

FEATURES

- Members of the Texas Instruments Widebus™ Family
- State-of-the-Art EPIC-IIB™ BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JESD 70
- Typical V_{OLP} (Output Ground Bounce) <1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- High-Drive Outputs ($-32\text{-mA } I_{OH}$, $64\text{-mA } I_{OL}$)
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL), Thin Shrink Small-Outline (DGG), and Thin Very Small-Outline (DGV) Packages and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings

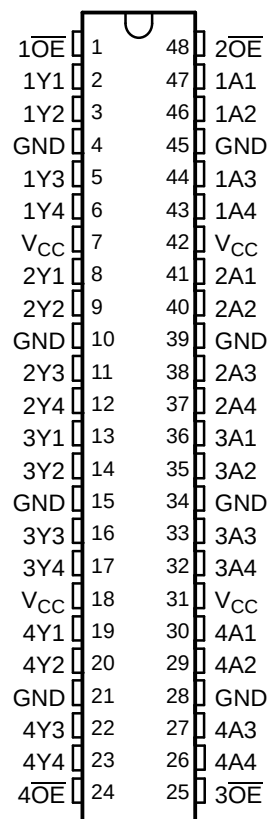
DESCRIPTION

The SN54ABT16244 and SN74ABT16244A are 16-bit buffers and line drivers designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. These devices can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. These devices provide true outputs and symmetrical $\overline{OE}$ (active-low output-enable) inputs.

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.

The SN54ABT16244 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT16244A is characterized for operation from -40°C to 85°C .

SN54ABT16244... WD PACKAGE
SN74ABT16244A... DGG, DGV, OR DL PACKAGE
(TOP VIEW)



FUNCTION TABLE
(EACH BUFFER)

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



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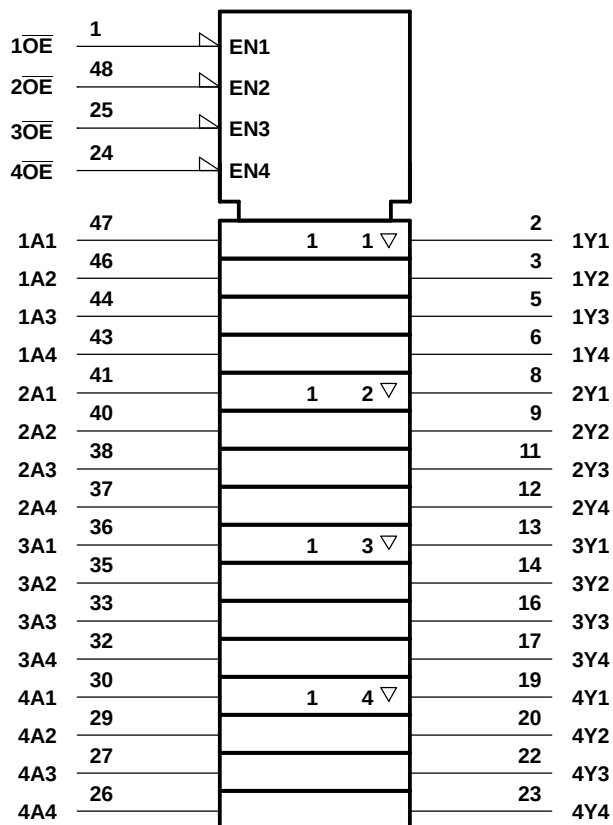
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54ABT16244, SN74ABT16244A 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

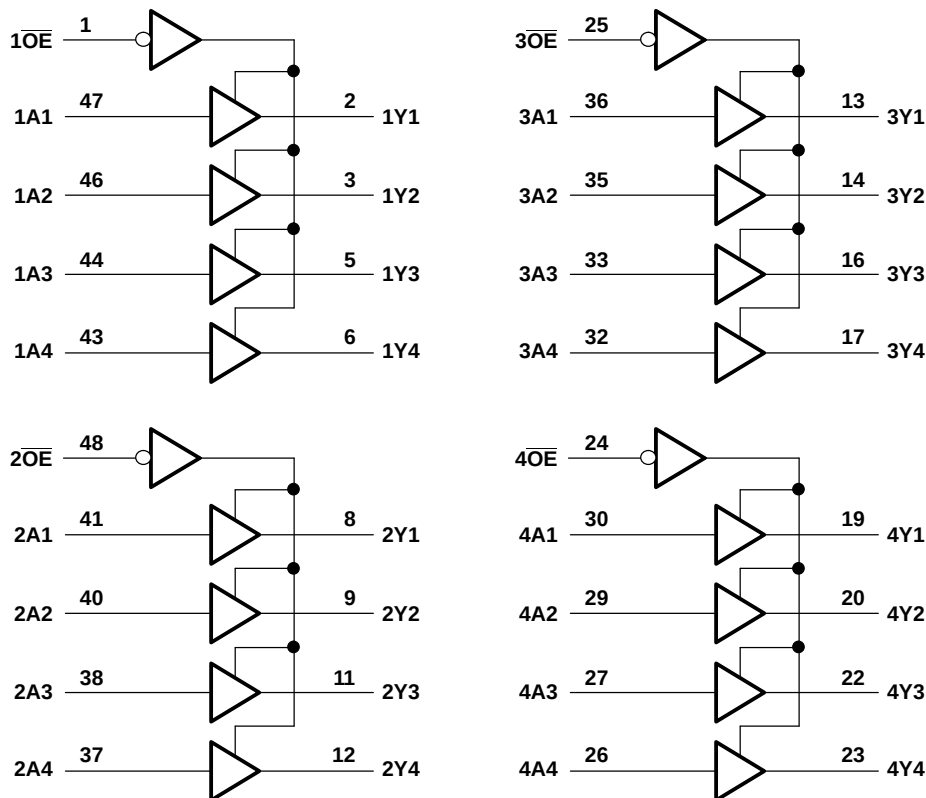
SCBS073H—SEPTEMBER 1991—REVISED AUGUST 2005

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	7	V
V_I	Input voltage range ⁽²⁾	-0.5	7	V
V_O	Voltage range applied to any output in the high or power-off state	-0.5	5.5	V
I_O	Current into any output in the low state	SN54ABT16244		96
		SN74ABT16244A		128
I_{IK}	Input clamp current	$V_I < 0$		-18
I_{OK}	Output clamp current	$V_O < 0$		-50
θ_{JA}	Package thermal impedance ⁽³⁾	DGG package		89
		DGV package		93
		DL package		94
T_{stg}	Storage temperature range	-65	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.
- The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- The package thermal impedance is calculated in accordance with EIA/JEDEC Std JESD 51.

SN54ABT16244, SN74ABT16244A

16-BIT BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

SCBS073H—SEPTEMBER 1991—REVISED AUGUST 2005

Recommended Operating Conditions⁽¹⁾

		SN54ABT16244		SN74ABT16244A		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	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
I _{OH}	High-level output current		–24		–32	mA
I _{OL}	Low-level output current		48		64	mA
Δt/Δv	Input transition rise or fall rate	Outputs enabled		10	10	ns/V
T _A	Operating free-air temperature	–55	125	–40	85	°C

(1) All unused 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	T _A = 25°C ⁽¹⁾			SN54ABT16244		SN74ABT16244A		UNIT
			MIN	TYP ⁽²⁾	MAX	MIN	MAX	MIN	MAX	
V _{IK}		V _{CC} = 4.5 V, I _I = –18 mA			–1.2		–1.2		–1.2	V
V _{OH}		V _{CC} = 4.5 V, I _{OH} = –3 mA	2.5			2.5		2.5		V
		V _{CC} = 5 V, I _{OH} = –3 mA	3			3		3		
		V _{CC} = 4.5 V, I _{OH} = –24 mA	2			2				
		V _{CC} = 4.5 V, I _{OH} = –32 mA	2 ⁽³⁾					2		
V _{OL}		V _{CC} = 4.5 V, I _{OL} = 48 mA			0.55		0.55			V
		V _{CC} = 4.5 V, I _{OL} = 64 mA			0.55 ⁽³⁾				0.55	
V _{hys}				100						mV
I _I		V _{CC} = 5.5 V, V _I = V _{CC} or GND			±1		±1		±1	μA
I _{OZH}		V _{CC} = 5.5 V, V _O = 2.7 V			10 ⁽⁴⁾		10		10 ⁽⁴⁾	μA
I _{OZL}		V _{CC} = 5.5 V, V _O = 0.5 V			–10 ⁽⁴⁾		–10		–10 ⁽⁴⁾	μA
I _{off}		V _{CC} = 0, V _I or V _O ≤ 5.5 V			±100				±100	μA
I _{CEX}		V _{CC} = 5.5 V, V _O = 5.5 V, Outputs high			50		50		50	μA
I _O ⁽⁵⁾		V _{CC} = 5.5 V, V _O = 2.5 V	–50	–100	–180	–50	–180	–50	–180	mA
I _{CC}		V _{CC} = 5.5 V, Outputs high			3		2		3	mA
		I _O = 0, Outputs low			32		32		32	
		V _I = V _{CC} or GND, Outputs disabled			3		2		3	
ΔI _{CC} ⁽⁶⁾	Data inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND, Outputs enabled			0.05		1.5		0.05	mA
		Outputs disabled			0.05		1		0.05	
	Control inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND			0.05		1.5		0.05	
C _i		V _I = 2.5 V or 0.5 V			3					pF
C _o		V _O = 2.5 V or 0.5 V			6					pF

(1) Characteristics for T_A = 25°C apply to the SN74ABT16244A only.

(2) All typical values are at V_{CC} = 5 V.

(3) On products compliant to MIL-PRF-38535, this parameter does not apply.

(4) This data-sheet limit may vary among suppliers.

(5) Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

(6) This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50 \text{ pF}$
(unless otherwise noted) (see [Figure 1](#))

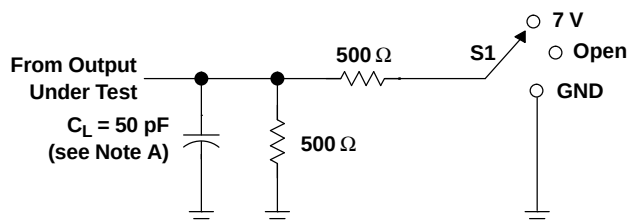
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT16244					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A	Y	0.7	2.3	3.2	0.7	3.6	ns
t _{PHL}			0.5	2.6	3.7	0.5	4.2	
t _{PZH}	$\overline{OE}$	Y	0.7	3	4	0.7	4.9	ns
t _{PZL}			0.9	3.2	5.5	0.9	6.5	
t _{PHZ}	$\overline{OE}$	Y	1.7	3.6	5	1.7	6	ns
t _{PLZ}			1.5	2.9	4.7	1.5	5.7	

Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50 \text{ pF}$
(unless otherwise noted) (see [Figure 1](#))

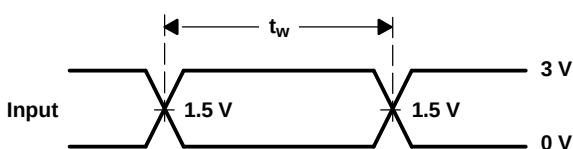
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74ABT16244A					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A or B	Y	1	2.3	3.2	1	3.5	ns
t _{PHL}			1	2.6	3.7	1	4.1	
t _{PZH}	$\overline{OE}$	Y	1	3	3.8	1	4.8	ns
t _{PZL}			1	3.2	4	1	4.8	
t _{PHZ}	$\overline{OE}$	Y	1	3.6	4.4	1	4.8	ns
t _{PLZ}			1	2.9	3.7	1	4.1	

PARAMETER MEASUREMENT INFORMATION

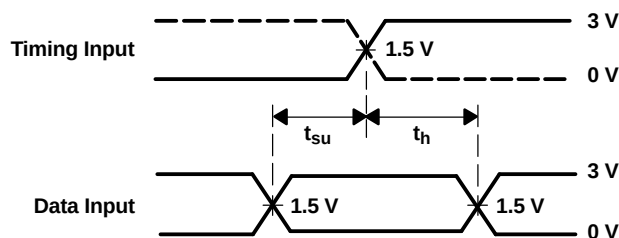


LOAD CIRCUIT

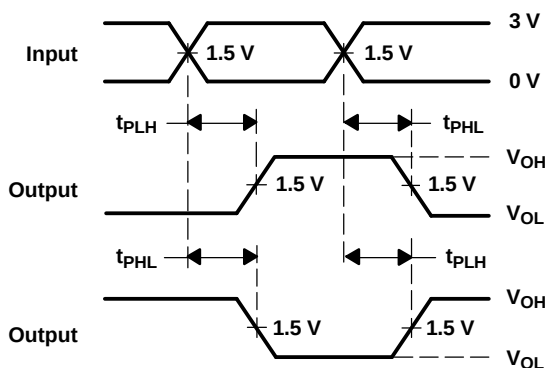
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



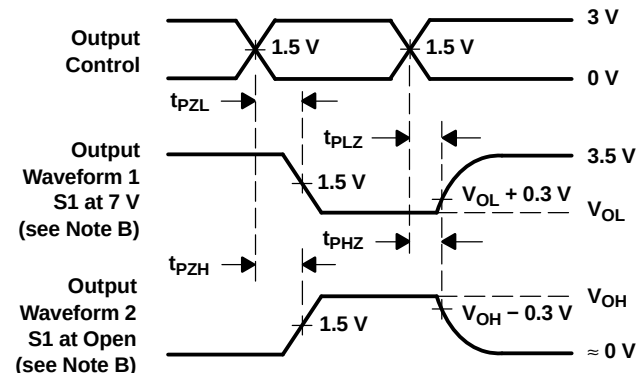
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- 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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 - The outputs are measured one at a time, with one 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
5962-9317401MXA	ACTIVE	CFP	WD	48	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9317401MX A SNJ54ABT16244W D	Samples
SN74ABT16244ADGGR	ACTIVE	TSSOP	DGG	48	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16244A	Samples
SN74ABT16244ADGVR	ACTIVE	TVSOP	DGV	48	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AH244A	Samples
SN74ABT16244ADL	ACTIVE	SSOP	DL	48	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16244A	Samples
SN74ABT16244ADLG4	ACTIVE	SSOP	DL	48	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16244A	Samples
SN74ABT16244ADLR	ACTIVE	SSOP	DL	48	1000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16244A	Samples
SN74ABT16244ADLRG4	ACTIVE	SSOP	DL	48	1000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16244A	Samples
SNJ54ABT16244WD	ACTIVE	CFP	WD	48	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9317401MX A SNJ54ABT16244W D	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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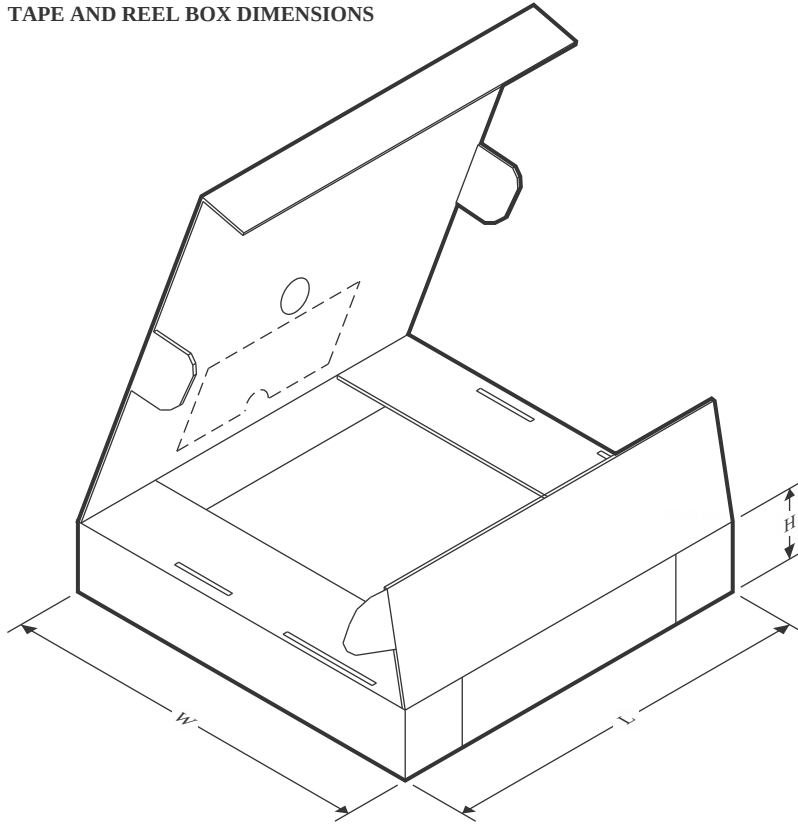
TAPE AND REEL INFORMATION



*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
SN74ABT16244ADGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74ABT16244ADGVR	TVSOP	DGV	48	2000	330.0	16.4	7.1	10.2	1.6	12.0	16.0	Q1
SN74ABT16244ADLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

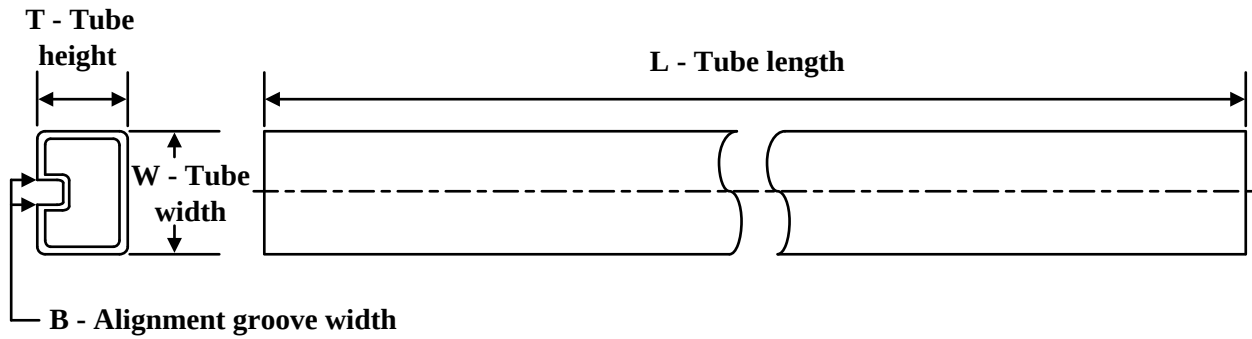
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ABT16244ADGGR	TSSOP	DGG	48	2000	367.0	367.0	45.0
SN74ABT16244ADGVR	TVSOP	DGV	48	2000	356.0	356.0	35.0
SN74ABT16244ADLR	SSOP	DL	48	1000	367.0	367.0	55.0

TUBE



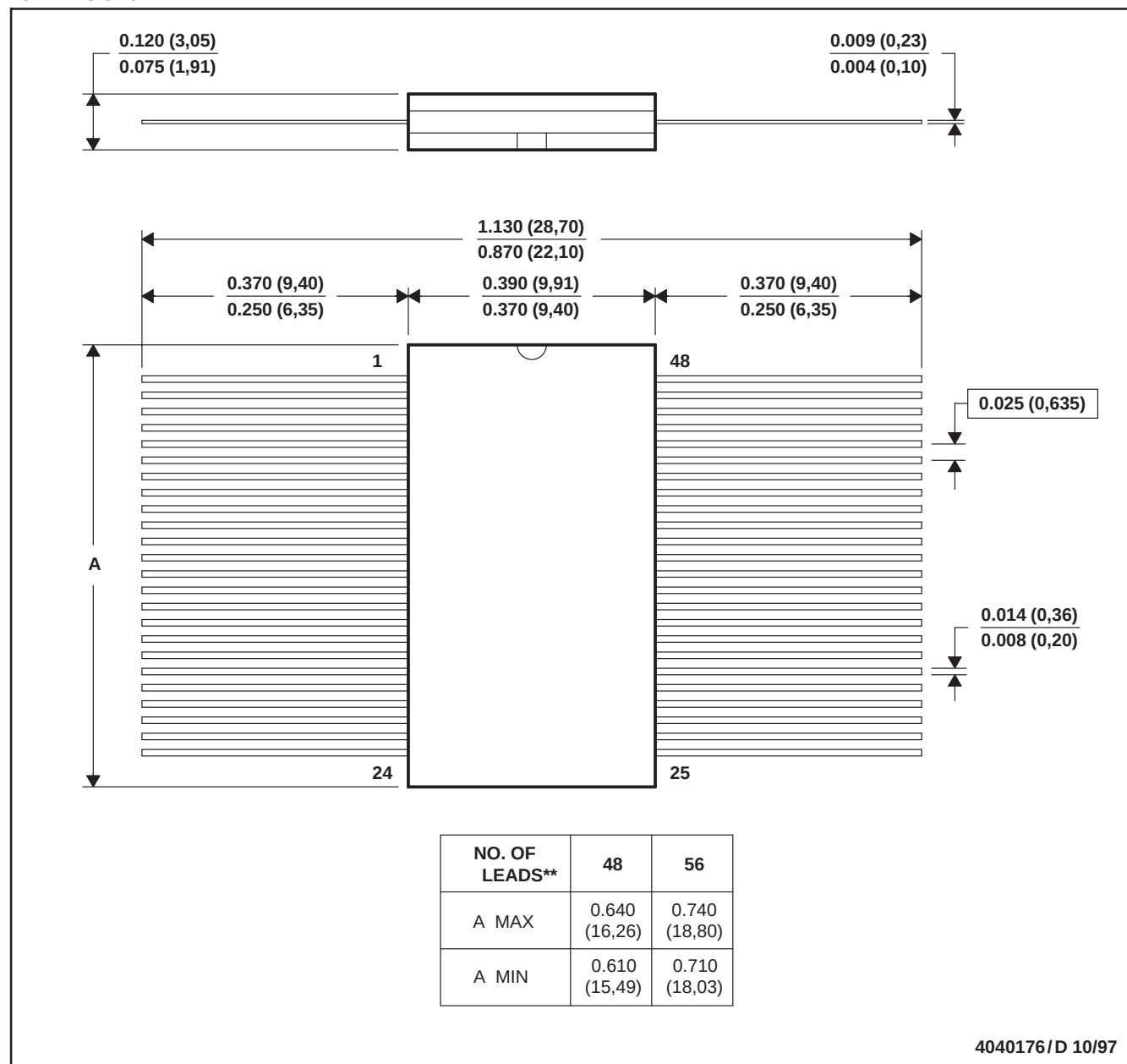
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74ABT16244ADL	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74ABT16244ADLG4	DL	SSOP	48	25	473.7	14.24	5110	7.87

WD (R-GDFP-F**)

CERAMIC DUAL FLATPACK

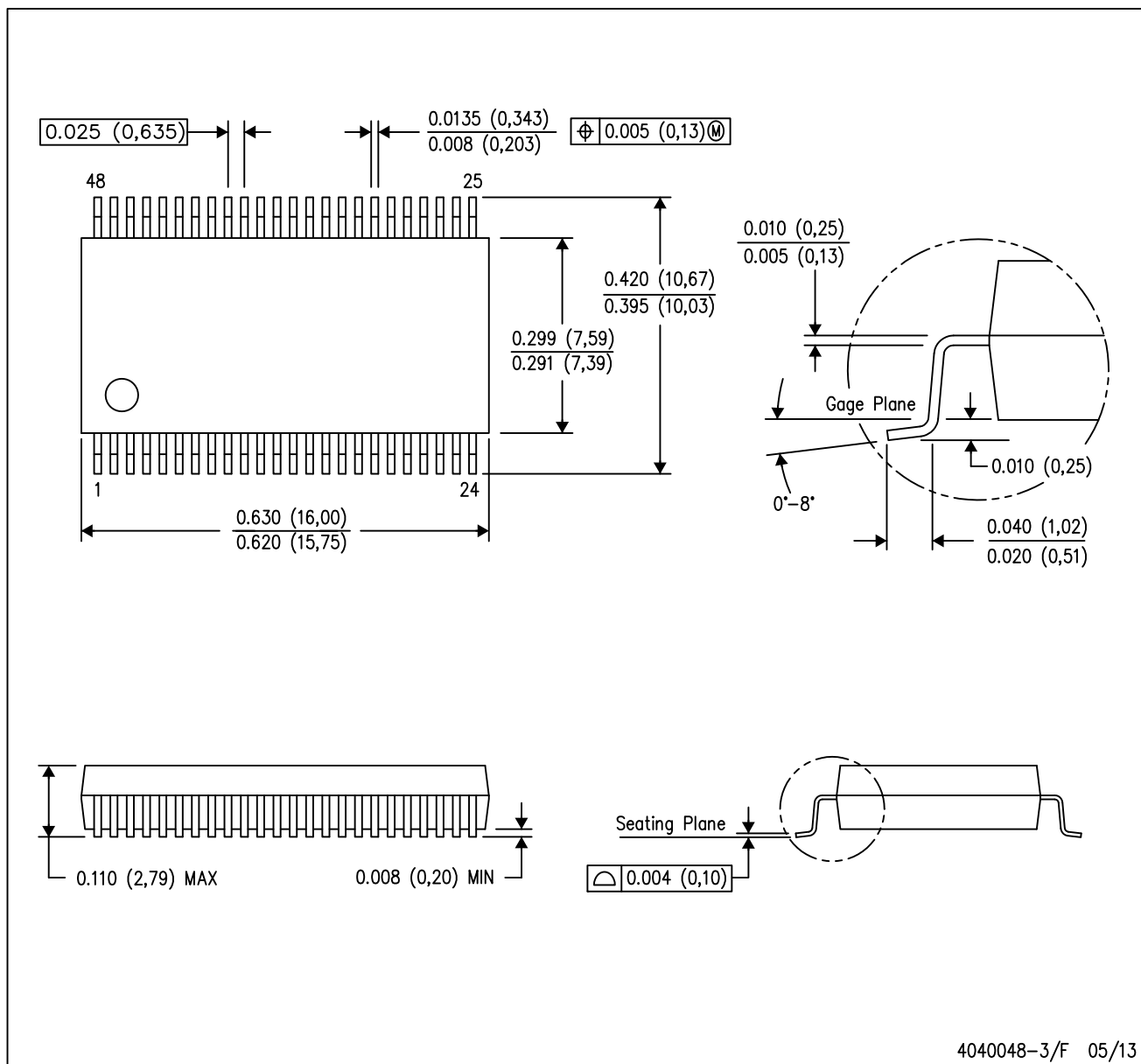
48 LEADS SHOWN



- 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

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE

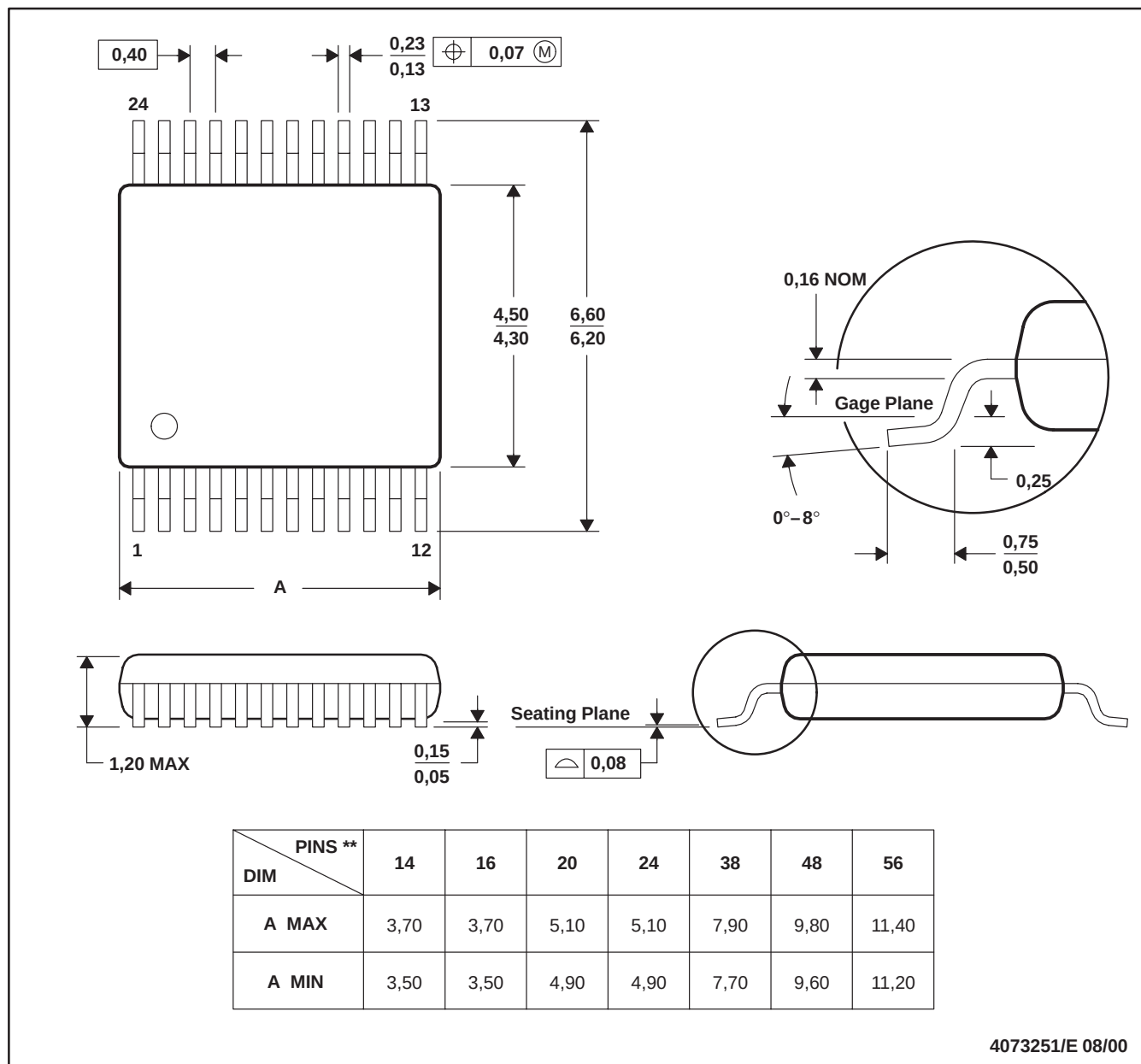


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MO-118

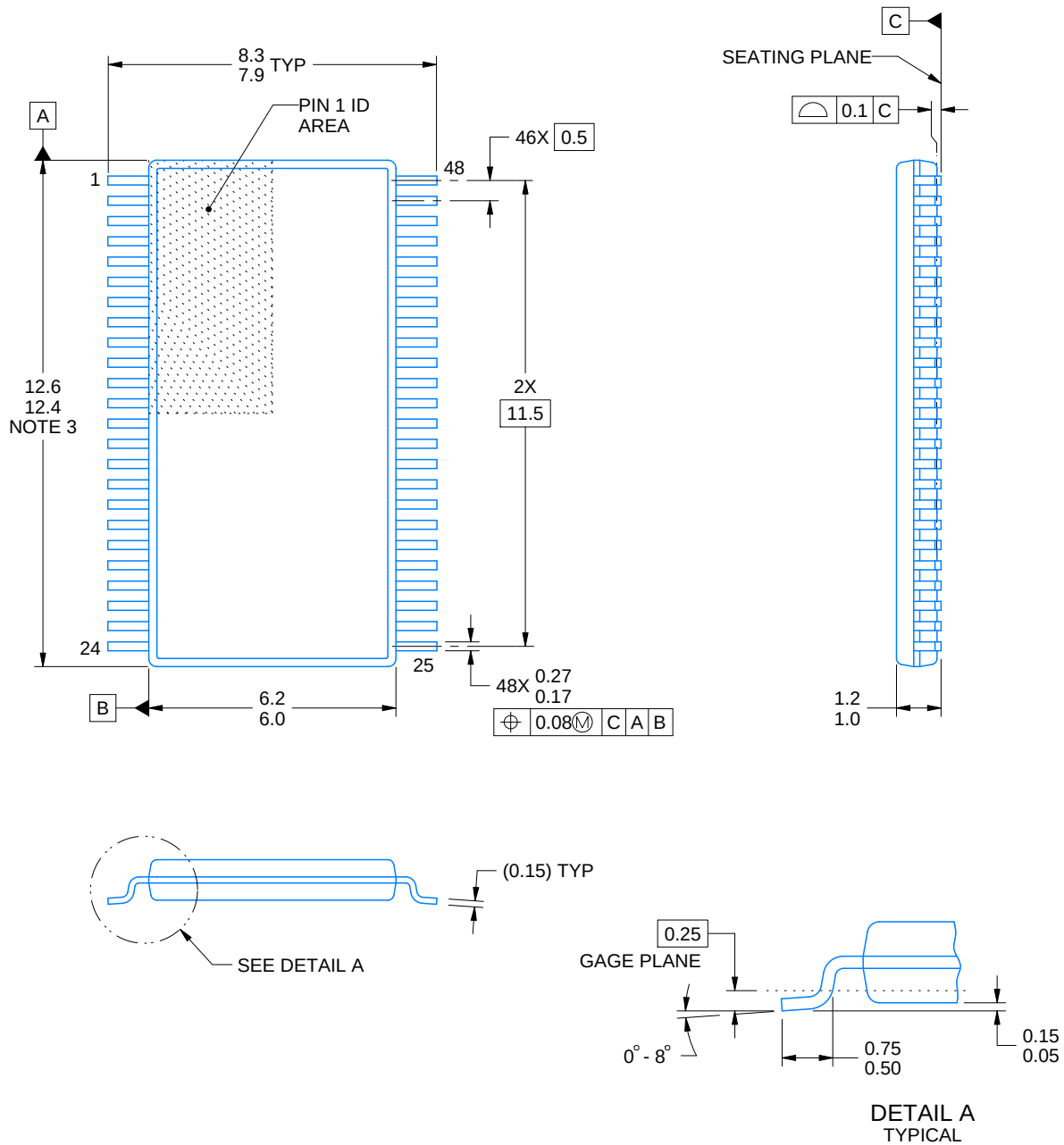
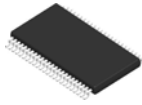
DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 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 flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194



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NOTES:

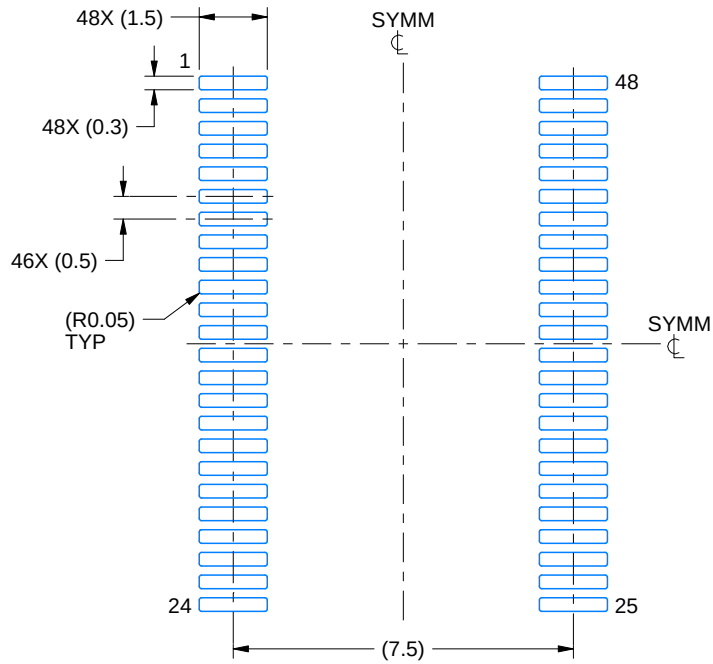
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

EXAMPLE BOARD LAYOUT

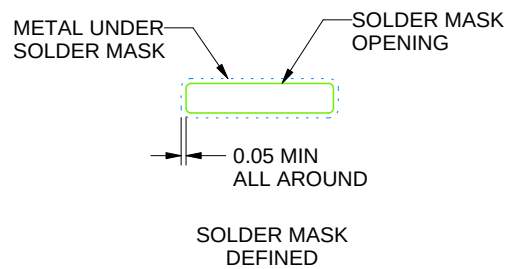
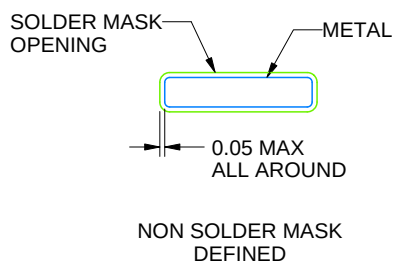
DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

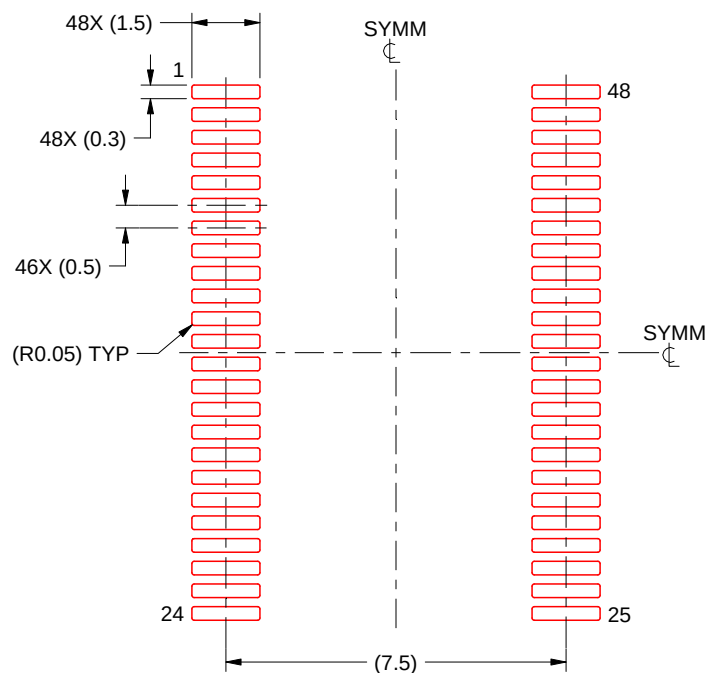
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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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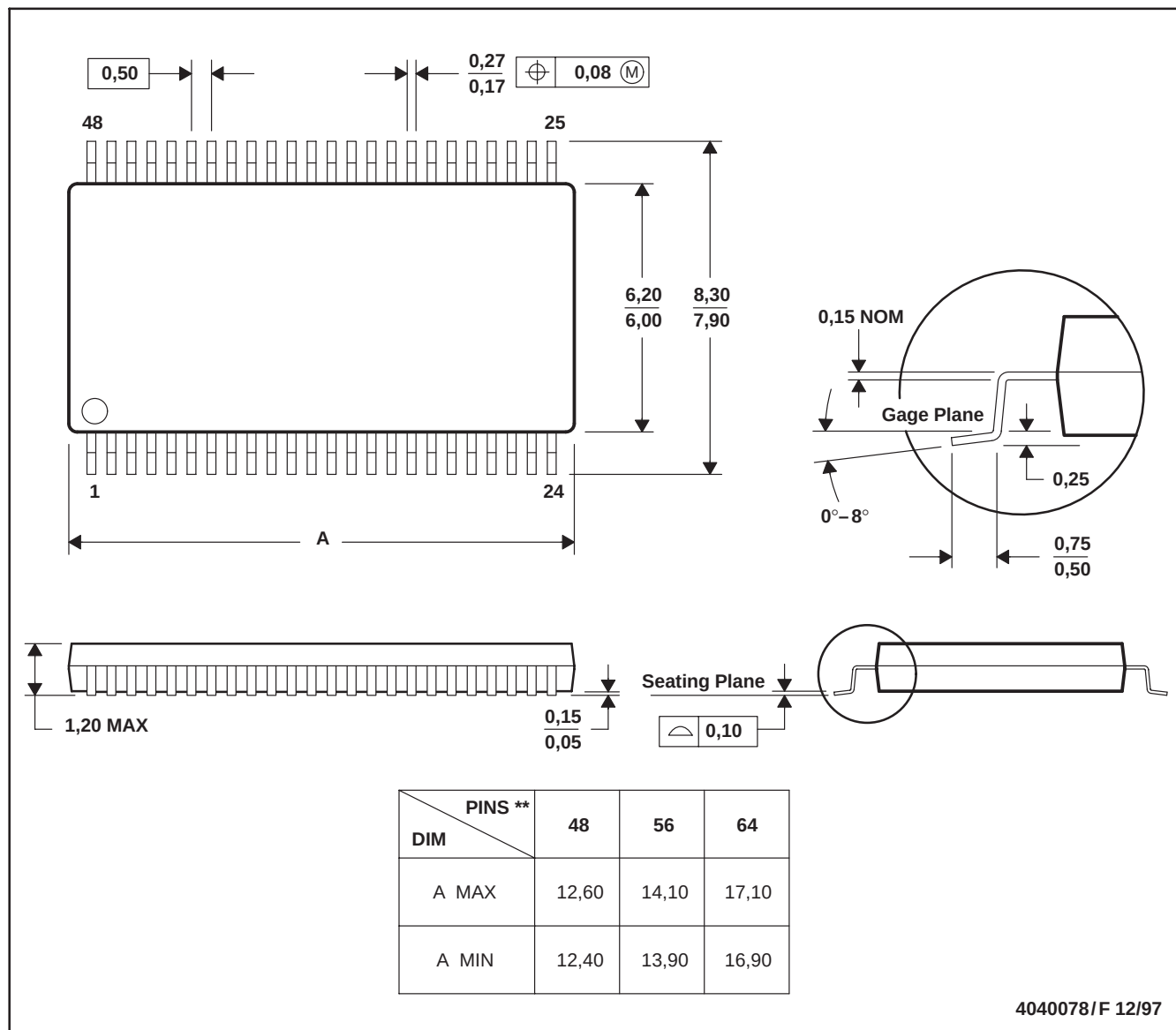
NOTES: (continued)

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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