

# Low- $R_{ON}$ , Low-Voltage SPST Analog Switch

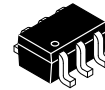
## FSA1156, FSA1157

### Description

The FSA1156 and FSA1157 are high-performance Single-Pole / Single-Throw (SPST) analog switches. The devices feature ultra-low  $R_{ON}$  of 0.75  $\Omega$  (typical) and operate over a wide  $V_{CC}$  range of 1.65 V to 5.5 V. The devices are fabricated with sub-micron CMOS technology to achieve fast switching speeds. The select input is TTL-level compatible. The FSA1156 has normally open operation; the FSA1157 has normally closed operation.

### Features

- Maximum 0.95  $\Omega$   $R_{ON}$  for 4.5 V Supply at 25°C
- 0.3  $\Omega$  Maximum  $R_{ON}$  Flatness at 4.5 V Supply
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Fast Turn-On and Turn-Off Time
- Over-Voltage Tolerant, TTL-Compatible Control Input
- Available in Space-saving 6-lead, MicroPak™ and SC70 Packages
- These Devices are Pb-Free and are RoHS Compliant

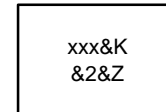


SC-88 (SC-70 6 Lead), 1.25x2  
 CASE 419AD



SIP6 1.45X1.0  
 CASE 127EB

### MARKING DIAGRAM



- xxx = Specific Device Code (156, EH, or 157)
- &K = 2-Digits Lot Run Traceability Code
- &2 = 2-Digit Date Code
- &Z = Assembly Plant Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FSA1156, FSA1157

## ORDERING INFORMATION

Part Number	Top Mark	Package	Shipping†
FSA1156P6X	156	SC-88 (SC-70 6 Lead), 1.25x2 (Pb-Free)	3000 / Tape & Reel
FSA1156L6X	EH	SIP6 1.45X1.0 (Pb-Free)	5000 / Tape & Reel
FSA1157P6X	157	SC-88 (SC-70 6 Lead), 1.25x2 (Pb-Free)	3000 / 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.

## PIN CONFIGURATIONS

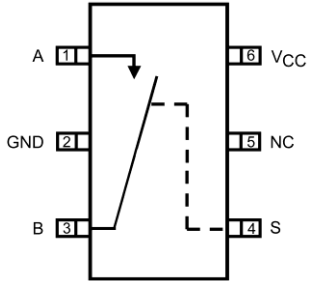


Figure 1. FSA1156 SC70 Top View (Normally Open)

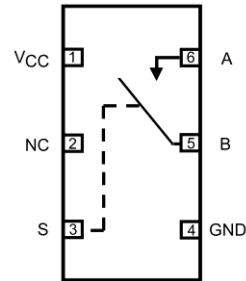


Figure 2. FSA1156 MicroPak Top Through View (Normally Open)

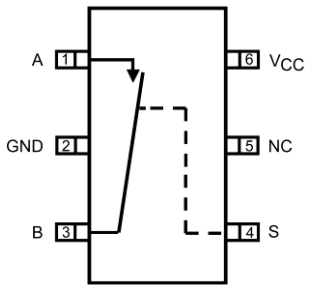


Figure 3. FSA1156 SC70 Top View (Normally Open)

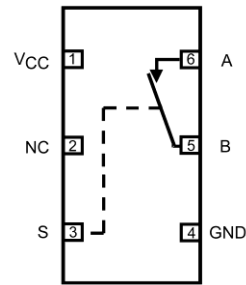


Figure 4. FSA1157 MicroPak Top Through View (Normally Open)

## PIN DEFINITIONS

Pin# SC70	Pin# Micropak	Name	Description
1	6	A	Data Ports
2	4	GND	Ground
3	5	B	Data Ports
4	3	S	Control Input
5	2	NC	No Connect
6	1	VCC	Supply Voltage

## TRUTH TABLE

Control Input (S)	FSA1156	FSA1157
Low	OFF	ON
High	ON	OFF

# FSA1156, FSA1157

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Unit	
V <sub>CC</sub>	Supply Voltage	-0.5	6.0	V	
V <sub>SW</sub>	Switch Voltage (Note 1)	-0.5	V <sub>CC</sub> + 0.5	V	
V <sub>IN</sub>	Input Voltage (Note 1)	-0.5	6.0	V	
I <sub>IK</sub>	Input Diode Current		-50	mA	
I <sub>SW</sub>	Switch Current		200	mA	
I <sub>SWPEAK</sub>	Peak Switch Current (Pulse at 1 ms Duration, < 10% Duty Cycle)		400	mA	
P <sub>D</sub>	Power Dissipation at 85°C, SC70 Package		180	mW	
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	Electrostatic Discharge Capability	Human Body Model, JESD22-A114		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. Input and output negative ratings may be exceeded if input and output diode current ratings are observed.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	1.65	5.50	V
V <sub>CNTRL</sub>	Control Input Voltage (Note 2)	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 Package		350	°C/W

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. Control input must be held HIGH or LOW and it must not float.

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## DC ELECTRICAL CHARACTERISTICS (Typical values are at 25°C unless otherwise specified.)

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Ambient Temperature (T <sub>A</sub> )					Units
				+25°C			-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		2.7 to 3.6					0.6	V
			4.5 to 5.5					0.8	
I <sub>IN</sub>	Control Input Leakage	V <sub>IN</sub> = 0 V 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	A = 1 V, 4.5 V, B = 4.5 V, 1 V	5.5	-2		2	20	20	nA
I <sub>A(ON)</sub>	On Leakage Current	A = 1 V, 4.5 V, B = 1 V, 4.5 V, or Floating	5.5	-4		4	-40	40	nA
R <sub>ON</sub>	Switch On Resistance (Note 3)	I <sub>OUT</sub> = 100 mA, B = 1.5 V	2.7		1.4	2.1		2.5	Ω
		I <sub>OUT</sub> = 100 mA, B = 3.5 V	4.5		0.75	0.90		1.00	
R <sub>FLAT(ON)</sub>	On Resistance Flatness (Note 4)	I <sub>OUT</sub> = 100 mA, B <sub>0</sub> = 0 V, 0.75 V, 1.5 V	2.7		0.6				Ω
		I <sub>OUT</sub> = 100 mA, B <sub>0</sub> = 0 V, 1 V, 2 V	4.5		0.1	0.2		0.3	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = 0 V or V <sub>CC</sub> , I <sub>OUT</sub> = 0 V	3.6		0.1	0.5		1.0	μA
			5.5		0.1	0.5		1.0	

3. On resistance is determined by the voltage drop between the A and B pins at the indicated current through the switch.

4. 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 (T <sub>A</sub> )					Units	Figure
				+25°C			-40 to +85°C			
				Min.	Typ.	Max.	Min.	Max.		
t <sub>ON</sub>	Turn-On Time	B = 1.5 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF	2.7 to 3.6		30	40		45	ns	Figure 7
		B = 3.0 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF	4.5 to 5.5		15	20		25		
t <sub>OFF</sub>	Turn-Off Time	B = 1.5 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF	2.7 to 3.6		25	35		45	ns	Figure 7
		B = 3.0 V, R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF	4.5 to 5.5		22	30		40		
Q	Charge Injection	C <sub>L</sub> = 1.0 nF, V <sub>GE</sub> = 0 V, R <sub>GEN</sub> = 0 Ω	2.7 to 3.6		10				pC	Figure 8
			4.5 to 5.5		20					
OIRR	Off Isolation	f = 1 MHz, R <sub>L</sub> = 50 Ω	2.7 to 3.6		-65				dB	Figure 9
			4.5 to 5.5		-65					
BW	-3db Bandwidth	R <sub>L</sub> = 50 Ω	2.7 to 3.6		300				MHz	Figure 10
			4.5 to 5.5		300					
THD	Total Harmonic Distortion	R <sub>L</sub> = 600 Ω, V <sub>IN</sub> = 0.5 V <sub>PP</sub> , f = 20 Hz to 20 kHz	2.7 to 3.6		0.001				%	Figure 11
			4.5 to 5.5		0.001					

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## CAPACITANCE

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Ambient Temperature +25°C			Units	Figure
				Min.	Typ.	Max.		
C <sub>IN</sub>	Control Pin Input Capacitance	f = 1 MHz	0.0		3		pF	Figure 12
C <sub>OFF</sub>	B Port Off Capacitance	f = 1 MHz	4.5		20		pF	Figure 12
C <sub>ON</sub>	On Capacitance	f = 1 MHz	4.5		65		pF	Figure 12

# FSA1156, FSA1157

## TYPICAL PERFORMANCE CHARACTERISTICS

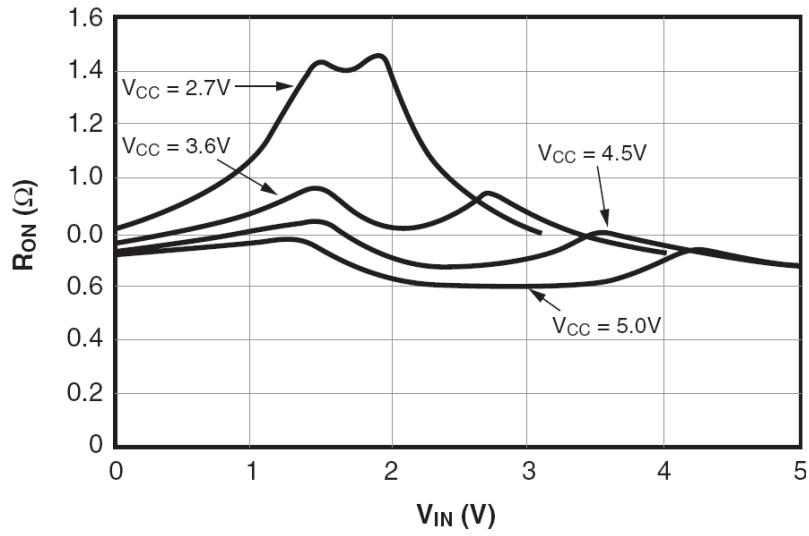


Figure 5. On Resistance vs. Input Voltage, Over Supply Voltage,  $T_A = 25^\circ\text{C}$

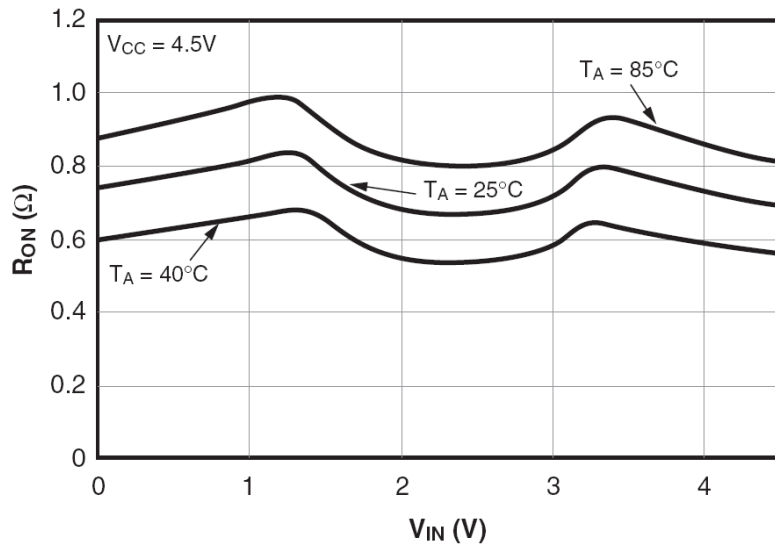
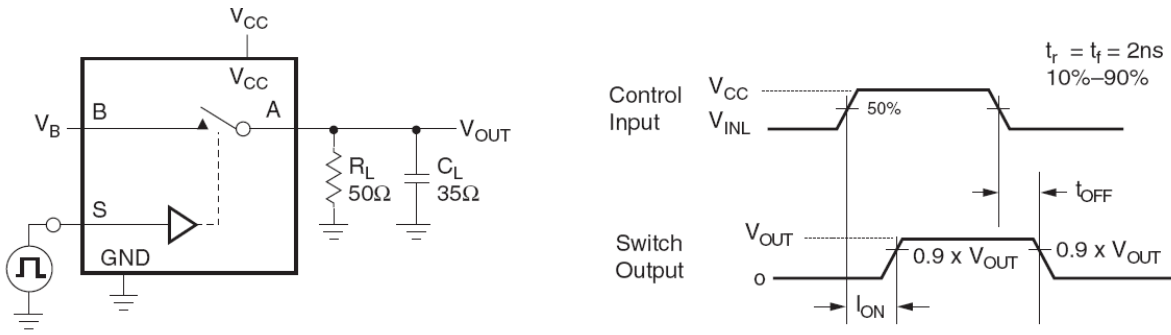


Figure 6. On Resistance vs. Input Voltage, Over Temperature

AC LOADINGS AND WAVEFORMS



$C_L$  Includes Fixture and Stray Capacitance

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

Figure 7. Turn On / Off Timing

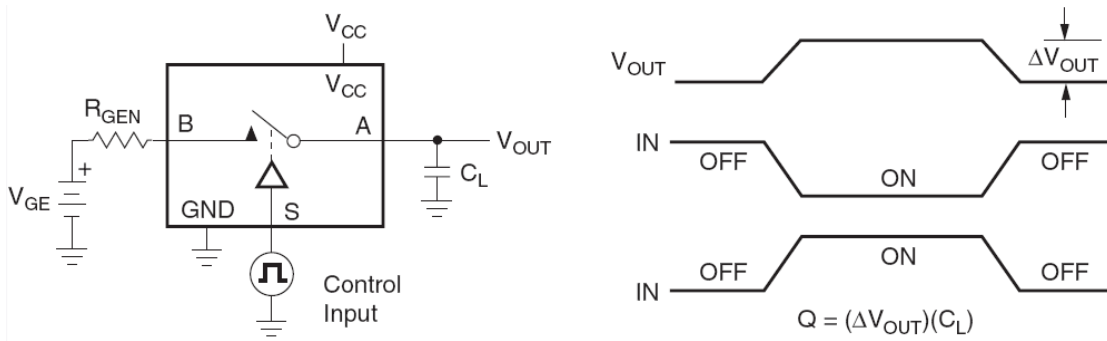


Figure 8. Charge Injection

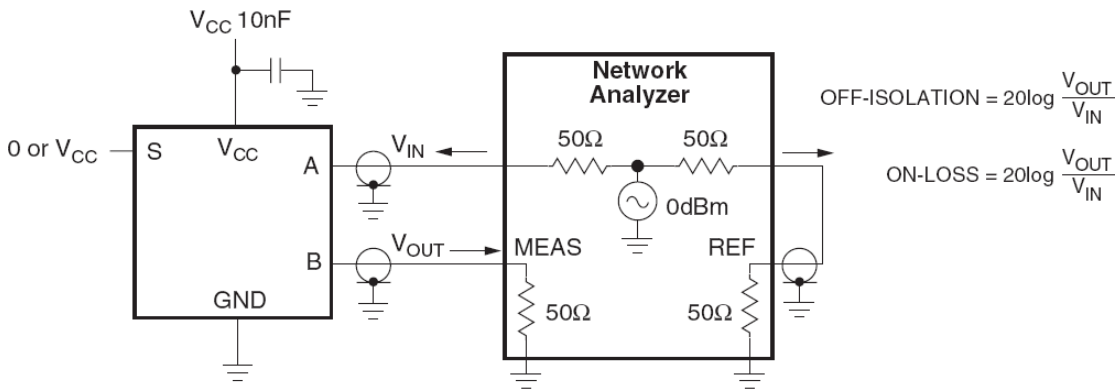


Figure 9. Off Isolation

# FSA1156, FSA1157

## AC LOADINGS AND WAVEFORMS (Continued)

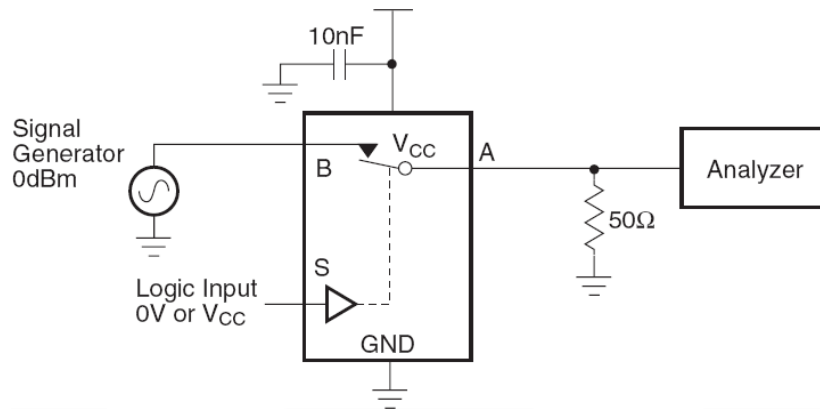


Figure 10. Bandwidth

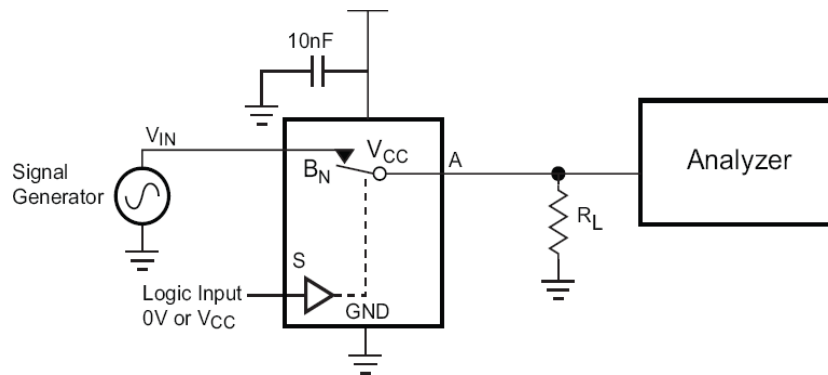


Figure 11. Harmonic Distortion

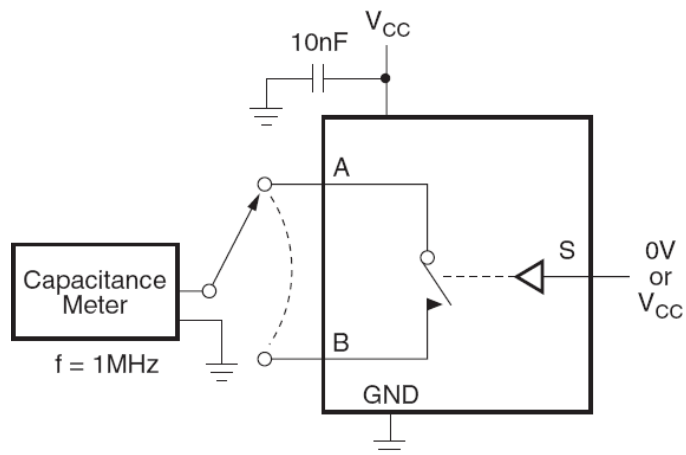


Figure 12. On / Off Capacitance

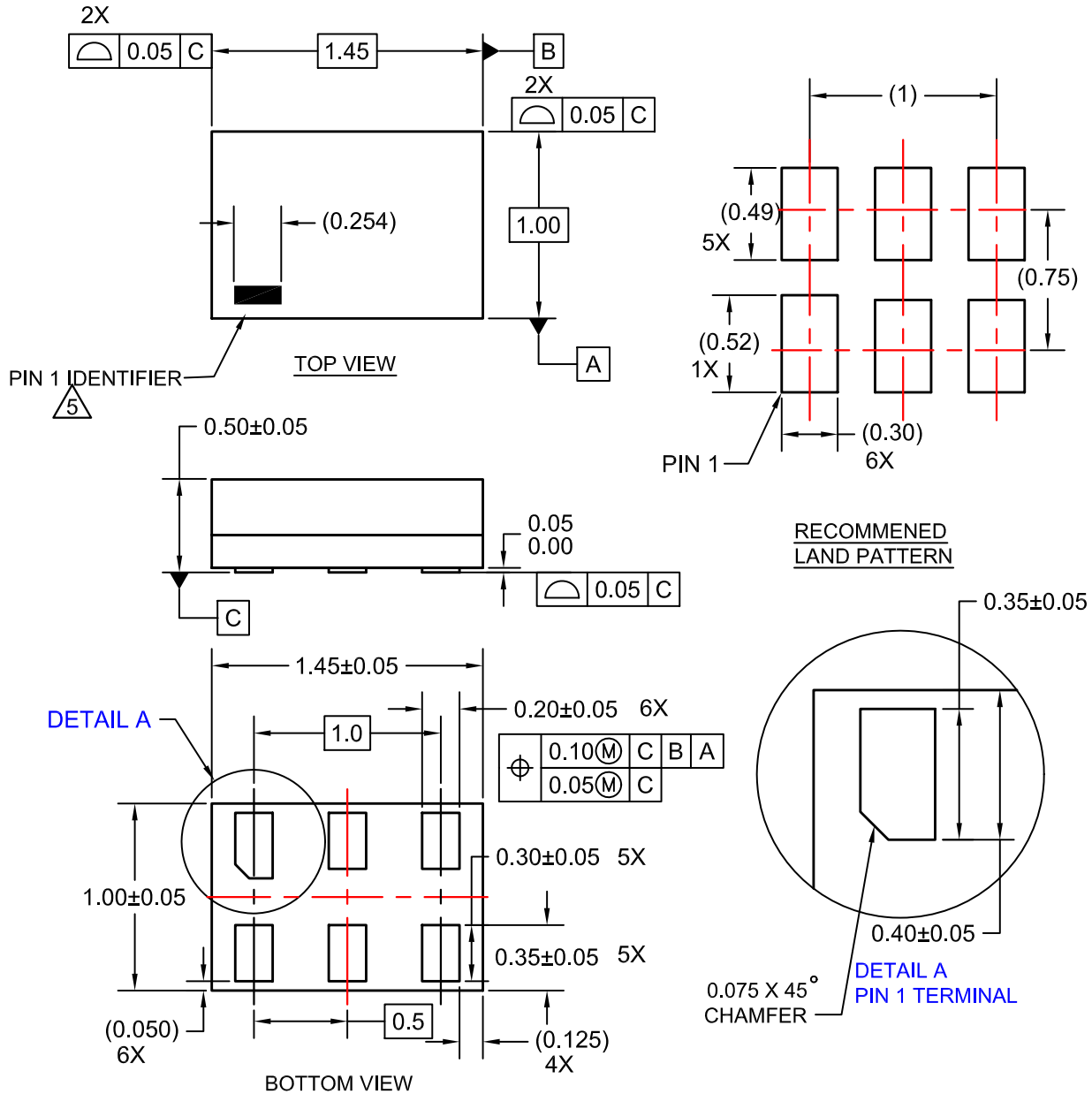
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**SIP6 1.45X1.0**  
CASE 127EB  
ISSUE O

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.

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# MECHANICAL CASE OUTLINE

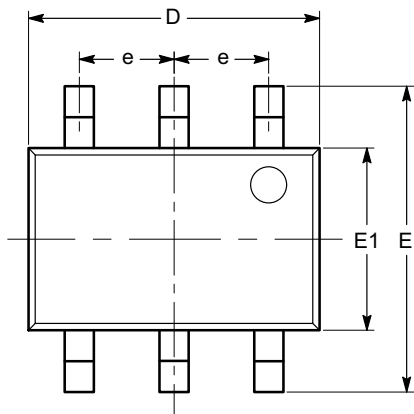
## PACKAGE DIMENSIONS

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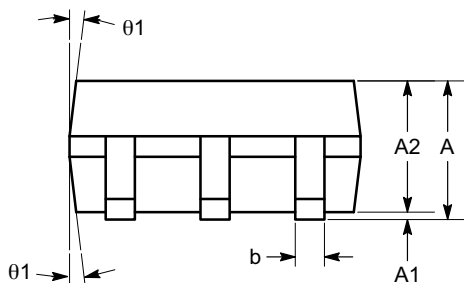
SC-88 (SC-70 6 Lead), 1.25x2  
CASE 419AD-01  
ISSUE A

DATE 07 JUL 2010

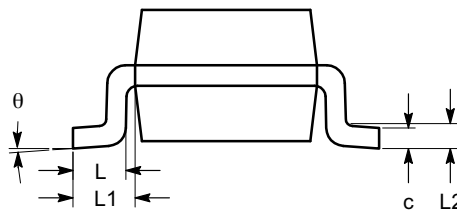


TOP VIEW

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		
$\theta$	0°		8°
$\theta_1$	4°		10°



SIDE VIEW



END VIEW

**Notes:**

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

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