FAIRCHILD SEMICONDUCTOR®

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FSA3357
Low Voltage SP3T Analog Switch (3:1 Multiplexer/Demultiplexer)

General Description

The FSA3357 is a high performance, single-pole/triple-throw (SP3T) Analog Switch or 3:1 Multiplexer/Demultiplexer. The device is fabricated with advanced sub-micron CMOS technology to achieve high speed enable and disable times and low On Resistance. The break before make select circuitry prevents disruption of signals on the B_0, B_1, or B_2 Ports due to the switches temporarily being enabled during select pin switching. The device is specified to operate over the 1.65 to 5.5V V_{CC} operating range. The control input tolerates voltages up to 5.5V independent of the V_{CC} operating range.

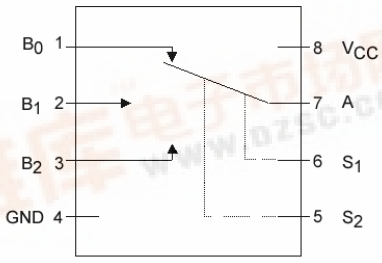
Features

- Useful in both analog and digital applications
- Space saving US8 8-lead surface mount package
- Low On Resistance; < 9Ω on typ @ 3.3V V_{CC}
- Broad V_{CC} operating range; 1.65V to 5.5V
- Rail-to-Rail signal handling
- Power down high impedance control input
- Overvoltage tolerance of control input to 7.0V
- Break before make enable circuitry
- 250 MHz - 3dB bandwidth

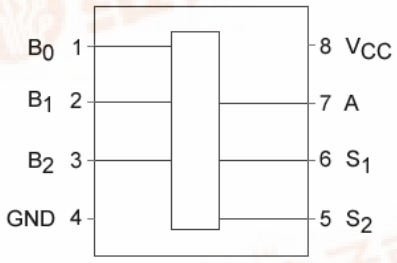
Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
FSA3357K8X	MAB08A	A357	8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide	3k Units on Tape and Reel

Analog Symbol



Connection Diagram



(Top View)

Function Table

S_1	S_2	Function
0	0	No Connection
1	0	B_0 Connected to A
0	1	B_1 Connected to A
1	1	B_2 Connected to A

Pin Descriptions

Pin Names	Description
A_1, B_0, B_1, B_2	Data Ports
S_1, S_2	Control Input

Absolute Maximum Ratings (Note 1)

Supply Voltage (V_{CC})	–0.5V to +7.0V
DC Switch Voltage (V_S) (Note 2)	–0.5V to V_{CC} +0.5V
DC Input Voltage (V_{IN}) (Note 2)	–0.5V to +7.0V
DC Input Diode Current (I_{IK})	
@ (I_{IK}) V_{IN} < 0V	–50 mA
DC Output Current (I_{OUT})	128 mA
DC V_{CC} or Ground Current (I_{CC}/I_{GND})	±100 mA
Storage Temperature Range (T_{STG})	–65°C to +150°C
Junction Temperature under Bias (T_J)	150°C
Junction Lead Temperature (T_L)	
(Soldering, 10 seconds)	260°C
Power Dissipation (P_D) @ +85°C	180 mW

Recommended Operating Conditions (Note 3)

Supply Voltage Operating (V_{CC})	1.65V to 5.5V
Control Input Voltage (V_{IN})	0V to V_{CC}
Switch Input Voltage (V_{IN})	0V to V_{CC}
Output Voltage (V_{OUT})	0V to V_{CC}
Operating Temperature (T_A)	–40°C to +85°C
Input Rise and Fall Time (t_r, t_f)	
Control Input V_{CC} = 2.3V - 3.6V	0 ns/V to 10 ns/V
Control Input V_{CC} = 4.5V - 5.5V	0 ns/V to 5 ns/V
Thermal Resistance (θ_{JA})	250°C/W

Note 1: Absolute maximum ratings are DC values beyond which the device may be damaged or have its useful life impaired. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

Note 2: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

Note 3: Control inputs must be held HIGH or LOW, they must not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	T_A = +25°C			T_A = –40°C to +85°C		Units	Conditions
			Min	Typ	Max	Min	Max		
V_{IH}	HIGH Level Input Voltage	1.65 – 1.95	0.75 V_{CC}			0.75 V_{CC}		V	
		2.3 – 5.5	0.7 V_{CC}			0.7 V_{CC}			
V_{IL}	LOW Level Input Voltage	1.65 – 1.95			0.25 V_{CC}		0.25 V_{CC}	V	
		2.3 – 5.5			0.3 V_{CC}		0.3 V_{CC}		
I_{IN}	Input Leakage Current	0 – 5.5			±0.1		±1.0	µA	0 ≤ V_{IN} ≤ 5.5V
I_{OFF}	OFF State Leakage Current	1.65 – 5.5			±0.1		±1.0	µA	0 ≤ A, B_n ≤ V_{CC}
R_{ON}	Switch On Resistance (Note 4)	4.5		5.0	7.0		7.0	Ω	V_{IN} = 0V, I_O = 30 mA
				6.0	12.0		12.0		V_{IN} = 2.4V, I_O = –30 mA
				7.0	15.0		15.0		V_{IN} = 4.5V, I_O = –30 mA
		3.0		6.5	9.0		9.0		V_{IN} = 0V, I_O = 24 mA
				9.0	20.0		20.0		V_{IN} = 3V, I_O = –24 mA
		2.3		8.0	12.0		12.0		V_{IN} = 0V, I_O = 8 mA
				11.0	30.0		30.0		V_{IN} = 2.3V, I_O = –8 mA
		1.65		10.0	20.0		20.0		V_{IN} = 0V, I_O = 4 mA
				17.0	50.0		50.0		V_{IN} = 1.65V, I_O = –4 mA
I_{CC}	Quiescent Supply Current All Channels ON or OFF	5.5			1.0		10.0	µA	V_{IN} = V_{CC} or GND I_{OUT} = 0
ASR	Analog Signal Range	V_{CC}	0.0		V_{CC}	0.0	V_{CC}	V	
ΔR_{ON}	On Resistance Match Between Channels (Note 4)(Note 5)(Note 6)	4.5		0.15				Ω	I_A = –30 mA, V_{Bn} = 3.15
		3.0		0.22					I_A = –24 mA, V_{Bn} = 2.1
		2.3		0.31					I_A = –8 mA, V_{Bn} = 1.6
		1.65		0.62					I_A = –4 mA, V_{Bn} = 1.15
R_{flat}	On Resistance Flatness (Note 4)(Note 5)(Note 7)	5.0		6.0				Ω	I_A = –30 mA, 0 ≤ V_{Bn} ≤ V_{CC}
		3.3		12.0					I_A = –24 mA, 0 ≤ V_{Bn} ≤ V_{CC}
		2.5		40.0					I_A = –8 mA, 0 ≤ V_{Bn} ≤ V_{CC}
		1.8		140.0					I_A = –4 mA, 0 ≤ V_{Bn} ≤ V_{CC}

Note 4: Measured by the voltage drop between A and B_n pins at the indicated current through the switch. On Resistance is determined by the lower of the voltages on the two (A or B_n Ports).

Note 5: Parameter is characterized but not tested in production.

Note 6: ΔR_{ON} = R_{ON} max – R_{ON} min measured at identical V_{CC}, temperature and voltage levels.

Note 7: Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$			$T_A = -40°C$ to $+85°C$		Units	Conditions	Figure Number
			Min	Typ	Max	Min	Max			
t_{PHL}	Propagation Delay	1.65 – 1.95		2.0				ns	V_I = OPEN	Figures 1, 2
t_{PLH}	Bus to Bus	2.3 – 2.7		1.1						
	(Note 8)	3.0 – 3.6		0.7						
		4.5 – 5.5		0.4						
t_{PZL}	Output Enable Time	1.65 – 1.95	5.0		32.0	5.0	34.0	ns	V_I = 2 x V_{CC} for t_{PZL} V_I = 0V for t_{PZH}	Figures 1, 2
t_{PZH}	Turn on Time	2.3 – 2.7	3.0		15.0	3.0	16.5			
	(A to B_n)	3.0 – 3.6	2.0		9.5	2.0	11.0			
		4.5 – 5.5	1.5		6.5	1.5	7.0			
t_{PLZ}	Output Disable Time	1.65 – 1.95	3.0		14.0	3.0	14.5	ns	V_I = 2 x V_{CC} for t_{PLZ} V_I = 0V for t_{PHZ}	Figures 1, 2
t_{PHZ}	Turn Off Time	2.3 – 2.7	2.0		7.2	2.0	7.8			
	(A Port to B_n Port)	3.0 – 3.6	1.5		5.1	1.5	5.5			
		4.5 – 5.5	0.8		3.7	0.8	4.0			
t_{B-M}	Break Before Make Time	1.65 – 1.95	0.5			0.5		ns		Figure 3
	(Note 9)	2.3 – 2.7	0.5			0.5				
		3.0 – 3.6	0.5			0.5				
		4.5 – 5.5	0.5			0.5				
Q	Charge Injection (Note 9)	5.0		3.0				pC	C_L = 0.1 nF, V_{GEN} = 0V R_{GEN} = 0Ω	Figure 4
		3.3		2.0						
OIRR	Off Isolation (Note 10)	1.65 – 5.5		–58.0				dB	R_L = 50Ω f = 10MHz	Figure 5
Xtalk	Crosstalk	1.65 – 5.5		–60.0				dB	R_L = 50Ω f = 10MHz	Figure 6
BW	–3dB Bandwidth	1.65 – 5.5		250.0				MHz	R_L = 50Ω	Figure 9
THD	Total Harmonic Distortion								R_L = 600Ω	
	(Note 9)	5.0		.01				%	0.5 V_{P-P} f = 600 Hz to 20 KHz	

Note 8: This parameter is guaranteed by design but not tested. The bus switch contributes no propagation delay other than the RC delay of the On Resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).

Note 9: Guaranteed by Design.

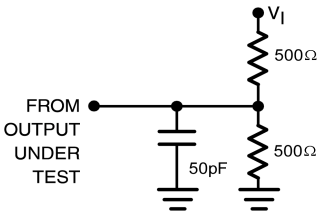
Note 10: Off Isolation = 20 $\log_{10}$ [V_A / V_{Bn}]

Capacitance (Note 11)

Symbol	Parameter	Typ	Max	Units	Conditions	Figure Number
C_{IN}	Control Pin Input Capacitance	2.0		pF	V_{CC} = 0V	
C_{IO-B}	B Port Off Capacitance	3.6		pF	V_{CC} = 5.0V	Figure 7
C_{IOA-ON}	A Port Capacitance When Switch Is Enabled	14.5		pF	V_{CC} = 5.0V	Figure 8

Note 11: T_A = +25°C, f = 1 MHz, Capacitance is characterized but not tested in production.

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 1. AC Test Circuit

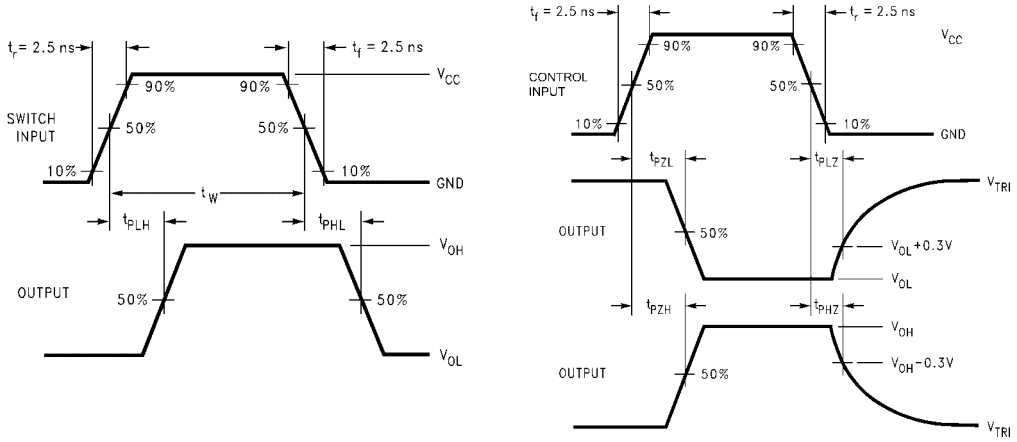


FIGURE 2. AC Waveforms

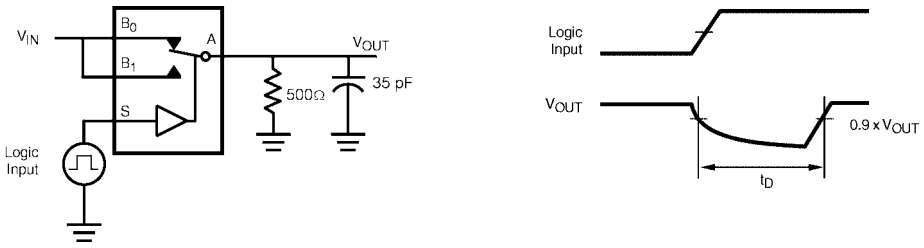


FIGURE 3. Break Before Make Interval Timing

AC Loading and Waveforms (Continued)

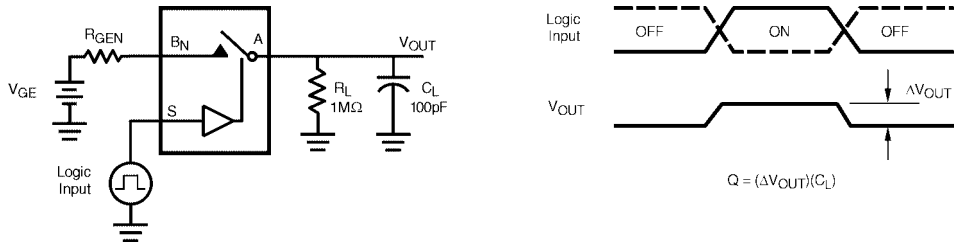


FIGURE 4. Charge Injection Test

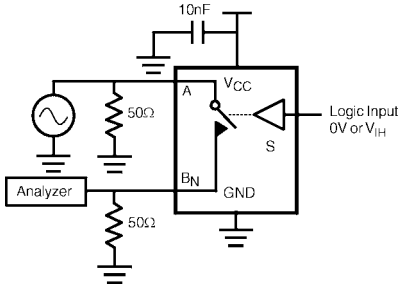


FIGURE 5. Off Isolation

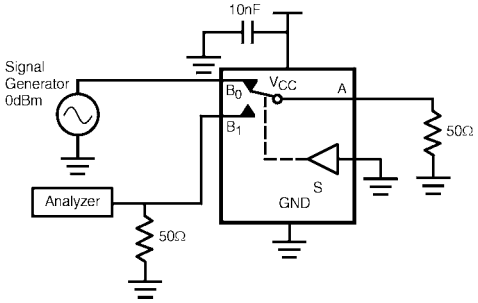


FIGURE 6. Crosstalk

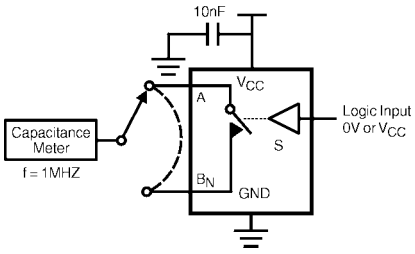


FIGURE 7. Channel Off Capacitance

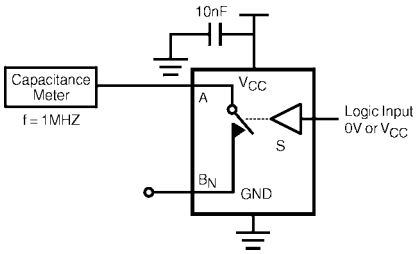


FIGURE 8. Channel On Capacitance

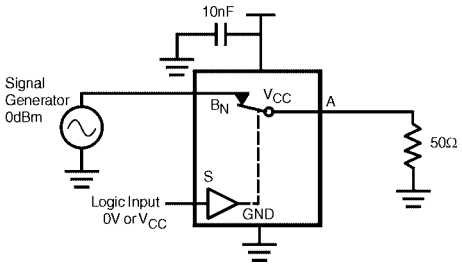


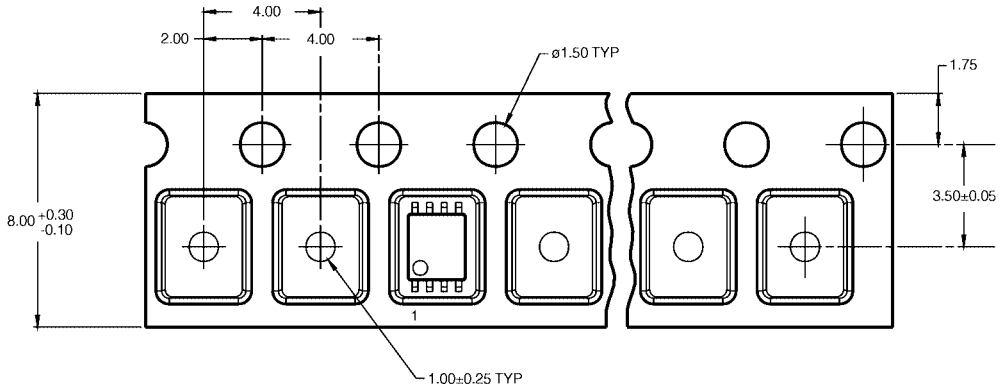
FIGURE 9. Bandwidth

Tape and Reel Specification

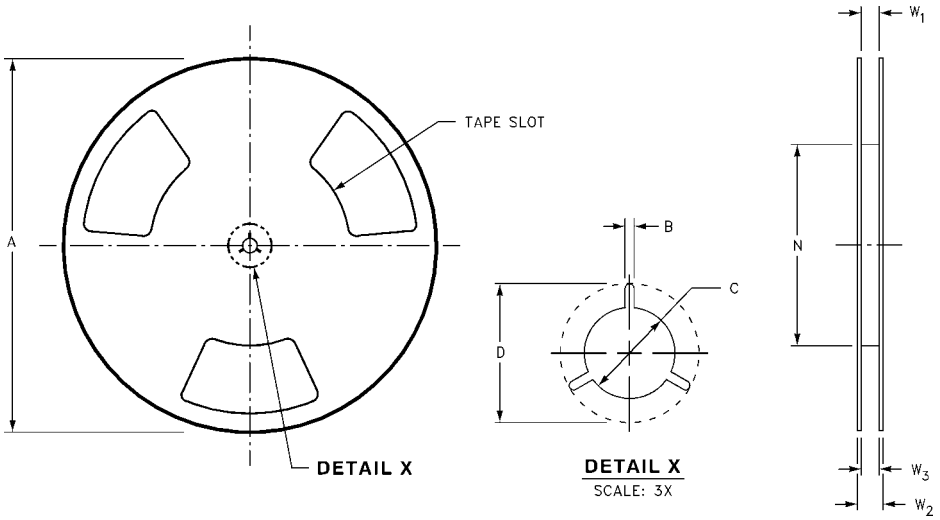
TAPE FORMAT

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
K8X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	250	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

TAPE DIMENSIONS inches (millimeters)

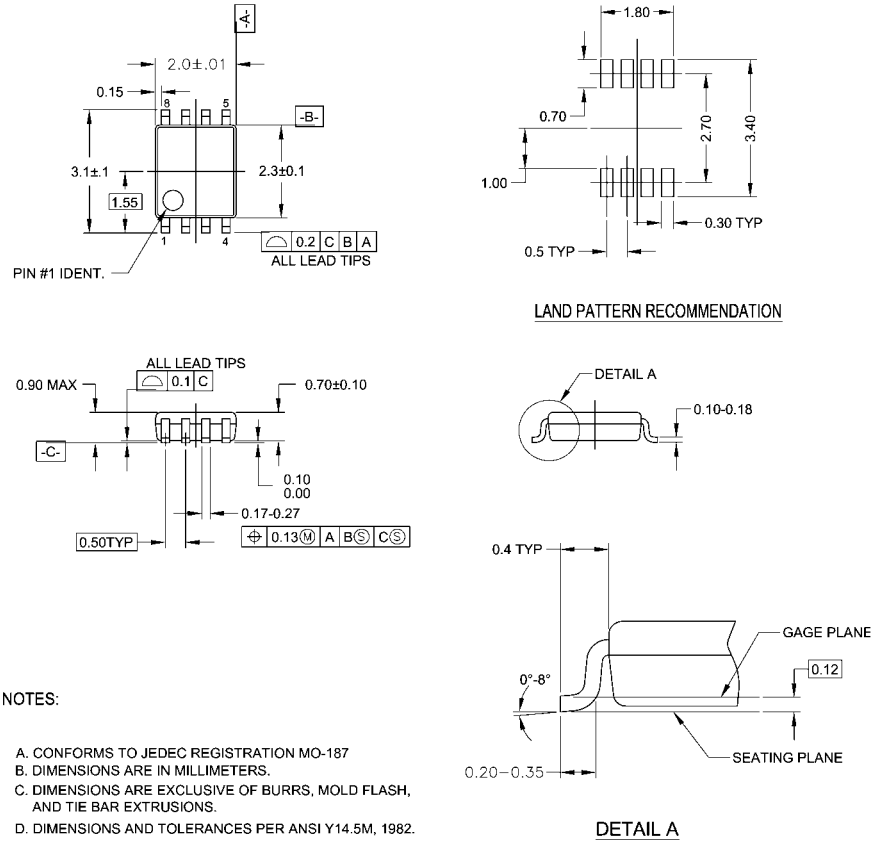


REEL DIMENSIONS inches (millimeters)



Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/–0.000 (8.40 + 1.50/–0.00)	0.567 (14.40)	W1 + 0.078/–0.039 (W1 + 2.00/–1.00)

Physical Dimensions inches (millimeters) unless otherwise noted



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-187
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MAB08AREVC

8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide
Package Number MAB08A