

# 54F161A,54F163A

*54F161A/54F163A Synchronous Presettable Binary Counter*



Literature Number: SNOS159A

## 54F/74F161A • 54F/74F163A Synchronous Presettable Binary Counter

### General Description

The 'F161A and 'F163A are high-speed synchronous modulo-16 binary counters. They are synchronously presettable for application in programmable dividers and have two types of Count Enable inputs plus a Terminal Count output for versatility in forming synchronous multi-stage counters. The 'F161A has an asynchronous Master-Reset input that overrides all other inputs and forces the outputs LOW. The 'F163A has a Synchronous Reset input that overrides counting and parallel loading and allows the outputs to be simultaneously reset on the rising edge of the clock. The 'F161A and 'F163A are high-speed versions of the 'F161 and 'F163.

### Features

- Synchronous counting and loading
- High-speed synchronous expansion
- Typical count frequency of 120 MHz
- Guaranteed 4000V minimum ESD protection

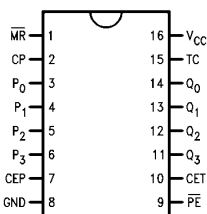
Commercial	Military	Package Number	Package Description
74F161APC		N16E	16-Lead (0.300" Wide) Molded Dual-In-Line
	54F161ADM (Note 2)	J16A	16-Lead Ceramic Dual-In-Line
74F161ASC (Note 1)		M16A	16-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F161ASJ (Note 1)		M16D	16-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F161AFM (Note 2)	W16A	16-Lead Cerpack
	54F161ALM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C
74F163APC		N16E	16-Lead (0.300" Wide) Molded Dual-In-Line
	54F163ADM (Note 2)	J16A	16-Lead Ceramic Dual-In-Line
74F163ASC (Note 1)		M16A	16-Lead (0.150" Wide) Molded Small Outline, JEDEC
74F163ASJ (Note 1)		M16D	16-Lead (0.300" Wide) Molded Small Outline, EIAJ
	54F163AFM (Note 2)	W16A	16-Lead Cerpack
	54F163ALM (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 = DMQB, FMQB and LMQB.

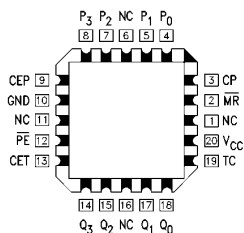
### Connection Diagrams

Pin Assignment  
for DIP, SOIC and Flatpak  
'F161A



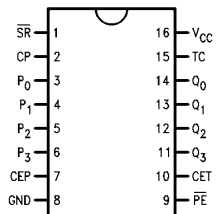
TL/F/9486-1

Pin Assignment  
for LCC  
'F161A



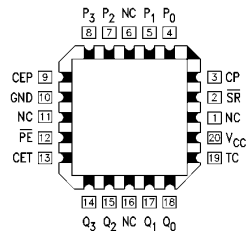
TL/F/9486-2

Pin Assignment  
for DIP, SOIC and Flatpak  
'F163A



TL/F/9486-7

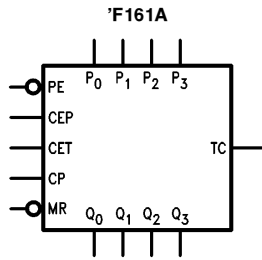
Pin Assignment  
for LCC  
'F163A



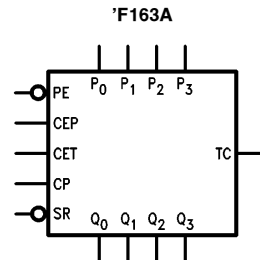
TL/F/9486-8

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

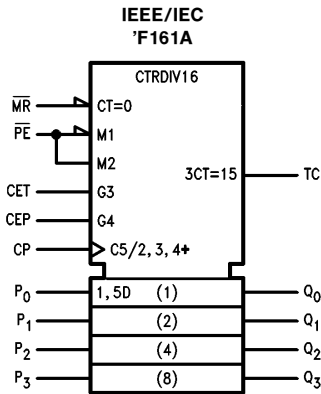
## Logic Symbols



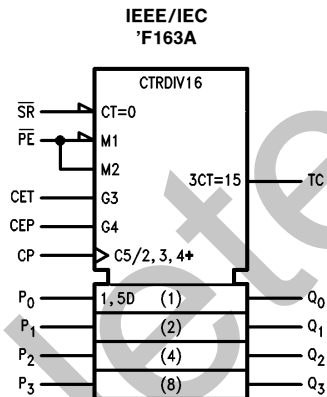
TL/F/9486-3



TL/F/9486-9



TL/F/9486-6



TL/F/9486-10

## Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input $I_{IH}/I_{IL}$ Output $I_{OH}/I_{OL}$
CEP	Count Enable Parallel Input	1.0/1.0	20 $\mu$ A/ -0.6 mA
CET	Count Enable Trickle Input	1.0/2.0	20 $\mu$ A/ -1.2 mA
CP	Clock Pulse Input (Active Rising Edge)	1.0/1.0	20 $\mu$ A/ -0.6 mA
$\overline{MR}$ ('F161A)	Asynchronous Master Reset Input (Active LOW)	1.0/1.0	20 $\mu$ A/ -0.6 mA
$\overline{SR}$ ('F163A)	Synchronous Reset Input (Active LOW)	1.0/2.0	20 $\mu$ A/ -1.2 mA
P <sub>0</sub> -P <sub>3</sub>	Parallel Data Inputs	1.0/1.0	20 $\mu$ A/ -0.6 mA
$\overline{PE}$	Parallel Enable Input (Active LOW)	1.0/2.0	20 $\mu$ A/ -1.2 mA
Q <sub>0</sub> -Q <sub>3</sub>	Flip-Flop Outputs	50/33.3	-1 mA/20 mA
TC	Terminal Count Output	50/33.3	-1 mA/20 mA

## Functional Description

The 'F161A and 'F163A count in modulo-16 binary sequence. From state 15 (HHHH) they increment to state 0 (LLLL). The clock inputs of all flip-flops are driven in parallel through a clock buffer. Thus all changes of the Q outputs (except due to Master Reset of the 'F161A) occur as a result of, and synchronous with, the LOW-to-HIGH transition of the CP input signal. The circuits have four fundamental modes of operation, in order of precedence: asynchronous reset ('F161A), synchronous reset ('F163A), parallel load, count-up and hold. Five control inputs—Master Reset ( $\overline{MR}$ , 'F161A), Synchronous Reset ( $\overline{SR}$ , 'F163A), Parallel Enable ( $\overline{PE}$ ), Count Enable Parallel (CEP) and Count Enable Trickle (CET)—determine the mode of operation, as shown in the Mode Select Table. A LOW signal on  $\overline{MR}$  overrides all other inputs and asynchronously forces all outputs LOW. A LOW signal on  $\overline{SR}$  overrides counting and parallel loading and allows all outputs to go LOW on the next rising edge of CP. A LOW signal on  $\overline{PE}$  overrides counting and allows information on the Parallel Data ( $P_n$ ) inputs to be loaded into the

flip-flops on the next rising edge of CP. With  $\overline{PE}$  and  $\overline{MR}$  ('F161A) or  $\overline{SR}$  ('F163A) HIGH, CEP and CET permit counting when both are HIGH. Conversely, a LOW signal on either CEP or CET inhibits counting.

The 'F161A and 'F163A use D-type edge triggered flip-flops and changing the  $\overline{SR}$ ,  $\overline{PE}$ , CEP and CET inputs when the CP is in either state does not cause errors, provided that the recommended setup and hold times, with respect to the rising edge of CP, are observed.

The Terminal Count (TC) output is HIGH when CET is HIGH and the counter is in state 15. To implement synchronous multi-stage counters, the TC outputs can be used with the CEP and CET inputs in two different ways. Please refer to the 'F568 data sheet. The TC output is subject to decoding spikes due to internal race conditions and is therefore not recommended for use as a clock or asynchronous reset for flip-flops, counters or registers.

$$\text{Logic Equations: Count Enable} = \text{CEP} \cdot \text{CET} \cdot \overline{PE}$$

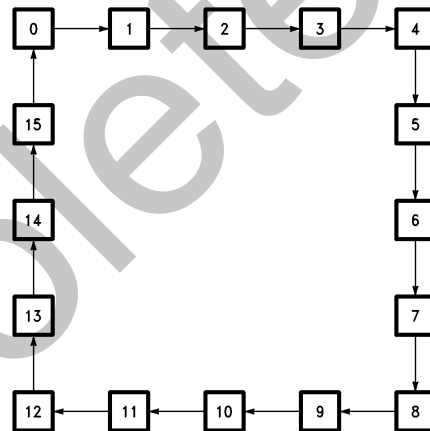
$$\text{TC} = Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3 \cdot \text{CET}$$

Mode Select Table

* $\overline{SR}$	$\overline{PE}$	CET	CEP	Action on the Rising Clock Edge (↗)
L	X	X	X	Reset (Clear)
H	L	X	X	Load ( $P_n \rightarrow Q_n$ )
H	H	H	H	Count (Increment)
H	H	L	X	No Change (Hold)
H	H	X	L	No Change (Hold)

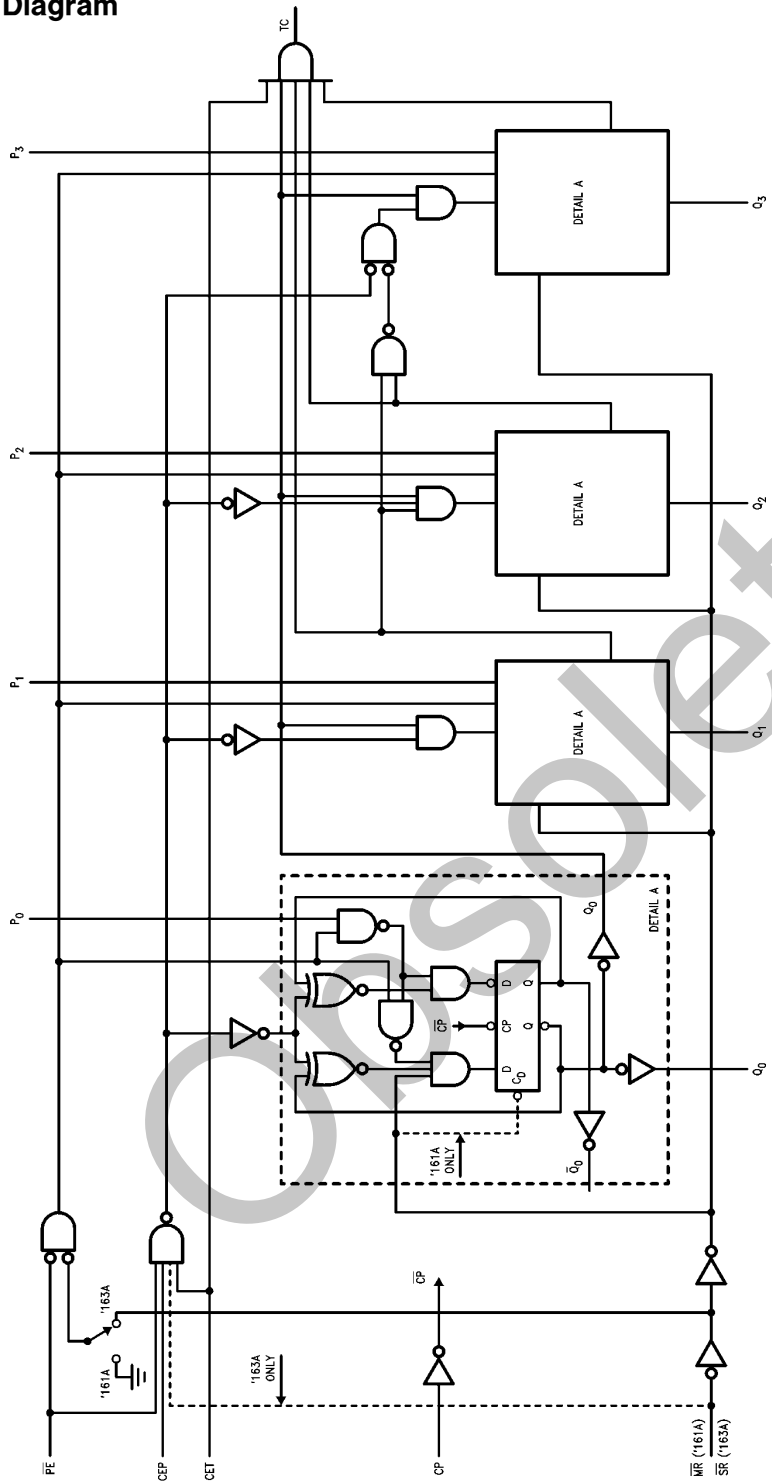
\*For 'F163A only  
H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

## State Diagram



TL/F/9486-5

# Block Diagram



TL/F/9486-4

## 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 <sub>CC</sub> 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 <sub>CC</sub> = 0V)	
Standard Output	-0.5V to V <sub>CC</sub>
TRI-STATE® Output	-0.5V to +5.5V

Current Applied to Output in LOW State (Max) twice the rated I<sub>OL</sub> (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.

## 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 <sub>CC</sub>	Conditions		
		Min	Typ	Max					
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal		
V <sub>IL</sub>	Input LOW Voltage				V		Recognized as a LOW Signal		
V <sub>CD</sub>	Input Clamp Diode Voltage				V	Min	I <sub>IN</sub> = -18 mA		
V <sub>OH</sub>	Output HIGH Voltage	54F 10% V <sub>CC</sub>	2.5		V	Min	I <sub>OH</sub> = -1 mA		
		74F 10% V <sub>CC</sub>	2.5						
		74F 5% V <sub>CC</sub>	2.7						
V <sub>OL</sub>	Output LOW Voltage	54F 10% V <sub>CC</sub>		0.5	V	Min	I <sub>OL</sub> = 20 mA		
		74F 10% V <sub>CC</sub>		0.5					
I <sub>IH</sub>	Input HIGH Current	54F		20.0	μA	Max	V <sub>IN</sub> = 2.7V		
		74F		5.0					
I <sub>BVI</sub>	Input HIGH Current Breakdown Test	54F		100	μA	Max	V <sub>IN</sub> = 7.0V		
		74F		7.0					
I <sub>CEX</sub>	Output HIGH Leakage Current	54F		250	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>		
		74F		50					
V <sub>ID</sub>	Input Leakage Test	74F	4.75		V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded		
I <sub>OD</sub>	Output Leakage Circuit Current	74F		3.75	μA	0.0	V <sub>IOD</sub> = 150 mV All Other Pins Grounded		
I <sub>IL</sub>	Input LOW Current				-0.6	mA	Max	V <sub>IN</sub> = 0.5V (CEP, CP, $\overline{MR}$ , P <sub>0</sub> -P <sub>3</sub> )	
					-1.2	mA	Max	V <sub>IN</sub> = 0.5V (CET, $\overline{PE}$ , $\overline{SR}$ )	
I <sub>OS</sub>	Output Short-Circuit Current				-60		mA	Max	V <sub>OUT</sub> = 0V
I <sub>CC</sub>	Power Supply Current				37	55	mA	Max	

## AC Electrical Characteristics

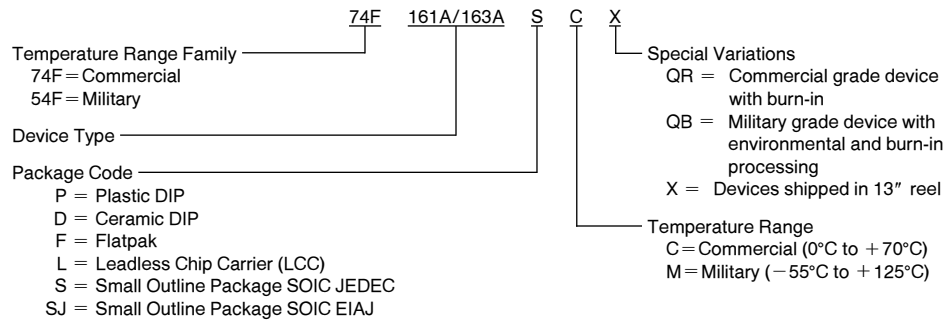
Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
f <sub>max</sub>	Maximum Count Frequency	100	120		75		90		MHz
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub> ( $\overline{PE}$ Input HIGH)	3.5	5.5	7.5	3.5	9.0	3.5	8.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub> ( $\overline{PE}$ Input LOW)	3.5	7.5	10.0	3.5	11.5	3.5	11.0	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub> ( $\overline{PE}$ Input LOW)	4.0	6.0	8.5	4.0	10.0	4.0	9.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to TC	4.0	6.0	8.5	4.0	10.0	4.0	9.5	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CP to TC	5.0	10.0	14.0	5.0	16.5	5.0	15.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CET to TC	5.0	10.0	14.0	5.0	15.5	5.0	15.0	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CET to TC	2.5	4.5	7.5	2.5	9.0	2.5	8.5	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay CET to TC	2.5	4.5	7.5	2.5	9.0	2.5	8.5	
t <sub>PHL</sub>	Propagation Delay $\overline{MR}$ to Q <sub>n</sub> ('F161A)	5.5	9.0	12.0	5.5	14.0	5.5	13.0	ns
t <sub>PHL</sub>	Propagation Delay $\overline{MR}$ to TC ('F161A)	4.5	8.0	10.5	4.5	12.5	4.5	11.5	ns

## AC Operating Requirements

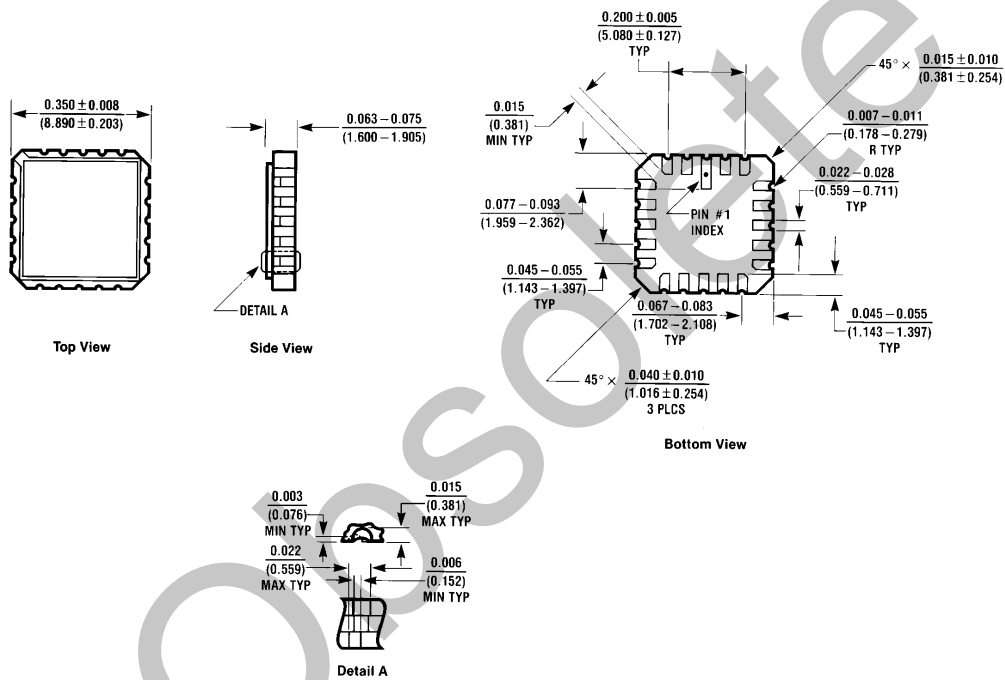
Symbol	Parameter	74F		54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V		T <sub>A</sub> , V <sub>CC</sub> = Mil		T <sub>A</sub> , V <sub>CC</sub> = Com		
		Min	Max	Min	Max	Min	Max	
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time, HIGH or LOW P <sub>n</sub> to CP	5.0		5.5		5.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time, HIGH or LOW P <sub>n</sub> to CP	5.0		5.5		5.0		
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time, HIGH or LOW $\overline{PE}$ or $\overline{SR}$ to CP	2.0		2.5		2.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time, HIGH or LOW P <sub>n</sub> to CP	2.0		2.5		2.0		
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time, HIGH or LOW $\overline{PE}$ or $\overline{SR}$ to CP	11.0		13.5		11.5		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time, HIGH or LOW $\overline{PE}$ or $\overline{SR}$ to CP	8.5		10.5		9.5		
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time, HIGH or LOW CEP or CET to CP	2.0		3.6		2.0		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time, HIGH or LOW CEP or CET to CP	0		0		0		
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time, HIGH or LOW CEP or CET to CP	11.0		13.0		11.5		ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold Time, HIGH or LOW CEP or CET to CP	5.0		6.0		5.0		
t <sub>w</sub> (H) t <sub>w</sub> (L)	Clock Pulse Width (Load) HIGH or LOW	0		0		0		ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	Clock Pulse Width (Count) HIGH or LOW	5.0		5.0		5.0		
t <sub>w</sub> (H) t <sub>w</sub> (L)	Clock Pulse Width (Count) HIGH or LOW	4.0		5.0		4.0		ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	Clock Pulse Width (Count) HIGH or LOW	6.0		8.0		7.0		
t <sub>w</sub> (L)	$\overline{MR}$ Pulse Width, LOW ( 'F161A)	5.0		5.0		5.0		ns
t <sub>rec</sub>	Recovery Time $\overline{MR}$ to CP ('F161A)	6.0		6.0		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:



## Physical Dimensions inches (millimeters)

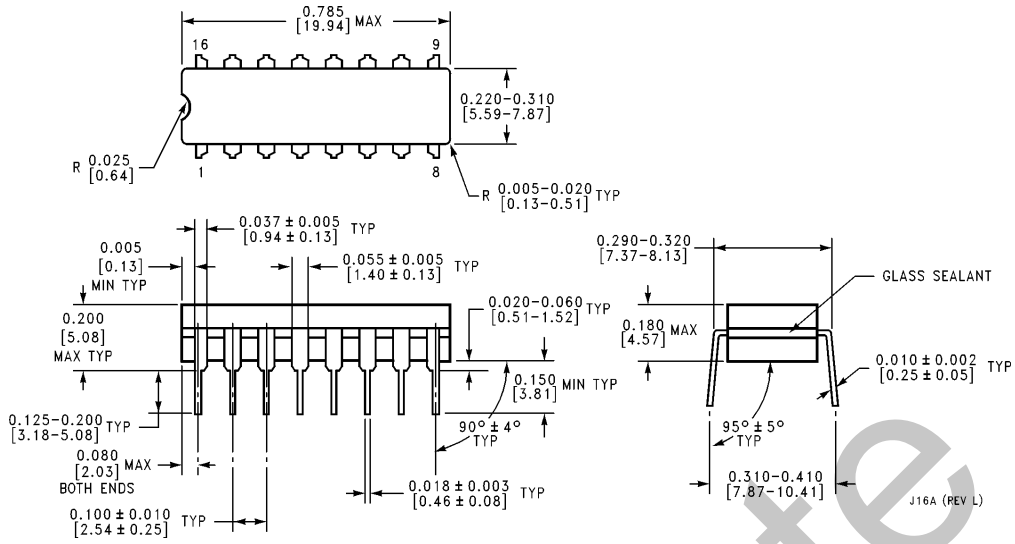


**20-Lead Ceramic Leadless Chip Carrier (L)  
NS Package Number E20A**

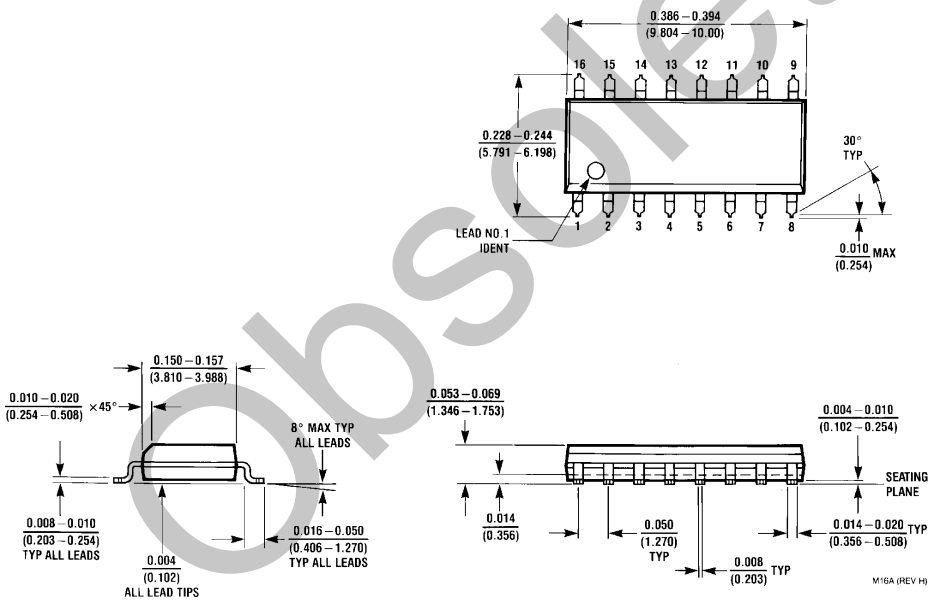
E20A (REV D)



**Physical Dimensions** inches (millimeters) (Continued)

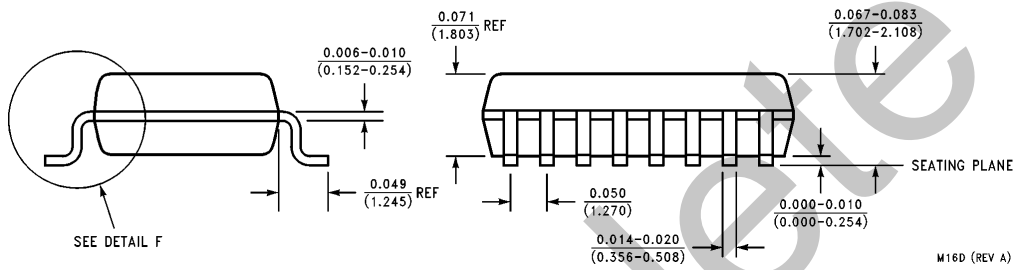
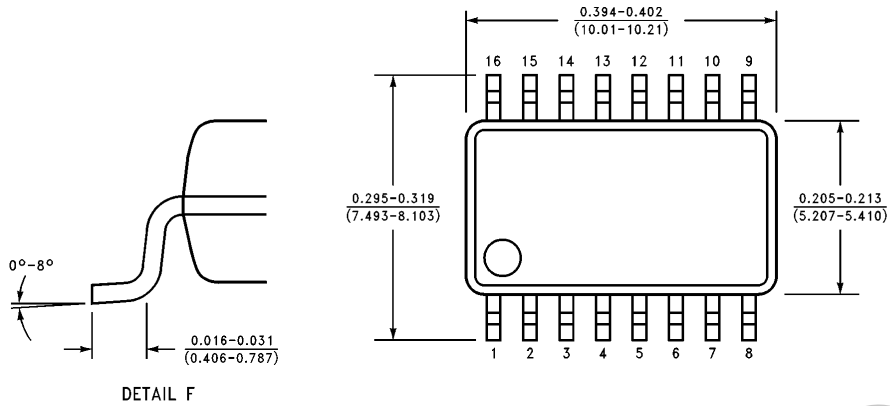


**16-Lead Ceramic Dual-In-Line Package (D)  
NS Package Number J16A**

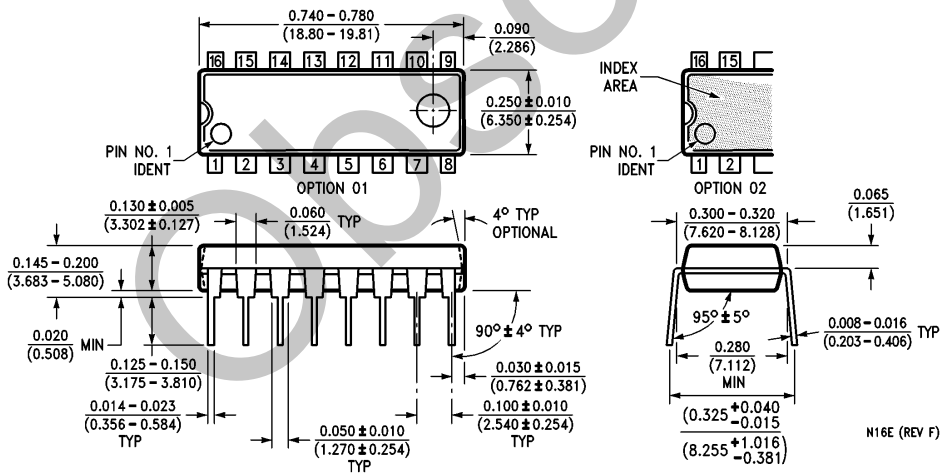


**16-Lead (0.150" Wide) Molded Small Outline Package, JEDEC (S)  
NS Package Number M16A**

**Physical Dimensions** inches (millimeters) (Continued)

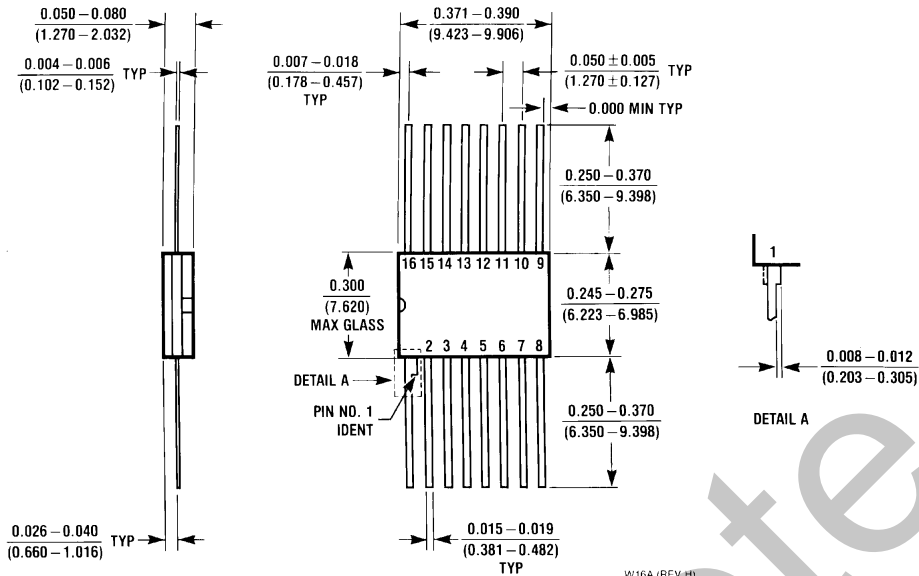


**16-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)**  
NS Package Number M16D



**16-Lead (0.300" Wide) Molded Dual-In-Line Package (P)**  
NS Package Number N16E

**Physical Dimensions** inches (millimeters) (Continued)



**16-Lead Ceramic Flatpak (F)  
NS Package Number W16A**

**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: (1800) 272-9959  
TWX: (910) 339-9240

**National Semiconductor GmbH**  
Livny-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,  
Ciba 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	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Mobile Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

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

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

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