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FSA2259 Low-Voltage, Dual-SPDT (0.8Ω) Analog Switch with 16kV ESD

Features

- 0.8Ω Typical On Resistance (R_{ON}) for +3.0V Supply
- 0.40Ω Maximum R_{ON} Flatness for +3.0V Supply
- -3db Bandwidth: > 50MHz
- Low I_{CCT} Current Over an Expanded Control Input Range
- Packaged in 10-Lead UMLP (1.4 x 1.8mm)
- Power-Off Protection on Common Ports
- Broad V_{CC} Operating Range: 1.65 to 4.4V
- ESD HBM JEDEC: JESD22-A114
 - I/O to GND: 8.5kV
 - Power to GND: 16.0kV

Applications

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

Description

The FSA2259 is a high-performance, dual, Single Pole Double Throw (SPDT) analog switch that features low R_{ON} of 0.8Ω (typical) at 3.0V V_{CC} . The FSA2259 operates over a wide V_{CC} range of 1.65V to 4.4V and is designed for break-before-make operation. The select input is TTL-level compatible.

The FSA2259 features very low quiescent current even when the control voltage is lower than the V_{CC} supply. This feature suits mobile handset applications by allowing direct interface with baseband processor general-purpose I/Os with minimal battery consumption.

Related Resources

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

Ordering Information

| Part Number | Top Mark | Operating Temperature Range | Package |
|-------------|----------|-----------------------------|--|
| FSA2259UMX | JT | -40 to +85°C | 10-Lead, Quad, Ultrathin Molded Leadless Package (UMLP), 1.4 x 1.8mm |

Analog Symbol

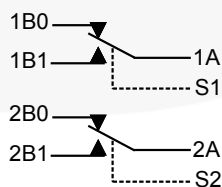


Figure 1. FSA2259

Pin Configuration

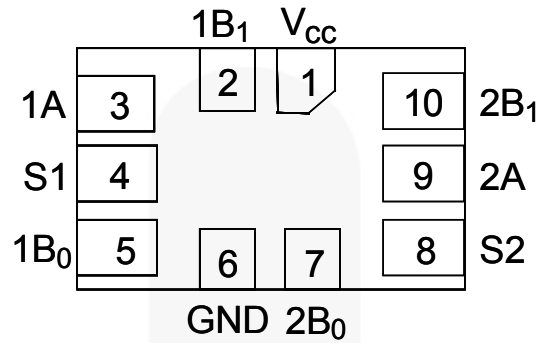


Figure 2. 10-Pin UMLP (Top Through View)

Pin Description

| Pin# | Name | Description |
|------|-----------------|--------------------|
| 1 | V _{CC} | Supply Voltage |
| 2 | 1B ₁ | Data Ports |
| 3 | 1A | Data Ports |
| 4 | S1 | Switch Select Pins |
| 5 | 1B ₀ | Data Ports |
| 6 | GND | Ground |
| 7 | 2B ₀ | Data Ports |
| 8 | S2 | Switch Select Pins |
| 9 | 2A | Data Ports |
| 10 | 2B ₁ | Data Ports |

Truth Table

| Control Input, S _n | Function |
|-------------------------------|---------------------------------|
| LOW Logic Level | nB ₀ Connected to nA |
| HIGH Logic Level | nB ₁ Connected to nA |

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 | 5.5 | V |
| V_{SW} | Switch I/O Voltage ⁽¹⁾ | 1B0, 1B1, 2B0, 2B1, 1A, 2A Pins | -0.5 | $V_{CC} + 0.3$ | V |
| V_{IN} | Control Input Voltage ⁽¹⁾ | S1, S2 | -0.5 | 5.5 | V |
| I_{IK} | Input Clamp Diode Current | | | -50 | mA |
| I_{SW} | Switch I/O Current (Continuous) | | | 350 | mA |
| I_{SWPEAK} | Peak Switch Current (Pulsed at 1ms Duration, <10% Duty Cycle) | | | 500 | 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 | I/O to GND | | 8.5 | kV |
| | | Power to GND | | 16.0 | |
| | | All Other Pins | | 8.0 | |
| | Charged Device Model, JEDEC: JESD22-C101 | | | 2.0 | kV |

Note:

- 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 | 1.65 | 4.40 | V |
| V_{IN} | Control Input Voltage | 0 | V_{CC} | V |
| V_{SW} | Switch I/O Voltage | 0 | V_{CC} | V |
| T_A | Operating Temperature | -40 | +85 | °C |

DC Electrical Characteristics

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

| Symbol | Parameter | Conditions | V _{CC} (V) | T _A =+25°C | | | T _A =-40 to +85°C | | Unit |
|--|--|--|---------------------|-----------------------|------|------|------------------------------|------|------|
| | | | | Min. | Typ. | Max. | Min. | Max. | |
| V _{IH} | Control Input Voltage High | | 3.60 to 4.30 | | | | 1.7 | | V |
| | | | 2.70 to 3.60 | | | | 1.5 | | |
| | | | 2.30 to 2.70 | | | | 1.4 | | |
| | | | 1.65 to 1.95 | | | | 0.9 | | |
| V _{IL} | Control Input Voltage Low | | 3.60 to 4.30 | | | | | 0.7 | V |
| | | | 2.70 to 3.60 | | | | | 0.5 | |
| | | | 2.30 to 2.70 | | | | | 0.4 | |
| | | | 1.65 to 1.95 | | | | | 0.4 | |
| I _{IN} | Control Input Leakage (S1,S2) | V _{IN} =0 to V _{CC} | 1.65 to 4.30 | | | | -0.5 | 0.5 | μA |
| I _{NO(OFF)} , I _{NC(OFF)} | Off Leakage Current of Port nB0 and nB1 | nA=0.3V, V _{CC} =0.3V nB0 or nB1=V _{CC} -0.3V, 0.3V, or Floating Figure 4 | 1.95 to 4.30 | -10 | | 10 | -50 | 50 | nA |
| I _{A(ON)} | On Leakage Current of Port nA | nA=0.3V, V _{CC} =0.3V nB0 or nB1=V _{CC} -0.3V, 0.3V, or Floating Figure 5 | 1.95 to 4.30 | -20 | | 20 | -100 | 100 | nA |
| I _{OFF} | Power-Off Leakage Current (Common Port Only 1A, 2A) | Common Port (1A, 2A), V _{IN} =0V to 4.3V, V _{CC} =0V nB0, nB1=Floating | 0V | | | | | ±1 | μA |
| R _{ON} | Switch On Resistance ^(2,5) | I _{ON} =100mA, nB0 or nB1=0.7V, 3.6V Figure 3 | 4.30 | | 0.50 | | | 1.00 | Ω |
| | | I _{ON} =100mA, nB0 or nB1=0.7V, 2.3V Figure 3 | 3.00 | | 0.80 | | | 1.20 | |
| | | I _{ON} =100mA, nB0 or nB1=0V, 0.7V, 1.6V, 2.3V Figure 3 | 2.30 | | 1.10 | | | | |
| | | I _{ON} =100mA, nB0 or nB1=0V, 0.7V, 1.65V Figure 3 | 1.65 | | 1.50 | | | | |
| ΔR _{ON} | On Resistance Matching Between Channels ^(3,5) | I _{ON} =100mA, nB0 or nB1=0.7V | 4.30 | | 0.08 | | | 0.25 | Ω |
| | | | 3.00 | | 0.20 | | | 0.25 | |
| | | | 2.30 | | 0.40 | | | | |
| | | | 1.65 | | 0.50 | | | | |
| R _{FLAT(ON)} | On Resistance Flatness ^(4,5) | I _{OUT} =100mA, nB0 or nB1=0V to V _{CC} | 4.30 | | | | | 0.4 | Ω |
| | | | 3.00 | | | | | 0.4 | |
| | | | 2.30 | | 0.9 | | | | |
| | | | 1.65 | | 1.2 | | | | |
| I _{CC} | Quiescent Supply Current | V _{IN} =0 or V _{CC} , I _{OUT} =0 | 4.30 | -100 | | 100 | -500 | 500 | nA |
| I _{CCT} | Increase in I _{CC} per Input | Input at 2.6V | 4.30 | | 3 | | | 7 | μA |
| | | Input at 1.8V | | | 7 | | | 15 | |

Notes:

- On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
- ΔR_{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.
- Guaranteed by characterization, not production tested for V_{CC}=1.65 – 3.0V.

AC Electrical Characteristics

All typical value are for $V_{CC}=3.3V$ at $25^{\circ}C$ unless otherwise specified.

| Symbol | Parameter | Conditions | V_{CC} (V) | $T_A=+25^{\circ}C$ | | | $T_A=-40$ to $+85^{\circ}C$ | | Unit | Figure |
|-----------|--|---|--------------|--------------------|------|------|-----------------------------|------|------|----------------------|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| t_{ON} | Turn-On Time | nB0 or nB1=1.5V, $R_L=50\Omega$, $C_L=35pF$ | 3.60 to 4.30 | | | 55 | | 60 | ns | Figure 6 Figure 7 |
| | | | 2.70 to 3.60 | | | 60 | | 65 | | |
| | | | 2.30 to 2.70 | | | 65 | | 70 | | |
| | | | 1.65 to 1.95 | | 70 | | | | | |
| t_{OFF} | Turn-Off Time | nB0 or nB1=1.5V, $R_L=50\Omega$, $C_L=35pF$ | 3.60 to 4.30 | | | 30 | 5 | 35 | ns | Figure 8 |
| | | | 2.70 to 3.60 | | | 35 | 5 | 40 | | |
| | | | 2.30 to 2.70 | | | 40 | 5 | 45 | | |
| | | | 1.65 to 1.95 | | 40 | | | | | |
| t_{BBM} | Break-Before-Make Time ⁽⁶⁾ | nB0 or nB1=1.5V, $R_L=50\Omega$, $C_L=35pF$ | 3.60 to 4.30 | | 15 | | 2 | | ns | Figure 8 |
| | | | 2.70 to 3.60 | | 15 | | 2 | | | |
| | | | 2.30 to 2.70 | | 15 | | 2 | | | |
| | | | 1.65 to 1.95 | | 16 | | 2 | | | |
| Q | Charge Injection ⁽⁶⁾ | $C_L=1.0nF$, $V_S=0V$, $R_S=0\Omega$ | 1.65 to 4.30 | | 25 | | | | pC | Figure 12 |
| OIRR | Off Isolation ⁽⁶⁾ | $f=100kHz$, $R_L=50\Omega$, $C_L=0pF$ | 1.65 to 4.30 | | -80 | | | | dB | Figure 10 |
| Xtalk | Crosstalk ⁽⁶⁾ | $f=100kHz$, $R_L=50\Omega$, $C_L=0pF$ | 1.65 to 4.30 | | -100 | | | | dB | Figure 11 |
| BW | -3db Bandwidth ⁽⁶⁾ | $R_L=50\Omega$, $C_L=0pF$ | 1.65 to 4.30 | | >50 | | | | MHz | Figure 9 |
| THD+N | Total Harmonic Distortion + Noise ⁽⁶⁾ | $f=20Hz$ to $20kHz$, $R_L=32\Omega$, $V_{IN}=2V_{pp}$ | 1.65 to 4.30 | | .06 | | | | % | Figure 15 |

Notes:

6. Guaranteed by characterization, not production tested

Capacitance

All capacitance specifications are guaranteed by characterization and are not production tested.

| Symbol | Parameter | Conditions | V_{CC} (V) | $T_A=+25^{\circ}C$ | | | Unit | Figure |
|-----------|-------------------------------|------------|--------------|--------------------|------|------|------|-----------|
| | | | | Min. | Typ. | Max. | | |
| C_{IN} | Control Pin Input Capacitance | $f=1MHz$ | 0 | | 1.5 | | pF | Figure 13 |
| C_{OFF} | B Port Off Capacitance | $f=1MHz$ | 3.3 | | 30 | | pF | Figure 13 |
| C_{ON} | A Port On Capacitance | $f=1MHz$ | 3.3 | | 50 | | pF | Figure 14 |

Test Diagrams

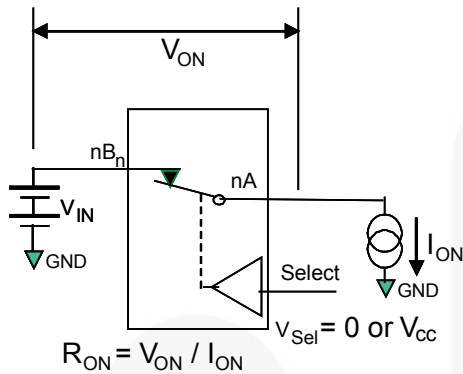
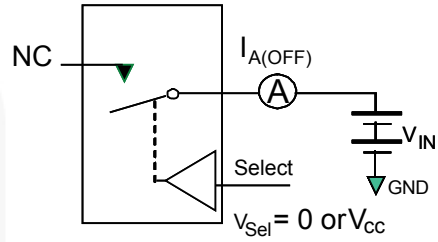


Figure 3. On Resistance



**Each switch port is tested separately.

Figure 4. Off Leakage (Ports Tested Separately)

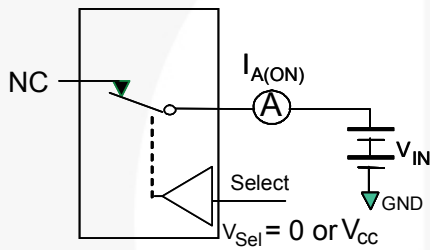


Figure 5. On Leakage

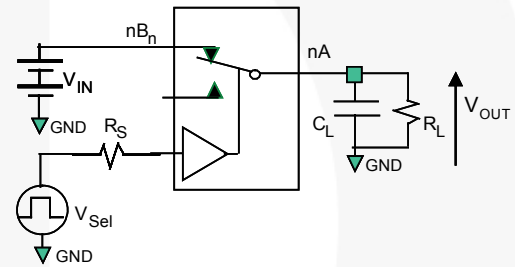


Figure 6. Test Circuit Load

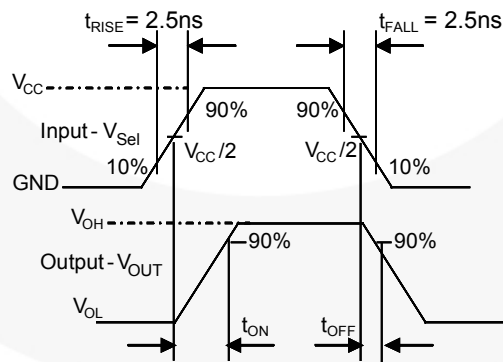


Figure 7. Turn-On / Turn-Off Waveforms

Test Diagrams (Continued)

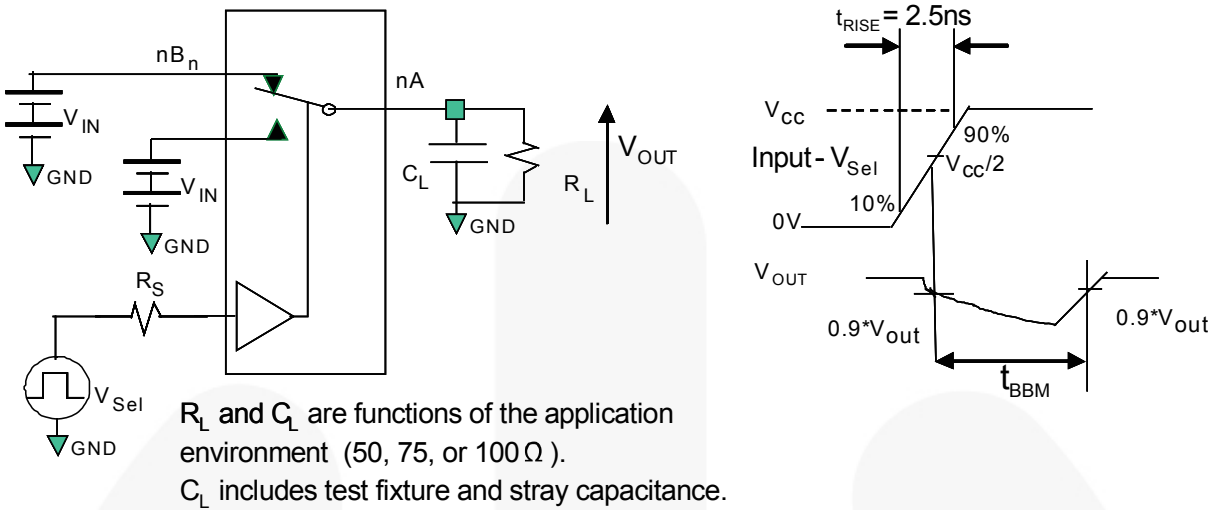


Figure 8. Break-Before-Make Interval Timing

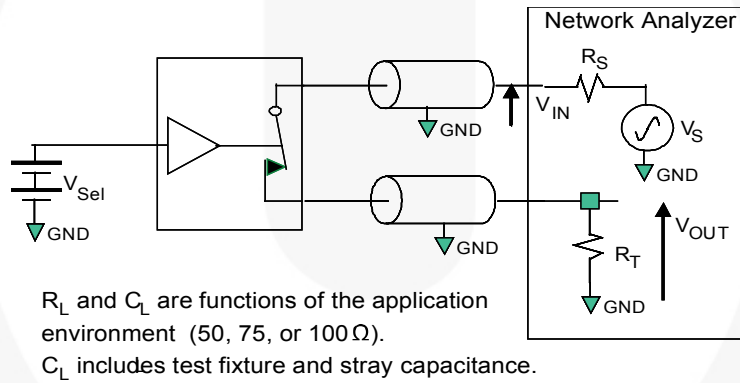


Figure 9. Bandwidth

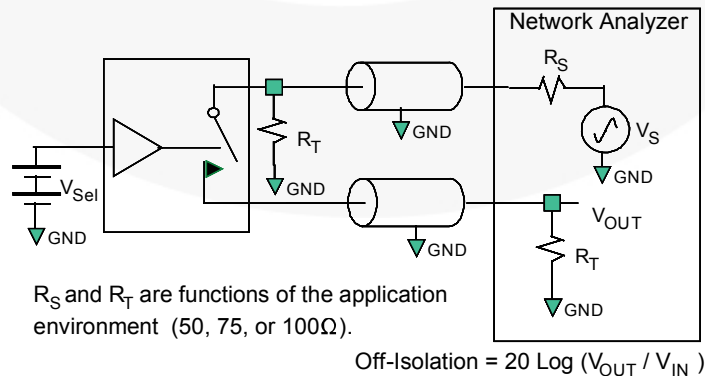


Figure 10. Channel Off Isolation

Test Diagrams (Continued)

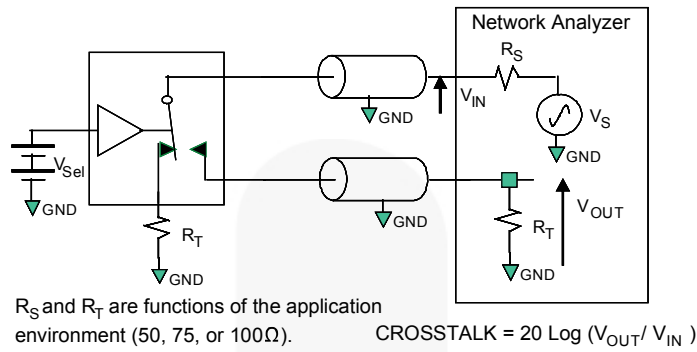


Figure 11. Adjacent Channel Crosstalk

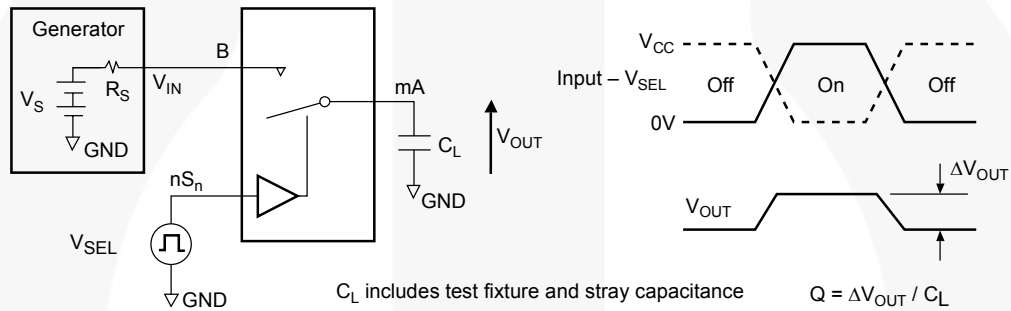


Figure 12. Charge Injection Test

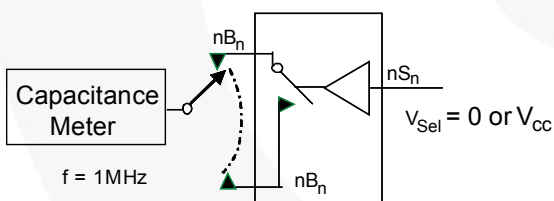


Figure 13. Channel Off Capacitance

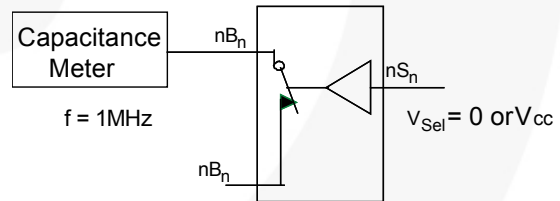


Figure 14. Channel On Capacitance

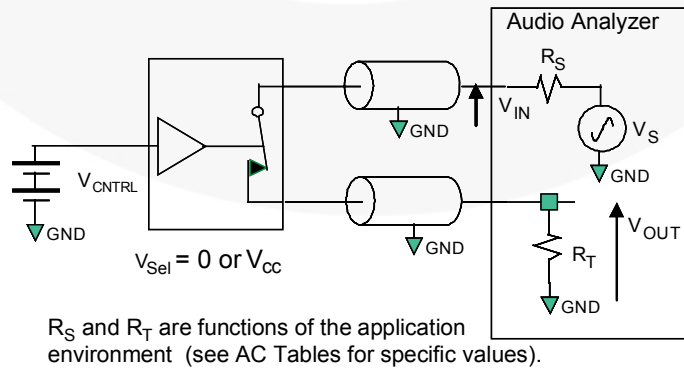
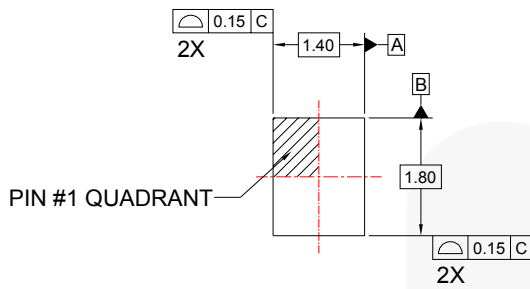
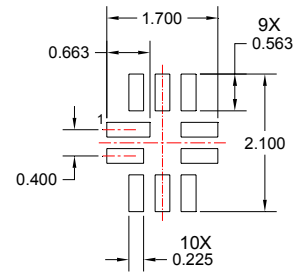


Figure 15. Total Harmonic Distortion

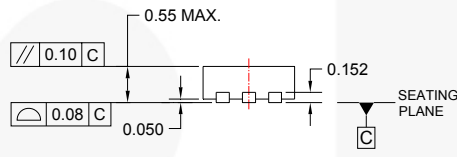
Physical Dimensions



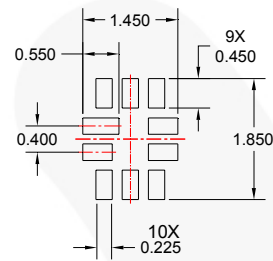
TOP VIEW



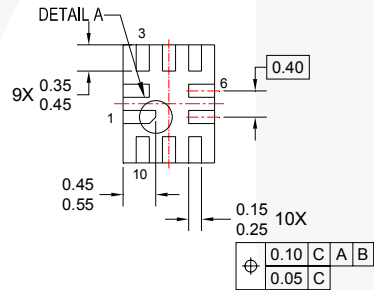
RECOMMENDED LAND PATTERN



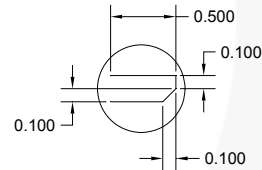
SIDE VIEW



OPTIONAL MINIMAL TOE LAND PATTERN



BOTTOM VIEW



DETAIL A
PIN #1 TERMINAL
SCALE: 2X

NOTES:

- A. DIMENSIONS ARE IN MILLIMETERS.
- B. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- C. DRAWING FILENAME: UMLP10Arev2

Figure 16. 10-Lead Quad Ultrathin Molded Leadless Package (UMLP)

Click here for tape and reel specifications, available at:
http://www.fairchildsemi.com/products/analog/pdf/UMLP10_TNR.pdf



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| FACT® | OptoHiT™ | SuperSOT™-8 | UniFET™ |
| FAST® | OPTOLOGIC® | SupreMOS® | VCX™ |
| FastvCore™ | OPTOPLANAR® | SyncFET™ | VisualMax™ |
| FETBench™ |  ™ | Sync-Lock™ | XS™ |
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|--------------------------|-----------------------|---|
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