



# SGM44599

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

### GENERAL DESCRIPTION

The SGM44599 is a high-speed, low-voltage, advanced dual-independent 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).

The SGM44599 is configured as a dual double-pole/double-throw (DPDT) device with two logic control inputs that control two multiplexer/demultiplexer each. The configuration can also be used as a dual differential 2-to-1 multiplexer/ demultiplexer.

SGM44599 is available in Green TQFN-3×3-16L and TQFN-2.5×2.5-16L packages.

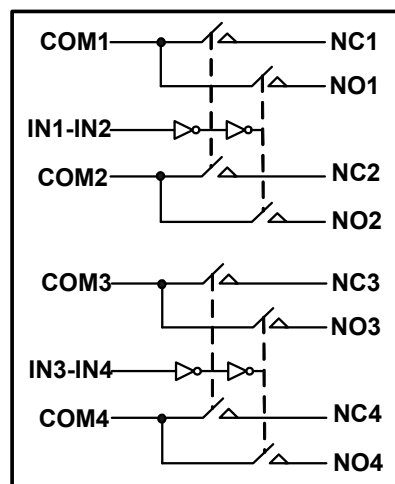
### APPLICATIONS

- Communication Systems
- Cell Phones
- Portable Instrumentation
- Audio Signal Routing
- Audio and Video Switching
- PCMCIA Cards
- Computer Peripherals
- Modems
- PDA's

### FEATURES

- Low Voltage Operation: 1.8V to 5.5V
- On-Resistance: 4Ω (TYP)
- Low On-Resistance Flatness
- -3dB Bandwidth: 300MHz
- Rail-to-Rail Input and Output Operation
- High Off-Isolation: -75dB at 1MHz
- Low Crosstalk: -100dB at 1MHz
- Typical Power Consumption (< 0.01μW)
- TTL/CMOS Compatible
- Available in Green TQFN-3×3-16L and TQFN-2.5×2.5-16L Packages
- Extended Industrial Temperature Range: -40°C to +85°C

### BLOCK DIAGRAM



**PACKAGE/ORDERING INFORMATION**

| MODEL    | PIN-PACKAGE      | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER  | PACKAGE MARKING | PACKAGE OPTION      |
|----------|------------------|-----------------------------|------------------|-----------------|---------------------|
| SGM44599 | TQFN-3×3-16L     | -40°C to +85°C              | SGM44599YTQ16/TR | 44599           | Tape and Reel, 3000 |
|          | TQFN-2.5×2.5-16L | -40°C to +85°C              | SGM44599YTB16/TR | 44599           | Tape and Reel, 3000 |

**ABSOLUTE MAXIMUM RATINGS**

|   |                                   |
|---|-----------------------------------|
| V <sub>+</sub> to GND.....              | -0.3V to 6V                       |
| Analog, Digital voltage range.....      | -0.3V to (V <sub>+</sub> ) + 0.3V |
| Continuous Current NO, NC, or COM ..... | ±100mA                            |
| Operating Temperature Range.....        | -40°C to +85°C                    |
| Junction Temperature.....               | 150°C                             |
| Storage Temperature Range.....          | -65°C to +150°C                   |
| Lead Temperature (soldering, 10s).....  | 260°C                             |
| ESD Susceptibility                      |                                   |
| HBM.....                                | 2000V                             |
| MM.....                                 | 200V                              |

**NOTE:**

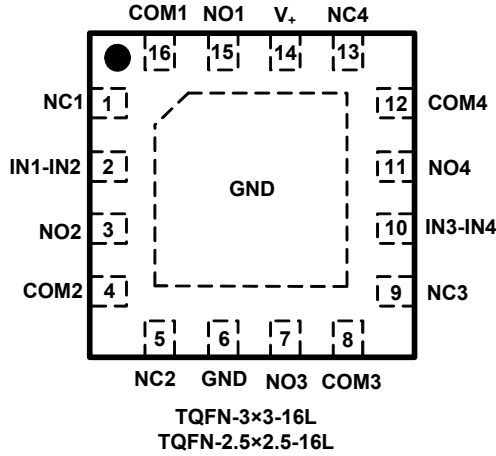
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

**PIN CONFIGURATIONS (TOP VIEW)**



**PIN DESCRIPTION**

| NAME             | PIN          |                  | FUNCTION   |
|------------------|--------------|------------------|--|
|                  | TQFN-3x3-16L | TQFN-2.5x2.5-16L |  |
| V <sub>+</sub>   | 14           |                  | Power Supply.  |
| GND              | 6            |                  | Ground.  |
| IN <sub>x</sub>  | 2, 10        |                  | Digital Control Pin to Connect the COM Terminal to the NO or NC Terminals. |
| COM <sub>x</sub> | 16, 4, 8, 12 |                  | Common Terminal.   |
| NO <sub>x</sub>  | 15, 3, 7, 11 |                  | Normally-Open Terminal.  |
| NC <sub>x</sub>  | 1, 5, 9, 13  |                  | Normally-Closed Terminal.  |

NOTE: NO<sub>x</sub>, NC<sub>x</sub> and COM<sub>x</sub> terminals may be an input or output.

**FUNCTION TABLE**

| IN1-IN2 | FUNCTION    |             |
|---------|-------------|-------------|
|         | NC1 and NC2 | NO1 and NO2 |
| 0       | ON          | OFF         |
| 1       | OFF         | ON          |

| IN3-IN4 | FUNCTION    |             |
|---------|-------------|-------------|
|         | NC3 and NC4 | NO3 and NO4 |
| 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°C to +85°C. Typical values are at  $V_+$  = +5.0V,  $T_A$  = +25°C, unless otherwise noted.)

| PARAMETER                            | SYMBOL                                | CONDITIONS   | TEMP           | MIN   | TYP  | MAX   | UNITS |
|--------------------------------------|---------------------------------------|--|----------------|-------|------|-------|-------|
| <b>ANALOG SWITCH</b>                 |                                       |  |                |       |      |       |       |
| Analog Signal Range                  | $V_{NO}, V_{NC}, V_{COM}$             |  | -40°C to +85°C | 0     |      | $V_+$ | V     |
| On-Resistance                        | $R_{ON}$                              | $V_+ = 4.5V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -100mA, \text{ Test Circuit 1}$ | +25°C          |       | 4    | 6.2   | Ω     |
|                                      |                                       |  | -40°C to +85°C |       |      | 7.2   | Ω     |
| On-Resistance Match Between Channels | $\Delta R_{ON}$                       | $V_+ = 4.5V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -100mA, \text{ Test Circuit 1}$ | +25°C          |       | 0.4  | 2.6   | Ω     |
|                                      |                                       |  | -40°C to +85°C |       |      | 3.1   | Ω     |
| On-Resistance Flatness               | $R_{FLAT(ON)}$                        | $V_+ = 4.5V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_+, I_{COM} = -100mA, \text{ Test Circuit 1}$ | +25°C          |       | 2    | 3.1   | Ω     |
|                                      |                                       |  | -40°C to +85°C |       |      | 3.6   | Ω     |
| Source OFF Leakage Current           | $I_{NC(OFF)}, I_{NO(OFF)}$            | $V_+ = 5.5V, V_{NO} \text{ or } V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3.3V$                           | -40°C to +85°C |       |      | 1     | μA    |
| Channel ON Leakage Current           | $I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$ | $V_+ = 5.5V, V_{COM} = 0.3V/3.3V, V_{NO} \text{ or } V_{NC} = 0.3V/3.3V \text{ or floating}$       | -40°C to +85°C |       |      | 1     | μA    |
| <b>DIGITAL INPUTS</b>                |                                       |  |                |       |      |       |       |
| Input High Voltage                   | $V_{INH}$                             |  | -40°C to +85°C | 1.6   |      |       | V     |
| Input Low Voltage                    | $V_{INL}$                             |  | -40°C to +85°C |       |      | 0.5   | V     |
| Input Leakage Current                | $I_{IN}$                              | $V_+ = 5.5V, V_{IN} = 0V \text{ or } 5.5V$   | -40°C to +85°C |       |      | 1     | μA    |
| <b>DYNAMIC CHARACTERISTICS</b>       |                                       |  |                |       |      |       |       |
| Turn-On Time                         | $t_{ON}$                              | $V_{NC} \text{ or } V_{NO} = 3.0V, R_L = 300\Omega, C_L = 35pF, \text{ Test Circuit2}$             | +25°C          |       | 31.5 |       | ns    |
| Turn-Off Time                        | $t_{OFF}$                             |  | +25°C          |       | 30.0 |       | ns    |
| Break-Before-Make Time Delay         | $t_D$                                 | $V_{NC} \text{ or } V_{NO} = 3.0V, R_L = 300\Omega, C_L = 35pF, \text{ Test Circuit4}$             | +25°C          |       | 11.5 |       | ns    |
| Charge Injection                     | Q                                     | $V_G = GND, R_G = 0\Omega, C_L = 1.0nF, Q = C_L \times V_{OUT}, \text{ Test Circuit3}$             | +25°C          |       | 3.5  |       | pC    |
| Off Isolation                        | $O_{ISO}$                             | Signal = 0dBm, $R_L = 50\Omega$ , Test Circuit5  | 1MHz           | +25°C |      | -75   | dB    |
|                                      |                                       |  | 10MHz          | +25°C |      | -55   |       |
| Channel-to-Channel Crosstalk         | $X_{TALK}$                            | Signal = 0dBm, $R_L = 50\Omega$ , Test Circuit6  | 1MHz           | +25°C |      | -100  | dB    |
|                                      |                                       |  | 10MHz          | +25°C |      | -60   |       |
| -3dB Bandwidth                       | BW                                    | Signal = 0dBm, $R_L = 50\Omega$ , Test Circuit7  | +25°C          |       | 300  |       | MHz   |
| Channel ON Capacitance               | $C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$ |  | +25°C          |       | 43.2 |       | pF    |
| <b>POWER REQUIREMENTS</b>            |                                       |  |                |       |      |       |       |
| Power Supply Range                   | $V_+$                                 |  | -40°C to +85°C | 1.8   |      | 5.5   | V     |
| Power Supply Current                 | $I_+$                                 | $V_+ = 5.5V, V_{IN} = 0V \text{ or } V_+$  | -40°C to +85°C |       |      | 1     | μA    |

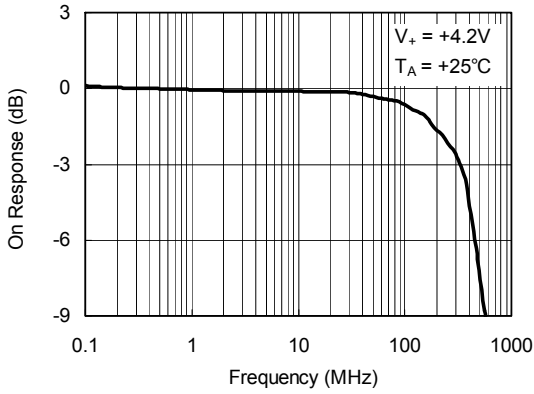
**ELECTRICAL CHARACTERISTICS**

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

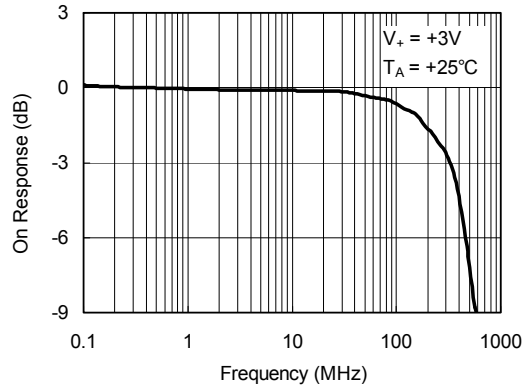
| PARAMETER                            | SYMBOL                                | CONDITIONS   | TEMP                           | MIN           | TYP  | MAX   | UNITS    |
|--------------------------------------|---------------------------------------|--|--------------------------------|---------------|------|-------|----------|
| <b>ANALOG SWITCH</b>                 |                                       |  |                                |               |      |       |          |
| Analog Signal Range                  | $V_{NO}, V_{NC}, V_{COM}$             |  | $-40^\circ C$ to $+85^\circ C$ | 0             |      | $V_+$ | V        |
| On-Resistance                        | $R_{ON}$                              | $V_+ = 2.7V, 0V \leq V_{NO}$ or $V_{NC} \leq V_+$ ,<br>$I_{COM} = -100mA$ , Test Circuit 1 | $+25^\circ C$                  |               | 10   | 15    | $\Omega$ |
|                                      |                                       |  | $-40^\circ C$ to $+85^\circ C$ |               |      | 18    | $\Omega$ |
| On-Resistance Match Between Channels | $\Delta R_{ON}$                       | $V_+ = 2.7V, 0V \leq V_{NO}$ or $V_{NC} \leq V_+$ ,<br>$I_{COM} = -100mA$ , Test Circuit 1 | $+25^\circ C$                  |               | 1    | 3     | $\Omega$ |
|                                      |                                       |  | $-40^\circ C$ to $+85^\circ C$ |               |      | 4     | $\Omega$ |
| On-Resistance Flatness               | $R_{FLAT(ON)}$                        | $V_+ = 2.7V, 0V \leq V_{NO}$ or $V_{NC} \leq V_+$ ,<br>$I_{COM} = -100mA$ , Test Circuit 1 | $+25^\circ C$                  |               | 6    | 9     | $\Omega$ |
|                                      |                                       |  | $-40^\circ C$ to $+85^\circ C$ |               |      | 12    | $\Omega$ |
| Source OFF Leakage Current           | $I_{NC(OFF)}, I_{NO(OFF)}$            | $V_+ = 3.6V, V_{NO}$ or $V_{NC} = 3.3V/0.3V$ ,<br>$V_{COM} = 0.3V/3.3V$                    | $-40^\circ C$ to $+85^\circ C$ |               |      | 1     | $\mu A$  |
| Channel ON Leakage Current           | $I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$ | $V_+ = 3.6V, V_{COM} = 0.3V/3.3V$ ,<br>$V_{NO}$ or $V_{NC} = 0.3V/3.3V$ or floating        | $-40^\circ C$ to $+85^\circ C$ |               |      | 1     | $\mu A$  |
| <b>DIGITAL INPUTS</b>                |                                       |  |                                |               |      |       |          |
| Input High Voltage                   | $V_{INH}$                             |  | $-40^\circ C$ to $+85^\circ C$ | 1.5           |      |       | V        |
| Input Low Voltage                    | $V_{INL}$                             |  | $-40^\circ C$ to $+85^\circ C$ |               |      | 0.4   | V        |
| Input Leakage Current                | $I_{IN}$                              | $V_+ = 2.7V, V_{IN} = 0V$ or $2.7V$  | $-40^\circ C$ to $+85^\circ C$ |               |      | 1     | $\mu A$  |
| <b>DYNAMIC CHARACTERISTICS</b>       |                                       |  |                                |               |      |       |          |
| Turn-On Time                         | $t_{ON}$                              | $V_{NC}$ or $V_{NO} = 1.5V, R_L = 300\Omega$ ,<br>$C_L = 35pF$ , Test Circuit2             | $+25^\circ C$                  |               | 38.0 |       | ns       |
| Turn-Off Time                        | $t_{OFF}$                             |  | $+25^\circ C$                  |               | 44.0 |       | ns       |
| Break-Before-Make Time Delay         | $t_D$                                 | $V_{NC}$ or $V_{NO} = 1.5V, R_L = 300\Omega$ ,<br>$C_L = 35pF$ , Test Circuit4             | $+25^\circ C$                  |               | 5.8  |       | ns       |
| Charge Injection                     | Q                                     | $V_G = GND, R_G = 0\Omega, C_L = 1.0nF$ ,<br>$Q = C_L \times V_{OUT}$ , Test Circuit3      | $+25^\circ C$                  |               | 2.6  |       | pC       |
| Off Isolation                        | $O_{ISO}$                             | Signal = 0dBm, $R_L = 50\Omega$ ,<br>Test Circuit5   | 1MHz                           | $+25^\circ C$ |      | -75   | dB       |
|                                      |                                       |  | 10MHz                          | $+25^\circ C$ |      | -55   | dB       |
| Channel-to-Channel Crosstalk         | $X_{TALK}$                            | Signal = 0dBm, $R_L = 50\Omega$ ,<br>Test Circuit6   | 1MHz                           | $+25^\circ C$ |      | -100  | dB       |
|                                      |                                       |  | 10MHz                          | $+25^\circ C$ |      | -60   | dB       |
| -3dB Bandwidth                       | BW                                    | Signal = 0dBm, $R_L = 50\Omega$ ,<br>Test Circuit7   | $+25^\circ C$                  |               | 300  |       | MHz      |
| Channel ON Capacitance               | $C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$ |  | $+25^\circ C$                  |               | 43.2 |       | pF       |

TYPICAL PERFORMANCE CHARACTERISTICS

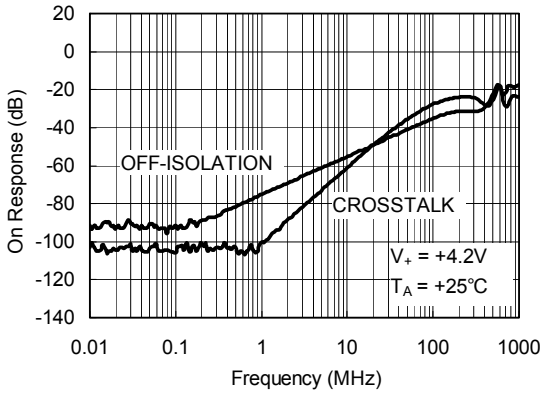
On Response vs. Frequency



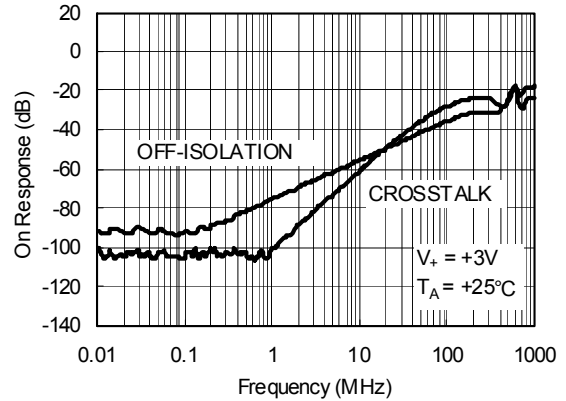
On Response vs. Frequency



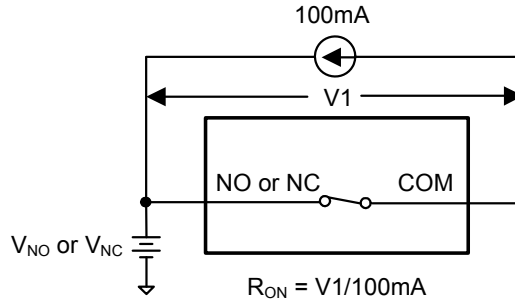
Response vs. Frequency



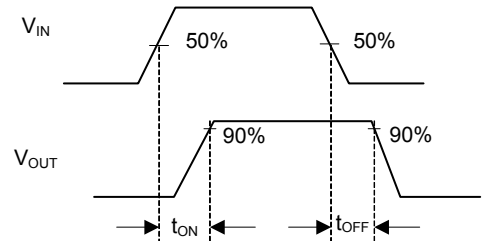
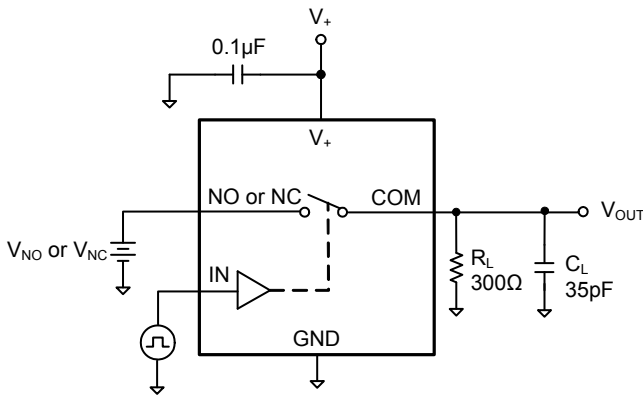
Response vs. Frequency



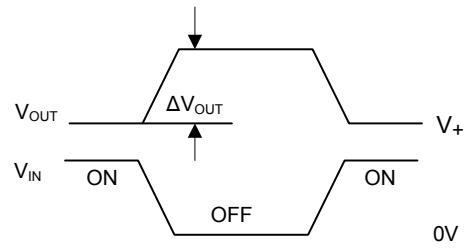
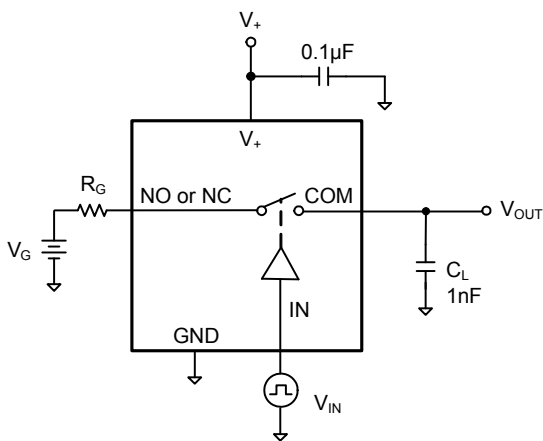
TEST CIRCUITS



Test Circuit 1. On Resistance



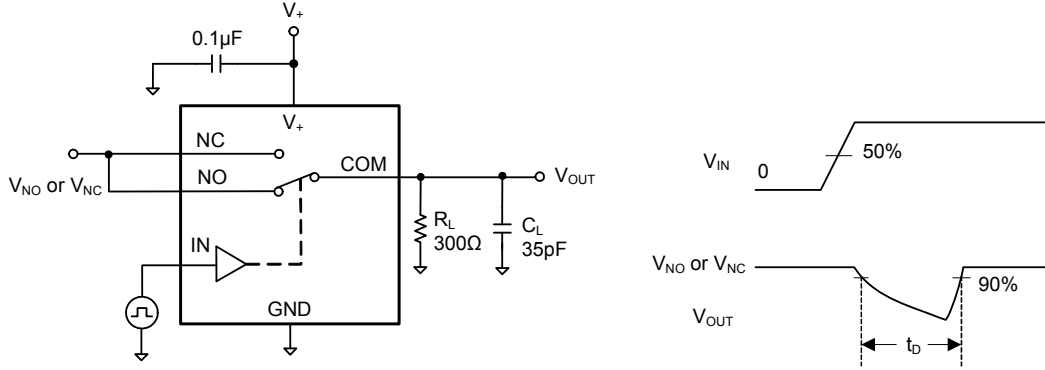
Test Circuit 2. Switching Times ( $t_{ON}$ ,  $t_{OFF}$ )



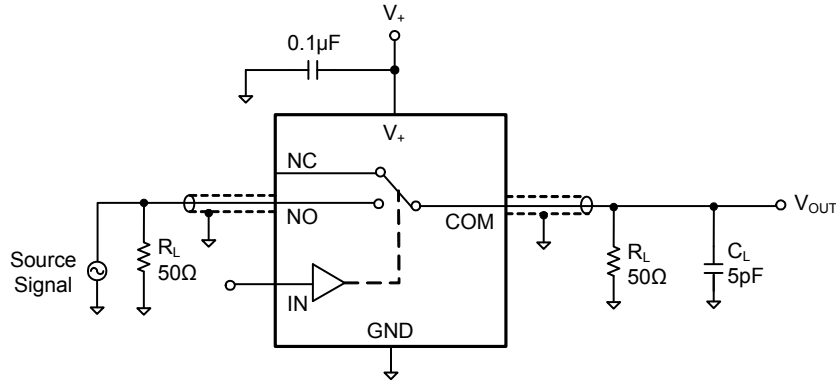
$Q = C_L \times \Delta V_{OUT}$

Test Circuit 3. Charge Injection

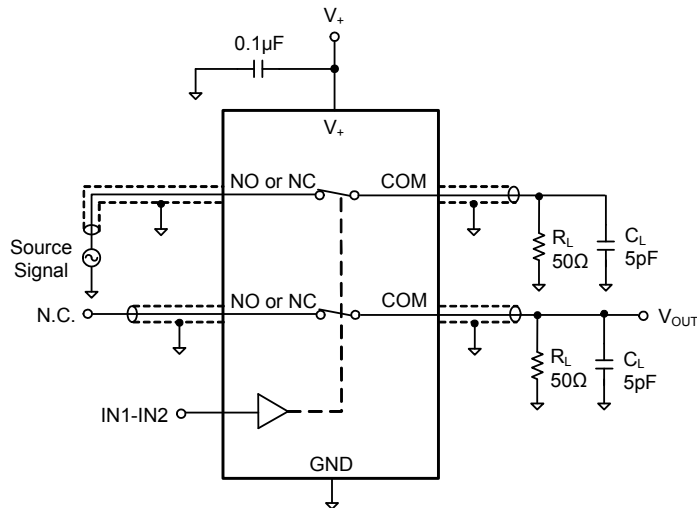
TEST CIRCUITS (Cont.)



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



Test Circuit 5. Off Isolation

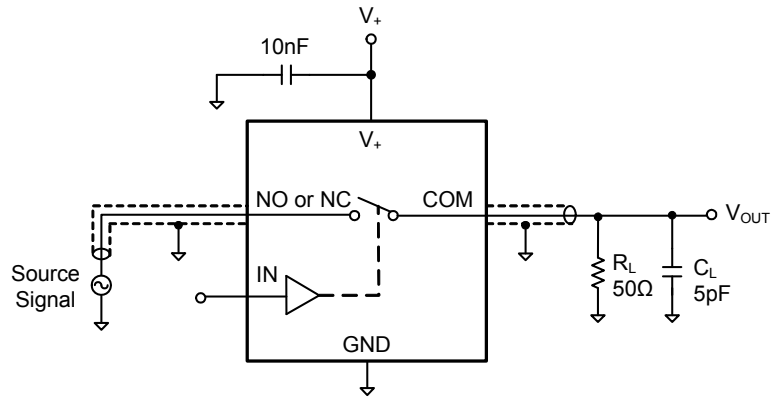


$$\text{Channel To Channel Crosstalk} = -20 \times \log \frac{V_{NO \text{ or } V_{NC}}}{V_{OUT}}$$

Test Circuit 6. Channel-to-Channel Crosstalk



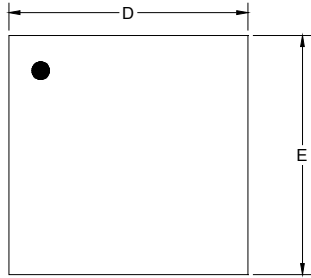
TEST CIRCUITS (Cont.)



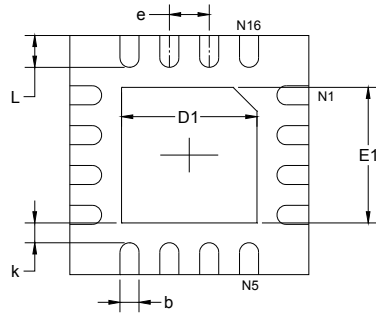
Test Circuit 7. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

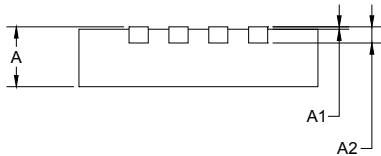
TQFN-3×3-16L



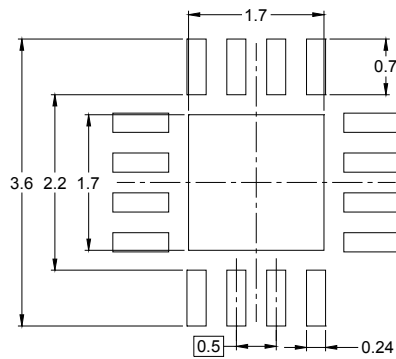
TOP VIEW



BOTTOM VIEW



SIDE VIEW

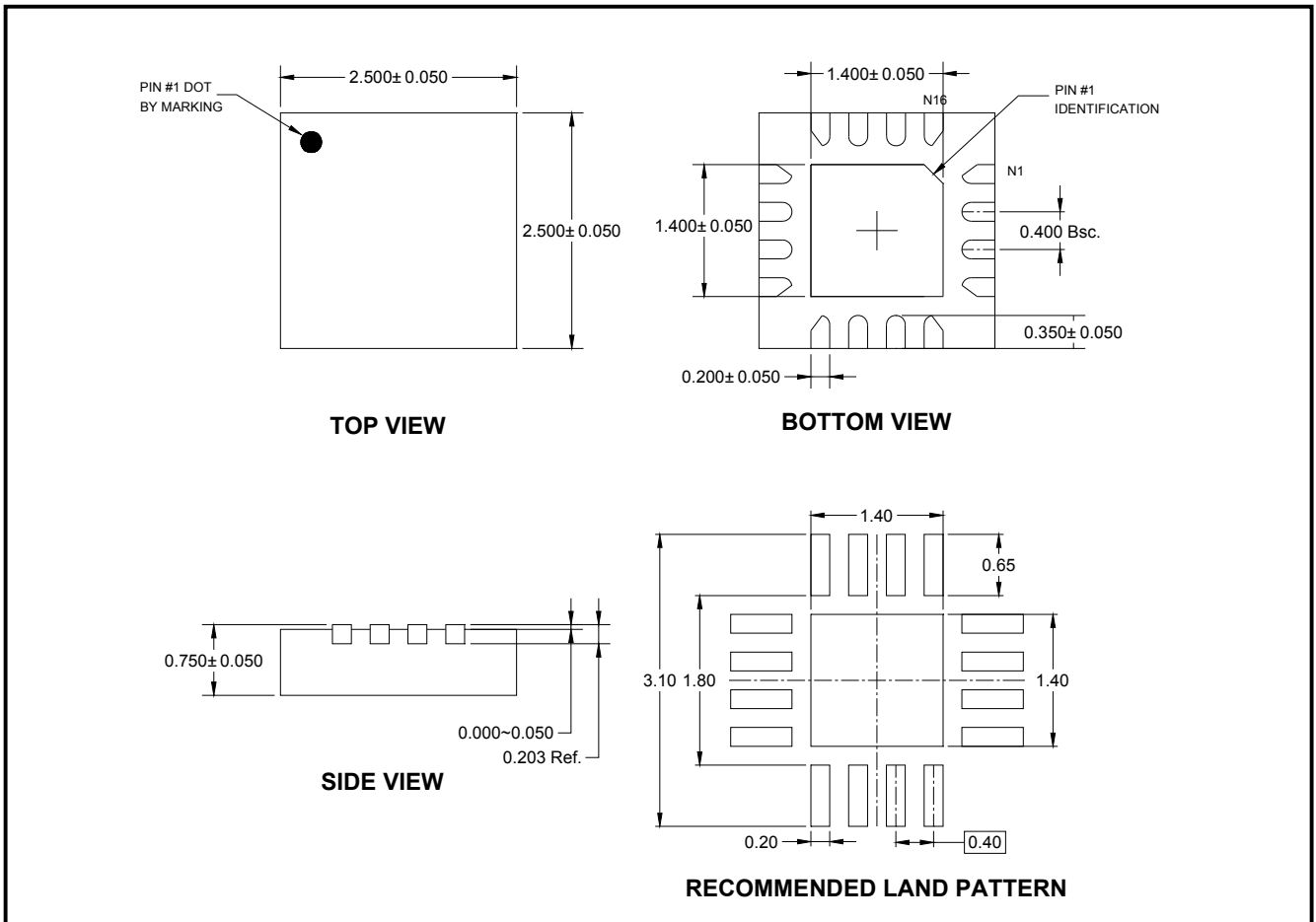


RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>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 OUTLINE DIMENSIONS

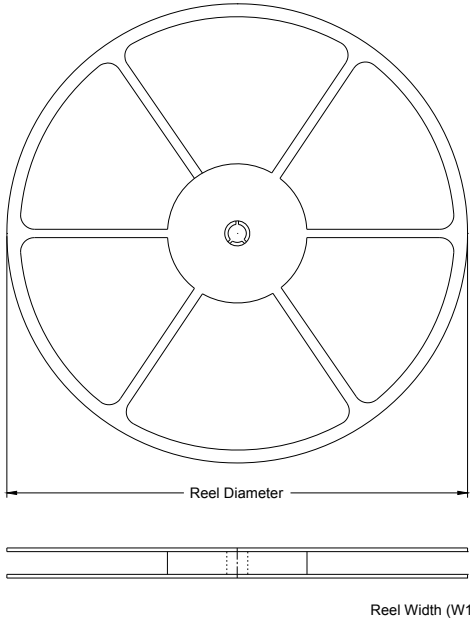
TQFN-2.5×2.5-16L



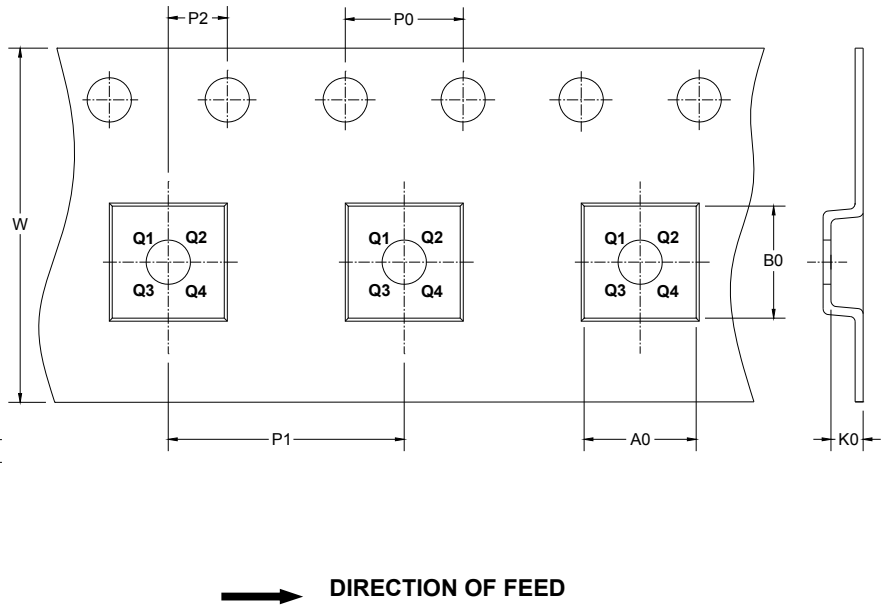
NOTE: All linear dimensions are in millimeters.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

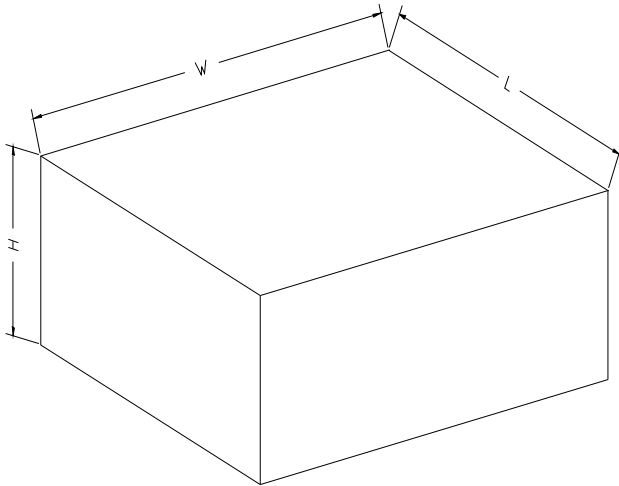
KEY PARAMETER LIST OF TAPE AND REEL

| 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"           | 12.40              | 3.35    | 3.35    | 1.13    | 4.00    | 4.00    | 2.00    | 12.00  | Q1            |
| TQFN-2.5×2.5-16L | 7"            | 13.0               | 2.8     | 2.8     | 1.1     | 4.0     | 4.0     | 2.0     | 12.0   | Q1            |

# SGM44599

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

## 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 |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368         | 227        | 224         | 8            |
| 7"          | 442         | 410        | 224         | 18           |
| 13"         | 386         | 280        | 370         | 5            |