

March 2012

FSA4157, FSA4157A Low-Voltage, 1Ω SPDT Analog Switch

Features

- FSA4157A Features Lower I_{CC} when the S Input is Lower Than V_{CC}
- Maximum 1.15Ω On Resistance (R_{ON}) at 4.5V V_{CC}
- 0.3Ω Maximum R_{ON} Flatness at 4.5V V_{CC}
- Space-Saving 6-lead, MicroPak[™] and SC70 6 Packages
- Broad V_{CC} Operating Range:
 FSA4157: 1.65V to 5.5V
 FSA4157A: 2.7V to 5.5V
- Fast Turn-On and Turn-Off Time
- Break-Before-Make Enable Circuitry
- Over-Voltage Tolerant TTL-Compatible Control Circuitry

Description

FSA4157 and FSA4157A are high performance Single Pole/Double Throw (SPDT) analog switches. Both devices feature ultra low R_{ON} of 1.15 Ω maximum at 4.5V V_{CC} and operates over the wide V_{CC} range of 1.65V to 5.5V for FSA4157, and 2.7V to 5.5V for FSA4157A. The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation. The select input is TTL level compatible.

The FSA4157A features very low quiescent current even when the control voltage is lower than the $V_{\rm CC}$ supply. This feature services the mobile handset applications very well allowing for the direct interface with baseband processor general purpose I/Os.

Ordering Information

Part Number	Top Mark	Package Description	Packing Method
FSA4157P6X	A57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units Tape and Reel
FSA4157L6X	EG	6-Lead MicroPak,™ 1.0mm Wide	5000 Units Tape and Reel
FSA4157AP6X	B57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units Tape and Reel
FSA4157AL6X	EU	6-Lead MicroPak™, 1.0mm Wide	5000 Units Tape and Reel

Pin Configurations

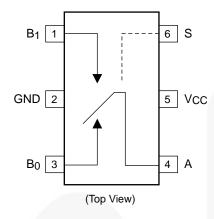


Figure 1. SC70 Pin Assignments

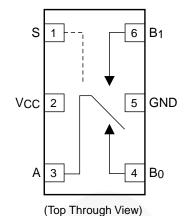


Figure 2. MicroPak™ Pin Assignments

Pin Definitions

Pin# SC70	Pin# MicroPak™	Name	Description
1	6	B1	Data Ports
2	5	GND	Ground
3	4	В0	Data Ports
4	3	Α	Data Ports
5	2	V _{cc}	Supply Voltage
6	1	S	Control Input

Truth Table

Control Input (S)	Function
Low	B0 connected to A
High	B1 connected to A

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	Paramete	er	Min.	Max.	Unit
V _{CC}	Supply Voltage		-0.5	6.0	V
Vs	DC Switch Voltage ⁽¹⁾		-0.5	V _{CC} + 0.5	V
V _{IN}	DC Input Voltage ⁽¹⁾		-0.5	6.0	V
I _{IK}	DC Input Diode Current		-50		mA
I _{SW}	Switch Current			200	mA
I _{SWPEAK}	Peak Switch Current (Pulse at 1ms duration, <10% Duty Cycle)			400	mA
D	Dower Dissipation at 95°C	SC70		180	mW
P _D	Power Dissipation at 85°C	MicroPak™		100	IIIVV
T _{STG}	Storage Temperature Range		-65	+150	°C
TJ	Maximum Junction Temperature			+150	°C
TL	Lead Temperature (Soldering, 10 seconds)			+260	°C
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114 (FSA4157A)		7500	V

Note:

1. Input and output negative ratings may be exceeded if 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	Parameter			Max.	Unit	
V	Cumply Voltage	FSA4157	1.65	5.50	V	
V_{CC}	Supply Voltage	FSA4157A	2.7	5.5		
V _{CNTRL}	Control Input Voltage ⁽²⁾			V _{CC}	V	
V _{SW}	Switch Input Voltage			V _{CC}	V	
T _A	Operating Temperature			+85	°C	
0	Thermal Resistance in Still Air	SC70		350	°C/W	
θ_{JA}	Thermal Resistance in Still All	MicroPak™ (Estimated)		330	C/VV	

Note:

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

DC Electrical Characteristics

Typical values are at 25°C unless otherwise specified.

				Ambient Temperature					
Symbol	Parameter	Conditions	V _{cc} (V)	-25°			-40 to +85°C		Units
				Min.	Тур.	Max.	Min.	Max.	
		FSA4157 Only	1.8 to 2.7				1.0		
V_{IH}	Input Voltage High		2.7 to 3.6				2.0		V
			4.5 to 5.5				2.4		
		FSA4157 Only	1.8 to 2.7					0.4	
V_{IL}	Input Voltage Low	FSA4157A Only	2.7 to 3.6					0.4	V
VIL	input voltage Low		2.7 to 3.6					0.6	\ \ \
			4.5 to 5.5					0.8	
	Control Input	\/ 0\/ to \/	2.7 to 3.6				-1.0	1.0	
I _{IN}	Leakage	V _{IN} =0V to V _{CC}	4.5 to 5.5				-1.0	1.0	μA
I _{NO(OFF)} , I _{NC(OFF)}	Off Leakage Current of Port B0 and B1	A=1V, 4.5v, B ₀ or B ₁ =4.5, 1V	5.5	-2		2	-20	20	nA
I _{A(ON)}	On Leakage Current of Port A	A=1V, 4.5v, B ₀ or B ₁ =4.5, 1V,4.5V or Floating	5.5	-4		4	-40	40	nA
D	Switch On	I _{OUT} =100mA, B ₀ or B ₁ =1.5V	2.7		2.6	4.0		4.3	Ω
R _{ON}	Resistance	I _{OUT} =100mA, B ₀ or B ₁ =3.5V	4.5		0.95	1.15		1.30	1 12
ΔR_{ON}	On Resistance Matching Between Channels ⁽⁴⁾	I _{OUT} =100mA, B ₀ or B ₁ =1.5V	4.5		0.06	0.12		0.15	Ω
D	On Resistance	I _{OUT} =100mA, B ₀ or B ₁ =0V, 0.75V,1.5V	2.7		1.4				
K _{FLAT} (ON)	R _{FLAT(ON)} Flatness ⁽⁴⁾	I _{OUT} =100mA, B ₀ or B _I =0V, 1V, 2V	4.5		0.2	0.3		0.4	Ω
	Quiescent Supply	V _{IN} =0V or V _{CC} ,	3.6		0.1	0.5		1.0	
I _{CC}	Current	I _{OUT} =0V	5.5		0.1	0.5		1.0	μA
Δl_{CC}	Increase in I _{CC} per Input	One Input at 2.7V, others at V _{CC} or GND (FSA4157A Only)	4.3		0.2			10.0	μA

- Measured by the voltage drop between the A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltage on the two (A or B ports).
- $\Delta R_{ON} = R_{ON \, max} R_{ON \, min}$ measured at identical V_{CC} , temperature, and voltage. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

AC Electrical Characteristics

Typical values are at 25°C unless otherwise specified.

				Ambient Temperature					1114-	- •
Symbol Parameter		Conditions	V _{cc} (V)	-25°			-40 to +85°C		Units	Figure
				Min.	Тур.	Max.	Min.	Max.		
	_	$\begin{array}{c} B_0 \text{ or } B_1\text{=}1.5\text{V}, \\ R_L\text{=}50\Omega, \ C_L\text{=}35\text{pF} \\ \text{(FSA4157A Only)} \end{array}$	2.7 to 3.6			60		65		
t _{ON}	Turn-On Time	B_0 or B_1 =1.5V, R_L =50 Ω , C_L =35pF	2.7 to 3.6			50		60	ns	Figure 8
		B_0 or B_1 =1.5V, R_L =50 Ω , C_L =35pF	4.5 to 5.5			35		40		
4	Turn-Off	B_0 or B_1 =1.5V, R_L =50 Ω , C_L =35pF	2.7 to 3.6			20		30		Figure 8
OFF	t _{OFF} Time	B_0 or B_1 =1.5V, R_L =50 Ω , C_L =35pF	4.5 to 5.5			15		20	ns	rigule 6
	Break-	FSA4157	2.7 to 3.6							
t _{BBM}	Before-Make		4.5 to 5.5		20				ns	Figure 9
	Time	FSA4157A Only	4.5 to 5.5		25					
Q	Charge	C _L =1.0nF,	2.7 to 3.6		10				рC	Figure
Q	Injection	$V_{GE}=0V, R_{GEN}=0\Omega$	4.5 to 5.5		20				рС	11
OIRR	Off Isolation	$f=1MHz, R_L=50\Omega$	2.7 to 3.6		-70				dB	Figure
Ontit	On isolation	1-11VII 12, TC3032	4.5 to 5.5		-70				uD_	10
Va. II			2.7 to 3.6		-70					Figure
Xtalk	Xtalk Crosstalk	$f=1MHz, R_L=50\Omega$	4.5 to 5.5		-70				dB	10
DW	-3db	D 500	2.7 to 3.6			300			N 41 1-	Figure 13
BVV	BW Bandwidth	$R_L=50\Omega$	4.5 to 5.5			300			MHz	
THD	Total Harmon Distortion	R _L =600Ω, V _{IN} =0.5	2.7 to 3.6		0.002				%	Figure
חווט		f=20Hz to 20kHz	4.5 to 5.5		0.002				70	14

Capacitance

Symbol	Symbol Parameter		V _{cc} (V)	Ambient Temperature -25°			Units	Figure
		S		Min.	Тур.	Max.		D
C _{IN}	Control Pin Input Capacitance	f=1MHz	0		3.5		pF	Figure 12
C _{OFF}	B Port Off Capacitance	f=1MHz	4.5		12.0		pF	Figure 12
C _{ON}	On Capacitance	f=1MHz	4.5		40.0		pF	Figure 12

Typical Performance Characteristics

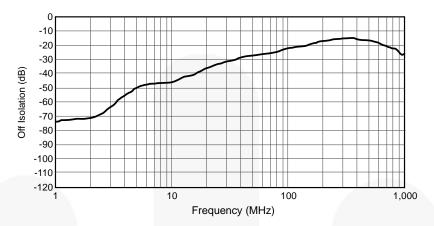


Figure 3. Off Isolation, $V_{CC} = 2.7V$ to 5.5V

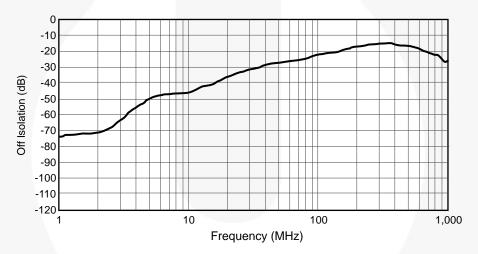


Figure 4. Crosstalk, $V_{CC} = 2.7V$ to 5.5V

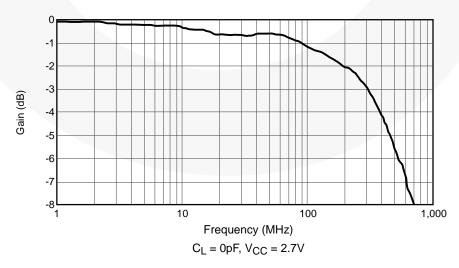


Figure 5. Bandwidth, $V_{CC} = 2.7V$ to 5.5V

Typical Performance Characteristics (Continued)

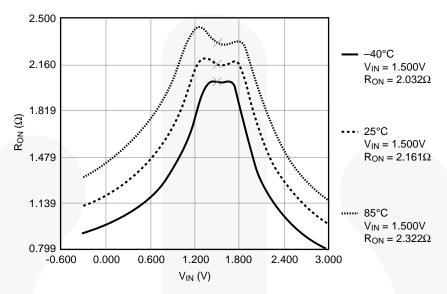


Figure 6. R_{ON} Switch On Resistance, $I_{ON} = 100$ mA, $V_{CC} = 2.7$

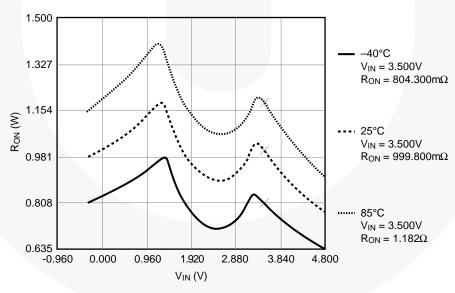
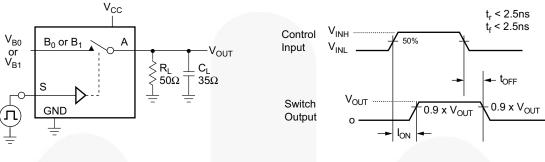


Figure 7. R_{ON} Switch On Resistance, $I_{ON} = 100$ mA, $V_{CC} = 4.5$ V

AC Loadings and Waveforms



 $\mathbf{C}_{\mathbf{L}}$ Includes Fixture and Stray Capacitance

Logic Input Waveforms Inverted for Switches that have the Opposite Logic Sense

Figure 8. Turn On / Off Timing

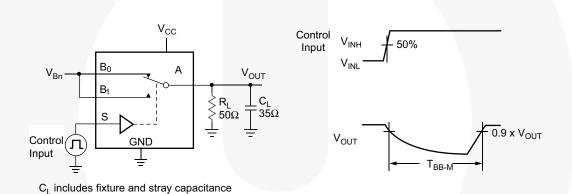


Figure 9. Break Before Make Timing

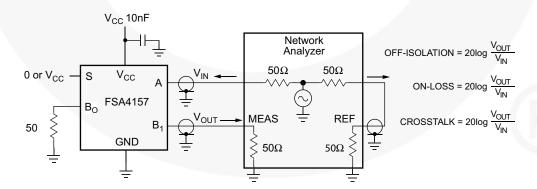


Figure 10. Off Isolation and Crosstalk

AC Loadings and Waveforms (Continued)

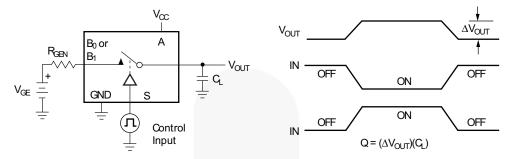


Figure 11. Charge Injection

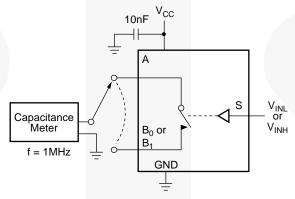


Figure 12. On / Off Capacitance Measurement Setup

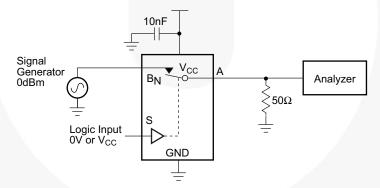


Figure 13. Bandwidth

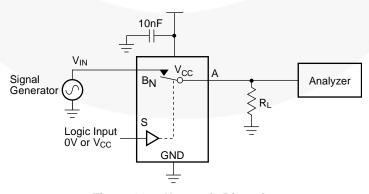


Figure 14. Harmonic Distortion

Physical Dimensions

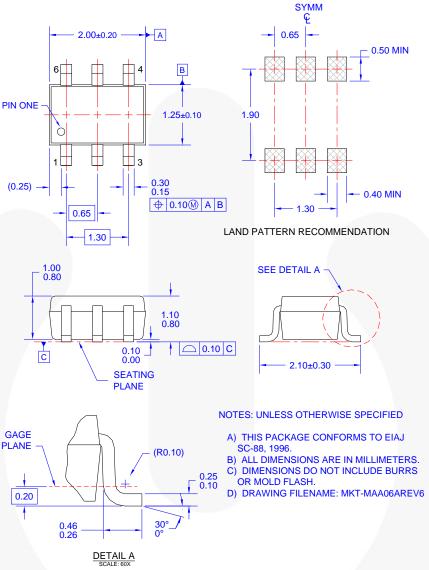


Figure 15. 6-Lead, SC70, EIAJ SC88 1.25mm Wide Package

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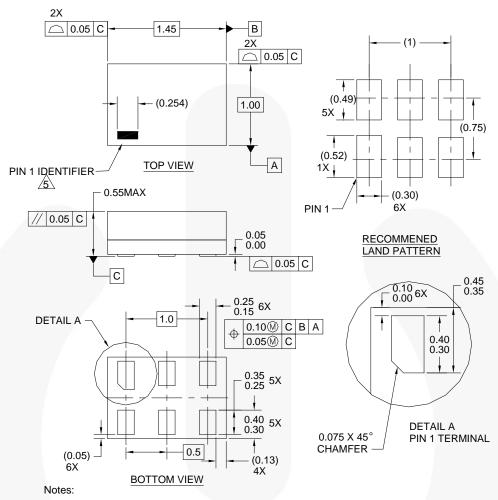
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Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications: http://www.fairchildsemi.com/products/analog/pdf/sc70-6 tr.pdf.

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

Physical Dimensions (Continued)



- 1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-1994
- 4. FILENAME AND REVISION: MAC06AREV4
- 5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY

OTHER LINE IN THE MARK CODE LAYOUT.

Figure 16. 6-Lead, Micropak™ 1.0mm Wide Package

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Tape and Reel Specifications

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications: http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf.

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





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Definition of Terms

Delimition of Terms		
Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
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