

## FEATURES

Controlled Baseline

 One Assembly/Test Site, One Fabrication Site

- Extended Temperature Performance of -55°C to 125°C
- Enhanced Diminishing Manufacturing Sources (DMS) Support
- Enhanced Product-Change Notification
- Qualification Pedigree (1)
- Typical V<sub>OLP</sub> (Output Ground Bounce) <0.8 V at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C
- Typical V<sub>OHV</sub> (Output V<sub>OH</sub> Undershoot) >2.3 V at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C
- Supports Mixed-Mode Voltage Operation on All Ports
- I<sub>off</sub> Supports Partial-Power-Down Mode Operation
- (1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

## **DESCRIPTION/ORDERING INFORMATION**

This hex Schmitt-trigger inverter is designed for 2-V to 5.5-V  $V_{CC}$  operation.

The SN74LV14A contains six independent inverters. This device performs the Boolean function  $Y = \overline{A}$ .

This device is fully specified for partial-power-down applications using I<sub>off</sub>. The I<sub>off</sub> circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

T <sub>A</sub>	PACKAG	GE <sup>(1)</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 105°C	TSSOP – PW	Tape and reel	SN74LV14ATPWREP	LV14AEP
–55°C to 125°C	SOIC – D	Tape and reel	SN74LV14AMDREP	LV14AEP
-55 C 10 125 C	TSSOP – PW	Tape and reel	SN74LV14AMPWREP	LV14AEP

#### ORDERING INFORMATION

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

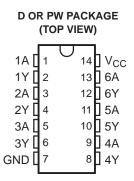
### FUNCTION TABLE (each inverter)

INPUT A	OUTPUT Y
Н	L
L	н



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.

- 2000-V Human-Body Model (A114-A)
- 200-V Machine Model (A115-A)
- 1000-V Charged-Device Model (C101)

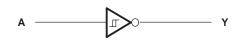


# SN74LV14A-EP HEX SCHMITT-TRIGGER INVERTER

SCLS499C-MAY 2003-REVISED JUNE 2006



### LOGIC DIAGRAM, EACH INVERTER (POSITIVE LOGIC)



## Absolute Maximum Ratings<sup>(1)</sup>

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

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage range		-0.5	7	V
VI	Input voltage range <sup>(2)</sup>		-0.5	7	V
Vo	Voltage range applied to any output in the high-	impedance or power-off state <sup>(2)</sup>	-0.5	7	V
Vo	Output voltage range <sup>(2)(3)</sup>		-0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	Input clamp current	V <sub>1</sub> < 0		-20	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0		-50	
I <sub>O</sub>	Continuous output current	$V_{O} = 0$ to $V_{CC}$		±25	mA
	Continuous current through $V_{CC}$ or GND			±50	mA
0	Thermal impedance <sup>(4)</sup>	D package		133.5	°C/W
$\theta_{JA}$		PW package		113	C/W
T <sub>stg</sub>	Storage temperature range		-65	150	°C

(1) 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.

The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed. (2)

(3) This value is limited to 5.5 V maximum.

(4) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions<sup>(1)</sup>

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage		2	5.5	V
		$V_{CC} = 2 V$	1.5		
V	High lovel input veltage	$V_{CC}$ = 2.3 V to 2.7 V	$V_{CC}  imes 0.7$		V
V <sub>IH</sub>	High-level input voltage	$V_{CC}$ = 3 V to 3.6 V	$V_{CC}  imes 0.7$		v
		$V_{CC}$ = 4.5 V to 5.5 V	$V_{CC}  imes 0.7$		
		$V_{CC} = 2 V$		0.5	
v		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		$V_{\text{CC}} \times 0.3$	V
V <sub>IL</sub>	Low-level input voltage	$V_{CC}$ = 3 V to 3.6 V		$V_{CC}  imes 0.3$	v
		$V_{CC}$ = 4.5 V to 5.5 V		$V_{CC}  imes 0.3$	
VI	Input voltage		0	5.5	V
Vo	Output voltage		0	V <sub>CC</sub>	V
		$V_{CC} = 2 V$		-50	μΑ
		$V_{CC}$ = 2.3 V to 2.7 V		-2	
I <sub>OH</sub>	High-level output current	$V_{CC}$ = 3 V to 3.6 V		-6	mA
		$V_{CC}$ = 4.5 V to 5.5 V		-12	
		$V_{CC} = 2 V$		50	μΑ
		$V_{CC}$ = 2.3 V to 2.7 V		2	
I <sub>OL</sub> Low-level output current	Low-level output current	$V_{CC}$ = 3 V to 3.6 V		6	
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		12	
т		SN74LV14AT	-40	105	°C
Τ <sub>Α</sub>	Operating free-air temperature	SN74LV14AM	-55	125	Ű

(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. See the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

# SN74LV14A-EP HEX SCHMITT-TRIGGER INVERTER

SCLS499C-MAY 2003-REVISED JUNE 2006

## **Electrical Characteristics**

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

	ww	w.ti.com
SN74LV14AT	SN74LV14AM	
		— UI

TEXAS

INSTRUMENTS

PARAMETER	TEST CONDITIONS	V <sub>cc</sub>	SN74L	V14AT	SN74L		
PARAMETER	TEST CONDITIONS	Vcc	MIN	TYP MAX	MIN	ΤΥΡ ΜΑ	X
V <sub>T+</sub>		2.5 V		1.75		1.7	8
Positive-going		3.3 V		2.31		2.3	1 V
threshold		5 V		3.5		3	5
V <sub>T-</sub>		2.5 V	0.75		0.75		
Negative-going		3.3 V	0.99		0.97		V
threshold		5 V	1.5		1.5		
$\Delta V_T$		2.5 V	0.25	1	0.25		1
Hysteresis		3.3 V	0.33	1.32	0.33	1.3	7 V
$(V_{T+} - V_{T-})$		5 V	0.5	2	0.5		2
	I <sub>OH</sub> = -50 μA	2 V to 5.5 V	$V_{CC} - 0.1$		V <sub>CC</sub> – 0.1		
N/	$I_{OH} = -2 \text{ mA}$	2.3 V	2		2		V
V <sub>OH</sub>	$I_{OH} = -6 \text{ mA}$	3 V	2.48		2.48		v
	I <sub>OH</sub> = -12 mA	4.5 V	3.8		3.8		
	I <sub>OL</sub> = 50 μA	2 V to 5.5 V		0.1		0	1
M <sub>a</sub> .	$I_{OL} = 2 \text{ mA}$	2.3 V		0.4		0	4 V
V <sub>OL</sub>	$I_{OL} = 6 \text{ mA}$	3 V		0.44		0.4	4 <sup>v</sup>
	$I_{OL} = 12 \text{ mA}$	4.5 V		0.55		0.5	5
lı	$V_{I} = V_{CC} \text{ or } GND$	0 to 5.5 V		±1		<u>+</u>	1 μA
I <sub>CC</sub>	$V_{I} = V_{CC}$ or GND, $I_{O} = 0$	5.5 V		20		2	0 μΑ
I <sub>off</sub>	$V_{I} \text{ or } V_{O} = 0 \text{ to } 5.5 \text{ V}$	0 V		5			5 μΑ
C <sub>i</sub>	$V_1 = V_{CC}$ or GND	3.3 V		2.3		2.3	nf
Ui		5 V		2.3		2.3	pf

## **Switching Characteristics**

over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V  $\pm$  0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	(INPUT) (OUTPUT) CAPACITANCE		T,	₄ = 25°0	0	MIN	МАХ	UNIT	
FARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX		IVIAA	UNIT
t <sub>pd</sub>	А	Y	$C_L = 50 \text{ pF}$		9.6	16.3	1	20.4	ns

## **Switching Characteristics**

over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V  $\pm$  0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM	TO LOAD $T_A = 25^{\circ}C$				MIN	МАХ	UNIT	
FARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	IVITIN	IVIAA	
t <sub>pd</sub>	А	Y	$C_L = 50 \text{ pF}$		6.7	10.6	1	14	ns

## Noise Characteristics<sup>(1)</sup>

 $V_{CC}$  = 3.3 V,  $C_L$  = 50 pF,  $T_A$  = 25°C

	PARAMETER	MIN	TYP	MAX	UNIT
V <sub>OL(P)</sub>	Quiet output, maximum dynamic V <sub>OL</sub>		0.2	0.8	V
V <sub>OL(V)</sub>	Quiet output, minimum dynamic V <sub>OL</sub>		-0.1	-0.8	V
V <sub>OH(V)</sub>	Quiet output, minimum dynamic V <sub>OH</sub>		3.1		V
V <sub>IH(D)</sub>	High-level dynamic input voltage	2.31			V
V <sub>IL(D)</sub>	Low-level dynamic input voltage			0.99	V

(1) Characteristics are for surface-mount packages only.

## **Operating Characteristics**

 $T_A = 25^{\circ}C$ 

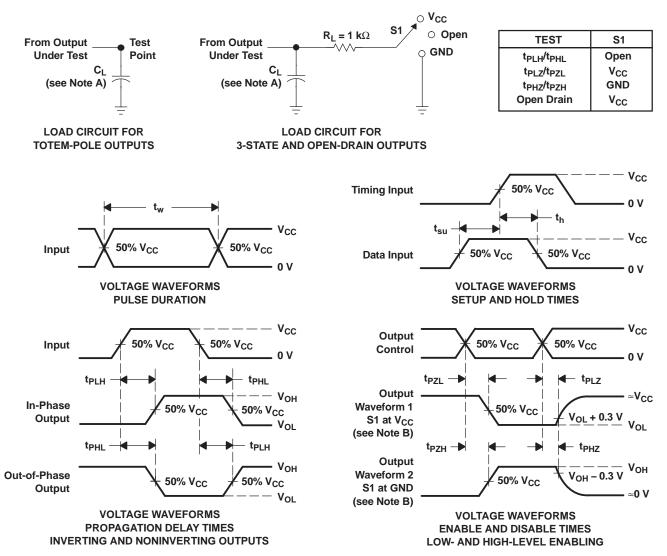
	PARAMETER	TEST CONDITIONS	V <sub>cc</sub>	TYP	UNIT
~	Dower dissinction conscitutes		3.3 V	8.8	~L
Cp	Power dissipation capacitance	$C_L = 50 \text{ pF},  f = 10 \text{ MHz}$	5 V	9.6	pF

# SN74LV14A-EP HEX SCHMITT-TRIGGER INVERTER

SCLS499C-MAY 2003-REVISED JUNE 2006



### PARAMETER MEASUREMENT INFORMATION



NOTES: A. CL 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  $\leq$  1 MHz, Z<sub>O</sub> = 50  $\Omega$ , t<sub>f</sub>  $\leq$  3 ns, t<sub>f</sub>  $\leq$  3 ns.
- D. The outputs are measured one at a time, with one input 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.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .
- H. All parameters and waveforms are not applicable to all devices.

#### Figure 1. Load Circuits and Voltage Waveforms

### **PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74LV14AMDREP	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV14AMPWREP	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV14AMPWREPG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV14ATPWREP	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
V62/03662-01XE	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
V62/03662-02XE	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
V62/03662-02YE	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

<sup>(3)</sup> 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.

#### OTHER QUALIFIED VERSIONS OF SN74LV14A-EP :

- Catalog: SN74LV14A
- Automotive: SN74LV14A-Q1

NOTE: Qualified Version Definitions:

• Catalog - TI's standard catalog product



## PACKAGE OPTION ADDENDUM

22-Sep-2008

• Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

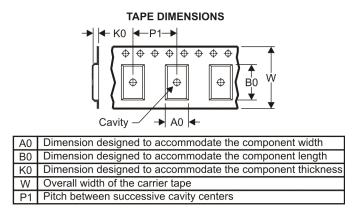
# **PACKAGE MATERIALS INFORMATION**

www.ti.com

Texas Instruments

### **TAPE AND REEL INFORMATION**





## 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
SN74LV14AMDREP	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LV14AMPWREP	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV14ATPWREP	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TEXAS INSTRUMENTS

www.ti.com

# PACKAGE MATERIALS INFORMATION

30-Jul-2010



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV14AMDREP	SOIC	D	14	2500	346.0	346.0	33.0
SN74LV14AMPWREP	TSSOP	PW	14	2000	346.0	346.0	29.0
SN74LV14ATPWREP	TSSOP	PW	14	2000	346.0	346.0	29.0

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.





NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



A. An integration of the information o

Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. Falls within JEDEC MO-153



## LAND PATTERN DATA



NOTES: A. All linear dimensions are in millimeters.

- B. This drawing is subject to change without notice.
- C. Publication IPC-7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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

**TI E2E Community Home Page** 

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2011, Texas Instruments Incorporated