September 1998

National Semiconductor

54AC520 • 54ACT520
8-Bit Identity Comparator

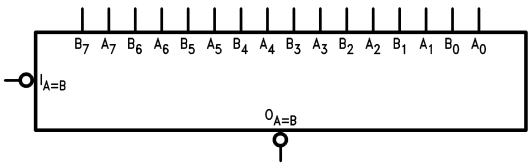
General Description

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 $\overline{I}_{A=B}$ also serves as an active LOW enable input.

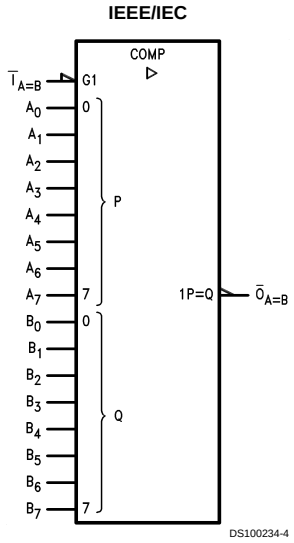
Features

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

Logic Symbols



DS100234-1



DS100234-4

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

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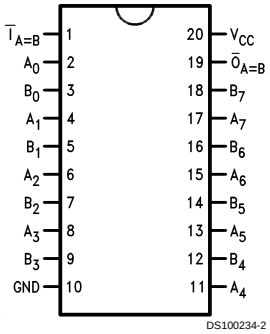
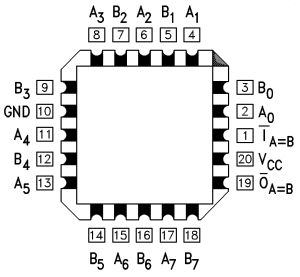
Connection Diagrams

Pin Assignment for DIP and Flatpak



DS100234-2

Pin Assignment for LCC



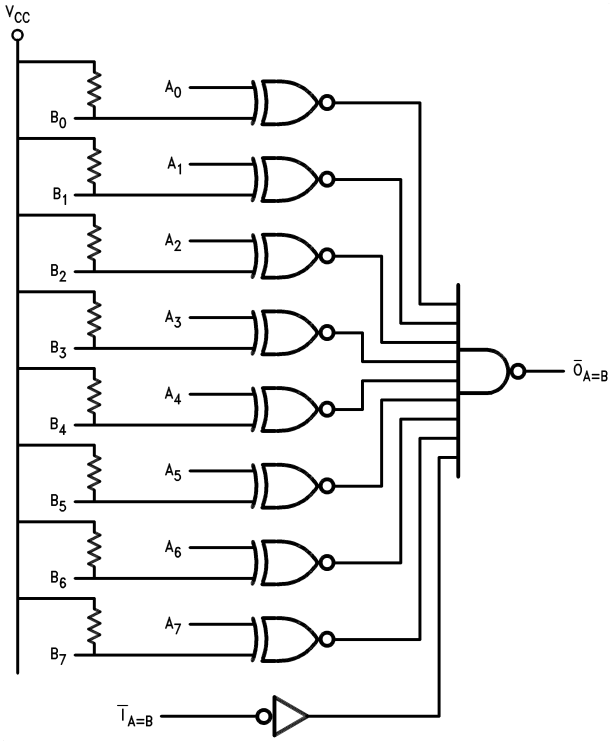
DS100234-3

Truth Table

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

H = HIGH Voltage Level
L = LOW Voltage Level
*$A_0 = B_0$, $A_1 = B_1$, $A_2 = B_2$, 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 (ΔV/Δt)	
'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 (ΔV/Δt)	
'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 T_A = −55˚C to +125˚C Guaranteed Limits	Units	Conditions
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 μA
		4.5	4.4		
		5.5	5.4		
					(Note 2) V_{IN} = V_{IL} or V_{IH}
		3.0	2.4	V	I_{OH} = −12 mA
		4.5	3.7		I_{OH} = −24 mA
		5.5	4.7		I_{OH} = −24 mA
V_{OL}	Maximum Low Level Output Voltage	3.0	0.1	V	I_{OUT} = 50 μA
		4.5	0.1		
		5.5	0.1		
					(Note 2) V_{IN} = V_{IL} or V_{IH}
		3.0	0.50	V	I_{OL} = 12 mA
		4.5	0.50		I_{OL} = 24 mA
		5.5	0.50		I_{OL} = 24 mA
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_{CC} (V)	54AC T_A = −55˚C to +125˚C Guaranteed Limits	Units	Conditions
I_{IL}	Maximum Input Low Leakage Current	5.5	−1.5	mA	$V_I = V_{CC}$ B Inputs Only
I_{OLD}	Minimum Dynamic (Note 3)	5.5	50	mA	V_{OLD} = 1.65V Max
I_{OHD}	Output Current	5.5	−50	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5	80.0	µA	$V_{IN} = V_{CC}$
I_{CC}	Maximum Quiescent Supply Current	5.5	8.0	mA	V_{IN} = 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_{CC} (V)	54ACT T_A = −55˚C to +125˚C Guaranteed Limits	Units	Conditions
V_{IH}	Minimum High Level Input Voltage	4.5 5.5	2.0 2.0	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
V_{IL}	Maximum Low Level Input Voltage	4.5 5.5	0.8 0.8	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
V_{OH}	Minimum High Level Output Voltage	4.5 5.5	4.4 5.4	V	I_{OUT} = −50 µA
		 4.5 5.5	 3.70 4.70	 V	(Note 4) $V_{IN} = V_{IL}$ or V_{IH} I_{OH} = −24 mA I_{OH} = −24 mA
V_{OL}	Maximum Low Level Output Voltage	4.5 5.5	0.1 0.1	V	I_{OUT} = 50 µA
		 4.5 5.5	 0.50 0.50	 V	(Note 4) $V_{IN} = V_{IL}$ or V_{IH} I_{OL} = 24 mA I_{OL} = 24 mA
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	µA	$V_I = V_{CC}$, GND
I_{IH}	Maximum Input High Leakage Current	5.5	10.0	µA	$V_I = V_{CC}$ B Inputs Only
I_{IL}	Maximum Input Low Leakage Current	5.5	−1.0	mA	$V_I = V_{CC}$ B Inputs Only
I_{CCT}	Maximum I_{CC}/Input	5.5	1.6	mA	$V_I = V_{CC}$ − 2.1V
I_{OLD}	Minimum Dynamic (Note 5)	5.5	50	mA	V_{OLD} = 1.65V Max
I_{OHD}	Output Current	5.5	−50	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5	80.0	µA	$V_{IN} = V_{CC}$ or GND

DC Characteristics for 'ACT Family Devices (Continued)

Symbol	Parameter	V_{CC} (V)	54ACT T_A = −55°C to +125°C Guaranteed Limits	Units	Conditions
I_{CC}	Maximum Quiescent Supply Current	5.5	8.0	mA	V_{IN} = 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_{CC} (V) (Note 6)	54AC T_A = −55°C to +125°C C_L = 50 pF Min	54AC Max	Units	Fig. No.
t_{PLH}	Propagation Delay	3.3	1.0	14.0	ns	
	A_n or B_n to $\overline{O}_{A=B}$	5.0	1.5	10.5		
t_{PHL}	Propagation Delay	3.3	1.0	15.0	ns	
	A_n or B_n to $\overline{O}_{A=B}$	5.0	1.5	11.0		
t_{PLH}	Propagation Delay	3.3	1.0	10.0	ns	
	$\bar{I}_{A=B}$ to $\overline{O}_{A=B}$	5.0	1.5	7.5		
t_{PHL}	Propagation Delay	3.3	1.0	10.5	ns	
	$\bar{I}_{A=B}$ to $\overline{O}_{A=B}$	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_{CC} (V) (Note 7)	54ACT T_A = −55°C to +125°C C_L = 50 pF Min	54ACT Max	Units	Fig. No.
t_{PLH}	Propagation Delay	5.0	1.5	12.0	ns	
	A_n or B_n to $\overline{O}_{A=B}$					
t_{PHL}	Propagation Delay	5.0	1.5	12.0	ns	
	A_n or B_n to $\overline{O}_{A=B}$					
t_{PLH}	Propagation Delay	5.0	1.5	8.5	ns	
	$\bar{I}_{A=B}$ to $\overline{O}_{A=B}$					
t_{PHL}	Propagation Delay	5.0	1.5	9.0	ns	
	$\bar{I}_{A=B}$ to $\overline{O}_{A=B}$					

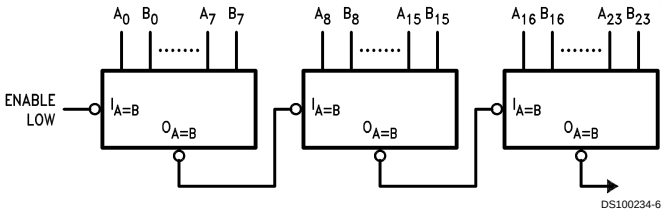
Note 7: Voltage Range 5.0 is 5.0V ±0.5V

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

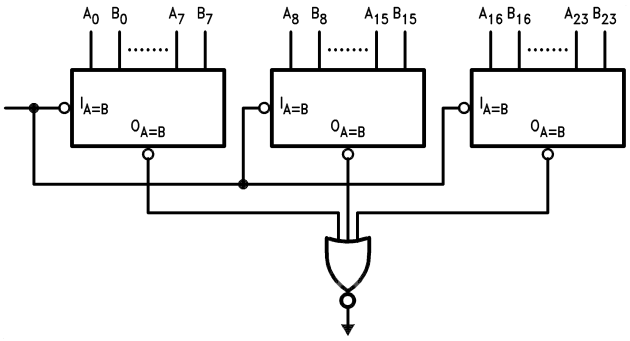
Applications

Ripple Expansion

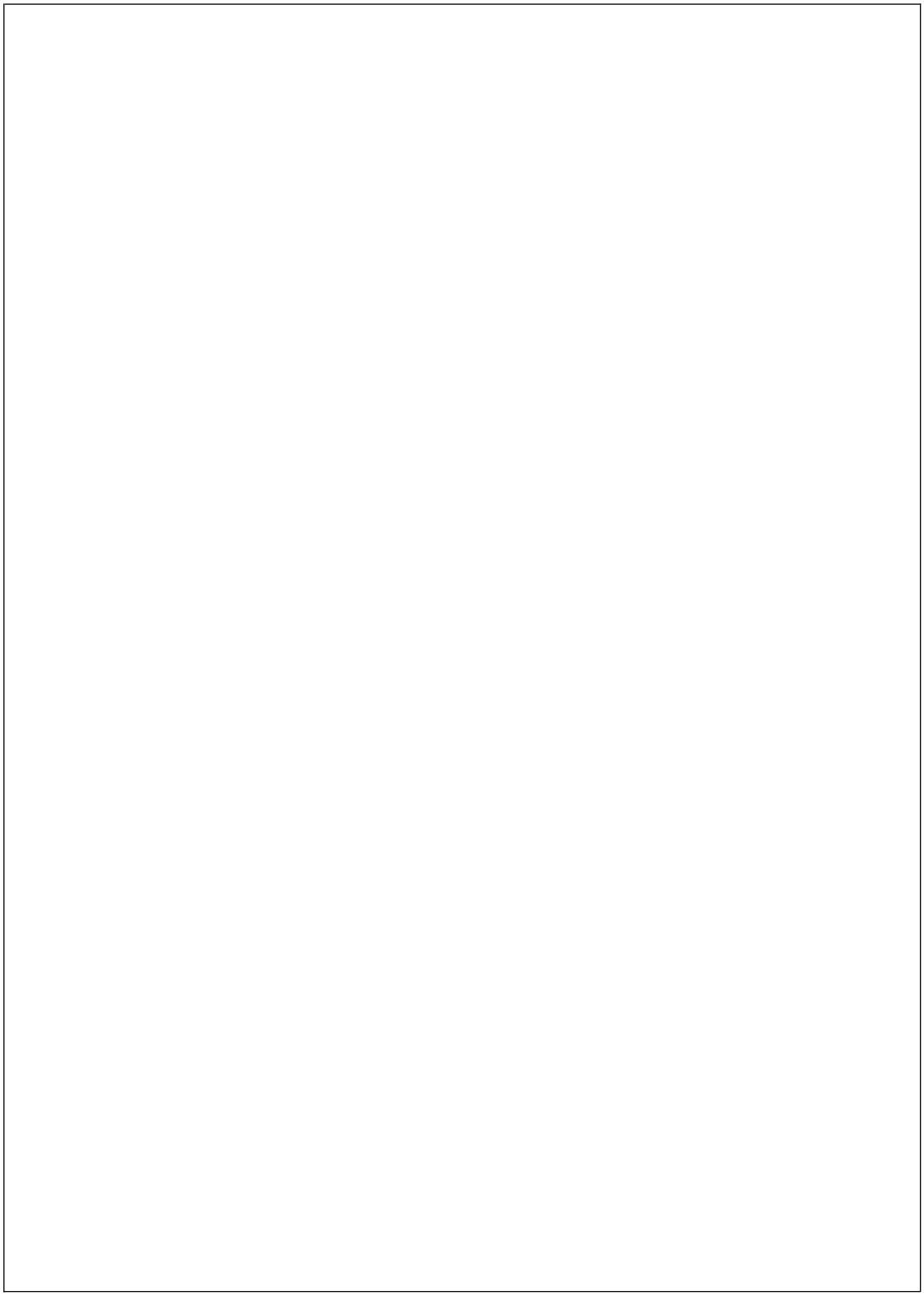


DS100234-6

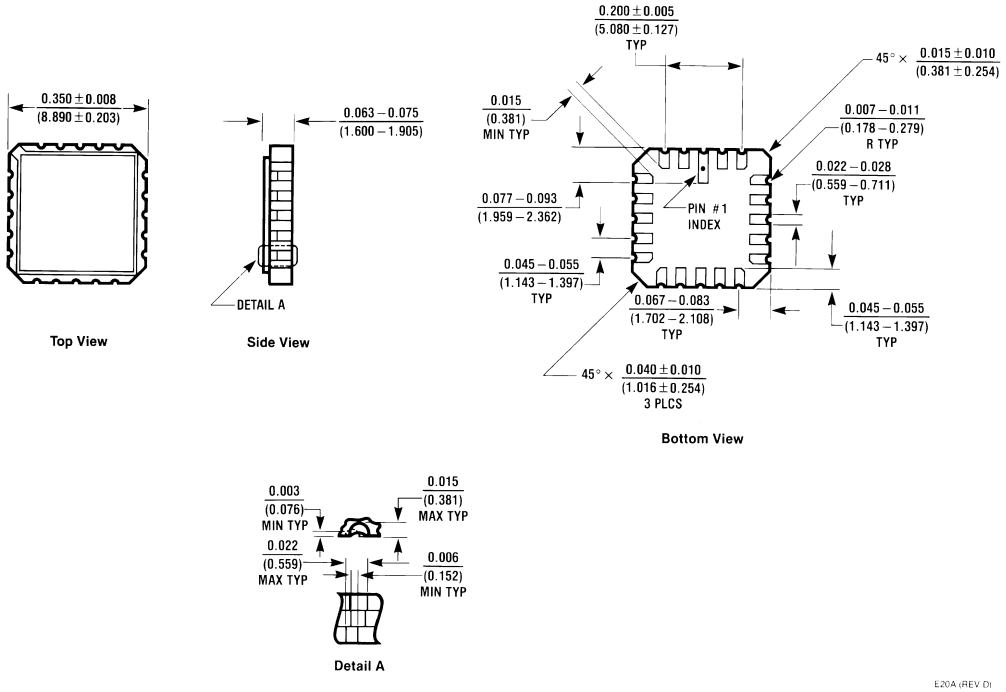
Parallel Expansion



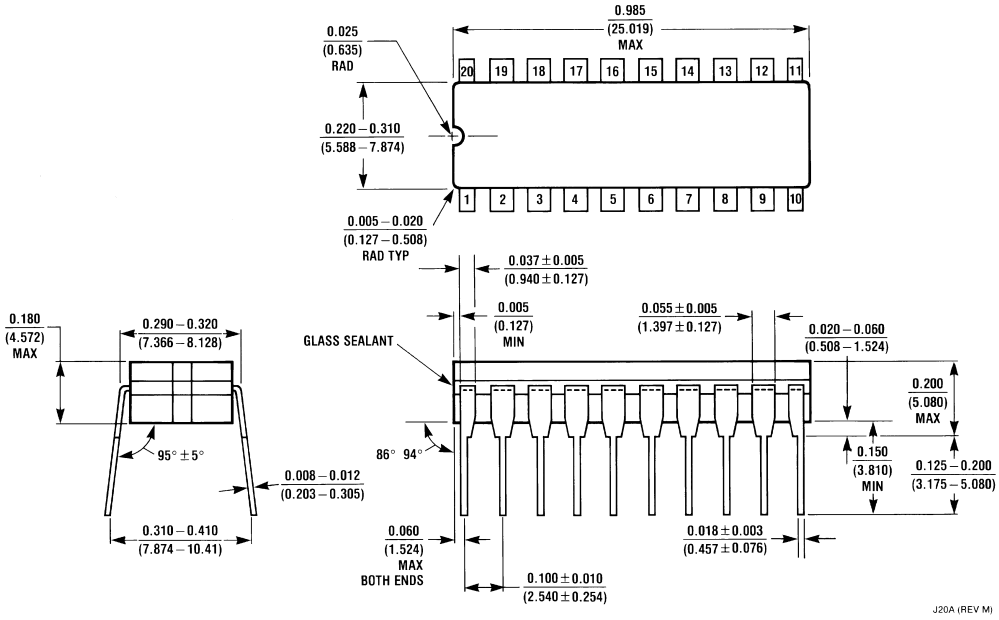
DS100234-7



Physical Dimensions inches (millimeters) unless otherwise noted

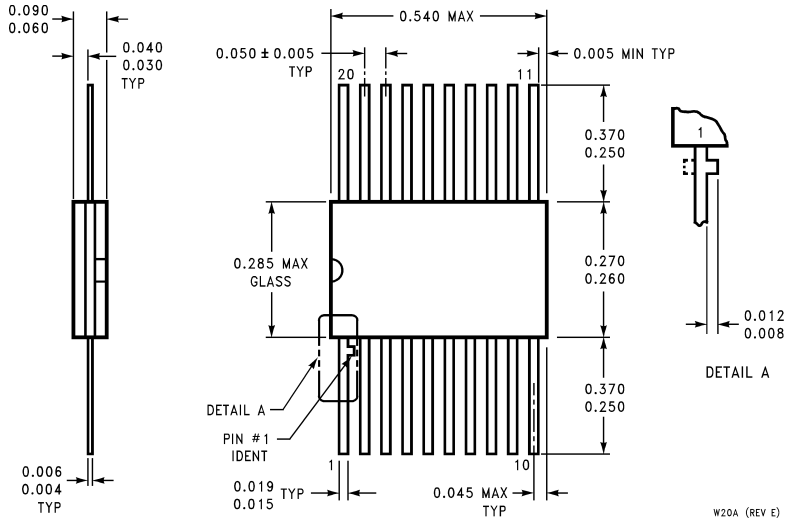


20 Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A



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

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



20 Lead Ceramic Flatpak (F)
NS Package Number W20A

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