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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  $\rm B_0,~B_1,~or~B_2$  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  $\rm V_{CC}$  operating range. The control input tolerates voltages up to 5.5V independent of the  $\rm V_{CC}$  operating range.

#### **Features**

- Useful in both analog and digital applications
- Space saving US8 8-lead surface mount package
- Low On Resistance;  $< 9\Omega$  on typ @ 3.3V V<sub>CC</sub>
- Broad V<sub>CC</sub> 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
- Space saving Pb-Free MicroPak<sup>™</sup> packaging

## **Applications**

- Cell Phone
- PDA
- Video

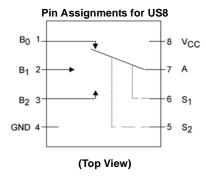
## **Ordering Code:**

Product				
Order	Package	Code	Package Description	Supplied As
Number	Number	Top Mark		
FSA3357K8X	MAB08A	A357	8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide	3k Units on Tape and Reel
FSA3357L8X	MAC08A	FE	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5k Units on Tape and Reel

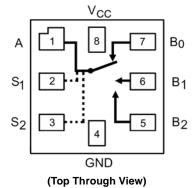
Pb-Free package per JEDEC J-STD-020B.

 $\label{eq:microPak} \mbox{MicroPak}^{\mbox{\tiny TM}} \mbox{ is a trademark of Fairchild Semiconductor Corporation}.$ 

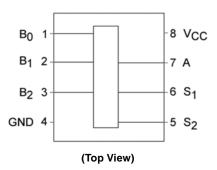
## **Analog Symbols**



### Pin Assignments for MicroPak



## **Connection Diagram**



## **Pin Descriptions**

Pin Names	Description
A <sub>1</sub> , B <sub>0</sub> , B <sub>1</sub> , B <sub>2</sub>	Data Ports
S <sub>1</sub> , S <sub>2</sub>	Control Input

## **Function Table**

S <sub>1</sub>	S <sub>2</sub>	Function
0	0	No Connection
1	0	B <sub>0</sub> Connected to A
0	1	B <sub>1</sub> Connected to A
1	1	B <sub>2</sub> Connected to A

## **Absolute Maximum Ratings**(Note 1)

DC Input Voltage (V<sub>IN</sub>) (Note 2)  $-0.5 \mbox{V to } +7.0 \mbox{V}$ 

DC Input Diode Current (I<sub>IK</sub>)

Junction Lead Temperature (T<sub>L</sub>)

(Soldering, 10 seconds) 260°C Power Dissipation ( $P_D$ ) @ +85°C 180 mW

## **Recommended Operating Conditions**

(Note 3)

Input Rise and Fall Time (t<sub>r</sub>, t<sub>f</sub>)

 $\label{eq:control_log_var} \begin{array}{lll} \text{Control Input V}_{\text{CC}} = 2.3 \text{V} - 3.6 \text{V} & 0 \text{ ns/V to 10 ns/V} \\ \text{Control Input V}_{\text{CC}} = 4.5 \text{V} - 5.5 \text{V} & 0 \text{ ns/V to 5 ns/V} \\ \text{Thermal Resistance } (\theta_{\text{JA}}) & 250^{\circ}\text{C/W} \\ \text{MicroPak 8L Package} & 224^{\circ}\text{C/W} \end{array}$ 

**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 <sub>CC</sub>		T <sub>A</sub> = +25°C	;	T <sub>A</sub> = -40°C	to +85°C	Units	Conditions
Symbol	Farameter	(V)	Min	Тур	Max	Min	Max	Units	Conditions
V <sub>IH</sub>	HIGH Level	1.65 – 1.95	0.75 V <sub>CC</sub>			0.75 V <sub>CC</sub>		V	
	Input Voltage	2.3 - 5.5	0.7 V <sub>CC</sub>			0.7 V <sub>CC</sub>		V	
V <sub>IL</sub>	LOW Level	1.65 – 1.95			0.25 V <sub>CC</sub>		0.25 V <sub>CC</sub>	V	
	Input Voltage	2.3 - 5.5			$0.3~\mathrm{V}_\mathrm{CC}$		0.3 V <sub>CC</sub>	V	
I <sub>IN</sub>	Input Leakage Current	0 – 5.5			±0.1		±1.0	μА	$0 \le V_{IN} \le 5.5V$
I <sub>OFF</sub>	OFF State Leakage Current	1.65 – 5.5			±0.1		±1.0	μА	$0 \le A, B_n \le V_{CC}$
R <sub>ON</sub>	Switch On Resistance	4.5		5.0	7.0		7.0		V <sub>IN</sub> = 0V, I <sub>O</sub> = 30 mA
	(Note 4)			6.0	12.0		12.0		$V_{IN} = 2.4V, I_{O} = -30 \text{ mA}$
				7.0	15.0		15.0		$V_{IN} = 4.5V, I_{O} = -30 \text{ mA}$
		3.0		6.5	9.0		9.0		V <sub>IN</sub> = 0V, I <sub>O</sub> = 24 mA
				9.0	20.0		20.0	Ω	V <sub>IN</sub> = 3V, I <sub>O</sub> = -24 mA
		2.3		8.0	12.0		12.0		V <sub>IN</sub> = 0V, I <sub>O</sub> = 8 mA
				11.0	30.0		30.0		V <sub>IN</sub> = 2.3V, I <sub>O</sub> = -8 mA
		1.65		10.0	20.0		20.0		$V_{IN} = 0V$ , $I_O = 4 \text{ mA}$
				17.0	50.0		50.0		$V_{IN} = 1.65V$ , $I_{O} = -4 \text{ mA}$
I <sub>CC</sub>	Quiescent Supply Current	5.5			1.0		10.0	μА	V <sub>IN</sub> = V <sub>CC</sub> or GND
	All Channels ON or OFF	5.5			1.0		10.0	μА	I <sub>OUT</sub> = 0
ASR	Analog Signal Range	V <sub>CC</sub>	0.0		V <sub>CC</sub>	0.0	V <sub>CC</sub>	V	
∆R <sub>ON</sub>	On Resistance Match	4.5		0.15					$I_A = -30 \text{ mA}, V_{Bn} = 3.15$
	Between Channels	3.0		0.22				Ω	$I_A = -24 \text{ mA}, V_{Bn} = 2.1$
	(Note 4)(Note 5)(Note 6)	2.3		0.31				22	$I_A = -8 \text{ mA}, V_{Bn} = 1.6$
		1.65		0.62					$I_A = -4 \text{ mA}, V_{Bn} = 1.15$
R <sub>flat</sub>	On Resistance Flatness	5.0		6.0					$I_A = -30 \text{ mA}, \ 0 \le V_{Bn} \le V_{CC}$
	(Note 4)(Note 5)(Note 7)	3.3		12.0				Ω	$I_A = -24 \text{ mA}, \ 0 \le V_{Bn} \le V_{CC}$
		2.5		40.0				32	$I_A = -8 \text{ mA}, \ 0 \le V_{Bn} \le V_{CC}$
		1.8		140.0					$I_A = -4 \text{ mA}, \ 0 \le V_{Bn} \le V_{CC}$

### DC Electrical Characteristics (Continued)

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

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

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

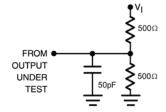
Note 10: Off Isolation =  $20 \log_{10} [V_A / V_{Bn}]$ 

## Capacitance (Note 11)

Symbol	Parameter	Тур	Max	Units	Conditions	Figure Number
C <sub>IN</sub>	Control Pin Input Capacitance	2.0		pF	V <sub>CC</sub> = 0V	
C <sub>IO-B</sub>	B Port Off Capacitance	3.6		pF	V <sub>CC</sub> = 5.0V	Figure 7
C <sub>IOA-ON</sub>	A Port Capacitance When Switch Is Enabled	14.5		pF	V <sub>CC</sub> = 5.0V	Figure 8

Note 11:  $T_A = +25\,^{\circ}C$ , f = 1 MHz, Capacitance is characterized but not tested in production.

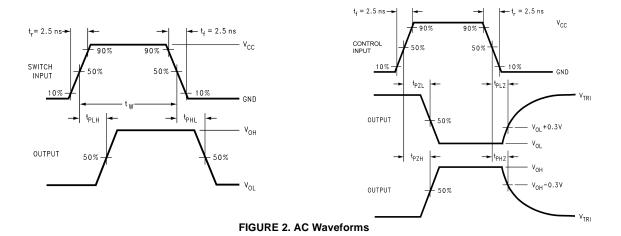
## **AC Loading and Waveforms**

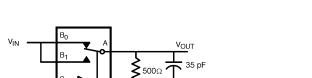


Note: Input driven by  $50\Omega$  source terminated in  $50\Omega$ Note:  $C_L$  includes load and stray capacitance Note: Input PRR = 1.0 MHz;  $t_W$  = 500 ns

> Logic Input

FIGURE 1. AC Test Circuit





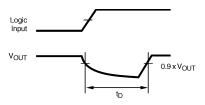
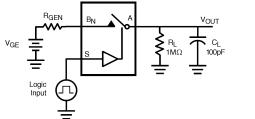


FIGURE 3. Break Before Make Interval Timing

## AC Loading and Waveforms (Continued)



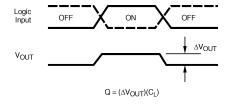


FIGURE 4. Charge Injection Test

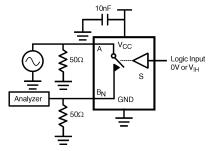


FIGURE 5. Off Isolation

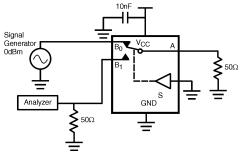


FIGURE 6. Crosstalk

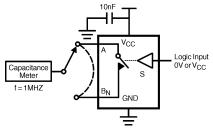


FIGURE 7. Channel Off Capacitance

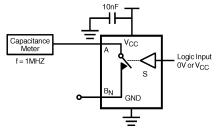


FIGURE 8. Channel On Capacitance

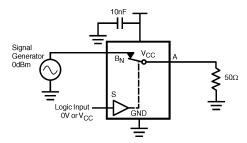


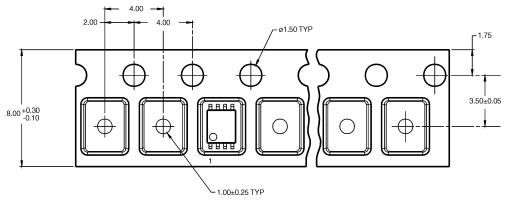
FIGURE 9. Bandwidth

## **Tape and Reel Specification**

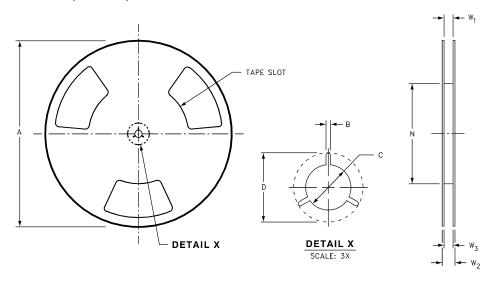
## TAPE FORMAT for US8

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

## TAPE DIMENSIONS inches (millimeters)



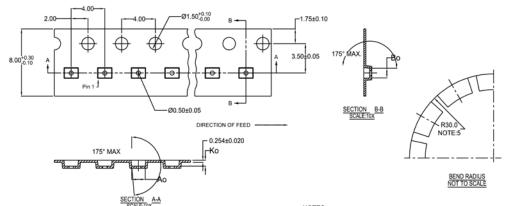
## **REEL DIMENSIONS** inches (millimeters)



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

#### TAPE FORMAT for MicroPak

Package	Tape	Number	Cavity	Cover Tape
Designator	Section	Cavities	Status	Status
	Leader (Start End)	125 (typ)	Empty	Sealed
L8X	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed



10	300056	2.30±0.05	1.78±0.05	0.68 ± 0.05
8	300038	1.78±0.05	1.78±0.05	0.68 ± 0.05
6	300033	160+0.05	1 15+0 05	0.70 + 0.05

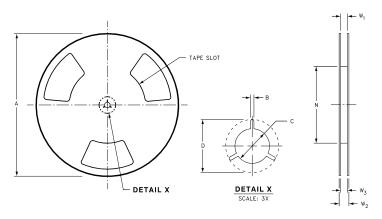
NOTES: UNLESS OTHERWISE SPECIFIED

- 1. ACCUMULATED 50 SPROCKETS, SPROCKET HOLE PITCH IS 200.00 ±0.30MM
- 2. NO INDICATED CORNER RADIUS IS 0.127MM
- 3. CAMBER NOT TO EXCEED 1MM IN 100MM
- 4. SMALLEST ALLOWABLE BENDING RADIUS
- 5. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE



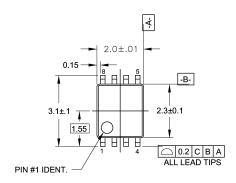
SCALE: 6X

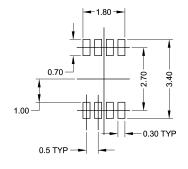
#### **REEL DIMENSIONS** inches (millimeters)



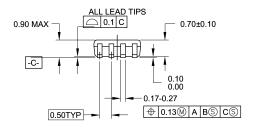
Tape Size	Α	В	С	D	N	W1	W2	W3
0 mm	7.0	0.059	0.512	0.795	2.165	0.331 + 0.059/-0.000	0.567	W1 + 0.078/-0.039
8 mm	(177.8)	(1.50)	(13.00)	(20.20)	(55.00)	(8.40 + 1.50/-0.00)	(14.40)	(W1 + 2.00/-1.00)

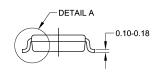
## Physical Dimensions inches (millimeters) unless otherwise noted

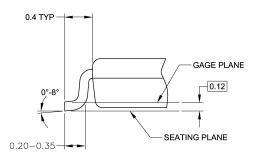




#### LAND PATTERN RECOMMENDATION







**DETAIL A** 

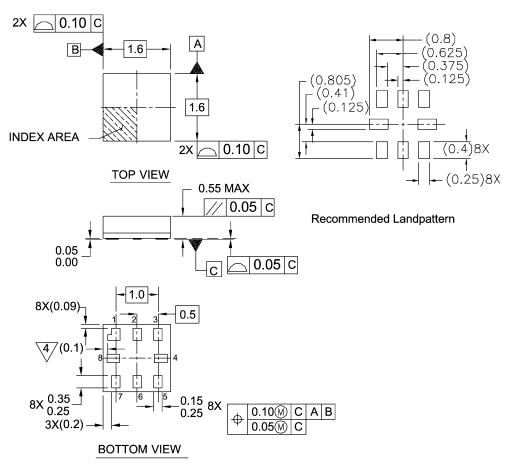
#### NOTES:

- 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

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



#### Notes:

- 1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y.14M-1994

4/PIN 1 FLAG, END OF PACKAGE OFFSET.

MAC08AREVC

Pb-Free 8-Lead MicroPak, 1.6 mm Wide Package Number MAC08A

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provided in the labeling, can be reasonably expected to result in 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.

### PRODUCT STATUS DEFINITIONS

Definition of terms

<b>Datasheet Identification</b>	Product Status	Definition				
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.				
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.				
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