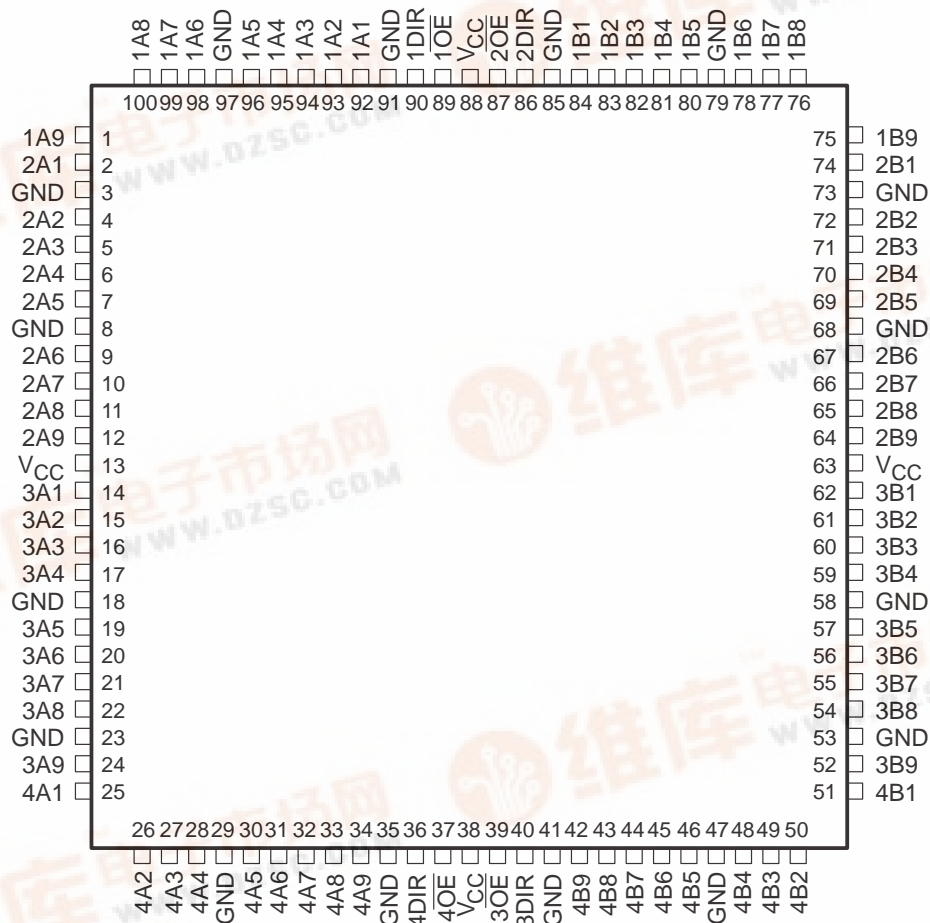


36-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS228G – JUNE 1992 – REVISED MAY 1997

- Members of the Texas Instruments *Widebus+*™ Family
- State-of-the-Art *EPIC-II B*™ BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Typical V_{OLP} (Output Ground Bounce) < 0.8 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- High-Impedance State During Power Up and Power Down
- Released as DSCC SMD 5962-9557701NXD
- PZ Package Qualified for Military Per MIL-PRF-38535 (QML)
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- High-Drive Outputs ($-32\text{-mA } I_{OH}$, $64\text{-mA } I_{OL}$)
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Package Options Include 100-Pin Plastic Thin Quad Flat (PZ) Package With $14 \times 14\text{-mm}$ Body Using 0.5-mm Lead Pitch and Space-Saving 100-Pin Ceramic Quad Flat (HS) Package†

'ABTH32245 . . . PZ PACKAGE
(TOP VIEW)



† The HS package is not production released.

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.

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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.

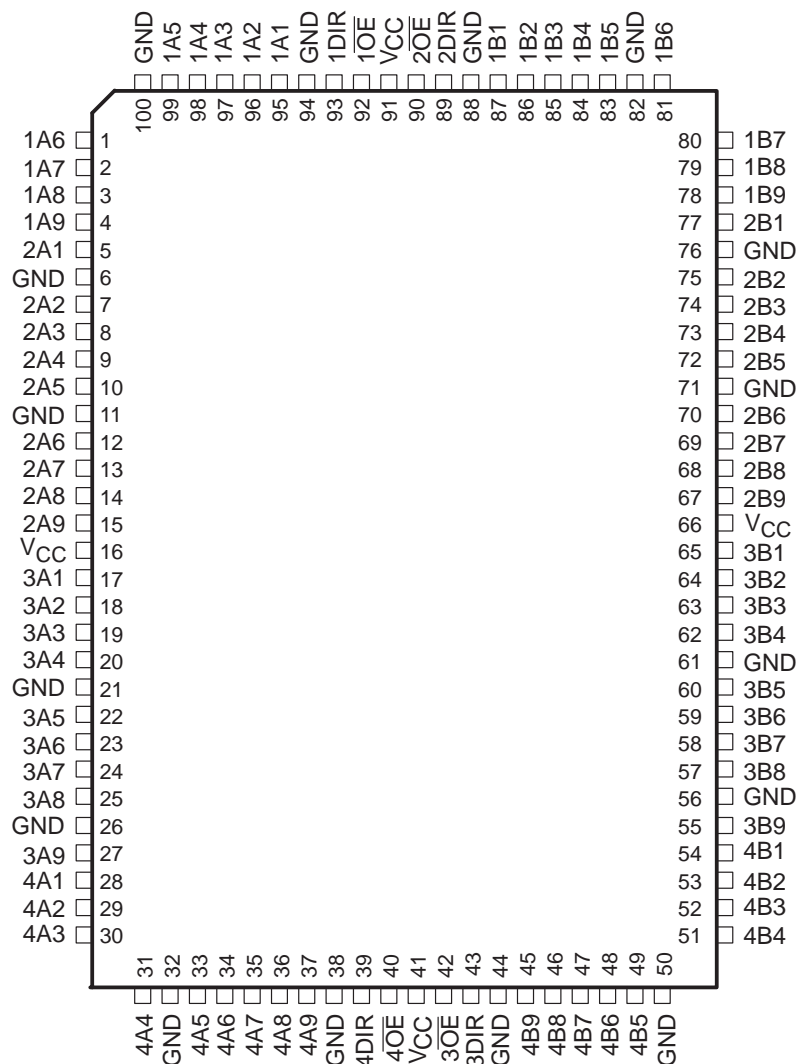
SN54ABTH32245, SN74ABTH32245

36-BIT BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

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SN54ABTH32245 . . . HS PACKAGE†
(TOP VIEW)



† For HS package availability, please contact the factory or your local TI Field Sales Office.

description

The 'ABTH32245 are 36-bit (quad 9-bit) noninverting 3-state transceivers designed for synchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

These devices can be used as four 9-bit transceivers, two 18-bit transceivers, or one 36-bit transceiver. They allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) inputs. The output-enable (\overline{OE}) inputs can be used to disable the device so that the buses are effectively isolated.

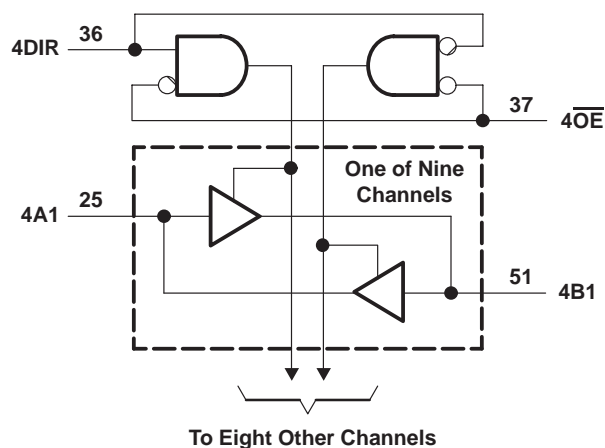
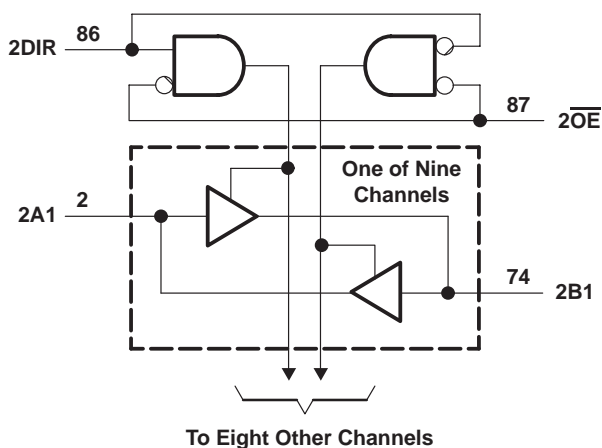
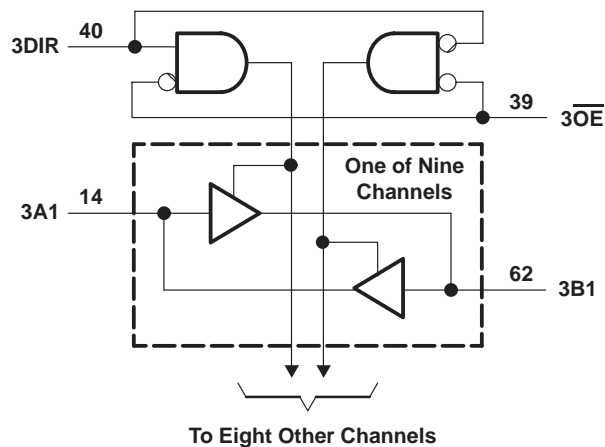
When V_{CC} is between 0 and 2.1 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 2.1 V, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Active bus-hold circuitry holds unused or floating data inputs at a valid logic level.

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The SN54ABTH32245 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABTH32245 is characterized for operation from -40°C to 85°C .

INPUTS		OPERATION
$\overline{\text{OE}}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation



SN54ABTH32245, SN74ABTH32245

36-BIT BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

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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 (except I/O ports) (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_{OL} : SN54ABTH32245	96 mA
SN74ABTH32245	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): PZ package	50°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 EIA/JEDEC Std JESD51.

recommended operating conditions (see Note 3)

		SN54ABTH32245		SN74ABTH32245		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
$\Delta t/\Delta v$	Input transition rise or fall rate		10		10	ns/V
	Outputs enabled					
$\Delta t/\Delta V_{CC}$	Power-up ramp rate	200		200		μs/V
T_A	Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: Unused control pins must be held high or low to prevent them from floating.

SN54ABTH32245, SN74ABTH32245
36-BIT BUS TRANSCEIVERS
WITH 3-STATE OUTPUTS

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

PARAMETER		TEST CONDITIONS	SN54ABTH32245			SN74ABTH32245			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		$V_{CC} = 4.5\text{ V}$, $I_I = -18\text{ mA}$			-1.2			-1.2	V
V_{OH}		$V_{CC} = 4.5\text{ V}$, $I_{OH} = -3\text{ mA}$	2.5			2.5			V
		$V_{CC} = 5\text{ V}$, $I_{OH} = -3\text{ mA}$	3			3			
		$V_{CC} = 4.5\text{ V}$, $I_{OH} = -24\text{ mA}$	2						
		$V_{CC} = 4.5\text{ V}$, $I_{OH} = -32\text{ mA}$				2			
V_{OL}		$V_{CC} = 4.5\text{ V}$, $I_{OL} = 48\text{ mA}$			0.55			0.55	V
		$V_{CC} = 4.5\text{ V}$, $I_{OL} = 64\text{ mA}$						0.55	
V_{hys}				100			100		mV
I_I	Control inputs	$V_{CC} = 0\text{ to }5.5\text{ V}$, $V_I = V_{CC}\text{ or GND}$						± 1	μA
	A or B ports	$V_{CC} = 2.1\text{ V to }5.5\text{ V}$, $V_I = V_{CC}\text{ or GND}$						± 20	
	Control inputs	$V_{CC} = 5.5\text{ V}$, $V_I = V_{CC}\text{ or GND}$			± 1				μA
	A or B ports	$V_{CC} = 5.5\text{ V}$, $V_I = V_{CC}\text{ or GND}$			± 20				
$I_{I(hold)}$	A or B ports	$V_{CC} = 4.5\text{ V}$, $V_I = 0.8\text{ V}$	100			100			μA
		$V_{CC} = 4.5\text{ V}$, $V_I = 2\text{ V}$	-100			-100			
I_{OZPU}^\ddagger		$V_{CC} = 0\text{ to }2.1\text{ V}$, $V_O = 0.5\text{ V to }2.7\text{ V}$, $\overline{OE} = X$			± 50			± 50	μA
I_{OZPD}^\ddagger		$V_{CC} = 2.1\text{ V to }5.5\text{ V}$, $V_O = 0.5\text{ V to }2.7\text{ V}$, $\overline{OE} = X$			± 50			± 50	μA
I_{off}		$V_{CC} = 0$, $V_I\text{ or }V_O \leq 4.5\text{ V}$						± 100	μA
I_{CEX}		$V_{CC} = 5.5\text{ V}$, $V_O = 5.5\text{ V}$, Outputs high			50			50	μA
I_O^\S		$V_{CC} = 5.5\text{ V}$, $V_O = 2.5\text{ V}$	-50	-100	-180	-50	-100	-180	mA
I_{CC}		$V_{CC} = 5.5\text{ V}$, $I_O = 0$, $V_I = V_{CC}\text{ or GND}$			3			3	mA
		Outputs high			3			3	
		Outputs low			20			20	
ΔI_{CC}^\P		$V_{CC} = 5.5\text{ V}$, One input at 3.4 V, Other inputs at $V_{CC}\text{ or GND}$			1			1	mA
		Outputs high			1			1	
		Outputs low			1			1	
C_i	Control inputs	$V_I = 2.5\text{ V or }0.5\text{ V}$		3.5			3.5		pF
C_{io}	A or B ports	$V_O = 2.5\text{ V or }0.5\text{ V}$		9.5			9.5		pF

† All typical values are at $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$.

‡ This parameter is specified by characterization.

§ 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.

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)	$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}^\#$			SN54ABTH32245		SN74ABTH32245		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	1.7	3.2	4.4	1	5.3	1.7	5	ns
t_{PHL}			1.7	3.3	4.6	1	5.3	1.7	5.2	
t_{PZH}	\overline{OE}	B or A	1.6	4.2	6.1	1	7.6	1.6	7.3	ns
t_{PZL}			2.7	5.2	7	1.5	8.2	2.7	8.1	
t_{PHZ}	\overline{OE}	B or A	1.3	3.9	6.1	0.8	6.7	1.3	6.5	ns
t_{PLZ}			2	4.4	6.6	1	7.2	2	6.9	

These limits apply only to the SN74ABTH32245

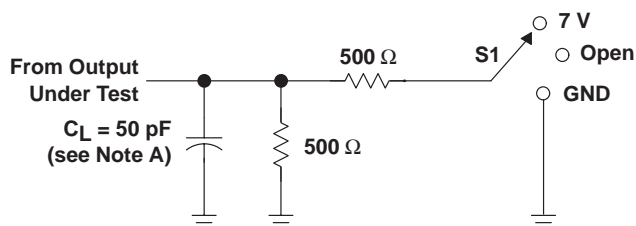
SN54ABTH32245, SN74ABTH32245

36-BIT BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

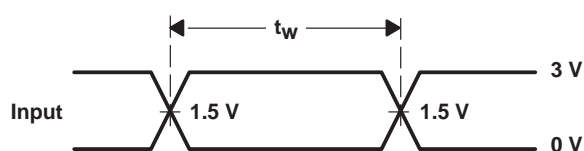
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PARAMETER MEASUREMENT INFORMATION

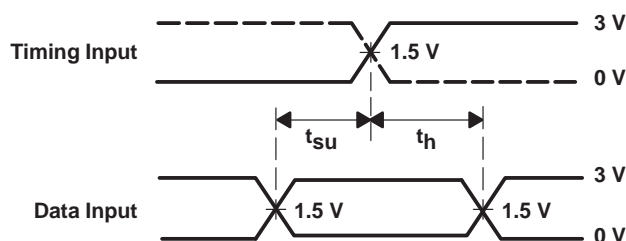


LOAD CIRCUIT

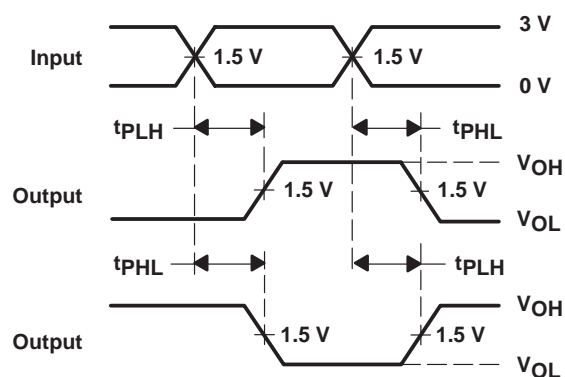
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



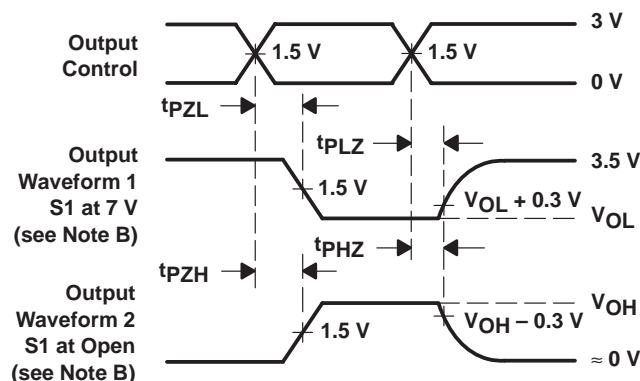
VOLTAGE WAVEFORMS
PULSE DURATION



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/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9557701NXD	ACTIVE	LQFP	PZ	100	90	TBD	Call TI	Level-2-220C-1 YR
SN74ABTH32245PZ	ACTIVE	LQFP	PZ	100	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
SN74ABTH32245PZG4	ACTIVE	LQFP	PZ	100	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR

⁽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⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

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.

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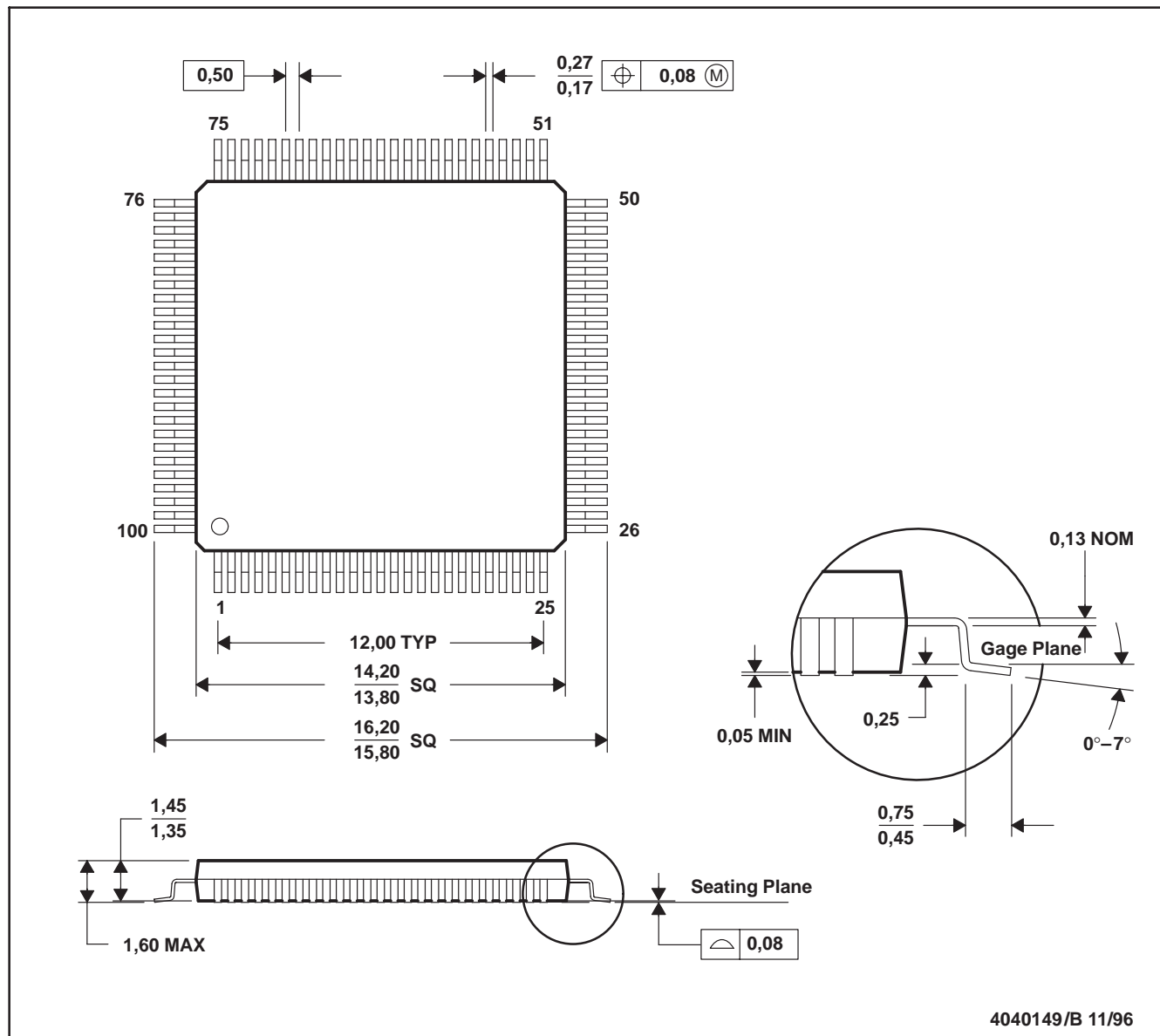
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MECHANICAL DATA

MTQF013A – OCTOBER 1994 – REVISED DECEMBER 1996

PZ (S-PQFP-G100)

PLASTIC QUAD FLATPACK



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-026

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