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March 2011



## FSA2156 Low-Voltage SPST 0.4Ω Analog Switch

### Features

- Maximum 0.7Ω On Resistance (R<sub>ON</sub>) for +2.7V Supply
- 0.25Ω Maximum R<sub>ON</sub> Flatness for +2.7V Supply
- Space-Saving MicroPak<sup>™</sup> and SC70 Packaging
- Broad V<sub>CC</sub> Operating Range: 1.65 to 4.3V
- Fast Turn-on and Turn-off Times
- Over-Voltage Tolerant TTL-Compatible Control Input
- Suitable for 2 UL USB2.0 Applications: 200mA
- Low I<sub>CCT</sub> Current Over Expanded Control Input Range

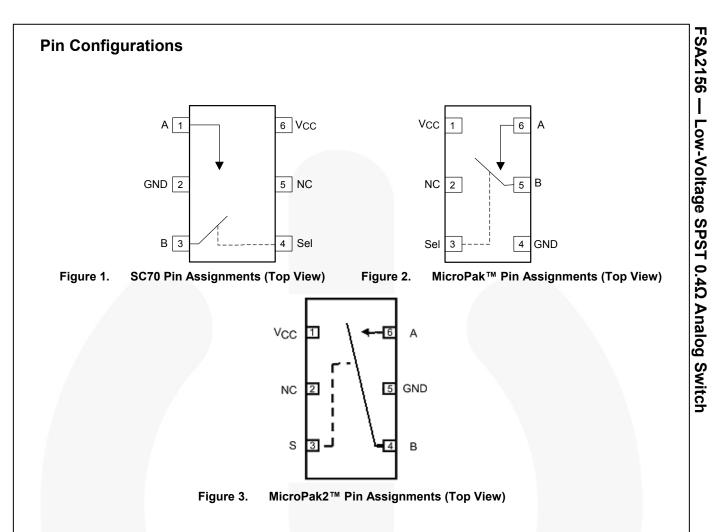
### Description

The FSA2156 is a high-performance Single-Pole Single-Throw (SPST) analog switch that features ultra low  $R_{\rm ON}$  of 0.4 $\Omega$  (typical) at 2.7V V<sub>CC</sub>. The FSA2156 operates over the wide V<sub>CC</sub> range of 1.65V to 4.3V and is fabricated with sub-micron CMOS technology to achieve fast switching speeds. The select input is TTL-level compatible.

FSA2156 features very low quiescent current even when the control voltage is lower than the  $V_{CC}$  supply. This feature facilitates longer battery life in mobile handset applications and allows for the direct interface with baseband-processor, general-purpose I/Os.

#### **Ordering Information** Part Number **Top Mark Packing Method Package Description** 3000 Units on Tape and FSA2156P6X 256 6-lead SC70, EIAJ SC88, 1.25mm Wide Reel 5000 Units on Tape and FSA2156L6X FY 6-lead MicroPak™, 1.0mm Wide Reel FSA2156FHX FY 6-Lead, MicroPak2<sup>™</sup>, 1x1mm Body, .35mm Pitch 5000 Units on Tape and Reel

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## **Pin Definitions**

Pin # SC70	Pin # MicroPak™	Pin # MicroPak2™	Name	Description
1	6	6	A	Switch I/O Data Ports
2	4	5	GND	Ground
3	5	4	В	Switch I/O Data Ports
4	3	3	Sel	Control Input
5	2	2	NC	No Connect
6	1	1	V <sub>CC</sub>	Supply Voltage

## **Truth Table**

Control Input (S)	Function
Logic Level LOW	Switch Open (OFF)
Logic Level HIGH	Switch Closed (ON)

## **Absolute Maximum Ratings**

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Pa	Parameter					
V <sub>CC</sub>	Supply Voltage				-0.5	4.6	V
V <sub>SW</sub>	Switch I/O Voltage <sup>(1)</sup>				-0.5	V <sub>CC</sub> + 0.3	V
V <sub>CNTRL</sub>	Control Input Voltage <sup>(1)</sup>				-0.5	4.6	V
I <sub>IK</sub>	Input Clamp Diode Current				± 50	± 50	mA
I <sub>SW</sub>	Switch I/O Current (Continuous)					500	mA
I <sub>SWPEAK</sub>	Pulsed at 1ms Duration, <10% Duty Cycle					500	mA
Р	Power Dissipation at 95°C	SC70 Package MicroPak™ Package			180	mW	
P <sub>D</sub>	Power Dissipation at 85°C				180	mW	
T <sub>STG</sub>	Storage Temperature Range				-65	+150	°C
TJ	Maximum Junction Temperature					+150	°C
TL	Lead Temperature (Soldering, 10 se	econds)				+260	°C
		Human B	ody Model,	All Pins		2	kV
ESD	Electrostatic Discharge Capability		ESD22-A114	I/O to GND		8	kV
LOD	Licensiane Discharge Capability	Charge Discharge Model, JEDEC:JESD22-C101				2	kV

Note:

1. The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.

## **Recommended Operating Conditions**

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Paramete	Parameter			
V <sub>cc</sub>	Supply Voltage		1.65	4.30	V
V <sub>CNTRL</sub>	Control Input Voltage <sup>(2)</sup>	Control Input Voltage <sup>(2)</sup>			V
V <sub>SW</sub>	Switch I/O Voltage	0	V <sub>CC</sub>	V	
I <sub>SW</sub>	Switch I/O Load Current			350	mA
T <sub>A</sub>	Operating Temperature		-40	+85	°C
0		SC70 6L Package		350	°C/W
$\theta_{JA}$	Thermal Resistance (free air)	MicroPak™ 6L Package		310	°C/W

Note:

2. Control input must be held HIGH or LOW; it must not float.

FSA2156 — Low-Voltage SPST 0.4Ω Analog Switch

## **DC Electrical Characteristics**

All typical values are at 25°C unless otherwise specified.

Symbol	Parameter	Condition	V <sub>cc</sub> (V)	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		Unit
				Min.	Тур.	Max.	Min.	Max.	
			3.6 to 4.3				1.4		
N/	Input Voltage		2.7 to 3.6				1.3		v
V <sub>IH</sub>	High		2.3 to 2.7				1.1		v
			1.65 to 1.95				0.9		
			3.6 to 4.3					0.7	V
V	Input Voltago Low		2.7 to 3.6					0.5	
V <sub>IL</sub>	Input Voltage Low		2.3 to 2.7					0.4	V
			1.65 to 1.95					0.4	
I <sub>IN</sub>	Control Input Leakage	$V_{CNTRL}$ =0 to $V_{CC}$	1.65 to 4.3				-0.5	0.5	μA
I <sub>NO(0FF)</sub>	Off Leakage Current of Port B	$V_A$ =0.3V, $V_{CC}$ – 0.3V, $V_B$ =0.3V, $V_{CC}$ – 0.3V or Floating, Figure 5	1.95 to 4.3	-10		10	-50	50	nA
I <sub>A(ON)</sub>	On Leakage Current of Port A	$V_A$ =0.3V, $V_{CC}$ – 0.3V, $V_B$ =Floating, Figure 6	1.95 to 4.3	-20		20	-100	100	nA
	Power Off Leakage Current	Port A V <sub>A</sub> =0.3V, 4.3V, V <sub>CC</sub> =0V, V <sub>B</sub> =0V	0V					±25	μA
I <sub>OFF</sub>	Power Off Leakage Current <sup>(3)</sup>	Port A $V_A$ =0.3V, 4.3V, $V_{CC}$ =0V, $V_B$ =Floating	0V	-4		+4	-35	35	nA
	Switch On Resistance <sup>(4)</sup>	I <sub>ON</sub> =100mA, V <sub>B</sub> =0V, 0.7V, 3.6V and 4.3V	4.3		0.36			0.60	Ω
R <sub>on</sub>		I <sub>ON</sub> =100mA, V <sub>B</sub> =0V, 0.7V, 2.0V and 2.7V	2.7		0.40			0.70	
	Figure 4	I <sub>ON</sub> =100mA, V <sub>B</sub> =0V, 0.7V, 1.6V and 2.3V	2.3		0.55			0.80	
		I <sub>ON</sub> =100mA, V <sub>B</sub> =0.7V	1.65		1.50				
		I <sub>ON</sub> =100mA, V <sub>B</sub> =0V, 0.7V, 3.6V and 4.3V	4.3					0.25	
в	On Resistance Flatness <sup>(5)</sup>	I <sub>ON</sub> =100mA, V <sub>B</sub> =0V, 0.7V, 2.0V and 2.7V	2.7					0.25	0
R <sub>FLAT(ON)</sub>	Figure 4	I <sub>ON</sub> =100mA, B=0V, 0.7V, 1.6V and 2.3V	2.3					0.30	Ω
		I <sub>ON</sub> =100mA, V <sub>B</sub> =0V, 0.7V, 0.9V and 1.65V	1.65		0.90			6	
I <sub>CC</sub>	Quiescent Supply Current	$V_{SW}$ =0 or $V_{CC}$ , $I_{OUT}$ =0	4.3	-100	30	100	-500	500	nA
	Increase in I <sub>CC</sub>	V <sub>CNTRL</sub> =2.6V	4.2		3			6	
I <sub>CCT</sub>	per Input	V <sub>CNTRL</sub> =1.8V	4.3		7	12		15	μA

#### Notes:

3. Guaranteed by characterization; not production tested.

4. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.

5. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

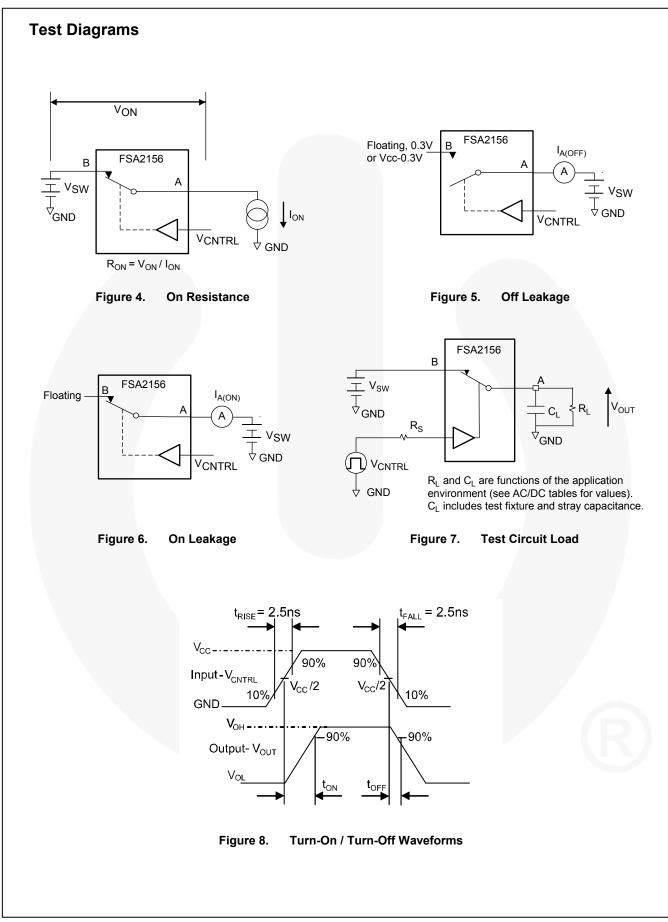
## **AC Electrical Characteristics**

All typical values are at 25°C unless otherwise specified.

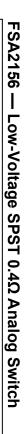
Symbol	Parameter	Condition	V <sub>cc</sub> (V)	т	<sub>A</sub> =+25	°C		40°C 85°C	Unit	Figure	
-				Min.	Тур.	Max.	Min.	Max.		-	
			3.6 to 4.3			55		60			
+	Turn-On Time	V <sub>B</sub> =1.5V,	2.7 to 3.6			60		65		Figure 7	
t <sub>on</sub>	Tum-On Time	$R_L = 50\Omega, C_L = 35pF$	2.3 to 2.7			65		70	ns	Figure 8	
			1.65 to 1.95		40						
			3.6 to 4.3			65		70			
+	Turn Off Times	Time $V_B$ =1.5V, R <sub>L</sub> =50 $\Omega$ , C <sub>L</sub> =35pF	2.7 to 3.6			70		75		Figure 7	
t <sub>OFF</sub>	Turn-Off Time		2.3 to 2.7			75		80	ns	Figure 8	
					1.65 to 1.95		90				
0	Charge	C <sub>L</sub> =1.0nF, V <sub>S</sub> =0V,	2.3 to 4.3		6					Liguro 11	
Q	Injection	R <sub>s</sub> =0Ω	1.65 to 1.95		1.3				рС	Figure 11	
OIRR	Off Isolation	f=100kHz R <sub>T</sub> =50Ω	1.65 to 4.3		-65				dB	Figure 10	
BW	-3db Bandwidth	R <sub>T</sub> =50Ω C <sub>L</sub> =0pF	1.65 to 4.3		80				MHz	Figure 9	
THD	Total Harmonic Distortion	R <sub>T</sub> =600Ω, V <sub>SW</sub> =0.5V <sub>PP</sub> , f=20Hz to 20kHz	1.65 to 4.3		.02				%		

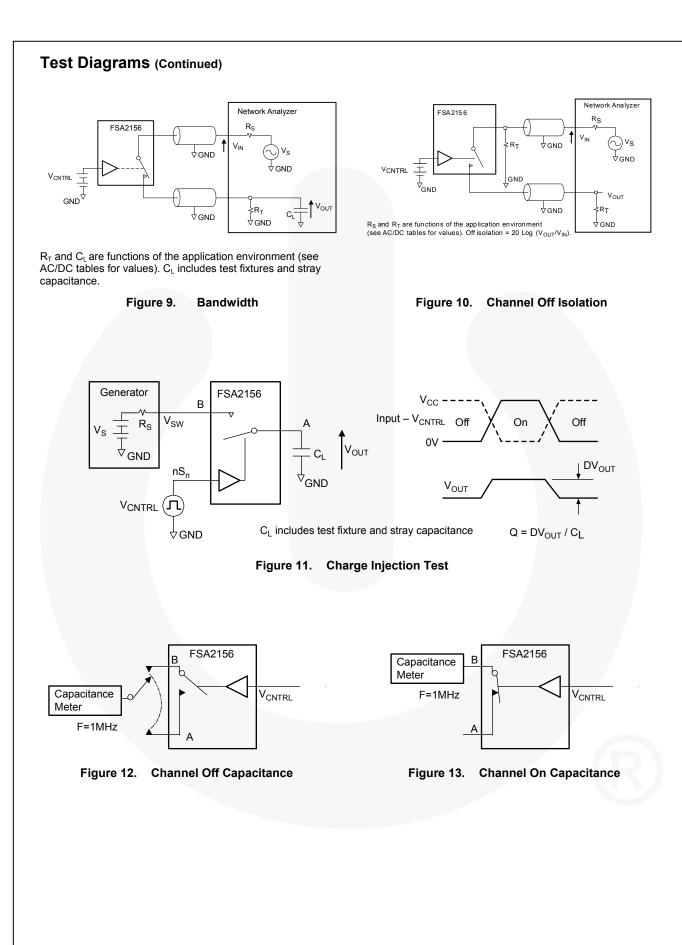
## Capacitance

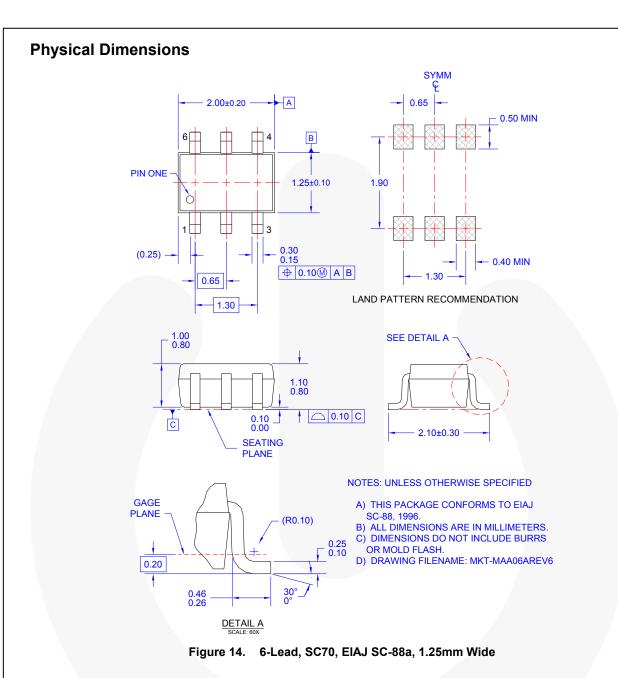
Symbol	Parameter	Condition		T <sub>A</sub> =+25°C			Unit	Figures	
Symbol	Farameter	Condition	V <sub>cc</sub> (V)	Min.	Тур.	Max.	Onit	rigules	
C <sub>IN</sub>	Control Pin Input Capacitance	f=1MHz	0		1.5		pF	Figure 12	
C <sub>OFF</sub>	B-Port Off Capacitance	f=1MHz	4.3		38		pF	Figure 12	
C <sub>ON</sub>	A-Port On Capacitance	f=1MHz	4.3		115		pF	Figure 13	



FSA2156 — Low-Voltage SPST 0.4Ω Analog Switch







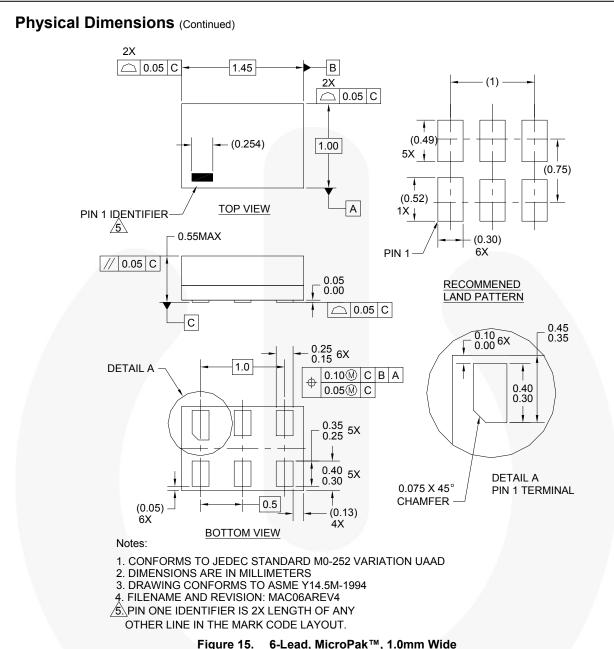
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Package Designator	Package Designator Tape Section		Cavity Status	Cover Type Status	
	Leader (Start End)	125 (Typical)	Empty	Sealed	
P6X	Carrier	3000	Filled	Sealed	
	Trailer (Hub End)	75 (Typical)	Empty	Sealed	



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Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
L6X	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

FSA2156

— Low-Voltage SPST 0.4Ω Analog Switch

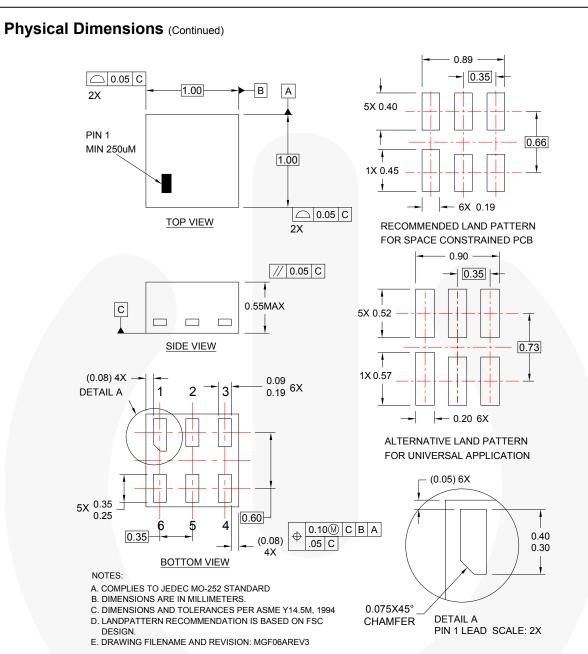


Figure 16. 6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch

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Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
FHX	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed



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