

# FSA1156, FSA1157 Low- $R_{ON}$ Low-Voltage SPST Analog Switch

## Features

- Maximum  $0.9\Omega$   $R_{ON}$  for 4.5V Supply at 25°C
- $0.3\Omega$  Maximum  $R_{ON}$  Flatness for 4.5V Supply
- Broad  $V_{CC}$  Operating Range: 1.65V to 5.5V
- Fast Turn-on and Turn-off Time
- Over-voltage Tolerant, TTL-compatible Control Input
- Available in SC70 and MicroPak™ Space-saving, Surface-mount Packages

## General 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 1.65V to 5.5V. 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.

## Ordering Information

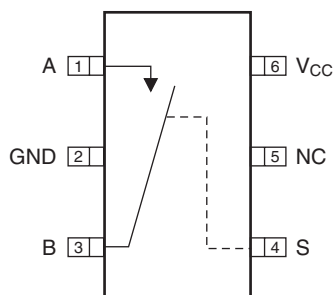
| Order Number | Package Number | Top Mark | Package Description                 | Packing Method           |
|--------------|----------------|----------|-------------------------------------|--------------------------|
| FSA1156P6    | MAA06A         | 156      | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 250 Units Tape and Reel  |
| FSA1156P6X   | MAA06A         | 156      | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3000 Units Tape and Reel |
| FSA1156L6X   | MAC06A         | EH       | 6-Lead MicroPak, 1.0mm Wide         | 5000 Units Tape and Reel |
| FSA1157P6    | MAA06A         | 157      | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 250 Units Tape and Reel  |
| FSA1157P6X   | MAA06A         | 157      | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3000 Units Tape and Reel |
| FSA1157L6X   | MAC06A         | EJ       | 6-Lead MicroPak, 1.0mm Wide         | 5000 Units Tape and Reel |

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

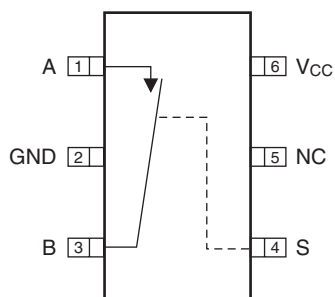
MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

## Analog Symbols

Pin Assignment for SC70 Package

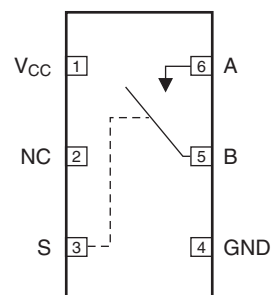


(Top View)  
FSA1156 (Normally Open)

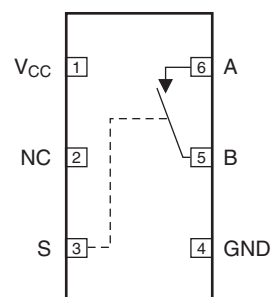


(Top View)  
FSA1157 (Normally Closed)

Pin Assignment for MicroPak™



(Top Through View)  
FSA1156 (Normally Open)



(Top Through View)  
FSA1157 (Normally Closed)

Figure 1. Pin Configurations

### Truth Table

| Control Input(s) | FSA1156 | FSA1157 |
|------------------|---------|---------|
| LOW Logic Level  | OFF     | ON      |
| HIGH Logic Level | ON      | OFF     |

### Pin Descriptions

| Pin Names | Function      |
|-----------|---------------|
| A, B      | Data Ports    |
| S         | Control Input |
| NC        | No Connect    |

## 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    |
| $V_{SW}$     | Switch Voltage <sup>(1.)</sup>                                | -0.5 | $V_{CC} + 0.5V$ | V    |
| $V_{IN}$     | Input Voltage <sup>(1.)</sup>                                 | -0.5 | +6.0            | V    |
| $I_{IK}$     | Input Diode Current                                           |      | -50             | mA   |
| $I_{SW}$     | Switch Current                                                |      | 200             | mA   |
| $I_{SWPEAK}$ | Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle) |      | 400             | mA   |
| $P_D$        | Power Dissipation at 85°C, SC70 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    |

**Note:**

1. The input and output negative ratings may be exceeded if the 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                                | 1.65 | 5.50     | V    |
| $V_{IN}$      | Control Input Voltage <sup>(2.)</sup>         | 0    | $V_{CC}$ | V    |
| $V_{SW}$      | Switch Input Voltage                          | 0    | $V_{CC}$ | V    |
| $T_A$         | Operating Temperature                         | -40  | +85      | °C   |
| $\Theta_{JA}$ | Thermal Resistance in Still Air, SC70 package | 350  |          | °C/W |

**Note:**

2. Control input must be held HIGH or LOW. It must not float.

## DC Electrical Characteristics

All typical values are at 25°C unless otherwise specified.

| Symbol                     | Parameter                              | Conditions                                                                 | $V_{CC}$ (V) | $T_A = +25^\circ\text{C}$ |      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |       |      | Unit          |
|----------------------------|----------------------------------------|----------------------------------------------------------------------------|--------------|---------------------------|------|-------------------------------------------------|-------|------|---------------|
|                            |                                        |                                                                            |              | 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                      |                                                                            | 2.7 to 3.6   |                           |      |                                                 |       | 0.6  | V             |
|                            |                                        |                                                                            | 4.5 to 5.5   |                           |      |                                                 |       | 0.8  |               |
| $I_{IN}$                   | Control Input Leakage                  | $V_{IN} = 0\text{V to } V_{CC}$                                            | 2.7 to 3.6   |                           |      |                                                 | -1.0  | 1.0  | $\mu\text{A}$ |
|                            |                                        |                                                                            | 4.5 to 5.5   |                           |      |                                                 | -1.0  | 1.0  |               |
| $I_{NO(OFF)}, I_{NC(OFF)}$ | Off Leakage Current                    | A = 1V, 4.5V;<br>B = 4.5V, 1V                                              | 5.5          | -2.0                      |      | 2.0                                             | 20.0  | 20.0 | nA            |
| $I_{A(ON)}$                | On Leakage Current                     | A = 1V, 4.5V;<br>B = 1V, 4.5V or Floating                                  | 5.5          | -4.0                      |      | 4.0                                             | -40.0 | 40.0 | nA            |
| $R_{ON}$                   | Switch On Resistance <sup>(3.)</sup>   | $I_{OUT} = 100\text{mA}$ , B = 1.5V                                        | 2.7          |                           | 1.4  | 2.1                                             |       | 2.5  | $\Omega$      |
|                            |                                        | $I_{OUT} = 100\text{mA}$ , B = 3.5V                                        | 4.5          |                           | 0.75 | 0.90                                            |       | 1.00 |               |
| $R_{FLAT(ON)}$             | On Resistance Flatness <sup>(4.)</sup> | $I_{OUT} = 100\text{mA}$ ;<br>$B_0 = 0\text{V}, 0.75\text{V}, 1.5\text{V}$ | 2.7          |                           | 0.6  |                                                 |       |      | $\Omega$      |
|                            |                                        | $I_{OUT} = 100\text{mA}$ ;<br>$B_0 = 0\text{V}, 1\text{V}, 2\text{V}$      | 4.5          |                           | 0.1  | 0.2                                             |       | 0.3  |               |
| $I_{CC}$                   | Quiescent Supply Current               | $V_{IN} = 0\text{V or } V_{CC}$ ,<br>$I_{OUT} = 0\text{V}$                 | 3.6          |                           | 0.1  | 0.5                                             |       | 1.0  | $\mu\text{A}$ |
|                            |                                        |                                                                            | 5.5          |                           | 0.1  | 0.5                                             |       | 1.0  |               |

### Notes:

- On resistance is determined by the voltage drop between the A and B pins at the indicated current through the switch.
- 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) | $T_A = +25^\circ\text{C}$ |       | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      |      | Unit | Figure Number |
|-----------|---------------------------|-------------------------------------------------------------------------|--------------|---------------------------|-------|-------------------------------------------------|------|------|------|---------------|
|           |                           |                                                                         |              | Min.                      | Typ.  | Max.                                            | Min. | Max. |      |               |
| $t_{ON}$  | Turn-On Time              | $B = 1.5\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$                    | 2.7 to 3.6   |                           | 30    | 40                                              |      | 45   | ns   | Figure 4      |
|           |                           | $B = 3.0\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$                    | 4.5 to 5.5   |                           | 15    | 20                                              |      | 25   |      |               |
| $t_{OFF}$ | Turn-Off Time             | $B = 1.5\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$                    | 2.7 to 3.6   |                           | 25    | 35                                              |      | 45   | ns   | Figure 4      |
|           |                           | $B = 3.0\text{V}, R_L = 50\Omega, C_L = 35\text{pF}$                    | 4.5 to 5.5   |                           | 22    | 30                                              |      | 40   |      |               |
| Q         | Charge Injection          | $C_L = 1.0\text{nF}, V_{GE} = 0\text{V}, R_{GEN} = 0\Omega$             | 2.7 to 3.6   |                           | 10    |                                                 |      |      | pC   | Figure 5      |
|           |                           |                                                                         | 4.5 to 5.5   |                           | 20    |                                                 |      |      |      |               |
| OIRR      | Off Isolation             | $f = 1\text{MHz}, R_L = 50\Omega$                                       | 2.7 to 3.6   |                           | -65   |                                                 |      |      | dB   | Figure 6      |
|           |                           |                                                                         | 4.5 to 5.5   |                           | -65   |                                                 |      |      |      |               |
| BW        | –3db Bandwidth            | $R_L = 50\Omega$                                                        | 2.7 to 3.6   |                           | 300   |                                                 |      |      | MHz  | Figure 7      |
|           |                           |                                                                         | 4.5 to 5.5   |                           | 300   |                                                 |      |      |      |               |
| THD       | Total Harmonic Distortion | $R_L = 600\Omega, V_{IN} = 0.5V_{PP}, f = 20\text{Hz to } 20\text{kHz}$ | 2.7 to 3.6   |                           | 0.001 |                                                 |      |      | %    | Figure 8      |
|           |                           |                                                                         | 4.5 to 5.5   |                           | 0.001 |                                                 |      |      |      |               |

## Capacitance

| Symbol    | Parameter                     | Conditions        | $V_{CC}$ (V) | $T_A = +25^\circ\text{C}$ |      |      | Units | Figure Number |
|-----------|-------------------------------|-------------------|--------------|---------------------------|------|------|-------|---------------|
|           |                               |                   |              | Min.                      | Typ. | Max. |       |               |
| $C_{IN}$  | Control Pin Input Capacitance | $f = 1\text{MHz}$ | 0.0          |                           | 3    |      | pF    | Figure 9      |
| $C_{OFF}$ | A/B Port Off Capacitance      | $f = 1\text{MHz}$ | 4.5          |                           | 20   |      | pF    | Figure 9      |
| $C_{ON}$  | A/B Port On Capacitance       | $f = 1\text{MHz}$ | 4.5          |                           | 65   |      | pF    | Figure 9      |

## Typical Characteristics

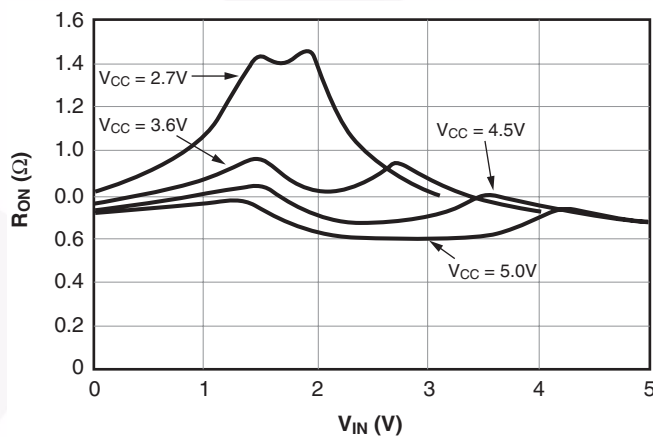


Figure 2. On Resistance vs. Input Voltage, Over Supply Voltage,  $T_A=25^\circ$

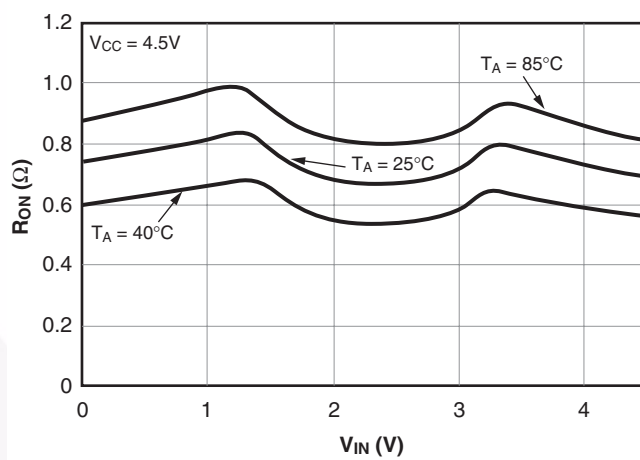
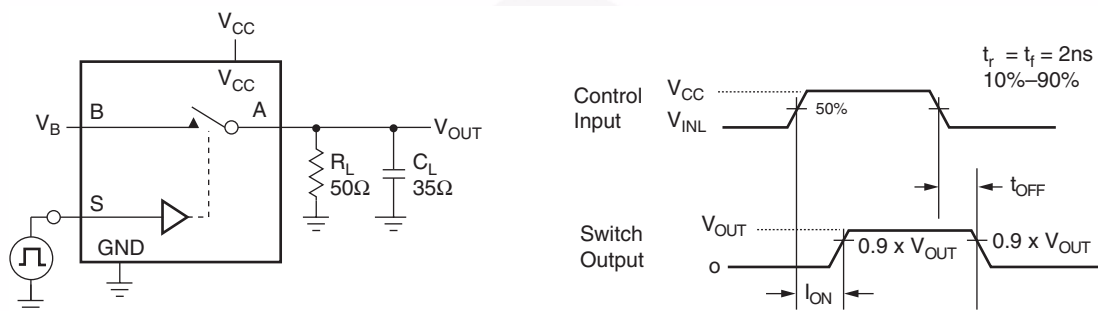


Figure 3. On Resistance vs. Input Voltage, Over Temperature

## AC Loading and Waveforms



$C_L$  Includes Fixture and Stray Capacitance

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

Figure 4. Turn-On / Off Timing

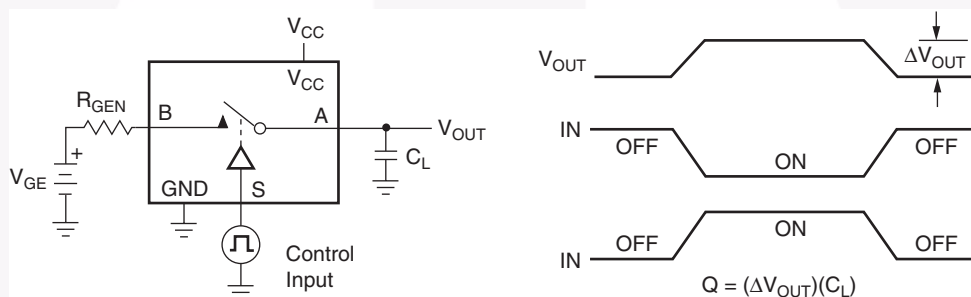


Figure 5. Charge Injection

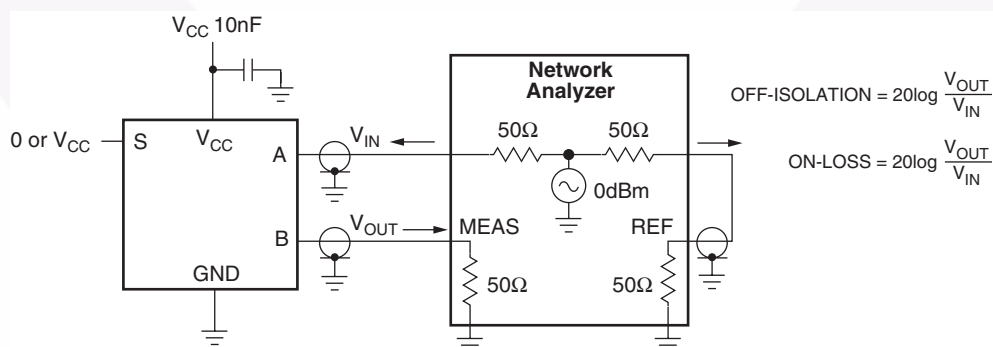


Figure 6. Off Isolation

## AC Loading and Waveforms (Continued)

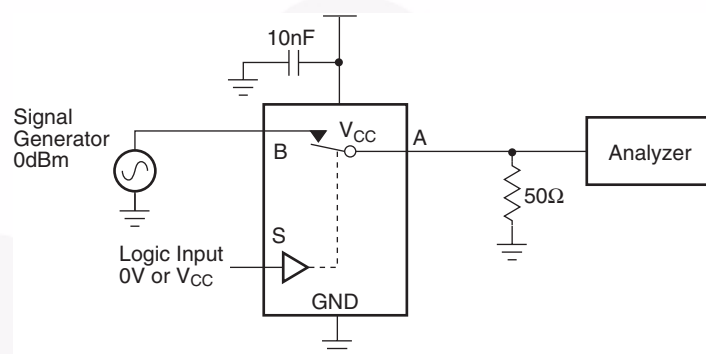


Figure 7. Bandwidth

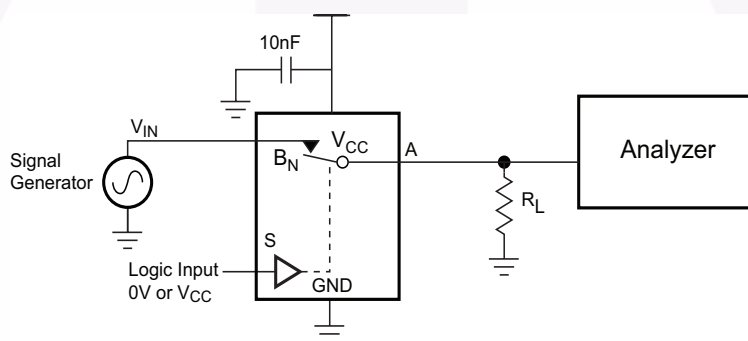


Figure 8. Harmonic Distortion

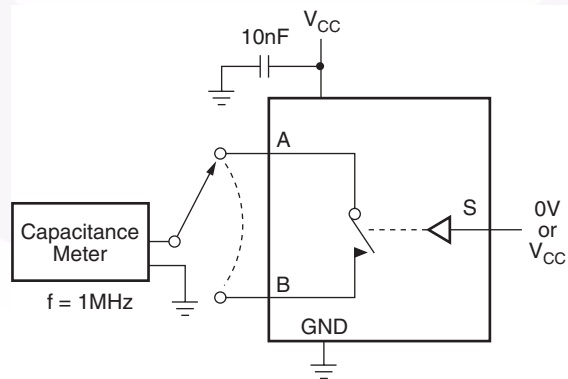
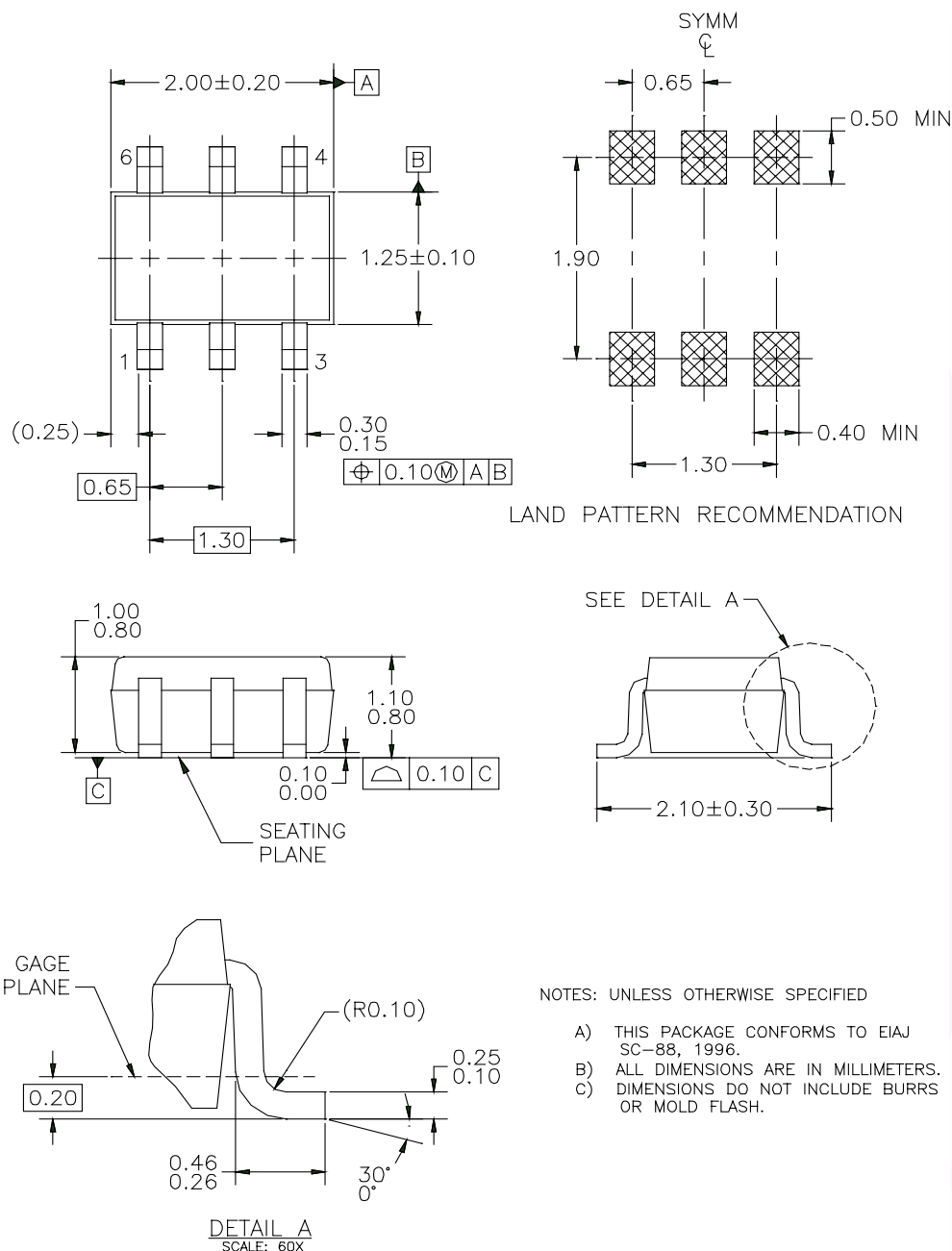


Figure 9. On / Off Capacitance



## Physical Dimensions



MAA06AREV5

Figure 10. 6-Lead SC70, EIAJ SC88, 1.25mm Wide

**Note:** [click here for tape and reel specifications, available at:](http://www.fairchildsemi.com/products/analog/pdf/sc70-6_tr.pdf)

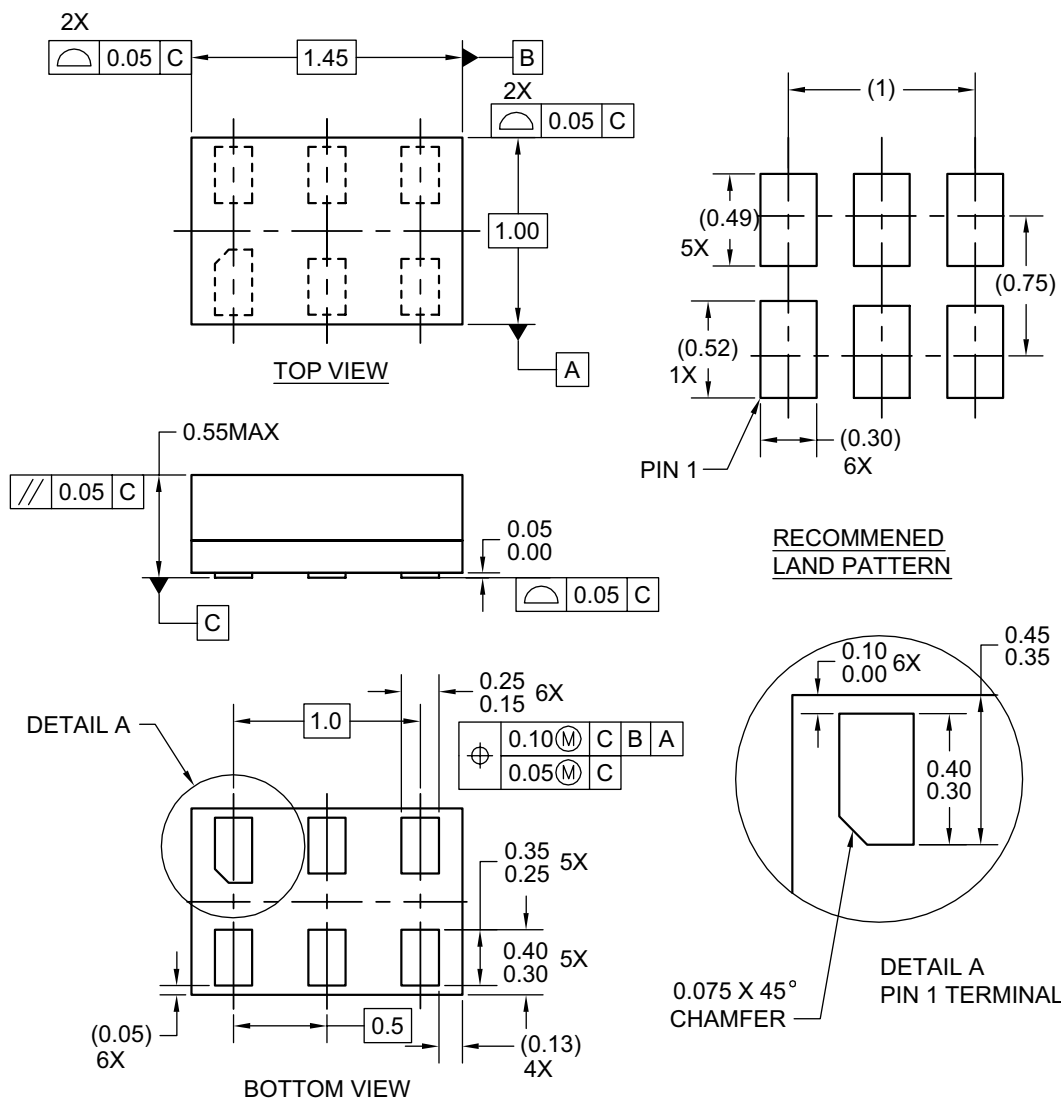
[http://www.fairchildsemi.com/products/analog/pdf/sc70-6\\_tr.pdf](http://www.fairchildsemi.com/products/analog/pdf/sc70-6_tr.pdf)

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>

## 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 11. 6-Lead MicroPak, 1.0mm Wide

**Note:** [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](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf)

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>



## TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

|                                      |                                              |                                        |                                  |
|--------------------------------------|----------------------------------------------|----------------------------------------|----------------------------------|
| ACE <sup>®</sup>                     | FPST <sup>™</sup>                            | PDP-SPM <sup>™</sup>                   | SupreMOS <sup>™</sup>            |
| Build it Now <sup>™</sup>            | FRFET <sup>®</sup>                           | Power220 <sup>®</sup>                  | SyncFET <sup>™</sup>             |
| CorePLUS <sup>™</sup>                | Global Power Resource <sup>SM</sup>          | POWEREDGE <sup>™</sup>                 | SYSTEM <sup>®</sup>              |
| CROSSVOLT <sup>™</sup>               | Green FPS <sup>™</sup>                       | Power-SPM <sup>™</sup>                 | GENERAL <sup>®</sup>             |
| CTL <sup>™</sup>                     | Green FPS <sup>™</sup> e-Series <sup>™</sup> | PowerTrench <sup>®</sup>               | The Power Franchise <sup>®</sup> |
| Current Transfer Logic <sup>™</sup>  | GTO <sup>™</sup>                             | Programmable Active Droop <sup>™</sup> | <b>power</b>                     |
| EcoSPARK <sup>®</sup>                | i-Lo <sup>™</sup>                            | QFET <sup>®</sup>                      | franchise                        |
| EZSWITCH <sup>™</sup> *              | IntelliMAX <sup>™</sup>                      | QS <sup>™</sup>                        | TinyBoost <sup>™</sup>           |
| <b>EZ</b> <sup>™</sup>               | ISOPLANAR <sup>™</sup>                       | QT Optoelectronics <sup>™</sup>        | TinyBuck <sup>™</sup>            |
| <b>F</b> <sup>®</sup>                | MegaBuck <sup>™</sup>                        | Quiet Series <sup>™</sup>              | TinyLogic <sup>®</sup>           |
| Fairchild <sup>®</sup>               | MICROCOUPLER <sup>™</sup>                    | RapidConfigure <sup>™</sup>            | TINYOPTO <sup>™</sup>            |
| Fairchild Semiconductor <sup>®</sup> | MicroFET <sup>™</sup>                        | SMART START <sup>™</sup>               | TinyPower <sup>™</sup>           |
| FACT Quiet Series <sup>™</sup>       | MicroPak <sup>™</sup>                        | SPM <sup>®</sup>                       | TinyPVM <sup>™</sup>             |
| FACT <sup>®</sup>                    | MillerDrive <sup>™</sup>                     | STEALTH <sup>™</sup>                   | TinyWire <sup>™</sup>            |
| FAST <sup>®</sup>                    | Motion-SPM <sup>™</sup>                      | SuperFET <sup>™</sup>                  | μSerDes <sup>™</sup>             |
| FastvCore <sup>™</sup>               | OPTOLOGIC <sup>®</sup>                       | SuperSOT <sup>™</sup> 3                | UHC <sup>®</sup>                 |
| FlashWriter <sup>®</sup> *           | OPTOPLANAR <sup>®</sup>                      | SuperSOT <sup>™</sup> 6                | Ultra FRFET <sup>™</sup>         |
|                                      |                                              | SuperSOT <sup>™</sup> 8                | UniFET <sup>™</sup>              |
|                                      |                                              |                                        | VCX <sup>™</sup>                 |

\* EZSWITCH<sup>™</sup> and FlashWriter<sup>®</sup> are trademarks of System General Corporation, used under license by Fairchild Semiconductor.

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
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.                                                                       |
| Preliminary              | First Production       | This 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        | This 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      | This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.                                      |

Rev. I33

# AMEYA360

Components Supply Platform

Authorized Distribution Brand :



Website :

Welcome to visit [www.ameya360.com](http://www.ameya360.com)

Contact Us :

➤ Address :

401 Building No.5, JiuGe Business Center, Lane 2301, Yishan Rd  
Minhang District, Shanghai , China

➤ Sales :

Direct    +86 (21) 6401-6692  
Email     amall@ameya360.com  
QQ        800077892  
Skype     ameyasales1 ameyasales2

➤ Customer Service :

Email     service@ameya360.com

➤ Partnership :

Tel        +86 (21) 64016692-8333  
Email     mkt@ameya360.com