

FSA1256(A) / FSA1257(A) / FSA1258(A)

Low- R_{ON} Low-Voltage, Dual SPST Analog Switch with Low- I_{CCT} “A” Option

Features

- FSA1256A, FSA1257A, FSA1258A Feature Low I_{CCT} when S Input is Lower than V_{CC}
- Maximum 1.1 Ω On Resistance (R_{ON}) for 4.5 V Supply
- 0.4 Ω Max. R_{ON} Flatness for 4.5 V Supply
- Space-Saving Pb-Free MicroPak™ Packaging
- Broad V_{CC} Operating Range:
 - FSA1256, FSA1257, FSA1258: 1.65 V to 5.5 V
 - FSA1256A, FSA1257A, FSA1258A: 2.7 V to 5.5 V
- Fast Turn-On and Turn-Off Times
- FSA1258, FSA1258A Feature Break-Before-Make Enable Circuitry
- Over-Voltage Tolerant TTL-Compatible Control Input

Applications

- Cell Phone, PDA, Digital Camera, and Notebook
- LCD Monitor, TV, and Set-Top Box

Description

The FSA1256, FSA1256A, FSA1257, FSA1257A, FSA1258, and FSA1258A are high performance dual Single-Pole / Single-Throw (SPST) analog switches. All devices feature ultra-low R_{ON} of 1.1 Ω maximum at 4.5 V V_{CC} . The FSA1256, FSA1257, and FSA1258 operate over a wide V_{CC} range of 1.65 V to 5.5 V. The FSA1256A, FSA1257A, and FSA1258A operation range is 2.7 V to 5.5 V. 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 and FSA1256A feature two Normally Open (NO) switches. The FSA1257 and FSA1257A feature two Normally Closed (NC) switches. The FSA1258 and FSA1258A have one NO switch and one NC switch.

IMPORTANT NOTE:

For additional performance information, please contact analogswitch@fairchildsemi.com.

Ordering Information

| Part Number | Top Mark | Package Description | Packing Method |
|-------------|----------|--------------------------------|--------------------------|
| FSA1256L8X | EB | 8-Lead, MicroPak™, 1.6 mm Wide | 5000 Units Tape and Reel |
| FSA1256AL8X | FN | 8-Lead, MicroPak, 1.6 mm Wide | 5000 Units Tape and Reel |
| FSA1257L8X | EC | 8-Lead, MicroPak, 1.6 mm Wide | 5000 Units Tape and Reel |
| FSA1257AL8X | FP | 8-Lead, MicroPak, 1.6 mm Wide | 5000 Units Tape and Reel |
| FSA1258L8X | ED | 8-Lead, MicroPak, 1.6 mm Wide | 5000 Units Tape and Reel |
| FSA1258AL8X | FS | 8-Lead, MicroPak, 1.6 mm Wide | 5000 Units Tape and Reel |

MicroPak™ is a trademark of Fairchild Semiconductor Corporation.

Analog Symbols

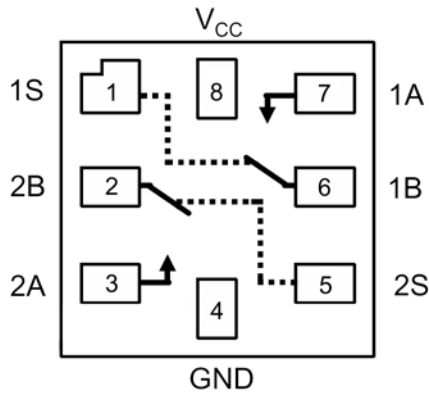


Figure 1. FSA1256, FSA1256A

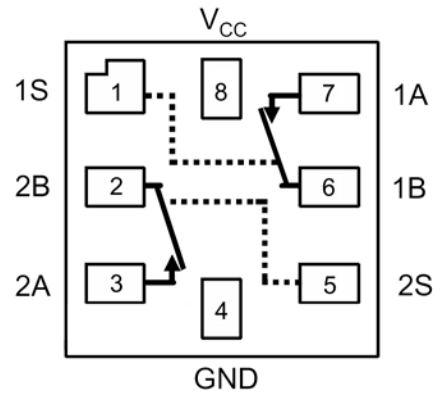


Figure 2. FSA1257, FSA1257A

Truth Tables

| Control Input (s) | Function |
|-------------------|------------------|
| LOW Logic Level | Disconnect |
| HIGH Logic Level | A Connected to B |

| Control Input (s) | Function |
|-------------------|------------------|
| LOW Logic Level | A Connected to B |
| HIGH Logic Level | Disconnected |

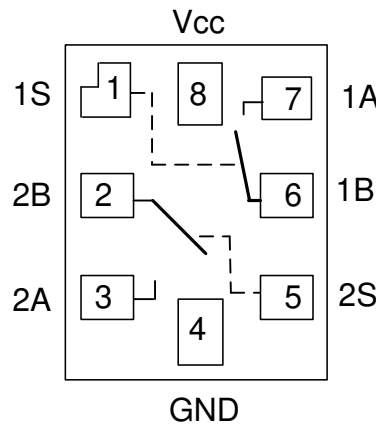


Figure 3. FSA1258, FSA1258A

Truth Table

| Control Input, 1S | Function | Control Input 2S | Function |
|-------------------|--------------------|------------------|--------------------|
| LOW Logic Level | 1A Connected to 1B | LOW Logic Level | Disconnect |
| HIGH Logic Level | Disconnect | HIGH Logic Level | 2A Connected to 2B |

Pin Descriptions

| Name | Description |
|------------------------------------|-------------------|
| A, B ₀ , B ₁ | Data Ports |
| S | Switch Select Pin |

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. | Units |
|---------------------|---|------------------------------|-----------------------|-------|
| V _{CC} | Supply Voltage | -0.5 | 6.0 | V |
| V _S | Switch Voltage ⁽¹⁾ | -0.5 | V _{CC} + 0.5 | V |
| V _{in} | Input Voltage ⁽¹⁾ | -0.5 | 6.0 | V |
| | Power Dissipation at 85°C, MicroPak 8-Lead Package | | 180 | mW |
| I _{IK} | Input Diode Current | | -50 | mA |
| I _{SW} | Switch Current | | 200 | mA |
| I _{SWPEAK} | Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle) | | 400 | mA |
| 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) | FSA1256, FSA1257, FSA1258 | 5.5 | kV |
| | | FSA1256A, FSA1257A, FSA1258A | 4.5 | |

Note:

1. Input and output negative ratings may be exceeded if 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. | Units | |
|-----------------|--|------------------------------|-----------------|-------|---|
| V _{CC} | Supply Voltage | FSA1256, FSA1257, FSA1258 | 1.65 | 5.50 | V |
| | | FSA1256A, FSA1257A, FSA1258A | 2.70 | 5.50 | |
| V _{IN} | Control Input Voltage ⁽²⁾ | 0 | V _{CC} | V | |
| V _{IN} | Switch Input Voltage | 0 | V _{CC} | V | |
| Θ _{JA} | Thermal Resistance in Still Air, MicroPak 8L Package (Modeled) | | 224 | °C/W | |
| T _A | Operating Temperature | -40 | +85 | °C | |

Note:

2. Unused inputs must be held HIGH or LOW. They must not float.

DC Electrical Characteristics

All typical values are at 25°C unless otherwise specified. The 1.65 V to 1.95 V range applies to FSA1256, FSA1257, and FSA1258 only.

| Symbol | Parameter | Conditions | V _{CC} (V) | T _A =+25°C | | | T _A =-40 to +85°C | | Unit |
|---|--|--|---------------------|-----------------------|------|------|------------------------------|------|------|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| V _{IH} | Input Voltage High ⁽³⁾ | | 4.5 to 5.5 | | | | 2.4 | | V |
| | | | 2.7 to 3.6 | | | | 2.0 | | |
| | | | 1.65 to 1.95 | | | | 0.9 | | |
| V _{IL} | Input Voltage Low ⁽³⁾ | FSA1256A, FSA1257A, FSA1258A Only | 4.5 to 5.5 | | | | | 0.8 | V |
| | | | 2.7 to 3.6 | | | | | 0.4 | |
| | | | 2.7 to 3.6 | | | | | 0.6 | |
| | | FSA1256, FSA1257, FSA1258 Only | 1.65 to 1.95 | | | | | 0.4 | |
| I _{IN} | Control Input Leakage (S) | V _{IN} =0 to V _{CC} | 1.95 to 5.5 | | | | -1 | 1 | μA |
| I _{NO(OFF)} , I _{NC(OFF)} | Off Leakage Current | A=1 V, 4.5 V 1B or 2B=1 V, 4.5 V | 5.5 | | ±2 | | -20 | 20 | nA |
| R _{ON} | Switch On Resistance ^(3,4) | I _{OUT} =100 mA, 1B or 2B=3.5 V | 4.5 | | 0.95 | 1.15 | | 1.30 | Ω |
| | | I _{OUT} =100 mA, 1B or 2B=1.5 V | 2.7 | | 2.6 | 4.0 | | 4.3 | |
| | | I _{OUT} =100 mA, 1B or 2B=1.2 V | 1.65 | | 8.0 | 9.5 | | 10.5 | |
| ΔR _{ON} | On Resistance Matching Between Channels ^(3,5) | I _{OUT} =100 mA, 1B or 2B=3.5 V | 4.5 | | 0.06 | 0.12 | | 0.15 | Ω |
| R _{FLAT(ON)} | On Resistance Flatness ^(3,6) | I _{OUT} =100 mA, 1B or 2B=0 V, 1.0 V, 2.0 V | 4.5 | | 0.2 | 0.3 | | 0.4 | Ω |
| | | I _{OUT} =100 mA, 1B or 2B=0 V, 0.75 V, 1.5 V | 2.7 | | 1.4 | | | | |
| | | I _{OUT} =100 mA, 1B or 2B=0 V, 1.0 V, 1.2 V | 1.65 | | 1.8 | | | | |
| I _{CC} | Quiescent Supply Current | V _{IN} =0 V or V _{CC} , I _{OUT} =0 V | 5.5 | | 0.1 | 0.5 | | 1.0 | μA |
| | | | 3.6 | | 0.1 | 0.5 | | 1.0 | |
| I _{CC} T | Increase in I _{CC} per Input | One Input at 2.6 V, Others at V _{CC} or GND (FSA1256A, FSA1257A, FSA1258A Only) | 4.3 | | 0.2 | | | 10.0 | μA |

Notes:

- Guaranteed, but not tested for V_{CC}=1.65 V.
- On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
- Δ R_{ON}=R_{ON max} – R_{ON min} measured at identical V_{CC}, temperature, and voltage.
- Flatness is defined as the difference between the maximum and minimum value of on resistance (R_{ON}) over the specified range of conditions.

AC Electrical Characteristics

All typical values are at 25°C unless otherwise specified. The 1.65 V to 1.95 V range applies to FSA1256, FSA1257, and FSA1258 only.

| Symbol | Parameter | Conditions | V _{CC} (V) | T _A =+25°C | | | T _A =-40 to +85°C | | Unit | Figure |
|------------------|--|--|---------------------|-----------------------|-------|------|------------------------------|------|------|-----------|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| t _{ON} | Turn-On Time ⁽⁷⁾ | 1B or 2B=3.0 V, R _L =50 Ω, C _L =35 pF | 4.5 to 5.5 | | 10 | 35 | | 40 | ns | Figure 8 |
| | | 1B or 2B=1.5 V, R _L =50 Ω, C _L =35 pF | 2.7 to 3.6 | | 15 | 50 | | 60 | | |
| | | 1B or 2B=1.0 V R _L =50 Ω, C _L =35 pF | 1.65 to 1.95 | | 35 | 110 | | 120 | | |
| t _{OFF} | Turn-Off Time ⁽⁷⁾ | 1B or 2B=3.0 V, R _L =50 Ω, C _L =35 pF | 4.5 to 5.5 | | 4 | 15 | | 20 | ns | Figure 8 |
| | | 1B or 2B=1.5 V, R _L =50 Ω, C _L =35 pF | 2.7 to 3.6 | | 8 | 20 | | 30 | | |
| | | 1B or 2B=1.0 V R _L =50 Ω, C _L =35 pF | 1.65 to 1.95 | | 10 | 30 | | 40 | | |
| t _{BBM} | Break-Before-Make Time ⁽⁷⁾ | 1B or 2B=3.0 V, R _L =50 Ω, C _L =35 pF | 4.5 to 5.5 | | 7 | | | | ns | Figure 9 |
| | | 1B or 2B=1.5 V, R _L =50 Ω, C _L =35 pF | 2.7 to 3.6 | | 12 | | | | | |
| Q | Charge Injection ⁽⁷⁾ | C _L =1.0 nF, V _{GEN} =0 V, R _{GEN} =0 Ω | 4.5 to 5.5 | | 20 | | | | pC | Figure 13 |
| | | | 2.7 to 3.6 | | 10 | | | | | |
| | | | 1.65 to 1.95 | | 5 | | | | | |
| OIRR | Off Isolation ⁽⁷⁾ | f=1 MHz, R _L =50 Ω, | 1.65 to 5.50 | | -70 | | | | dB | Figure 11 |
| Xtalk | Crosstalk ⁽⁷⁾ | f=1 MHz, R _L =50 Ω, | 1.65 to 4.30 | | -100 | | | | dB | Figure 12 |
| BW | -3db Bandwidth ⁽⁷⁾ | R _L =50 Ω | 1.65 to 4.30 | | 300 | | | | MHz | Figure 10 |
| THD | Total Harmonic Distortion ⁽⁷⁾ | f=20 Hz to 20 kHz, R _L =600 Ω, V _{IN} =0.5 V _{PP} | 1.65 to 4.30 | | 0.002 | | | | % | Figure 16 |

Notes:

7. Guaranteed, but not tested for V_{CC}=1.65 V.

Capacitance

| Symbol | Parameter | Conditions | V _{CC} (V) | T _A =+25°C | | | Unit | Figure |
|------------------|-------------------------------|------------|---------------------|-----------------------|------|------|------|-----------|
| | | | | Min. | Typ. | Max. | | |
| C _{IN} | Control Pin Input Capacitance | f=1 MHz | 0 | | 3.0 | | pF | Figure 15 |
| C _{OFF} | B Port Off Capacitance | f=1 MHz | 4.5 | | 11.5 | | pF | Figure 14 |
| C _{ON} | A Port On Capacitance | f=1 MHz | 4.5 | | 27.0 | | pF | Figure 15 |

Test Diagrams

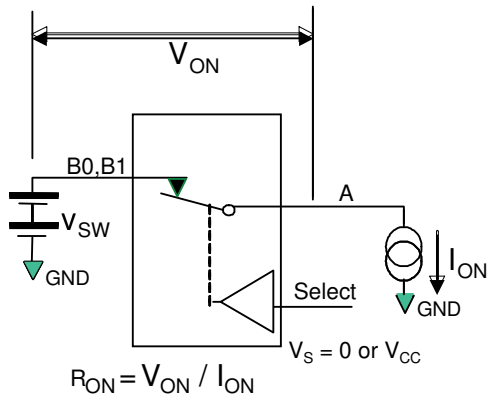


Figure 4. On Resistance

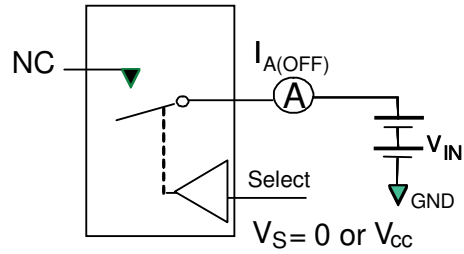


Figure 5. Off Leakage (Ports Tested Separately)

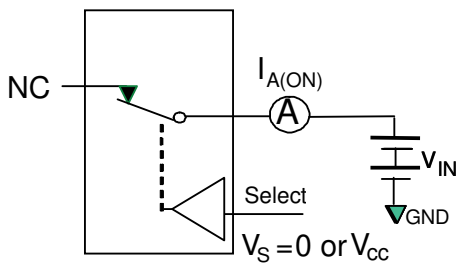


Figure 6. On Leakage

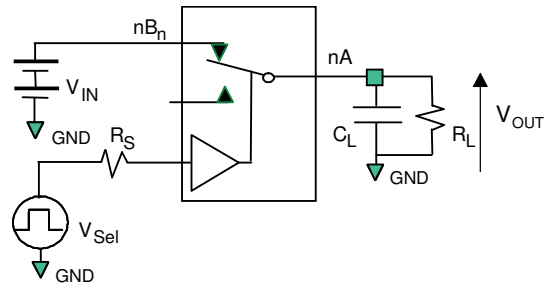


Figure 7. Test Circuit Load

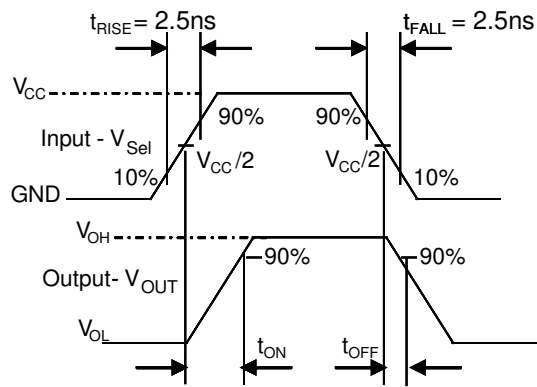


Figure 8. Turn-On / Turn-Off Waveforms

Test Diagrams (Continued)

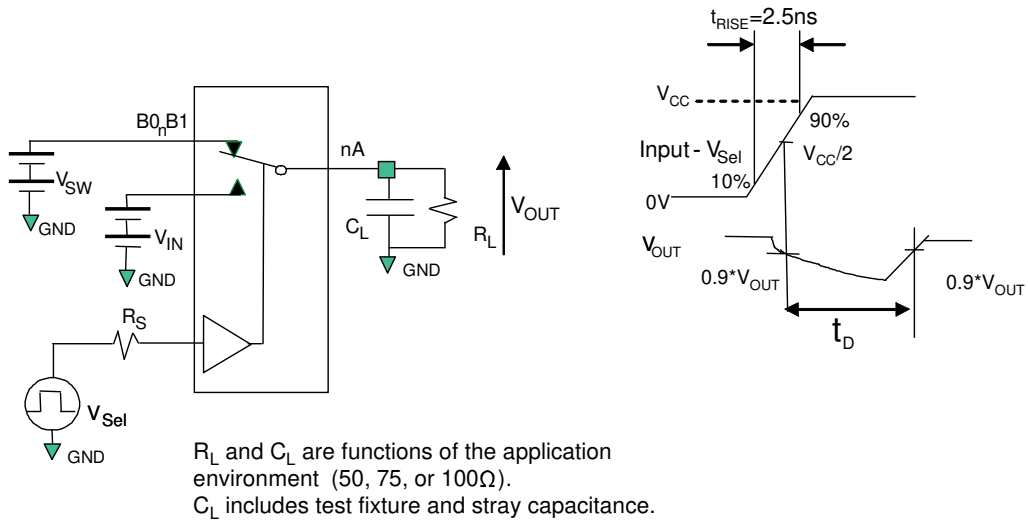


Figure 9. Break-Before-Make Interval Timing

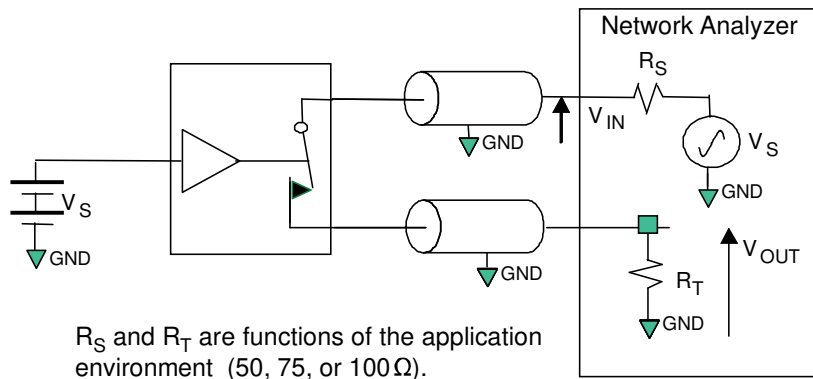


Figure 10. Bandwidth

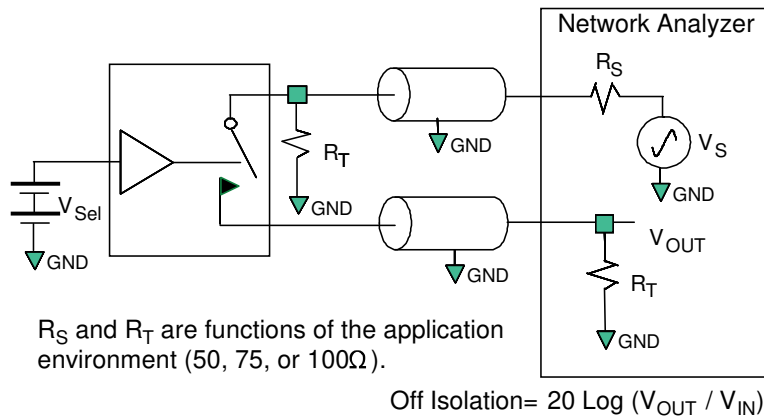


Figure 11. Channel Off Isolation

Test Diagrams (Continued)

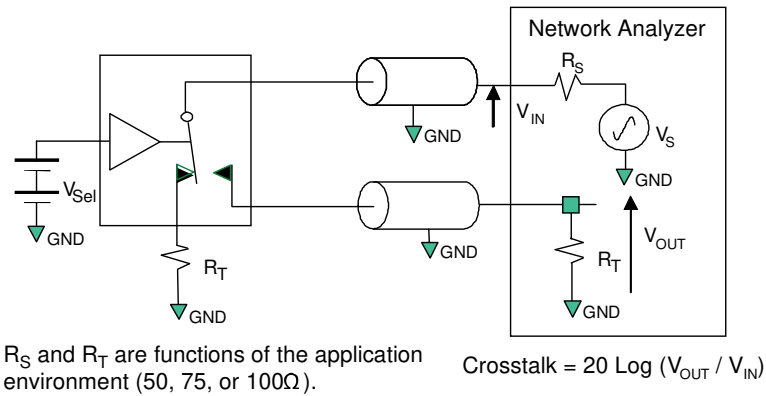


Figure 12. Adjacent Channel Crosstalk

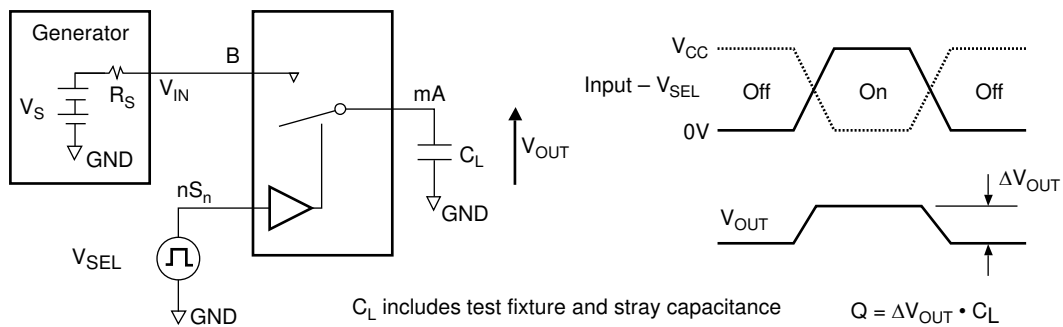


Figure 13. Charge Injection Test

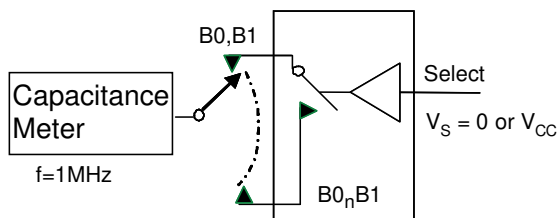


Figure 14. Channel Off Capacitance

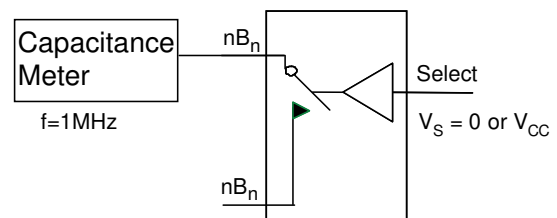


Figure 15. Channel On Capacitance

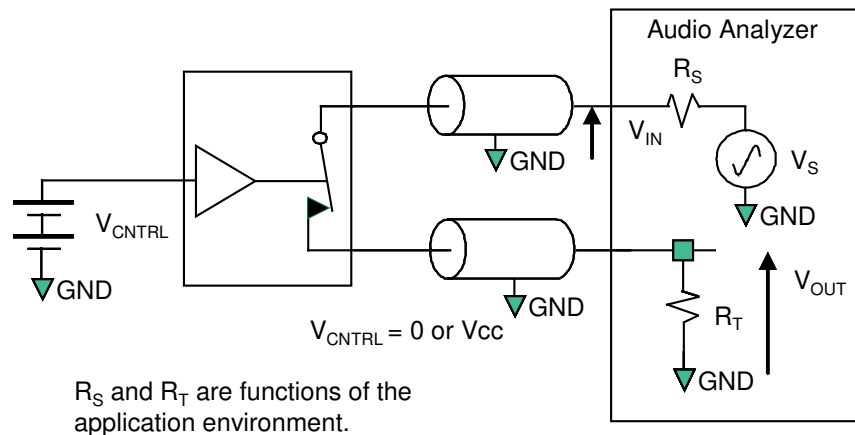
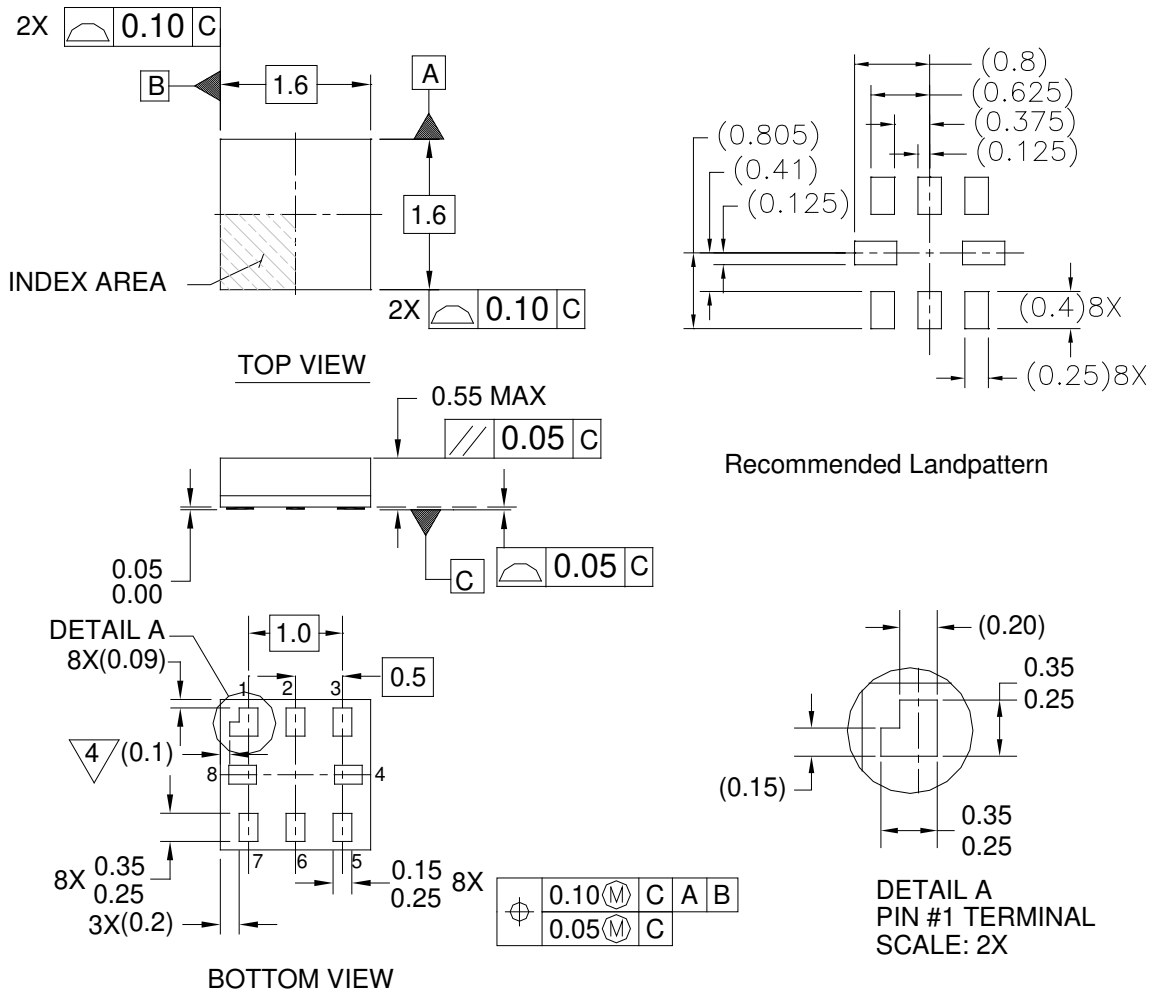


Figure 16. Total Harmonic Distortion

Physical Dimensions



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
5. DRAWING FILE NAME: MKT-MAC08AREV4

MAC08AREV4

Figure 17. 8-Lead MicroPak™, 1.6 mm Wide

For tape and reel specifications for MicroPak, please visit:
http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf

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