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FAIRCHILD SEMICONDUCTOR®

February 2008

FSA5157
0.4Ω Low-Voltage SPDT Analog Switch

Features

- Typical 0.4Ω On Resistance (R_{ON}) for +2.7V Supply
- FSA5157 Features Less than 12µA I_{CCT} Current When S Input is Lower than V_{CC}
- 0.25Ω Maximum R_{ON} Flatness for +2.7V Supply
- 1.0 x 1.45mm 6-Lead MicroPak™ Package
- Broad V_{CC} Operating Range: 1.65V to 4.3V
- Low THD (0.02% Typical for 32Ω Load)
- High-Current Handling Capability (350mA Continuous Current Under 3.3V Supply)
- Control Logic is 1.8V CMOS Logic Compatible

Applications

- Cellular Phone
- PDA
- Portable Media Player

General Description

The FSA5157 is a low on resistance, low-power, Single Pole Double Throw (SPDT) analog switch. This product has been designed for switching audio signals in applications such as cell phones and portable media players. The ultra-low 0.4Ω impedance, sub-µA current consumption, and 1.65V to 4.3V operating voltage range makes this product ideal for battery-powered applications. The FSA5157 also features bi-directional operation and break-before-make functionality. This device is fully specified for operation at 1.8V, 2.5V, and 3.3V.

A growing number of applications require the voltage applied to the select input to be lower than the V_{CC} applied. Under this condition, most switches would typically consume over 100µA of current. This would be an unacceptable level for battery-powered applications. The FSA5157 is designed to minimize current consumption under this condition. The I_{CCT} is specified for <12µA under a worst-case condition of V_{CC} = 4.3V and V_{IN} = 1.8V.

Ordering Information

Order Number	Top Mark	Package Description	Packing Method
FSA5157P6X	C57	6-Lead SC70, EIAJ SC88, 1.25mm Wide	3000 Units on Tape and Reel
FSA5157L6X	FT	6-Lead MicroPak, 1.0mm Wide	5000 Units on Tape and Reel

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

Application Diagram

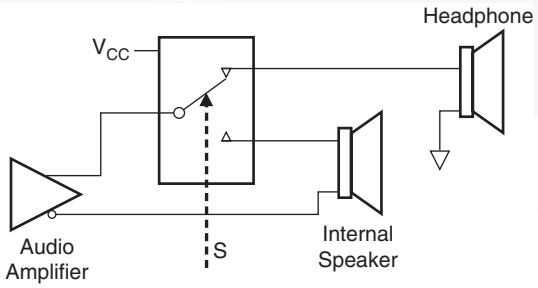

Figure 1. Application Diagram

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Pin Assignments

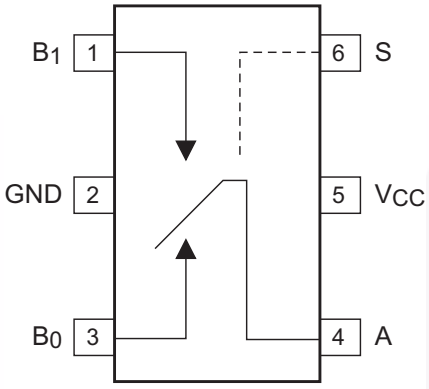


Figure 2. 6-Lead SC70

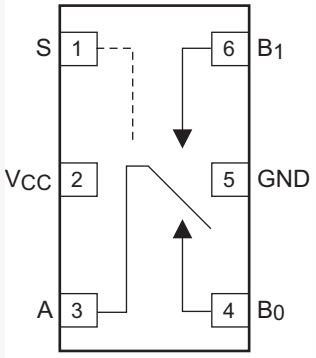


Figure 3. 6-Lead MicroPak™

Truth Tables

Control Input(s)	Function
LOW Logic Level	B_0 Connected to A
HIGH Logic Level	B_1 Connected to A

Pin Descriptions

Pin Names	Function
A, B_0, B_1	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	Units
V_{CC}	Supply Voltage	−0.5	5.5	V
V_S	Switch Voltage(1)	−0.5	V_{CC} + 0.3V	V
V_{IN}	Input Voltage(1)	−0.5	V_{CC}	V
I_{IK}	Input Diode Current		−50	mA
I_{SW}	Switch Current		350	mA
I_{SWPEAK}	Peak Switch Current (Pulsed at 1ms duration, <10% Duty Cycle)		500	mA
P_D	SC70 6L Package		180	mW
	MicroPak 6L 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 voltage 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.	Rating
V_{CC}	Supply Voltage	1.65	4.30	V
V_{IN}	Control Input Voltage(2)	0	V_{CC}	V
V_{IN}	Switch Input Voltage	0	V_{CC}	V
T_A	Operating Temperature	−40	+85	°C

Note:

2. Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

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

Symbol	Parameter	Conditions	V_{CC} (V)	T_A=+25°C			T_A= -40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V_{IH}	Input Voltage High		3.6 to 4.3				1.4		V
			2.7 to 3.6				1.3		
			2.3 to 2.7				1.1		
			1.65 to 1.95				0.9		
V_{IL}	Input Voltage Low		3.6 to 4.3					0.7	V
			2.7 to 3.6					0.5	
			2.3 to 2.7					0.4	
			1.65 to 1.95					0.4	
I_{IN}	Control Input Leakage	V_{IN} = 0V to V_{CC}	1.65 to 4.3				–0.5	0.5	µA
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Off-Leakage Current of Port B_0 and B_1	A = 0.3V, V_{CC} –0.3V, B_0 or B_1 = 0.3V, V_{CC} – 0.3V or Floating	1.95 to 4.3	-10		10	–50	50	nA
$I_{A(ON)}$	On Leakage Current of Port A	A = 0.3V, V_{CC} –0.3V, B_0 or B_1 = 0.3V, V_{CC} – 0.3V or Floating	1.95 to 4.3	–20		20	–100	100	nA
R_{ON}	Switch On Resistance(3)	I_{OUT} = 100mA, B_0 or B_1 = 0V, 0.7V, 3.6V, 4.3V	4.3		0.36			0.60	Ω
		I_{OUT} = 100mA, B_0 or B_1 = 0V, 0.7V, 2.0V, 2.7V	2.7		0.4			0.7	
		I_{OUT} = 100mA, B_0 or B_1 = 0V, 0.7V, 2.0V, 2.3V	2.3		0.55			0.80	
		I_{OUT} = 100mA, B_0 or B_1 = 0.7V	1.65		1.5	2.5		3.0	
ΔR_{ON}	On Resistance Matching Between Channels(4)	I_{OUT} = 100mA, B_0 or B_1 = 0.7V	4.3		0.04			0.75	Ω
			2.7		0.06			0.13	
			2.3		0.12			0.20	
			1.65		1.0				
$R_{FLAT(ON)}$	On Resitance Flatness(5)	I_{OUT} = 100mA, B_0 or B_1 = 0V to V_{CC}	4.3					0.25	Ω
			2.7					0.25	
			2.3					0.3	
			1.65		0.3				
I_{CC}	Quiescent Supply Current	V_{IN} = 0V or V_{CC}, I_{OUT} = 0	4.3	–100	30	100	–500	500	nA
I_{CCT}	Increase in I_{CC} per Control Input	V_{IN} = 1.8V	4.3		7.0	12.0		15.0	µA
		V_{IN} = 2.6V	4.3		3.0	6.0		7.0	

Notes:

3. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
4. $\Delta R_{ON} = R_{ONmax} - R_{ONmin}$ measured at identical V_{CC}, temperature, and voltage.
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	Conditions	V_{CC} (V)	T_A = +25×C			T_A = -40×C to +85×C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t_{ON}	Turn-On Time	B_0 or B_1 = 1.5V, R_L = 50Ω, C_L = 35pF	3.6 to 4.3			55		60	ns	Figure 7
			2.7 to 3.6			60		65		
			2.3 to 2.7			65		70		
			1.65 to 1.95		70			90		
t_{OFF}	Turn-Off Time	B_0 or B_1 = 1.5V, R_L = 50Ω, C_L = 35pF	3.6 to 4.3			30		35	ns	Figure 7
			2.7 to 3.6			35		40		
			2.3 to 2.7			40		45		
			1.65 to 1.95		40			55		
t_{BBM}	Break-Before-Make Time	B_0 or B_1 = 1.5V, R_L = 50Ω, C_L = 35pF	3.6 to 4.3				5		ns	Figure 8
			2.7 to 3.6				5			
			2.3 to 2.7				5			
			1.65 to 1.95				5			
Q	Charge Injection	C_L = 1.0 nF, V_{GEN} = 0V, R_{GEN} = 0Ω	3.6 to 4.3		6				pC	Figure 11
			2.7 to 3.6		6					
			2.3 to 2.7		6					
			1.65 to 1.95							
OIRR	Off-Isolation	f = 100kHz, R_L =50Ω, C_L = 5pF (Stray)	3.6 to 4.3		-75				dB	Figure 9
			2.7 to 3.6		-75					
			2.3 to 2.7		-75					
			1.65 to 1.95		-75					
Xtalk	Crosstalk	f = 100kHz, R_L =50Ω, C_L = 5pF (Stray)	3.6 to 4.3		-75				dB	Figure 10
			2.7 to 3.6		-75					
			2.3 to 2.7		-75					
			1.65 to 1.95		-70					
BW	-3db Bandwidth	R_L = 50Ω	1.65 to 4.3		80				MHz	Figure 13
THD	Total Harmonic Distortion		3.6 to 4.3						%	Figure 14
		R_L = 32Ω, V_{IN} = $2V_{PP}$, f = 20Hz to 20kHz	2.7 to 3.6		0.02					
		R_L = 32Ω, V_{IN} =$1.5V_{PP}$, f = 20Hz to 20kHz	2.3 to 2.7		0.036					
		R_L = 32Ω, V_{IN} =$1.2V_{PP}$, f = 20Hz to 20kHz	1.65 to 1.95		0.01					

Capacitance

Symbol	Parameter	Conditions	V_{CC} (V)	T_A =+25°C			T_A =40°C to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
C_{IN}	Control Pin Input Capacitance	f = 1MHz	0.0		1.5				pF	Figure 12
C_{OFF}	B Port OFF Capacitance	f = 1MHz	4.5		21.0				pF	Figure 12
C_{ON}	A Port ON Capacitance	f = 1MHz	4.5		90.0				pF	Figure 12

Typical Characteristics

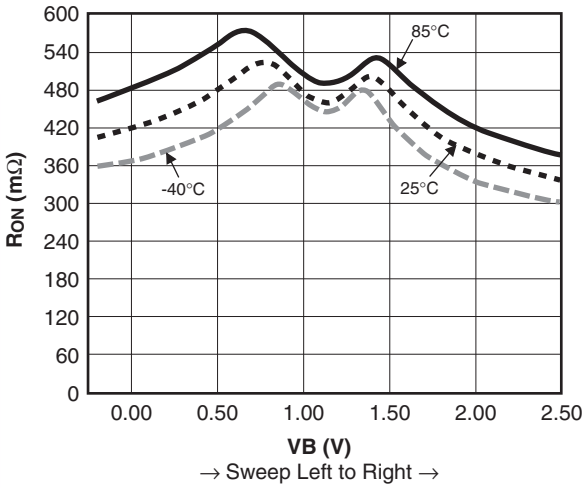


Figure 4. R_{ON} Switch On Resistance, I_{ON} = 100mA, V_{CC} = 2.3V B0

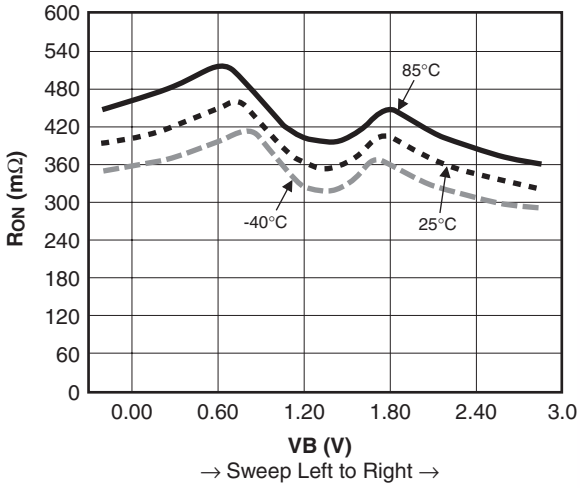


Figure 5. R_{ON} Switch On Resistance, I_{ON} = 100mA, V_{CC} = 2.7V B0

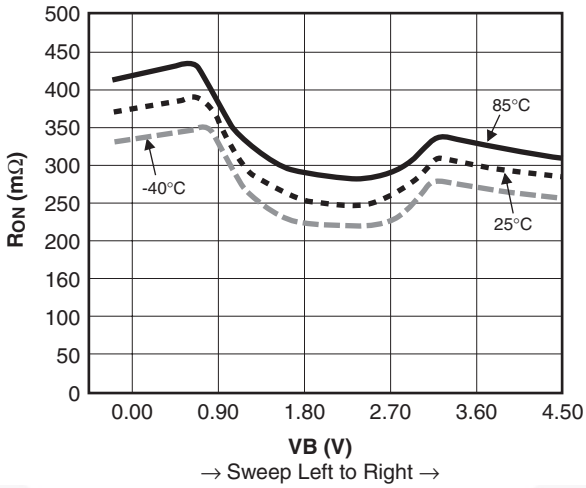
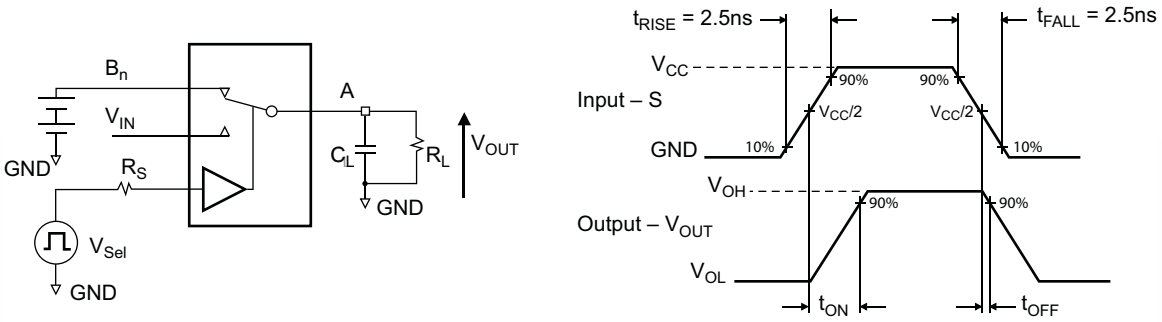


Figure 6. R_{ON} Switch On Resistance, I_{ON} = 100mA, V_{CC} = 4.3V B0

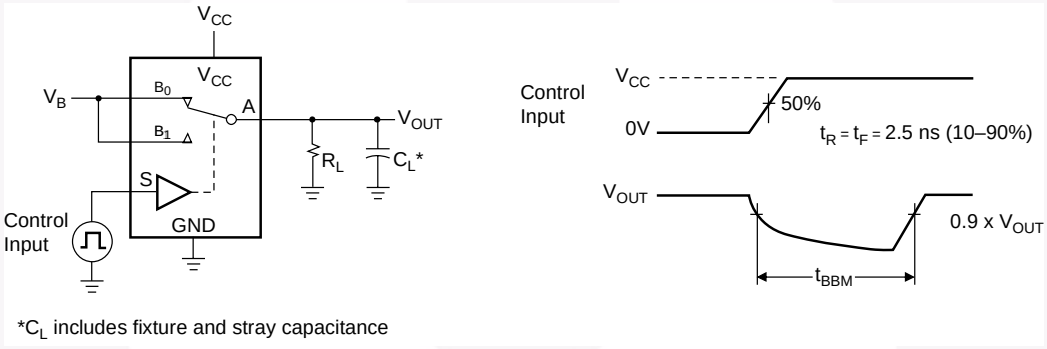
AC Loading and Waveforms



Notes:

6. R_L, R_S, and C_L are functions of the application environment (*see AC Electrical table for specific values*).
7. C_L includes test fixture and stray capacitance.

Figure 7. Turn-Off Timing



*C_L includes fixture and stray capacitance

Figure 8. Break-Before-Make Timing

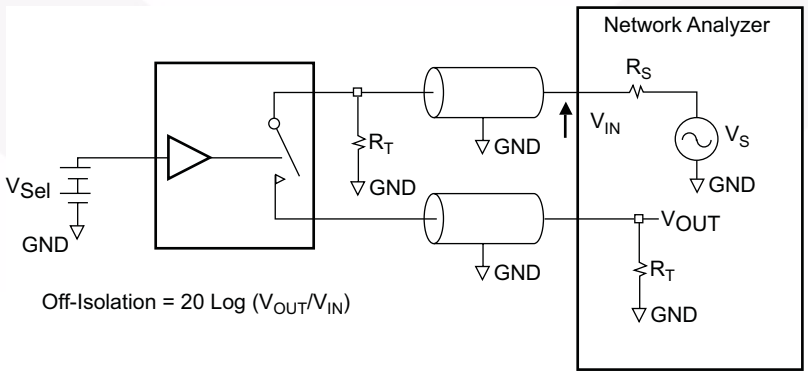


Figure 9. Off Isolation

AC Loading and Waveforms (continued)

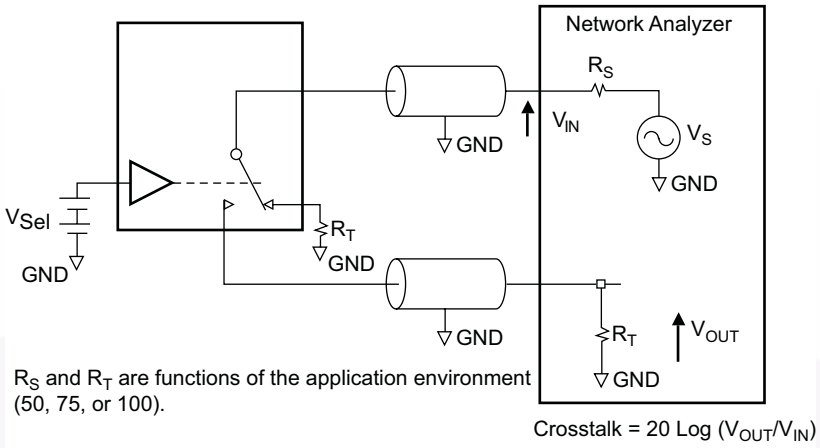


Figure 10. Non-Adjacent Channel-to-Channel Crosstalk

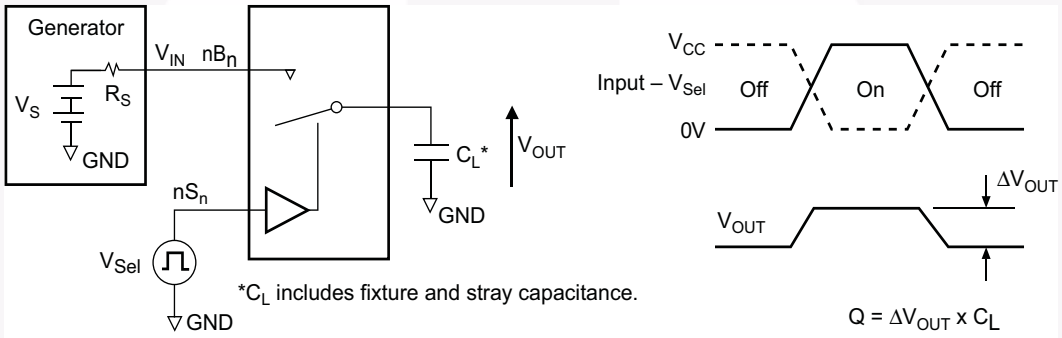


Figure 11. Charge Injection Test

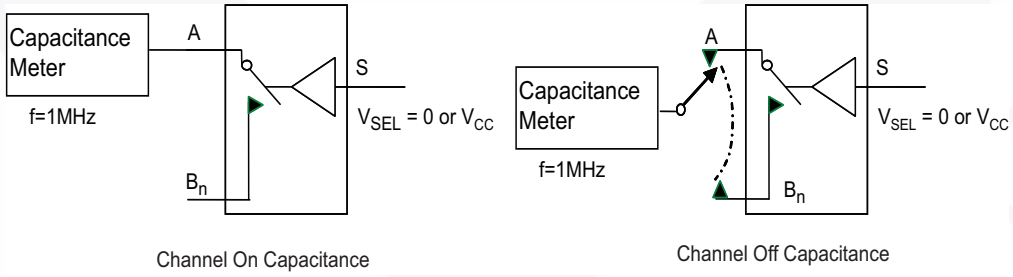


Figure 12. On/Off Capacitance Measurement Setup

AC Loading and Waveforms (continued)

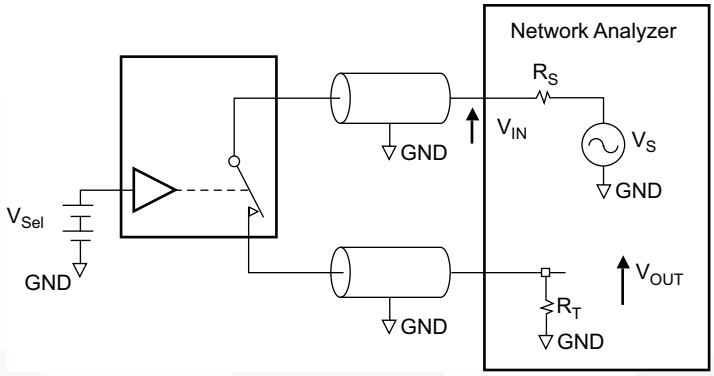


Figure 13. Bandwidth

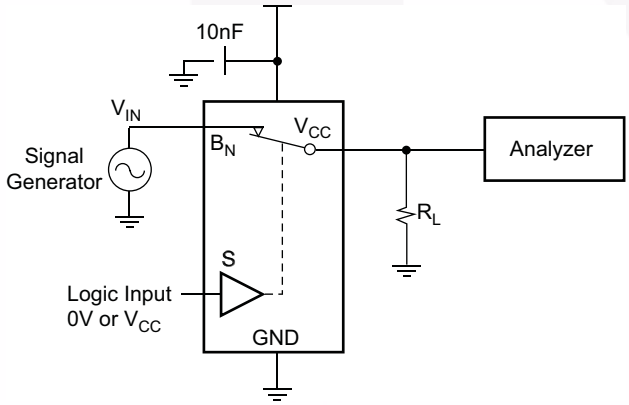


Figure 14. Harmonic Distortion

Physical Dimensions

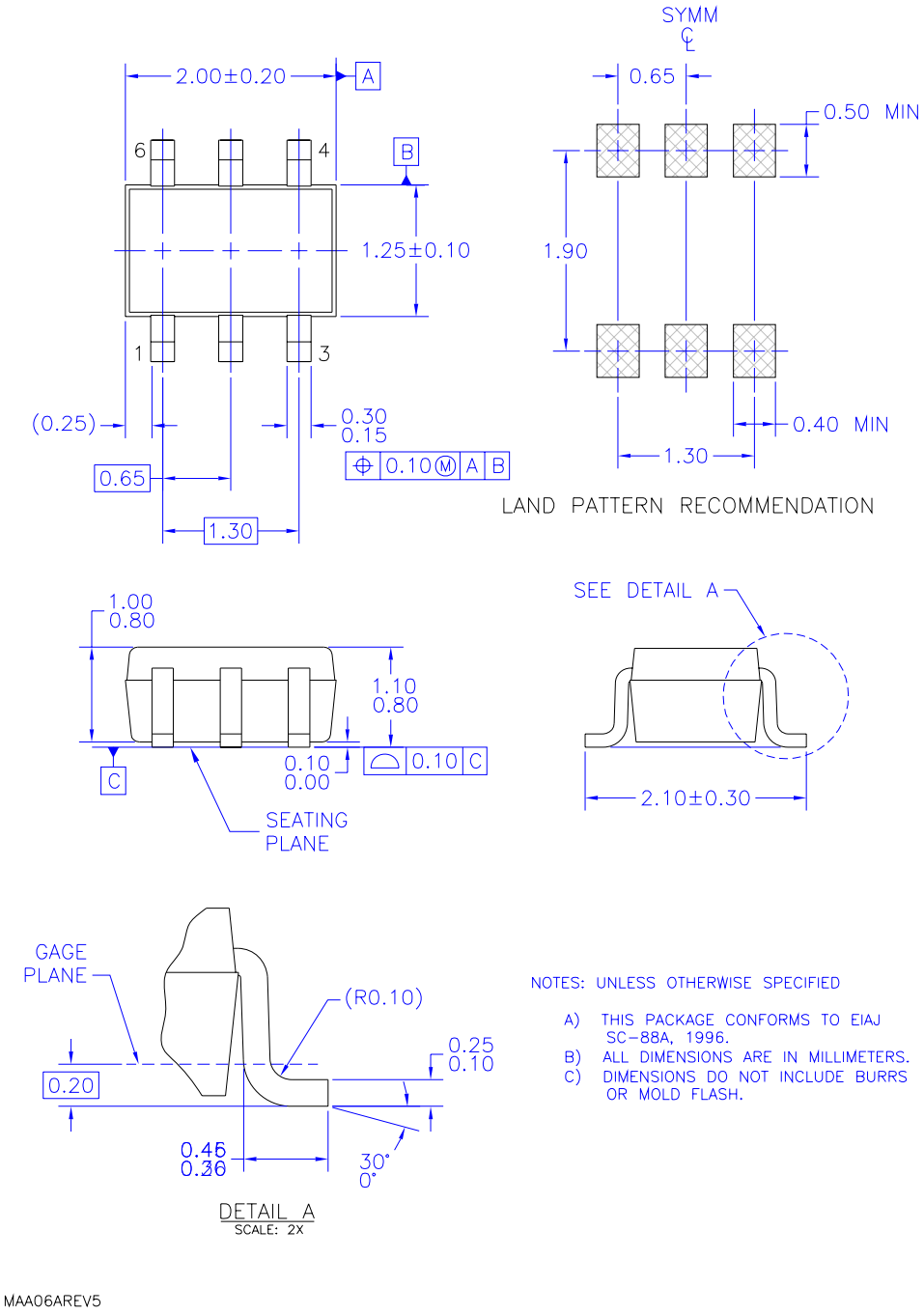


Figure 15. 6-Lead SC70, EIAJ SC88, 1.25mm Wide

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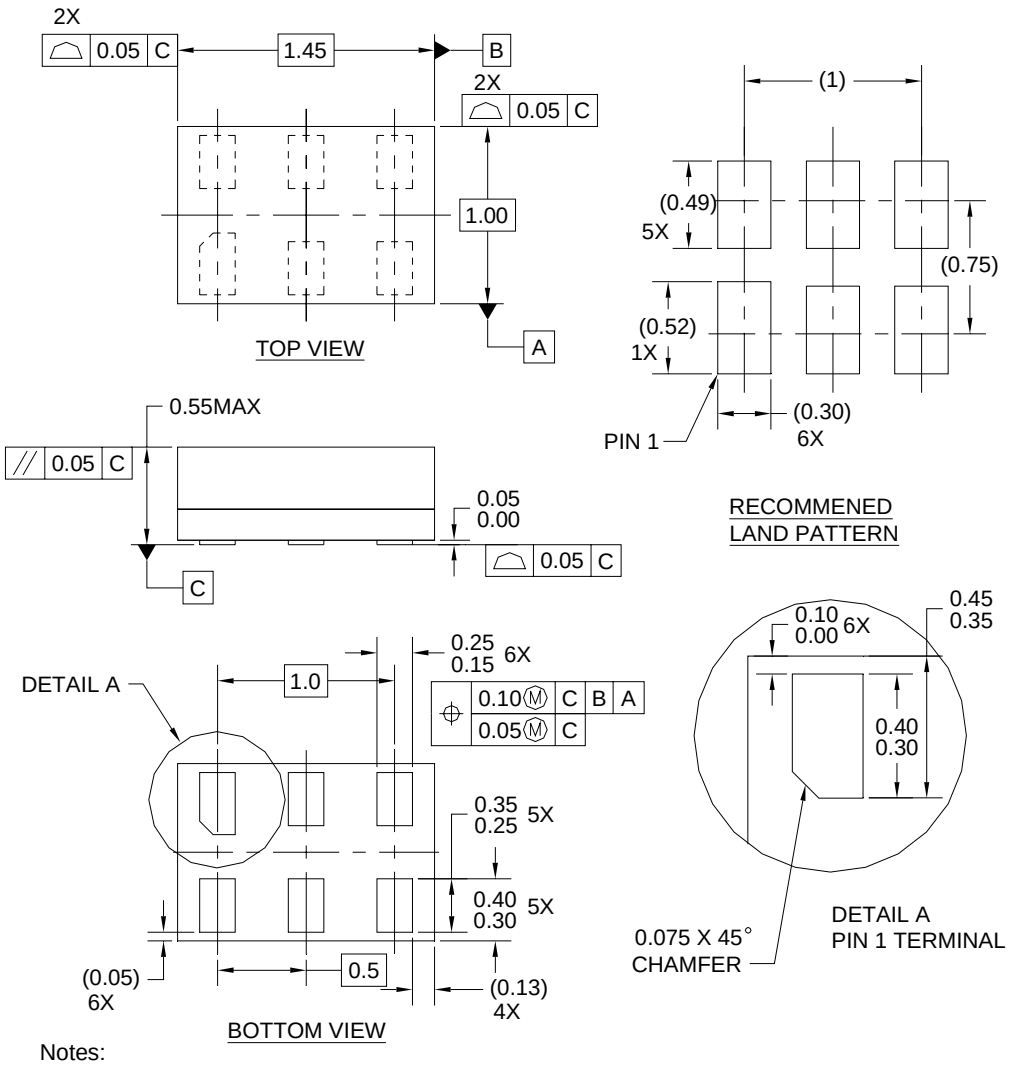
Physical Dimensions



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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

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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.
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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 the design.
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Rev. I33

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