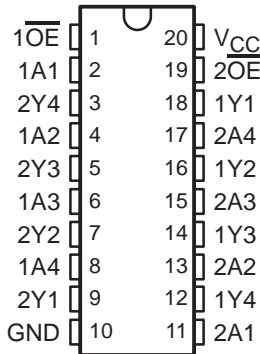


SN54LVTH240, SN74LVTH240 3.3-V ABT OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

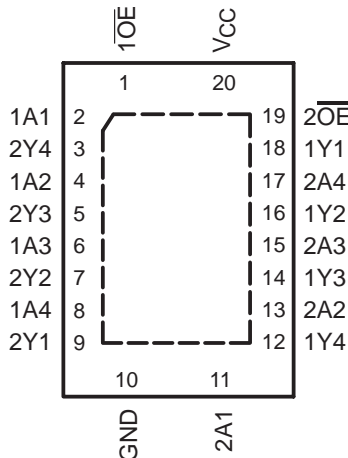
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- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})
- Support Unregulated Battery Operation Down to 2.7 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- I_{off} and 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)

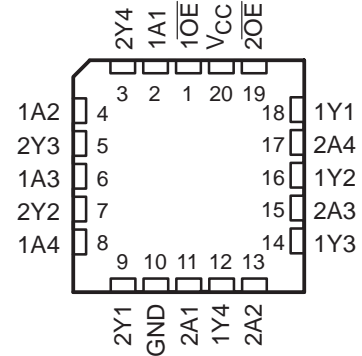
SN54LVTH240 ... J OR W PACKAGE
SN74LVTH240 ... DB, DW, NS,
OR PW PACKAGE
(TOP VIEW)



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†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QFN – RGY	Tape and reel	SN74LVTH240RGYR	LXH240
	SOIC – DW	Tube	SN74LVTH240DW	LVTH240
		Tape and reel	SN74LVTH240DWR	
	SOP – NS	Tape and reel	SN74LVTH240NSR	LVTH240
	SSOP – DB	Tape and reel	SN74LVTH240DBR	LXH240
	TSSOP – PW	Tube	SN74LVTH240PW	LXH240
		Tape and reel	SN74LVTH240PWR	
-55°C to 125°C	VFBGA – GQN	Tape and reel	SN74LVTH240GQNR	LXH240
	VFBGA – ZQN (Pb-free)		SN74LVTH240ZQNR	
	CDIP – J	Tube	SNJ54LVTH240J	SNJ54LVTH240J
	CFP – W	Tube	SNJ54LVTH240W	SNJ54LVTH240W
	LCCC – FK	Tube	SNJ54LVTH240FK	SNJ54LVTH240FK

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



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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.

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

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description/ordering information (continued)

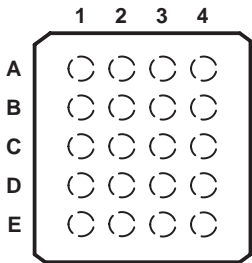
These devices are organized as two 4-bit buffer/line drivers with separate output-enable (\overline{OE}) inputs. When \overline{OE} is low, the devices pass data from the A inputs to the Y outputs. When \overline{OE} is high, the outputs are in the high-impedance state.

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	$\overline{1OE}$	V_{CC}	$\overline{2OE}$
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

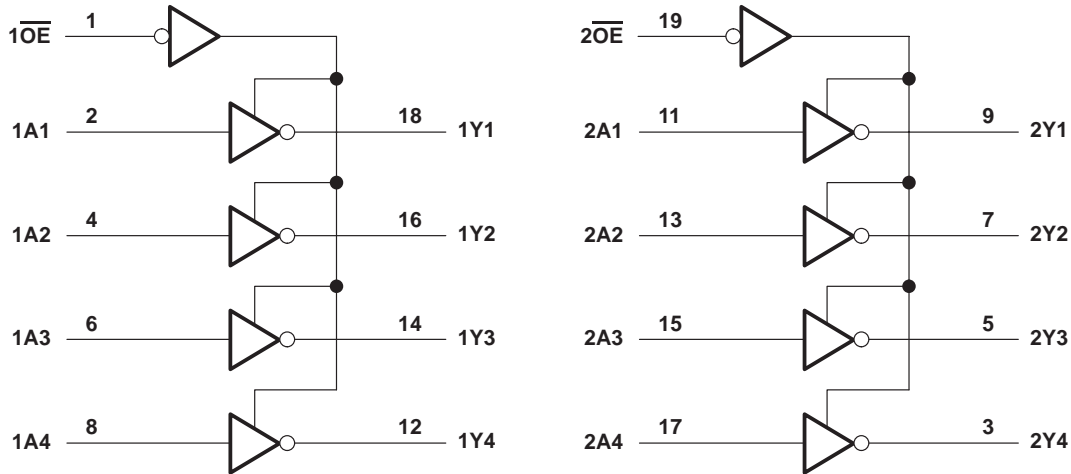
SN54LVTH240, SN74LVTH240

3.3-V ABT OCTAL BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

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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)[†]

Supply voltage range, V_{CC}	–0.5 V to 4.6 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high state, V_O (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Current into any output in the low state, I_O : SN54LVTH240	96 mA
SN74LVTH240	128 mA
Current into any output in the high state, I_O (see Note 2): SN54LVTH240	48 mA
SN74LVTH240	64 mA
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ_{JA} (see Note 3): DB package	70°C/W
(see Note 3): DW package	58°C/W
(see Note 3): GQN/ZQN package	78°C/W
(see Note 3): NS package	60°C/W
(see Note 3): PW package	83°C/W
(see Note 4): RGY package	37°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. 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_{CC}	Supply voltage		2.7	3.6	2.7	3.6	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			5.5		5.5	V
I_{OH}	High-level output current			–24		–32	mA
I_{OL}	Low-level output current			48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate		200		200		μ s/V
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 5: 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.

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}		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$, $I_{OH} = -100\text{ }\mu\text{A}$		$V_{CC}-0.2$			$V_{CC}-0.2$			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						
			$I_{OH} = -32\text{ mA}$				2			
V_{OL}		$V_{CC} = 2.7\text{ V}$	$I_{OL} = 100\text{ }\mu\text{A}$			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	μA
		$V_{CC} = 3.6\text{ V}$, $V_I = V_{CC}\text{ or GND}$				± 1			± 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 $V_O = 0\text{ to }4.5\text{ V}$							± 100	μA
$I_{I(\text{hold})}$	Data inputs	$V_{CC} = 3\text{ V}$	$V_I = 0.8\text{ V}$	75			75			μA
			$V_I = 2\text{ V}$	-75			-75			
		$V_{CC} = 3.6\text{ V}\ddagger$, $V_I = 0\text{ to }3.6\text{ V}$							500 -750	
I_{OZH}		$V_{CC} = 3.6\text{ V}$, $V_O = 3\text{ V}$				5			5	μA
I_{OZL}		$V_{CC} = 3.6\text{ V}$, $V_O = 0.5\text{ V}$				-5			-5	μA
I_{OZPU}		$V_{CC} = 0\text{ to }1.5\text{ V}$, $V_O = 0.5\text{ V to }3\text{ V}$, $OE = \text{don't care}$				$\pm 100^*$			± 100	μA
I_{OZPD}		$V_{CC} = 1.5\text{ V to }0$, $V_O = 0.5\text{ V to }3\text{ V}$, $OE = \text{don't care}$				$\pm 100^*$			± 100	μA
I_{CC}		$V_{CC} = 3.6\text{ V}$, $I_O = 0$, $V_I = V_{CC}\text{ or GND}$	Outputs high			0.19			0.19	mA
			Outputs low			5			5	
			Outputs disabled			0.19			0.19	
$\Delta I_{CC}\S$		$V_{CC} = 3\text{ V to }3.6\text{ V}$, One input at $V_{CC} - 0.6\text{ V}$, Other inputs at $V_{CC}\text{ or GND}$				0.2			0.2	mA
C_i		$V_I = 3\text{ V or }0$				3			3	pF
C_o		$V_O = 3\text{ V or }0$				7			7	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

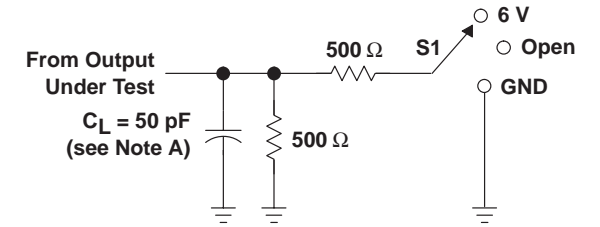
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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

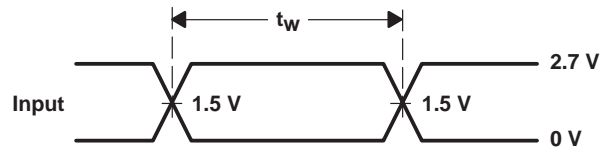
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH240				SN74LVTH240				UNIT	
			V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V			V _{CC} = 2.7 V		
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN		MAX
t _{PLH}	A	Y	0.9	4.3	5.1		1.1	2.2	3.8	4.6		ns
t _{PHL}			1.2	4.7	4.9		1.3	2.6	4	4.2		
t _{PZH}	\overline{OE}	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		

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

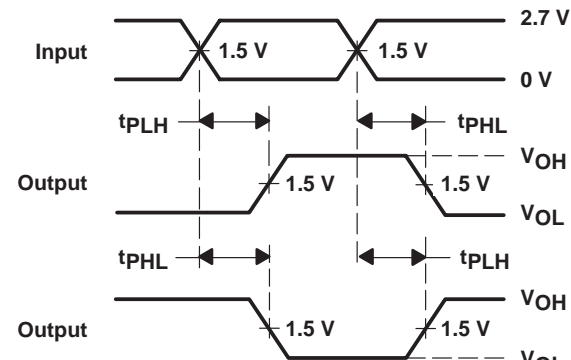
PARAMETER MEASUREMENT INFORMATION



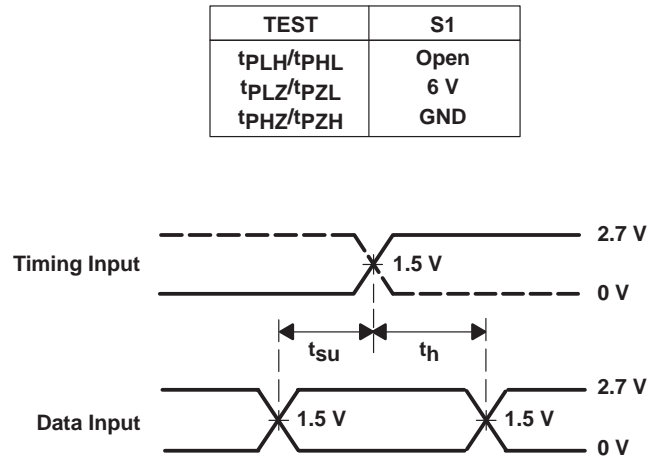
LOAD CIRCUIT



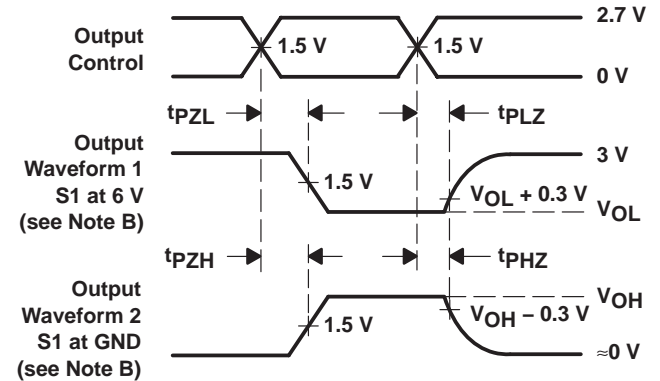
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 D. The outputs are measured one at a time with one transition per measurement.
 E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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)

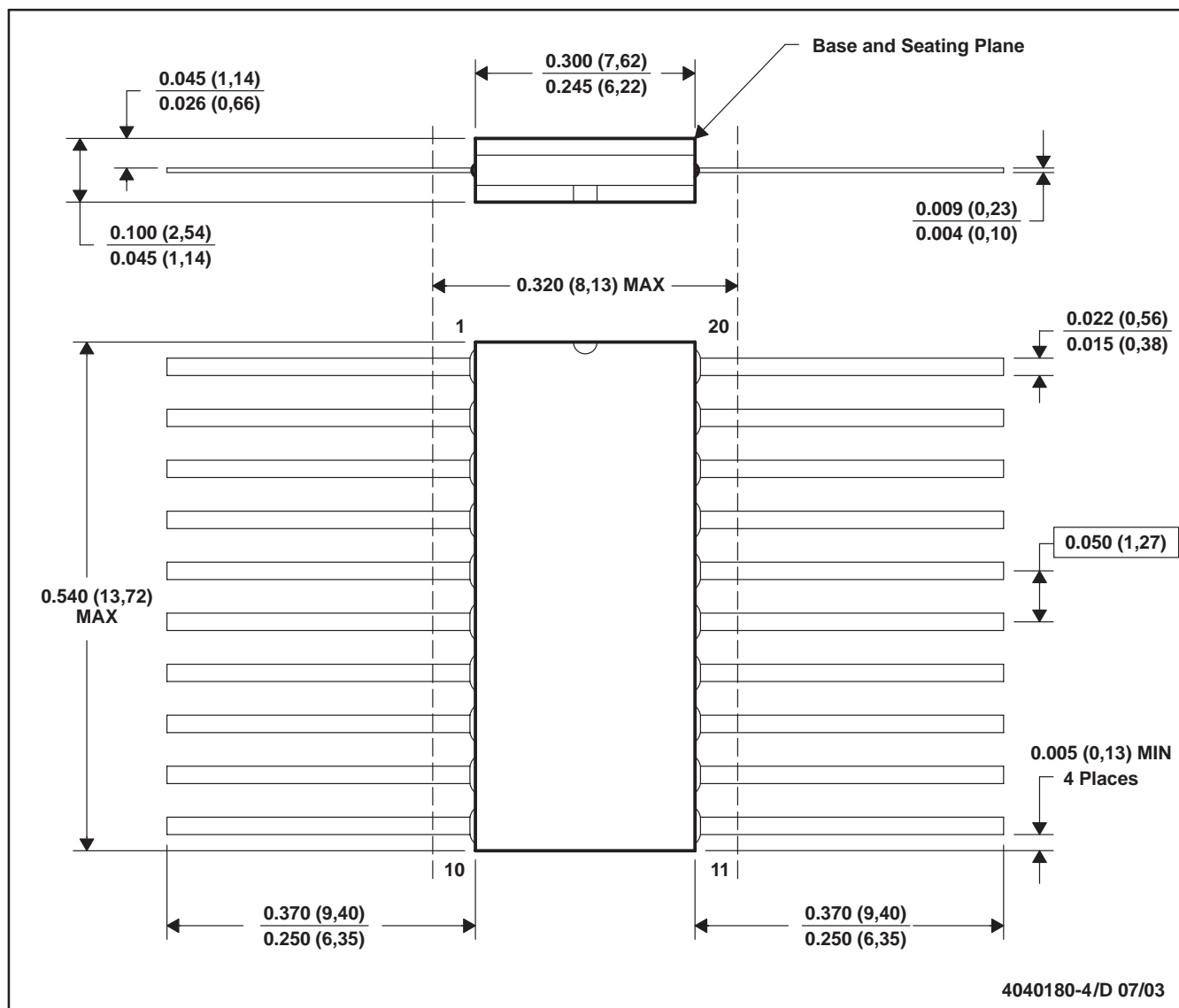


4040083/F 03/03

- 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:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within Mil-Std 1835 GDFP2-F20

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

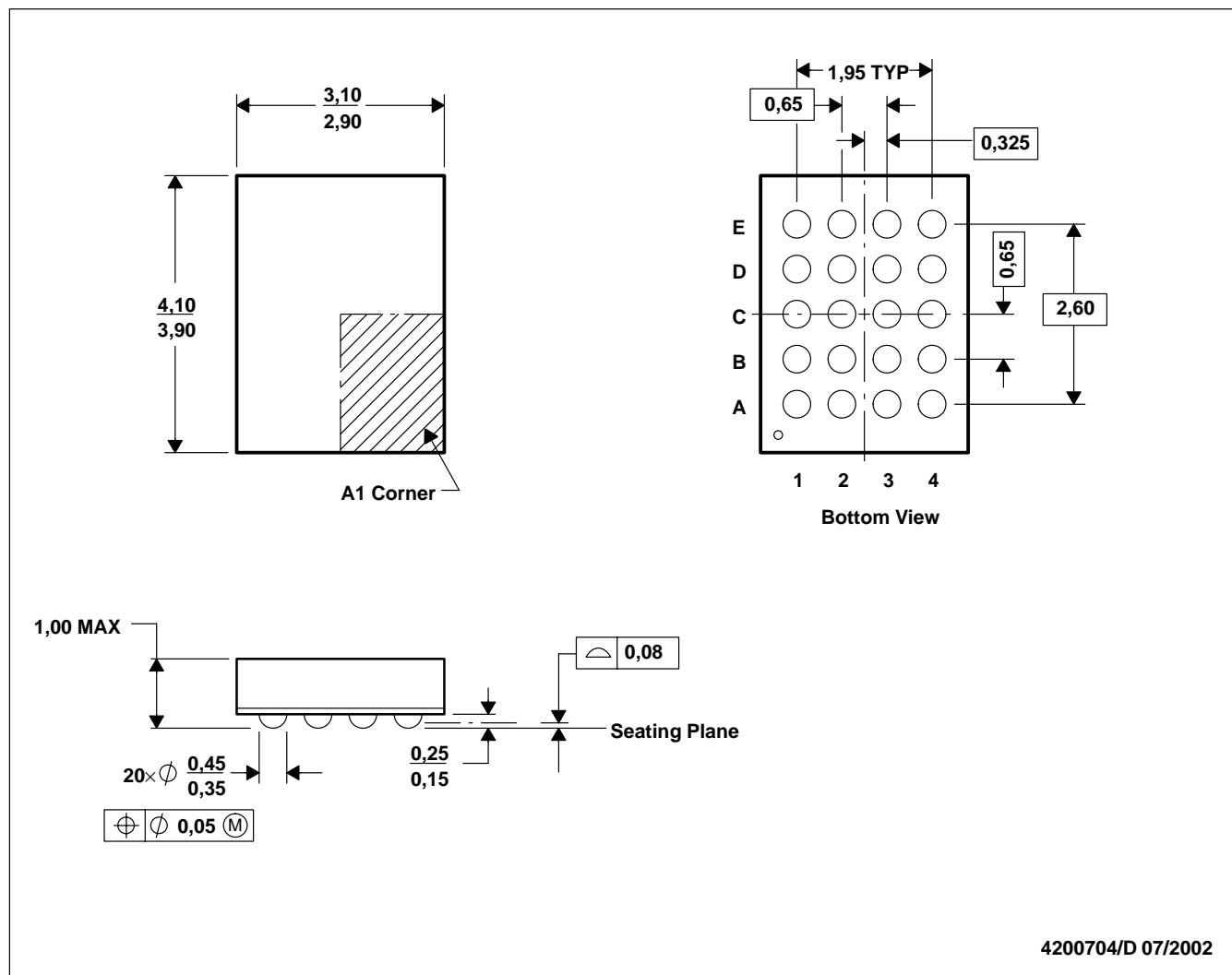
28 TERMINAL SHOWN



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

GQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY

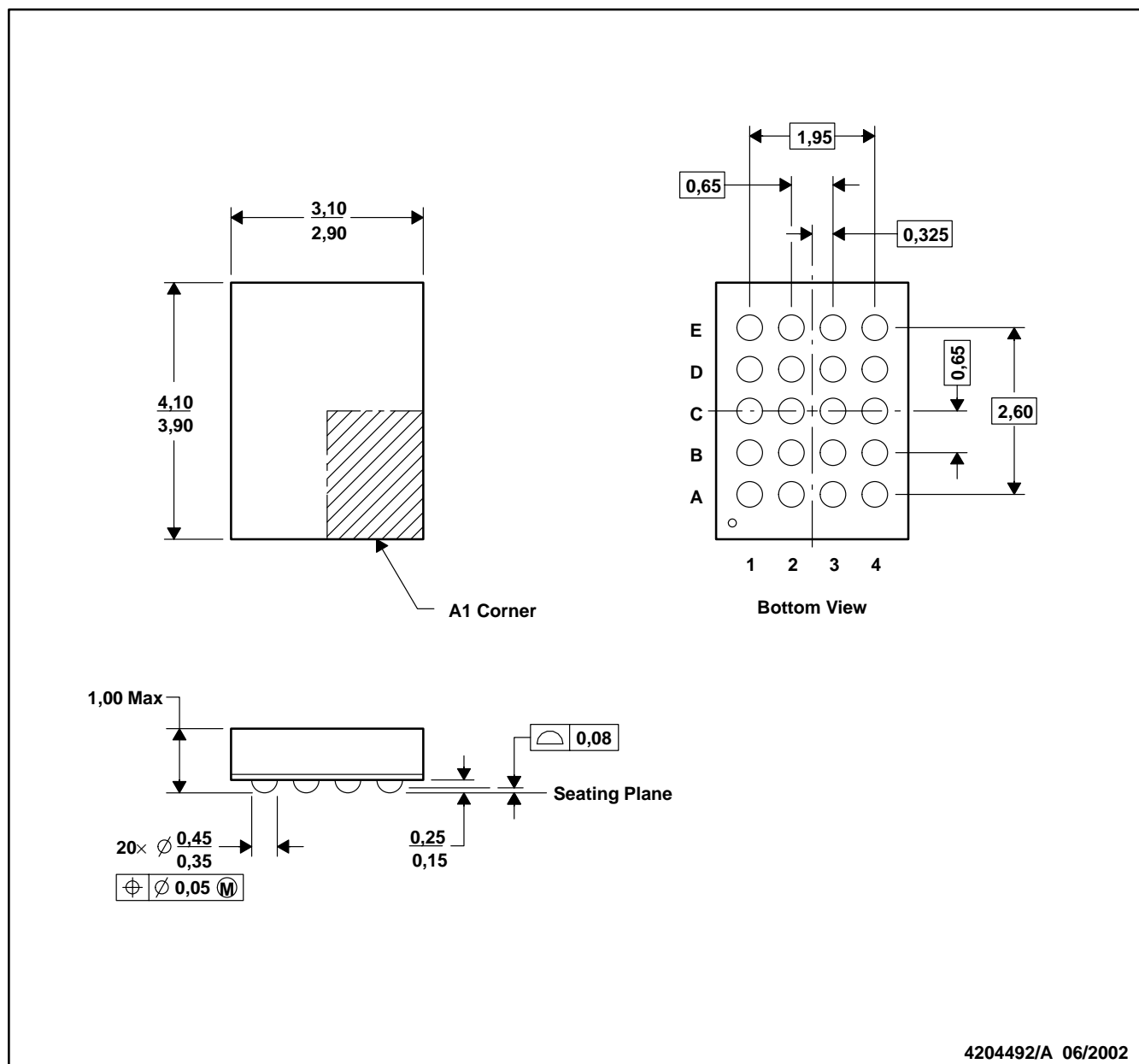


- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. MicroStar Junior™ configuration
 - D. Falls within JEDEC MO-225 variation BC.
 - E. This package is tin-lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead-free.

MicroStar Junior is a trademark of Texas Instruments.

ZQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY

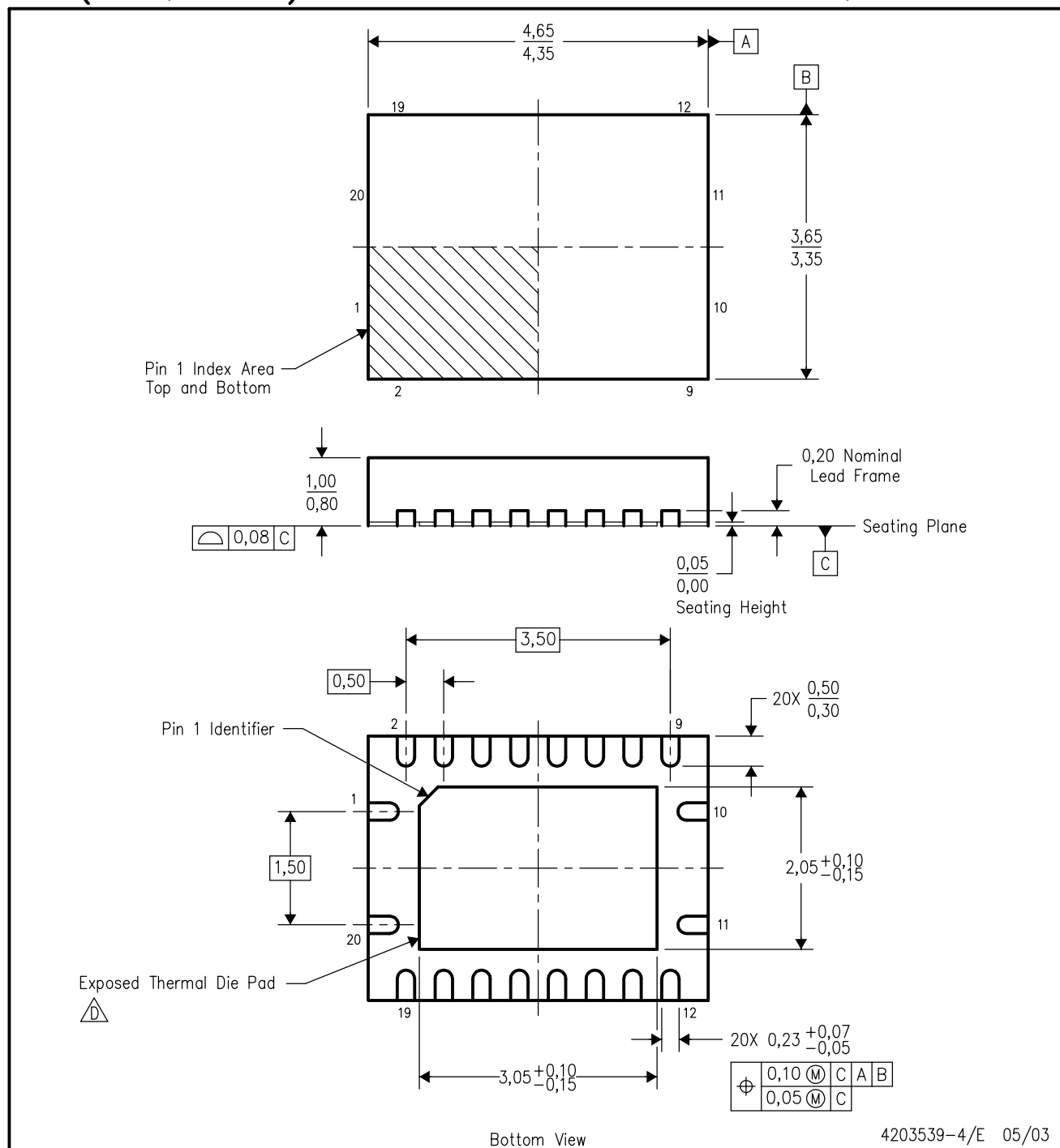


- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - MicroStar Junior™ configuration.
 - Fall within JEDEC MO-225 variation BC.
 - This package is lead-free. Refer to the 20 GQN package (drawing 4200704) for tin-lead (SnPb).

MicroStar Junior is a trademark of Texas Instruments.

RGY (R-PQFP-N20)

PLASTIC QUAD FLATPACK



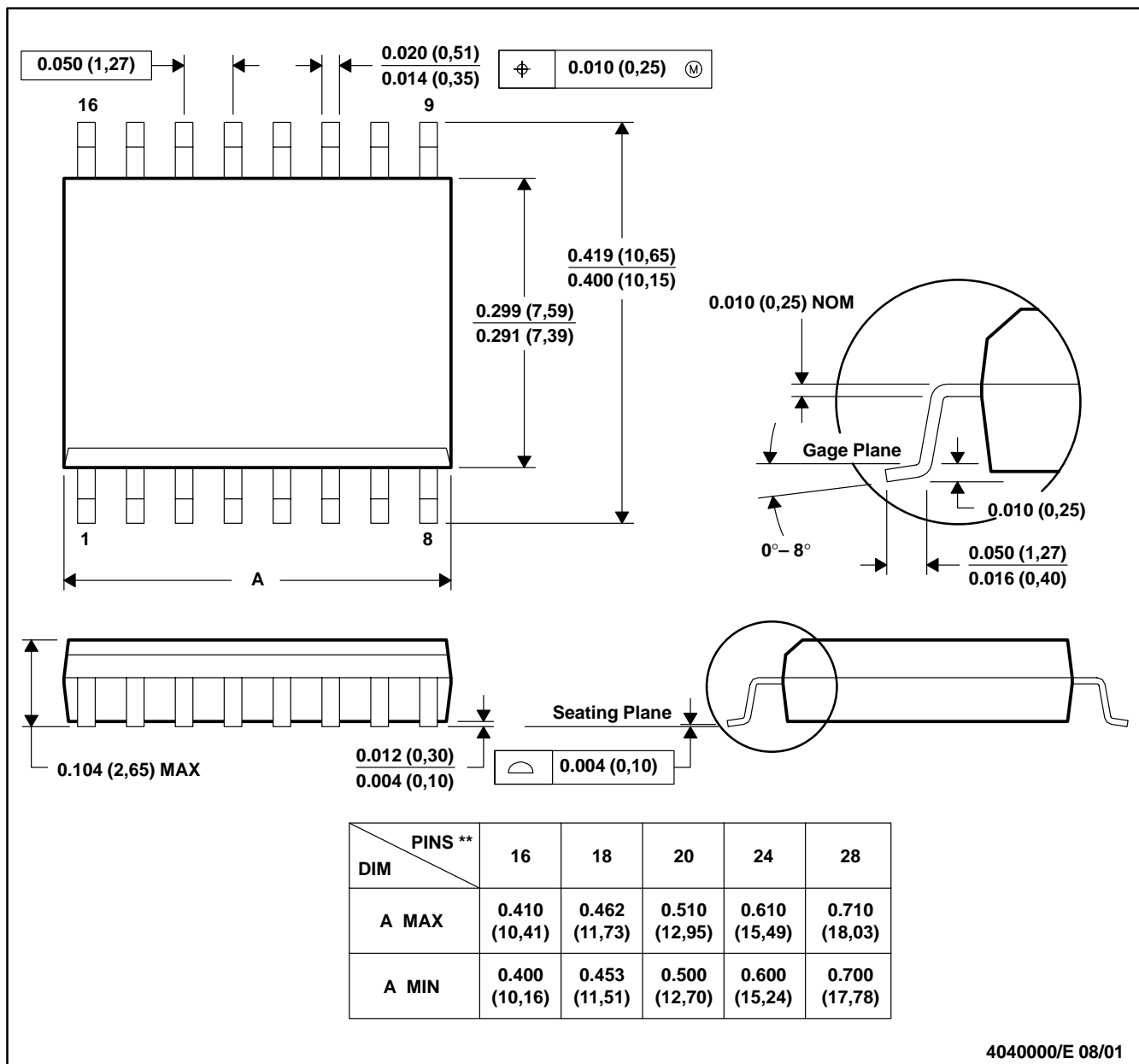
4203539-4/E 05/03

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - QFN (Quad Flatpack No-Lead) package configuration.
 - The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermally connected to the backside of the die and possibly selected ground leads.
 - Package complies to JEDEC MO-241 variation BC.

DW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

16 PINS SHOWN



- 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 MS-013

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

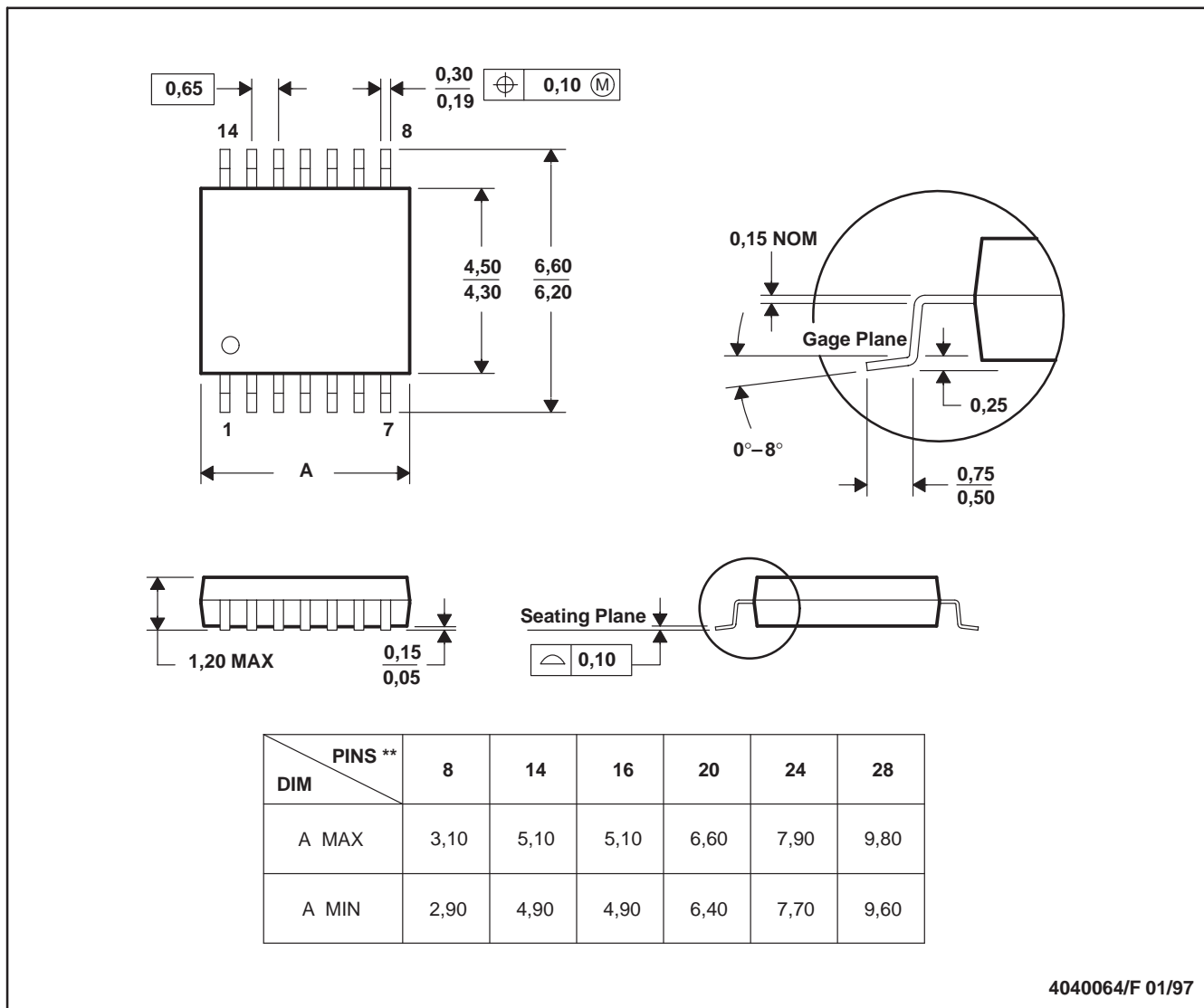


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 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-153

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