

FSA1156 • FSA1157

Low R_{ON} Low Voltage SPST Analog Switch

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 Ω (typical) and will operate over the 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 and the FSA1157 has Normally Closed operation.

Features

- Maximum 0.9 Ω On Resistance (R_{ON}) for 4.5V supply at 25°C
- 0.3 Ω 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
- Available in Lead (Pb) Free MicroPak packaging

Ordering Code:

| Order Number | Product Code Top Mark | Package Number | Package Description | Supplied As |
|---------------|--------------------------|----------------|---|----------------------------|
| FSA1156P6 | 156 | MAA06A | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 250 Units on Tape and Reel |
| FSA1156P6X | 156 | MAA06A | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3k Units on Tape and Reel |
| FSA1156P6X_NL | 156 | MAA06A | Pb-Free 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3k Units on Tape and Reel |
| FSA1156L6X | EH | MAC06A | Pb-Free 6-Lead MicroPak, 1.0mm Wide | 5k Units on Tape and Reel |
| FSA1157P6 | 157 | MAA06A | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 250 Units on Tape and Reel |
| FSA1157P6X | 157 | MAA06A | 6-Lead SC70, EIAJ SC88, 1.25mm Wide | 3k Units on Tape and Reel |
| FSA1157L6X | EJ | MAC06A | Pb-Free 6-Lead MicroPak, 1.0mm Wide | 5k Units on Tape and Reel |

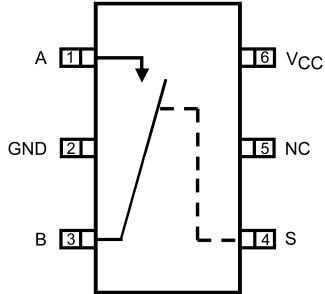
Pb-Free package per JEDEC J-STD-020B.

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

FSA1156 • FSA1157 Low R_{ON} Low Voltage SPST Analog Switch

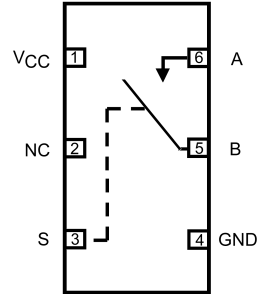
Analog Symbols

Pin Assignments for SC70 Package



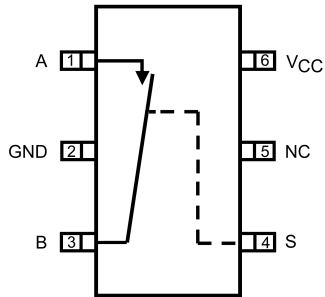
(Top View)
FSA1156 (Normally Open)

Pin Assignments for MicroPak™



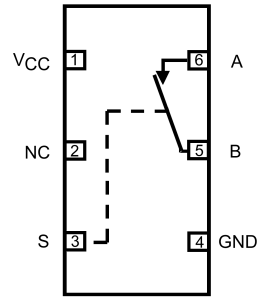
(Top Through View)
FSA1156 (Normally Open)

Pin Assignments for SC70 Package



(Top View)
FSA1157 (Normally Closed)

Pin Assignment for MicroPak™



(Top Through View)
FSA1157 (Normally Closed)

Truth Table

| Control Input (S) | Function of FSA1156 | Function of FSA1157 |
|-------------------|---------------------|---------------------|
| L | OFF | ON |
| H | ON | OFF |

H = HIGH Logic Level
L = LOW Logic Level

Pin Descriptions

| Pin Name | Description |
|----------|---------------|
| A, B | Data Ports |
| S | Control Input |
| NC | No Connect |

| Absolute Maximum Ratings (Note 1) | | Recommended Operating Conditions (Note 3) | |
|---|--------------------------|--|----------------|
| Supply Voltage (V_{CC}) | -0.5V to +6.0V | Supply Voltage (V_{CC}) | 1.65V to 5.5V |
| Switch Voltage (Note 2) | -0.5V to $V_{CC} + 0.5V$ | Control Input Voltage (Note 3) | 0V to V_{CC} |
| Input Voltage (V_{IN}) (Note 2) | -0.5V to +6.0V | Switch Input Voltage | 0V to V_{CC} |
| Input Diode Current | -50 mA | Operating Temperature | -40°C to 85°C |
| Switch Current | 200 mA | Thermal Resistance θ_{JA} in Still Air | |
| Peak Switch Current (Pulsed at 1mS duration, <10% Duty Cycle) | 400 mA | SC70 package | 350°C/W |
| Power Dissipation at 85°C SC70 package | 180 mW | Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum rating. The "Recommended Operating Conditions" table will define the conditions for actual device operation. | |
| Storage Temperature Range (T_{STG}) | -60°C to +150°C | Note 2: The input and output negative ratings may be exceeded if the input and output diode current ratings are observed. | |
| Maximum Junction Temperature (T_J) | +150°C | Note 3: Control input must be held HIGH or LOW and it must not float. | |
| Lead Temperature (T_L) (Soldering, 10 seconds) | +260°C | | |
| ESD (Human Body Model) | 8000V | | |

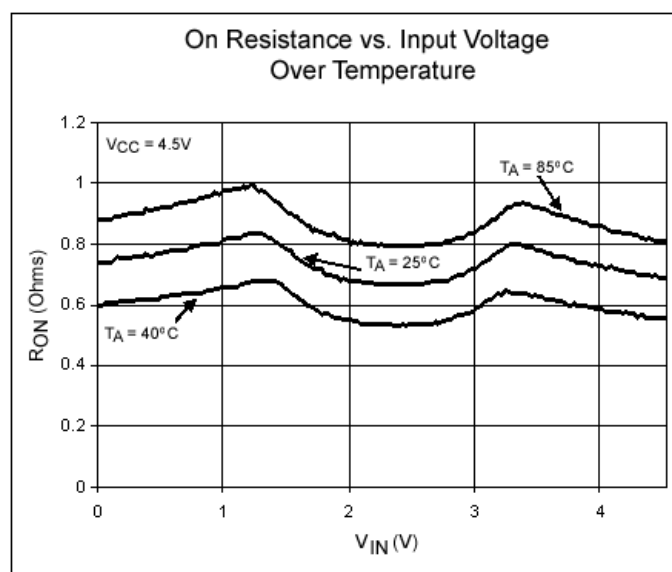
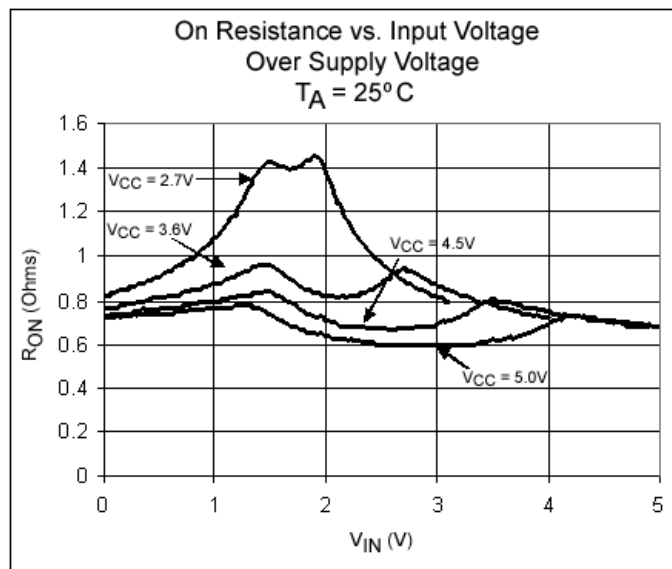
DC Electrical Characteristics (all typical values are at 25°C unless otherwise specified)

| Symbol | Parameter | V_{CC} (V) | $T_A = +25^\circ C$ | | | $T_A = -40^\circ C$ to $+85^\circ C$ | | Units | Conditions |
|----------------------------------|---------------------------------|-----------------|---------------------|------|-----|--------------------------------------|------|----------|---|
| | | | 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 | 2.7 to 3.6 | | | | -1.0 | 1.0 | μA | $V_{IN} = 0V$ to V_{CC} |
| | | 4.5 to 5.5 | | | | -1.0 | 1.0 | | |
| $I_{NO(OFF)}$, $I_{NC(OFF)}$ | OFF Leakage Current | 5.5 | -2.0 | | 2.0 | -20.0 | 20.0 | nA | A = 1V, 4.5V B = 4.5V, 1V |
| $I_{A(ON)}$ | ON Leakage Current | 5.5 | -4.0 | | 4.0 | -40.0 | 40.0 | nA | A = 1V, 4.5V B = 1V, 4.5V or Floating |
| R_{ON} | Switch On Resistance (Note 4) | 2.7 | | 1.4 | 2.1 | | 2.5 | Ω | $I_{OUT} = 100mA$, B = 1.5V $I_{OUT} = 100mA$, B = 3.5V |
| | | 4.5 | | 0.75 | 0.9 | | 1.0 | | |
| $R_{FLAT(ON)}$ | On Resistance Flatness (Note 5) | 2.7 | | 0.6 | | | | Ω | $I_{OUT} = 100mA$, $B_0 = 0V$, 0.75V, 1.5V $I_{OUT} = 100mA$, $B_0 = 0V$, 1V, 2V |
| | | 4.5 | | 0.1 | 0.2 | | 0.3 | | |
| I_{CC} | Quiescent Supply Current | 3.6 | | 0.1 | 0.5 | | 1.0 | μA | $V_{IN} = 0V$ or V_{CC} , $I_{OUT} = 0V$ |
| | | 5.5 | | 0.1 | 0.5 | | 1.0 | | |

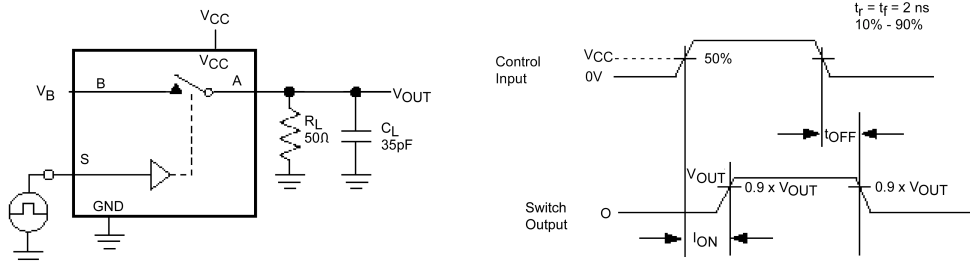
Note 4: On Resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
Note 5: Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.

| AC Electrical Characteristics (all typical value are at 25°C unless otherwise specified) | | | | | | | | | | |
|--|-------------------------------|------------------------|-------------------------|-------|------|---------------------------------|------------|---------------|--|---------------|
| Symbol | Parameter | V _{CC} (V) | T _A = +25 °C | | | T _A = -40°C to +85°C | | Units | Conditions | Figure Number |
| | | | Min | Typ | Max | Min | Max | | | |
| t _{ON} | Turn ON Time | 2.7 to 3.6 | | 30.0 | 40.0 | | | ns | B = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 1 |
| | | 4.5 to 5.5 | | 15.0 | 20.0 | | 25.0 | | B = 3.0V, R _L = 50Ω, C _L = 35 pF | |
| t _{OFF} | Turn OFF Time | 2.7 to 3.6 | | 25.0 | 35.0 | | | ns | B = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 1 |
| | | 4.5 to 5.5 | | 22.0 | 30.0 | | 40.0 | | B = 3.0V, R _L = 50Ω, C _L = 35 pF | |
| Q | Charge Injection | 2.7 to 3.6 | | 10.0 | | | | pC | C _L = 1.0nF, V _{GE} = 0V, R _{GEN} = 0Ω | Figure 2 |
| | | 4.5 to 5.5 | | 20.0 | | | | | | |
| OIRR | OFF- Isolation | 2.7 to 3.6 | | -65.0 | | | | dB | f = 1MHz, R _L = 50Ω | Figure 3 |
| | | 4.5 to 5.5 | | -65.0 | | | | | | |
| BW | -3db Bandwidth | 2.7 to 3.6 | | 300 | | | | MHz | R _L = 50Ω | Figure 4 |
| | | 4.5 to 5.5 | | 300 | | | | | | |
| THD | Total Harmonic Distortion | 2.7 to 3.6 | | 0.001 | | | | % | R _L = 600Ω, V _{IN} = 0.5V PP, f = 20Hz to 20kHz | Figure 5 |
| | | 4.5 to 5.5 | | 0.001 | | | | | | |
| Capacitance | | | | | | | | | | |
| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | Units | Conditions | Figure Number | | |
| | | | Min | Typ | Max | | | | | |
| C _{IN} | Control Pin Input Capacitance | 0 | | 3.0 | | pF | f = 1MHz | Figure 6 | | |
| C _{OFF} | A/B Port OFF Capacitance | 4.5 | | 20.0 | | pF | f = 1MHz | Figure 6 | | |
| C _{ON} | A/B Port ON Capacitance | 4.5 | | 65.0 | | pF | f = 1MHz | Figure 6 | | |

Typical Operating Characteristics



AC Loading and Waveforms



C_L Includes Fixture and Stray Capacitance

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

FIGURE 1. Turn ON/OFF Timing

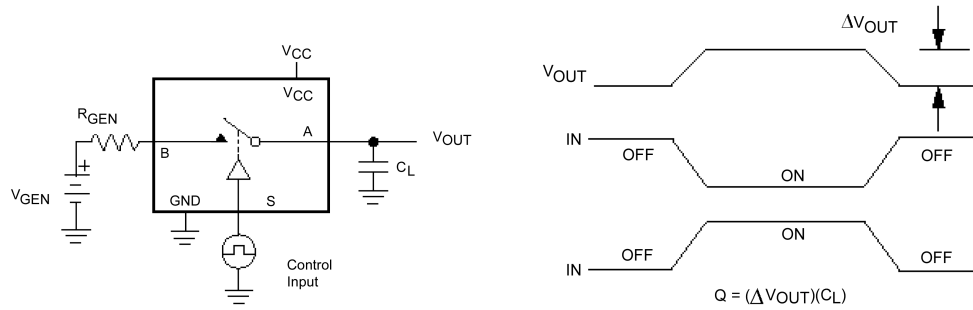


FIGURE 2. Charge Injection

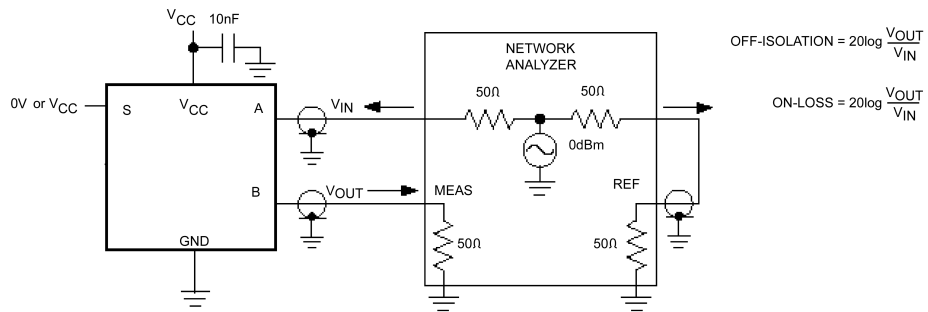


FIGURE 3. OFF Isolation

AC Loading and Waveforms (Continued)

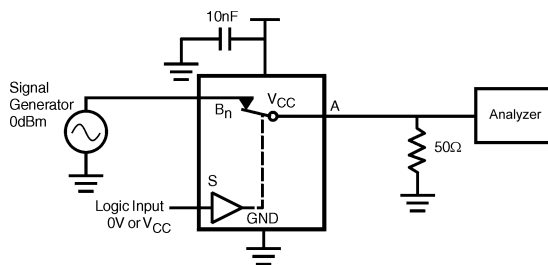


FIGURE 4. Bandwidth

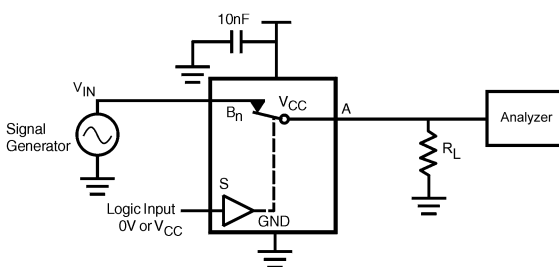


FIGURE 5. Harmonic Distortion

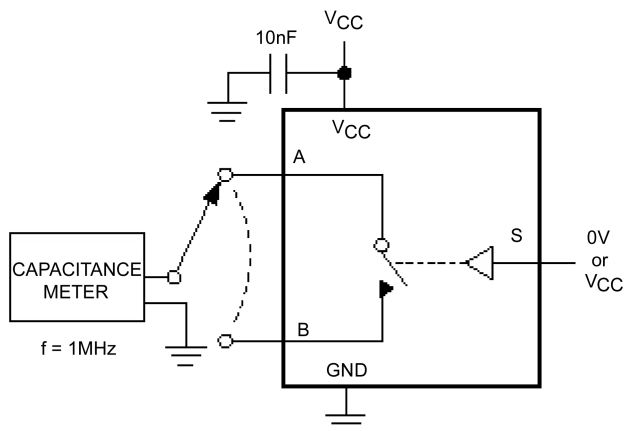


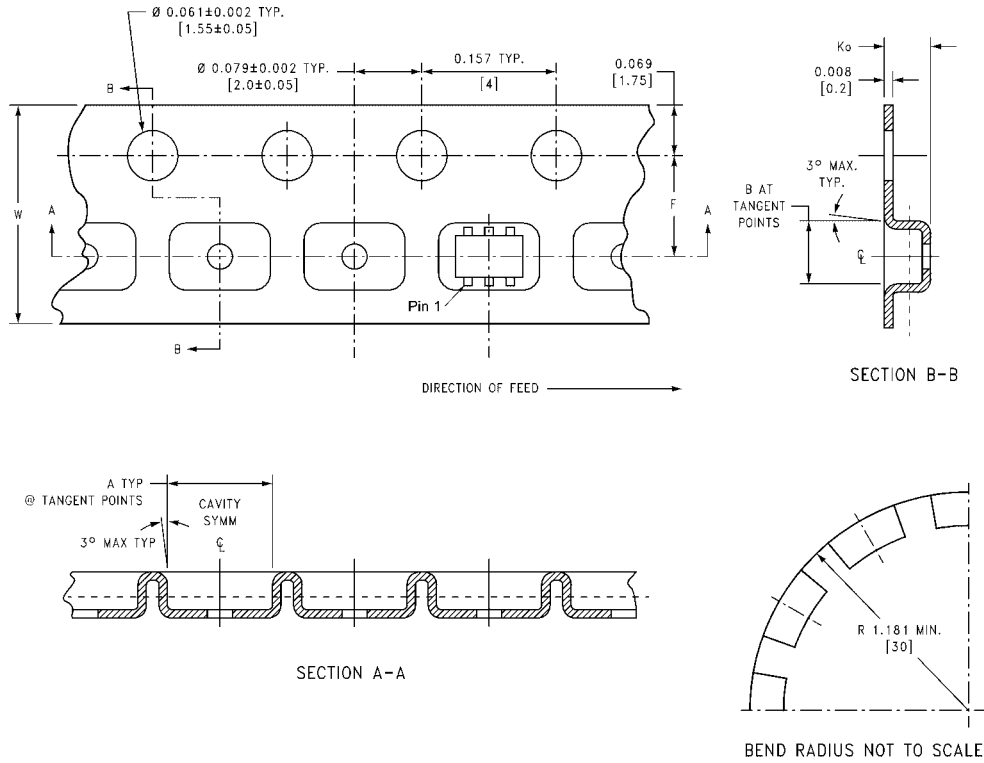
FIGURE 6. ON/OFF Capacitance

Tape and Reel Specification

TAPE FORMAT for SC70

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| P6X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

TAPE DIMENSIONS inches (millimeters)

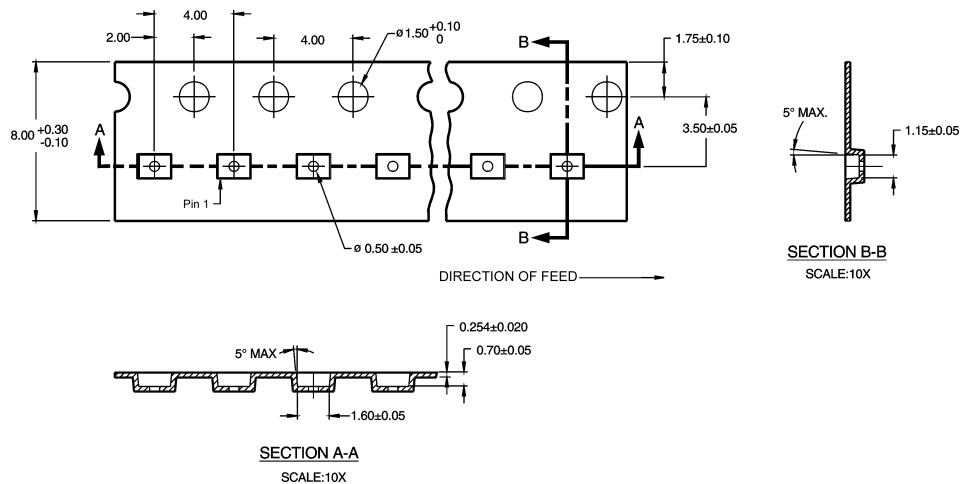


Tape and Reel Specification (Continued)

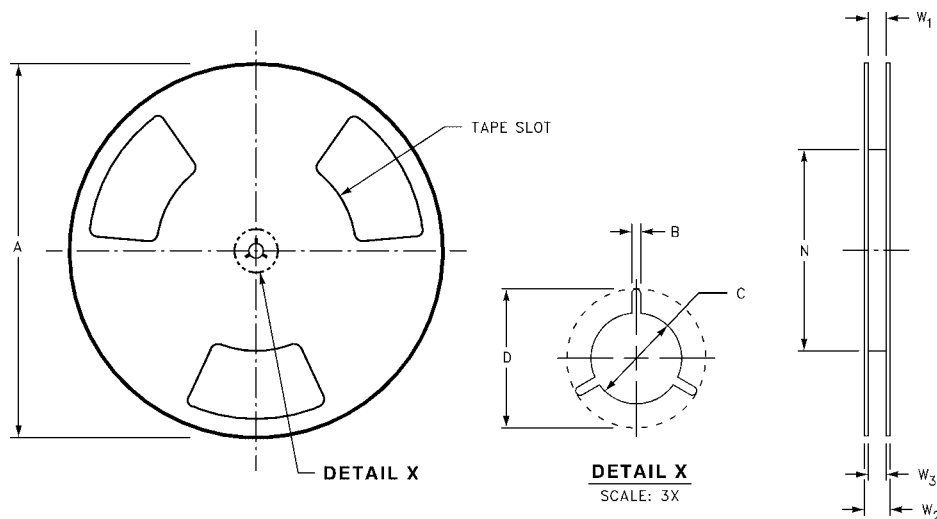
TAPE FORMAT for MircoPak

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| L6X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 5000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

TAPE DIMENSIONS inches (millimeters)

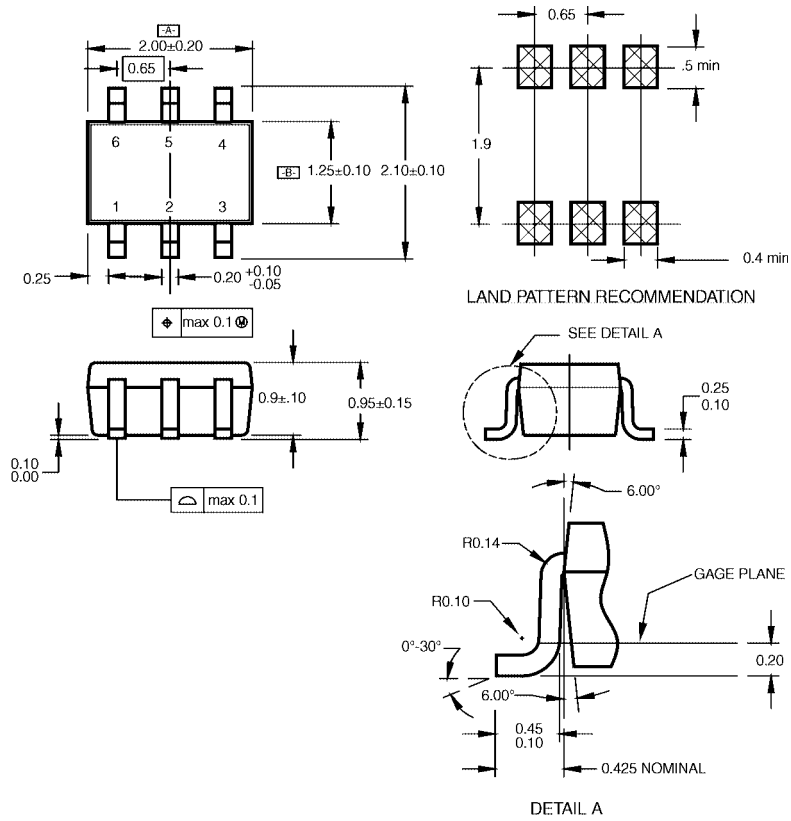


REEL DIMENSIONS inches (millimeters)



| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.331 + 0.059 / -0.000 (8.40 + 1.50 / -0.00) | 0.567 (14.40) | W1 + 0.078 / -0.039 (W1 + 2.00 / -1.00) |

Physical Dimensions inches (millimeters) unless otherwise noted



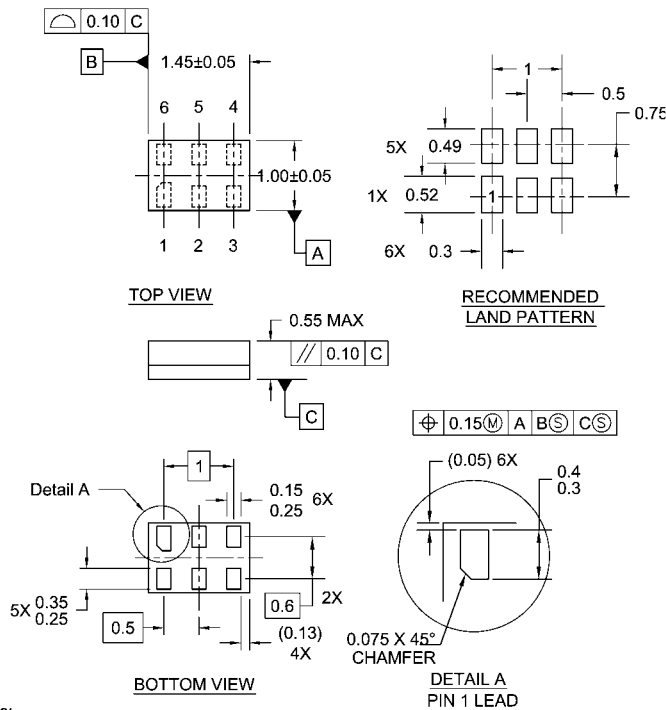
NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA06ARevC

**6-Lead SC70, EIAJ SC88, 1.25mm Wide
Package Number MAA06A**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



- Notes:
1. JEDEC PACKAGE REGISTRATION IS ANTICIPATED
 2. DIMENSIONS ARE IN MILLIMETERS
 3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

**Pb-Free 6-Lead MicroPak, 1.0mm Wide
Package Number MAC06A**

Technology Description

The Fairchild Switch family derives from and embodies Fairchild's proven switch technology used for several years in its 74LVX3L384 (FST3384) bus switch product.

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