



March 2004  
Revised April 2005

**FSA1256 • FSA1256A • FSA1257 • FSA1257A • FSA1258 • FSA1258A**  
**Low R<sub>ON</sub> Low Voltage Dual SPST Analog Switch with Low I<sub>CCT</sub> “A” Option**

**General Description**

The FSA1256, FSA1256A, FSA1257, FSA1257A, FSA1258, and FSA1258A are high performance dual Single Pole/Single Throw (SPST) analog switches. All devices feature ultra low R<sub>ON</sub> of 1.1Ω maximum at 4.5V V<sub>CC</sub>. The FSA1256, FSA1257, and FSA1258 operate over a wide V<sub>CC</sub> range of 1.65V to 5.5V. The FSA1256A, FSA1257A, and FSA1258A operation range is 2.7V to 5.5V. These devices are fabricated with sub-micron CMOS technology to achieve fast switching speeds and are designed for break-before-make operation. The select input is TTL level compatible. The FSA1256 and FSA1256A feature two Normally Open (NO) switches. The FSA1257 and FSA1257A feature two Normally Closed (NC) switches. The FSA1258 and FSA1258A have one NO switch and one NC switch.

**Features**

- FSA1256A, FSA1257A, FSA1258A feature low I<sub>CCT</sub> when S Input is lower than V<sub>CC</sub>
- Maximum 1.1Ω On Resistance (R<sub>ON</sub>) for 4.5V supply
- 0.4Ω max R<sub>ON</sub> flatness for 4.5V supply
- Space saving Pb-Free MicroPak™ packaging
- Broad V<sub>CC</sub> operating range:
  - FSA1256, FSA1257, FSA1258: 1.65V to 5.5V
  - FSA1256A, FSA1257A, FSA1258A: 2.7V to 5.5V
- Fast turn-on and turn-off time
- FSA1258, FSA1258A feature break-before-make enable circuitry
- Over-voltage tolerant TTL compatible control input

**Ordering Code:**

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
FSA1256L8X	MAC08A	EB	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5K Units on Tape and Reel
FSA1256AL8X	MAC08A	FN	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5K Units on Tape and Reel
FSA1257L8X	MAC08A	EC	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5K Units on Tape and Reel
FSA1257AL8X	MAC08A	FP	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5K Units on Tape and Reel
FSA1258L8X	MAC08A	ED	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5K Units on Tape and Reel
FSA1258AL8X	MAC08A	FS	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5K Units on Tape and Reel

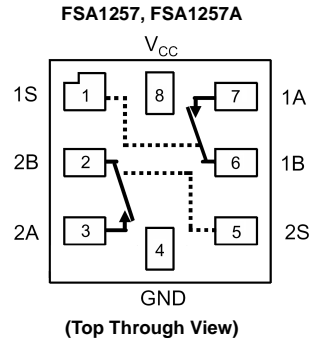
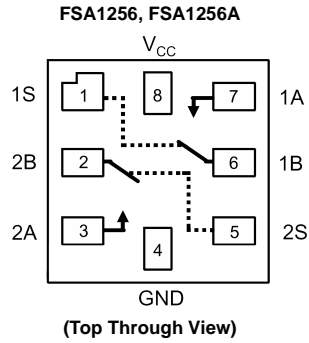
Pb-Free package per JEDEC J-STD-020B.

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

FSA1256 • FSA1256A • FSA1257 • FSA1257A • FSA1258 • FSA1258A Low RON Low Voltage Dual SPST Analog Switch with Low ICCT “A” Option



### Analog Symbols



### Truth Tables

**FSA1256, FSA1256A**

Control Input(s)	Function
L	Disconnect
H	A Connected to B

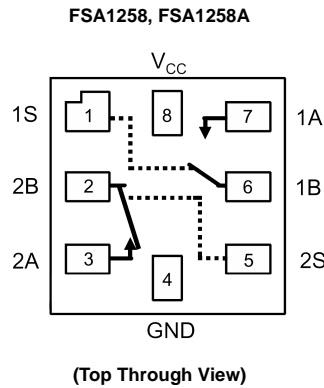
**FSA1257, FSA1257A**

Control Input(s)	Function
L	A Connected to B
H	Disconnect

H = HIGH Logic Level

L = LOW Logic Level

### Analog Symbol



### Truth Table

**FSA1258, FSA1258A**

Control Input 1S	Function	Control Input 2S	Function
L	1A Connected to 1B	L	Disconnect
H	Disconnect	H	2A Connected to 2B

H = HIGH Logic Level

L = LOW Logic Level

### Pin Descriptions

Pin Names	Function
A, B	Data Ports
S	Control Input

Absolute Maximum Ratings <sup>(Note 1)</sup>		Recommended Operating Conditions	
Supply Voltage ( $V_{CC}$ )	-0.5V to +6.0V	Supply Voltage ( $V_{CC}$ )	FSA1256, FSA1257, FSA1258 1.65V to 5.5V
Switch Voltage ( $V_S$ ) (Note 2)	-0.5V to $V_{CC} + 0.5V$	FSA1256A, FSA1257A, FSA1258A	2.7V to 5.5V
Input Voltage ( $V_{IN}$ ) (Note 2)	-0.5V to +6.0V	Control Input Voltage ( $V_{IN}$ ) (Note 3)	0V to $V_{CC}$
Input Diode Current	-50 mA	Switch Input Voltage ( $V_{IN}$ )	0V to $V_{CC}$
Switch Current	200 mA	Operating Temperature ( $T_A$ )	-40°C to +85°C
Peak Switch Current (Pulsed at 1 ms duration, <10% Duty Cycle)	400 mA	Thermal Resistance ( $\theta_{JA}$ ) in still air	MicroPak 8L package 224°C/W (modeled)
Power Dissipation @ 85°C			
MicroPak 8L package	180 mW		
Storage Temperature Range ( $T_{STG}$ )	-65°C to +150°C		
Maximum Junction Temperature ( $T_J$ )	+150°C		
Lead Temperature ( $T_L$ )			
Soldering, 10 seconds	+260°C		
ESD			
Human Body Model			
FSA1256, FSA1257, FSA1258	5.5kV		
FSA1256A, FSA1257A, FSA1258A	4.5kV		

**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 (All typical values are @ 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					0.4	V	FSA1256A, FSA1257A, FSA1258A Only
		2.7 to 3.6					0.6		
		4.5 to 5.5					0.8		
$I_{IN}$	Control Input Leakage	2.7 to 3.6				-1.0	1.0	$\mu\text{A}$	$V_{IN} = 0V \text{ to } V_{CC}$
		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 1B or 2B = 1V, 4.5V
$R_{ON}$	Switch On Resistance (Note 4)	2.7		2.6	4.0		4.3	$\Omega$	$I_{OUT} = 100 \text{ mA}$ , 1B or 2B = 1.5V
		4.5		0.95	1.15		1.3		$I_{OUT} = 100 \text{ mA}$ , 1B or 2B = 3.5V
$\Delta R_{ON}$	On Resistance Matching Between Channels (Note 5)	4.5		0.06	0.12		0.15	$\Omega$	$I_{OUT} = 100 \text{ mA}$ , 1B or 2B = 3.5V
$R_{FLAT(ON)}$	On Resistance Flatness (Note 6)	2.7		1.4				$\Omega$	$I_{OUT} = 100 \text{ mA}$ , 1B or 2B = 0V, 0.75V, 1.5V
		4.5		0.2	0.3		0.4		$I_{OUT} = 100 \text{ mA}$ , 1B or 2B = 0V, 1V, 2V
$I_{CC}$	Quiescent Supply Current	3.6		0.1	0.5		1.0	$\mu\text{A}$	$V_{IN} = 0V \text{ or } V_{CC}$ , $I_{OUT} = 0V$
		5.5		0.1	0.5		1.0		
$I_{CCT}$	Increase in $I_{CC}$ per Input	4.3		0.2			10.0	$\mu\text{A}$	One Input at 2.6V, Others at $V_{CC}$ or GND (FSA1256A, FSA1257A, FSA1258A Only)

**Note 4:** On Resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.

**Note 5:**  $\Delta R_{ON} = R_{ONmax} - R_{ONmin}$ , measured at identical  $V_{CC}$ , temperature, and voltage.

**Note 6:** Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.

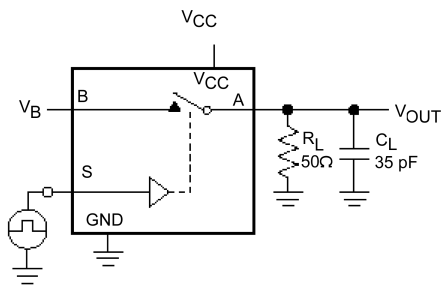
**AC Electrical Characteristics** (All typical value are @ 25°C unless otherwise specified)

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	15.0	50.0		60.0	ns	1B or 2B = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		4.5 to 5.5	10.0	35.0		40.0		1B or 2B = 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	8.0	20.0		30.0	ns	1B or 2B = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		4.5 to 5.5	4.0	15.0		20.0		1B or 2B = 3.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF		
t <sub>B-M</sub>	Break-Before-Make Time	2.7 to 3.6	12.0				ns	1B or 2B = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 2	
		4.5 to 5.5	7.0					1B or 2B = 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> = 1.0 nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω	Figure 4	
		4.5 to 5.5	20.0							
OIRR	OFF-Isolation	2.7 to 3.6	-70.0				dB	f = 1MHz, R <sub>L</sub> = 50Ω	Figure 3	
		4.5 to 5.5	-70.0							
Xtalk	Crosstalk	2.7 to 3.6	-100				dB	f = 1MHz, R <sub>L</sub> = 50Ω	Figure 6	
		4.5 to 5.5	-100							
BW	-3db Bandwidth	2.7 to 3.6	300				MHz	R <sub>L</sub> = 50Ω	Figure 7	
		4.5 to 5.5	300							
THD	Total Harmonic Distortion	2.7 to 3.6	0.002				%	R <sub>L</sub> = 600Ω, V <sub>IN</sub> = 0.5V P.P, f = 20Hz to 20kHz	Figure 8	
		4.5 to 5.5	0.002							

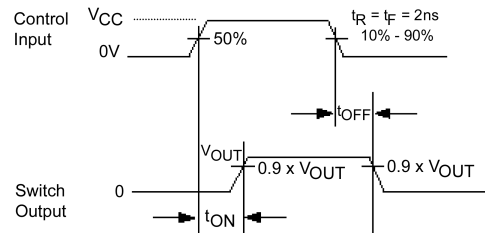
**Capacitance**

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			T <sub>A</sub> = 40°C to +85°C		Units	Conditions
			Min	Typ	Max	Min	Max		
C <sub>IN</sub>	Control Pin Input Capacitance	0.0		3.0			pF	f = 1MHz (see Figure 6)	
C <sub>OFF</sub>	B Port OFF Capacitance	4.5		11.5			pF	f = 1MHz (see Figure 6)	
C <sub>ON</sub>	A Port ON Capacitance	4.5		27.0			pF	f = 1MHz (see Figure 6)	

## 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/Turn-Off Timing

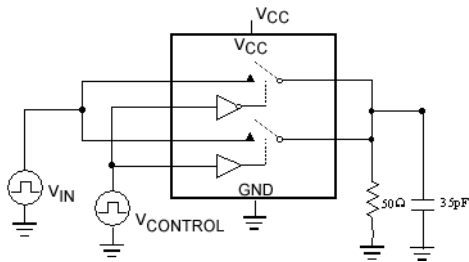


FIGURE 2. Break-Before-Make Timing

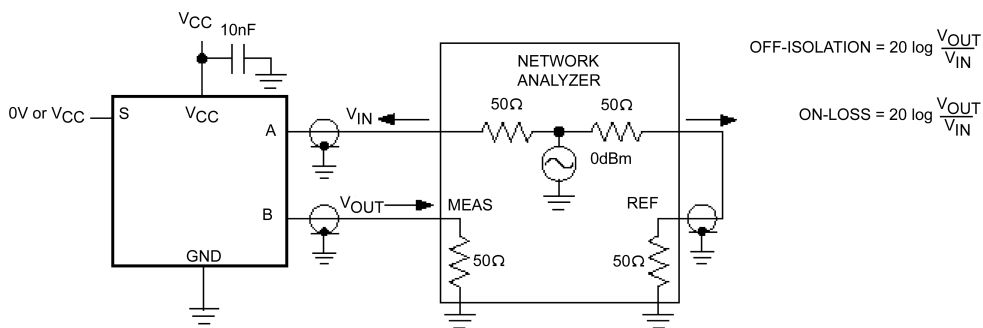
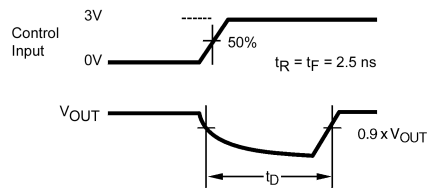
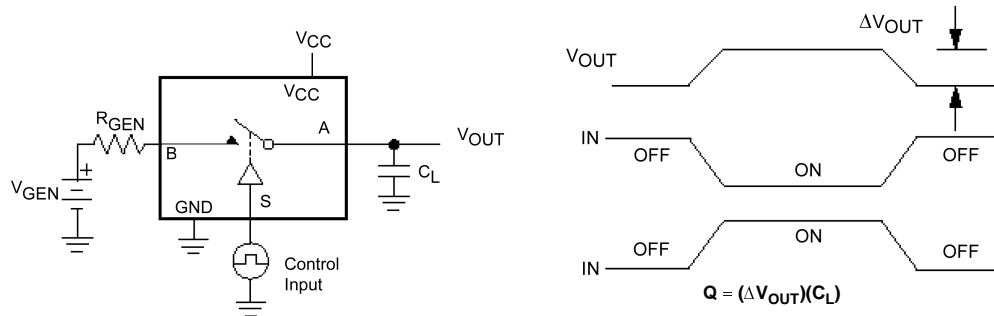


FIGURE 3. OFF Isolation

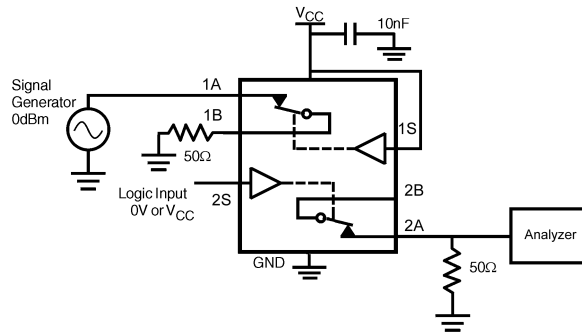
$$\text{OFF-ISOLATION} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

$$\text{ON-LOSS} = 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}}$$

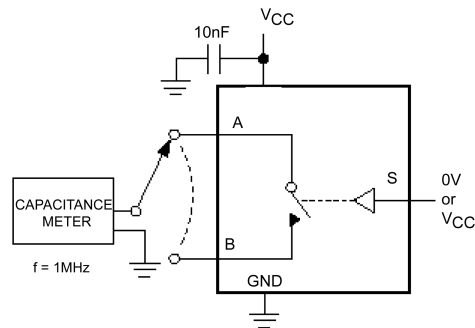
**AC Loading and Waveforms** (Continued)



**FIGURE 4. Charge Injection**



**FIGURE 5. Crosstalk**



**FIGURE 6. ON/OFF Capacitance Measurement Setup**

## AC Loading and Waveforms (Continued)

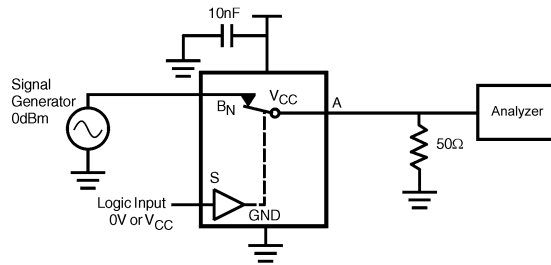


FIGURE 7. Bandwidth

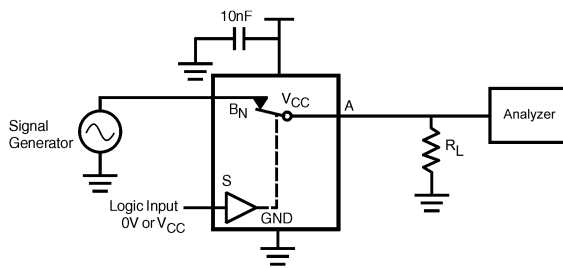


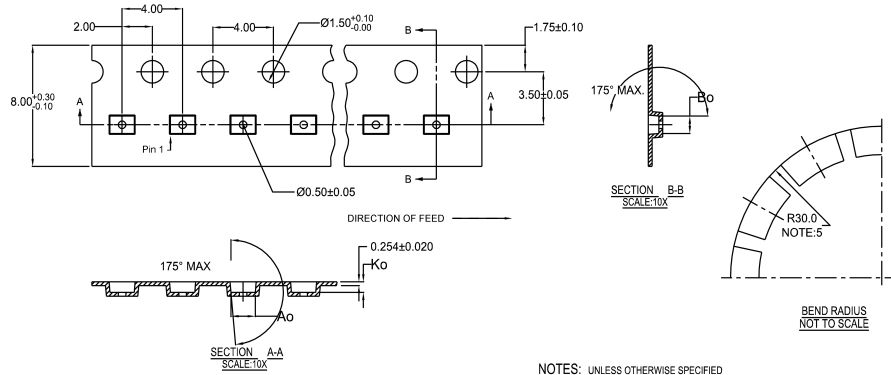
FIGURE 8. Harmonic Distortion

FSA1256 • FSA1256A • FSA1257 • FSA1257A • FSA1258 • FSA1258A

## Tape and Reel Specification

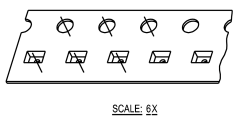
Tape Format For Micropak

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
L8X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

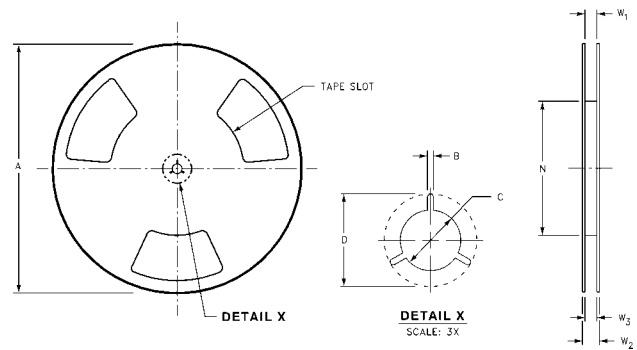


10	300056	2.30±0.05	1.78±0.05	0.68±0.05
8	300038	1.78±0.05	1.78±0.05	0.68±0.05
6	300033	1.60±0.05	1.15±0.05	0.70±0.05

- NOTES: UNLESS OTHERWISE SPECIFIED
1. ACCUMULATED 50 SPROCKETS. SPROCKET HOLE PITCH IS 200.00 ±0.30MM
  2. NO INDICATED CORNER RADIUS IS 0.127MM
  3. CAMBER NOT TO EXCEED 1MM IN 100MM
  4. SMALLEST ALLOWABLE BENDING RADIUS
  5. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE



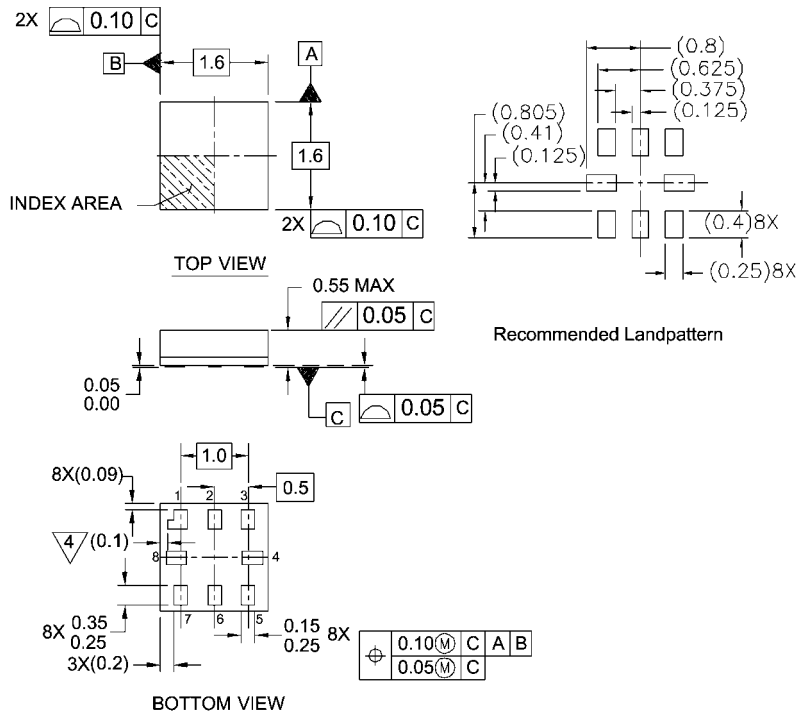
**REEL DIMENSIONS** inches (millimeters)



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:**

1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y.14M-1994
- 4/ PIN 1 FLAG, END OF PACKAGE OFFSET.

MAC08AREVC

**Pb-Free 8-Lead MicroPak, 1.6 mm Wide  
Package Number MAC08A**

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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