

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 Ω 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

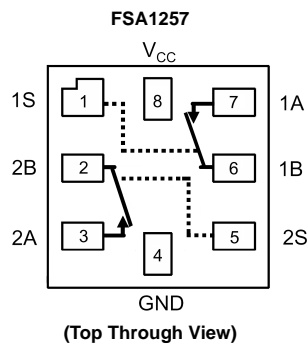
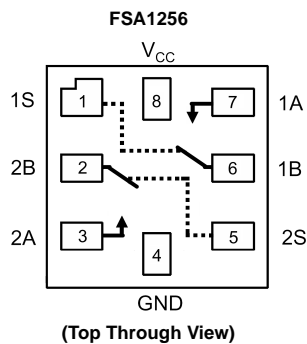
- Maximum 1.1 Ω On Resistance (R_{ON}) for 4.5V supply
- 0.4 Ω max R_{ON} flatness for 4.5V supply
- Space saving Pb-Free MicroPak™ packaging
- Broad V_{CC} operating range: 1.65V to 5.5V
- Fast turn-on and turn-off time
- FSA1258 features break-before-make enable circuitry
- Over-voltage tolerant TTL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

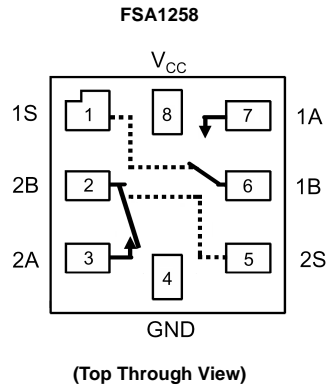
| FSA1256 | |
|------------------|------------------|
| Control Input(s) | Function |
| L | Disconnect |
| H | A Connected to B |

H = HIGH Logic Level L = LOW Logic Level

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

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

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) | | Recommended Operating Conditions | |
|---|--------------------------|---|----------------------|
| Supply Voltage (V_{CC}) | -0.5V to +6.0V | Supply Voltage (V_{CC}) | 1.65V to 5.5V |
| Switch Voltage (V_S) (Note 2) | -0.5V to $V_{CC} + 0.5V$ | Control Input Voltage (V_{IN}) (Note 3) | 0V to V_{CC} |
| Input Voltage (V_{IN}) (Note 2) | -0.5V to +6.0V | Switch Input Voltage (V_{IN}) | 0V to V_{CC} |
| Input Diode Current | -50 mA | Operating Temperature (T_A) | -40°C to +85°C |
| Switch Current | 200 mA | Thermal Resistance (θ_{JA}) in still air | |
| Peak Switch Current (Pulsed at 1 ms duration, <10% Duty Cycle) | 400 mA | 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 | 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. | |
| Maximum Junction Temperature (T_J) | +150°C | Note 2: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed. | |
| Lead Temperature (T_L) | | Note 3: Unused inputs must be held HIGH or LOW. They may not float. | |
| Soldering, 10 seconds | +260°C | | |
| ESD | | | |
| Human Body Model | 5.5kV | | |

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 | | |
| 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 | μA | $V_{IN} = 0V \text{ to } V_{CC}$ |
| | | 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 | | Ω | $I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 1.5V$ |
| | | 4.5 | 0.95 | 1.18 | 1.3 | | | $I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 3.5V$ |
| ΔR_{ON} | On Resistance Matching Between Channels (Note 5) | 4.5 | 0.06 | 0.12 | 0.15 | | Ω | $I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 3.5V$ |
| $R_{FLAT(ON)}$ | On Resistance Flatness (Note 6) | 2.7 | 1.4 | | | | Ω | $I_{OUT} = 100 \text{ mA}, 1B \text{ or } 2B = 0V, 0.75V, 1.5V$ |
| | | 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 | | μA | $V_{IN} = 0V \text{ or } V_{CC}, I_{OUT} = 0V$ |
| | | 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.

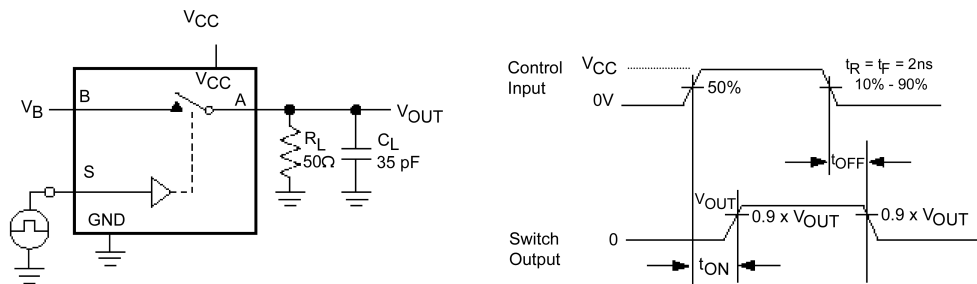
AC Electrical Characteristics (All typical value are @ 25°C unless otherwise specified)

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions | Figure Number |
|------------------|---------------------------|------------------------|------------------------|------|-----|---------------------------------|-----|--|------------|---------------|
| | | | Min | Typ | Max | Min | Max | | | |
| t _{ON} | Turn ON Time | 2.7 to 3.6 | 15.0 | 50.0 | | 60.0 | ns | 1B or 2B = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 1 | |
| | | 4.5 to 5.5 | 10.0 | 35.0 | | 40.0 | | 1B or 2B = 3.0V, R _L = 50Ω, C _L = 35 pF | | |
| t _{OFF} | Turn OFF Time | 2.7 to 3.6 | 4.0 | 20.0 | | 30.0 | ns | 1B or 2B = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 1 | |
| | | 4.5 to 5.5 | 8.0 | 15.0 | | 20.0 | | 1B or 2B = 3.0V, R _L = 50Ω, C _L = 35 pF | | |
| t _{B-M} | Break-Before-Make Time | 2.7 to 3.6 | 12.0 | | | | ns | 1B or 2B = 1.5V, R _L = 50Ω, C _L = 35 pF | Figure 2 | |
| | | 4.5 to 5.5 | 7.0 | | | | | 1B or 2B = 3.0V, R _L = 50Ω, C _L = 35 pF | | |
| Q | Charge Injection | 2.7 to 3.6 | 10.0 | | | | pC | C _L = 1.0 nF, V _{GEN} = 0V, R _{GEN} = 0Ω | Figure 4 | |
| | | 4.5 to 5.5 | 20.0 | | | | | | | |
| OIRR | OFF-Isolation | 2.7 to 3.6 | -70.0 | | | | dB | f = 1MHz, R _L = 50Ω | Figure 3 | |
| | | 4.5 to 5.5 | -70.0 | | | | | | | |
| Xtalk | Crosstalk | 2.7 to 3.6 | -100 | | | | dB | f = 1MHz, R _L = 50Ω | Figure 6 | |
| | | 4.5 to 5.5 | -100 | | | | | | | |
| BW | -3db Bandwidth | 2.7 to 3.6 | 300 | | | | MHz | R _L = 50Ω | Figure 7 | |
| | | 4.5 to 5.5 | 300 | | | | | | | |
| THD | Total Harmonic Distortion | 2.7 to 3.6 | 0.002 | | | | % | R _L = 600Ω, V _{IN} = 0.5V P.P, f = 20Hz to 20kHz | Figure 8 | |
| | | 4.5 to 5.5 | 0.002 | | | | | | | |

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 | | 3.0 | | | | pF | f = 1MHz (see Figure 6) |
| C _{OFF} | B Port OFF Capacitance | 4.5 | | 11.5 | | | | pF | f = 1MHz (see Figure 6) |
| C _{ON} | 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

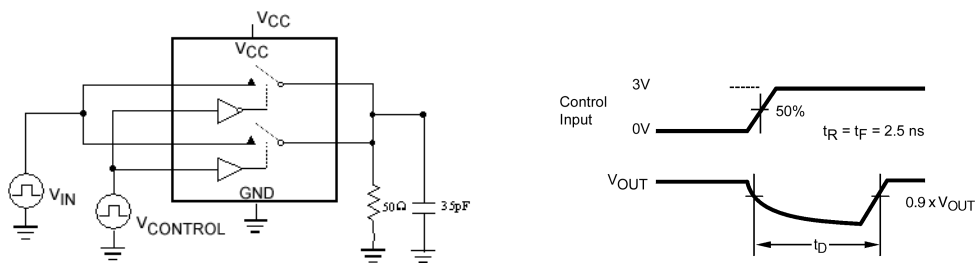


FIGURE 2. Break-Before-Make Timing

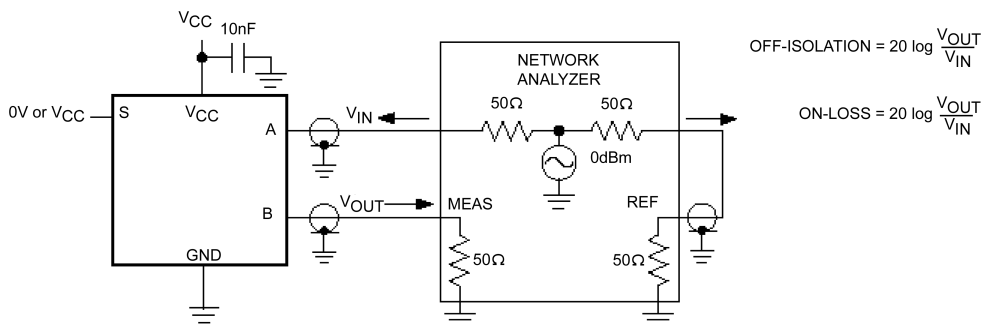


FIGURE 3. OFF Isolation

AC Loading and Waveforms (Continued)

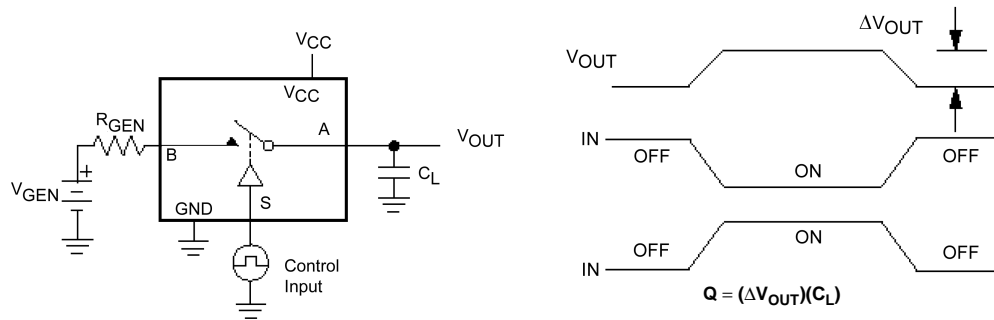


FIGURE 4. Charge Injection

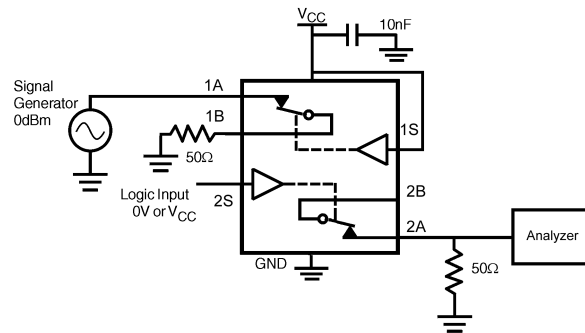


FIGURE 5. Crosstalk

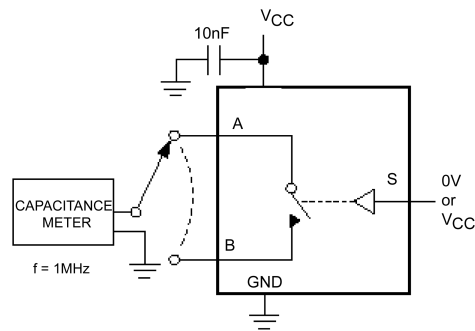


FIGURE 6. ON/OFF Capacitance Measurement Setup

AC Loading and Waveforms (Continued)

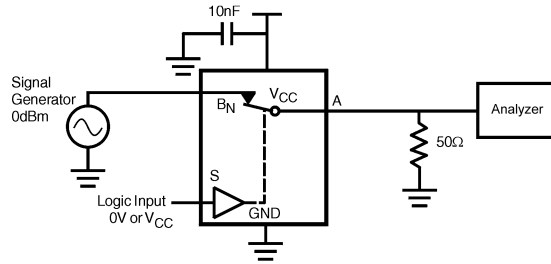


FIGURE 7. Bandwidth

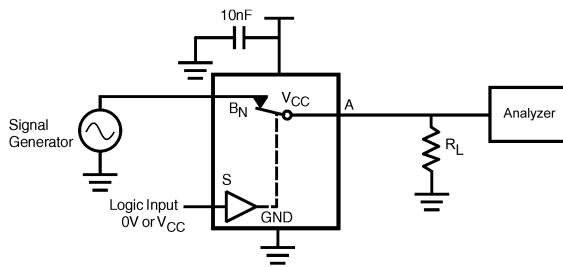
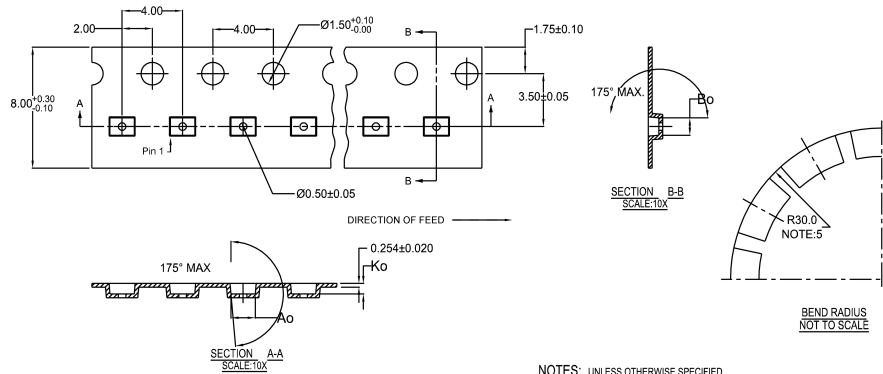


FIGURE 8. Harmonic Distortion

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 |

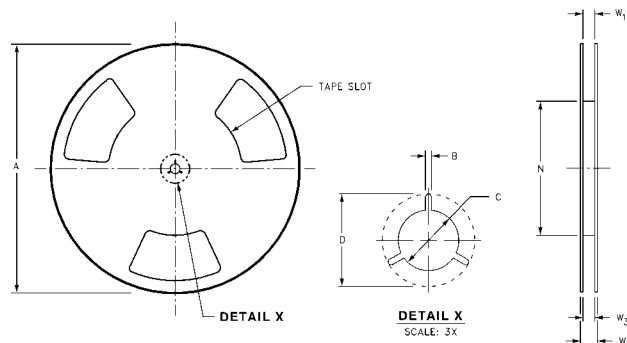
NOTES: UNLESS OTHERWISE SPECIFIED

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



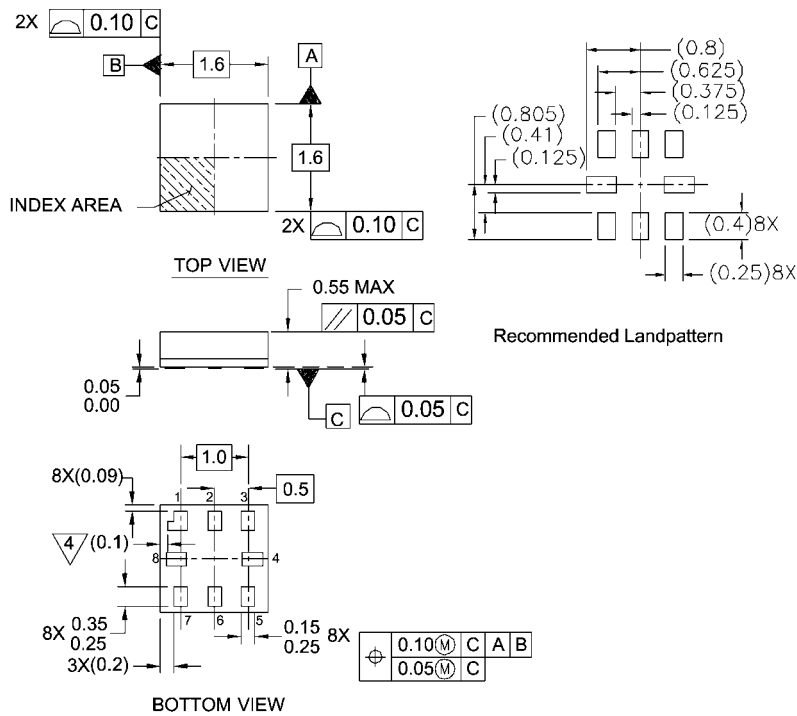
SCALE: 6X

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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