



T-52-07

May 1991

74FR16540

16-Bit Buffer/Line Driver with TRI-STATE® Outputs

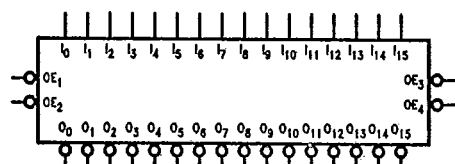
General Description

The 'FR16540 contains sixteen inverting buffers with TRI-STATE outputs designed to be employed as a memory and address driver, clock driver, or bus-oriented transmitter/receiver. The device is byte controlled. Each byte has separate TRI-STATE control inputs which can be shorted together for full 16-bit operation.

Features

- Inverting buffers
- TRI-STATE outputs drive bus lines
- Output sink capability of 64 mA, source capability of 15 mA
- Separate TRI-STATE control pins for each byte
- Guaranteed 4000V minimum ESD protection
- Guaranteed multiple output switching, 250 pF delays and pin to pin skew
- 16-bit version of the 'F540, 'F240, or FR240

Logic Symbol



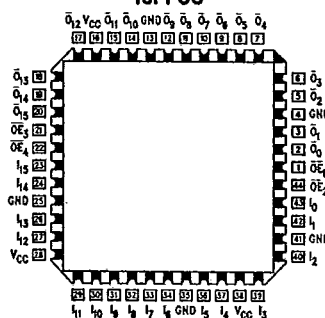
TL/F/10615-1

Pin Descriptions

Pin Names	Description
$\overline{OE}_n$	Output Enable Inputs
I_0-I_{15}	Inputs
O_0-O_{15}	TRI-STATE Outputs

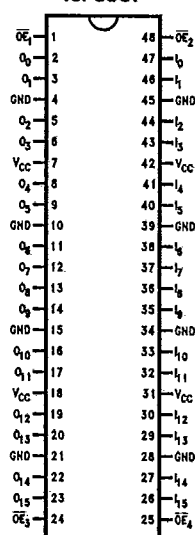
Connection Diagrams

Pin Assignment for PCC



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Pin Assignment for SSOP



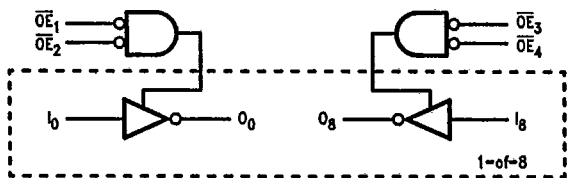
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9000-2694

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Logic Diagram

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Truth Table

Inputs				Outputs			
Byte1 [0:7]		Byte2 [8:15]		I ₀ -I ₇ I ₈ -I ₁₅		O ₀ -O ₇ O ₈ -O ₁₅	
OE ₁	OE ₂	OE ₃	OE ₄				
L	L	L	L	H	H	L	L
H	X	L	L	X	L	Z	H
X	H	L	L	X	H	Z	L
L	L	H	X	L	X	H	Z
L	L	X	H	H	X	L	Z
H	H	H	H	X	X	Z	Z
L	L	L	L	L	L	H	H

H = High Voltage Level
L = Low Voltage Level
X = Immaterial
Z = High Impedance

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

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.

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Voltage Applied to Output in HIGH State (with V _{CC} = 0V)	-0.5V to V _{CC}
Standard Output 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

Recommended Operating Conditions

Free Air Ambient Temperature	-55°C to +125°C
Military Commercial	0°C to +70°C
Supply Voltage	+4.5V to +5.5V
Military Commercial	+4.5V to +5.5V

DC Electrical Characteristics

Symbol	Parameter	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
V _{OH}	Output HIGH Voltage	2.4 2.0			V	Min	I _{OH} = -3 mA I _{OH} = -15 mA
V _{OL}	Output LOW Voltage			0.55	V	Min	I _{OL} = 64 mA
I _{IH}	Input HIGH Current			5.0	μA	Max	V _{IN} = 2.7V
I _{BVI}	Input HIGH Current Breakdown Test			7.0	μA	Max	V _{IN} = 7.0V (OE _n)
I _{IL}	Input LOW Current			-120	μA	Max	V _{IN} = 0.5V
I _{OS}	Output Short-Circuit Current	-100		-225	mA	Max	V _{OUT} = 0V
I _{OZH}	Output Leakage Current		0	20	μA	Max	V _{OUT} = 2.7V
I _{OZL}	Output Leakage Current		0	-20	μA	Max	V _{OUT} = 0.5V
I _{CEX}	Output High Leakage Current			50	μA	Max	V _{OUT} = V _{CC}
V _{ID}	Input Leakage Test	4.75			V	0.0	I _{ID} = 1.9 μA All Other Pins Grounded
I _{OD}	Output Circuit Leakage Current			3.75	μA	0.0	V _{ID} = 150 mV All Other Pins Grounded
I _{ZZ}	Bus Drainage Test			100	μA	0.0	V _{OUT} = 5.25V
I _{CCH}	Power Supply Current		14	20	mA	Max	V _O = HIGH
I _{CCL}	Power Supply Current		75	92	mA	Max	V _O = LOW
I _{CCZ}	Power Supply Current		38	50	mA	Max	V _O = HIGH Z
C _{IN}	Input Capacitance		8		pF	5.0	

AC Electrical Characteristics

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Symbol	Parameter	74FR			74FR		Units
		$T_A = +25^{\circ}\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A = \text{Comm}$ $V_{CC} = \text{Comm}$ $C_L = 50\text{ pF}$		
		Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay In to On	1.0	2.8	4.3	1.0	4.3	ns
		1.0	2.0	4.3	1.0	4.3	
t_{PZH} t_{PZL}	Output Enable Time	3.4	5.6	11.6	3.4	11.6	ns
		3.4	7.8	11.6	3.4	11.6	
t_{PHZ} t_{PLZ}	Output Disable Time	1.8	4.0	6.6	1.8	6.6	ns
		1.8	4.4	6.6	1.8	6.6	

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Extended AC Characteristics

Symbol	Parameter	74FR		74FR		Units
		$T_A = \text{Comm}$ $V_{CC} = \text{Comm}$ $C_L = 50 \text{ pF}$ 16 Outputs Switching (Note 2)		$T_A = \text{Comm}$ $V_{CC} = \text{Comm}$ $C_L = 250 \text{ pF}$ (Note 3)		
		Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay In to On	1.0 1.0	6.0 6.0	3.2 3.2	8.2 8.2	ns
t_{PZH} t_{PZL}	Output Enable Time	3.4 3.4	14.5 14.5			
t_{PHZ} t_{PLZ}	Output Disable Time	1.8 1.8	6.6 6.6			ns
t_{OSHL} (Note 1)	Pin to Pin Skew for HL Transitions		1.4			
t_{OSLH} (Note 1)	Pin to Pin Skew for LH Transitions		1.6			ns
t_{OST} (Note 1)	Pin to Pin Skew for HL/LH Transitions		3.0			ns

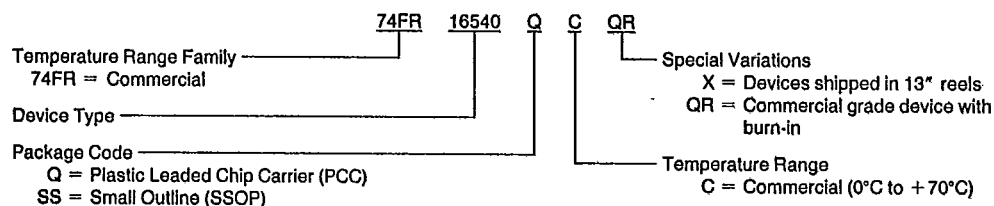
Note 1: Skew is defined as the absolute value of the difference between the actual propagation delays for any two outputs of the same device. The specification applies to any outputs switching HIGH to LOW (t_{OSHL}), LOW to HIGH, (t_{OSLH}), or HIGH to LOW and/or LOW to HIGH, (t_{OST}). Specifications guaranteed with all outputs switching in phase. This specification is guaranteed but not tested.

Note 2: This specification is guaranteed but not tested. The limits apply to propagation delays for all paths described switching in phase, i.e., all low-to-high, high-to-low, TRI-STATE-to-high, etc.

Note 3: These specifications guaranteed but not tested. The limits represent propagation delays with 250 pF load capacitors in place of the 50 pF load capacitors in the standard AC load. This specification pertains to single output switching only.

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:

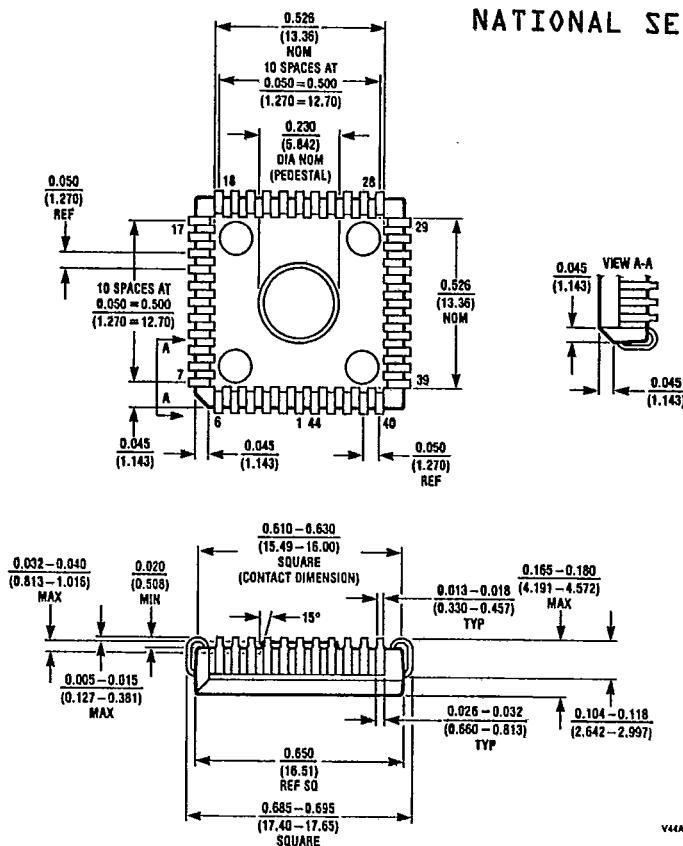


Physical Dimensions inches (millimeters)

Lit. # 114637

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44-Lead Plastic Chip Carrier (Q)
NS Package Number V44A

V44A (REV H)

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