54F410,74F410

54F410 74F410 Register Stack-16 x 4 RAM TRI-STATE(RM) Output Register

Literature Number: SNOS197A

National Semiconductor

August 1995

54F/74F410 Register Stack—16 x 4 RAM TRI-STATE® Output Register

General Description

The 'F410 is a register-oriented high-speed 64-bit Read/Write Memory organized as 16-words by 4-bits. An edge-triggered 4-bit output register allows new input data to be written while previous data is held. TRI-STATE outputs are provided for maximum versatility. The 'F410 is fully compatible with all TTL families.

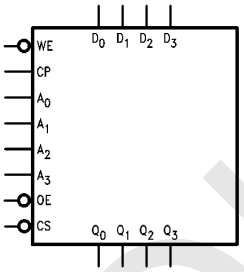
Features

- Edge-triggered output register
- Typical access time of 35 ns
- TRI-STATE outputs
- Optimized for register stack operation
- 18-pin package
- 9410 replacement

Commercial	Military	Package Number	Package Description
74F410PC		N18A	18-Lead (0.300″ Wide) Molded Dual-In-Line
	54F410DM (Note 1)	J18A	18-Lead Ceramic Dual-In-Line
74F410SC		M20B	20-Lead (0.300″ Wide) Molded Small Outline, JEDEC
54F410LM		W20A	20-Lead Cerpak

Note 1: Military grade device with environmental and burn-in processing. Use suffix = DMQB, LMQB

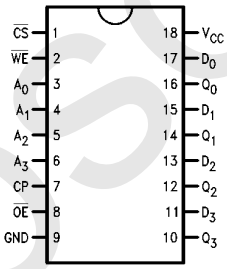
Logic Symbol



TL/F/9538–3

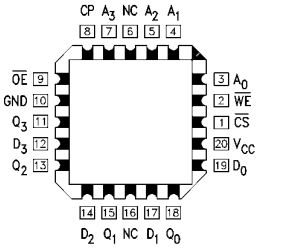
Connection Diagrams

Pin Assignment for DIP and SOIC



TL/F/9538–1

Pin Assignment for LCC



TL/F/9538–2

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

Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
A_0-A_3	Address Inputs	1.0/1.0	20 μA/ $-$0.6 mA
D_0-D_3	Data Inputs	1.0/1.0	20 μA/ $-$0.6 mA
$\overline{CS}$	Chip Select Input (Active LOW)	1.0/2.0	20 μA/ $-$1.2 mA
$\overline{OE}$	Output Enable Input (Active LOW)	1.0/1.0	20 μA/ $-$0.6 mA
$\overline{WE}$	Write Enable Input (Active LOW)	1.0/1.0	20 μA/ $-$0.6 mA
CP	Clock Input (Outputs Change on LOW-to-HIGH Transition)	1.0/2.0	20 μA/ $-$1.2 mA
Q_0-Q_3	TRI-STATE Outputs	150/40 (33.3)	$-$3 mA/24 mA (20 mA)

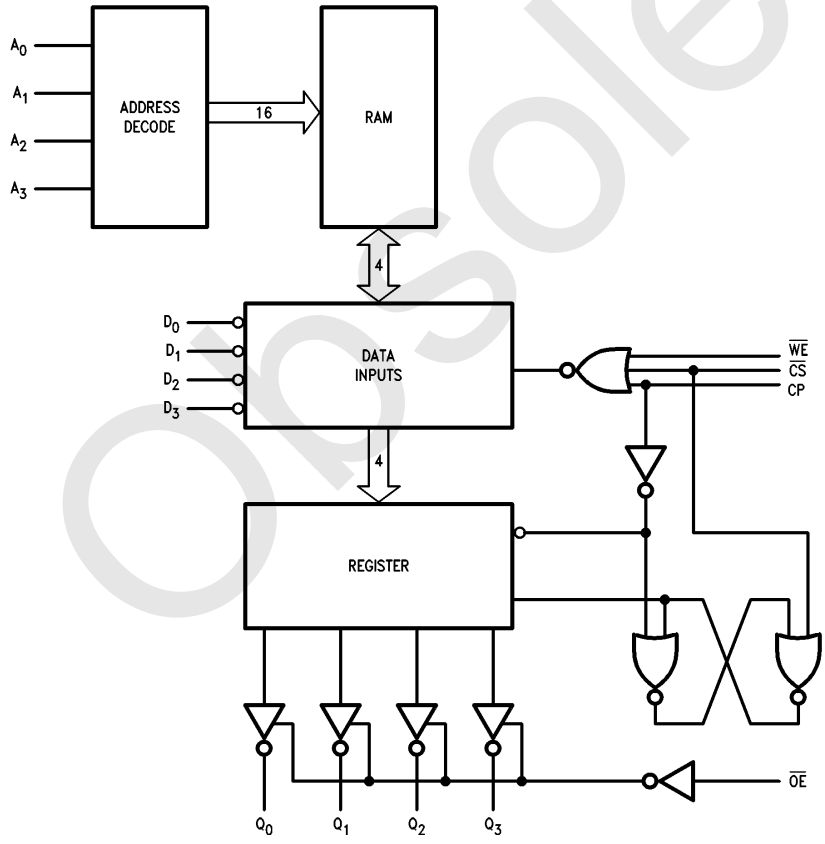
Functional Description

Write Operation—When the three control inputs, Write Enable ($\overline{WE}$), Chip Select ($\overline{CS}$), and Clock (CP), are LOW the information on the data inputs (D_0-D_3) is written into the memory location selected by the address inputs (A_0-A_3). If the input data changes while $\overline{WE}$, $\overline{CS}$, and CP are LOW, the contents of the selected memory location follow these changes, provided setup and hold time criteria are met.

Read Operation—Whenever $\overline{CS}$ is LOW and CP goes from LOW-to-HIGH, the contents of the memory location selected by the address inputs (A_0-A_3) are edge-triggered into the Output Register.

The ($\overline{OE}$) input controls the output buffers. When $\overline{OE}$ is HIGH the four outputs (Q_0-Q_3) are in a high impedance or OFF state; when $\overline{OE}$ is LOW, the outputs are determined by the state of the Output Register.

Block Diagram



TL/F/9538–4

Absolute Maximum Ratings (Note 1)

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

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +175°C
Plastic	−55°C to +150°C
V_{CC} Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Output in HIGH State (with V_{CC} = 0V)	
Standard Output	−0.5V to V_{CC}
TRI-STATE Output	−0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I_{OL} (mA)

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

Free Air Ambient Temperature	
Military	−55°C to +125°C
Commercial	0°C to +70°C
Supply Voltage	
Military	+4.5V to +5.5V
Commercial	+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter		54F/74F Min	54F/74F Typ	54F/74F Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0			V		Recognized as a HIGH Signal
V_{IL}	Input LOW Voltage				0.8	V		Recognized as a LOW Signal
V_{CD}	Input Clamp Diode Voltage				−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	54F 10% V_{CC}	2.5			V	Min	I_{OH} = −1 mA
		54F 10% V_{CC}	2.4					I_{OH} = −3 mA
		74F 10% V_{CC}	2.5					I_{OH} = −1 mA
		74F 10% V_{CC}	2.4					I_{OH} = −3 mA
		74F 5% V_{CC}	2.7					I_{OH} = −3 mA
V_{OL}	Output LOW Voltage	54F 10% V_{CC}			0.5	V	Min	I_{OL} = 20 mA
		74F 10% V_{CC}			0.5			I_{OL} = 24 mA
I_{IH}	Input HIGH Current	54F			20.0	μA	Max	V_{IN} = 2.7V
		74F			5.0			
I_{BVI}	Input HIGH Current Breakdown Test	54F			100	μA	Max	V_{IN} = 7.0V
		74F			7.0			
I_{CEX}	Output HIGH Leakage Current	54F			250	μA	Max	V_{OUT} = V_{CC}
		74F			50			
V_{ID}	Input Leakage Test	74F	4.75			V	0.0	I_{ID} = 1.9 μA All Other Pins Grounded
I_{OD}	Output Leakage Circuit Current	74F			3.75	μA	0.0	V_{IOD} = 150 mV All Other Pins Grounded
I_{IL}	Input LOW Current				−0.6	mA	Max	V_{IN} = 0.5V (A_n, D_n, $\overline{OE}$, $\overline{WE}$)
					−1.2			V_{IN} = 0.5V ($\overline{CS}$, CP)
I_{OZH}	Output Leakage Current				50	μA	Max	V_{OUT} = 2.7V
I_{OZL}	Output Leakage Current				−50	μA	Max	V_{OUT} = 0.5V
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{ZZ}	Bus Drainage Test				500	μA	0.0V	V_{OUT} = 5.25V

DC Electrical Characteristics (Continued)

Symbol	Parameter	54F/74F			Units	V_{CC}	Conditions
		Min	Typ	Max			
I_{CCH}	Power Supply Current		47	70	mA	Max	V_O = HIGH
I_{CCL}	Power Supply Current		47	70	mA	Max	V_O = LOW
I_{CCZ}	Power Supply Current		47	70	mA	Max	V_O = HIGH Z

AC Electrical Characteristics

Symbol	Parameter	74F T_A = +25°C V_{CC} = +5.0V C_L = 50 pF		54F T_A, V_{CC} = Mil C_L = 50 pF		74F T_A, V_{CC} = Com C_L = 50 pF		Units
		Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay CP to Q	3.0 3.5	8.5 9.0	2.5 3.0	11.0 12.0	2.5 3.0	9.5 10.0	ns
t_{PZH} t_{PZL}	Enable Time $\overline{OE}$ to Q	3.0 3.5	8.0 9.0	2.5 3.0	10.5 13.0	2.5 3.0	9.0 10.0	ns
t_{PHZ} t_{PLZ}	Disable Time $\overline{OE}$ to Q	2.5 2.5	6.5 7.0	2.0 2.0	8.5 9.5	2.0 2.0	7.5 8.0	

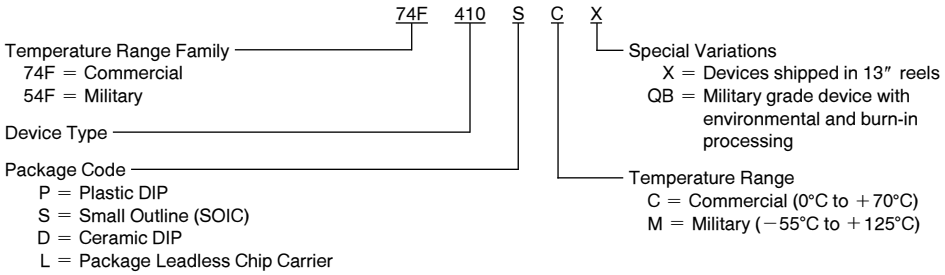
AC Operating Requirements

Symbol	Parameter	74F T_A = +25°C V_{CC} = +5.0V		54F T_A, V_{CC} = Mil		74F T_A, V_{CC} = Com		Units
		Min	Max	Min	Max	Min	Max	
READ MODE								
t_s(H) t_s(L)	Setup Time, HIGH or LOW A_n to CP	15.0 15.0		23 23		17.0 17.0		ns
t_h(H) t_h(L)	Hold Time, HIGH or LOW A_n to CP	0 0		0 0		0 0		ns
WRITE MODE								
t_s(H) t_s(L)	Setup Time, HIGH or LOW A_n to $\overline{WE}$	0 0		0 0		0 0		ns
t_h(H) t_h(L)	Hold Time, HIGH or LOW A_n to $\overline{WE}$	0 0		0 0		0 0		ns
t_s(H) t_s(L)	Setup Time, HIGH or LOW D_n to $\overline{WE}$	5.0 5.0		8.5 8.5		6.0 6.0		ns
t_h(H) t_h(L)	Hold Time, HIGH or LOW D_n to $\overline{WE}$	0 0		2.5 2.5		0 0		ns
t_w	$\overline{WE}$ Pulse Width Required to Write	7.5		9.5		8.5		ns
t_w	$\overline{CS}$ Pulse Width Required to Write	7.5		9.5		8.5		ns
t_w	CP Pulse Width Required to Write	7.5		9.5		8.5		ns

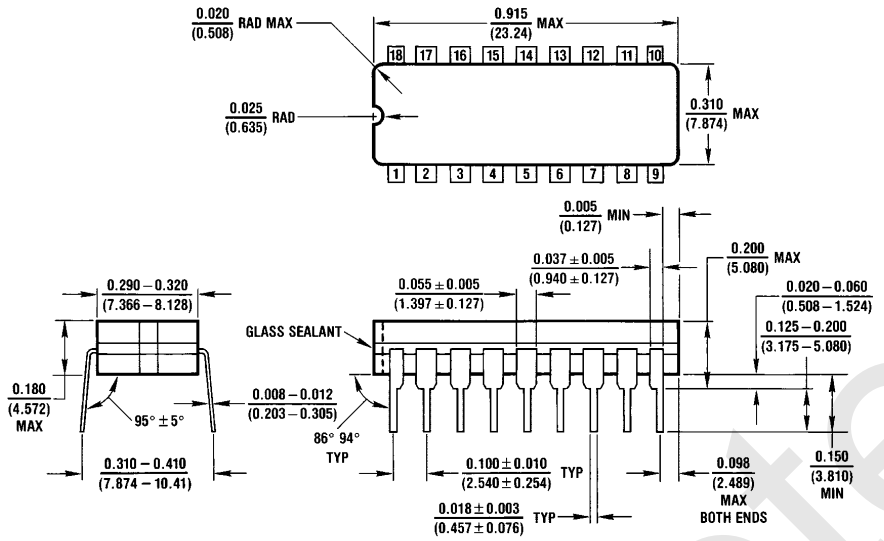
Note: Military temperature range for this device is −40°C to +85°C.

Ordering Information

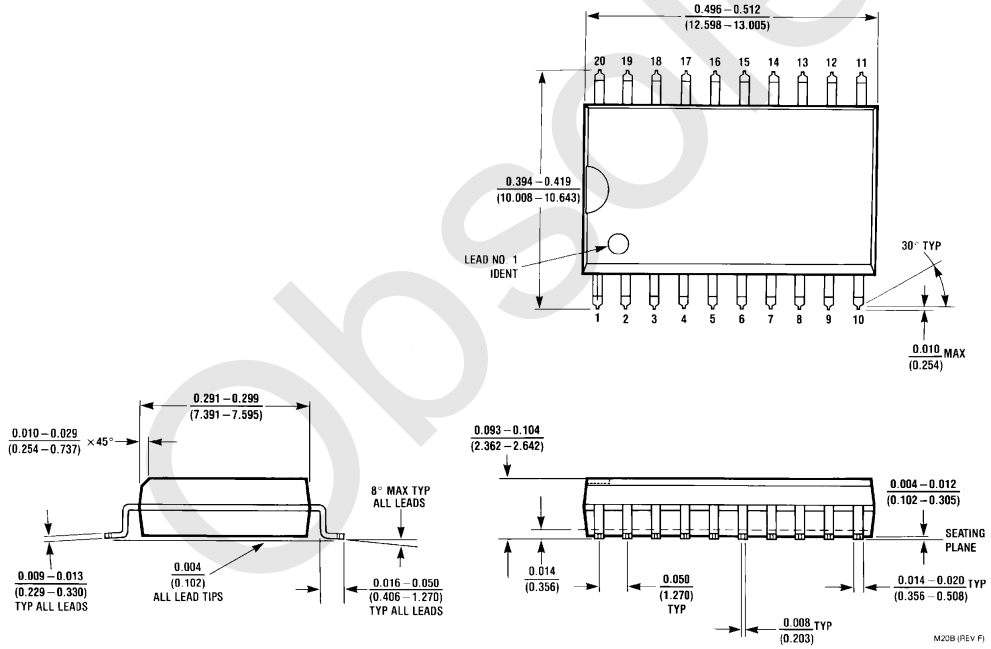
The device number is used to form part of a simplified purchasing code where a package type and temperature range are defined as follows:



Physical Dimensions inches (millimeters)

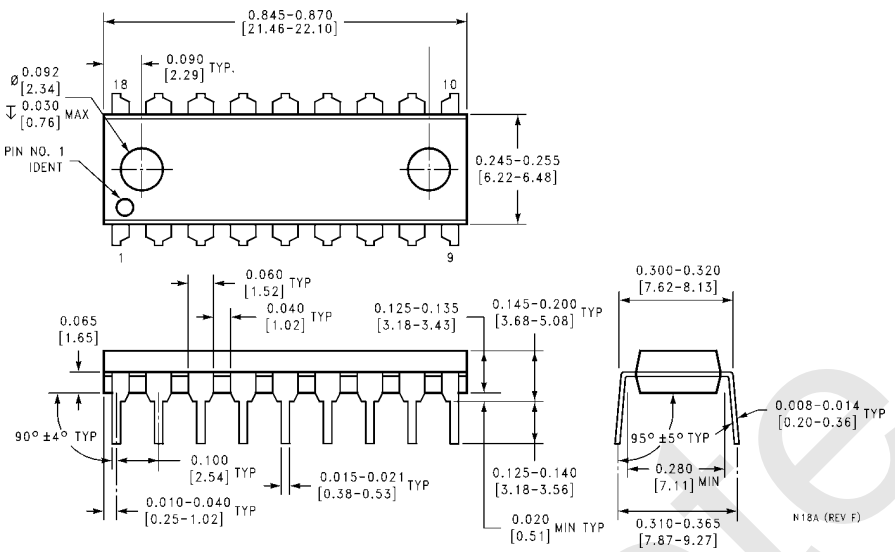


18-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J18A



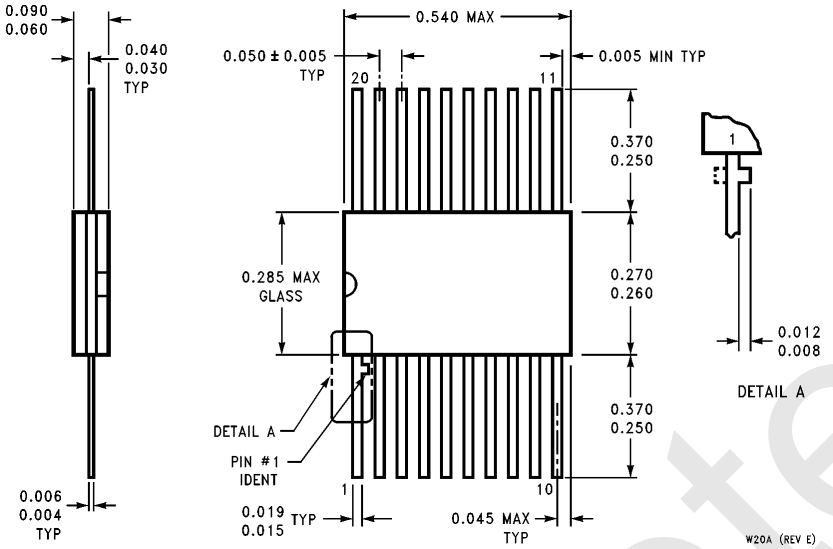
20-Lead (0.300″ Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M20B

Physical Dimensions inches (millimeters) (Continued)



18-Lead (0.300″ Wide) Molded Dual-In-Line Package (P)
NS Package Number N18A

Physical Dimensions inches (millimeters) (Continued)



20-Lead Cerpack
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 is 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
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408

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