

## 54AC/74AC520 • 54ACT/74ACT520 8-Bit Identity Comparator

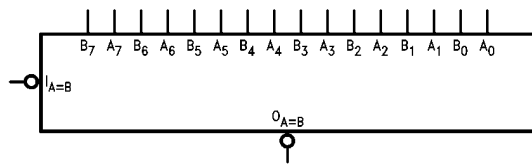
### General Description

The 'AC/'ACT520 are expandable 8-bit comparators. They compare two words of up to eight bits each and provide a LOW output when the two words match bit for bit. The expansion input  $I_{A=B}$  also serves as an active LOW enable input.

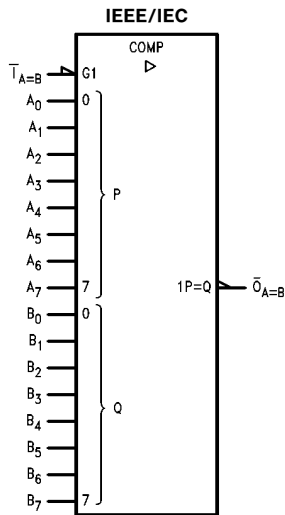
### Features

- Compares two 8-bit words in 6.5 ns typ
- Expandable to any word length
- 20-pin package
- Outputs source/sink 24 mA
- 'ACT520 has TTL-compatible inputs

### Logic Symbols



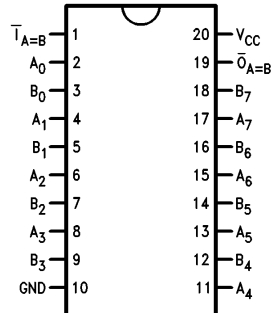
TL/F/10194-1



TL/F/10194-4

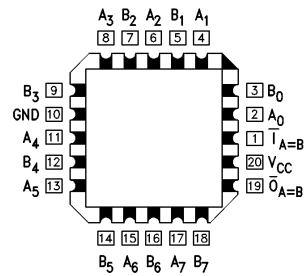
### Connection Diagrams

Pin Assignment  
for DIP, Flatpak and SOIC



TL/F/10194-2

Pin Assignment  
for LCC



TL/F/10194-3

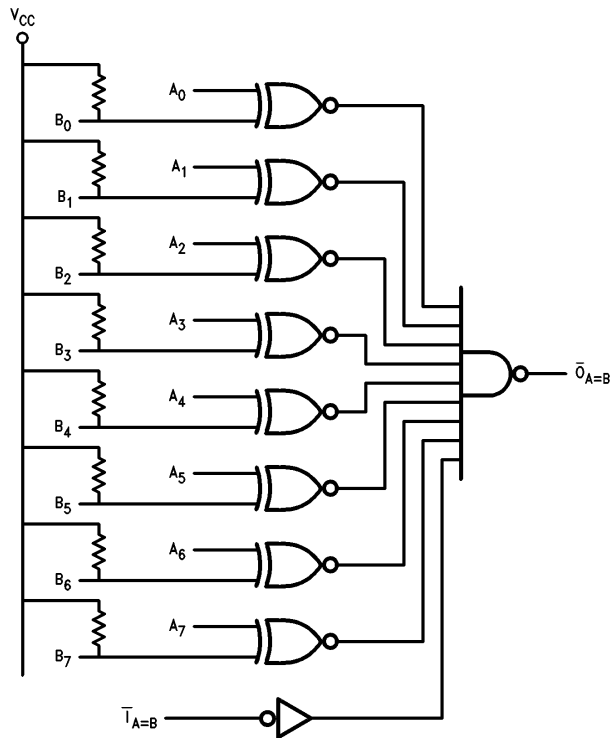
Pin Names	Description
A <sub>0</sub> –A <sub>7</sub>	Word A Inputs
B <sub>0</sub> –B <sub>7</sub>	Word B Inputs
$\overline{T}_{A=B}$	Expansion or Enable Input
$\overline{O}_{A=B}$	Identity Output

## Truth Table

Inputs		Outputs
$\bar{A} = B$	A, B	$\bar{O}_{A=B}$
L	A = B*	L
L	A $\neq$ B	H
H	A = B*	H
H	A $\neq$ B	H

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 \*A<sub>0</sub> = B<sub>0</sub>, A<sub>1</sub> = B<sub>1</sub>, A<sub>2</sub> = B<sub>2</sub>, etc.

## Logic Diagram



TL/F/10194-5

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 Rating (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 ( $I_{IK}$ )	
$V_I = -0.5V$	-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 ( $I_{OK}$ )	
$V_O = -0.5V$	-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 ( $V_{CC}$ )	
'AC	2.0V to 6.0V
'ACT	4.5V to 5.5V
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
54AC/ACT	-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		54AC	74AC		Units	Conditions
			$T_A = +25^\circ\text{C}$		$T_A =$ -55°C to +125°C	$T_A =$ -40°C to +85°C			
			Typ	Guaranteed Limits					
$V_{IH}$	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	2.25	3.15	3.15	3.15	3.15		
		5.5	2.75	3.85	3.85	3.85	3.85		
$V_{IL}$	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9	0.9	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	2.25	1.35	1.35	1.35	1.35		
		5.5	2.75	1.65	1.65	1.65	1.65		
$V_{OH}$	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	2.9	2.9	V	$I_{OUT} = -50 \mu\text{A}$
		4.5	4.49	4.4	4.4	4.4	4.4		
		5.5	5.49	5.4	5.4	5.4	5.4		
		3.0		2.56	2.4	2.46	2.46	V	* $V_{IN} = V_{IL}$ or $V_{IH}$ -12 mA $I_{OH}$ -24 mA -24 mA
		4.5		3.86	3.7	3.76	3.76		
		5.5		4.86	4.7	4.76	4.76		
$V_{OL}$	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	0.1	0.1	V	$I_{OUT} = 50 \mu\text{A}$
		4.5	0.001	0.1	0.1	0.1	0.1		
		5.5	0.001	0.1	0.1	0.1	0.1		
		3.0		0.36	0.50	0.44	0.44	V	* $V_{IN} = V_{IL}$ or $V_{IH}$ 12 mA $I_{OL}$ 24 mA 24 mA
		4.5		0.36	0.50	0.44	0.44		
		5.5		0.36	0.50	0.44	0.44		
$I_{IN}$	Maximum Input Leakage Current	5.5		±0.1	±1.0	±1.0	±1.0	μA	$V_I = V_{CC}, \text{GND}$ A Inputs Only
$I_{IH}$	Maximum Input High Leakage Current	5.5		10.0	10.0	10.0	10.0	μA	$V_I = V_{CC}$ B Inputs Only
$I_{IL}$	Maximum Input Low Leakage Current	5.5	-0.3	-0.6	-1.0	-1.0	-1.0	mA	$V_I = V_{CC}$ B Inputs Only

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

## DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V <sub>CC</sub> (V)	74AC		54AC	74AC	Units	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -55°C to +125°C	T <sub>A</sub> = -40°C to +85°C		
			Typ	Guaranteed Limits				
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5			50	75	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>		5.5			-50	-75	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		4.0	80.0	40.0	μA	V <sub>IN</sub> = V <sub>CC</sub>
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	2.3	4.8	8.0	8.0	mA	V <sub>IN</sub> = GND

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

**Note:** I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.

I<sub>CC</sub> for 54AC @ 25°C is identical to 74AC @ 25°C.

## DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V <sub>CC</sub> (V)	74ACT		54ACT	74ACT	Units	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -55°C to +125°C	T <sub>A</sub> = -40°C to +85°C		
			Typ	Guaranteed Limits				
V <sub>IH</sub>	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0	2.0	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	1.5	2.0	2.0	2.0		
V <sub>IL</sub>	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	0.8	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	1.5	0.8	0.8	0.8		
V <sub>OH</sub>	Minimum High Level Output Voltage	4.5	4.49	4.4	4.4	4.4	V	I <sub>OUT</sub> = -50 μA
		5.5	5.49	5.4	5.4	5.4		
		4.5		3.86	3.70	3.76		
5.5		4.86	4.70	4.76				
V <sub>OL</sub>	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	0.1	V	I <sub>OUT</sub> = 50 μA
		5.5	0.001	0.1	0.1	0.1		
		4.5		0.36	0.50	0.44		
5.5		0.36	0.50	0.44				
I <sub>IN</sub>	Maximum Input Leakage Current	5.5		±0.1	±1.0	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND
I <sub>IH</sub>	Maximum Input High Leakage Current	5.5		10.0	10.0	10.0	μA	V <sub>I</sub> = V <sub>CC</sub> B Inputs Only
I <sub>IL</sub>	Maximum Input Low Leakage Current	5.5	-0.3	-0.6	-1.0	-1.0	mA	V <sub>I</sub> = V <sub>CC</sub> B Inputs Only
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5	0.6		1.6	1.5	mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1V
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5			50	75	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>		5.5			-50	-75	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		4.0	80.0	40.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	2.3	4.8	8.0	8.0	mA	V <sub>IN</sub> = GND

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

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

**Note:** I<sub>CC</sub> for 54ACT @ 25°C is identical to 74ACT @ 25°C.

### AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC			54AC		74AC		Units
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_A = B$	3.3 5.0	4.0 2.5	7.5 5.5	11.5 8.5	1.0 1.5	14.0 10.5	3.0 2.0	13.0 9.5	ns
t <sub>PHL</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_A = B$	3.3 5.0	4.5 3.0	8.0 5.5	12.0 9.0	1.0 1.5	15.0 11.0	3.5 2.5	13.5 10.0	ns
t <sub>PLH</sub>	Propagation Delay $\overline{I}_A = B$ to $\overline{O}_A = B$	3.3 5.0	3.5 2.5	5.5 4.5	8.5 6.5	1.0 1.5	10.0 7.5	2.5 2.0	9.5 7.0	ns
t <sub>PHL</sub>	Propagation Delay $\overline{I}_A = B$ to $\overline{O}_A = B$	3.3 5.0	3.5 2.5	5.5 4.5	8.5 6.5	1.0 1.5	10.5 8.0	2.5 2.0	9.5 7.0	ns

\*Voltage Range 3.3 is 3.3V ±0.3V  
Voltage Range 5.0 is 5.0V ±0.5V

### AC Electrical Characteristics

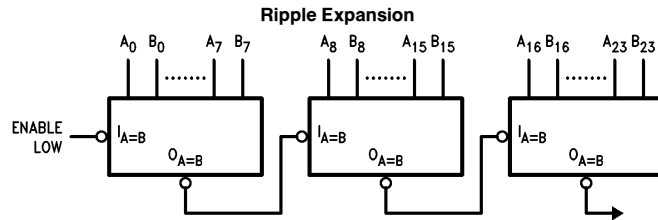
Symbol	Parameter	V <sub>CC</sub> * (V)	74ACT			54ACT		74ACT		Units
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_A = B$	5.0	3.0	5.5	8.5	1.5	12.0	2.5	9.5	ns
t <sub>PHL</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_A = B$	5.0	3.0	6.0	10.0	1.5	12.0	2.5	11.5	ns
t <sub>PLH</sub>	Propagation Delay $\overline{I}_A = B$ to $\overline{O}_A = B$	5.0	2.0	4.0	6.0	1.5	8.5	2.0	6.5	ns
t <sub>PHL</sub>	Propagation Delay $\overline{I}_A = B$ to $\overline{O}_A = B$	5.0	2.5	5.0	7.5	1.5	9.0	2.0	8.5	ns

\*Voltage Range 5.0 is 5.0V ±0.5V

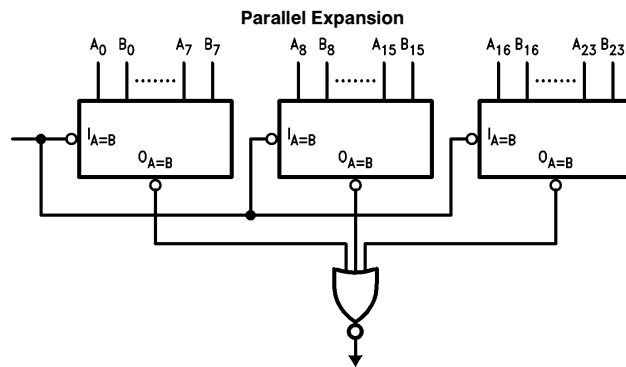
## Capacitance

Symbol	Parameter	Typ	Units	Conditions
$C_{IN}$	Input Capacitance	4.5	pF	$V_{CC} = OPEN$
$C_{PD}$	Power Dissipation Capacitance	40	pF	$V_{CC} = 5.0V$

## Applications



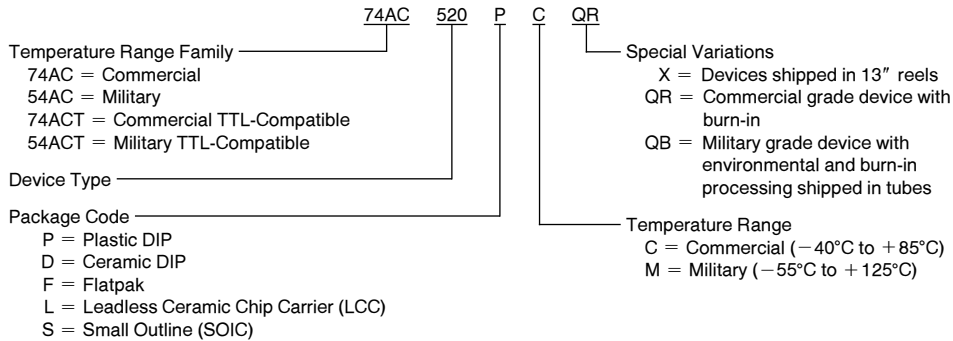
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TL/F/10194-7

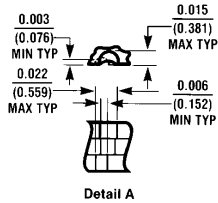
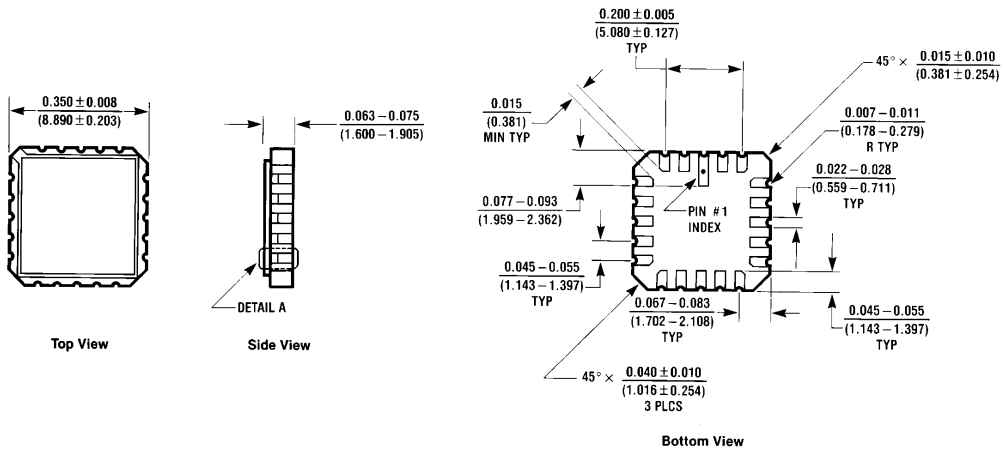
## Ordering Information

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



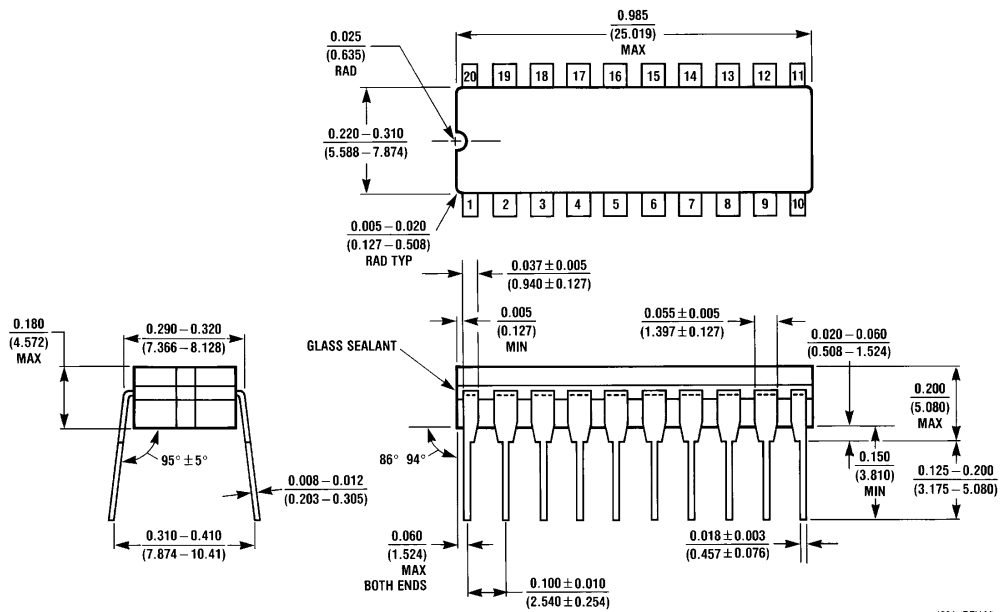


**Physical Dimensions** inches (millimeters)



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

E20A (REV D)

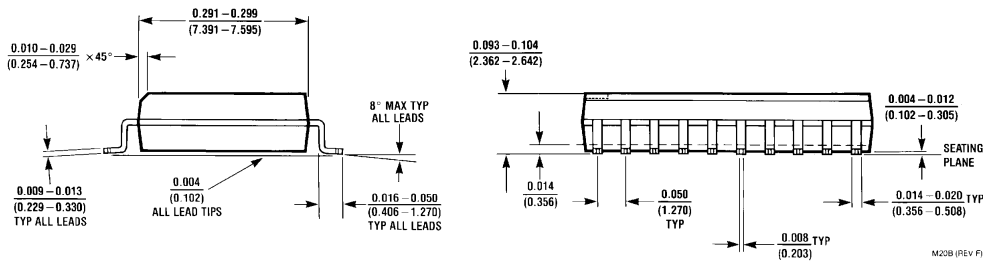
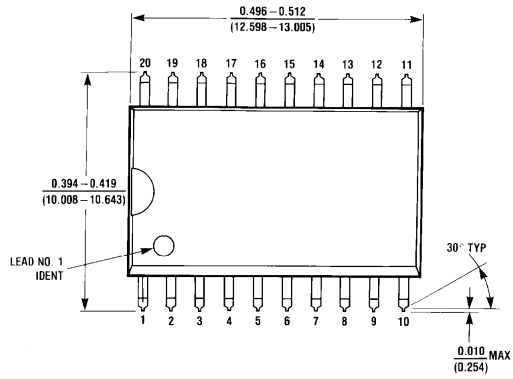


**20 Lead Ceramic Dual-In-Line Package (D)**  
**NS Package Number J20A**

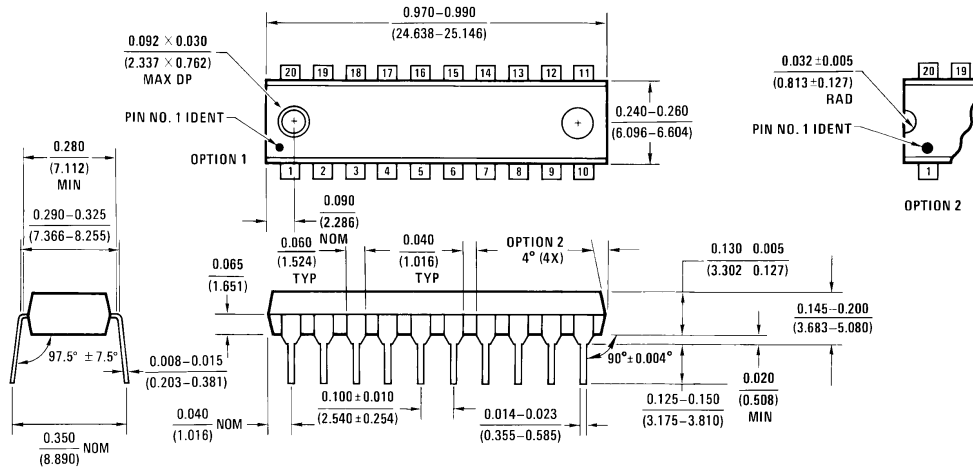
J20A (REV M)



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



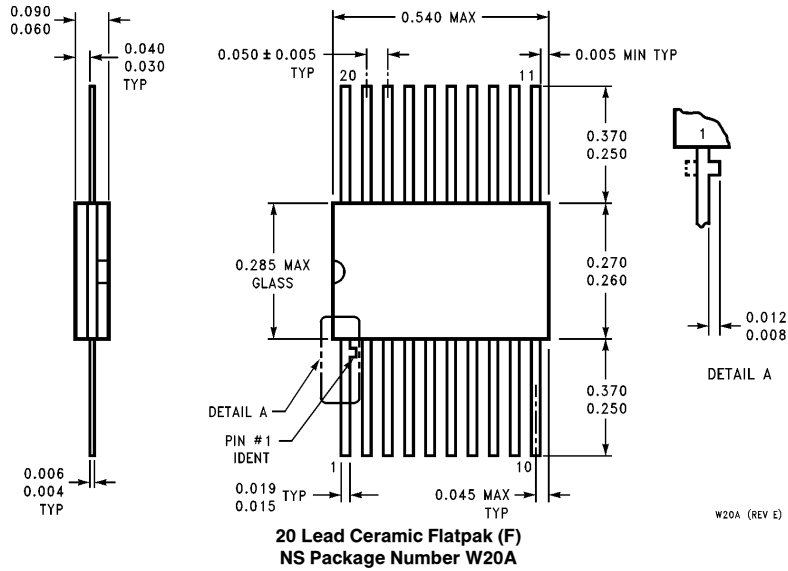
**20 Lead Small Outline Integrated Circuit (S)**  
NS Package Number M20B



**20 Lead Plastic Dual-In-Line Package (P)**  
NS Package Number N20B

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

Lit. # 114820



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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.



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