

SN74ALVC16245

16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS

SCAS419D – JANUARY 1993 – REVISED AUGUST 1995

- **EPIC™** (Enhanced-Performance Implanted CMOS) Submicron Process
- Member of the Texas Instruments **Widebus™** Family
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Latch-Up Performance Exceeds 250 mA Per JEDEC Standard JESD-17
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages

description

The SN74ALVC16245 16-bit (dual-octal) noninverting bus transceiver is designed for 2.3-V to 3.6-V V_{CC} operation; it is tested at 2.5-V, 2.7-V, and 3.3-V V_{CC} .

The SN74ALVC16245 is designed for asynchronous communication between data buses. The control-function implementation minimizes external timing requirements.

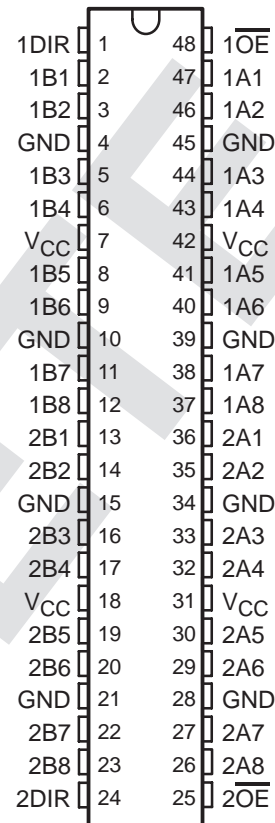
This device can be used as two 8-bit transceivers or one 16-bit transceiver. It allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable (\overline{OE}) input can be used to disable the device so that the buses are effectively isolated.

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

The SN74ALVC16245 is available in TI's shrink small-outline (DL) and thin shrink small-outline (DGG) packages, which provide twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The SN74ALVC16245 is characterized for operation from -40°C to 85°C .

DGG OR DL PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each 8-bit section)

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



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.

EPIC and Widebus 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

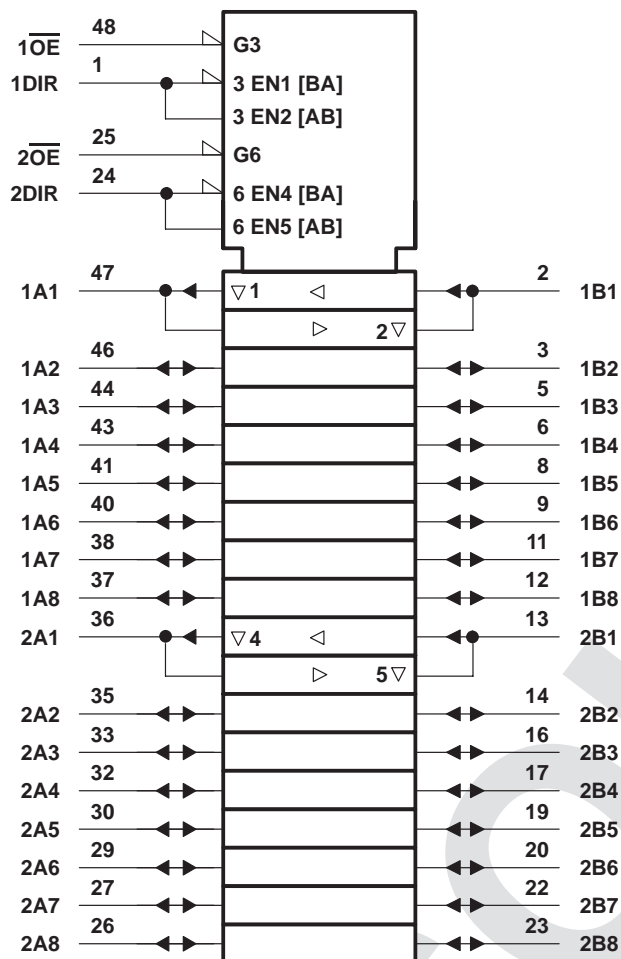
SN74ALVC16245

16-BIT BUS TRANSCEIVER

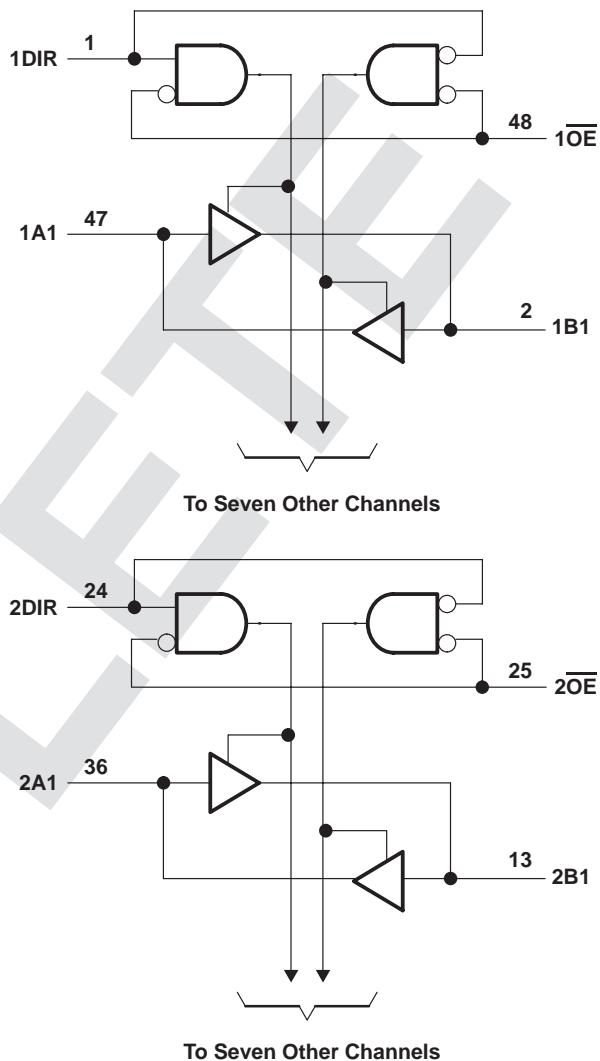
WITH 3-STATE OUTPUTS

SCAS419D – JANUARY 1993 – REVISED AUGUST 1995

logic symbol†



logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

SN74ALVC16245

16-BIT BUS TRANSCEIVER

WITH 3-STATE OUTPUTS

SCAS419D – JANUARY 1993 – REVISED AUGUST 1995

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 : Except I/O ports (see Note 1)	–0.5 V to $V_{CC} + 4.6$ V
I/O ports (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Output voltage range, V_O (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	±50 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±50 mA
Continuous current through V_{CC} or GND	±100 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3): DGG package	0.85 W
DL package	1.2 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 value is limited to 4.6 V maximum.
 3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

recommended operating conditions (see Note 4)

		MIN	MAX	UNIT
V_{CC}	Supply voltage	2.3	3.6	V
V_{IH}	High-level input voltage	$V_{CC} = 2.3$ V to 2.7 V	1.7	V
		$V_{CC} = 2.7$ V to 3.6 V	2	
V_{IL}	Low-level input voltage	$V_{CC} = 2.3$ V to 2.7 V	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	0.8	
V_I	Input voltage	0	V_{CC}	V
V_O	Output voltage	0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 2.3$ V	–12	mA
		$V_{CC} = 2.7$ V	–12	
		$V_{CC} = 3$ V	–24	
I_{OL}	Low-level output current	$V_{CC} = 2.3$ V	12	mA
		$V_{CC} = 2.7$ V	12	
		$V_{CC} = 3$ V	24	
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	ns/V
T_A	Operating free-air temperature	–40	85	°C

NOTE 4: Unused control inputs must be held high or low to prevent them from floating.



SN74ALVC16245

16-BIT BUS TRANSCEIVER

WITH 3-STATE OUTPUTS

SCAS419D – JANUARY 1993 – REVISED AUGUST 1995

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

PARAMETER		TEST CONDITIONS	V _{CC} [†]	T _A = –40°C to 85°C			UNIT
				MIN	TYP [‡]	MAX	
V _{OH}	I _{OH} = –100 μA		MIN to MAX	V _{CC} –0.2			V
	I _{OH} = –6 mA, V _{IH} = 1.7 V		2.3 V	2.0			
	I _{OH} = –12 mA	V _{IH} = 1.7 V	2.3 V	1.7			
		V _{IH} = 2 V	2.7 V	2.2			
		V _{IH} = 2 V	3 V	2.4			
	I _{OH} = –24 mA, V _{IH} = 2 V		3 V	2			
V _{OL}	I _{OL} = 100 μA		MIN to MAX	0.2			V
	I _{OL} = 6 mA, V _{IL} = 0.7 V		2.3 V	0.4			
	I _{OL} = 12 mA	V _{IL} = 0.7 V	2.3 V	0.7			
		V _{IL} = 0.8 V	2.7 V	0.4			
	I _{OL} = 24 mA, V _{IL} = 0.8 V		3 V	0.55			
I _I	V _I = V _{CC} or GND		3.6 V	±5			μA
I _{hold}	V _I = 0.7 V		2.3 V	45			μA
	V _I = 1.7 V			–45			
	V _I = 0.8 V		3 V	75			
	V _I = 2 V			–75			
I _{OZ} [§]	V _O = V _{CC} or GND		3.6 V	±10			μA
I _{CC}	V _I = V _{CC} or GND, I _O = 0		3.6 V	40			μA
ΔI _{CC}	V _{CC} = 3 V to 3.6 V, One input at V _{CC} – 0.6 V, Other inputs at V _{CC} or GND			750			μA
C _i	Control inputs	V _I = V _{CC} or GND	3.3 V	4			pF
C _{io}	A or B ports	V _O = V _{CC} or GND	3.3 V	9			pF

[†] For conditions shown as MIN or MAX, use the appropriate values under recommended operating conditions.

[‡] All typical values are at V_{CC} = 3.3 V.

[§] For I/O ports, the parameter I_{OZ} includes the input leakage current.

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figures 1 and 2)

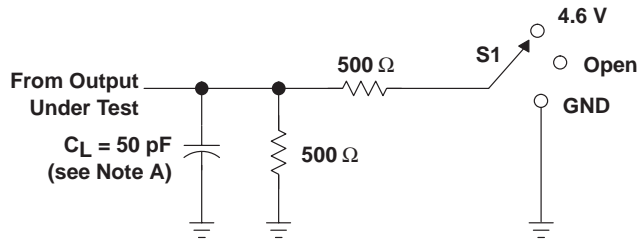
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 2.5 V ± 0.2 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _{pd}	A or B	B or A	1	5	4		1	3.6	ns
t _{en}	$\overline{\text{OE}}$	B or A	1	6.8	6		1	5	ns
t _{dis}	$\overline{\text{OE}}$	B or A	1	6	5.2		1	5	ns

operating characteristics, T_A = 25° C

PARAMETER		TEST CONDITIONS	V _{CC} = 2.5 V ± 0.2 V	V _{CC} = 3.3 V ± 0.3 V	UNIT
			TYP	TYP	
C _{pd}	Power dissipation capacitance	Outputs enabled	22	29	pF
			Outputs disabled	4	

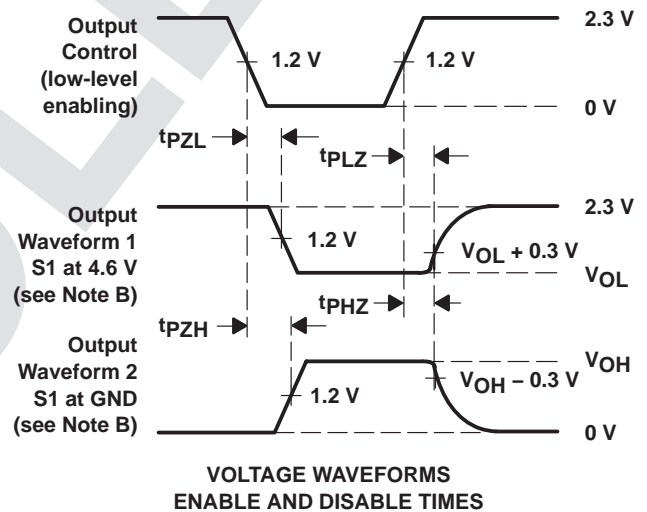
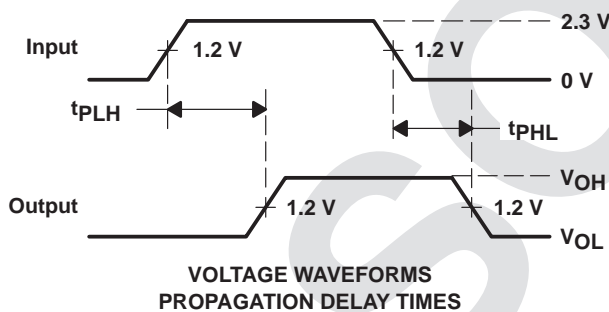
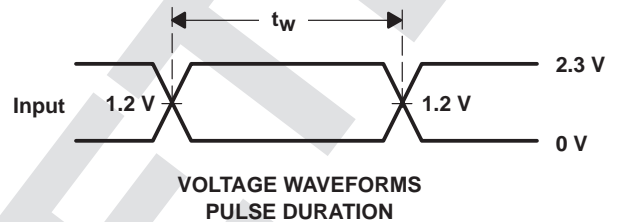
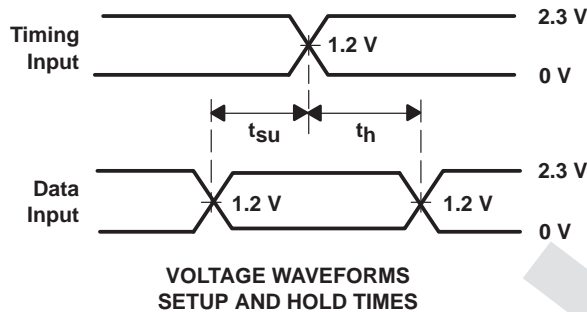


PARAMETER MEASUREMENT INFORMATION
 $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$



LOAD CIRCUIT

TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	4.6 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 $\leq 10\text{ MHz}$, $Z_O = 50\text{ }\Omega$, $t_r \leq 2.5\text{ ns}$, $t_f \leq 2.5\text{ ns}$.
 - D. The outputs are measured one at a time with one transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

SN74ALVC16245

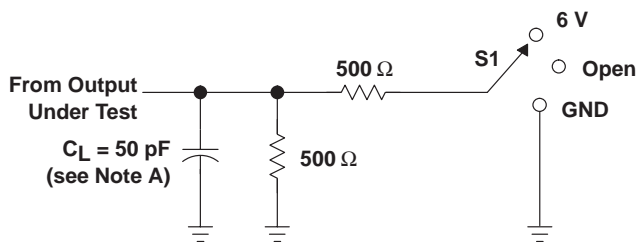
16-BIT BUS TRANSCEIVER

WITH 3-STATE OUTPUTS

SCAS419D – JANUARY 1993 – REVISED AUGUST 1995

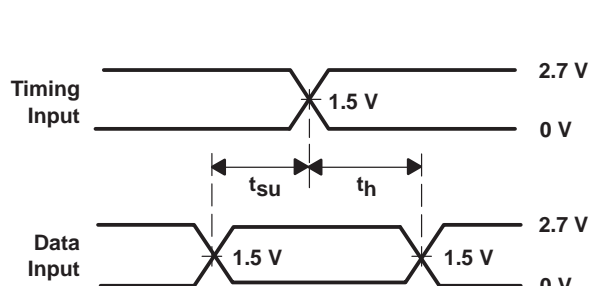
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7\text{ V AND } 3.3\text{ V} \pm 0.3\text{ V}$

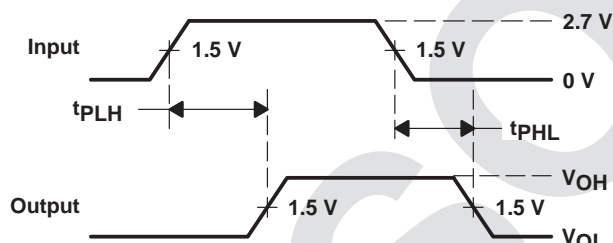


LOAD CIRCUIT

TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



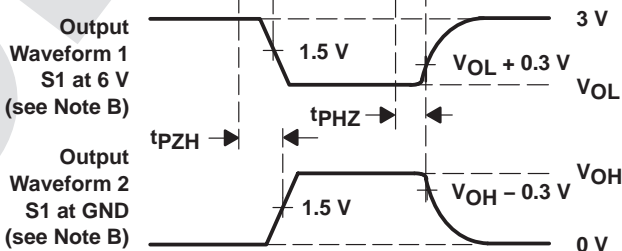
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

- 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: $PRR \leq 10\text{ MHz}$, $Z_O = 50\text{ }\Omega$, $t_r \leq 2.5\text{ ns}$, $t_f \leq 2.5\text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 2. 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		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps