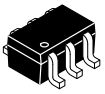
Low-Voltage 0.4 Ω SPDT Analog Switch

FSA5157

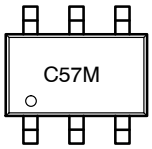
SIP6 1.45 x 1.0
CASE 127EB

MARKING DIAGRAMS

FT = Specific Device Code
KK = 2−Digits Lot Run Traceability Code
XY = 2−Digit Date Code
Z = Assembly Plant Code



SC−88/SC−70
6 Lead, 1.25 x 2
CASE 419AD



C57 = Specific Device Code
M = Assembly Operation Month

*Date Code orientation and/or position may vary depending upon manufacturing location.

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 0.4 Ω impedance, sub−μA current consumption, and 1.65 V to 4.3 V 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 1.8 V, 2.5 V, and 3.3 V.

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 100 μA 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 <12 μA under a worst−case condition of V_{CC} = 4.3 V and V_{IN} = 1.8 V.

Features

- Typical 0.4 Ω On Resistance (R_{ON}) for +2.7 V Supply
- FSA5157 Features Less than 12 μA I_{CCT} Current When S Input is Lower than V_{CC}
- 0.25 Ω Maximum R_{ON} Flatness for +2.7 V Supply
- 1.45 x 1 mm 6−Lead Package
- Broad V_{CC} Operating Range: 1.65 V to 4.3 V
- Low THD (0.02% Typical for 32 Ω Load)
- High−Current Handling Capability (350 mA Continuous Current under 3.3 V Supply)
- Control Logic is 1.8 V CMOS Logic Compatible
- These Devices are Pb−Free and are RoHS Compliant

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

Applications

- Cellular Phone
- PDA
- Portable Media Player

APPLICATION DIAGRAM

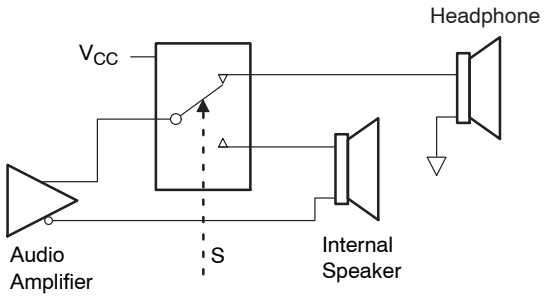


Figure 1. Application Diagram

© Semiconductor Components Industries, LLC, 2006

PIN CONFIGURATIONS

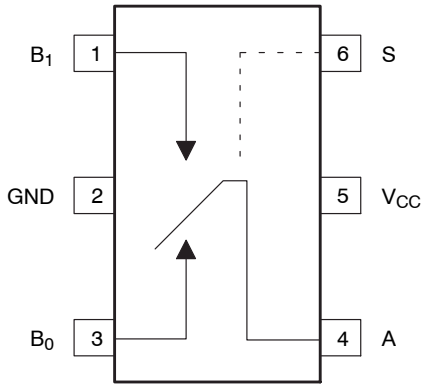


Figure 2. 6−Lead SC70

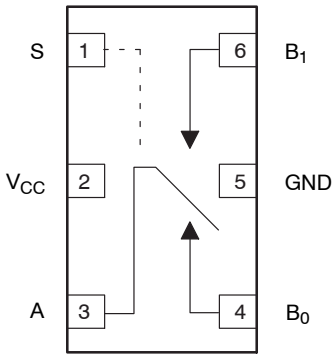


Figure 3. SIP6

PIN DEFINITIONS

Pin Names	Function
A, B_0, B_1	Data Ports
S	Control Input

TRUTH TABLE

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

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	−0.5	5.5	V
V_S	Switch Voltage (Note 1)	−0.5	V_{CC} + 0.3 V	V
V_{IN}	Input Voltage (Note 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 1 ms Duration, < 10% Duty Cycle)		500	mA
P_D	SC70 6L Package		180	mW
	SIP6 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

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The Input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	1.65	4.30	V
V_{IN}	Control Input Voltage (Note 2)	0	V_{CC}	V
V_{IN}	Switch Input Voltage	0	V_{CC}	V
T_A	Operating Temperature	−40	+85	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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		Unit
				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} = 0 V 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 = 0.3 V, V_{CC} −0.3 V, B_0 or B_1 = 0.3 V, V_{CC} −0.3 V or Floating	1.95 to 4.3	−10		10	−50	50	nA
$I_{A(ON)}$	On Leakage Current of Port A	A = 0.3 V, V_{CC} −0.3 V, B_0 or B_1 = 0.3 V, V_{CC} −0.3 V or Floating	1.95 to 4.3	−20		20	−100	100	nA
R_{ON}	Switch On Resistance (Note 3)	I_{OUT} = 100 mA, B_0 or B_1 = 0 V, 0.7 V, 3.6 V, 4.3 V	4.3		0.36			0.60	Ω
		I_{OUT} = 100 mA, B_0 or B_1 = 0 V, 0.7 V, 2.0 V, 2.7 V	2.7		0.4			0.70	
		I_{OUT} = 100 mA, B_0 or B_1 = 0 V, 0.7 V, 2.0 V, 2.3 V	2.3		0.55			0.80	
		I_{OUT} = 100 mA, B_0 or B_1 = 0.7 V	1.65		1.5	2.5		3.0	
ΔR_{ON}	On Resistance Matching Between Channels (Note 4)	I_{OUT} = 100 mA, B_0 or B_1 = 0.7 V	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 Resistance Flatness (Note 5)	I_{OUT} = 100 mA, B_0 or B_1 = 0 V 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} = 0 V 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} = 1.8 V	4.3		7.0	12.0		15.0	μA
		V_{IN} = 2.6 V	4.3		3.0	6.0		7.0	

3. On resistance is determined by the voltage drop between the A an 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		Unit	Figure
				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	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 = 1.5 V, R_L = 50 Ω, C_L = 35 pF	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 = 1.5 V, R_L = 50 Ω, C_L = 35 pF	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} = 0 V, R_{GEN} = 0 Ω	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 = 100 kHz, R_L = 50 Ω, C_L = 5 pF (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 = 100 kHz, R_L = 50 Ω, C_L = 5 pF (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 = 50 Ω	1.65 to 4.3		80				MHz	Figure 13
THD	Total Harmonic Distortion		3.6 to 4.3						%	Figure 14
		R_L = 32 Ω, V_{IN} = 2V_{PP}, f = 20 Hz to 20 kHz	2.7 to 3.6		0.02					
		R_L = 32 Ω, V_{IN} = 1.5V_{PP}, f = 20 Hz to 20 kHz	2.3 to 2.7		0.036					
		R_L = 32 Ω, V_{IN} = 1.2V_{PP}, f = 20 Hz to 20 kHz	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		Unit	Figure
				Min	Typ	Max	Min	Max		
C_{IN}	Control Pin Input Capacitance	f = 1 MHz	0.0		1.5				pF	Figure 12
C_{OFF}	B Port OFF Capacitance	f = 1 MHz	4.5		21.0				pF	Figure 12
C_{ON}	A Port ON Capacitance	f = 1 MHz	4.5		90.0				pF	Figure 12

TYPICAL CHARACTERISTICS

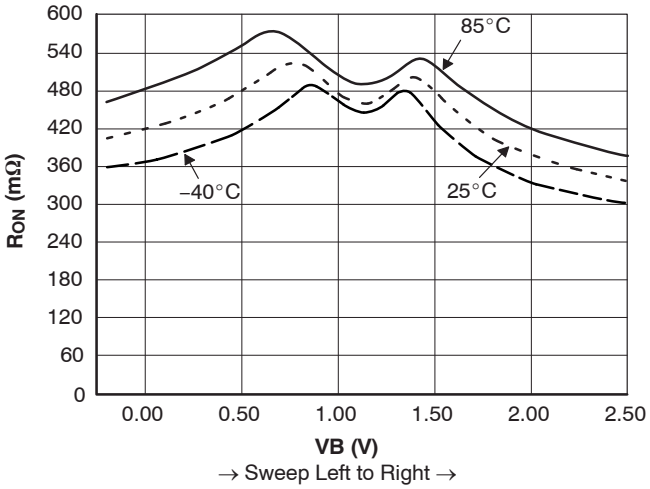


Figure 4. R_{ON} Switch On Resistance, I_{ON} = 100 mA, V_{CC} = 2.3 V B0

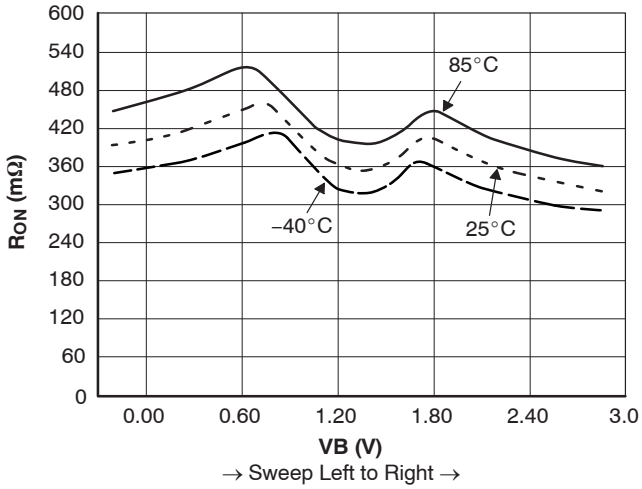


Figure 6. R_{ON} Switch On Resistance, I_{ON} = 100 mA, V_{CC} = 2.7 V B0

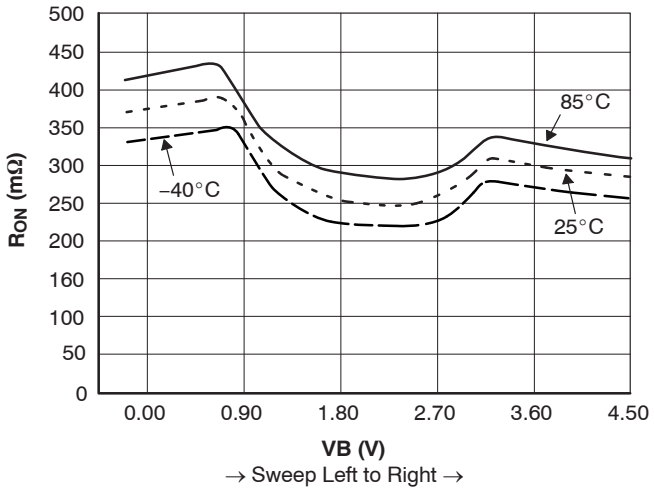
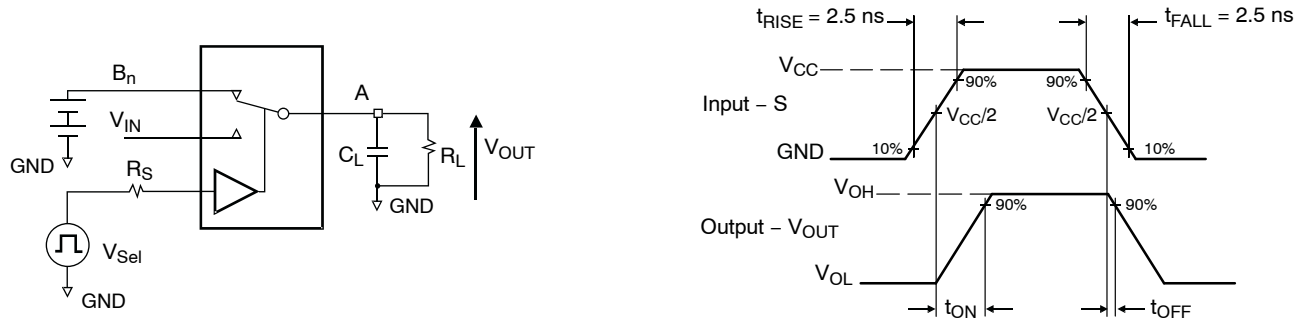


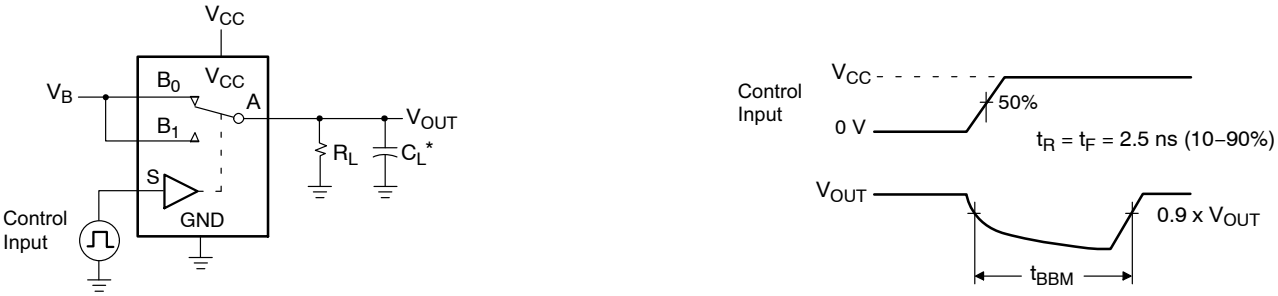
Figure 5. R_{ON} Switch On Resistance, I_{ON} = 100 mA, V_{CC} = 4.3 V B0

AC LOADINGS AND WAVEFORMS



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

Figure 7. Turn−Off Timing



*C_L includes test fixture and stray capacitance.

Figure 8. Break−Before−Make Timing

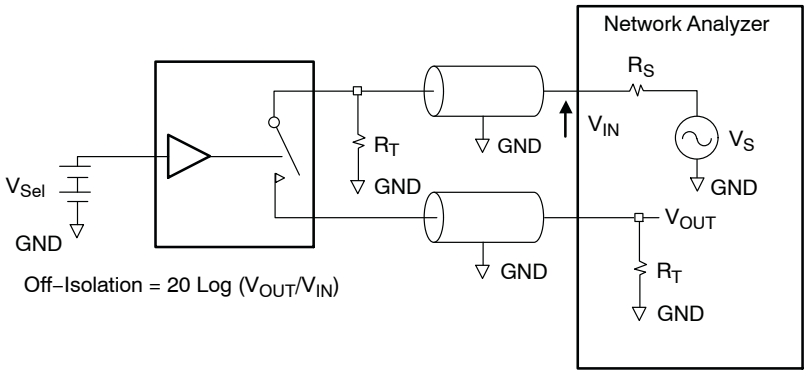
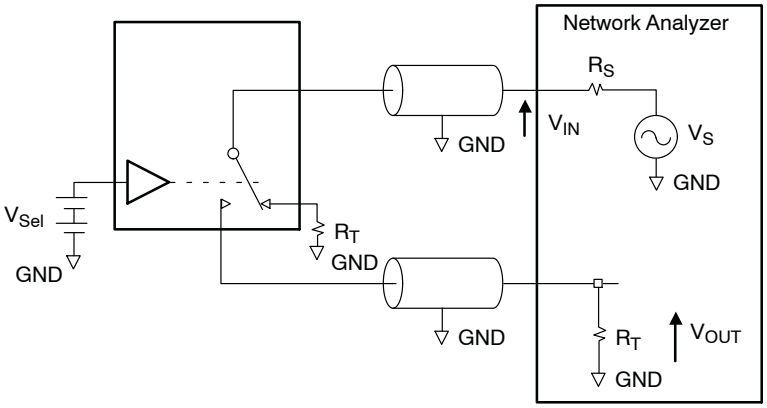


Figure 9. Off Isolation

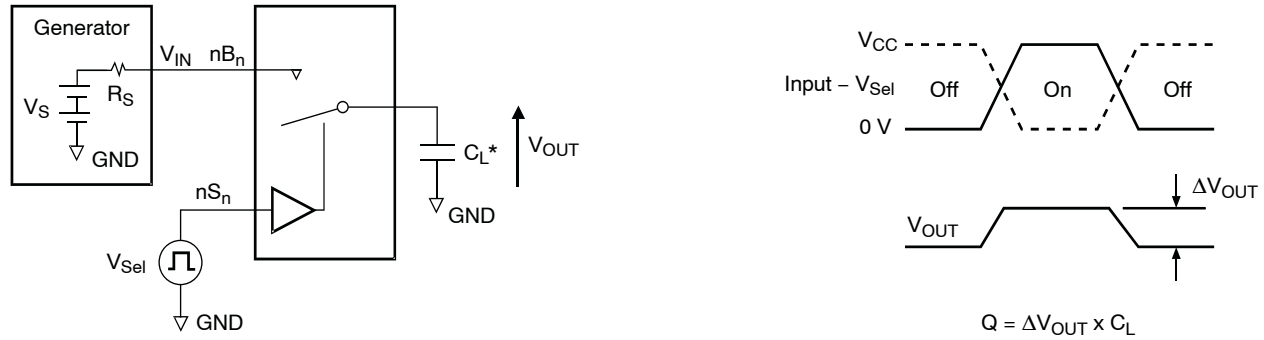
AC LOADINGS AND WAVEFORMS (Continued)



Crosstalk = 20 Log (V_{OUT}/V_{IN})

RS and RT are functions of the application environment (50, 75, or 100).

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



*C_L includes fixture and stray capacitance.

Figure 11. Charge Injection Test

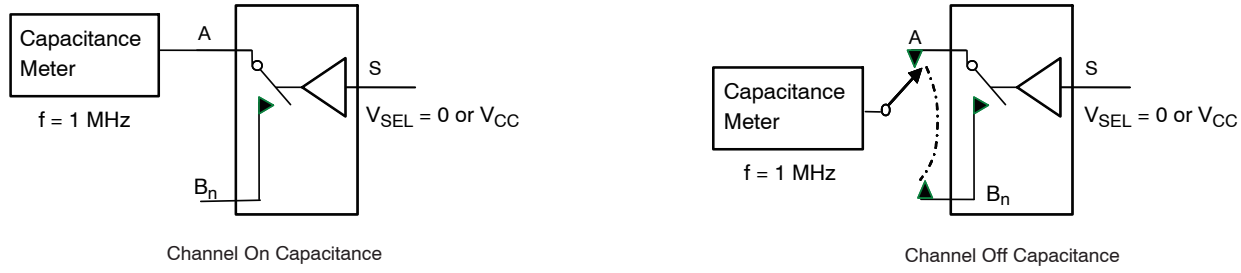


Figure 12. On/Off Capacitance Measurement Setup

AC LOADINGS AND WAVEFORMS (Continued)

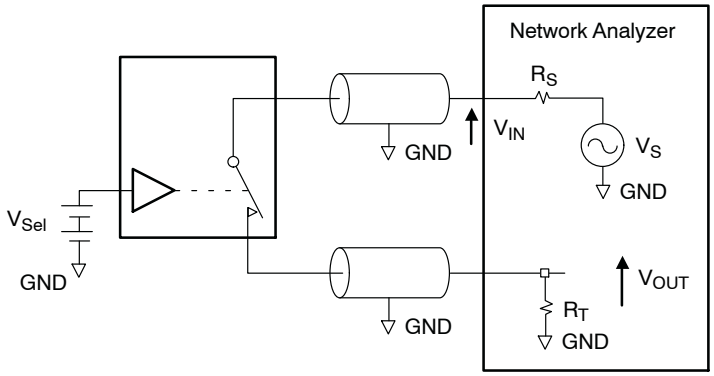


Figure 13. Bandwidth

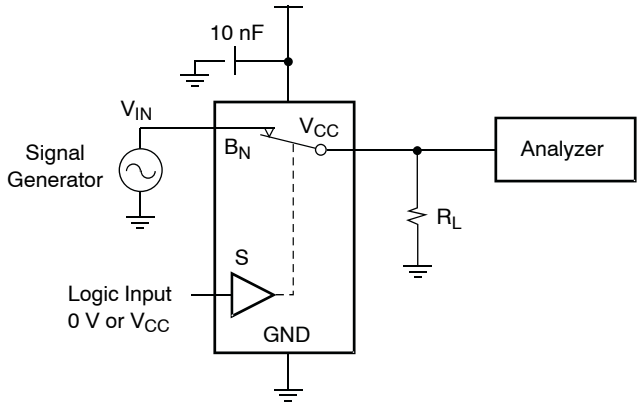


Figure 14. Harmonic Distortion

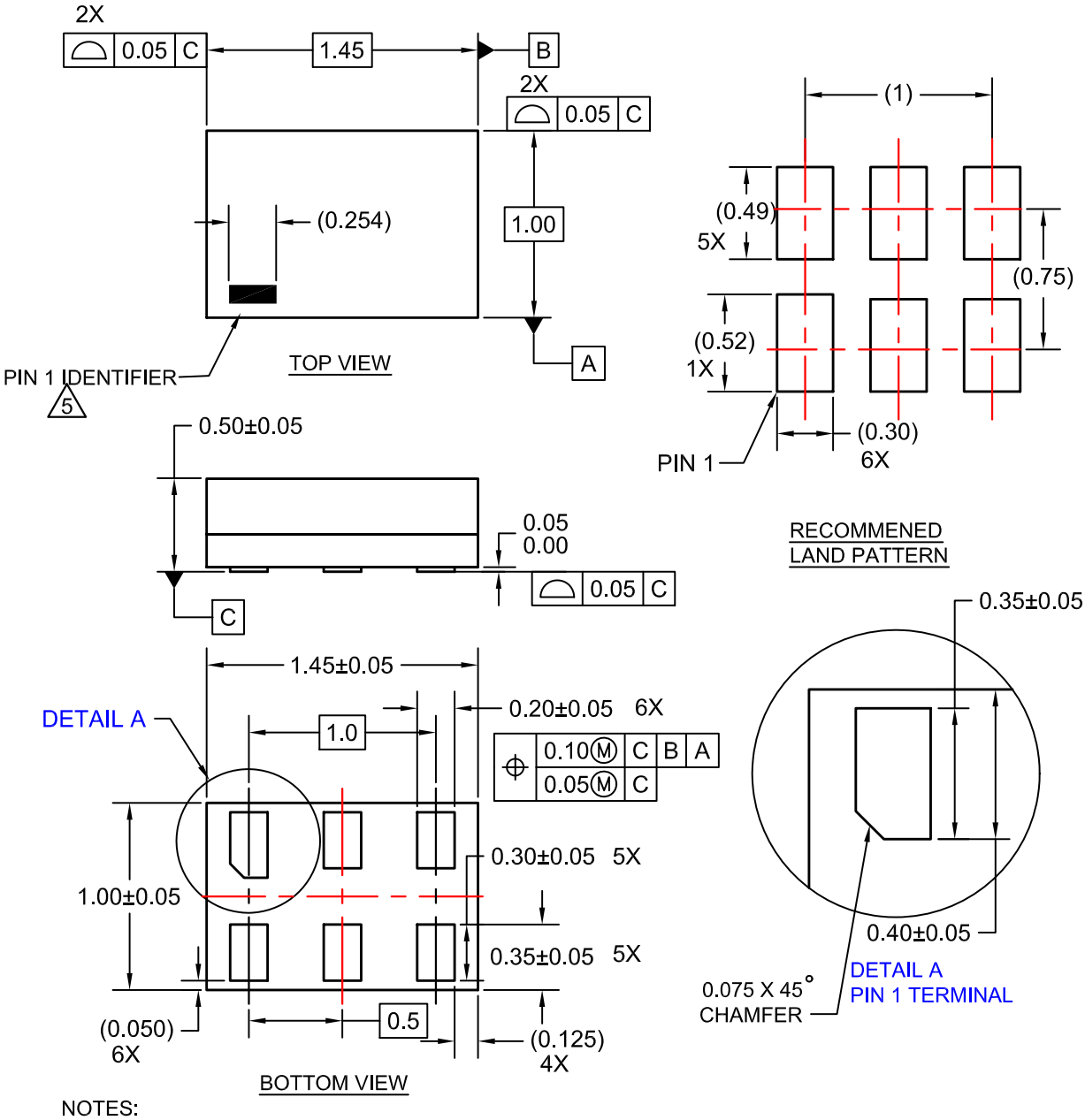
ORDERING INFORMATION

Part Number	Top Mark	Package	Shipping†
FSA5157P6X	C57	SC−88/SC−70 6 Lead, 1.25x2 (Pb−Free)	3000 / Tape & Reel
FSA5157L6X	FT	SIP6 1.45x1.0 (Pb−Free)	5000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

SIP6 1.45X1.0
CASE 127EB
ISSUE O

DATE 31 AUG 2016

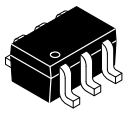


NOTES:

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

DOCUMENT NUMBER:	**98AON13590G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**SIP6 1.45X1.0**	**PAGE 1 OF 1**

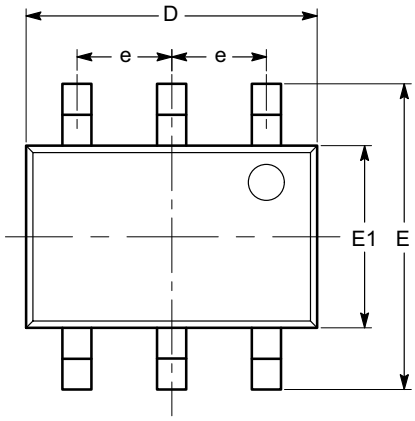
onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.



1

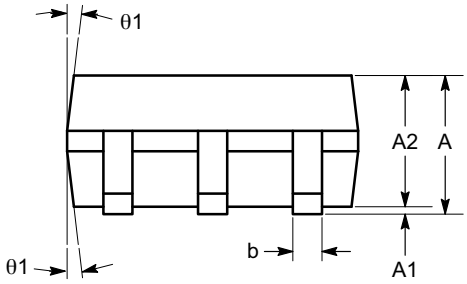
SC−88 (SC−70 6 Lead), 1.25x2
CASE 419AD
ISSUE A

DATE 07 JUL 2010

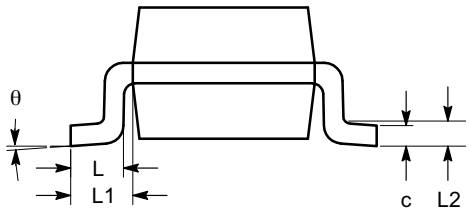


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	0.80		1.10
A1	0.00		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80	2.00	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e		0.65 BSC	
L	0.26	0.36	0.46
L1		0.42 REF	
L2		0.15 BSC	
θ	0°		8°
θ1	4°		10°



SIDE VIEW



END VIEW

Notes:
(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MO-203.

DOCUMENT NUMBER:	**98AON34266E**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	**SC−88 (SC−70 6 LEAD), 1.25X2**	**PAGE 1 OF 1**

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

© Semiconductor Components Industries, LLC, 2008

onsemi, ONSEMI , and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as−is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales