March 2014

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

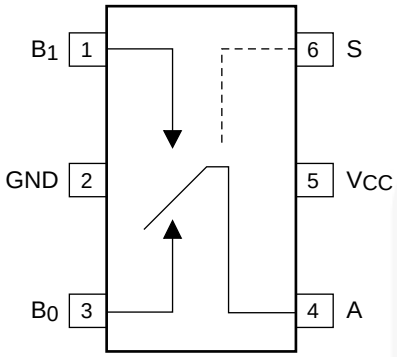
FSA4157 and FSA4157A are high performance Single Pole/Double Throw (SPDT) analog switches. Both devices feature ultra low R_{ON} of 1.15 Ω maximum at 4.5 V V_{CC} and operates over the wide V_{CC} range of 1.65 V to 5.5 V for FSA4157, and 2.7 V to 5.5 V for FSA4157A. The device is fabricated with sub-micron 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

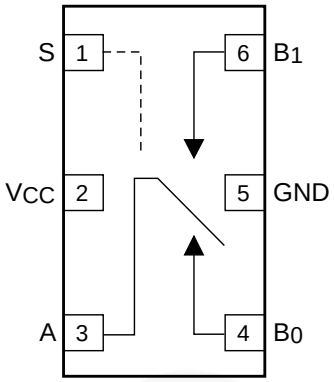
Part Number	Top Mark	Package Description	Packing Method
FSA4157P6X	A57	6-Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 Units Tape and Reel
FSA4157L6X	EG	6-Lead MicroPak,™ 1.0 mm Wide	5000 Units Tape and Reel
FSA4157AP6X	B57	6-Lead SC70, EIAJ SC88, 1.25 mm Wide	3000 Units Tape and Reel
FSA4157AL6X	EU	6-Lead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

Pin Configurations



(Top View)

Figure 1. SC70 Pin Assignments



(Top Through View)

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_I =0 V, 0.75 V,1.5 V	2.7		1.4				Ω
		I_{OUT}=100 mA, B_0 or B_I =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:

3. 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).
4. $\Delta R_{ON} = R_{ON\ max} - R_{ON\ min}$ 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

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	Conditions	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

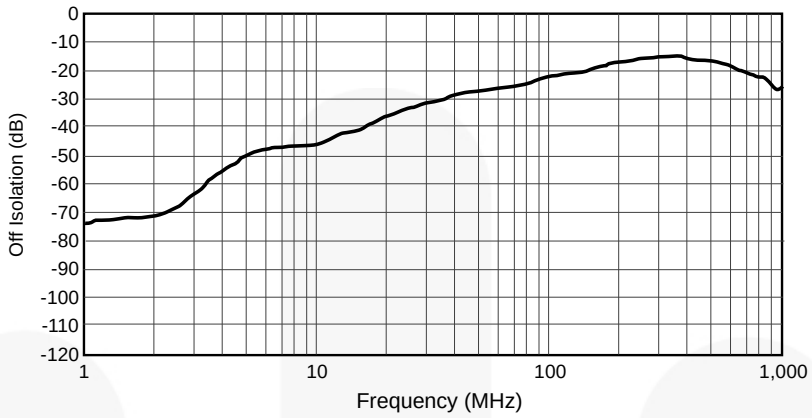


Figure 3. Off Isolation, V_{CC} = 2.7 V to 5.5 V

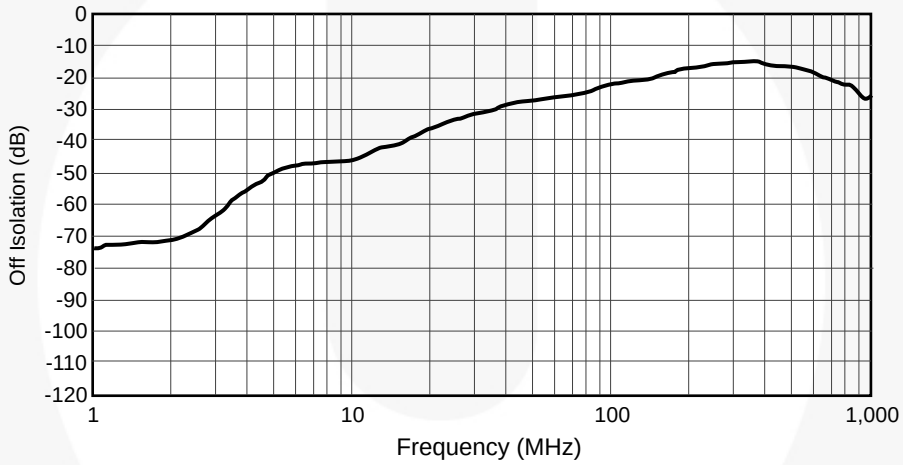
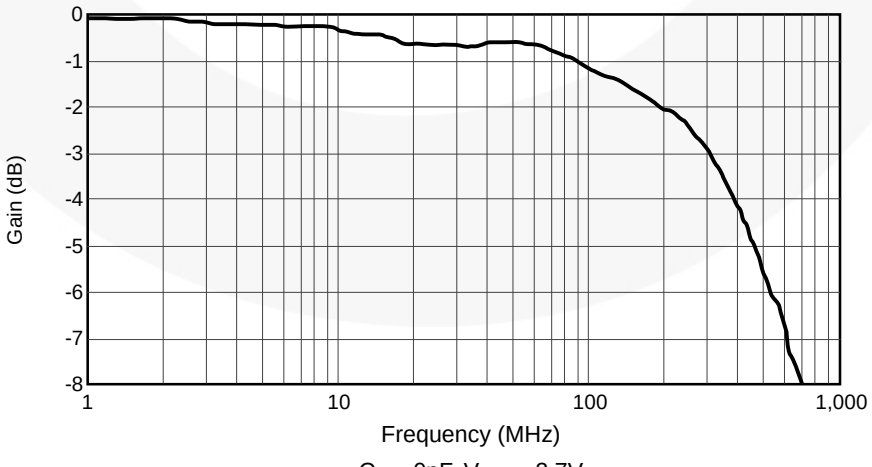


Figure 4. Crosstalk, V_{CC} = 2.7 V to 5.5 V



C_L = 0pF, V_{CC} = 2.7V

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

Typical Performance Characteristics (Continued)

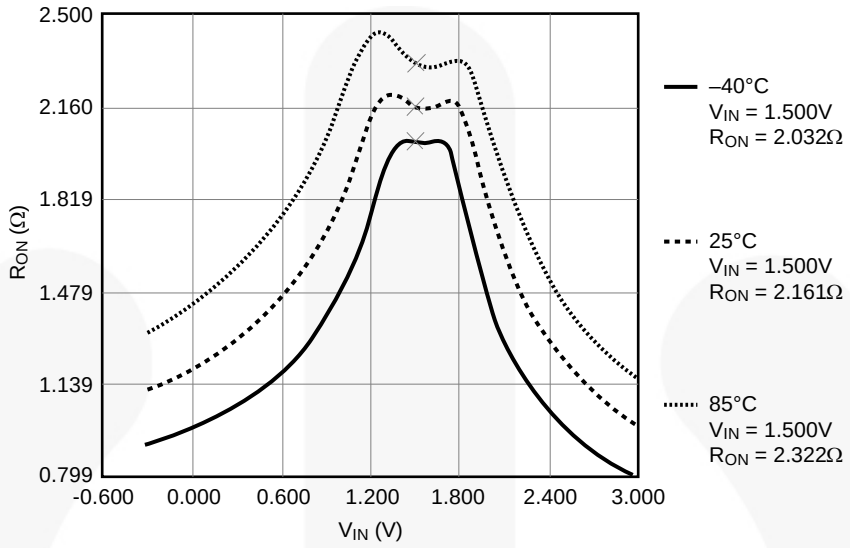


Figure 6. R_{ON} Switch On Resistance, I_{ON} = 100 mA, V_{CC} = 2.7

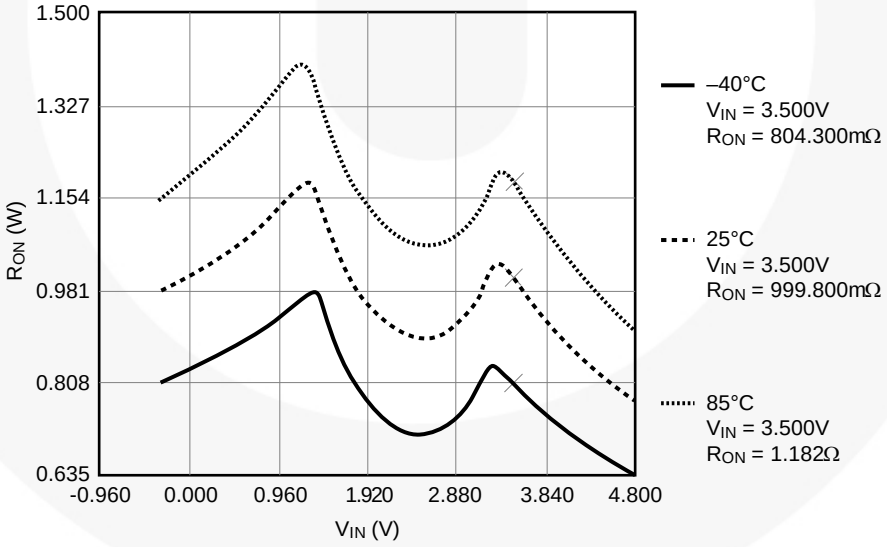
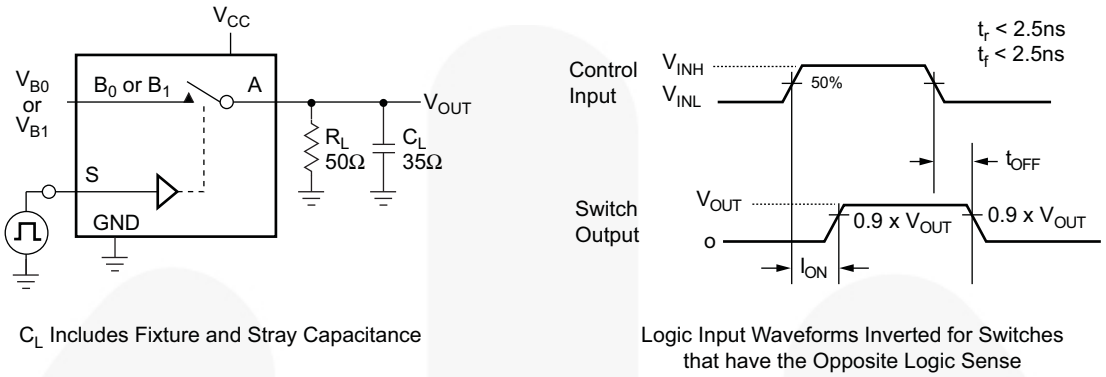


Figure 7. R_{ON} Switch On Resistance, I_{ON} = 100 mA, V_{CC} = 4.5 V

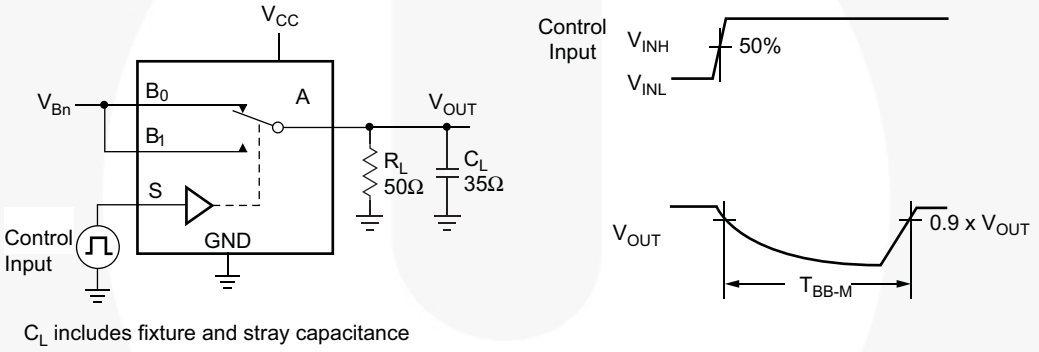
AC Loadings and Waveforms



C_L Includes Fixture and Stray Capacitance

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

Figure 8. Turn On / Off Timing



C_L includes fixture and stray capacitance

Figure 9. Break Before Make Timing

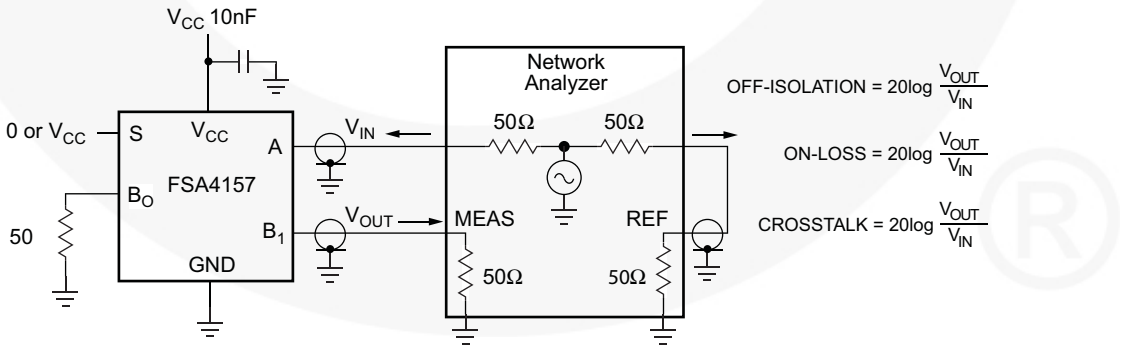


Figure 10. Off Isolation and Crosstalk

AC Loadings and Waveforms (Continued)

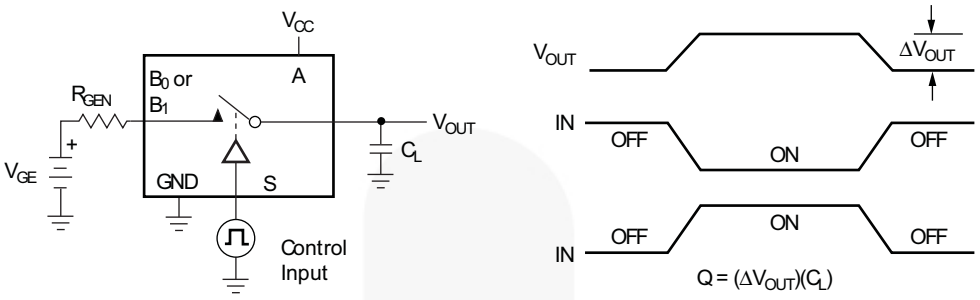


Figure 11. Charge Injection

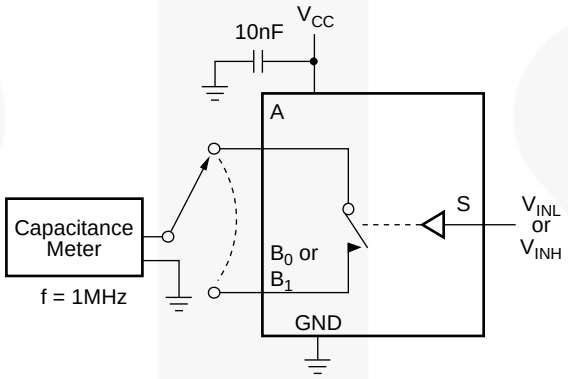


Figure 12. On / Off Capacitance Measurement Setup

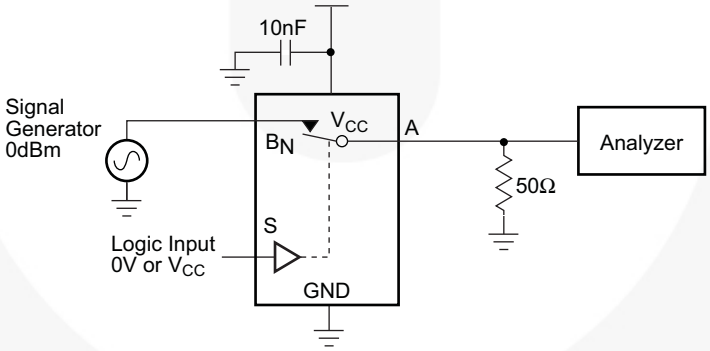


Figure 13. Bandwidth

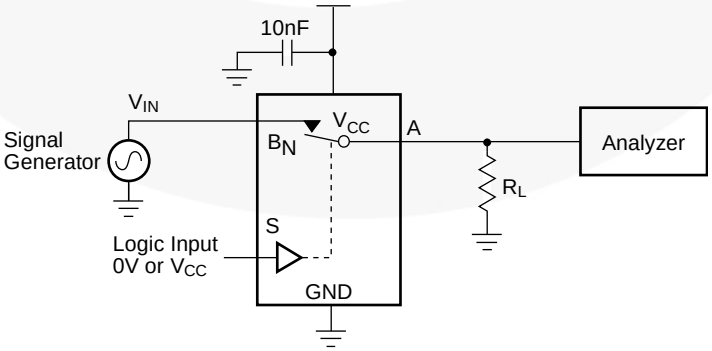
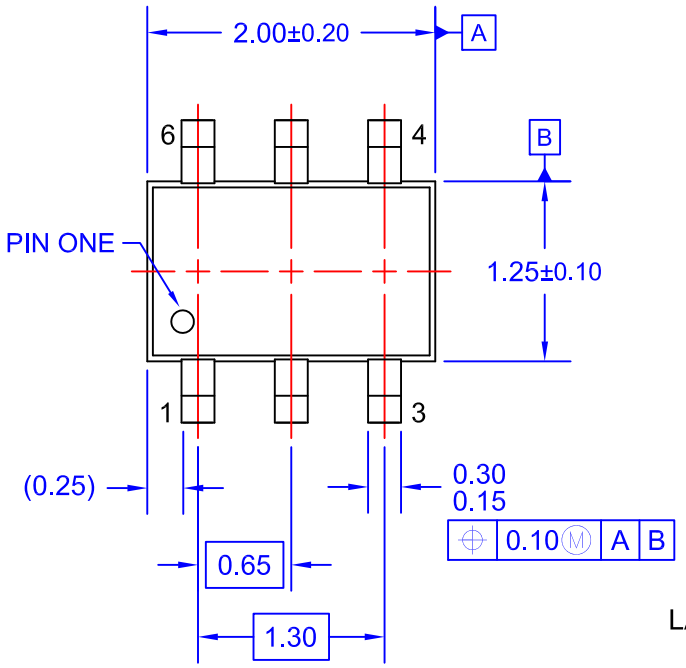
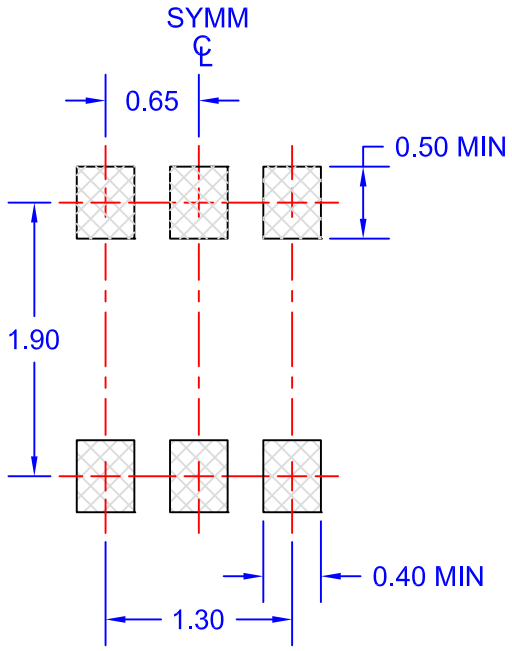
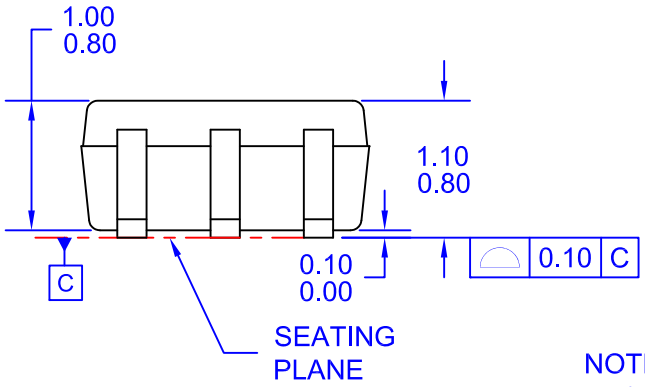


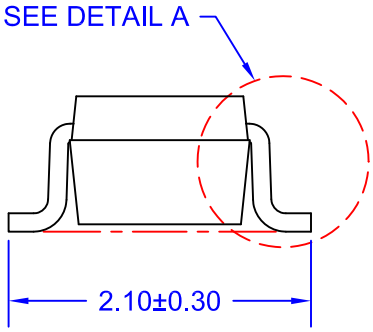
Figure 14. Harmonic Distortion





LAND PATTERN RECOMMENDATION





NOTES: UNLESS OTHERWISE SPECIFIED

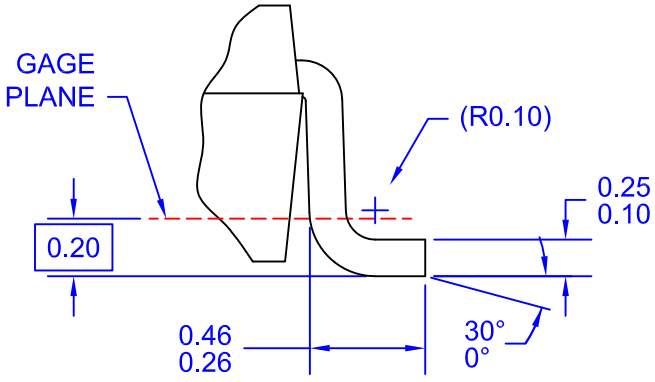
A) THIS PACKAGE CONFORMS TO EIAJ SC-88, 1996.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.

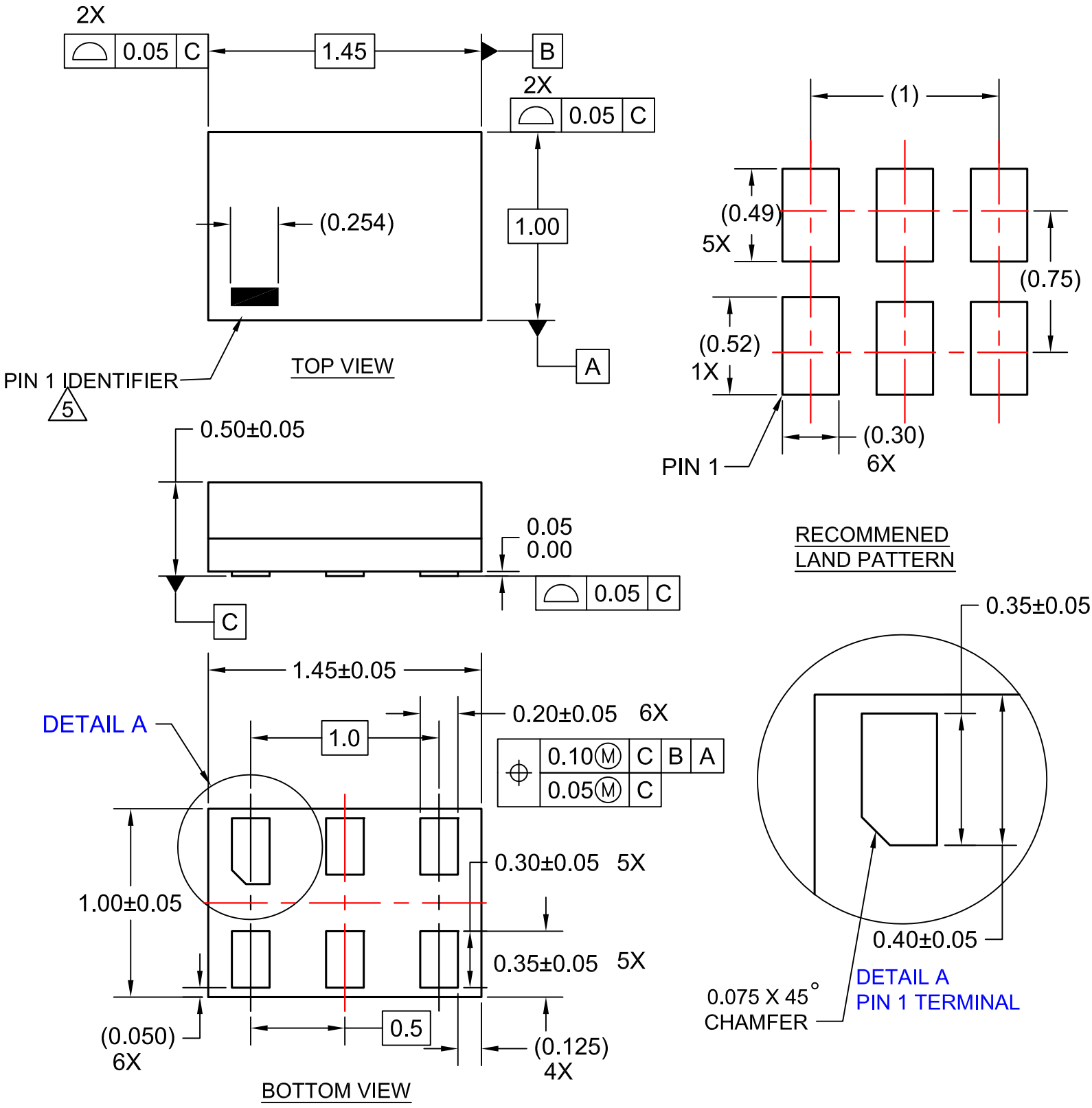
D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009

E) DRAWING FILENAME: MKT-MAA06AREV7



DETAIL A
SCALE: 60X

FAIRCHILD™



NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. LANDPATTERN RECOMMENDATION PER FSC
5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.
6. FILENAME AND REVISION: MAC06AREV6

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PRODUCT STATUS DEFINITIONS

Definition 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.
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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