

# FSA2257

## Low $R_{ON}$ Low-Voltage Dual SPDT Bi-Directional Analog Switch

### Features

- Maximum 1.15Ω On Resistance ( $R_{ON}$ ) for 4.5V Supply
- 0.3Ω Maximum  $R_{ON}$  Flatness for +5V Supply
- Space-Saving MicroPak™ Packaging
- Broad  $V_{CC}$  Operating Range: 1.65V to 5.5V
- Fast Turn-on / Turn-off Time
- Break-Before-Make Enable Circuitry
- Over-Voltage Tolerant TTL-Compatible Control Input


### Description

The FSA2257 is a high-performance bi-directional dual Single-Pole/Double-Throw (SPDT) analog switch. This switch can be configured as either a multiplexer or a demultiplexer by select pins. The device features ultra-low  $R_{ON}$  of 1.3Ω maximum at 4.5V  $V_{CC}$  and operates over the wide  $V_{CC}$  range of 1.65V to 5.5V. The device is fabricated with submicron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation. The select input is TTL-level compatible.

### Applications

- Cell Phone
- PDA
- Mobile Devices

### Ordering Information

| Part Number | Package Number |  Eco Status | Top Mark | Package Description   | Packing Method              |
|-------------|----------------|--|----------|---|-----------------------------|
| FSA2257L10X | MAC010A        | RoHS   | EP       | 10-Lead MicroPak™, 1.6 x 2.1mm  | 5000 Units on Tape and Reel |
| FSA2257MTCX | MTC14          | RoHS   | FSA2257  | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide | 2500 Units on Tape and Reel |
| FSA2257MUX  | MUA101A        | RoHS   | FSA 2257 | 10-Lead Molded Small Outline Package (MSOP), JEDEC MO-187, 3.0mm            | 4000 Units on Tape and Reel |

 For Fairchild's definition of Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

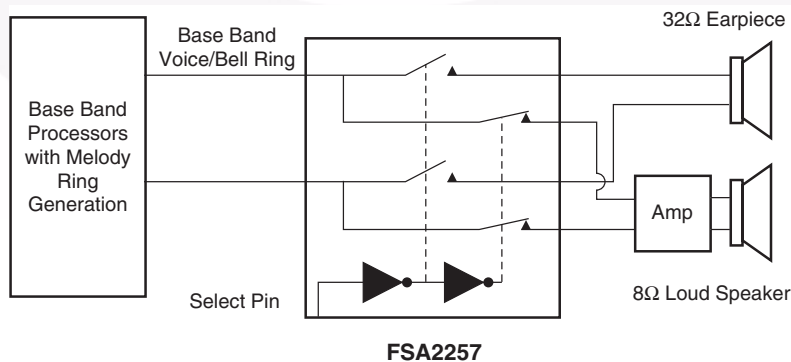


Figure 1. Block Diagram

### Connection Diagrams

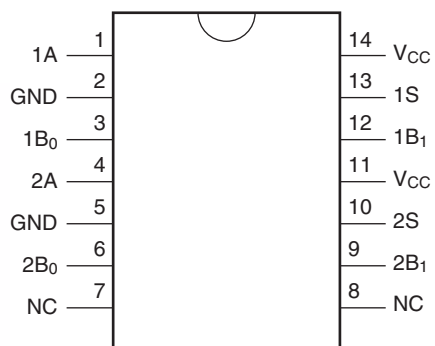


Figure 2. Pin Assignments for TSSOP (Top View)

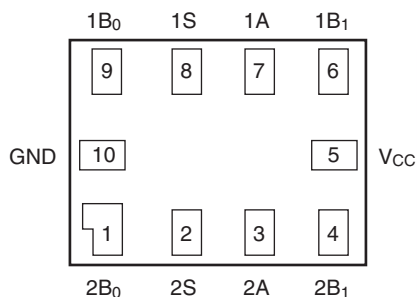


Figure 3. Pad Assignments for MicroPak (Top View)

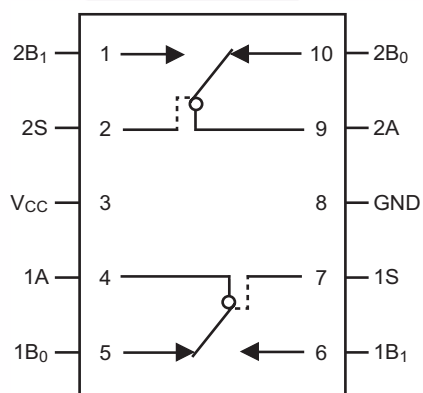


Figure 4. Pin Assignments for MSOP (Top View)

### Analog Symbols

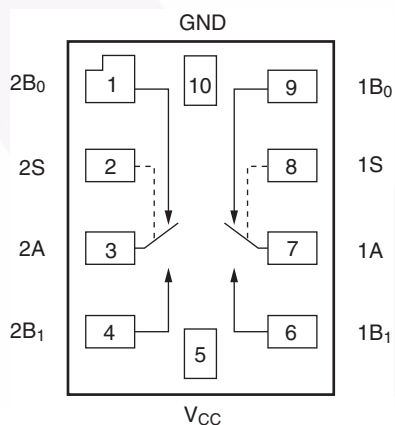


Figure 5. Analog Symbols (Top Through View)

### Truth Table

| Control Input(s) | Function             |
|------------------|----------------------|
| LOW Logic Level  | $B_0$ Connected to A |
| HIGH Logic Level | $B_1$ Connected to A |

### Pin Descriptions

| Pin Names        | Function      |
|------------------|---------------|
| A, $B_0$ , $B_1$ | Data Ports    |
| S                | Control Input |

## 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 <sub>CC</sub>  | Supply Voltage  | -0.5 | +6.0                 | V    |
| V <sub>SW</sub>  | DC Switch Voltage <sup>(2)</sup>                              | -0.5 | V <sub>CC</sub> +0.5 | V    |
| V <sub>IN</sub>  | DC Input Voltage <sup>(2)</sup>                               | -0.5 | +6.0                 | V    |
| I <sub>IK</sub>  | Input Diode Current   | -50  |                      | mA   |
|                  | Switch Current  |      | 200                  |      |
|                  | Peak Switch Current (Pulsed at 1ms duration, <10% duty cycle) |      | 400                  |      |
| T <sub>STG</sub> | Storage Temperature Range                                     | -65  | +150                 | °C   |
| T <sub>J</sub>   | Maximum Junction Temperature                                  |      | +150                 | °C   |
| T <sub>L</sub>   | Lead Temperature (Soldering, 10 seconds)                      |      | +260                 | °C   |
| ESD              | Human Body Model, JESD22-A114                                 |      | 8000                 | V    |
|                  | Charged Device Model, JESD22-C101                             |      | 2000                 |      |

**Note:**

2. The input and output negative voltage 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 <sub>CC</sub> | Supply Voltage                       | 1.65 | 5.50            | V    |
| V <sub>IN</sub> | Control Input Voltage <sup>(3)</sup> | 0    | V <sub>CC</sub> | V    |
| V <sub>SW</sub> | Switch Input Voltage                 | 0    | V <sub>CC</sub> | V    |
| T <sub>A</sub>  | Operating Temperature                | -40  | +85             | °C   |

**Note:**

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

## DC Electrical Characteristics

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

| Symbol   | Parameter   | Conditions  | $V_{CC}$ (V) | $T_A = +25^\circ\text{C}$ |      |      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      | Units         |
|--|---|---|--------------|---------------------------|------|------|---|------|---------------|
|  |   |   |              | Min.                      | Typ. | Max. | Min.  | Max. |               |
| $V_{IH}$   | Input Voltage High  |   | 1.8 to 2.7   |                           |      |      | 1.0   |      | V             |
|  |   |   | 2.7 to 3.6   |                           |      |      | 2.0   |      |               |
|  |   |   | 4.5 to 5.5   |                           |      |      | 2.4   |      |               |
| $V_{IL}$   | Input Voltage Low   |   | 1.8 to 2.7   |                           |      |      |   | 0.4  | V             |
|  |   |   | 2.7 to 3.6   |                           |      |      |   | 0.6  |               |
|  |   |   | 4.5 to 5.5   |                           |      |      |   | 0.8  |               |
| $I_{IN}$   | Control Input Leakage   | $V_{IN} = 0\text{V to } V_{CC}$   | 2.7 to 3.6   |                           |      |      | -1.0  | 1.0  | $\mu\text{A}$ |
|  |   |   | 4.5 to 5.5   |                           |      |      | -1.0  | 1.0  |               |
| $I_{NO(OFF)}, I_{NC(OFF)}$                                   | Off-Leakage Current of Port $B_0$ and $B_1$                         | $A = 1\text{V, } 4.5\text{V, } B_0 \text{ or } B_1 = 1\text{V, } 4.5\text{V}$             | 5.5          | -2.0                      |      | 2.0  | -20.0   | 20.0 | nA            |
| $I_{A(ON)}$  | On Leakage Current of Port A  | $A = 1\text{V, } 4.5\text{V, } B_0 \text{ or } B_1 = 1\text{V, } 4.5\text{V or Floating}$ | 5.5          | -4.0                      |      | 4.0  | -40.0   | 40.0 | nA            |
| $R_{ON}$   | Switch ON Resistance MicroPak <sup>(4)</sup>                        | $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 1.5\text{V}$                              | 1.8          |                           | 4.6  |      |   |      | $\Omega$      |
|  |   |   | 2.7          |                           | 2.6  | 4.0  |   | 4.3  |               |
|  | $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$        | 4.5   |              | 0.95                      | 1.15 |      | 1.30  |      |               |
|  | Switch On Resistance MSOP / TSSOP <sup>(4)</sup>                    | $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 1.5\text{V}$                              | 2.7          |                           | 2.8  |      |   | 4.5  |               |
| $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$ |   | 4.5   |              | 1.5                       |      |      | 2.3   |      |               |
| $\Delta R_{ON}$  | On Resistance Matching Between Channels <sup>(4)</sup> MicroPak     | $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$                              | 4.5          |                           | 0.06 | 0.12 |   | 0.15 | $\Omega$      |
|  | On Resistance Matching Between Channels <sup>(5)</sup> MSOP / TSSOP | $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 3.5\text{V}$                              | 4.5          |                           | 0.7  |      |   | 0.3  |               |
| $R_{FLAT(ON)}$   | On Resistance Flatness <sup>(6)</sup>                               | $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 0\text{V, } 0.75\text{V, } 1.5\text{V}$   | 1.8          |                           | 3.0  |      |   |      | $\Omega$      |
|  |   |   | 2.7          |                           | 1.4  |      |   |      |               |
|  |   | $I_{OUT} = 100\text{mA, } B_0 \text{ or } B_1 = 0\text{V, } 1\text{V, } 2\text{V}$        | 4.5          |                           | 0.2  | 0.3  |   | 0.4  |               |
| $I_{CC}$   | Quiescent Supply Current  | $V_{IN} = 0\text{V or } V_{CC}, I_{OUT} = 0\text{V}$                                      | 3.6          |                           | 0.1  | 0.5  |   | 1.0  | $\mu\text{A}$ |
|  |   |   | 5.5          |                           | 0.1  | 0.5  |   | 1.0  |               |

### Notes:

4. On resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.
5.  $\Delta R_{ON} = R_{ONmax} - R_{ONmin}$  measured at identical  $V_{CC}$ , temperature, and voltage.
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

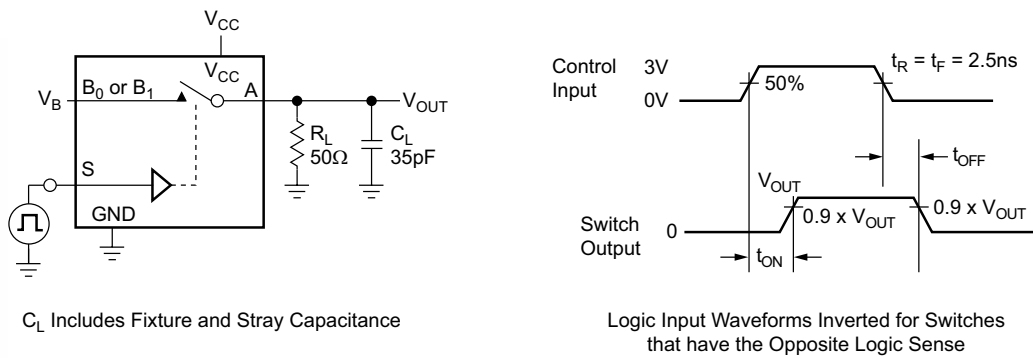
All typical values are at 25°C unless otherwise specified.

| Symbol    | Parameter                 | Conditions  | $V_{CC}$ (V)   | $T_A = +25^\circ\text{C}$ |       |      | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      |            | Figure Number |
|-----------|---------------------------|---|--|---------------------------|-------|------|---|------|------------|---------------|
|           |                           |   |  | Min.                      | Typ.  | Max. | Min.  | Max. | Units      |               |
| $t_{ON}$  | Turn-On Time              | $B_0$ or $B_1 = 1.5\text{V}$ ,<br>$R_L = 50\Omega$ , $C_L = 35\text{pF}$              | 1.8 to 2.7   |                           | 75    |      |   |      | ns         | Figure 6.     |
|           |                           |   | 2.7 to 3.6   |                           |       | 50   | 60  |      |            |               |
|           |                           | $B_0$ or $B_1 = 3.0\text{V}$ ,<br>$R_L = 50\Omega$ , $C_L = 35\text{pF}$              | 4.5 to 5.5   |                           |       | 35   | 40  |      |            |               |
| $t_{OFF}$ | Turn-Off Time             | $B_0$ or $B_1 = 1.5\text{V}$ ,<br>$R_L = 50\Omega$ , $C_L = 35\text{pF}$              | 1.8 to 2.7   |                           | 20    |      |   | ns   | Figure 6.  |               |
|           |                           |   | 2.7 to 3.6   |                           |       | 20   | 30  |      |            |               |
|           |                           | $B_0$ or $B_1 = 3.0\text{V}$ ,<br>$R_L = 50\Omega$ , $C_L = 35\text{pF}$              | 4.5 to 5.5   |                           |       | 15   | 20  |      |            |               |
| $t_{BBM}$ | Break-Before-Make Time    | $B_0$ or $B_1 = 1.5\text{V}$ ,<br>$R_L = 50\Omega$ , $C_L = 35\text{pF}$              | 2.7 to 3.6   |                           |       |      | 1   | ns   | Figure 7.  |               |
|           |                           |   | $B_0$ or $B_1 = 3.0\text{V}$ ,<br>$R_L = 50\Omega$ , $C_L = 35\text{pF}$ | 4.5 to 5.5                |       | 20   |   |      |            | 1             |
| Q         | Charge Injection          | $C_L = 1.0\text{nF}$ , $V_{GEN} = 0\text{V}$ ,<br>$R_{GEN} = 0\Omega$                 | 2.7 to 3.6   |                           | 20    |      |   | pC   | Figure 9.  |               |
|           |                           |   | 4.5 to 5.5   |                           | 10    |      |   |      |            |               |
| OIRR      | Off Isolation             | $f = 1\text{MHz}$ , $R_L = 50\Omega$  | 2.7 to 3.6   |                           | -70   |      |   | dB   | Figure 8.  |               |
|           |                           |   | 4.5 to 5.5   |                           | -70   |      |   |      |            |               |
| Xtalk     | Crosstalk                 | $f = 1\text{MHz}$ , $R_L = 50\Omega$  | 2.7 to 3.6   |                           | -75   |      |   | dB   | Figure 8.  |               |
|           |                           |   | 4.5 to 5.5   |                           | -75   |      |   |      |            |               |
| BW        | -3db Bandwidth            | $R_L = 50\Omega$  | 2.7 to 3.6   |                           | 200   |      |   | MHz  | Figure 11. |               |
|           |                           |   | 4.5 to 5.5   |                           | 200   |      |   |      |            |               |
| THD       | Total Harmonic Distortion | $R_L = 600\Omega$ , $V_{IN} = 0.5\text{V}_{PP}$<br>$f = 20\text{Hz to } 20\text{kHz}$ | 2.7 to 3.6   |                           | 0.002 |      |   | %    | Figure 12. |               |
|           |                           |   | 4.5 to 5.5   |                           | 0.002 |      |   |      |            |               |

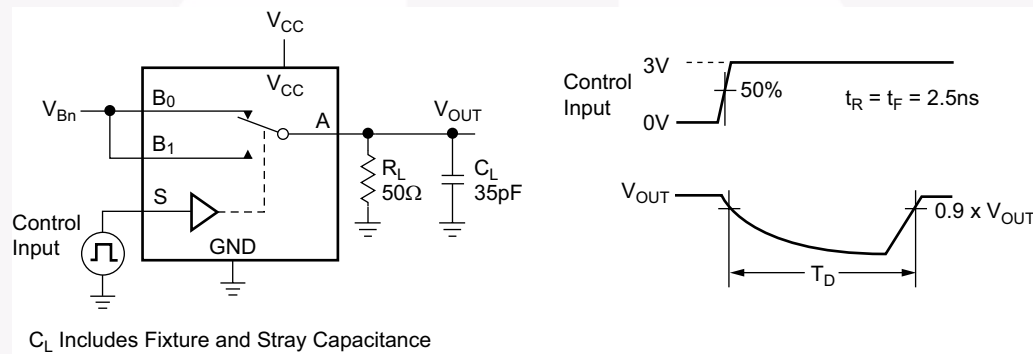
## Capacitance

| Symbol    | Parameter                     | Conditions        | $V_{CC}$ (V) | $T_A = +25^\circ\text{C}$ |      |      | $T_A = 40$ to $+85^\circ\text{C}$ |      | Units | Figure Number |
|-----------|-------------------------------|-------------------|--------------|---------------------------|------|------|-----------------------------------|------|-------|---------------|
|           |                               |                   |              | Min.                      | Typ. | Max. | Min.                              | Max. |       |               |
| $C_{IN}$  | Control Pin Input Capacitance | $f = 1\text{MHz}$ | 0.0          |                           | 3.5  |      |                                   |      | pF    | Figure 10.    |
| $C_{OFF}$ | B Port Off Capacitance        | $f = 1\text{MHz}$ | 4.5          |                           | 12.0 |      |                                   |      | pF    | Figure 10.    |
| $C_{ON}$  | A Port On Capacitance         | $f = 1\text{MHz}$ | 4.5          |                           | 40.0 |      |                                   |      | pF    | Figure 10.    |

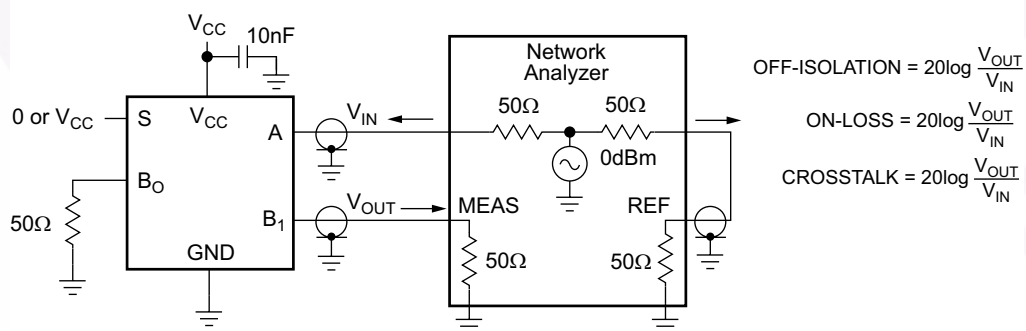
### AC Loading and Waveforms



**Figure 6. Turn-On / Turn-Off Timing**

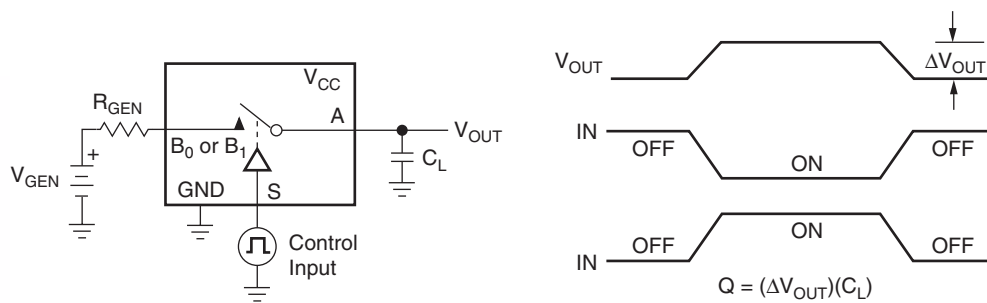


**Figure 7. Break-Before-Make Timing**

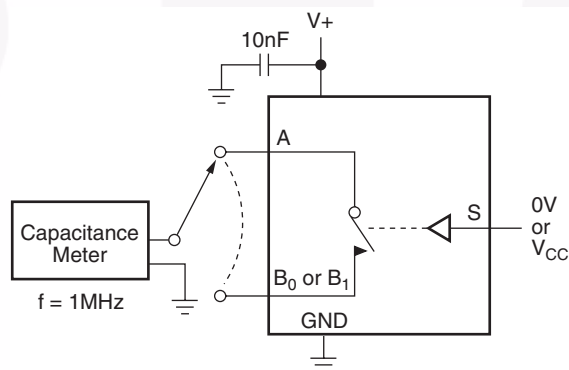


**Figure 8. Off Isolation and Crosstalk**

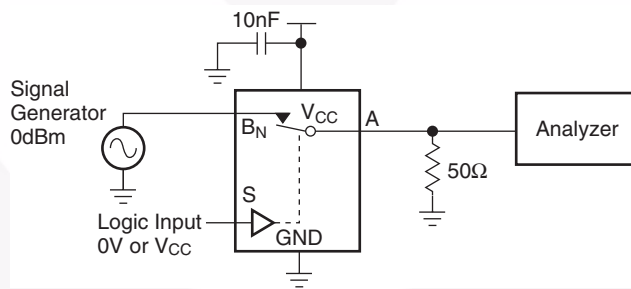
### AC Loading and Waveforms (Continued)



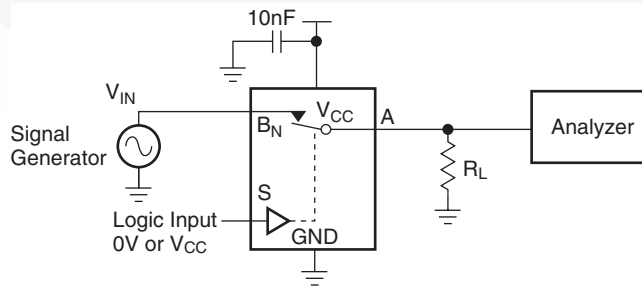
**Figure 9. Charge Injection**



**Figure 10. On / Off Capacitance Measurement Setup**

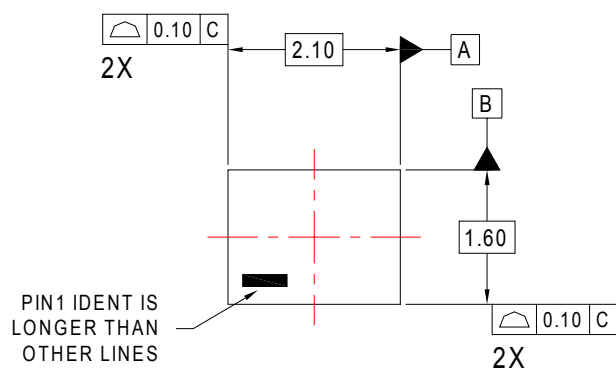


**Figure 11. Bandwidth**

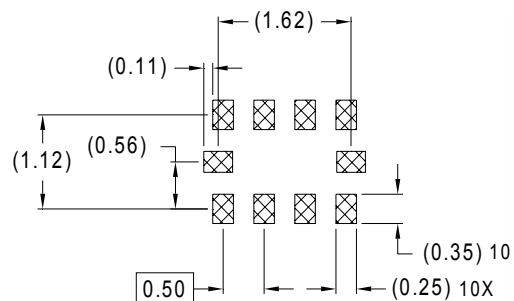


**Figure 12. Harmonic Distortion**

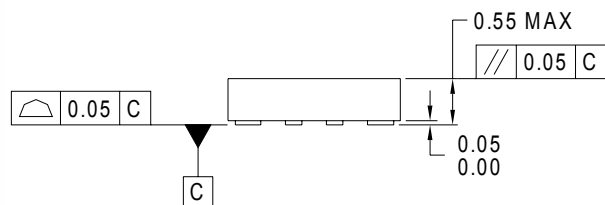
## Physical Dimensions



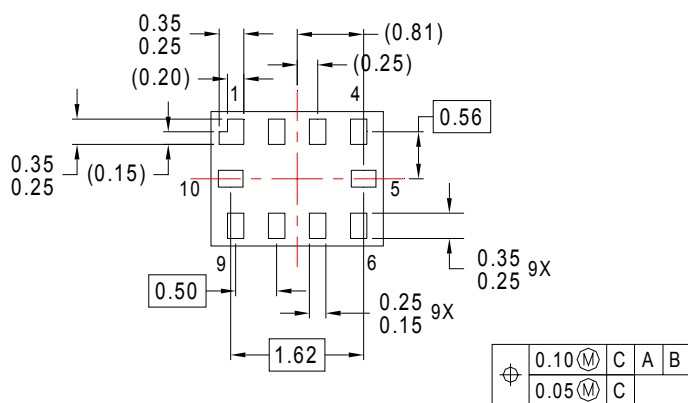
TOP VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW



BOTTOM VIEW

### NOTES:

- A. PACKAGE CONFORMS TO JEDEC REGISTRATION MO-255, VARIATION UABD
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
- D. DRAWING FILENAME: MKT-MAC10Arev4.

**Figure 13. 10-Lead MicroPak, 1.6 x 2.1mm**

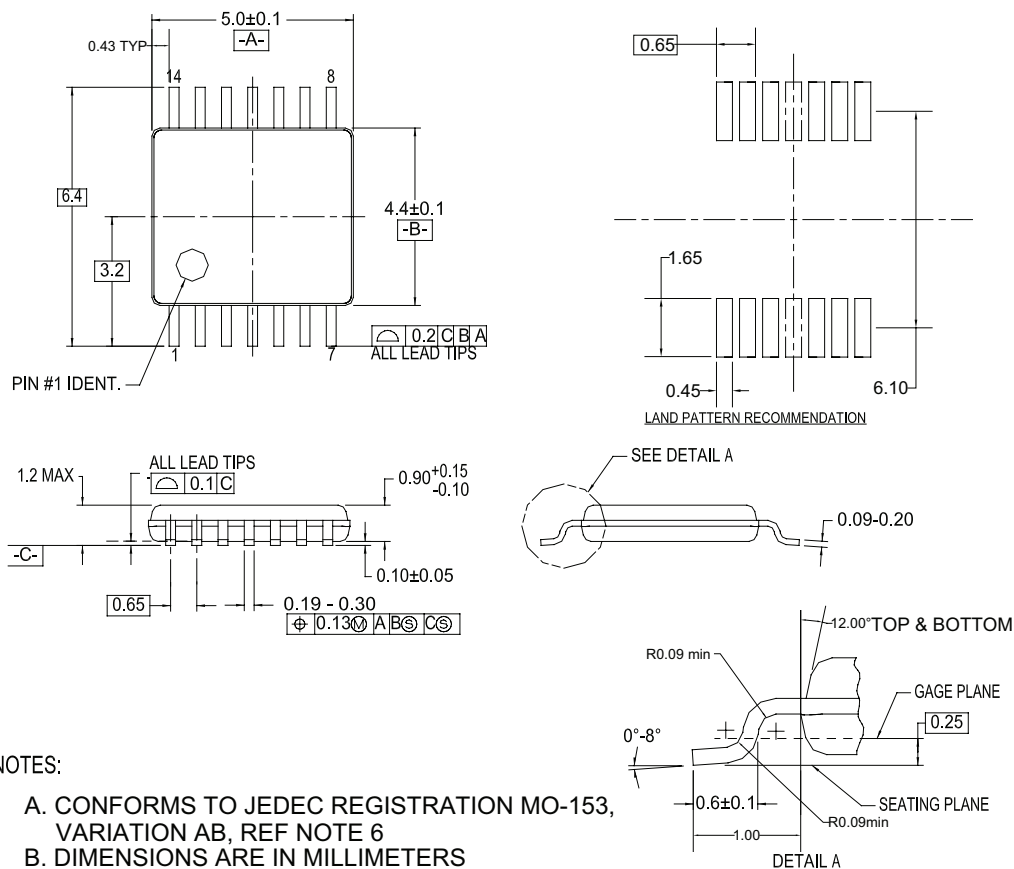
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**Note: click here for tape and reel specifications, available at:**  
[http://www.fairchildsemi.com/products/logic/pdf/micropak\\_tr.pdf](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf)

## Physical Dimensions (Continued)



### NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982
- E. LANDPATTERN STANDARD: SOP65P640X110-14M
- F. DRAWING FILE NAME: MTC14REV6

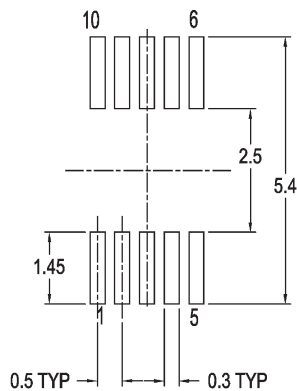
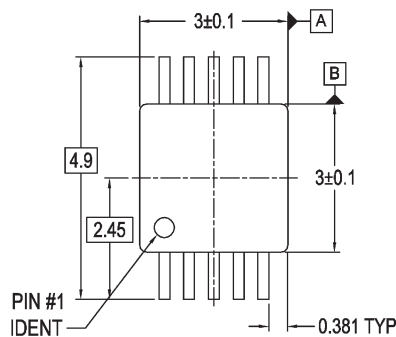
**Figure 14. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide**

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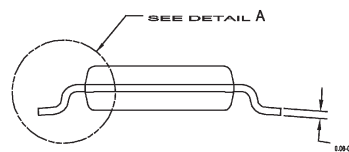
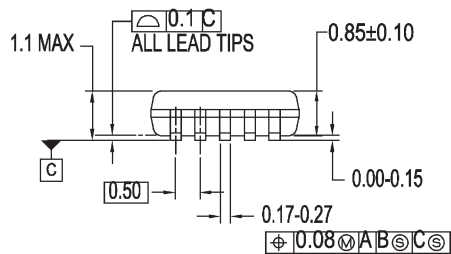
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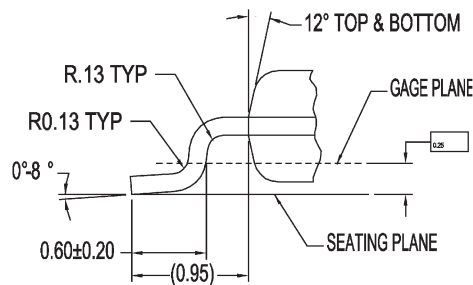
**Physical Dimensions** (Continued)



LAND PATTERN RECOMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

**NOTES:**

- A. CONFORMS TO JEDEC REGISTRATION MO-187, VARIATION BA, REF NOTE 6, DATE 11/00.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.

MUA10AREVA

**Figure 15. 10-Lead Molded Small Outline Package (MSOP), JEDEC MO-187, 3.0m**

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**Note: click here for tape and reel specifications, available at:**  
[http://www.fairchildsemi.com/products/analog/pdf/msop10\\_tr.pdf](http://www.fairchildsemi.com/products/analog/pdf/msop10_tr.pdf)


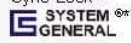


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F-PFS™  
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 Green FPS™  
 Green FPS™ e-Series™  
 Gmax™  
 GTO™  
 IntelliMAX™  
 ISOPLANAR™  
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 PDP SPM™  
 Power-SPM™

PowerTrench®  
 PowerXS™  
 Programmable Active Droop™  
 QFET®  
 QS™  
 Quiet Series™  
 RapidConfigure™  
  
 Saving our world, 1mW/W/kW at a time™  
 SmartMax™  
 SMART START™  
 SPM®  
 STEALTH™  
 SuperFET™  
 SuperSOT™.3  
 SuperSOT™.6  
 SuperSOT™.8  
 SupreMOS™  
 SyncFET™  
 Sync-Lock™  


The Power Franchise®  
  
 TinyBoost™  
 TinyBuck™  
 TinyLogic®  
 TINYOPTO™  
 TinyPower™  
 TinyPWM™  
 TinyWire™  
 TriFault Detect™  
 TRUECURRENT™  
 μSerDes™  
  
 UHC®  
 Ultra FRFET™  
 UniFET™  
 VCX™  
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