



March 2004  
Revised January 2005

## FSA1256 • FSA1257 • FSA1258

### Low $R_{ON}$ Low Voltage Dual SPST Analog Switch

#### General Description

The FSA1256, FSA1257, and FSA1258 are high performance dual Single Pole/Single Throw (SPST) analog switches. These devices feature ultra low  $R_{ON}$  of 1.1 $\Omega$  maximum at 4.5V  $V_{CC}$  and will operate over the wide  $V_{CC}$  range of 1.65V 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 features two Normally Open (NO) switches. The FSA1257 features two Normally Closed (NC) switches. The FSA1258 has one NO switch and one NC switch.

#### Features

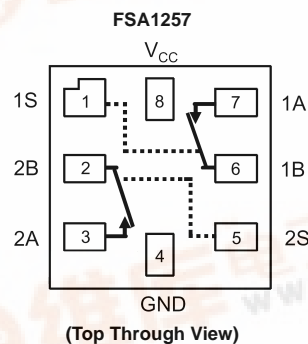
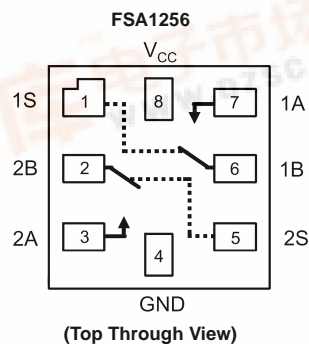
- Maximum 1.1 $\Omega$  On Resistance ( $R_{ON}$ ) for 4.5V supply
- 0.4 $\Omega$  max  $R_{ON}$  flatness for 4.5V supply
- Space saving Pb-Free MicroPak™ packaging
- Broad  $V_{CC}$  operating range: 1.65V to 5.5V
- Fast turn-on and turn-off time
- FSA1258 features break-before-make enable circuitry
- 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
FSA1257L8X	MAC08A	EC	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

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

#### Analog Symbols



#### Truth Tables

FSA1256	
Control Input(s)	Function
L	Disconnect
H	A Connected to B

H = HIGH Logic Level

L = LOW Logic Level

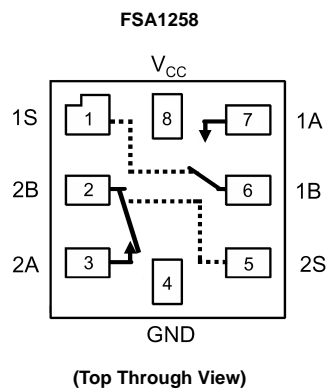
FSA1257	
Control Input(s)	Function
L	A Connected to B
H	Disconnect

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FSA1256 • FSA1257 • FSA1258 Low  $R_{ON}$  Low Voltage Dual SPST Analog Switch



## Analog Symbol



## Truth Table

FSA1258

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**(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
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	5.5kV

**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
Thermal Resistance ( $\theta_{JA}$ ) in still air	
MicroPak 8L package	224°C/W (modeled)

**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	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	$\Omega$	$I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 1.5V$
		4.5		0.95	1.18		1.3		$I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 3.5V$
$\Delta R_{ON}$	On Resistance Matching Between Channels (Note 5)	4.5		0.06	0.12		0.15	$\Omega$	$I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 3.5V$
$R_{FLAT(ON)}$	On Resistance Flatness (Note 6)	2.7		1.4				$\Omega$	$I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 0V, 0.75V, 1.5V$
		4.5		0.2	0.3		0.4		$I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 0V, 1V, 2V$
$I_{CC}$	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		

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

## 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

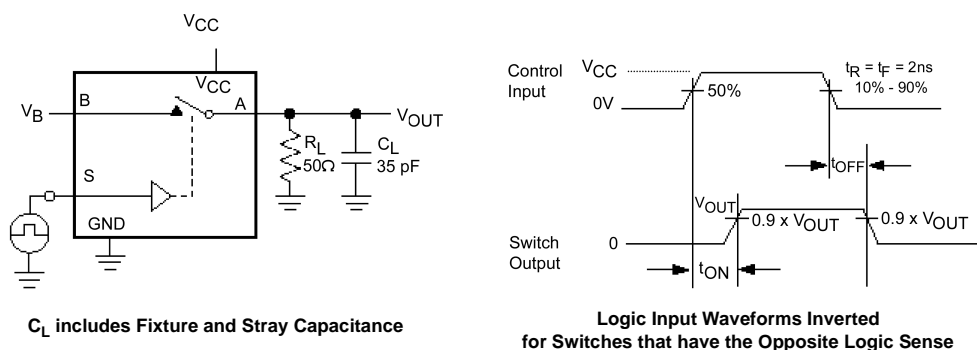


FIGURE 1. Turn-On/Turn-Off Timing

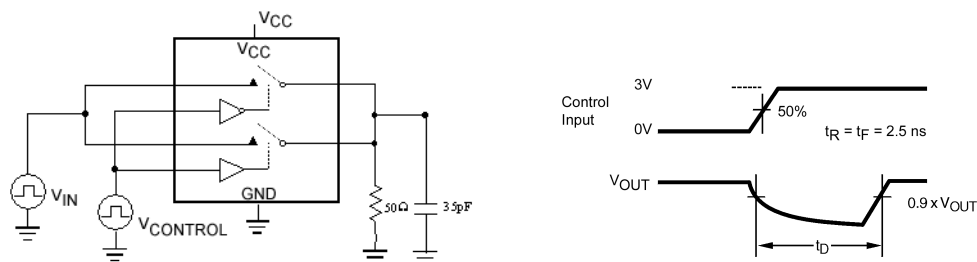


FIGURE 2. Break-Before-Make Timing

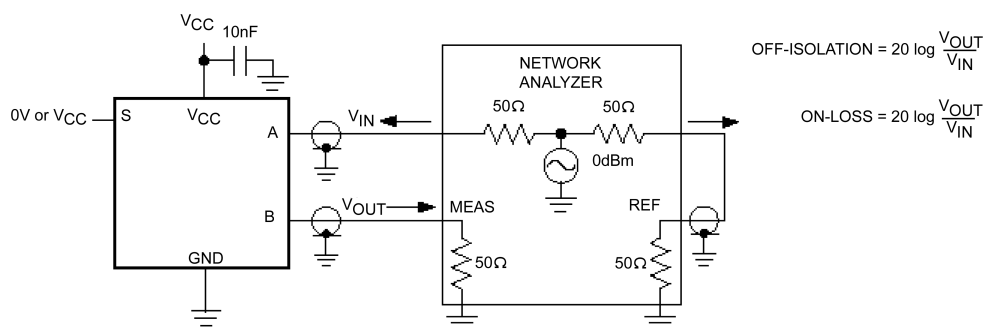


FIGURE 3. OFF Isolation

## AC Loading and Waveforms (Continued)

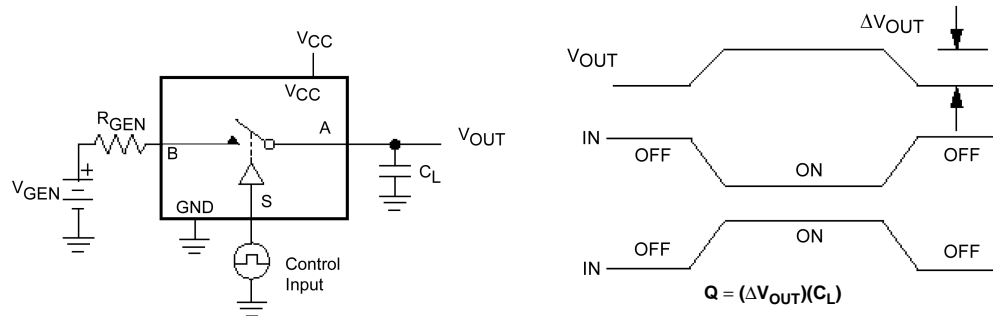


FIGURE 4. Charge Injection

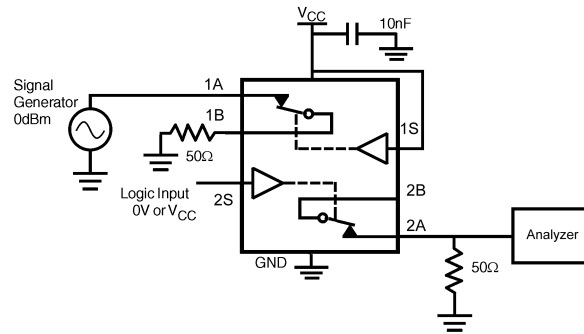


FIGURE 5. Crosstalk

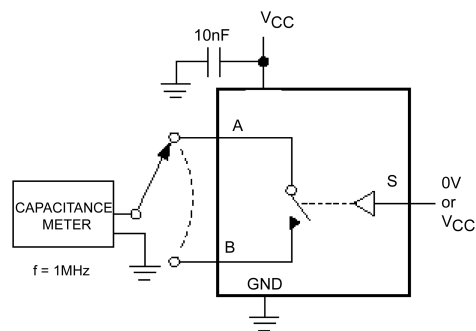


FIGURE 6. ON/OFF Capacitance Measurement Setup

## AC Loading and Waveforms (Continued)

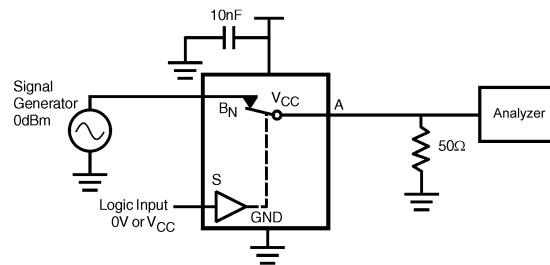


FIGURE 7. Bandwidth

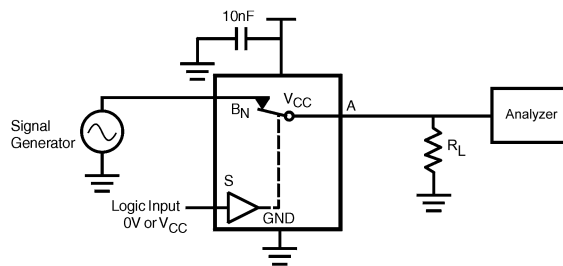
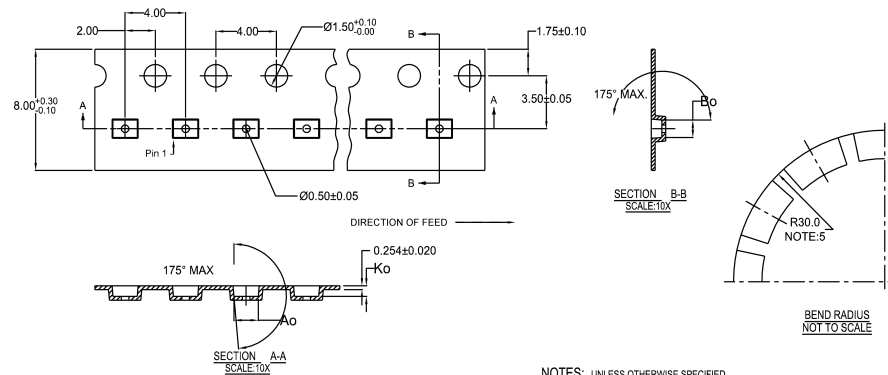


FIGURE 8. Harmonic Distortion

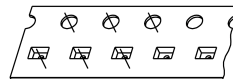
## Tape and Reel Specification

### 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

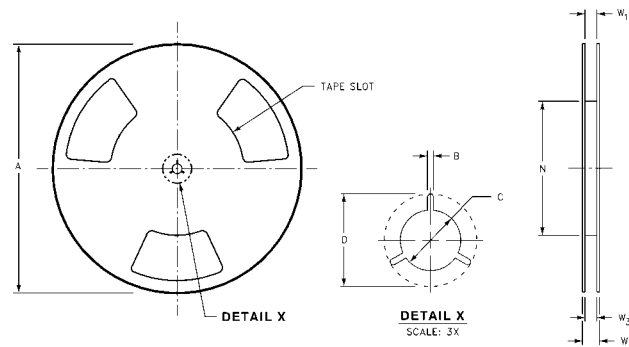


SCALE: 6X

#### 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

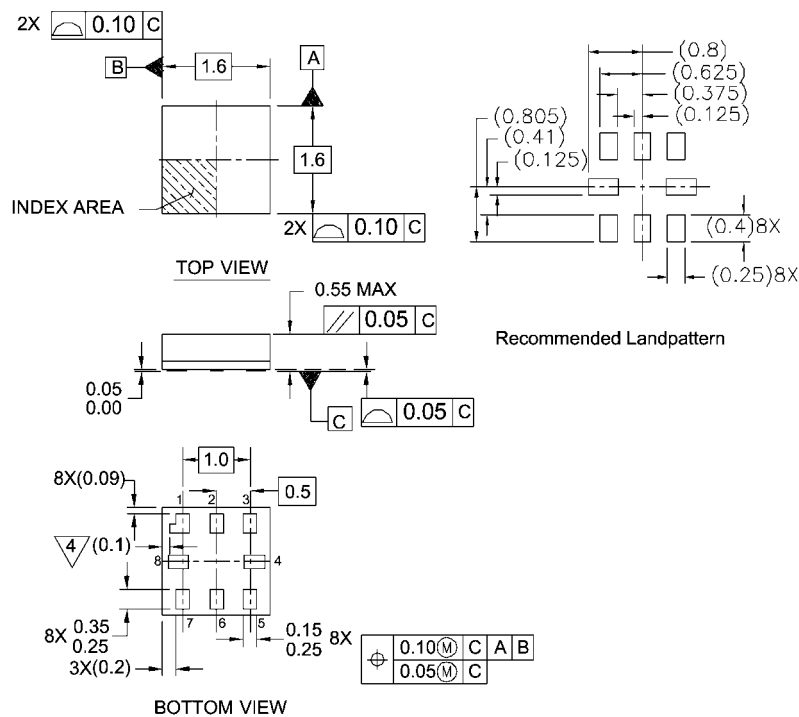
### REEL DIMENSIONS inches (millimeters)



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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