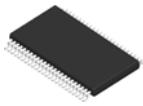
NOTES:

- 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 M0-118

PowerPAD is a trademark of Texas Instruments.

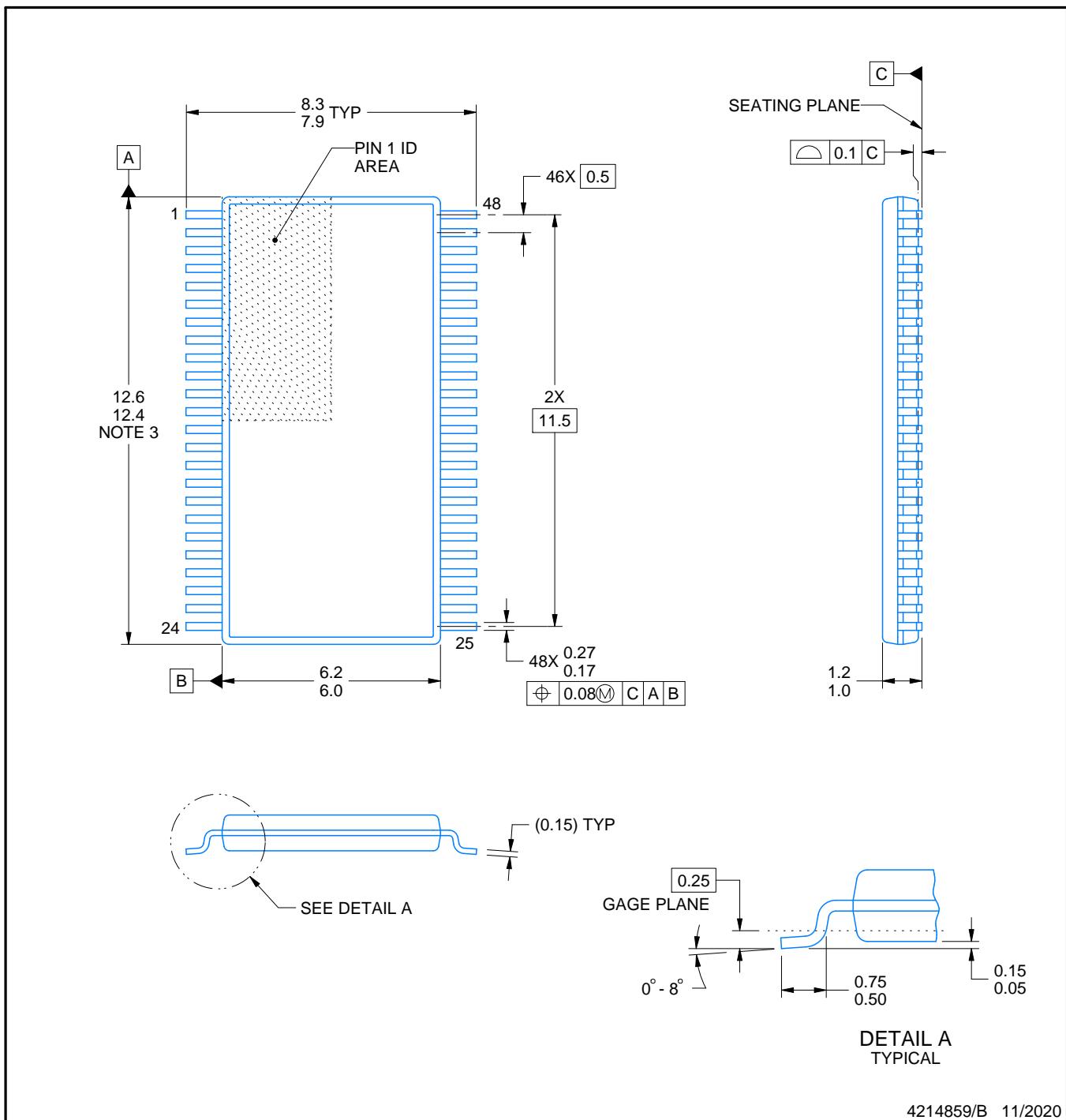
PACKAGE OUTLINE

DGG0048A



TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

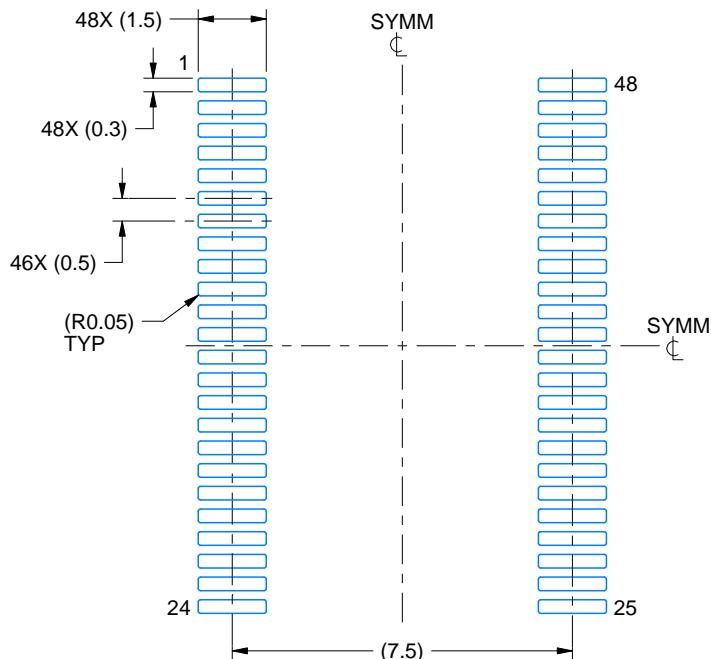
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

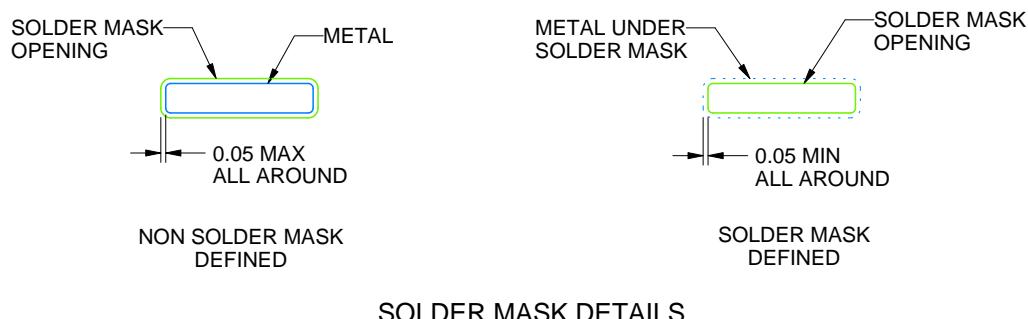
DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

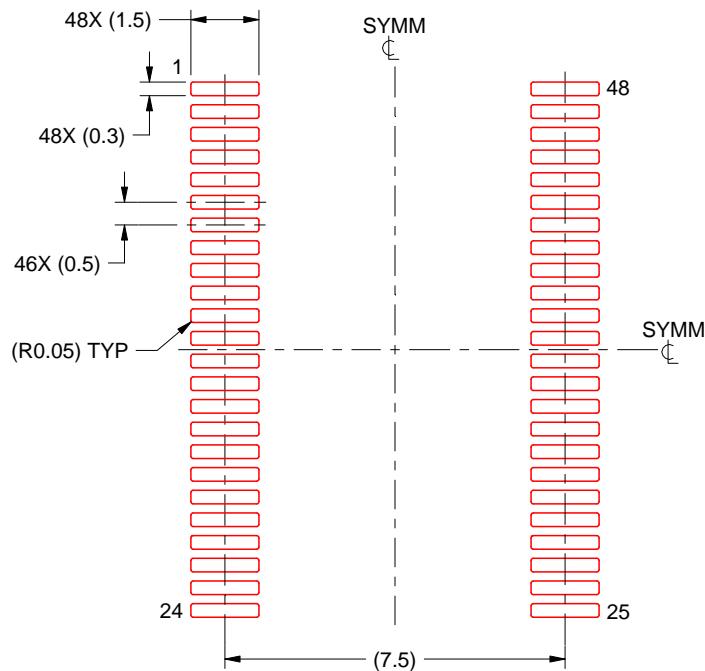
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

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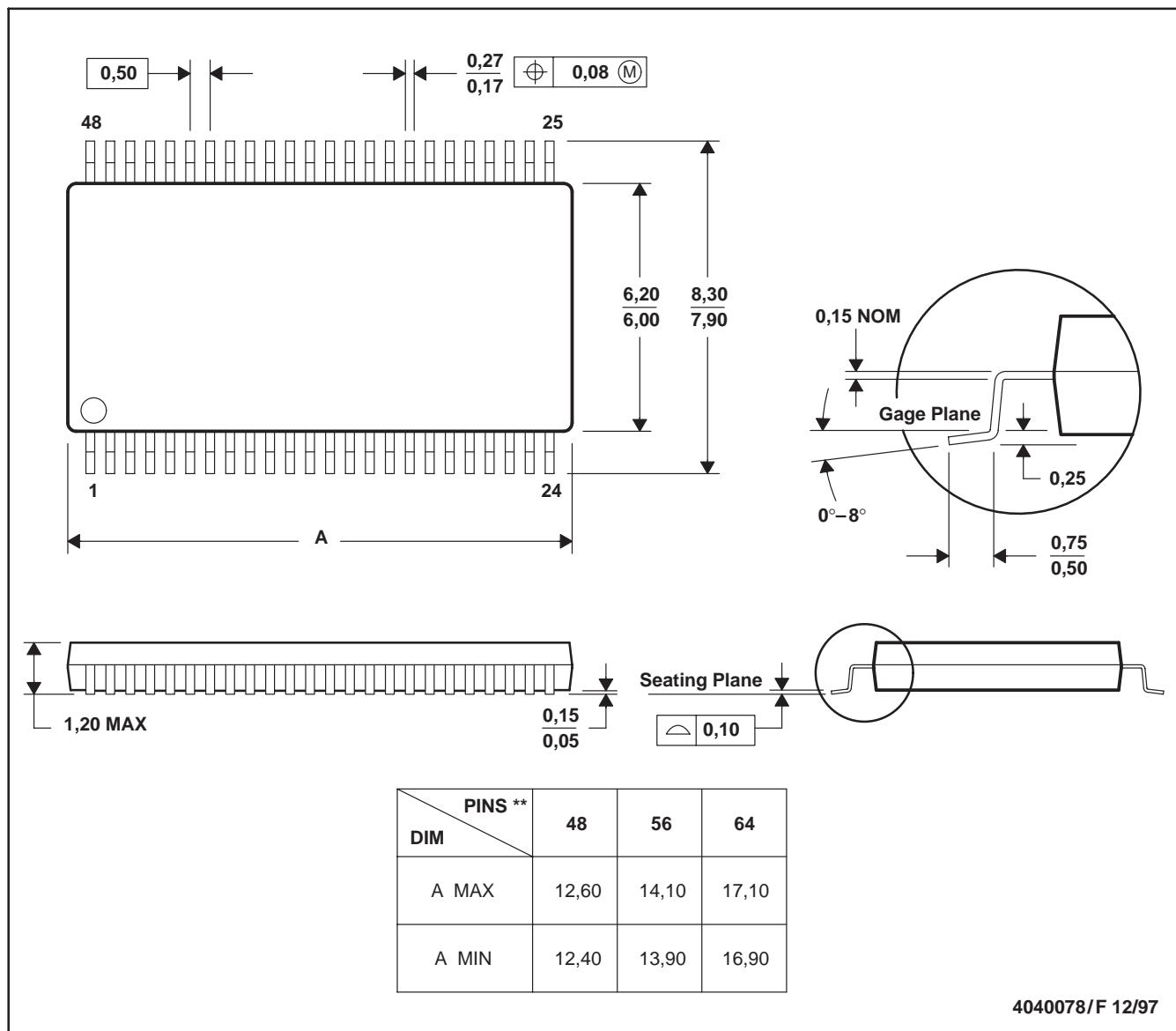
NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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

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