

August 1999 Revised October 2006

FSTU3257

Quad 2:1 Multiplexer/Demultiplexer Bus Switch with –2V Undershoot Protection

General Description

The Fairchild Switch FSTU3257 is a quad 2:1 high-speed CMOS TTL-compatible multiplexer/demultiplexer bus switch. The low on resistance of the switch allows inputs to be connected to outputs without adding propagation delay or generating additional ground bounce noise.

When $\overline{\text{OE}}$ is LOW, the select pin connects the A Port to the selected B Port output. The A and B Ports are "undershoot hardened" with Undershoot Hardened Circuit (UHC®TM) protection to support an extended range of 2.0V below ground. Fairchild's integrated UHC senses undershoot at the I/O and responds by preventing voltage differentials from developing and turning on the switch. When $\overline{\text{OE}}$ is HIGH, the switch is OPEN and a high-impedance state exists between the two ports.

Features

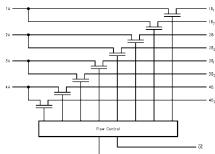
- Undershoot hardened to -2V (A and B Ports)
- Soft enable turn-on to minimize bus to bus charge sharing during enable
- \blacksquare 4 Ω switch connection between two ports.
- Minimal propagation delay through the switch.
- Low I_{CC}.
- Zero bounce in flow-through mode.
- Control inputs compatible with TTL level.
- See Applications Note AN-5008 for details

Ordering Code:

Order Number	Package Number	Package Description
FSTU3257M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
FSTU3257QSC	MQA16	16-Lead Quarter Size Outline Package (QSOP), JEDEC MO-137, 0.150" Wide
FSTU3257MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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

Logic Diagram

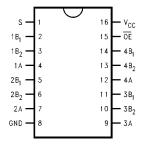


Pin Descriptions

Pin Name	Description
1 III Name	Description
ŌE	Bus Switch Enable
S	Select Input
Α	Bus A
B ₁ -B ₂	Bus B

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Connection Diagram



Truth Table

S	OE	Function
Χ	Н	Disconnect
L	L	$A = B_1$
Н	L	$A = B_2$

Absolute Maximum Ratings(Note 1)

Recommended Operating Conditions (Note 4)

ESD

Human Body Model

Power Supply Operating (V_{CC}) 4.0V to 5.5V Input Voltage (V_{IN}) 0V to 5.5V Output Voltage (V_{OUT}) 0V to 5.5V

128mA Input Rise and Fall Time $(t_r,\,t_f)$

Switch Control Input 0nS/V to 5nS/V Switch I/O 0nS/V to DC

Free Air Operating Temperature (T_A) $-40~^{\circ}C$ to $+85~^{\circ}C$

5kV Note 1: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum rating. The Recommended Operating Conditions tables will define the conditions for actual device operation.

Note 2: V_S is the voltage observed/applied at either the A or B Ports across the switch.

Note 3: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

Note 4: Unused control inputs must be held HIGH or LOW. They may not

float.

DC Electrical Characteristics

		V _{CC}	T _A = -40 °C to +85 °C					
Symbol	Parameter	(V)	Min	Typ (Note 5)	Max	Units	Conditions	
V _{IK}	Clamp Diode Voltage	4.5			-1.2	V	I _{IN} = -18mA	
V _{IH}	HIGH Level Input Voltage	4.0-5.5	2.0			V		
V _{IL}	LOW Level Input Voltage	4.0-5.5			0.8	V		
II	Input Leakage Current	5.5			±1.0	μΑ	0≤ V _{IN} ≤5.5V	
I _{OZ}	OFF-STATE Leakage Current	5.5			±1.0	μА	0 ≤A, B ≤V _{CC}	
R _{ON}	Switch On Resistance	4.5		4	7	Ω	V _{IN} = 0V, I _{IN} = 64mA	
	(Note 6)	4.5		4	7	Ω	V _{IN} = 0V, I _{IN} = 30mA	
		4.5		8	15	Ω	V _{IN} = 2.4V, I _{IN} = 15mA	
		4.0		11	20	Ω	V _{IN} = 2.4V, I _{IN} = 15mA	
I _{CC}	Quiescent Supply Current	5.5			3	μА	V _{IN} = V _{CC} or GND, I _{OUT} = 0	
ΔI _{CC}	Increase in I _{CC} per Input	5.5			2.5	mA	One input at 3.4V	
							Other inputs at V _{CC} or GND	
V _{IKU}	Voltage Undershoot	5.5			-2.0	V	$0.0 \text{ mA} \ge I_{IN} \ge -50 \text{ mA}$	
							OE = 5.5V	

Note 5: Typical values are at V_{CC} = 5.0V and T_A = +25°C

Note 6: Measured by the voltage drop between A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

AC Electrical Characteristics

Symbol	Parameter	$T_{A} = -40 ^{\circ}\text{C to} + 85 ^{\circ}\text{C},$ $C_{L} = 50 \text{pF}, \text{RU} = \text{RD} = 500 \Omega$ $V_{CC} = 4.5 - 5.5 \text{V} \qquad V_{CC} = 4.0 \text{V}$				Units	Conditions	Figure No.
		Min	Max	Min	Max			
t _{PHL} ,t _{PLH}	Prop Delay Bus to Bus (Note 7)		0.25		0.25		V _I = OPEN	Figures 2, 3
	Prop Delay, Select to Bus A	7.0	30.0		35.0	ns		
t _{PZH} , t _{PZL}	Output Enable Time, Select to Bus B	7.0	30.0		35.0		$V_I = 7V$ for t_{PZL}	Figures
	Output Enable Time, OE to Bus A, B	7.0	30.0		35.0	ns	$V_I = OPEN$ for t_{PZH}	2, 3
t _{PHZ} , t _{PLZ}	Output Disable Time, Select to Bus B	1.5	8.4		9.8		$V_I = 7V$ for t_{PLZ}	Figures
	Output Disable Time, Output Enable Time, OE to Bus A, B	1.5	8.8		9.8	ns	$V_I = OPEN ext{ for } t_{PHZ}$	2, 3

Note 7: This parameter is guaranteed by design but is not tested. The bus switch contributes no propagation delay other than the RC delay of the typical On resistance of the switch and the 50pF load capacitance, when driven by an ideal voltage the source (zero output impedance).

Capacitance (Note 8)

Symbo	I	Parameter	Тур	Max	Units	Conditions
C _{IN}		Control Pin Input Capacitance	3		pF	V _{CC} = 5.0V
C _{I/O} A Port		Input/Output Capacitance	7.5		pF	V _{CC} , OE = 5.0V
		t Impuroutput Capacitance			pF	VCC, OL = 3.0V
C _{I/O} ON State		Input/Output Capacitance ON State (A or B Port)	14		pF	V _{CC} = 5.0V Switch ON

Note 8: T_A = +25°C, f = 1 MHz, Capacitance is characterized but not tested.

Undershoot Characteristic (Note 9)

Symbol	Parameter	Min	Тур	Max	Units	Conditions
V _{OUTU}	Output Voltage During Undershoot	2.5	V _{OH} - 0.3		V	Figure 1

Note 9: This is intended to characterize the device's protective capabilities by maintaining output signal integrity during an input transient voltage undershoot event.

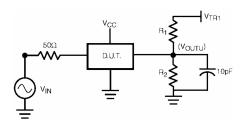
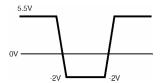


FIGURE 1.

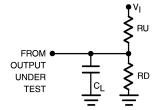
Device Test Conditions

Parameter	Value	Units
V_{IN}	See Waveform	V
R ₁ - R ₂	100K	Ω
V_{TRI}	11.0	V
V _{CC}	5.5	V

Transient Input Voltage (V_{IN}) Waveform



AC Loading and Waveforms



Note: Input driven by 50Ω source terminated in 50Ω Note: C_L includes load and stray capacitance Note: Input PRR = 1.0 MHz, t_W = 500 ns

FIGURE 2. AC Test Circuit

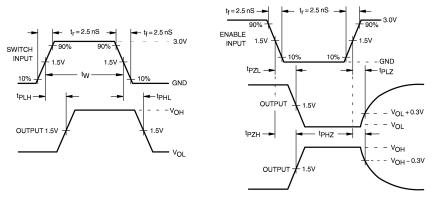
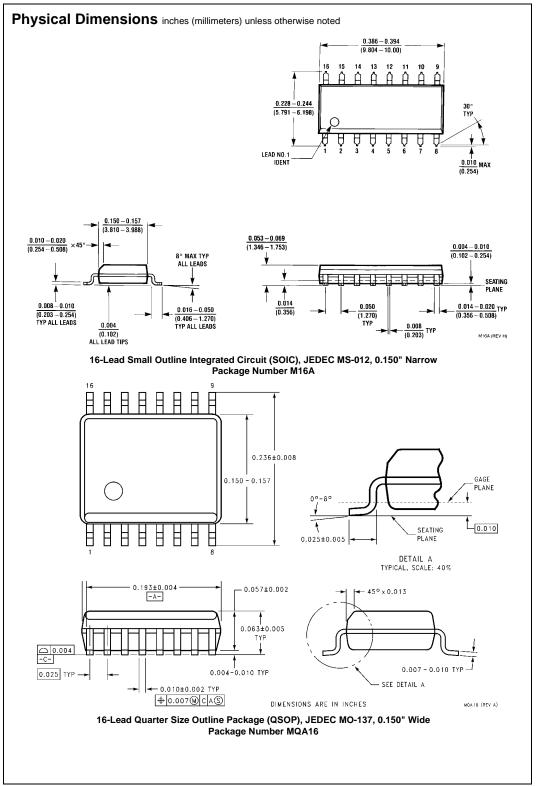
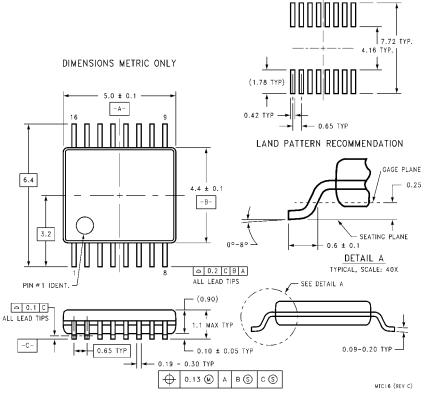


FIGURE 3. AC Waveforms



Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC16

Technology Description

The Fairchild Switch family derives from and embodies Fairchild's proven switch technology used for several years in its 74LVX3L384 (FST3384) bus switch product.

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