FAIRCHILD
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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 I_{CCT} 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
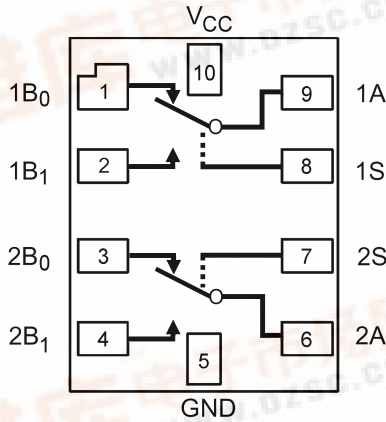
(Top Through View)

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$_0$, 1B$_1$, 2B$_0$, 2B$_1$	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)	$T_A = +25°C$ Min	Typ	Max	$T_A = −40°C$ to $+85°C$ Min	Max	Units	Conditions
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	µA	V_{IN} = 0V to V_{CC}
$I_{NO(OFF)}$, $I_{NC(OFF)}$	OFF-Leakage Current of Port nB_0 and nB_1	3.6	-5.0		5.0	−50.0	50.0	nA	nA = 0.3V, 3.3V, nB_0 or nB_1 = 0.3V, 3.3V
		2.7	−5.0		5.0	−50.0	50.0		nA = 0.3V, 2.4V, nB_0 or nB_1 = 0.3V, 2.4V or Floating
		1.95	−5.0		5.0	−50.0	50.0		nA = 0.3V, 1.65V, nB_0 or nB_1 = 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_0 or nB_1 = 0.3V, 3.3V or Floating
		2.7	−5.0		5.0	−50.0	50.0		nA = 0.3V, 2.4V nB_0 or nB_1 = 0.3V, 2.4V or Floating
		1.95	−5.0		5.0	−50.0	50.0		nA = 0.3V, 1.65V nB_0 or nB_1 = 0.3V, 1.65V or Floating
R_{ON}	Switch On Resistance (Note 4)	2.7		0.35			0.6		I_{OUT} = 100 mA, nB_0 or nB_1 = 0V, 0.7V, 2.0V, 2.7V
		2.3		0.45			0.75	Ω	I_{OUT} = 100 mA, nB_0 or nB_1 = 0V, 0.7V, 1.6V, 2.3V
		1.65		1.0			3.9		I_{OUT} = 100 mA, nB_0 or nB_1 = 0.8V
ΔR_{ON}	On Resistance Matching Between Channels (Note 5)	2.7		0.04			0.075		I_{OUT} = 100 mA, nB_0 or nB_1 = 0.7V
		2.3		0.16			0.08	Ω	
		1.65		0.1					
$R_{FLAT(ON)}$	On Resistance Flatness (Note 6)	2.7					0.25		I_{OUT} = 100 mA, nB_0 or nB_1 = 0V to V_{CC}
		2.3					0.3	Ω	
		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_{CC} (V)	$T_A = +25°C$ Min	Typ	Max	$T_A = -40°C$ to $+85°C$ Min	Max	Units	Conditions
V_{IH}	Input Voltage High	3.6 to 4.3				1.7			
		2.7 to 3.6				1.5		V	
		2.3 to 2.7				1.4			
V_{IL}	Input Voltage Low	3.6 to 4.3					0.7		
		2.7 to 3.6					0.5	V	
		2.3 to 2.7					0.4		
I_{IN}	Control Input Leakage	2.3 to 4.3				−0.5	0.5	µA	$V_{IN} = 0V$ to V_{CC}
$I_{NO(OFF)}$, $I_{NC(OFF)}$	OFF-Leakage Current of Port nB_0 and nB_1	4.3	-10.0		10.0	−100	100		nA = 0.3V, 4.0V, nB_0 or $nB_1 = 4.0V$, 0.3V
		3.6	−5.0		5.0	−50.0	50.0	nA	nA = 0.3V, 3.3V, nB_0 or $nB_1 = 0.3V$, 3.3V or Floating
		2.7	−5.0		5.0	−50.0	50.0		nA = 0.3V, 2.4V, nB_0 or $nB_1 = 0.3V$, 2.4V or Floating
$I_{A(ON)}$	ON Leakage Current of Port A	4.3	−20.0		20.0	−200	200		nA = 0.3V, 4.0V nB_0 or $nB_1 = 0.3V$, 4.0V or Floating
		3.6	−5.0		5.0	−50.0	50.0	nA	nA = 0.3V, 3.3V nB_0 or $nB_1 = 0.3V$, 3.3V or Floating
		2.7	−5.0		5.0	−50.0	50.0		nA = 0.3V, 2.4V nB_0 or $nB_1 = 0.3V$, 2.4V or Floating
R_{ON}	Switch On Resistance (Note 7)	4.3		0.35			0.6		$I_{OUT} = 100$ mA, nB_0 or $nB_1 = 0V$, 0.7V, 3.6V, 4.3V
		3.0		0.35			0.6	Ω	$I_{OUT} = 100$ mA, nB_0 or $nB_1 = 0V$, 0.7V, 2.3V, 3.0V
		2.7		0.35			0.6		$I_{OUT} = 100$ mA, nB_0 or $nB_1 = 0V$ 0.7V, 2.0V, 2.7V
ΔR_{ON}	On Resistance Matching Between Channels (Note 8)	4.3		0.04			0.075		
		3.0		0.04			0.075	Ω	$I_{OUT} = 100$ mA, nB_0 or $nB_1 = 0.7V$
		2.7		0.04			0.075		
$R_{FLAT(ON)}$	On Resistance Flatness (Note 9)	4.3		0.15			0.25		
		3.0		0.15			0.25	Ω	$I_{OUT} = 100$ mA, nB_0 or $nB_1 = 0V$ to V_{CC}
		2.7		0.15			0.25		
I_{CC}	Quiescent Supply Current	4.3	−100	80.0	100	−500	500	nA	$V_{IN} = 0V$ or V_{CC}, $I_{OUT} = 0V$
I_{CCT}	Increase in I_{CC} per Input	4.3		7.0	10.0		15.0	µA	$V_{IN} = 1.8V$
				0.5	2.0		7.0		$V_{IN} = 2.6V$

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

Note 8: $\Delta R_{ON} = R_{ONmax} - R_{ONmin}$ measured at identical V_{CC}, 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.

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AC Electrical Characteristics - FSA2267

(All typical value are @ 25°C unless otherwise specified)

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$ Min	Typ	Max	$T_A = -40°C$ to $+85°C$ Min	Max	Units	Conditions	Figure Number
t_{ON}	Turn ON Time	2.7 to 3.6		30.0	38.0		42.0		nB_0 or $nB_1 = 1.5V$,	
		2.3 to 2.7		29.0	37.0		40.0	ns	$R_L = 50\Omega$, $C_L = 35$ pF	Figure 1
		1.65 to 1.95		27.0	35.0		38.0			
t_{OFF}	Turn OFF Time	2.7 to 3.6		13.0	16.0		18.0		nB_0 or $nB_1 = 1.5V$,	
		2.3 to 2.7		14.0	18.0		20.0	ns	$R_L = 50\Omega$, $C_L = 35$ pF	Figure 1
		1.65 to 1.95		15.0	21.0		25.0			
t_{B-M}	Break-Before-Make Time	2.7 to 3.6		17.0		2.0			nB_0 or $nB_1 = 1.5V$,	
		2.3 to 2.7		15.0		2.0		ns	$R_L = 50\Omega$, $C_L = 35$ pF	Figure 2
		1.65 to 1.95		12.0		2.0				
Q	Charge Injection	2.7 to 3.6		9.0					$C_L = 100$ pF, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$	
		2.3 to 2.7		9.0				pC	$C_L = 100$ pF, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$	Figure 4
		1.65 to 1.95		9.0					$C_L = 100$ pF, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$	
OIRR	OFF-Isolation	2.7 to 3.6		−80.0						
		2.3 to 2.7		−80.0				dB	$f = 100kHz$, $R_L = 50\Omega$, $C_L = 5$ pF (Stray)	Figure 3
		1.65 to 1.95		−80.0						
Xtalk	Crosstalk	2.7 to 3.6		−80.0						
		2.3 to 2.7		−80.0				dB	$f = 100kHz$, $R_L = 50\Omega$, $C_L = 5$ pF (Stray)	Figure 3
		1.65 to 1.95		−80.0						
BW	−3db Bandwidth	1.65 to 3.6		45.0				MHz	$R_L = 50\Omega$	Figure 6
THD	Total Harmonic Distortion	2.7 to 3.6		0.024					$R_L = 32\Omega$, $V_{IN} = 2V$ P.P, $f = 20Hz$ to $20kHz$	
		2.3 to 2.7		0.015				%	$R_L = 32\Omega$, $V_{IN} = 1.5V$ P.P, $f = 20Hz$ to $20kHz$	Figure 7
		1.65 to 1.95		0.35					$R_L = 32\Omega$, $V_{IN} = 1.2V$ P.P, $f = 20Hz$ to $20kHz$	

AC Electrical Characteristics - FSA2267A

(All typical value are @ 25°C unless otherwise specified)

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$ Min	Typ	Max	$T_A = -40°C$ to $+85°C$ Min	Max	Units	Conditions	Figure Number
t_{ON}	Turn ON Time	3.6 to 4.3		37.0	46.0		48.0		nB_0 or $nB_1 = 1.5V$,	
		2.7 to 3.6		37.0	50.0		57.0	ns	$R_L = 50\Omega$, $C_L = 35$ pF	Figure 1
		2.3 to 2.7		60.0						
t_{OFF}	Turn OFF Time	3.6 to 4.3		15.0	23.0		25.0		nB_0 or $nB_1 = 1.5V$,	
		2.7 to 3.6		16.0	28.0		30.0	ns	$R_L = 50\Omega$, $C_L = 35$ pF	Figure 1
		2.3 to 2.7		50.0						
t_{B-M}	Break-Before-Make Time	3.6 to 4.3		8.0		2.0			nB_0 or $nB_1 = 1.5V$,	
		2.7 to 3.6		8.0		2.0		ns	$R_L = 50\Omega$, $C_L = 35$ pF	Figure 2
		2.3 to 2.7		8.0		2.0				
Q	Charge Injection	3.6 to 4.3		24.0					$C_L = 100$ pF, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$	
		2.7 to 3.6		24.0				pC	$C_L = 100$ pF, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$	Figure 4
		2.3 to 2.7		24.0					$C_L = 100$ pF, $V_{GEN} = 0V$, $R_{GEN} = 0\Omega$	
OIRR	OFF-Isolation	3.6 to 4.3		−75.0						
		2.7 to 3.6		−75.0				dB	$f = 100kHz$, $R_L = 50\Omega$, $C_L = 5$ pF (Stray)	Figure 3
		2.3 to 2.7		−75.0						
Xtalk	Crosstalk	3.6 to 4.3		−70.0						
		2.7 to 3.6		−70.0				dB	$f = 100kHz$, $R_L = 50\Omega$, $C_L = 5$ pF (Stray)	Figure 3
		2.3 to 2.7		−70.0						
BW	−3db Bandwidth	2.3 to 4.3		45.0				MHz	$R_L = 50\Omega$	Figure 6
THD	Total Harmonic Distortion	3.6 to 4.3		0.02					$R_L = 32\Omega$, $V_{IN} = 2V$ P.P, $f = 20Hz$ to $20kHz$	
		2.7 to 3.6		0.02				%	$R_L = 32\Omega$, $V_{IN} = 1.5V$ P.P, $f = 20Hz$ to $20kHz$	Figure 7
		2.3 to 2.7		0.02					$R_L = 32\Omega$, $V_{IN} = 1.2V$ P.P, $f = 20Hz$ to $20kHz$	

Capacitance

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$			$T_A = 40°C$ to $+85°C$		Units	Conditions
			Min	Typ	Max	Min	Max		
C_{IN}	Control Pin Input Capacitance	0.0		1.5				pF	f = 1MHz (see Figure 5)
C_{OFF}	B Port OFF Capacitance	3.3		30.0				pF	f = 1MHz (see Figure 5)
C_{ON}	A Port ON Capacitance	3.3		126				pF	f = 1MHz (see Figure 5)

AC Loading and Waveforms
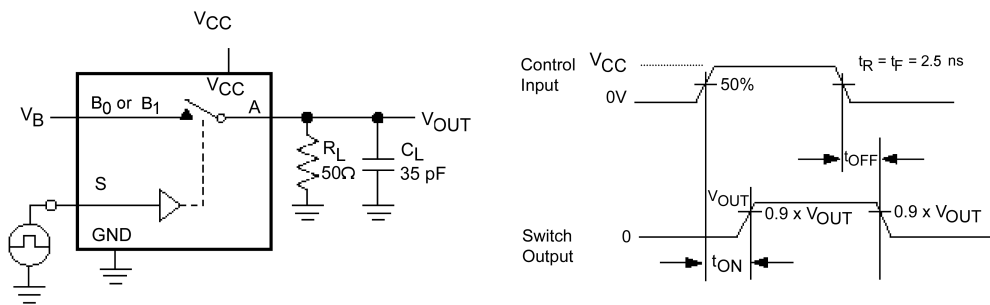
C_L includes Fixture and Stray Capacitance

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

FIGURE 1. Turn-On/Turn-Off Timing
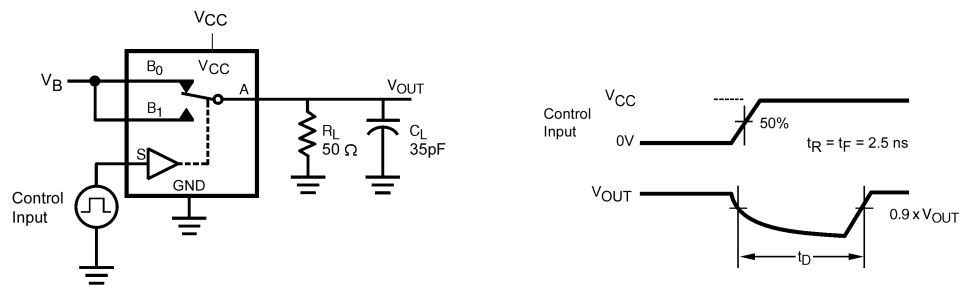
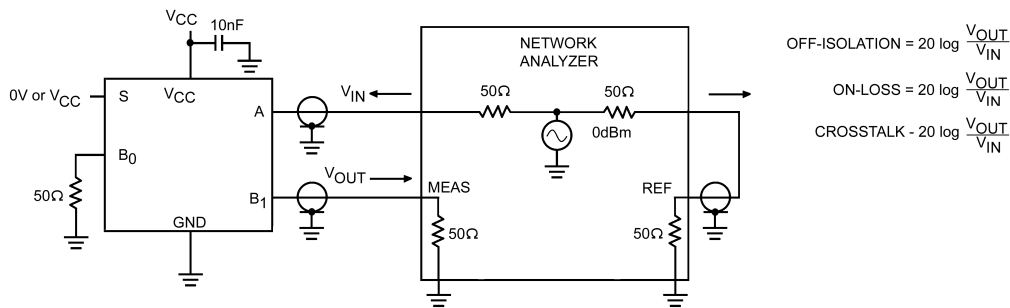**C_L Includes Fixture and Stray Capacitance**

FIGURE 2. Break-Before-Make Timing

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

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

CROSSTALK - $20 \log \frac{V_{OUT}}{V_{IN}}$

FIGURE 3. OFF Isolation and Crosstalk

AC Loading and Waveforms (Continued)
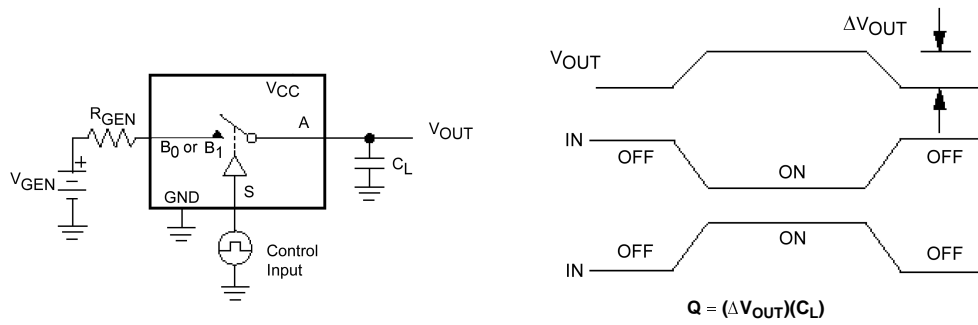
FIGURE 4. Charge Injection

$$Q = (\Delta V_{OUT})(C_L)$$

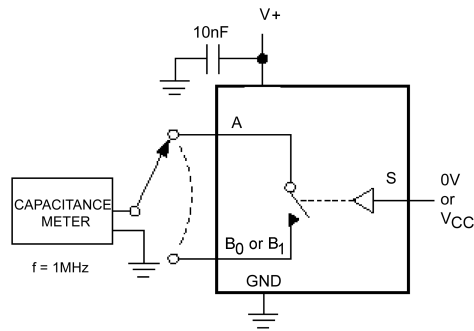**FIGURE 5. ON/OFF Capacitance Measurement Setup**
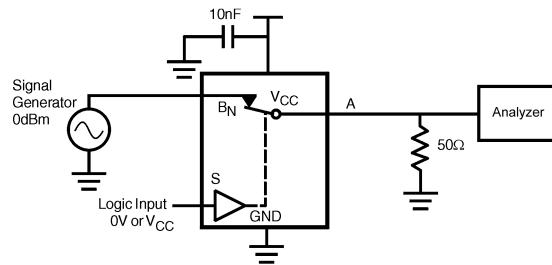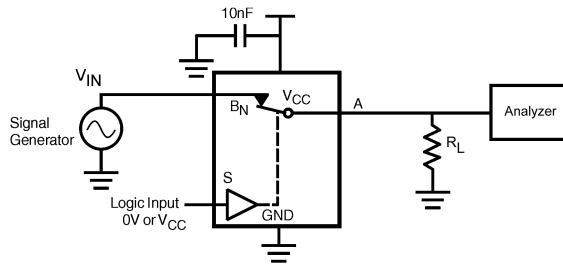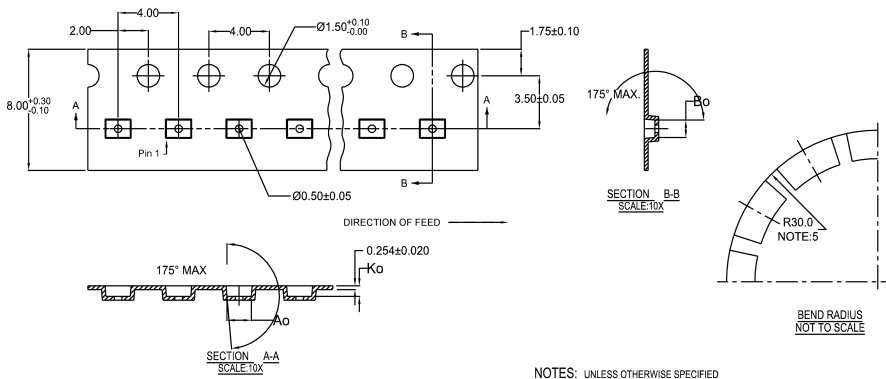

FIGURE 6. Bandwidth

**FIGURE 7. Harmonic Distortion**

Tape and Reel Specification

Tape Format For Micropak 10

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
	Leader (Start End)	125 (typ)	Empty	Sealed
L10X	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
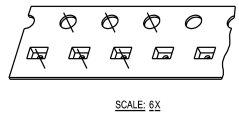
REEL DIMENSIONS inches (millimeters)
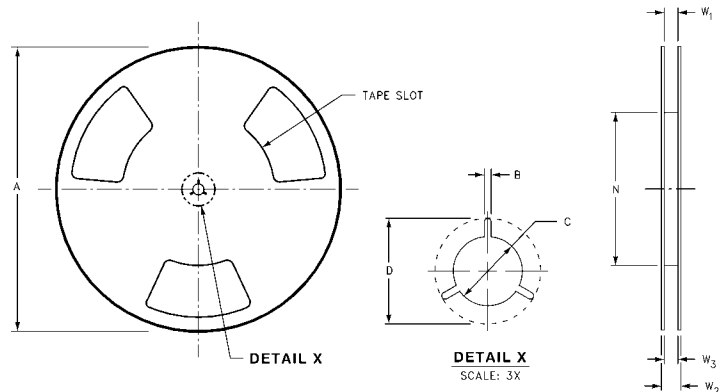
Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/–0.000 (8.40 + 1.50/–0.00)	0.567 (14.40)	W1 + 0.078/–0.039 (W1 + 2.00/–1.00)

FSA2267 • FSA2267A 0.35Ω Low Voltage Dual SPDT Analog Switch

Physical Dimensions inches (millimeters) unless otherwise noted

TOP VIEW

LAND PATTERN RECOMENDATION

0.55 MAX

BOTTOM VIEW

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

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