National Semiconductor

June 1996

54AC/74AC245 • 54ACT/74ACT245 Octal Bidirectional Transceiver with TRI-STATE® Inputs/Outputs

General Description

The 'AC/'ACT245 contains eight non-inverting bidirectional buffers with TRI-STATE outputs and is intended for bus-oriented applications. Current sinking capability is 24 mA at both the A and B ports. The Transmit/Receive ($T/\overline{R}$) input determines the direction of data flow through the bidirectional transceiver. Transmit (active-HIGH) enables data from A ports to B ports; Receive (active-LOW) enables data from B ports to A ports. The Output Enable input, when HIGH, disables both A and B ports by placing them in a HIGH Z condition.

Features

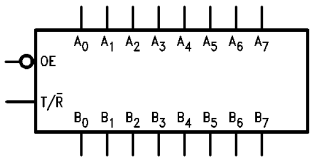
- I_{CC} and I_{OZ} reduced by 50%
- Noninverting buffers
- Bidirectional data path
- A and B outputs source/sink 24 mA
- 'ACT245 has TTL-compatible inputs
- Standard Military Drawing (SMD)
  - — 'AC245: 5962-87758
  - — 'ACT245: 5962-87663

Commercial	Military	Package Number	Package Description
74ACT245PC		N20A	20-Lead Molded Dual-In-Line (0.300″ Wide)
74ACT245SC (Note 1)		M20B	20-Lead Molded Small Outline (0.300″ Wide), JEDEC
74ACT245SJ (Note 1)		M20D	20-Lead Molded Small Outline, EIAJ Type II
74ACT245MTC (Note 1)		MTC20	20-Lead Molded Thin Shrink Small Outline Package, JEDEC
74ACT245MSA (Note 1)		MSA20	20-Lead Molded Small Shrink Outline Package, (EIAJ SSOP)
	54ACT245DM (Note 2)	J20A	20-Lead Ceramic Dual-In-Line
	54ACT245FM (Note 2)	W20A	20-Lead Cerpak
	54ACT245LM (Note 2)	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Note 1: Devices also available in 13″ Tape and Reel. Use suffix SCX, SJX, and MTCX.

Note 2: Military grade device with environmental and burn-in processing, use suffix DMQB, FMQB and LMQB.

Logic Symbols



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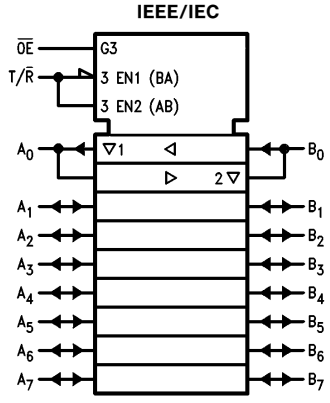
Pin Names	Description
$\overline{OE}$	Output Enable Input
$T/\overline{R}$	Transmit/Receive Input
A_0–A_7	Side A TRI-STATE Inputs or TRI-STATE Outputs
B_0–B_7	Side B TRI-STATE Inputs or TRI-STATE Outputs

IEEE/IEC



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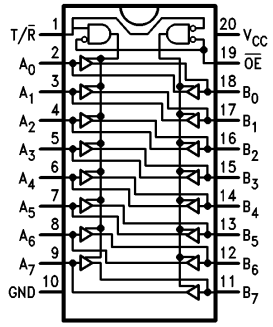
FACT™ is a trademark of National Semiconductor Corporation.

54AC/74AC245 • 54ACT/74ACT245 Octal Bidirectional Transceiver with TRI-STATE Inputs/Outputs

Connection Diagrams

Pin Assignment for DIP, Flatpak, SSOP, SOIC and TSSOP



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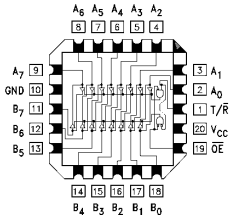
Pin Assignment for LCC



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Truth Table

Inputs		Outputs
$\overline{OE}$	T/$\overline{R}$	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	HIGH-Z State

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

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
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 $T_A = +25°C$	74AC $T_A = -55°C$ to $+125°C$	54AC $T_A = -55°C$ to $+125°C$	74AC $T_A = -40°C$ to $+85°C$	Units	Conditions
			Typ	Guaranteed Limits				
V_{IH}	Minimum High Level Input Voltage	3.0	1.5	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		
		5.5	2.75	3.85	3.85	3.85		
V_{IL}	Maximum Low Level Input Voltage	3.0	1.5	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		
		5.5	2.75	1.65	1.65	1.65		
V_{OH}	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	2.9	V	$I_{OUT} = -50\ \mu A$
		4.5	4.49	4.4	4.4	4.4		
		5.5	5.49	5.4	5.4	5.4		
								*$V_{IN} = V_{IL}$ or V_{IH}
		3.0		2.56	2.4	2.46		-12 mA
		4.5		3.86	3.7	3.76	V	I_{OH} -24 mA
		5.5		4.86	4.7	4.76		-24 mA
V_{OL}	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	0.1	V	$I_{OUT} = 50\ \mu A$
		4.5	0.001	0.1	0.1	0.1		
		5.5	0.001	0.1	0.1	0.1		
								*$V_{IN} = V_{IL}$ or V_{IH}
		3.0		0.36	0.50	0.44		12 mA
		4.5		0.36	0.50	0.44	V	I_{OL} 24 mA
		5.5		0.36	0.50	0.44		24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	±1.0	μA	$V_I = V_{CC}$, 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 $T_A = +25°C$	74AC	54AC $T_A = -55°C$ to $+125°C$	74AC $T_A = -40°C$ to $+85°C$	Units	Conditions
			Typ	Guaranteed Limits				
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 GND
I_{OZT}	Maximum I/O Leakage Current	5.5		±0.3	±6.0	±3.0	μA	V_I(OE) = V_{IL}, V_{IH} $V_I = V_{CC}$, GND $V_O = V_{CC}$, 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}.
I_{CC} for 54AC @ 25°C is identical to 74AC @ 25°C.

DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V_{CC} (V)	74ACT $T_A = +25°C$		54ACT $T_A = -55°C$ to $+125°C$	74ACT $T_A = -40°C$ to $+85°C$	Units	Conditions
			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 Output Voltage	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		
		4.5		3.86	3.70	3.76	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} −24 mA
		5.5		4.86	4.70	4.76		I_{OH} −24 mA
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		
		4.5		0.36	0.50	0.44	V	*V_{IN} = V_{IL} or V_{IH} I_{OL} 24 mA
		5.5		0.36	0.50	0.44		I_{OL} 24 mA
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 GND
I_{OZT}	Maximum I/O Leakage Current	5.5		±0.3	±6.0	±3.0	μA	V_I (OE) = V_{IL}, V_{IH} $V_I = V_{CC}$, GND $V_O = V_{CC}$, 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_{CC} for 54ACT @ 25°C is identical to 74ACT @ 25°C.

AC Electrical Characteristics

Symbol	Parameter	V_{CC}* (V)	74AC $T_A = +25°C$, $C_L = 50$ pF			54AC $T_A = -55°C$ to $+125°C$, $C_L = 50$ pF		74AC $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}	Propagation Delay A_n to B_n or B_n to A_n	3.3	1.5	5.0	8.5	1.0	11.5	1.0	9.0	ns
		5.0	1.5	3.5	6.5	1.0	8.5	1.0	7.0	
t_{PHL}	Propagation Delay A_n to B_n or B_n to A_n	3.3	1.5	5.0	8.5	1.0	10.0	1.0	9.0	ns
		5.0	1.5	3.5	6.0	1.0	7.5	1.0	7.0	
t_{PZH}	Output Enable Time	3.3	2.5	7.0	11.5	1.0	13.5	2.0	12.5	ns
		5.0	1.5	5.0	8.5	1.0	10.0	1.0	9.0	
t_{PZL}	Output Enable Time	3.3	2.5	7.5	12.0	1.0	14.5	2.0	13.5	ns
		5.0	1.5	5.5	9.0	1.0	10.5	1.0	9.5	
t_{PHZ}	Output Disable Time	3.3	2.0	6.5	12.0	1.0	13.5	1.0	12.5	ns
		5.0	1.5	5.5	9.0	1.0	10.5	1.0	10.0	
t_{PLZ}	Output Disable Time	3.3	2.0	7.0	11.5	1.0	14.0	1.5	13.0	ns
		5.0	1.5	5.5	9.0	1.0	10.5	1.0	10.0	

*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)	74ACT $T_A = +25°C$, $C_L = 50$ pF			54ACT $T_A = -55°C$ to $+125°C$, $C_L = 50$ pF		74ACT $T_A = -40°C$ to $+85°C$, $C_L = 50$ pF		Units
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}	Propagation Delay A_n to B_n or B_n to A_n	5.0	1.5	4.0	7.5	1.0	9.0	1.5	8.0	ns
t_{PHL}	Propagation Delay A_n to B_n or B_n to A_n	5.0	1.5	4.0	8.0	1.0	10.0	1.0	9.0	ns
t_{PZH}	Output Enable Time	5.0	1.5	5.0	10.0	1.0	12.0	1.5	11.0	ns
t_{PZL}	Output Enable Time	5.0	1.5	5.5	10.0	1.0	13.0	1.5	12.0	ns
t_{PHZ}	Output Disable Time	5.0	1.5	5.5	10.0	1.0	12.0	1.0	11.0	ns
t_{PLZ}	Output Disable Time	5.0	2.0	5.0	10.0	1.0	12.0	1.5	11.0	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
$C_{I/O}$	Input/Output Capacitance	15.0	pF	V_{CC} = 5.0V
C_{PD}	Power Dissipation Capacitance	45.0	pF	V_{CC} = 5.0V

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:

74ACT 245 P C X

Temperature Range Family
- 74AC = Commercial
- 54AC = Military
- 74ACT = Commercial TTL-Compatible
- 54ACT = Military TTL-Compatible

Device Type

Package Code
- P = Plastic DIP
- D = Ceramic DIP
- F = Flatpak
- L = Leadless Ceramic Chip Carrier (LCC)
- S = Small Outline (SOIC)
- MSA = Shrink Small Outline (EIAJ SSOP)
- MTC = Thin Shrink Small Outline (JEDEC TSSOP)

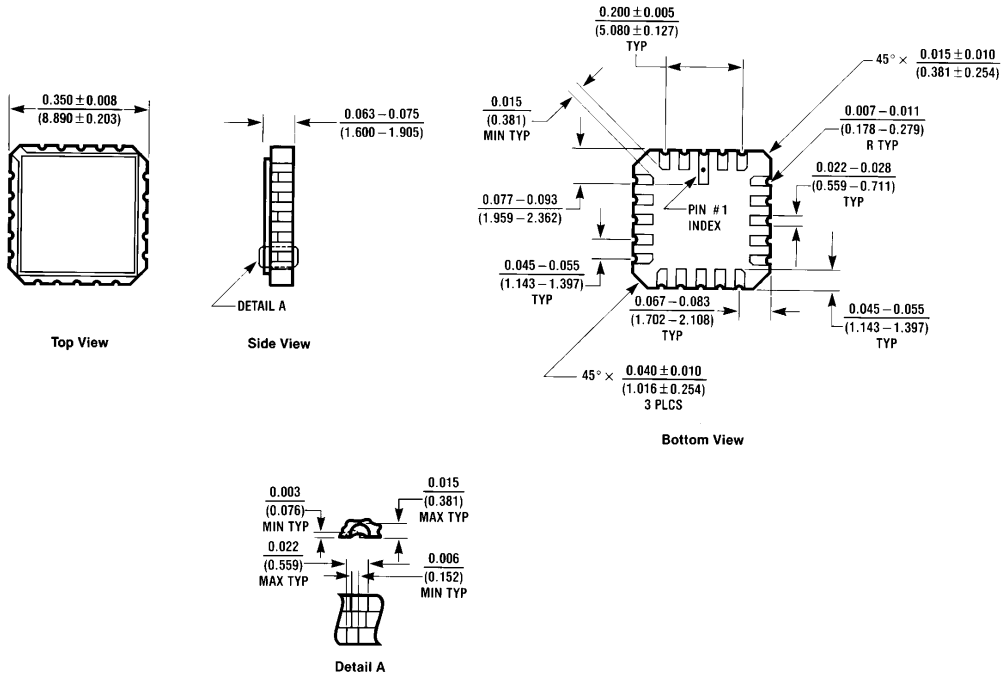
Temperature Range
- C = Commercial (−40°C to +85°C)
- M = Military (−55°C to +125°C)
- J = Commercial EIAJ (−40°C to +85°C)

Special Variations
- X = Devices shipped in 13" reels
- QB = Military grade device with environmental and burn-in processing shipped in tubes

NOTE: NOT REQUIRED FOR MSA PACKAGE CODE

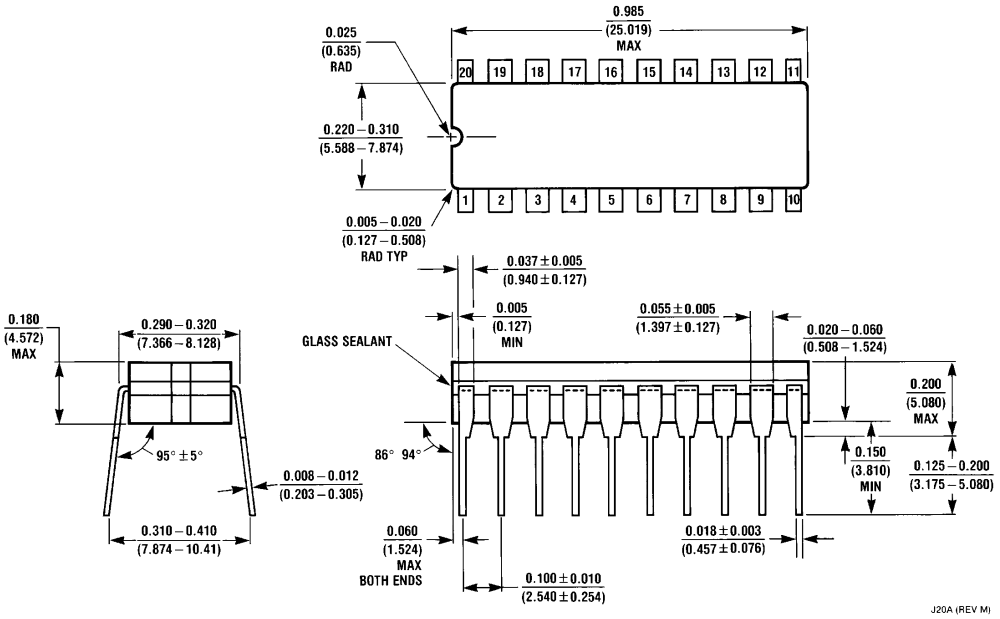
TL/F/9944–6

Physical Dimensions inches (millimeters) unless otherwise noted

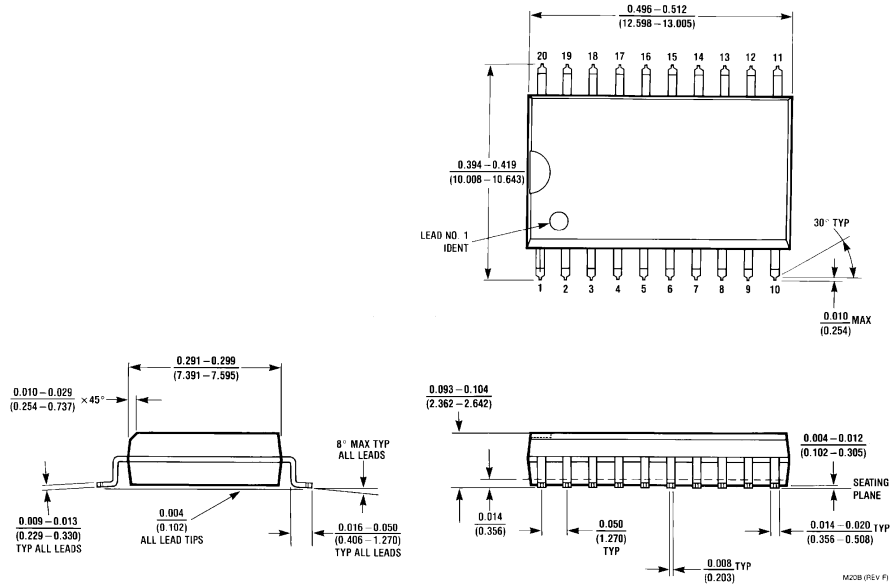


20 Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A

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

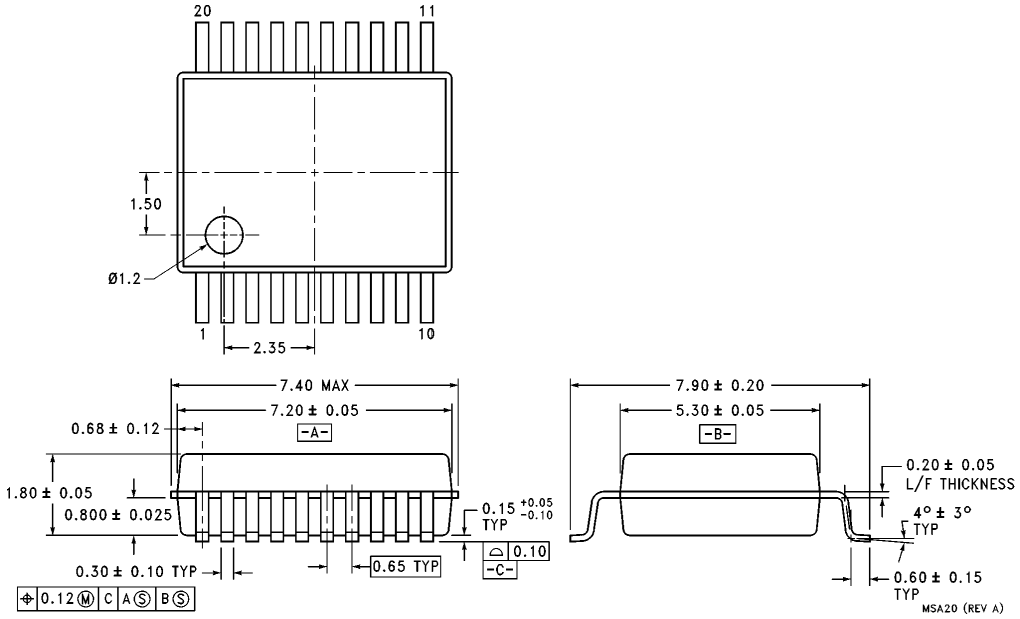


20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A



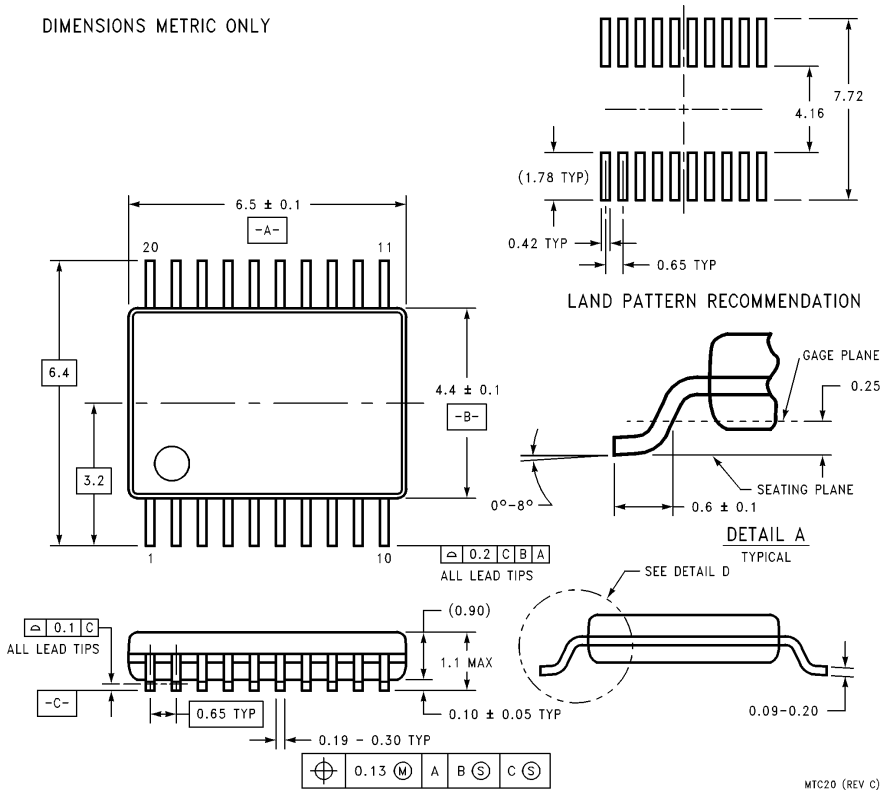
20-Lead Small Outline Integrated Circuit (S)
NS Package Number M20B

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

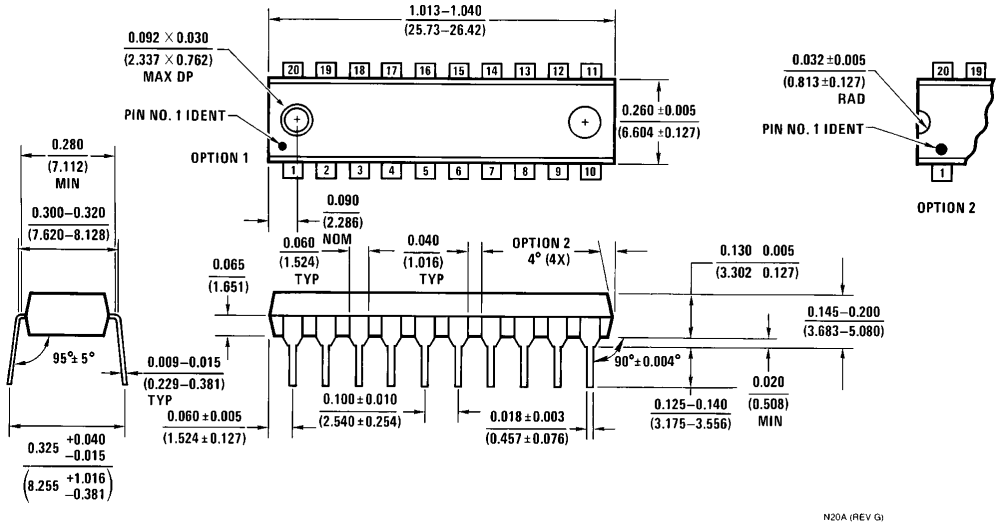


20-Lead Plastic EIAJ SSOP (MSA)
NS Package Number MSA20

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

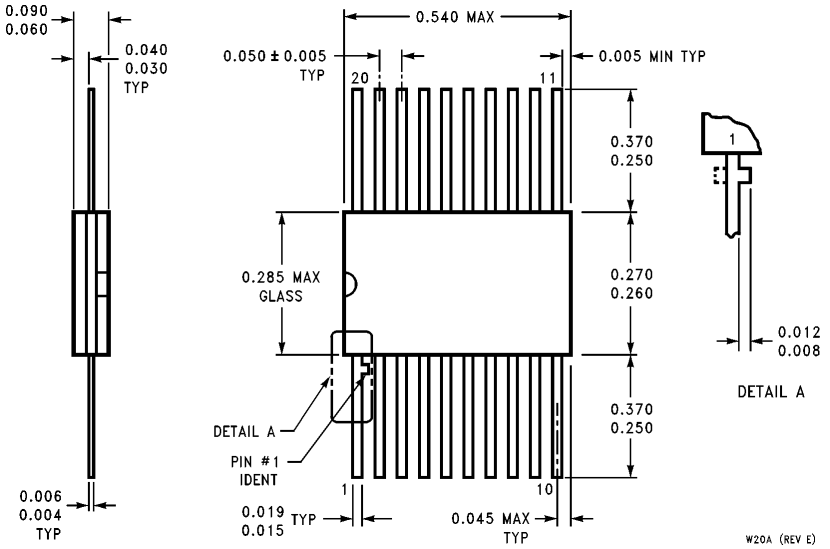


20-Lead Molded Thin Shrink Small Outline Package, JEDEC
NS Package Number MTC20



20-Lead Plastic Dual-In-Line Package (P)
NS Package Number N20A

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



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

LIFE SUPPORT POLICY

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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.

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National Semiconductor was acquired by Texas Instruments.

http://www.ti.com/corp/docs/investor_relations/pr_09_23_2011_national_semiconductor.html

This file is the datasheet for the following electronic components:

74AC245 - http://www.ti.com/product/74ac245?HQS=TI-null-null-dscatalog-df-pf-null-wwe

54AC245 - http://www.ti.com/product/54ac245?HQS=TI-null-null-dscatalog-df-pf-null-wwe

54ACT245 - http://www.ti.com/product/54act245?HQS=TI-null-null-dscatalog-df-pf-null-wwe

74ACT245 - http://www.ti.com/product/74act245?HQS=TI-null-null-dscatalog-df-pf-null-wwe