

## FSA1156, FSA1157

### Low- $R_{ON}$ Low-Voltage SPST Analog Switch

#### Features


- Maximum  $0.9\Omega$   $R_{ON}$  for 4.5V Supply at 25°C
- $0.3\Omega$  Maximum  $R_{ON}$  Flatness for 4.5V Supply
- Broad  $V_{CC}$  Operating Range: 1.65V to 5.5V
- Fast Turn-on and Turn-off Time
- Over-voltage Tolerant, TTL-compatible Control Input
- Available in SC70 and MicroPak™ Space-saving, Surface-mount Packages

#### General Description

The FSA1156 and FSA1157 are high-performance Single-Pole / Single-Throw (SPST) analog switches. The devices feature ultra-low  $R_{ON}$  of  $0.75\Omega$  (typical) and operate over a wide  $V_{CC}$  range of 1.65V to 5.5V. The devices are fabricated with sub-micron CMOS technology to achieve fast switching speeds. The select input is TTL-level compatible. The FSA1156 has normally open operation; the FSA1157 has normally closed operation.

#### Ordering Information

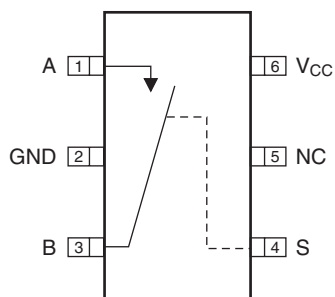
Order Number	Package Number	Top Mark	Package Description	Packing Method
FSA1156P6	MAA06A	156	6-Lead SC70, EIAJ SC88, 1.25mm Wide	250 Units Tape and Reel
FSA1156P6X	MAA06A	156	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units Tape and Reel
FSA1156L6X	MAC06A	EH	6-Lead MicroPak, 1.0mm Wide	5000 Units Tape and Reel
FSA1157P6	MAA06A	157	6-Lead SC70, EIAJ SC88, 1.25mm Wide	250 Units Tape and Reel
FSA1157P6X	MAA06A	157	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units Tape and Reel
FSA1157L6X	MAC06A	EJ	6-Lead MicroPak, 1.0mm Wide	5000 Units Tape and Reel

 All packages are lead free per JEDEC: J-STD-020B standard.

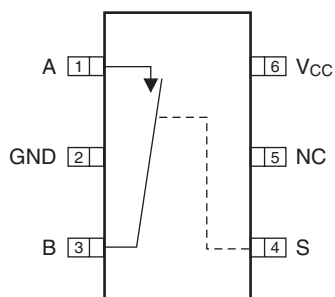
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## Analog Symbols

Pin Assignment for SC70 Package

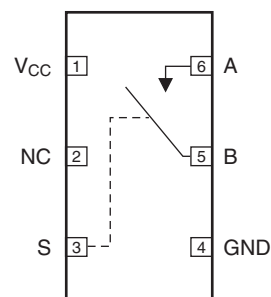


(Top View)  
FSA1156 (Normally Open)

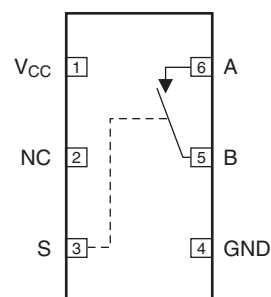


(Top View)  
FSA1157 (Normally Closed)

Pin Assignment for MicroPak™



(Top Through View)  
FSA1156 (Normally Open)



(Top Through View)  
FSA1157 (Normally Closed)

Figure 1. Pin Configurations

### Truth Table

Control Input(s)	FSA1156	FSA1157
LOW Logic Level	OFF	ON
HIGH Logic Level	ON	OFF

### Pin Descriptions

Pin Names	Function
A, B	Data Ports
S	Control Input
NC	No Connect

## 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	Parameter	Min.	Max.	Unit
$V_{CC}$	Supply Voltage	-0.5	+6.0	V
$V_{SW}$	Switch Voltage <sup>(1.)</sup>	-0.5	$V_{CC} + 0.5V$	V
$V_{IN}$	Input Voltage <sup>(1.)</sup>	-0.5	+6.0	V
$I_{IK}$	Input Diode Current		-50	mA
$I_{SW}$	Switch Current		200	mA
$I_{SWPEAK}$	Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle)		400	mA
$P_D$	Power Dissipation at 85°C, SC70 Package		180	mW
$T_{STG}$	Storage Temperature Range	-65	+150	°C
$T_J$	Maximum Junction Temperature		+150	°C
$T_L$	Lead Temperature (Soldering, 10 seconds)		+260	°C
ESD	Human Body Model		8000	V

**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	Parameter	Min.	Max.	Unit
$V_{CC}$	Supply Voltage	1.65	5.50	V
$V_{IN}$	Control Input Voltage <sup>(2.)</sup>	0	$V_{CC}$	V
$V_{SW}$	Switch Input Voltage	0	$V_{CC}$	V
$T_A$	Operating Temperature	-40	+85	°C
$\Theta_{JA}$	Thermal Resistance in Still Air, SC70 package	350		°C/W

**Note:**

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

## DC Electrical Characteristics

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

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			Unit
				Min.	Typ.	Max.	Min.	Max.	
$V_{IH}$	Input Voltage High		2.7 to 3.6				2.0		V
			4.5 to 5.5				2.4		
$V_{IL}$	Input Voltage Low		2.7 to 3.6					0.6	V
			4.5 to 5.5					0.8	
$I_{IN}$	Control Input Leakage	$V_{IN} = 0\text{V to } V_{CC}$	2.7 to 3.6				-1.0	1.0	$\mu\text{A}$
			4.5 to 5.5				-1.0	1.0	
$I_{NO(OFF)}, I_{NC(OFF)}$	Off Leakage Current	A = 1V, 4.5V; B = 4.5V, 1V	5.5	-2.0		2.0	20.0	20.0	nA
$I_{A(ON)}$	On Leakage Current	A = 1V, 4.5V; B = 1V, 4.5V or Floating	5.5	-4.0		4.0	-40.0	40.0	nA
$R_{ON}$	Switch On Resistance <sup>(3.)</sup>	$I_{OUT} = 100\text{mA}, B = 1.5\text{V}$	2.7		1.4	2.1		2.5	$\Omega$
		$I_{OUT} = 100\text{mA}, B = 3.5\text{V}$	4.5		0.75	0.90		1.00	
$R_{FLAT(ON)}$	On Resistance Flatness <sup>(4.)</sup>	$I_{OUT} = 100\text{mA};$ $B_0 = 0\text{V}, 0.75\text{V}, 1.5\text{V}$	2.7		0.6				$\Omega$
		$I_{OUT} = 100\text{mA};$ $B_0 = 0\text{V}, 1\text{V}, 2\text{V}$	4.5		0.1	0.2		0.3	
$I_{CC}$	Quiescent Supply Current	$V_{IN} = 0\text{V or } V_{CC},$ $I_{OUT} = 0\text{V}$	3.6		0.1	0.5		1.0	$\mu\text{A}$
			5.5		0.1	0.5		1.0	

### Notes:

- On resistance is determined by the voltage drop between the A and B pins at the indicated current through the switch.
- 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	Conditions	$V_{CC}$ (V)	$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			Unit	Figure Number
				Min.	Typ.	Max.	Min.	Max.		
$t_{ON}$	Turn-On Time	$B = 1.5\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$	2.7 to 3.6		30	40		45	ns	Figure 4
		$B = 3.0\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$	4.5 to 5.5		15	20		25		
$t_{OFF}$	Turn-Off Time	$B = 1.5\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$	2.7 to 3.6		25	35		45	ns	Figure 4
		$B = 3.0\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$	4.5 to 5.5		22	30		40		
Q	Charge Injection	$C_L = 1.0\text{nF}, V_{GE} = 0\text{V}, R_{GEN} = 0\Omega$	2.7 to 3.6		10				pC	Figure 5
			4.5 to 5.5		20					
OIRR	Off Isolation	$f = 1\text{MHz}, R_L = 50\Omega$	2.7 to 3.6		-65				dB	Figure 6
			4.5 to 5.5		-65					
BW	-3db Bandwidth	$R_L = 50\Omega$	2.7 to 3.6		300				MHz	Figure 7
			4.5 to 5.5		300					
THD	Total Harmonic Distortion	$R_L = 600\Omega, V_{IN} = 0.5V_{PP}, f = 20\text{Hz to } 20\text{kHz}$	2.7 to 3.6		0.001				%	Figure 8
			4.5 to 5.5		0.001					

## Capacitance

Symbol	Parameter	Conditions	$V_{CC}$ (V)	$T_A = +25^\circ\text{C}$			Units	Figure Number
				Min.	Typ.	Max.		
$C_{IN}$	Control Pin Input Capacitance	$f = 1\text{MHz}$	0.0		3		pF	Figure 9
$C_{OFF}$	A/B Port Off Capacitance	$f = 1\text{MHz}$	4.5		20		pF	Figure 9
$C_{ON}$	A/B Port On Capacitance	$f = 1\text{MHz}$	4.5		65		pF	Figure 9

## Typical Characteristics

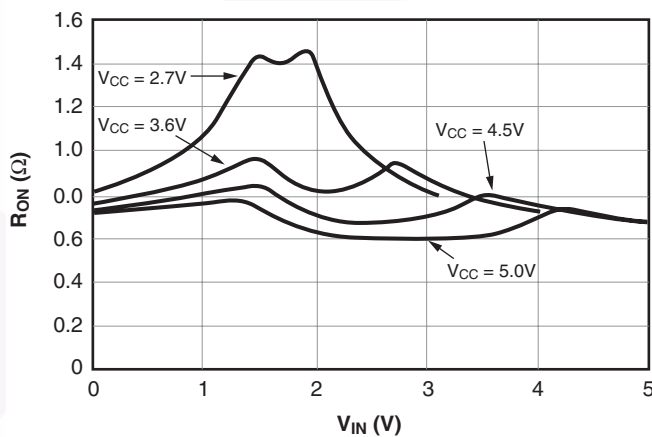


Figure 2. On Resistance vs. Input Voltage, Over Supply Voltage,  $T_A=25^\circ$

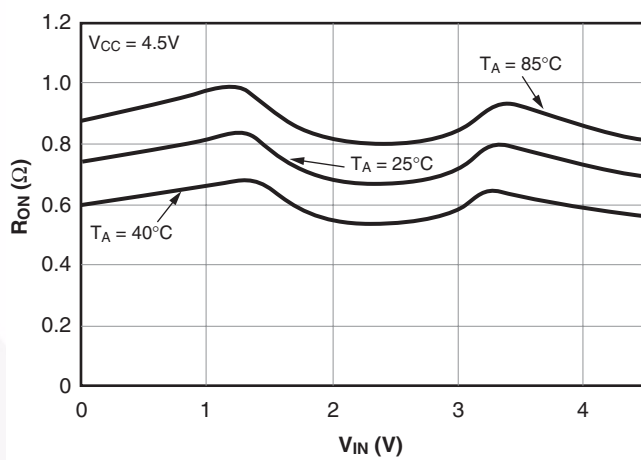
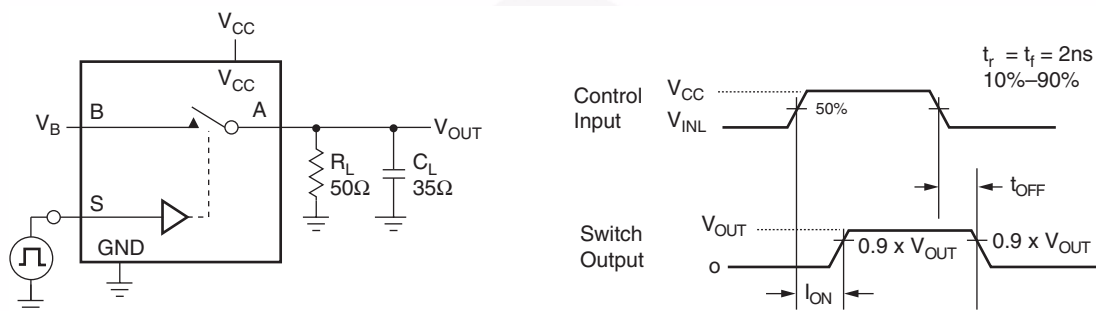


Figure 3. On Resistance vs. Input Voltage, Over Temperature

## AC Loading and Waveforms



$C_L$  Includes Fixture and Stray Capacitance

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

Figure 4. Turn-On / Off Timing

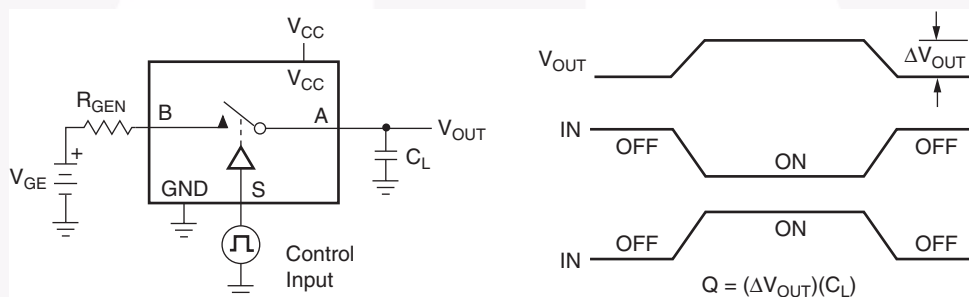


Figure 5. Charge Injection

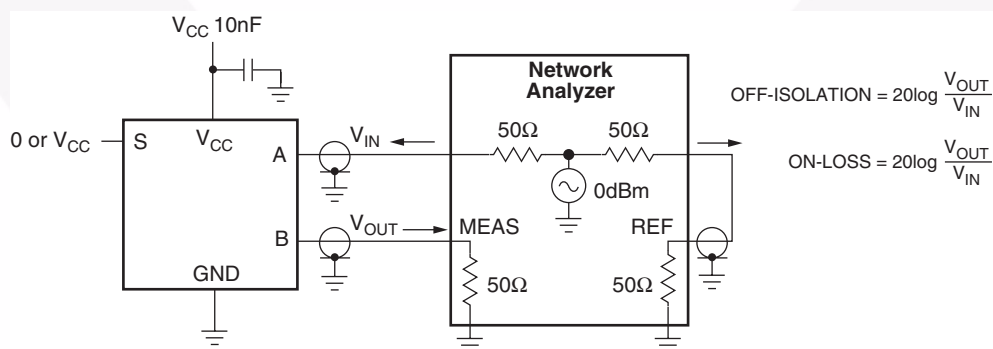


Figure 6. Off Isolation

## AC Loading and Waveforms (Continued)

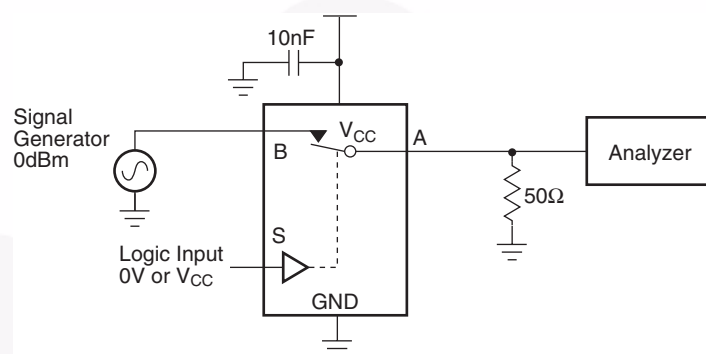


Figure 7. Bandwidth

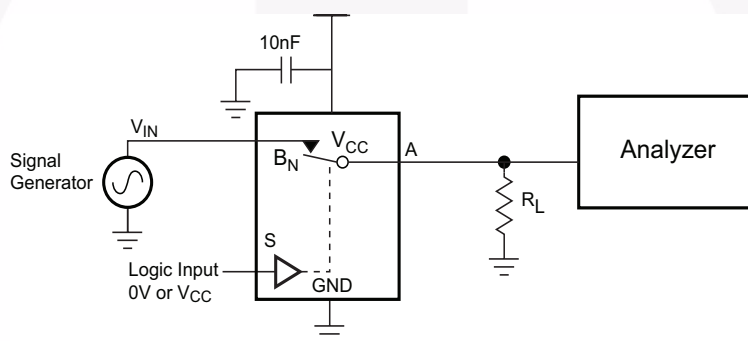


Figure 8. Harmonic Distortion

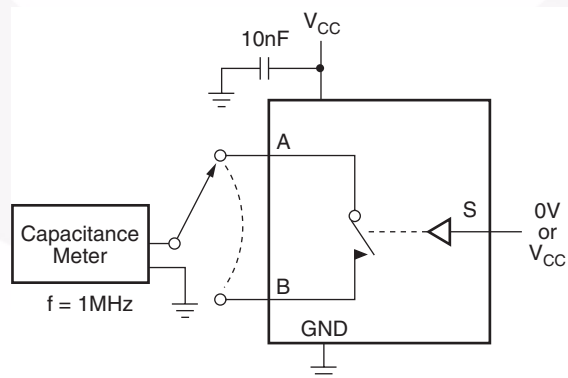
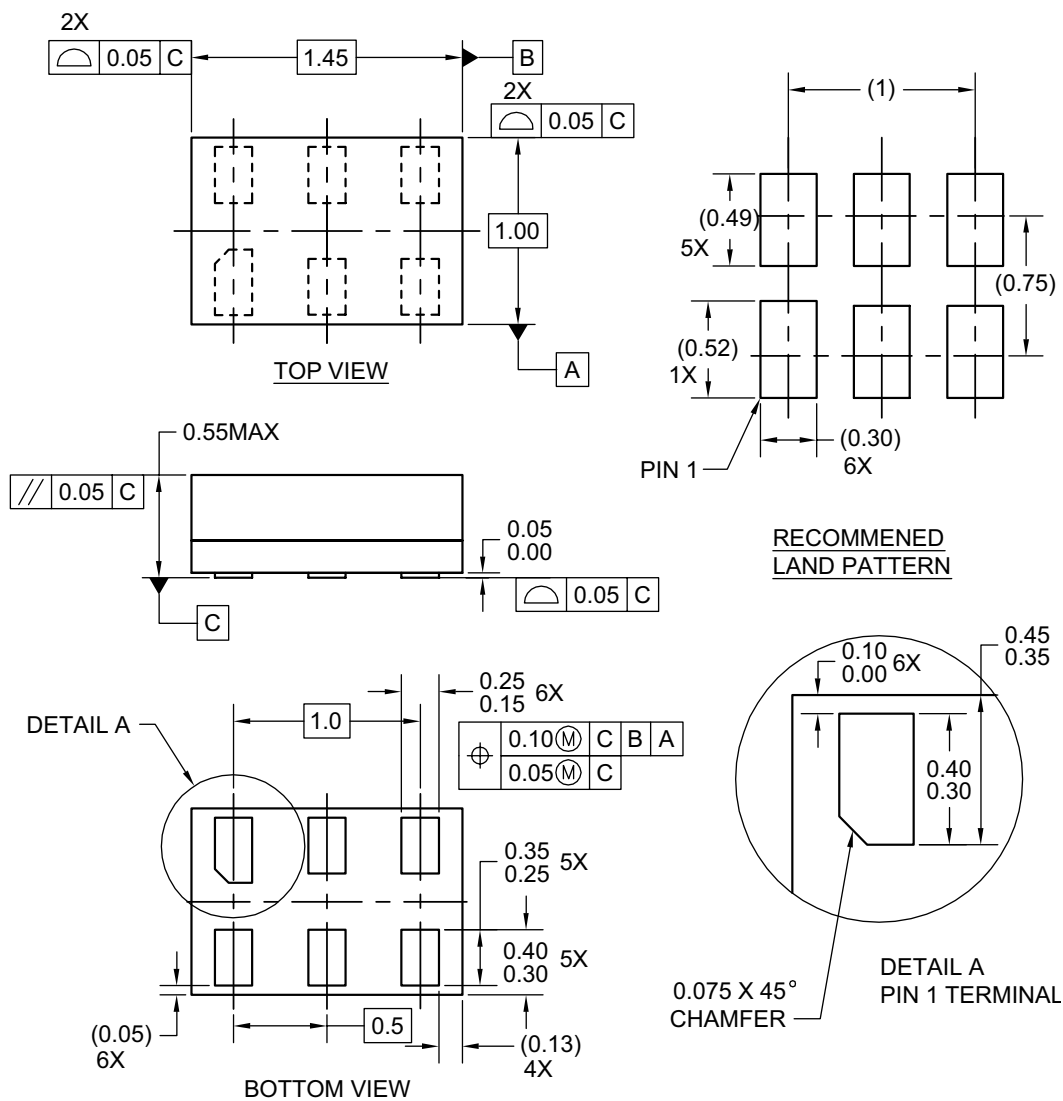


Figure 9. On / Off Capacitance



## MAA06AREV5

## Physical Dimensions (Continued)



## Notes:

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06AREVC

Figure 11. 6-Lead MicroPak, 1.0mm Wide

**Note:** [click here for tape and reel specifications, available at:](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf)

[http://www.fairchildsemi.com/products/logic/pdf/micropak\\_tr.pdf](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf)

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