

SN74CBT16233

16-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER

SCDS010K – MAY 1995 – REVISED NOVEMBER 2001

- Member of the Texas Instruments Widebus™ Family
- 5-Ω Switch Connection Between Two Ports
- TTL-Compatible Input Levels

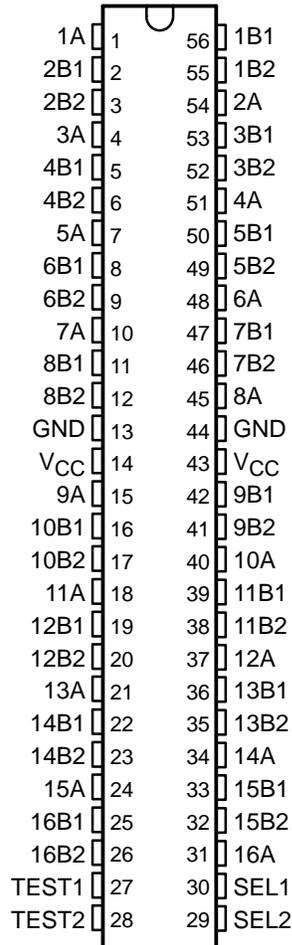
description

The SN74CBT16233 is a 16-bit 1-of-2 FET multiplexer/demultiplexer used in applications in which two separate data paths must be multiplexed onto, or demultiplexed from, a single path. This device can be used for memory interleaving, where two different banks of memory need to be addressed simultaneously. The device can be used as two 8-bit to 16-bit multiplexers or as one 16-bit to 32-bit multiplexer.

Two select (SEL1 and SEL2) inputs control the data flow. When the TEST inputs are asserted, the A port is connected to both the B1 and the B2 ports. SEL1, SEL2, and the TEST inputs can be driven with a 5-V CMOS, a 5-V TTL, or a low-voltage TTL driver.

This device is designed so it does not have through current when switching directions.

DGG, DGV, OR DL PACKAGE (TOP VIEW)



ORDERING INFORMATION

T _A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SSOP – DL	Tube	SN74CBT16233DL	CBT16233
		Tape and reel	SN74CBT16233DLR	
	TSSOP – DGG	Tape and reel	SN74CBT16233DGGR	CBT16233
	TVSOP – DGV	Tape and reel	SN74CBT16233DGVR	CY233

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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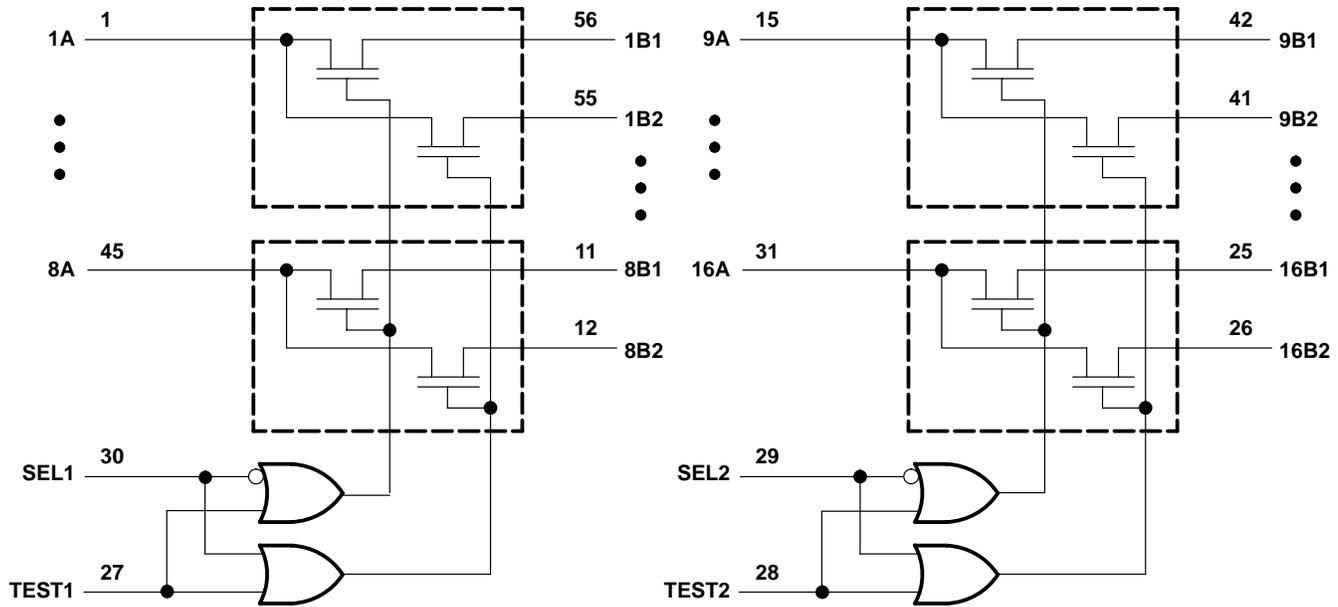
16-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER

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FUNCTION TABLE
(each multiplexer/demultiplexer)

INPUTS		FUNCTION
SEL	TEST	
L	L	A = B1
H	L	A = B2
X	H	A = B1 and A = B2

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
Continuous channel current	128 mA
Input clamp current, I_{IK} ($V_I < 0$)	-50 mA
Package thermal impedance, θ_{JA} (see Note 2):	
DGG package	64°C/W
DGV package	48°C/W
DL package	56°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 51-7.

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recommended operating conditions (see Note 3)

		MIN	MAX	UNIT
V _{CC}	Supply voltage	4.75	5.25	V
V _{IH}	High-level control input voltage	2		V
V _{IL}	Low-level control input voltage		0.8	V
T _A	Operating free-air temperature	-40	85	°C

NOTE 3: 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		MIN	TYP†	MAX	UNIT
V _{IK}		V _{CC} = 4.75 V,	I _I = -18 mA			-1.2	V
I _I		V _{CC} = 0,	V _I = 5.25 V			10	μA
		V _{CC} = 5.25 V,	V _I = 5.25 V or GND			±1	μA
I _{CC}		V _{CC} = 5.25 V,	I _O = 0,			3	μA
			V _I = V _{CC} or GND				
ΔI _{CC} ‡	Control inputs	V _{CC} = 5.25 V,	One input at 3.4 V,			2.5	mA
			Other inputs at V _{CC} or GND				
C _i	Control inputs	V _I = 3 V or 0			4.5		pF
C _{io(OFF)}		V _O = 3 V or 0			4		pF
r _{on} §		V _{CC} = 4.75 V	V _I = 0	I _I = 64 mA	5	7	Ω
				I _I = 30 mA	5	7	
			V _I = 2.4 V,	I _I = 15 mA	7	12	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.

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

§ Measured by the voltage drop between A and B terminals at the indicated current through the switch. On-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	MAX	UNIT
t _{pd} ¶	A or B	B or A		0.25	ns
t _{pd}	SEL	A	1.6	5.3	ns
t _{en}	TEST or SEL	B	1.3	5.2	ns
t _{dis}	TEST or SEL	B	1	5.3	ns

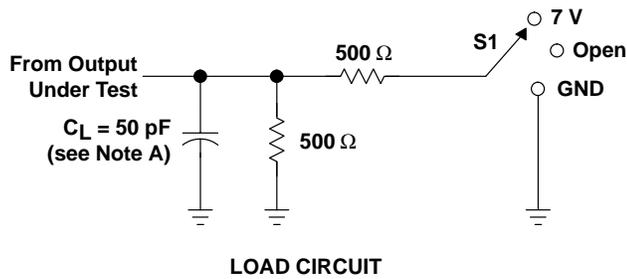
¶ The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).



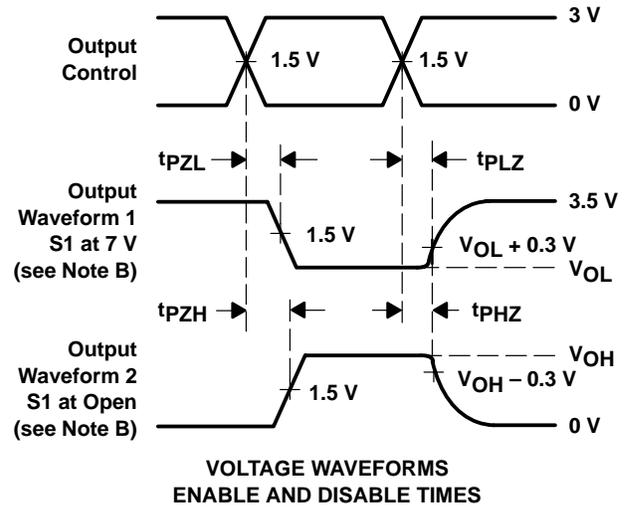
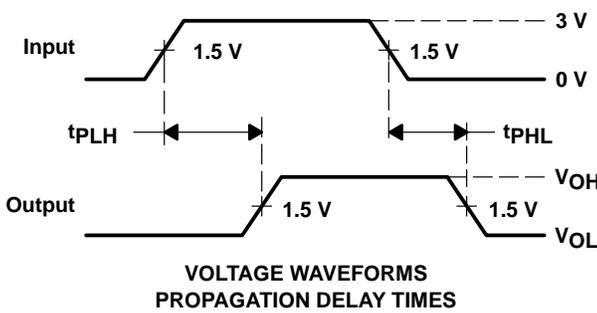
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PARAMETER MEASUREMENT INFORMATION



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



- 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 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
74CBT16233DGGRE4	ACTIVE	TSSOP	DGG	56	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CBT16233	Samples
SN74CBT16233DGGR	ACTIVE	TSSOP	DGG	56	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CBT16233	Samples
SN74CBT16233DGVR	ACTIVE	TVSOP	DGV	56	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CY233	Samples
SN74CBT16233DL	ACTIVE	SSOP	DL	56	20	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CBT16233	Samples
SN74CBT16233DLR	ACTIVE	SSOP	DL	56	1000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CBT16233	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.

OBSELETE: 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.

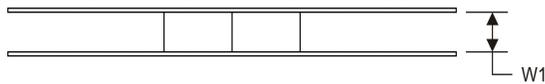
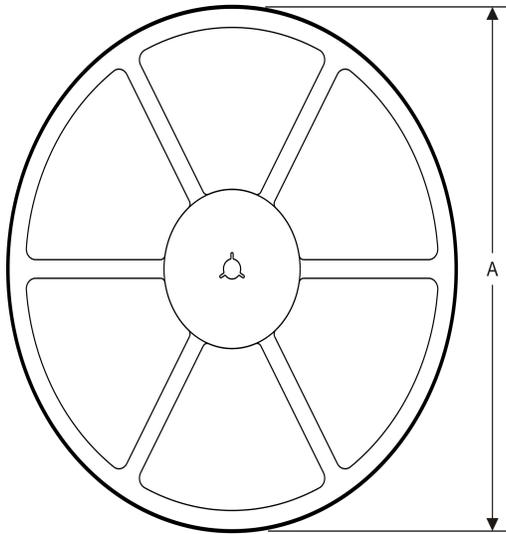
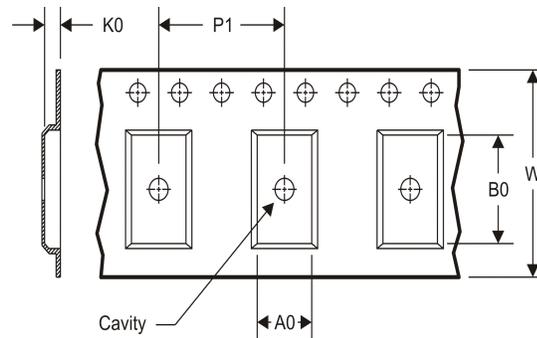
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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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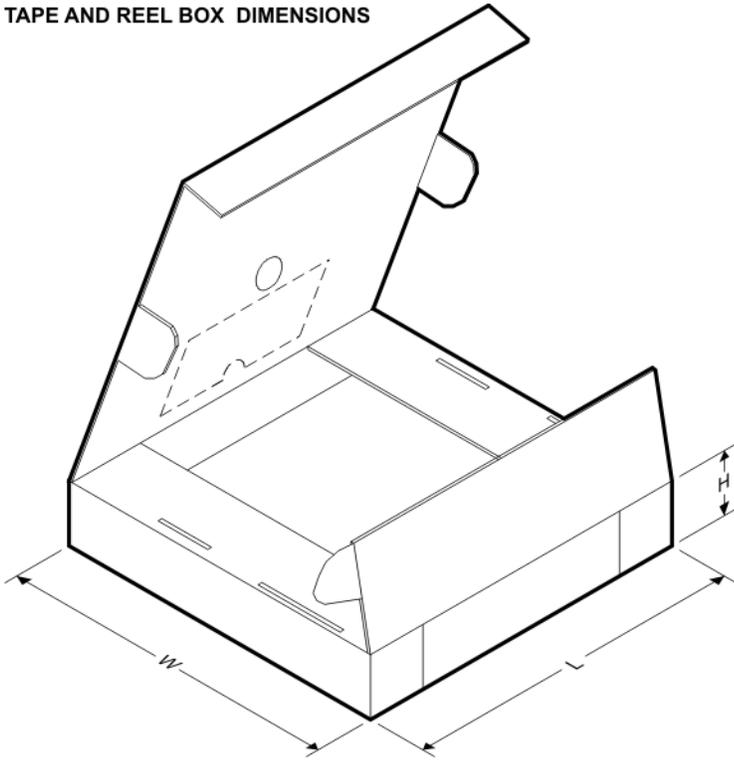
TAPE AND REEL INFORMATION
REEL DIMENSIONS

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

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
SN74CBT16233DGGR	TSSOP	DGG	56	2000	330.0	24.4	8.6	15.6	1.8	12.0	24.0	Q1
SN74CBT16233DGVR	TVSOP	DGV	56	2000	330.0	24.4	6.8	11.7	1.6	12.0	24.0	Q1
SN74CBT16233DLR	SSOP	DL	56	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS


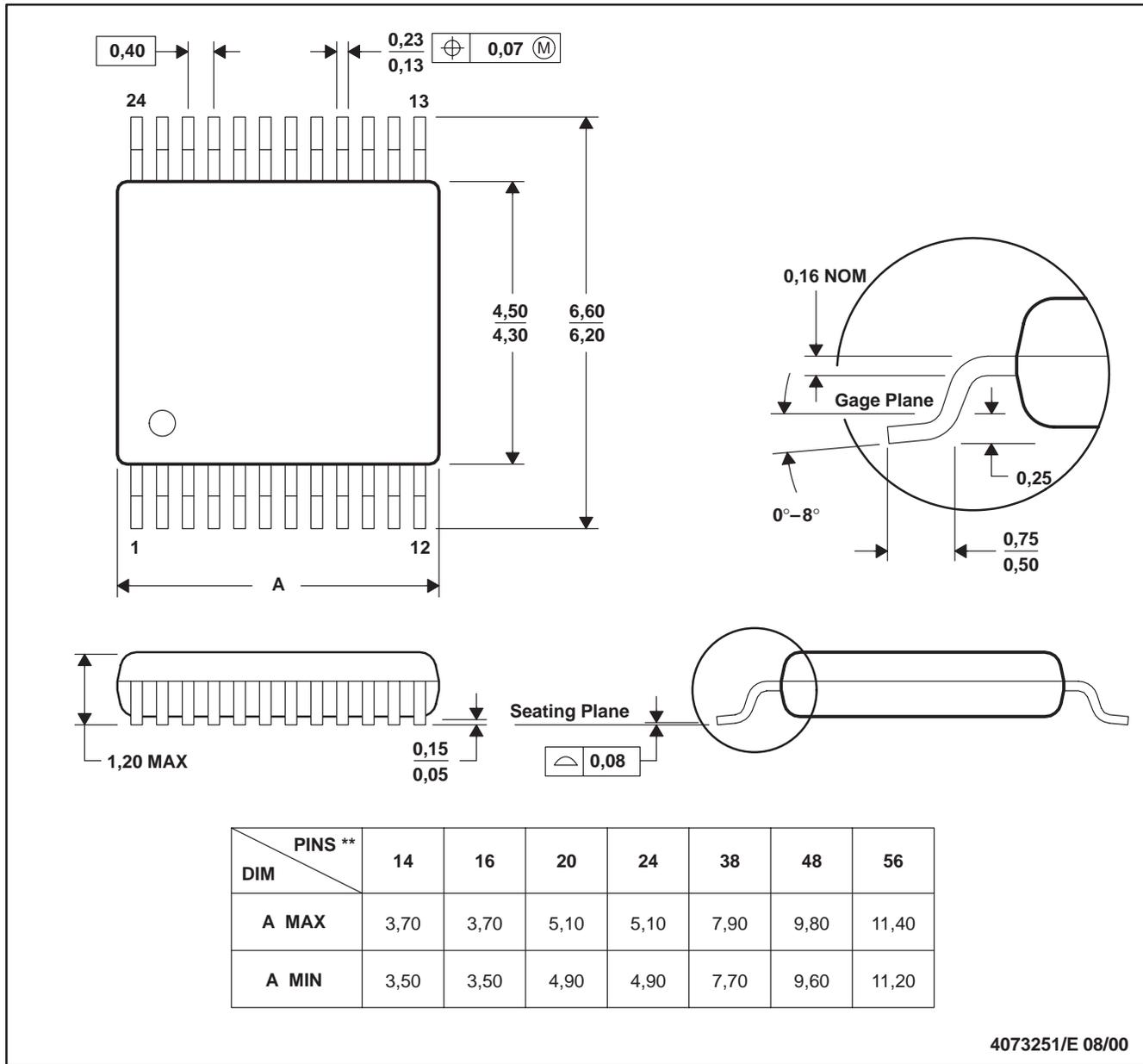
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CBT16233DGGR	TSSOP	DGG	56	2000	367.0	367.0	45.0
SN74CBT16233DGVR	TVSOP	DGV	56	2000	367.0	367.0	45.0
SN74CBT16233DLR	SSOP	DL	56	1000	367.0	367.0	55.0

DGV (R-PDSO-G**)

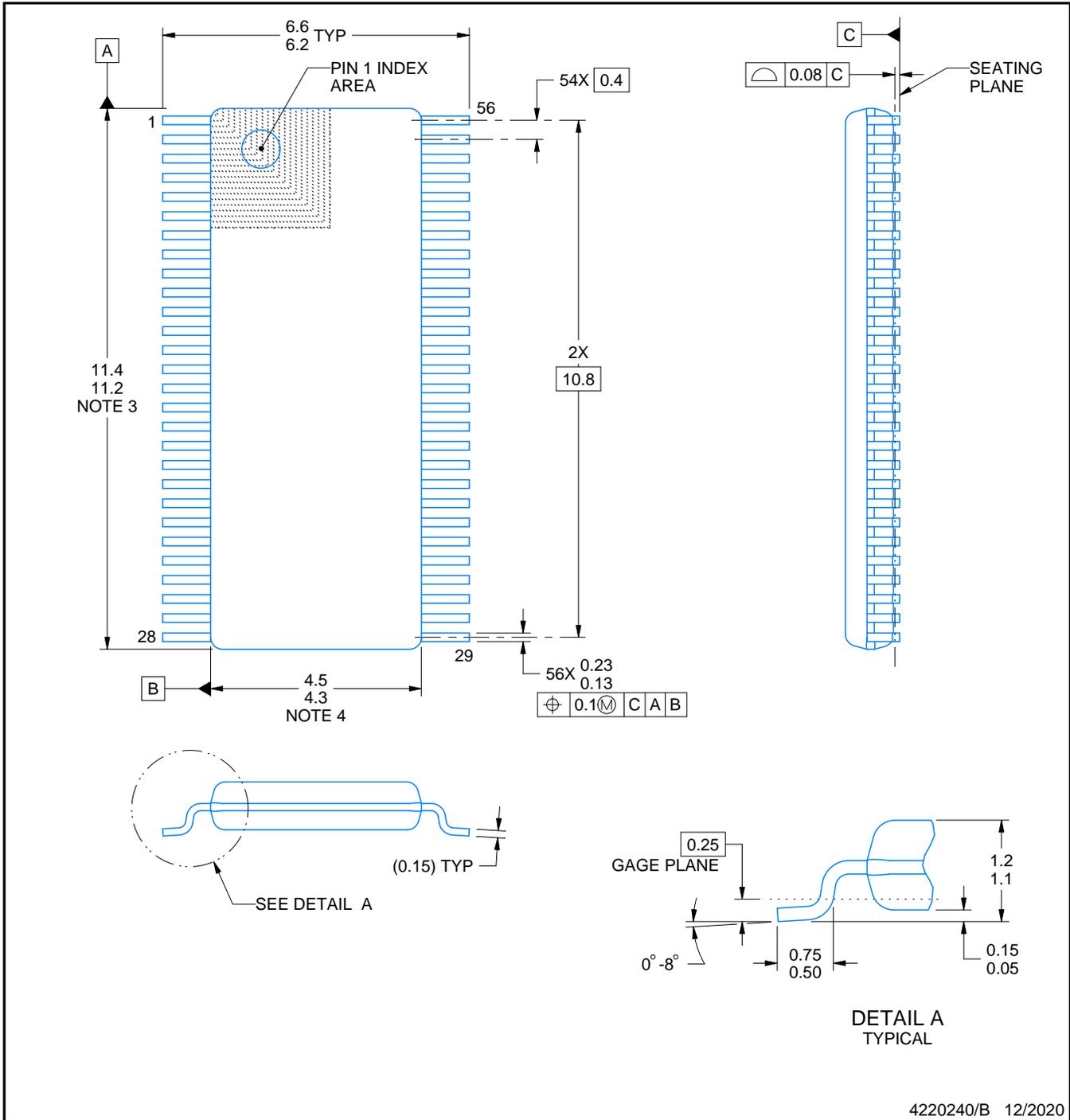
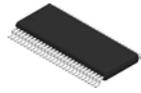
PLASTIC SMALL-OUTLINE

24 PINS SHOWN



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- 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:

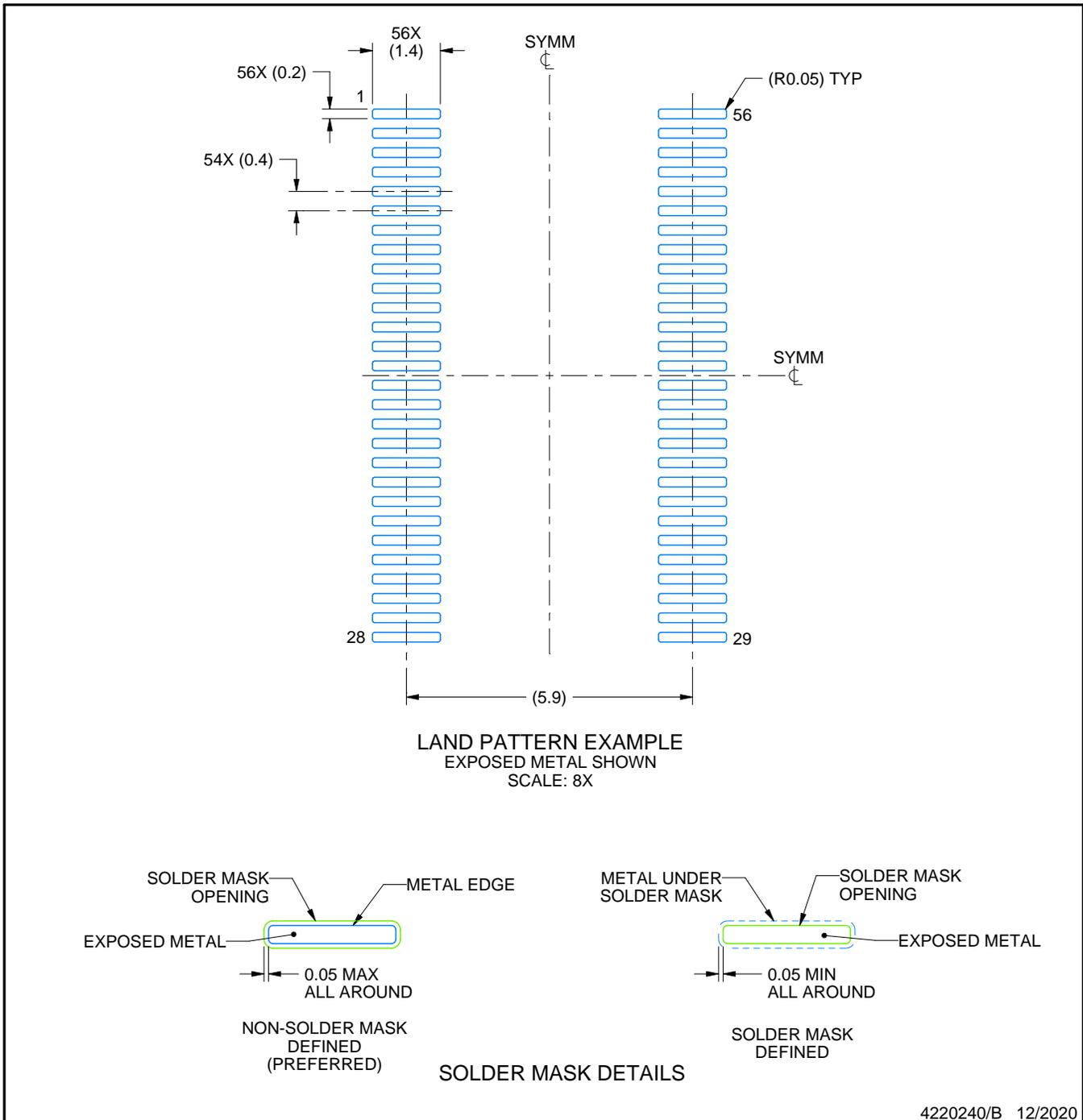
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-194.

EXAMPLE BOARD LAYOUT

DGV0056A

TVSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

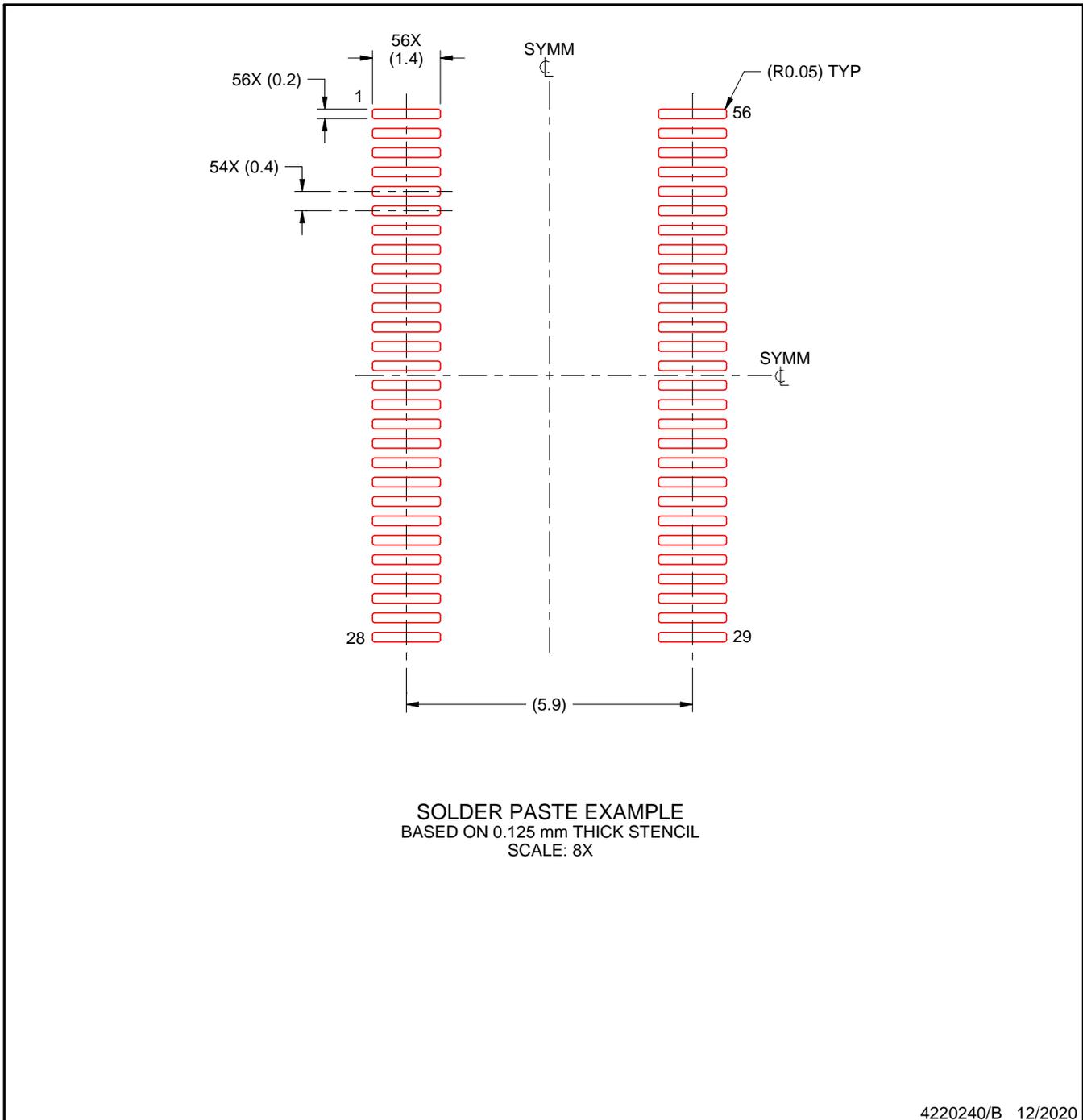
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DGV0056A

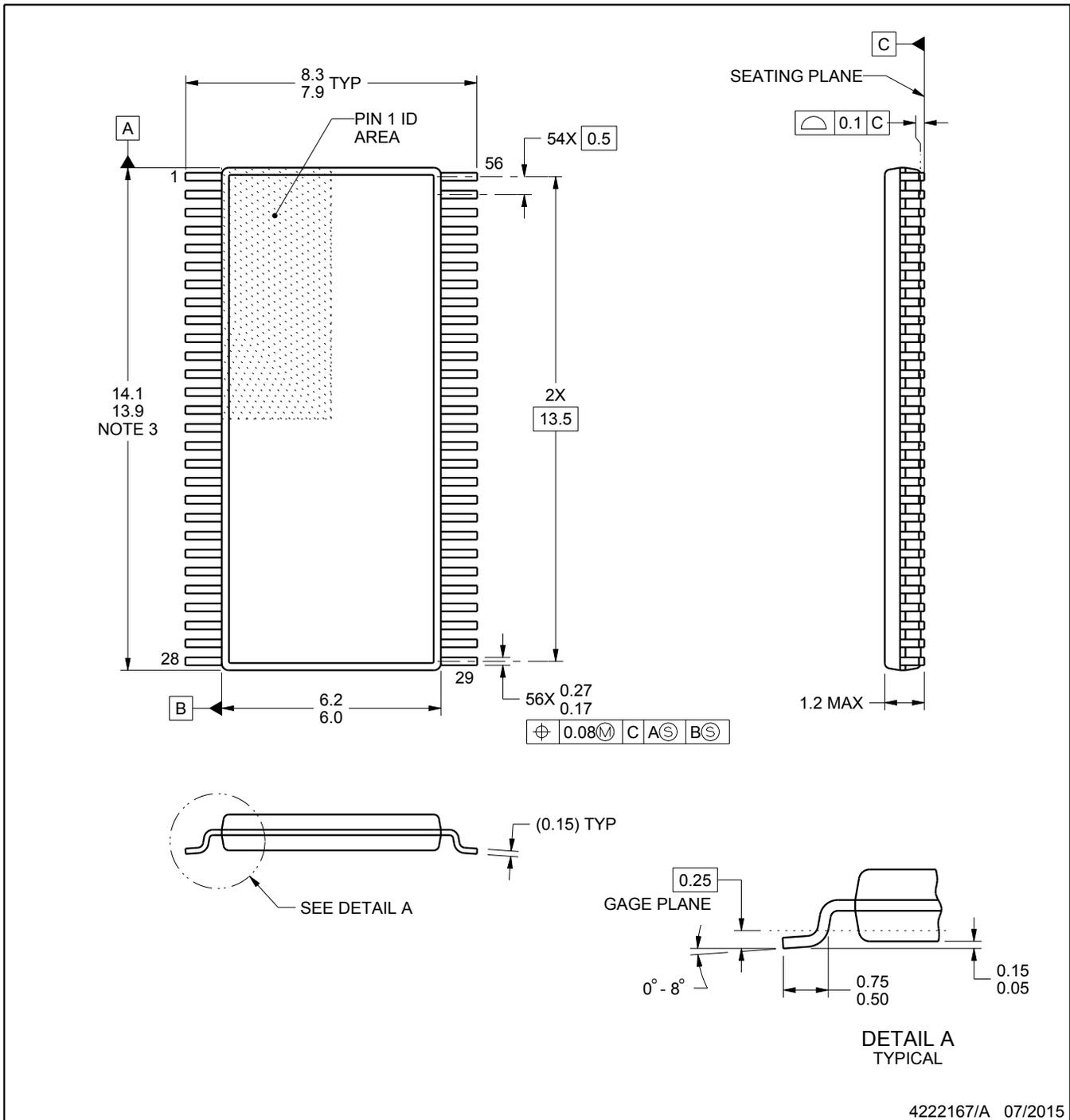
TVSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

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



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NOTES:

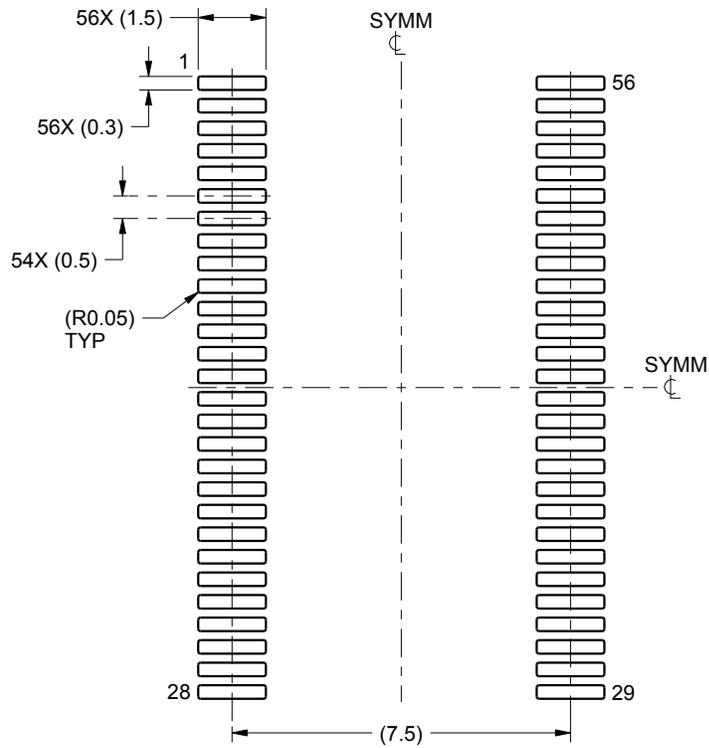
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

EXAMPLE BOARD LAYOUT

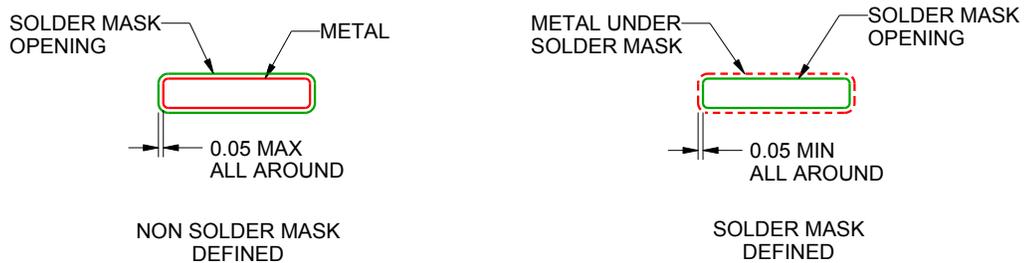
DGG0056A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

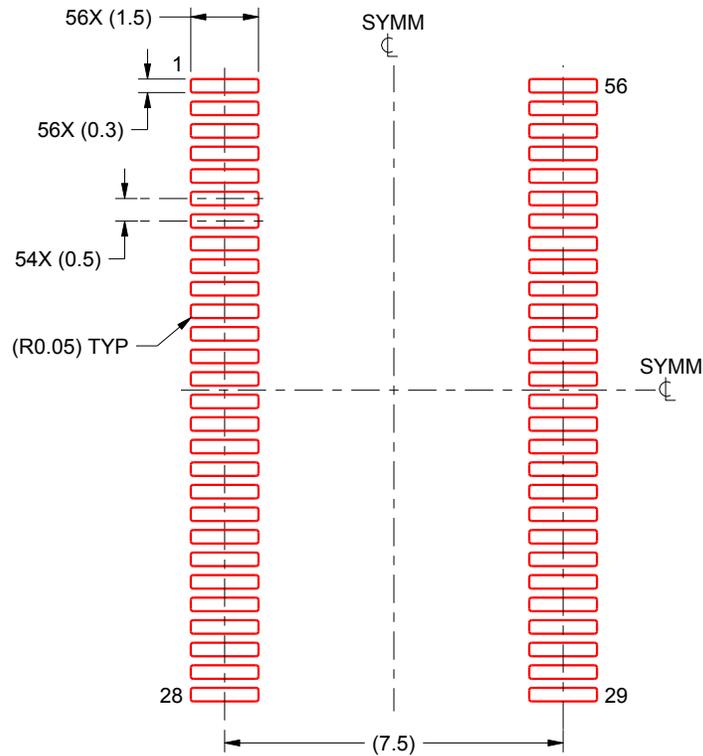
- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DGG0056A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4222167/A 07/2015

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.

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