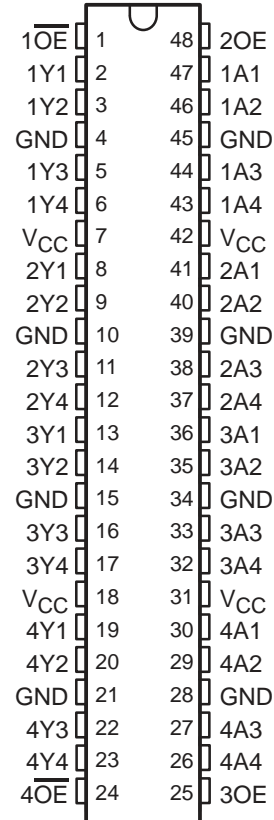


SN54ABT16241A, SN74ABT16241A 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS096G – FEBRUARY 1991 – REVISED OCTOBER 1998

- Members of the Texas Instruments *Widebus™* Family
- State-of-the-Art *EPIC-II B™* BiCMOS Design Significantly Reduces Power Dissipation
- 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 ($-32\text{-mA } I_{OH}$, $64\text{-mA } I_{OL}$)
- Latch-Up Performance Exceeds 500 mA Per JESD 17
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)
- 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

SN54ABT16241A . . . WD PACKAGE
SN74ABT16241A . . . DGG, DGV, OR DL PACKAGE
(TOP VIEW)



description

The 'ABT16241A devices 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 complementary output-enable (OE and \overline{OE}) 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. OE should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

The SN54ABT16241A is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT16241A is characterized for operation from -40°C to 85°C .



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.

Widebus and EPIC-II B are trademarks of Texas Instruments Incorporated.

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

 **TEXAS
INSTRUMENTS**

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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.

SN54ABT16241A, SN74ABT16241A

16-BIT BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

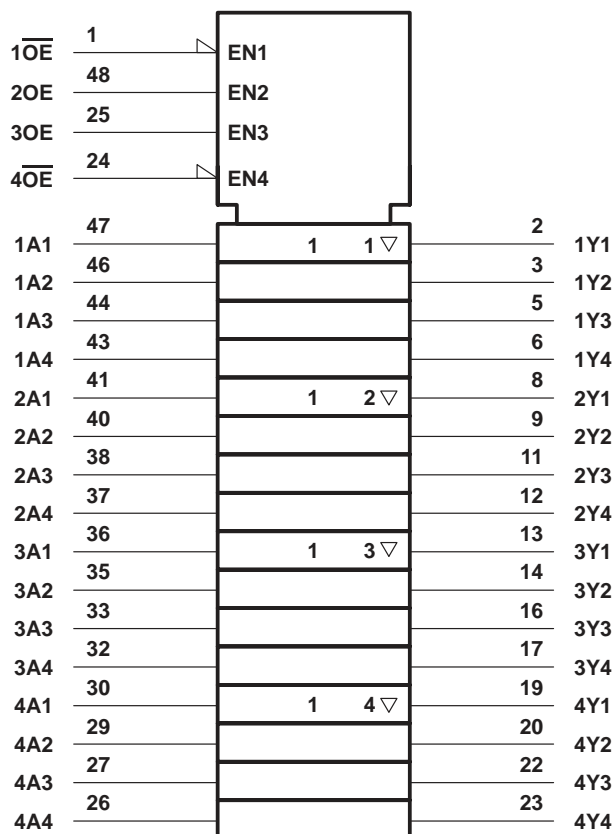
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FUNCTION TABLES

INPUTS		OUTPUTS
1OE, 4OE	1A, 4A	1Y, 4Y
L	H	H
L	L	L
H	X	Z

INPUTS		OUTPUTS
2OE, 3OE	2A, 3A	2Y, 3Y
H	H	H
H	L	L
L	X	Z

logic symbol†

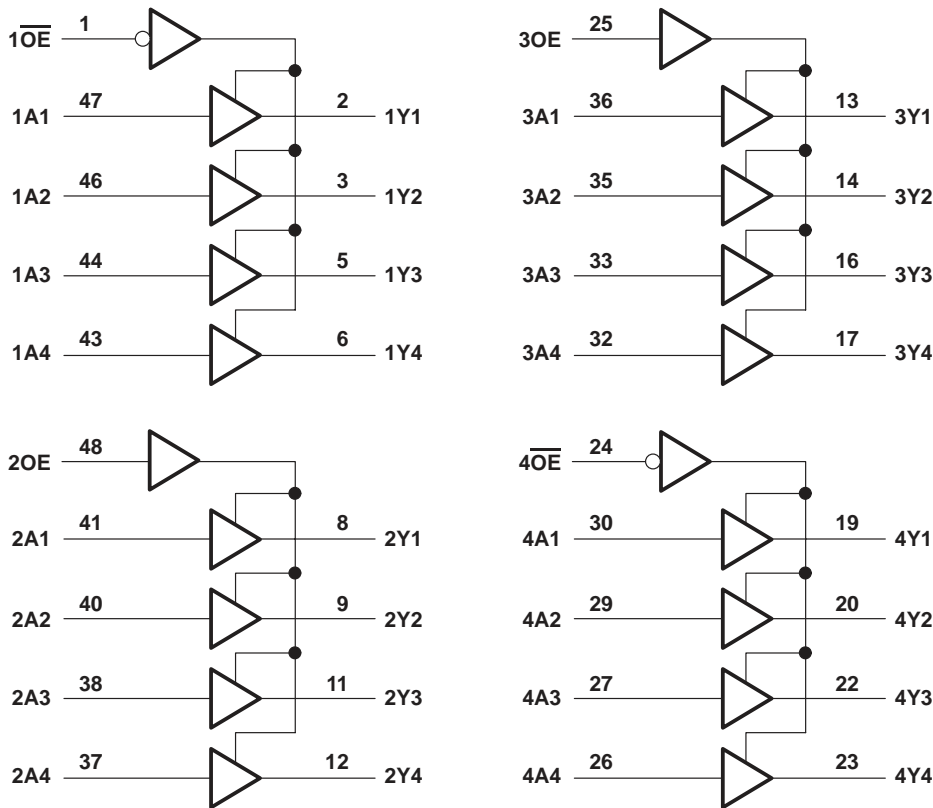


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

SN54ABT16241A, SN74ABT16241A
**16-BIT BUFFERS/DRIVERS
 WITH 3-STATE OUTPUTS**

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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 7 V
- Voltage range applied to any output in the high or power-off state, V_O -0.5 V to 5.5 V
- Current into any output in the low state, I_O : SN54ABT16241A 96 mA
 SN74ABT16241A 128 mA
- Input clamp current, I_{IK} ($V_I < 0$) -18 mA
- Output clamp current, I_{OK} ($V_O < 0$) -50 mA
- Package thermal impedance, θ_{JA} (see Note 2): DGG package 89°C/W
 DGV package 93°C/W
 DL package 94°C/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 negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 2. The package thermal impedance is calculated in accordance with JESD 51.

SN54ABT16241A, SN74ABT16241A

16-BIT BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

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recommended operating conditions (see Note 3)

		SN54ABT16241A		SN74ABT16241A		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

NOTE 3: 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			SN54ABT16241A		SN74ABT16241A		UNIT	
		MIN	TYP†	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				
I _{OH} = -32 mA		2*					2			
V _{OL}	V _{CC} = 4.5 V	I _{OL} = 48 mA		0.55		0.55			V	
		I _{OL} = 64 mA		0.55*			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		10		10	μA	
I _{OZL}	V _{CC} = 5.5 V, V _O = 0.5 V			-10		-10		-10	μA	
I _{off}	V _{CC} = 0, V _I or V _O ≤ 4.5 V			±100				±100	μA	
I _{CEX}	V _{CC} = 5.5 V, V _O = 5.5 V	Outputs high		50		50		50	μA	
I _{O‡}	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, I _O = 0, V _I = V _{CC} or GND	Outputs high		3		3		3	mA	
		Outputs low		34		34		34		
		Outputs disabled		3		3		3		
ΔI _{CC} §	Data inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND	Outputs enabled		1		1.5		1	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		1.5		1.5		1.5		
C _i	V _I = 2.5 V or 0.5 V		3.5						pF	
C _o	V _O = 2.5 V or 0.5 V		7.5						pF	

* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at V_{CC} = 5 V.

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

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



SN54ABT16241A, SN74ABT16241A
16-BIT BUFFERS/DRIVERS
WITH 3-STATE OUTPUTS

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT16241A					UNIT	
			$V_{CC} = 5$ V, $T_A = 25^\circ$ C			MIN	MAX		
			MIN	TYP	MAX				
t_{PLH}	A	Y	0.9	2.7	3.4	0.9	3.8	ns	
t_{PHL}			0.9	2.7	3.9	0.9	4.6		
t_{PZH}	OE or \overline{OE}	Y	1.2	3.3	4.2	1.2	5.1	ns	
t_{PZL}			1.3	3.4	5.9	1.3	7		
t_{PHZ}	OE or \overline{OE}	Y	1.5	4.1	5.5	1.5	7	ns	
t_{PLZ}			1.7	3.6	5.1	1.7	5.7		

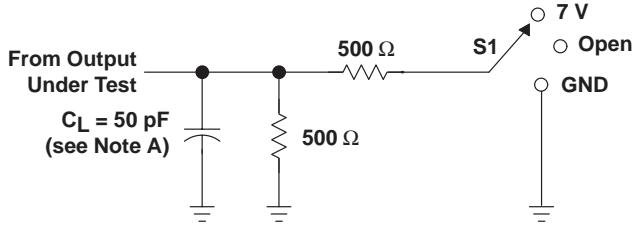
switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74ABT16241A					UNIT	
			$V_{CC} = 5$ V, $T_A = 25^\circ$ C			MIN	MAX		
			MIN	TYP	MAX				
t_{PLH}	A	Y	1	2.7	3.4	1	3.7	ns	
t_{PHL}			1	2.7	3.9	1	4.5		
t_{PZH}	OE or \overline{OE}	Y	1.2	3.3	4.2	1.2	5	ns	
t_{PZL}			1.3	3.4	5.9	1.3	6.9		
t_{PHZ}	OE or \overline{OE}	Y	1.5	4.1	5.2	1.5	6.2	ns	
t_{PLZ}			1.7	3.6	5.1	1.7	5.6		

SN54ABT16241A, SN74ABT16241A
16-BIT BUFFERS/DRIVERS
WITH 3-STATE OUTPUTS

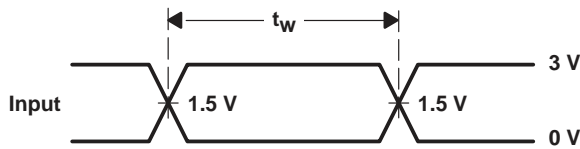
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PARAMETER MEASUREMENT INFORMATION

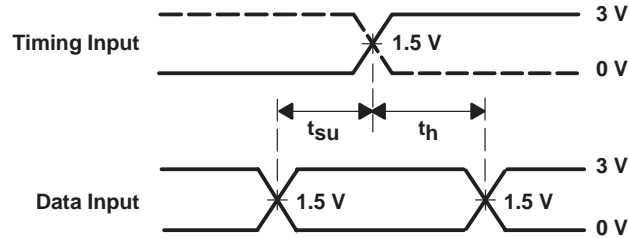


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open

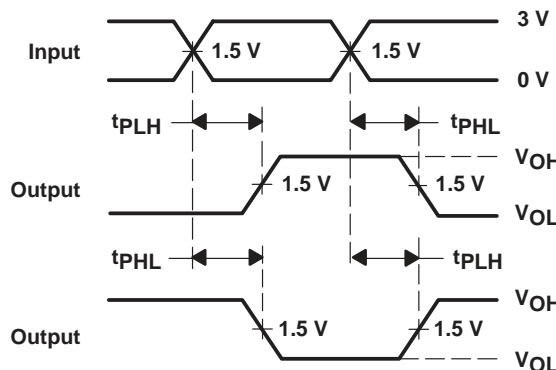
LOAD CIRCUIT



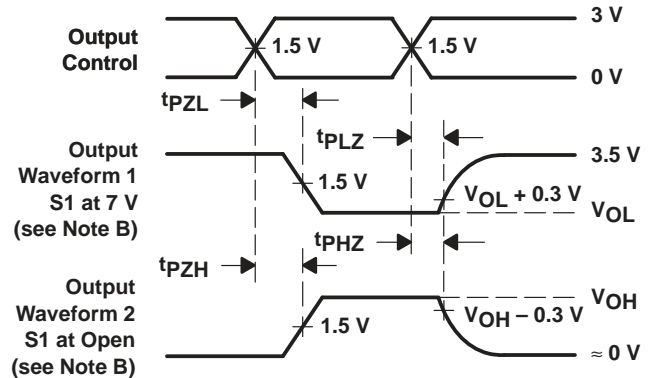
VOLTAGE WAVEFORMS
PULSE DURATION



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: 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: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$, $t_r \leq 2.5$ ns, $t_f \leq 2.5$ ns.
 D. 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
SN74ABT16241ADGGR	ACTIVE	TSSOP	DGG	48	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16241A	Samples
SN74ABT16241ADGVR	ACTIVE	TVSOP	DGV	48	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AH241A	Samples
SN74ABT16241ADL	ACTIVE	SSOP	DL	48	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16241A	Samples
SN74ABT16241ADLR	ACTIVE	SSOP	DL	48	1000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16241A	Samples
SN74ABT16241ADLRG4	ACTIVE	SSOP	DL	48	1000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16241A	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
SN74ABT16241ADGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74ABT16241ADGVR	TVSOP	DGV	48	2000	330.0	16.4	7.1	10.2	1.6	12.0	16.0	Q1
SN74ABT16241ADLR	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)
SN74ABT16241ADGGR	TSSOP	DGG	48	2000	367.0	367.0	45.0
SN74ABT16241ADGVR	TVSOP	DGV	48	2000	356.0	356.0	35.0
SN74ABT16241ADLR	SSOP	DL	48	1000	367.0	367.0	55.0

TUBE

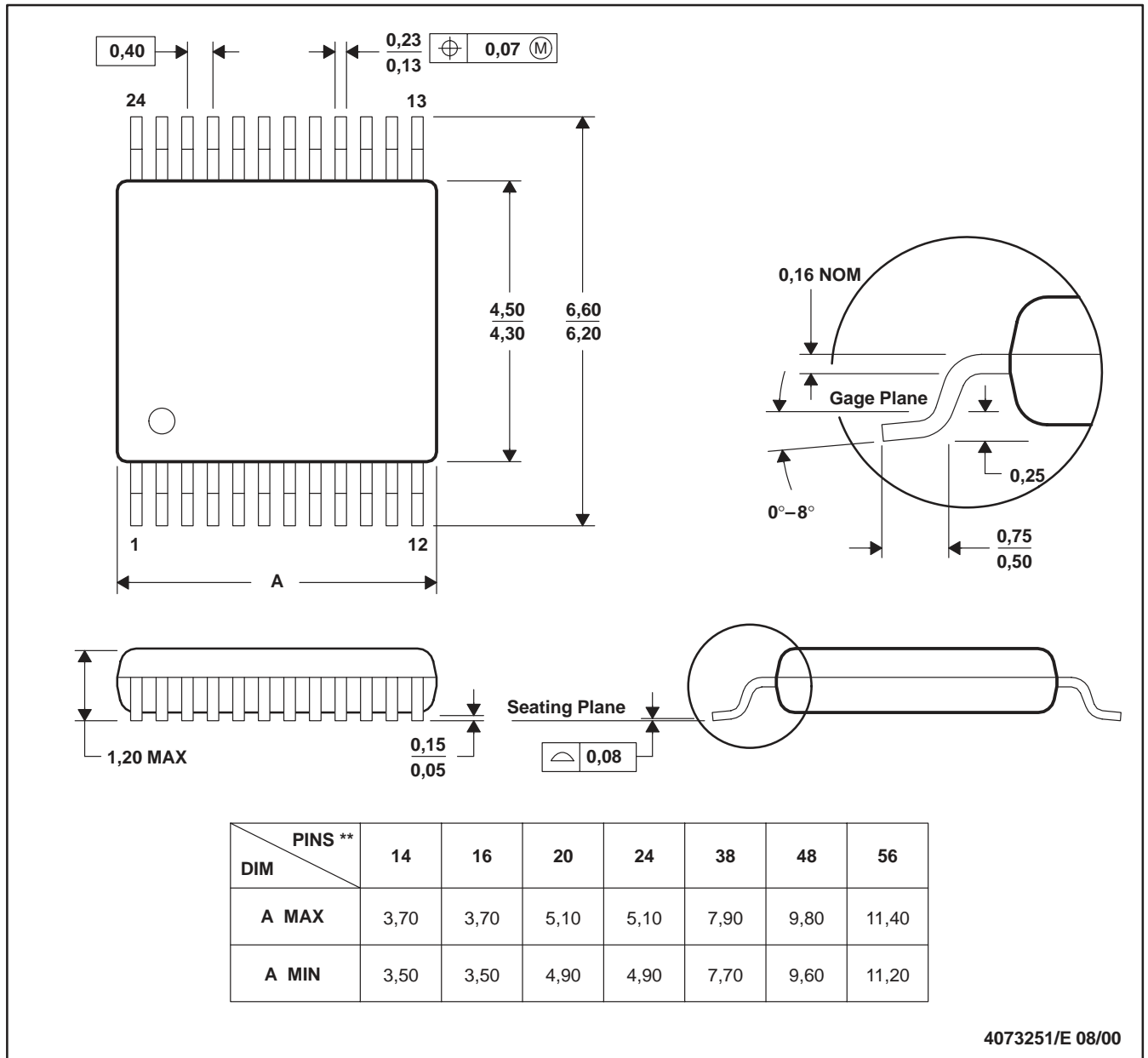

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74ABT16241ADL	DL	SSOP	48	25	473.7	14.24	5110	7.87

DGV (R-PDSO-G**)

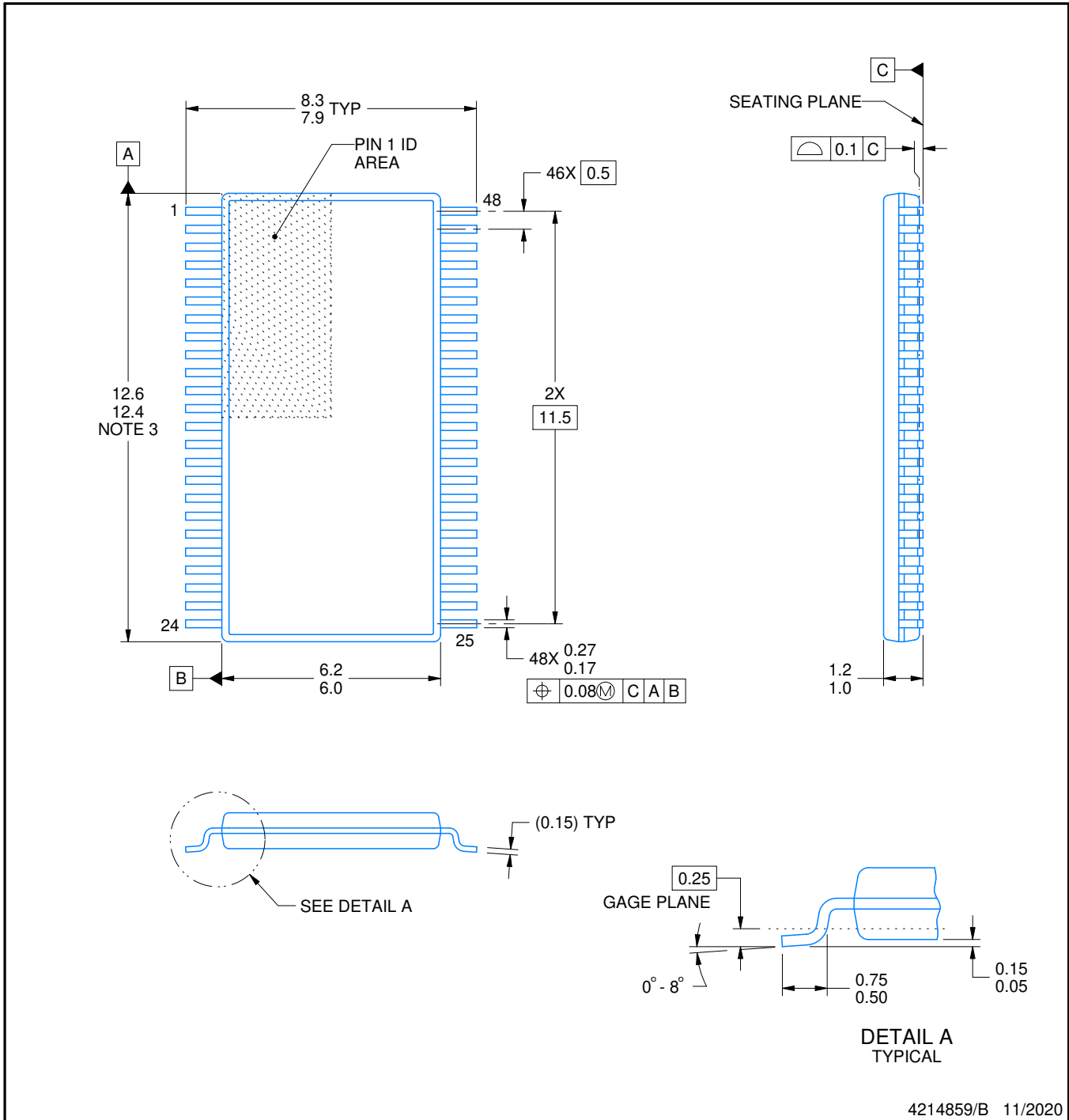
PLASTIC SMALL-OUTLINE

24 PINS SHOWN



4073251/E 08/00

- 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



4214859/B 11/2020

NOTES:

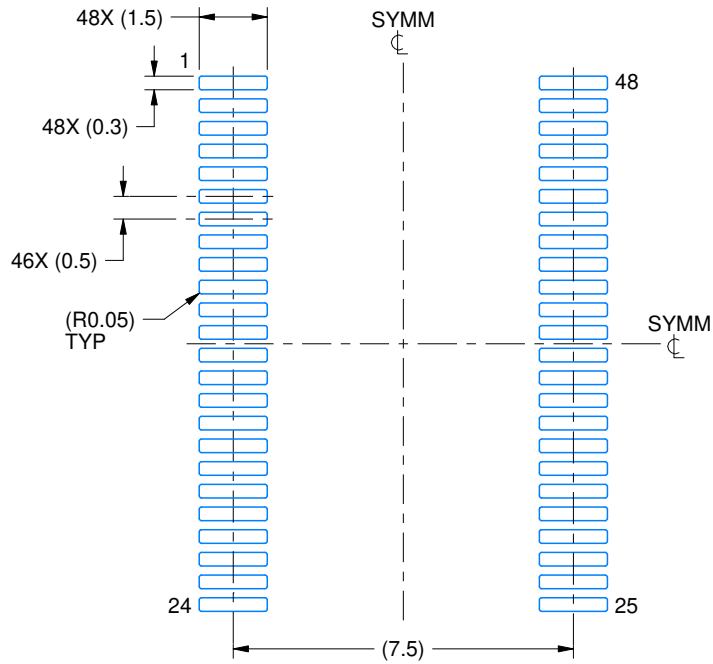
- All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

EXAMPLE BOARD LAYOUT

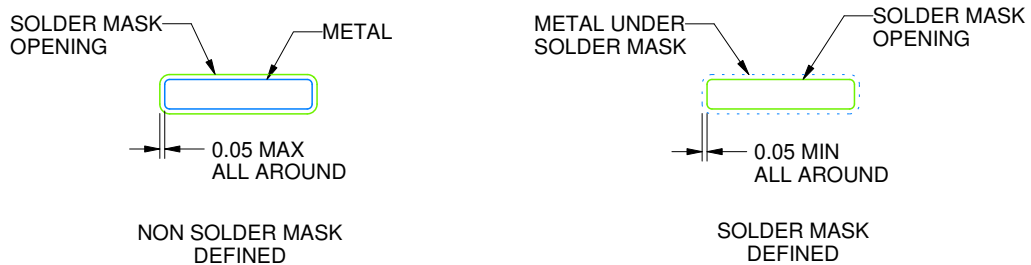
DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

4214859/B 11/2020

NOTES: (continued)

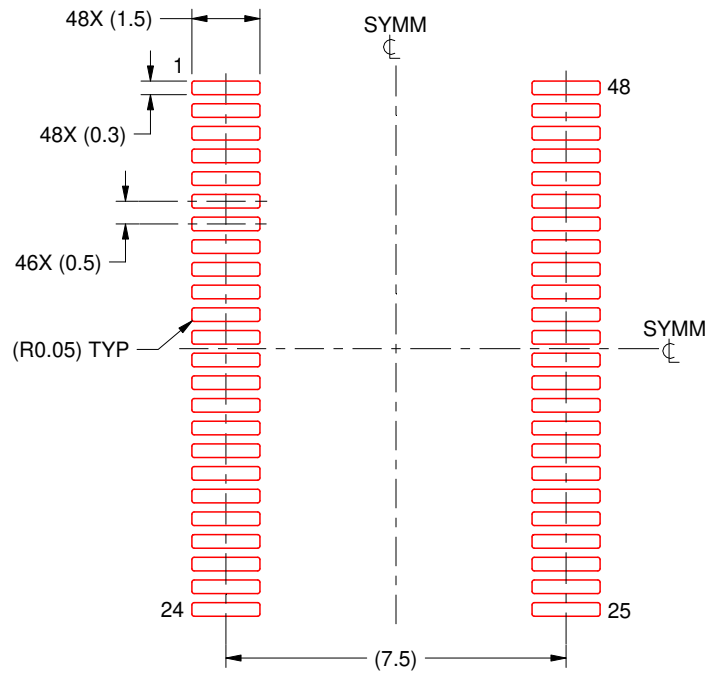
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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

4214859/B 11/2020

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

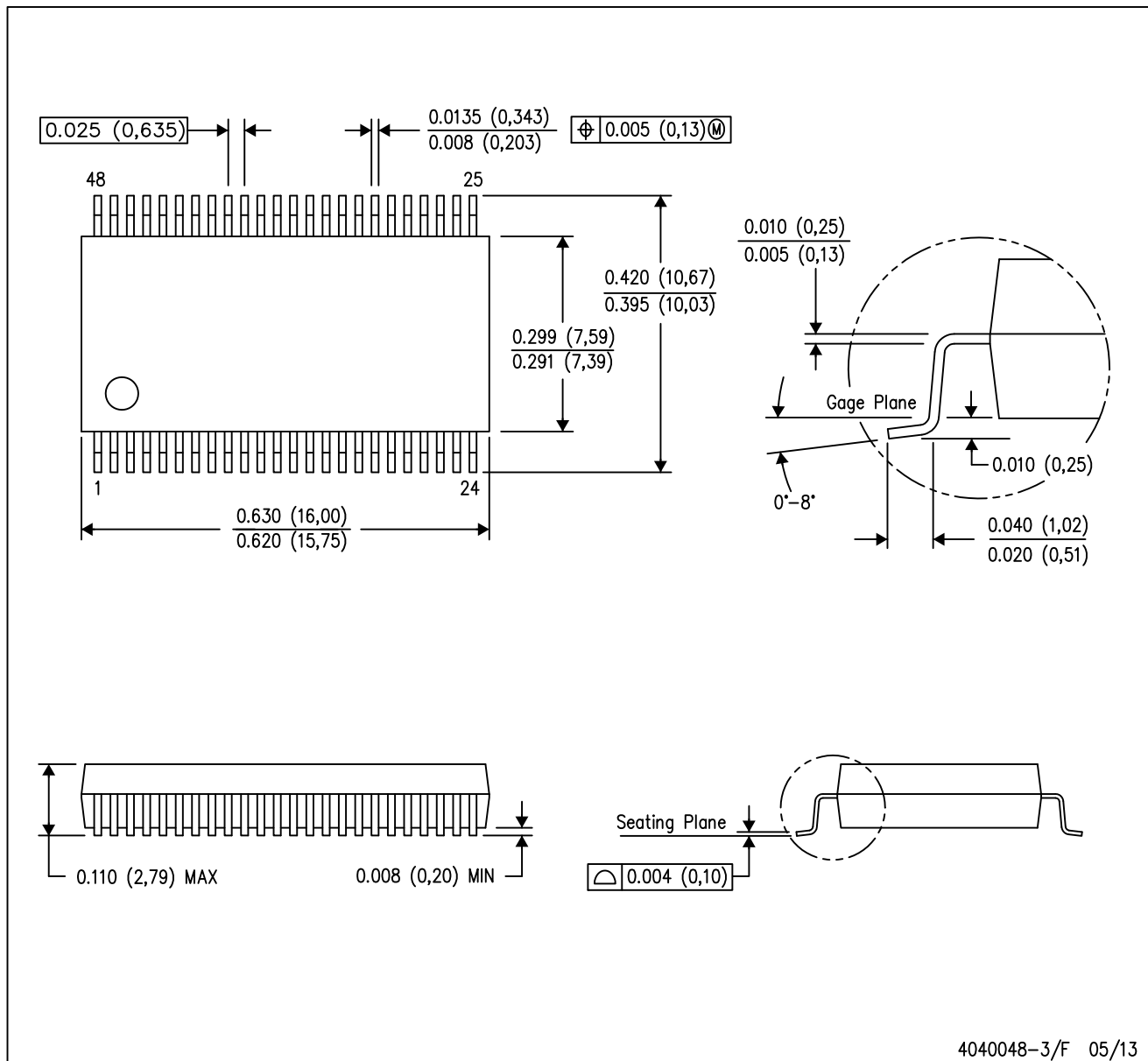


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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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