

54ACT323

*54ACT323 8-Bit Universal Shift/Storage Register with Synchronous Reset and
Common I/O Pins*



Literature Number: SNOS137

54ACT323 8-Bit Universal Shift/Storage Register with Synchronous Reset and Common I/O Pins

General Description

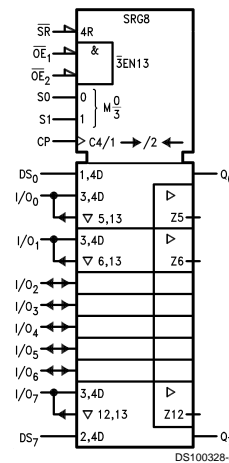
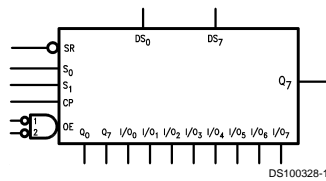
The 'ACT323 is an 8-bit universal shift/storage register with TRI-STATE® outputs. Parallel load inputs and flip-flop outputs are multiplexed to minimize pin count. Separate serial inputs and outputs are provided for Q₀ and Q₇ to allow easy cascading. Four operation modes are possible: hold (store), shift left, shift right and parallel load.

Features

- I_{CC} and I_{OZ} reduced by 50%

- Common parallel I/O for reduced pin count
- Additional serial inputs and outputs for expansion
- Four operating modes: shift left, shift right, load and store
- TRI-STATE outputs for bus-oriented applications
- Outputs source/sink 24 mA
- TTL-compatible inputs
- Standard Military Drawing (SMD)
 - 'ACT323: 5962-91607

Logic Symbols

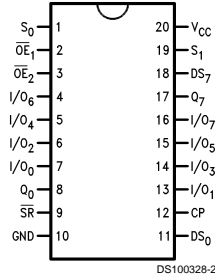


Pin Name	Description
CP	Clock Pulse Input
DS ₀	Serial Data Input for Right Shift
DS ₇	Serial Data Input for Left Shift
S ₀ , S ₁	Mode Select Inputs
\overline{SR}	Synchronous Reset Input
$\overline{OE}_1, \overline{OE}_2$	TRI-STATE Output Enable Inputs
I/O ₀ -I/O ₇	Multiplexed Parallel Data Inputs or TRI-STATE Parallel Data Outputs
Q ₀ , Q ₇	Serial Outputs

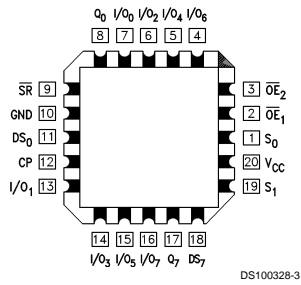
TRI-STATE® is a registered trademark of National Semiconductor Corporation.
FACT™ is a trademark of Fairchild Semiconductor Corporation.

Connection Diagrams

Pin Assignment for
DIP and Flatpak



Pin Assignment
for LCC



Functional Description

The 'ACT323 contains eight edge-triggered D-type flip-flops and the interstage logic necessary to perform synchronous reset, shift left, shift right, parallel load and hold operations. The type of operation is determined by S_0 and S_1 , as shown in the Mode Select Table. All flip-flop outputs are brought out through TRI-STATE buffers to separate I/O pins that also serve as data inputs in the parallel load mode. Q_0 and Q_7 are also brought out on other pins for expansion in serial shifting of longer words.

A LOW signal on \overline{SR} overrides the Select inputs and allows the flip-flops to be reset by the next rising edge of CP. All other state changes are also initiated by the LOW-to-HIGH CP transition. Inputs can change when the clock is in either state provided only that the recommended setup and hold times, relative to the rising edge of CP, are observed.

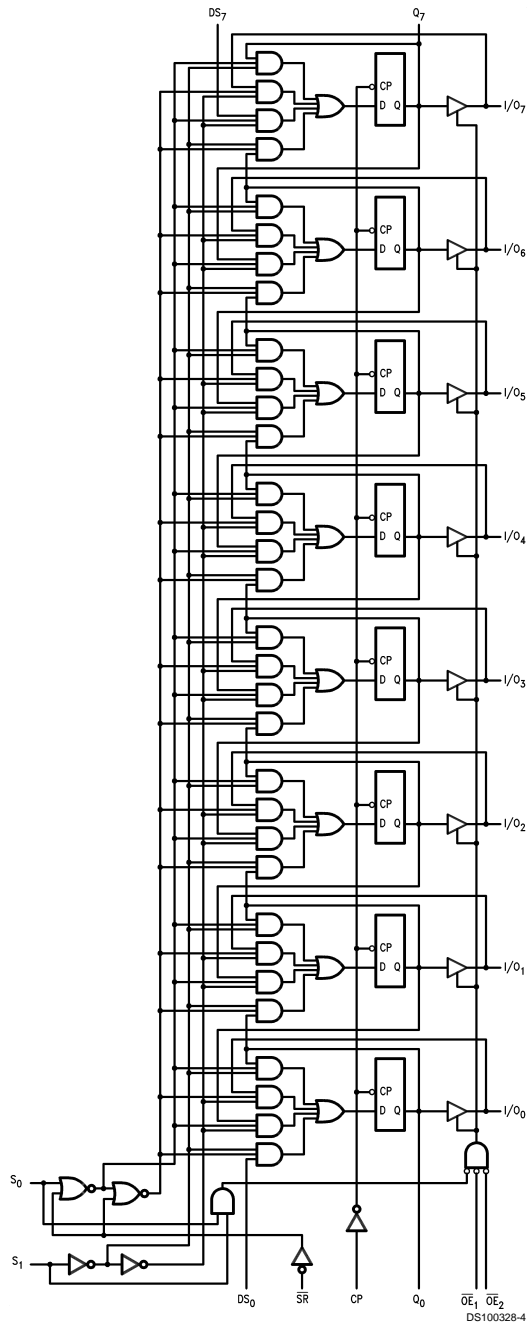
A HIGH signal on either \overline{OE}_1 or \overline{OE}_2 disables the TRI-STATE buffers and puts the I/O pins in the high impedance state. In this condition the shift, load, hold and reset operations can still occur. The TRI-STATE buffers are also disabled by HIGH signals on both S_0 and S_1 in preparation for a parallel load operation.

Mode Select Table

Inputs				Response
\overline{SR}	S_1	S_0	CP	
L	X	X	↗	Synchronous Reset; $Q_0-Q_7 = \text{LOW}$
H	H	H	↗	Parallel Load; $I/O_n \rightarrow Q_n$
H	L	H	↗	Shift Right; $DS_0 \rightarrow Q_0, Q_0 \rightarrow Q_1, \text{ etc.}$
H	H	L	↗	Shift Left; $DS_7 \rightarrow Q_7, Q_7 \rightarrow Q_6, \text{ etc.}$
H	L	L	X	Hold

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
↗ = LOW-to-HIGH Clock Transition

Logic Diagram



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 1)

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

Junction Temperature (T_J)

CDIP

175°C

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'ACT	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)	
54ACT	-55°C to +125°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
'ACT Devices	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns

Note 1: 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 'ACT Family Devices

Symbol	Parameter	V_{CC} (V)	54ACT	Units	Conditions
			$T_A =$		
			-55°C to +125°C		
			Guaranteed Limits		
V_{IH}	Minimum High Level Input Voltage	4.5	2.0	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	2.0		
V_{IL}	Maximum Low Level Input Voltage	4.5	0.8	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		5.5	0.8		
V_{OH}	Minimum High Level Output Voltage	4.5	4.4	V	$I_{OUT} = -50 \mu A$
		5.5	5.4		
		4.5	3.70	V	(Note 2) $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -24$ mA $I_{OH} = -24$ mA
		5.5	4.70		
V_{OL}	Maximum Low Level Output Voltage	4.5	0.1	V	$I_{OUT} = 50 \mu A$
		5.5	0.1		
		4.5	0.50	V	(Note 2) $V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = -24$ mA $I_{OL} = -24$ mA
		5.5	0.50		
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	µA	$V_I = V_{CC}, GND$
I_{OZT}	Maximum I/O Leakage Current	5.5	±5.5	µA	$V_{IO} = V_{CC}$ or GND $V_{IN} = V_{IH}, V_{IL}$
I_{CCT}	Maximum I_{CC} /Input	5.5	1.6	mA	$V_I = V_{CC} - 2.1V$
I_{OLD}	Minimum Dynamic Output Current (Note 3)	5.5	50	mA	$V_{OLD} = 1.65V$ Max
I_{OHD}	Current (Note 3)	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 2: All outputs loaded; thresholds on input associated with output under test.

Note 3: Maximum test duration 2.0 ms, one output loaded at a time.

Note 4: I_{CC} for 54ACT is identical to 74ACT @ 25°C.

AC Electrical Characteristics

Symbol	Parameter	V _{CC} (V) (Note 5)	54ACT		Units
			T _A = -55°C to +125°C C _L = 50 pF		
			Min	Max	
f _{max}	Maximum Input Frequency	5.0	70		MHz
t _{PLH}	Propagation Delay CP to Q ₀ or Q ₇	5.0	1.0	16.5	ns
t _{PHL}	Propagation Delay CP to Q ₀ or Q ₇	5.0	1.0	17.0	ns
t _{PLH}	Propagation Delay CP to I/O _n	5.0	1.0	16.5	ns
t _{PHL}	Propagation Delay CP to I/O _n	5.0	1.0	18.0	ns
t _{PZH}	Output Enable Time	5.0	1.0	15.5	ns
t _{PZL}	Output Enable Time	5.0	1.0	15.5	ns
t _{PHZ}	Output Disable Time	5.0	1.0	15.5	ns
t _{PLZ}	Output Disable Time	5.0	1.0	15.0	ns

Note 5: Voltage Range 5.0 is 5.0V ±0.5V

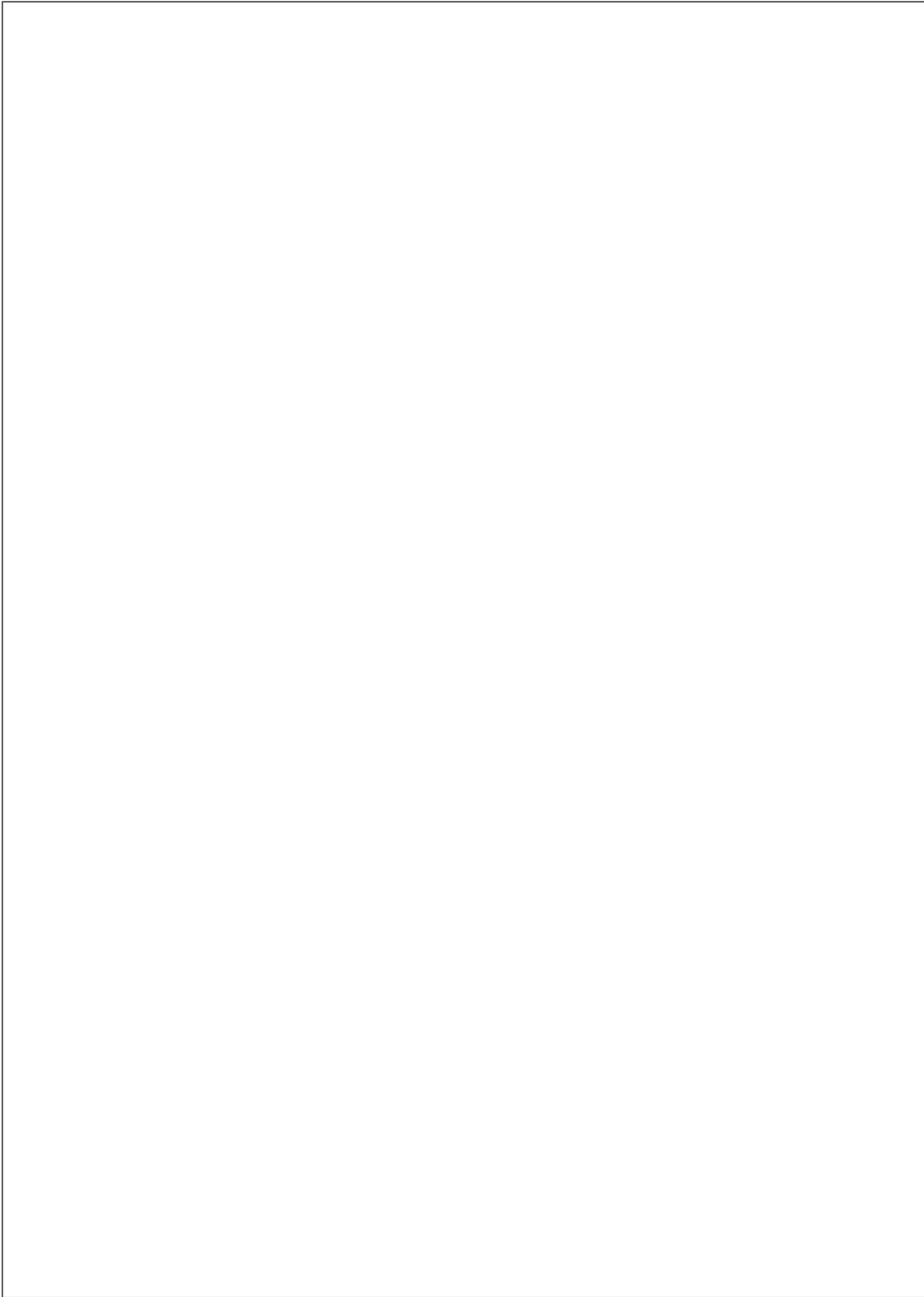
AC Operating Requirements

Symbol	Parameter	V _{CC} (V) (Note 6)	54ACT		Units
			T _A = -55°C to +125°C C _L = 50 pF V _{CC} = +5.0V		
			Guaranteed Minimum		
t _s	Setup Time, HIGH or LOW S ₀ or S ₁ to CP	5.0	6.0		ns
t _h	Hold Time, HIGH or LOW S ₀ or S ₁ to CP	5.0	2.0		ns
t _s	Setup Time, HIGH or LOW I/O _n , DS ₀ , DS ₇ to CP	5.0	4.5		ns
t _h	Hold Time, HIGH or LOW I/O _n , DS ₀ , DS ₇ to CP	5.0	2.0		ns
t _s	Setup Time, HIGH or LOW SR to CP	5.0	3.0		ns
t _h	Hold Time, HIGH or LOW SR to CP	5.0	1.5		ns
t _w	CP Pulse Width HIGH or LOW	5.0	5.0		ns

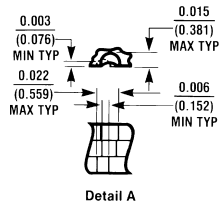
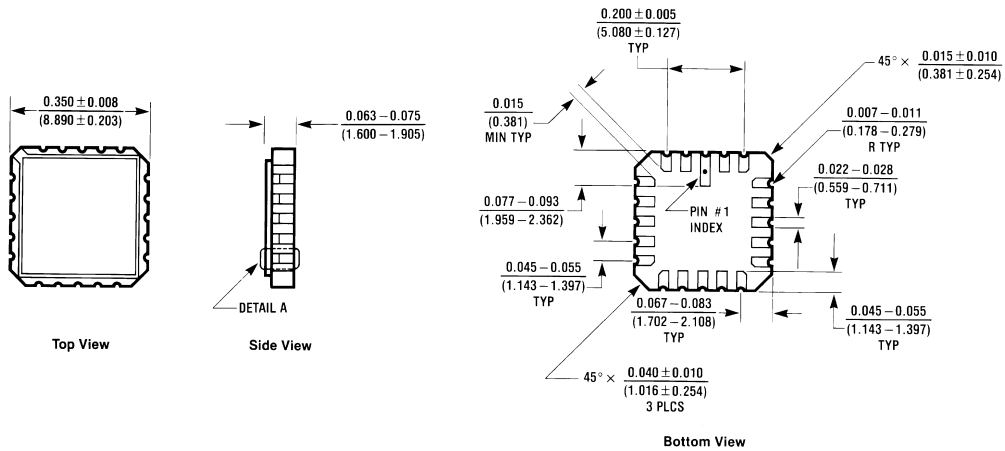
Note 6: Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = OPEN
C _{PD}	Power Dissipation Capacitance	170	pF	V _{CC} = 5.0V

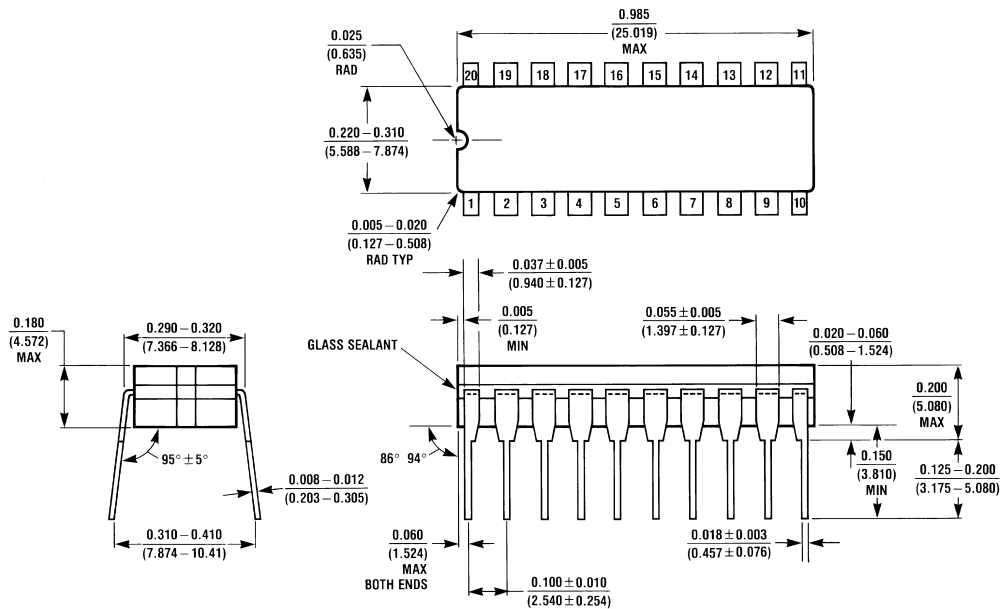


Physical Dimensions inches (millimeters) unless otherwise noted



E20A (REV D)

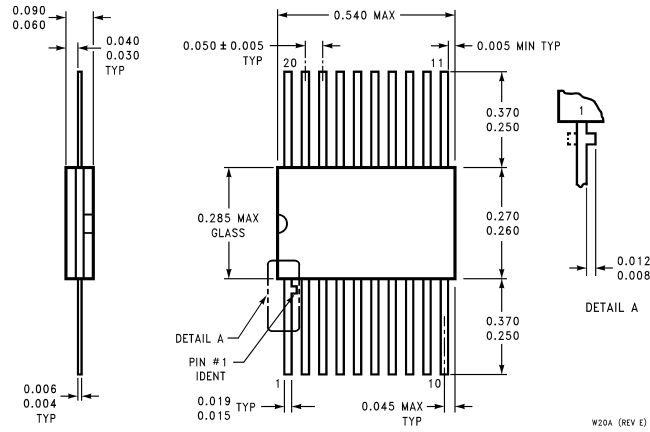
20 Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A



J20A (REV M)

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

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

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

www.national.com

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

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Transportation and Automotive	www.ti.com/automotive
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

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