

**FAIRCHILD**  
SEMICONDUCTOR™

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## FSA2257

### Low $R_{ON}$ Low Voltage Dual SPDT Bi-Directional Analog Switch

#### General Description

The FSA2257 is a high performance bi-directional dual Single Pole Double Throw (SPDT) analog switch. This switch can be configured as either a multiplexer or a demultiplexer by select pins. The device features ultra low  $R_{ON}$  of 1.3Ω maximum at 4.5V  $V_{CC}$  and will operate over the wide  $V_{CC}$  range of 1.65V to 5.5V. The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation. The select input is TTL level compatible.

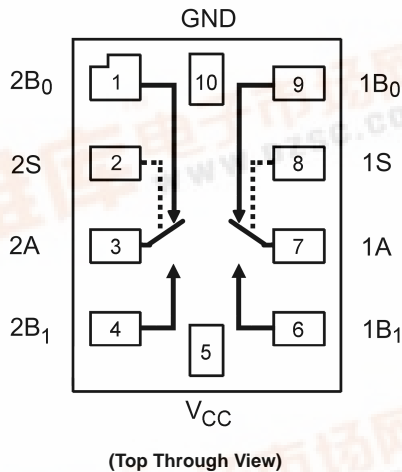
#### Features

- Maximum 1.15Ω ON Resistance ( $R_{ON}$ ) for 4.5V supply
- 0.3Ω max  $R_{ON}$  flatness for +5V supply
- Space saving MicroPak™ packaging
- Broad  $V_{CC}$  operating range: 1.65V to 5.5V
- Fast turn-on and turn-off time
- 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
FSA2257L10X	MAC010A	EP	10-Lead MicroPak, 1.6 mm x 2.1mm	5K Units on Tape and Reel

#### Analog Symbols



#### 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
A, $B_0$ , $B_1$	Data Ports
S	Control Input

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FSA2257 Low  $R_{ON}$  Low Voltage Dual SPDT Bi-Directional Analog Switch



**Absolute Maximum Ratings** (Note 1)

Supply Voltage ( $V_{CC}$ )	-0.5V to +6.0V
Switch Voltage ( $V_S$ ) (Note 2)	-0.5V to $V_{CC} + 0.5V$
Input Voltage ( $V_{IN}$ ) (Note 2)	-0.5V to +6.0V
Input Diode Current	-50 mA
Switch Current	200 mA
Peak Switch Current (Pulsed at 1 ms duration, <10% Duty Cycle)	400 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	8000V

**Recommended Operating Conditions**

Supply Voltage ( $V_{CC}$ )	1.65V to 5.5V
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** (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					0.6	V	
		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 of Port $B_0$ and $B_1$	5.5	-2.0	2.0	-20.0	20.0	nA	A = 1V, 4.5V $B_0$ or $B_1 = 1V, 4.5V$	
$I_{A(ON)}$	ON Leakage Current of Port A	5.5	-4.0	4.0	-40.0	40.0	nA	A = 1V, 4.5V $B_0$ or $B_1 = 1V, 4.5V$ or Floating	
$R_{ON}$	Switch ON Resistance (Note 4)	2.7	2.6	4.0		4.3	$\Omega$	$I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 1.5V$	
		4.5	0.95	1.15		1.3		$I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 3.5V$	
$\Delta R_{ON}$	ON Resistance Matching Between Channels (Note 5)	2.7				0.15	$\Omega$	$I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 1.5V$	
		4.5	0.06	0.12				$I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 3.5V$	
$R_{FLAT(ON)}$	ON Resistance Flatness (Note 6)	2.7	1.4				$\Omega$	$I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 0V, 0.75V, 1.5V$	
		4.5	0.2	0.3		0.4		$I_{OUT} = 100 \text{ mA}, B_0 \text{ or } B_1 = 0V, 1V, 2V$	
$I_{CC}$	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			

**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.

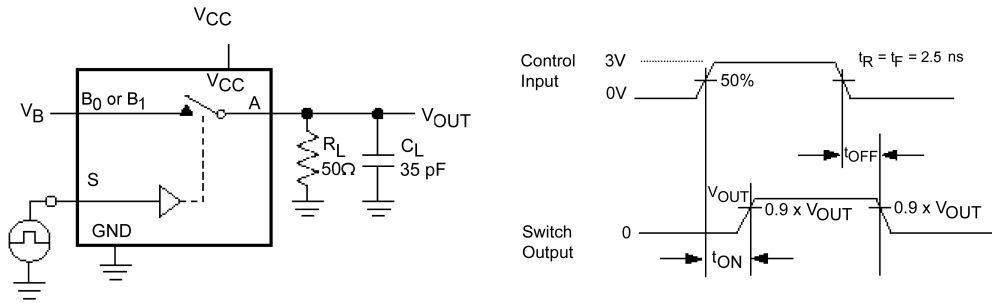
### AC Electrical Characteristics (All typical value are @ 25°C unless otherwise specified)

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		50.0		60.0	ns	B <sub>0</sub> or B <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		4.5 to 5.5		35.0		40.0		B <sub>0</sub> or B <sub>1</sub> = 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		20.0		30.0	ns	B <sub>0</sub> or B <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 1	
		4.5 to 5.5		15.0		20.0		B <sub>0</sub> or B <sub>1</sub> = 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			1.0		ns	B <sub>0</sub> or B <sub>1</sub> = 1.5V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF	Figure 2	
		4.5 to 5.5		20.0	1.0			B <sub>0</sub> or B <sub>1</sub> = 3.0V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35 pF		
Q	Charge Injection	2.7 to 3.6		20.0			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		10.0						
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		-75.0			dB	f = 1MHz, R <sub>L</sub> = 50Ω	Figure 3	
		4.5 to 5.5		-75.0						
BW	-3db Bandwidth	2.7 to 3.6		350			MHz	R <sub>L</sub> = 50Ω	Figure 6	
		4.5 to 5.5		350						
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 7	
		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		3.5			pF	f = 1MHz (see Figure 5)	
C <sub>OFF</sub>	B Port OFF Capacitance	4.5		12.0			pF	f = 1MHz (see Figure 5)	
C <sub>ON</sub>	A Port ON Capacitance	4.5		40.0			pF	f = 1MHz (see Figure 5)	

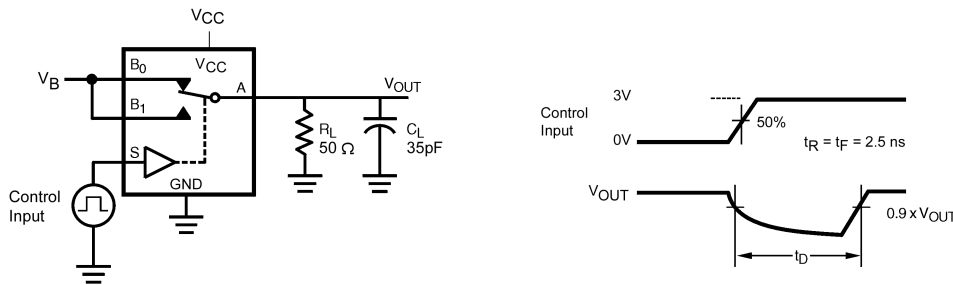
## AC Loading and Waveforms



$C_L$  includes Fixture and Stray Capacitance

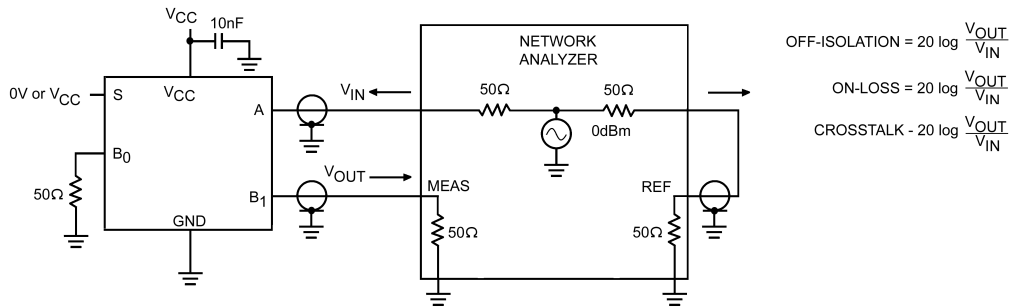
Logic Input Waveforms Inverted for Switches that have the Opposite Logic Sense

FIGURE 1. Turn-On/Turn-Off Timing



$C_L$  Includes Fixture and Stray Capacitance

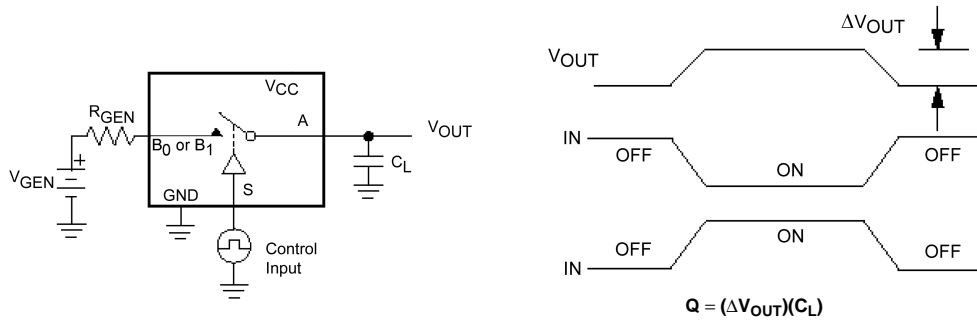
FIGURE 2. Break-Before-Make Timing



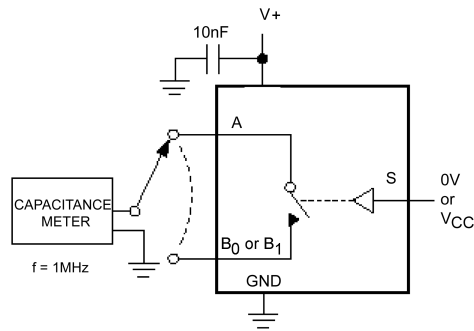
$$\begin{aligned} \text{OFF-ISOLATION} &= 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}} \\ \text{ON-LOSS} &= 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}} \\ \text{CROSSTALK} &= 20 \log \frac{V_{\text{OUT}}}{V_{\text{IN}}} \end{aligned}$$

FIGURE 3. OFF Isolation and Crosstalk

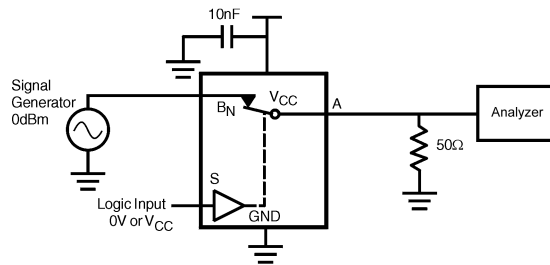
**AC Loading and Waveforms** (Continued)



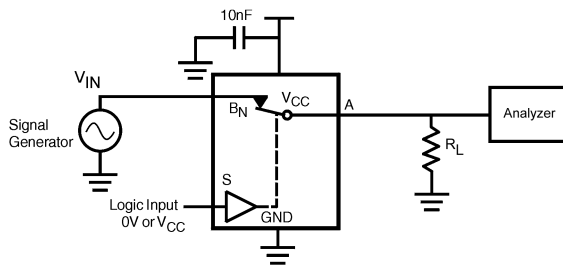
**FIGURE 4. Charge Injection**



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



**FIGURE 6. Bandwidth**

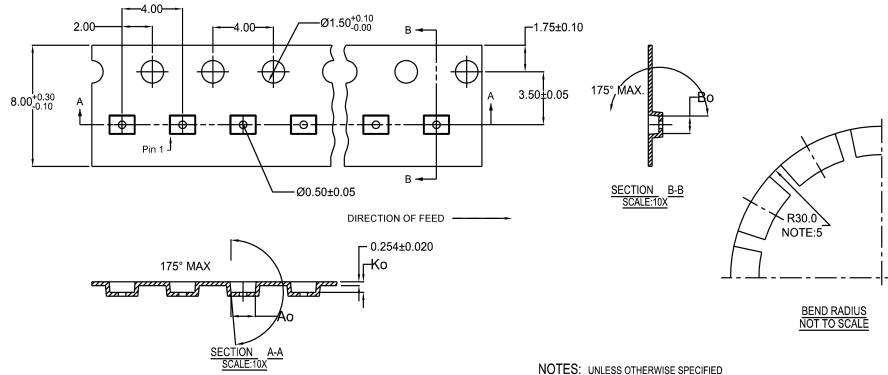


**FIGURE 7. Harmonic Distortion**

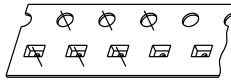
## Tape and Reel Specification

Tape Format For Micropak 10

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
L10X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed



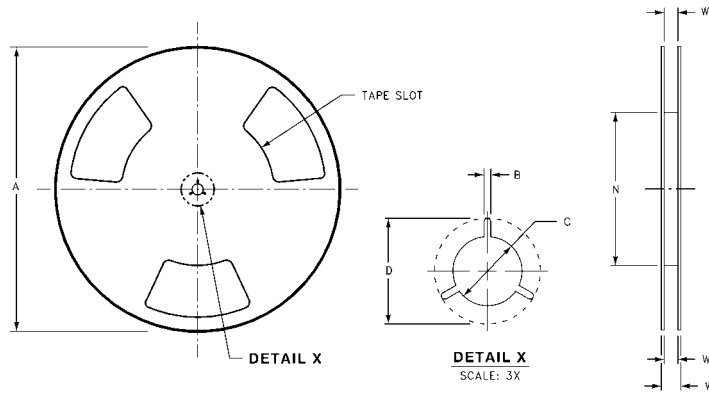
10	300056	2.30±0.05	1.78±0.05	0.68±0.05
8	300038	1.78±0.05	1.78±0.05	0.68±0.05
6	300033	1.60±0.05	1.15±0.05	0.70±0.05



NOTES: UNLESS OTHERWISE SPECIFIED

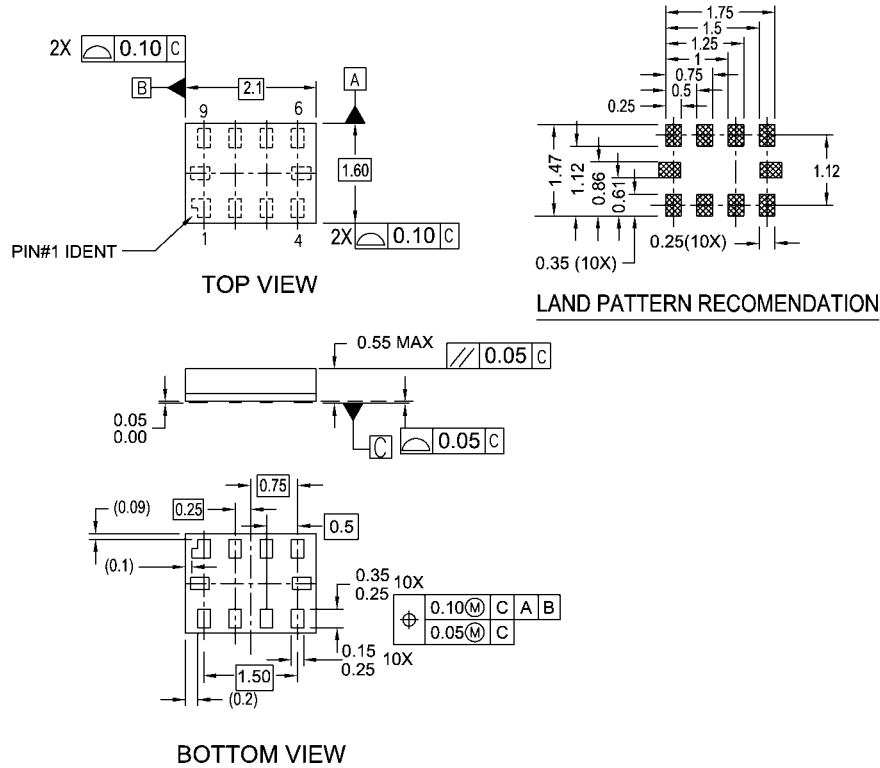
1. ACCUMULATED 50 SPROCKETS. SPROCKET HOLE PITCH IS 200.00 ±0.30MM
2. NO INDICATED CORNER RADIUS IS 0.127MM
3. CAMBER NOT TO EXCEED 1MM IN 100MM
4. SMALLEST ALLOWABLE BENDING RADIUS
5. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE

### 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:**

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

MAC010ARevB

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

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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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