

FSA3259

Dual SP3T Analog Switch

General Description

The FSA3259 Dual Single Pole Triple Throw (SP3T) analog switch operates from a single 1.65V to 5.5V supply. It features a typical On Resistance (R_{ON}) of $<9\Omega$ at a +3.3V supply and 25°C. The device is fabricated with sub-micron CMOS technology to achieve fast switching speeds and is designed for break-before-make operation.

The FSA3259 also features wide-bandwidth ($>250\text{Mhz}$), high Off Isolation and low crosstalk. The dual SP3T configuration allows for maximum design flexibility.

Features

- $< 9\Omega$ typical On Resistance (R_{ON}) @ +3.3V
- Ideal for 3:1 Multiplex/Demultiplex cell phone applications
- Broad V_{CC} operating range: 1.65V to 5.5V
- 250MHz – 3dB Bandwidth
- Break-before-make enable circuitry

Applications

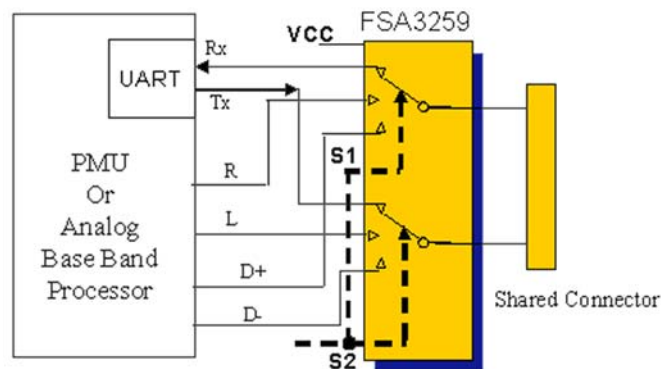
- Cell phone, PDA
- Video
- Multi-port USB

Ordering Code:

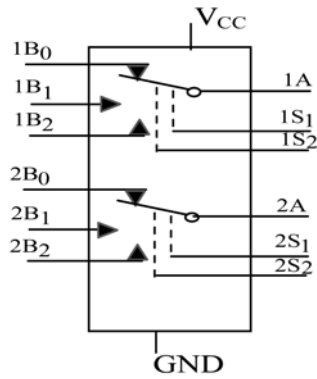
| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| FSA3259BQX | MLP016E | Pb-Free 16-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.5mm |

Pb-Free package per JEDEC J-STD-020B.
DQFN package available in Tape and Reel only.

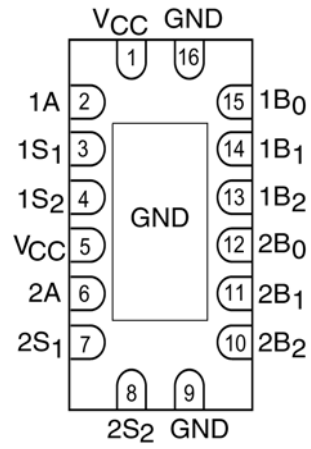
Application Diagram



Analog Symbol



Connection Diagram



(Top Through View)

Pin Descriptions

| Pin Name | Description |
|---|----------------|
| nA, nB ₀ , nB ₁ , nB ₂ | Data Ports |
| nS ₁ , nS ₂ | Control Inputs |

Truth Table

| Control Inputs (S ₁ , S ₂) | | Function |
|---|-----------------|---------------------------------|
| nS ₁ | nS ₂ | |
| L | L | No Connection |
| H | L | nB ₀ Connected to nA |
| L | H | nB ₁ Connected to nA |
| H | H | nB ₂ Connected to nA |

H = HIGH Logic Level

L = LOW Logic Level

Absolute Maximum Ratings(Note 1)

| | |
|---|---------------------------|
| Supply Voltage (V_{CC}) | -0.5V to +7.0V |
| Switch Voltage (Note 2) | -0.5V to $V_{CC} + 0.05V$ |
| Input Voltage (V_{IN}) (Note 2) | -0.5V to +7.0V |
| Input Diode Current (I_{IK}) | -50 mA |
| Switch Current | 100 mA |
| Peak Switch Current (Pulsed at 1mS) | |
| Duration, <10% Duty Cycle) | 150mA |
| Power Dissipation @ 85°C | TBD |
| Storage Temperature Range (T_{STG}) | -65°C to +150°C |
| Maximum Junction Temperature (T_J) | +150°C |
| Lead Temperature (T_L) | |
| (Soldering, 10 Seconds) | +260°C |
| ESD | |
| Human Body Model | 5000V |
| I/O to GND | 8000V |

Recommended Operating Conditions

(Note 3)

| | |
|---|----------------|
| Supply Voltage (V_{CC}) | 1.65V to 5.5V |
| Control Input Voltage (V_{IN}) (Note 3) | 0V to V_{CC} |
| Switch Input Voltage | 0V to V_{CC} |
| Operating Temperature | -40°C to 85°C |

Note 1: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum rating. The Recommended Operating Conditions tables will define the conditions for actual device operation.

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

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

DC Electrical Characteristics (All Typical values are @ 25°C unless otherwise specified)

| Symbol | Parameter | V_{CC} (V) | $T_A = +25^\circ\text{C}$ | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | Units | Conditions |
|--------------------------------|--|-----------------|---------------------------|------|---------------------|---|--|---------------|--|
| | | | Min | Typ | Max | Min | Max | | |
| V_{IH} | Input Voltage HIGH | 1.65 to 1.95 | $0.75 \cdot V_{CC}$ | | | $0.75 \cdot V_{CC}$ | | V | |
| | | 2.3 to 5.5 | $0.7 \cdot V_{CC}$ | | | $0.7 \cdot V_{CC}$ | | | |
| V_{IL} | Input Voltage LOW | 1.65 to 1.95 | | | $0.25 \cdot V_{CC}$ | $0.25 \cdot V_{CC}$ | V | | |
| | | 2.3 to 5.5 | | | $0.3 \cdot V_{CC}$ | $0.3 \cdot V_{CC}$ | | | |
| I_{IN} | Control Input Leakage | 0 to 5.5 | -0.1 | | 0.1 | -1.0 | 1.0 | μA | $V_{IN} = 0V \text{ to } 5.5V$ |
| $I_{NC(OFF)}$ $I_{NO(OFF)}$ | OFF-Leakage Current of Ports $nB_0, nB_1, nB_2,$ and nA | 1.65 to 5.5 | -0.1 | | 0.1 | -1.0 | 1.0 | μA | $0 < nA, nB_0, nB_1,$ $nB_2 < V_{CC}$ |
| R_{ON} | Switch On Resistance (Note 4) | 4.5 | | 5.0 | 7.0 | | 7.0 | Ω | $I_{OUT} = 30\text{mA}, V_{IN} = 0$ |
| | | | | 6.0 | 12.0 | | 12.0 | | $I_{OUT} = -30\text{mA}, V_{IN} = 2.4$ |
| | | | | 7.0 | 15.0 | | 15.0 | | $I_{OUT} = 30\text{mA}, V_{IN} = 4.5$ |
| | | 3.0 | | 6.5 | 9.0 | | 9.0 | | $I_{OUT} = 24\text{mA}, V_{IN} = 0$ |
| | | | | 9.0 | 20.0 | | 20.0 | | $I_{OUT} = -24\text{mA}, V_{IN} = 3.0$ |
| | | 2.3 | | 8.0 | 12.0 | | 12.0 | | $I_{OUT} = 8\text{mA}, V_{IN} = 0$ |
| | | | | 11.0 | 30.0 | | 30.0 | | $I_{OUT} = -8\text{mA}, V_{IN} = 2.3$ |
| | | 1.65 | | 10.0 | 20.0 | | 20.0 | | $I_{OUT} = 4\text{mA}, V_{IN} = 0$ |
| | | | 17.0 | 50.0 | | 50.0 | $I_{OUT} = -4\text{mA}, V_{IN} = 1.65$ | | |
| ΔR_{ON} | On Resistance Matching between Channels (Note 5) | 4.5 | | 0.15 | | | | Ω | $I_{OUT} = -30\text{mA}, nB_0, nB_1, nB_2 = 3.15V$ |
| | | 3.0 | | 0.22 | | | | | $I_{OUT} = -24\text{mA}, nB_0, nB_1, nB_2 = 2.1V$ |
| | | 2.3 | | 0.31 | | | | | $I_{OUT} = -8\text{mA}, nB_0, nB_1, nB_2 = 1.6V$ |
| | | 1.65 | | 0.62 | | | | | $I_{OUT} = -4\text{mA}, nB_0, nB_1, nB_2 = 1.15V$ |
| $R_{FLAT(ON)}$ | On Resistance Flatness (Note 6) | 5.0 | | 6.0 | | | | Ω | $I_{IA} = -30\text{mA}, 0 \leq nB_0, nB_1, nB_2 \leq V_{CC}$ |
| | | 3.3 | | 12.0 | | | | | $I_{IA} = -24\text{mA}, 0 \leq nB_0, nB_1, nB_2 \leq V_{CC}$ |
| | | 2.5 | | 40.0 | | | | | $I_{IA} = -8\text{mA}, 0 \leq nB_0, nB_1, nB_2 \leq V_{CC}$ |
| | | 1.8 | | 140 | | | | | $I_{IA} = -4\text{mA}, 0 \leq nB_0, nB_1, nB_2 \leq V_{CC}$ |
| I_{CC} | Quiescent Supply Current | 5.5 | | 1.0 | 20.0 | | 20.0 | μA | $V_{IN} = 0 \text{ or } V_{CC}, I_{OUT} = 0$ |

Note 4: On Resistance is determined by the voltage drop between A and B pins at the indicated current through the switch.

Note 5: $\Delta R_{ON} = R_{ONmax} - R_{ONmin}$ measured at identical V_{CC} , temperature and voltage.

Note 6: Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specific range of conditions.

AC Electrical Characteristics (All Typical value are @ 25°C unless otherwise specified)

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions | Figure Number |
|--|---|------------------------|------------------------|-------|------|---------------------------------|------|-------|--|---------------|
| | | | Min | Typ | Max | Min | Max | | | |
| t _{PLH} | Propagation Delay | 1.65 - 1.95 | | 2.0 | | | | ns | V _I = Open R _L = R _{L1} = 500Ω, C _L = 50pF | Figures 1, 2 |
| t _{PHL} | Bus-to-Bus | 2.3 - 2.7 | | 1.1 | | | | | | |
| | | 3.0 - 3.6 | | 0.7 | | | | | | |
| | | 4.5 - 5.5 | | 0.4 | | | | | | |
| t _{ON} (t _{PZL} , t _{PZH}) | Turn ON Time (nA to nB _n) | 1.65 - 1.95 | 5.0 | | 32.0 | 5.0 | 34.0 | ns | V _I = 2*V _{CC} for t _{PZL} V _I = 0 for t _{PZH} R _L = R _{L1} = 500Ω C _L = 50pF | Figures 1, 2 |
| | | 2.3 - 2.7 | 3.0 | | 15.0 | 3.0 | 16.5 | | | |
| | | 3.0 - 3.6 | 2.0 | | 9.5 | 2.0 | 11.0 | | | |
| | | 4.5 - 5.5 | 1.5 | | 6.5 | 1.5 | 7.0 | | | |
| t _{OFF} (t _{PLZ} , t _{PHZ}) | Turn OFF Time (nA to nB _n) | 1.65 - 1.95 | 3.0 | | 14.0 | 3.0 | 14.5 | ns | V _I = 2*V _{CC} for t _{PLZ} V _I = 0 for t _{PHZ} R _L = R _{L1} = 500Ω C _L = 50pF | Figures 1, 2 |
| | | 2.3 - 2.7 | 2.0 | | 7.2 | 2.0 | 7.8 | | | |
| | | 3.0 - 3.6 | 1.5 | | 5.1 | 1.5 | 5.5 | | | |
| | | 4.5 - 5.5 | 0.8 | | 3.7 | 0.8 | 4.0 | | | |
| t _{B-M} | Break-Before-Make Time | 1.65 - 5.5 | 0.5 | | | 0.5 | | ns | nB ₀ or nB ₁ = 1.5V, R _L = 50Ω, C _L = 35pF | Figure 3 |
| Q | Charge Injection | 5.0 | | 3.0 | | | | pC | C _L = 0.1 nF, V _{GEN} = 0V, R _{GEN} = 0Ω | Figure 4 |
| | | 3.3 | | 2.0 | | | | | | |
| OIRR | OFF-Isolation | 1.65 - 5.5 | | -58.0 | | | | dB | f = 10MHz, R _L = 50Ω | Figure 5 |
| Xtalk | Crosstalk | 1.65 - 5.5 | | -60.0 | | | | dB | f = 10MHz, R _L = 50Ω | Figure 6 |
| BW | -3dB Bandwidth | 1.65 - 5.5 | | 250 | | | | MHz | R _L = 50Ω | Figure 9 |
| THD | Total Harmonic Distortion | 5.0 | | 0.01 | | | | % | R _L = 600Ω, V _{IN} = 0.5V _{P,P} , f = 600Hz to 20kHz | |

Capacitance

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions |
|------------------|--|------------------------|------------------------|------|-----|---------------------------------|-----|-------|-------------------------|
| | | | Min | Typ | Max | Min | Max | | |
| C _{IN} | Control Pin (nS _n) Input Capacitance | 0 | | 2.0 | | | | pF | f = 1MHz (see Figure 7) |
| C _{OFF} | nB _n Port OFF Capacitance | 5.0 | | 3.6 | | | | pF | f = 1MHz (see Figure 7) |
| C _{ON} | nA Port ON Capacitance | 5.0 | | 14.5 | | | | pF | f = 1MHz (see Figure 8) |

AC Loading and Waveforms

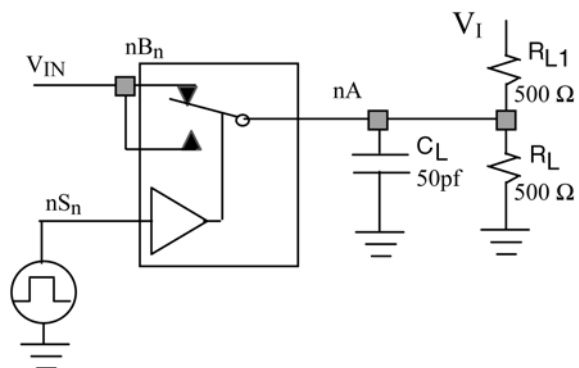


FIGURE 1. AC Test Circuit

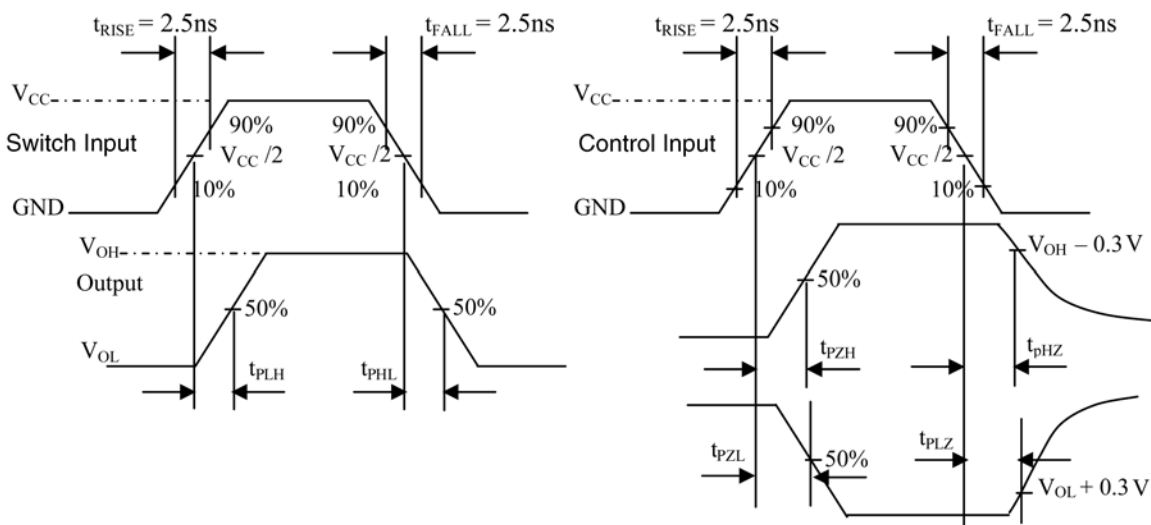


FIGURE 2. AC Waveforms and Measure Points

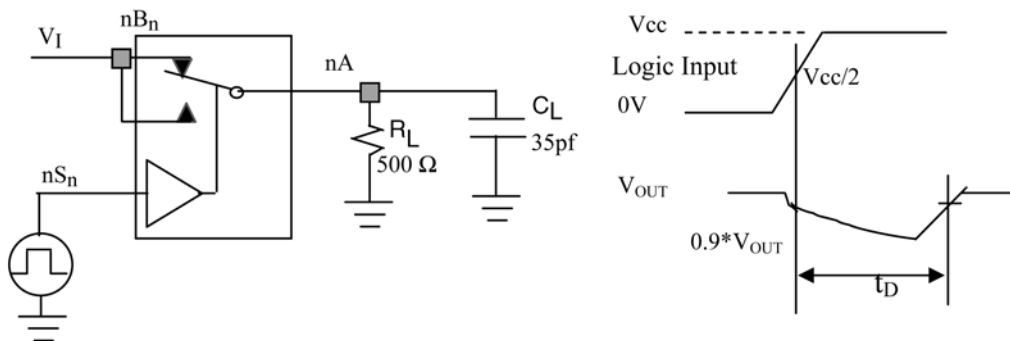


FIGURE 3. Break-Before-Make Interval Timing

AC Loading and Waveforms (continued)

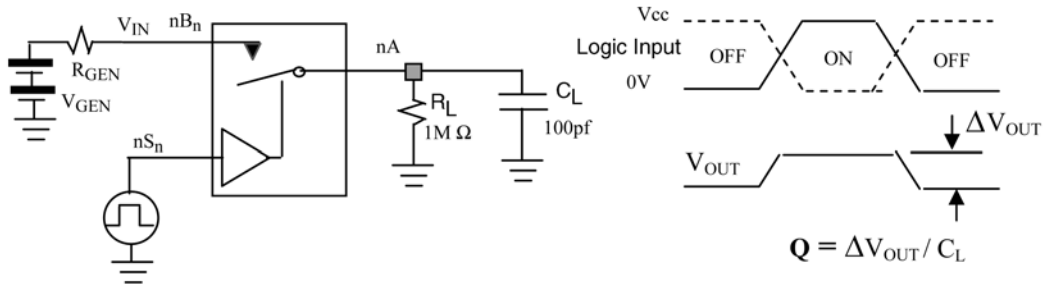


FIGURE 4. Charge Injection Testing

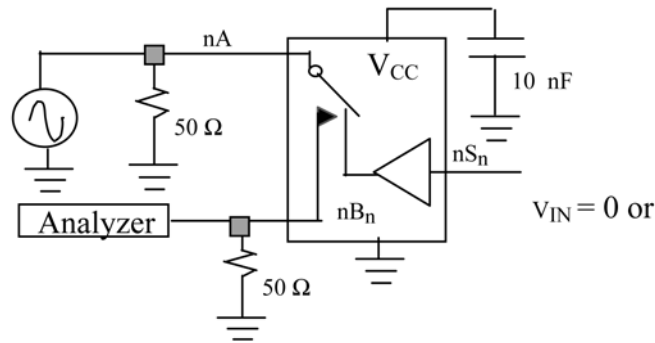


FIGURE 5. OFF Isolation

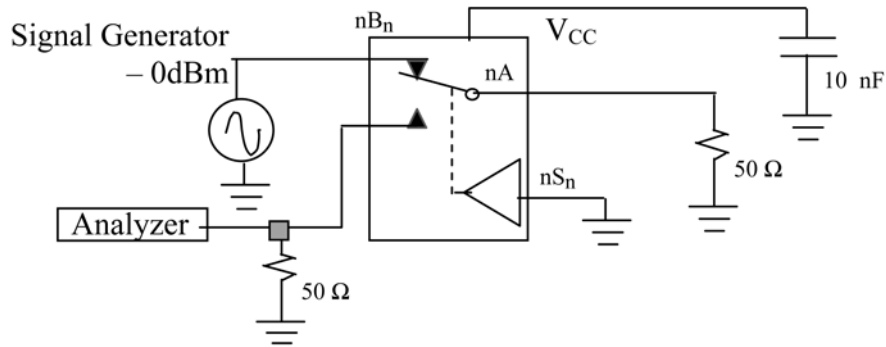


FIGURE 6. Crosstalk

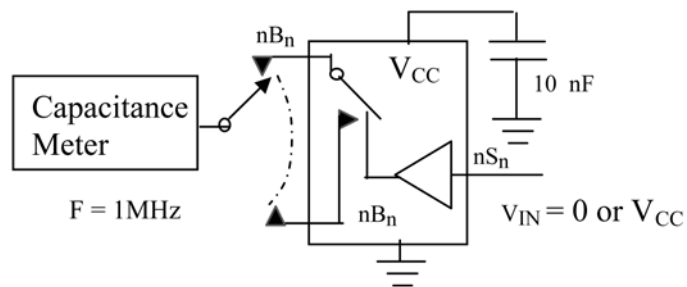


FIGURE 7. Channel OFF Capacitance

AC Loading and Waveforms (continued)

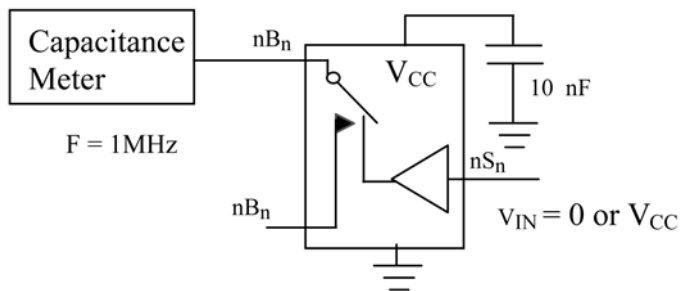


FIGURE 8. Channel ON Capacitance

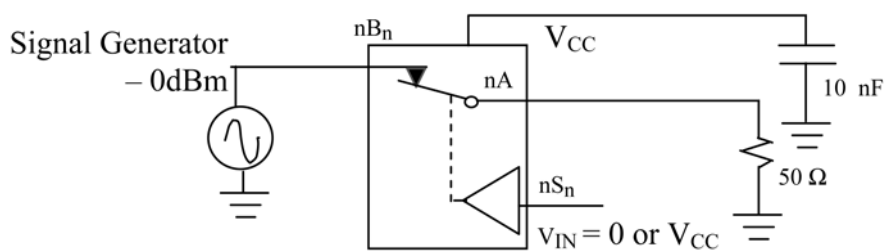


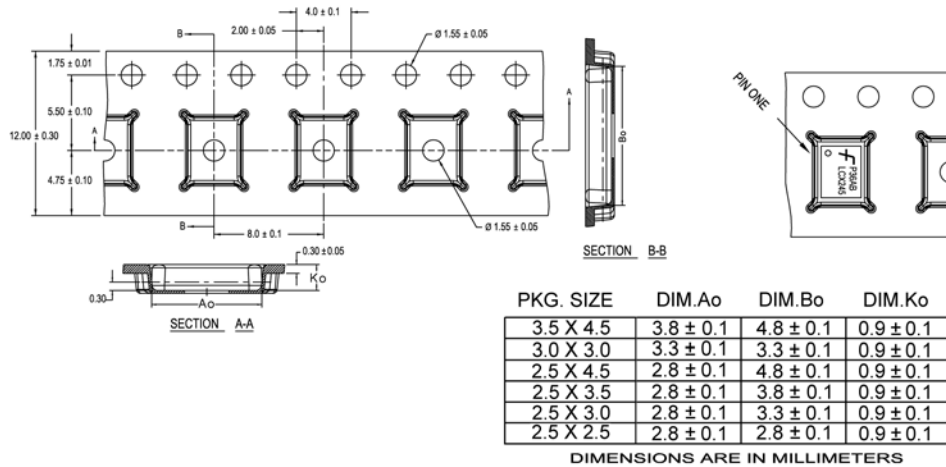
FIGURE 9. Bandwidth

Tape and Reel Specification

Tape Format for DQFN

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| BQX | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 2500/3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

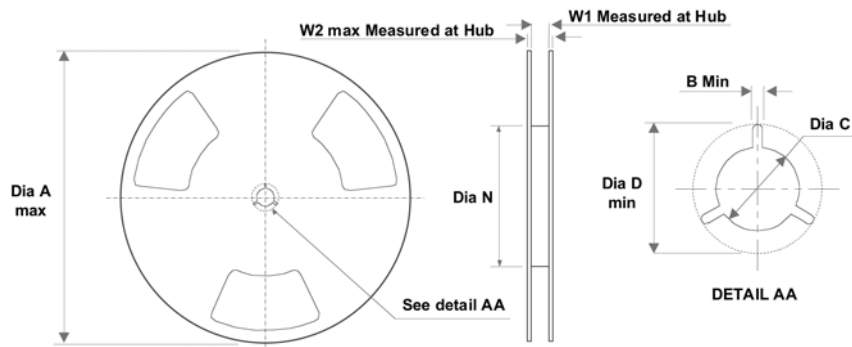
TAPE DIMENSIONS inches (millimeters)



NOTES: unless otherwise specified

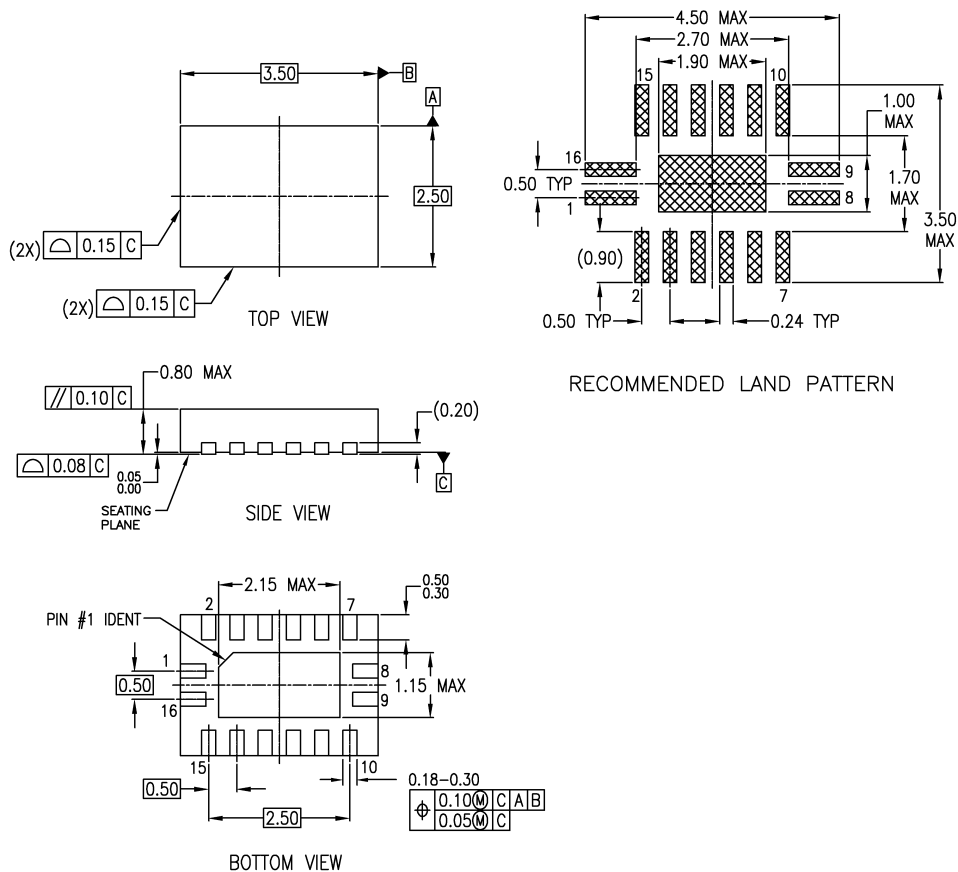
1. Cumulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is ±0.002[0.05] for these dimensions on all 12mm tapes.
5. Ao and Bo measured on a plane 0.120[0.30] above the bottom of the pocket.
6. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Dimension in inches rounded.

REEL DIMENSIONS inches (millimeters)



| Tape Size | A | B | C | D | N | W1 | W2 |
|-----------|---------------|-----------------|------------------|------------------|----------------|-----------------|-----------------|
| 12 mm | 13.0 (330) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 7.008 (178) | 0.488 (12.4) | 0.724 (18.4) |

Physical Dimensions inches (millimeters) unless otherwise noted



NOTES:

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

MLP016ErevA

**Pb-Free 16-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.5mm
Package Number MLP016E**

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provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is 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.

PRODUCT STATUS DEFINITIONS

Definition of terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|------------------------|---|
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