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# FSA66

## Low-Voltage UHS Single SPST Normally Open Analog Switch

### Features

- Space-saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Broad  $V_{CC}$  operating range: 1.65V–5.5V
- Rail-to-rail signal handling
- $5\Omega$  switch connection between two ports
- Minimal propagation delay through the switch
- Low  $I_{CC}$
- Zero bounce in flow-through mode
- Control input compatible with CMOS input levels
- >250 MHz –3dB bandwidth

### General Description

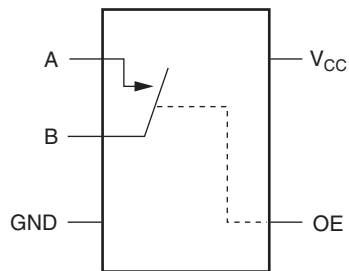
The FSA66 is a ultra high-speed (UHS) CMOS compatible Single-Pole/Single-Throw (SPST) analog switch. The low On Resistance ( $R_{ON}$ ) of the switch allows input to be connected to output with minimal propagation delay and without generating additional ground bounce noise. The device is organized as 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.

### Ordering Information

Order Number	Package Number	PB-Free	Product Code Top Mark	Package Description	Packing Method
FSA66M5X	MA05B	Yes	7Z66	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
FSA66P5X	MAA05A	Yes	Z66	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3k Units on Tape and Reel
FSA66L6X	MAC06	Yes	EE	6-Lead MicroPak, 1.0mm Wide	5k Units on Tape and Reel

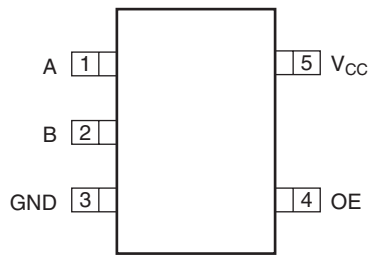
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## Analog Symbol



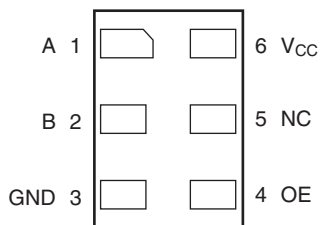
## Connection Diagrams

### Pin Assignments for SC70



(Top View)

### Pin Assignments for MicroPak



(Top Through View)

## Pin Descriptions

Pin Names	Function
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

## Absolute Maximum Ratings

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 defines the conditions for actual device operation.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	-0.5V to +7.0V
$V_S$	DC Switch Voltage	-0.5V to $V_{CC} + 0.5V$
$V_{IN}$	DC Input Voltage <sup>(1)</sup>	-0.5V to +7.0V
$I_{IK}$	DC Input Diode Current, $V_{IN} < 0V$	-50mA
$I_{OUT}$	DC Output Sink Current	128mA
$I_{CC}/I_{GND}$	DC $V_{CC}/GND$ Current	$\pm 100mA$
$T_{STG}$	Storage Temperature Range	-65°C to +150°C
$T_J$	Junction Lead Temperature under Bias	+150°C
$T_L$	Junction Lead Temperature (soldering, 10 seconds)	+260°C
$P_D$	Power Dissipation @ 85°C	
	SOT23-5	200mW
	SC70-5	150mW

## Recommended Operating Conditions<sup>(2)</sup>

Symbol	Parameter	Rating
$V_{CC}$	Power Supply Operating	1.65V to 5.5V
$V_{IN}$	Control Input Voltage	0V to 5.5V
$V_{IN}$	Switch Input Voltage	0V to $V_{CC}$
$V_{OUT}$	Switch Output Voltage	0V to $V_{CC}$
$t_r, t_f$	Input Rise and Fall Time	
	Control Input; $V_{CC} = 2.3V$ to $3.6V$	0ns/V to 10ns
	Control Input; $V_{CC} = 4.5V$ to $5.5V$	0ns/V to 5ns
	Switch I/O	0ns/V to DC
$T_A$	Operating Temperature	-40°C to +85°C
$\theta_{JA}$	Thermal Resistance	
	SOT23-5	300°C/W
	SC70-5	425°C/W

### Notes:

1. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.
2. Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			T <sub>A</sub> = -40°C to +85°C			Units
				Min.	Typ.	Max.	Min.	Typ. <sup>(4)</sup>	Max.	
V <sub>IH</sub>	HIGH-Level Input Voltage		1.65 to 1.95	-	-	-	0.75 V <sub>CC</sub>	-	-	V
			2.3 to 5.5	-	-	-	0.7 V <sub>CC</sub>	-	-	
V <sub>IL</sub>	LOW-Level Input Voltage		1.65 to 1.95	-	-	-	-	-	0.25 V <sub>CC</sub>	V
			2.3 to 5.5	-	-	-	-	-	0.3 V <sub>CC</sub>	
I <sub>IN</sub>	Control Input Leakage Current	0 ≤ V <sub>IN</sub> ≤ 5.5V	0 to 5.5	-	-	-	-	±0.05	±1.0	μA
I <sub>OFF</sub>	OFF Leakage Current	0 ≤ A, B ≤ V <sub>CC</sub>	1.65 to 5.5	-	-	-	-	±0.05	±10.0	μA
R <sub>ON</sub>	Switch ON Resistance <sup>(3)</sup>	V <sub>IN</sub> = 0V, I <sub>IN</sub> = 30mA	4.5	-	-	-	-	3	7	Ω
		V <sub>IN</sub> = 2.4V, I <sub>IN</sub> = 15mA		-	-	-	-	5	12	
		V <sub>IN</sub> = 4.5V, I <sub>IN</sub> = 30mA		-	-	-	-	7	15	
		V <sub>IN</sub> = 0V, I <sub>IN</sub> = 24mA	3.0	-	-	-	-	4	9	
		V <sub>IN</sub> = 3V, I <sub>IN</sub> = 24mA		-	-	-	-	10	20	
		V <sub>IN</sub> = 0V, I <sub>IN</sub> = 8mA	2.3	-	-	-	-	5	12	
		V <sub>IN</sub> = 2.3V, I <sub>IN</sub> = 8mA		-	-	-	-	13	30	
		V <sub>IN</sub> = 0V, I <sub>IN</sub> = 4mA	1.8	-	-	-	-	7	28	
V <sub>IN</sub> = 1.8V, I <sub>IN</sub> = 4mA	-	-		-	-	25	60			
R <sub>flat</sub>	On Resistance Flatness <sup>(3)(5)(6)</sup>	I <sub>A</sub> = -30mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	5.0	-	6	-	-	-	-	Ω
		I <sub>A</sub> = -24mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	3.3	-	12	-	-	-	-	
		I <sub>A</sub> = -8mA, 0 ≤ V <sub>B</sub> ≤ V <sub>CC</sub>	2.5	-	28	-	-	-	-	
		I <sub>A</sub> = -4mA, 0 ≤ V <sub>Bn</sub> ≤ V <sub>CC</sub>	1.8	-	125	-	-	-	-	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND I <sub>OUT</sub> = 0V	1.65 to 5.5	-	-	-	-	0.05	10	μA

**Notes:**

3. 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.
4. All typical values are at the specified V<sub>CC</sub>, and T<sub>A</sub> = 25°C.
5. Parameter is characterized, but not tested in production.
6. 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 @ 25°C unless otherwise specified.

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C, C <sub>L</sub> = 50pF, R <sub>U</sub> = R <sub>D</sub> = 500Ω			Units	Figure Number
				Min.	Typ. <sup>(7)</sup>	Max.		
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay Bus to Bus <sup>(8)</sup>	V <sub>IN</sub> = OPEN	1.65 to 1.95	–	–	4.3	ns	Figure 1 Figure 2
			2.3 to 2.7	–	–	1.2		
			3.0 to 3.6	–	–	0.8		
			4.5 to 5.5	–	–	0.3		
t <sub>PZL</sub> , t <sub>PZH</sub>	Output Enable Time	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>	1.65 to 1.95	1.5	7.0	14.2	ns	Figure 1 Figure 2
			2.3 to 2.7	1.5	3.3	7.0		
			3.0 to 3.6	1.5	2.4	5.5		
			4.5 to 5.5	1.5	2.0	4.5		
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Output Disable Time	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>	1.65 to 1.95	1.5	9.2	18.2	ns	Figure 1 Figure 2
			2.3 to 2.7	1.5	5.3	9.0		
			3.0 to 3.6	1.5	4.0	7.0		
			4.5 to 5.5	1.5	2.7	5.0		
Q	Charge Injection <sup>(9)</sup>	C <sub>L</sub> = 0.1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, f = 1MHz	1.65 to 5.5	0.05			pC	Figure 3
OIRR	Off Isolation <sup>(10)</sup>	R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 10MHz	1.65 to 5.5	–50			dB	Figure 4
BW	-3db Bandwidth	R <sub>L</sub> = 50Ω	1.65 to 5.5	>250			MHz	Figure 5
THD	Total Harmonic Distortion <sup>(7)</sup>	R <sub>L</sub> = 600Ω, 0.5V <sub>P-P</sub> , f = 600Hz to 20KHz	5	.011			%	

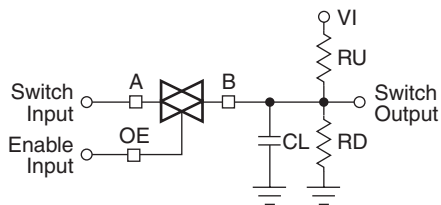
## Capacitance

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
C <sub>IN</sub>	Control Pin Input Capacitance	V <sub>CC</sub> = 0V	–	2	–	pF
C <sub>I/O</sub>	Input/Output Capacitance	V <sub>CC</sub> = 5.0V	–	6	–	pF

### Notes:

- All typical values are at the specified V<sub>CC</sub> and T<sub>A</sub> = 25°C.
- This parameter is guaranteed by design, but is not tested. The switch contributes no propagation delay other than the RC delay of the typical ON Resistance of the switch and the 50 pF load capacitance when driven by an ideal voltage source (zero output impedance).
- Guaranteed by design.
- Off Isolation = 20 log<sub>10</sub> [V<sub>A</sub>/V<sub>BN</sub>].

## AC Loading and Waveforms

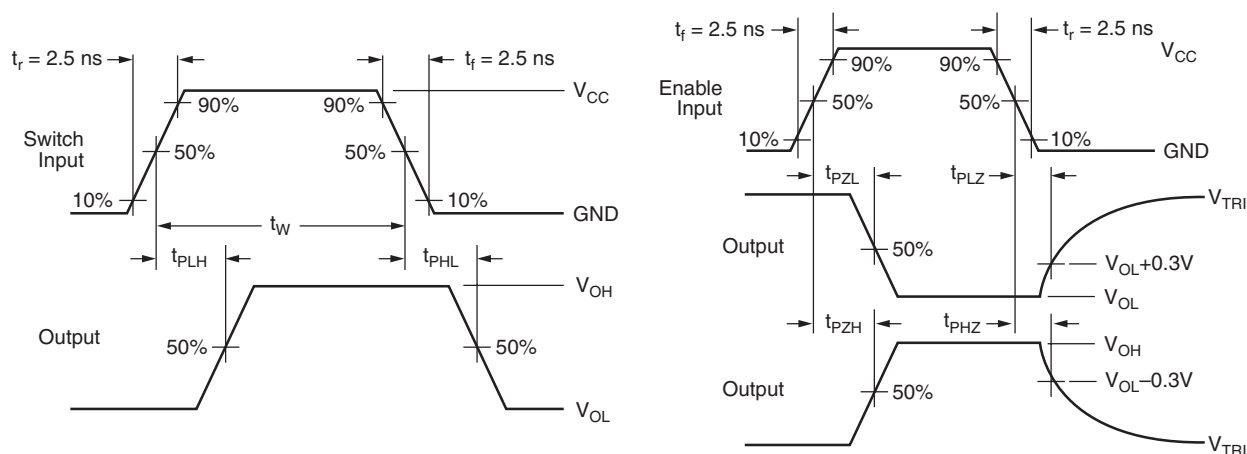


Input driven by  $50\Omega$  source terminated in  $50\Omega$ .

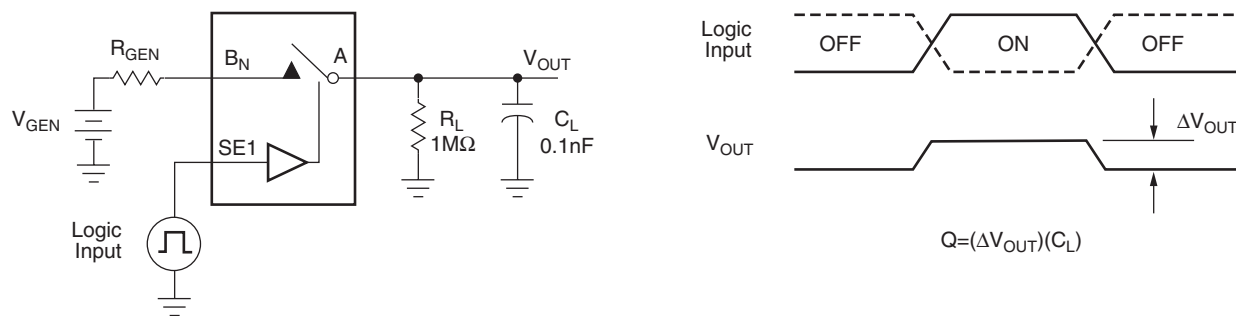
$C_L$  includes load and stray capacitance.

Input PRR = 1.0MHz;  $t_w = 500\text{ns}$ .

**Figure 1. AC Test Circuit**

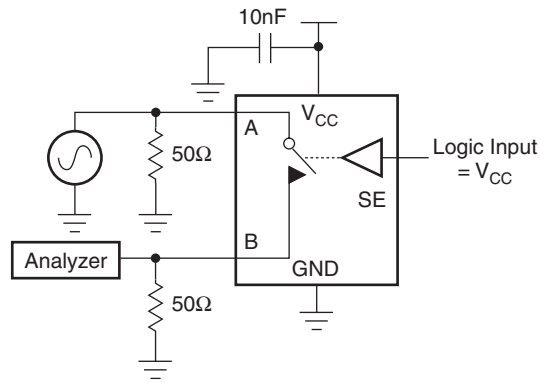


**Figure 2. AC Waveforms**

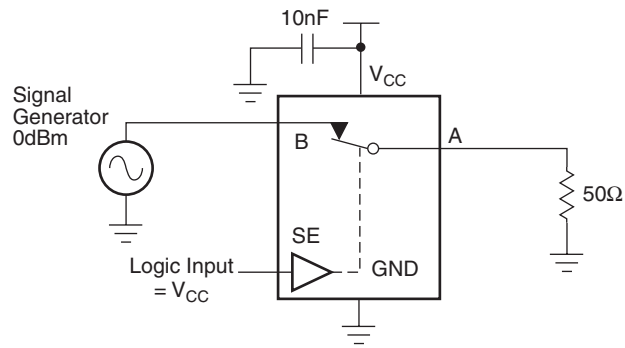


**Figure 3. Charge Injection Test**

**AC Loading and Waveforms (Continued)**



**Figure 4. Off Isolation**



**Figure 5. Bandwidth**



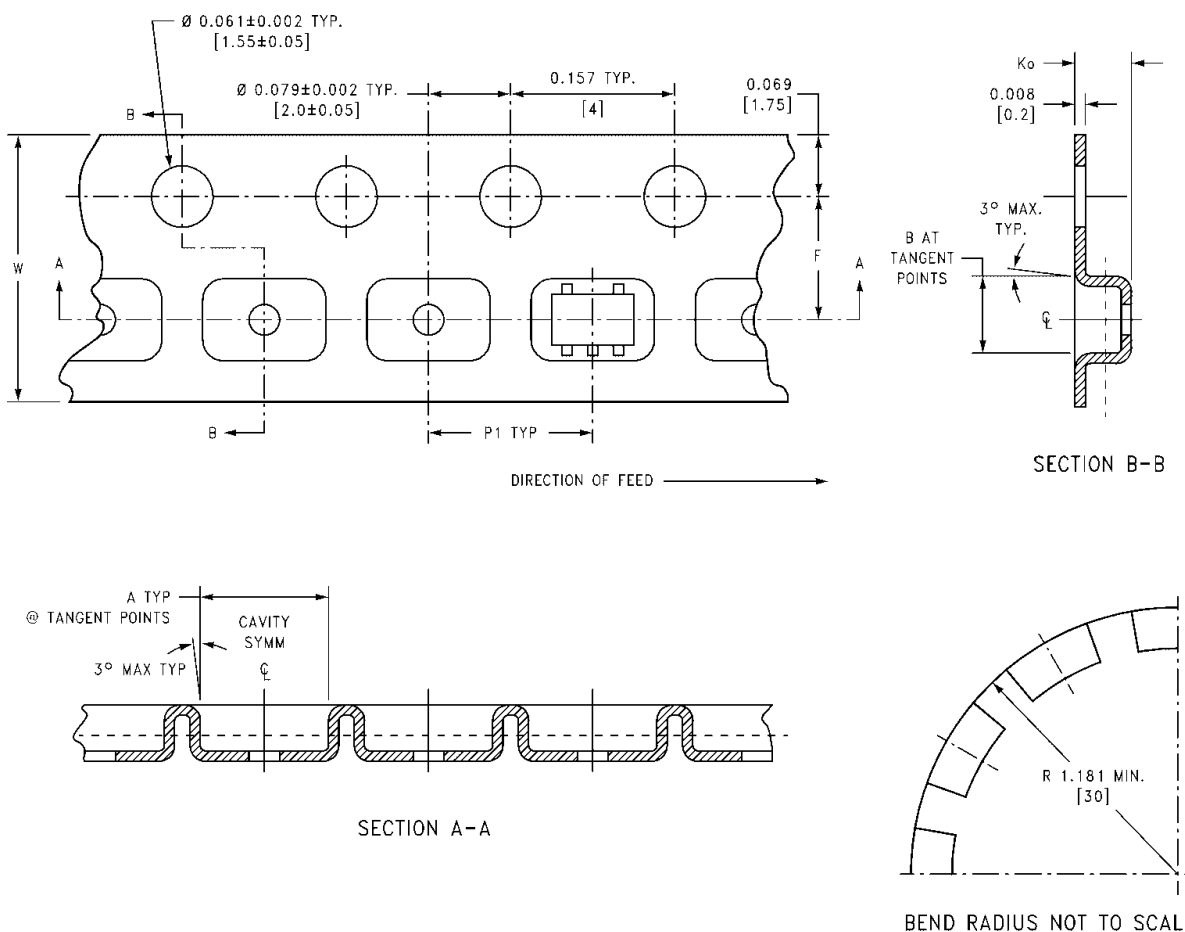
## Tape Specification

### Tape Format for SOT23, SC70

Package Designator	Tape Section	Cavity Number	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

Dimensions are in millimeters (inches) unless otherwise specified.



Package	Tape Size	Dim A	Dim B	Dim F	Dim K <sub>O</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)

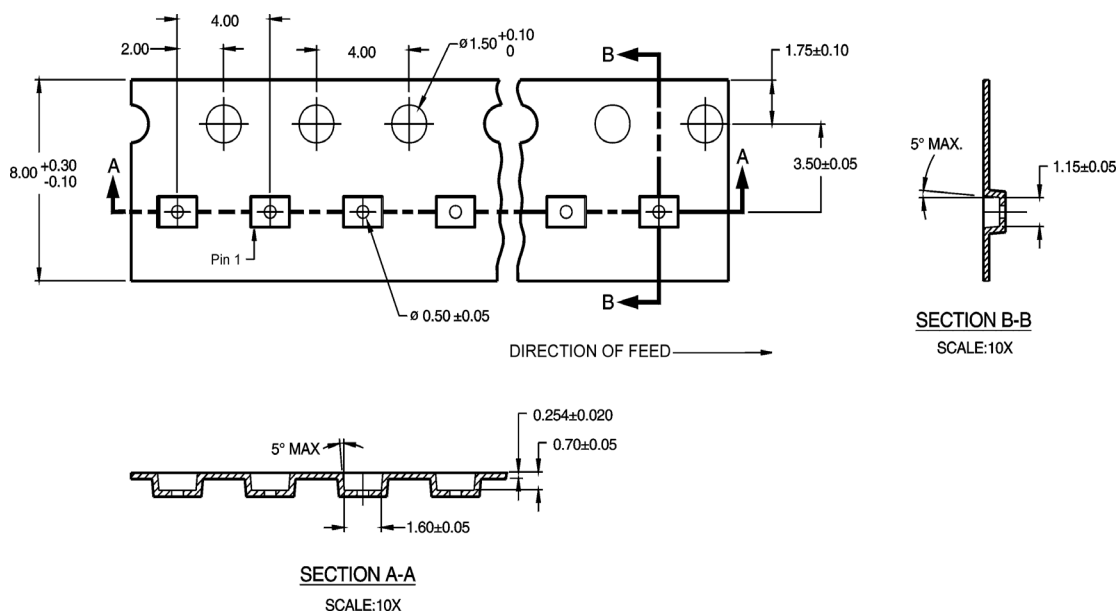
## Tape Specification (Continued)

### Tape Format

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

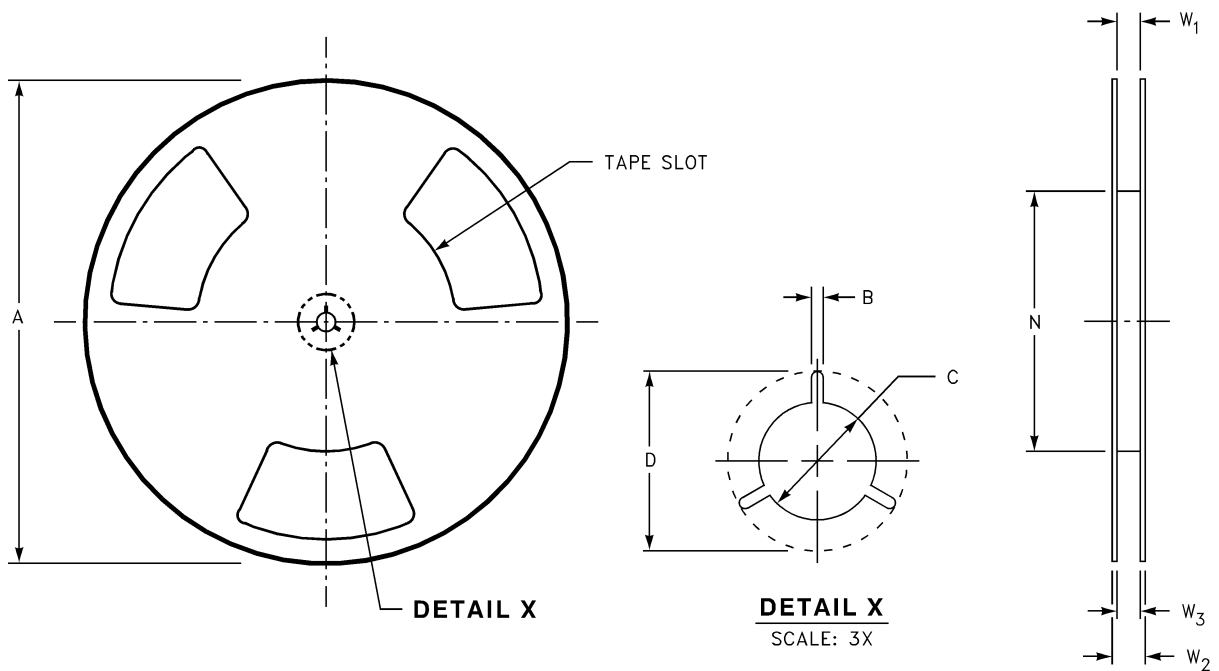
### Tape Dimensions

Dimensions are in millimeters (inches) unless otherwise specified.



## Reel Dimensions for Micropack 6

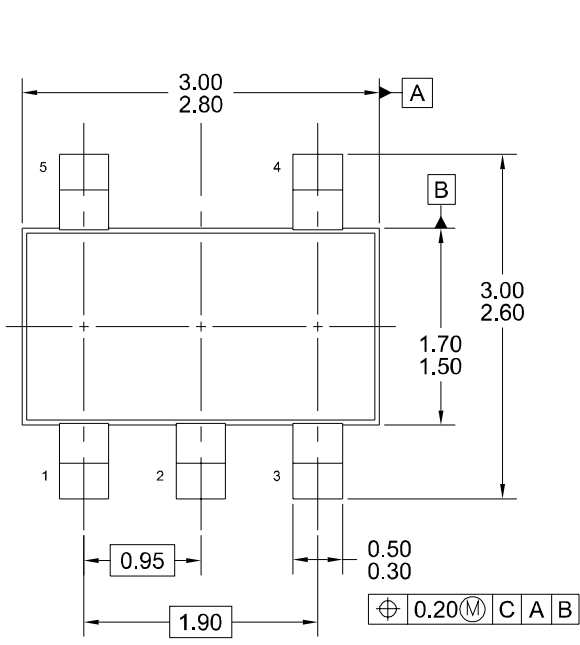
Dimensions are in millimeters (inches) unless otherwise specified.



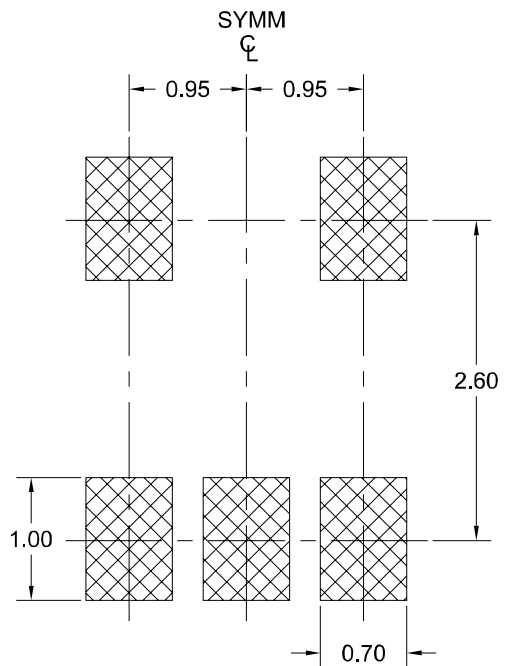
Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 +0.059 / -0.000 (8.40 +1.50 / -0.00)	0.567 (14.40)	W1 +0.078 / -0.039 (W1 +2.00 / -1.00)

### Physical Dimensions

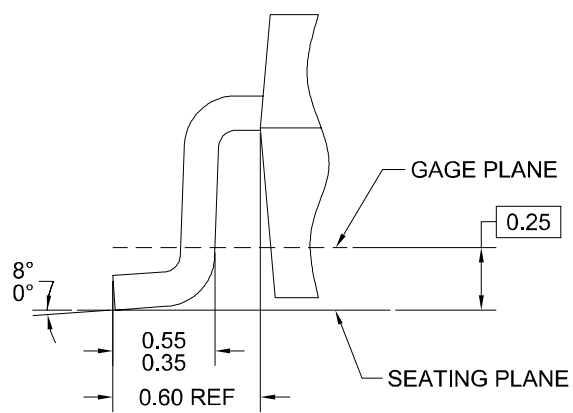
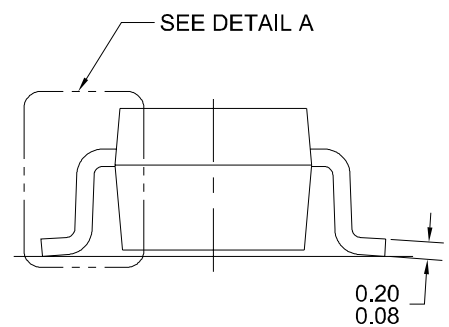
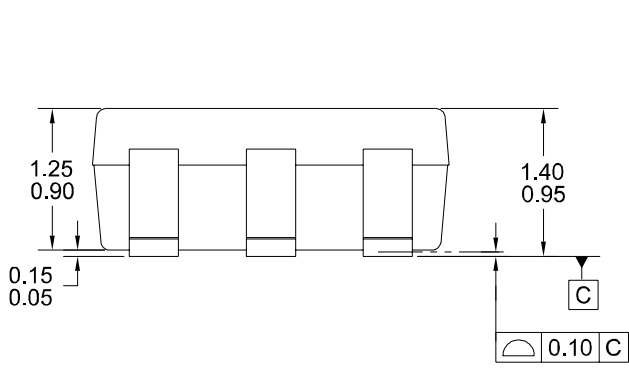
Dimensions are in inches (millimeters) unless otherwise noted.



BOTTOM VIEW



LAND PATTERN RECOMMENDATION



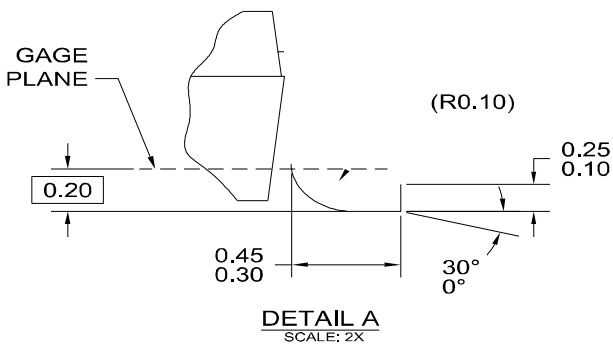
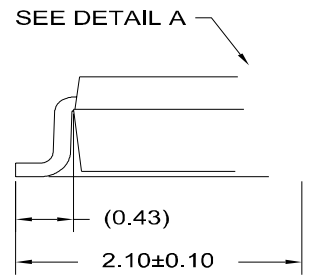
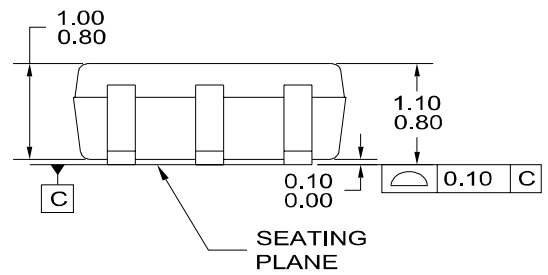
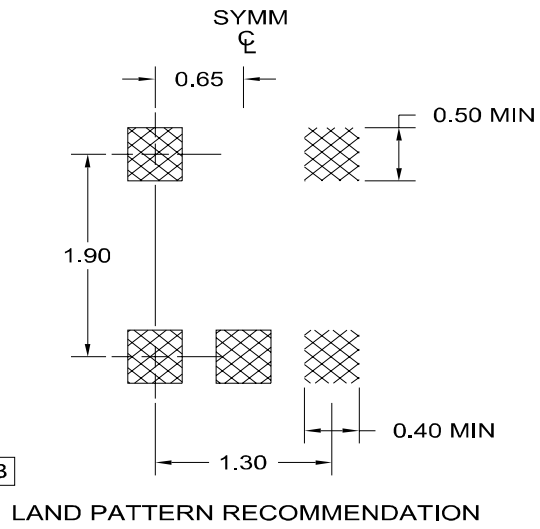
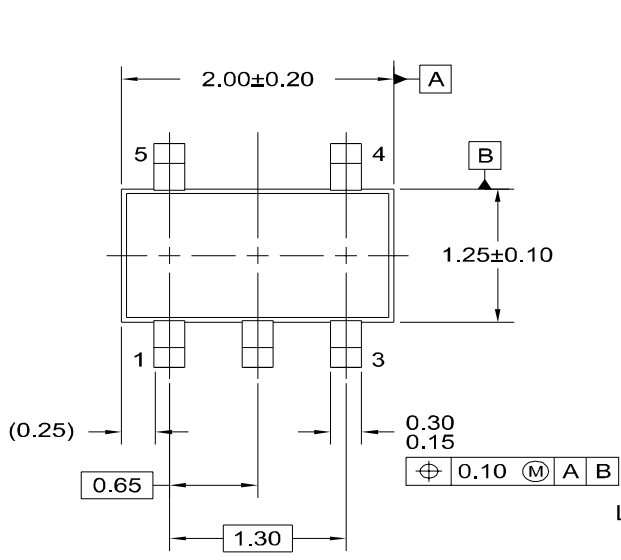
- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.

MA05BrevC

5-Lead SOT23, JEDEC MO-178, 1.6mm

### Physical Dimensions (Continued)

Dimensions are inches (millimeters) unless otherwise noted.



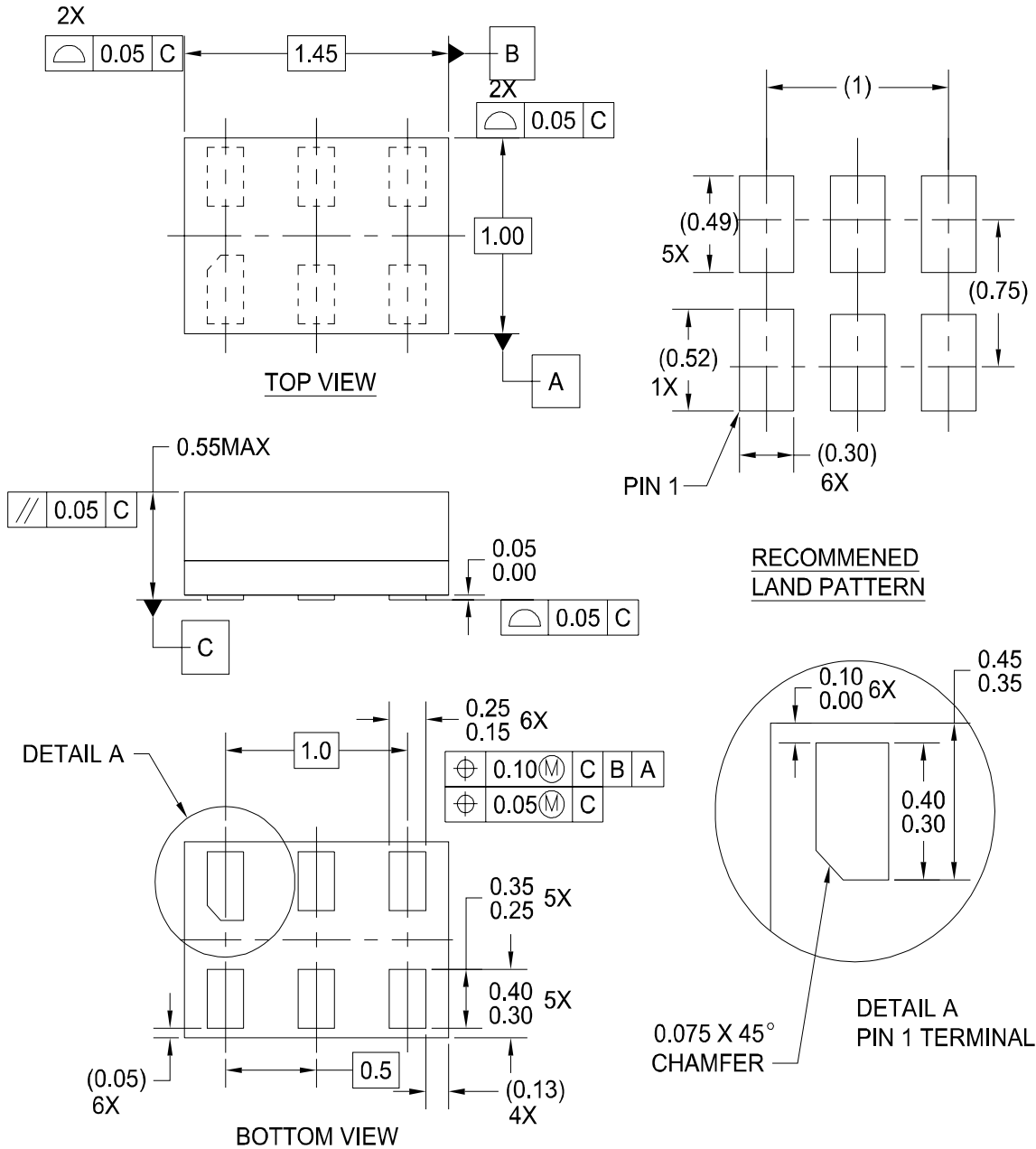
- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO EIAJ SC-88A, 1996.
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.

MAA05AREVD

5-Lead SC70, EIAJ SC-88a, 1.25mm Wide

## Physical Dimensions

Dimensions are inches (millimeters) unless otherwise noted.



**Notes:**

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06AREVC

Pb-Free 6-Lead MicroPak, 1.0mm Wide

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### Definition of Terms

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