

## FSA2357 — Low R<sub>ON</sub> 3:1 Analog Switch

### Features

- 10µA Maximum I<sub>CCT</sub> Current Over an Expanded Control Voltage Range: V<sub>IN</sub>=2.6V, V<sub>CC</sub>=4.5V
- On Capacitance (C<sub>ON</sub>): 70pF Typical
- 0.55Ω Typical On Resistance (R<sub>ON</sub>)
- -3db Bandwidth: > 120MHz
- Low Power Consumption (1µA maximum)
- Packaged in Pb-Free 14-Pin TSSOP and DQFN
- Priority Enable Control Circuitry

### Applications

- HDMI 5V Power Routing, LCD Monitor, TV, and Set-Top Box
- Cell Phone, PDA, Digital Camera, and Notebook

### Description

The FSA2357 is a Double-Pole, Triple Throw (DP3T) multiplexer that routes three dual-channel sources of data or audio under the control of three select pins. The FSA2357 features very low quiescent current, which allows mobile handset applications direct interface with the baseband processor general-purpose I/Os. Typical applications involve switching in portables and consumer applications, such as cell phones, digital cameras, and notebooks with hubs or controllers.

### IMPORTANT NOTE:

For additional information, please contact [analogswitch@fairchildsemi.com](mailto:analogswitch@fairchildsemi.com).

### Ordering Information

| Part Number | Top Mark |  Eco Status | Packing Description  |
|-------------|----------|--|--|
| FSA2357BQX  | 2357     | Green  | 14-Terminal Depopulated very thin Quad Flat-pack No leads (DQFN) 2.5 x 3.0mm, JEDEC MO-241 |
| FSA2357MTCX | FSA2357  | RoHS   | 14-Lead Thin Shrink Small Outline Package (TSSOP) 4.4mm wide, JEDEC MO-153                 |

 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).

### Analog Symbol

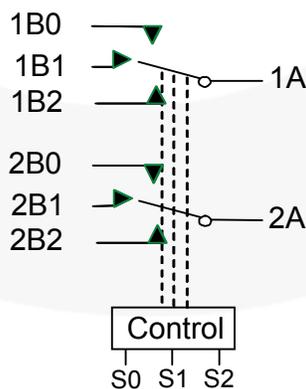


Figure 1. Analog Symbol

## Pin Configurations

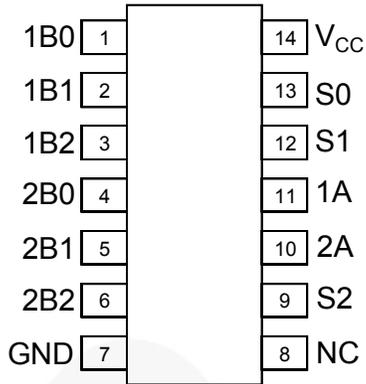


Figure 2. TSSOP-14 (Top Through View)

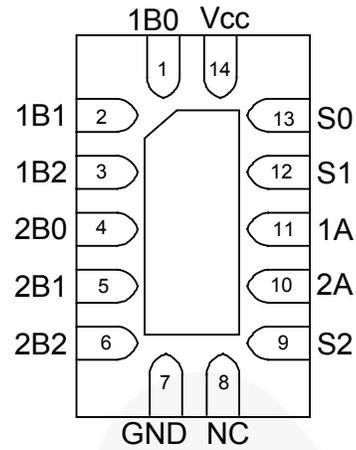


Figure 3. DQFN-14 (Top Through View)

## Pin Descriptions

| Name       | Description               |
|------------|---------------------------|
| S0, S1, S2 | Switch Control Selects    |
| 1A, 2A     | A Data Bus (Common)       |
| 1Bn, 2Bn   | Multiplexed Source inputs |

## Truth Table

| S0   | S1   | S2   | Function            |
|------|------|------|---------------------|
| HIGH | X    | X    | 1B0 = 1A; 2B0 = 2A  |
| LOW  | HIGH | X    | 1B1 = 1A; 2B1 = 2A  |
| LOW  | LOW  | HIGH | 1B2 = 1A; 2B2 = 2A  |
| LOW  | LOW  | LOW  | Disconnected (Hi-Z) |

## 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            | 6.0  | V              |   |
| $V_{SW}$     | Switch I/O Voltage <sup>(1)</sup>                             | 1Bn, 2Bn Pins   | -0.5 | $V_{CC} + 0.3$ | V |
| $V_{CNTRL}$  | Control Input Voltage <sup>(1)</sup>                          | S0, S1 Pins     | -0.5 | 6.0            | 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             |   |
| $P_D$        | Power Dissipation at 85°C                                     | DQFN-14         | 2.5  | $\mu$ W        |   |
|              |   | TSSOP-14        | 2.5  |                |   |
| $T_{STG}$    | 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                          | All Pins        | 5500 | kV             |   |
|              |   | I/O to GND      | 8000 |                |   |
|              |   | $V_{CC}$ to GND | 8000 |                |   |
|              | Charged Device Model, JEDEC-JESD22-C101                       | 2000            |      |                |   |

### Note:

- 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                        | 2.7      | 5.5      | V    |
| $V_{CNTRL}$   | Control Input Voltage ( $V_{S0:S1}$ ) | 0        | $V_{CC}$ | V    |
| $V_{SW}$      | Switch I/O Voltage                    | 0        | $V_{CC}$ | V    |
| $T_A$         | Operating Temperature                 | -40      | +85      | °C   |
| $\theta_{JA}$ | Thermal Resistance (Free Air)         | DQFN-14  | 145      | °C/W |
|               |                                       | TSSOP-14 |          |      |

## DC Electrical Characteristics

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

| Symbol                | Parameter  | Conditions  | V <sub>CC</sub> (V)      | T <sub>A</sub> = -40°C to +85°C |      |                 | Unit |
|-----------------------|--|---|--------------------------|---------------------------------|------|-----------------|------|
|                       |  |   |                          | Min.                            | Typ. | Max.            |      |
|                       | Analog Signal Range  |   |                          | V <sub>CC</sub> -5.5            |      | V <sub>CC</sub> | V    |
| V <sub>IK</sub>       | Clamp Diode Voltage  |   |                          |                                 |      | 1.2             | V    |
| V <sub>IH</sub>       | Control Input Voltage HIGH   |   | 2.7 to 3.6<br>3.6 to 4.5 | 1.2                             |      |                 | V    |
|                       |  |   |                          | 1.5                             |      |                 |      |
| V <sub>IL</sub>       | Control Input Voltage LOW  |   | 2.7 to 3.6<br>3.6 to 4.5 |                                 |      | 0.5             | V    |
|                       |  |   |                          |                                 |      | 0.7             |      |
| I <sub>IN</sub>       | Control Input Leakage  | V <sub>IN</sub> = 0 to V <sub>CC</sub>                                  | 4.5                      |                                 |      | ±1              | μA   |
| I <sub>NO(OFF)</sub>  | Off-Leakage Current of Port (1Bn, 2Bn)                                       | 1Bn, 2Bn or 1A, 2A = 0.3V, V <sub>CC</sub> -0.3V, or Floating           | 5.5                      | -100                            | 10   | 100             | nA   |
| I <sub>NC(ON)</sub>   | On-Leakage Current of Port 1Bn, 2Bn  | 1Bn, 2Bn or 1A, 2A = 0.3V, V <sub>CC</sub> -0.3V, or Floating           | 5.5                      | -100                            | 10   | 100             | nA   |
| R <sub>ON</sub>       | Switch On Resistance <sup>(2)</sup>  | 1Bn or 2Bn = 0V, 0.7V, 2.0V, 2.7V; I <sub>ON</sub> = -100mA<br>Figure 4 | 2.7                      |                                 | 0.75 | 2.00            | Ω    |
|                       |  |   | 4.5                      |                                 | 0.55 | 0.90            |      |
| ΔR <sub>ON</sub>      | Delta On Resistance <sup>(3)</sup>   | 1Bn or 2Bn = 0.7V, V <sub>CC</sub> , I <sub>ON</sub> = -100mA           | 2.7                      |                                 | 0.50 |                 | Ω    |
|                       |  |   | 4.5                      |                                 | 0.30 |                 |      |
| R <sub>FLAT(ON)</sub> | On Resistance Flatness <sup>(4)</sup>  | 1Bn or 2Bn = 0V, 0.7V, 2.0V, 2.7V; I <sub>ON</sub> = -100mA<br>Figure 4 | 2.7 to 4.5               |                                 | 0.23 | 0.40            | Ω    |
| I <sub>CC</sub>       | Quiescent Supply Current   | V <sub>SW</sub> = 0 or V <sub>CC</sub> -0.3<br>I <sub>OUT</sub> = 0     | 5.5                      |                                 | 22   | 500             | μA   |
| I <sub>CCCT</sub>     | Increase in Quiescent Supply Current per Control Voltage and V <sub>CC</sub> | V <sub>CNTRL</sub> = 3.3V   | 5.5                      |                                 | 5    | 20              | μA   |

### Notes:

- R<sub>ON</sub> measured by the voltage drop between 1Bn (2Bn) and 1A (2A) pins at identical current through the switch. R<sub>ON</sub> is determined by the lower of the voltage on the two pins.
- Guaranteed by characterization; not production tested.
- Flatness is defined as the difference between the maximum and minimum values of on resistance over the specified range of conditions.

## AC Electrical Characteristics

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

| Symbol    | Parameter                        | Conditions   | $V_{CC}$ (V) | $T_A = -40^{\circ}C$ to $+85^{\circ}C$ |      |      | Unit |
|-----------|----------------------------------|--|--------------|--|------|------|------|
|           |                                  |  |              | Min.                                   | Typ. | Max. |      |
| $t_{ON}$  | Turn-On Time S[0:1] to Output    | $V_{Bn} = 1.5V$ , $R_L = 50\Omega$ ,<br>$C_L = 35pF$<br>Figure 8                 | 2.7 to 4.5   |  | 30   | 60   | ns   |
| $t_{OFF}$ | Turn-Off Time S[0:1] to Output   | $V_{Bn} = 1.5V$ , $R_L = 50\Omega$ ,<br>$C_L = 35pF$<br>Figure 8                 | 2.7 to 4.5   |  | 38   | 80   | ns   |
| $t_{PD}$  | Propagation Delay <sup>(5)</sup> | $R_L = 50\Omega$ , $C_L = 5pF$<br>Figure 9                                       | 3.6          |  | 0.25 |      | ns   |
| $t_{BBM}$ | Break-Before-Make <sup>(5)</sup> | $R_L = 50\Omega$ , $C_L = 5pF$<br>$V_{IN1} = V_{IN2} = V_{IN3} = 1.5V$           | 2.7 to 4.5   | 1.0                                    | 6.0  |      | ns   |
| Q         | Charge Injection                 | $R_{GEN} = 0\Omega$ , $C_L = 100pF$ ,<br>$R_L = OPEN$<br>Figure 10               | 2.7 to 4.5   |  | 9    |      | pC   |
| $O_{IRR}$ | Off-Isolation                    | $f = 100kHz$ , $R_L = 50\Omega$<br>Figure 12                                     | 2.7 to 4.5   |  | -68  |      | dB   |
| Xtalk     | Non-Adjacent Channel Crosstalk   | $f = 100kHz$ , $R_L = 50\Omega$<br>Figure 13                                     | 2.7 to 4.5   |  | -60  |      | dB   |
| THD       | Total Harmonic Distortion        | $f = 20Hz$ to $20kHz$ ,<br>$R_L = 600\Omega$ , $V_{SW} = 0.5V_{pp}$<br>Figure 16 | 2.7 to 4.5   |  | 0.01 |      | %    |
| BW        | -3db Bandwidth                   | $R_L = 50\Omega$ , $C_L = 0$ , $5pF$<br>Figure 11                                | 2.7 to 4.5   |  | 90   |      | MHz  |

**Note:**

5. Guaranteed by characterization; not production tested.

## Capacitance

| Symbol     | Parameter                     | Conditions  | $T_A = -40^{\circ}C$ to $+85^{\circ}C$ |  | Unit |
|------------|-------------------------------|---|--|--|------|
|            |                               |   | Typical                                |  |      |
| $C_{IN}$   | Control Pin Input Capacitance | $V_{CC} = 0V$   | 2.75                                   |  | pF   |
| $C_{ON}$   | A/B On Capacitance            | $V_{CC} = 3.3V$ , S[0:1] = 01, 10, 11,<br>$f = 1MHz$<br>Figure 15 | 70                                     |  | pF   |
| $C_{OFFA}$ | Port 1A, 2A Off Capacitance   | $V_{CC} = 3.3V$ , S[0:1] = 00<br>Figure 14                        | 42                                     |  | pF   |
| $C_{OFFB}$ | Port 1Bn, 2Bn Off Capacitance | $V_{CC} = 3.3V$ , S[0:1] = 00<br>Figure 14                        | 20                                     |  | pF   |

Test Diagrams

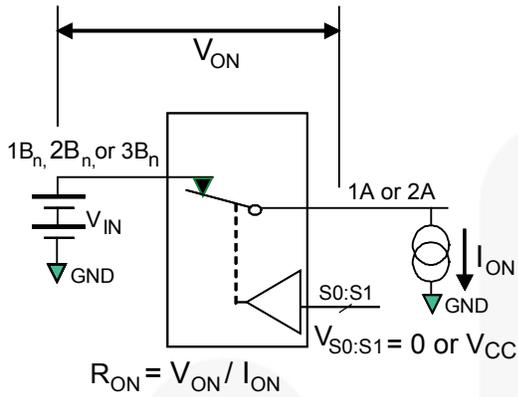
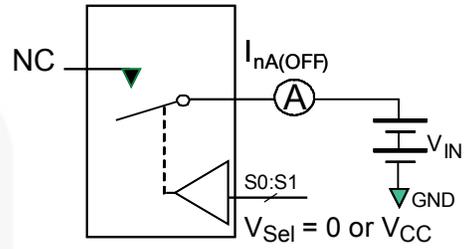
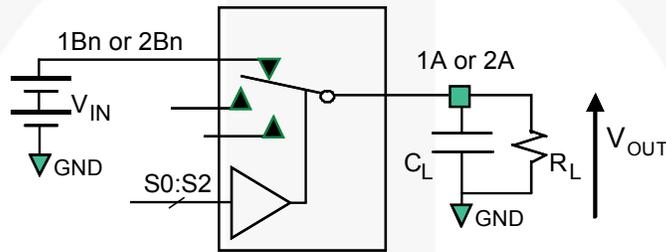


Figure 4. On Resistance



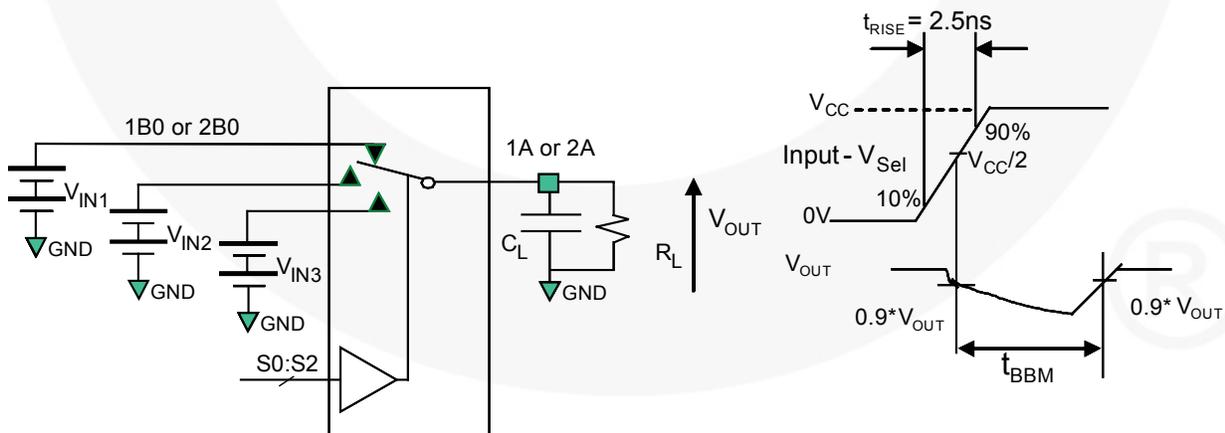
\*\*Each switch port is tested separately

Figure 5. Off Leakage



$R_L$  and  $C_L$  are functions of the application environment (see tables for specific values).  $C_L$  includes test fixture and stray capacitance.

Figure 6. AC Test Circuit Load



$R_L$  and  $C_L$  are functions of the application environment (see tables for specific values).  $C_L$  includes test fixture and stray capacitance.

Figure 7. Break-Before-Make Timing

Test Diagrams (Continued)

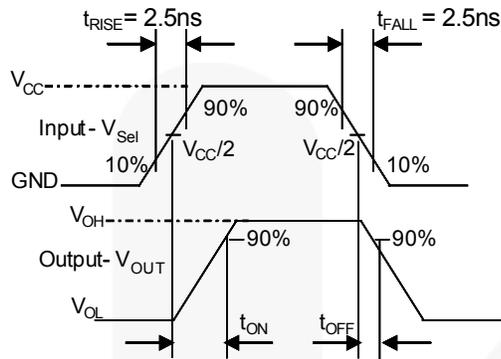


Figure 8. Turn-On / Turn-Off Waveforms

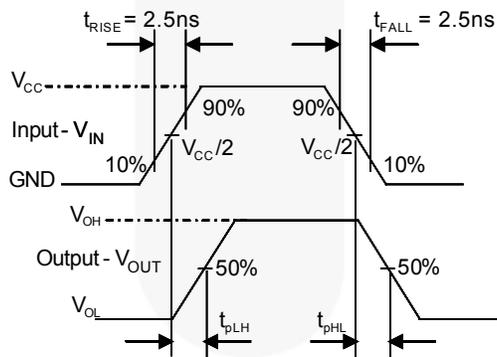


Figure 9. Switch Propagation Delay Waveforms

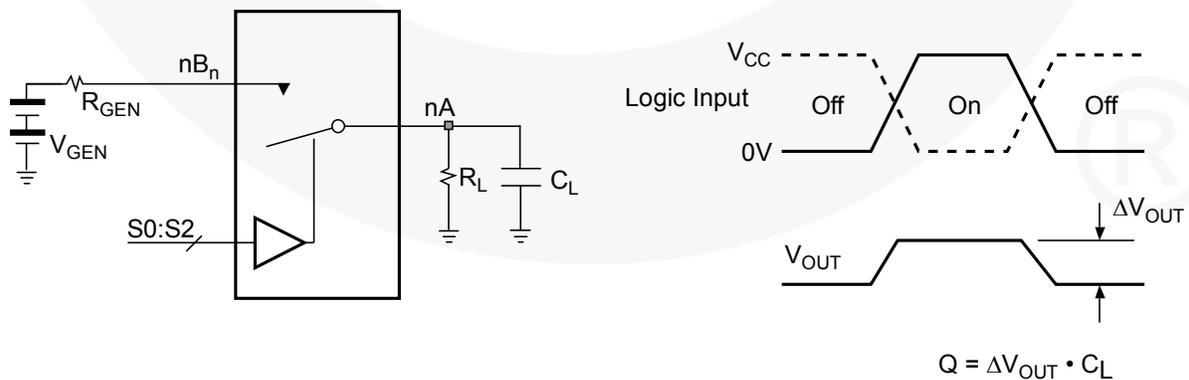
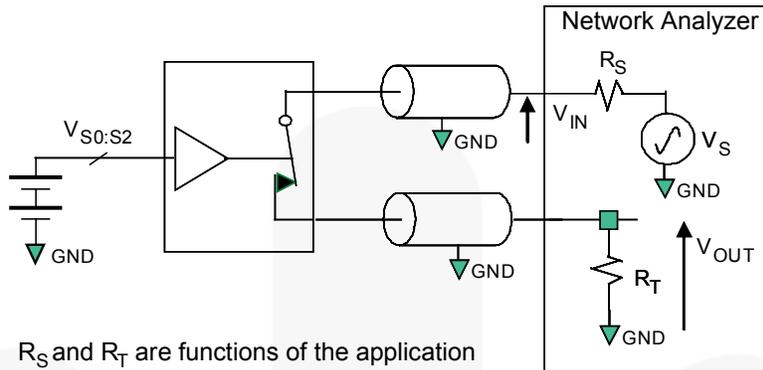
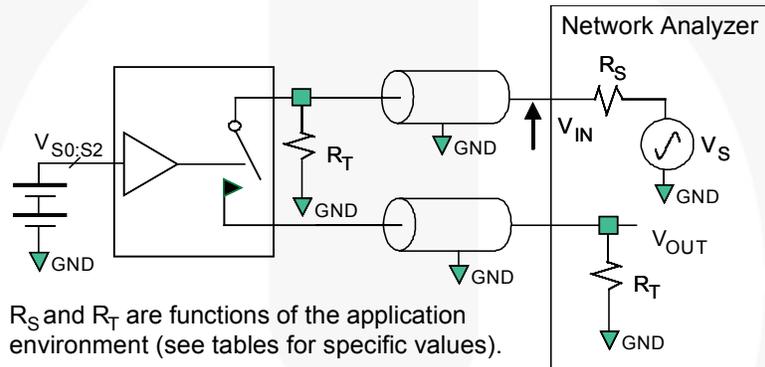


Figure 10. Charge Injection Test

**Test Diagrams** (Continued)

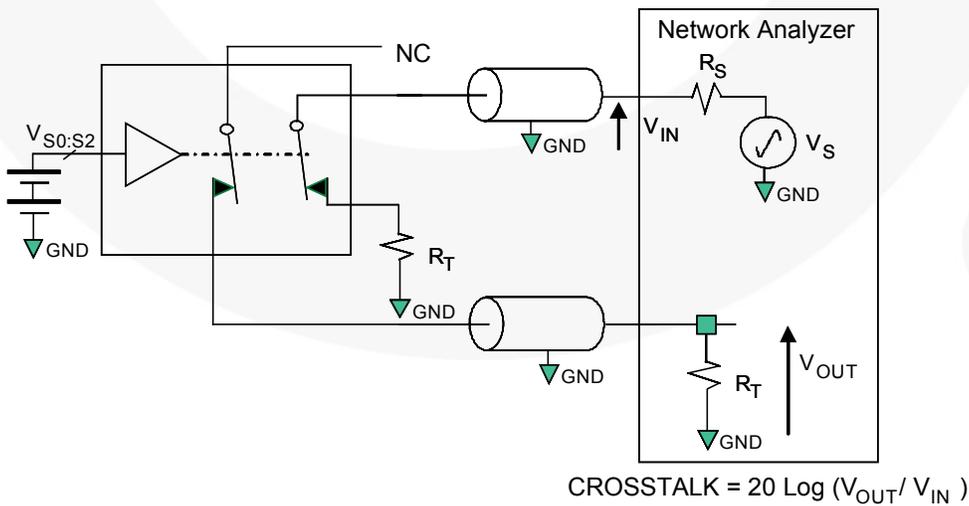


**Figure 11. Bandwidth**



$$\text{Off-Isolation} = 20 \text{ Log } (V_{\text{OUT}} / V_{\text{IN}})$$

**Figure 12. Channel Off Isolation**



**Figure 13. Non-Adjacent Channel-to-Channel Crosstalk**

Test Diagrams (Continued)

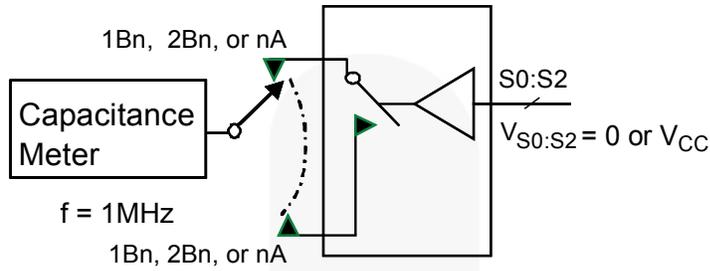


Figure 14. Channel Off Capacitance

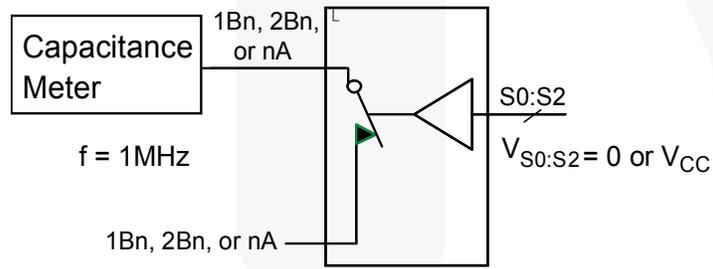


Figure 15. Channel On Capacitance

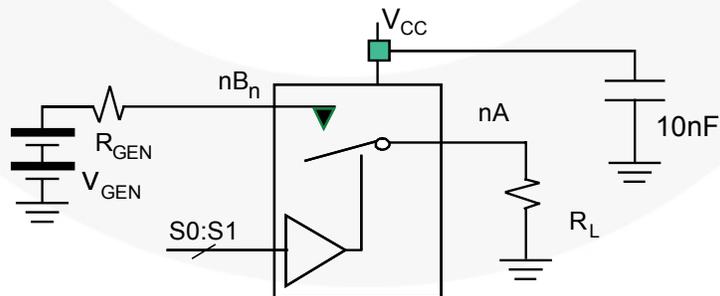
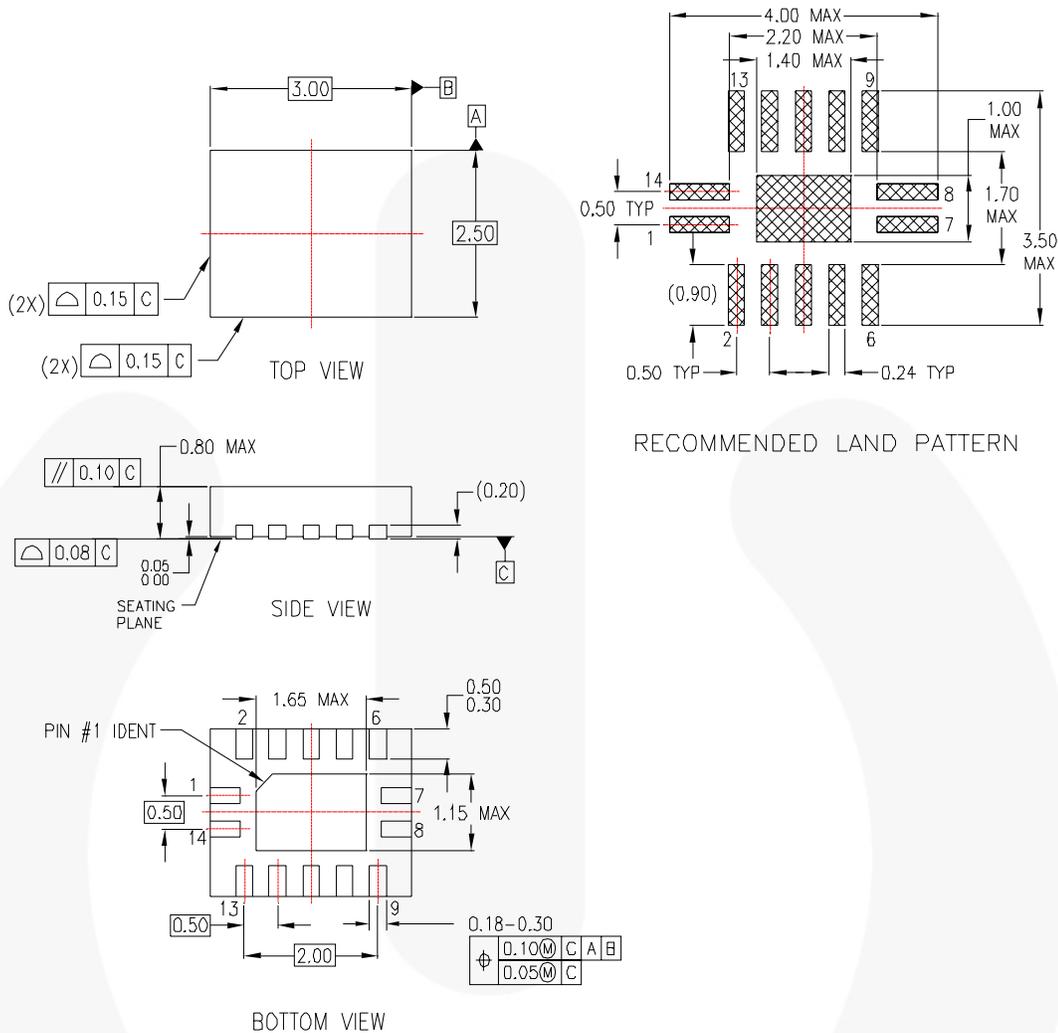


Figure 16. Total Harmonic Distortion

## Physical Dimensions



### NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

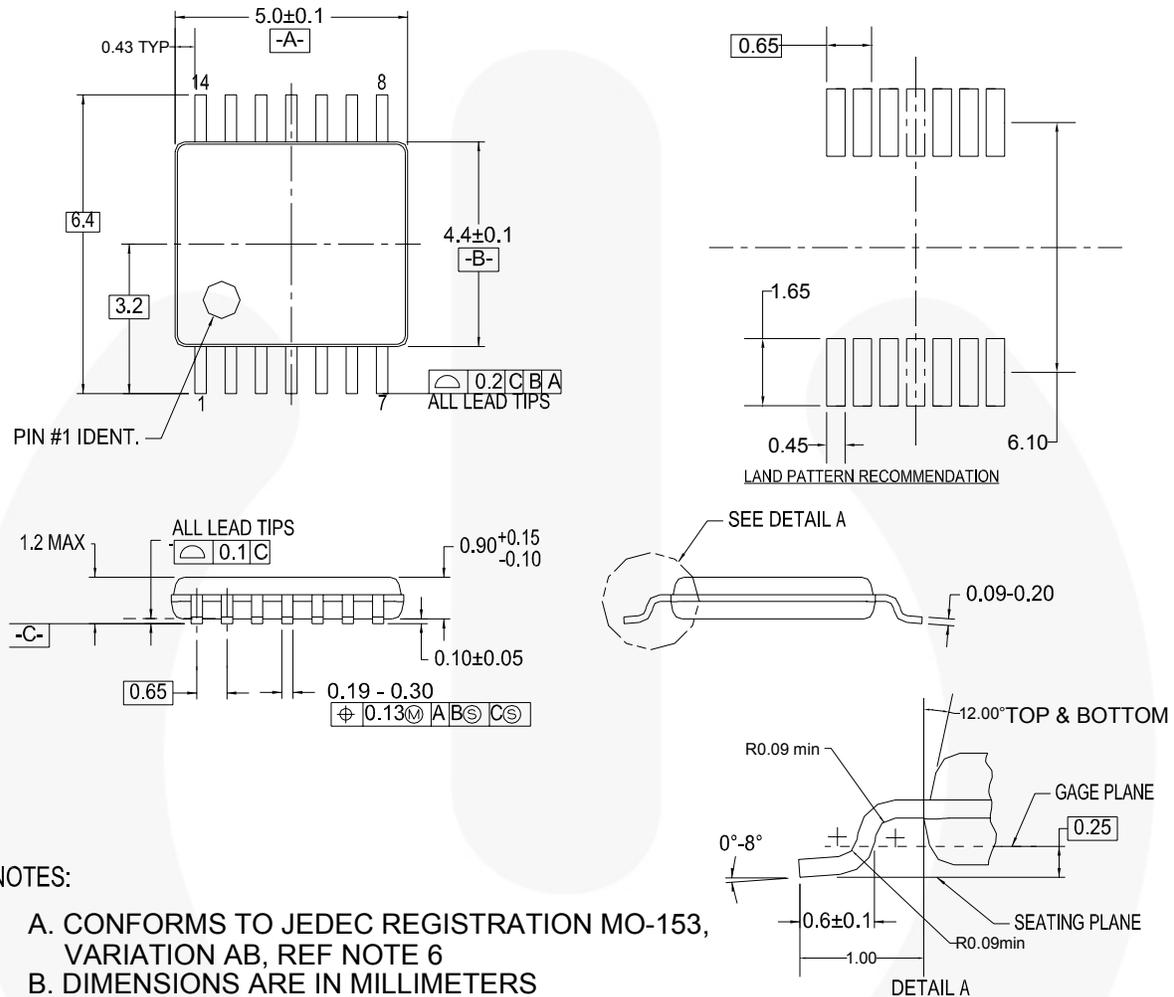
MLP14ArevA

**Figure 17. 14-Terminal Depopulated Very Thin Quad Flat-Pack, No leads (DQFN)**

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## Physical Dimensions



**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 18. 14-Lead Thin Shrink Small Outline Package (TSSOP)**

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| Current Transfer Logic™   | GTO™  |  | TinyPower™  |
| EcoSPARK®   | IntelliMAX™   | Saving our world, 1mW/W/kW at a time™   | TinyPWM™  |
| EfficientMax™   | ISOPLANAR™  | SmartMax™   | TinyWire™   |
| EZSWITCH™   | MegaBuck™   | SMART START™  | TriFault Detect™  |
|  | MICROCOUPLER™   | SPM®  | TRUECURRENT™  |
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| Fairchild Semiconductor®  | MillerDrive™  | SuperSOT™.3   | UHC®  |
| FACT Quiet Series™  | MotionMax™  | SuperSOT™.6   | Ultra FRFET™  |
| FACT®   | Motion-SPM™   | SuperSOT™.8   | UniFET™   |
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| FastvCore™  | OPTOPLANAR®   | SyncFET™  | VisualMax™  |
| FETBench™   |  | Sync-Lock™  | XST™  |
| FlashWriter®  | PDP SPM™  |  |   |
|   | Power-SPM™  |   |   |

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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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| Advance Information      | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.   |
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| No Identification Needed | Full Production       | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.   |
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