

## FSA2267 • FSA2267A

### 0.35Ω Low Voltage Dual SPDT Analog Switch

#### General Description

The FSA2267 and FSA2267A are Dual Single Pole Double Throw (SPDT) analog switches. The FSA2267 operates from a single 1.65V to 3.6V supply while the FSA2267A operates from a single 2.3V to 4.3V supply. Each features an ultra-low On Resistance of 0.35Ω at a +2.7V supply and 25C. Both devices are fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation.

FSA2267A features very low quiescent current even when the control voltage is lower than the  $V_{CC}$  supply. This feature services the mobile handset applications very well allowing for the direct interface with baseband processor general purpose I/Os.

#### Features

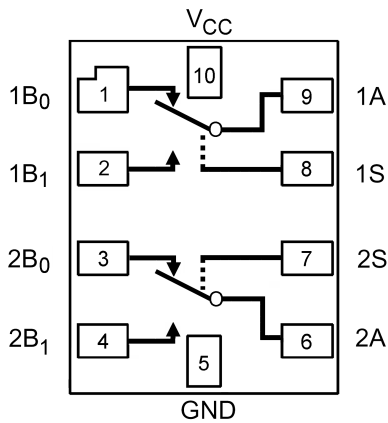
- Typical 0.35Ω On Resistance ( $R_{ON}$ ) for +2.7V supply
- FSA2267A features lower  $I_{CC}$  when S Input is lower than  $V_{CC}$
- 0.25Ω maximum  $R_{ON}$  flatness for +2.7V supply
- 1.6mm x 2.1mm 10-Lead Pb-Free MicroPak™ package
- Broad  $V_{CC}$  operating range
- Low THD (0.02% typical for 32Ω load)
- High current handling capability (350mA continuous current under 3.3V supply)

#### Ordering Code:

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
FSA2267L10X	MAC010A	FC	Pb-Free 10-Lead MicroPak, 1.6 mm x 2.1mm	5K Units on Tape and Reel
FSA2267AL10X (Preliminary)	MAC010A	FD	Pb-Free 10-Lead MicroPak, 1.6 mm x 2.1mm	5K Units on Tape and Reel

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

#### Analog Symbols



(Top Through View)

#### Truth Table

Control Input(s)	Function
L	$B_0$ Connected to A
H	$B_1$ Connected to A

H = HIGH Logic Level  
L = LOW Logic Level

#### Pin Descriptions

Pin Names	Function
1A, 2A, 1B <sub>0</sub> , 1B <sub>1</sub> , 2B <sub>0</sub> , 2B <sub>1</sub>	Data Ports
1S, 2S	Control Input

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

### Absolute Maximum Ratings (Note 1)

Supply Voltage ( $V_{CC}$ )	-0.5V to +4.6V
Switch Voltage ( $V_S$ ) (Note 2)	-0.5V to $V_{CC} + 0.5V$
Input Voltage ( $V_{IN}$ ) (Note 2)	-0.5V to +4.6V
Input Diode Current	-50 mA
Switch Current	350 mA
Peak Switch Current (Pulsed at 1 ms duration, <10% Duty Cycle)	500 mA
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: FSA2267	7500V
Human Body Model: FSA2267A	7000V

### Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ )	
FSA2267	1.65V to 3.6V
FSA2267A	2.3V to 4.3V
Control Input Voltage ( $V_{IN}$ ) (Note 3)	0V to $V_{CC}$
Switch Input Voltage ( $V_{IN}$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	-40°C to +85°C

**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 - FSA2267

(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		
		2.3 to 2.7				1.7			
		1.65 to 1.95				0.65 $V_{CC}$			
$V_{IL}$	Input Voltage Low	2.7 to 3.6				0.8	V		
		2.3 to 2.7				0.7			
		1.65 to 1.95				0.35 $V_{CC}$			
$I_{IN}$	Control Input Leakage	1.65 to 3.6				-0.5	0.5	$\mu\text{A}$	$V_{IN} = 0V$ to $V_{CC}$
$I_{NO(OFF)}$ , $I_{NC(OFF)}$	OFF-Leakage Current of Port nB <sub>0</sub> and nB <sub>1</sub>	3.6	-5.0	5.0	-50.0	50.0	nA		nA = 0.3V, 3.3V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 3.3V
		2.7	-5.0	5.0	-50.0	50.0			nA = 0.3V, 2.4V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 2.4V or Floating
		1.95	-5.0	5.0	-50.0	50.0			nA = 0.3V, 1.65V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 1.65V or Floating
$I_{A(ON)}$	ON Leakage Current of Port A	3.6	-5.0	5.0	-50.0	50.0	nA		nA = 0.3V, 3.3V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 3.3V or Floating
		2.7	-5.0	5.0	-50.0	50.0			nA = 0.3V, 2.4V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 2.4V or Floating
		1.95	-5.0	5.0	-50.0	50.0			nA = 0.3V, 1.65V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 1.65V or Floating
$R_{ON}$	Switch On Resistance (Note 4)	2.7	0.35				0.6	$\Omega$	$I_{OUT} = 100$ mA, nB <sub>0</sub> or nB <sub>1</sub> = 0V, 0.7V, 2.0V, 2.7V
		2.3	0.45				0.75		
		1.65	1.0				3.9		
$\Delta R_{ON}$	On Resistance Matching Between Channels (Note 5)	2.7	0.04				0.075	$\Omega$	$I_{OUT} = 100$ mA, nB <sub>0</sub> or nB <sub>1</sub> = 0.7V
		2.3	0.16				0.08		
		1.65	0.1						
$R_{FLAT(ON)}$	On Resistance Flatness (Note 6)	2.7					0.25	$\Omega$	$I_{OUT} = 100$ mA, nB <sub>0</sub> or nB <sub>1</sub> = 0V to $V_{CC}$
		2.3					0.3		
		1.65	0.3						
$I_{CC}$	Quiescent Supply Current	3.6	-100	100	-500	500	nA	$V_{IN} = 0V$ or $V_{CC}$ , $I_{OUT} = 0V$	

**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.

DC Electrical Characteristics - FSA2267A									
(All typical values 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
			Min	Typ	Max	Min	Max		
V <sub>IH</sub>	Input Voltage High	3.6 to 4.3				1.7	V		
		2.7 to 3.6				1.5			
		2.3 to 2.7				1.4			
V <sub>IL</sub>	Input Voltage Low	3.6 to 4.3				0.7	V		
		2.7 to 3.6				0.5			
		2.3 to 2.7				0.4			
I <sub>IN</sub>	Control Input Leakage	2.3 to 4.3				-0.5	0.5	µA	V <sub>IN</sub> = 0V to V <sub>CC</sub>
I <sub>NO(OFF)</sub> , I <sub>NC(OFF)</sub>	OFF-Leakage Current of Port nB <sub>0</sub> and nB <sub>1</sub>	4.3	-10.0	10.0		-100	100	nA	nA = 0.3V, 4.0V, nB <sub>0</sub> or nB <sub>1</sub> = 4.0V, 0.3V
		3.6	-5.0	5.0		-50.0	50.0		nA = 0.3V, 3.3V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 3.3V or Floating
		2.7	-5.0	5.0		-50.0	50.0		nA = 0.3V, 2.4V, nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 2.4V or Floating
I <sub>A(ON)</sub>	ON Leakage Current of Port A	4.3	-20.0	20.0		-200	200	nA	nA = 0.3V, 4.0V nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 4.0V or Floating
		3.6	-5.0	5.0		-50.0	50.0		nA = 0.3V, 3.3V nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 3.3V or Floating
		2.7	-5.0	5.0		-50.0	50.0		nA = 0.3V, 2.4V nB <sub>0</sub> or nB <sub>1</sub> = 0.3V, 2.4V or Floating
R <sub>ON</sub>	Switch On Resistance  (Note 7)	4.3		0.35			0.6	Ω	I <sub>OUT</sub> = 100 mA, nB <sub>0</sub> or nB <sub>1</sub> = 0V, 0.7V, 3.6V, 4.3V
		3.0		0.35			0.6		I <sub>OUT</sub> = 100 mA, nB <sub>0</sub> or nB <sub>1</sub> = 0V, 0.7V, 2.3V, 3.0V
		2.7		0.35			0.6		I <sub>OUT</sub> = 100 mA, nB <sub>0</sub> or nB <sub>1</sub> = 0V 0.7V, 2.0V, 2.7V
ΔR <sub>ON</sub>	On Resistance Matching Between Channels (Note 8)	4.3		0.04			0.075	Ω	I <sub>OUT</sub> = 100 mA, nB <sub>0</sub> or nB <sub>1</sub> = 0.7V
		3.0		0.04			0.075		
		2.7		0.04			0.075		
R <sub>FLAT(ON)</sub>	On Resistance Flatness (Note 9)	4.3		0.15			0.25	Ω	I <sub>OUT</sub> = 100 mA, nB <sub>0</sub> or nB <sub>1</sub> = 0V to V <sub>CC</sub>
		3.0		0.15			0.25		
		2.7		0.15			0.25		
I <sub>CC</sub>	Quiescent Supply Current	4.3	-100	80.0	100	-500	500	nA	V <sub>IN</sub> = 0V or V <sub>CC</sub> , I <sub>OUT</sub> = 0V
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	4.3		7.0	10.0		15.0	µA	V <sub>IN</sub> = 1.8V
				0.5	2.0		7.0		V <sub>IN</sub> = 2.6V

**Note 7:** On Resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.

**Note 8:** ΔR<sub>ON</sub> = R<sub>ONmax</sub> - R<sub>ONmin</sub> measured at identical V<sub>CC</sub>, temperature, and voltage.

**Note 9:** Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.

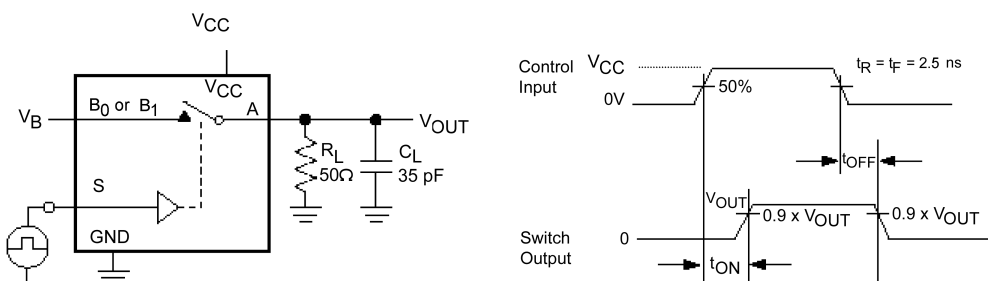
AC Electrical Characteristics - FSA2267										
(All typical value are @ 25°C unless otherwise specified)										
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		Units	Conditions	Figure Number
			Min	Typ	Max	Min	Max			
t <sub>ON</sub>	Turn ON Time	2.7 to 3.6	30.0	38.0		42.0	ns	nB <sub>0</sub> or nB <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		2.3 to 2.7	29.0	37.0		40.0				
		1.65 to 1.95	27.0	35.0		38.0				
t <sub>OFF</sub>	Turn OFF Time	2.7 to 3.6	13.0	16.0		18.0	ns	nB <sub>0</sub> or nB <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		2.3 to 2.7	14.0	18.0		20.0				
		1.65 to 1.95	15.0	21.0		25.0				
t <sub>B-M</sub>	Break-Before-Make Time	2.7 to 3.6	17.0		2.0		ns	nB <sub>0</sub> or nB <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 2	
		2.3 to 2.7	15.0		2.0					
		1.65 to 1.95	12.0		2.0					
Q	Charge Injection	2.7 to 3.6	9.0				pC	C <sub>L</sub> = 100 pF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω C <sub>L</sub> = 100 pF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω C <sub>L</sub> = 100 pF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω	Figure 4	
		2.3 to 2.7	9.0							
		1.65 to 1.95	9.0							
OIRR	OFF-Isolation	2.7 to 3.6	-80.0				dB	f = 100kHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5 pF (Stray)	Figure 3	
		2.3 to 2.7	-80.0							
		1.65 to 1.95	-80.0							
Xtalk	Crosstalk	2.7 to 3.6	-80.0				dB	f = 100kHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5 pF (Stray)	Figure 3	
		2.3 to 2.7	-80.0							
		1.65 to 1.95	-80.0							
BW	-3db Bandwidth	1.65 to 3.6	45.0				MHz	R <sub>L</sub> = 50Ω	Figure 6	
THD	Total Harmonic Distortion	2.7 to 3.6	0.024				%	R <sub>L</sub> = 32Ω, V <sub>IN</sub> = 2V P.P, f= 20Hz to 20kHz R <sub>L</sub> = 32Ω, V <sub>IN</sub> = 1.5V P.P, f= 20Hz to 20kHz R <sub>L</sub> = 32Ω, V <sub>IN</sub> = 1.2V P.P, f= 20Hz to 20kHz	Figure 7	
		2.3 to 2.7	0.015							
		1.65 to 1.95	0.35							

AC Electrical Characteristics - FSA2267A										
(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	3.6 to 4.3	37.0	46.0		48.0	ns	nB <sub>0</sub> or nB <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		2.7 to 3.6	37.0	50.0		57.0				
		2.3 to 2.7	60.0							
t <sub>OFF</sub>	Turn OFF Time	3.6 to 4.3	15.0	23.0		25.0	ns	nB <sub>0</sub> or nB <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		2.7 to 3.6	16.0	28.0		30.0				
		2.3 to 2.7	50.0							
t <sub>B-M</sub>	Break-Before-Make Time	3.6 to 4.3	8.0		2.0		ns	nB <sub>0</sub> or nB <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 2	
		2.7 to 3.6	8.0		2.0					
		2.3 to 2.7	8.0		2.0					
Q	Charge Injection	3.6 to 4.3	24.0				pC	C <sub>L</sub> = 100 pF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω C <sub>L</sub> = 100 pF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω C <sub>L</sub> = 100 pF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω	Figure 4	
		2.7 to 3.6	24.0							
		2.3 to 2.7	24.0							
OIRR	OFF-Isolation	3.6 to 4.3	-75.0				dB	f = 100kHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5 pF (Stray)	Figure 3	
		2.7 to 3.6	-75.0							
		2.3 to 2.7	-75.0							
Xtalk	Crosstalk	3.6 to 4.3	-70.0				dB	f = 100kHz, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5 pF (Stray)	Figure 3	
		2.7 to 3.6	-70.0							
		2.3 to 2.7	-70.0							
BW	-3db Bandwidth	2.3 to 4.3	45.0				MHz	R <sub>L</sub> = 50Ω	Figure 6	
THD	Total Harmonic Distortion	3.6 to 4.3	0.02				%	R <sub>L</sub> = 32Ω, V <sub>IN</sub> = 2V P.P, f= 20Hz to 20kHz R <sub>L</sub> = 32Ω, V <sub>IN</sub> = 1.5V P.P, f= 20Hz to 20kHz R <sub>L</sub> = 32Ω, V <sub>IN</sub> = 1.2V P.P, f= 20Hz to 20kHz	Figure 7	
		2.7 to 3.6	0.02							
		2.3 to 2.7	0.02							

## 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		1.5				pF	f = 1MHz (see Figure 5)
C <sub>OFF</sub>	B Port OFF Capacitance	3.3		30.0				pF	f = 1MHz (see Figure 5)
C <sub>ON</sub>	A Port ON Capacitance	3.3		126				pF	f = 1MHz (see Figure 5)

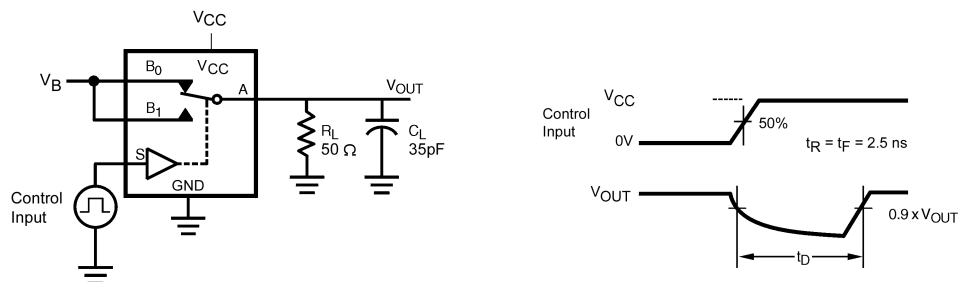
## AC Loading and Waveforms



C<sub>L</sub> includes Fixture and Stray Capacitance

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

FIGURE 1. Turn-On/Turn-Off Timing



C<sub>L</sub> Includes Fixture and Stray Capacitance

FIGURE 2. Break-Before-Make Timing

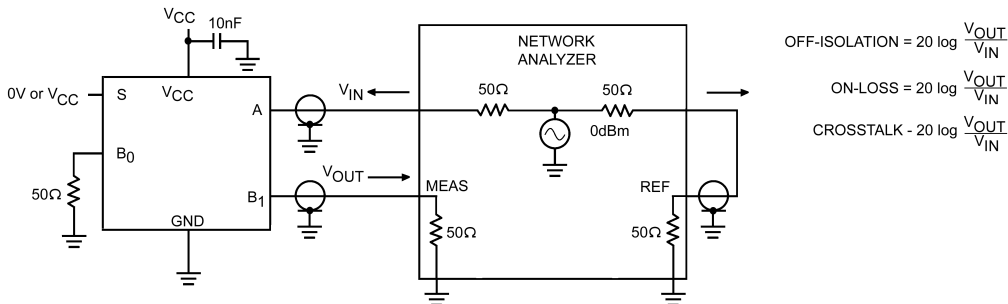


FIGURE 3. OFF Isolation and Crosstalk

AC Loading and Waveforms (Continued)

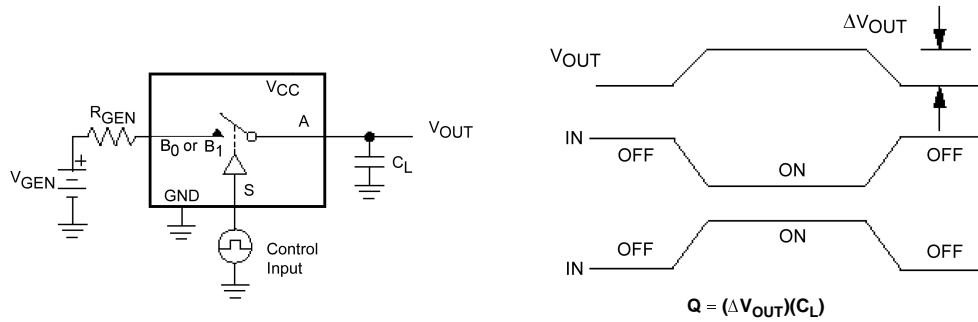


FIGURE 4. Charge Injection

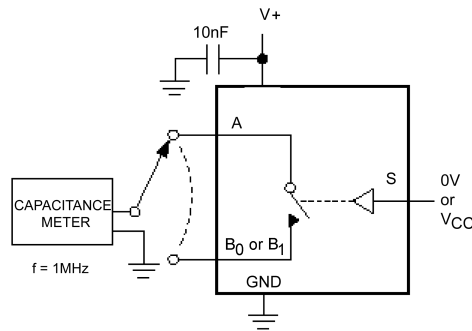


FIGURE 5. ON/OFF Capacitance Measurement Setup

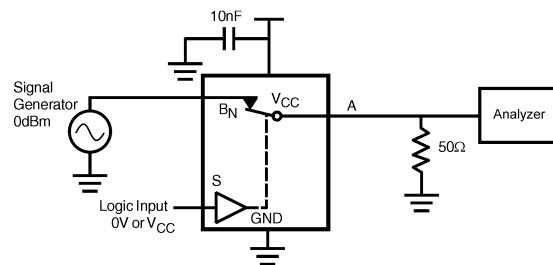


FIGURE 6. Bandwidth

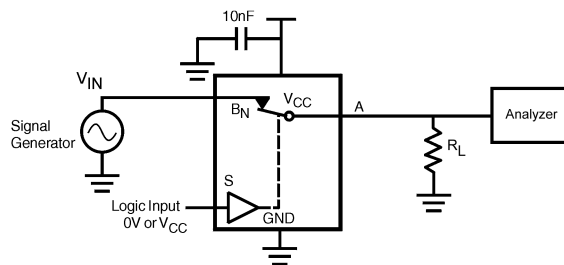
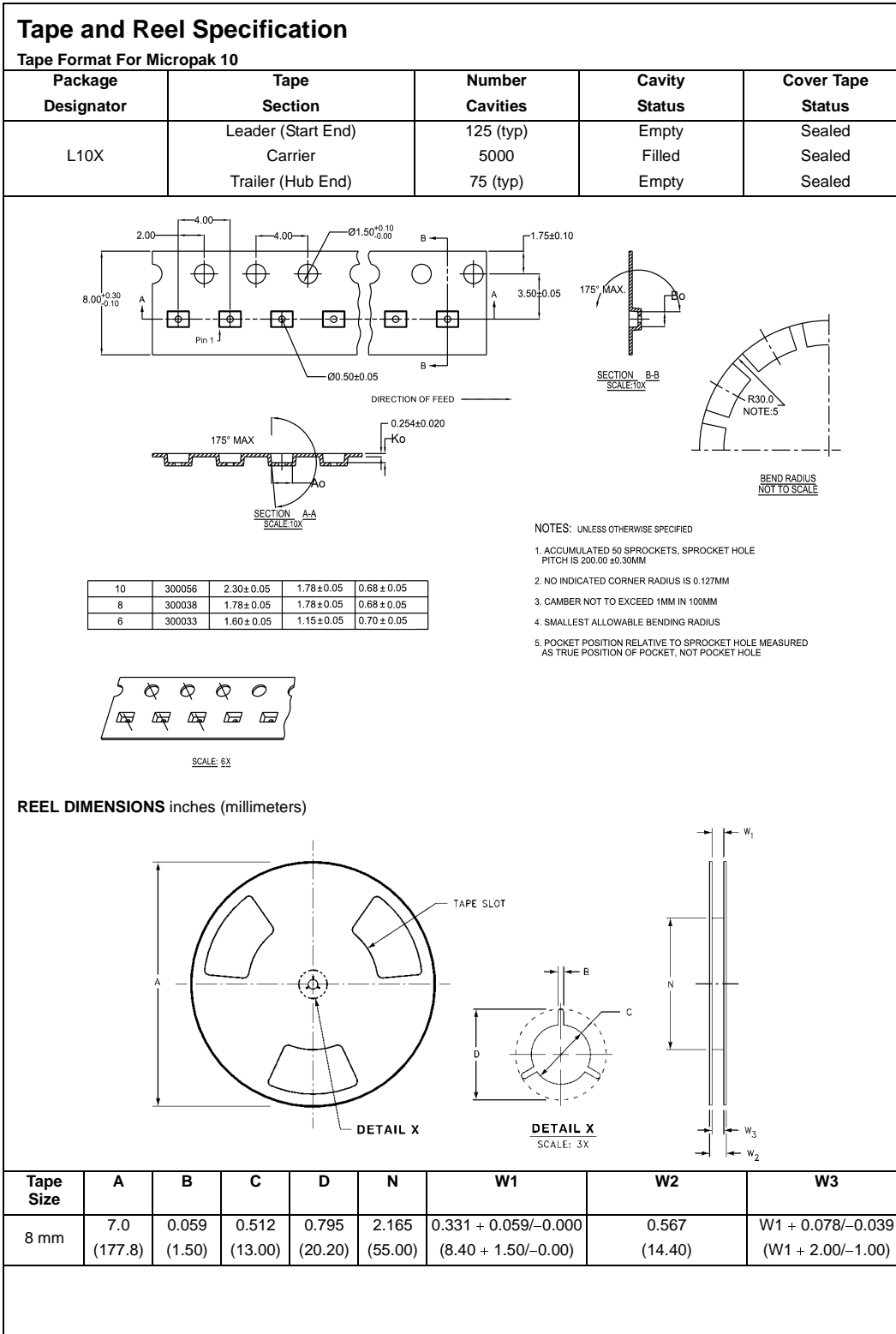
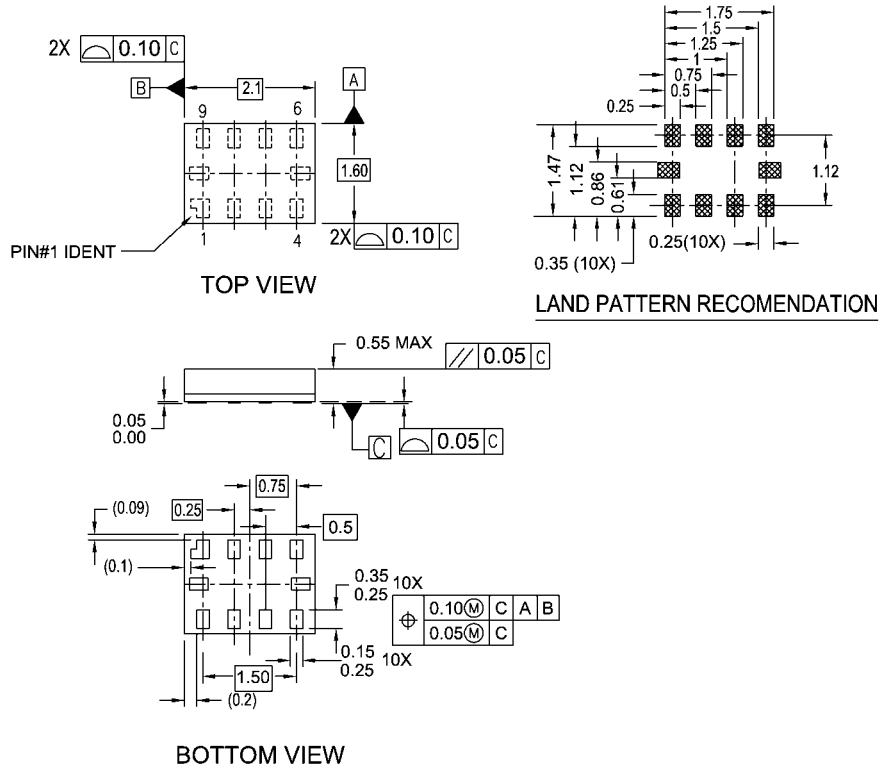


FIGURE 7. Harmonic Distortion



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



**NOTES:**

- A. PACKAGE CONFORMS TO JEDEC MO255, VARIATION UABD
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES CONFORMS TO ASME Y14.5M, 1994.

MAC010ARevB

**Pb-Free 10-Lead MicroPak, 1.6 mm x 2.1mm  
Package Number MAC010A**

Fairchild does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and Fairchild reserves the right at any time without notice to change said circuitry and specifications.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
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.

[www.fairchildsemi.com](http://www.fairchildsemi.com)