

# 54AC520 • 54ACT520

## 8-Bit Identity Comparator

### General Description

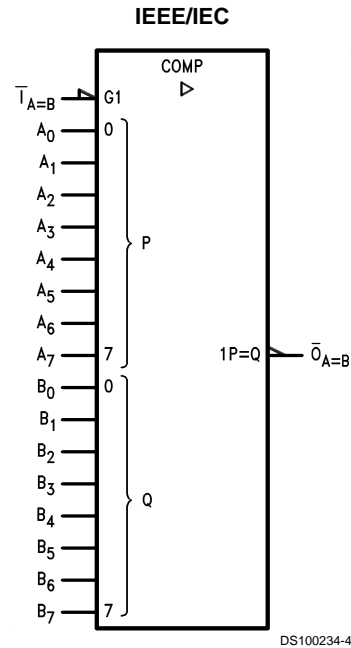
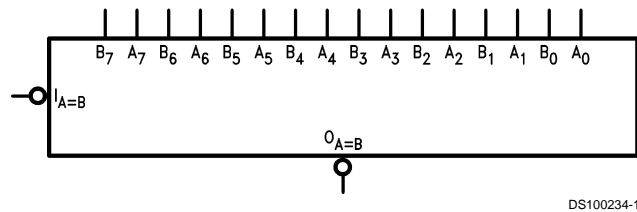
The 'AC/'ACT520 are expandable 8-bit comparators. They compare two words of up to eight bits each and provide a LOW output when the two words match bit for bit. The expansion input  $\bar{T}_{A=B}$  also serves as an active LOW enable input.

### 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
- Standard Microcircuit Drawing (SMD)
  - 54AC520: 5962-90916
  - 54ACT520: 5962-89793

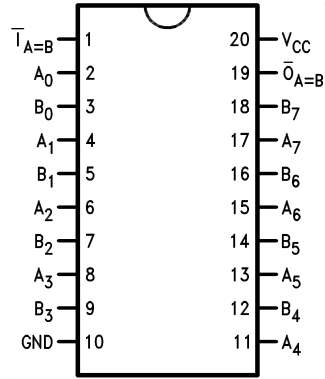
### Logic Symbols



Pin Names	Description
$A_0$ – $A_7$	Word A Inputs
$B_0$ – $B_7$	Word B Inputs
$T_{A=B}$	Expansion or Enable Input
$\bar{O}_{A=B}$	Identity Output

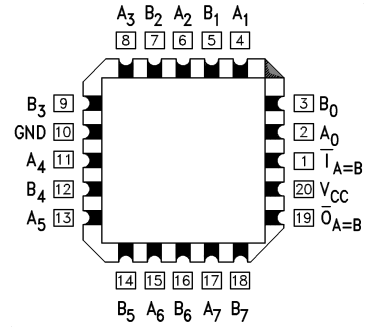
## Connection Diagrams

Pin Assignment  
for DIP and Flatpak



DS100234-2

Pin Assignment  
for LCC



DS100234-3

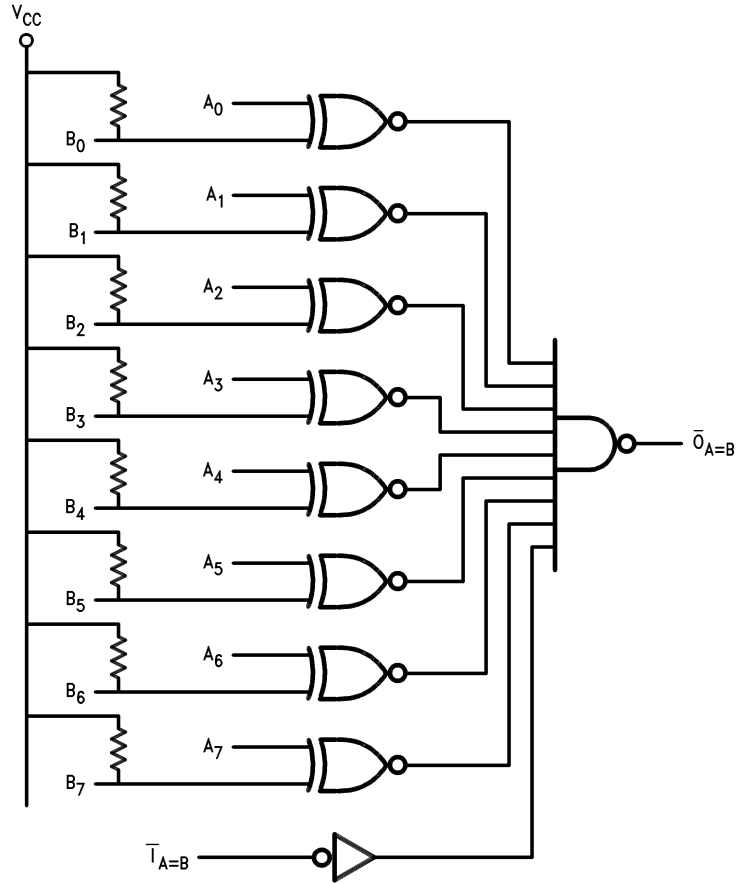
Inputs		Outputs
$\bar{I}_{A=B}$	A, B	$\bar{O}_{A=B}$
L	A = B*	L
L	A ≠ B	H
H	A = B*	H
H	A ≠ B	H

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



DS100234-5

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.

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

**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 ( $T_A$ )	
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

**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.

**DC Characteristics for 'AC Family Devices**

Symbol	Parameter	$V_{CC}$ (V)	54AC		Units	Conditions	
			$T_A =$ -55°C to +125°C				
			Guaranteed Limits				
$V_{IH}$	Minimum High Level Input Voltage	3.0	2.1		V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	3.15				
		5.5	3.85				
$V_{IL}$	Maximum Low Level Input Voltage	3.0	0.9		V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	1.35				
		5.5	1.65				
$V_{OH}$	Minimum High Level Output Voltage	3.0	2.9		V	$I_{OUT} = -50 \mu A$	
		4.5	4.4				
		5.5	5.4				
			3.0	2.4		V	(Note 2) $V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA}$
			4.5	3.7			
			5.5	4.7			
$V_{OL}$	Maximum Low Level Output Voltage	3.0	0.1		V	$I_{OUT} = 50 \mu A$	
		4.5	0.1				
		5.5	0.1				
			3.0	0.50		V	(Note 2) $V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 24 \text{ mA}$
			4.5	0.50			
			5.5	0.50			
$I_{IN}$	Maximum Input Leakage Current	5.5	±1.0		μA	$V_I = V_{CC}, GND$ A Inputs Only	
$I_{IH}$	Maximum Input High Leakage Current	5.5	20.0		μA	$V_I = V_{CC}$ B Inputs Only	

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

Symbol	Parameter	V <sub>CC</sub> (V)	54AC	Units	Conditions
			T <sub>A</sub> = -55°C to +125°C		
			Guaranteed Limits		
I <sub>IL</sub>	Maximum Input Low Leakage Current	5.5	-1.5	mA	V <sub>I</sub> = V <sub>CC</sub> B Inputs Only
I <sub>OLD</sub>	Minimum Dynamic (Note 3)	5.5	50	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>	Output Current	5.5	-50	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	80.0	μA	V <sub>IN</sub> = V <sub>CC</sub>
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	8.0	mA	V <sub>IN</sub> = GND

**Note 2:** All outputs loaded; thresholds on input associated with output under test.

**Note 3:** Maximum test duration 2.0 ms, one output loaded at a time.

## DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V <sub>CC</sub> (V)	54ACT	Units	Conditions
			T <sub>A</sub> = -55°C to +125°C		
			Guaranteed Limits		
V <sub>IH</sub>	Minimum High Level Input Voltage	4.5	2.0	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	2.0		
V <sub>IL</sub>	Maximum Low Level Input Voltage	4.5	0.8	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	0.8		
V <sub>OH</sub>	Minimum High Level Output Voltage	4.5	4.4	V	I <sub>OUT</sub> = -50 μA
		5.5	5.4		
		4.5	3.70	V	(Note 4) V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -24 mA
		5.5	4.70		
V <sub>OL</sub>	Maximum Low Level Output Voltage	4.5	0.1	V	I <sub>OUT</sub> = 50 μA
		5.5	0.1		
		4.5	0.50	V	(Note 4) V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 24 mA
		5.5	0.50		
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	±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	μA	V <sub>I</sub> = V <sub>CC</sub> B Inputs Only
I <sub>IL</sub>	Maximum Input Low Leakage Current	5.5	-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	1.6	mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1V
I <sub>OLD</sub>	Minimum Dynamic (Note 5)	5.5	50	mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>	Output Current	5.5	-50	mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	80.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND

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

Symbol	Parameter	V <sub>CC</sub> (V)	54ACT		Units	Conditions
			T <sub>A</sub> = -55°C to +125°C			
			Guaranteed Limits			
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	8.0		mA	V <sub>IN</sub> = GND

**Note 4:** All outputs loaded; thresholds on input associated with output under test.

**Note 5:** Maximum test duration 2.0 ms, one output loaded at a time.

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V) (Note 6)	54AC		Units	Fig. No.
			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF			
			Min	Max		
t <sub>PLH</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_{A=B}$	3.3	1.0	14.0	ns	
		5.0	1.5	10.5		
t <sub>PHL</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_{A=B}$	3.3	1.0	15.0	ns	
		5.0	1.5	11.0		
t <sub>PLH</sub>	Propagation Delay $\overline{I}_{A=B}$ to $\overline{O}_{A=B}$	3.3	1.0	10.0	ns	
		5.0	1.5	7.5		
t <sub>PHL</sub>	Propagation Delay $\overline{I}_{A=B}$ to $\overline{O}_{A=B}$	3.3	1.0	10.5	ns	
		5.0	1.5	8.0		

**Note 6:** 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) (Note 7)	54ACT		Units	Fig. No.
			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF			
			Min	Max		
t <sub>PLH</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_{A=B}$	5.0	1.5	12.0	ns	
t <sub>PHL</sub>	Propagation Delay A <sub>n</sub> or B <sub>n</sub> to $\overline{O}_{A=B}$	5.0	1.5	12.0	ns	
t <sub>PLH</sub>	Propagation Delay $\overline{I}_{A=B}$ to $\overline{O}_{A=B}$	5.0	1.5	8.5	ns	
t <sub>PHL</sub>	Propagation Delay $\overline{I}_{A=B}$ to $\overline{O}_{A=B}$	5.0	1.5	9.0	ns	

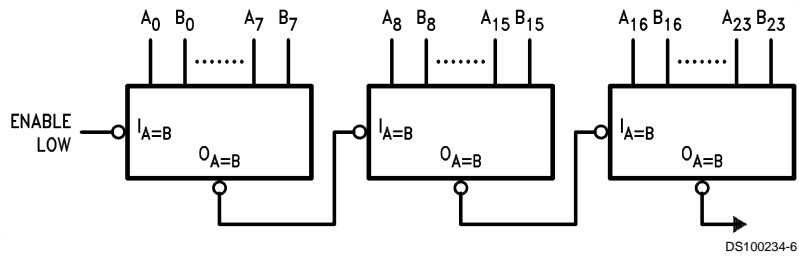
**Note 7:** Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

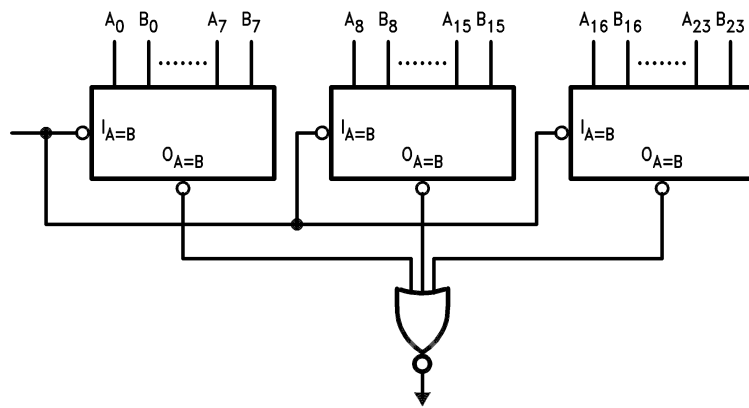
Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = OPEN
C <sub>PD</sub>	Power Dissipation Capacitance	40	pF	V <sub>CC</sub> = 5.0V

# Applications

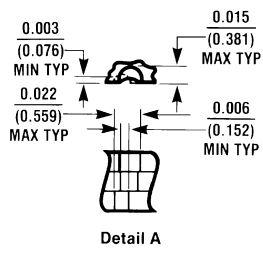
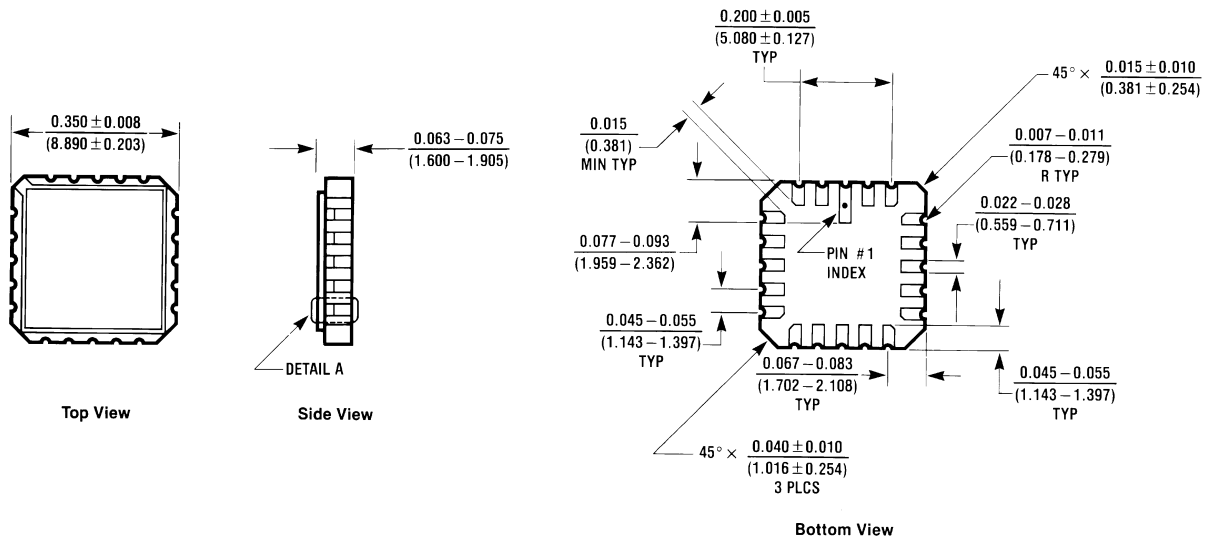
## Ripple Expansion



## Parallel Expansion

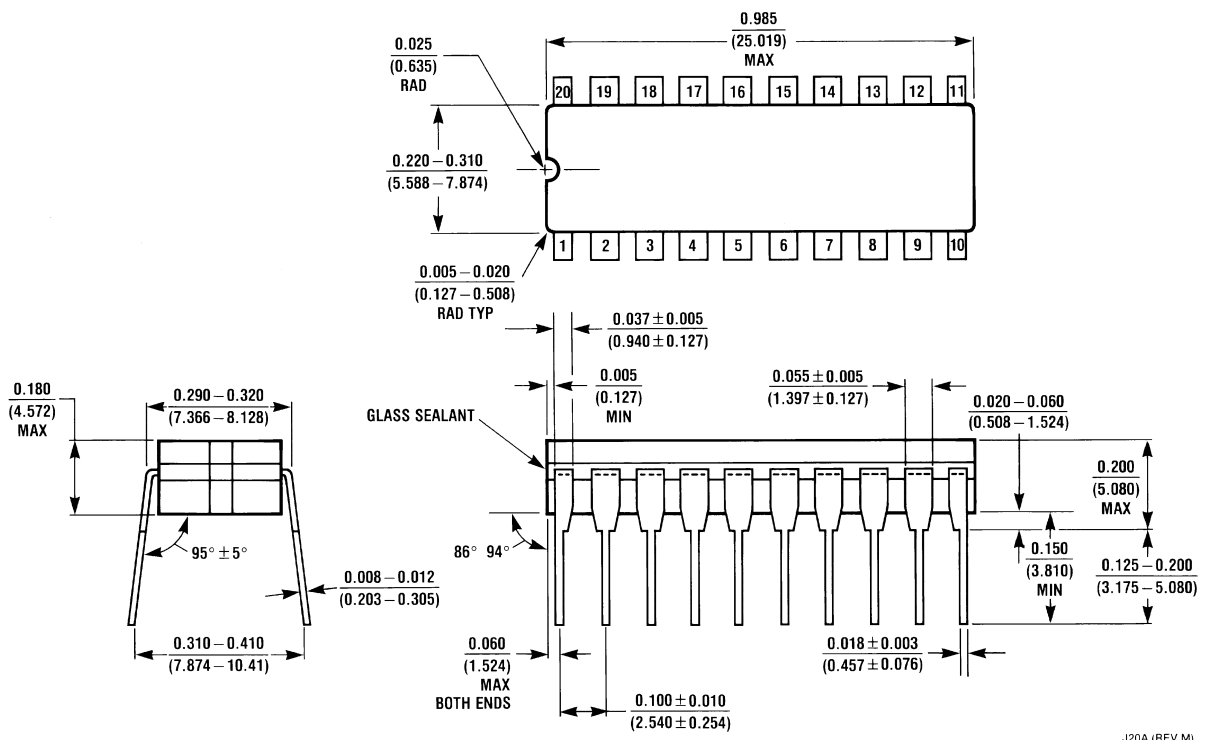


**Physical Dimensions** inches (millimeters) unless otherwise noted



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

E20A (REV D)

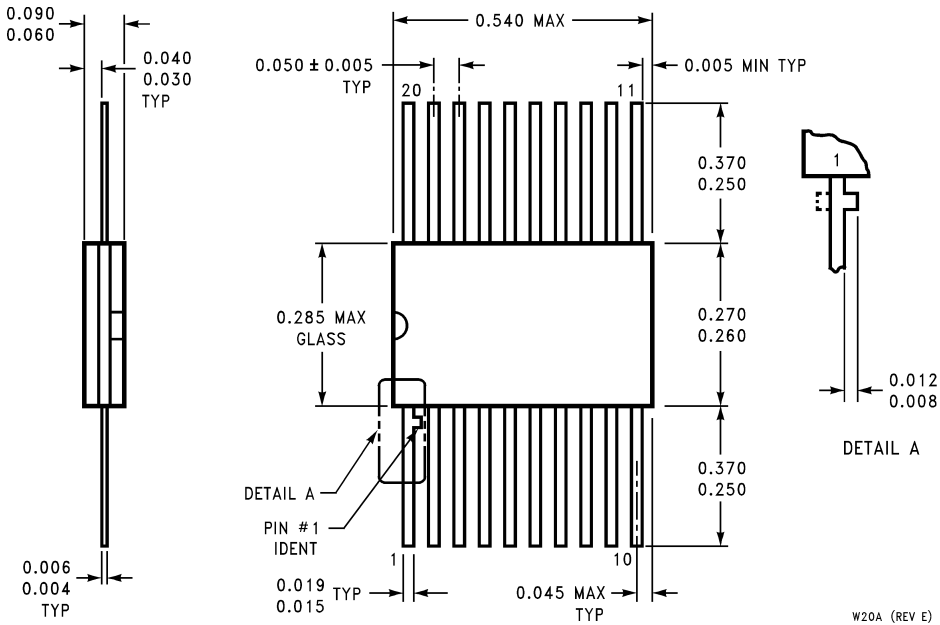


**20 Lead Ceramic Dual-In-Line Package (D)  
 NS Package Number J20A**

J20A (REV M)



**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**20 Lead Ceramic Flatpak (F)  
NS Package Number W20A**

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