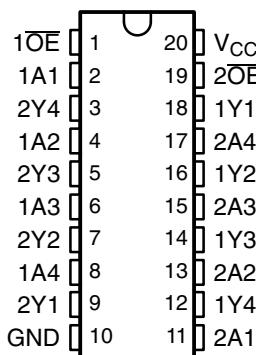
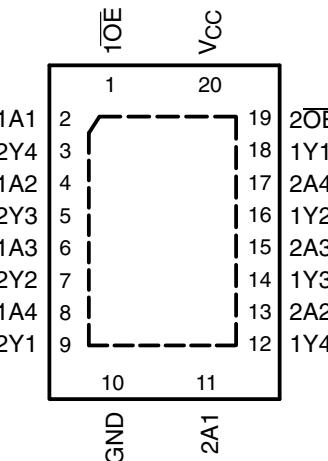


- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Support Unregulated Battery Operation Down to 2.7 V
- Typical  $V_{OLP}$  (Output Ground Bounce) <0.8 V at  $V_{CC}$  = 3.3 V,  $T_A$  = 25°C
- $I_{off}$  and Power-Up 3-State Support Hot Insertion
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Latch-Up Performance Exceeds 500 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)

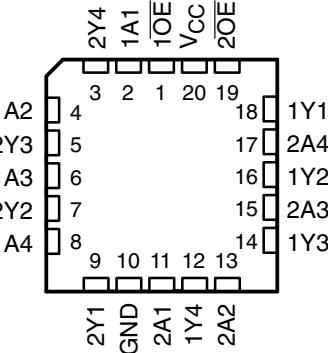
SN54LVTH240 . . . J OR W PACKAGE  
SN74LVTH240 . . . DB, DW, NS,  
OR PW PACKAGE  
(TOP VIEW)



SN74LVTH240 . . . RGY PACKAGE  
(TOP VIEW)



SN54LVTH240 . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

These octal buffers and line drivers are designed specifically for low-voltage (3.3-V)  $V_{CC}$  operation, but with the capability to provide a TTL interface to a 5-V system environment.

## ORDERING INFORMATION

$T_A$	PACKAGE <sup>†</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
$-40^{\circ}\text{C}$ to $85^{\circ}\text{C}$	QFN – RGY	SN74LVTH240RGYR	LXH240
	SOIC – DW	Tube	LVTH240
		SN74LVTH240DW	
	SOP – NS	SN74LVTH240NSR	LVTH240
	SSOP – DB	SN74LVTH240DBR	LXH240
	TSSOP – PW	Tube	LXH240
		SN74LVTH240PW	
$-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$	Tape and reel	SN74LVTH240PWR	LXH240
		SN74LVTH240GQNR	
	VFBGA – ZQN (Pb-free)	SN74LVTH240ZQNR	
$-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$	CDIP – J	SNJ54LVTH240J	SNJ54LVTH240J
	CFP – W	SNJ54LVTH240W	SNJ54LVTH240W
	LCCC – FK	SNJ54LVTH240FK	SNJ54LVTH240FK

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

 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.

**SN54LVTH240, SN74LVTH240  
3.3-V ABT OCTAL BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS**

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**description/ordering information (continued)**

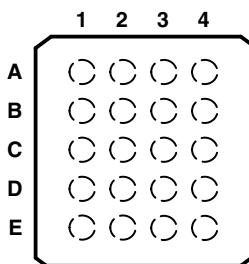
These devices are organized as two 4-bit buffer/line drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the devices pass data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

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 holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

These devices are fully specified for hot-insertion applications using  $I_{off}$  and power-up 3-state. The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

**SN74LVTH240 . . . GQN OR ZQN PACKAGE  
(TOP VIEW)**



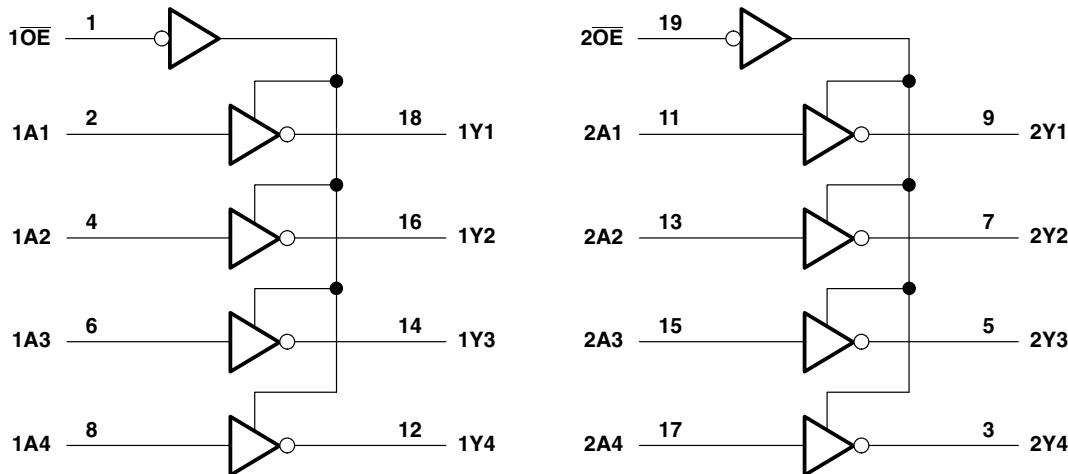
**terminal assignments**

	1	2	3	4
A	1A1	$1\overline{OE}$	$V_{CC}$	$2\overline{OE}$
B	1A2	2A4	2Y4	1Y1
C	1A3	2Y3	2A3	1Y2
D	1A4	2A2	2Y2	1Y3
E	GND	2Y1	2A1	1Y4

**FUNCTION TABLE  
(each 4-bit buffer)**

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

## logic diagram (positive logic)



Pin numbers shown are for the DB, DW, FK, J, NS, PW, RGY, and W packages.

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

<sup>†</sup> 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. This current flows only when the output is in the high state and  $V_O > V_{CC}$ .  
 3. The package thermal impedance is calculated in accordance with JESD 51-7.  
 4. The package thermal impedance is calculated in accordance with JESD 51-5.

**SN54LVTH240, SN74LVTH240  
3.3-V ABT OCTAL BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS**

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**recommended operating conditions (see Note 5)**

		SN54LVTH240		SN74LVTH240		UNIT
		MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	2.7	3.6	2.7	3.6	V
V <sub>IH</sub>	High-level input voltage	2		2		V
V <sub>IL</sub>	Low-level input voltage			0.8	0.8	V
V <sub>I</sub>	Input voltage			5.5	5.5	V
I <sub>OH</sub>	High-level output current			-24	-32	mA
I <sub>OL</sub>	Low-level output current			48	64	mA
Δt/Δv	Input transition rise or fall rate	Outputs enabled		10	10	ns/V
Δt/ΔV <sub>CC</sub>	Power-up ramp rate			200	200	μs/V
T <sub>A</sub>	Operating free-air temperature	-55	125	-40	85	°C

NOTE 5: All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



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**SN54LVTH240, SN74LVTH240**  
**3.3-V ABT OCTAL BUFFERS/DRIVERS**  
**WITH 3-STATE OUTPUTS**

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

PARAMETER	TEST CONDITIONS	SN54LVTH240			SN74LVTH240			UNIT
		MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_{IK}$	$V_{CC} = 2.7 \text{ V}$ , $I_I = -18 \text{ mA}$			-1.2			-1.2	V
$V_{OH}$	$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$ , $I_{OH} = -100 \mu\text{A}$	$V_{CC} - 0.2$			$V_{CC} - 0.2$			V
	$V_{CC} = 2.7 \text{ V}$ , $I_{OH} = -8 \text{ mA}$	2.4			2.4			
	$V_{CC} = 3 \text{ V}$	$I_{OH} = -24 \text{ mA}$	2				2	
		$I_{OH} = -32 \text{ mA}$						
$V_{OL}$	$V_{CC} = 2.7 \text{ V}$	$I_{OL} = 100 \mu\text{A}$		0.2			0.2	V
		$I_{OL} = 24 \text{ mA}$		0.5			0.5	
	$V_{CC} = 3 \text{ V}$	$I_{OL} = 16 \text{ mA}$		0.4			0.4	
		$I_{OL} = 32 \text{ mA}$		0.5			0.5	
		$I_{OL} = 48 \text{ mA}$		0.55				
		$I_{OL} = 64 \text{ mA}$					0.55	
$I_I$	Control inputs	$V_{CC} = 0 \text{ or } 3.6 \text{ V}$ , $V_I = 5.5 \text{ V}$		10			10	$\mu\text{A}$
		$V_{CC} = 3.6 \text{ V}$ , $V_I = V_{CC} \text{ or GND}$		$\pm 1$			$\pm 1$	
	Data inputs	$V_{CC} = 3.6 \text{ V}$	$V_I = V_{CC}$	1			1	
			$V_I = 0$		-5		-5	
$I_{off}$	$V_{CC} = 0$ , $V_I$ or $V_O = 0$ to $4.5 \text{ V}$						$\pm 100$	$\mu\text{A}$
$I_{I(hold)}$	Data inputs	$V_{CC} = 3 \text{ V}$	$V_I = 0.8 \text{ V}$	75			75	$\mu\text{A}$
			$V_I = 2 \text{ V}$	-75			-75	
		$V_{CC} = 3.6 \text{ V}^\ddagger$	$V_I = 0$ to $3.6 \text{ V}$				500 -750	
$I_{OZH}$	$V_{CC} = 3.6 \text{ V}$ , $V_O = 3 \text{ V}$			5			5	$\mu\text{A}$
$I_{OZL}$	$V_{CC} = 3.6 \text{ V}$ , $V_O = 0.5 \text{ V}$			-5			-5	$\mu\text{A}$
$I_{OZPU}$	$V_{CC} = 0$ to $1.5 \text{ V}$ , $V_O = 0.5 \text{ V}$ to $3 \text{ V}$ , $\overline{OE}$ = don't care			$\pm 100^*$			$\pm 100$	$\mu\text{A}$
$I_{OZPD}$	$V_{CC} = 1.5 \text{ V}$ to $0$ , $V_O = 0.5 \text{ V}$ to $3 \text{ V}$ , $\overline{OE}$ = don't care			$\pm 100^*$			$\pm 100$	$\mu\text{A}$
$I_{CC}$	$V_{CC} = 3.6 \text{ V}$ , $I_O = 0$ , $V_I = V_{CC} \text{ or GND}$	Outputs high		0.19			0.19	$\text{mA}$
		Outputs low		5			5	
		Outputs disabled		0.19			0.19	
$\Delta I_{CC}^\$$	$V_{CC} = 3 \text{ V}$ to $3.6 \text{ V}$ , One input at $V_{CC} - 0.6 \text{ V}$ , Other inputs at $V_{CC}$ or GND			0.2			0.2	$\text{mA}$
$C_i$	$V_I = 3 \text{ V}$ or $0$			3			3	$\text{pF}$
$C_o$	$V_O = 3 \text{ V}$ or $0$			7			7	$\text{pF}$

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

† All typical values are at  $V_{CC} = 3.3 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

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

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

**SN54LVTH240, SN74LVTH240  
3.3-V ABT OCTAL BUFFERS/DRIVERS  
WITH 3-STATE OUTPUTS**

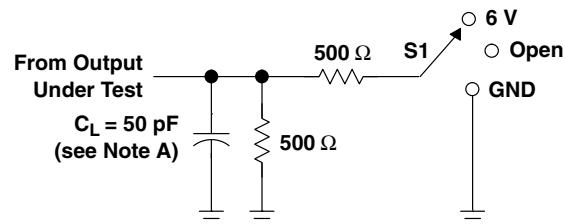
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**switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50 \text{ pF}$  (unless otherwise noted) (see Figure 1)**

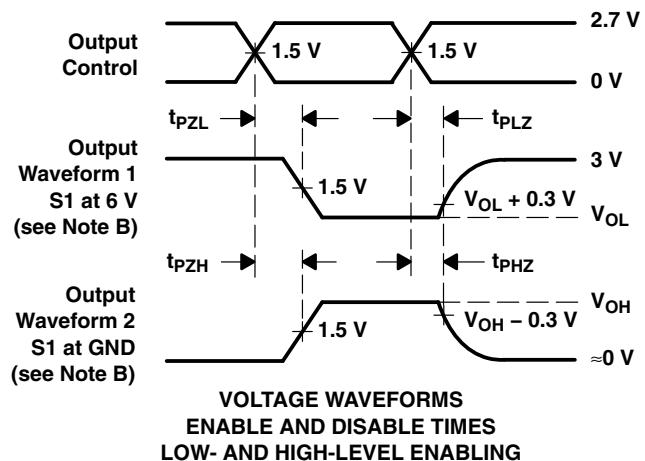
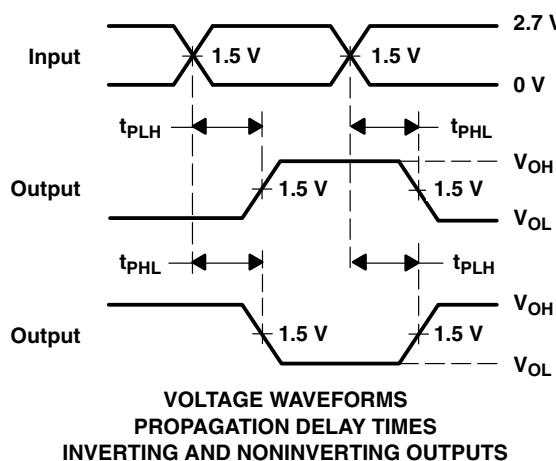
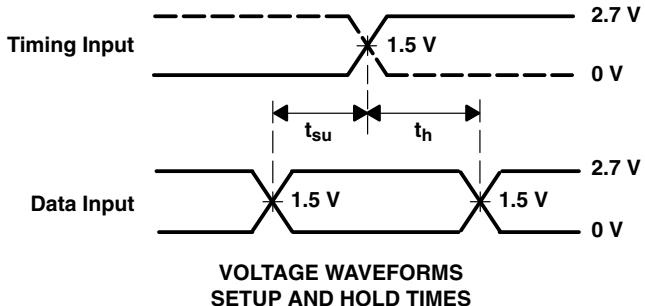
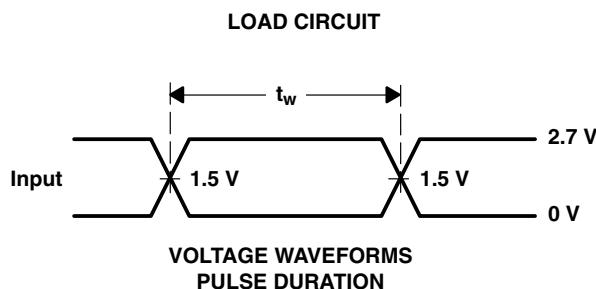
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH240		SN74LVTH240				UNIT	
			$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		$V_{CC} = 2.7 \text{ V}$		$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$			
			MIN	MAX	MIN	MAX	MIN	TYP <sup>†</sup>	MAX	
$t_{PLH}$	A	Y	0.9	4.3	5.1	1.1	2.2	3.8	4.6	ns
$t_{PHL}$			1.2	4.7	4.9	1.3	2.6	4	4.2	
$t_{PZH}$	$\overline{OE}$	Y	1	5.7	6.7	1.1	2.6	4.6	5.6	ns
$t_{PZL}$			1.2	5.5	6.2	1.4	2.7	4.4	5	
$t_{PHZ}$	$\overline{OE}$	Y	1	5.1	5.2	2	2.9	4.4	4.6	ns
$t_{PLZ}$			1.1	5.4	5.4	1.8	3	4.3	4.3	

<sup>†</sup> All typical values are at  $V_{CC} = 3.3 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

PARAMETER MEASUREMENT INFORMATION



TEST	S1
$t_{PLH}/t_{PHL}$	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 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.  
E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9950801Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9950801Q2A SNJ54LVTH 240FK	Samples
5962-9950801QRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9950801QR A SNJ54LVTH240J	Samples
5962-9950801QSA	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9950801QS A SNJ54LVTH240W	Samples
5962-9950801V2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type		5962- 9950801V2A SNV54LVTH 240FK	Samples
5962-9950801VRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type		5962-9950801VR A SNV54LVTH240J	Samples
SN74LVTH240DBLE	OBsolete	SSOP	DB	20		TBD	Call TI	Call TI	-40 to 85		
SN74LVTH240DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH240	Samples
SN74LVTH240DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH240	Samples
SN74LVTH240DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH240	Samples
SN74LVTH240DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH240	Samples
SN74LVTH240DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH240	Samples
SN74LVTH240GQNR	OBsolete	BGA MICROSTAR JUNIOR	GQN	20		TBD	Call TI	Call TI	-40 to 85	LXH240	
SN74LVTH240NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH240	Samples
SN74LVTH240PW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH240	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVTH240PWLE	DEPRECATED	TSSOP	PW	20		TBD	Call TI	Call TI	-40 to 85		
SN74LVTH240PWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH240	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SN74LVTH240PWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	LXH240	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SNJ54LVTH240FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962-9950801Q2A SNJ54LVTH240FK	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SNJ54LVTH240J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9950801QR A SNJ54LVTH240J	<span style="background-color: red; color: white; padding: 2px;">Samples</span>
SNJ54LVTH240W	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9950801QS A SNJ54LVTH240W	<span style="background-color: red; color: white; padding: 2px;">Samples</span>

(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.

**DEPRECATED:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

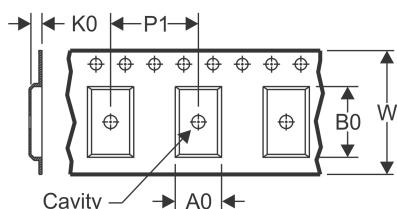
**OTHER QUALIFIED VERSIONS OF SN54LVTH240, SN54LVTH240-SP, SN74LVTH240 :**

- Catalog: [SN74LVTH240](#), [SN54LVTH240](#)
- Enhanced Product: [SN74LVTH240-EP](#), [SN74LVTH240-EP](#)
- Military: [SN54LVTH240](#)
- Space: [SN54LVTH240-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**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
SN74LVTH240DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LVTH240DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74LVTH240NSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1
SN74LVTH240PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVTH240DBR	SSOP	DB	20	2000	367.0	367.0	38.0
SN74LVTH240DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LVTH240NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74LVTH240PWR	TSSOP	PW	20	2000	367.0	367.0	38.0

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

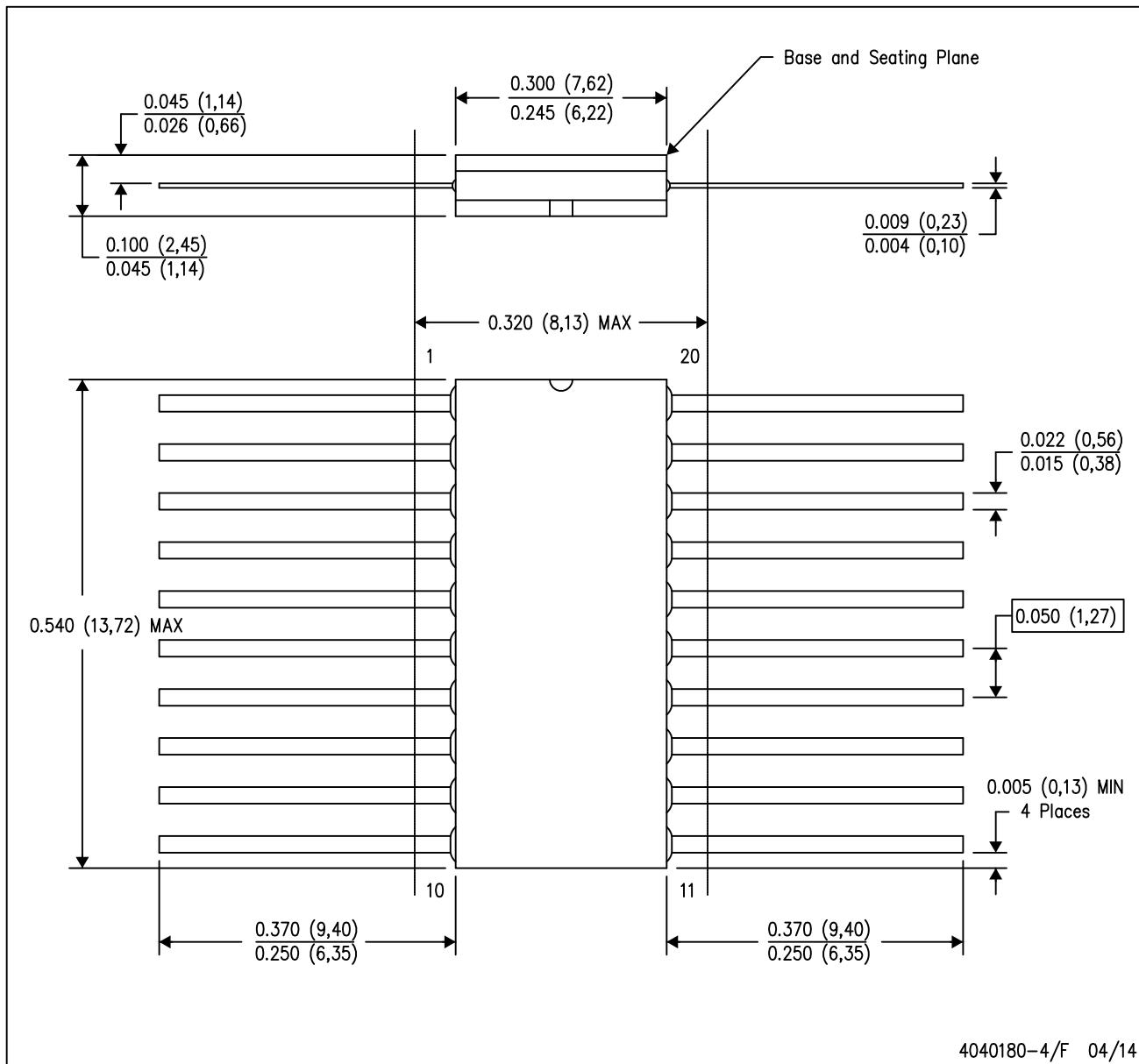


4040083/F 03/03

NOTES: A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.  
C. This package is hermetically sealed with a ceramic lid using glass frit.  
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.  
E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



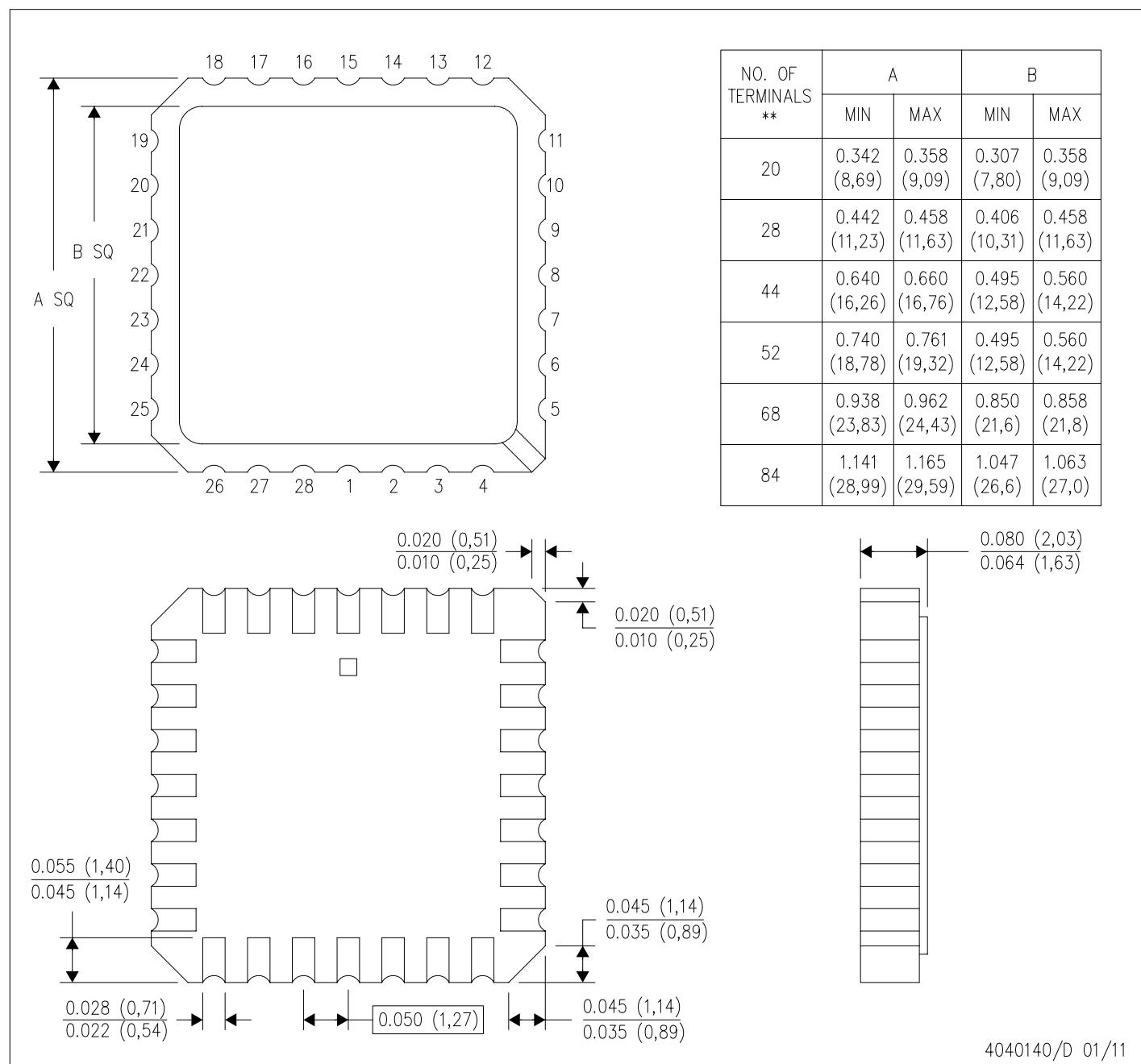
NOTES:

- 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 GDFP2-F20

FK (S-CQCC-N\*\*)

28 TERMINAL SHOWN

LEADLESS CERAMIC CHIP CARRIER



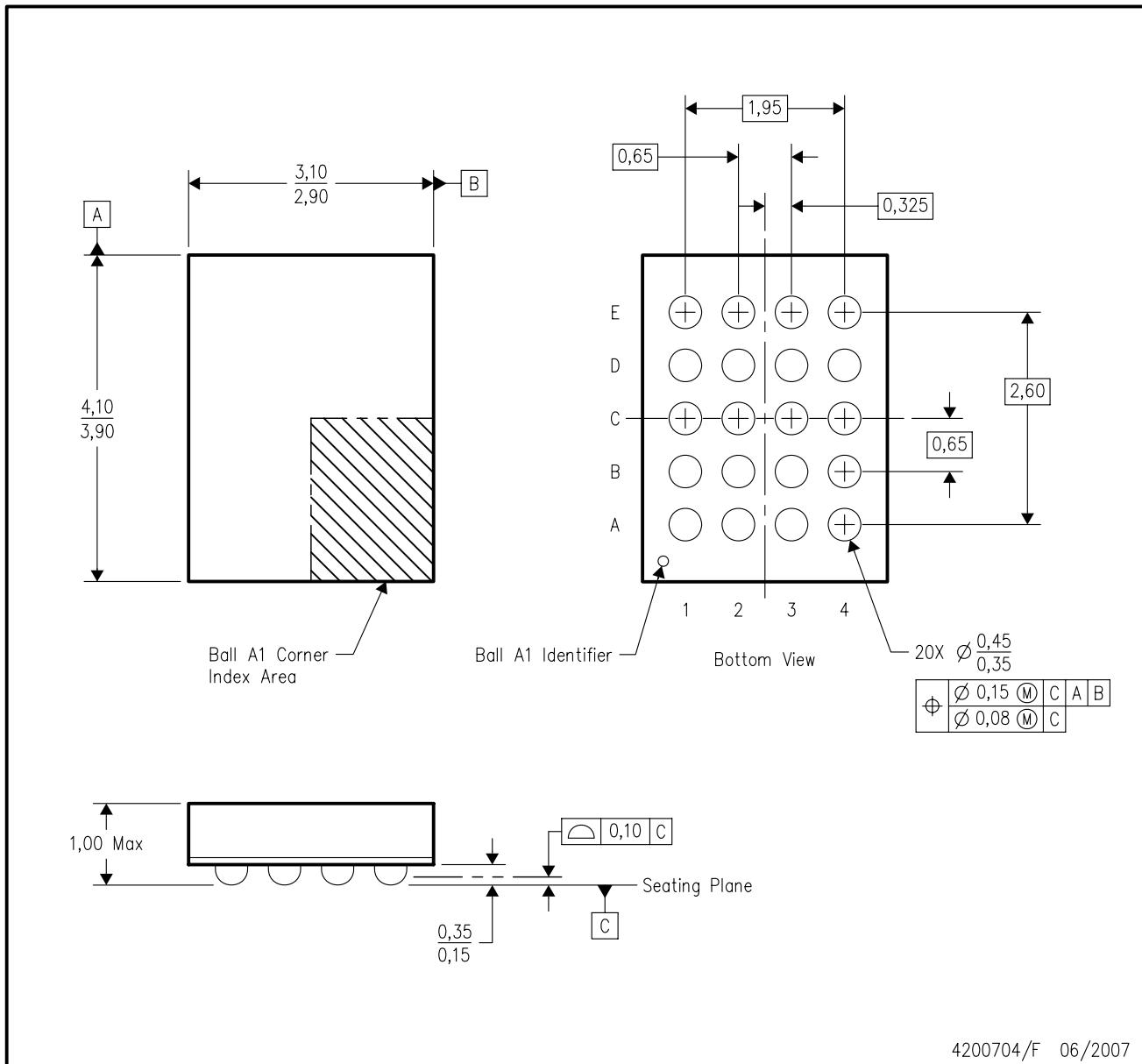
NOTES:

- 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 metal lid.
- D. Falls within JEDEC MS-004

4040140/D 01/11

## GQN (R-PBGA-N20)

## PLASTIC BALL GRID ARRAY



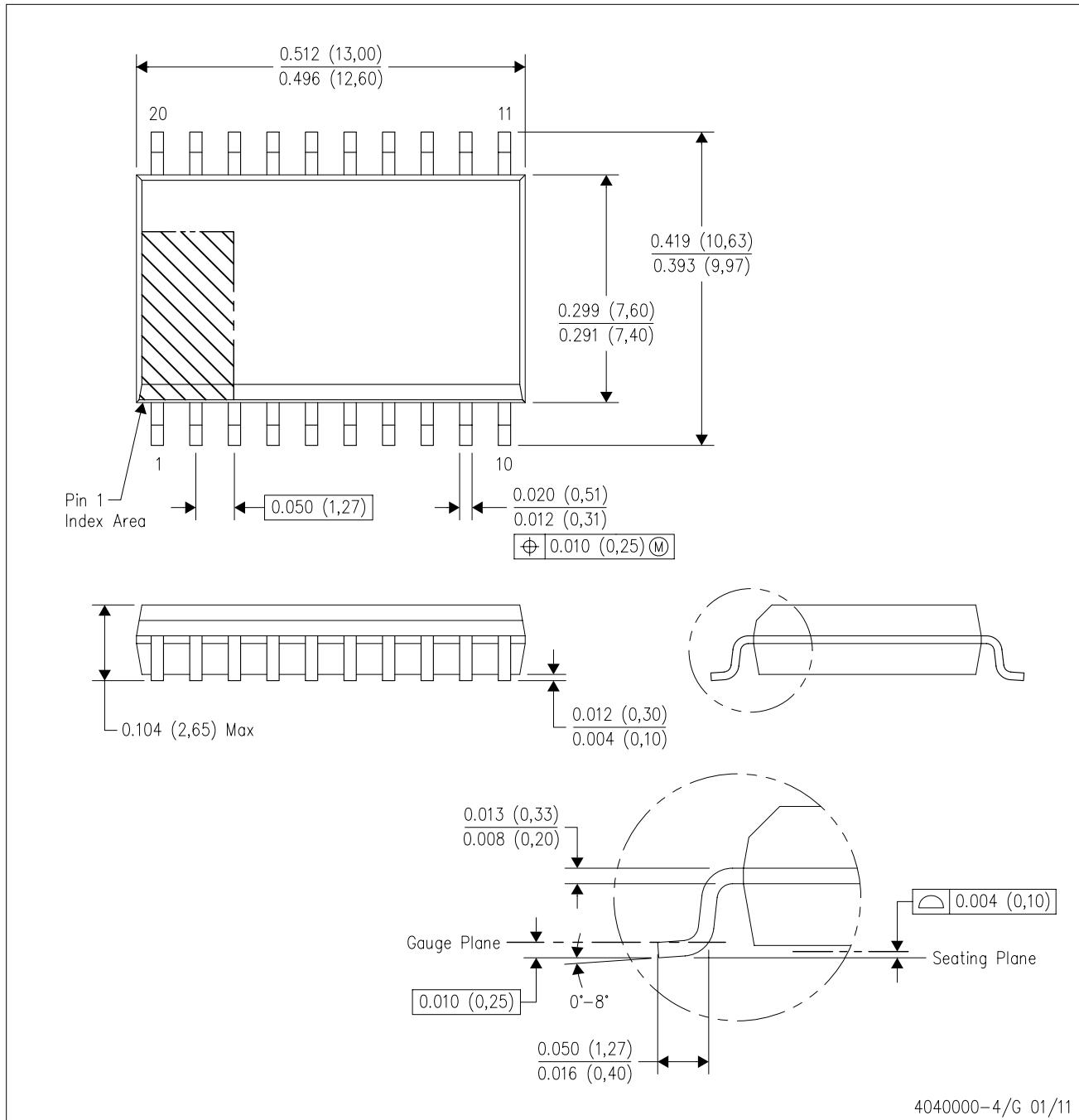
4200704/F 06/2007

NOTES:

- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
- This drawing is subject to change without notice.
- Falls within JEDEC MO-285 variation BC-2.
- This package is tin-lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead-free.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE

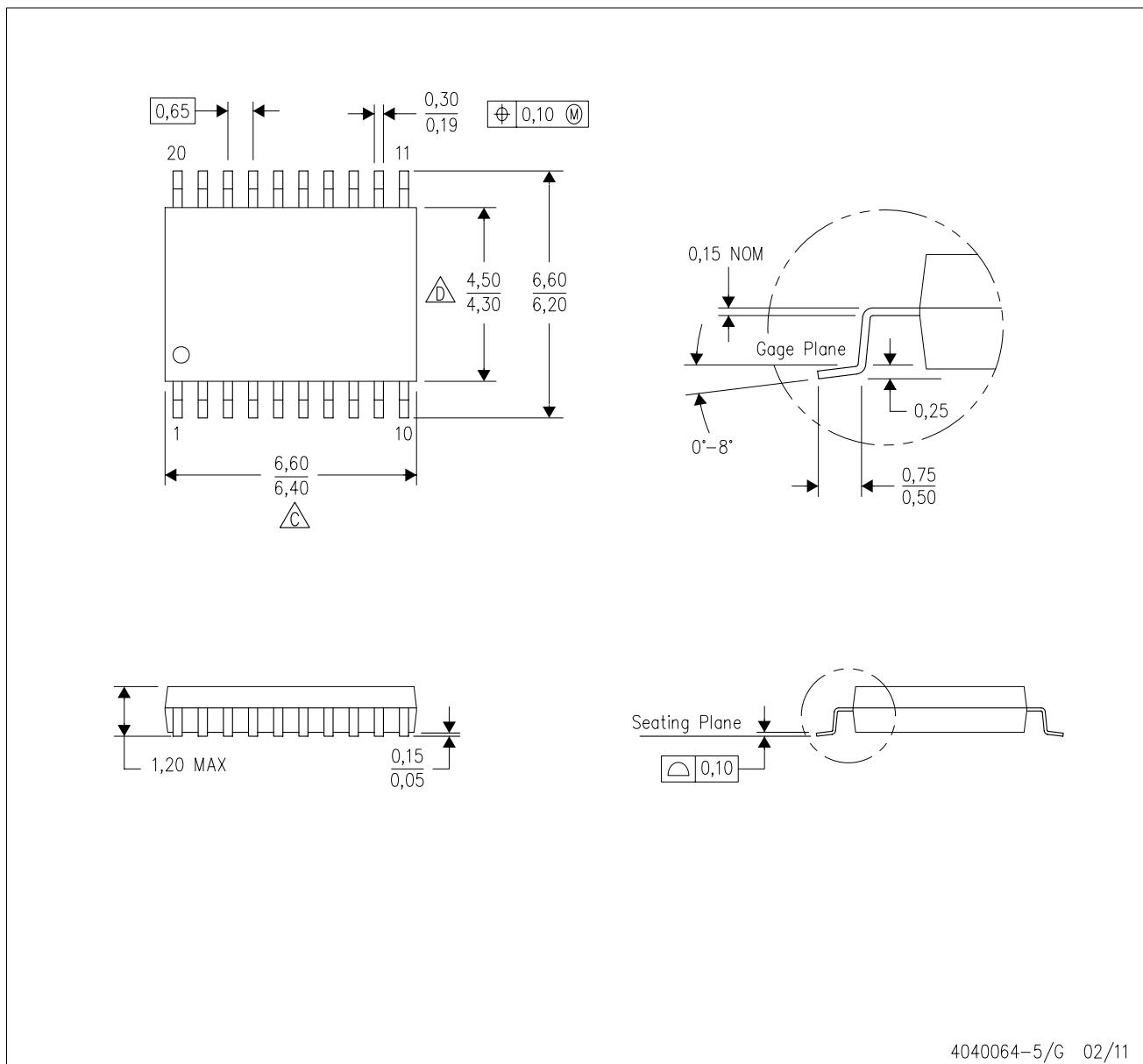


NOTES:

- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
- 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 MS-013 variation AC.

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

B. This drawing is subject to change without notice.

 C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

 D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. Falls within JEDEC MO-153

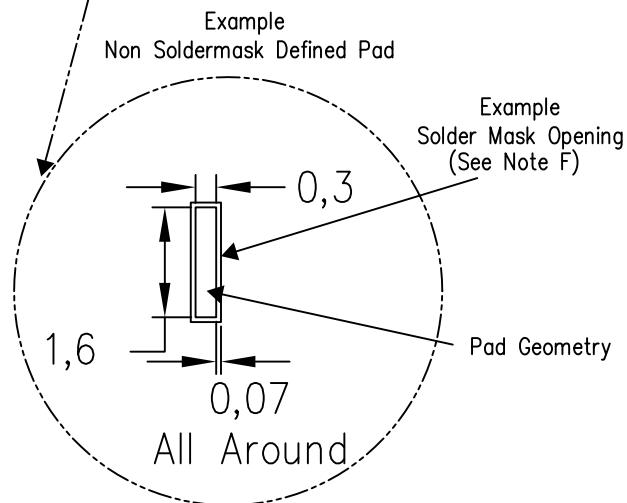
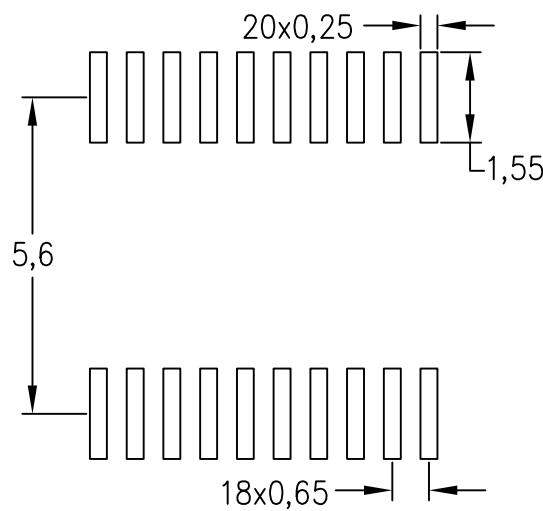
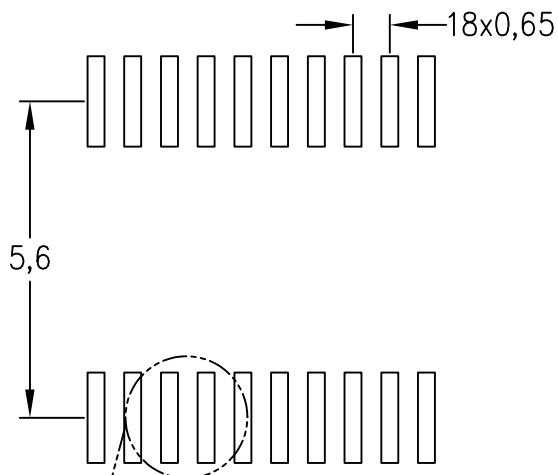
4040064-5/G 02/11

## PW (R-PDSO-G20)

## PLASTIC SMALL OUTLINE

## Example Board Layout

Based on a stencil thickness  
of .127mm (.005inch).



4211284-5/F 12/12

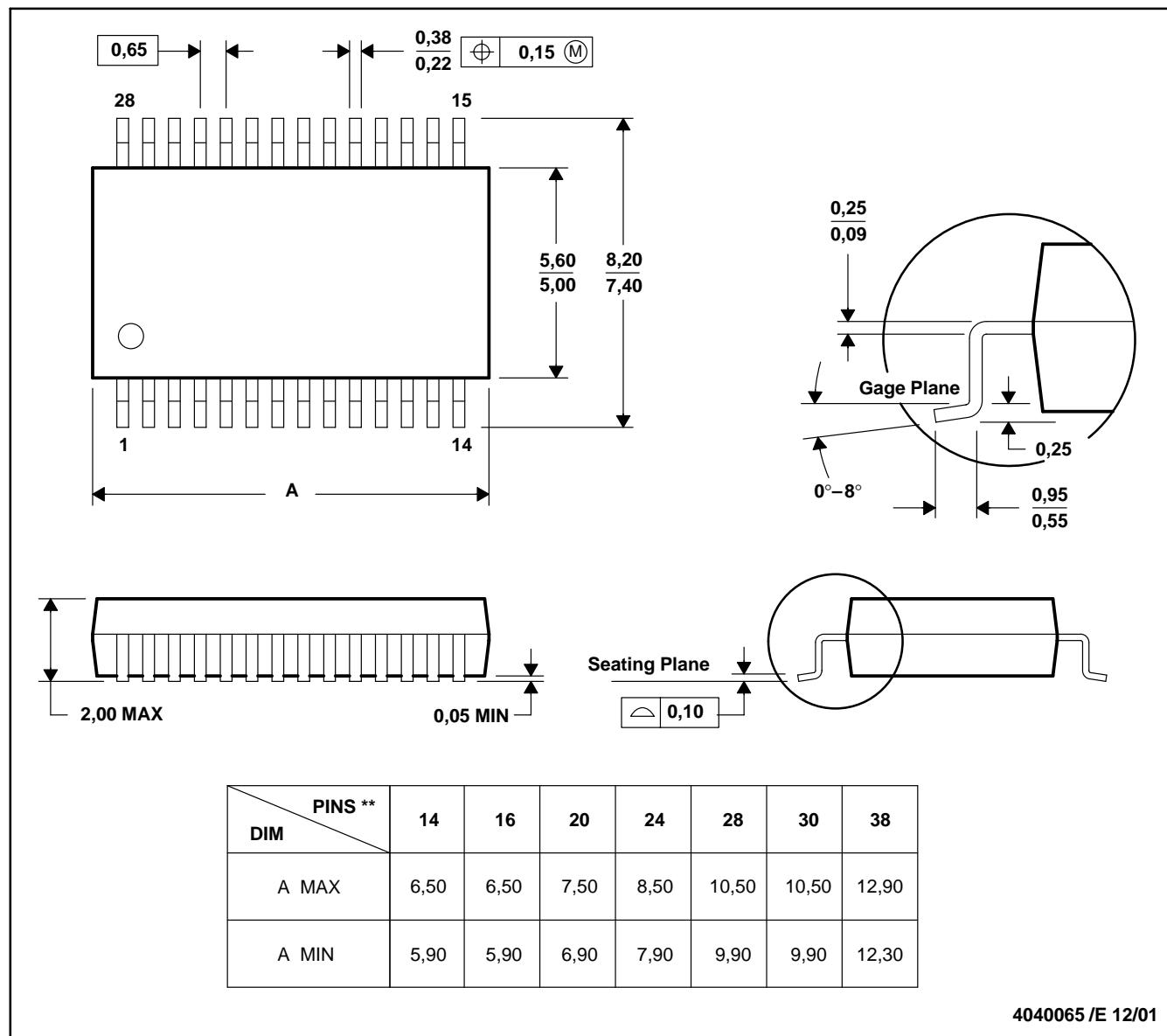
NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate design.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



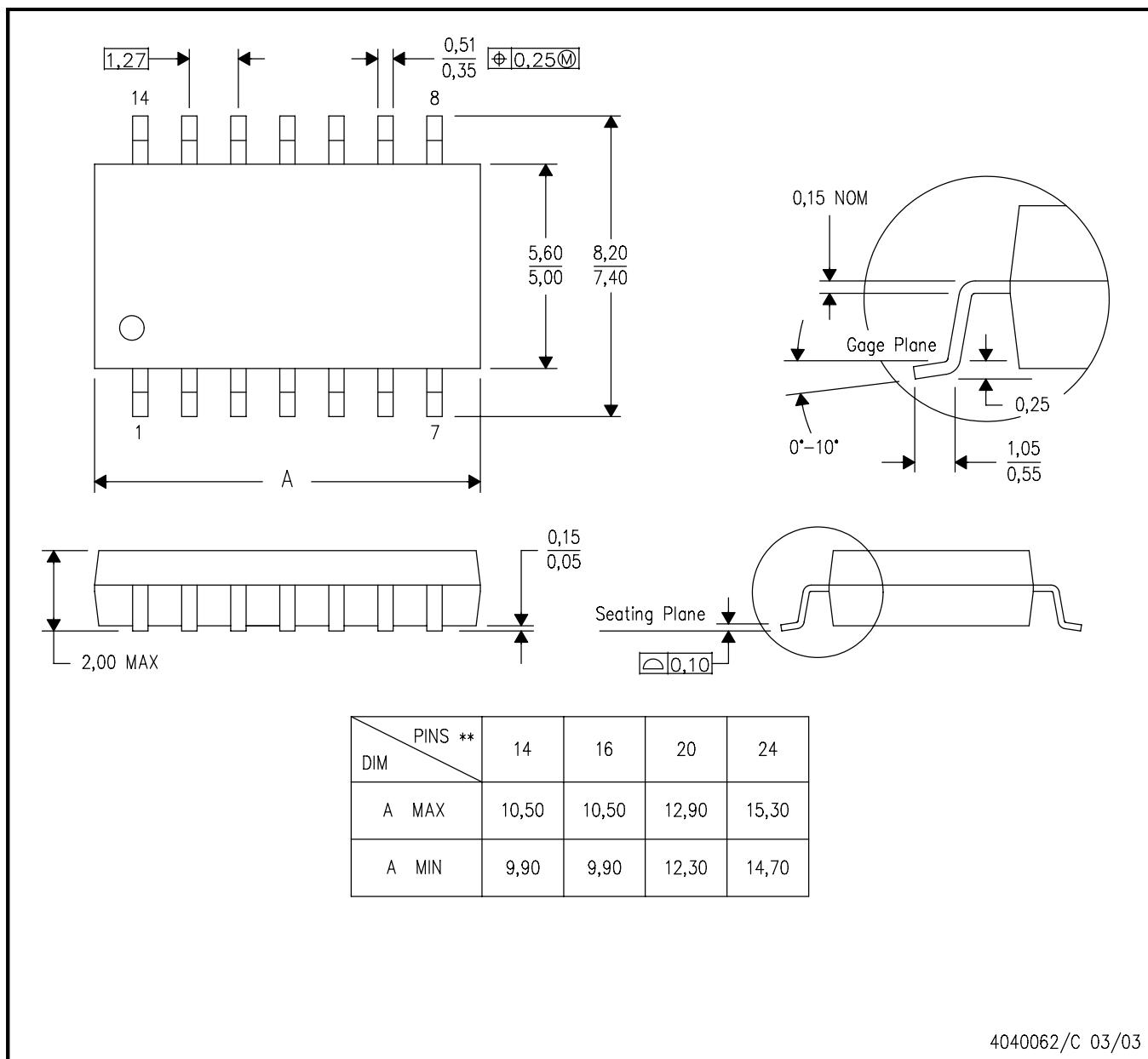
NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

## MECHANICAL DATA

NS (R-PDSO-G\*\*)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



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.

4040062/C 03/03

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>
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