

# Low-Voltage, 1 $\Omega$ SPDT Analog Switch

## FSA4157, FSA4157A

### Description

FSA4157 and FSA4157A are high performance Single Pole/Double Throw (SPDT) analog switches. Both devices feature ultra low  $R_{ON}$  of 1.15  $\Omega$  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.

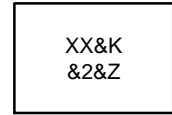
### Features

- FSA4157A Features Lower  $I_{CC}$  when the S Input is Lower than  $V_{CC}$
- Maximum 1.15  $\Omega$  On Resistance ( $R_{ON}$ ) at 4.5 V  $V_{CC}$
- 0.3  $\Omega$  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
- These Devices are Pb-Free and are RoHS Compliant

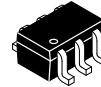


SIP6 1.45X1.0  
CASE 127EB

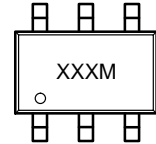
### MARKING DIAGRAMS



- XX = Specific Device Code (EG, EU)
- &K = 2-Digits Lot Run Traceability Code
- &2 = 2-Digit Date Code
- &Z = Assembly Plant Code



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



- XXX = Specific Device Code (A57, B57)
- M = Assembly Operation Month

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

### ORDERING INFORMATION

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

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 2.

# FSA4157, FSA4157A

## ORDERING INFORMATION

| Part Number | Top Mark | Package                                | Shipping†          |
|-------------|----------|----------------------------------------|--------------------|
| FSA4157P6X  | A57      | SC-88 (SC-70 6 Lead), 1.25x2 (Pb-Free) | 3000 / Tape & Reel |
| FSA4157AP6X | B57      | SC-88 (SC-70 6 Lead), 1.25x2 (Pb-Free) | 3000 / Tape & Reel |

## DISCONTINUED (Note 1)

|             |    |                         |                    |
|-------------|----|-------------------------|--------------------|
| FSA4157L6X  | EG | SIP6 1.45X1.0 (Pb-Free) | 5000 / Tape & Reel |
| FSA4157AL6X | EU | 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.

- DISCONTINUED:** These devices are not recommended for new design. Please contact your onsemi representative for information. The most current information on these devices may be available on [www.onsemi.com](http://www.onsemi.com).

## PIN CONFIGURATIONS

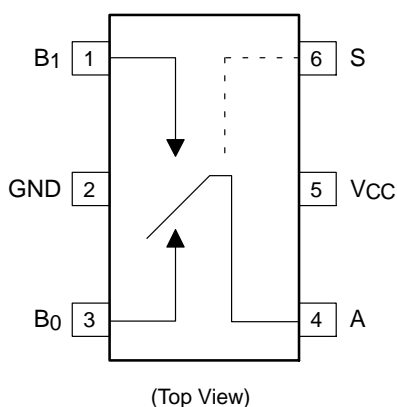


Figure 1. SC70 Pin Assignments

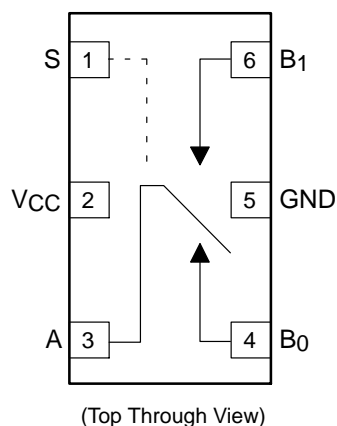


Figure 2. MicroPak Pin Assignments

## 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 <sub>CC</sub> | Supply Voltage |
| 6         | 1             | S               | Control Input  |

## TRUTH TABLE

| Control Input (S) | Function          |
|-------------------|-------------------|
| Low               | B0 connected to A |
| High              | B1 connected to A |

# FSA4157, FSA4157A

## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                                      | Min                                       | Max                   | Unit      |
|---------------------|----------------------------------------------------------------|-------------------------------------------|-----------------------|-----------|
| V <sub>CC</sub>     | Supply Voltage                                                 | -0.5                                      | 6.0                   | V         |
| V <sub>S</sub>      | DC Switch Voltage (Note 2)                                     | -0.5                                      | V <sub>CC</sub> + 0.5 | V         |
| V <sub>IN</sub>     | DC Input Voltage (Note 2)                                      | -0.5                                      | 6.0                   | V         |
| I <sub>IK</sub>     | DC 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<br>SC70<br>MicroPak                  |                                           | 180<br>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 (FSA4157A) |                       | 7500<br>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.

2. 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                  | FSA4157              | 1.65            | 5.50 | V    |
|                    |                                 | FSA4157A             | 2.7             | 5.5  |      |
| V <sub>CNTRL</sub> | Control Input Voltage (Note 3)  | 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                 |                 | 350  | °C/W |
|                    |                                 | MicroPak (Estimated) |                 | 330  |      |

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.

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

# FSA4157, FSA4157A

## DC ELECTRICAL CHARACTERISTICS

(Typical values are at 25°C unless otherwise specified.)

| Symbol                                         | Parameter                                        | Conditions                                                                       | V <sub>CC</sub> (V) | Ambient Temperature |      |      |              |      | Unit |
|------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------|---------------------|---------------------|------|------|--------------|------|------|
|                                                |                                                  |                                                                                  |                     | -25°C               |      |      | -40 to +85°C |      |      |
|                                                |                                                  |                                                                                  |                     | Min.                | Typ. | Max. | Min.         | Max. |      |
| V <sub>IH</sub>                                | 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 <sub>IL</sub>                                | 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 <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> ,<br>I <sub>NC(OFF)</sub> | Off Leakage Current of Port B0 and B1            | A = 1 V, 4.5 V, B <sub>0</sub> or B <sub>1</sub> = 4.5, 1 V                      | 5.5                 |                     | ±2   |      | -20          | 20   | nA   |
| I <sub>A(ON)</sub>                             | On Leakage Current of Port A                     | A = 1 V, 4.5V, B <sub>0</sub> or B <sub>1</sub> = 4.5, 1 V, 4.5 V or Floating    | 5.5                 |                     | ±4   |      | -40          | 40   | nA   |
| R <sub>ON</sub>                                | Switch On Resistance                             | I <sub>OUT</sub> = 100 mA, B <sub>0</sub> or B <sub>1</sub> = 1.5 V              | 2.7                 |                     | 2.6  | 4.0  |              | 4.3  | Ω    |
|                                                |                                                  | I <sub>OUT</sub> = 100 mA, B <sub>0</sub> or B <sub>1</sub> = 3.5 V              | 4.5                 |                     | 0.95 | 1.15 |              | 1.30 |      |
| ΔR <sub>ON</sub>                               | On Resistance Matching Between Channels (Note 5) | I <sub>OUT</sub> = 100 mA, B <sub>0</sub> or B <sub>1</sub> = 1.5 V              | 4.5                 |                     | 0.06 | 0.12 |              | 0.15 | Ω    |
| R <sub>FLAT(ON)</sub>                          | On Resistance Flatness (Note 5)                  | I <sub>OUT</sub> = 100 mA, B <sub>0</sub> or B <sub>1</sub> = 0 V, 0.75 V, 1.5 V | 2.7                 |                     | 1.4  |      |              |      | Ω    |
|                                                |                                                  | I <sub>OUT</sub> = 100 mA, B <sub>0</sub> or B <sub>1</sub> = 0 V, 1 V, 2 V      | 4.5                 |                     | 0.2  | 0.3  |              | 0.4  |      |
| 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  |      |
| ΔI <sub>CC</sub>                               | Increase in I <sub>CC</sub> per Input            | One Input at 2.7 V, others at V <sub>CC</sub> or GND (FSA4157A Only)             | 4.3                 |                     | 0.2  |      |              | 10.0 | μA   |

4. 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).

5.  $\Delta R_{ON} = R_{ON\ max} - R_{ON\ min}$  measured at identical V<sub>CC</sub>, temperature, and voltage.

6. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

# FSA4157, FSA4157A

## AC ELECTRICAL CHARACTERISTICS

(Typical values are at 25°C unless otherwise specified.)

| Symbol           | Parameter               | Conditions                                                                                                    | V <sub>CC</sub> (V) | Ambient Temperature |       |      |              |      | Unit      | Figure   |
|------------------|-------------------------|---------------------------------------------------------------------------------------------------------------|---------------------|---------------------|-------|------|--------------|------|-----------|----------|
|                  |                         |                                                                                                               |                     | -25°C               |       |      | -40 to +85°C |      |           |          |
|                  |                         |                                                                                                               |                     | Min.                | Typ.  | Max. | Min.         | Max. |           |          |
| t <sub>ON</sub>  | Turn-On Time            | B <sub>0</sub> or B <sub>1</sub> = 1.5 V,<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF<br>(FSA4157A Only) | 2.7 to 3.6          |                     |       | 60   |              | 65   | ns        | Figure 8 |
|                  |                         | B <sub>0</sub> or B <sub>1</sub> = 1.5V,<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF                     | 2.7 to 3.6          |                     |       | 50   |              | 60   |           |          |
|                  |                         | B <sub>0</sub> or B <sub>1</sub> = 1.5 V,<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF                    | 4.5 to 5.5          |                     |       | 35   |              | 40   |           |          |
| t <sub>OFF</sub> | Turn-Off Time           | B <sub>0</sub> or B <sub>1</sub> = 1.5 V,<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF                    | 2.7 to 3.6          |                     |       | 20   |              | 30   | ns        | Figure 8 |
|                  |                         | B <sub>0</sub> or B <sub>1</sub> = 1.5 V,<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 35 pF                    | 4.5 to 5.5          |                     |       | 15   |              | 20   |           |          |
| t <sub>BBM</sub> | 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 <sub>L</sub> = 1.0 nF,<br>V <sub>GE</sub> = 0 V, R <sub>GEN</sub> = 0 Ω                                     | 2.7 to 3.6          |                     | 10    |      |              | pC   | Figure 11 |          |
|                  |                         |                                                                                                               | 4.5 to 5.5          |                     | 20    |      |              |      |           |          |
| OIRR             | Off Isolation           | f = 1 MHz, R <sub>L</sub> = 50 Ω                                                                              | 2.7 to 3.6          |                     | -70   |      |              | dB   | Figure 10 |          |
|                  |                         |                                                                                                               | 4.5 to 5.5          |                     | -70   |      |              |      |           |          |
| Xtalk            | Crosstalk               | f = 1 MHz, R <sub>L</sub> = 50 Ω                                                                              | 2.7 to 3.6          |                     | -70   |      |              | dB   | Figure 10 |          |
|                  |                         |                                                                                                               | 4.5 to 5.5          |                     | -70   |      |              |      |           |          |
| BW               | -3db Bandwidth          | R <sub>L</sub> = 50 Ω                                                                                         | 2.7 to 3.6          |                     |       | 300  |              | MHz  | Figure 13 |          |
|                  |                         |                                                                                                               | 4.5 to 5.5          |                     |       | 300  |              |      |           |          |
| THD              | Total Harmon Distortion | R <sub>L</sub> = 600 Ω, V <sub>IN</sub> = 0.5,<br>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 <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                 |                           | 3.5  |      | pF    | Figure 12 |
| C <sub>OFF</sub> | B Port Off Capacitance        | f = 1 MHz  | 4.5                 |                           | 12.0 |      | pF    | Figure 12 |
| C <sub>ON</sub>  | On Capacitance                | f = 1 MHz  | 4.5                 |                           | 40.0 |      | pF    | Figure 12 |

# FSA4157, FSA4157A

## TYPICAL PERFORMANCE CHARACTERISTICS

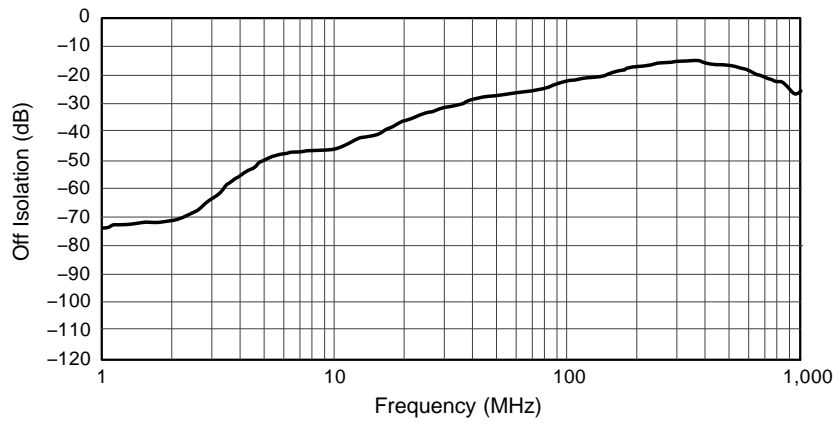


Figure 3. Off Isolation,  $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

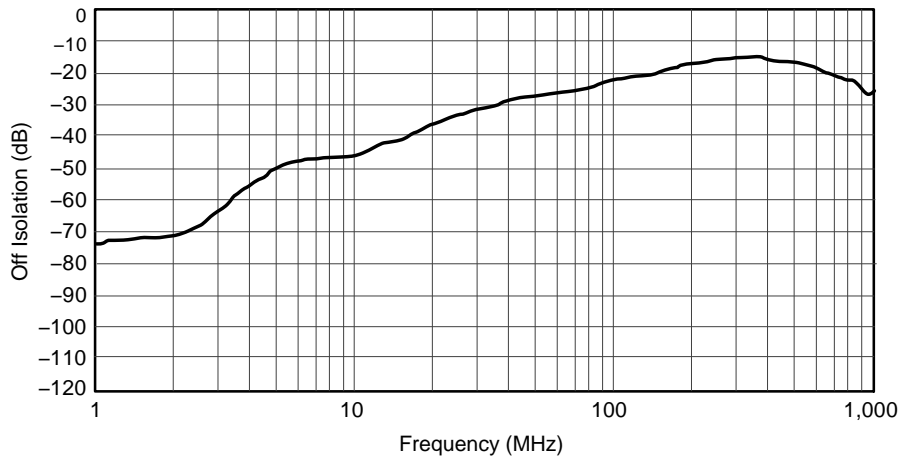


Figure 4. Crosstalk,  $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

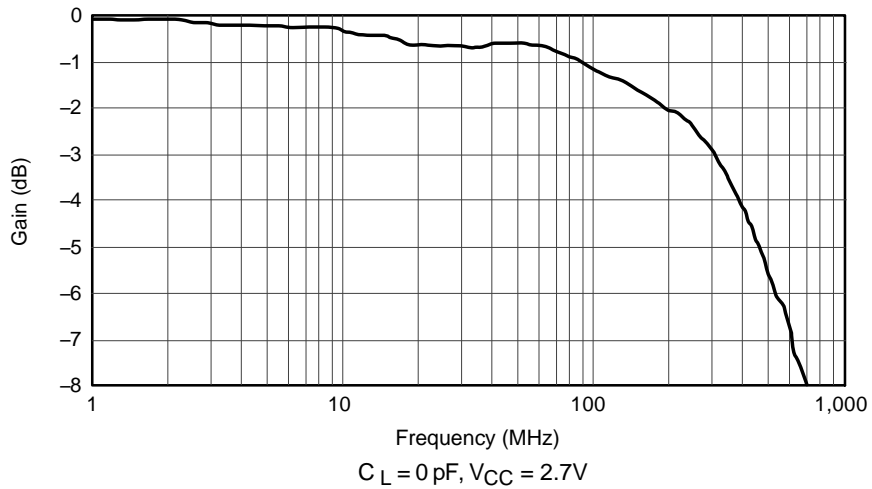


Figure 5. Crosstalk,  $V_{CC} = 2.7\text{ V to }5.5\text{ V}$

# FSA4157, FSA4157A

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

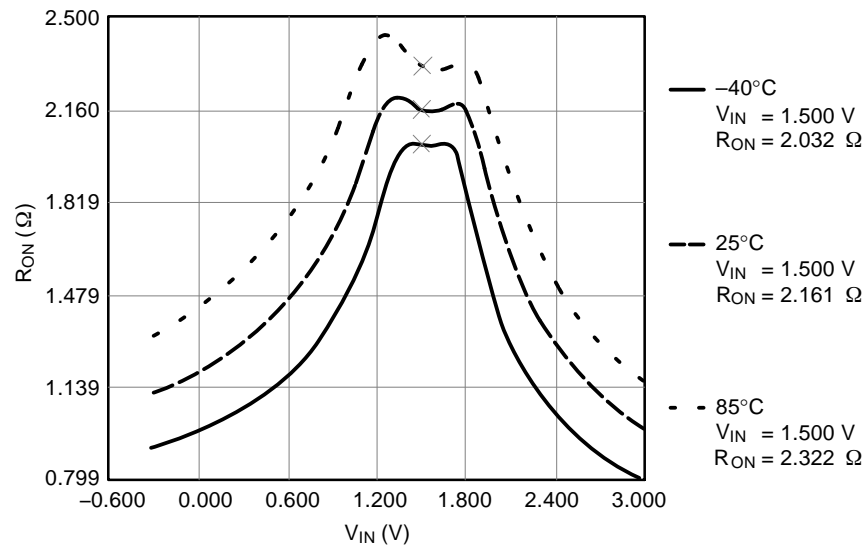


Figure 6.  $R_{ON}$  Switch On Resistance,  $I_{ON} = 100\text{ mA}$ ,  $V_{CC} = 2.7\text{ V}$

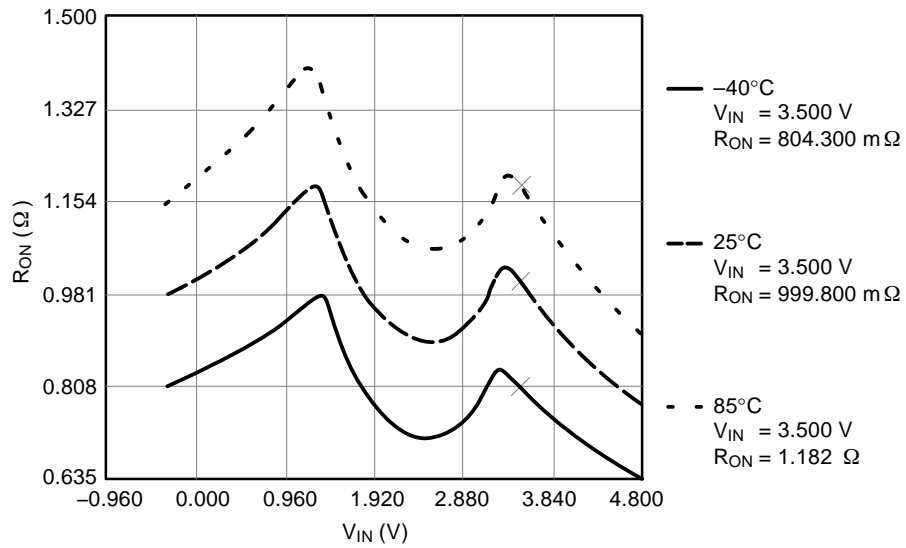


Figure 7.  $R_{ON}$  Switch On Resistance,  $I_{ON} = 100\text{ mA}$ ,  $V_{CC} = 4.5\text{ V}$

# FSA4157, FSA4157A

## AC LOADINGS AND WAVEFORMS

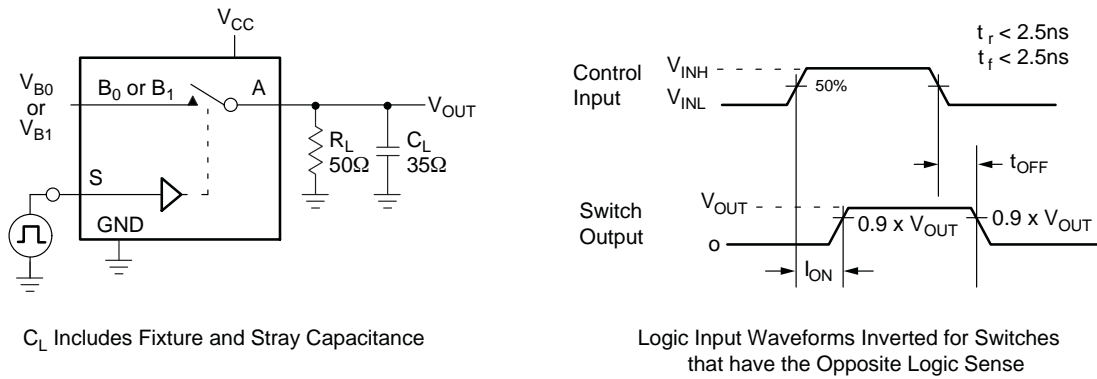


Figure 8. Turn On / Off Timing

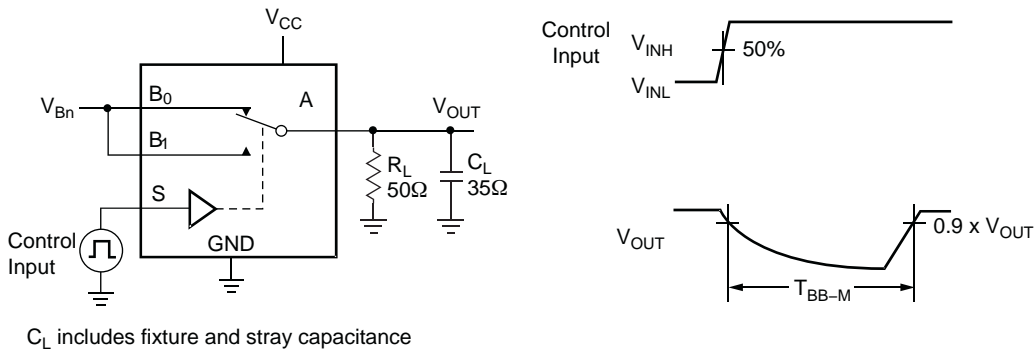


Figure 9. Break Before Make Timing

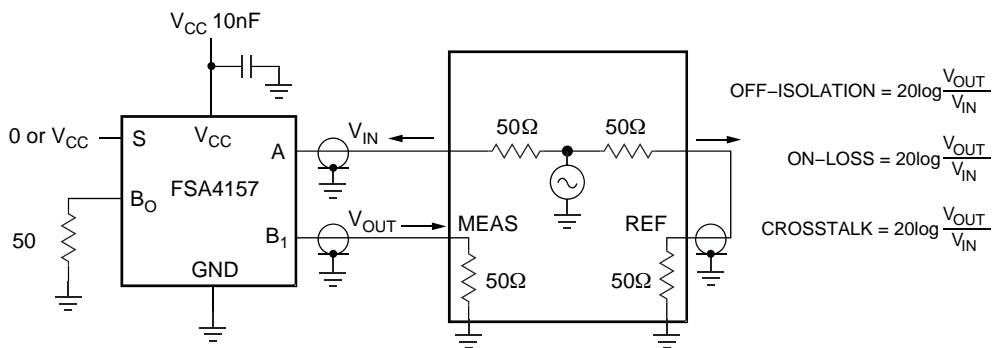


Figure 10. Off Isolation and Crosstalk

# FSA4157, FSA4157A

## AC LOADINGS AND WAVEFORMS (Continued)

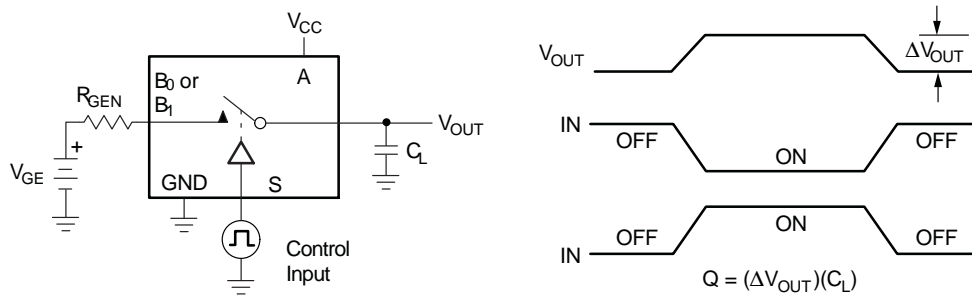


Figure 11. Charge Injection

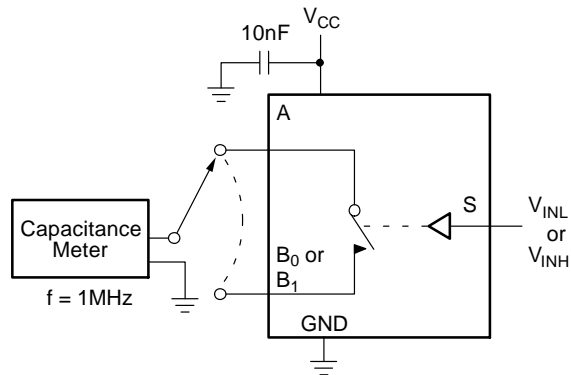


Figure 12. On / Off Capacitance Measurement Setup

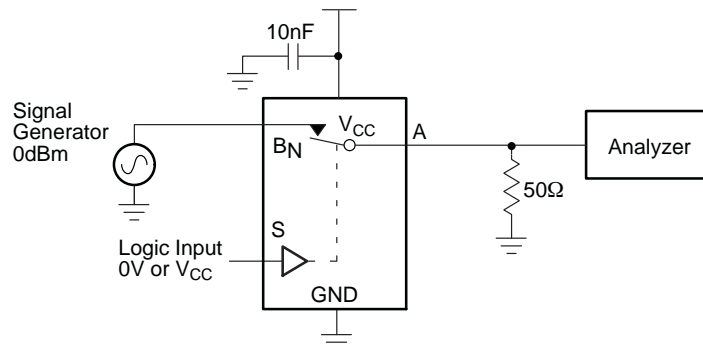


Figure 13. Bandwidth

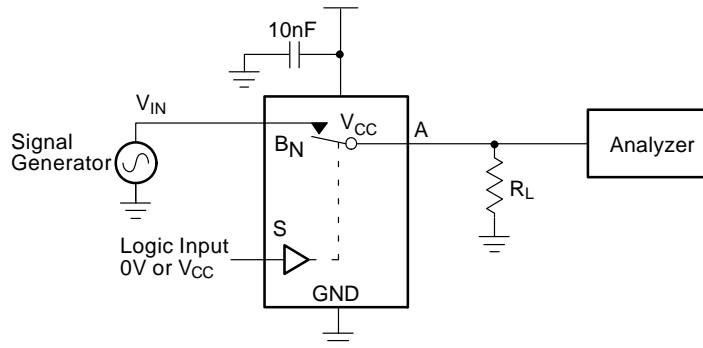
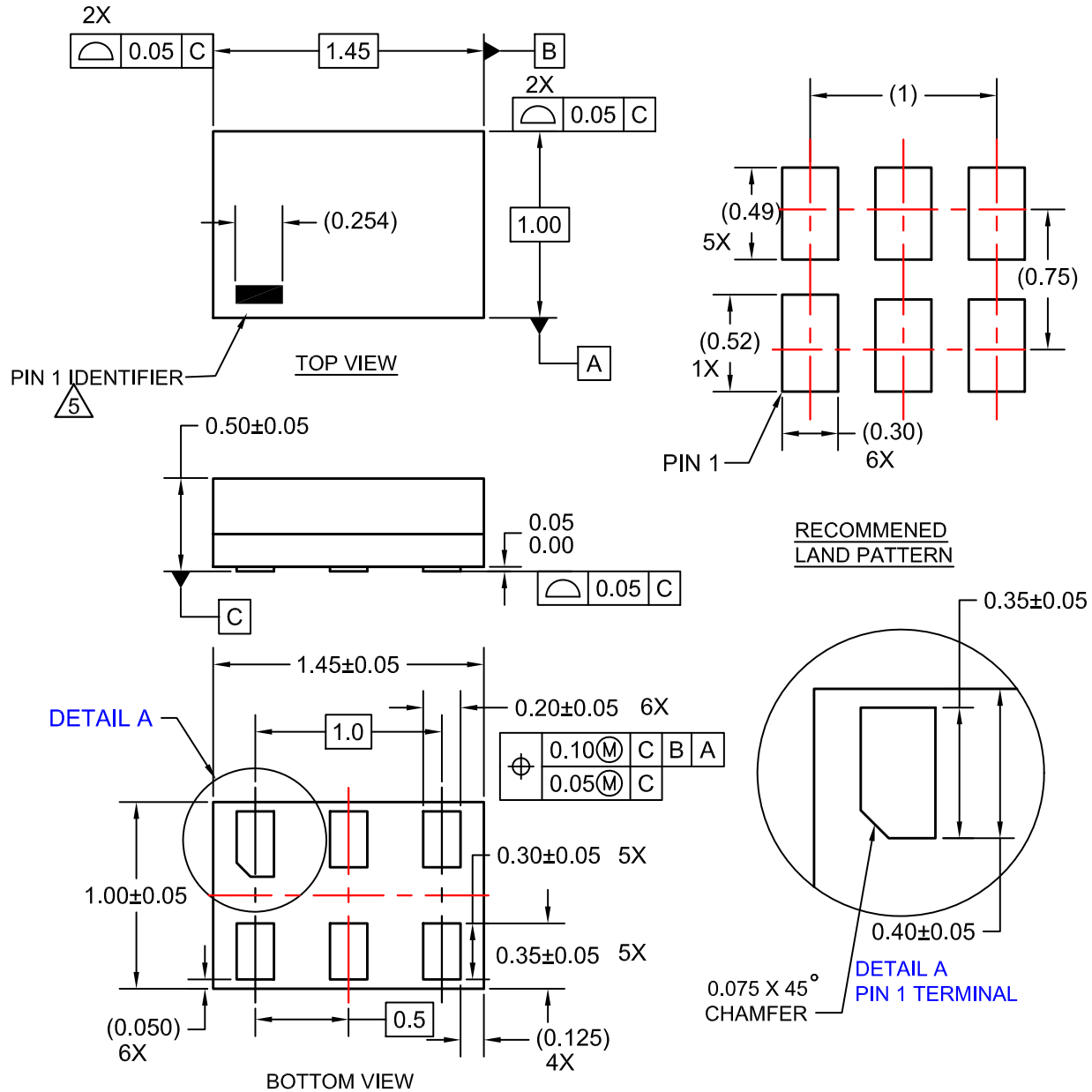


Figure 14. Harmonic Distortion

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

DATE 31 AUG 2016

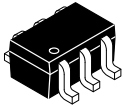


NOTES:

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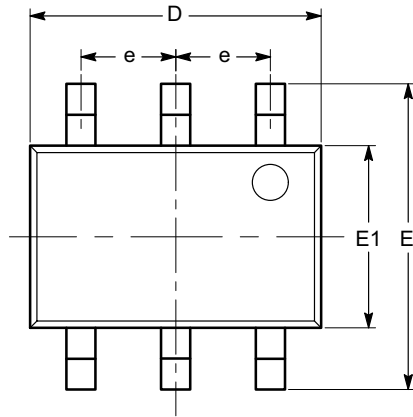
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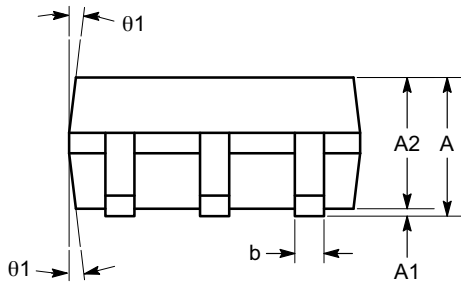
**SC-88 (SC-70 6 Lead), 1.25x2**  
CASE 419AD  
ISSUE A

DATE 07 JUL 2010

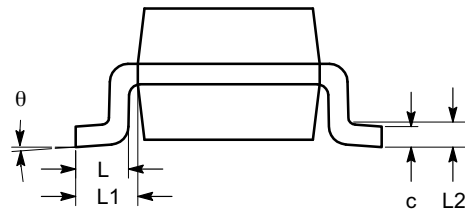


TOP VIEW

| 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 |      |      |
| $\theta$   | 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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| <b>DESCRIPTION:</b>     | <b>SC-88 (SC-70 6 LEAD), 1.25X2</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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