- **Member of the Texas Instruments** Widebus™ Family
- **Undershoot Protection for Off-Isolation on** A and B Ports Up to -2 V
- **Bidirectional Data Flow, With Near-Zero Propagation Delay**
- Low ON-State Resistance (ron) Characteristics ($r_{on} = 3 \Omega$ Typical)
- **Low Input/Output Capacitance Minimizes Loading and Signal Distortion** $(C_{io(OFF)} = 5.5 pF Typical)$
- **Data and Control Inputs Provide Undershoot Clamp Diodes**
- **Low Power Consumption** $(I_{CC} = 3 \mu A Max)$
- V_{CC} Operating Range From 4 V to 5.5 V
- Data I/Os Support 0 to 5-V Signaling Levels (0.8-V, 1.2-V, 1.5-V, 1.8-V, 2.5-V, 3.3-V, 5-V)
- Control Inputs Can be Driven by TTL or 5-V/3.3-V CMOS Outputs
- **I**off Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- **ESD Performance Tested Per JESD 22**
 - 2000-V Human-Body Model (A114-B, Class II)
 - 1000-V Charged-Device Model (C101)
- **Supports Both Digital and Analog Applications: PCI Interface, Memory** Interleaving, Bus Isolation, Low-Distortion Signal Gating

NC 48 1 1 OE 47 🛮 1A1 1B1 🛚 1B2 🛮 3 46 1 1A2 GND 4 45 | GND 44 🛛 1A3 1B3 🛮 5 1B4 🛮 6 43 1A4 V_{CC} **□** 7 42 V_{CC} 41 1 1A5 1B5 | 8 40 🛮 1A6 1B6 📙 9 GND [] 10 39 GND 1B7 🛮 11 38 🛮 1A7 37 1A8 1B8 🛮 12 2B1 ∏ 13 36 T 2A1 2B2 14 35 2A2 GND [] 15 34 GND 2B3 16 33 2A3

2B4 🛮 17

2B6 20

GND [] 21

2B7 22

2B8 [] 23

NC [24

 V_{CC} $\cup{4}$ 2B5 🛮 19

18

DGG, DGV, OR DL PACKAGE

(TOP VIEW)

NC - No internal connection

32 2A4 31 V_{CC}

30 2A5

29 2A6

28 GND

27 2A7

26 2A8

25 20E

description/ordering information

ORDERING INFORMATION

TA	PACK	AGE [†]	ORDERABLE PART NUMBER	TOP-SIDE MARKING		
−40°C to 85°C	CCOD DI	Tube	SN74CBT16245CDL	ODT400450		
	SSOP – DL	Tape and reel	SN74CBT16245CDLR	CBT16245C		
	TSSOP – DGG	Tube	SN74CBT16245CDGG	CBT16245C		
	1330P - DGG	Tape and reel	SN74CBT16245CDGGR	CB116245C		
	TVSOP - DGV	Tape and reel	SN74CBT16245CDGVR	CY245C		

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



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 is a trademark of Texas Instruments.



description/ordering information (continued)

The SN74CBT16245C is a high-speed TTL-compatible FET bus switch with low ON-state resistance (r_{on}), allowing for minimal propagation delay. Active Undershoot-Protection Circuitry on the A and B ports of the SN74CBT16245C provides protection for undershoot up to -2 V by sensing an undershoot event and ensuring that the switch remains in the proper OFF state.

The SN74CBT16245C is organized as two 8-bit bus switches with separate output-enable $(1\overline{OE}, 2\overline{OE})$ inputs. It can be used as two 8-bit bus switches or as one 16-bit bus switch. When \overline{OE} is low, the associated 8-bit bus switch is ON, and the A port is connected to the B port, allowing bidirectional data flow between ports. When \overline{OE} is high, the associated 8-bit bus switch is OFF and the high-impedance state exists between the A and B ports.

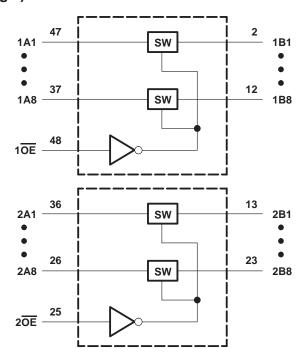
This device is fully specified for partial-power-down applications using I_{off}. The I_{off} feature ensures that damaging current will not backflow through the device when it is powered down. The device has isolation during power off.

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.

FUNCTION TABLE (each 8-bit bus switch)

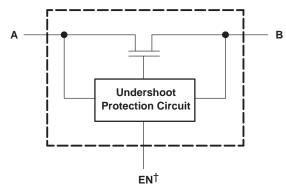
INPUT OE	INPUT/OUTPUT A	FUNCTION
L	В	A port = B port
Н	Z	Disconnect

logic diagram (positive logic)





simplified schematic, each FET switch (SW)



†EN is the internal enable signal applied to the switch.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage range, V _{CC}	0.5 V to 7 V
Control input voltage range, V _{IN} (see Notes 1 and 2)	0.5 V to 7 V
Switch I/O voltage range, V _{I/O} (see Notes 1, 2, and 3)	0.5 V to 7 V
Control input clamp current, I _{IK} (V _{IN} < 0)	–50 mA
I/O port clamp current, $I_{I/OK}$ ($V_{I/O}$ < 0)	–50 mA
ON-state switch current, I _{I/O} (see Note 4)	±128 mA
Continuous current through V _{CC} or GND terminals	±100 mA
Package thermal impedance, θ _{JA} (see Note 5): DGG package	70°C/W
DGV package	58°C/W
DL package	63°C/W
Storage temperature range, T _{sto}	. −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. All voltages are with respect to ground unless otherwise specified.
 - 2. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 - 3. V_I and V_O are used to denote specific conditions for $V_{I/O}$.
 - 4. II and IO are used to denote specific conditions for II/O.
 - 5. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 6)

		MIN	MAX	UNIT
Vcc	Supply voltage	4	5.5	V
VIH	High-level control input voltage	2	5.5	V
VIL	Low-level control input voltage	0	8.0	V
V _{I/O}	Data input/output voltage	0	5.5	V
TA	Operating free-air temperature	-40	85	°C

NOTE 6: 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.



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

PAF	RAMETER		TEST CONDITIO	NS	MIN	TYP [†]	MAX	UNIT
VIK	Control inputs	$V_{CC} = 4.5 \text{ V},$	$I_{IN} = -18 \text{ mA}$				-1.8	V
VIKU	Data inputs	V _{CC} = 5 V,	$0 \text{ mA} > I_{I} \ge -50 \text{ mA},$ $V_{IN} = V_{CC} \text{ or GND},$	Switch OFF			-2	V
I _{IN}	Control inputs	$V_{CC} = 5.5 \text{ V},$	$V_{IN} = V_{CC}$ or GND				±1	μΑ
loz‡		V _{CC} = 5.5 V,	$V_O = 0 \text{ to } 5.5 \text{ V},$ $V_I = 0,$	Switch OFF, V _{IN} = V _{CC} or GND			±10	μА
l _{off}		$V_{CC} = 0$,	$V_0 = 0 \text{ to } 5.5 \text{ V},$	V _I = 0			10	μΑ
ICC		V _{CC} = 5.5 V,	$I_{I/O} = 0,$ $V_{IN} = V_{CC} \text{ or GND},$	Switch ON or OFF			3	μА
∆lcc§	Control inputs	$V_{CC} = 5.5 \text{ V},$	One input at 3.4 V,	Other inputs at V _{CC} or GND			2.5	mA
C _{in}	Control inputs	$V_{IN} = 3 V \text{ or } 0$				3.5		pF
C _{io(OFF)})	$V_{I/O} = 3 \text{ V or } 0,$	Switch OFF,	$V_{IN} = V_{CC}$ or GND		5.5		pF
C _{io(ON)}		$V_{I/O} = 3 \text{ V or } 0,$	Switch ON,	V _{IN} = V _{CC} or GND		14		pF
		$V_{CC} = 4 \text{ V},$ TYP at $V_{CC} = 4 \text{ V}$	V _I = 2.4 V,	I _O = -15 mA		8	12	
r_{on} ¶				I _O = 64 mA		3	6	Ω
		V _{CC} = 4.5 V	V _I = 0	I _O = 30 mA	3 6			
			V _I = 2.4 V,	$I_{O} = -15 \text{ mA}$		5	10	

 $V_{\mbox{\footnotesize{IN}}}$ and $I_{\mbox{\footnotesize{IN}}}$ refer to control inputs. $V_{\mbox{\footnotesize{I}}},\,V_{\mbox{\footnotesize{O}}},\,I_{\mbox{\footnotesize{I}}},$ and $I_{\mbox{\footnotesize{O}}}$ refer to data pins.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM	TO	V _{CC} =	: 4 V	VCC =	= 5 V 5 V	UNIT
	(INPUT)	(OUTPUT)	MIN	MAX	MIN	MAX	
tpd#	A or B	B or A		0.24		0.15	ns
t _{en}	ŌĒ	A or B		5.4	1.5	5	ns
t _{dis}	ŌĒ	A or B		5.6	1.5	5.6	ns

[#] The propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).



[†] All typical values are at V_{CC} = 5 V (unless otherwise noted), T_A = 25°C.

For I/O ports, the parameter IOZ includes the input leakage current.

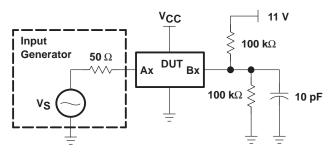
[§] This is the increase in supply current for each input that is at the specified voltage level, rather than V_{CC} or GND.

[¶] Measured by the voltage drop between the A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

undershoot characteristics (see Figures 1 and 2)

PARAMETER		TEST CONDI	MIN	TYP†	MAX	UNIT	
VOUTU	$V_{CC} = 5.5 \text{ V},$	Switch OFF,	$V_{IN} = V_{CC}$ or GND	2	V _{OH} -0.3		V

 $[\]dagger$ All typical values are at V_{CC} = 5 V (unless otherwise noted), T_A = 25°C.





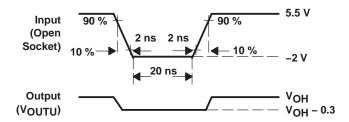
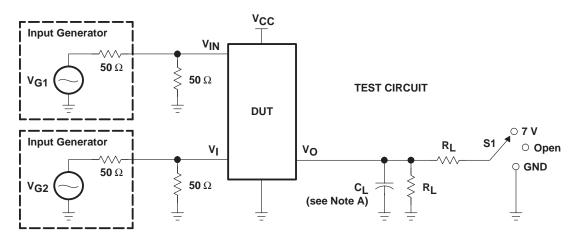
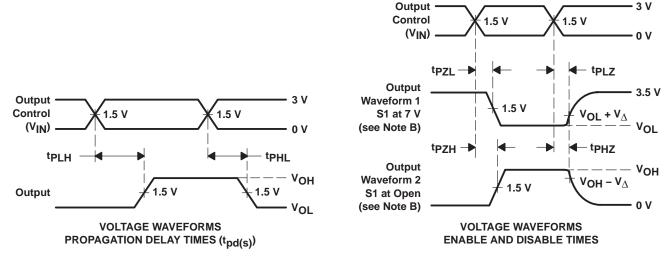


Figure 2. Transient Input Voltage (V_I) and Output Voltage (V_{OUTU}) Waveforms (Switch OFF)

PARAMETER MEASUREMENT INFORMATION



TEST	VCC	S1	RL	VI	CL	$v_{\!\scriptscriptstyle\Delta}$
^t pd(s)	$\begin{array}{c} \textbf{5 V} \pm \textbf{0.5 V} \\ \textbf{4 V} \end{array}$	Open Open	500 Ω 500 Ω	V _{CC} or GND V _{CC} or GND	50 pF 50 pF	
tPLZ/tPZL	5 V ± 0.5 V 4 V	7 V 7 V	500 Ω 500 Ω	GND GND	50 pF 50 pF	0.3 V 0.3 V
tPHZ/tPZH	5 V ± 0.5 V 4 V	Open Open	500 Ω 500 Ω	V _{CC}	50 pF 50 pF	0.3 V 0.3 V



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, $Z_O = 50 \Omega$, $t_f \leq$ 2.5 ns, $t_f \leq$ 2.5 ns.
- D. The outputs are measured one at a time with one transition per measurement.
- E. tpl 7 and tpHZ are the same as tdis.
- F. tpzL and tpzH are the same as ten.
- G. t_{PLH} and t_{PHL} are the same as $t_{pd(s)}$. The tpd propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).
- H. All parameters and waveforms are not applicable to all devices.

Figure 3. Test Circuit and Voltage Waveforms







com 27-Sep-2007

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
74CBT16245CDGGRE4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBT16245CDGGRG4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBT16245CDGVRE4	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBT16245CDGVRG4	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT16245CDGGR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT16245CDGVR	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT16245CDL	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT16245CDLG4	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT16245CDLR	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT16245CDLRG4	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(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.

PACKAGE MATERIALS INFORMATION

www.ti.com 11-Aug-2009

TAPE AND REEL INFORMATION





A0	Dimension designed to accommodate the component width
	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74CBT16245CDGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	15.8	1.8	12.0	24.0	Q1
SN74CBT16245CDGVR	TVSOP	DGV	48	2000	330.0	16.4	7.1	10.2	1.6	12.0	16.0	Q1
SN74CBT16245CDLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

www.ti.com 11-Aug-2009



*All dimensions are nominal

7 III GITTIOTIOTOTIO GITO TIOTITICA							
Device Package Ty		e Type Package Drawing		SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CBT16245CDGGR	TSSOP	DGG	48	2000	346.0	346.0	41.0
SN74CBT16245CDGVR	TVSOP	DGV	48	2000	346.0	346.0	33.0
SN74CBT16245CDLR	SSOP	DL	48	1000	346.0	346.0	49.0

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 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 protrusion not to exceed 0,15.

D. Falls within JEDEC MO-153

DL (R-PDSO-G**)

48 PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



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 MO-118

DGV (R-PDSO-G**)

24 PINS SHOWN

PLASTIC SMALL-OUTLINE



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 per side.

D. Falls within JEDEC: 24/48 Pins – MO-153 14/16/20/56 Pins – MO-194

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:

Applications Products Amplifiers amplifier.ti.com Audio www.ti.com/audio Data Converters Automotive www.ti.com/automotive dataconverter.ti.com DLP® Products Broadband www.dlp.com www.ti.com/broadband DSP Digital Control dsp.ti.com www.ti.com/digitalcontrol Clocks and Timers www.ti.com/clocks Medical www.ti.com/medical Military Interface www.ti.com/military interface.ti.com Optical Networking Logic logic.ti.com www.ti.com/opticalnetwork Power Mgmt power.ti.com Security www.ti.com/security Telephony Microcontrollers microcontroller.ti.com www.ti.com/telephony Video & Imaging www.ti-rfid.com www.ti.com/video RF/IF and ZigBee® Solutions www.ti.com/lprf Wireless www.ti.com/wireless

> Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2009, Texas Instruments Incorporated