

FSA4157, FSA4157A

Low-Voltage, 1Ω SPDT Analog Switch

Features

- FSA4157A Features Lower I_{CC} when the S Input is Lower Than V_{CC}
- Maximum 1.15Ω On Resistance (R_{ON}) at 4.5V V_{CC}
- 0.3Ω max R_{ON} Flatness at 4.5V V_{CC}
- Space-Saving 6-lead, MicroPak™ and SC70 6 Packages
- Broad V_{CC} Operating Range:
 - FSA4157: 1.65V to 5.5V
 - FSA4157A: 2.7V to 5.5V
- 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 1.15Ω maximum at 4.5V V_{CC} and will operate over the wide V_{CC} range of 1.65V to 5.5V for FSA4157, and 2.7V to 5.5V 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.

Technology Description

The Fairchild Switch family derives from and embodies Fairchild's proven switch technology used for several years in its 74LVXL384 (FST3384) bus switch product.

Ordering Information

| Part Number | Top Mark | Package Description | Packing Method |
|-------------|----------|-------------------------------------|-----------------------------|
| FSA4157P6 | A57 | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 250 Units on Tape and Reel |
| FSA4157P6X | A57 | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3000 Units on Tape and Reel |
| FSA4157L6X | EG | 6-Lead MicroPak, 1.0mm Wide | 5000 Units on Tape and Reel |
| FSA4157AP6 | B57 | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 250 Units on Tape and Reel |
| FSA4157AP6X | B57 | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3000 Units on Tape and Reel |
| FSA4157AL6X | EU | 6-Lead MicroPak, 1.0mm Wide | 5000 Units on Tape and Reel |

Note:

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

Pin Configurations

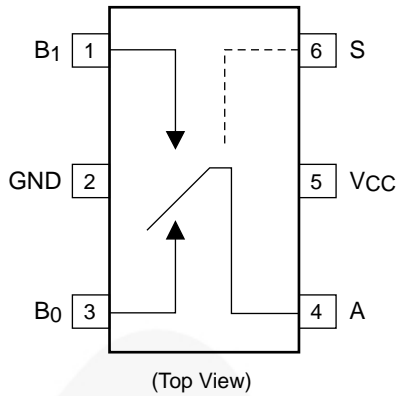


Figure 1. SC70 Pin Assignments

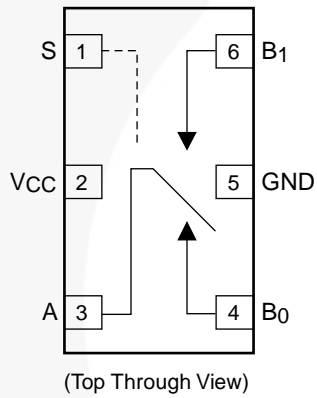


Figure 2. MicroPak Pin Assignments

Truth Table

| Control Input(s) | Function |
|------------------|-------------------|
| Low | B0 Connected to A |
| High | B1 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. | Unit |
|---------------------|--|-----------|-----------------------|------|
| V _{CC} | Supply Voltage | -0.5 | 6.0 | V |
| V _S | DC Switch Voltage ⁽²⁾ | -0.5 | V _{CC} + 0.5 | V |
| V _{IN} | DC Input Voltage ⁽²⁾ | -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 1ms 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 | Human Body Model, JESD22-A114 (FSA4157A) | | 7500 | V |

Note:

- 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 ⁽³⁾ | 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:

- 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 | | | | | Units |
|--|--|--|---------------------|---------------------|------|------|--------------|------|-------|
| | | | | -25° | | | -40 to +85°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| V _{IH} | Input Voltage High | | 2.7 to 3.6 | | | | 2.0 | | V |
| | | | 4.5 to 5.5 | | | | 2.4 | | |
| V _{IL} | Input Voltage Low | FSA4157A Only | 2.7 to 3.6 | | | | | 0.4 | V |
| | | | 2.7 to 3.6 | | | | | 0.6 | |
| | | | 4.5 to 5.5 | | | | | 0.8 | |
| I _{IN} | Control Input Leakage | V _{IN} =0V 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=1V, 4.5V, B ₀ or B ₁ =4.5, 1V | 5.5 | -2.0 | | 2.0 | -20.0 | 20.0 | nA |
| I _{A(ON)} | On Leakage Current of Port A | A=1V, 4.5V, B ₀ or B ₁ =4.5, 1V, 4.5V or Floating | 5.5 | -4.0 | | 4.0 | -40.0 | 40.0 | nA |
| R _{ON} | Switch On Resistance | I _{OUT} =100mA, B ₀ or B ₁ =1.5V | 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 ⁽⁵⁾ | I _{OUT} =100mA, B ₀ or B ₁ =1.5V | 4.5 | | 0.06 | 0.12 | | 0.15 | Ω |
| R _{FLAT(ON)} | On Resistance Flatness ⁽⁶⁾ | I _{OUT} =100mA, B ₀ or B ₁ =0V, 0.75V, 1.5V | 2.7 | | 1.4 | | | | Ω |
| | | I _{OUT} =100mA, B ₀ or B ₁ =0V, 1V, 2V | 4.5 | | 0.2 | 0.3 | | 0.4 | |
| I _{CC} | Quiescent Supply Current | V _{IN} =0V or V _{CC} , I _{OUT} =0V | 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 2.7V, others at V _{CC} or GND (FSA4157A Only) | 4.3 | | 0.2 | | | 10.0 | μA |

Notes:

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. ΔR_{ON} = R_{ON max} – R_{ON min} measured at identical V_{CC}, 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.

AC Electrical Characteristics

Typical values are at 25°C unless otherwise specified.

| Symbol | Parameter | Conditions | V _{CC} (V) | Ambient Temperature | | | | | Units | Figure |
|------------------|---------------------------|---|---------------------|---------------------|-------|------|--------------|------|-------|-----------|
| | | | | -25° | | | -40 to +85°C | | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| t _{ON} | Turn-On Time | B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =35pF (FSA4157A Only) | 2.7 to 3.6 | | | 60.0 | | 65.0 | ns | Figure 8 |
| | | B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =35pF | 2.7 to 3.6 | | | 50.0 | | 60.0 | | |
| | | B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =35pF | 4.5 to 5.5 | | | 35.0 | | 40.0 | | |
| t _{OFF} | Turn-Off Time | B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =35pF | 2.7 to 3.6 | | | 20.0 | | 30.0 | ns | Figure 8 |
| | | B ₀ or B ₁ =1.5V, R _L =50Ω, C _L =35pF | 4.5 to 5.5 | | | 15.0 | | 20.0 | | |
| t _{BBM} | Break-Before-Make Time | FSA4157 | 2.7 to 3.6 | | | | | | ns | Figure 9 |
| | | | 4.5 to 5.5 | | 20.0 | | | | | |
| | | (FSA4157A Only) | 4.5 to 5.5 | | 25.0 | | | | | |
| Q | Charge Injection | C _L =1.0nF, V _{GE} =0V, R _{GEN} =0Ω | 2.7 to 3.6 | | 10.0 | | | | pC | Figure 11 |
| | | | 4.5 to 5.5 | | 20.0 | | | | | |
| OIRR | Off Isolation | f=1MHz, R _L =50Ω | 2.7 to 3.6 | | -70.0 | | | | dB | Figure 10 |
| | | | 4.5 to 5.5 | | -70.0 | | | | | |
| Xtalk | Crosstalk | f=1MHz, R _L =50Ω | 2.7 to 3.6 | | -70.0 | | | | dB | Figure 10 |
| | | | 4.5 to 5.5 | | -70.0 | | | | | |
| BW | -3db Bandwidth | R _L =50Ω | 2.7 to 3.6 | | | 300 | | | MHz | Figure 13 |
| | | | 4.5 to 5.5 | | | 300 | | | | |
| THD | Total Harmonic Distortion | R _L =600Ω, V _{IN} =0.5, f=20Hz to 20kHz | 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 | | | | | Units | Figure |
|------------------|-------------------------------|------------|---------------------|---------------------|------|------|-------------|------|-------|-----------|
| | | | | -25° | | | 40 to +85°C | | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| C _{IN} | Control Pin Input Capacitance | f=1MHz | 0 | | 3.5 | | | | pF | Figure 12 |
| C _{OFF} | B Port Off Capacitance | f=1MHz | 4.5 | | 12.0 | | | | pF | Figure 12 |
| C _{ON} | On Capacitance | f=1MHz | 4.5 | | 40.0 | | | | pF | Figure 12 |

Typical Performance Characteristics

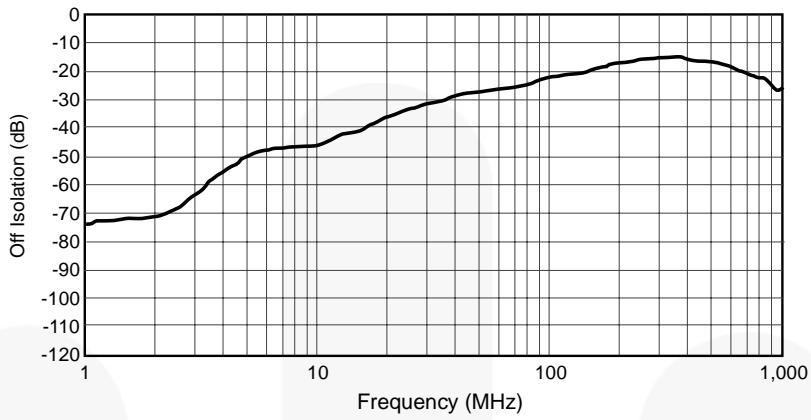


Figure 3. Off Isolation, $V_{CC} = 2.7V$ to $5.5V$

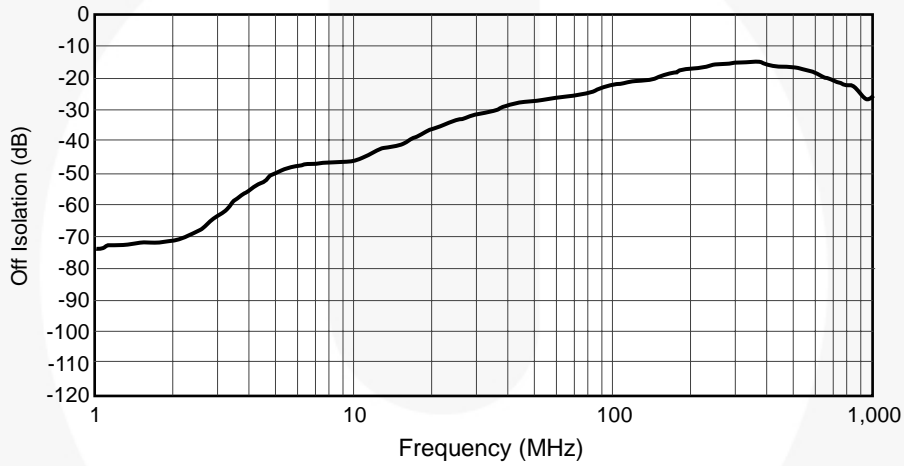


Figure 4. Crosstalk, $V_{CC} = 2.7V$ to $5.5V$

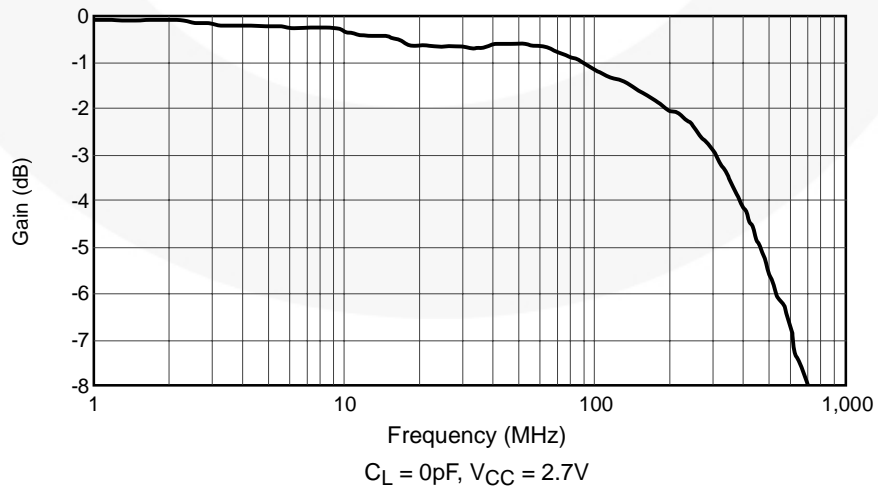


Figure 5. Bandwidth, $V_{CC} = 2.7V$ to $5.5V$

Typical Performance Characteristics (Continued)

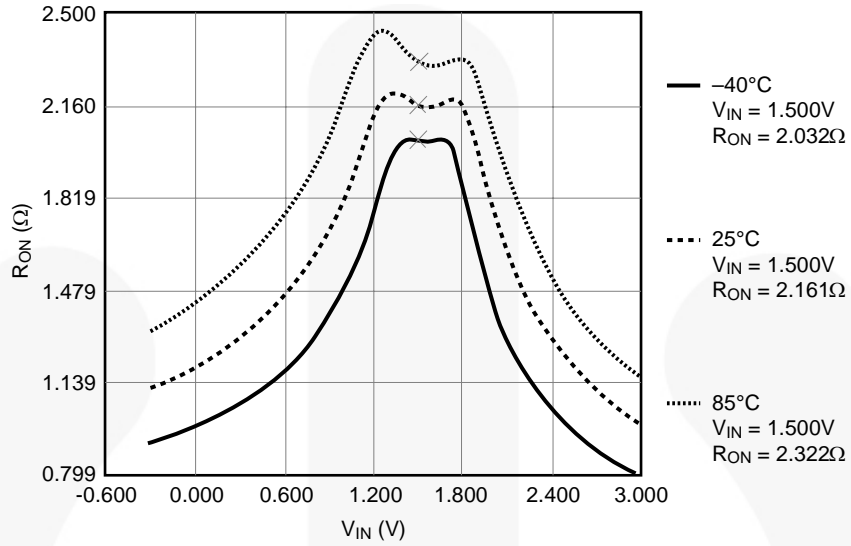


Figure 6. RON Switch On Resistance, I_{ON} = 100mA, V_{CC} = 2.7

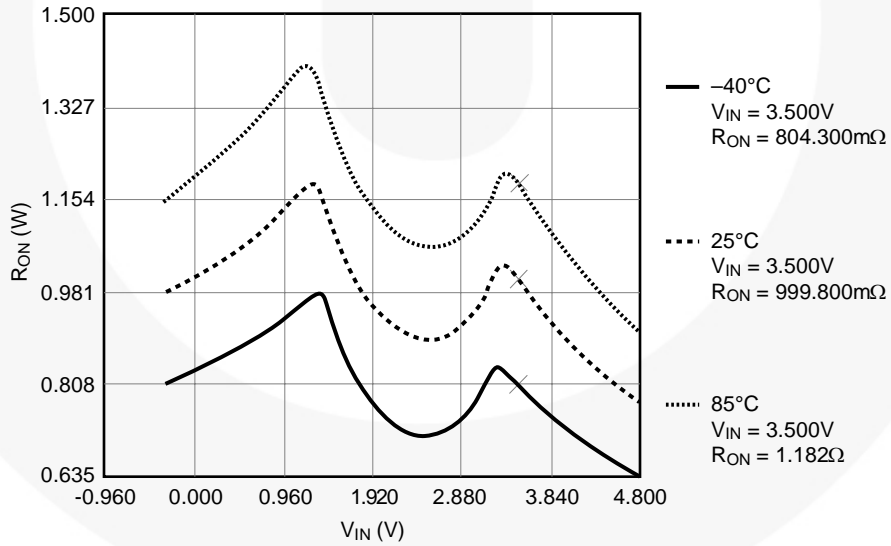


Figure 7. RON Switch On Resistance, I_{ON} = 100mA, V_{CC} = 4.5V

AC Loadings and Waveforms

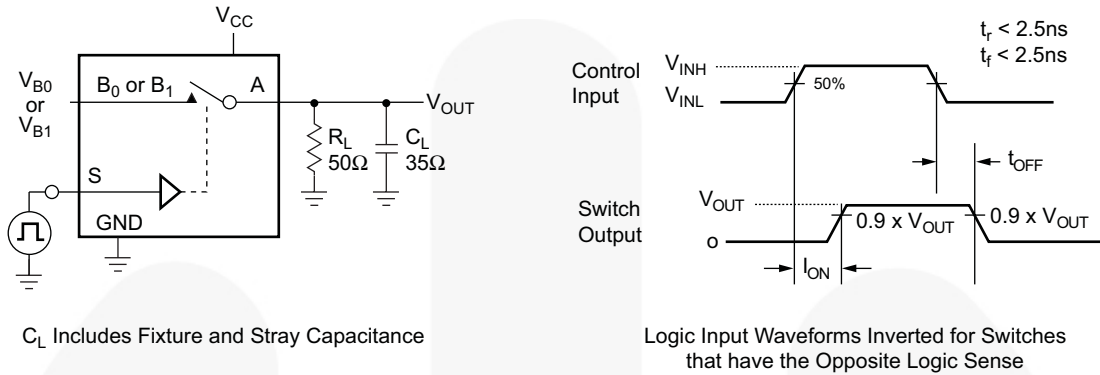


Figure 8. Turn On / Off Timing

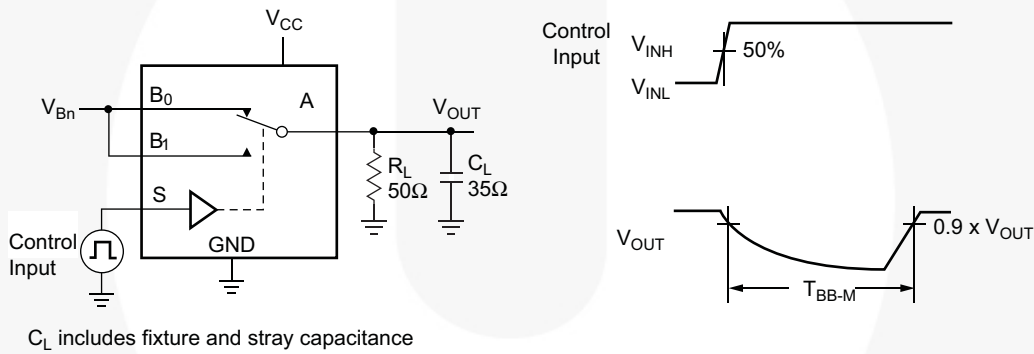


Figure 9. Break Before Make Timing

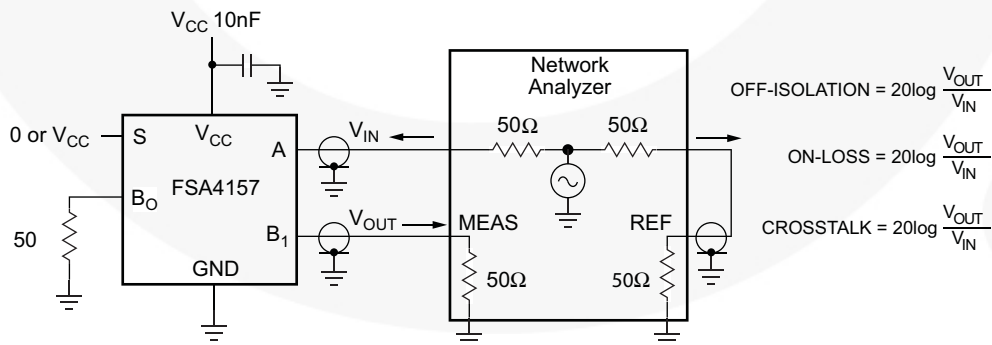


Figure 10. Off Isolation and Crosstalk

AC Loadings and Waveforms (Continued)

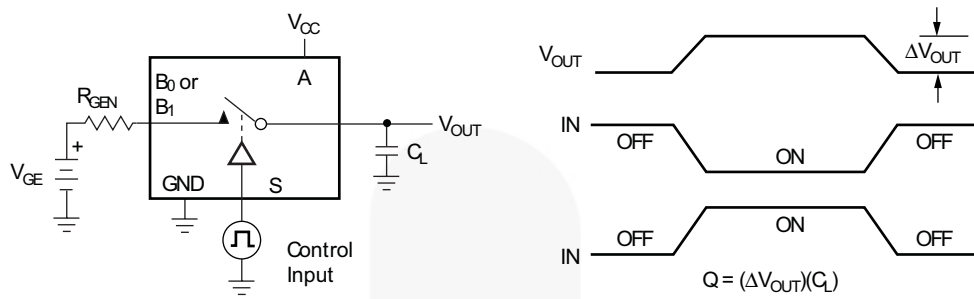


Figure 11. Charge Injection

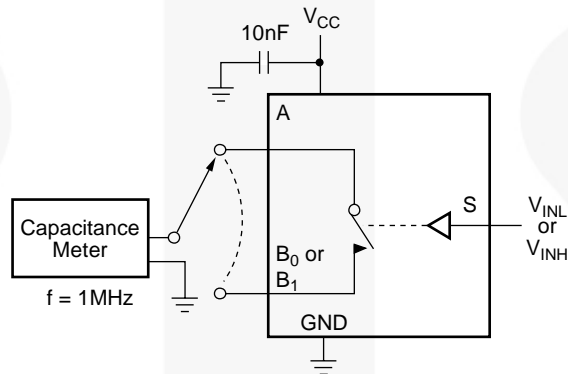


Figure 12. On / Off Capacitance Measurement Setup

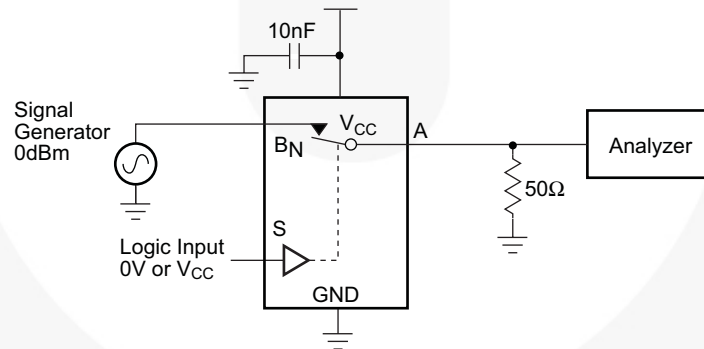


Figure 13. Bandwidth

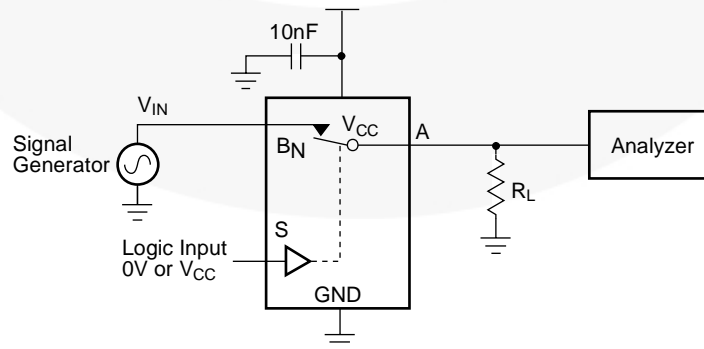
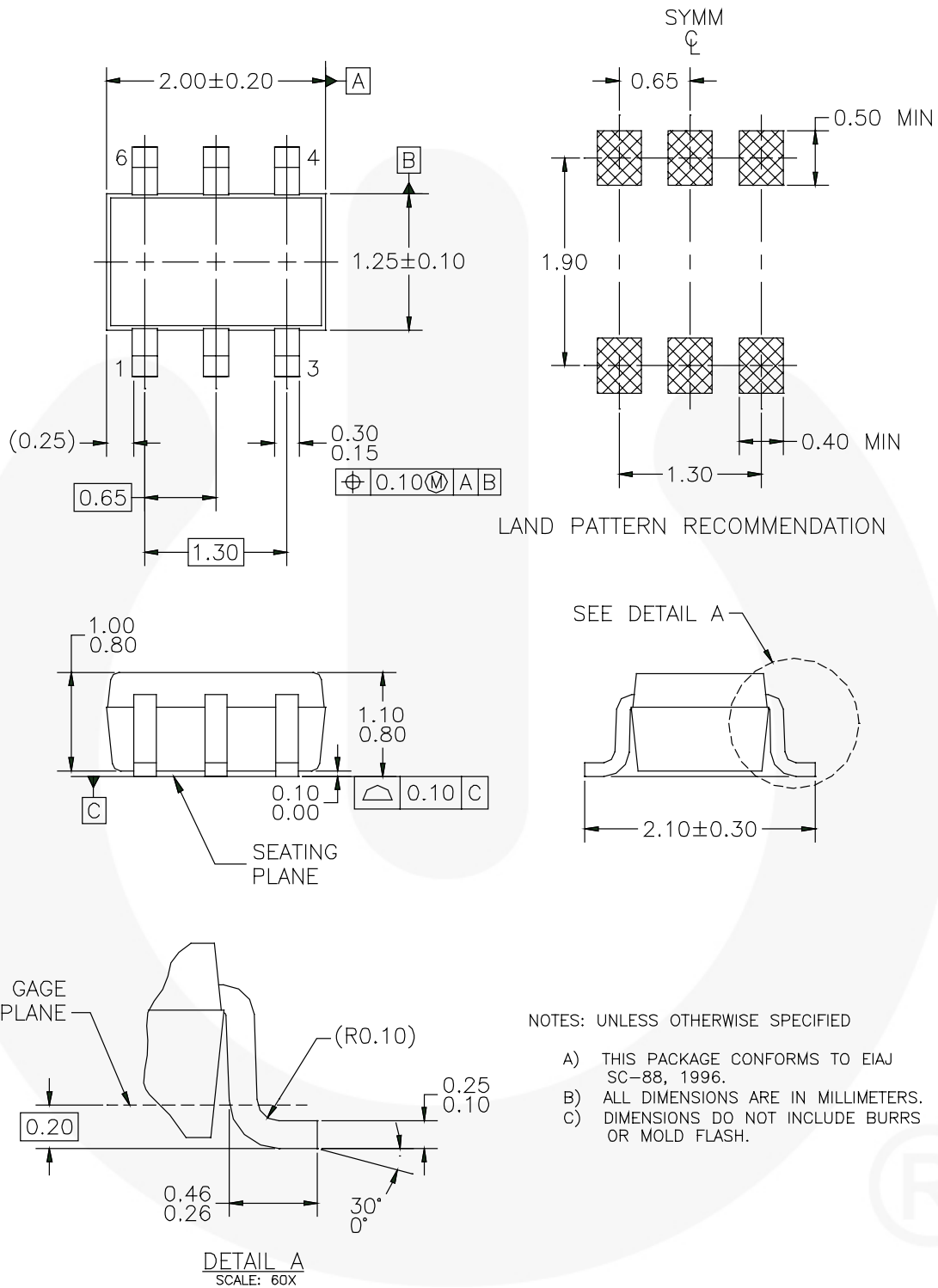


Figure 14. Harmonic Distortion

Physical Dimensions



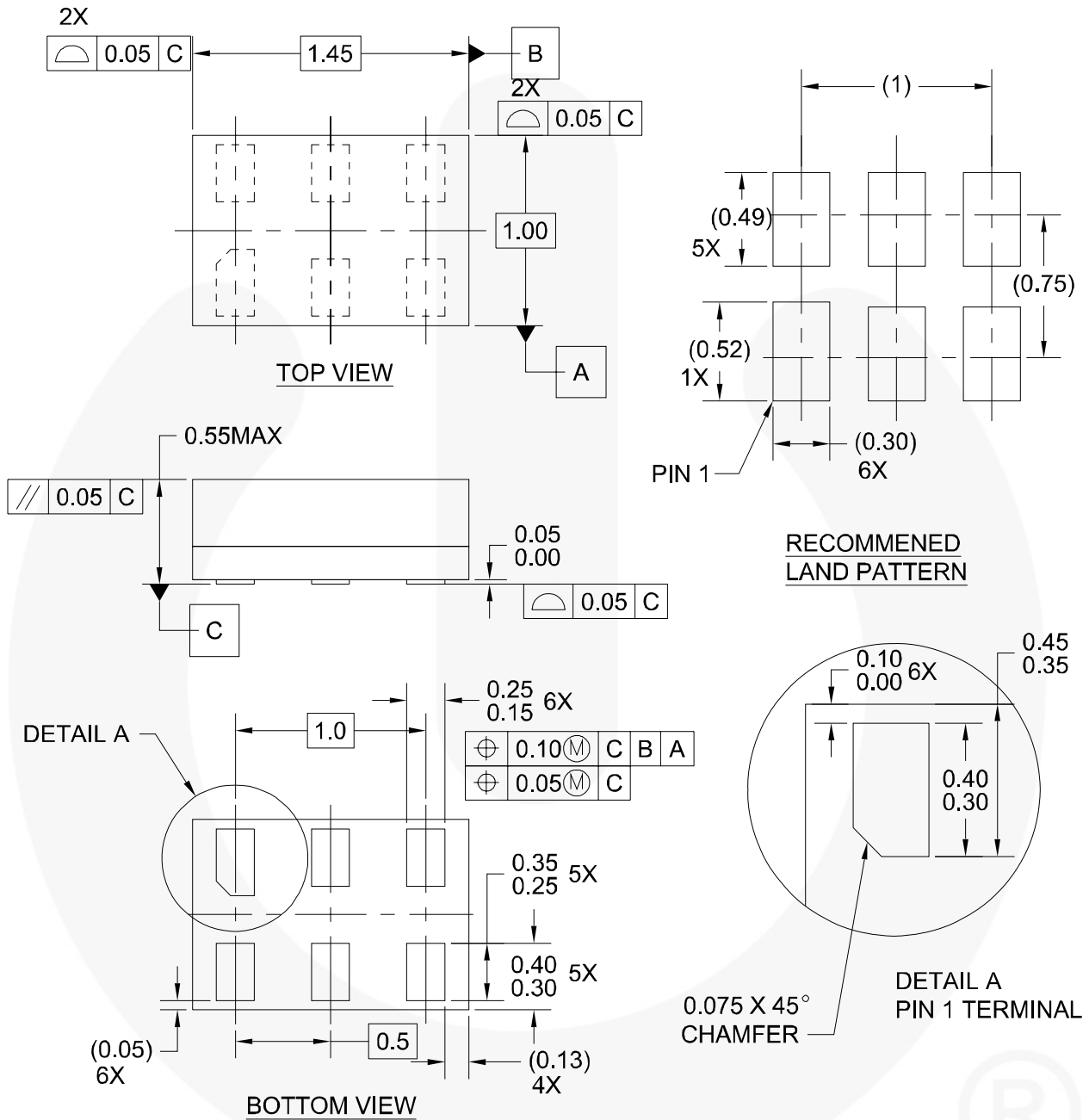
MAA06AREV5

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

[Click here for tape and reel specifications, available at:](#)

http://www.fairchildsemi.com/products/analog/pdf/sc70-6_tr.pdf

Physical Dimensions (Continued)



Notes:

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 Package

[Click here for tape and reel specifications, available at:
http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf)



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| CROSSVOLT™ | <i>i-Lo</i> ™ | PowerTrench® | the power franchise |
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| EcoSPARK® | MegaBuck™ | QS™ | TinyLogic® |
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| FACT Quiet Series™ | MillerDrive™ | SMART START™ | TinyWire™ |
| FACT® | Motion-SPM™ | SPM® | μSerDes™ |
| FAST® | OPTOLOGIC® | STEALTH™ | UHC® |
| FastvCore™ | OPTOPLANAR® | SuperFET™ | UniFET™ |
| FPS™ |  ® | SuperSOT™-3 | VCX™ |
| FRFET® | PDP-SPM™ | SuperSOT™-6 | |
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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

| 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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