

# FSA4157, FSA4157A

## Low-Voltage, 1Ω SPDT Analog Switch

### Features

- FSA4157A Features Lower I<sub>CC</sub> when the S Input is Lower Than V<sub>CC</sub>
- Maximum 1.15Ω On Resistance (R<sub>ON</sub>) at 4.5V V<sub>CC</sub>
- 0.3Ω max R<sub>ON</sub> Flatness at 4.5V V<sub>CC</sub>
- Space-Saving 6-lead, MicroPak™ and SC70 6 Packages
- Broad V<sub>CC</sub> 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<sub>ON</sub> of 1.15Ω maximum at 4.5V V<sub>CC</sub> and will operate over the wide V<sub>CC</sub> 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<sub>CC</sub> supply. This feature services the mobile handset applications very well allowing for the direct interface with baseband processor general purpose I/Os.

### Technology Description

The Fairchild Switch family derives from and embodies Fairchild's proven switch technology used for several years in its 74LVXL384 (FST3384) bus switch product.

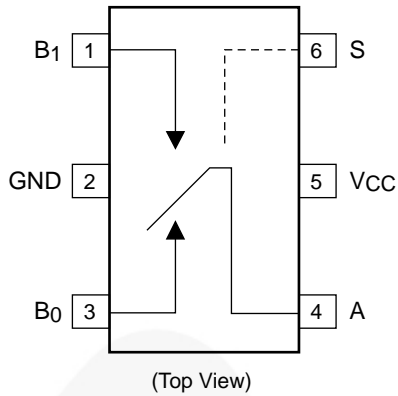
### Ordering Information

Part Number	Top Mark	Package Description	Packing Method
FSA4157P6	A57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	250 Units on Tape and Reel
FSA4157P6X	A57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units on Tape and Reel
FSA4157L6X	EG	6-Lead MicroPak, 1.0mm Wide	5000 Units on Tape and Reel
FSA4157AP6	B57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	250 Units on Tape and Reel
FSA4157AP6X	B57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units on Tape and Reel
FSA4157AL6X	EU	6-Lead MicroPak, 1.0mm Wide	5000 Units on Tape and Reel

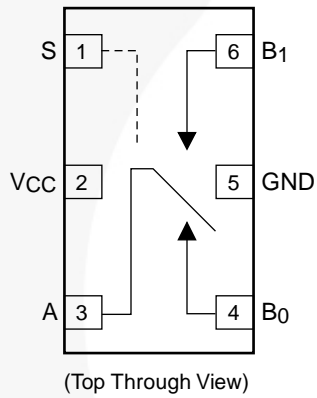
#### Note:

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

## Pin Configurations



**Figure 1. SC70 Pin Assignments**



**Figure 2. MicroPak Pin Assignments**

## Truth Table

Control Input(s)	Function
Low	B0 Connected to A
High	B1 Connected to A

## Pin Descriptions

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

## 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 <sub>CC</sub>	Supply Voltage	-0.5	6.0	V
V <sub>S</sub>	DC Switch Voltage <sup>(2)</sup>	-0.5	V <sub>CC</sub> + 0.5	V
V <sub>IN</sub>	DC Input Voltage <sup>(2)</sup>	-0.5	6.0	V
I <sub>IK</sub>	DC Input Diode Current	-50		mA
I <sub>SW</sub>	Switch Current		200	mA
I <sub>SWPEAK</sub>	Peak Switch Current (Pulse at 1ms duration, <10% Duty Cycle)		400	mA
P <sub>D</sub>	Power Dissipation at 85°C	SC70	180	mW
		MicroPak™		
T <sub>STG</sub>	Storage Temperature Range	-65	+150	°C
T <sub>J</sub>	Maximum Junction Temperature		+150	°C
T <sub>L</sub>	Lead Temperature (Soldering, 10 seconds)		+260	°C
ESD	Human Body Model, JESD22-A114 (FSA4157A)		7500	V

**Note:**

- 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	Min.	Max.	Unit	
V <sub>CC</sub>	Supply Voltage	FSA4157	1.65	5.50	V
		FSA4157A	2.7	5.5	
V <sub>CNTRL</sub>	Control Input Voltage <sup>(3)</sup>	0	V <sub>CC</sub>	V	
V <sub>SW</sub>	Switch Input Voltage	0	V <sub>CC</sub>	V	
T <sub>A</sub>	Operating Temperature	-40	+85	°C	
θ <sub>JA</sub>	Thermal Resistance in Still Air	SC70		350	°C/W
		MicroPak™ (Estimated)		330	

**Note:**

- 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.

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Ambient Temperature					Units
				-25°			-40 to +85°C		
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	Input Voltage High		2.7 to 3.6				2.0		V
			4.5 to 5.5				2.4		
V <sub>IL</sub>	Input Voltage Low	FSA4157A Only	2.7 to 3.6					0.4	V
			2.7 to 3.6					0.6	
			4.5 to 5.5					0.8	
I <sub>IN</sub>	Control Input Leakage	V <sub>IN</sub> =0V to V <sub>CC</sub>	2.7 to 3.6				-1.0	1.0	μA
			4.5 to 5.5				-1.0	1.0	
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	Off Leakage Current of Port B0 and B1	A=1V, 4.5V, B <sub>0</sub> or B <sub>1</sub> =4.5, 1V	5.5	-2.0		2.0	-20.0	20.0	nA
I <sub>A(ON)</sub>	On Leakage Current of Port A	A=1V, 4.5V, B <sub>0</sub> or B <sub>1</sub> =4.5, 1V, 4.5V or Floating	5.5	-4.0		4.0	-40.0	40.0	nA
R <sub>ON</sub>	Switch On Resistance	I <sub>OUT</sub> =100mA, B <sub>0</sub> or B <sub>1</sub> =1.5V	2.7		2.6	4.0		4.3	Ω
		I <sub>OUT</sub> =100mA, B <sub>0</sub> or B <sub>1</sub> =3.5V	4.5		0.95	1.15		1.30	
ΔR <sub>ON</sub>	On Resistance Matching Between Channels <sup>(5)</sup>	I <sub>OUT</sub> =100mA, B <sub>0</sub> or B <sub>1</sub> =1.5V	4.5		0.06	0.12		0.15	Ω
R <sub>FLAT(ON)</sub>	On Resistance Flatness <sup>(6)</sup>	I <sub>OUT</sub> =100mA, B <sub>0</sub> or B <sub>1</sub> =0V, 0.75V, 1.5V	2.7		1.4				Ω
		I <sub>OUT</sub> =100mA, B <sub>0</sub> or B <sub>1</sub> =0V, 1V, 2V	4.5		0.2	0.3		0.4	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =0V or V <sub>CC</sub> , I <sub>OUT</sub> =0V	3.6		0.1	0.5		1.0	μA
			5.5		0.1	0.5		1.0	
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	One Input at 2.7V, others at V <sub>CC</sub> or GND (FSA4157A Only)	4.3		0.2			10.0	μA

### Notes:

4. 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).
5. ΔR<sub>ON</sub> = R<sub>ON max</sub> – R<sub>ON min</sub> measured at identical V<sub>CC</sub>, temperature, and voltage.
6. 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.

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Ambient Temperature					Units	Figure
				-25°			-40 to +85°C			
				Min.	Typ.	Max.	Min.	Max.		
t <sub>ON</sub>	Turn-On Time	B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF (FSA4157A Only)	2.7 to 3.6			60.0		65.0	ns	Figure 8
		B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	2.7 to 3.6			50.0		60.0		
		B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	4.5 to 5.5			35.0		40.0		
t <sub>OFF</sub>	Turn-Off Time	B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	2.7 to 3.6			20.0		30.0	ns	Figure 8
		B <sub>0</sub> or B <sub>1</sub> =1.5V, R <sub>L</sub> =50Ω, C <sub>L</sub> =35pF	4.5 to 5.5			15.0		20.0		
t <sub>BBM</sub>	Break-Before-Make Time	FSA4157	2.7 to 3.6						ns	Figure 9
			4.5 to 5.5		20.0					
		(FSA4157A Only)	4.5 to 5.5		25.0					
Q	Charge Injection	C <sub>L</sub> =1.0nF, V <sub>GE</sub> =0V, R <sub>GEN</sub> =0Ω	2.7 to 3.6		10.0				pC	Figure 11
			4.5 to 5.5		20.0					
OIRR	Off Isolation	f=1MHz, R <sub>L</sub> =50Ω	2.7 to 3.6		-70.0				dB	Figure 10
			4.5 to 5.5		-70.0					
Xtalk	Crosstalk	f=1MHz, R <sub>L</sub> =50Ω	2.7 to 3.6		-70.0				dB	Figure 10
			4.5 to 5.5		-70.0					
BW	-3db Bandwidth	R <sub>L</sub> =50Ω	2.7 to 3.6			300			MHz	Figure 13
			4.5 to 5.5			300				
THD	Total Harmonic Distortion	R <sub>L</sub> =600Ω, V <sub>IN</sub> =0.5, f=20Hz to 20kHz	2.7 to 3.6		0.002				%	Figure 14
			4.5 to 5.5		0.002					

## Capacitance

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Ambient Temperature					Units	Figure
				-25°			40 to +85°C			
				Min.	Typ.	Max.	Min.	Max.		
C <sub>IN</sub>	Control Pin Input Capacitance	f=1MHz	0		3.5				pF	Figure 12
C <sub>OFF</sub>	B Port Off Capacitance	f=1MHz	4.5		12.0				pF	Figure 12
C <sub>ON</sub>	On Capacitance	f=1MHz	4.5		40.0				pF	Figure 12

Typical Performance Characteristics

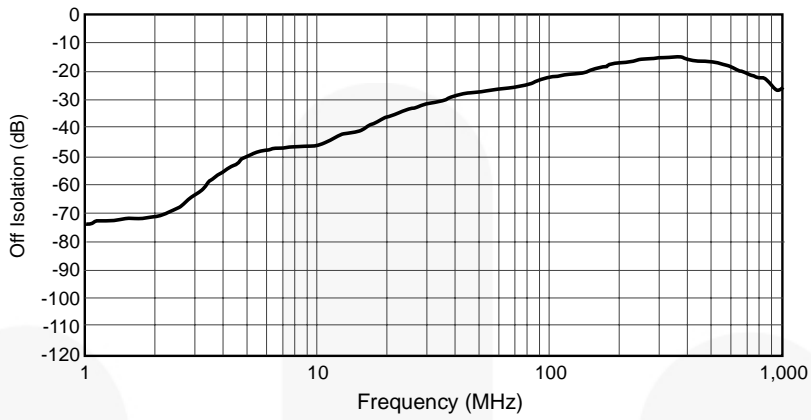


Figure 3. Off Isolation,  $V_{CC} = 2.7V$  to  $5.5V$

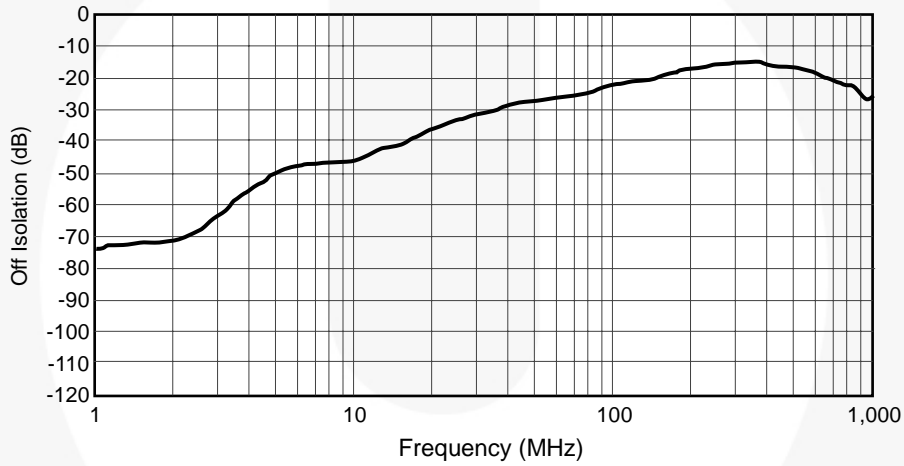


Figure 4. Crosstalk,  $V_{CC} = 2.7V$  to  $5.5V$

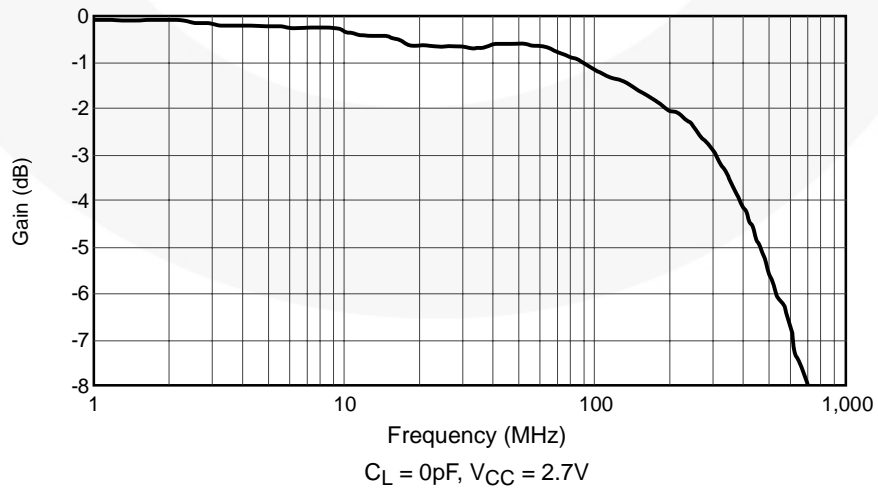
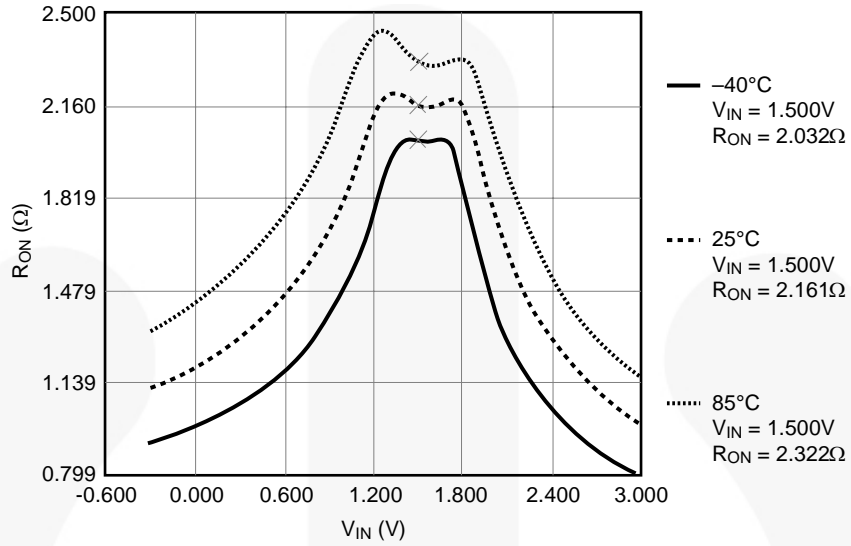
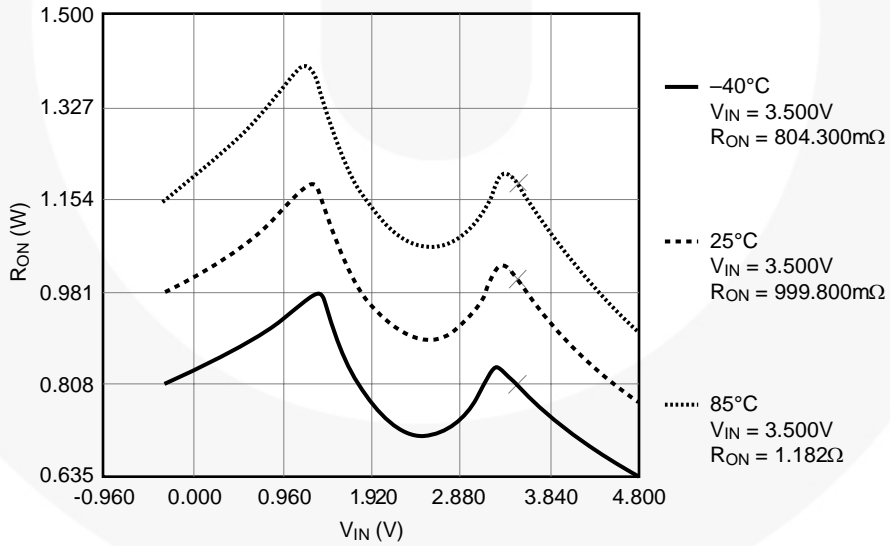


Figure 5. Bandwidth,  $V_{CC} = 2.7V$  to  $5.5V$

**Typical Performance Characteristics** (Continued)

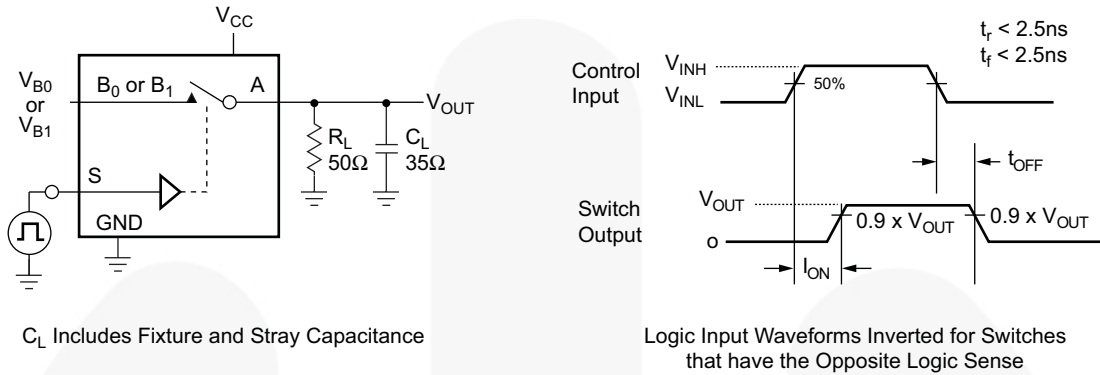


**Figure 6. R<sub>ON</sub> Switch On Resistance, I<sub>ON</sub> = 100mA, V<sub>CC</sub> = 2.7**

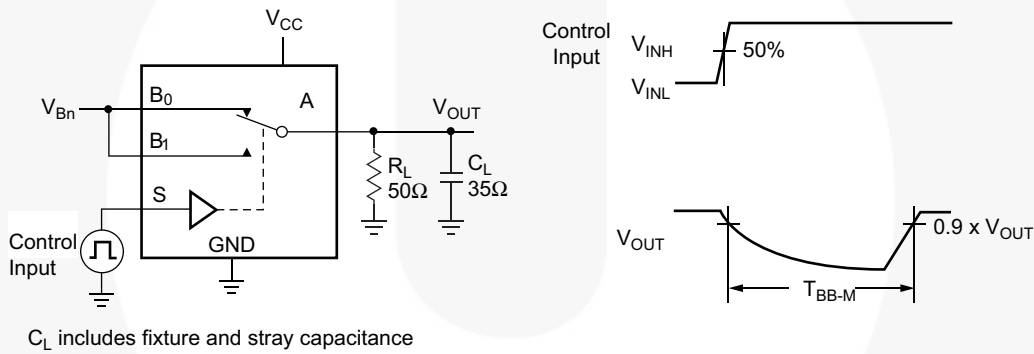


**Figure 7. R<sub>ON</sub> Switch On Resistance, I<sub>ON</sub> = 100mA, V<sub>CC</sub> = 4.5V**

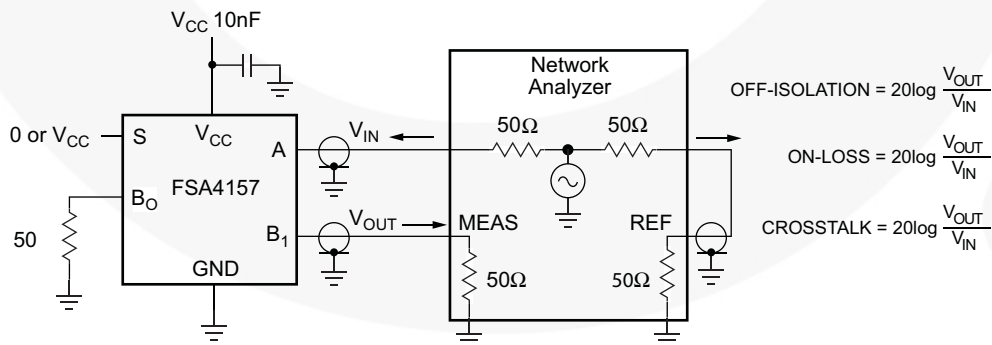
## AC Loadings and Waveforms



**Figure 8. Turn On / Off Timing**



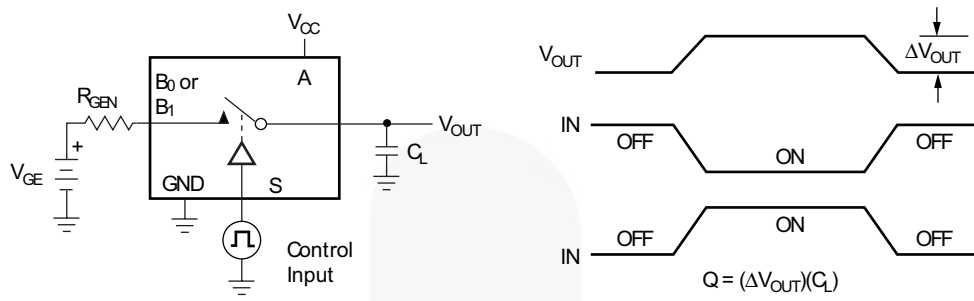
**Figure 9. Break Before Make Timing**



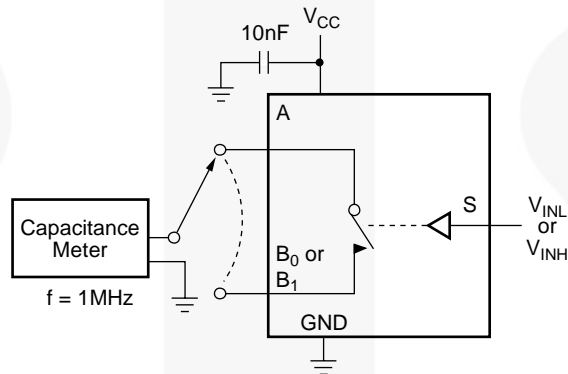
**Figure 10. Off Isolation and Crosstalk**



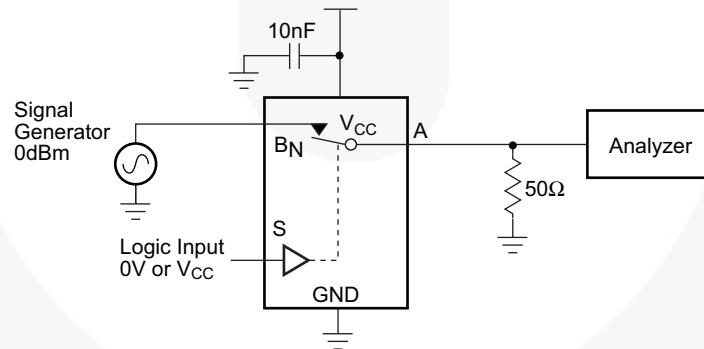
**AC Loadings and Waveforms (Continued)**



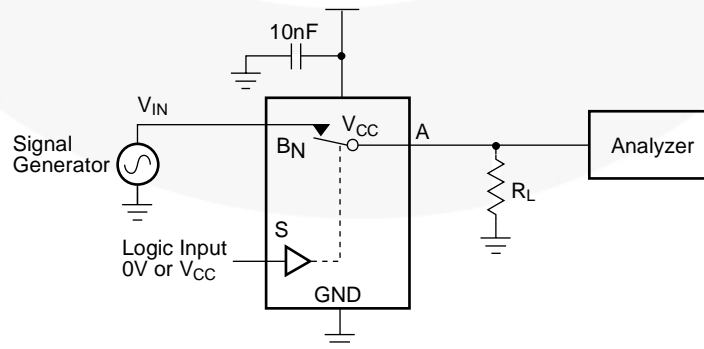
**Figure 11. Charge Injection**



**Figure 12. On / Off Capacitance Measurement Setup**

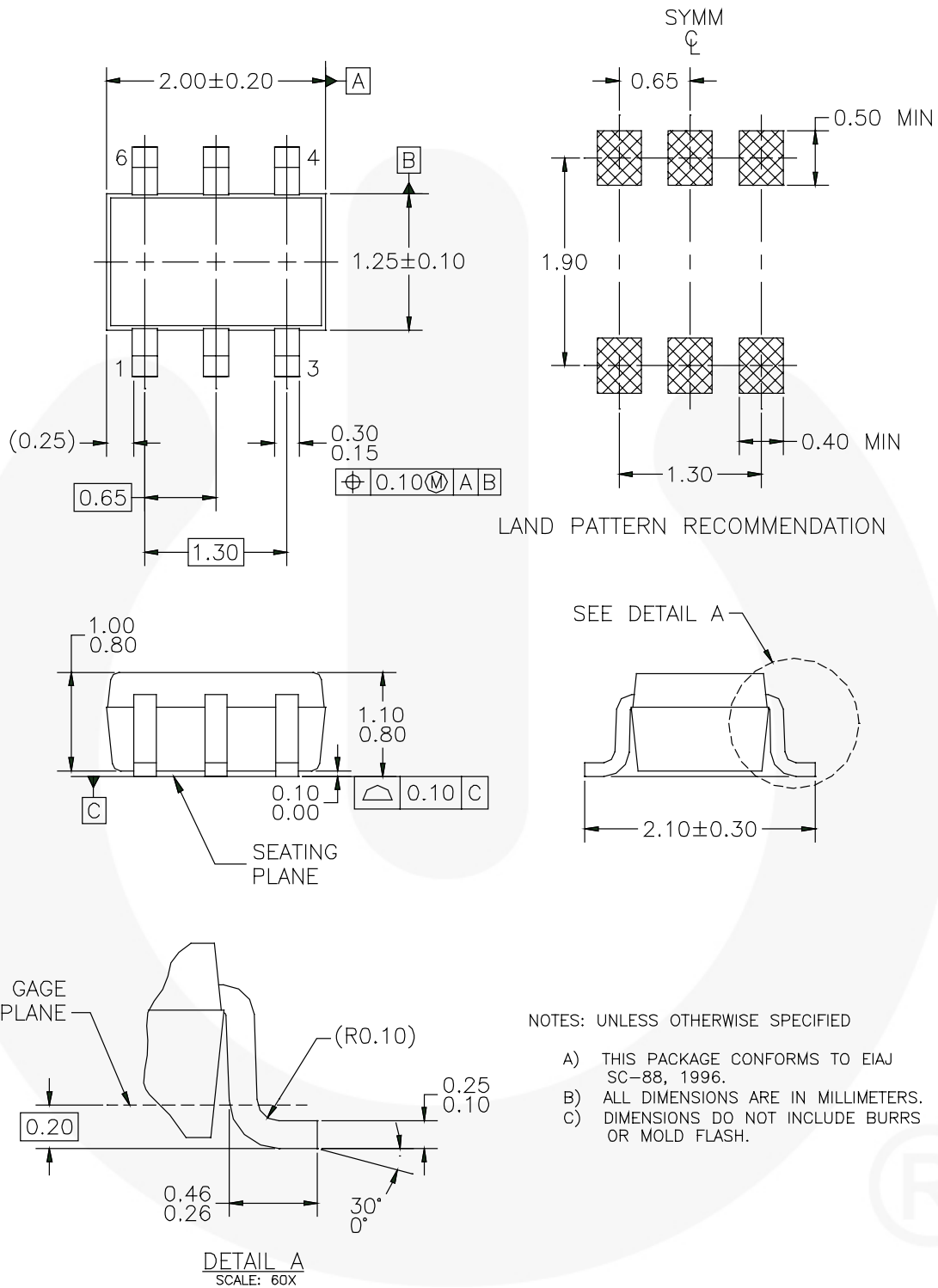


**Figure 13. Bandwidth**



**Figure 14. Harmonic Distortion**

## Physical Dimensions



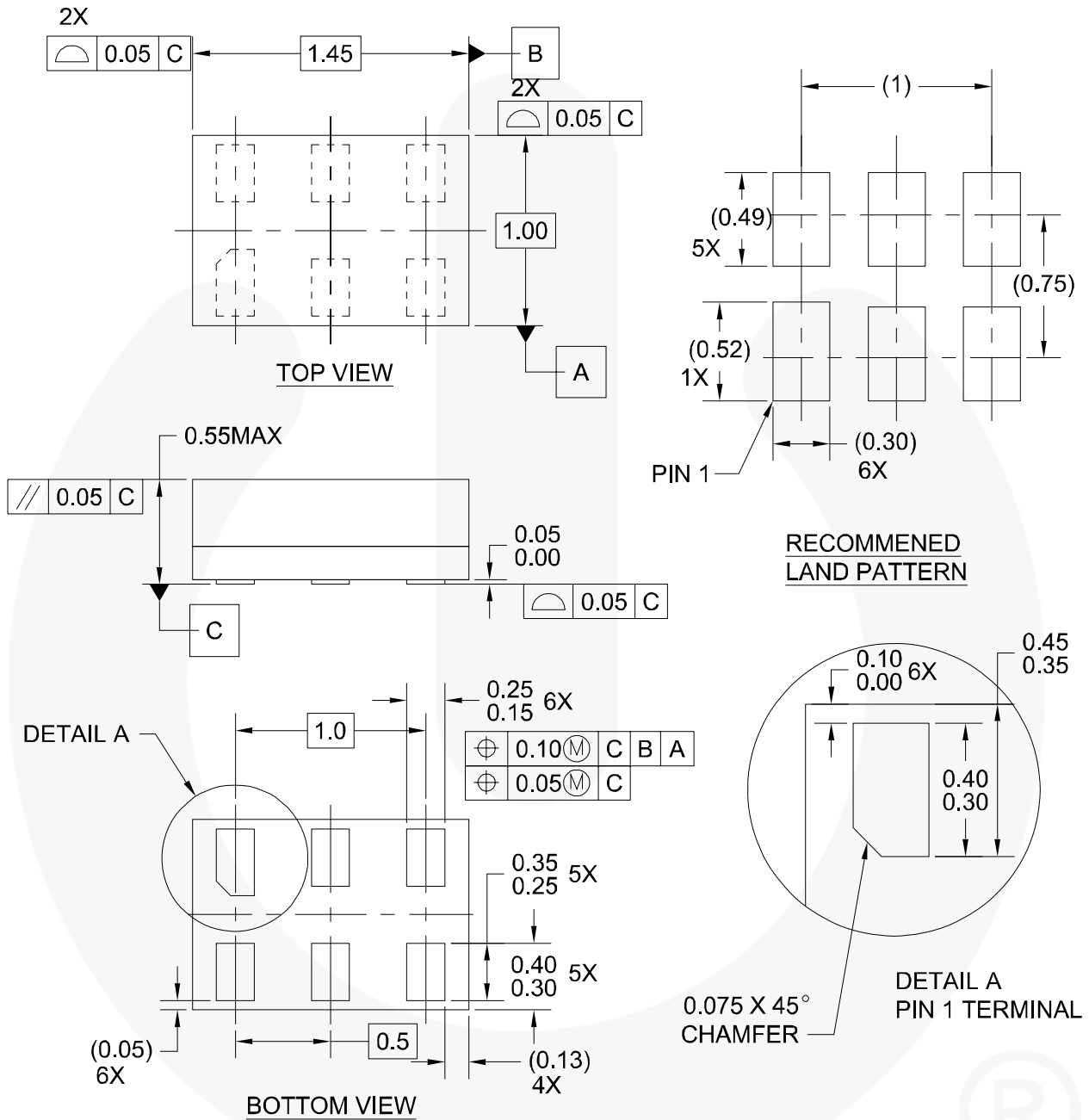
MAA06AREV5

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

[Click here for tape and reel specifications, available at:](#)

[http://www.fairchildsemi.com/products/analog/pdf/sc70-6\\_tr.pdf](http://www.fairchildsemi.com/products/analog/pdf/sc70-6_tr.pdf)

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

[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)



## TRADEMARKS

The following are registered and unregistered trademarks and service marks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx®	Green FPS™	Power247®	SuperSOT™-8
Build it Now™	Green FPS™ e-Series™	POWEREDGE®	SyncFET™
CorePLUS™	GTO™	Power-SPM™	The Power Franchise®
CROSSVOLT™	<i>i-Lo</i> ™	PowerTrench®	the <b>power</b> franchise
CTL™	IntelliMAX™	Programmable Active Droop™	TinyBoost™
Current Transfer Logic™	ISOPLANAR™	QFET®	TinyBuck™
EcoSPARK®	MegaBuck™	QS™	TinyLogic®
<b>F</b> ®	MICROCOUPLER™	QT Optoelectronics™	TINYOPTO™
Fairchild®	MicroFET™	Quiet Series™	TinyPower™
Fairchild Semiconductor®	MicroPak™	RapidConfigure™	TinyPWM™
FACT Quiet Series™	MillerDrive™	SMART START™	TinyWire™
FACT®	Motion-SPM™	SPM®	μSerDes™
FAST®	OPTOLOGIC®	STEALTH™	UHC®
FastvCore™	OPTOPLANAR®	SuperFET™	UniFET™
FPS™	 ®	SuperSOT™-3	VCX™
FRFET®	PDP-SPM™	SuperSOT™-6	
Global Power Resource <sup>SM</sup>	Power220®		

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in 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

Datasheet Identification	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; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

Rev. I31