



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

## General Description

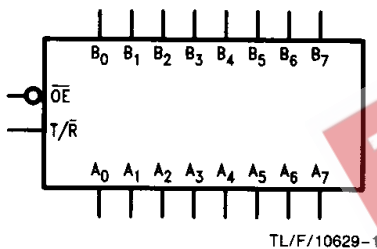
These devices are octal bus transceivers designed for asynchronous two-way data flow between the A and B busses. These devices are functionally equivalent to the 'F640, 'F643, and 'F645. The 25Ω series resistors in the outputs reduce ringing and eliminate the need for external resistors. Both busses 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/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 25Ω series resistors in the outputs.

## Features

- 25Ω 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/R) input controls the direction of data flow
- Guaranteed 4000V minimum ESD protection
- 'F2645 is a low power version of the 'F245 with 25Ω series resistors in the outputs
- 'F2640 is an inverting option of the 'F2645
- 'F2643 has noninverting A bus and inverting B bus

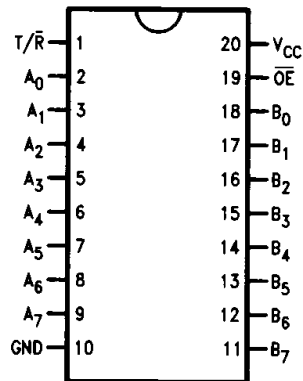
54F/74F2640 • 54F/74F2643 • 54F/74F2645  
Octal Bus Transceiver with 25Ω Series Resistors in the Outputs

## Logic Symbol



## Connection Diagrams

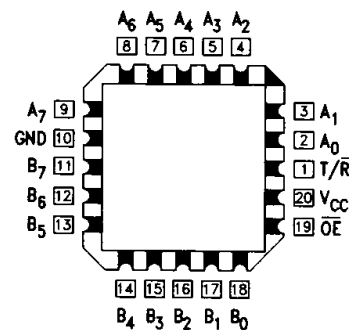
Pin Assignment for DIP, SOIC and Flatpak



## Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I <sub>IH</sub> /I <sub>IL</sub> Output I <sub>OH</sub> /I <sub>OL</sub>
OE	Output Enable Input (Active LOW)	1.0/1.0	20 μA/ -0.6 mA
T/R	Transmit/Receive Input	1.0/1.0	20 μA/ -0.6 mA
A <sub>0</sub> -A <sub>7</sub>	Side A Inputs or TRI-STATE Outputs	3.5/0.667	70 μA/ -0.4 mA
B <sub>0</sub> -B <sub>7</sub>	Side B Inputs or TRI-STATE Outputs	750/20	-15 mA/12 mA
		3.5/0.667	70 μA/ -0.4 mA
		750/20	-15 mA/12 mA

Pin Assignment for LCC and PCC



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## Functional Description

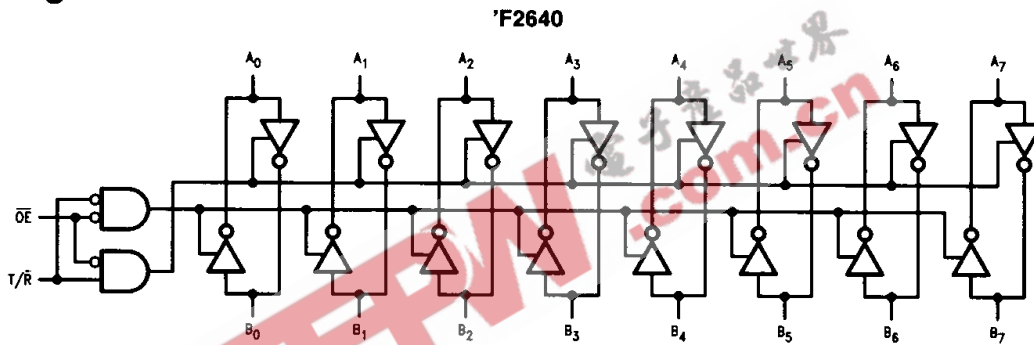
The output enable ( $\overline{OE}$ ) is active LOW. If the device is disabled ( $\overline{OE}$  HIGH), the outputs are in the high impedance state. The transmit/receive input ( $T/\overline{R}$ ) controls whether data is transmitted from the A bus to the B bus or from the B bus to the A bus. When 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

## Function Table

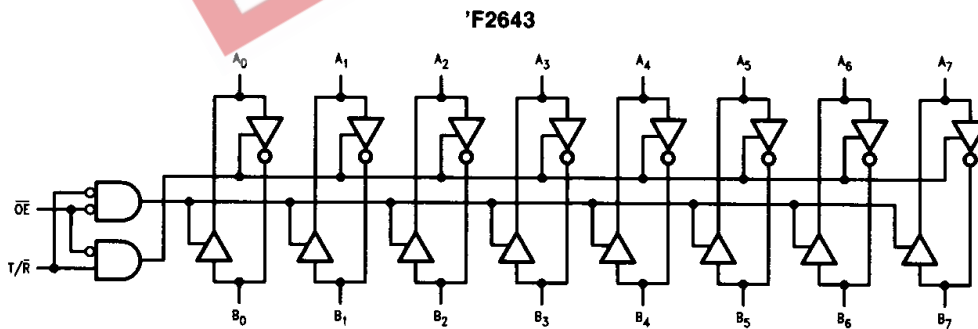
Inputs		Outputs		
$\overline{OE}$	$T/\overline{R}$	'F2640	'F2643	'F2645
L	L	Bus $\overline{B}$ data to Bus A	Bus B data to Bus A	Bus B data to Bus A
L	H	Bus $\overline{A}$ data to Bus B	Bus $\overline{A}$ data to Bus B	Bus A data to Bus B
H	X	Z	Z	Z

H = High voltage level  
 L = Low voltage level  
 X = Don't care  
 Z = High-impedance state

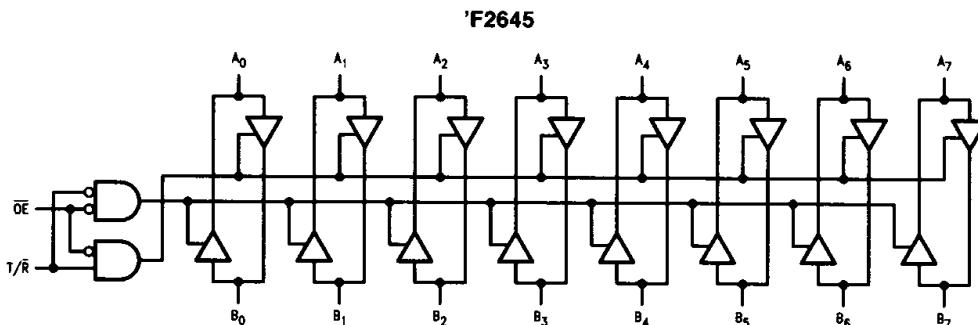
## Logic Diagrams



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 <sub>CC</sub> 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 <sub>CC</sub> = 0V)	-0.5V to V <sub>CC</sub>
Standard Output TRI-STATE Output	-0.5V to +5.5V

Current Applied to Output in LOW State (Max)

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

### 'F2640 AC Electrical Characteristics:

Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PZH</sub> t <sub>PZL</sub>	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 <sub>PHZ</sub> t <sub>PLZ</sub>	Disable Time OE Input to A Output	1.5		7.0			1.0	7.5	ns
		1.5		6.0			1.5	6.0	
t <sub>PZH</sub> t <sub>PZL</sub>	Enable Time OE Input to B Output	2.5		7.5			2.0	9.0	ns
		2.5		8.0			2.0	8.5	
t <sub>PHZ</sub> t <sub>PLZ</sub>	Disable Time OE Input to B Output	1.5		6.5			1.0	7.5	ns
		1.5		6.0			1.5	6.0	

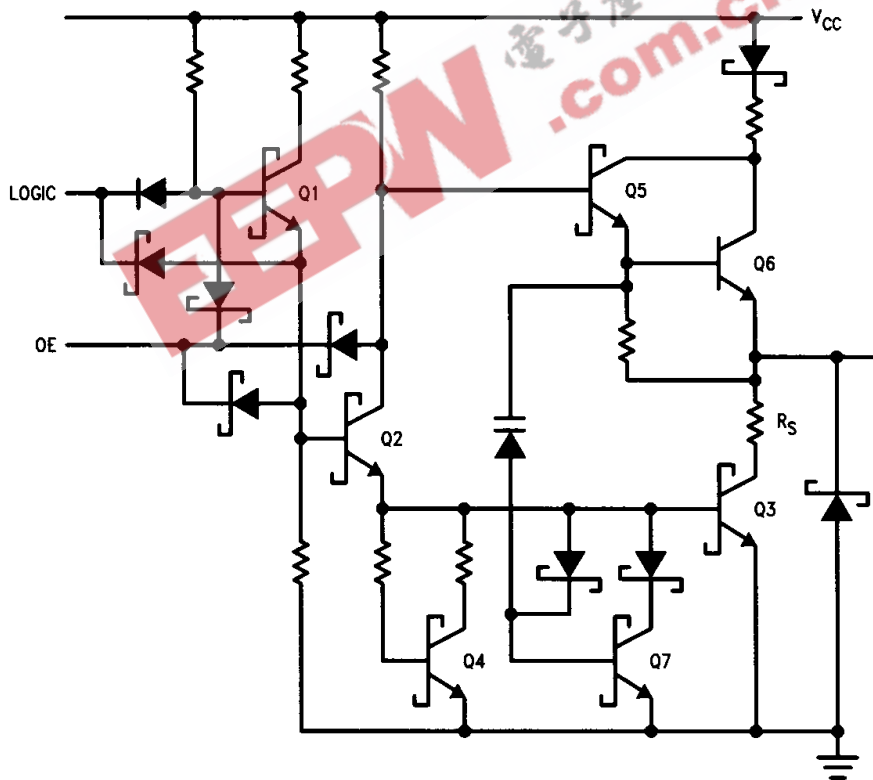
### 'F2643 AC Electrical Characteristics:

Symbol	Parameter	74F			54F		74F		Units
		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> , V <sub>CC</sub> = Mil C <sub>L</sub> = 50 pF		T <sub>A</sub> , V <sub>CC</sub> = Com C <sub>L</sub> = 50 pF		
		Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PZH</sub> t <sub>PZL</sub>	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 <sub>PHZ</sub> t <sub>PLZ</sub>	Disable Time OE Input to A Output	1.5		7.0			1.0	8.0	ns
		1.0		5.5			1.0	5.5	
t <sub>PZH</sub> t <sub>PZL</sub>	Enable Time OE Input to B Output	2.5		7.5			2.0	9.0	ns
		2.5		8.0			2.0	8.5	
t <sub>PHZ</sub> t <sub>PLZ</sub>	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		6.0			1.5	7.0	ns
		2.5		7.5			2.5	8.0	
$t_{PLH}$ $t_{PHL}$	Propagation Delay B Input to A Output	1.5		6.0			1.5	7.0	ns
		2.5		7.5			2.5	8.0	
$t_{PZH}$ $t_{PZL}$	Enable Time $\overline{OE}$ 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 $\overline{OE}$ Input to A Output	1.5		7.0			1.0	8.0	ns
		1.0		5.5			1.0	5.5	
$t_{PZH}$ $t_{PZL}$	Enable Time $\overline{OE}$ Input to B Output	2.5		7.5			2.0	9.5	ns
		2.5		8.5			2.5	9.0	
$t_{PHZ}$ $t_{PLZ}$	Disable Time $\overline{OE}$ Input to B Output	1.5		6.5			1.0	7.5	ns
		1.0		6.5			1.0	6.5	

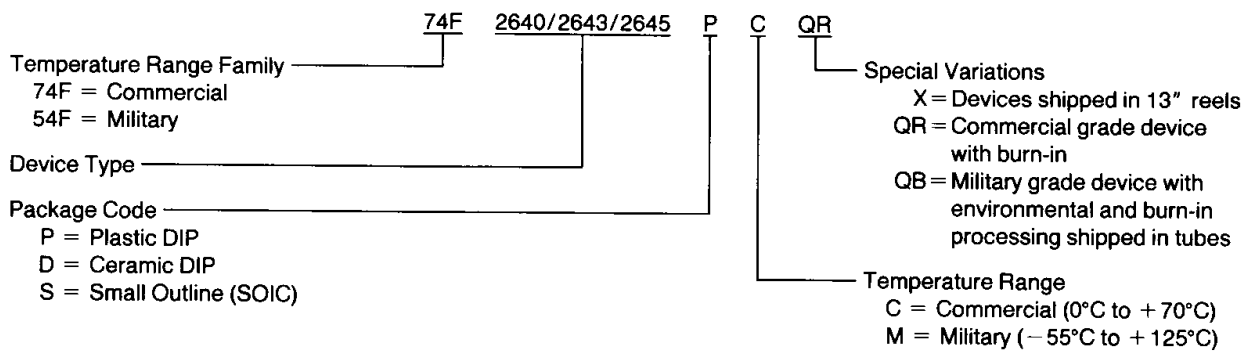
Basic FAST Circuit Showing Series Resistor Placement



TL/F/10629-7

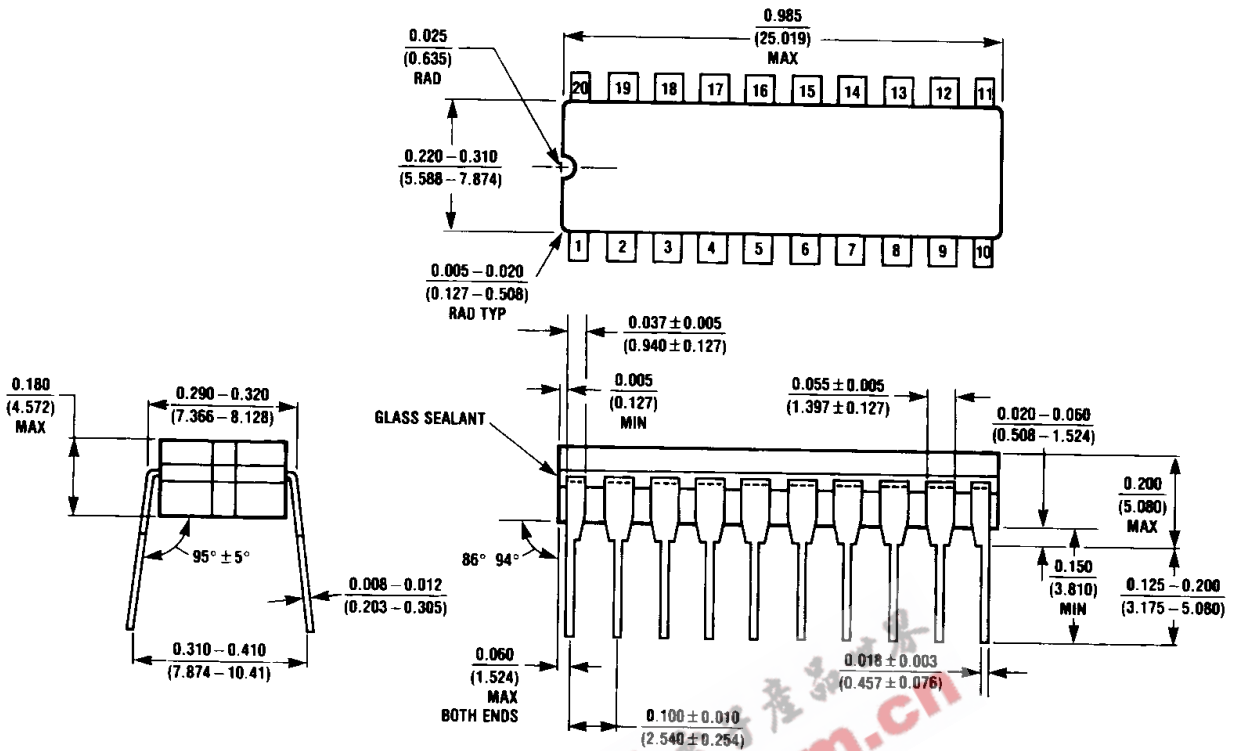
## Ordering Information

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



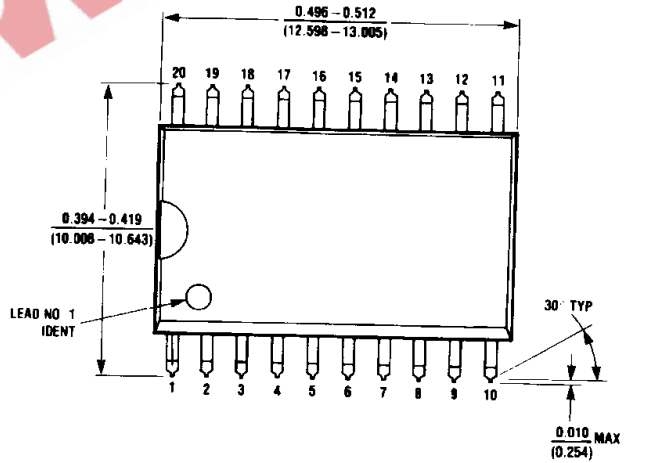
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**Physical Dimensions** inches (millimeters)



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

J20A (REV M)



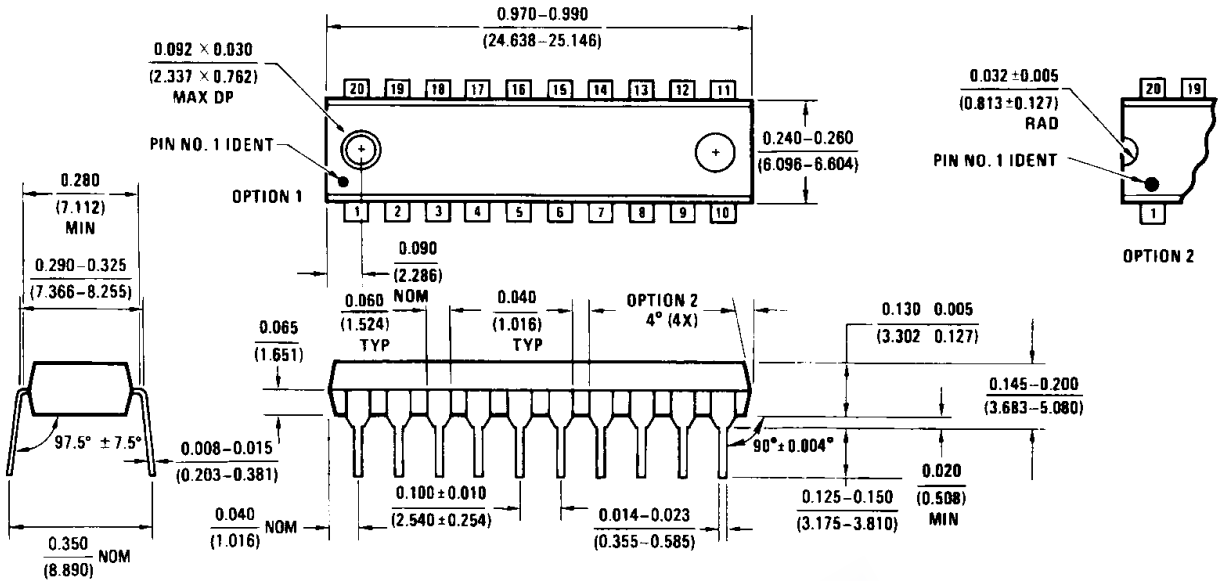
**20-Lead Small Outline Integrated Circuit (S)**  
NS Package Number M20B

M20B (REV F)

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

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

Lit. # 114659



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

N20B (REV A)

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