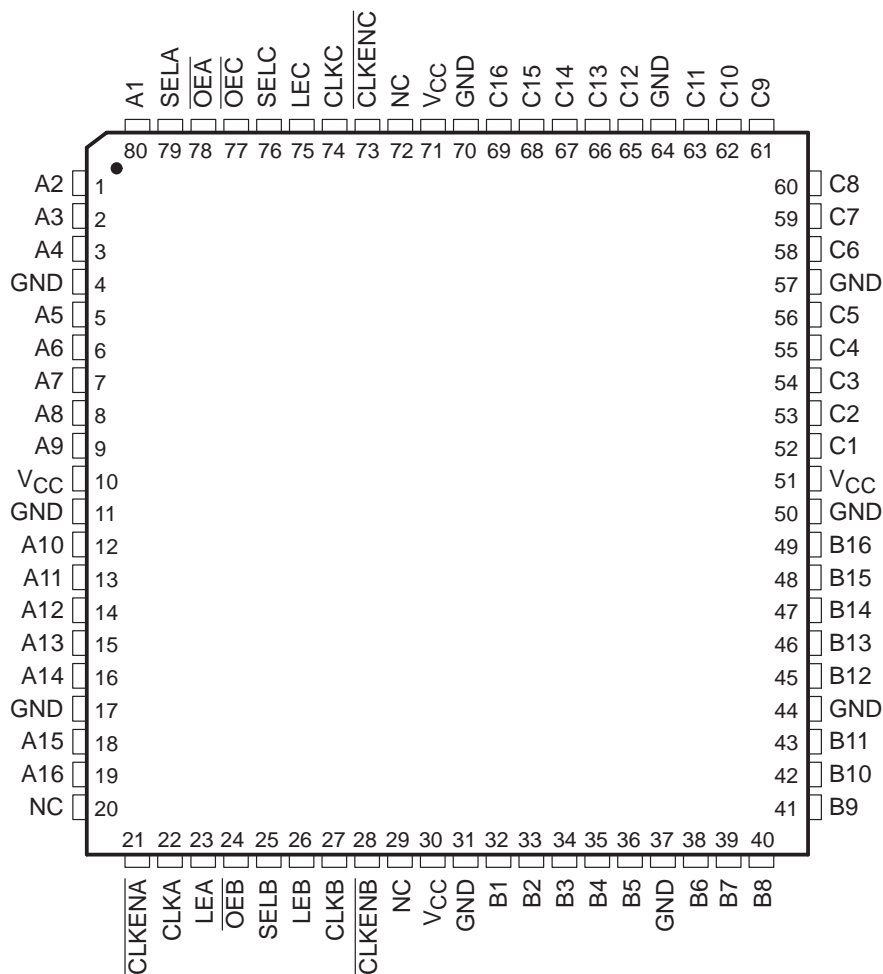


SN54ABTH32316, SN74ABTH32316 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

SCBS179E – 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
- *UBE*™ (Universal Bus Exchanger) Combines D-Type Latches and D-Type Flip-Flops for Operation in Transparent, Latched, Clocked, or Clock-Enabled Mode
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015
- 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
- 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 80-Pin Plastic Thin Quad Flat (PN) Package With $12 \times 12\text{-mm}$ Body Using 0.5-mm Lead Pitch and 84-Pin Ceramic Quad Flat (HT) Package

'ABTH32316 . . . PN PACKAGE
(TOP VIEW)



NC – No internal connection



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+, EPIC-II B, and UBE 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.



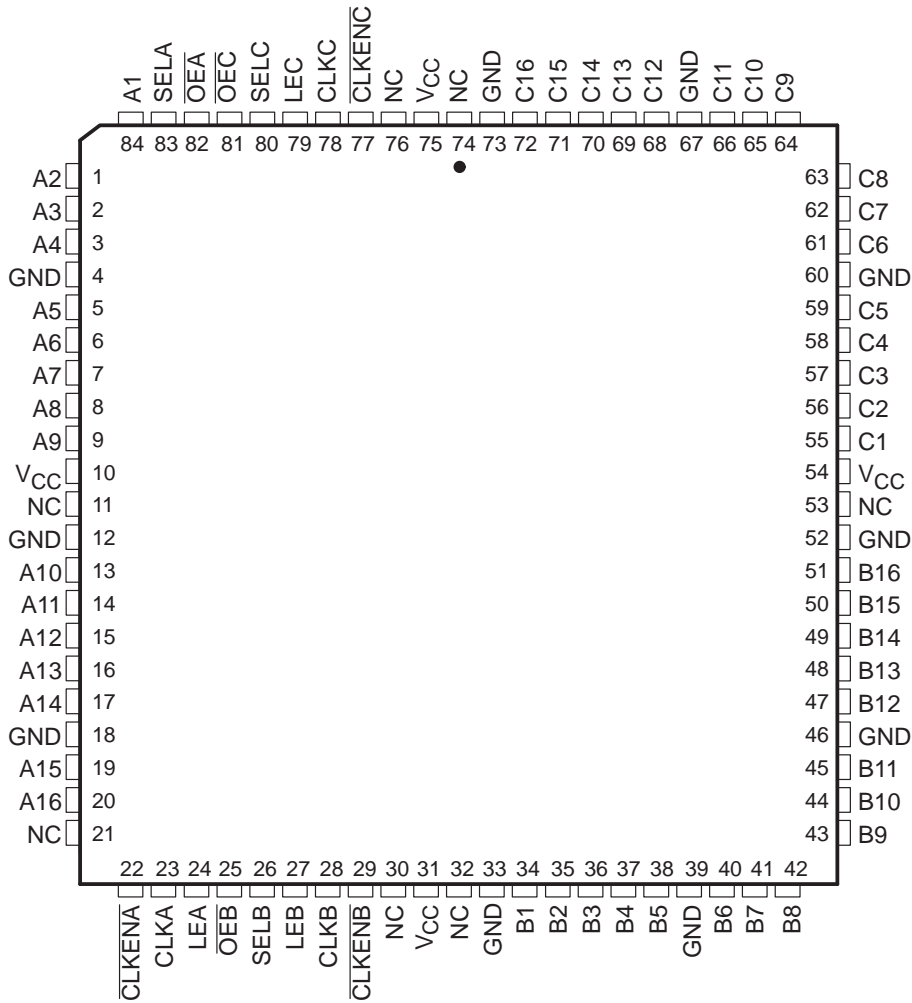
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1997, Texas Instruments Incorporated

SN54ABTH32316, SN74ABTH32316 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

SCBS179E – JUNE 1992 – REVISED MAY 1997

SN54ABTH32316 . . . HT PACKAGE
(TOP VIEW)



NC – No internal connection

description

The 'ABTH32316 consist of three 16-bit registered input/output (I/O) ports. These registers combine D-type latches and flip-flops to allow data flow in transparent, latch, and clock modes. Data from one input port can be exchanged to one or more of the other ports. Because of the universal storage element, multiple combinations of real-time and stored data can be exchanged among the three ports.

Data flow in each direction is controlled by the output-enable (\overline{OEA} , \overline{OEB} , and \overline{OEC}), select-control (SELA, SELB, and SELC), latch-enable (LEA, LEB, and LEC), and clock (CLKA, CLKB, and CLKC) inputs. The A data register operates in the transparent mode when LEA is high. When LEA is low, data is latched if CLKA is held at a high or low logic level. If LEA and clock-enable A (\overline{CLKENA}) are low, data is stored on the low-to-high transition of CLKA. Output data selection is accomplished by the select-control pins. All three ports have active-low output enables, so when the output-enable input is low, the outputs are active; when the output-enable input is high, the outputs are in the high-impedance state.

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.



description (continued)

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

The SN54ABTH32316 is characterized for operation over the full military temperature range of -55°C to 125°C .
 The SN74ABTH32316 is characterized for operation from -40°C to 85°C .

Function Tables

STORAGE†

INPUTS				OUTPUT
CLKENA	CLKA	LEA	A	
H	X	L	X	Q_0^{\ddagger}
L	↑	L	L	L
L	↑	L	H	H
X	H	L	X	Q_0^{\ddagger}
X	L	L	X	Q_0^{\ddagger}
X	X	H	L	L
X	X	H	H	H

† A-port register shown. B and C ports are similar but use CLKENB, CLKENC, CLKB, CLKC, LEB, and LEC.

‡ Output level before the indicated steady-state input conditions were established

A-PORT OUTPUT

INPUTS		OUTPUT A
$\overline{\text{OEA}}$	SELA	
H	X	Z
L	H	Output of C register
L	L	Output of B register

B-PORT OUTPUT

INPUTS		OUTPUT B
$\overline{\text{OEB}}$	SELB	
H	X	Z
L	H	Output of A register
L	L	Output of C register

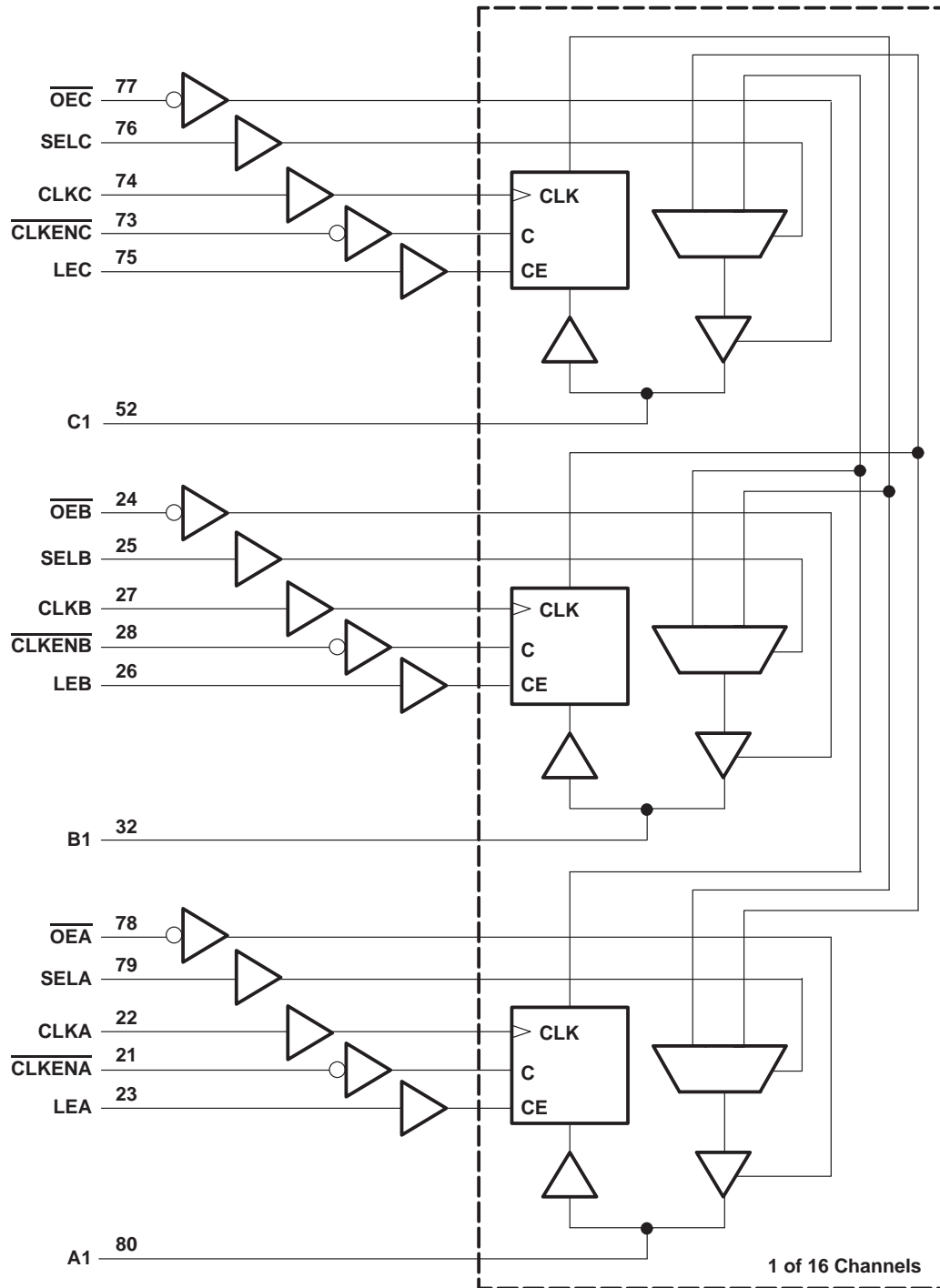
C-PORT OUTPUT

INPUTS		OUTPUT C
$\overline{\text{OEC}}$	SELC	
H	X	Z
L	H	Output of B register
L	L	Output of A register

SN54ABTH32316, SN74ABTH32316 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

SCBS179E – JUNE 1992 – REVISED MAY 1997

logic diagram (positive logic)



Pin numbers shown are for the PN package.

SN54ABTH32316, SN74ABTH32316 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

SCBS179E – JUNE 1992 – REVISED MAY 1997

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_O : SN54ABTH32316	96 mA
SN74ABTH32316	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): PN package	62°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)

		SN54ABTH32316		SN74ABTH32316		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	Outputs enabled			10	ns/V
$\Delta t/\Delta V_{CC}$	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.



SN54ABTH32316, SN74ABTH32316 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

SCBS179E – JUNE 1992 – REVISED MAY 1997

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

PARAMETER		TEST CONDITIONS	SN54ABTH32316			SN74ABTH32316			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	
		$V_{CC} = 4.5\text{ V}$			2			2	
V_{OL}		$V_{CC} = 4.5\text{ V}$			0.55				V
								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			± 1	μA
	A, B, or C ports	$V_{CC} = 2.1\text{ V to }5.5\text{ V}$, $V_I = V_{CC}\text{ or GND}$			± 100			± 20	
$I_I(\text{hold})$	A, B, or C ports	$V_{CC} = 4.5\text{ V}$			100			100	μA
					-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		$V_{CC} = 2.1\text{ V to }0$, $V_O = 0.5\text{ V to }2.7\text{ V}$, $\overline{OE} = X$			± 50			± 50	μA
I_{off}		$V_{CC} = 0$, $V_I\text{ or }V_O \leq 4.5\text{ V}$			± 100			± 100	μA
I_{CEX}		$V_{CC} = 5.5\text{ V}$, $V_O = 5.5\text{ V}$			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}		$V_{CC} = 5.5\text{ V}$, $I_O = 0$, $V_I = V_{CC}\text{ or GND}$			2			2	mA
				40			40		
				1			1		
ΔI_{CC}^\parallel		$V_{CC} = 5.5\text{ V}$, One input at 3.4 V, Other inputs at V_{CC} or GND			1			0.5	mA
C_i	Control inputs	$V_I = 2.5\text{ V or }0.5\text{ V}$			3			3	pF
C_{io}	A, B, or C ports	$V_O = 2.5\text{ V or }0.5\text{ V}$			11.5			11.5	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.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

			SN54ABTH32316		SN74ABTH32316		UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		0	150	0	150	MHz
t_w	Pulse duration	LE high	3.3		3.3		ns
		CLK high or low	3.3		3.3		
t_{su}	Setup time	A, B, or C before CLK \uparrow	2.6		2.4		ns
		A or B before LE \downarrow	2.5		2.1		
		CLKEN before CLK \uparrow	3.5		3.2		
t_h	Hold time	A, B, or C after CLK \uparrow	1.8		1.4		ns
		A or B after LE \downarrow	2.4		2.1		
		CLKEN after CLK \uparrow	1.5		1.1		



SN54ABTH32316, SN74ABTH32316 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

SCBS179E – JUNE 1992 – REVISED MAY 1997

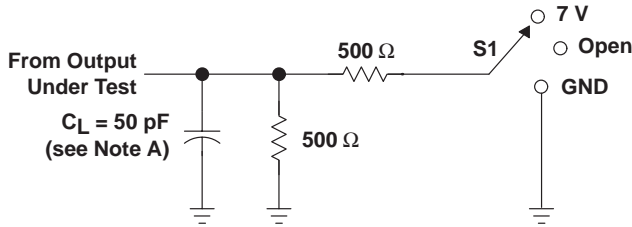
switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABTH32316		SN74ABTH32316		UNIT
			MIN	MAX	MIN	MAX	
f_{max}			150		150		MHz
t_{PLH}	A, B, or C	C, B, or A	0.8	6.5	1.4	6.1	ns
t_{PHL}			0.5	6.8	1.1	6.6	
t_{PLH}	SEL	A, B, or C	0.8	6.7	1.4	6.5	ns
t_{PHL}			0.8	6.8	1.8	6.5	
t_{PLH}	LE	A, B, or C	1.5	8	2.6	7.5	ns
t_{PHL}			1.5	7.4	2.6	6.9	
t_{PLH}	CLK	A, B, or C	1.5	8	2.5	7.5	ns
t_{PHL}			1.5	7.2	2.5	6.7	
t_{PZH}	\overline{OE}	A, B, or C	0.8	6.7	1.5	6.4	ns
t_{PZL}			1.5	7.1	2.4	6.8	
t_{PHZ}	\overline{OE}	A, B, or C	0.8	7.2	1.5	6	ns
t_{PLZ}			0.8	6.4	1.9	6.1	

SN54ABTH32316, SN74ABTH32316 16-BIT TRI-PORT UNIVERSAL BUS EXCHANGERS

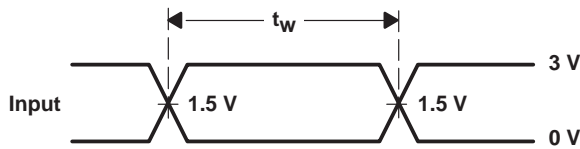
SCBS179E – JUNE 1992 – REVISED MAY 1997

PARAMETER MEASUREMENT INFORMATION

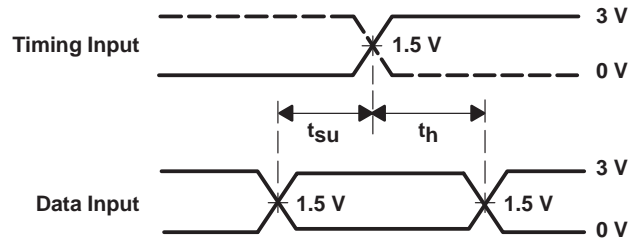


LOAD CIRCUIT

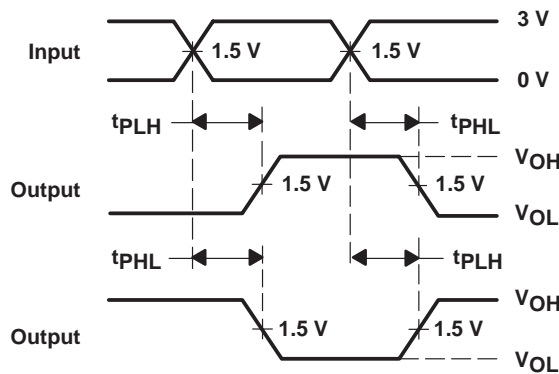
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



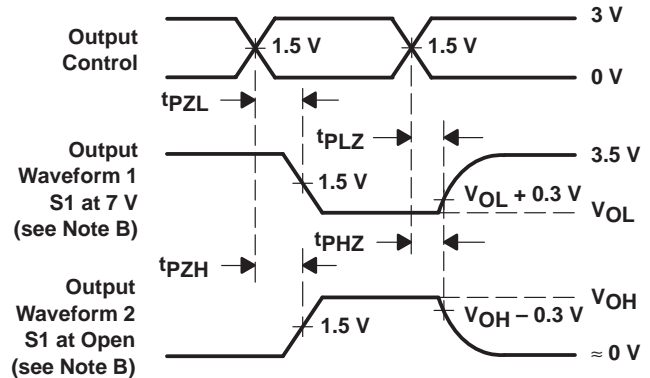
VOLTAGE WAVEFORMS
PULSE DURATION



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: 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.

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⁾
5962-9680801QXA	ACTIVE	CFP	HT	84	1	TBD	POST-PLATE	N / A for Pkg Type
SN74ABTH32316PN	ACTIVE	LQFP	PN	80	119	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
SN74ABTH32316PNG4	ACTIVE	LQFP	PN	80	119	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR
SNJ54ABTH32316HT	ACTIVE	CFP	HT	84	1	TBD	POST-PLATE	N / A for Pkg Type

⁽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⁾ 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)

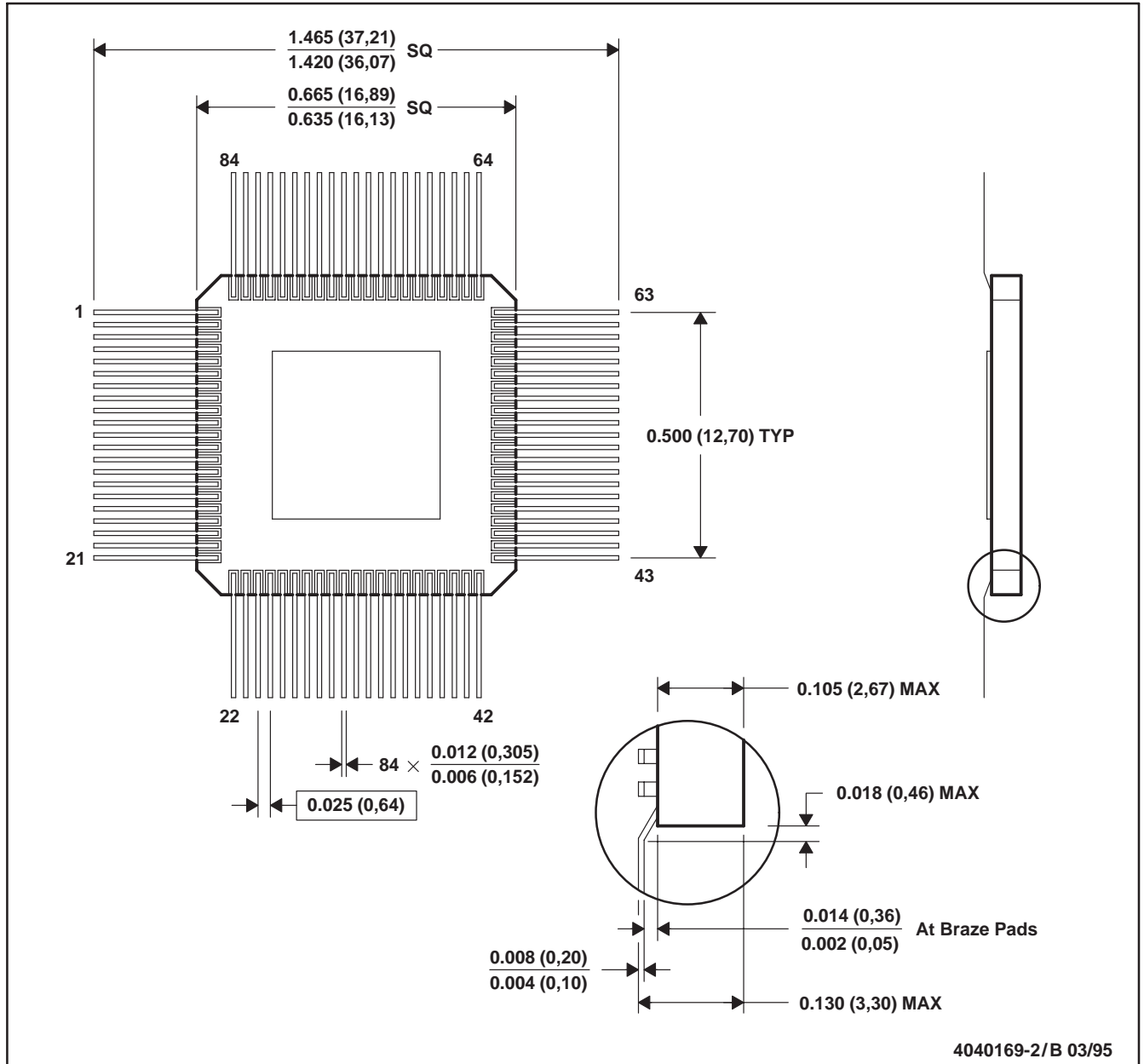
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

HT (S-CQFP-F84)

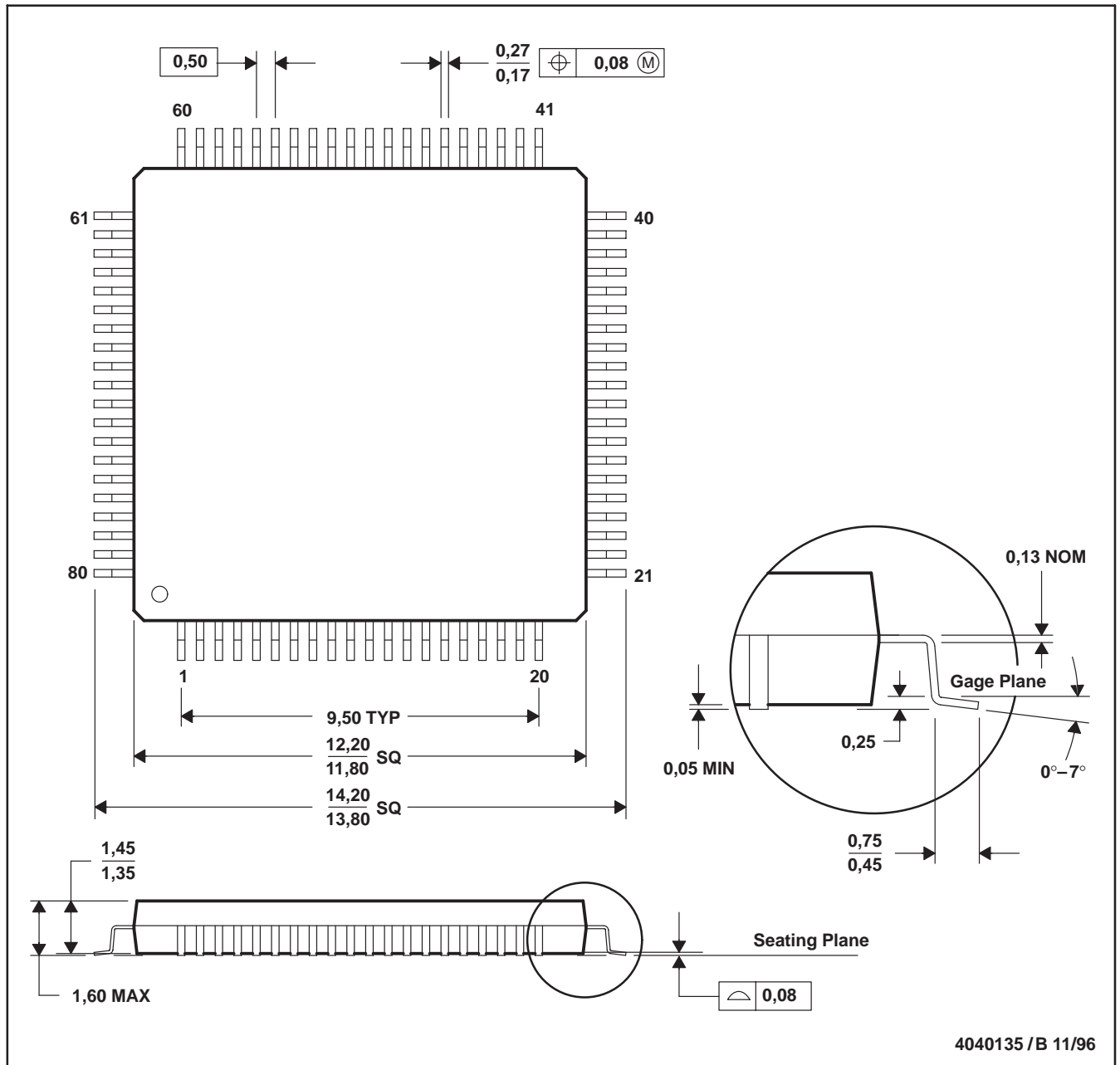
CERAMIC QUAD FLATPACK



- 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 metal lid.
 D. The terminals are gold plated.
 E. Falls within JEDEC MO-090 AA

PN (S-PQFP-G80)

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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
Low Power Wireless	www.ti.com/lpw	Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265



ООО «НИОКРсистемс» - это оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов. Реализуемая нашей компанией продукция насчитывает более полумиллиона наименований.

Благодаря этому наша компания предлагает к поставке практически не ограниченный ассортимент компонентов как оптовыми, мелкооптовыми партиями, так и в розницу.

Благодаря развитой сети поставщиков, помогаем в поиске и приобретении экзотичных или снятых с производства компонентов.

Наша компания это:

- Гарантия качества поставляемой продукции
- Широкий ассортимент
- Минимальные сроки поставок
- Техническая поддержка
- Подбор комплектации
- Индивидуальный подход
- Гибкое ценообразование
- Работаем по 275 ФЗ