

# FSAL200 — Wide Bandwidth Quad 2:1 Analog Multiplexer / De-multiplexer Switch

## Features

- Typical 6Ω Switch Connection Between Two Ports
- Minimal Propagation Delay Through the Switch
- Low I<sub>CC</sub>
- Zero Bounce in Flow-Through Mode
- Control Inputs Compatible with TTL Level
- Rail-to-Rail Signal Handling
- Route Communications Signals Include:
  - 10/100 Ethernet
  - 100VG—AnyLAN
  - ATM25
  - SONET OC1 51.8Mbps
  - USB1.1
  - T1/E1
  - Token Ring 4/16Mbps

## Description

The Fairchild Switch FSAL200 is a rail-to-rail quad 2:1 high-speed CMOS TTL-compatible analog multiplexer / de-multiplexer switch. The low on resistance of the switch allows inputs to be connected to outputs without adding propagation delay or generating additional ground bounce noise.

When OE is low, the select pin connects the A Port to the selected B Port output. When OE is high, the switch is open and a high-impedance state exists between the two ports.

## Ordering Information

| Part Number | Package Description                                                        | Packing Method |
|-------------|----------------------------------------------------------------------------|----------------|
| FSAL200MTC  | 16-Lead Thin Shrink Small Outline Package(TSSOP), JEDEC MO-153, 4.4mm Wide | Rails          |
| FSAL200MTCX | 16-Lead Thin Shrink Small Outline Package(TSSOP), JEDEC MO-153, 4.4mm Wide | Tape and Reel  |
| FSAL200QSC  | 16-Lead Quarter Size Outline Package (QSOP), JEDEC MO-137, 0.150" Wide     | Rails          |
| FSAL200QSCX | 16-Lead Quarter Size Outline Package (QSOP), JEDEC MO-137, 0.150" Wide     | Tape and Reel  |



All packages are Pb-free per JEDEC standard J-SDD-020B.

## Pin Configurations

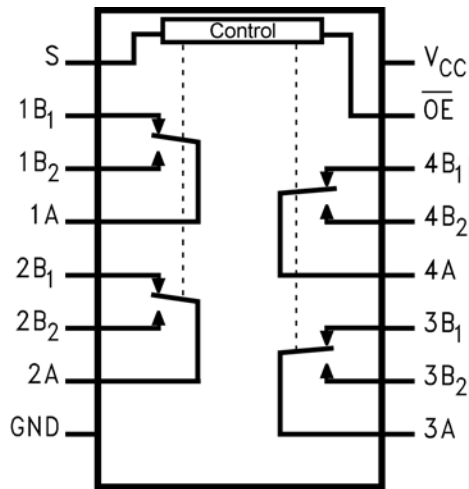


Figure 1. Analog Symbol

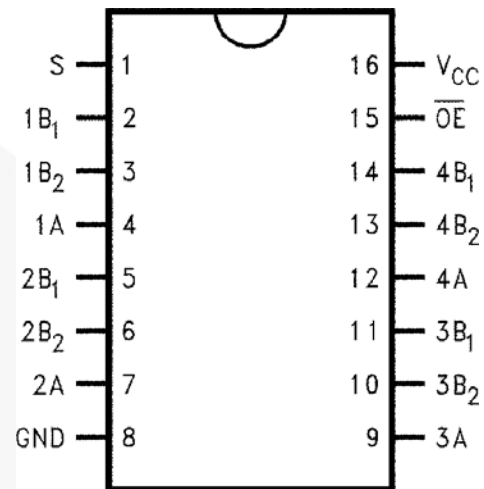


Figure 2. Connection Diagram

| Control Input(s) | $\overline{\text{OE}}$ | Function     |
|------------------|------------------------|--------------|
| X                | High                   | Disconnected |
| Low              | Low                    | A=B1         |
| High             | Low                    | A=B2         |

## Pin Descriptions

| Pin Names              | Function      |
|------------------------|---------------|
| $\overline{\text{OE}}$ | Switch Enable |
| S                      | Select Input  |
| A, B1, B2              | Data Ports    |

## 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 | 7.0  | V    |
| $V_{SW}$         | DC Switch Voltage <sup>(1)</sup>                     | -0.5 | 0.5  | V    |
| $V_{IN}$         | DC Input Voltage <sup>(1)</sup>                      | -0.5 | 7.0  | V    |
| $I_{IK}$         | DC Input Diode Current at ( $I_{IK}$ ) $V_{IN} < 0V$ |      | -50  | mA   |
| $I_{OUT}$        | DC Output Current                                    |      | 120  | mA   |
| $I_{CC}/I_{GND}$ | DC $V_{CC}$ or Ground Current                        |      | ±100 | mA   |
| $P_D$            | Power Dissipation at 85°C                            |      | 0.5  | W    |
| $T_{STG}$        | Storage Temperature Range                            | -65  | +150 | °C   |
| $T_A$            | Ambient Temperature with Power Applied               | -40  | +85  | °C   |

**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.     | Unit |
|---------------|--------------------------------------|----------------------------------|----------|------|
| $V_{CC}$      | Supply Voltage                       | 3.0                              | 5.5      | V    |
| $V_{IN}$      | Control Input Voltage <sup>(2)</sup> | 0                                | $V_{CC}$ | V    |
| $V_{SW}$      | Switch Input Voltage                 |                                  | $V_{CC}$ | V    |
| $V_{OUT}$     | Output Voltage                       |                                  | $V_{CC}$ | V    |
| $T_A$         | Operating Temperature                | -40                              | +85      | °C   |
| $t_r, t_f$    | Input Rise and Fall Time             | Control Input $V_{CC}=2.3V-3.6V$ | 0        | ns/V |
|               |                                      | Control Input $V_{CC}=4.5V-5.5V$ | 0        |      |
| $\theta_{JA}$ | Thermal Resistance in Still Air      |                                  |          | °C/W |

**Note:**

2. Control input must be held HIGH or LOW and it must not float.

## DC Electrical Characteristics

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 |      |                 | Units |
|-----------------------|-----------------------------------------------------------|--------------------------------------------------------------|---------------------|--------------------------------|------|-----------------|-------|
|                       |                                                           |                                                              |                     | Min.                           | Typ. | Max.            |       |
| V <sub>IH</sub>       | Input Voltage High                                        |                                                              | 4.5 to 5.5          | 2.0                            |      |                 | V     |
|                       |                                                           |                                                              | 3.0 to 3.6          | 2.0                            |      |                 |       |
| V <sub>IL</sub>       | Input Voltage Low                                         |                                                              | 4.5 to 5.5          | -0.5                           |      | 0.8             | V     |
|                       |                                                           |                                                              | 3.0 to 3.6          | -0.5                           |      | 0.8             |       |
| I <sub>OZ</sub>       | Off State Leakage Current                                 | 0 ≤ V <sub>IN</sub> ≤ 5.5V                                   | 0 to 5.5            |                                |      | 100             | μA    |
| R <sub>ON</sub>       | Switch On Resistance <sup>(3)</sup>                       | I <sub>ON</sub> =10 -30mA                                    | 4.5 to 5.5          |                                | 6    | 12              | Ω     |
|                       |                                                           | I <sub>ON</sub> =10 -30mA                                    | 3.0 to 3.6          |                                | 15   | 22              |       |
| I <sub>IN</sub>       | Control Input Leakage                                     | V <sub>IN</sub> =V <sub>CC</sub> or GND                      | 5.5                 |                                |      | ±1              | μA    |
|                       |                                                           | V <sub>IN</sub> =V <sub>CC</sub> or GND                      | 3.6                 |                                |      | ±1              |       |
| I <sub>CC</sub>       | Quiescent Supply Current, All Channels Off                | V <sub>IN</sub> =V <sub>CC</sub> or GND, I <sub>OUT</sub> =0 | 5.5                 |                                |      | 1               | μA    |
|                       | Analog Signal Range                                       |                                                              | V <sub>CC</sub>     | 0                              |      | V <sub>CC</sub> | V     |
| ΔR <sub>ON</sub>      | On Resistance Matching Between Channels <sup>(3)(4)</sup> | I <sub>A</sub> =-30 mA, V <sub>BN</sub> =3.15                | 4.5 to 5.5          |                                | 0.4  | 2.0             | Ω     |
|                       |                                                           | I <sub>A</sub> =-10 mA, V <sub>BN</sub> =2.1                 | 3.0 to 3.6          |                                | 1.0  | 3.0             |       |
| I <sub>O</sub>        | Output Current                                            | B <sub>n</sub> , B <sub>n</sub> , S-0V to 5V                 | 4.5 to 5.5          | 100                            |      |                 | mA    |
|                       |                                                           |                                                              | 3.0 to 3.6          | 80                             |      |                 |       |
| R <sub>FLAT(ON)</sub> | On Resistance Flatness <sup>(3)(5)</sup>                  | A <sub>1</sub> , B <sub>1</sub> , B <sub>2</sub> =0V to 5V   | 4.5 to 5.5          |                                | 3    |                 | Ω     |
|                       |                                                           | A <sub>1</sub> , B <sub>1</sub> , B <sub>2</sub> =0V to 5V   | 3.0 to 3.6          |                                | 7    |                 |       |

### Notes:

- Measured by the voltage drop between the A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B ports).
- ΔR<sub>ON</sub> = R<sub>ON</sub> maximum – R<sub>ON</sub> minimum measured at identical V<sub>CC</sub>, temperature, and voltage levels.
- 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 25°C unless otherwise specified.

| Symbol           | Parameter           | Conditions                                                         | V <sub>CC</sub> (V) | Min. | Typ. | Max. | Units | Figure   |
|------------------|---------------------|--------------------------------------------------------------------|---------------------|------|------|------|-------|----------|
| t <sub>ON</sub>  | Turn-On Time        | V <sub>Bn</sub> =3V                                                | 4.5 to 5.5          |      | 10   | 20   | ns    | Figure 3 |
|                  |                     | V <sub>Bn</sub> =1.5V                                              | 3.0 to 3.6          |      | 28   | 40   |       | Figure 4 |
| t <sub>OFF</sub> | Turn-Off Time       | V <sub>Bn</sub> =3V                                                | 4.5 to 5.5          |      | 5    | 10   | ns    | Figure 3 |
|                  |                     | V <sub>Bn</sub> =1.5V                                              | 3.0 to 3.6          |      | 4    | 20   |       | Figure 4 |
| Q                | Charge Injection    | C <sub>L</sub> =0.1nF, V <sub>GEN</sub> =0<br>R <sub>GEN</sub> =0Ω | 5.0                 |      | 7    |      | pC    | Figure 5 |
|                  |                     |                                                                    | 3.3                 |      | 3    |      |       |          |
| OIRR             | Off Isolation       | R <sub>L</sub> =100Ω, f=30MHz                                      | 4.5 to 5.5          |      | -55  |      | dB    | Figure 6 |
|                  |                     | R <sub>L</sub> =50Ω, f=1MHz                                        | 3.0 to 3.6          |      | -75  |      |       |          |
| Xtalk            | Crosstalk           | R <sub>L</sub> =100Ω, f=30MHz                                      | 4.5 to 5.5          |      | -70  |      | dB    | Figure 7 |
|                  |                     | R <sub>L</sub> =50Ω, f=1MHz                                        | 3.0 to 3.6          |      | -75  |      |       |          |
| BW               | -3db Bandwidth      | R <sub>L</sub> =100Ω                                               | 4.5 to 5.5          |      | 137  |      | MHz   | Figure 9 |
|                  |                     | R <sub>L</sub> =50Ω                                                | 3.0 to 3.6          |      | 110  |      |       |          |
| D                | ΔR <sub>ON/RL</sub> | R <sub>L</sub> =100Ω                                               | 4.5 to 5.5          |      | 2    |      | %     | Figure 9 |
|                  |                     |                                                                    | 3.0 to 3.6          |      | 3    |      |       |          |

### Notes:

6. Guaranteed by design.
7. Off Isolation = 20 log<sub>10</sub> [V<sub>A</sub> / V<sub>Bn</sub>].

## Capacitance

T<sub>A</sub>=+25°C, f=1MHz. Capacitance is characterized, but not tested in production.

| Symbol            | Parameter                     | Conditions                     | Typ. | Units | Figure    |
|-------------------|-------------------------------|--------------------------------|------|-------|-----------|
| C <sub>IN</sub>   | Control Pin Input Capacitance | V <sub>CC</sub> =0V            | 2.3  | pF    |           |
| C <sub>IO-B</sub> | B Port Off Capacitance        | V <sub>CC</sub> =5.0V and 3.0V | 8    | pF    | Figure 10 |
|                   | A Port Off Capacitance        | V <sub>CC</sub> =5.0V and 3.0V | 13   |       | Figure 10 |
| C <sub>ON</sub>   | Channel On Capacitance        | V <sub>CC</sub> =5.0V and 3.0V | 15   | pF    | Figure 7  |

## AC Loadings and Waveforms

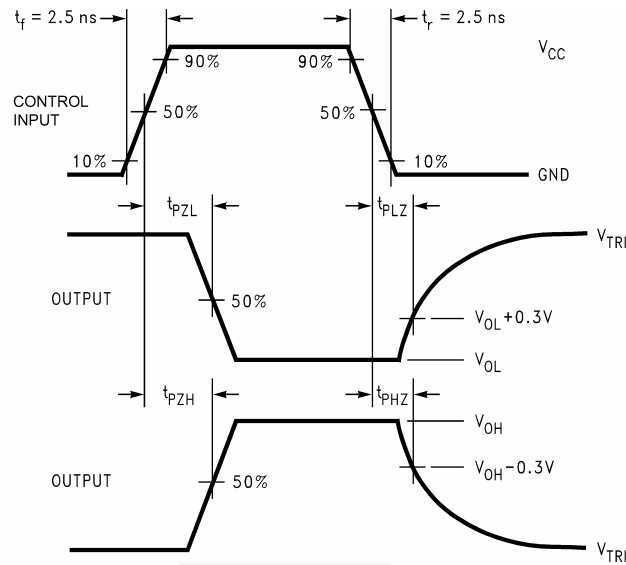


Figure 3. AC Waveforms

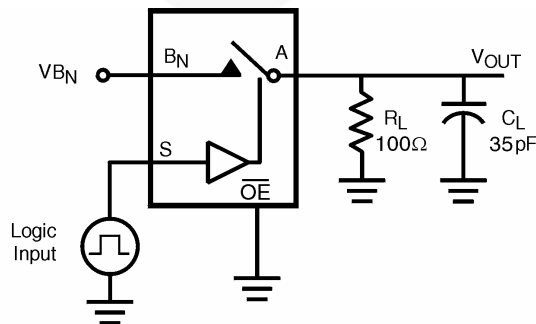


Figure 4.  $t_{on}$ ,  $t_{off}$  Loading

## AC Loadings and Waveforms (Continued)

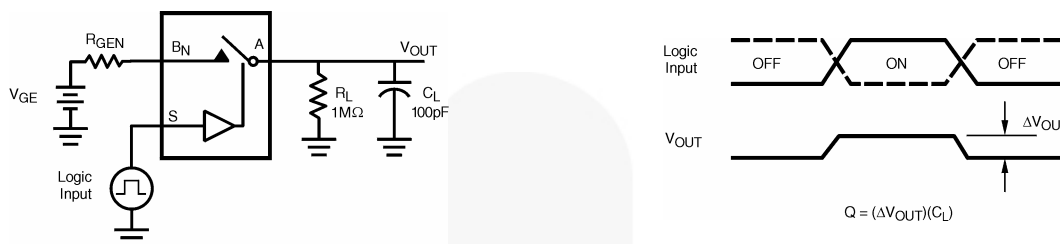


Figure 5. Charge Injection Test

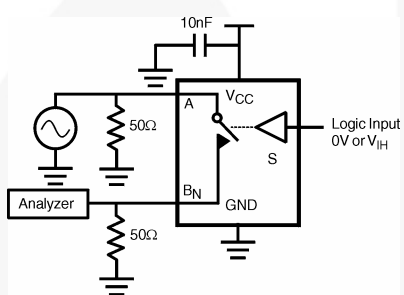


Figure 6. Off Isolation

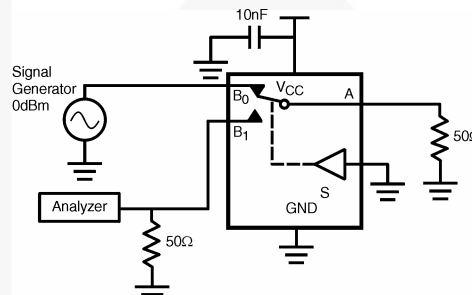


Figure 7. Channel On Capacitance

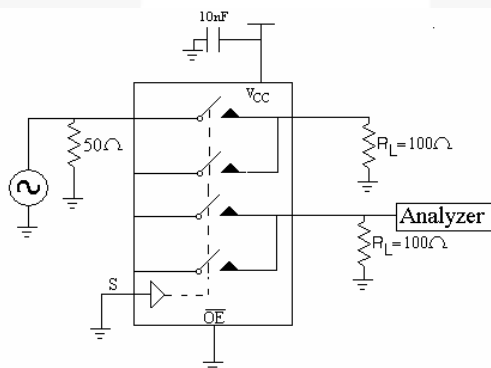


Figure 8. Crosstalk

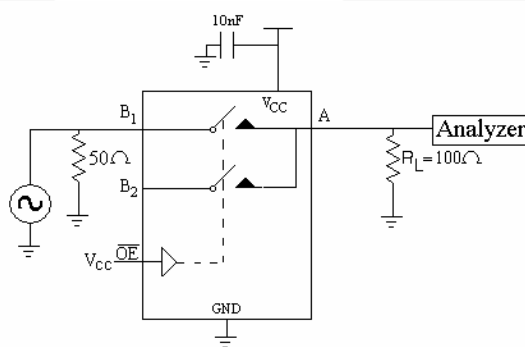


Figure 9. Bandwidth

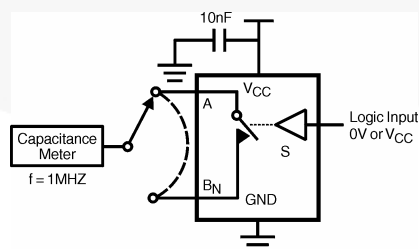
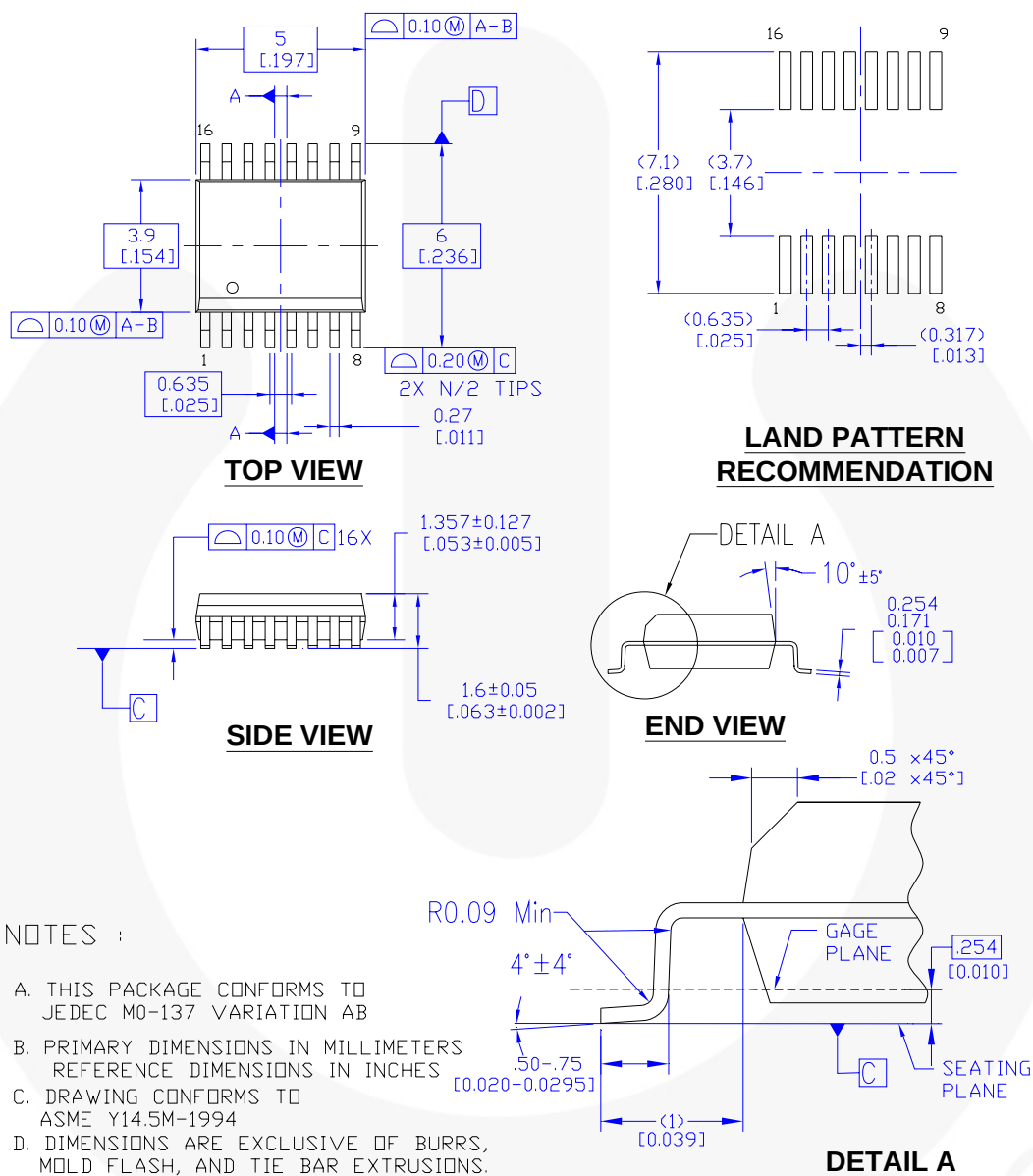


Figure 10. Channel Off Capacitance

## Physical Dimensions



MQA16AREVB

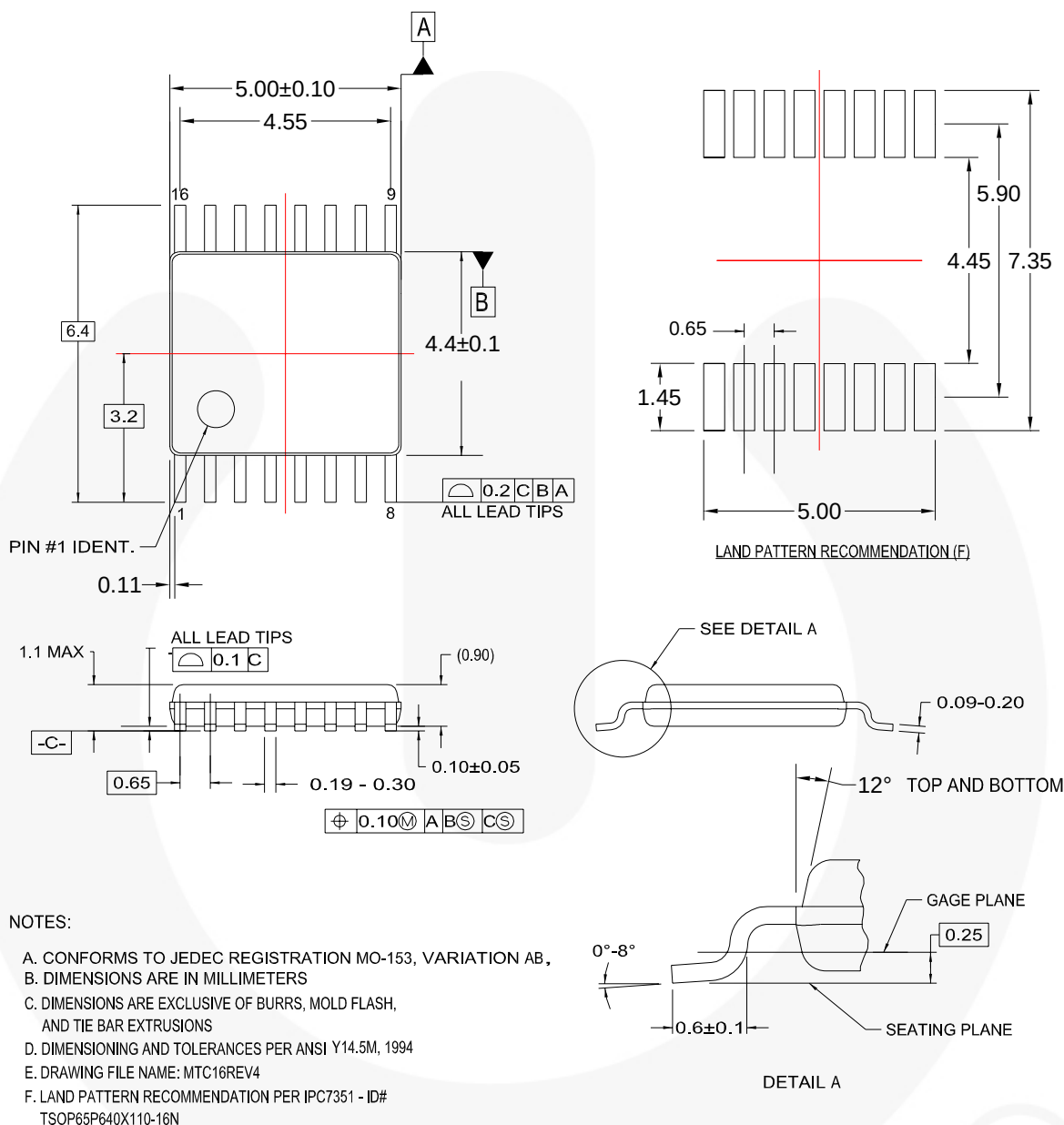
**Figure 11. 16-lead, Quarter Size Outline Package (QSOP), JEDEC MO-137. 0.150" wide**

*Click here for tape and reel specifications, available at:*

[http://www.fairchildsemi.com/products/analog/pdf/qsop16\\_tr.pdf](http://www.fairchildsemi.com/products/analog/pdf/qsop16_tr.pdf)



# Physical Dimensions (Continued)



MTC16rev4

**Figure 12. 16-lead, Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm wide**

[Click here for tape and reel specifications, available at:](http://www.fairchildsemi.com/products/analog/pdf/tssop16_tr.pdf)

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