

## FSAL200

### Wide Bandwidth Quad 2:1 Analog Multiplexer/Demultiplexer Switch

#### General Description

The Fairchild Switch FSAL200 is a rail-to-rail quad 2:1 high-speed CMOS TTL-compatible analog multiplexer/demultiplexer 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  $\overline{OE}$  is LOW, the select pin connects the A Port to the selected B Port output. When  $\overline{OE}$  is HIGH, the switch is OPEN and a high-impedance state exists between the two ports.

#### Features

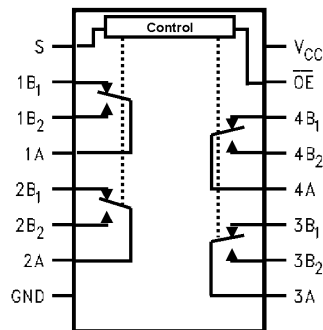
- Typical 6Ω switch connection between two ports
- Minimal propagation delay through the switch
- Low  $I_{CC}$
- Zero bounce in flow-through mode
- Control inputs compatible with TTL level
- Rail-to-rail signal handling
- Low insertion loss
- Route communications signals including:
  - 10/100 Ethernet
  - USB1.1
  - 100VG-AnyLAN
  - Token Ring 4/16 Mbps
  - ATM25
  - SONET OCI 51.8 Mbps
  - T1/E1

#### Ordering Code:

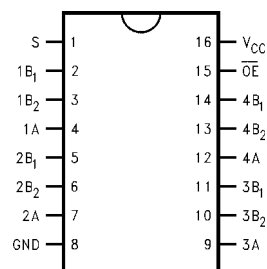
| Order Number | Package Number | Package Description                                                    |
|--------------|----------------|------------------------------------------------------------------------|
| FSAL200QSC   | MQA16          | 16-Lead Quarter Size Outline Package (QSOP), JEDEC MO-137, 0.150" Wide |

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

#### Analog Symbol



#### Connection Diagram



#### Truth Table

| S | $\overline{OE}$ | Function           |
|---|-----------------|--------------------|
| X | H               | Disconnect         |
| L | L               | A = B <sub>1</sub> |
| H | L               | A = B <sub>2</sub> |

#### Pin Descriptions

| Pin Name                           | Description   |
|------------------------------------|---------------|
| $\overline{OE}$                    | Switch Enable |
| S                                  | Select Input  |
| A, B <sub>1</sub> , B <sub>2</sub> | Data Port     |

**Absolute Maximum Ratings**(Note 1)

|                                                    |                         |
|----------------------------------------------------|-------------------------|
| Supply Voltage ( $V_{CC}$ )                        | -0.5V to +7.0V          |
| DC Switch Voltage ( $V_S$ ) (Note 2)               | -0.5V to $V_{CC}$ +0.5V |
| DC Input Voltage ( $V_{IN}$ ) (Note 2)             | -0.5V to +7.0V          |
| DC Input Diode Current ( $I_{IK}$ )                |                         |
| @ ( $I_{IK}$ ) $V_{IN} < 0V$                       | -50 mA                  |
| DC Output Current ( $I_{OUT}$ )                    | 120 mA                  |
| DC $V_{CC}$ or Ground Current ( $I_{CC}/I_{GND}$ ) | $\pm 100$ mA            |
| Storage Temperature Range ( $T_{STG}$ )            | -65°C to +150°C         |
| Power Dissipation ( $P_D$ ) @ +85°C                | 0.5 W                   |
| Ambient Temperature with Power Applied             | -40°C to +85°C          |

**Recommended Operating Conditions** (Note 3)

|                                         |                   |
|-----------------------------------------|-------------------|
| Supply Voltage Operating ( $V_{CC}$ )   | 3.0V to 5.5V      |
| Control Input Voltage ( $V_{IN}$ )      | 0V to $V_{CC}$    |
| Switch Input Voltage ( $V_{IN}$ )       | 0V to $V_{CC}$    |
| Output Voltage ( $V_{OUT}$ )            | 0V to $V_{CC}$    |
| Operating Temperature ( $T_A$ )         | -40°C to +85°C    |
| Input Rise and Fall Time ( $t_r, t_f$ ) |                   |
| Control Input $V_{CC} = 2.3V - 3.6V$    | 0 ns/V to 10 ns/V |
| Control Input $V_{CC} = 4.5V - 5.5V$    | 0 ns/V to 5 ns/V  |
| Thermal Resistance ( $\theta_{JA}$ )    | 350°C/W           |

**Note 1:** Absolute maximum ratings are DC values beyond which the device may be damaged or have its useful life impaired. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

**Note 2:** The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

**Note 3:** Control input must be held HIGH or LOW, it must not float.

**DC Electrical Characteristics**

| Symbol          | Parameter                                                | $V_{CC}$<br>(V)        | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |     |            | Units    | Conditions                                |
|-----------------|----------------------------------------------------------|------------------------|-------------------------------------------------|-----|------------|----------|-------------------------------------------|
|                 |                                                          |                        | Min                                             | Typ | Max        |          |                                           |
| $V_{IH}$        | HIGH Level Input Voltage                                 | 4.5 - 5.5<br>3.0 - 3.6 | 2.0<br>2.0                                      |     |            | V        |                                           |
| $V_{IL}$        | LOW Level Input Voltage                                  | 4.5 - 5.5<br>3.0 - 3.6 | -0.5<br>-0.5                                    |     | 0.8<br>0.8 | V        |                                           |
| $I_{OZ}$        | OFF State Leakage Current                                | 0 - 5.5                |                                                 |     | 100        | nA       | $0 \leq V_{IN} \leq 5.5V$                 |
| $R_{ON}$        | Switch On Resistance<br>(Note 4)                         | 4.5 - 5.5              |                                                 | 6   | 12         | $\Omega$ | $I_{ON} = 10 - 30$ mA                     |
|                 |                                                          | 3.0 - 3.6              |                                                 | 15  | 22         |          | $I_{ON} = 10 - 30$ mA                     |
| $I_{IN}$        | Control Input Leakage Current                            | 5.5                    |                                                 |     | $\pm 1$    | $\mu A$  | $V_{IN} = V_{CC}$ or GND                  |
|                 |                                                          | 3.6                    |                                                 |     | $\pm 1$    |          | $V_{IN} = V_{CC}$ or GND                  |
| $I_{CC}$        | Quiescent Supply Current<br>All Channels ON or OFF       | 5.5                    |                                                 |     | 1          | $\mu A$  | $V_{IN} = V_{CC}$ or GND<br>$I_{OUT} = 0$ |
|                 | Analog Signal Range                                      | $V_{CC}$               | 0                                               |     | $V_{CC}$   | V        |                                           |
| $\Delta R_{ON}$ | On Resistance Match Between<br>Channels (Note 4)(Note 5) | 4.5 - 5.5              |                                                 | 0.4 | 2          | $\Omega$ | $I_A = -30$ mA, $V_{Bn} = 3.15$           |
|                 |                                                          | 3.0 - 3.6              |                                                 | 1   | 3          |          | $I_A = -10$ mA, $V_{Bn} = 2.1$            |
| $I_O$           | Output Current                                           | 4.5 - 5.5              | 100                                             |     |            | mA       | $B_n, B_n, S = 0V$ to 5V                  |
|                 |                                                          | 3.0 - 3.6              | 80                                              |     |            |          |                                           |
| $R_{flat}$      | On Resistance Flatness<br>(Note 4)(Note 6)               | 4.5 - 5.5              |                                                 | 3   |            | $\Omega$ | $A, B_1, B_2 = 0V$ to 5V                  |
|                 |                                                          | 3.0 - 3.6              |                                                 | 7   |            |          | $A, B_1, B_2 = 0V$ to 5V                  |

**Note 4:** Measured by the voltage drop between 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).

**Note 5:**  $\Delta R_{ON} = R_{ON \text{ max}} - R_{ON \text{ min}}$  measured at identical  $V_{CC}$ , temperature and voltage levels.

**Note 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                                                                                                   |                                            |                        |                                 |        |     |       |                                                                          |               |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------|---------------------------------|--------|-----|-------|--------------------------------------------------------------------------|---------------|
| Symbol                                                                                                                          | Parameter                                  | V <sub>CC</sub><br>(V) | T <sub>A</sub> = −40°C to +85°C |        |     | Units | Conditions                                                               | Figure Number |
|                                                                                                                                 |                                            |                        | Min                             | Typ    | Max |       |                                                                          |               |
| t <sub>ON</sub>                                                                                                                 | Turn On Time                               | 4.5 – 5.5              |                                 | 10     | 20  | ns    | VB <sub>n</sub> = 3V                                                     | Figures 1, 2  |
|                                                                                                                                 | S to Output                                | 3.0 - 3.6              |                                 | 28     | 40  | ns    | VB <sub>n</sub> = 1.5V                                                   |               |
| t <sub>OFF</sub>                                                                                                                | Turn Off Time                              | 4.5 – 5.5              |                                 | 5      | 10  | ns    | VB <sub>n</sub> = 3V                                                     | Figures 1, 2  |
|                                                                                                                                 | S to Output                                | 3.0 - 3.6              |                                 | 4      | 20  | ns    | VB <sub>n</sub> = 1.5V                                                   |               |
| Q                                                                                                                               | Charge Injection<br>(Note 7)               | 5.0<br>3.3             |                                 | 7<br>3 |     | pC    | C <sub>L</sub> = 0.1 nF, V <sub>GEN</sub> = 0V<br>R <sub>GEN</sub> = 0 Ω | Figure 3      |
| OIRR                                                                                                                            | Off Isolation<br>(Note 8)                  | 4.5 - 5.5              |                                 | −55    |     | dB    | R <sub>L</sub> = 100 Ω<br>f = 30 MHz                                     | Figure 4      |
|                                                                                                                                 |                                            | 3.0 - 3.6              |                                 | −75    |     | dB    | R <sub>L</sub> = 50 Ω<br>f = 1 MHz                                       | Figure 4      |
| Xtalk                                                                                                                           | Crosstalk                                  | 4.5 - 5.5              |                                 | −70    |     | dB    | R <sub>L</sub> = 100 Ω<br>f = 30 MHz                                     | Figure 5      |
|                                                                                                                                 |                                            | 3.0 - 3.6              |                                 | −75    |     | dB    | R <sub>L</sub> = 50 Ω<br>f = 1 MHz                                       | Figure 5      |
| BW                                                                                                                              | −3dB Bandwidth                             | 4.5 - 5.5              |                                 | 137    |     | MHz   | R <sub>L</sub> = 100 Ω                                                   | Figure 8      |
|                                                                                                                                 |                                            | 3.0 - 3.6              |                                 | 110    |     | MHz   | R <sub>L</sub> = 50 Ω                                                    | Figure 8      |
| D                                                                                                                               | ΔR <sub>ON/RL</sub> Distortion<br>(Note 7) | 4.5 - 5.5              |                                 | 2      |     | %     | R <sub>L</sub> = 100 Ω                                                   |               |
|                                                                                                                                 |                                            | 3.0 - 3.6              |                                 | 3      |     |       |                                                                          |               |
| <b>Note 7:</b> Guaranteed by Design.<br><b>Note 8:</b> Off Isolation = 20 log <sub>10</sub> [V <sub>A</sub> / V <sub>Bn</sub> ] |                                            |                        |                                 |        |     |       |                                                                          |               |
| <b>Capacitance</b> (Note 9)                                                                                                     |                                            |                        |                                 |        |     |       |                                                                          |               |
| Symbol                                                                                                                          | Parameter                                  |                        | Typ                             | Max    |     | Units | Conditions                                                               | Figure Number |
| C <sub>IN</sub>                                                                                                                 | Control Pin Input Capacitance              |                        | 2.3                             |        |     | pF    | V <sub>CC</sub> = 0V                                                     |               |
| C <sub>IO-B</sub>                                                                                                               | B Port Off Capacitance                     |                        | 12                              |        |     | pF    | V <sub>CC</sub> = 5.0V and 3.0V                                          | Figure 6      |
|                                                                                                                                 | A Port Off Capacitance                     |                        | 20                              |        |     | pF    | V <sub>CC</sub> = 5.0V and 3.0V                                          | Figure 7      |
| C <sub>ON</sub>                                                                                                                 | Channel On Capacitance                     |                        | 15                              |        |     | pF    | V <sub>CC</sub> = 5.0V and 3.0V                                          | Figure 7      |
| <b>Note 9:</b> T <sub>A</sub> = +25°C, f = 1 MHz, Capacitance is characterized but not tested in production.                    |                                            |                        |                                 |        |     |       |                                                                          |               |

## AC Loading and Waveforms

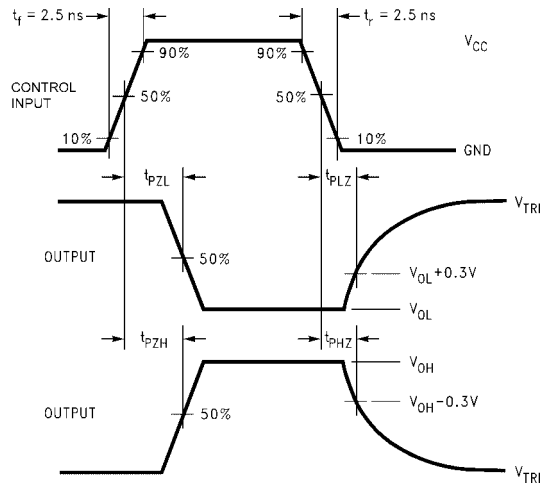


FIGURE 1. AC Waveforms

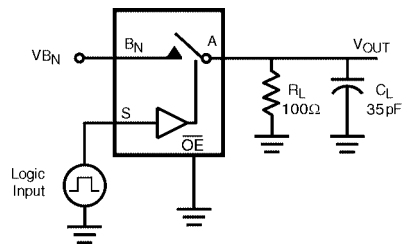


FIGURE 2.  $t_{ON}$ ,  $t_{OFF}$  Loading

# AC Loading and Waveforms (Continued)

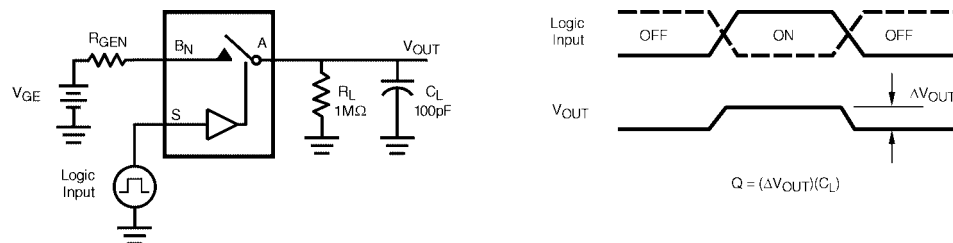


FIGURE 3. Charge Injection Test

Note:  $R_L = 50 \Omega$  when  $V_{CC} = 3.3 \pm 10\%$  for the Off Isolation, Crosstalk and Bandwidth test.

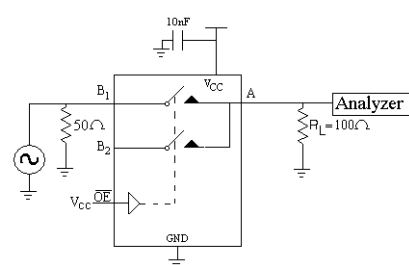


FIGURE 4. Off Isolation

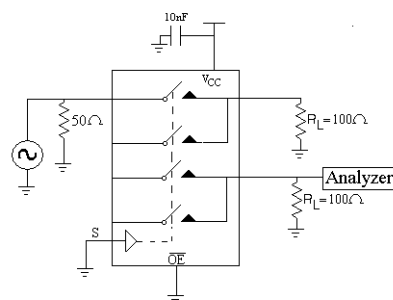


FIGURE 5. Crosstalk

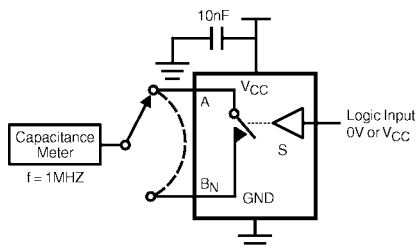


FIGURE 6. Channel Off Capacitance

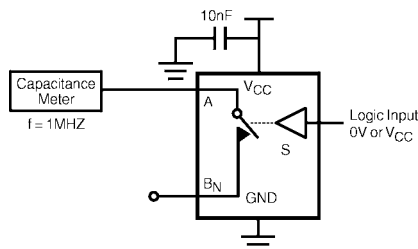


FIGURE 7. Channel On Capacitance

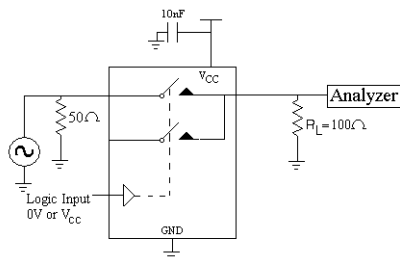
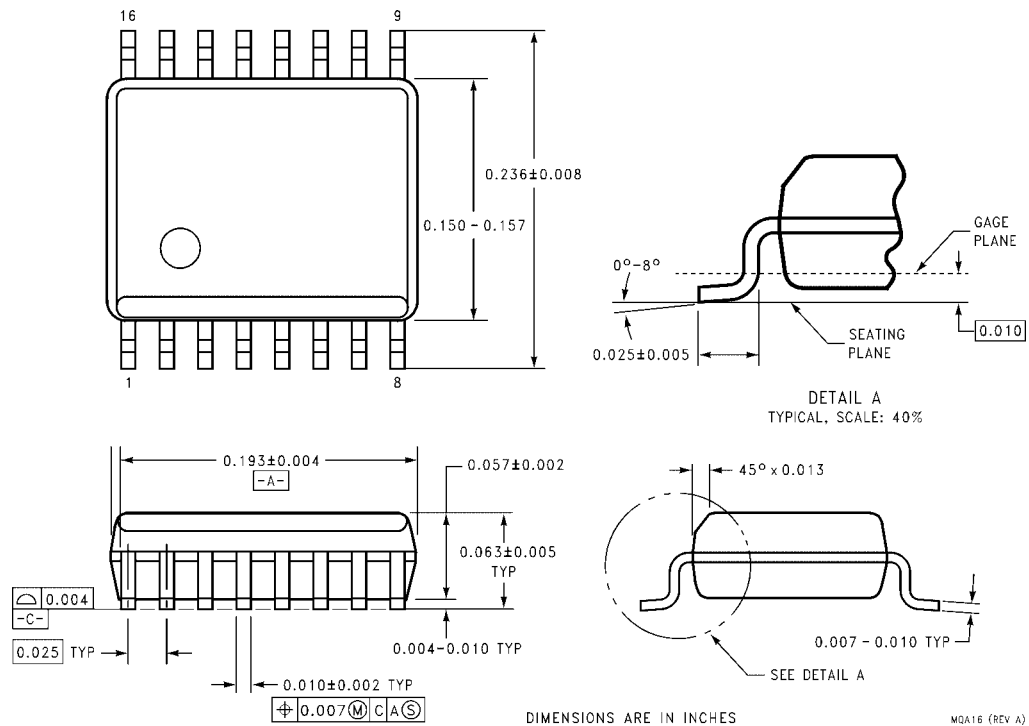


FIGURE 8. Bandwidth

## Physical Dimensions inches (millimeters) unless otherwise noted



**16-Lead Quarter Size Outline Package (QSOP), JEDEC MO-137, 0.150" Wide  
Package Number MQA16**

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