54ACTQ574

54ACTQ574 Quiet Series Octal D Flip-Flop with TRI-STATE Outputs

Literature Number: SNOS064

National Semiconductor

August 1998

54ACTQ574
Quiet Series Octal D Flip-Flop with TRI-STATE® Outputs

General Description

The ACTQ574 is a high-speed, low-power octal D-type flip-flop with a buffered Common Clock (CP) and a buffered common Output Enable ($\overline{OE}$). The information presented to the D inputs is stored in the flip-flops on the LOW-to-HIGH clock (CP) transition.

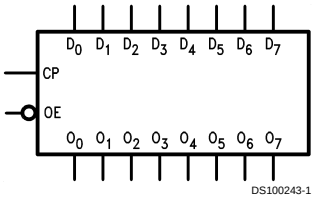
ACTQ574 utilizes Quiet Series technology to guarantee quiet output switching and improve dynamic threshold performance. FACT Quiet Series™ features GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

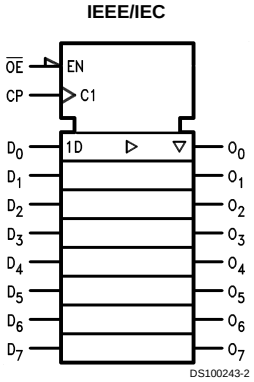
The ACTQ574 is functionally identical to the 'ACTQ374 but with different pin-out.

Features

- I_{CC} and I_{OZ} reduced by 50%
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Inputs and outputs on opposite sides of the package allowing easy interface with microprocessors
- Functionally identical to the ACTQ374
- TRI-STATE outputs drive bus lines or buffer memory address registers
- Outputs source/sink 24 mA
- Faster prop delays than the standard ACT574
- 4 kV minimum ESD immunity

Logic Diagrams





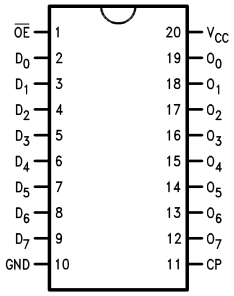
Pin Names	Description
D_0–D_7	Data Inputs
CP	Clock Pulse Input
$\overline{OE}$	TRI-STATE Output Enable Input
O_0–O_7	TRI-STATE Outputs

GTO™ is a trademark of National Semiconductor Corporation.
TRI-STATE® is a registered trademark of National Semiconductor Corporation.
FACT® is a registered trademark of Fairchild Semiconductor Corporation.
FACT Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

© 1998 National Semiconductor Corporation

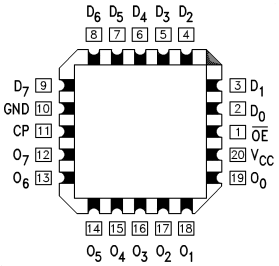
Connection Diagrams

Pin Assignment for DIP and Flatpak



DS100243-3

Pin Assignment for LCC



DS100243-4

Functional Description

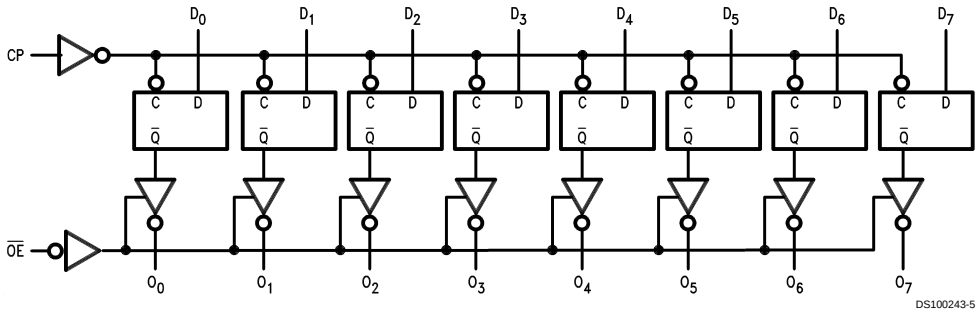
The ACTQ574 consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable ($\overline{OE}$) LOW, the contents of the eight flip-flops are available at the outputs. When $\overline{OE}$ is HIGH, the outputs go to the high impedance state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops.

Function Table

Inputs			Internal	Outputs	Function
$\overline{OE}$	CP	D	Q	O_N	
H	H	L	NC	Z	Hold
H	H	H	NC	Z	Hold
H	⌐	L	L	Z	Load
H	⌐	H	H	Z	Load
L	⌐	L	L	L	Data Available
L	⌐	H	H	H	Data Available
L	H	L	NC	NC	No Change in Data
L	H	H	NC	NC	No Change in Data

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance
⌐ = LOW-to-HIGH Transition
NC = No Change

Logic Diagram



DS100243-5

Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Diode Current (I_{IK})	
V_I = −0.5V	−20 mA
V_I = V_{CC} + 0.5V	+20 mA
DC Input Voltage (V_I)	−0.5V to V_{CC} + 0.5V
DC Output Diode Current (I_{OK})	
V_O = −0.5V	−20 mA
V_O = V_{CC} + 0.5V	+20 mA
DC Output Voltage (V_O)	−0.5V to V_{CC} + 0.5V
DC Output Source or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	−65˚C to +150˚C
DC Latch-Up Source or Sink Current	±300 mA
Junction Temperature (T_J)	
CDIP	175˚C

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'ACTQ	4.5V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
54ACTQ	−55˚C to +125˚C
Minimum Input Edge Rate ΔV/Δt	
'ACTQ Devices	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns

Note 1: All commercial packaging is not recommended for applications requiring greater than 2000 temperature cycles from −40˚C to +125˚C.

Note 2: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

DC Electrical Characteristics for 'ACTQ Family Devices

Symbol	Parameter	V_{CC} (V)	54ACTQ T_A = −55˚C to +125˚C Guaranteed Limits	Units	Conditions
V_{IH}	Minimum High Level Input Voltage	4.5	2.0	V	V_{OUT} = 0.1V
		5.5	2.0		or V_{CC} − 0.1V
V_{IL}	Maximum Low Level Input Voltage	4.5	0.8	V	V_{OUT} = 0.1V
		5.5	0.8		or V_{CC} − 0.1V
V_{OH}	Minimum High Level Output Voltage	4.5	4.4	V	I_{OUT} = −50 μA
		5.5	5.4		
					(Note 3)
					V_{IN} = V_{IL} or V_{IH}
		4.5	3.70	V	I_{OH}= −24 mA
		5.5	4.70		I_{OH}= −24 mA
V_{OL}	Maximum Low Level Output Voltage	4.5	0.1	V	I_{OUT} = 50 μA
		5.5	0.1		
					(Note 3)
					V_{IN} = V_{IL} or V_{IH}
		4.5	0.50	V	I_{OL} = 24 mA
		5.5	0.50		I_{OL} = 24 mA
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	μA	V_I = V_{CC}, GND
I_{OZ}	Maximum TRI-STATE Leakage Current	5.5	±5.0	μA	V_I = V_{IL}, V_{IH}
					V_O = V_{CC}, GND
I_{CCT}	Maximum I_{CC}/Input	5.5	1.6	mA	V_I = V_{CC} − 2.1V
I_{OLD}	(Note 4) Minimum Dynamic	5.5	50	mA	V_{OLD} = 1.65V Max
I_{OHD}	Output Current	5.5	−50	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5	80.0	μA	V_{IN} = V_{CC} or GND (Note 5)

DC Electrical Characteristics for 'ACTQ Family Devices (Continued)

Symbol	Parameter	V_{CC} (V)	54ACTQ T_A = −55°C to +125°C Guaranteed Limits	Units	Conditions
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	5.0	1.5	V	(Notes 6, 7)
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	5.0	−1.2	V	(Notes 6, 7)

Note 3: All outputs loaded; thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: I_{CC} for 54ACTQ @ 25°C is identical to 74ACTQ @ 25°C.

Note 6: Plastic DIP package.

Note 7: Max number of outputs defined as (n). Data inputs are driven 0V to 3V. One output @ GND.

Note 8: Max number of data inputs (n) switching. (n−1) inputs switching 0V to 3V ('ACTQ). Input-under-test switching: 3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), f = 1 MHz.

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V) (Note 9)	54ACTQ T_A = −55°C to +125°C C_L = 50 pF		Units
			Min	Max	
f_{max}	Maximum Clock Frequency	5.0	95		MHz
t_{PLH}, t_{PHL}	Propagation Delay CP to $\overline{O}_n$	5.0	1.0	11.0	ns
t_{PZH}, t_{PZL}	Output Enable Time	5.0	1.0	11.0	ns
t_{PHZ}, t_{PLZ}	Output Disable Time	5.0	1.0	10.0	ns

Note 9: Voltage Range 5.0 is 5.0V ±0.5V.

Note 10: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}). Parameter guaranteed by design.

AC Operating Requirements

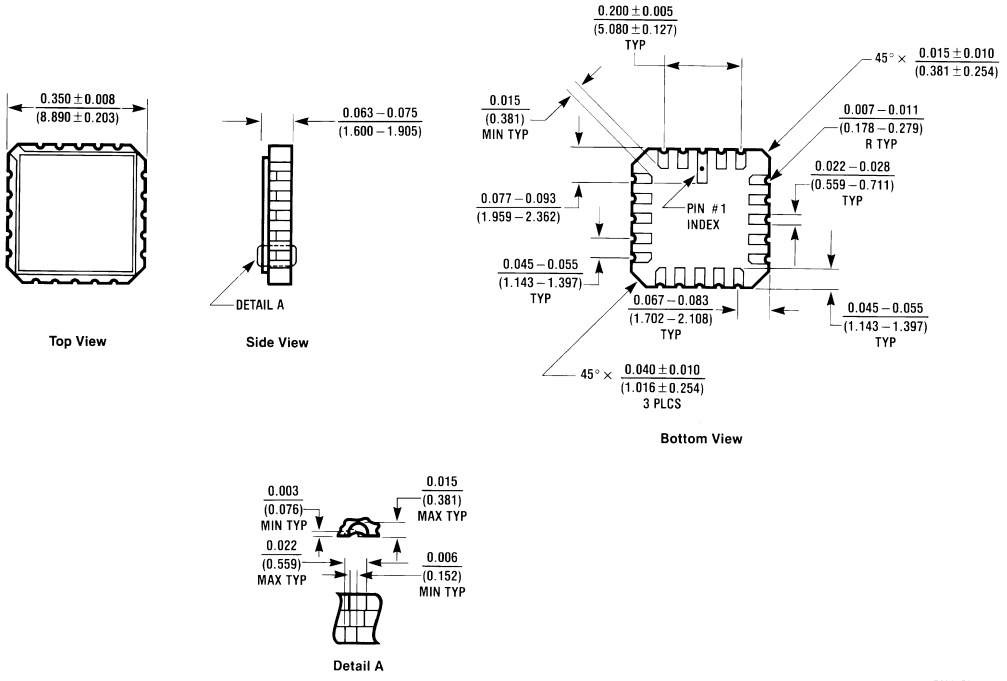
Symbol	Parameter	V_{CC} (V) (Note 11)	54ACTQ T_A = −55°C to +125°C C_L = 50 pF Guaranteed Minimum	Units
t_S	Setup Time, HIGH or LOW D_n to CP	5.0	3.5	ns
t_H	Hold Time, HIGH or LOW D_n to CP	5.0	2.0	ns
t_W	CP Pulse Width, HIGH or LOW	5.0	5.0	ns

Note 11: Voltage Range 5.0 is 5.0V ±0.5V

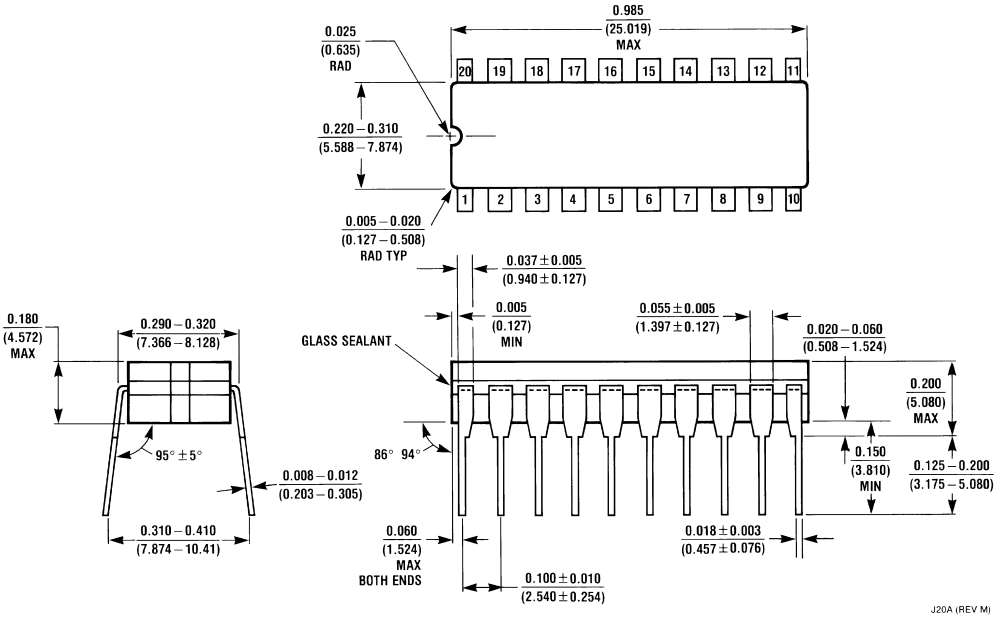
Capacitance

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = OPEN
C_{PD}	Power Dissipation Capacitance	40.0	pF	V_{CC} = 5.0V

Physical Dimensions inches (millimeters) unless otherwise noted

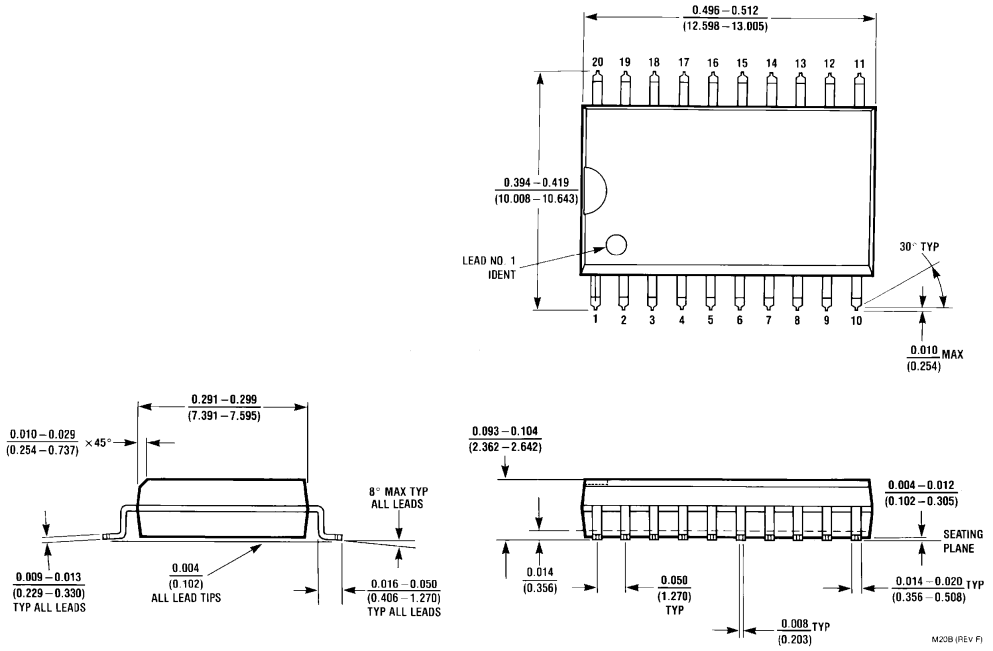


20-Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

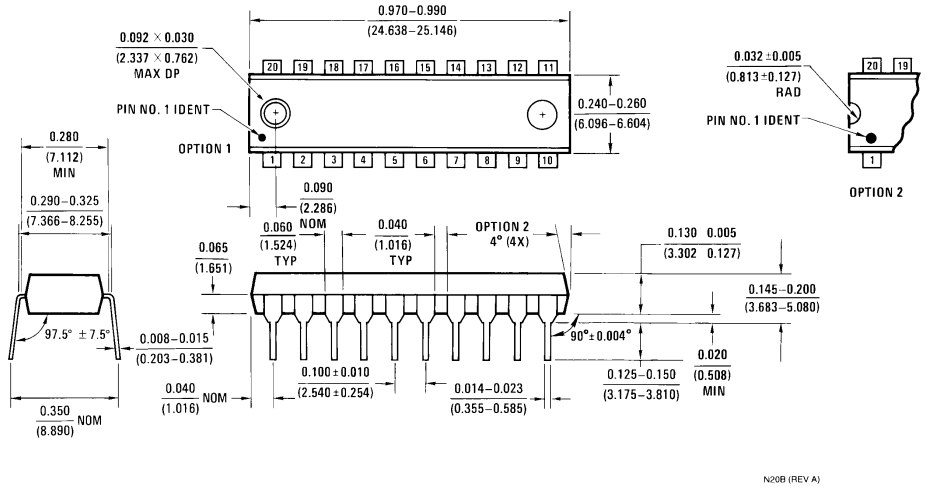


20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

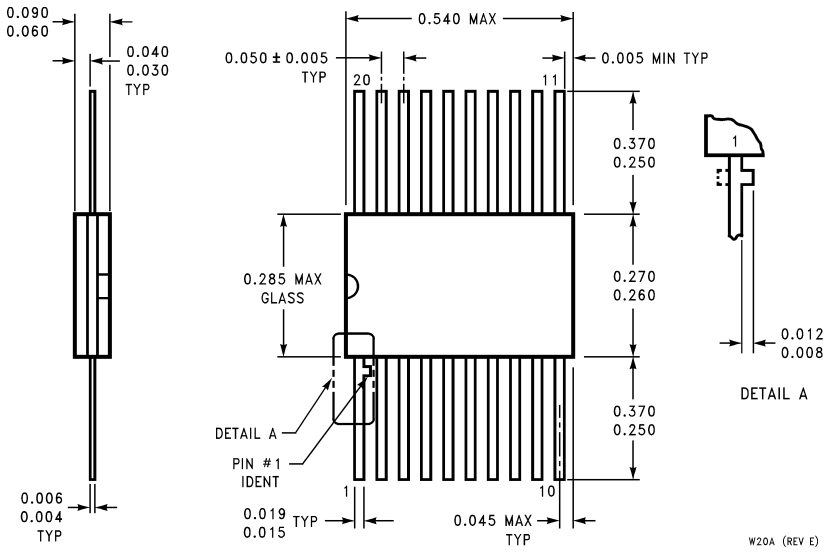


20-Lead Small Outline Integrated Circuit (S)
NS Package Number M20B



20-Lead Plastic Dual-In-LIne Package (P)
NS Package Number N20B

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Ceramic Flatpak (F)
NS Package Number W20A

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

National Semiconductor Corporation
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com

www.national.com

National Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80-530 85 85
English Tel: +49 (0) 1 80-532 78 32
Français Tel: +49 (0) 1 80-532 93 58
Italiano Tel: +49 (0) 1 80-534 16 80

National Semiconductor Asia Pacific Customer Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: sea.support@nsc.com

National Semiconductor Japan Ltd.
Tel: 81-3-5620-6175
Fax: 81-3-5620-6179

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

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		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		
	TI E2E Community Home Page		e2e.ti.com

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