

October 1989 Revised August 1999

74FR16541

16-Bit Buffer/Line Driver with 3-STATE Outputs

General Description

The 74FR16541 contains sixteen non-inverting buffers with 3-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 3-STATE control inputs which can be shorted together for full 16-bit operation.

Features

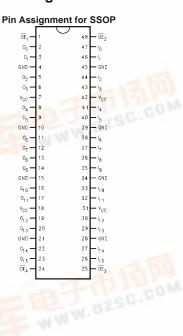
- Non-inverting buffers
- 3-STATE outputs drive bus lines
- Output sink capability of 64 mA, source capability of 15 mA
- Separate 3-STATE control pins for each byte
- Guaranteed multiple output switching, 250 pF delays and pin-to-pin skew
- 16-bit version of the 74F541, 74F244 or 74FR244

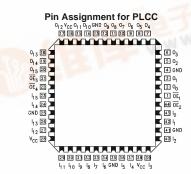
Ordering Code:

Order Number	Package Number	Package Description
74FR16541QC	V44A	44-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.650 Square
74FR16541SSC	MS48A	48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300 Wide

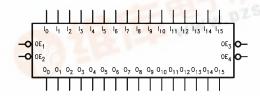
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagrams





Logic Symbol





Pin Descriptions

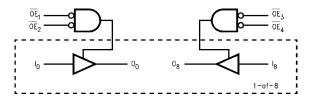
Pin Names	Description
ŌĒn	Output Enable Inputs
I ₀ -I ₁₅	Inputs
O ₀ -O ₁₅	3-STATE Outputs

Truth Table

		Outputs					
Byte1	[0:7]	Byte2	[8:15]	I ₀ –I ₇	I ₈ -I ₁₅	00-07	O ₈ -O ₁₅
OE ₁	$\overline{\text{OE}}_2$	OE ₃	$\overline{OE_4}$				
L	L	L	L	Н	Н	Н	Н
Н	Χ	L	L	Х	L	Z	L
Х	Н	L	L	Х	Н	Z	Н
L	L	Н	Χ	L	Χ	L	Z
L	L	Х	Н	Н	Χ	Н	Z
Н	Н	Н	Н	Х	Χ	Z	Z
L	L	L	L	L	L	L	L

- H = HIGH Voltage Level L = LOW Voltage Level X = Immaterial Z = High Impedance

Logic Diagram



Absolute Maximum Ratings(Note 1)

Recommended Operating Conditions

Storage Temperature —65°C to +150°C
Ambient Temperature under Bias —55°C to +125°C

 $\begin{array}{ll} \mbox{Ambient Temperature under Bias} & -55^{\circ}\mbox{C to } +125^{\circ}\mbox{C} \\ \mbox{Junction Temperature under Bias} & -55^{\circ}\mbox{C to } +150^{\circ}\mbox{C} \\ \end{array}$

 $\begin{array}{lll} \text{V}_{\text{CC}} \text{ Pin Potential to Ground Pin} & -0.5 \text{V to } +7.0 \text{V} \\ \text{Input Voltage (Note 2)} & -0.5 \text{V to } +7.0 \text{V} \\ \text{Input Current (Note 2)} & -30 \text{ mA to } +5.0 \text{ mA} \end{array}$

Voltage Applied to Output

in HIGH State (with $V_{CC} = 0V$)

 $\begin{array}{ll} \mbox{Standard Output} & -0.5\mbox{V to V}_{\mbox{CC}} \\ \mbox{3-STATE Output} & -0.5\mbox{V to } +5.5\mbox{V} \end{array}$

Current Applied to Output

in LOW State (Max) Twice the Rated I_{OL} (mA) ESD Last Passing Voltage (Min) 4000V

Free Air Ambient Temperature $0^{\circ}\text{C} \text{ to } +70^{\circ}\text{C}$ Supply Voltage +4.5V to +5.5V

-0.5V to $V_{\rm CC}$ 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.

DC Electrical Characteristics

Symbol	Parameter	Min	Тур	Max	Units	v _{cc}	Conditions
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	2.4			V	Min	$I_{OH} = -3 \text{ mA}$
	Voltage	2.0		V		IVIIII	$I_{OH} = -15 \text{ mA}$
V _{OL}	Output LOW Voltage			0.55	V	Min	I _{OL} = 64 mA
I _{IH}	Input HIGH Current			5.0	μΑ	Max	V _{IN} = 2.7V
I _{BVI}	Input HIGH Current			7.0			V _{IN} = 7.0V
	Breakdown Test				μА	Max	(\overline{OE}_n)
I _{IL}	Input LOW Current			-120	μΑ	Max	V _{IN} = 0.5V
Ios	Output Short-Circuit	-100		-225	mA	Max	V _{OLIT} = 0V
	Current	-100					VOUT - 0V
I _{OZH}	Output Leakage Current		0	20	μΑ	Max	V _{OUT} = 2.7V
I _{OZL}	Output Leakage Current		0	-20	μΑ	Max	V _{OUT} = 0.5V
I _{CEX}	Output HIGH Leakage Current			50	μА	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	μΑ	0.0	V _{IOD} = 150 mV
							All Other Pins Grounded
I _{ZZ}	Bus Drainage Test			100	μΑ	0.0	V _{OUT} = 5.25V
I _{CCH}	Power Supply Current		35	50	mA	Max	V _O = HIGH
I _{CCL}	Power Supply Current		92	110	mA	Max	$V_O = LOW$
I _{CCZ}	Power Supply Current		36	50	mA	Max	$V_O = HIGH Z$
C _{IN}	Input Capacitance		8		pF	5.0	

AC Electrical Characteristics

Symbol	Parameter	$T_A = +25^{\circ}C$ $V_{CC} = +5.0V$ $C_L = 50 \text{ pF}$			$T_A = 0$ °C to +70°C $V_{CC} = +5.0V$ $C_L = 50 \text{ pF}$		Units
		Min	Тур	Max	Min	Max	
t _{PLH}	Propagation Delay	1.5	2.8	4.3	1.5	4.3	ns
t _{PHL}	I _n to O _n	1.5	2.4	4.3	1.5	4.3	115
t _{PZH}	Output Enable Time	3.6	5.8	11.6	3.6	11.6	ns
t_{PZL}		3.6	6.6	11.6	3.6	11.6	115
t _{PHZ}	Output Disable Time	1.8	4.0	6.6	1.8	6.6	ns
t_{PLZ}		1.8	4.1	6.6	1.8	6.6	115

Extended AC Characteristics

	Parameter		$T_A = 0^{\circ}C \text{ to } +70^{\circ}C$ $V_{CC} = +5.0V$ $C_L = 50 \text{ pF}$		$T_A = 0$ °C to +70°C $V_{CC} = +5.0V$ $C_L = 250$ pF	
Symbol						
	(Note 4)		(Note 5)			
		Min	Max	Min	Max	
t _{PLH}	Propagation Delay	1.5	5.7	3.0	9.0	ns
t _{PHL}	A_n to B_n or B_n to A_n	1.5	5.7	3.0	9.0	115
t _{PZH}	Output Enable Time	3.6	12.5			ns
t _{PZL}		3.6	12.5			113
t _{PHZ}	Output Disable Time	1.8	6.6			ns
t _{PLZ}		1.8	6.6			113
t _{osHL}	Pin-to-Pin Skew		1.5			ns
(Note 3)	for HL Transitions	1.5				115
t _{osLH}	Pin-to-Pin Skew		1.3			ns
(Note 3)	for LH Transitions		1.5			113
t _{ost}	Pin-to-Pin Skew	2.0				ns
(Note 3)	for HL/LH Transitions					113

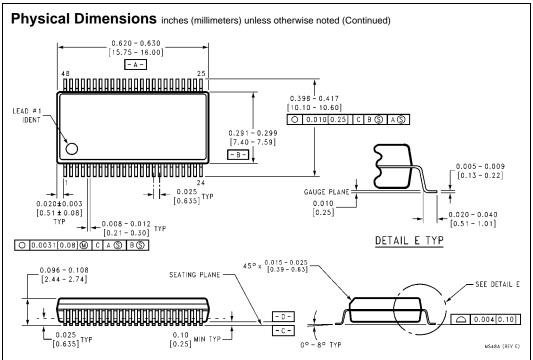
Note 3: Skew is defined as the absolute value of the difference between the actual propagation delays for any two outputs of the same device. The specification applies to any outputs switching HIGH-to-LOW, (tosHL), LOW-to-HIGH, (tosLH), or HIGH-to-LOW and/or LOW-to-HIGH, (tost). Specifications guaranteed with all outputs switching in phase.

Note 4: 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, 3-STATE-to-HIGH, etc.

Note 5: 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.

Physical Dimensions inches (millimeters) unless otherwise noted +0.006 0.650 -0.000 +0.15 16.51 0 PIN 1 IDENT 0.017±0.004 [0.43±0.10] TYP 45°X 0.045 45°X 0.045 0.029±0.003 [0.74±0.08] TYP 0.610±0.020 [15.49±0.51] SEATING PLANE 28 0.020 [0.51] MIN TYP - 0.050 [1.27] TYP 0.690-0.005 [17.53-0.13] 0.105±0.015 [2.67±0.38] TYP 0.500 [12.70] TYP 0.165-0.180 [4.19-4.57] TYP □ 0.004[0.10] V44A (REV K)

44-Lead Plastic Lead Chip Carrier (PLCC), JEDEC MO-047, 0.650 Square Package Number V44A



48-Lead Small Shrink Outline Package (SSOP), JEDEC MO-118, 0.300 Wide Package Number MS48A

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