

74AC399•54ACT/74ACT399 Quad 2-Port Register

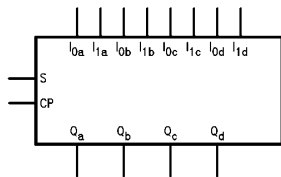
General Description

The 'AC/ACT399 is the logical equivalent of a quad 2-input multiplexer feeding into four edge-triggered flip-flops. A common Select input determines which of the two 4-bit words is accepted. The selected data enters the flip-flop on the rising edge of the clock.

Features

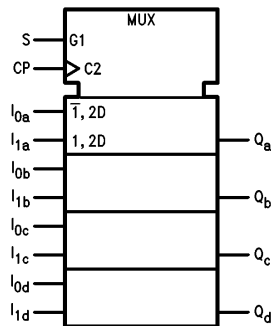
- I_{CC} reduced by 50%
- Select inputs from two data sources
- Fully positive edge-triggered operation
- Outputs source/sink 24 mA
- 'ACT/ACT399 has TTL-compatible inputs

Logic Symbols



TL/F/9789-1

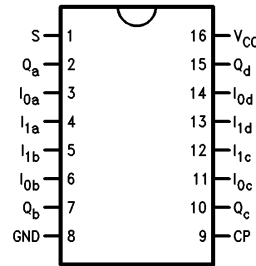
IEEE/IEC



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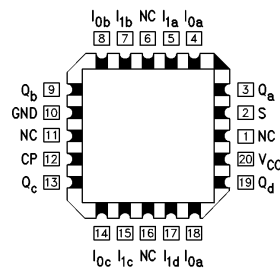
Connection Diagrams

Pin Assignment for DIP, Flatpak and SOIC



TL/F/9789-3

Pin Assignment for LCC



TL/F/9789-2

Pin Names	Description
S	Common Select Input
CP	Clock Pulse Input
I _{0a} -I _{0d}	Data Inputs from Source 0
I _{1a} -I _{1d}	Data Inputs from Source 1
Q _a -Q _d	Register True Outputs

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Functional Description

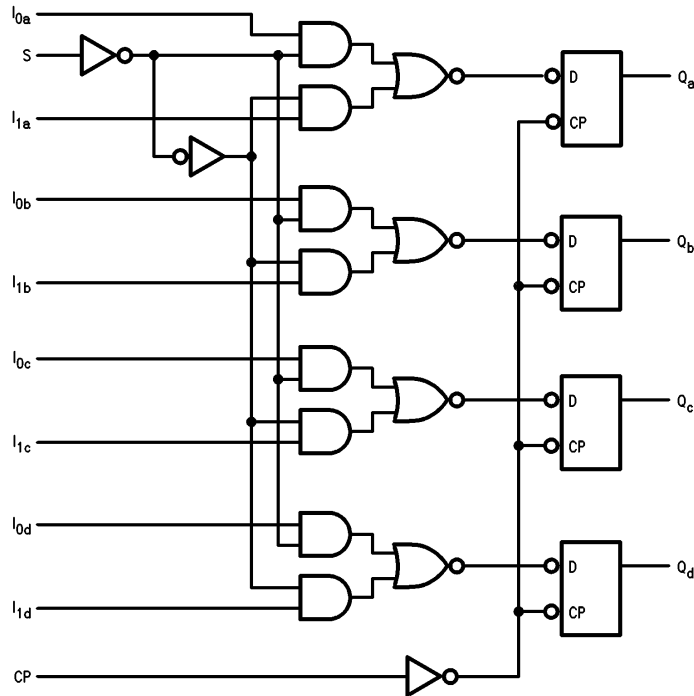
The 'AC/ACT399 is a high-speed quad 2-port register. It selects four bits of data from either of two sources (Ports) under control of a common Select input (S). The selected data is transferred to a 4-bit output register synchronous with the LOW-to-HIGH transition of the Clock input (CP). The 4-bit D-type output register is fully edge-triggered. The Data inputs (I_{0x} , I_{1x}) and Select input (S) must be stable only a setup time prior to and hold time after the LOW-to-HIGH transition of the Clock input for predictable operation.

Function Table

Inputs				Outputs	
S	I_0	I_1	CP	Q	\bar{Q}
L	L	X	↗	L	H
L	H	X	↗	H	L
H	X	L	↗	L	H
H	X	H	↗	H	L

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

Logic Diagram



TL/F/9789-4

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})	-20 mA
$V_I = -0.5V$	-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})	-20 mA
$V_O = -0.5V$	-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
PDIP	+140°C

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.

Recommended Operating Conditions

Supply Voltage (V_{CC})	2.0V to 6.0V
'AC	4.5V to 5.5V
'ACT	
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
74AC/ACT	-40°C to +85°C
54ACT	-55°C to +125°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
'AC Devices	
V_{IN} from 30% to 70% of V_{CC}	
V_{CC} @ 3.3V, 4.5V, 5.5V	125 mV/ns
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

DC Characteristics for 'AC Family Devices

Symbol	Parameter	V_{CC} (V)	74AC		74AC		Units	Conditions	
			$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$				
			Typ	Guaranteed Limits					
V_{IH}	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1		V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	3.15	3.15				
		5.5	2.75	3.85	3.85				
V_{IL}	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9		V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	1.35	1.35				
		5.5	2.75	1.65	1.65				
V_{OH}	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9		V	$I_{OUT} = -50 \mu\text{A}$	
		4.5	4.49	4.4	4.4				
		5.5	5.49	5.4	5.4				
			3.0		2.56	2.46		V	* $V_{IN} = V_{IL}$ or V_{IH} -12 mA $I_{OH} = -24 \text{ mA}$ -24 mA
			4.5		3.86	3.76			
			5.5		4.86	4.76			
V_{OL}	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1		V	$I_{OUT} = 50 \mu\text{A}$	
		4.5	0.001	0.1	0.1				
		5.5	0.001	0.1	0.1				
			3.0		0.36	0.44		V	* $V_{IN} = V_{IL}$ or V_{IH} 12 mA $I_{OL} = 24 \text{ mA}$ 24 mA
			4.5		0.36	0.44			
			5.5		0.36	0.44			
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0		μA	$V_I = V_{CC}, \text{GND}$	

*All outputs loaded; thresholds on input associated with output under test.

DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V _{CC} (V)	74AC		74AC		Units	Conditions
			T _A = +25°C		T _A = -40°C to +85°C			
			Typ	Guaranteed Limits				
I _{OZ}	Maximum TRI-STATE® Current	5.5		±0.5	±5.0		μA	V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = V _{CC} , GND
I _{OLD}	†Minimum Dynamic Output Current	5.5			75		mA	V _{OLD} = 1.65V Max
I _{OHD}		5.5			-75		mA	V _{OHD} = 3.85V Min
I _{CC}	Maximum Quiescent Supply Current	5.5		4.0	40.0		μA	V _{IN} = V _{CC} or GND

†Maximum test duration 2.0 ms, one output loaded at a time.

Note: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC}.

DC Electrical Characteristics for 'ACT Family Devices

Symbol	Parameter	V _{CC} (V)	74ACT		54ACT		74ACT		Units	Conditions
			T _A = 25°C		T _A = -55°C to +125°C		T _A = -40°C to +85°C			
			Typ	Guaranteed Limits						
V _{IH}	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0		2.0		V	V _{OUT} = 0.1V or V _{CC} - 0.1V
		5.5	1.5	2.0	2.0		2.0			
V _{IL}	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8		0.8		V	V _{OUT} = 0.1V or V _{CC} - 0.1V
		5.5	1.5	0.8	0.8		0.8			
V _{OH}	Minimum High Level	4.5	4.49	4.4	4.4		4.4		V	I _{OUT} = -50 μA
		5.5	5.49	5.4	5.4		5.4			
V _{OL}	Maximum Low Level Output Voltage	4.5		3.86	3.70		3.76		V	*V _{IN} = V _{IL} or V _{IH} I _{OH} = -24 mA -24 mA
		5.5		4.85	4.70		4.76			
V _{OL}	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1		0.1		V	I _{OUT} = 50 μA
		5.5	0.001	0.1	0.1		0.1			
V _{OL}	Maximum Low Level Output Voltage	4.5		0.36	0.50		0.44		V	*V _{IN} = V _{IL} or V _{IH} I _{OL} = 24 mA 24 mA
		5.5		0.36	0.50		0.44			
I _{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0		±1.0		μA	V _I = V _{CC} , GND
I _{CCT}	Maximum I _{CC} /Input	5.5	0.6		1.6		1.5		mA	V _I = V _{CC} - 2.1V
I _{OLD}	†Minimum Dynamic Output Current	5.5			50		75		mA	V _{OLD} = 1.65V Max
I _{OHD}		5.5			-50		-75		mA	V _{OHD} = 3.85V Min
I _{CC}	Maximum Quiescent Supply Current	5.5		4.0	80.0		40.0		μA	V _{IN} = V _{CC} or Ground

*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

AC Electrical Characteristics

Symbol	Parameter	V _{CC} * (V)	74AC			74AC		Units
			T _A = +25°C V _{CC} = +5.0V C _L = 50 pF			T _A , V _{CC} = Com C _L = 50 pF		
			Min	Typ	Max	Min	Max	
f _{max}	Input Clock Frequency	3.3 5.0	140 170	160 190		130 165	MHz	
t _{PLH}	Propagation Delay CP to Q	3.3 5.0	4.0 2.0	7.5 5.0	10.0 8.0	3.5 1.5	11.0 8.5	ns
t _{PHL}	Propagation Delay CP to Q	3.3 5.0	3.5 2.0	7.0 5.0	9.5 7.5	3.0 1.5	10.5 8.0	ns

*Voltage Range 5.0 is 5.0V ±0.5V

AC Operating Requirements

Symbol	Parameter	V _{CC} * (V)	74AC		74AC		Units
			T _A = +25°C C _L = 50 pF		T _A = -40°C to +85°C C _L = 50 pF		
			Typ	Guaranteed Minimum			
t _s	Setup Time, HIGH or LOW I _n to CP	3.3 5.0	2.0 1.5	4.0 3.0	4.0 3.0		ns
t _h	Hold Time, HIGH or LOW I _n to CP	3.3 5.0	0.5 0.5	1.0 1.0	1.0 1.0		ns
t _s	Setup Time, HIGH or LOW S to CP	3.3 5.0	3.5 2.0	5.5 4.0	5.5 4.0		ns
t _h	Hold Time, HIGH or LOW S to CP	3.3 5.0	0.5 0.5	1.0 1.0	1.0 1.0		ns
t _w	CP Pulse Width, HIGH or LOW	3.3 5.0	3.0 2.0	4.5 3.5	4.5 3.5		ns

*Voltage Range 5.0 is 5.0V ±0.5V

AC Electrical Characteristics

Symbol	Parameter	V _{CC} * (V)	74ACT			54ACT		74ACT		Units
			T _A = +25°C V _{CC} = +5.0V C _L = 50 pF			T _A , V _{CC} = Mil C _L = 50 pF		T _A , V _{CC} = Com C _L = 50 pF		
			Min	Typ	Max	Min	Max	Min	Max	
f _{max}	Input Clock Frequency	5.0	165	180	90		160		MHz	
t _{PLH}	Propagation Delay CP to Q	5.0	1.5	7.0	8.0	1.5	10.0	1.5	8.5	ns
t _{PHL}	Propagation Delay CP to Q	5.0	2.0	6.0	9.0	1.5	10.0	2.0	9.5	ns

*Voltage Range 5.0 is 5.0V ±0.5V

AC Operating Requirements

Symbol	Parameter	V _{CC} * (V)	74ACT		54ACT	74ACT	Units
			T _A = +25°C C _L = 50 pF		T _A = -55°C to +125°C C _L = 50 pF	T _A = -40°C to +85°C C _L = 50 pF	
			Typ	Guaranteed Minimum			
t _s	Setup Time, HIGH or LOW I _n to CP	5.0	0.8	2.5	3.5	2.5	ns
t _h	Hold Time, HIGH or LOW I _n to CP	5.0	0	1.0	3.0	1.0	ns
t _s	Setup Time, HIGH or LOW S to CP	5.0	0.8	4.0	6.0	4.0	ns
t _h	Hold Time, HIGH or LOW S to CP	5.0	-1.0	0.5	2.5	0.5	ns
t _w	CP Pulse Width, HIGH or LOW	5.0	1.7	3.5	5.0	3.5	ns

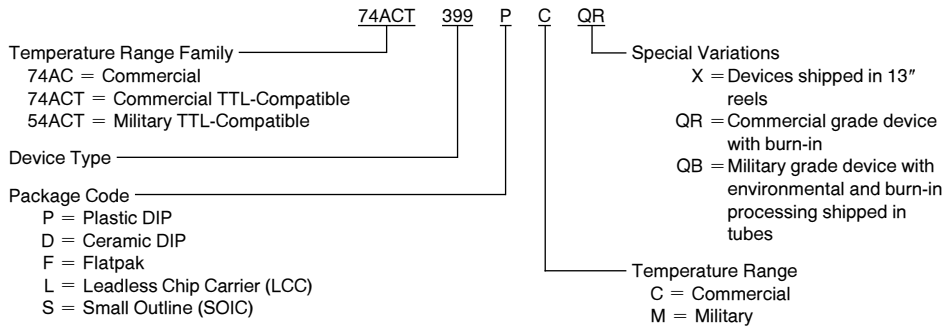
*Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

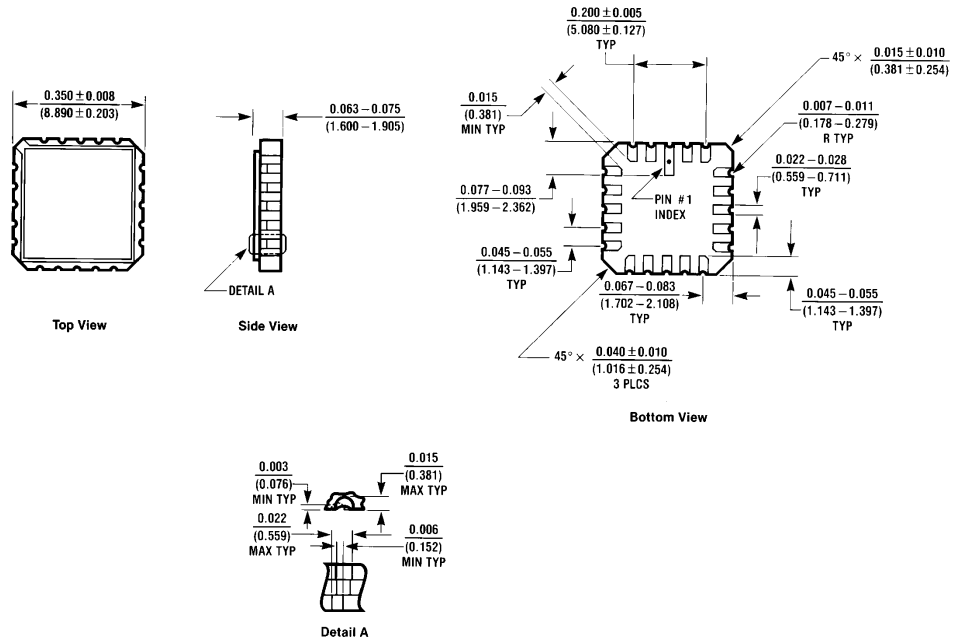
Symbol	Parameter	Typ	Units	Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = OPEN
C _{PD}	Power Dissipation Capacitance	30	pF	V _{CC} = 5.0V

Ordering Information

The Product Index and Selection Guide in Section 1 lists only the basic device numbers. The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

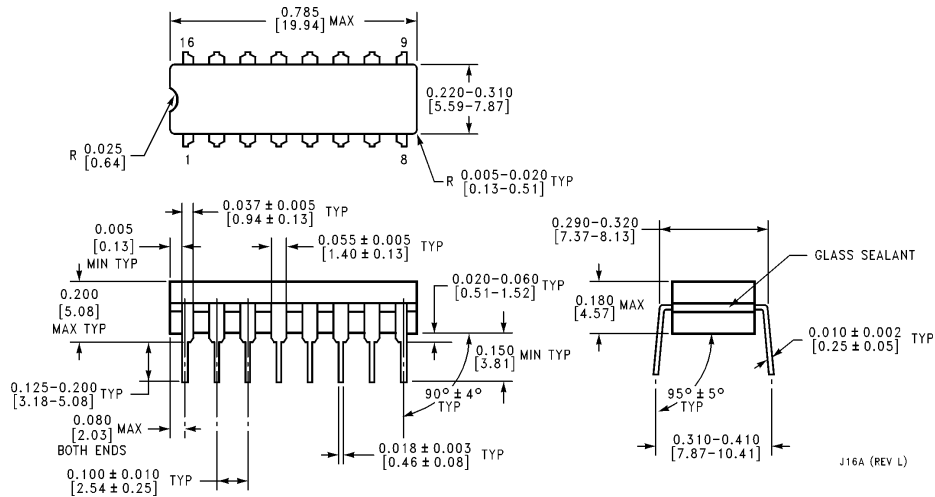


Physical Dimensions inches (millimeters)



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

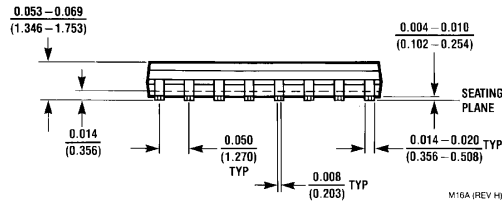
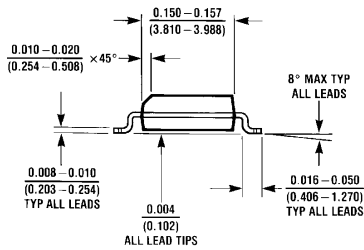
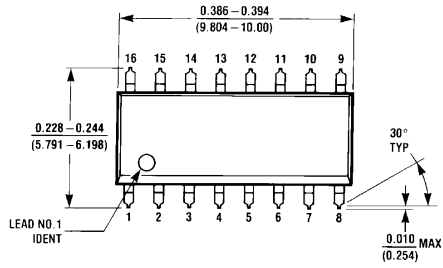
E20A (REV D)



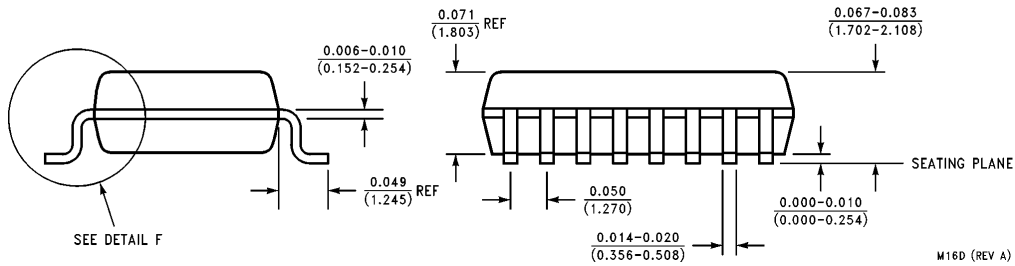
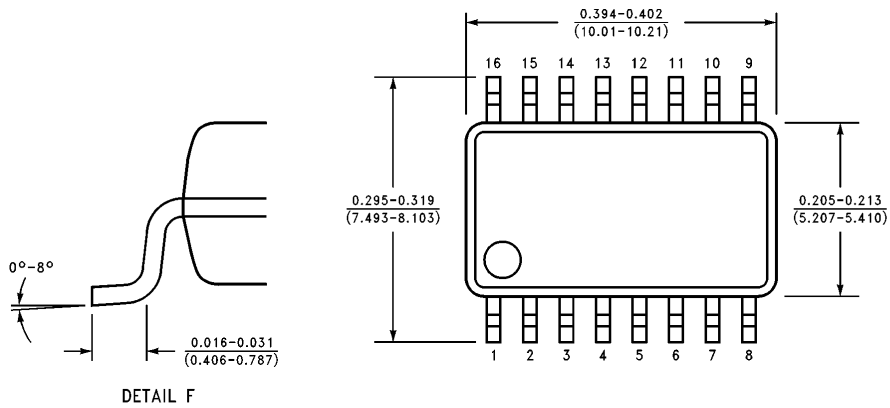
16-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J16A

J16A (REV L)

Physical Dimensions inches (millimeters) (Continued)

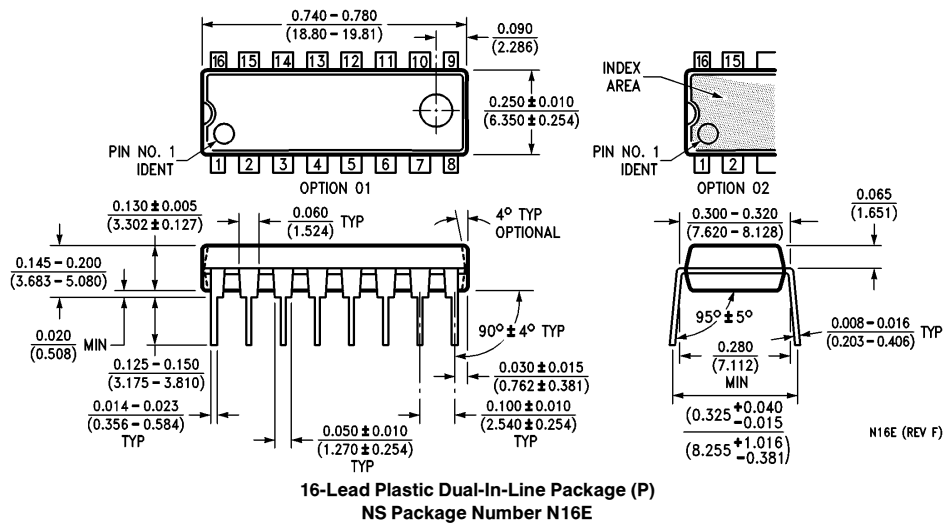


**16-Lead Small Outline Integrated Circuit (S)
NS Package Number M16A**



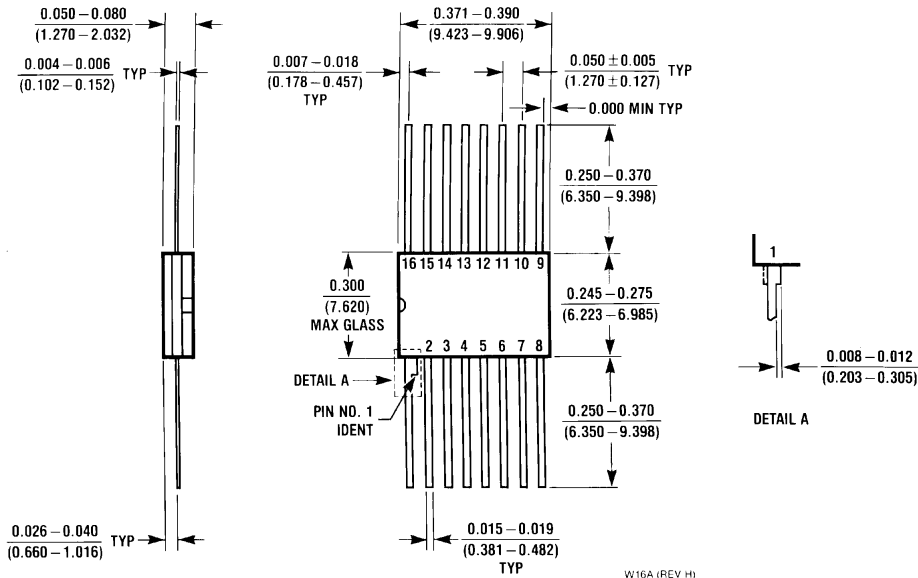
**16-Lead Small Outline Package-EIAJ (SJ)
NS Package Number M16D**

Physical Dimensions inches (millimeters) (Continued)



Physical Dimensions inches (millimeters) (Continued)

Lit. # 114542



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

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