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FSA1259A

Low-Voltage, 1 Ω Dual SPST Analog Switch with Power-Off Isolation

Features

- Power-Off Isolation ($V_{CC}=0$ V)
- 1 Ω On Resistance (R_{ON}) for 4.5 V V_{CC}
- 0.25 Ω Maximum R_{ON} Flatness for 4.5 V V_{CC}
- Space-Saving, US8 Surface Mount Package
- Broad V_{CC} Operating Range: 1.65 V to 5.50 V
- Fast Turn-On and Turn-Off Times
- Break-Before-Make Enable Circuitry

Description

The FSA1259A is a high-performance, dual, Single-Pole / Single-Throw (SPST) analog switch. The device features ultra-low R_{ON} of 1 Ω at 4.5 V V_{CC} and operates over the wide V_{CC} range of 1.65 V to 5.50 V.

The FSA1259A allows for reduced input thresholds on the select pins.

The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation.

Applications

- Cellular Phone
- Portable Media Player
- PDA

Ordering Information

| Part Number | Top Mark | Operating Temperature Range | Package | Packing Method |
|-------------|----------|-----------------------------|---|--------------------------|
| FSA1259AK8X | 59A | -40°C to +85°C | 8-Lead US8, JEDEC MO-187, Variation CA, 3.0 mm Wide | 3000 Units Tape and Reel |

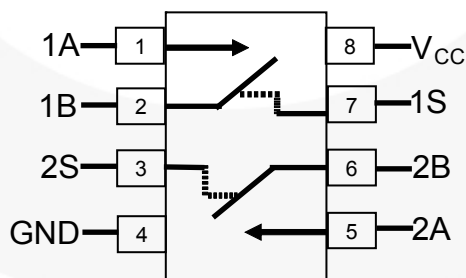


Figure 1. Analog Symbols

Pin Assignments

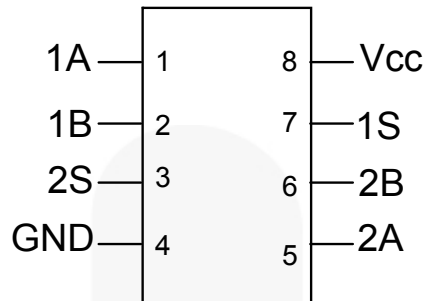


Figure 2. Pin Assignments (Top View)

Pin Definitions

| Pin # | Name | Description |
|-------|-----------------|----------------|
| 1 | 1A | Data Port |
| 2 | 1B | Data Port |
| 3 | 2S | Control Input |
| 4 | GND | Ground |
| 5 | 2A | Data Port |
| 6 | 2B | Data Port |
| 7 | 1S | Control Input |
| 8 | V _{CC} | Supply Voltage |

Truth Table

| Control Input (S) | Function |
|-------------------|------------------|
| LOW | Disconnected |
| HIGH | A Connected to B |

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Min. | Max. | Unit |
|--------------|--|------|----------------|---------|
| V_{CC} | Supply Voltage | -0.5 | 7.0 | V |
| V_{SW} | Switch Voltage ⁽¹⁾ | -0.5 | $V_{CC} + 0.5$ | V |
| V_{IN} | Input Voltage ⁽¹⁾ | -0.5 | 6.5 | V |
| I_{IK} | Input Diode Current | | -50 | mA |
| I_{SW} | Switch Current (Continuous) | | 200 | mA |
| I_{SWPEAK} | Peak Switch Current (Pulsed at 1 ms Duration, <10% Duty Cycle) | | 400 | mA |
| P_D | Power Dissipation at 85°C | | 3.0 | μ W |
| T_{STG} | Storage Temperature Range | -65 | +150 | °C |
| T_J | Maximum Junction Temperature | | +150 | °C |
| T_L | Lead Temperature (Soldering, 10 seconds) | | +260 | °C |
| ESD | Human Body Model (JEDEC: JESD22-A114) | | 8000 | V |
| | Charged Device Model (JEDEC: JESD22-C101) | | 2000 | V |
| | Machine Model (JEDEC: JESD22-A115) | | 350 | V |

Note:

1. The input and output negative ratings may be exceeded if the input and output diode current ratings are observed.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol | Parameter | Min. | Max. | Unit |
|---------------|--------------------------------------|------|----------|------|
| V_{CC} | Supply Voltage | 1.65 | 5.50 | V |
| A_{SEL} | Control Input Voltage ⁽²⁾ | 0 | V_{CC} | V |
| V_{SW} | Switch Input Voltage | 0 | V_{CC} | V |
| T_A | Operating Temperature | -40 | +85 | °C |
| θ_{JA} | Thermal Resistance, Still Air | | 215 | °C/W |

Note:

2. Control Input must be held HIGH or LOW; it must not float.

Electrical Characteristics

All typical values are at 25°C unless otherwise specified.

| Symbol | Parameter | V _{CC} (V) | Conditions | T _A =+25°C | | | T _A =–40 to +85°C | | Unit |
|----------------------|--|---------------------|---------------------------------------|-----------------------|------|------|------------------------------|------|---------|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| V _{IH} | Input Voltage High | 4.50 to 5.50 | | | | | 1.0 | | V |
| | | 3.00 to 3.60 | | | | | 1.0 | | |
| | | 2.30 to 2.70 | | | | | 0.95 | | |
| | | 1.65 to 1.95 | | | | | 0.95 | | |
| V _{IL} | Input Voltage Low | 4.50 to 5.50 | | | | | | 0.75 | V |
| | | 3.00 to 3.60 | | | | | | 0.65 | |
| | | 2.30 to 2.70 | | | | | | 0.55 | |
| | | 1.65 to 1.95 | | | | | | 0.5 | |
| I _{IN} | Control Input Leakage | 5.50 | V _{IN} =0 or V _{CC} | -10 | | 10 | -50 | 50 | nA |
| | | 3.60 | V _{IN} =0 or V _{CC} | -2 | | 2 | -20 | 20 | |
| | | 2.70 | V _{IN} =0 or V _{CC} | -2 | | 2 | -20 | 20 | |
| | | 1.95 | V _{IN} =0 or V _{CC} | -2 | | 2 | -20 | 20 | |
| I _{NO(OFF)} | Off-Leakage Current | 5.50 | A=1 V, B=4.5V or B=4.5 V, A= 1V | -10 | | 10 | -50 | 50 | nA |
| | | 3.60 | A=1 V, B=3.0 V or B=3.0 V, A=1 V | -5 | | 5 | -50 | 50 | |
| | | 2.70 | A=0.5 V, B=2.3 V or B=2.3, A=0.5 V | -5 | | 5 | -50 | 50 | |
| | | 1.95 | A=0.3 V, B=1.65 V or B=1.65, A=0.3 V | -5 | | 5 | -50 | 50 | |
| I _{NO(ON)} | On-Leakage Current of Port B | 5.50 | A=Floating; B=4.5 V, 1 V | -5 | | 5 | -50 | 50 | nA |
| | | 3.60 | A=Floating; B=3.0 V, 1 V | -2 | | 2 | -20 | 20 | |
| | | 2.70 | A=Floating; B=2.3 V, 0.5 V | -2 | | 2 | -20 | 20 | |
| | | 1.95 | A=Floating; B=1.65 V, 0.3 V | -2 | | 2 | -20 | 20 | |
| I _{A(ON)} | On-Leakage Current of Port A | 5.50 | A=1 V, 4.5 V; B=Floating | -5 | | 5 | -50 | 50 | nA |
| | | 3.60 | A=1 V, 3.0 V; B=Floating | -2 | | 2 | -20 | 20 | |
| | | 2.70 | A=0.5 V, 2.3; B=Floating | -2 | | 2 | -20 | 20 | |
| | | 1.95 | A=0.3 V, 1.65 V; B=Floating | -2 | | 2 | -20 | 20 | |
| I _{OFF} | Power Off Leakage Current of Port A & Port B | 0 | A=0 to 5.5 V; B=0 to 5.5 V | -1 | | 1 | -10 | 10 | μ A |

Electrical Characteristics (Continued)

All typical values are at 25°C unless otherwise specified.

| Symbol | Parameter | V_{CC} (V) | Conditions | $T_A=+25^\circ\text{C}$ | | | $T_A=-40$ to $+85^\circ\text{C}$ | | Unit |
|-----------------|--|--------------|---|----------------------------|------|------|----------------------------------|------|---------------|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| R_{PEAK} | Peak On Resistance | 4.50 | $I_{OUT}=-100$ mA, 1B or 2B=0 to V_{CC} | | 0.8 | 1.0 | | 1.2 | Ω |
| | | 3.00 | $I_{OUT}=-100$ mA, 1B or 2B=0 to V_{CC} | | 1.0 | 1.5 | | 1.8 | |
| | | 2.30 | $I_{OUT}=-8$ mA, 1B or 2B=0 to V_{CC} | | 1.5 | 2.0 | | 2.5 | |
| | | 1.65 | $I_{OUT}=-2$ mA, 1B or 2B=0 to V_{CC} | $T_A=25, 85^\circ\text{C}$ | 5.0 | 12.0 | | 15.0 | |
| | | | | $T_A=-40^\circ\text{C}$ | 20.0 | | | | |
| R_{ON} | Switch On Resistance ⁽³⁾ | 4.50 | $I_{OUT}=-100$ mA, 1B or 2B=2.5 V | | 0.70 | 0.85 | | 1.00 | Ω |
| | | 3.00 | $I_{OUT}=-100$ mA, 1B or 2B=2.0 V | | 0.9 | 1.3 | | 1.6 | |
| | | 2.30 | $I_{OUT}=-8$ mA, 1B or 2B=1.8V | | 1.4 | 2.0 | | 2.4 | |
| | | 1.65 | $I_{OUT}=-2$ mA, 1B or 2B=1.5 V | | 2.0 | 2.5 | | 3.5 | |
| ΔR_{ON} | On Resistance Matching Between Channels ⁽⁴⁾ | 4.50 | $I_{OUT}=-100$ mA, 1B or 2B=2.5 V | | 0.05 | 0.10 | | 0.10 | Ω |
| | | 3.00 | $I_{OUT}=-100$ mA, 1B or 2B=2.0 V | | 0.10 | 0.15 | | 0.15 | |
| | | 2.30 | $I_{OUT}=-8$ mA, 1B or 2B=1.8 V | | 0.15 | 0.20 | | 0.20 | |
| | | 1.65 | $I_{OUT}=-2$ mA, 1B or 2B=1.5 V | | 0.15 | 0.40 | | 0.40 | |
| $R_{FLAT(ON)}$ | On Resistance Flatness ⁽⁵⁾ | 4.50 | $I_{OUT}=-100$ mA, 1B or 2B=1.0 V, 1.5 V, 2.5 V | | 0.10 | 0.25 | | 0.25 | Ω |
| | | 3.00 | $I_{OUT}=-100$ mA, 1B or 2B=0.8 V, 2.0 V | | 0.1 | 0.3 | | 0.3 | |
| | | 2.30 | $I_{OUT}=-8$ mA, 1B or 2B=0.8 V, 1.8 V | | 0.2 | 1.0 | | 1.0 | |
| | | 1.65 | $I_{OUT}=-2$ mA, 1B or 2B=0.6 V, 1.5 V | | 1.5 | | | | |
| I_{CC} | Quiescent Supply Current | 5.50 | $V_{IN}=0$ or V_{CC} , $I_{OUT}=0$ | | 5 | 50 | | 500 | nA |
| | | 3.60 | $V_{IN}=0$ or V_{CC} , $I_{OUT}=0$ | | 1 | 25 | | 300 | |
| | | 2.70 | $V_{IN}=0$ or V_{CC} , $I_{OUT}=0$ | | 1 | 20 | | 250 | |
| | | 1.95 | $V_{IN}=0$ or V_{CC} , $I_{OUT}=0$ | | 1 | 15 | | 150 | |
| I_{CCT} | Increase in I_{CC} per Control Input | 4.5 to 5.5 | $A_{SEL}=1.8$ V | | 25 | | | 40 | μA |

Notes:

- On resistance is determined by the voltage drop between the A and B pins at the indicated current through the switch.
- $\Delta R_{ON}=R_{ON}$ maximum – R_{ON} minimum; measured at identical V_{CC} , temperature, and voltage.
- 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 values are at $V_{CC}=1.8\text{ V}$, 2.5 V , 3.0 V , 5.0 V at 25°C unless otherwise specified.

| Symbol | Parameter | V_{CC} (V) | Conditions | $T_A=+25^\circ\text{C}$ | | | $T_A=-40\text{ to }+85^\circ\text{C}$ | | Unit | Figure |
|-----------|---------------------------|--------------|--|-------------------------|------|------|---------------------------------------|------|------|-----------|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| t_{ON} | Turn-On Time | 4.50 to 5.50 | 1B or 2B= V_{CC} , $R_L=50\ \Omega$, $C_L=35\text{ pF}$ | 1.0 | 4.0 | 7.5 | 1.0 | 9.0 | ns | Figure 11 |
| | | 3.00 to 3.60 | | 1.5 | 6.0 | 9.5 | 1.0 | 10.0 | | |
| | | 2.30 to 2.70 | | 2.0 | 8.0 | 10.0 | 1.0 | 12.0 | | |
| | | 1.65 to 1.95 | | 3.0 | 14.0 | 18.0 | 1.0 | 20.0 | | |
| t_{OFF} | Turn-Off Time | 4.50 to 5.50 | 1B or 2B= V_{CC} , $R_L=50\ \Omega$, $C_L=35\text{ pF}$ | 4.5 | 13.0 | 17.0 | 3.5 | 20.0 | ns | Figure 11 |
| | | 3.00 to 3.60 | | 4.5 | 13.5 | 17.0 | 3.0 | 20.0 | | |
| | | 2.30 to 2.70 | | 4.5 | 16.0 | 20.0 | 3.0 | 23.0 | | |
| | | 1.65 to 1.95 | | 5.0 | 24.0 | 33.0 | 4.0 | 36.0 | | |
| Q | Charge Injection | 4.50 to 5.50 | $C_L=1.0\text{ nF}$, $V_{GEN}=0\text{ V}$, $R_{GEN}=0\ \Omega$ | | 15 | | | | pC | Figure 13 |
| | | 3.00 to 3.60 | | | 11 | | | | | |
| | | 2.30 to 2.70 | | | 8 | | | | | |
| | | 1.65 to 1.95 | | | 6 | | | | | |
| OIRR | Off-Isolation | 1.8 to 5.0 | $f=1\text{ MHz}$, $R_L=50\ \Omega$ | | -60 | | | | dB | Figure 12 |
| Xtalk | Crosstalk | 1.8 to 5.0 | $f=1\text{ MHz}$, $R_L=50\ \Omega$ | | -73 | | | | dB | Figure 12 |
| BW | -3 db Bandwidth | 4.50 to 5.50 | $R_L=50\ \Omega$ | | 240 | | | | MHz | Figure 15 |
| | | 3.00 to 3.60 | | | 240 | | | | | |
| | | 2.30 to 2.70 | | | 240 | | | | | |
| | | 1.65 to 1.95 | | | 240 | | | | | |
| THD | Total Harmonic Distortion | 1.8 | $R_L=600\ \Omega$, $V_{IN}=0.5\text{ V}_{PP}$, $f=20\text{ Hz to }20\text{ kHz}$ | | .003 | | | | % | Figure 16 |
| | | 5.0 | | | .001 | | | | | Figure 16 |

Capacitance

| Symbol | Parameter | V_{CC} (V) | Conditions | $T_A=+25^\circ\text{C}$ | | | Unit |
|-----------|-------------------------------|--------------|-------------------------------|-------------------------|------|------|------|
| | | | | Min. | Typ. | Max. | |
| C_{IN} | Control Pin Input Capacitance | 0 | $f=1\text{ MHz}$ Figure 14 | | 3 | | pF |
| C_{OFF} | B Port Off Capacitance | 1.65 to 5.50 | $f=1\text{ MHz}$ Figure 14 | | 21 | | pF |
| C_{ON} | A Port On Capacitance | 1.65 to 5.50 | $f=1\text{ MHz}$ Figure 14 | | 47 | | pF |

Typical Performance Characteristics

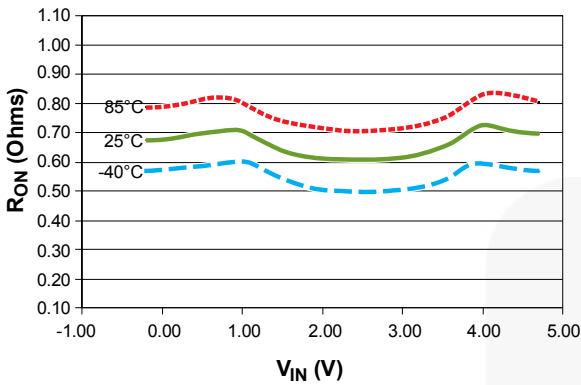


Figure 3. On Resistance ($V_{CC}=4.5$ V)

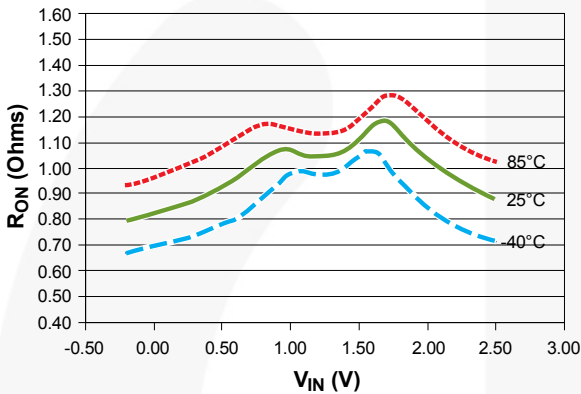


Figure 5. On Resistance ($V_{CC}=2.3$ V)

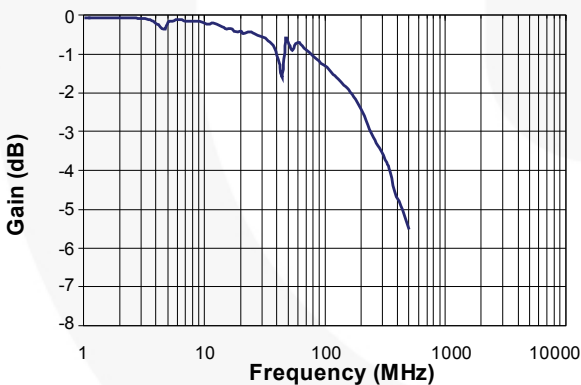


Figure 7. Frequency Response ($V_{CC}=5.5$ V, $C_L=0$ pF)

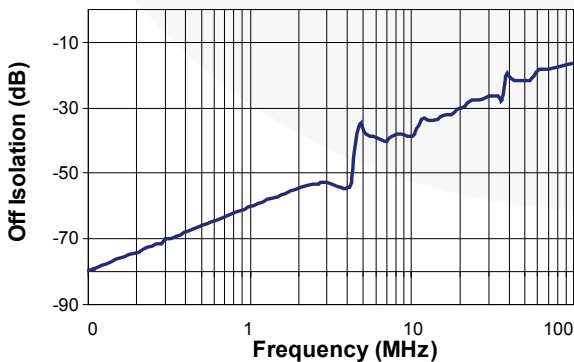


Figure 9. Frequency Response ($V_{CC}=5.0$ V, $C_L=0$ pF)

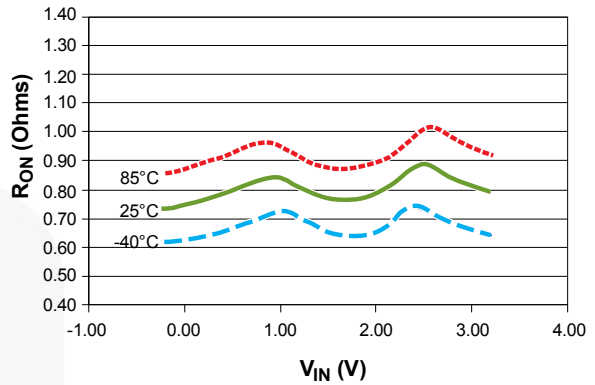


Figure 4. On Resistance ($V_{CC}=3.0$ V)

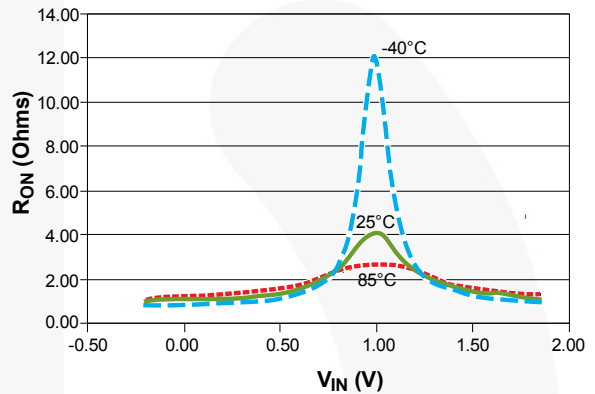


Figure 6. On Resistance ($V_{CC}=1.65$ V)

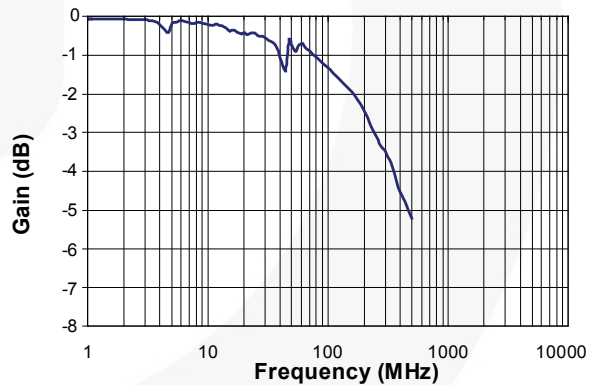


Figure 8. Frequency Response ($V_{CC}=3.3$ V, $C_L=0$ pF)

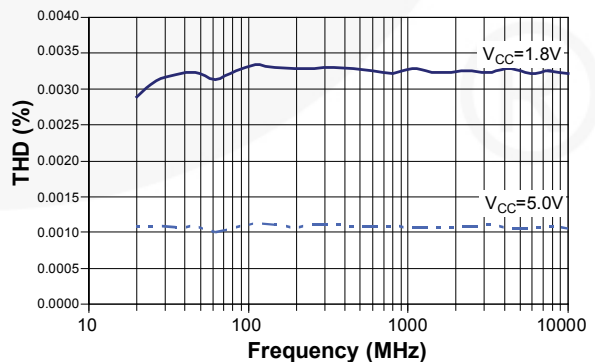


Figure 10. Total Harmonic Distortion

Test Diagrams

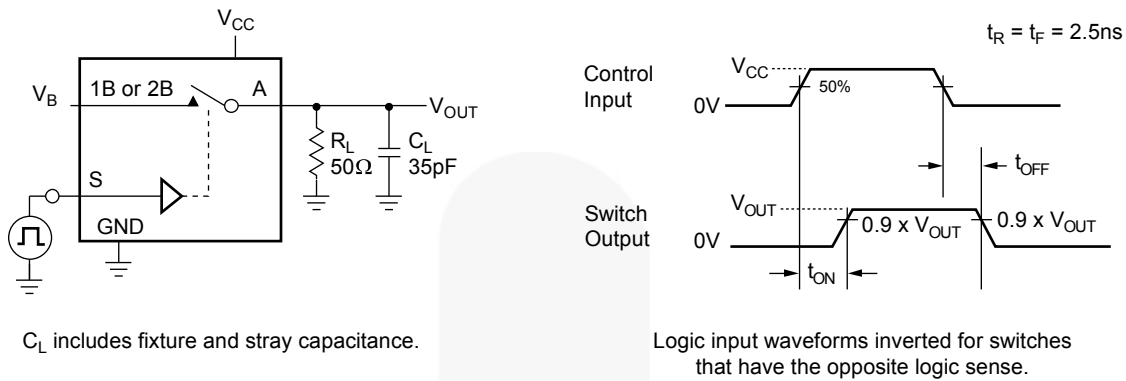


Figure 11. Turn On / Off Timing

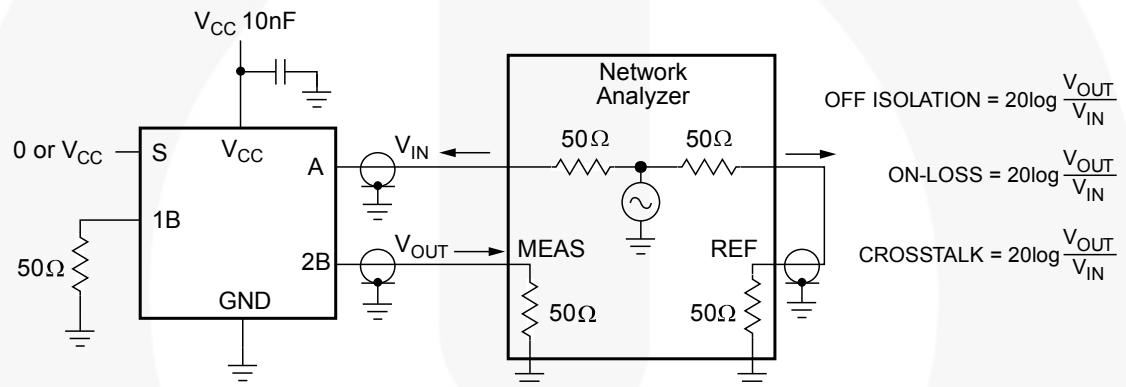


Figure 12. Off Isolation and Crosstalk

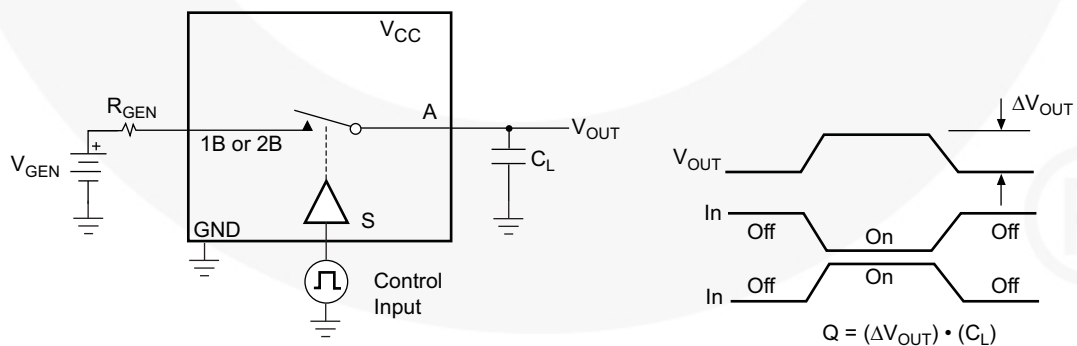


Figure 13. Charge Injection

Test Diagrams (Continued)

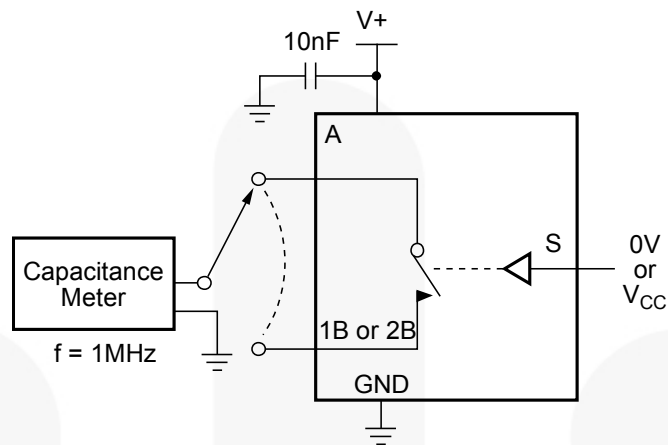


Figure 14. On / Off Capacitance Measurement Setup

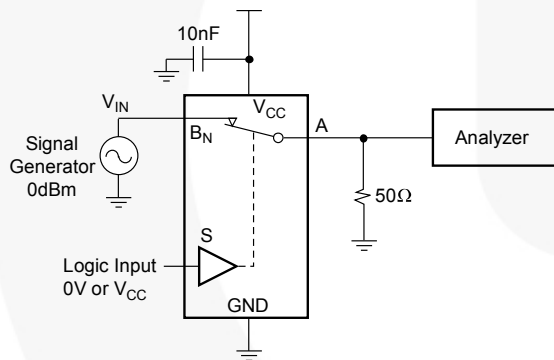


Figure 15. Bandwidth

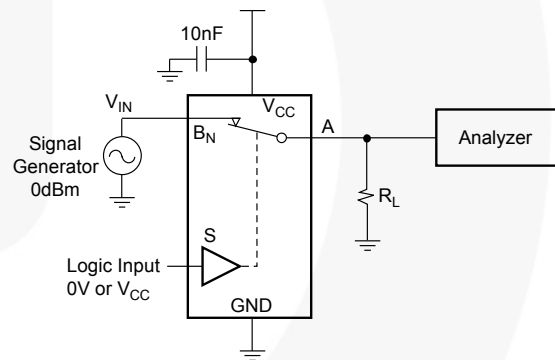


Figure 16. Harmonic Distortion

Physical Dimensions

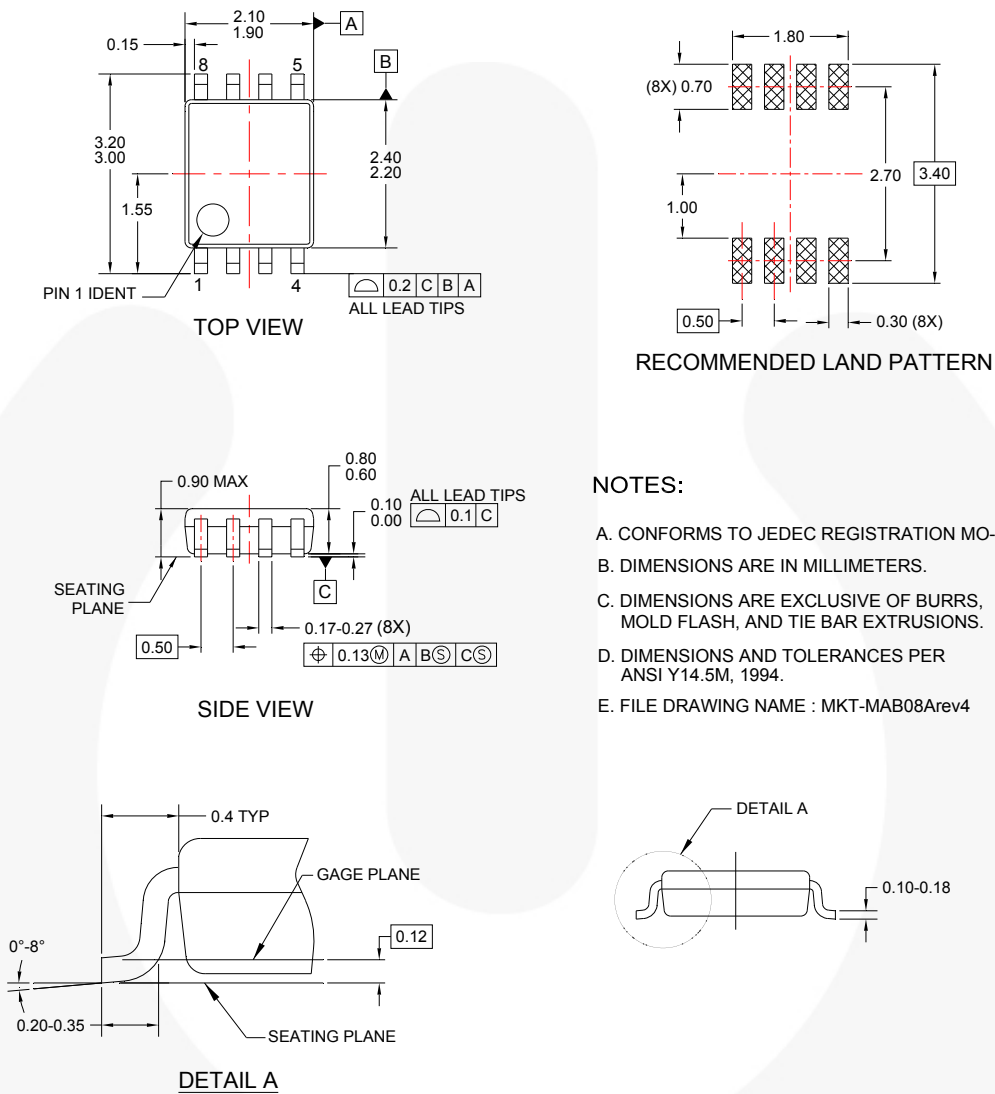


Figure 17. 8-Lead US8, JEDEC MO-187, Variation CA, 3.0 mm Wide Package

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