

## FSAT66

### Low Voltage Single SPST Normally Open Analog Switch with TTL Compatible Control Input

#### General Description

The FSAT66 is a high speed single pole/single throw normally open Analog Switch with a TTL compatible control input and is fabricated on a sub-micron CMOS process.

The low On Resistance of the switch allows input to be connected to output with minimal propagation delay and without generating additional ground bounce noise. The device is organized as a 1-bit switch with a switch enable (OE) signal. When OE is HIGH, the switch is on and Port A is connected to Port B. When OE is LOW, the switch is open and a high-impedance state exists between the two ports.

#### Features

- Space saving SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Broad V<sub>CC</sub> Operating Range 1.65V to 5.5V
- Rail-to-rail signal handling
- 5Ω switch connection between two ports
- Minimal propagation delay through the switch
- Low I<sub>CC</sub>
- Zero bounce in flow-through mode
- Control input compatible with TTL input levels
- >250 MHz–3dB bandwidth

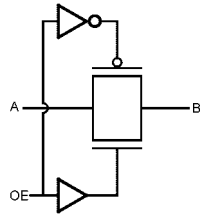
#### Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
FSAT66M5X (Preliminary)	MA05B	AT66	5-Lead SOT23, JEDEC MO-178, 1.6mm	3K Units on Tape and Reel
FSAT66P5X	MAA05A	T66	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3K Units on Tape and Reel
FSAT66L6X	MAC06A	EF	6-Lead MicroPak, 1.0mm Wide	5K Units on Tape and Reel

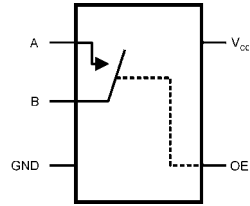
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FSAT66 Low Voltage Single SPST Normally Open Analog Switch with TTL Compatible Control Input

**Logic Symbol**



**Analog Symbol**



**Pin Descriptions**

Pin Names	Description
OE	Switch Enable Input
A	Bus A I/O
B	Bus B I/O
NC	No Connect

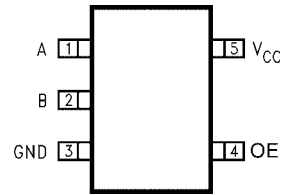
**Function Table**

OE	B <sub>0</sub>	Function
L	High-Z State	Disconnect
H	A <sub>0</sub>	Connect

H = HIGH Logic Level      L = LOW Logic Level

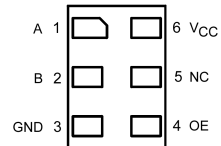
**Connection Diagrams**

**Pin Assignments for SOT23 and SC70**



(Top View)

**Pad Assignments for MicroPak**



(Top Thru View)

Absolute Maximum Ratings <sup>(Note 1)</sup>			Recommended Operating Conditions <sup>(Note 3)</sup>		
Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V		Power Supply Voltage ( $V_{CC}$ )	1.65V to 5.5V	
DC Switch Voltage ( $V_S$ )	-0.5V to $V_{CC} + 0.5V$		Control Input Voltage ( $V_{IN}$ )	0V to 5.5V	
DC Input Voltage ( $V_{IN}$ ) (Note 2)	-0.5V to +7.0V		Switch Input Voltage ( $V_{IN}$ )	0V to $V_{CC}$	
DC Input Diode Current @ ( $I_{IK}$ ) $V_{IN} < 0V$	-50 mA		Switch Output Voltage ( $V_{OUT}$ )	0V to $V_{CC}$	
DC Output ( $I_{OUT}$ ) Sink Current	±128 mA		Input Rise and Fall Time ( $t_r, t_f$ )		
DC $V_{CC}$ or Ground Current ( $I_{CC}/I_{GND}$ )	±100 mA		Control Input $V_{CC} = 2.3V$ to 3.6V	0 ns/V to 10 ns/V	
Storage Temperature Range ( $T_{STG}$ )	-65°C to +150°C		Control Input $V_{CC} = 4.5V$ to 5.5V	0 ns/V to 5 ns/V	
Junction Lead Temperature under Bias ( $T_J$ )	+150°C		Switch I/O	0 ns/V to DC	
Junction Lead Temperature ( $T_L$ ) (Soldering, 10 Seconds)	+260°C		Operating Temperature ( $T_A$ )	-40°C to +85°C	
Power Dissipation ( $P_D$ ) @ +85°C			Thermal Resistance ( $\theta_{JA}$ )		
SC70-5	150 mW		SC70-5	425°C/Watt	
MicroPak-6	200 mW		MicroPak-6	325°C/Watt	

**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 ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

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

**Note 3:** Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

Symbol	Parameter	$V_{CC}$ (V)	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			$T_A = +25^\circ\text{C}$			Units	Conditions
			Min	Typ (Note 4)	Max	Min	Typ	Max		
$V_{IH}$	HIGH Level Input Voltage	4.5 to 5.5	2.0						V	
		1.65 to 3.6	(0.25 $V_{CC} + 0.75$ )							
$V_{IL}$	LOW Level Input Voltage	4.5 to 5.5				0.8			V	
		1.65 to 3.6				0.165 $V_{CC}$				
$I_{IN}$	Control Input Leakage Current	0 to 5.5				±1.0			μA	$0 \leq V_{IN} \leq 5.5V$
$I_{OFF}$	OFF Leakage Current	1.65 to 5.5				±10.0			μA	$0 \leq A, B \leq V_{CC}$
$R_{ON}$	Switch On Resistance (Note 5)	4.5		3.0	7.0			Ω		
				5.0	12.0					
				7.0	15.0					
		3.0		4.0	9.0					
				10.0	20.0					
		2.3		5.0	12.0					
				13.0	30.0					
		1.65		7.0	28.0					
				25.0	60.0					
$R_{flat}$	On Resistance Flatness (Note 5)(Note 6) (Note 7)	5.0				6.0			Ω	$I_A = -30\text{ mA}, 0 \leq V_{Bn} \leq V_{CC}$ $I_A = -24\text{ mA}, 0 \leq V_{Bn} \leq V_{CC}$ $I_A = -8\text{ mA}, 0 \leq V_{Bn} \leq V_{CC}$ $I_A = -4\text{ mA}, 0 \leq V_{Bn} \leq V_{CC}$
		3.3				12.0				
		2.5				28.0				
		1.8				125				
$I_{CC}$	Quiescent Supply Current	1.65 to 5.5				10.0			μA	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0$

**Note 4:** All typical values are at the specified  $V_{CC}$ , and  $T_A = 25^\circ\text{C}$ .

**Note 5:** Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltages on the two (A or B) pins.

**Note 6:** Parameter is characterized but not tested in production.

**Note 7:** Flatness is defined as the difference between the minimum and maximum value of On Resistance over the specified range of conditions.

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C			Units	Conditions	Figure Number
			Min	Typ (Note 8)	Max			
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Bus to Bus (Note 9)	1.65 to 1.95		2.0	4.3	ns	V <sub>IN</sub> = OPEN	Figures 1, 2
		2.3 to 2.7		1.1	2.5			
		3.0 to 3.6		0.7	1.5			
		4.5 to 5.5		0.35	1.0			
t <sub>PZL</sub> , t <sub>PZH</sub>	Output Enable Time	1.65 to 1.95	1.5	4.0	12.0	ns	V <sub>IN</sub> = 2 x V <sub>CC</sub> for t <sub>PZL</sub> V <sub>IN</sub> = 0V for t <sub>PZH</sub>	Figures 1, 2
		2.3 to 2.7	1.2	2.5	7.0			
		3.0 to 3.6	0.8	2.0	5.5			
		4.5 to 5.5	0.5	1.5	4.5			
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Output Disable Time	1.65 to 1.95	2.5	7.5	15.0	ns	V <sub>IN</sub> = 2 x V <sub>CC</sub> for t <sub>PLZ</sub> V <sub>IN</sub> = 0V for t <sub>PHZ</sub>	Figures 1, 2
		2.3 to 2.7	2.0	5.5	9.0			
		3.0 to 3.6	1.5	4.5	7.0			
		4.5 to 5.5	1.0	3.5	5.5			
Q	Charge Injection (Note 10)	1.65 to 5.5		0.05		pC	C <sub>L</sub> = 0.1 nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0 Ω, f = 1 MHz	Figure 3
OIRR	Off Isolation (Note 11)	1.65 to 5.5		-50.0		dB	R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5 pF, f = 10 MHz	Figure 4
BW	-3dB Bandwidth	1.65 to 5.5		>250		MHz	R <sub>L</sub> = 50 Ω	Figure 5
THD	Total Harmonic Distortion (Note 8)	5.0		.011		%	R <sub>L</sub> = 600Ω 0.5 V <sub>P-P</sub> f = 600 Hz to 20 KHz	

**Note 8:** All typical values are at the specified V<sub>CC</sub>, and T<sub>A</sub> = 25°C.

**Note 9:** This parameter is guaranteed by design but is not tested. The switch contributes no propagation delay other than the RC delay of the On Resistance of the switch and the 50 pF load capacitance, when driven by an ideal voltage source (zero output impedance).

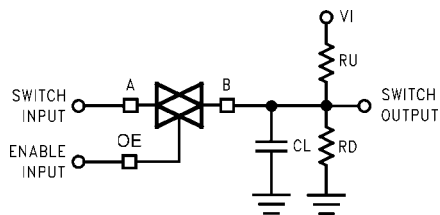
**Note 10:** Guaranteed by design.

**Note 11:** Off Isolation = 20 log<sub>10</sub> [V<sub>A</sub>/V<sub>B</sub>]

## Capacitance

Symbol	Parameter	Typ	Max	Units	Conditions
C <sub>IN</sub>	Control Pin Input Capacitance	2.0		pF	V <sub>CC</sub> = 0V
C <sub>I/O OFF</sub>	Input/Output Capacitance	6.0		pF	V <sub>CC</sub> = 5.0V, OE = 0.0V
C <sub>I/O ON</sub>	Input/Output Capacitance	12.0		pF	V <sub>CC</sub> = 5.0V, OE = V <sub>CC</sub>

### AC Loading and Waveforms



Input driven by 50Ω source terminated in 50Ω  
 $C_L$  includes load and stray capacitance.  
 Input PRR = 1.0 MHz;  $t_w = 500$  ns

FIGURE 1. AC Test Circuit

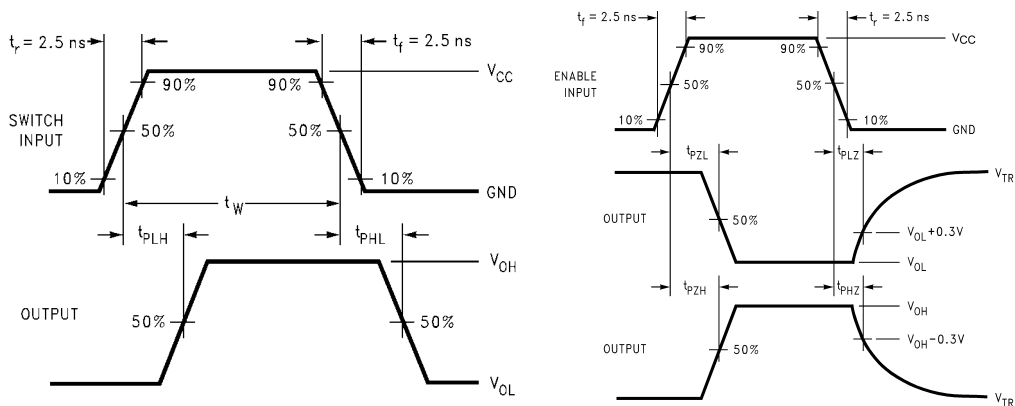


FIGURE 2. AC Waveforms

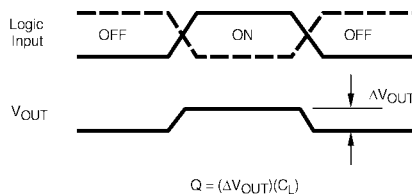
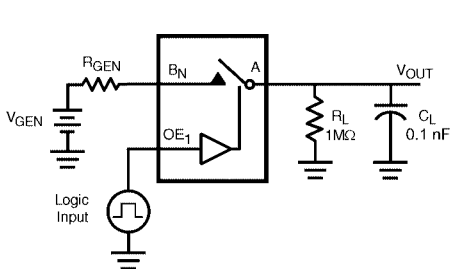


FIGURE 3. Charge Injection Test

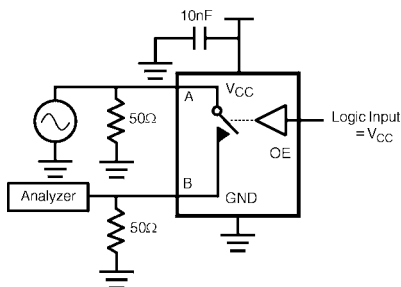


FIGURE 4. Off Isolation

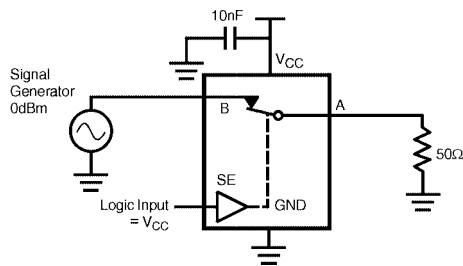


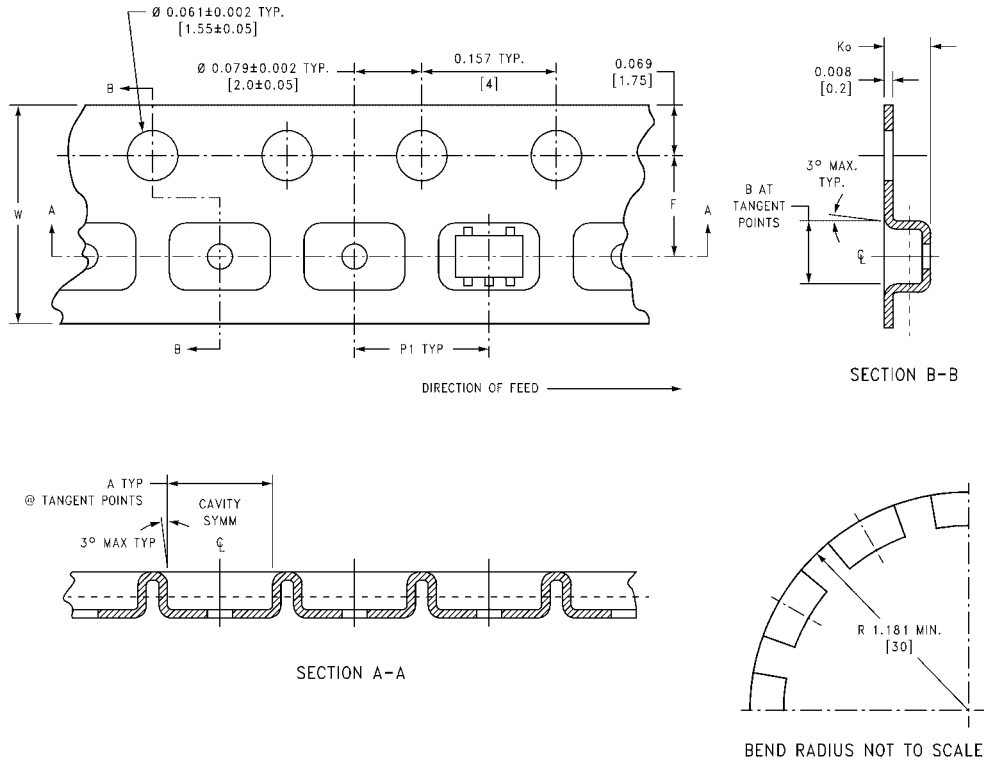
FIGURE 5. Crosstalk

### Tape and Reel Specification

**TAPE FORMAT FOR SOT23, SC70**

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
M5X, P5X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

**TAPE DIMENSIONS** inches (millimeters)

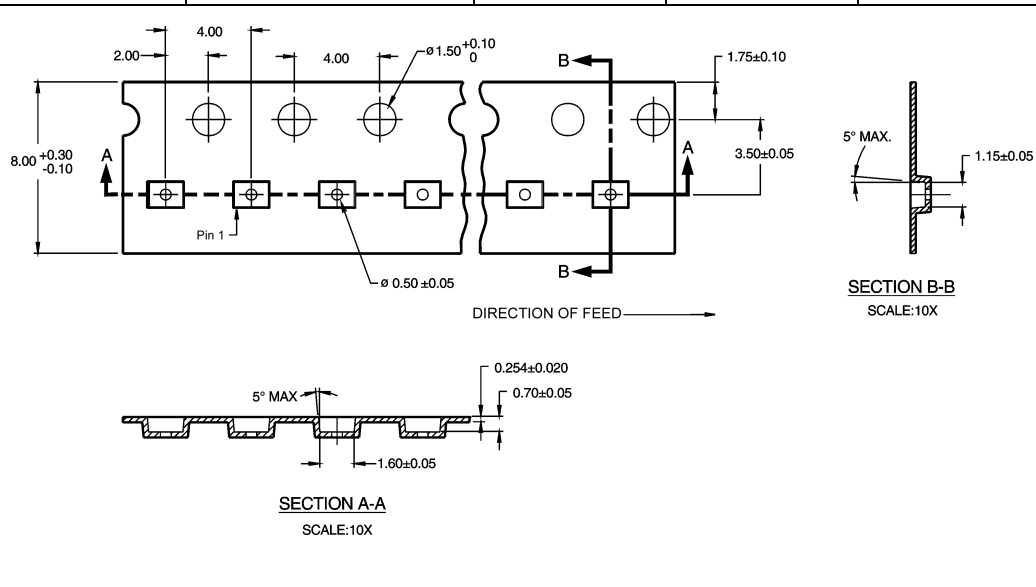


Package	Tape Size	DIM A	DIM B	DIM F	DIM K <sub>0</sub>	DIM P1	DIM W
SC70-5	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)
SOT23-5	8 mm	0.130 (3.3)	0.130 (3.3)	0.138 ± 0.002 (3.5 ± 0.05)	0.055 ± 0.004 (1.4 ± 0.11)	0.157 (4)	0.315 ± 0.012 (8 ± 0.3)

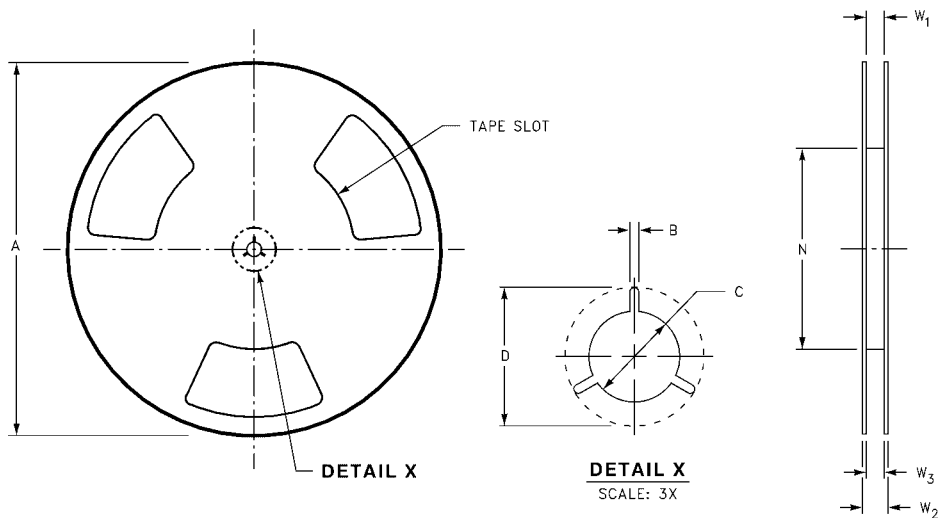
**Tape and Reel Specification** (Continued)

**TAPE FORMAT FOR MicroPak**

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

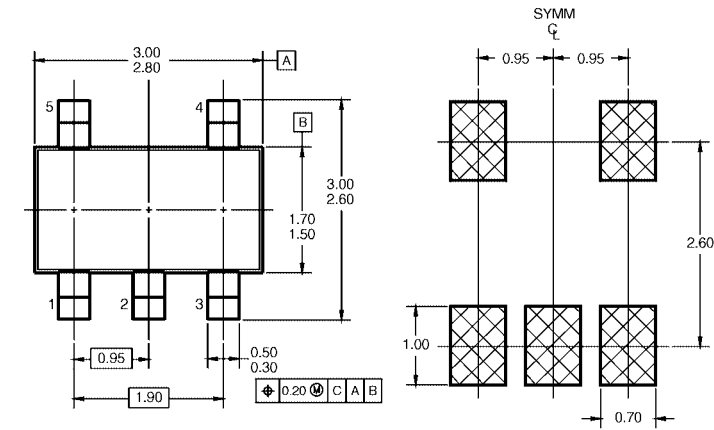


**REEL DIMENSIONS** inches (millimeters)

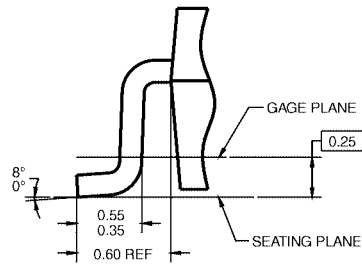
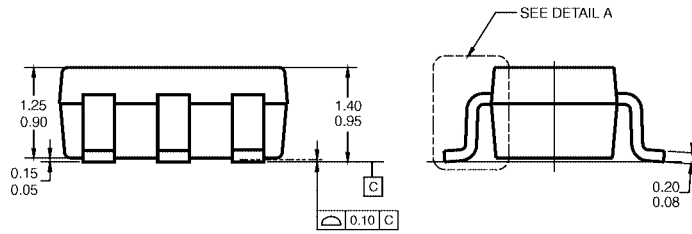


Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	$0.331 + 0.059 / -0.000$ ( $8.40 + 1.50 / -0.00$ )	0.567 (14.40)	$W1 + 0.078 / -0.039$ ( $W1 + 2.00 / -1.00$ )

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



LAND PATTERN RECOMMENDATION



DETAIL A

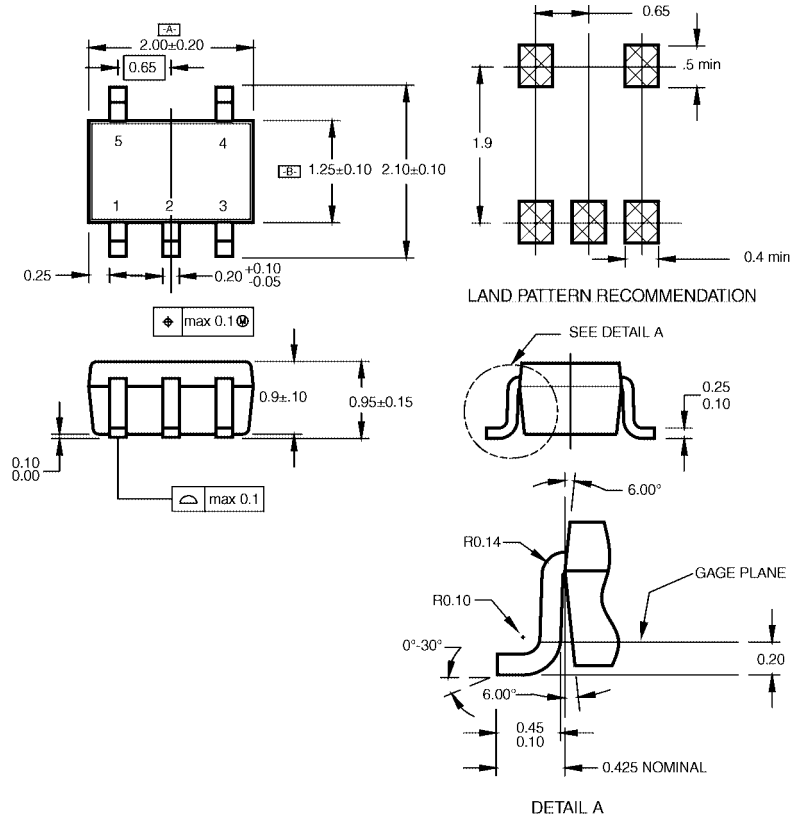
- NOTES: UNLESS OTHERWISE SPECIFIED  
 A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.  
 B) ALL DIMENSIONS ARE IN MILLIMETERS.

MA05BRevC

**5-Lead SOT23, JEDEC MO-178, 1.6mm  
 Package Number MA05B**



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



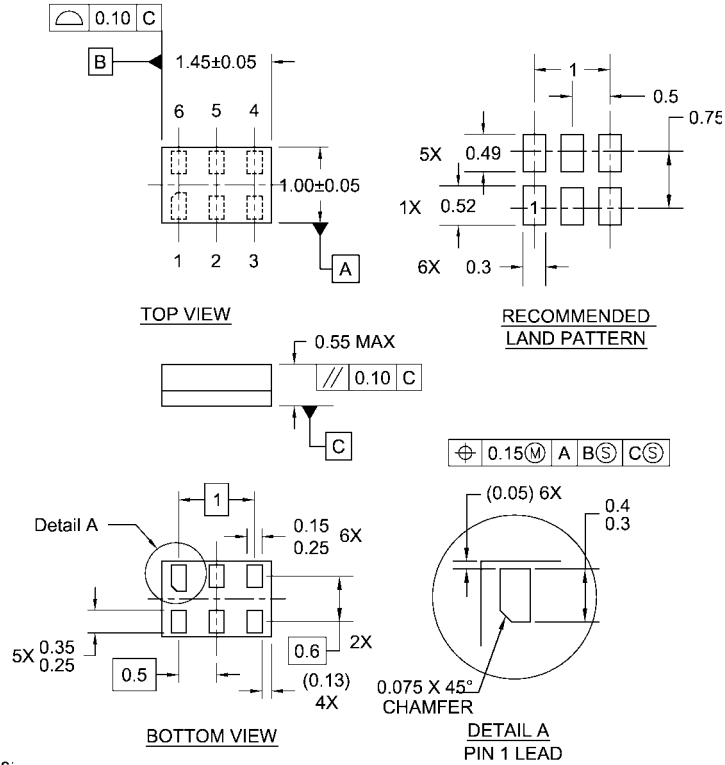
NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88A.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA05ARevC

**5-Lead SC70, EIAJ SC-88a, 1.25mm Wide  
Package Number MAA05A**

**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**

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