



SGM44600

4Ω, High Speed, Low Voltage Dual, DPDT Analog Switch

GENERAL DESCRIPTION

The SGM44600 is a dual, double-pole/double-throw (DPDT), TTL/CMOS compatible analog switch. It operates from a 1.8V to 5.5V single power supply.

The SGM44600 features high-speed, low on-resistance, low voltage and high bandwidth. The high performances make it very suitable for multiple applications, such as portable equipment, audio and video signal routing, etc. In addition, the SGM44600 can be used as a quad bidirectional 2-channel multiplexer/demultiplexer because it has four SPDT switches. Low power consumption is also one of the important reasons that make it a good choice.

The SGM44600 is available in Green TQFN-3×3-16L package. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- **Single Supply Voltage Range: 1.8V to 5.5V**
- **-3dB Bandwidth: 300MHz**
- **Low On-Resistance: 4Ω (TYP)**
- **Low On-Resistance Flatness**
- **High Off-Isolation: -75dB at 1MHz**
- **Low Crosstalk: -100dB at 1MHz**
- **Fast Switching Times ($V_{+} = 5V$):**
 - t_{ON} : 29.5ns
 - t_{OFF} : 29.5ns
- **Rail-to-Rail Input and Output Operation**
- **TTL/CMOS Compatible**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green TQFN-3×3-16L Package**

APPLICATIONS

Cellular Phones
Portable Equipment
Medical Equipment
Sample-and-Hold Circuits
Personal Digital Assistants
Battery-Powered Systems
Audio and Video Signal Routing

PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|----------|---------------------|-----------------------------|------------------|-----------------|---------------------|
| SGM44600 | TQFN-3×3-16L | -40°C to +85°C | SGM44600YTQ16/TR | 44600 XXXXX | Tape and Reel, 3000 |

NOTE: XXXXXX = Date Code and Vendor Code.

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

V₊ to GND0V to 6V
 Analog, Digital Voltage Range -0.3V to (V₊) + 0.3V
 Continuous Current NO, NC, or COM..... ±100mA
 Junction Temperature+150°C
 Storage Temperature Range -65°C to +150°C
 Lead Temperature (Soldering, 10s).....+260°C
 ESD Susceptibility
 HBM..... 2000V
 MM..... 200V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range 1.8V to 5.5V
 Operating Temperature Range -40°C to +85°C

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

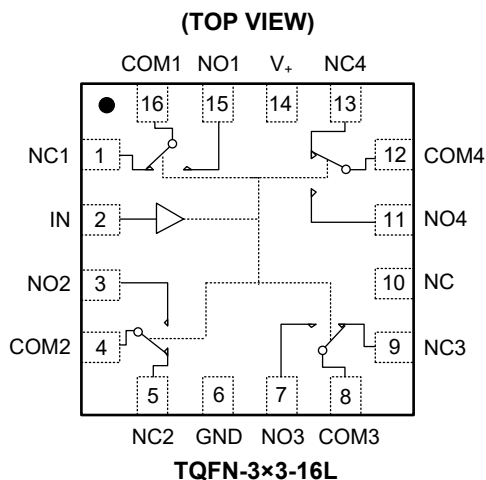
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

PIN CONFIGURATION



PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|--------------|------------------|---|
| 1, 5, 9, 13 | NC _x | Normally Closed Pins. |
| 2 | IN | Digital Control Input Pin to Connect the COM Pins to the NO or NC Pins. |
| 6 | GND | Ground. |
| 10 | NC | Not Internally Connected. |
| 14 | V ₊ | Positive Power Supply Pin. |
| 15, 3, 7, 11 | NO _x | Normally Open Pins. |
| 16, 4, 8, 12 | COM _x | Common Pins. |
| Exposed Pad | GND | Exposed Pad. It should be soldered to PCB board and connected to GND. |

NOTE: NO_x, NC_x and COM_x pins may be an input or output.

FUNCTION TABLE

| IN | FUNCTION | |
|----|-----------------|-----------------|
| | NC1, 2, 3 and 4 | NO1, 2, 3 and 4 |
| 0 | ON | OFF |
| 1 | OFF | ON |

ELECTRICAL CHARACTERISTICS

($V_+ = 4.5V$ to $5.5V$, $GND = 0V$, $V_{IH} = 1.6V$, $V_{IL} = 0.6V$, Full = $-40^\circ C$ to $+85^\circ C$. Typical values are at $V_+ = 5V$, $T_A = +25^\circ C$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--------------------------------------|---|---|-------|-------|------|-------|----------|
| ANALOG SWITCH | | | | | | | |
| Analog Signal Range | V_{NO}, V_{NC}, V_{COM} | | Full | 0 | | V_+ | V |
| On-Resistance | R_{ON} | $V_+ = 4.5V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$, Test Circuit 1 | +25°C | | 4 | 6 | Ω |
| | | | Full | | | 7 | Ω |
| On-Resistance Match Between Channels | ΔR_{ON} | $V_+ = 4.5V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$, Test Circuit 1 | +25°C | | 0.4 | 2.5 | Ω |
| | | | Full | | | 3 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_+ = 4.5V, V_{NO}$ or $V_{NC} = 1.2V, 4.5V,$ $I_{COM} = -100mA$, Test Circuit 1 | +25°C | | 2 | 3 | Ω |
| | | | Full | | | 3.5 | Ω |
| Source Off Leakage Current | $I_{NC(OFF)}, I_{NO(OFF)}$ | $V_+ = 5.5V, V_{NO}$ or $V_{NC} = 3.3V/0.3V,$ $V_{COM} = 0.3V/3.3V$ | Full | | | 1 | μA |
| Channel On Leakage Current | $I_{NC(ON)}, I_{NO(ON)},$ $I_{COM(ON)}$ | $V_+ = 5.5V, V_{COM} = 0.3V/3.3V,$ V_{NO} or $V_{NC} = 0.3V/3.3V$ or floating | Full | | | 1 | μA |
| DIGITAL INPUTS | | | | | | | |
| Input High Voltage | V_{INH} | | Full | 1.6 | | | V |
| Input Low Voltage | V_{INL} | | Full | | | 0.5 | V |
| Input Leakage Current | I_{IN} | $V_+ = 5.5V, V_{IN} = 0V$ or $5.5V$ | Full | | | 1 | μA |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Turn-On Time | t_{ON} | $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 2 | +25°C | | 29.5 | | ns |
| Turn-Off Time | t_{OFF} | | +25°C | | 29.5 | | ns |
| Break-Before-Make Time Delay | t_D | $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 4 | +25°C | | 10.0 | | ns |
| Charge Injection | Q | $V_S = GND, R_S = 0\Omega, V_{IH} = 3V, V_{IL} = 0V,$ $C_L = 1nF, Q = C_L \times V_{OUT}$, Test Circuit 3 | +25°C | | 4.8 | | pC |
| Off Isolation | O_{ISO} | $V_{BIAS} = 2.1V, \text{Signal} = 0dBm,$ $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 5 | 1MHz | +25°C | | -75 | dB |
| | | | 10MHz | +25°C | | -55 | |
| Channel-to-Channel Crosstalk | X_{TALK} | $V_{BIAS} = 2.1V, \text{Signal} = 0dBm,$ $V_{IH} = 3V, V_{IL} = 0V$, Test Circuit 6 | 1MHz | +25°C | | -100 | dB |
| | | | 10MHz | +25°C | | -60 | |
| -3dB Bandwidth | BW | $V_{BIAS} = 2.1V, \text{Signal} = 0dBm, V_{IH} = 3V,$ $V_{IL} = 0V$, Test Circuit 7 | +25°C | | 300 | | MHz |
| Channel On Capacitance | $C_{NC(ON)},$ $C_{NO(ON)},$ $C_{COM(ON)}$ | | +25°C | | 43.0 | | pF |
| POWER REQUIREMENTS | | | | | | | |
| Power Supply Range | V_+ | | Full | 1.8 | | 5.5 | V |
| Power Supply Current | I_+ | $V_+ = 5.5V, V_{IN} = 0V$ or V_+ | Full | | | 1 | μA |

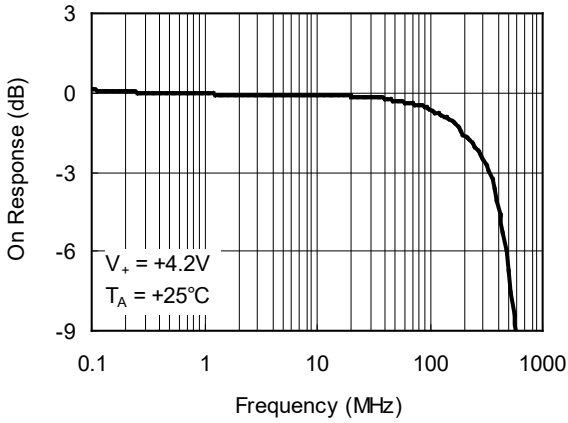
ELECTRICAL CHARACTERISTICS (continued)

($V_+ = 2.7V$ to $3.6V$, $V_{IH} = 1.6V$, $V_{IL} = 0.4V$, Full = $-40^\circ C$ to $+85^\circ C$. Typical values are at $V_+ = 3V$, $T_A = +25^\circ C$, unless otherwise noted.)

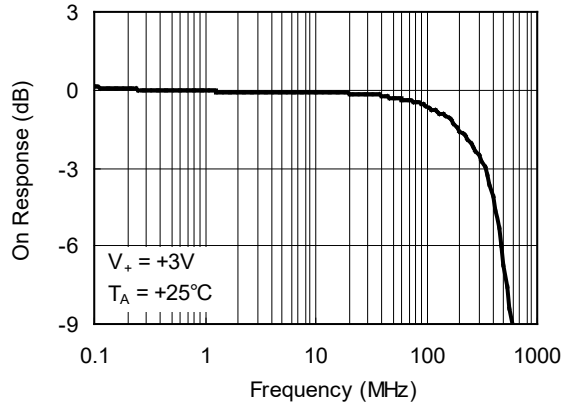
| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--------------------------------------|---|---|---------------|---------------|------|-------|----------|
| ANALOG SWITCH | | | | | | | |
| Analog Signal Range | V_{NO}, V_{NC}, V_{COM} | | Full | 0 | | V_+ | V |
| On-Resistance | R_{ON} | $V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -10mA$, Test Circuit 1 | $+25^\circ C$ | | 10 | 15 | Ω |
| | | | Full | | | 18 | Ω |
| On-Resistance Match Between Channels | ΔR_{ON} | $V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.2V,$ $I_{COM} = -100mA$, Test Circuit 1 | $+25^\circ C$ | | 1 | 3 | Ω |
| | | | Full | | | 4 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_+ = 2.7V, V_{NO}$ or $V_{NC} = 1.2V, 4.5V,$ $I_{COM} = -100mA$, Test Circuit 1 | $+25^\circ C$ | | 6 | 9 | Ω |
| | | | Full | | | 12 | Ω |
| Source Off Leakage Current | $I_{NC(OFF)}, I_{NO(OFF)}$ | $V_+ = 3.6V, V_{NO}$ or $V_{NC} = 3.3V/0.3V,$ $V_{COM} = 0.3V/3.3V$ | Full | | | 1 | μA |
| Channel On Leakage Current | $I_{NC(ON)}, I_{NO(ON)},$ $I_{COM(ON)}$ | $V_+ = 3.6V, V_{COM} = 0.3V/3.3V,$ V_{NO} or $V_{NC} = 0.3V/3.3V$ or floating | Full | | | 1 | μA |
| DIGITAL INPUTS | | | | | | | |
| Input High Voltage | V_{INH} | | Full | 1.5 | | | V |
| Input Low Voltage | V_{INL} | | Full | | | 0.4 | V |
| Input Leakage Current | I_{IN} | $V_+ = 5.5V, V_{IN} = 0V$ or $3.6V$ | Full | | | 1 | μA |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Turn-On Time | t_{ON} | $V_{IH} = 1.5V, V_{IL} = 0V$, Test Circuit 2 | $+25^\circ C$ | | 38.0 | | ns |
| Turn-Off Time | t_{OFF} | | $+25^\circ C$ | | 45.0 | | ns |
| Break-Before-Make Time Delay | t_D | $V_{IH} = 1.5V, V_{IL} = 0V$, Test Circuit 4 | $+25^\circ C$ | | 5.6 | | ns |
| Charge Injection | Q | $V_S = GND, R_S = 0\Omega, V_{IH} = 1.5V, V_{IL} = 0V,$ $C_L = 1nF, Q = C_L \times V_{OUT}$, Test Circuit 3 | $+25^\circ C$ | | 2.6 | | pC |
| Off Isolation | O_{ISO} | $V_{BIAS} = 1.5V, \text{Signal} = 0dBm,$ $V_{IH} = 1.5V, V_{IL} = 0V$, Test Circuit 5 | 1MHz | $+25^\circ C$ | | -75 | dB |
| | | | 10MHz | $+25^\circ C$ | | -55 | |
| Channel-to-Channel Crosstalk | X_{TALK} | $V_{BIAS} = 1.5V, \text{Signal} = 0dBm,$ $V_{IH} = 1.5V, V_{IL} = 0V$, Test Circuit 6 | 1MHz | $+25^\circ C$ | | -100 | dB |
| | | | 10MHz | $+25^\circ C$ | | -60 | |
| -3dB Bandwidth | BW | $V_{BIAS} = 1.5V, \text{Signal} = 0dBm, V_{IH} = 1.5V,$ $V_{IL} = 0V$, Test Circuit 7 | $+25^\circ C$ | | 300 | | MHz |
| Channel On Capacitance | $C_{NC(ON)},$ $C_{NO(ON)},$ $C_{COM(ON)}$ | | $+25^\circ C$ | | 43.0 | | pF |

TYPICAL PERFORMANCE CHARACTERISTICS

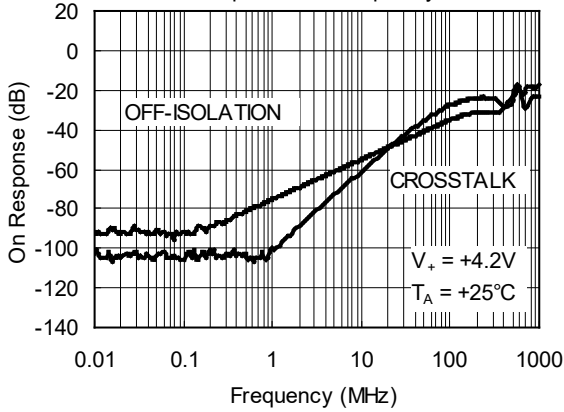
On Response vs. Frequency



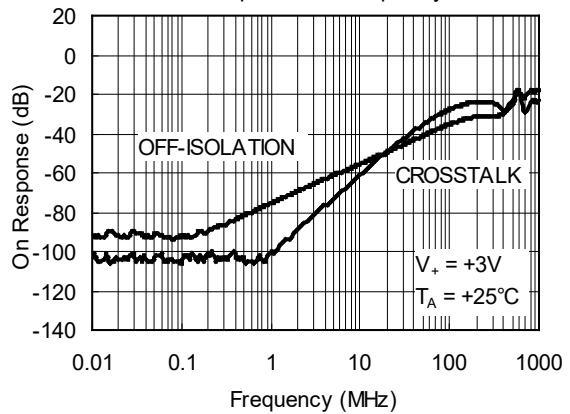
On Response vs. Frequency



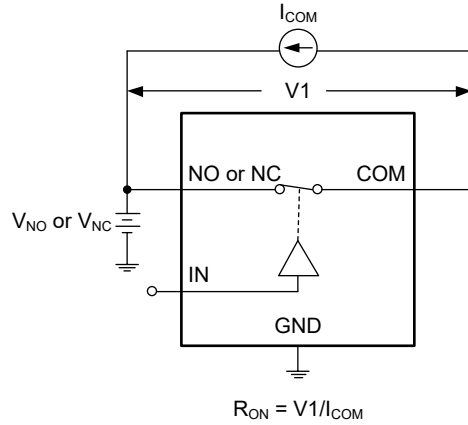
Response vs. Frequency



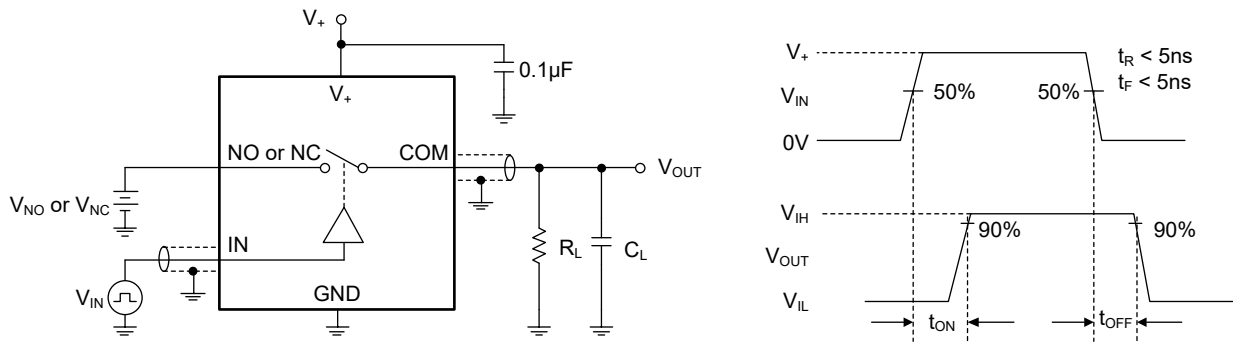
Response vs. Frequency



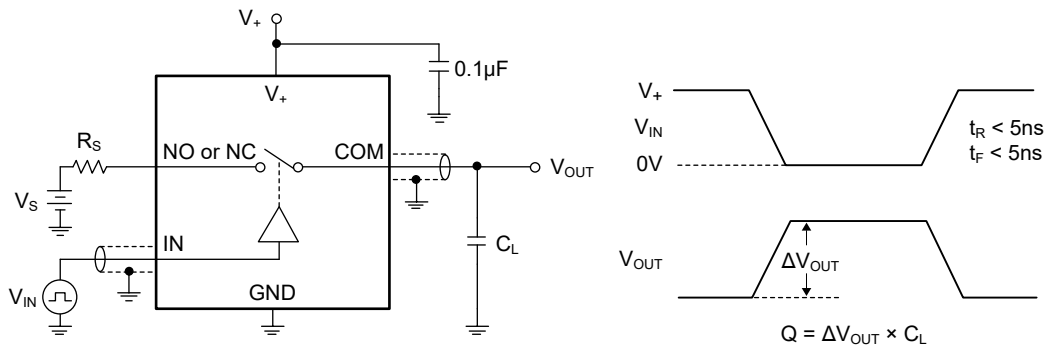
TEST CIRCUITS



Test Circuit 1. On-Resistance

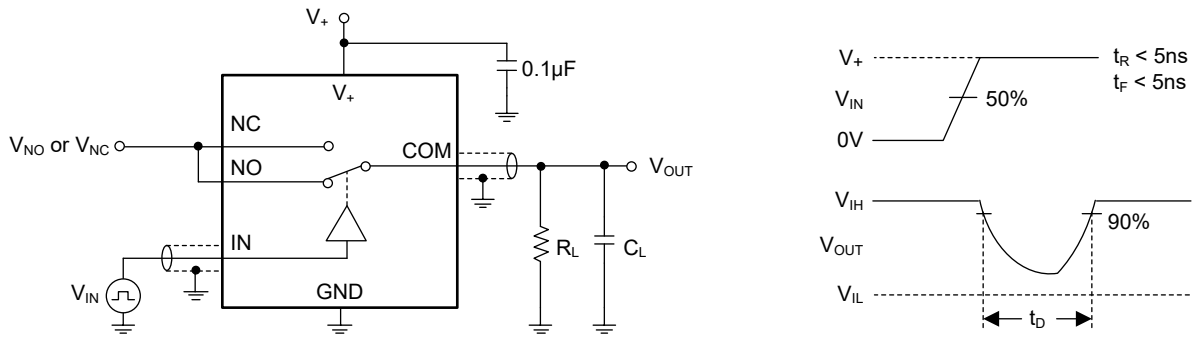


Test Circuit 1. Switching Times (t_{ON} , t_{OFF})

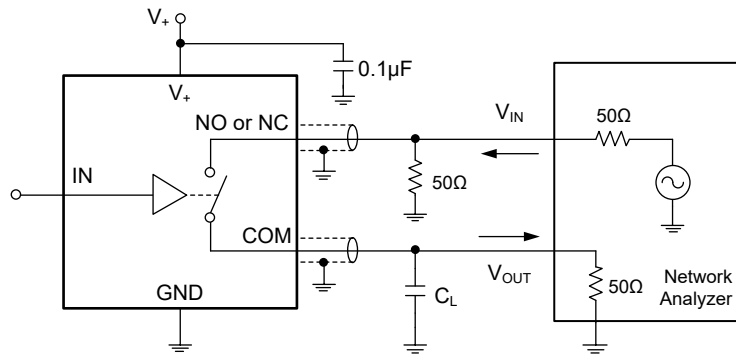


Test Circuit 2. Charge Injection

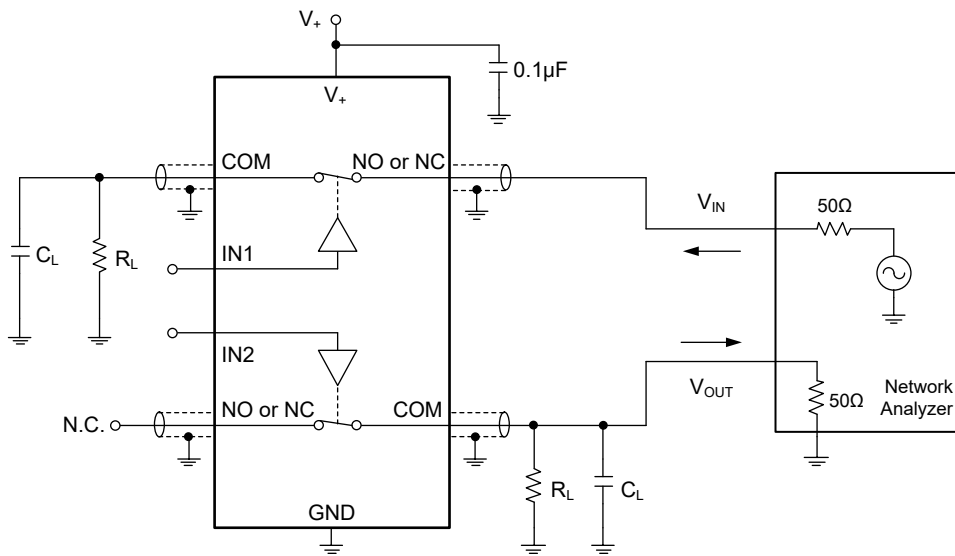
TEST CIRCUITS (continued)



Test Circuit 4. Break-Before-Make Time Delay (t_D)



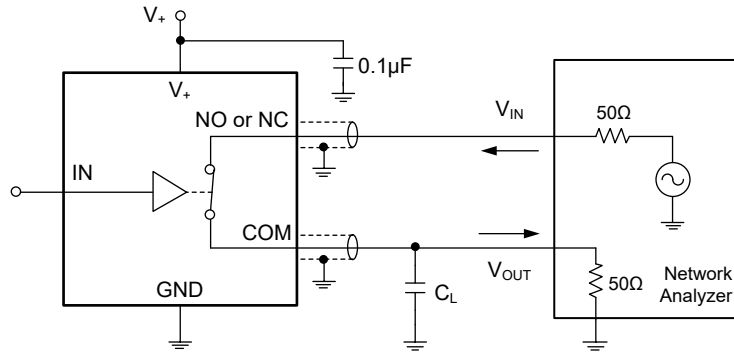
Test Circuit 3. Off Isolation



$$\text{Channel-to-Channel Crosstalk} = -20 \log (V_{NO} \text{ or } V_{NC}/V_{OUT})$$

Test Circuit 4. Channel-to-Channel Crosstalk

TEST CIRCUITS (continued)



Test Circuit 5. -3dB Bandwidth

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

JANUARY 2013 – REV.A.4 to REV.B.1

| | |
|--|--------|
| Added Recommended Land Pattern Information | 10 |
| Added Tape and Reel Information..... | 11, 12 |

MAY 2011 – REV.A.3 to REV.A.4

| | |
|--|--------|
| Added Recommended Land Pattern Information | 10 |
| Added Tape and Reel Information..... | 11, 12 |

MAY 2009 – REV.A.2 to REV.A.3

| | |
|---------------------------------------|---|
| Updated Pin Description section | 3 |
|---------------------------------------|---|

NOVEMBER 2008 – REV.A.1 to REV.A.2

| | |
|---|---|
| Changed Absolute Maximum Ratings section..... | 2 |
|---|---|

MAY 2008 – REV.A to REV.A.1

| | |
|--|------|
| Changed Electrical Characteristics section | 3, 4 |
| Changed Test Circuits section | 6, 7 |

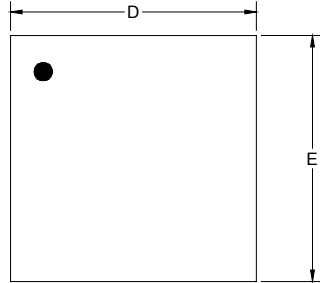
Changes from Original (JANUARY 2008) to REV.A

| | |
|--|-----|
| Changed from product preview to production data..... | All |
|--|-----|

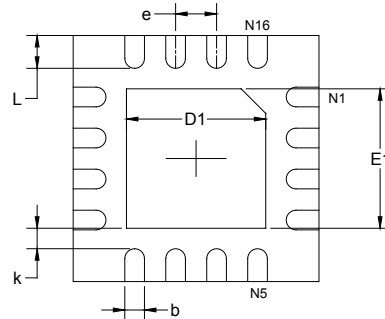
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

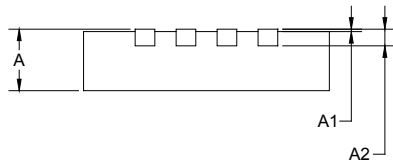
TQFN-3×3-16L



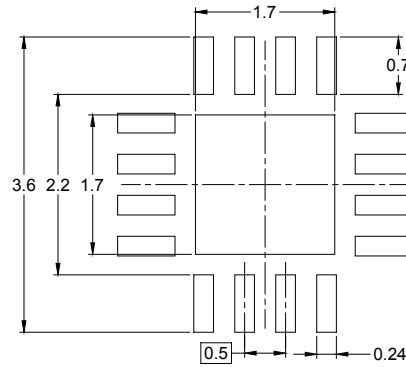
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.700 | 0.800 | 0.028 | 0.031 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A2 | 0.203 REF | | 0.008 REF | |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| D1 | 1.600 | 1.800 | 0.063 | 0.071 |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 1.600 | 1.800 | 0.063 | 0.071 |
| k | 0.200 MIN | | 0.008 MIN | |
| b | 0.180 | 0.300 | 0.007 | 0.012 |
| e | 0.500 TYP | | 0.020 TYP | |
| L | 0.300 | 0.500 | 0.012 | 0.020 |

PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| TQFN-3×3-16L | 13" | 12.4 | 3.35 | 3.35 | 1.13 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |

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PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|-----------|-------------|------------|-------------|--------------|
| 13" | 386 | 280 | 370 | 5 |

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