



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 0.75 $\Omega$  (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 $\Omega$  On Resistance ( $R_{ON}$ ) 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

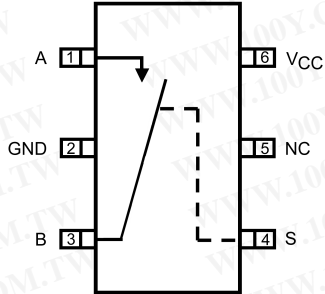
#### Ordering Code:

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.

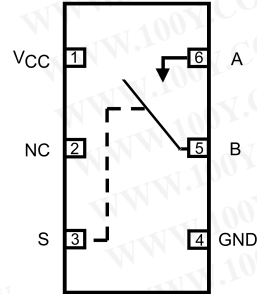
## Analog Symbols

Pin Assignments for SC70 Package



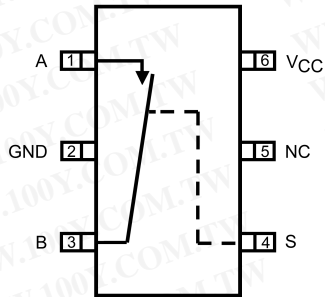
(Top View)  
FSA1156 (Normally Open)

Pin Assignments for MicroPak™



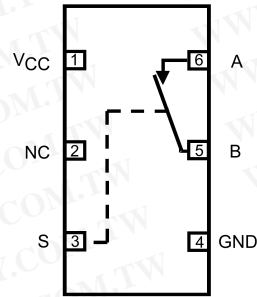
(Top Through View)  
FSA1156 (Normally Open)

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 $\theta_{JA}$ 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)	$T_A = +25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		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	$\mu\text{A}$	$V_{IN} = 0\text{V to } V_{CC}$
		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	$\Omega$	$I_{OUT} = 100\text{mA}$ , B = 1.5V $I_{OUT} = 100\text{mA}$ , B = 3.5V
		4.5		0.75	0.9		1.0		
$R_{FLAT(ON)}$	On Resistance Flatness (Note 5)	2.7		0.6				$\Omega$	$I_{OUT} = 100\text{mA}$ , $B_0 = 0\text{V}$ , 0.75V, 1.5V $I_{OUT} = 100\text{mA}$ , $B_0 = 0\text{V}$ , 1V, 2V
		4.5		0.1	0.2		0.3		
$I_{CC}$	Quiescent Supply Current	3.6		0.1	0.5		1.0	$\mu\text{A}$	$V_{IN} = 0\text{V or } V_{CC}$ , $I_{OUT} = 0\text{V}$
		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.

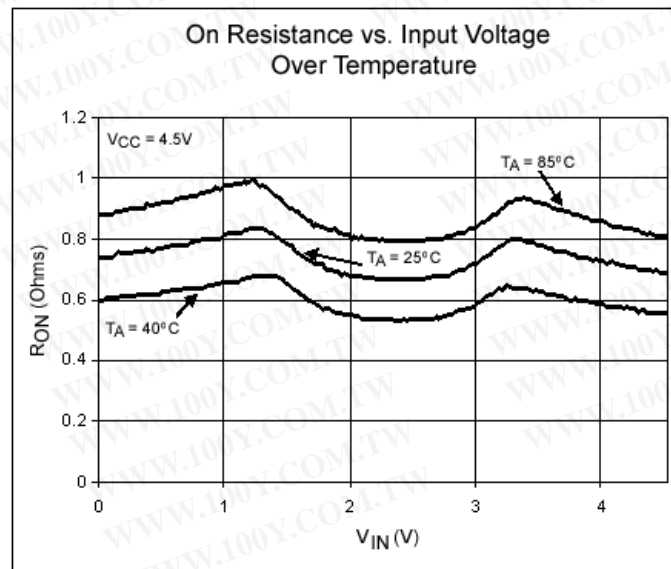
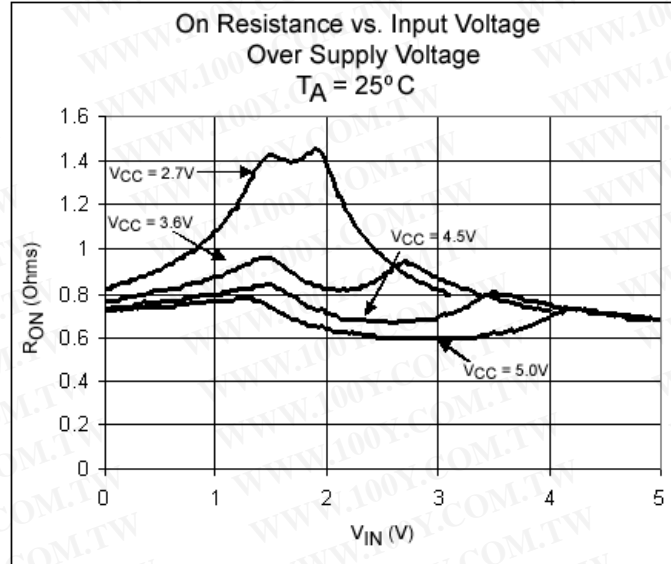
## AC Electrical Characteristics (all typical value are at 25°C unless otherwise specified)

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25 °C			T <sub>A</sub> = -40°C to +85°C		Units	Conditions	Figure Number
			Min	Typ	Max	Min	Max			
t <sub>ON</sub>	Turn ON Time	2.7 to 3.6		30.0	40.0		45.0	ns	B = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1
		4.5 to 5.5		15.0	20.0		25.0		B = 3.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	
t <sub>OFF</sub>	Turn OFF Time	2.7 to 3.6		25.0	35.0		45.0	ns	B = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1
		4.5 to 5.5		22.0	30.0		40.0		B = 3.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	
Q	Charge Injection	2.7 to 3.6		10.0				pC	C <sub>L</sub> = 1.0nF, V <sub>GE</sub> = 0V, R <sub>GEN</sub> = 0Ω	Figure 2
		4.5 to 5.5		20.0						
OIRR	OFF- Isolation	2.7 to 3.6		-65.0				dB	f = 1MHz, R <sub>L</sub> = 50Ω	Figure 3
		4.5 to 5.5		-65.0						
BW	-3db Bandwidth	2.7 to 3.6		300				MHz	R <sub>L</sub> = 50Ω	Figure 4
		4.5 to 5.5		300						
THD	Total Harmonic Distortion	2.7 to 3.6		0.001				%	R <sub>L</sub> = 600Ω, V <sub>IN</sub> = 0.5V PP, f = 20Hz to 20kHz	Figure 5
		4.5 to 5.5		0.001						

## Capacitance

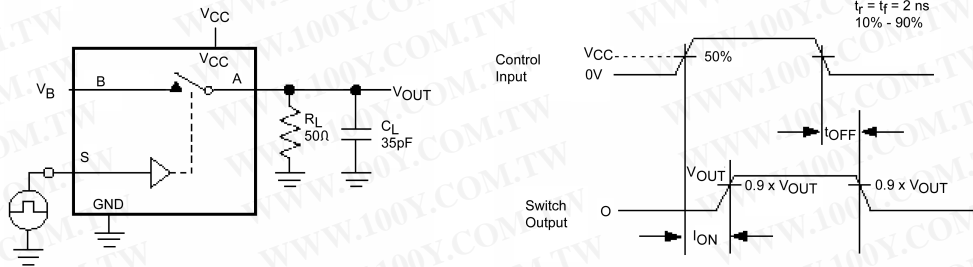
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			Units	Conditions	Figure Number
			Min	Typ	Max			
C <sub>IN</sub>	Control Pin Input Capacitance	0		3.0		pF	f = 1MHz	Figure 6
C <sub>OFF</sub>	A/B Port OFF Capacitance	4.5		20.0		pF	f = 1MHz	Figure 6
C <sub>ON</sub>	A/B Port ON Capacitance	4.5		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

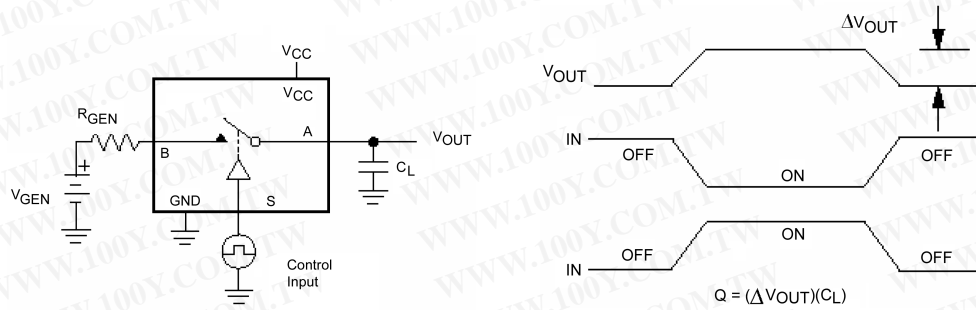


FIGURE 2. Charge Injection

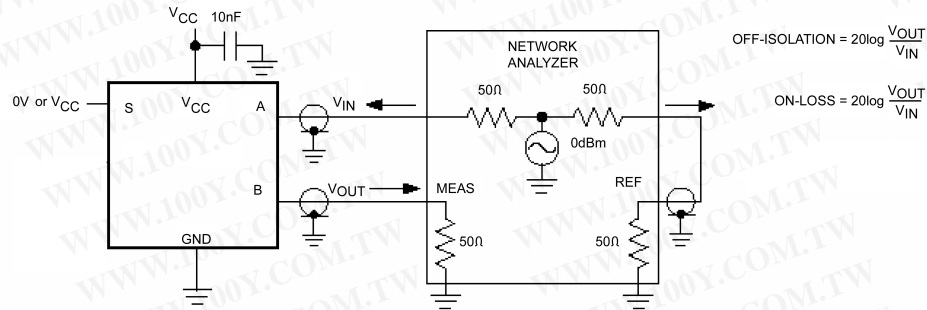


FIGURE 3. OFF Isolation

## AC Loading and Waveforms (Continued)

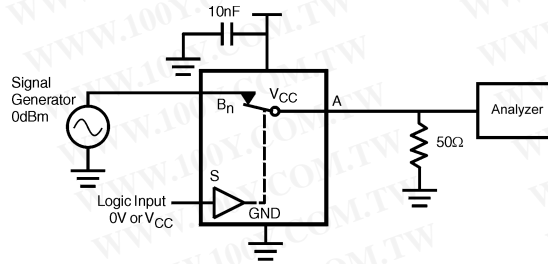


FIGURE 4. Bandwidth

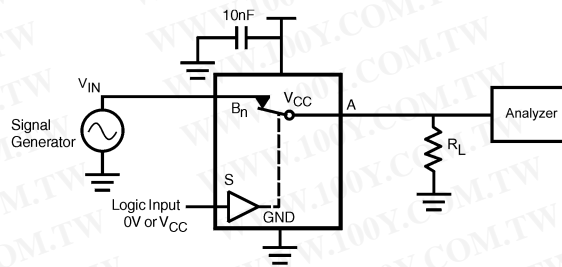


FIGURE 5. Harmonic Distortion

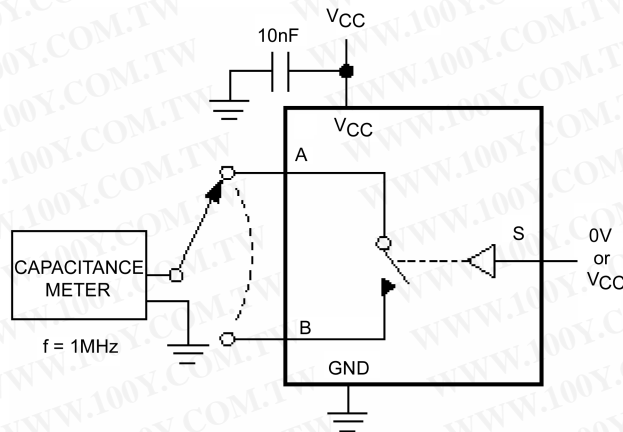


FIGURE 6. ON/OFF Capacitance

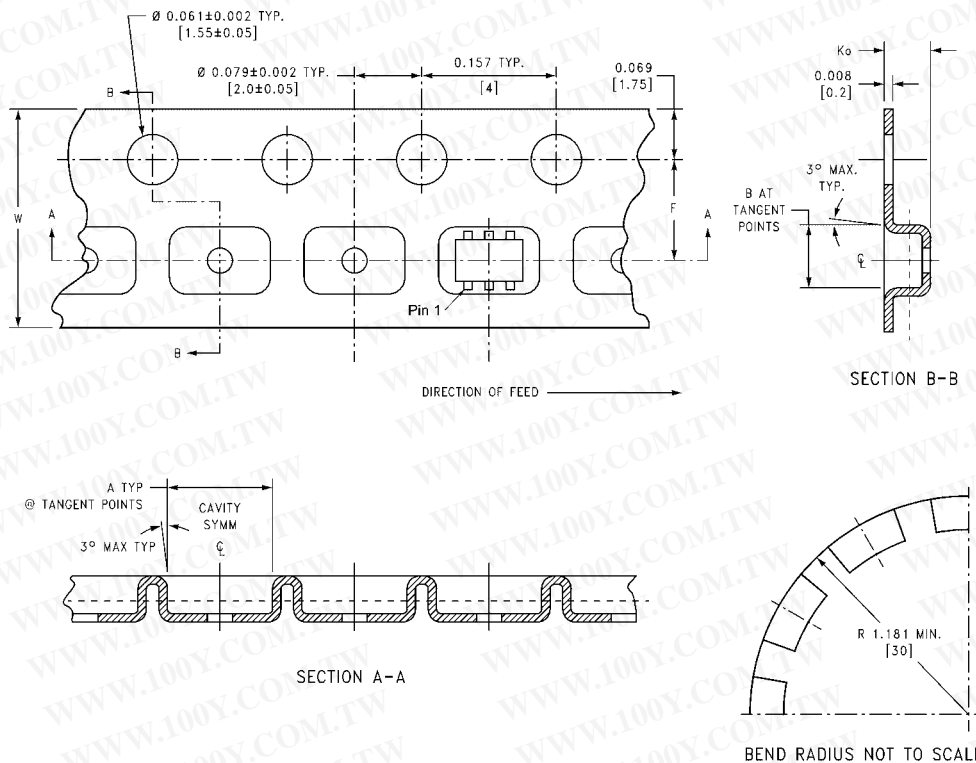
FSA1156 • FSA1157

## 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)



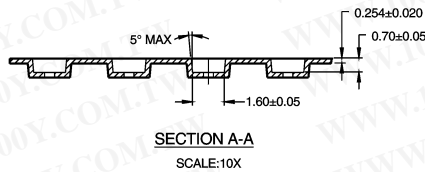
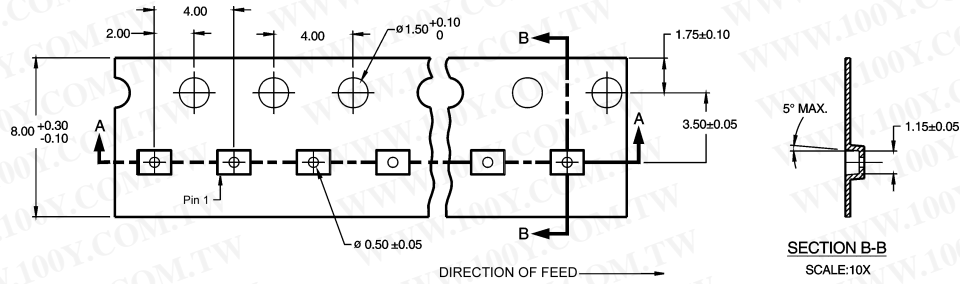


# **Tape and Reel Specification** (Continued)

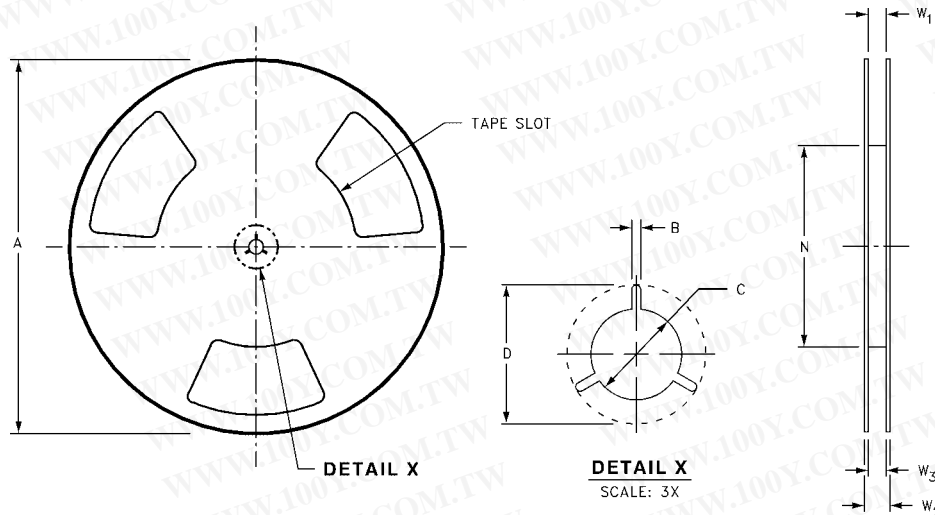
## **TAPE FORMAT for MircoPak**

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)

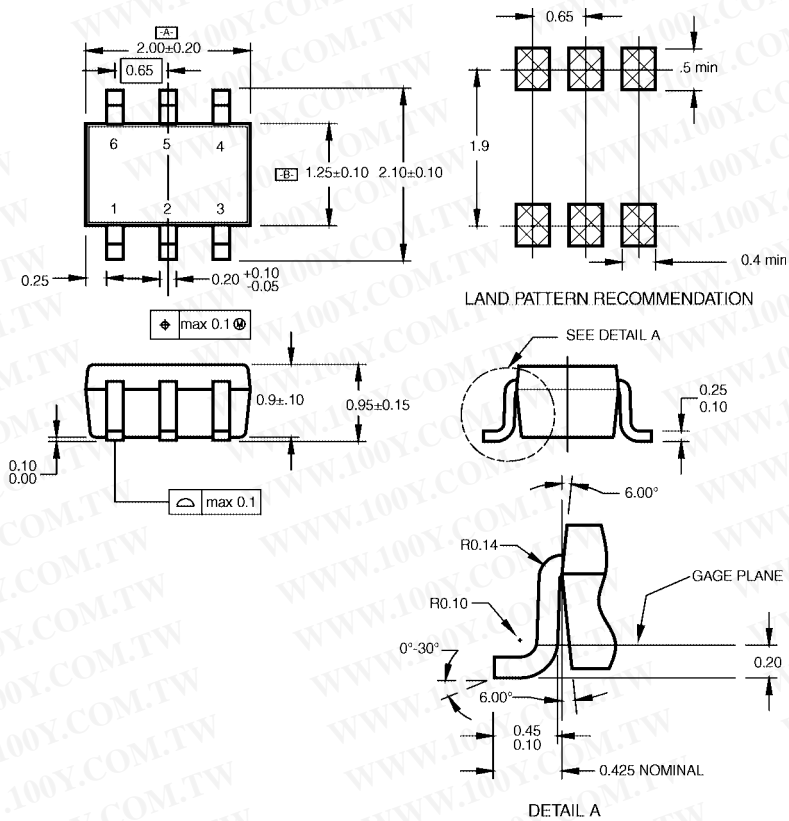


## **REEL DIMENSIONS** inches (millimeters)



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



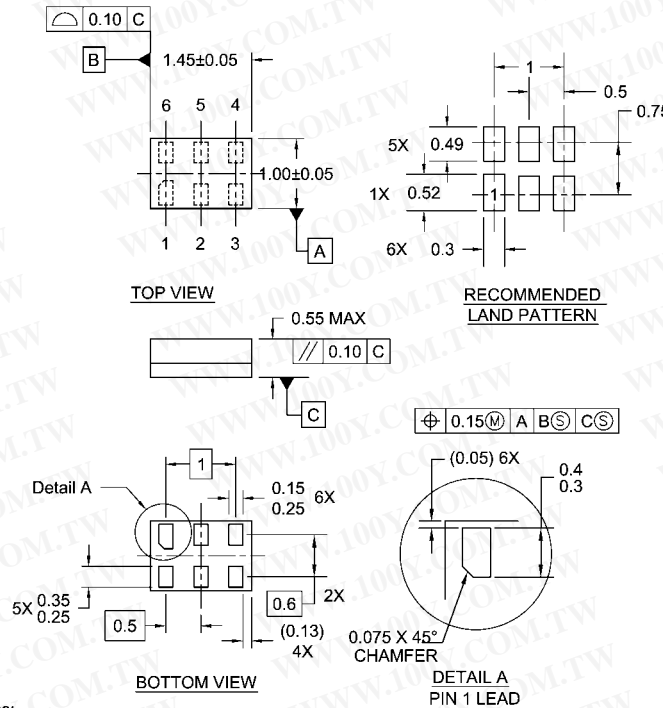
## NOTES:

- 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.

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