# SGM44602
# 4Ω, High Speed, Low Voltage Dual, DPDT Analog Switch

## GENERAL DESCRIPTION

The SGM44602 is a dual, high-speed, low-voltage, double-pole/double-throw (DPDT) CMOS analog switch that is designed to operate from a single 1.8V to 5.5V power supply. It features high-bandwidth (300MHz) and low on-resistance (4Ω TYP), targeted applications for audio switching.

The SGM44602 consists of four SPDT switches. The configuration can be used as a bidirectional quad 2-channel multiplexer/demultiplexer with a single switch-enable ($IN_{1-4}$) input.

SGM44602 can handle rail-to-rail analog signals and is available in Pb-free TQFN-16 (2.6mm × 1.8mm) package.

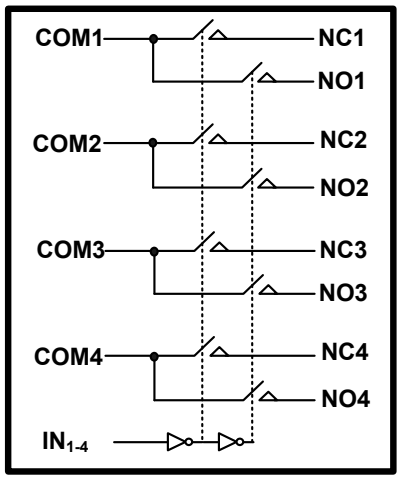
## FEATURES

- **Low Voltage Operation: 1.8V to 5.5V**
- **Low On-Resistance: 4Ω (TYP)**
- **Low On-Resistance Flatness**
- **-3dB Bandwidth: 300MHz**
- **High Off-Isolation: -75dB at 1MHz**
- **Low Crosstalk: -100dB at 1MHz**
- **Rail-to-Rail Input and Output Operation**
- **Typical Power Consumption (<0.01μW)**
- **TTL/CMOS Compatible**
- **Lead (Pb) Free TQFN-16 (2.6mm ×1.8mm) Package**
- **Extended Industrial Temperature Range: -40℃ to +85℃**

## APPLICATIONS

Communication Systems
Cell Phones
Portable Instrumentation
Audio Signal Routing
Audio and Video Switching
PCMCIA Cards
Computer Peripherals
Modems
PDAs

## BLOCK DIAGRAM



## ORDERING INFORMATION

| MODEL | PIN-PACKAGE | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKAGE OPTION |
|---|---|---|---|---|---|
| SGM44602 | TQFN-16 (2.6mm × 1.8mm) | - 40℃ to +85℃ | SGM44602YTQA16/TR | 44602 | Tape and Reel, 3000 |

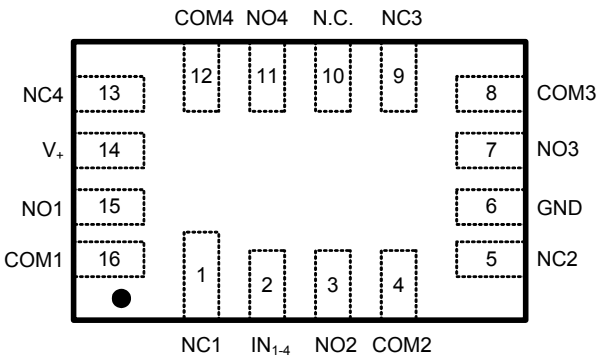
## ABSOLUTE MAXIMUM RATINGS

$V_+$ to GND.....0V to 6V
Analog, Digital voltage range….....-0.3V to ($V_+$) + 0.3V
Continuous Current NO, NC, or COM .....±100mA
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150℃
Storage Temperature.....-65℃ to +150℃
Lead Temperature (soldering, 10s).....260℃

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## PIN CONFIGURATION (TOP VIEW)

**SGM44602YTQA16**




TQFN-16 (2.6mm × 1.8mm)

## PIN DESCRIPTION

| NAME | TQFN PIN | FUNCTION |
|---|---|---|
| $V_+$ | 14 | Power supply |
| GND | 6 | Ground |
| $IN_{1-4}$ | 2 | Digital control pin to connect the COM terminal to the NO or NC terminals |
| N.C. | 10 | Not internally connected. |
| $COM_X$ | 16, 4, 8, 12 | Common terminal |
| $NO_X$ | 15, 3, 7, 11 | Normally-open terminal |
| $NC_X$ | 1, 5, 9, 13 | Normally-closed terminal |

Note: $NO_X$, $NC_X$ and $COM_X$ terminals may be an input or output.

## FUNCTION TABLE

| $IN_{1-4}$ | 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, $V_{IL}$ = +0.5V, $T_A$ = -40℃ to +85℃. Typical values are at $V_+$ = +5.0V, $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | | -40℃ to +85℃ | 0 | | $V_+$ | V |
| On-Resistance | $R_{ON}$ | $V_+$ = 4.5V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 4 | 6 | Ω |
| | | | | -40℃ to +85℃ | | | 7 | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_+$ = 4.5V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 0.4 | 2.5 | Ω |
| | | | | -40℃ to +85℃ | | | 3 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_+$ = 4.5V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 2 | 3 | Ω |
| | | | | -40℃ to +85℃ | | | 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 | | -40℃ to +85℃ | | | 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 | | -40℃ to +85℃ | | | 1 | μA |
| **DIGITAL INPUTS** | | | | | | | | |
| Input High Voltage | $V_{INH}$ | | | -40℃ to +85℃ | 1.6 | | | V |
| Input Low Voltage | $V_{INL}$ | | | -40℃ to +85℃ | | | 0.5 | V |
| Input Leakage Current | $I_{IN}$ | $V_+$ = 5.5V, $V_{IN}$ = 0V or 5.5V | | -40℃ to +85℃ | | | 1 | μA |
| **DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{NC}$ or $V_{NO}$ = 3.0V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit2 | | +25℃ | | 32 | | ns |
| Turn-Off Time | $t_{OFF}$ | | | +25℃ | | 26 | | ns |
| Break-Before-Make Time Delay | $t_D$ | $V_{NC}$ or $V_{NO}$ = 3.0V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit4 | | +25℃ | | 15.5 | | ns |
| Charge Injection | Q | $V_G$ = GND, $R_G$ = 0Ω, $C_L$ = 1.0nF, Q = $C_L$ x $V_{OUT}$, Test Circuit3 | | +25℃ | | 4.8 | | pC |
| Off Isolation | $O_{ISO}$ | Signal = 0dBm, $R_L$ = 50Ω, Test Circuit5 | 1MHz | +25℃ | | -75 | | dB |
| | | | 10MHz | +25℃ | | -55 | | |
| Channel-to-Channel Crosstalk | $X_{TALK}$ | Signal = 0dBm, $R_L$ = 50Ω, Test Circuit6 | 1MHz | +25℃ | | -100 | | dB |
| | | | 10MHz | +25℃ | | -60 | | |
| -3dB Bandwidth | BW | Signal = 0dBm, $R_L$ = 50Ω, Test Circuit7 | | +25℃ | | 300 | | MHz |
| Channel ON Capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$ | | | +25℃ | | 45 | | pF |
| **POWER REQUIREMENTS** | | | | | | | | |
| Power Supply Range | $V_+$ | | | -40℃ to +85℃ | 1.8 | | 5.5 | V |
| Power Supply Current | $I_+$ | $V_+$ = 5.5V, $V_{IN}$ = 0V or $V_+$ | | -40℃ to +85℃ | | | 1 | μA |

Specifications subject to changes without notice.

# ELECTRICAL CHARACTERISTICS

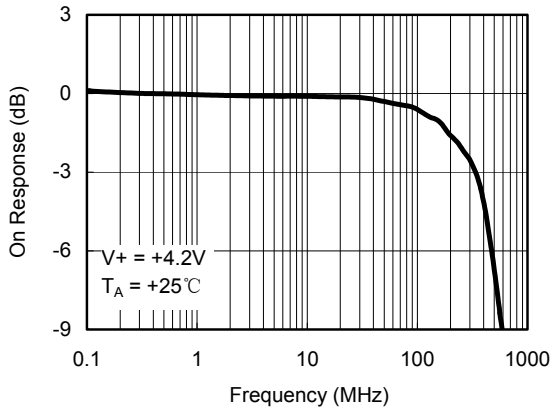
($V_+$ = +2.7V to +3.6V, $V_{IH}$ = +1.6V, $V_{IL}$ = +0.4V, $T_A$ = -40℃ to +85℃. Typical values are at $V_+$ = +3.0V, $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | | -40℃ to +85℃ | 0 | | $V_+$ | V |
| On-Resistance | $R_{ON}$ | $V_+$ = 2.7V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -10mA, Test Circuit 1 | | +25℃ | | 10 | 15 | Ω |
| | | | | -40℃ to +85℃ | | | 18 | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_+$ = 2.7V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 1 | 3 | Ω |
| | | | | -40℃ to +85℃ | | | 4 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_+$ = 2.7V, 0V ≤ $V_{NO}$ or $V_{NC}$ ≤ $V_+$, $I_{COM}$ = -100mA, Test Circuit 1 | | +25℃ | | 6 | 9 | Ω |
| | | | | -40℃ to +85℃ | | | 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 | | -40℃ to +85℃ | | | 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 | | -40℃ to +85℃ | | | 1 | μA |
| **DIGITAL INPUTS** | | | | | | | | |
| Input High Voltage | $V_{INH}$ | | | -40℃ to +85℃ | 1.5 | | | V |
| Input Low Voltage | $V_{INL}$ | | | -40℃ to +85℃ | | | 0.4 | V |
| Input Leakage Current | $I_{IN}$ | $V_+$ = 2.7V, $V_{IN}$ = 0V or 2.7V | | -40℃ to +85℃ | | | 1 | μA |
| **DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{NC}$ or $V_{NO}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit2 | | +25℃ | | 34 | | Ns |
| Turn-Off Time | $t_{OFF}$ | | | +25℃ | | 40 | | Ns |
| Break-Before-Make Time Delay | $t_D$ | $V_{NC}$ or $V_{NO}$ = 1.5V, $R_L$ = 300Ω, $C_L$ = 35pF, Test Circuit4 | | +25℃ | | 20 | | Ns |
| Charge Injection | Q | $V_G$ = GND, $R_G$ = 0Ω, $C_L$ = 1.0nF, Q = $C_L$ x $V_{OUT}$, Test Circuit3 | | +25℃ | | 3.4 | | pC |
| Off Isolation | $O_{ISO}$ | Signal = 0dBm, $R_L$ = 50Ω, Test Circuit5 | 1MHz | +25℃ | | -75 | | dB |
| | | | 10MHz | +25℃ | | -55 | | dB |
| Channel-to-Channel Crosstalk | $X_{TALK}$ | Signal = 0dBm, $R_L$ = 50Ω, Test Circuit6 | 1MHz | +25℃ | | -100 | | dB |
| | | | 10MHz | +25℃ | | -60 | | dB |
| –3dB Bandwidth | BW | Signal = 0dBm, $R_L$ = 50Ω, Test Circuit7 | | +25℃ | | 300 | | MHz |
| Channel ON Capacitance | $C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$ | | | +25℃ | | 45 | | pF |

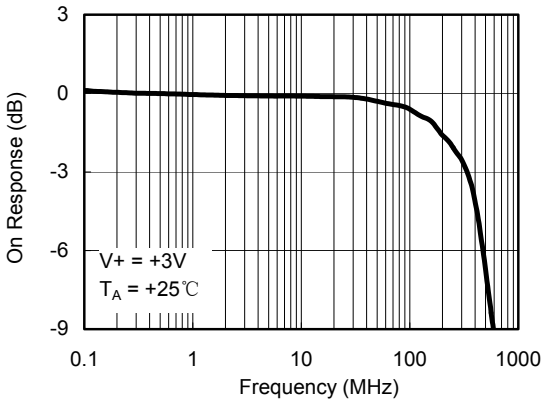
Specifications subject to changes without notice.

## TYPICAL PERFORMANCE CHARACTERISTICS

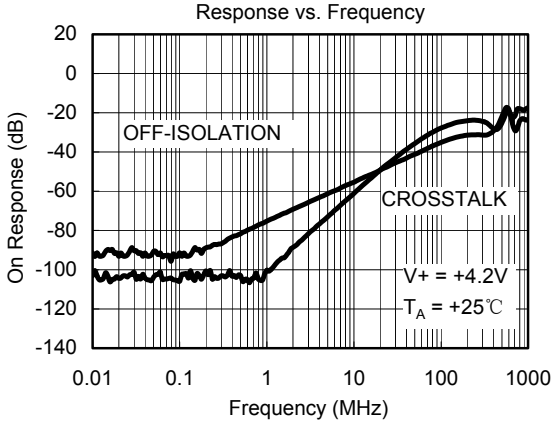
On Response vs. Frequency



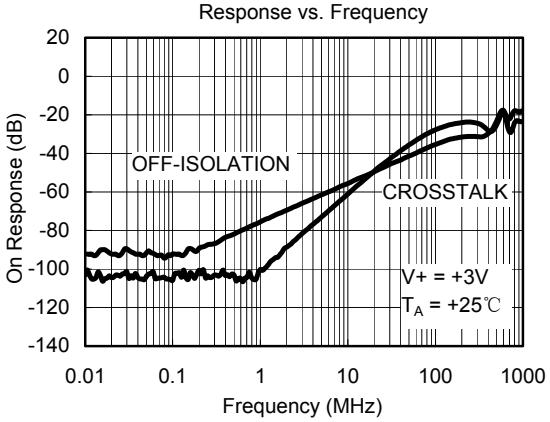

On Response vs. Frequency



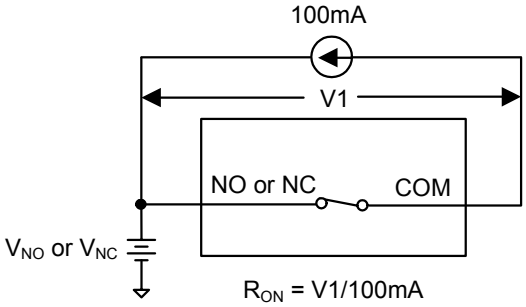

Response vs. Frequency



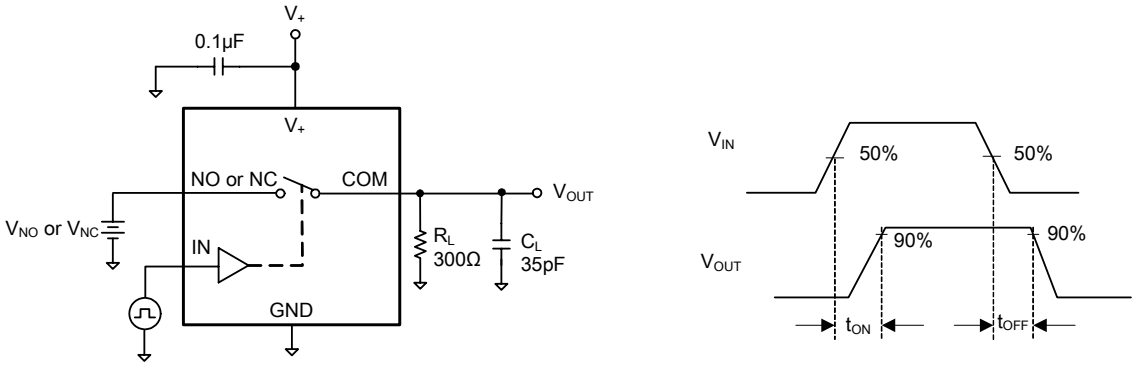

Response vs. Frequency



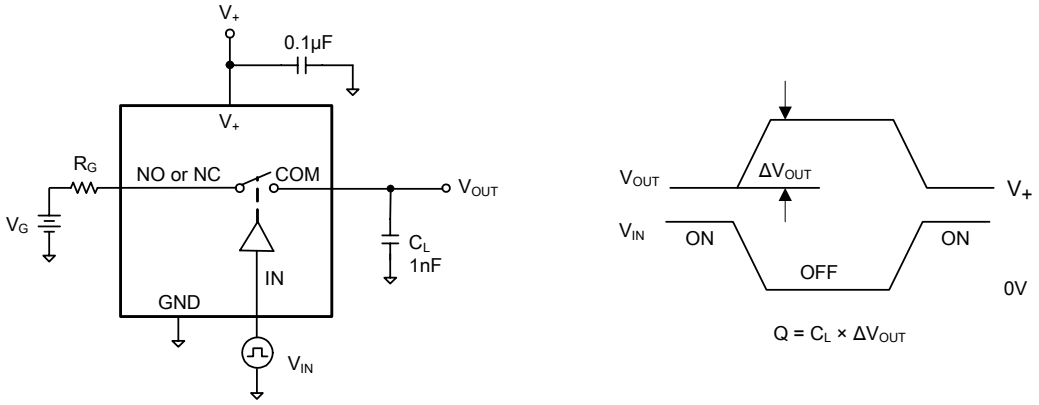
# TEST CIRCUITS




Test Circuit 1. On Resistance

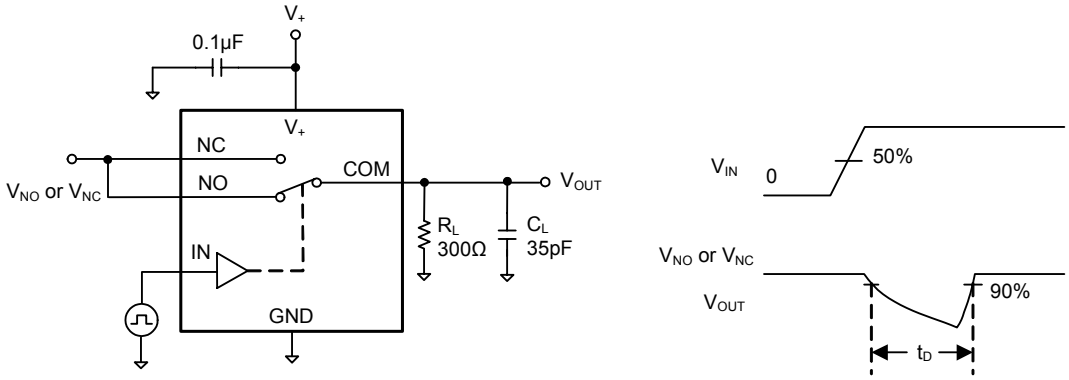



Test Circuit 2. Switching Times ($t_{ON}$, $t_{OFF}$)

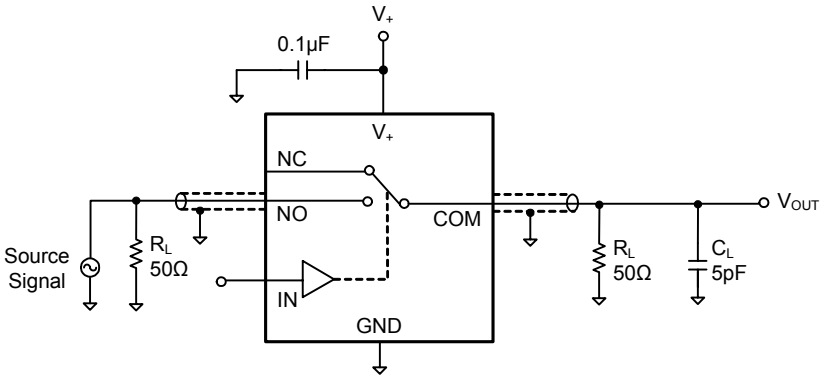



Test Circuit 3. Charge Injection

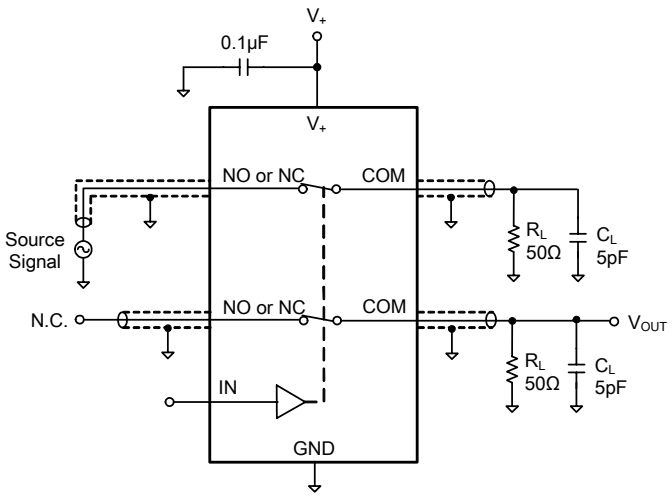
## TEST CIRCUITS (Cont.)




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



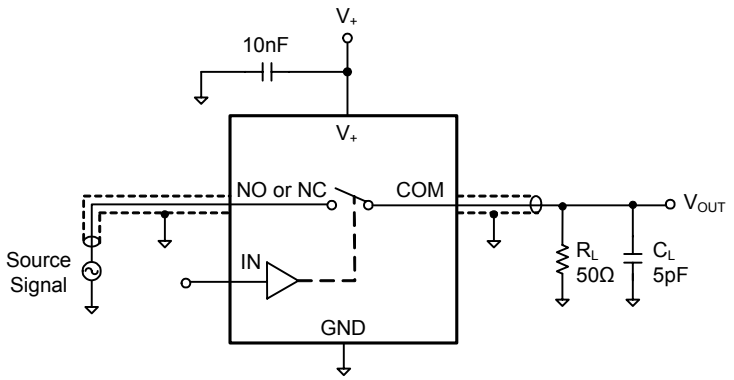

Test Circuit 5. Off Isolation




$$\text{Channel To Channel Crosstalk} = -20 \times \log\frac{V_{NO} \text{ or } V_{NC}}{V_{OUT}}$$

Test Circuit 6. Channel-to-Channel Crosstalk

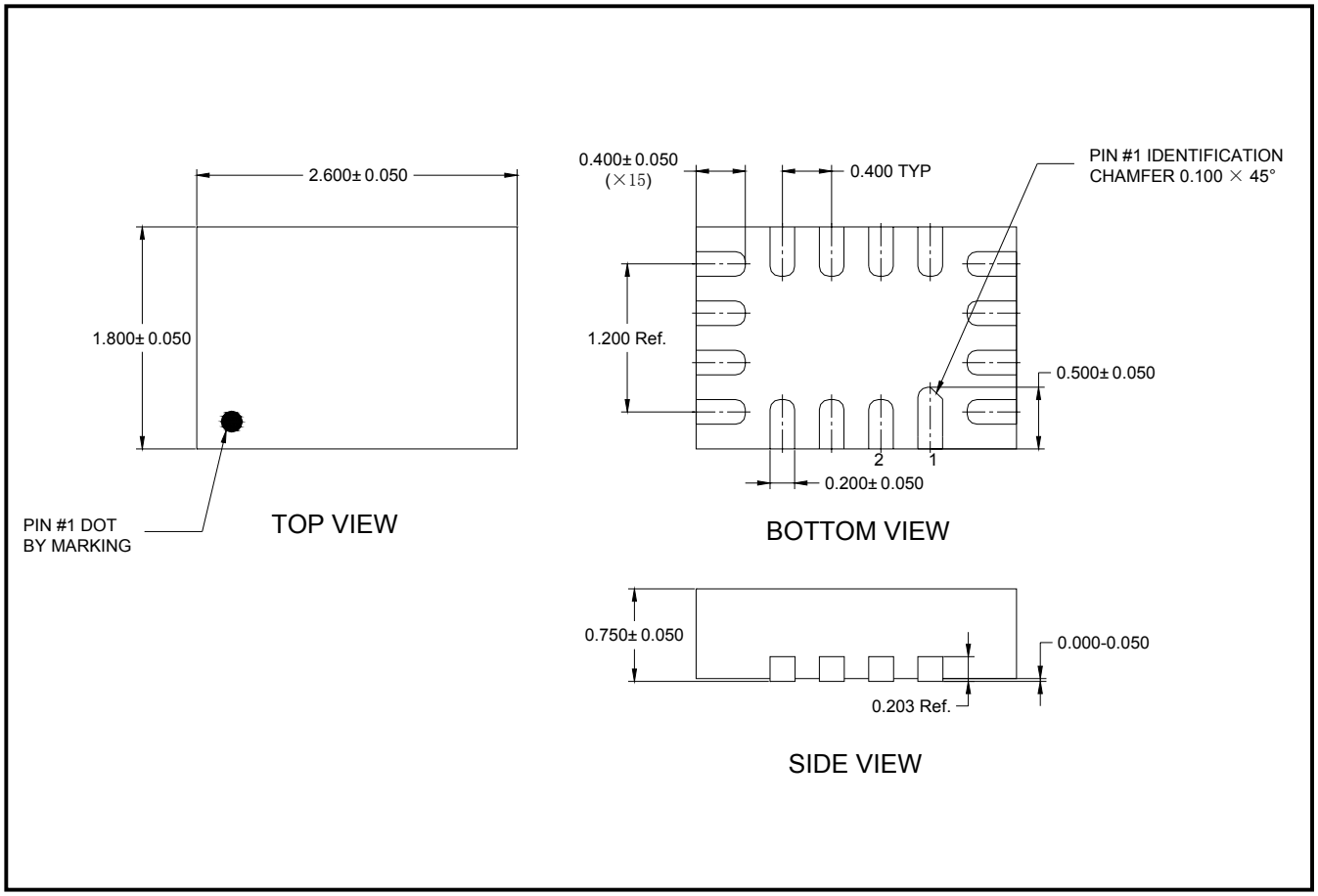
## TEST CIRCUITS (Cont.)




Test Circuit 7. -3dB Bandwidth

# PACKAGE OUTLINE DIMENSIONS

## TQFN-16 (2.6mm × 1.8mm)




Note: All linear dimensions are in millimeters.

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