

54F299,74F299

54F299 Octal Universal Shift/Storage Register with Common Parallel I/O Pins



Literature Number: SNOS185A

54F/74F299 Octal Universal Shift/Storage Register with Common Parallel I/O Pins

General Description

The 'F299 is an 8-bit universal shift/storage register with TRI-STATE® outputs. Four modes of operation are possible: hold (store), shift left, shift right and load data. The parallel load inputs and flip-flop outputs are multiplexed to reduce the total number of package pins. Additional outputs, Q₀-Q₇, are provided to allow easy serial cascading. A separate active LOW Master Reset is used to reset the register.

Features

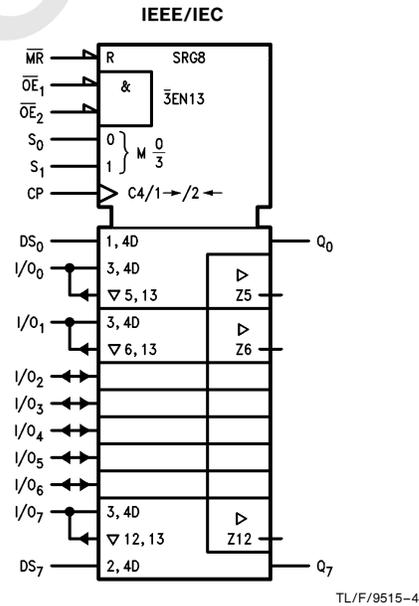
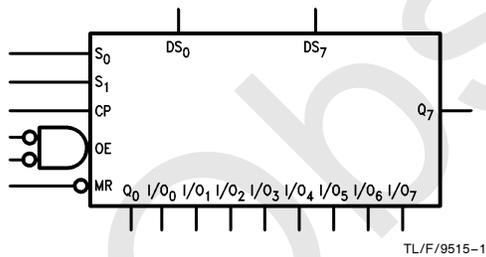
- Common parallel I/O for reduced pin count
- Additional serial inputs and outputs for expansion
- Four operating modes: shift left, shift right, load and store
- TRI-STATE outputs for bus-oriented applications
- Guaranteed 4000V minimum ESD protection

Commercial	Military	Package Number	Package Description
74F299PC		N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
	54F299DM (Note 2)	J20A	20-Lead Ceramic Dual-In-Line
74F299SC (Note 1)		M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
74F299SJ (Note 1)		M20D	20-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F299FM (Note 2)	W20A	20-Lead Cerpack
	54F299LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Note 1: Devices also available in 13" reel. Use suffix = SCX and SJX.

Note 2: Military grade device with environmental and burn-in processing. Use suffix = DMOB, FMOB and LMOB.

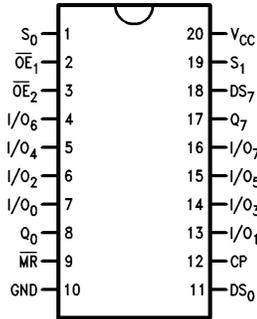
Logic Symbols



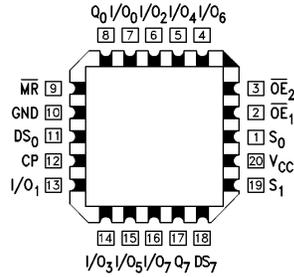
TRI-STATE® is a registered trademark of National Semiconductor Corporation.

Connection Diagrams

Pin Assignment
for DIP, SOIC and Flatpak



Pin Assignment
for LCC



TL/F/9515-3

TL/F/9515-2

Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 μ A/ -0.6 mA
DS ₀	Serial Data Input for Right Shift	1.0/1.0	20 μ A/ -0.6 mA
DS ₇	Serial Data Input for Left Shift	1.0/1.0	20 μ A/ -0.6 mA
S ₀ , S ₁	Mode Select Inputs	1.0/2.0	20 μ A/ -1.2 mA
MR	Asynchronous Master Reset Input (Active LOW)	1.0/1.0	20 μ A/ -0.6 mA
OE ₁ , OE ₂	TRI-STATE Output Enable Inputs (Active LOW)	1.0/1.0	20 μ A/ -0.6 mA
I/O ₀ -I/O ₇	Parallel Data Inputs or TRI-STATE Parallel Outputs	3.5/1.083 150/40(33.3)	70 μ A/ -0.65 mA -3 mA/24 mA (20 mA)
Q ₀ , Q ₇	Serial Outputs	50/33.3	-1 mA/20 mA

Functional Description

The 'F299 contains eight edge-triggered D-type flip-flops and the interstage logic necessary to perform synchronous shift left, shift right, parallel load and hold operations. The type of operation is determined by S₀ and S₁, 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. Q₀ and Q₇ are also brought out on other pins for expansion in serial shifting of longer words.

A LOW signal on MR overrides the Select and CP inputs and resets the flip-flops. All other state changes are initiated by the rising edge of the clock. 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.

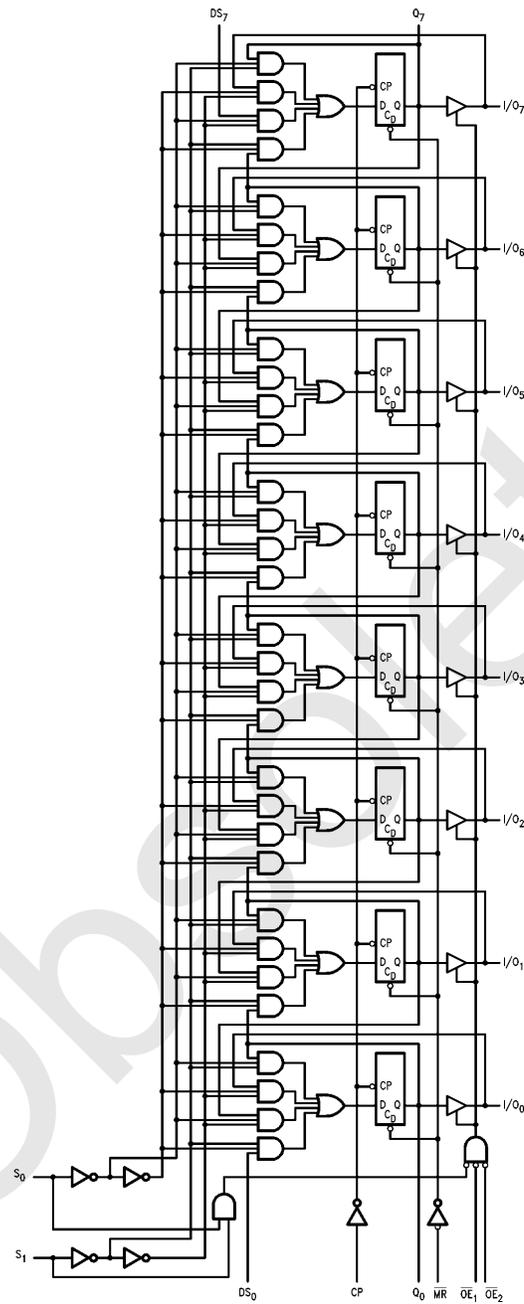
A HIGH signal on either OE₁ or OE₂ disables the TRI-STATE buffers and puts the I/O pins in the high impedance state. In this condition the shift, hold, load and reset operations can still occur. The TRI-STATE outputs are also disabled by HIGH signals on both S₀ and S₁ in preparation for a parallel load operation.

Mode Select Table

Inputs				Response
MR	S ₁	S ₀	CP	
L	X	X	X	Asynchronous Reset; Q ₀ -Q ₇ = LOW
H	H	H	↗	Parallel Load; I/O _n → Q _n
H	L	H	↗	Shift Right; DS ₀ → Q ₀ , Q ₀ → Q ₁ , etc.
H	H	L	↗	Shift Left; DS ₇ → Q ₇ , Q ₇ → Q ₆ , etc.
H	L	L	X	Hold

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

Logic Diagram



TL/F/9515-5

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 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
ESD Last Passing Voltage (Min)	4000V

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.

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)

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			Units	V _{CC}	Conditions
		Min	Typ	Max			
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} 54F 10% V _{CC} 74F 10% V _{CC} 74F 10% V _{CC} 74F 5% V _{CC} 74F 5% V _{CC}	2.5 2.4 2.5 2.4 2.7 2.7		V	Min	I _{OH} = -1 mA (Q ₀ , Q ₇ , I/O _n) I _{OH} = -3 mA (I/O _n) I _{OH} = -1 mA (Q ₀ , Q ₇ , I/O _n) I _{OH} = -3 mA (I/O _n) I _{OH} = -1 mA (Q ₀ , Q ₇ , I/O _n) I _{OH} = -3 mA (I/O _n)
V _{OL}	Output LOW Voltage	54 10% V _{CC} 74 10% V _{CC} 74 10% V _{CC}		0.5 0.5 0.5	V	Min	I _{OL} = 20 mA I _{OL} = 20 mA (Q ₀ , Q ₇) I _{OL} = 24 mA (I/O _n)
I _{IH}	Input HIGH Current	54F 74F		20.0 5.0	μA	Max	V _{IN} = 2.7V (CP, DS ₀ , DS ₇ , S ₀ , S ₁ , MR, OE ₁ , OE ₂)
I _{BVI}	Input HIGH Current Breakdown Test	54F 74F		100 7.0	μA	Max	V _{IN} = 7.0V (CP, DS ₀ , DS ₇ , S ₀ , S ₁ , MR, OE ₁ , OE ₂)
I _{BVIT}	Input HIGH Current Breakdown Test (I/O)	54F 74F		1.0 0.5	mA	Max	V _{IN} = 5.5V (I/O _n)
I _{CEX}	Output HIGH Leakage Current	54F 74F		250 50	μA	Max	V _{OUT} = V _{CC}
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 -1.2	mA	Max	V _{IN} = 0.5V (CP, DS ₀ , DS ₇ , MR, OE ₁ , OE ₂) V _{IN} = 0.5V (S ₀ , S ₁)
I _{IH} + I _{OZH}	Output Leakage Current			70	μA	Max	V _{I/O} = 2.7V (I/O _n)
I _{IL} + I _{OZL}	Output Leakage Current			-650	μA	Max	V _{I/O} = 0.5V (I/O _n)
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
I _{CCH}	Power Supply Current		68	95	mA	Max	V _O = HIGH
I _{CCL}	Power Supply Current		68	95	mA	Max	V _O = LOW
I _{CCZ}	Power Supply Current		68	95	mA	Max	V _O = HIGH Z

AC Electrical Characteristics

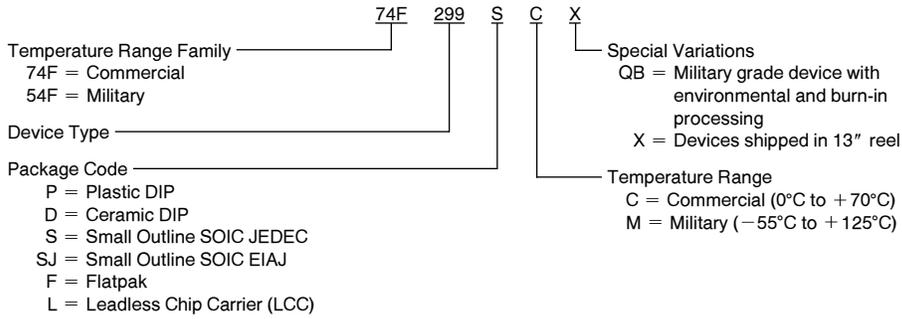
Symbol	Parameter	74F			54F		74F		Units
		$T_A = +25^\circ\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A, V_{CC} = \text{Mil}$ $C_L = 50\text{ pF}$		$T_A, V_{CC} = \text{Com}$ $C_L = 50\text{ pF}$		
		Min	Typ	Max	Min	Max	Min	Max	
f_{max}	Maximum Input Frequency	70	100		85		70		MHz
t_{PLH} t_{PHL}	Propagation Delay CP to Q_0 or Q_7	4.0 4.5	7.0 6.5	8.0 8.0	4.0 4.5	9.0 9.5	4.0 4.5	8.5 8.5	ns
t_{PLH} t_{PHL}	Propagation Delay CP to I/O_n	3.5 4.0	7.0 8.5	9.0 9.0	3.5 4.0	10.0 11.0	3.5 4.0	10.0 10.0	
t_{PHL}	Propagation Delay $\overline{\text{MR}}$ to Q_0 or Q_7	5.5	7.5	9.5	5.5	12.5	5.5	10.5	ns
t_{PHL}	Propagation Delay $\overline{\text{MR}}$ to I/O_n	5.5	11.0	10.0	5.5	12.0	5.5	10.5	
t_{PZH} t_{PZL}	Output Enable Time $\overline{\text{OE}}$ to I/O_n	3.5 4.0	6.0 7.0	8.0 10.0	3.0 4.0	9.5 13.0	3.5 4.0	9.0 11.0	ns
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{\text{OE}}$ to I/O_n	2.0 1.0	4.5 4.0	6.0 5.5	1.5 1.0	7.0 6.5	2.0 1.0	7.0 6.5	
t_{PZH} t_{PZL}	Output Enable Time S_n to I/O_n	3.5 4.0		9.0 10.0	3.0 4.0	10.5 13.0	3.5 4.0	10.0 11.0	ns
t_{PHZ} t_{PLZ}	Output Disable Time S_n to I/O_n	2.5 1.5		6.0 5.5	1.5 1.0	7.0 6.5	2.5 1.5	7.0 6.5	

AC Operating Requirements

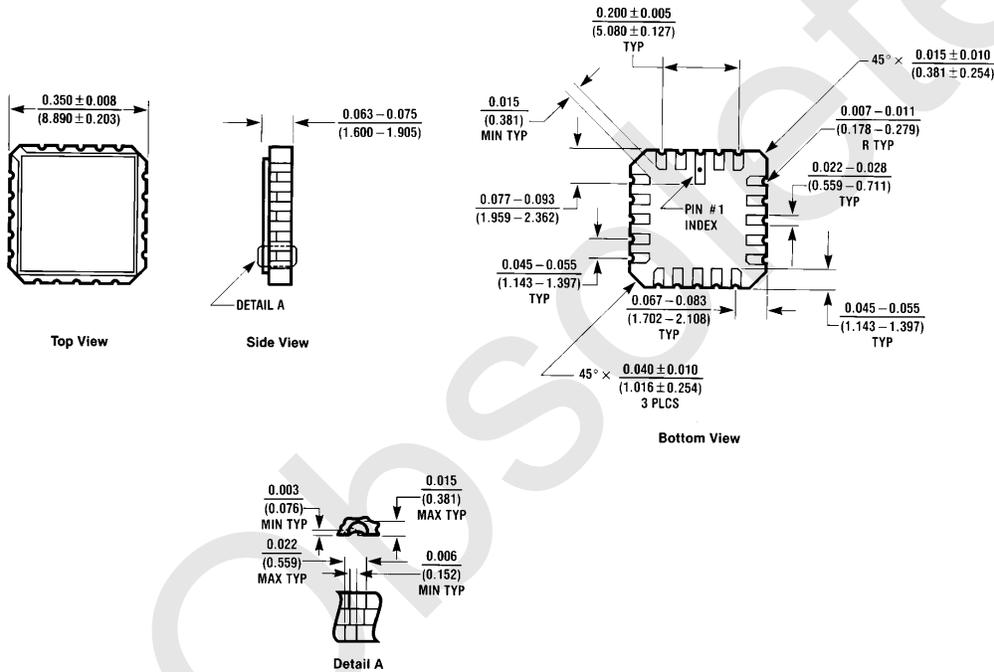
Symbol	Parameter	74F		54F		74F		Units
		$T_A = +25^\circ\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A, V_{CC} = \text{Mil}$		$T_A, V_{CC} = \text{Com}$		
		Min	Max	Min	Max	Min	Max	
$t_s(\text{H})$ $t_s(\text{L})$	Setup Time, HIGH or LOW S_0 or S_1 to CP	8.5 8.5		10.0 7.5		8.5 8.5		ns
$t_h(\text{H})$ $t_h(\text{L})$	Hold Time, HIGH or LOW S_0 or S_1 to CP	0 0		0 0		0 0		
$t_s(\text{H})$ $t_s(\text{L})$	Setup Time, HIGH or LOW $I/O_n, DS_0$ or DS_7 to CP	5.0 5.0		5.0 5.0		5.0 5.0		ns
$t_h(\text{H})$ $t_h(\text{L})$	Hold Time, HIGH or LOW $I/O_n, DS_0$ or DS_7 to CP	2.0 2.0		2.0 2.0		2.0 2.0		
$t_w(\text{H})$ $t_w(\text{L})$	CP Pulse Width HIGH or LOW	5.0 5.0		5.0 5.0		5.0 5.0		ns
$t_w(\text{L})$	$\overline{\text{MR}}$ Pulse Width, LOW	5.0		6.0		5.0		ns
t_{rec}	Recovery Time, $\overline{\text{MR}}$ to CP	7.0		12.0		7.0		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:



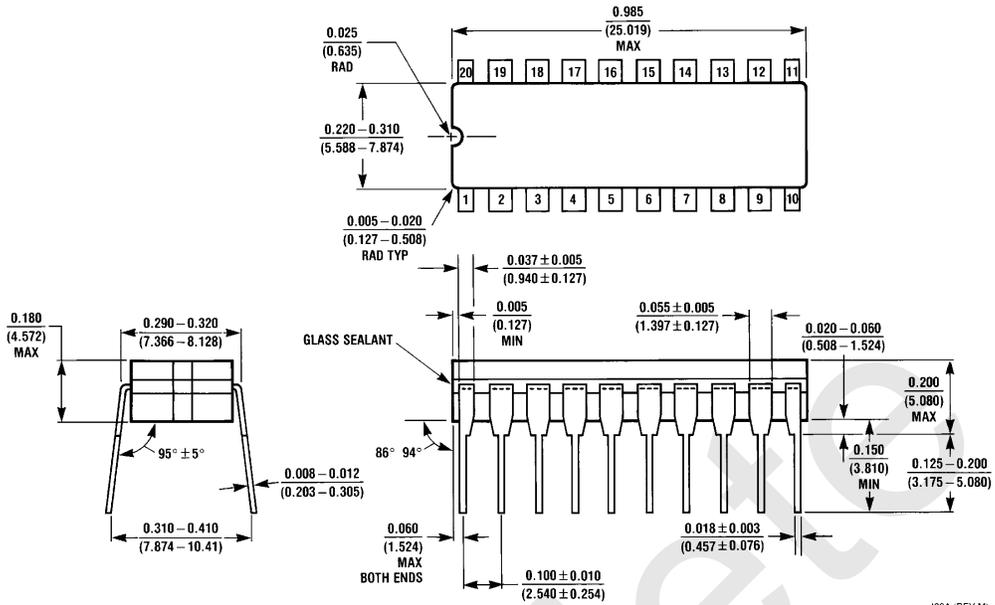
Physical Dimensions inches (millimeters)



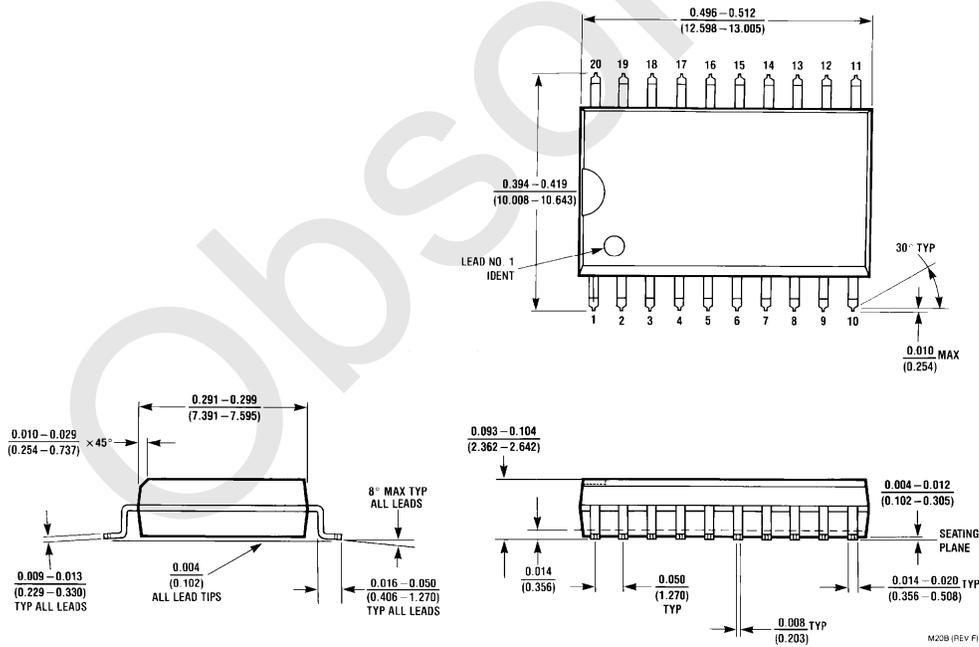
20-Lead Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

E20A (REV D)

Physical Dimensions inches (millimeters) (Continued)

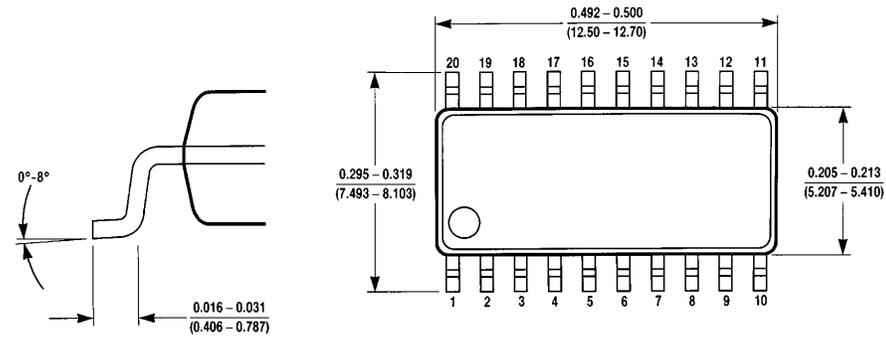


**20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A**

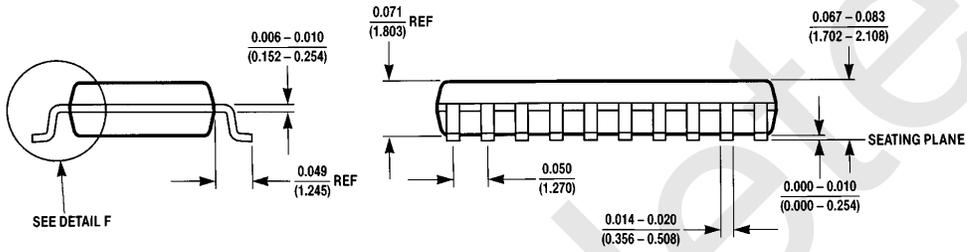


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M20B**

Physical Dimensions inches (millimeters) (Continued)



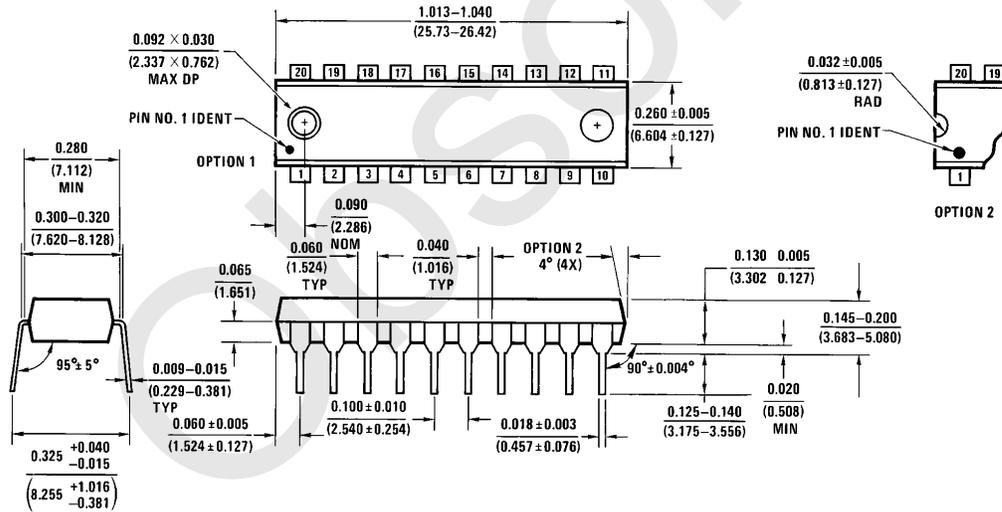
DETAIL F



SEE DETAIL F

M20D (REV A)

**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)
NS Package Number MD20D**

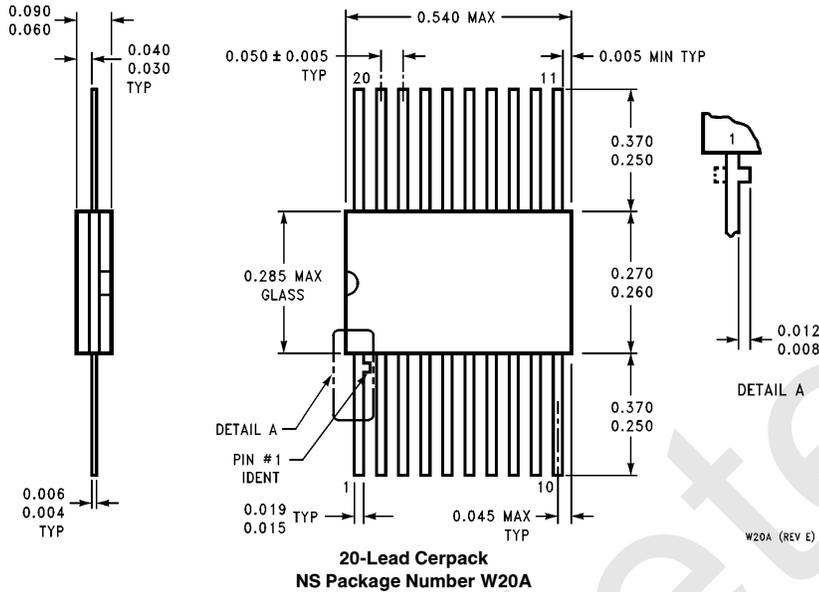


N20A (REV G)

**20-Lead (0.300" Wide) Molded Dual-In-Line Package (P)
NS Package Number N20A**

Obsolete

Physical Dimensions inches (millimeters) (Continued)



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
 2900 Semiconductor Drive
 P.O. Box 58090
 Santa Clara, CA 95052-8090
 Tel: 1(800) 272-9959
 TWX: (910) 339-9240

National Semiconductor GmbH
 Livry-Gargan-Str. 10
 D-82256 Fürstenfeldbruck
 Germany
 Tel: (81-41) 35-0
 Telex: 527849
 Fax: (81-41) 35-1

National Semiconductor Japan Ltd.
 Sumitomo Chemical
 Engineering Center
 Bldg. 7F
 1-7-1, Nakase, Mihama-Ku
 Chiba-City,
 Chiba Prefecture 261
 Tel: (043) 299-2300
 Fax: (043) 299-2500

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 Semicondutores Do Brazil Ltda.
 Rue Deputado Lacorda Franco
 120-3A
 Sao Paulo-SP
 Brazil 05418-000
 Tel: (55-11) 212-5066
 Telex: 391-1131931 NSBR BR
 Fax: (55-11) 212-1181

National Semiconductor (Australia) Pty. Ltd.
 Building 16
 Business Park Drive
 Monash Business Park
 Nottingham, Melbourne
 Victoria 3168 Australia
 Tel: (3) 558-9999
 Fax: (3) 558-9998

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

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