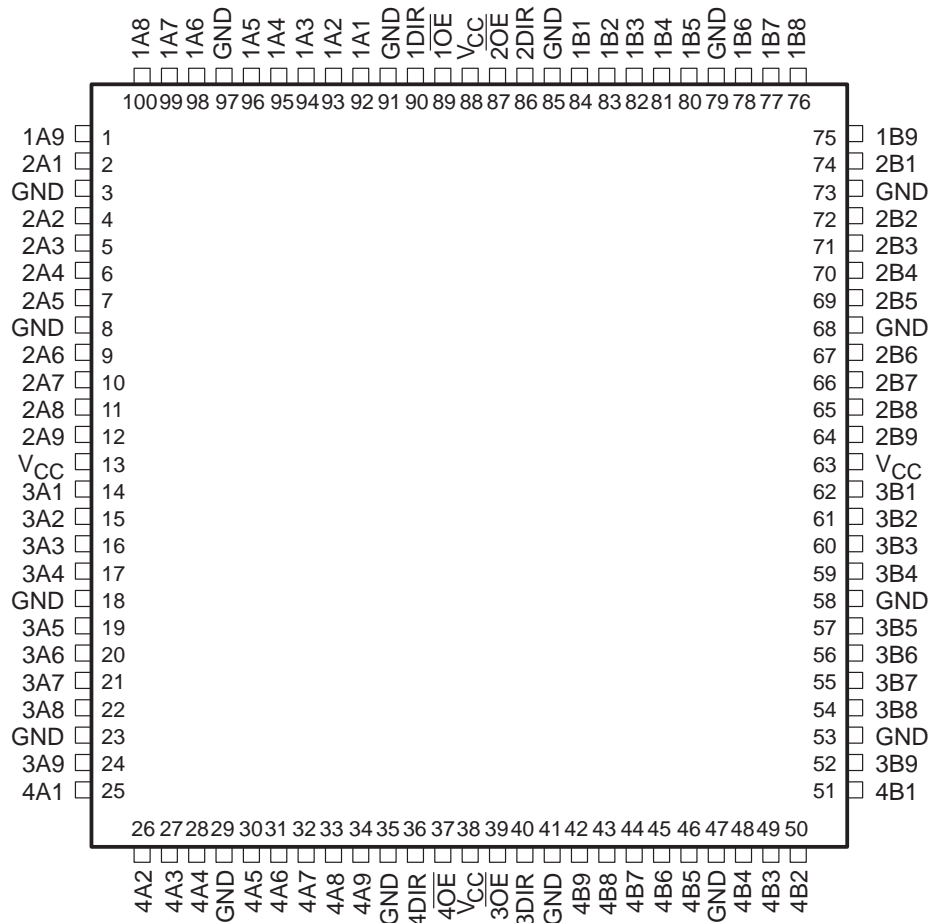


# SN54ABT32245, SN74ABT32245 36-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS228C – JUNE 1992 – APRIL 1995

- 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,  $T_A = 25^\circ\text{C}$
- 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 Inputs Eliminate the Need for External Pullup Resistors
- Packaged in 100-Pin Plastic Thin Quad Flat (PZ) Package With  $14 \times 14\text{-mm}$  Body Using 0.5-mm Lead Pitch

SN74ABT32245 . . . PZ PACKAGE  
(TOP VIEW)



## description

The 'ABT32245 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 upon 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.

Widebus+ and EPIC-II B 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  
POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251-1443

Copyright © 1995, Texas Instruments Incorporated

# SN54ABT32245, SN74ABT32245 36-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS228C – JUNE 1992 – APRIL 1995

---

## description (continued)

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.

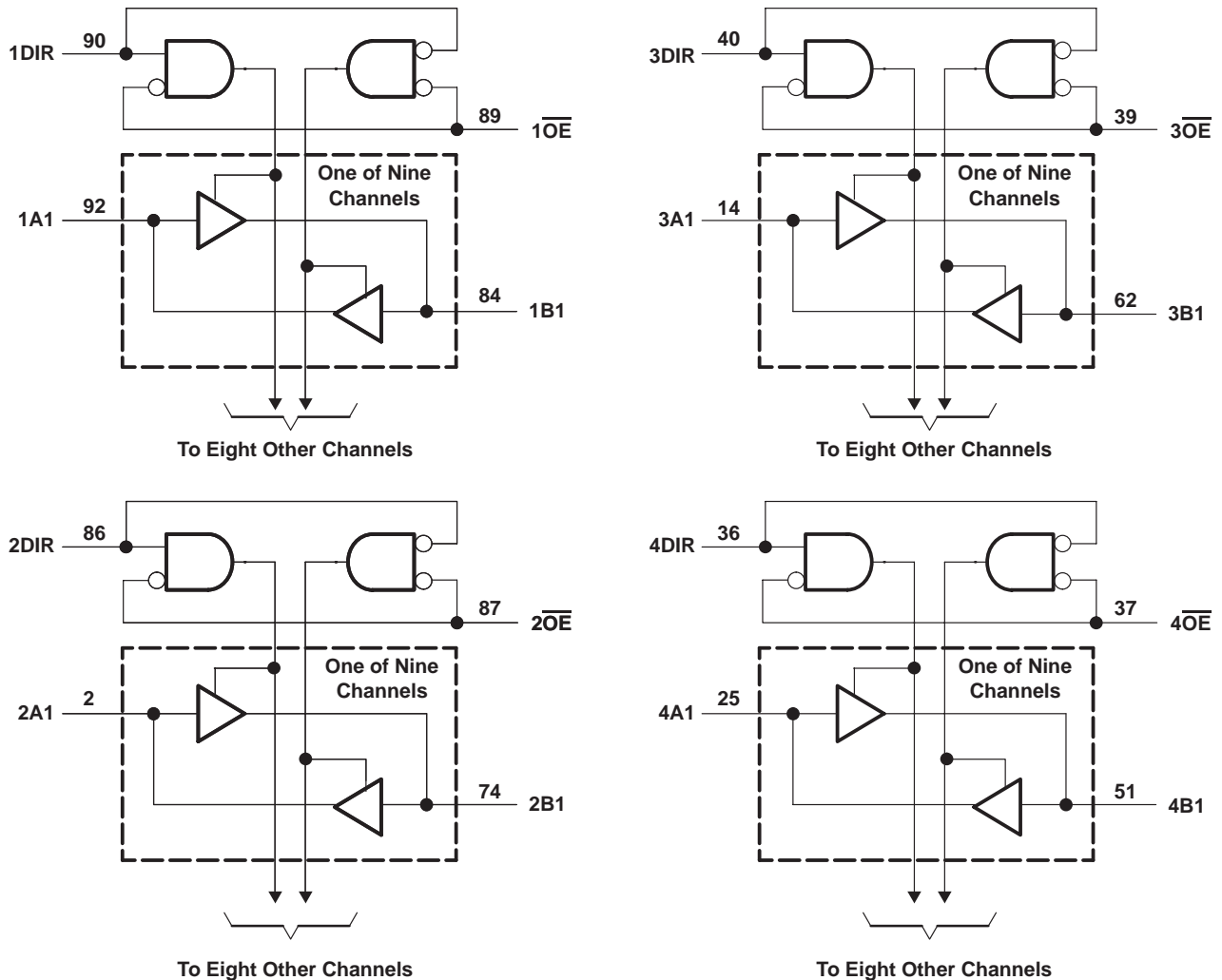
Active bus-hold circuitry holds unused or floating data inputs at a valid logic level.

The SN54ABT32245 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ABT32245 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

FUNCTION TABLE  
(each 9-bit section)

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

**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, $V_I$ (except I/O ports) (see Note 1) .....	-0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, $V_O$ .....	-0.5 V to 5.5 V
Current into any output in the low state, $I_{OL}$ : SN54ABT32245 .....	96 mA
SN74ABT32245 .....	128 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ ) .....	-18 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ ) .....	-50 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2) .....	1.2 W
Storage temperature range .....	$-65^\circ\text{C}$ to $150^\circ\text{C}$

† 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 maximum package power dissipation is calculated using a junction temperature of  $150^\circ\text{C}$  and a board trace length of 75 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

# SN54ABT32245, SN74ABT32245

## 36-BIT BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

SCBS228C – JUNE 1992 – APRIL 1995

#### recommended operating conditions

		SN54ABT32245		SN74ABT32245		UNIT
		MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5.5	4.5	5.5	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	0	V <sub>CC</sub>	0	V <sub>CC</sub>	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	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

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265  
 POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251-1443

# SN54ABT32245, SN74ABT32245 36-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS228C – JUNE 1992 – APRIL 1995

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

PARAMETER	TEST CONDITIONS	SN54ABT32245			SN74ABT32245			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			
	$V_{CC} = 4.5\text{ V}$ $I_{OH} = -24\text{ mA}$ $I_{OH} = -32\text{ mA}$	2			2			
$V_{OL}$	$V_{CC} = 4.5\text{ V}$ $I_{OL} = 48\text{ mA}$ $I_{OL} = 64\text{ mA}$	0.55			0.55			V
		0.55			0.55			
$I_I$	Control inputs $V_{CC} = 0\text{ to }5.5\text{ V}$ , $V_I = V_{CC}\text{ or GND}$	$\pm 1$			$\pm 1$			$\mu\text{A}$
	A or B ports $V_{CC} = 2.1\text{ V to }5.5\text{ V}$ , $V_I = V_{CC}\text{ or GND}$	$\pm 20$			$\pm 20$			
$I_{I(\text{hold})}$	A or B ports $V_{CC} = 4.5\text{ V}$ $V_I = 0.8\text{ V}$ $V_I = 2\text{ V}$	100			100			$\mu\text{A}$
		-100			-100			
$I_{OZPU}^\ddagger$	$V_{CC} = 0\text{ to }2.1\text{ V}$ , $\overline{OE} = X$ , $V_O = 0.5\text{ V to }2.7\text{ V}$	$\pm 50$			$\pm 50$			$\mu\text{A}$
$I_{OZPD}^\ddagger$	$V_{CC} = 2.1\text{ V to }0$ , $\overline{OE} = X$ , $V_O = 0.5\text{ V to }2.7\text{ V}$	$\pm 50$			$\pm 50$			$\mu\text{A}$
$I_{OZH}^\S$	$V_{CC} = 2.1\text{ V to }5.5\text{ V}$ , $V_O = 2.7\text{ V}$ , $\overline{OE} \geq 2\text{ V}$	10			10			$\mu\text{A}$
$I_{OZL}^\S$	$V_{CC} = 2.1\text{ V to }5.5\text{ V}$ , $V_O = 0.5\text{ V}$ , $\overline{OE} \geq 2\text{ V}$	-10			-10			$\mu\text{A}$
$I_{\text{off}}$	$V_{CC} = 0$ , $V_I\text{ or }V_O \leq 4.5\text{ V}$	$\pm 100$			$\pm 100$			$\mu\text{A}$
$I_{CEX}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 5.5\text{ V}$   Outputs high	50			50			$\mu\text{A}$
$I_O^\parallel$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.5\text{ V}$	-50	-100	-180	-50	-100	-180	mA
$I_{CC}$	$V_{CC} = 5.5\text{ V}$ , $I_O = 0$ , $V_I = V_{CC}\text{ or GND}$	Outputs high			3			mA
		Outputs low			20			
		Outputs disabled			2			
$\Delta I_{CC}^\#$	$V_{CC} = 5.5\text{ V}$ , One input at 3.4 V, Other inputs at $V_{CC}$ or GND	1			1			mA
$C_i$	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.

§ The parameters  $I_{OZH}$  and  $I_{OZL}$  include the input leakage current.

¶ 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.

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



**SN54ABT32245, SN74ABT32245**  
**36-BIT BUS TRANSCEIVERS**  
**WITH 3-STATE OUTPUTS**

SCBS228C – JUNE 1992 – APRIL 1995

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

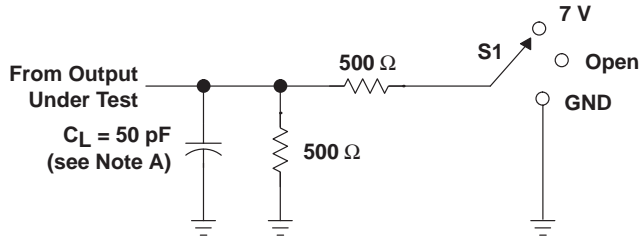
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5$ V, $T_A = 25^\circ$ C			SN54ABT32245		SN74ABT32245		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	A or B	B or A	1.7	3.2	4.4	1.7	5.3	1.7	5	ns
$t_{PHL}$			1.7	3.3	4.6	1.7	5.3	1.7	5.2	
$t_{PZH}$	$\overline{OE}$	B or A	1.6	4.2	6.1	1.6	7.6	1.6	7.3	ns
$t_{PZL}$			2.7	5.2	7	2.7	8.2	2.7	8.1	
$t_{PHZ}$	$\overline{OE}$	B or A	1.3	3.9	6.1	1.3	6.7	1.3	6.5	ns
$t_{PLZ}$			2	4.4	6.6	2	7.2	2	6.9	

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



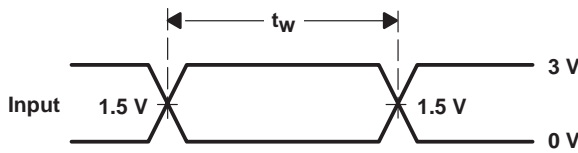
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265  
 POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251-1443

PARAMETER MEASUREMENT INFORMATION

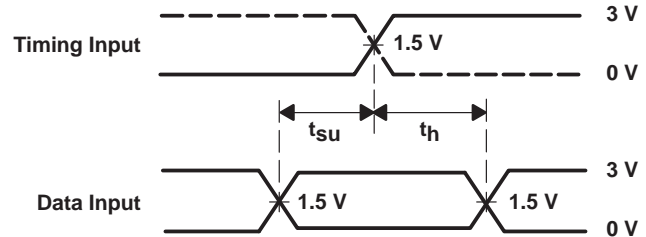


TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	7 V
$t_{PHZ}/t_{PZH}$	Open

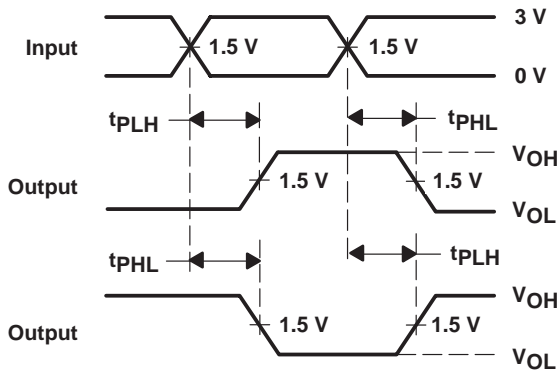
LOAD CIRCUIT FOR OUTPUTS



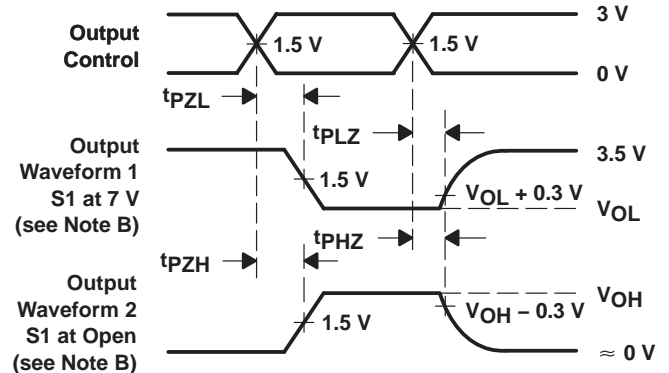
VOLTAGE WAVEFORMS  
PULSE DURATION



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:  $PRR \leq 10$  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.

Figure 1. Load Circuit and Voltage Waveforms

## 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 TI 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. Information of third parties may be subject to additional restrictions.

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.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

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

### Products

Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.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>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2008, Texas Instruments Incorporated