



May 1990

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

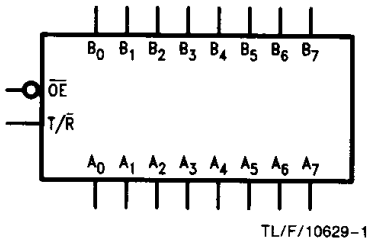
General Description

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

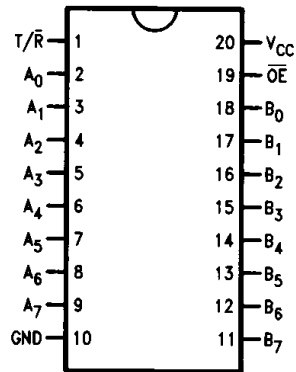
- 25Ω series resistors in the outputs eliminates the need for external resistors
- Designed for asynchronous two-way data flow between busses
- Outputs sink 12 mA and source 15 mA
- Transmit/receive (T/R) input controls the direction of data flow
- Guaranteed 4000V minimum ESD protection
- 'F2645 is 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

Logic Symbol



Connection Diagrams

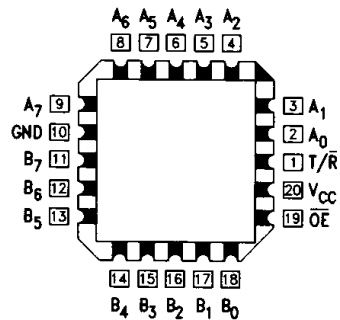
Pin Assignment for DIP, SOIC and Flatpak



Unit Loading/Fan Out

Pin Names	Description	54F/74F	
		U.L. HIGH/LOW	Input I _{IH} /I _{IL} Output I _{OH} /I _{OL}
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 ₀ -A ₇	Side A Inputs or TRI-STATE Outputs	3.5/0.667	70 μA / -0.4 mA -15 mA / 12 mA
B ₀ -B ₇	Side B Inputs or TRI-STATE Outputs	3.5/0.667	70 μA / -0.4 mA -15 mA / 12 mA

Pin Assignment for LCC and PCC



FAST® and TRI-STATE® are registered trademarks of National Semiconductor Corporation.

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

Functional Description

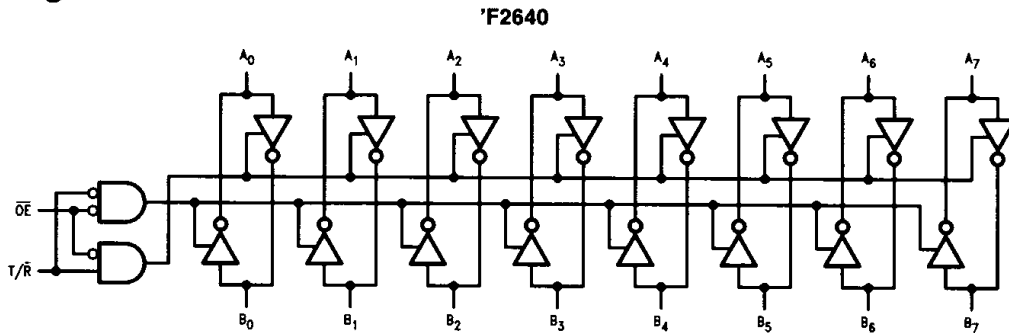
The output enable (\overline{OE}) is active LOW. If the device is disabled (\overline{OE} HIGH), the outputs are in the high impedance state. The transmit/receive input (T/\overline{R}) controls whether data is transmitted from the A bus to the B bus or from the B bus to the A bus. When T/\overline{R}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

Function Table

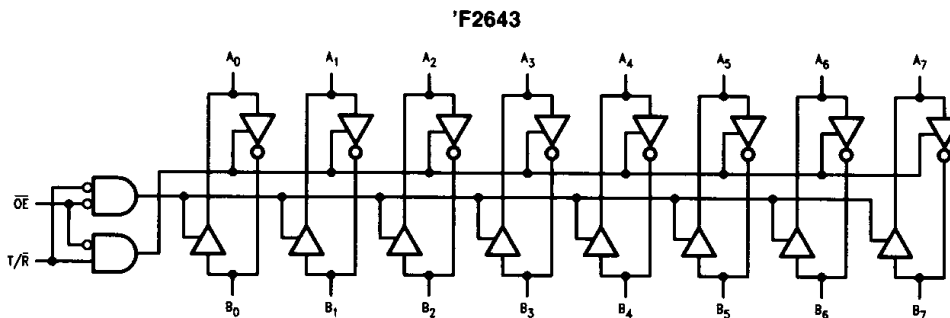
Inputs		Outputs		
\overline{OE}	T/\overline{R}	'F2640	'F2643	'F2645
L	L	Bus \overline{B} data to Bus A	Bus B data to Bus A	Bus B data to Bus A
L	H	Bus \overline{A} data to Bus B	Bus \overline{A} data to Bus B	Bus A data to Bus B
H	X	Z	Z	Z

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

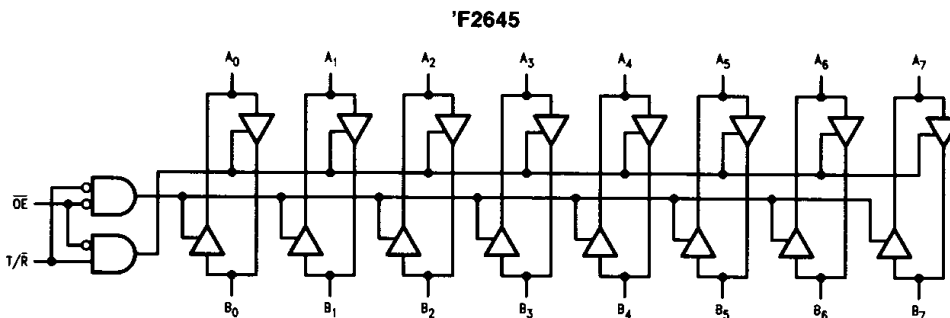
Logic Diagrams



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 _{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)	
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}
I _{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 \overline{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 \overline{OE} Input to A Output	1.5		7.0			1.0	7.5	ns
		1.5		6.0			1.5	6.0	
t _{PZH} t _{PZL}	Enable Time \overline{OE} Input to B Output	2.5		7.5			2.0	9.0	ns
		2.5		8.0			2.0	8.5	
t _{PHZ} t _{PLZ}	Disable Time \overline{OE} Input to B Output	1.5		6.5			1.0	7.5	ns
		1.5		6.0			1.5	6.0	

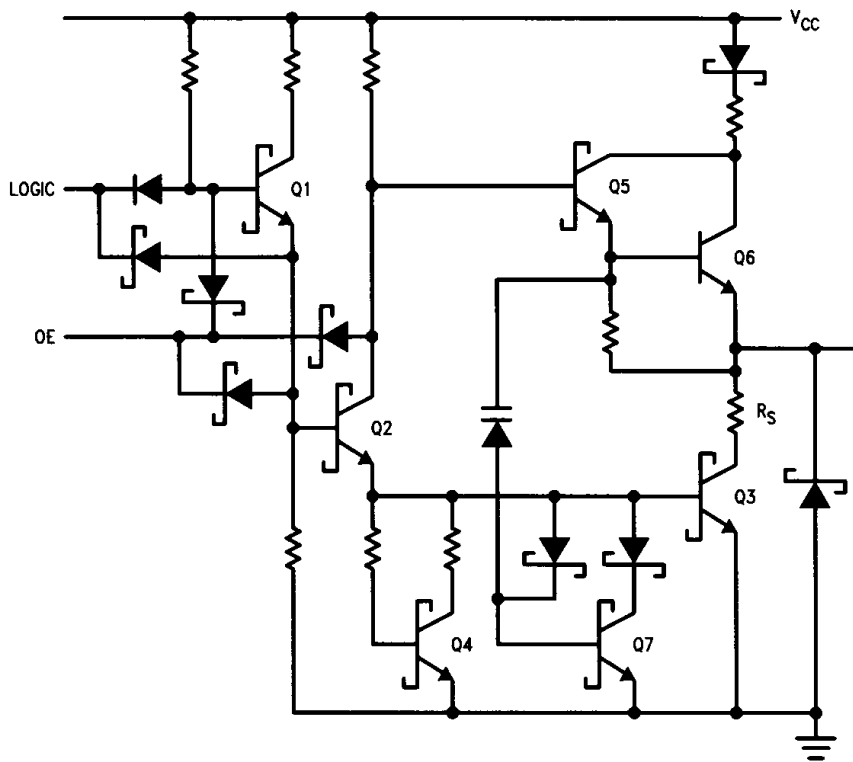
'F2643 AC Electrical Characteristics:

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 \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	9.0	ns
		2.5		8.0			2.0	8.5	
t _{PHZ} t _{PLZ}	Disable Time \overline{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°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	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 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	ns
		1.0		5.5			1.0	5.5	
t _{PZH} t _{PZL}	Enable Time 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 OE Input to B Output	1.5		6.5			1.0	7.5	ns
		1.0		6.5			1.0	6.5	

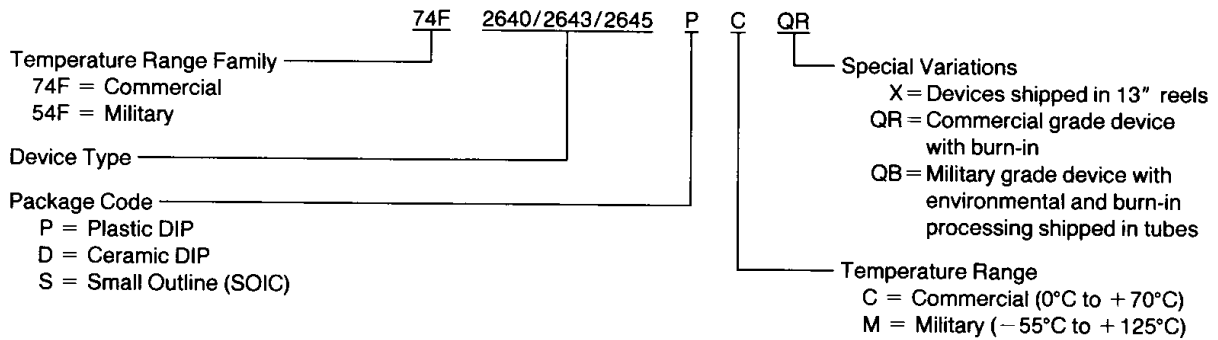
Basic FAST Circuit Showing Series Resistor Placement



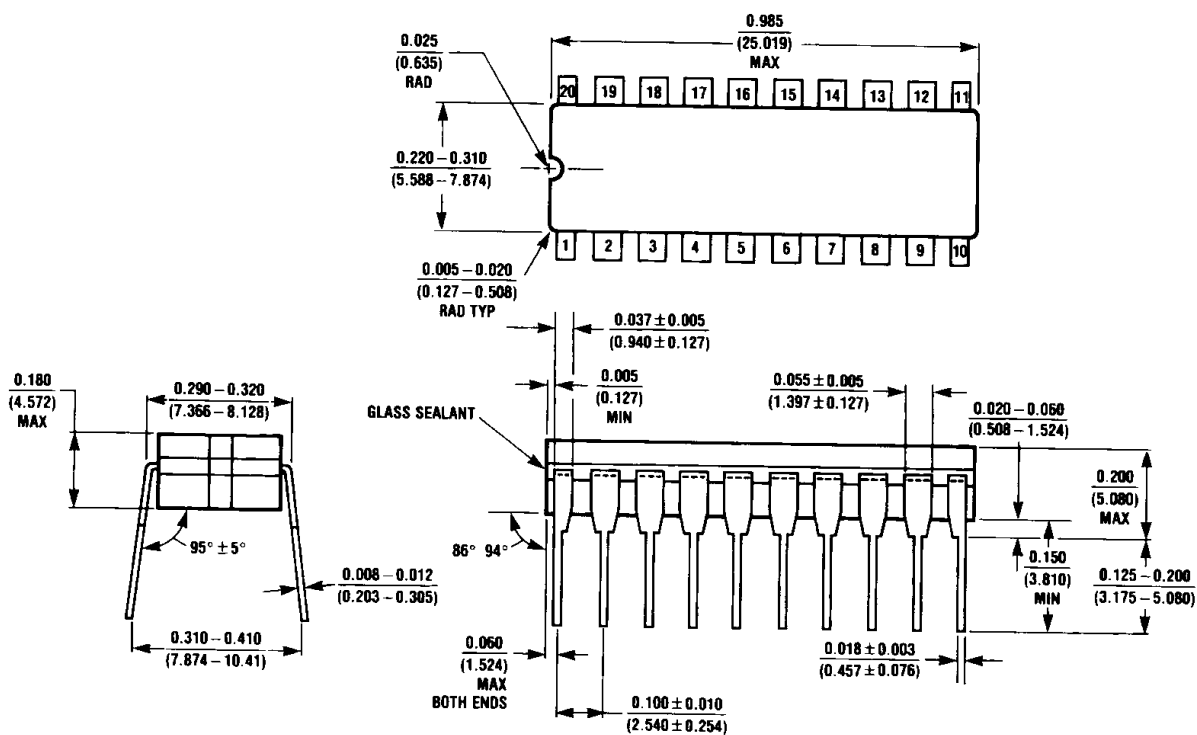
TL/F/10629-7

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:

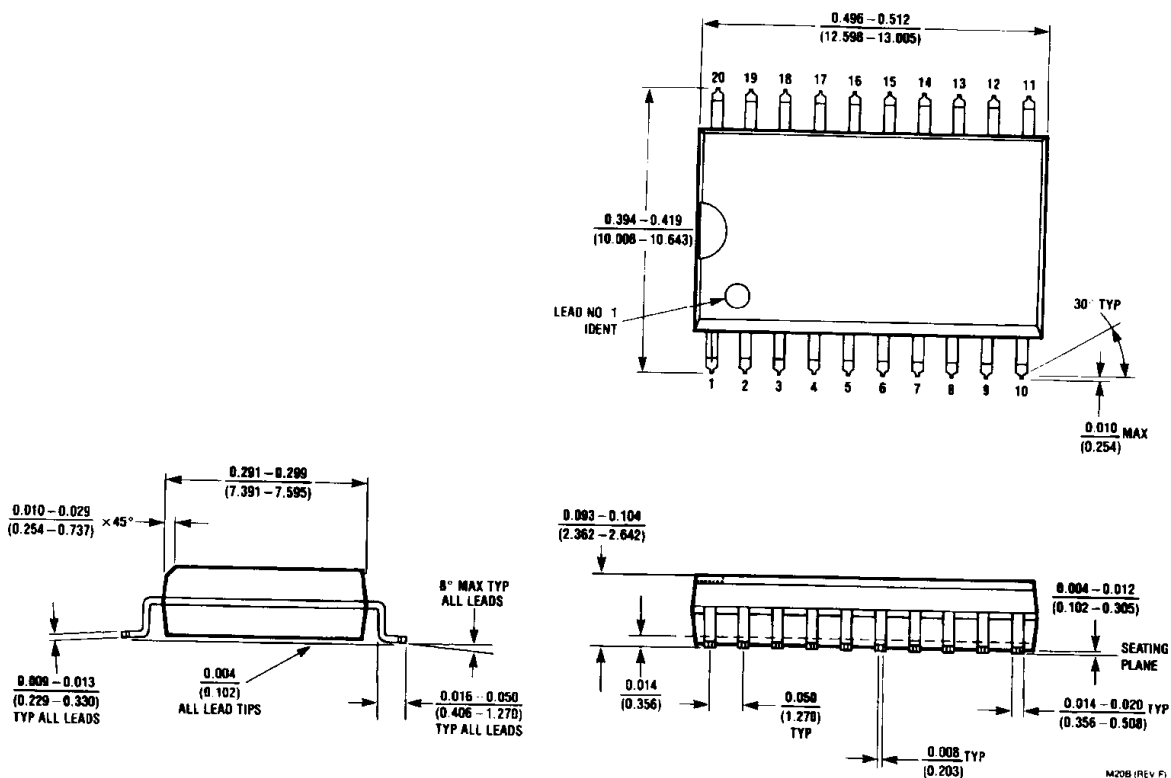


Physical Dimensions inches (millimeters)



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

J20A (REV M)



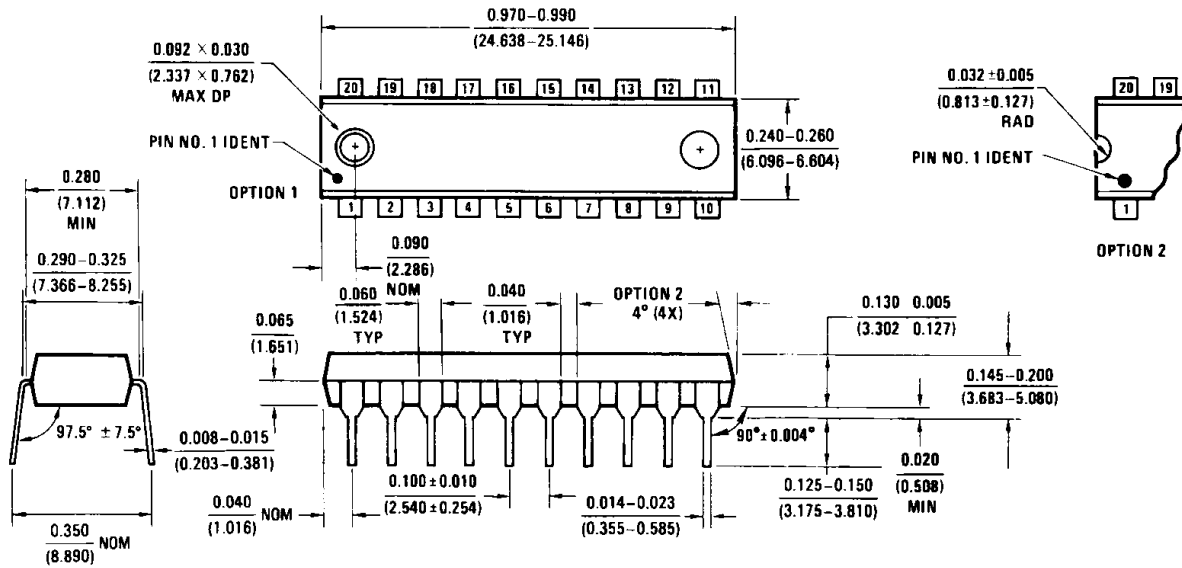
20-Lead Small Outline Integrated Circuit (S)
NS Package Number M20B

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)

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

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.

022567 ✓



National Semiconductor Corporation
2900 Semiconductor Drive
P.O. Box 58090
Santa Clara, CA 95052-8090
Tel: 1(800) 272-9959
TWX: (910) 339-9240

National Semiconductor GmbH
Industriestrasse 10
D-8080 Furstenfeldbruck
West Germany
Tel: (0-81-41) 103-0
Telex: 527-649
Fax: (08141) 103554

National Semiconductor Japan Ltd.
Sanseido Bldg. 5F
4-15 Nishi Shinjuku
Shinjuku-Ku,
Tokyo 160, Japan
Tel: 3-299-7001
FAX: 3-299-7000

National Semiconductor Hong Kong Ltd.
Suite 513, 5th Floor
Chinachem Golden Plaza,
77 Mody Road, Tsimshatsui East,
Kowloon, Hong Kong
Tel: 3-7231290
Telex: 52996 NSSEA HX
Fax: 3-3112536

National Semicondutores Do Brasil Ltda.
Av. Brig. Faria Lima, 1383
6.0 Andor-Conj. 62
01451 Sao Paulo, SP, Brasil
Tel: (55/11) 212-5066
Fax: (55/11) 211-1181 NSBR BR

National Semiconductor (Australia) PTY, Ltd.
1st Floor, 441 St. Kilda Rd.
Melbourne, 3004
Victoria, Australia
Tel: (03) 267-5000
Fax: 61-3-2677458