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March 2013

# FSA2467
# 0.4Ω Low-Voltage Dual DPDT Analog Switch

## Features

- Typical 0.4Ω On Resistance ($R_{ON}$) for +2.7V Supply
- Features Less then12µA $I_{CCT}$ Current when Sn Input is Lower than $V_{CC}$
- 0.25Ω Maximum $R_{ON}$ Flatness for +2.7V Supply
- 3 x 3mm 16-Lead MLP Package
- 1.8x2.6mm 16-Lead UMLP Package
- Broad $V_{CC}$ Operating Range
- Low THD (0.02% Typical for 32Ω Load)

## Applications

- Cell Phone
- PDA
- Portable Media Player

## Description

The FSA2467 is a dual Double-Pole, Double-Throw (DPDT) analog switch. The FSA2467 operates from a single 1.65V to 4.3V supply. The FSA2467 features an ultra-low on resistance of 0.4Ω at a +2.7V supply and 25°C. This device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation.

FSA2467 features very low quiescent current even when the control voltage is lower than the $V_{CC}$ supply. This feature allows mobile handset applications direct interface with baseband processor general-purpose I/Os.

## Ordering Information

| Part Number | Top Mark | Package Description |
|---|---|---|
| FSA2467MPX | FSA<br>2467 | 16-lead Molded Leadless Package (MLP), JEDEC MO-220, 3 x 3mm Square |
| FSA2467UMX | GC | 16-lead Ultrathin Molded Leadless Package (UMLP), 1.8 x 2.6mm |

## Application Diagram

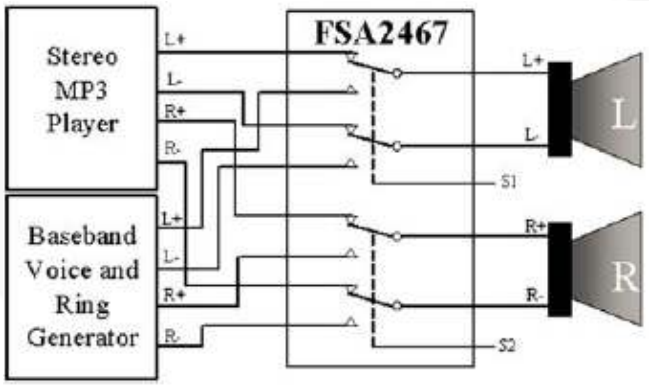



**Figure 1. Application Diagram**

## Pin Assignments

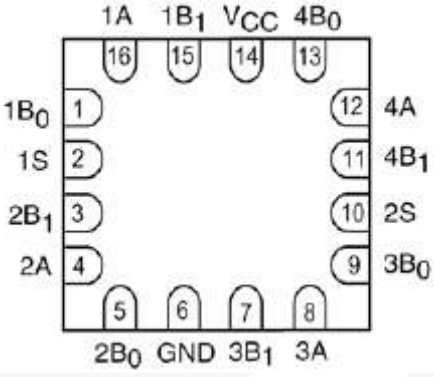



Figure 2. MLP (Top Through View)

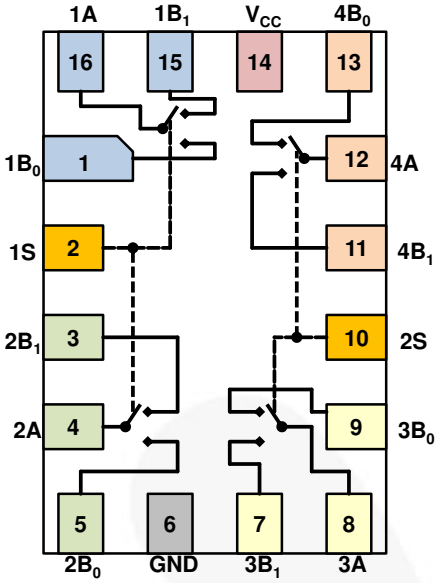



Figure 3. UMLP (Top View)

## Truth Table

| Control Inputs | Function |
|---|---|
| LOW | $nB_0$ Connected to nA |
| HIGH | $nB_1$ Connected to nA |

## Pin Descriptions

| Name | Function |
|---|---|
| nA, $nB_0$, $nB_1$ | Data Ports |
| nS | Control Input |

## Analog Symbol

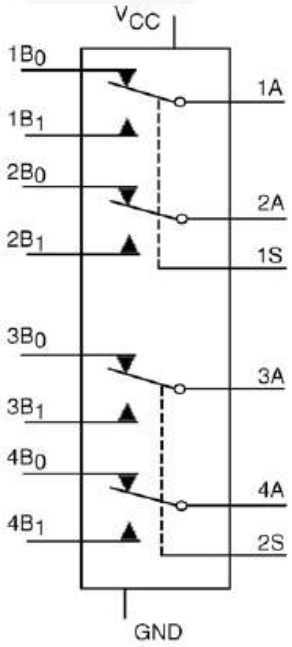



Figure 4. Analog Symbol

## 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 | 5.0 | V |
| $V_S$ | Switch Voltage | | -0.5 | $V_{CC}$+0.3 | V |
| $V_{IN}$ | Input Voltage | | -0.5 | 5.0 | V |
| $I_{IK}$ | Input Diode Current | | -50 | | mA |
| $I_{SW}$ | Switch Current | | | 350 | mA |
| $I_{SWPEAK}$ | Peak Switch Current (Pulsed at 1ms duration, <10% Duty Cycle) | | | 500 | mA |
| $T_{STG}$ | Storage Temperature Range | | -65 | +150 | ºC |
| $T_J$ | Junction Temperature | | | +150 | ºC |
| $T_L$ | Lead Temperature, Soldering 10 Seconds | | | +260 | ºC |
| ESD | Electrostatic Discharge Capability | Human Body Model, JESD22-A114 | | 5.5 | kV |

## 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 | 4.30 | V |
| $V_{IN}$ | Control Input Voltage[1] | 0 | $V_{CC}$ | V |
| $V_s$ | Switch Input Voltage | 0 | $V_{CC}$ | V |
| $T_A$ | Operating Temperature | -40 | +85 | ºC |

**Note:**

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

## DC Electrical Characteristics

Typical values are at 25ºC unless otherwise specified.

| Symbol | Parameter | Condition | $V_{CC}$ (V) | $T_A$ = +25ºC | | | $T_A$ = -40 to +85ºC | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min | Max. | |
| $V_{IH}$ | Input Voltage High | | 4.3 | | | | 1.4 | | V |
| | | | 2.7 to 3.6 | | | | 1.3 | | |
| | | | 2.3 to 2.7 | | | | 1.1 | | |
| | | | 1.65 to 1.95 | | | | 0.9 | | |
| $V_{IL}$ | Input Voltage Low | | 4.3 | | | | | 0.7 | V |
| | | | 2.7 to 3.6 | | | | | 0.5 | |
| | | | 2.3 to 2.7 | | | | | 0.4 | |
| | | | 1.65 to 1.95 | | | | | 0.4 | |
| $I_{IN}$ | Control Input Leakage | $V_{IN}$=0V to $V_{CC}$ | 1.65 to 4.30 | | | | -0.5 | 0.5 | µA |
| $I_{NO(OFF)}$ $I_{NC(OFF)}$ | Off Leakage Current of Port $nB_0$ and $nB_1$ | nA=0.3V, $V_{CC}$-0.3V | 1.95 to 4.30 | -10 | | 10 | -50 | 50 | nA |
| | | $nB_0$ or $nB_1$=0.3V, $V_{CC}$-0.3V or floating | | | | | | | |
| $I_{A(ON)}$ | On Leakage Current of Port A | nA=0.3V,$V_{CC}$-0.3V | 1.95 to 4.30 | -10 | | 10 | -50 | 50 | nA |
| | | $nB_0$ or $nB_1$=0.3V, $V_{CC}$-0.3V or Floating | | | | | | | |
| $R_{ON}$ | Switch On Resistance[2] | $I_{OUT}$=100mA | 4.3 | | 0.4 | | | 0.6 | Ω |
| | | $nB_0$ or $nB_1$=0V,0.8V, 1.8V,2.7V | 2.7 | | 0.4 | | | 0.6 | |
| | | $I_{OUT}$=100mA, $nB_0$ or $nB_1$=0V,0.7V, 1.2V, 2.3V | 2.3 | 0.55 | | | | 0.95 | |
| | | $I_{OUT}$=100mA, $nB_0$ or $nB_1$=1.0V | 1.8 | 0.8 | | | | 2.0 | |
| $\Delta R_{ON}$ | On Resistance Matching Between Channels[3] | $I_{OUT}$=100mA, $nB_0$ or $nB_1$=0.8V | 2.7 | 0.04 | | | | 0.10 | Ω |
| | | $I_{OUT}$=100mA, $nB_0$ or $nB_1$=0.7V | 2.3 | 0.03 | | | | 0.10 | |
| $R_{FLAT(ON)}$ | On Resistance Flatness[4] | $I_{OUT}$=100mA, $B_0$ or $nB_1$=0V to $V_{CC}$ | 2.7 | | | | | 0.25 | Ω |
| | | | 2.3 | | | | | 0.3 | |
| $I_{CC}$ | Quiescent Supply Current | $V_{IN}$=0V to $V_{CC}$ $I_{OUT}$=0V | 4.3 | -100 | | 100 | -500 | 500 | nA |
| $I_{CCT}$ | Increase in $I_{CC}$ Current per Control Voltage | $V_{IN}$=1.8V | 4.3 | | 7 | 12 | | 15 | µA |
| | | $V_{IN}$=2.6V | 4.3 | | 3 | 6 | | 7 | |

**Notes**:

2. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
3. $\Delta R_{ON}=R_{ON\ max} - R_{ON\ min}$ measured at identical $V_{CC}$, temperature and voltage.
4. Flatness is defined as the difference between the maximum and minimum value of on resistance over the specified range of conditions.

## AC Electrical Characteristics

Typical values are at 25ºC unless otherwise specified.

| Symbol | Parameter | Condition | $V_{CC}$ | $T_A$ = +25ºC | | | $T_A$ = -40 to +85ºC | | Unit | Figure |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | Min. | Max. | | |
| $t_{ON}$ | Turn-On Time | nB0 or nB1=1.5V | 3.6 to 4.3 | | | 50 | | 60 | ns | Figure 8 |
| | | $R_L$=50Ω, $C_L$=35pF | 2.7 to 3.6 | | | 65 | | 75 | | |
| | | | 2.3 to 2.7 | | | 80 | | 90 | | |
| $t_{OFF}$ | Turn-Off Time | nB0 or nB1=1.5V | 3.6 to 4.3 | | | 32 | | 40 | ns | Figure 8 |
| | | $R_L$=50Ω, $C_L$=35pF | 2.7 to 3.6 | | | 42 | | 50 | | |
| | | | 2.3 to 2.7 | | | 52 | | 60 | | |
| $t_{BBM}$ | Break-Before-Make Time | nB0 or nB1=1.5V | 3.6 to 4.3 | | 12 | | | | ns | Figure 9 |
| | | $R_L$=50Ω, $C_L$=35pF | 2.7 to 3.6 | | 15 | | | | | |
| | | | 2.3 to 2.7 | | 20 | | | | | |
| Q | Charge Injection | $C_L$=100pF, $V_{GEN}$=0V, $R_{GEN}$=0Ω | 3.6 to 4.3 | | 15 | | | | pC | Figure 11 |
| | | $C_L$=100pF, $V_{GEN}$=0V, $R_{GEN}$=0Ω | 2.7 to 3.6 | | 10 | | | | | |
| | | $C_L$=100pF, $V_{GEN}$=0V, $R_{GEN}$=0Ω | 2.3 to 2.7 | | 8 | | | | | |
| OIRR | Off Isolation | f=100KHz, $R_L$=50Ω,$C_L$=5pF | 3.6 to 4.3 | | -75 | | | | dB | Figure 10 |
| | | | 2.7 to 3.6 | | -75 | | | | | |
| | | | 2.3 to 2.7 | | -75 | | | | | |
| Xtalk | Crosstalk | f=100KHz, $R_L$=50Ω, $C_L$=5pF | 3.6 to 4.3 | | -75 | | | | dB | Figure 10 |
| | | | 2.7 to 3.6 | | -75 | | | | | |
| | | | 2.3 to 2.7 | | -75 | | | | | |
| BW | -3dB Bandwidth | $R_L$=50Ω | 2.3 to 4.3 | | 85 | | | | MHZ | Figure 13 |
| THD | Total Harmonic Distortion | $R_L$=32Ω, $V_{IN}$=2$V_{PP}$, f=20 to 20kHZ | 3.6 to 4.3 | | 0.02 | | | | % | Figure 14 |
| | | $R_L$=32Ω, $V_{IN}$=2$V_{PP}$, f=20 to 20kHZ | 2.7 to 3.6 | | 0.02 | | | | | |
| | | $R_L$=32Ω, $V_{IN}$=2$V_{PP}$, f=20 to 20kHZ | 2.3. to 2.7 | | 0.02 | | | | | |

## Capacitance

| Symbol | Parameter | Condition | $V_{CC}$ | $T_A$ = +25ºC Typical | Unit | Figure |
|---|---|---|---|---|---|---|
| $C_{IN}$ | Control Pin Input Capacitance | f=1MHZ | 0 | 1.5 | pF | Figure 8 |
| $C_{OFF}$ | B Port Off Capacitance | f=1MHZ | 3.3 | 32 | pF | Figure 8 |
| $C_{ON}$ | A Port On Capacitance | f=1MHZ | 3.3 | 118 | pF | Figure 8 |

## Typical Applications

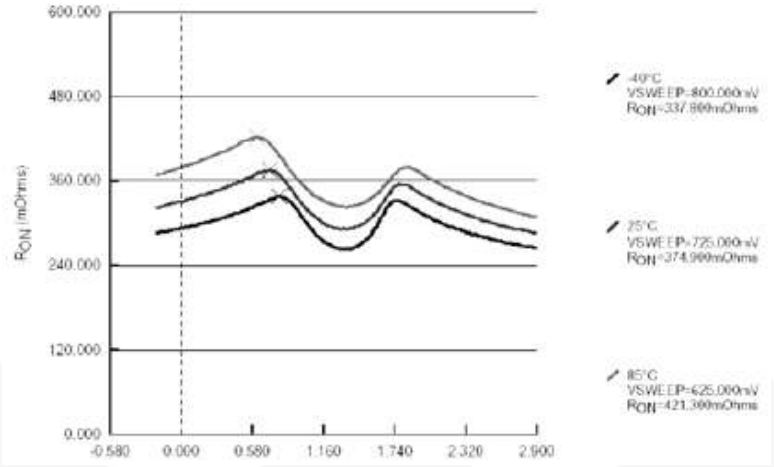



**Figure 5. $R_{ON}$ at 2.7V $V_{CC}$**

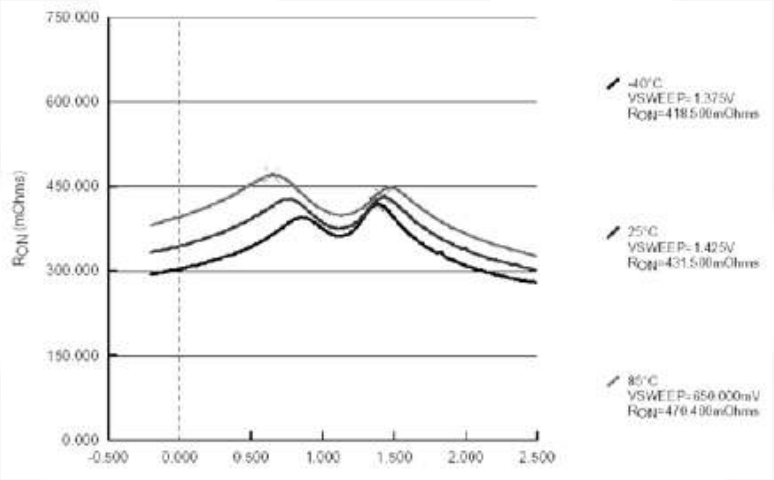



**Figure 6. $R_{ON}$ at 2.3V $V_{CC}$**

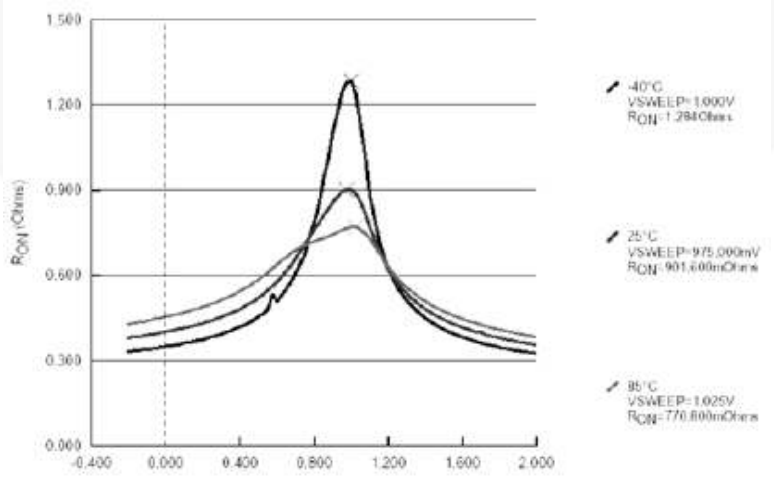
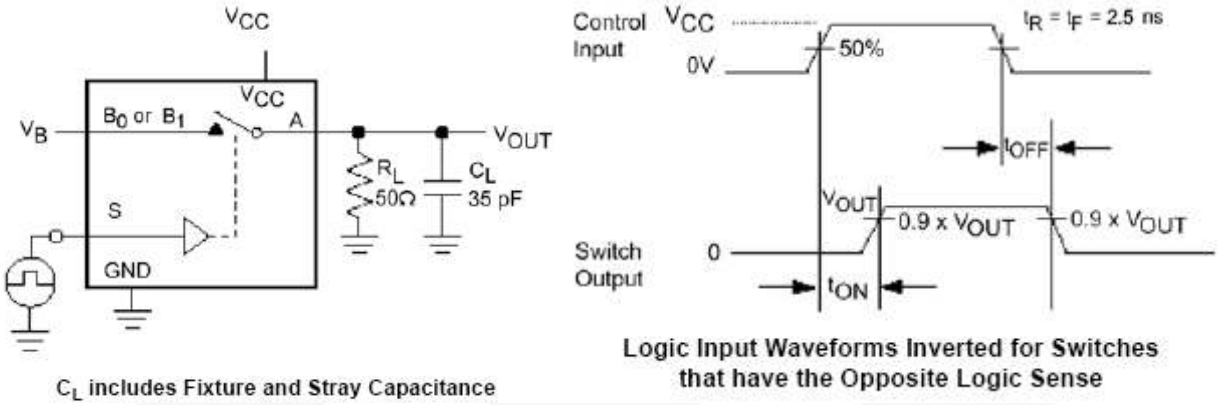



**Figure 7. $R_{ON}$ at 1.8V $V_{CC}$**

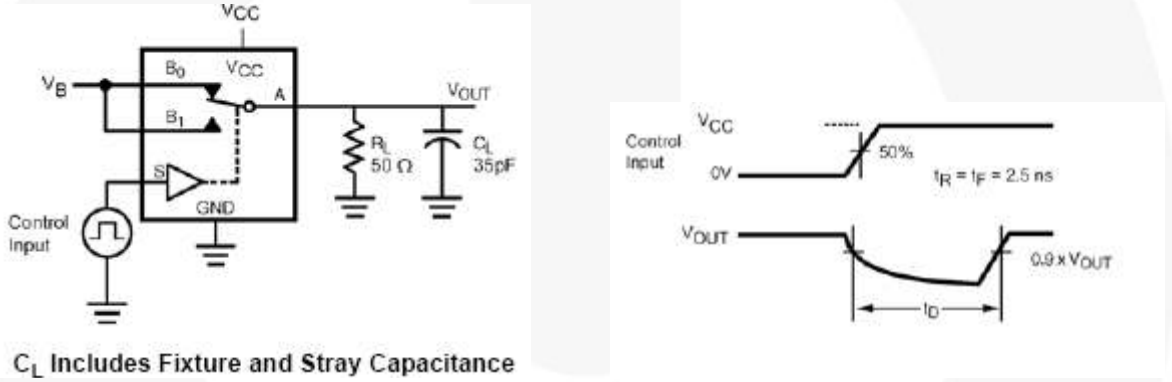
## AC Loadings and Waveforms




$C_L$ includes Fixture and Stray Capacitance

Logic Input Waveforms Inverted for Switches that have the Opposite Logic Sense

**Figure 8. Turn-On / Turn-Off Timing**




$C_L$ Includes Fixture and Stray Capacitance

**Figure 9. Break-Before-Make Timing**

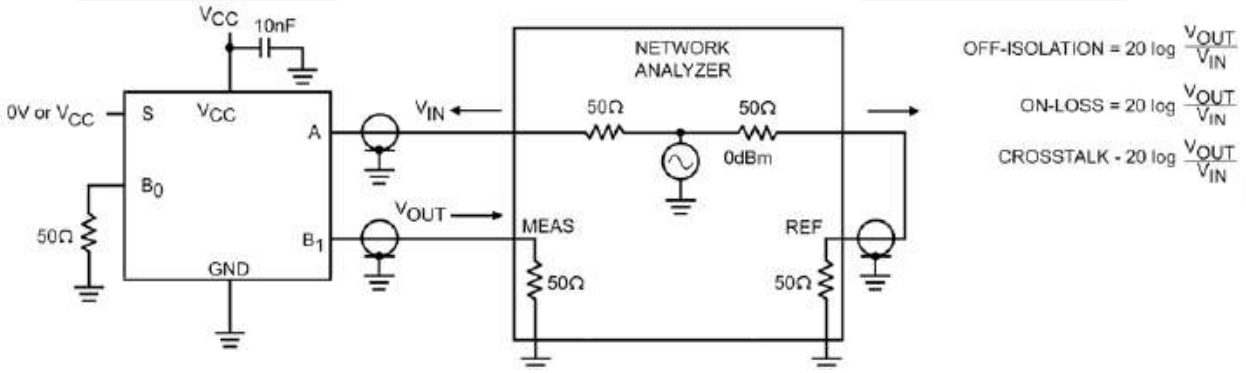



**Figure 10. Off Isolation and Crosstalk**

## AC Loadings and Waveforms (Continued)

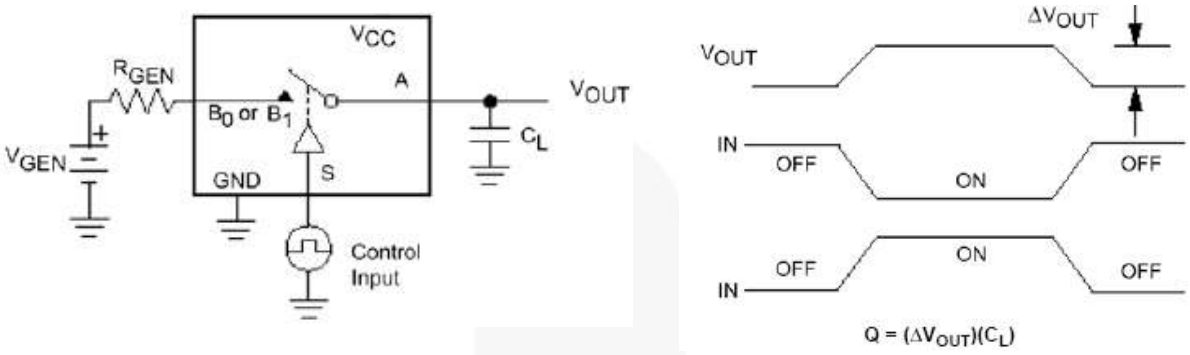



**Figure 11. Charge Injection**

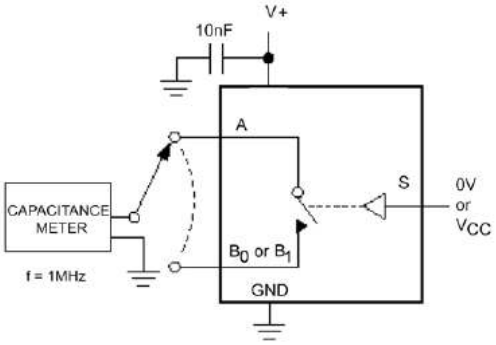



**Figure 12. On / Off Capacitance Measurement Setup**

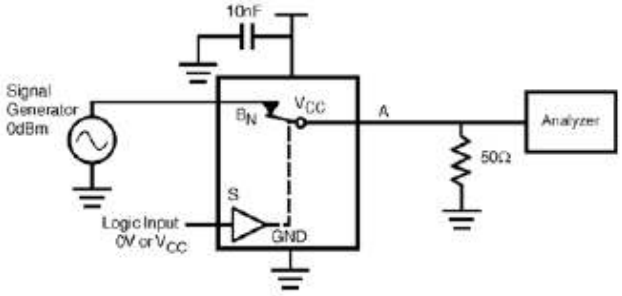



**Figure 13. Bandwidth**

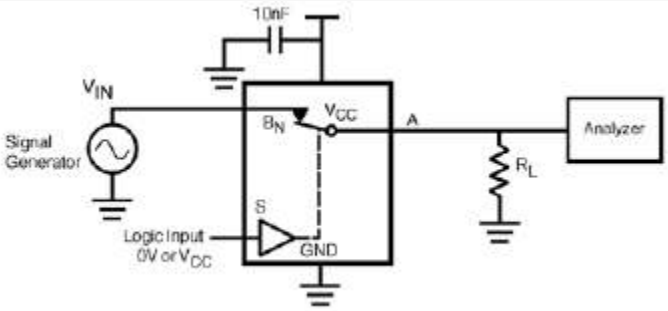
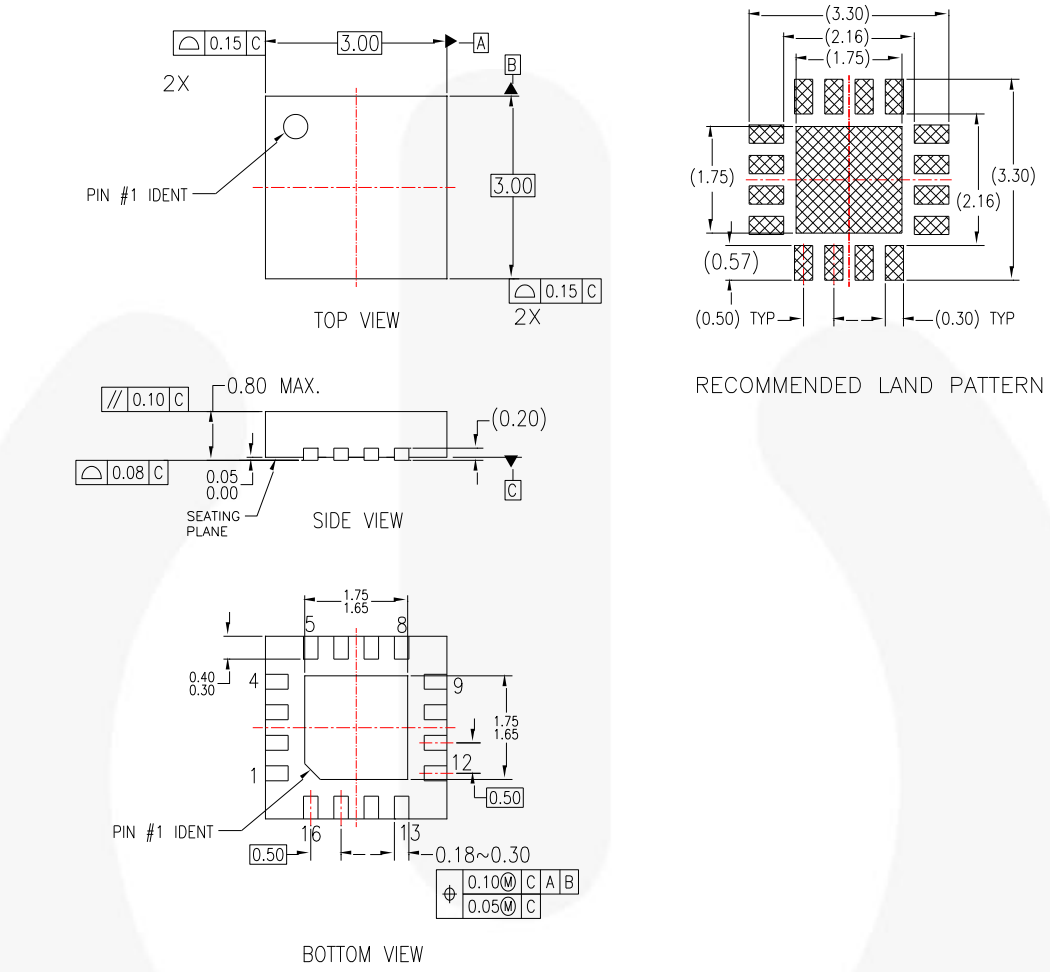



**Figure 14. Harmonic Distortion**

## Package Dimensions




NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-220, VARIATION WEED-Pending, DATED pending

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

D. DIMENSIONS ARE EXCLUSIVE OF BURS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

MLP16BrevB

**Figure 15. 16-Lead, Molded Leadless Package (MLP), JEDEC MO-220 3x3mm Square**

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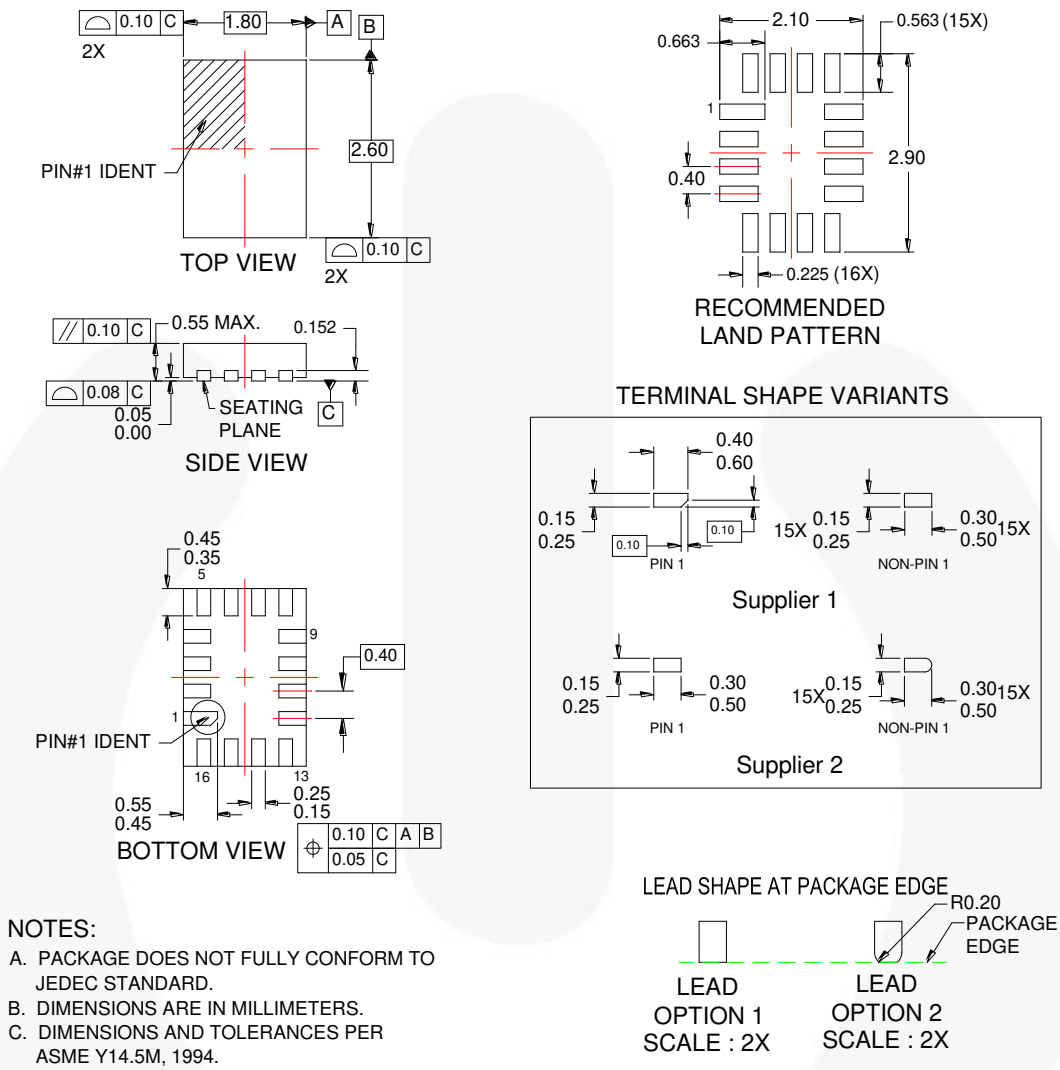
## Package Dimensions

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B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY.
E. DRAWING FILENAME: MKT-UMLP16Arev4.
F. TERMINAL SHAPE MAY VARY ACCORDING TO PACKAGE SUPPLIER, SEE TERMINAL SHAPE VARIANTS.

**Figure 16. 16-Lead, Ultrathin Molded Leadless Package (UMLP)**

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|---|---|---|
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