FAIRCHILD SEMICONDUCTOR™

November 2003
Revised July 2004

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 0.75Ω (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 0.9Ω On Resistance (R_{ON}) for 4.5V supply at 25°C
- 0.3Ω 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

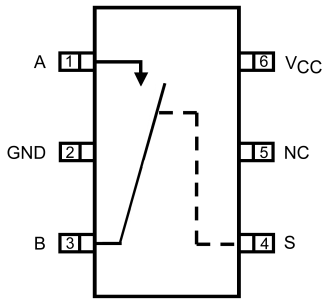
Ordering Code:

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
FSA1156L6X	EH	MAC06A	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	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

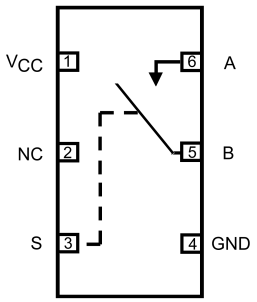
Analog Symbols

Pin Assignments for SC70 Package



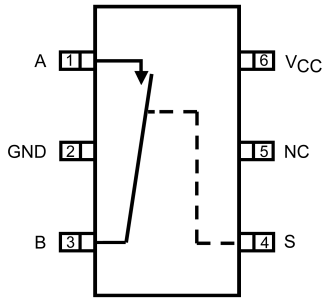
(Top View)
FSA1156 (Normally Open)

Pin Assignments for MicroPak™



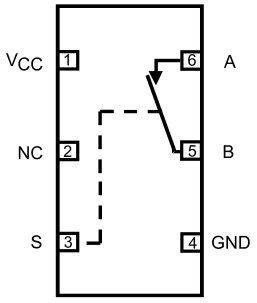
(Top Through View)
FSA1156 (Normally Open)

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)

Supply Voltage (V_{CC})	–0.5V to +6.0V
Switch Voltage (Note 2)	–0.5V to V_{CC} +0.5V
Input Voltage (V_{IN}) (Note 2)	–0.5V to +6.0V
Input Diode Current	–50 mA
Switch Current	200 mA
Peak Switch Current	
(Pulsed at 1mS duration,	
<10% Duty Cycle)	400 mA
Power Dissipation at 85°C	
SC70 package	180 mW
Storage Temperature Range (T_{STG})	–60°C to +150°C
Maximum Junction Temperature (T_J)	+150°C
Lead Temperature (T_L)	
(Soldering, 10 seconds)	+260°C
ESD (Human Body Model)	8000V

Recommended Operating Conditions (Note 3)

Supply Voltage (V_{CC})	1.65V to 5.5V
Control Input Voltage (Note 3)	0V to V_{CC}
Switch Input Voltage	0V to V_{CC}
Operating Temperature	–40°C to 85°C
Thermal Resistance θ_{JA} in Still Air	
SC70 package	350°C/W

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.

Note 2: The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.

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

DC Electrical Characteristics (all typical values 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
			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	2.7		1.4	2.1		2.5	Ω	I_{OUT} = 100mA, B = 1.5V
	(Note 4)	4.5		0.75	0.9		1.0		I_{OUT} = 100mA, B = 3.5V
$R_{FLAT(ON)}$	On Resistance Flatness	2.7		0.6				Ω	I_{OUT} = 100mA, B_0 = 0V, 0.75V,1.5V
	(Note 5)	4.5		0.1	0.2		0.3		I_{OUT} = 100mA, B_0 = 0V, 1V, 2V
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.

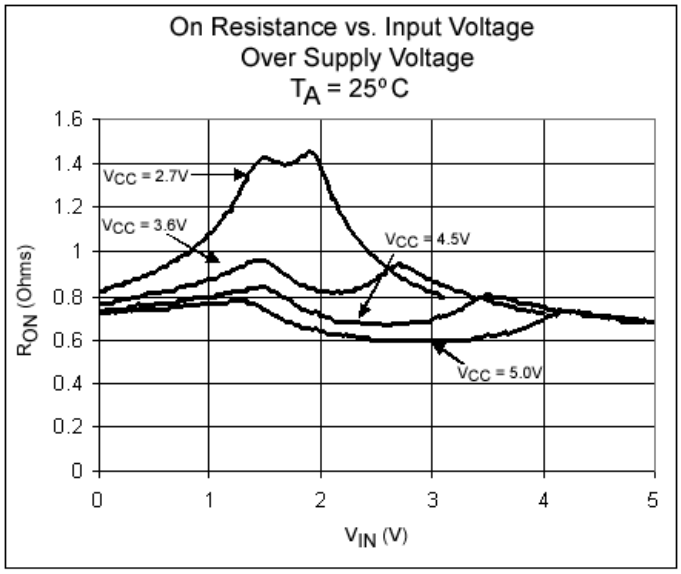
AC Electrical Characteristics (all typical value are at 25°C unless otherwise specified)

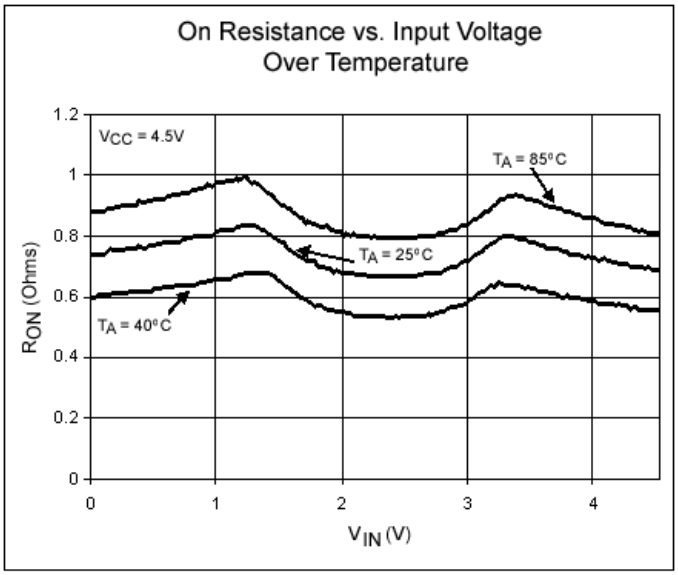
Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$			$T_A = -40°C$ to $+85°C$		Units	Conditions	Figure Number
			Min	Typ	Max	Min	Max			
t_{ON}	Turn ON Time	2.7 to 3.6		30.0	40.0		45.0	ns	B = 1.5V, $R_L = 50\Omega$, $C_L = 35$ pF	Figure 1
		4.5 to 5.5		15.0	20.0		25.0		B = 3.0V, $R_L = 50\Omega$, $C_L = 35$ pF	
t_{OFF}	Turn OFF Time	2.7 to 3.6		25.0	35.0		45.0	ns	B = 1.5V, $R_L = 50\Omega$, $C_L = 35$ pF	Figure 1
		4.5 to 5.5		22.0	30.0		40.0		B = 3.0V, $R_L = 50\Omega$, $C_L = 35$ pF	
Q	Charge Injection	2.7 to 3.6		10.0				pC	$C_L = 1.0$nF, $V_{GE} = 0$V, $R_{GEN} = 0\Omega$	Figure 2
		4.5 to 5.5		20.0						
OIRR	OFF- Isolation	2.7 to 3.6		–65.0				dB	f = 1MHz, $R_L = 50\Omega$	Figure 3
		4.5 to 5.5		–65.0						
BW	–3db Bandwidth	2.7 to 3.6		300				MHz	$R_L = 50\Omega$	Figure 4
		4.5 to 5.5		300						
THD	Total Harmonic Distortion	2.7 to 3.6		0.001				%	$R_L = 600\Omega$, $V_{IN} = 0.5$V PP, f = 20Hz to 20kHz	Figure 5
		4.5 to 5.5		0.001						

Capacitance

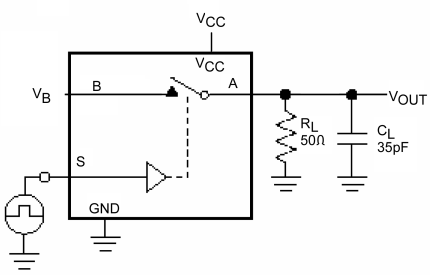
Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$			Units	Conditions	Figure Number
			Min	Typ	Max			
C_{IN}	Control Pin Input Capacitance	0		3.0		pF	f = 1MHz	Figure 6
C_{OFF}	A/B Port OFF Capacitance	4.5		20.0		pF	f = 1MHz	Figure 6
C_{ON}	A/B Port ON Capacitance	4.5		65.0		pF	f = 1MHz	Figure 6

Typical Operating Characteristics

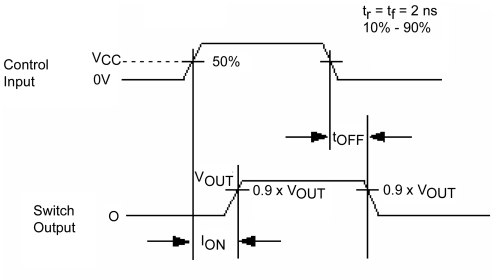




AC Loading and Waveforms

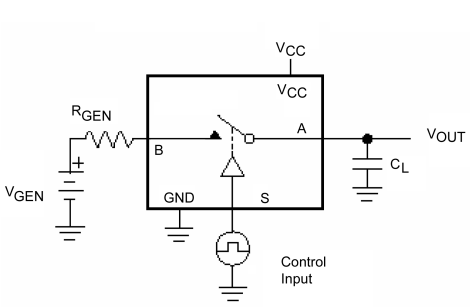


C_L Includes Fixture and Stray Capacitance



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

FIGURE 1. Turn ON/OFF Timing



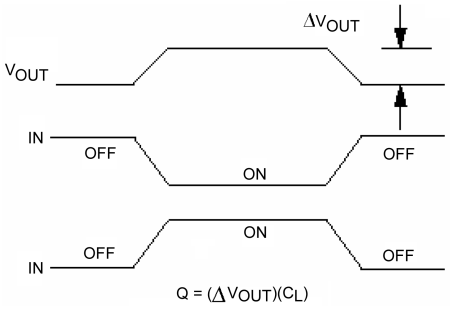


FIGURE 2. Charge Injection

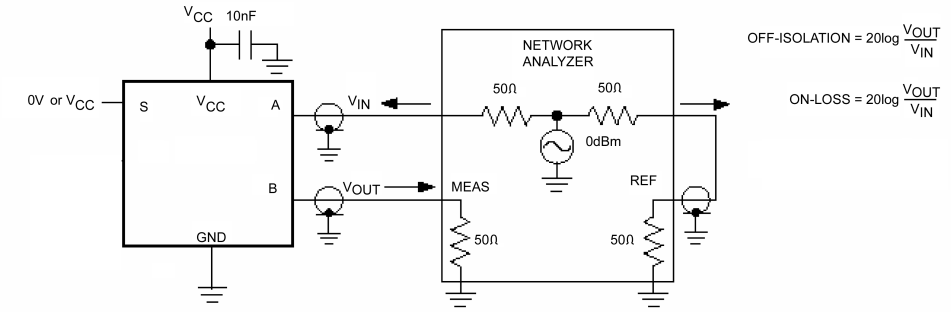


FIGURE 3. OFF Isolation

AC Loading and Waveforms (Continued)

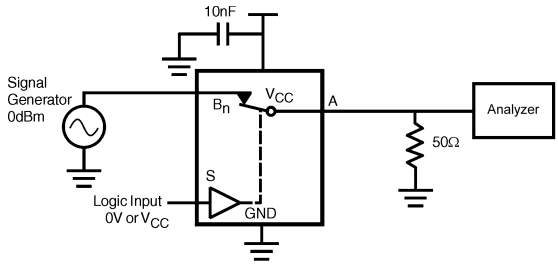


FIGURE 4. Bandwidth

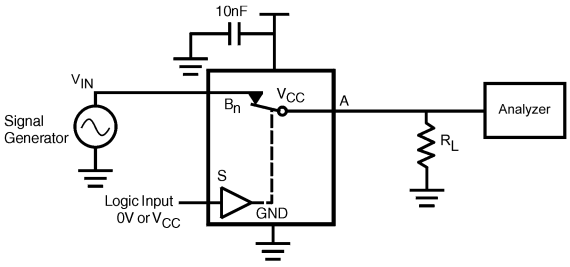


FIGURE 5. Harmonic Distortion

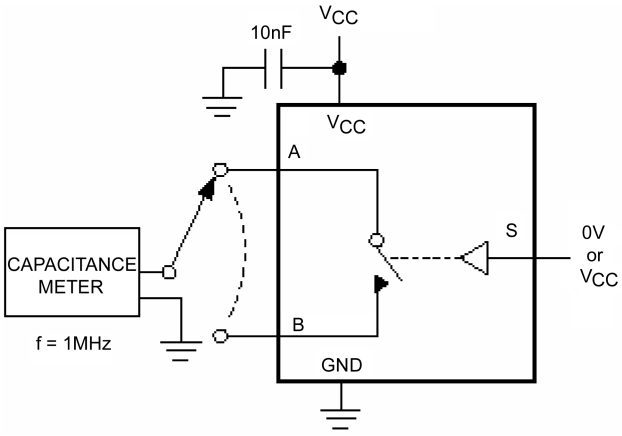


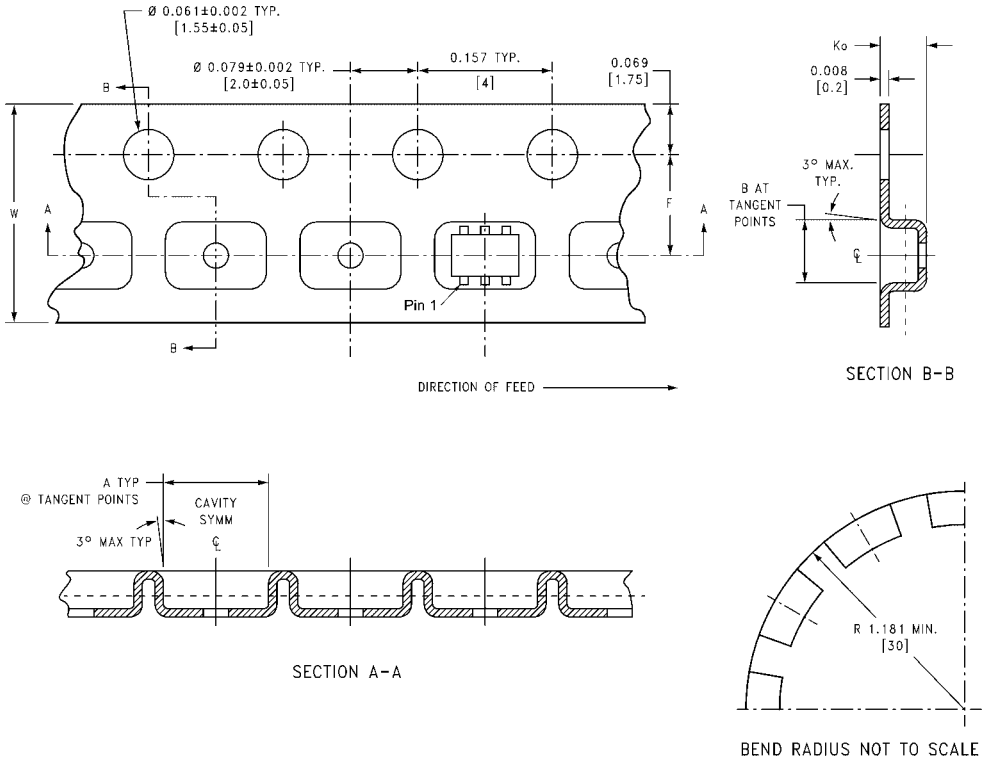
FIGURE 6. ON/OFF Capacitance

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)

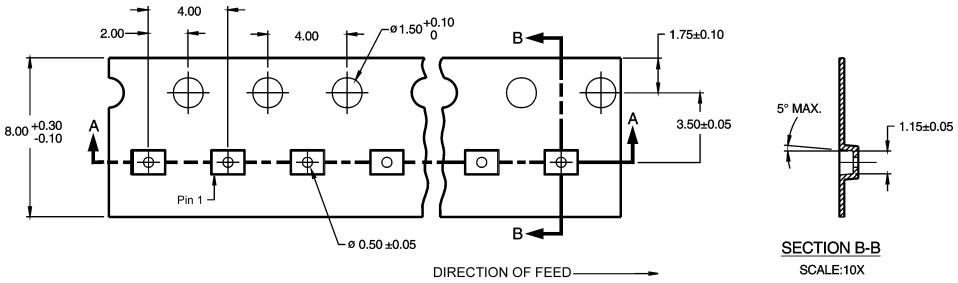


Tape and Reel Specification (Continued)

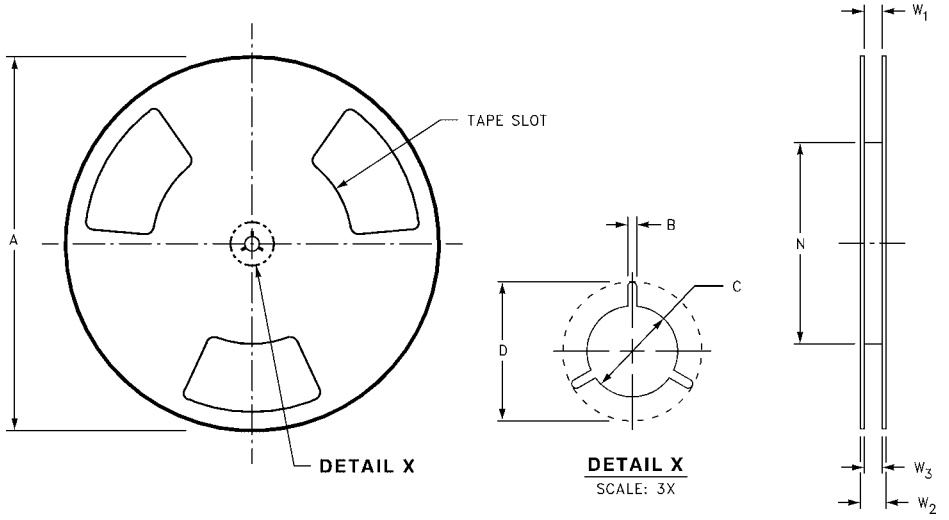
TAPE FORMAT for MircoPak

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)

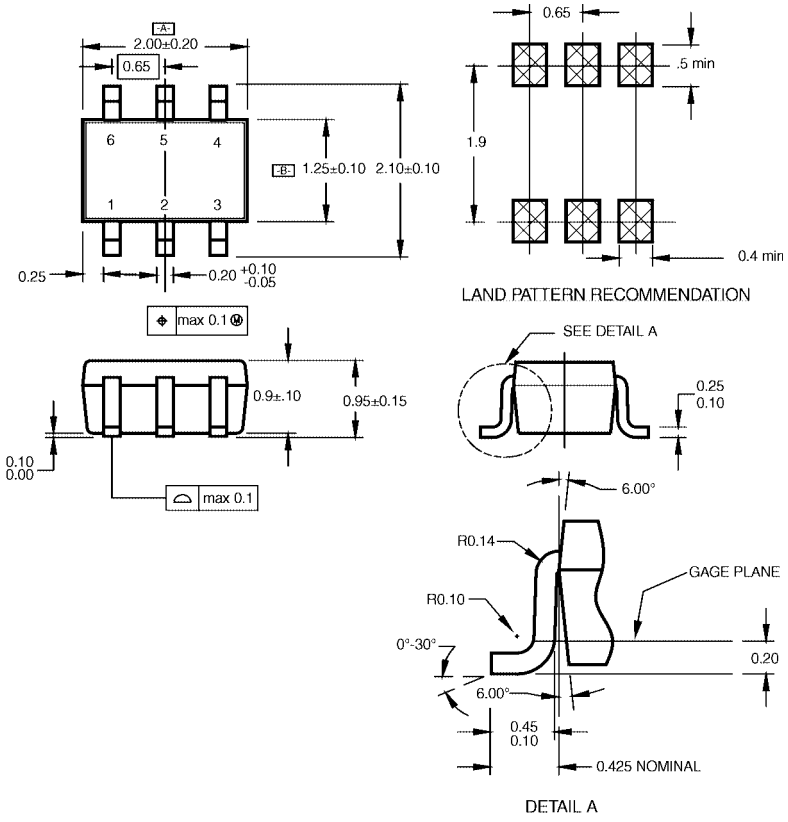


REEL DIMENSIONS inches (millimeters)



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



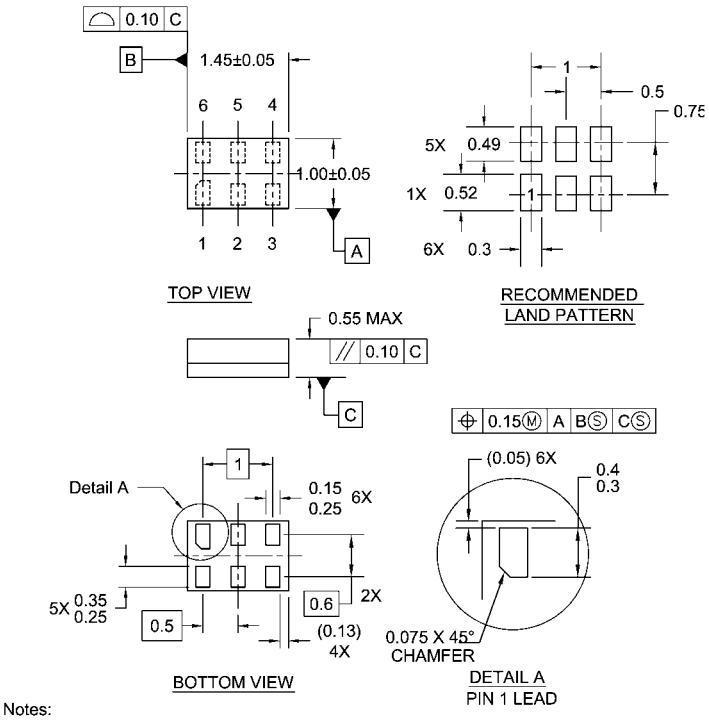
NOTES:

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

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.