

FSA4157, FSA4157A

Low-Voltage, 1 Ω SPDT Analog Switch

Features

- FSA4157A Features Lower I_{CC} when the S Input is Lower Than V_{CC}
- Maximum 1.15 Ω On Resistance (R_{ON}) at 4.5 V V_{CC}
- 0.3 Ω Maximum R_{ON} Flatness at 4.5 V V_{CC}
- Space-Saving 6-lead, MicroPak™ and SC70 6 Packages
- Broad V_{CC} Operating Range:
 - FSA4157: 1.65 V to 5.5 V
 - FSA4157A: 2.7 V to 5.5 V
- 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 4.5 V V_{CC} and operates over the wide V_{CC} range of 1.65 V to 5.5 V for FSA4157, and 2.7 V to 5.5 V 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_{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, 1.25 mm Wide	3000 Units Tape and Reel
FSA4157L6X	EG	6-Lead MicroPak,™ 1.0 mm Wide	5000 Units Tape and Reel
FSA4157AP6X	B57	6-Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 Units Tape and Reel
FSA4157AL6X	EU	6-Lead MicroPak™, 1.0 mm Wide	5000 Units Tape and Reel

Pin Configurations

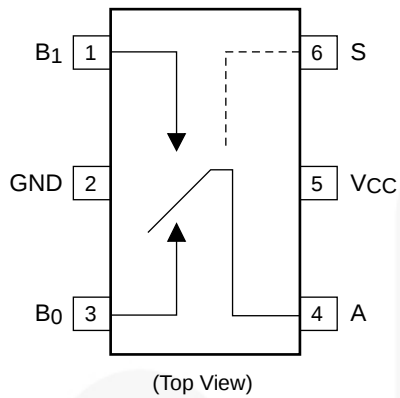


Figure 1. SC70 Pin Assignments

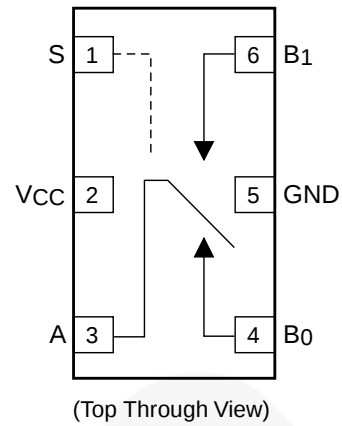


Figure 2. MicroPak™ Pin Assignments

Pin Definitions

Pin# SC70	Pin# MicroPak™	Name	Description
1	6	B1	Data Ports
2	5	GND	Ground
3	4	B0	Data Ports
4	3	A	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	Parameter		Min.	Max.	Unit
V_{CC}	Supply Voltage		-0.5	6.0	V
V_S	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 1 ms duration, <10% Duty Cycle)			400	mA
P_D	Power Dissipation at 85°C	SC70		180	mW
		MicroPak™			
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	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		Min.	Max.	Unit
V_{CC}	Supply Voltage	FSA4157	1.65	5.50	V
		FSA4157A	2.7	5.5	
V_{CNTRL}	Control Input Voltage ⁽²⁾		0	V_{CC}	V
V_{SW}	Switch Input Voltage		0	V_{CC}	V
T_A	Operating Temperature		-40	+85	°C
θ_{JA}	Thermal Resistance in Still Air	SC70		350	°C/W
		MicroPak™ (Estimated)		330	

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.

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

Notes:

- 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).
- $\Delta R_{ON} = R_{ON\text{ max}} - R_{ON\text{ min}}$ 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.

Symbol	Parameter	Conditions	V _{CC} (V)	Ambient Temperature					Unit	Figure
				-25°			-40 to +85°C			
				Min.	Typ.	Max.	Min.	Max.		
t _{ON}	Turn-On Time	B ₀ or B ₁ =1.5 V, R _L =50 Ω, C _L =35 pF (FSA4157A Only)	2.7 to 3.6			60		65	ns	Figure 8
		B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =35pF	2.7 to 3.6			50		60		
		B ₀ or B ₁ =1.5 V, R _L =50 Ω, C _L =35pF	4.5 to 5.5			35		40		
t _{OFF}	Turn-Off Time	B ₀ or B ₁ =1.5 V, R _L =50 Ω, C _L =35 pF	2.7 to 3.6			20		30	ns	Figure 8
		B ₀ or B ₁ =1.5 V, R _L =50 Ω, C _L =35 pF	4.5 to 5.5			15		20		
t _{BBM}	Break-Before-Make Time	FSA4157	2.7 to 3.6						ns	Figure 9
			4.5 to 5.5		20					
		FSA4157A Only	4.5 to 5.5		25					
Q	Charge Injection	C _L =1.0 nF, V _{GE} =0 V, R _{GEN} =0 Ω	2.7 to 3.6		10				pC	Figure 11
			4.5 to 5.5		20					
OIRR	Off Isolation	f=1 MHz, R _L =50 Ω	2.7 to 3.6		-70				dB	Figure 10
			4.5 to 5.5		-70					
Xtalk	Crosstalk	f=1 MHz, R _L =50 Ω	2.7 to 3.6		-70				dB	Figure 10
			4.5 to 5.5		-70					
BW	-3db Bandwidth	R _L =50 Ω	2.7 to 3.6			300			MHz	Figure 13
			4.5 to 5.5			300				
THD	Total Harmon Distortion	R _L =600 Ω, V _{IN} =0.5, f=20 Hz to 20 kHz	2.7 to 3.6		0.002				%	Figure 14
			4.5 to 5.5		0.002					

Capacitance

Symbol	Parameter	Condition s	$V_{CC} (V)$	Ambient Temperature -25°			Unit	Figure
				Min.	Typ.	Max.		
C_{IN}	Control Pin Input Capacitance	$f=1 MHz$	0		3.5		pF	Figure 12
C_{OFF}	B Port Off Capacitance	$f=1 MHz$	4.5		12.0		pF	Figure 12
C_{ON}	On Capacitance	$f=1 MHz$	4.5		40.0		pF	Figure 12

Typical Performance Characteristics

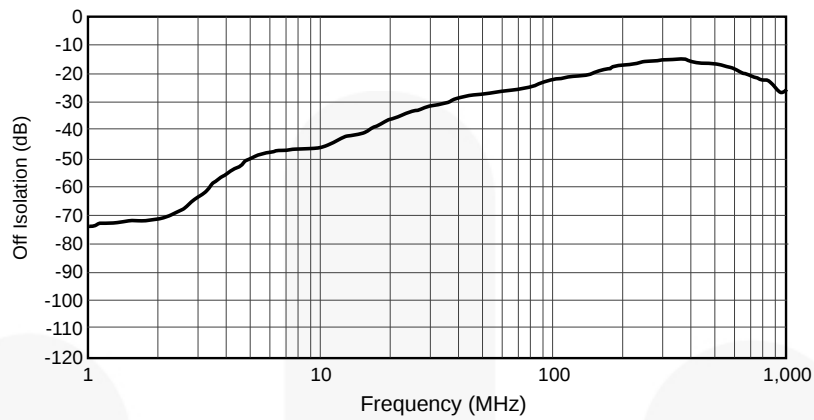


Figure 3. Off Isolation, $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

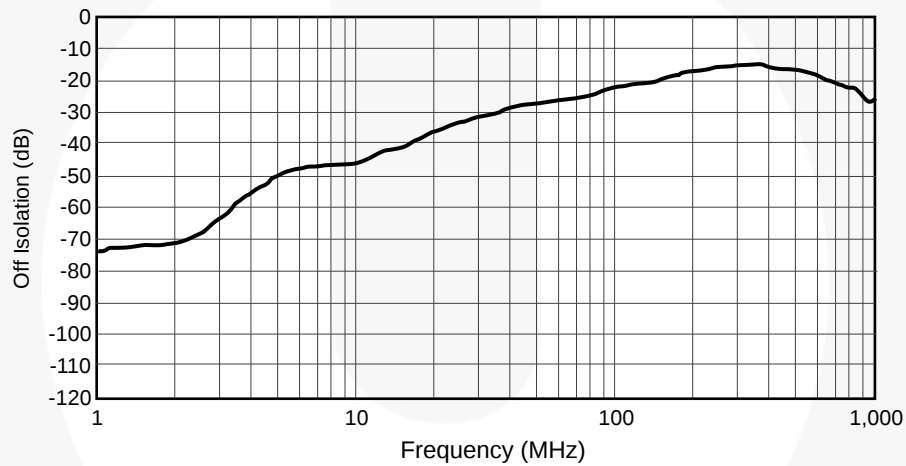


Figure 4. Crosstalk, $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

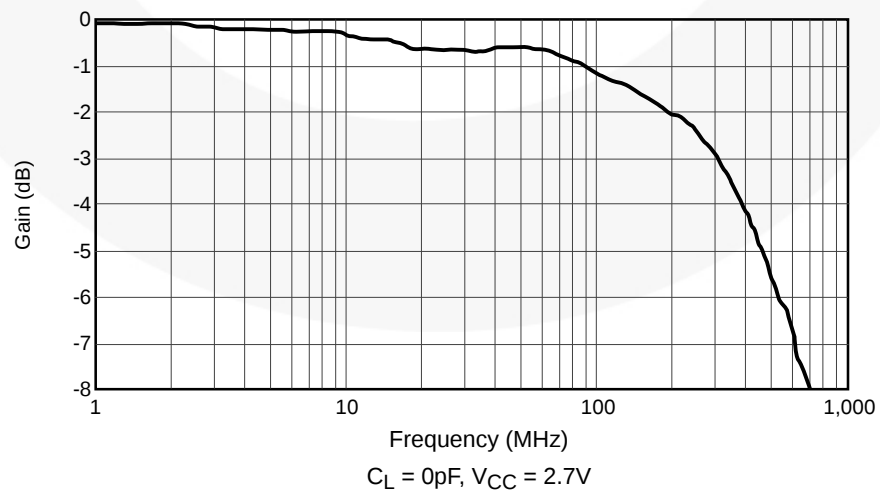


Figure 5. Bandwidth, $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

Typical Performance Characteristics (Continued)

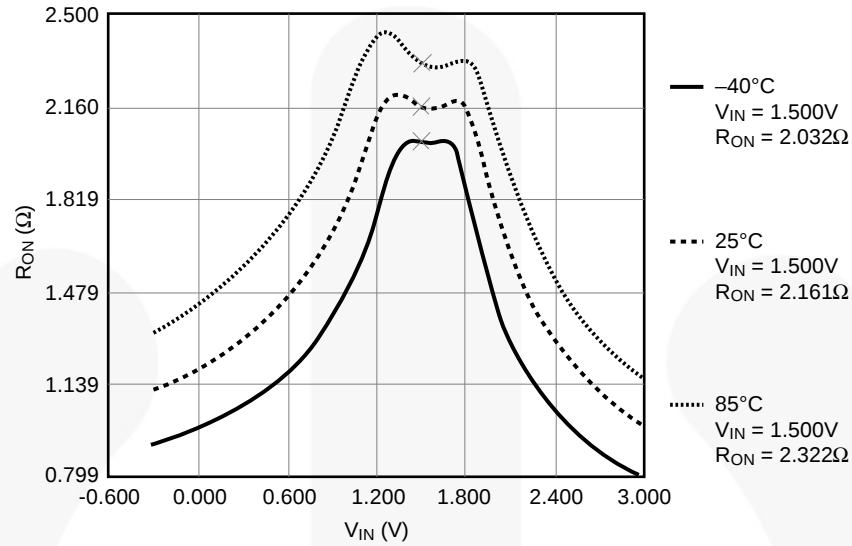


Figure 6. R_{ON} Switch On Resistance, $I_{\text{ON}} = 100\text{ mA}$, $V_{\text{CC}} = 2.7$

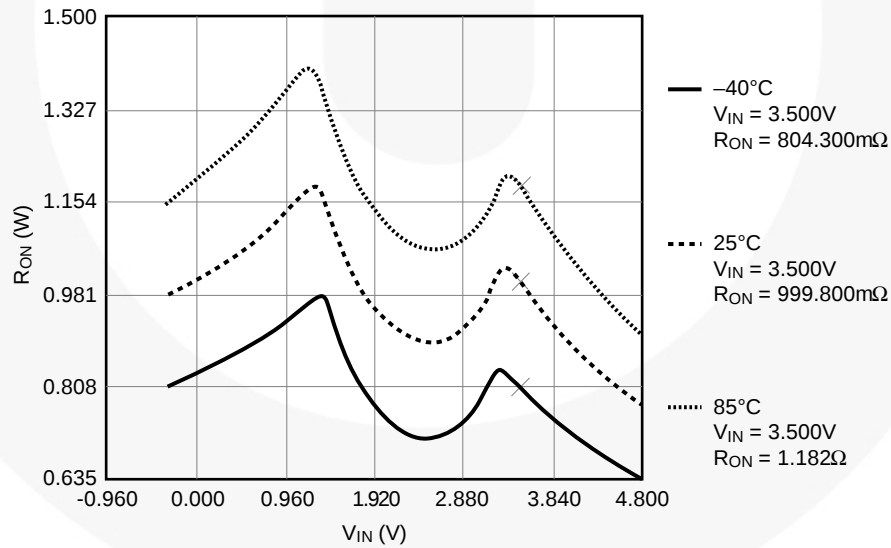


Figure 7. R_{ON} Switch On Resistance, $I_{\text{ON}} = 100\text{ mA}$, $V_{\text{CC}} = 4.5\text{ V}$

AC Loadings and Waveforms

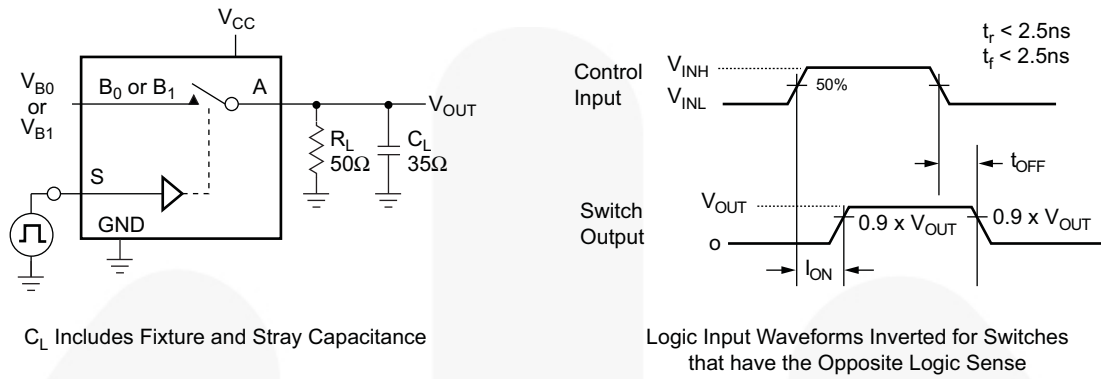


Figure 8. Turn On / Off Timing

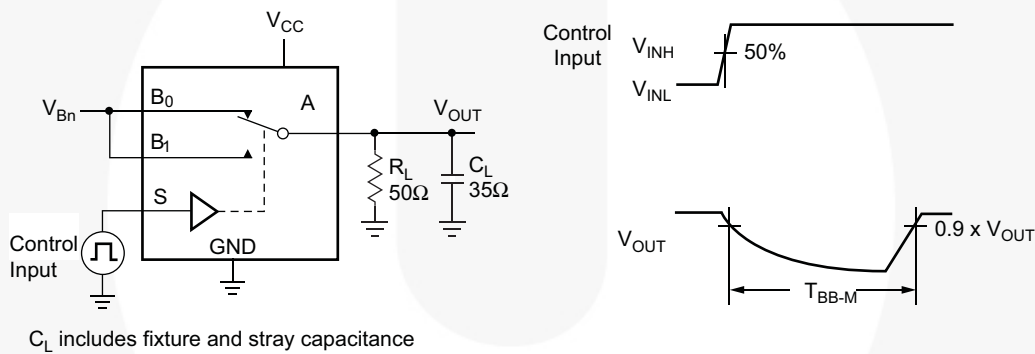


Figure 9. Break Before Make Timing

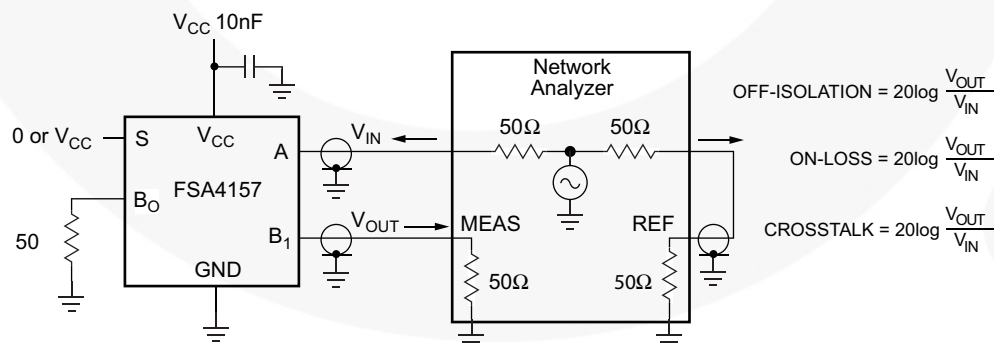


Figure 10. Off Isolation and Crosstalk

AC Loadings and Waveforms (Continued)

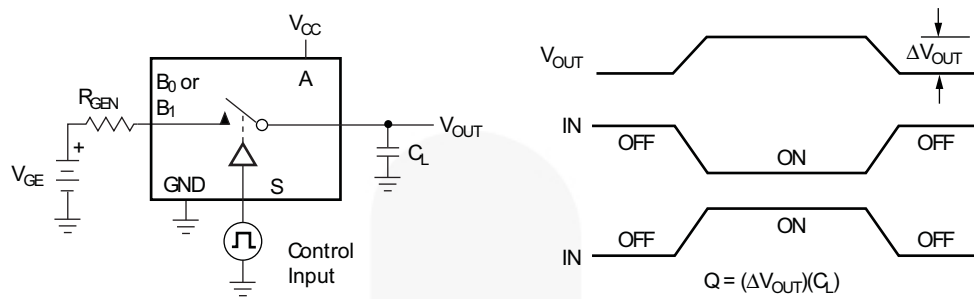


Figure 11. Charge Injection

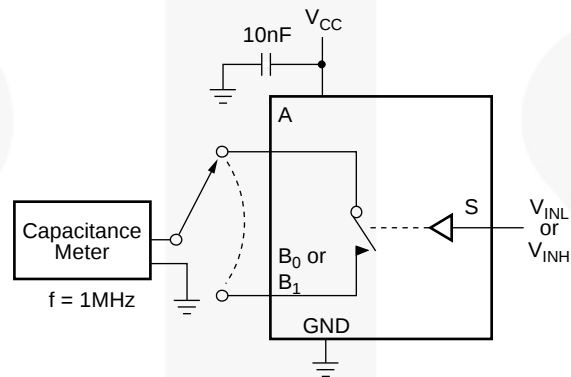


Figure 12. On / Off Capacitance Measurement Setup

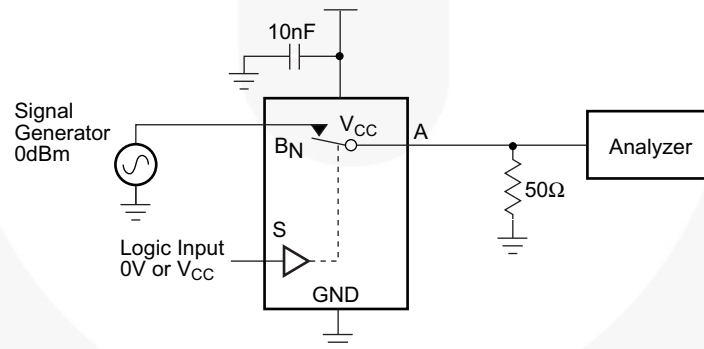


Figure 13. Bandwidth

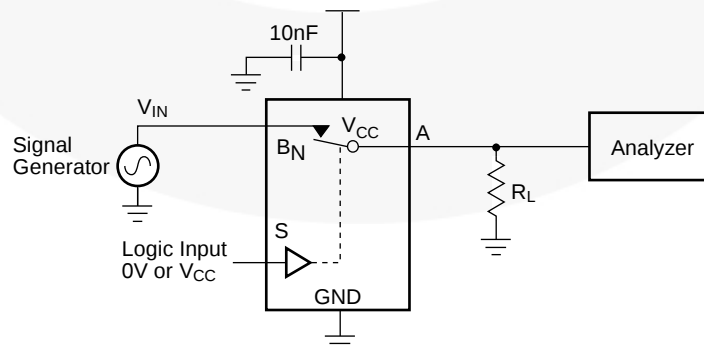


Figure 14. Harmonic Distortion

Physical Dimensions

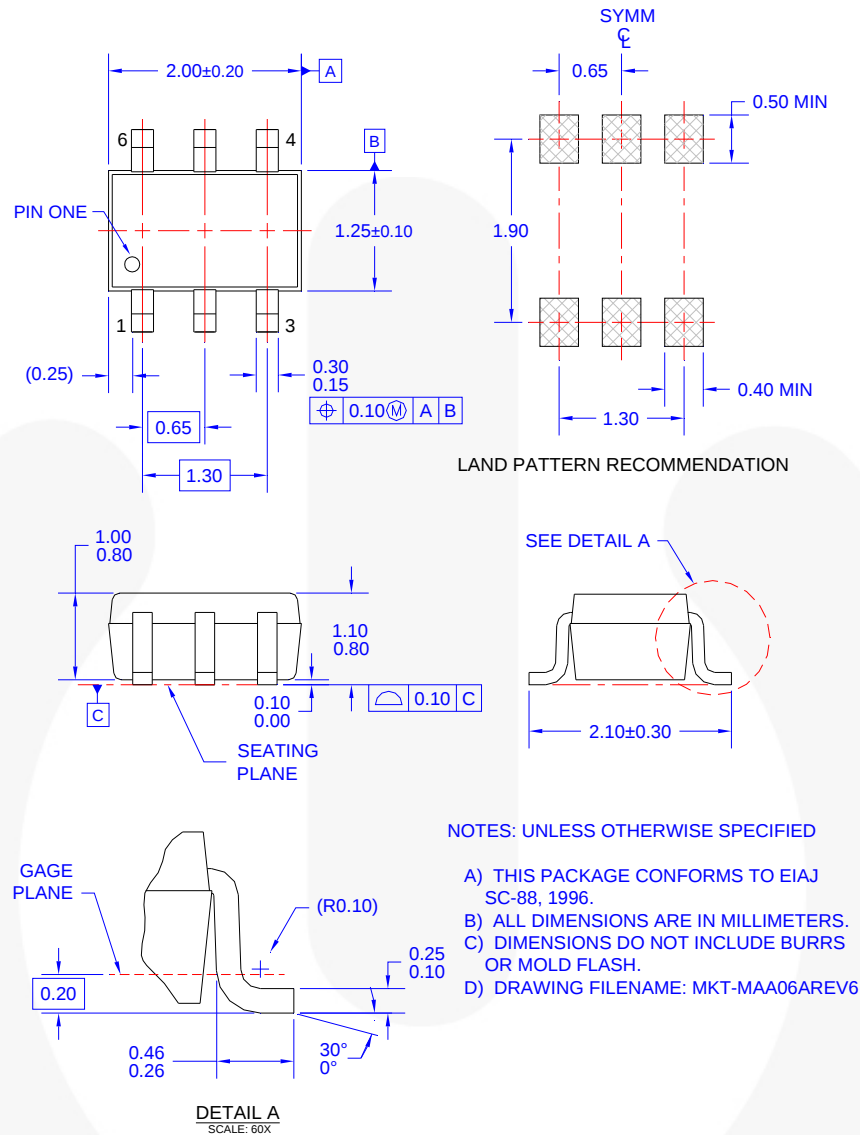


Figure 15. 6-Lead, SC70, EIAJ SC88 1.25 mm Wide Package

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

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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
P6X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

Physical Dimensions (Continued)

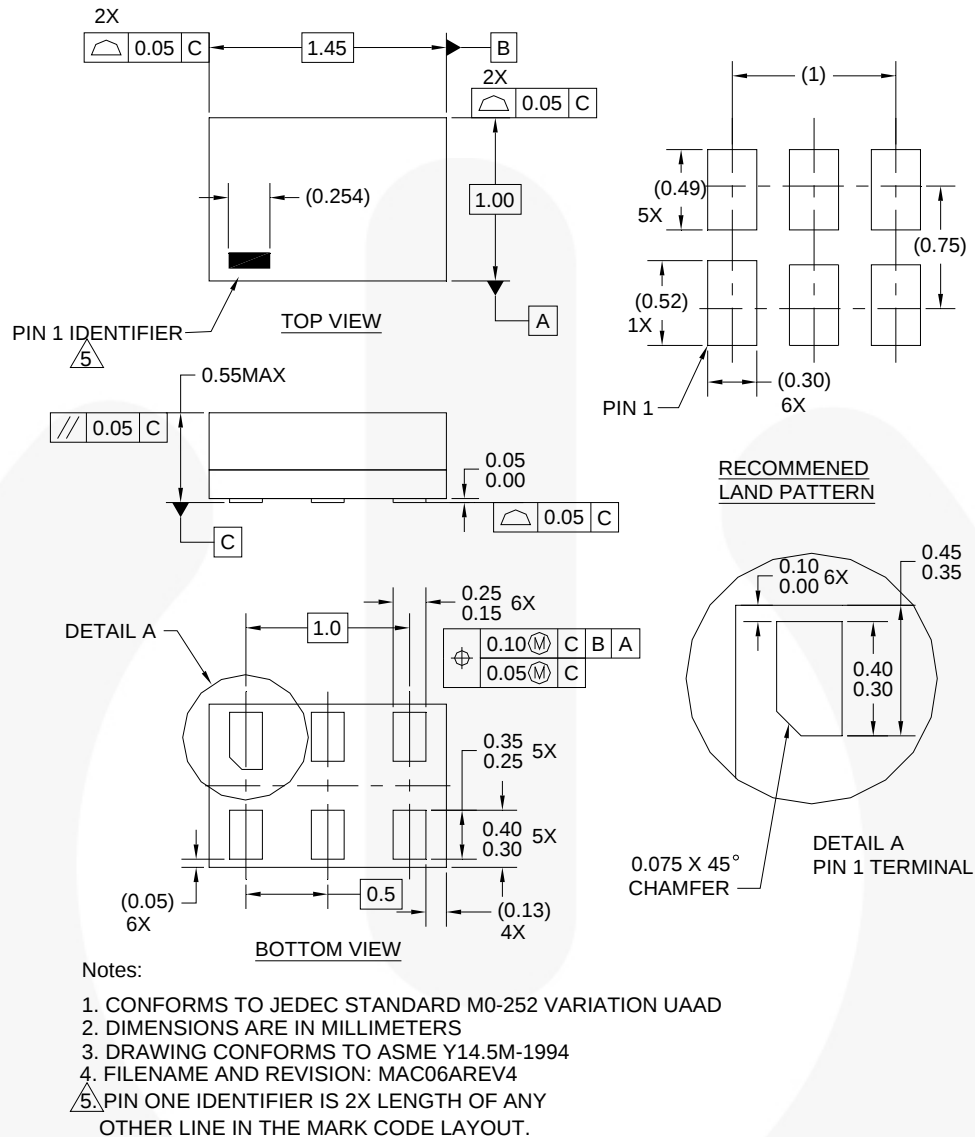


Figure 16. 6-Lead, Micropak™ 1.0 mm Wide Package

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http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf.

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



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Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	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	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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