54F676,74F676

54F676 74F676 16-Bit Serial/Parallel-In, Serial-Out Shift Register

Literature Number: SNOS213A

National Semiconductor

December 1994

54F/74F676
16-Bit Serial/Parallel-In, Serial-Out Shift Register

General Description

The 'F676 contains 16 flip-flops with provision for synchronous parallel or serial entry and serial output. When the Mode (M) input is HIGH, information present on the parallel data (P_0–P_{15}) inputs is entered on the falling edge of the Clock Pulse ($\overline{CP}$) input signal. When M is LOW, data is shifted out of the most significant bit position while information present on the Serial (SI) input shifts into the least significant bit position. A HIGH signal on the Chip Select ($\overline{CS}$) input prevents both parallel and serial operations.

Features

- 16-bit parallel-to-serial conversion
- 16-bit serial-in, serial-out
- Chip select control
- Slim 24 lead 300 mil package

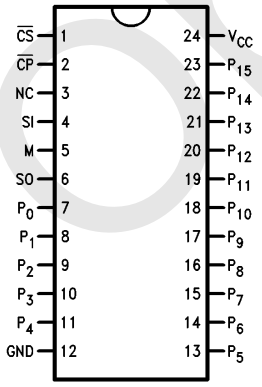
Commercial	Military	Package Number	Package Description
74F676PC		N24A	24-Lead (0.600″ Wide) Molded Dual-In-Line
74F676SPC		N24C	24-Lead (0.300″ Wide) Molded Dual-In-Line
	54F676DM (Note 2)	J24A	24-Lead (0.600″ Wide) Ceramic Dual-In-Line
	54F676SDM (Note 2)	J24F	24-Lead (0.300″ Wide) Ceramic Dual-In-Line
74F676SC (Note 1)		M24B	24-Lead (0.300″ Wide) Molded Small Outline, JEDEC
	54F676FM (Note 2)	W24C	24-Lead Cerpack
	54F676LM (Note 2)	E28A	24-Lead Ceramic Leadless Chip Carrier, Type C

Note 1: Devices also available in 13″ reel. Use suffix = SCX.

Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMQB, FMQB and LMQB.

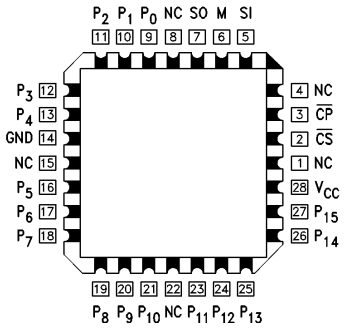
Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



TL/F/9588–2

Pin Assignment for LCC

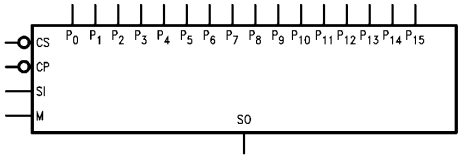


TL/F/9588–3

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

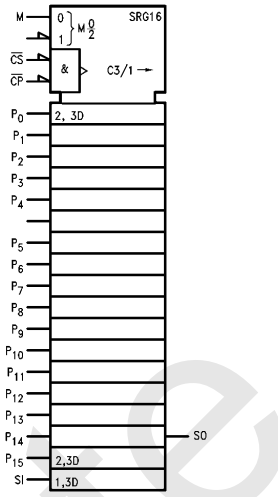
RRD-B30M105/Printed in U. S. A.

Logic Symbols



TL/F/9588–1

IEEE/IEC



TL/F/9588–4

Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
P_0–P_{15}	Parallel Data Inputs	1.0/1.0	20 μA/−0.6 mA
$\overline{CS}$	Chip Select Input (Active LOW)	1.0/1.0	20 μA/−0.6 mA
$\overline{CP}$	Clock Pulse Input (Active LOW)	1.0/1.0	20 μA/−0.6 mA
M	Mode Select Input	1.0/1.0	20 μA/−0.6 mA
SI	Serial Data Input	1.0/1.0	20 μA/−0.6 mA
SO	Serial Output	50/33.3	−1 mA/20 mA

Functional Description

The 16-bit shift register operates in one of three modes, as indicated in the Shift Register Operations Table.

HOLD—a HIGH signal on the Chip Select ($\overline{CS}$) input prevents clocking, and data is stored in the sixteen registers.

Shift/Serial Load—data present on the SI pin shifts into the register on the falling edge of $\overline{CP}$. Data enters the Q_0 position and shifts toward Q_{15} on successive clocks, finally appearing on the SO pin.

Parallel Load—data present on P_0–P_{15} are entered into the register on the falling edge of $\overline{CP}$. The SO output represents the Q_{15} register output.

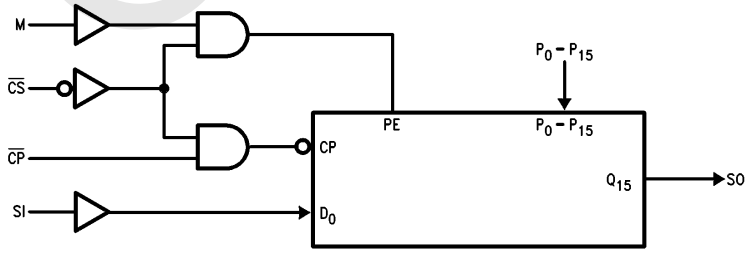
To prevent false clocking, $\overline{CP}$ must be LOW during a LOW-to-HIGH transition of $\overline{CS}$.

Shift Register Operations Table

Control Input			Operating Mode
$\overline{CS}$	M	$\overline{CP}$	
H	X	X	Hold
L	L	⌥	Shift/Serial Load
L	H	⌥	Parallel Load

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

Block Diagram



TL/F/9588–5

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
		74F 10% V_{CC}	2.5					I_{OH} = −1 mA
		74F 5% V_{CC}	2.7					I_{OH} = −1 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} = 20 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
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{CC}	Power Supply Current				72	mA	Max	

AC Electrical Characteristics

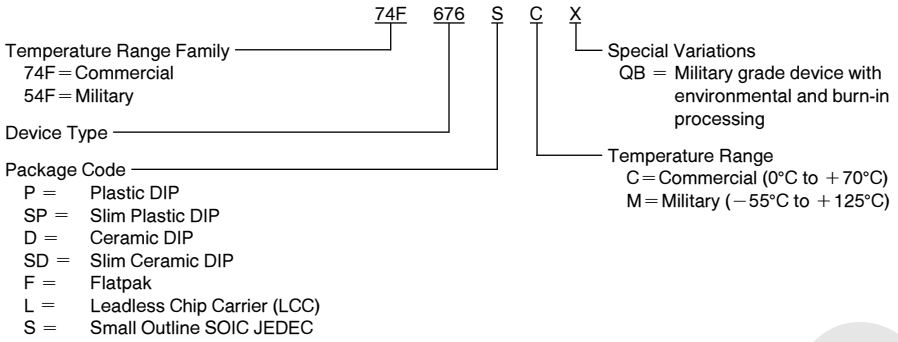
Symbol	Parameter	74F $T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			54F T_A, V_{CC} = Mil, $C_L = 50$ pF		74F T_A, V_{CC} = Com, $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	Min	Max	
f_{max}	Maximum Clock Frequency	100	110		45		90		MHz
t_{PLH} t_{PHL}	Propagation Delay $\overline{CP}$ to SO	4.5 5.0	9.0 9.0	11.0 12.5	4.5 5.0	17.0 14.5	4.5 5.0	12.0 13.5	ns

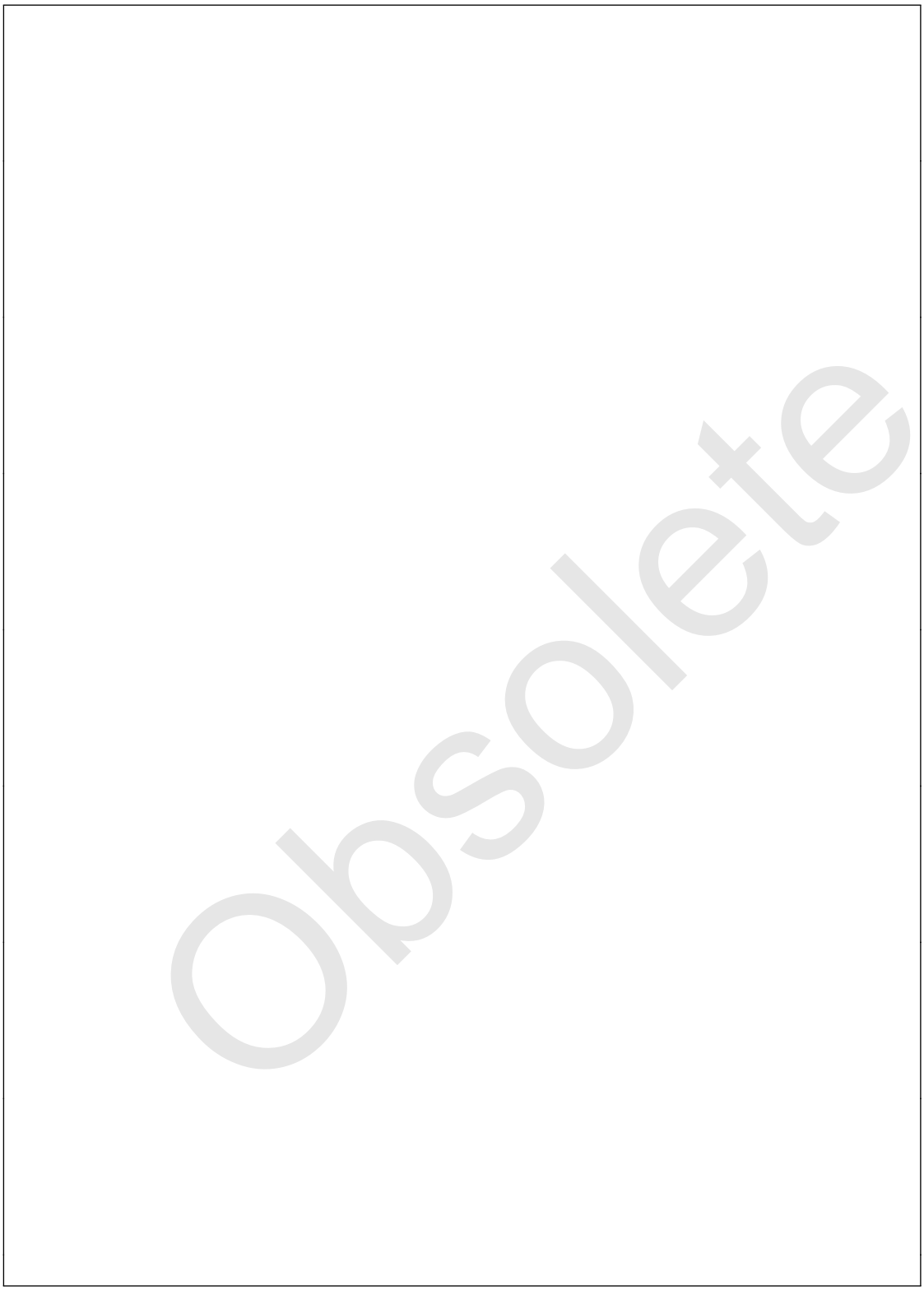
AC Operating Requirements

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	
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW SI to $\overline{CP}$	4.0 4.0		4.0 4.0		4.0 4.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW SI to $\overline{CP}$	4.0 4.0		4.0 4.0		4.0 4.0		
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW P_n to $\overline{CP}$	3.0 3.0		3.0 3.0		3.0 3.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW P_n to $\overline{CP}$	4.0 4.0		4.0 4.0		4.0 4.0		
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW M to $\overline{CP}$	8.0 8.0		8.0 8.0		8.0 8.0		ns
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW M to $\overline{CP}$	2.0 2.0		2.0 2.0		2.0 2.0		
$t_s(L)$	Setup Time, LOW $\overline{CS}$ to $\overline{CP}$	10.0		12.0		10.0		ns
$t_h(H)$	Hold Time, HIGH $\overline{CS}$ to $\overline{CP}$	10.0		10.0		10.0		
$t_w(H)$ $t_w(L)$	$\overline{CP}$ Pulse Width HIGH or LOW	4.0 6.0		5.0 9.0		4.0 6.0		ns

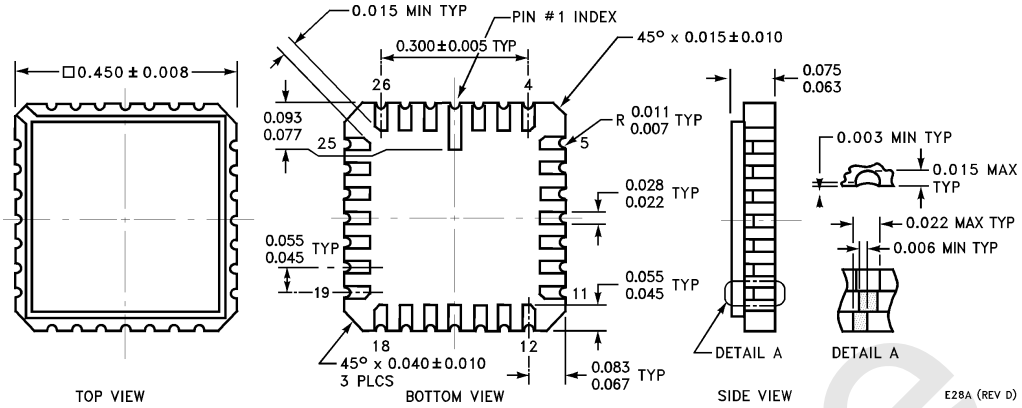
Ordering Information

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

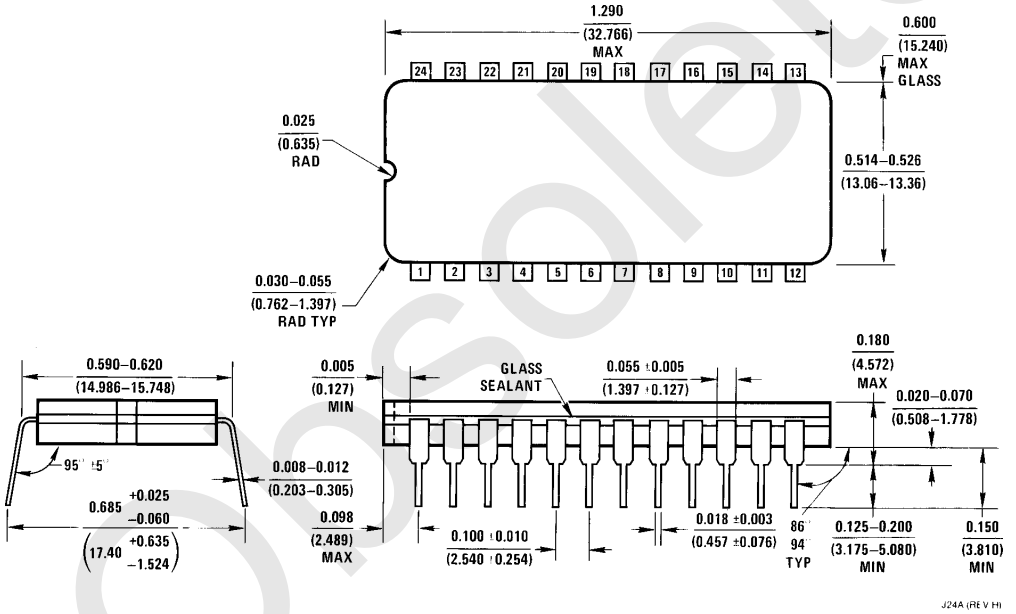



Obsolete

Physical Dimensions inches (millimeters)

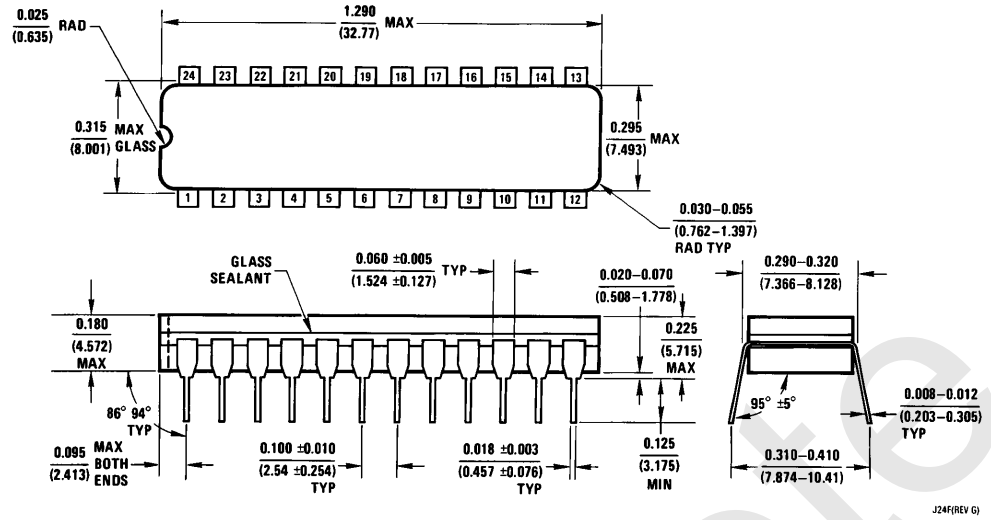


28-Lead Ceramic Leadless Chip Carrier (L)
NS Package Number E28A

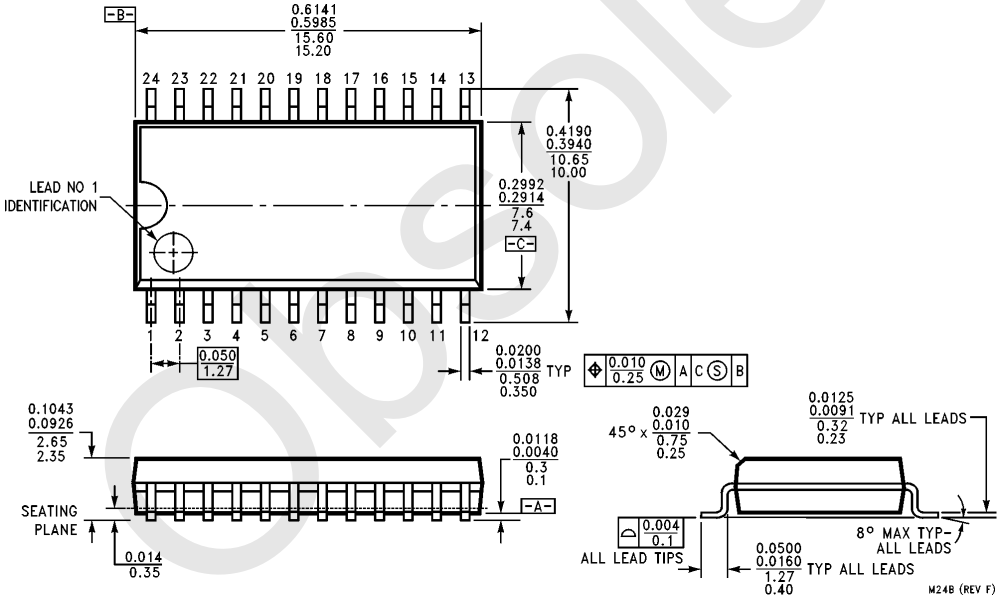


24-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J24A

Physical Dimensions inches (millimeters) (Continued)

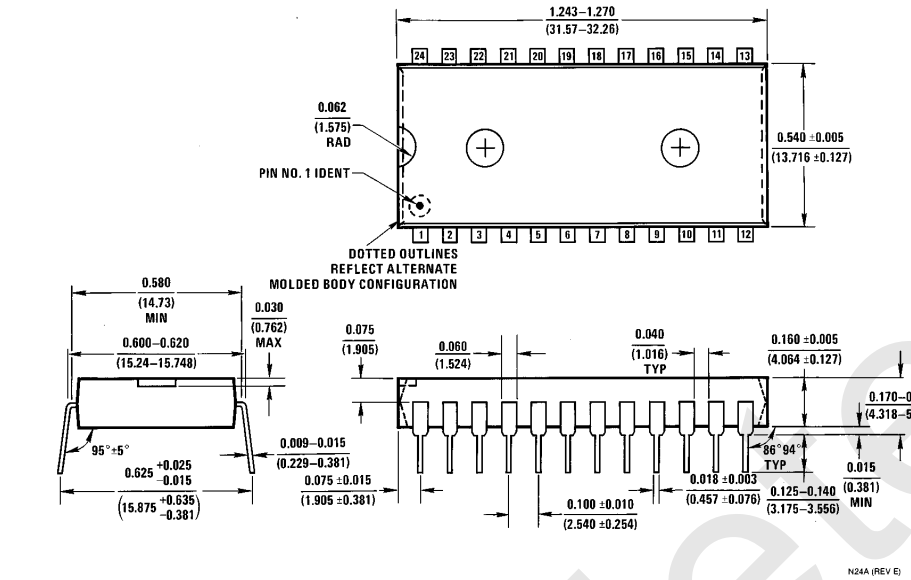


24-Lead (0.300″ Wide) Ceramic Dual-In-Line Package (SD)
NS Package Number J24F

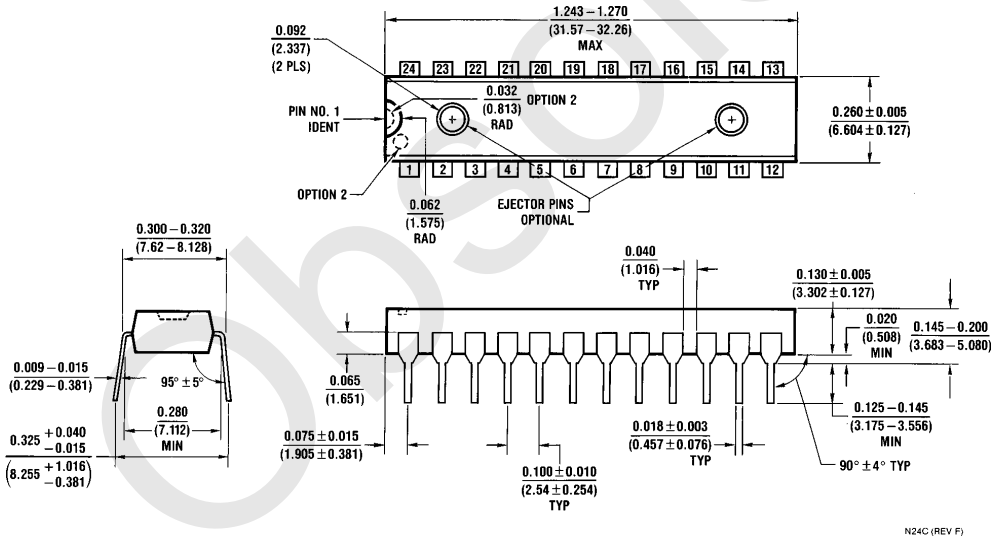


24-Lead (0.300″ Wide) Molded Small Outline Package, JEDEC
NS Package Number M24B

Physical Dimensions inches (millimeters) (Continued)

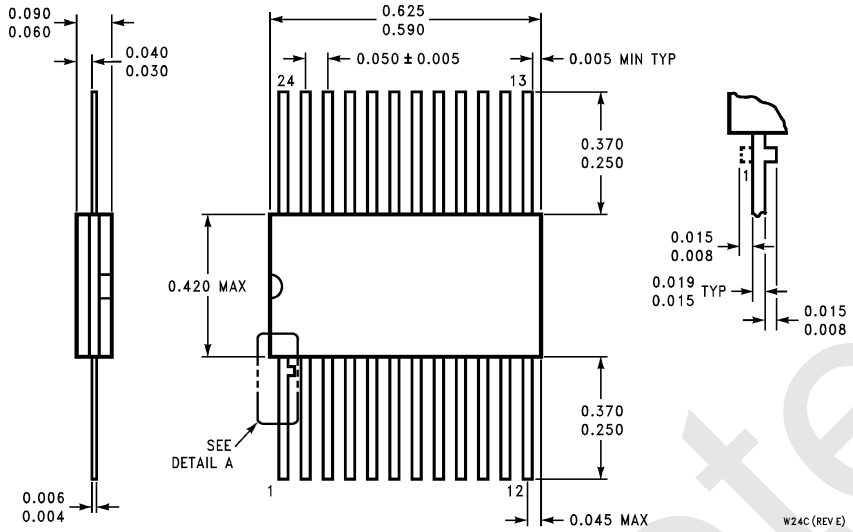


24-Lead (0.600″ Wide) Molded Dual-In-Line Package (P)
NS Package Number N24A



24-Lead (0.300″ Wide) Molded Dual-In-Line Package (SP)
NS Package Number N24C

Physical Dimensions inches (millimeters) (Continued)



24 Lead Ceramic Flatpak (F)
NS Package Number W24C

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