



May 1990

54F/74F2640 • 54F/74F2643 • 54F/74F2645

Octal Bus Transceiver with 25 Ω Series Resistors in the Outputs

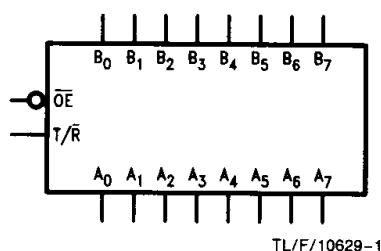
General Description

These devices are octal bus transceivers designed for asynchronous two-way data flow between the A and B busses. These devices are functionally equivalent to the 'F640, 'F643, and 'F645. The 25 Ω series resistors in the outputs reduce ringing and eliminate the need for external resistors. Both busses are capable of sinking 12 mA, sourcing 15 mA, have TRI-STATE outputs, and a common output enable pin. The direction of data flow is determined by the transmit/receive (T/ $\bar{R}$) input. The 'F2640 is an inverting version of the 'F2645. The 'F2643 has a noninverting A bus and an inverting B bus. The 'F2645 is a low power version of the 'F245 with 25 Ω series resistors in the outputs.

Features

- 25 Ω series resistors in the outputs eliminates the need for external resistors
- Designed for asynchronous two-way data flow between busses
- Outputs sink 12 mA and source 15 mA
- Transmit/receive (T/ $\bar{R}$) input controls the direction of data flow
- Guaranteed 4000V minimum ESD protection
- 'F2645 is a low power version of the 'F245 with 25 Ω series resistors in the outputs
- 'F2640 is an inverting option of the 'F2645
- 'F2643 has noninverting A bus and inverting B bus

Logic Symbol

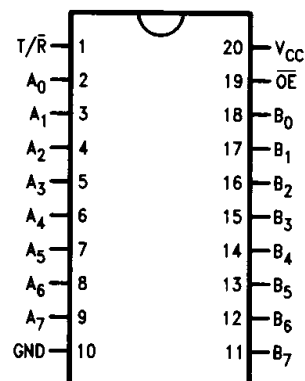


Unit Loading/Fan Out

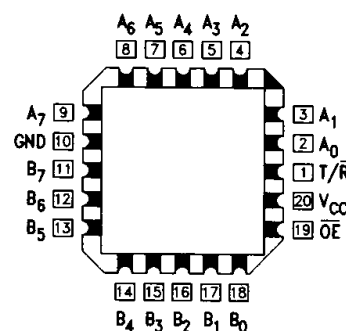
Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
$\overline{OE}$	Output Enable Input (Active LOW)	1.0/1.0	20 μ A / -0.6 mA
T/ $\bar{R}$	Transmit/Receive Input	1.0/1.0	20 μ A / -0.6 mA
A ₀ -A ₇	Side A Inputs or TRI-STATE Outputs	3.5/0.667	70 μ A / -0.4 mA
B ₀ -B ₇	Side B Inputs or TRI-STATE Outputs	3.5/0.667	70 μ A / -0.4 mA
		750/20	-15 mA/12 mA
		750/20	-15 mA/12 mA

Connection Diagrams

Pin Assignment for
DIP, SOIC and Flatpak



Pin Assignment for LCC and PCC



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54F/74F2640 • 54F/74F2643 • 54F/74F2645
Octal Bus Transceiver with 25 Ω Series Resistors in the Outputs

Functional Description

The output enable ($\overline{OE}$) is active LOW. If the device is disabled ($\overline{OE}$ HIGH), the outputs are in the high impedance state. The transmit/receive input ($T/\overline{R}$) controls whether data is transmitted from the A bus to the B bus or from the B bus to the A bus. When $T/\overline{R}$ is LOW, B data is sent to the A bus. When $T/\overline{R}$ is HIGH, A data is sent to the B bus.

Function Table

Inputs		Outputs		
$\overline{OE}$	$T/\overline{R}$	'F2640	'F2643	'F2645
L	L	Bus $\overline{B}$ data to Bus A	Bus B data to Bus A	Bus B data to Bus A
L	H	Bus $\overline{A}$ data to Bus B	Bus $\overline{A}$ data to Bus B	Bus A data to Bus B
H	X	Z	Z	Z

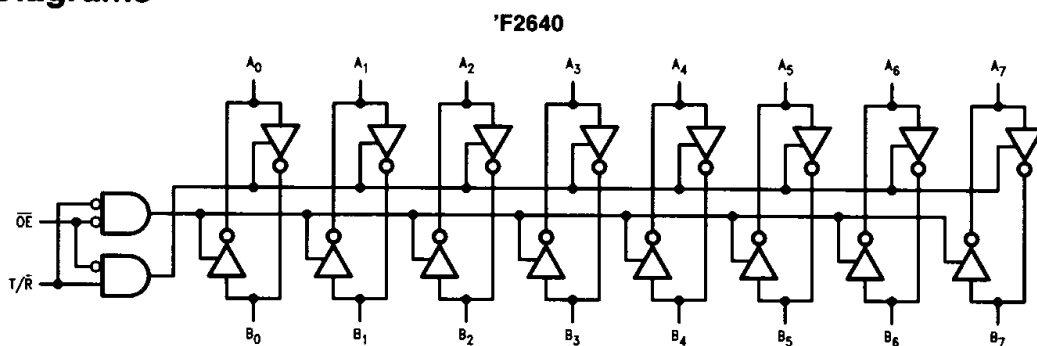
H = High voltage level

L = Low voltage level

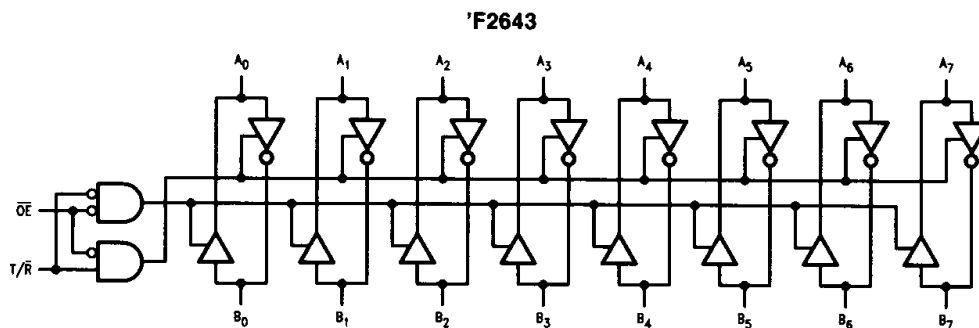
X = Don't care

Z = High-impedance state

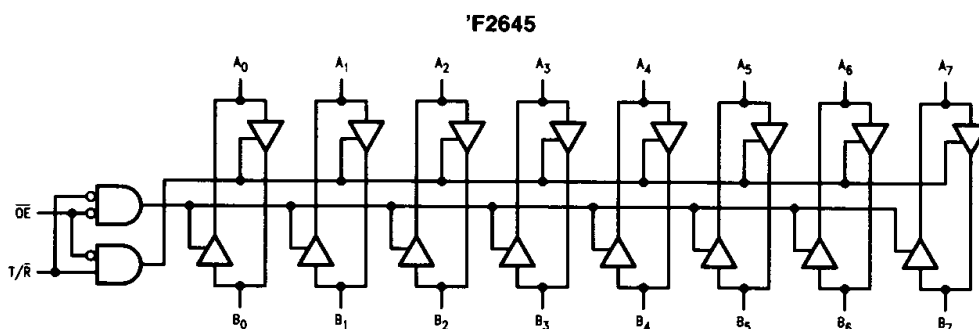
Logic Diagrams



TL/F/10629-4



TL/F/10629-5



TL/F/10629-6

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature	− 65°C to + 150°C
Ambient Temperature under Bias	− 55°C to + 125°C
Junction Temperature under Bias	− 55°C to + 175°C
V _{CC} Pin Potential to Ground Pin	− 0.5V to + 7.0V
Input Voltage (Note 2)	− 0.5V to + 7.0V
Input Current (Note 2)	− 30 mA to + 5.0 mA
Voltage Applied to Output in HIGH State (with V _{CC} = 0V)	− 0.5V to V _{CC}
Standard Output	− 0.5V to V _{CC}
TRI-STATE Output	− 0.5V to + 5.5V

Current Applied to Output in LOW State (Max)

twice the rated I_{OL} (mA)

ESD Last Passing Voltage (Min)

4000V

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

Free Air Ambient Temperature

Military

− 55°C to + 125°C

Commercial

0°C to + 70°C

Supply Voltage

Military

+ 4.5V to + 5.5V

Commercial

+ 4.5V to + 5.5V

DC Electrical Characteristics

Symbol	Parameter	54F/74F			Units	V _{CC}	Conditions
		Min	Typ	Max			
V _{IH}	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V _{IL}	Input LOW Voltage			0.8	V		Recognized as a LOW Signal
V _{CD}	Input Clamp Diode Voltage			− 1.2	V	Min	I _{IN} = − 18 mA (Non I/O Pins)
V _{OH}	Output HIGH Voltage	54F 10% V _{CC} 74F 10% V _{CC}	2.0 2.0		V	Min	I _{OH} = − 12 mA (A _n , B _n) I _{OH} = − 15 mA (A _n , B _n)
V _{OL}	Output LOW Voltage	74F 10% V _{CC} 74F 10% V _{CC}		0.50 0.75	V	Min	I _{OL} = 1 mA (A _n , B _n) I _{OL} = 12 mA (A _n , B _n)
I _{IH}	Input HIGH Current	54F 74F		20.0 5.0	μA	Max	V _{IN} = 2.7V (Non I/O Pins)
I _{BVI}	Input HIGH Current Breakdown Test	54F 74F		100 7.0	μA	Max	V _{IN} = 7.0V (Non I/O Pins)
I _{BVIT}	Input HIGH Current Breakdown (I/O)	54F 74F		1.0 0.5	mA	Max	V _{IN} = 5.5V (A _n , B _n)
I _{CEX}	Output HIGH Leakage Current	54F 74F		250 50	μA	Max	V _{OUT} = V _{CC}
V _{ID}	Input Leakage Test	74F	4.75		V	0.0	I _{ID} = 1.9 μA All Other Pins Grounded
I _{OD}	Output Leakage Circuit Current	74F		3.75	μA	0.0	V _{IOD} = 150 mV All Other Pins Grounded
I _{IL}	Input LOW Current			− 0.6	mA	Max	V _{IN} = 0.5V (Non I/O Pins)
I _{IH} + I _{OZH}	Output Leakage Current			70	μA	Max	V _{OUT} = 2.7V (A _n , B _n)
I _{IL} + I _{OZL}	Output Leakage Current			− 650	μA	Max	V _{OUT} = 0.5V (A _n , B _n)
I _{OS}	Output Short-Circuit Current		− 100	− 225	mA	Max	V _{OUT} = 0V
I _{ZZ}	Bus Drainage Test			500	μA	0.0V	V _{OUT} = 5.25
I _{CCH}	Power Supply Current ('F2640)			82	mA	Max	V _O = HIGH, V _{IN} = 0.2V
I _{CCL}	Power Supply Current ('F2640)			82	mA	Max	V _O = LOW
I _{CCZ}	Power Supply Current ('F2640)			95	mA	Max	V _O = HIGH Z
I _{CCH}	Power Supply Current ('F2643)			82	mA	Max	V _O = HIGH, V _{IN} = 0.2V (A _n)
I _{CCL}	Power Supply Current ('F2643)			82	mA	Max	V _O = LOW, V _{IN} = 0.2V (B _n)
I _{CCZ}	Power Supply Current ('F2643)			95	mA	Max	V _O = HIGH Z
I _{CCH}	Power Supply Current ('F2645)			82	mA	Max	V _O = HIGH
I _{CCL}	Power Supply Current ('F2645)			82	mA	Max	V _O = LOW, V _{IN} = 0.2V
I _{CCZ}	Power Supply Current ('F2645)			95	mA	Max	V _O = HIGH Z

'F2640 AC Electrical Characteristics:

Symbol	Parameter	74F			54F		74F		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	
t _{PLH} t _{PHL}	Propagation Delay A Input to B Output	2.5		7.5			2.0	8.0	ns
		2.5		7.5			2.5	7.5	
t _{PLH} t _{PHL}	Propagation Delay B Input to A Output	2.5		7.5			2.0	8.0	ns
		2.5		7.5			2.5	7.5	
t _{PZH} t _{PZL}	Enable Time OE Input to A Output	2.5		7.5			2.0	9.0	ns
		2.5		8.0			2.0	8.5	
t _{PHZ} t _{PLZ}	Disable Time OE Input to A Output	1.5		7.0			1.0	7.5	
		1.5		6.0			1.5	6.0	ns
t _{PZH} t _{PZL}	Enable Time OE Input to B Output	2.5		7.5			2.0	9.0	
		2.5		8.0			2.0	8.5	
t _{PHZ} t _{PLZ}	Disable Time OE Input to B Output	1.5		6.5			1.0	7.5	ns
		1.5		6.0			1.5	6.0	

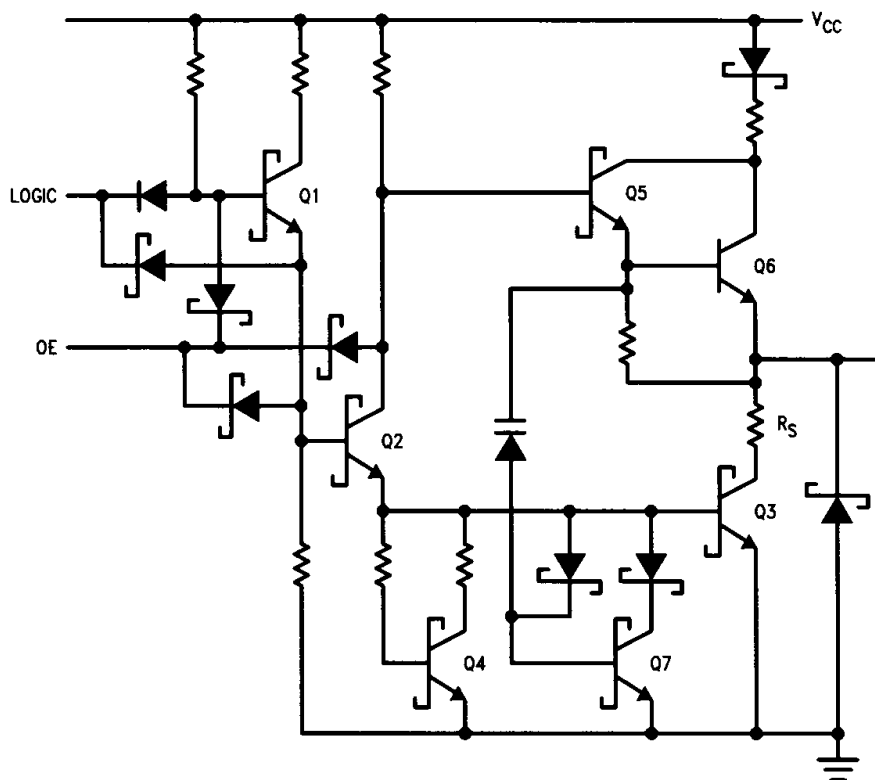
'F2643 AC Electrical Characteristics:

Symbol	Parameter	74F			54F		74F		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	
t _{PLH} t _{PHL}	Propagation Delay A Input to B Output	2.5		7.5			2.0	8.0	ns
		2.5		7.5			2.5	7.5	
t _{PLH} t _{PHL}	Propagation Delay B Input to A Output	2.5		7.0			2.5	8.0	ns
		2.5		7.5			2.5	8.0	
t _{PZH} t _{PZL}	Enable Time OE Input to A Output	2.5		8.0			2.0	9.0	ns
		2.5		8.5			2.0	8.5	
t _{PHZ} t _{PLZ}	Disable Time OE Input to A Output	1.5		7.0			1.0	8.0	
		1.0		5.5			1.0	5.5	ns
t _{PZH} t _{PZL}	Enable Time OE Input to B Output	2.5		7.5			2.0	9.0	
		2.5		8.0			2.0	8.5	
t _{PHZ} t _{PLZ}	Disable Time OE Input to B Output	1.5		6.5			1.0	7.5	ns
		1.5		6.0			1.5	6.0	

'F2645 AC Electrical Characteristics:

Symbol	Parameter	74F			54F		74F		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A, V_{CC} = \text{Mil}$ $C_L = 50\text{ pF}$		$T_A, V_{CC} = \text{Com}$ $C_L = 50\text{ pF}$		
		Min	Typ	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay A Input to B Output	1.5 2.5		6.0 7.5			1.5 2.5	7.0 8.0	ns
t_{PLH} t_{PHL}	Propagation Delay B Input to A Output	1.5 2.5		6.0 7.5			1.5 2.5	7.0 8.0	ns
t_{pZH} t_{pZL}	Enable Time $\overline{OE}$ Input to A Output	2.5 2.5		8.0 8.5			2.0 2.0	9.0 8.5	ns
t_{PHZ} t_{PLZ}	Disable Time $\overline{OE}$ Input to A Output	1.5 1.0		7.0 5.5			1.0 1.0	8.0 5.5	
t_{pZH} t_{pZL}	Enable Time $\overline{OE}$ Input to B Output	2.5 2.5		7.5 8.5			2.0 2.5	9.5 9.0	ns
t_{PHZ} t_{PLZ}	Disable Time $\overline{OE}$ Input to B Output	1.5 1.0		6.5 6.5			1.0 1.0	7.5 6.5	

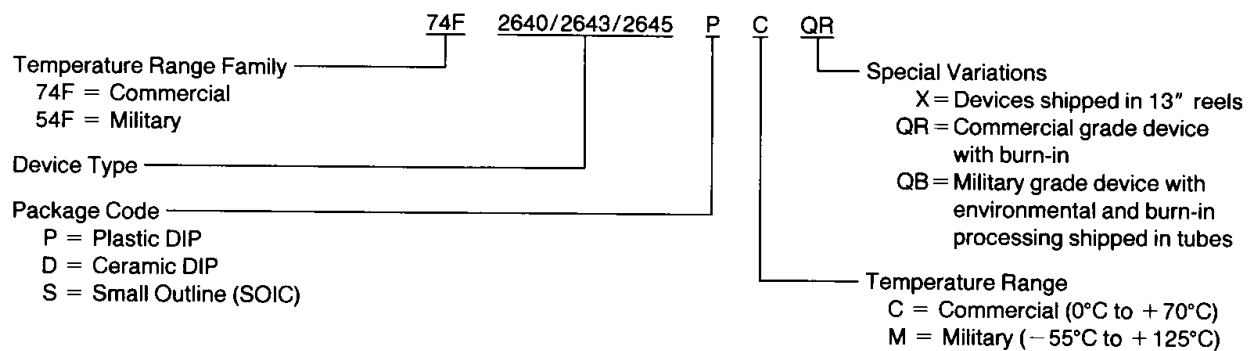
Basic FAST Circuit Showing Series Resistor Placement



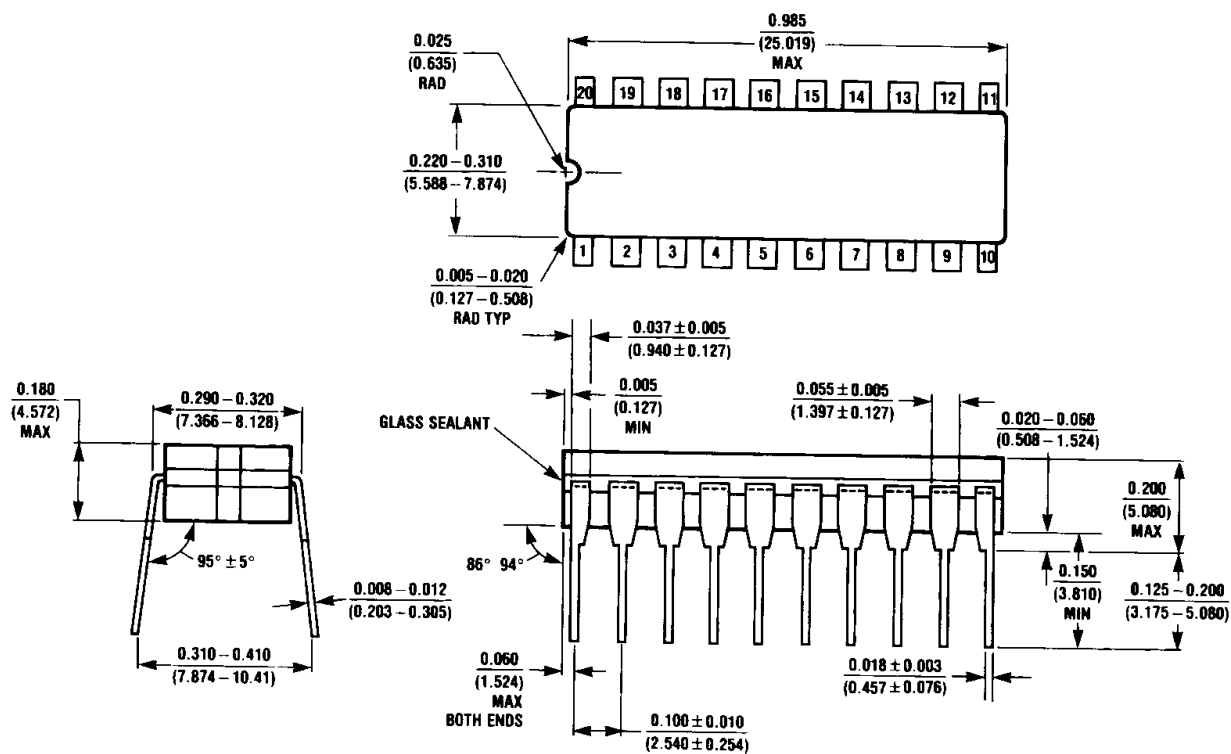
TL/F/10629-7

Ordering Information

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

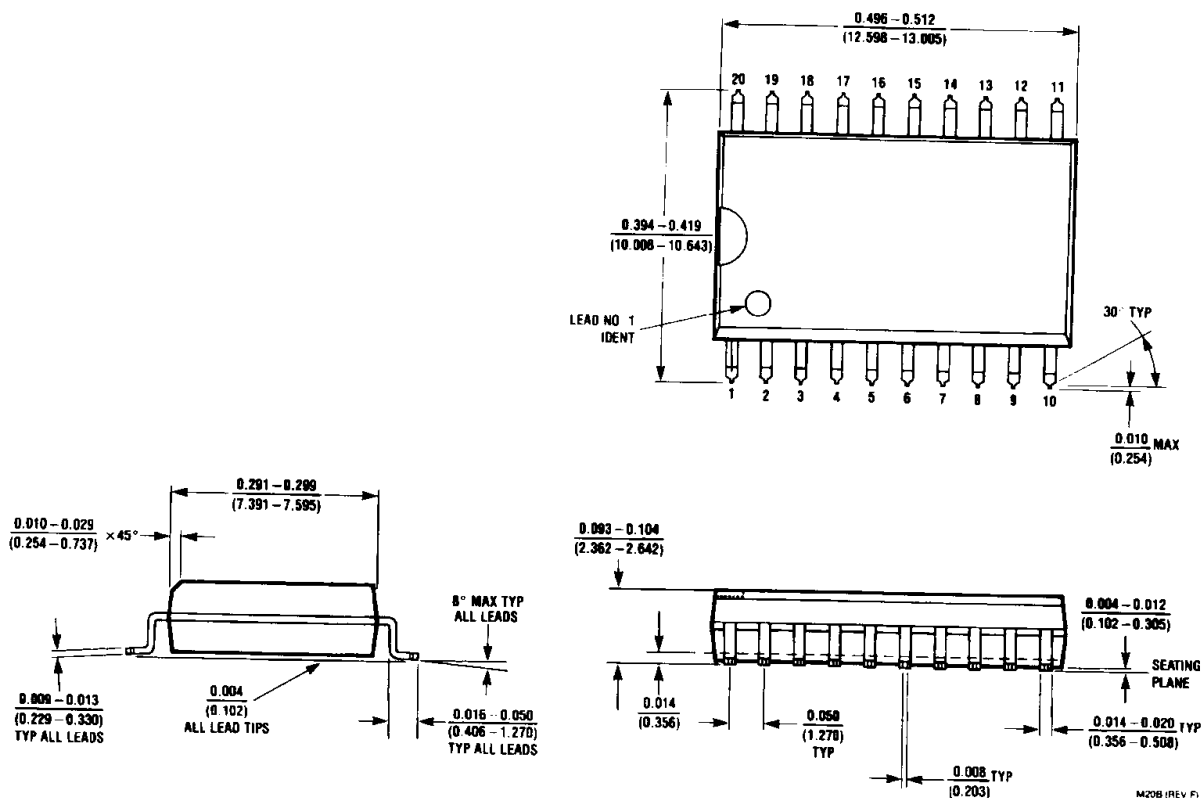


Physical Dimensions inches (millimeters)



J20A (REV M)

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

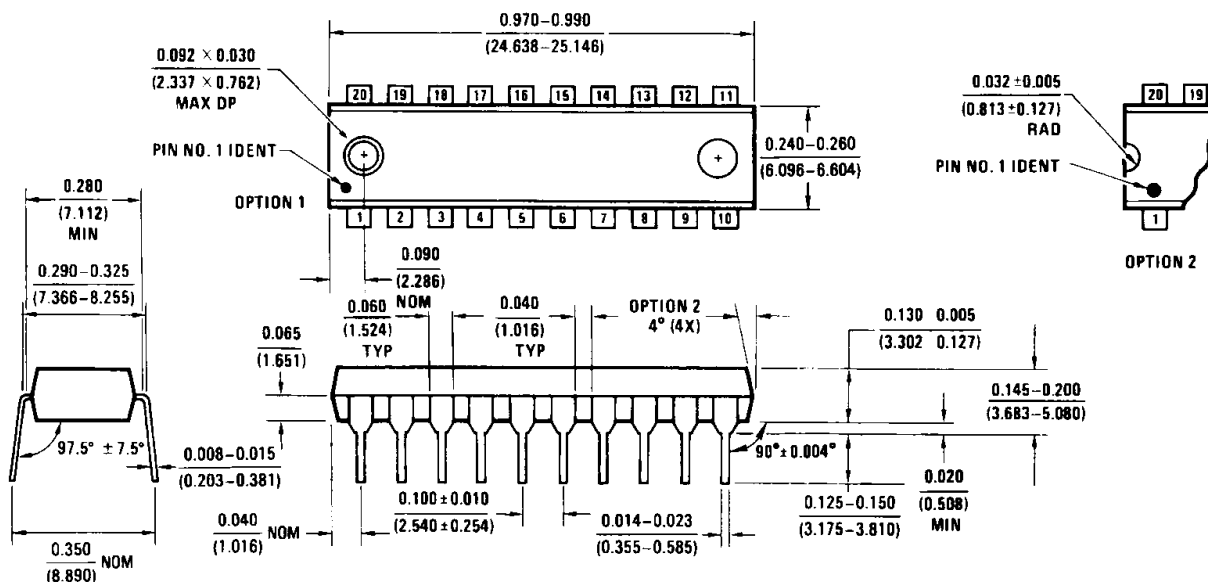


M20B (REV F)

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

Physical Dimensions inches (millimeters) (Continued)

Lit. # 114659



N20B (REV A)

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

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