# SGM3712
# 1Ω, High Voltage, Rail-to-Rail Negative
# Signal Passing, Dual, SPDT Analog Switch

## GENERAL DESCRIPTION

The SGM3712 is a high voltage, $-V_{CC}$ to $+V_{CC}$ wide range positive and negative signal passing dual single-pole/double-throw (SPDT) analog switch that is designed to operate from a single 2.7V to 12V power supply. Targeted applications include battery powered equipment that benefit from the SGM3712's low 1Ω (TYP) on-resistance for dual NO to COM switches and dual NC to COM switches and fast switching speeds.

The SGM3712 has excellent on-resistance matching (0.01Ω TYP) between switches and guarantees excellent on-resistance flatness over all signal range. This ensures excellent linearity and low distortion when switching audio signals.

The SGM3712 is a committed dual single-pole/double-throw (SPDT) that consist of two normally open (NO) and two normally closed (NC) switches. This configuration can be used as a dual 2-to-1 multiplexer.

The SGM3712 can pass $-V_{CC}$ to $+V_{CC}$ wide range positive and negative signals with very low distortion.

The SGM3712 is available in Green SOIC-14 and WLCSP-1.27×2.13-15B packages. It operates over an ambient temperature range of -40℃ to +85℃.

## FEATURES

- **Wide Voltage Operation: 2.7V to 12V**
- **On-Resistance for Switches: 1Ω (TYP)**
- **$-V_{CC}$ to $+V_{CC}$ Rail-to-Rail Low Distortion Positive and Negative Signal Passing**
- **Fast Switching Times**
- **High Off-Isolation**
- **Very Low Crosstalk**
- **1.8V Logic Compatible Control Pin**
- **Break-Before-Make Switching**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green WLCSP-1.27×2.13-15B and SOIC-14 Packages**

## APPLICATIONS

Portable Instrumentation
Battery-Operated Equipment

## PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| SGM3712 | WLCSP-1.27×2.13-15B | -40℃ to +85℃ | SGM3712YG/TR | XXXXX 3712 | Tape and Reel, 3000 |
| | SOIC-14 | -40℃ to +85℃ | SGM3712YS14G/TR | SGM3712YS14 XXXXX | Tape and Reel, 2500 |

NOTE: XXXXX = 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

$V_{CC}$ to GND............................................................0V to 13.2V
IN1, IN2, EN to GND...................................................0V to 6V
Analog Voltage Range [(1)]........... (-$V_{CC}$ - 0.3V) to ($V_{CC}$ + 0.3V)
Continuous Current from NO to COM.......................±350mA
Continuous Current from NC to COM.......................±350mA
Peak Current from NO to COM................................±400mA
Peak Current from NC to COM................................±400mA
I/O Clamp Current ($V_I$ < 0)...........................................-30mA
Junction Temperature................................................+150℃
Storage Temperature Range .......................-65℃ to +150℃
Lead Temperature (Soldering, 10s)...........................+260℃

NOTE:
1. Signals on NC, NO, or COM exceeding $V_{CC}$ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

## RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range ..........................................2.7V to 12V
Operating Temperature Range.......................-40℃ to +85℃

## 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.
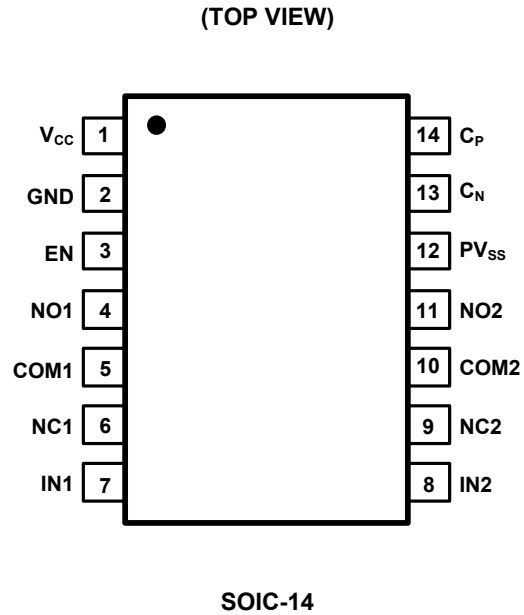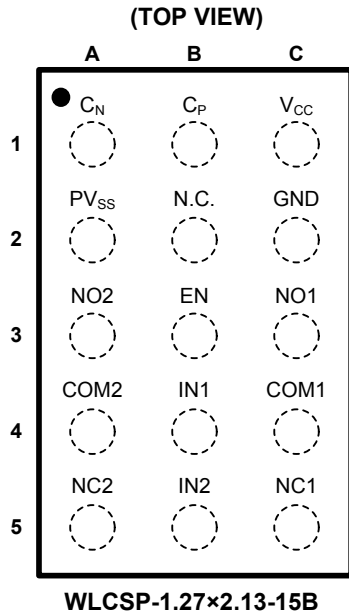
## ESD SENSITIVITY CAUTION

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 CONFIGURATIONS

**(TOP VIEW)**

|   | A | B | C |
|---|---|---|---|
| **1** | ● $C_N$ | $C_P$ | $V_{CC}$ |
| **2** | $PV_{SS}$ | N.C. | GND |
| **3** | NO2 | EN | NO1 |
| **4** | COM2 | IN1 | COM1 |
| **5** | NC2 | IN2 | NC1 |

**WLCSP-1.27×2.13-15B**

**(TOP VIEW)**

| $V_{CC}$ | 1 | | 14 | $C_P$ |
| GND | 2 | | 13 | $C_N$ |
| EN | 3 | | 12 | $PV_{SS}$ |
| NO1 | 4 | | 11 | NO2 |
| COM1 | 5 | | 10 | COM2 |
| NC1 | 6 | | 9 | NC2 |
| IN1 | 7 | | 8 | IN2 |

**SOIC-14**

## PIN DESCRIPTION

| PIN | | NAME | FUNCTION |
|---|---|---|---|
| **WLCSP-1.27×2.13-15B** | **SOIC-14** | | |
| A1 | 13 | $C_N$ | Charge Pump Flying Capacitor Negative Terminal. |
| B1 | 14 | $C_P$ | Charge Pump Flying Capacitor Positive Terminal. |
| C1 | 1 | $V_{CC}$ | Power Supply. |
| A2 | 12 | $PV_{SS}$ | Negative Supply Voltage Output. Connect one 0.1µF ceramic capacitor from $PV_{SS}$ to GND. |
| B2 | – | N.C. | No Connection. |
| C2 | 2 | GND | Ground. |
| A3 | 11 | NO2 | Normally-Open Terminal. |
| B3 | 3 | EN | Enable Control. When EN = "Low", both NC and NO will be disconnected with COM, negative charge pump doesn't work and the SGM3712 will be in shutdown state. When EN = "High", negative charge pump will work, the SGM3712 will be in working state, and NC or NO will be connected with COM depending on the logical state of IN. |
| C3 | 4 | NO1 | Normally-Open Terminal. |
| A4 | 10 | COM2 | Common Terminal. |
| B4 | 7 | IN1 | Digital Control Pin to Connect the COM Terminal to the NO or NC Terminal. |
| C4 | 5 | COM1 | Common Terminal. |
| A5 | 9 | NC2 | Normally-Closed Terminal. |
| B5 | 8 | IN2 | Digital Control Pin to Connect the COM Terminal to the NO or NC Terminal. |
| C5 | 6 | NC1 | Normally-Closed Terminal. |

NOTE: NO, NC and COM terminals may be an input or output.

# FUNCTION TABLE

**Table 1. Function Table of Switch 1:**

| EN | IN1 | COM1 | NEGATIVE CHARGE PUMP |
|:---:|:---:|:---:|:---:|
| 0 | X | COM1 is disconnected with NO1 and NC1 | Turn off |
| 1 | 0 | COM1 = NC1 | Turn on |
| 1 | 1 | COM1 = NO1 | Turn on |

**Table 2. Function Table of Switch 2:**

| EN | IN2 | COM2 | NEGATIVE CHARGE PUMP |
|:---:|:---:|:---:|:---:|
| 0 | X | COM2 is disconnected with NO2 and NC2 | Turn off |
| 1 | 0 | COM2 = NC2 | Turn on |
| 1 | 1 | COM2 = NO2 | Turn on |

# ELECTRICAL CHARACTERISTICS

($V_{CC}$ = 5.0V, Full = -40℃ to +85℃. Typical values are at $T_A$ = +25℃, unless otherwise noted.)

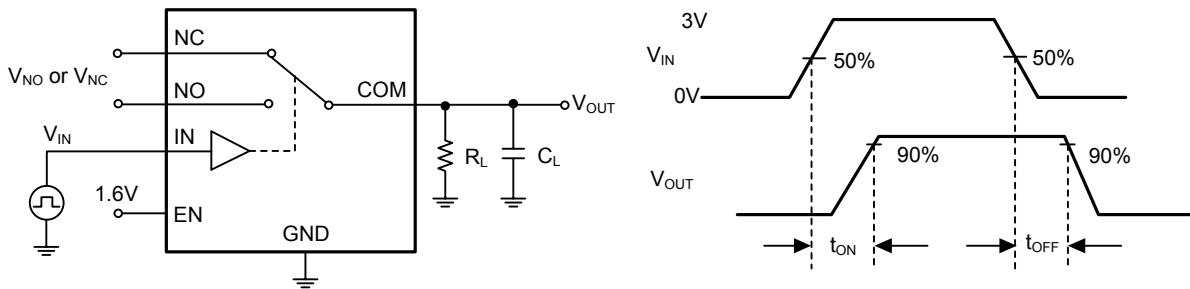| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | | Full | $-V_{CC}$ | | $+V_{CC}$ | V |
| On-Resistance | $R_{ON}$ | $-V_{CC} \leq V_{NO}$, $V_{NC} \leq V_{CC}$, $I_{COM}$ = -50mA, Test Circuit 1 | | +25℃ | | 1 | | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $-V_{CC} \leq V_{NO}$ or $V_{NC} \leq V_{CC}$, $I_{COM}$ = -50mA, Test Circuit 1 | | +25℃ | | 0.01 | | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $-V_{CC} \leq V_{NO}$ or $V_{NC} \leq V_{CC}$, $I_{COM}$ = -50mA, Test Circuit 1 | | +25℃ | | 0.02 | | Ω |
| Source OFF Leakage Current | $I_{NC(OFF)}$, $I_{NO(OFF)}$ | $V_{NO}$ or $V_{NC}$ = -4.5V, 4.5V, $V_{COM}$ = 4.5V, -4.5V | | +25℃ | | 0.01 | | µA |
| Channel ON Leakage Current | $I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$ | $V_{NO}$ or $V_{NC}$ = -4.5V, 4.5V, $V_{COM}$ = floating, or $V_{NO}$ or $V_{NC}$ = floating, $V_{COM}$ = -4.5V, 4.5V | | +25℃ | | 0.01 | | µA |
| **DIGITAL INPUTS** | | | | | | | | |
| Input High Voltage | $V_{INH}$ | $V_{CC}$ = 2.7V to 12V | | +25℃ | 1.6 | | | V |
| Input Low Voltage | $V_{INL}$ | $V_{CC}$ = 2.7V to 12V | | +25℃ | | | 0.3 | V |
| Pull Down Resistor | $R_{PULL\ DOWN}$ | | | +25℃ | | 600 | | kΩ |
| **DYNAMIC CHARACTERISTICS** | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{NO}$ or $V_{NC}$ = 1.0V, $V_{IH}$ = 1.6V, $V_{IL}$ = 0V, $R_L$ = 50Ω, $C_L$ = 35pF, Test Circuit 2 | | +25℃ | | 400 | | ns |
| Turn-Off Time | $t_{OFF}$ | $V_{NO}$ or $V_{NC}$ = 1.0V, $V_{IH}$ = 1.6V, $V_{IL}$ = 0V, $R_L$ = 50Ω, $C_L$ = 35pF, Test Circuit 2 | | +25℃ | | 100 | | ns |
| Break-Before-Make Time Delay | $t_D$ | $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 1.0V, $R_L$ = 50Ω, $C_L$ = 35pF, Test Circuit 3 | | +25℃ | | 300 | | ns |
| Off Isolation | $O_{ISO}$ | f = 1kHz, $R_L$ = 32Ω, Signal = 0dBm, Test Circuit 4 | | +25℃ | | -135 | | dB |
| | | f = 1MHz, $R_L$ = 50Ω, Signal = 0dBm, $C_L$ = 5pF, Test Circuit 4 | | | | -70 | | |
| Channel-to-Channel Crosstalk | $X_{TALK}$ | f = 1kHz, $R_L$ = 32Ω, Signal = 0dBm, Test Circuit 5 | | +25℃ | | -120 | | dB |
| | | f = 1MHz, $R_L$ = 50Ω, Signal = 0dBm, $C_L$ = 5pF, Test Circuit 5 | | | | -90 | | |
| -3dB Bandwidth | BW | Signal = 0dBm, $R_L$ = 50Ω, $C_L$ = 5pF, Test Circuit 6 | | +25℃ | | 100 | | MHz |
| Channel ON Capacitance | $C_{ON}$ | | | +25℃ | | 50 | | pF |
| Injection Select Input to Common I/O | Q | $V_G$ = GND, $R_G$ = 0Ω, $C_L$ = 1.0nF, Test Circuit 7 | | +25℃ | | 500 | | pC |
| Total Harmonic Distortion + Noise | THD+N | A-Weighting, Test Circuit 8 | $V_{NO}$, $V_{NC}$ = 2$V_{RMS}$, $R_L$ = 600Ω | +25℃ | | -116 | | dB |
| | | | $V_{NO}$, $V_{NC}$ = 2$V_{PP}$, $R_L$ = 600Ω | | | -115 | | |
| | | | $V_{NO}$, $V_{NC}$ = 2$V_{PP}$, $R_L$ = 32Ω | | | -112 | | |
| | | | $V_{NO}$, $V_{NC}$ = 1$V_{PP}$, $R_L$ = 600Ω | | | -111 | | |
| | | | $V_{NO}$, $V_{NC}$ = 1$V_{PP}$, $R_L$ = 32Ω | | | -108 | | |
| Start Up Time | $t_{start}$ | Switch $V_{EN}$ = 0V to $V_{EN}$ = 1.6V | | +25℃ | | 0.5 | | ms |
| **POWER REQUIREMENTS** | | | | | | | | |
| Power Supply Current | $I_{CC}$ | $V_{IN}$ = 0V or 1.6V, $V_{EN}$ = 1.6V | | +25℃ | | 600 | | µA |
| Power Supply Current in Shutdown State | $I_{CC}$ | $V_{IN}$ = 0V or 1.6V, $V_{EN}$ = 0V | | +25℃ | | 0.4 | | µA |

## ELECTRICAL CHARACTERISTICS (continued)

($V_{CC}$ = 12V, Full = -40℃ to +85℃. Typical values are at $T_A$ = +25℃, unless otherwise noted.)

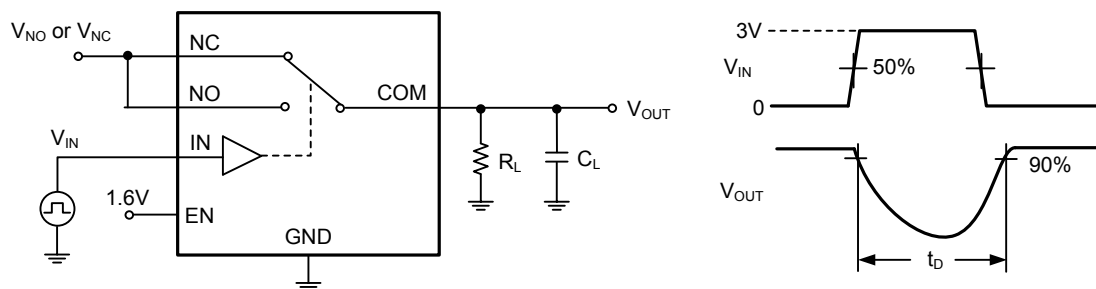| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **ANALOG SWITCH** | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | Full | $-V_{CC}$ | | $+V_{CC}$ | V |
| On-Resistance | $R_{ON}$ | $-V_{CC} \leq V_{NO}$, $V_{NC} \leq V_{CC}$, $I_{COM}$ = -50mA, Test Circuit 1 | +25℃ | | 1 | | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $-V_{CC} \leq V_{NO}$ or $V_{NC} \leq V_{CC}$, $I_{COM}$ = -50mA, Test Circuit 1 | +25℃ | | 0.01 | | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $-V_{CC} \leq V_{NO}$ or $V_{NC} \leq V_{CC}$, $I_{COM}$ = -50mA, Test Circuit 1 | +25℃ | | 0.02 | | Ω |
| Source OFF Leakage Current | $I_{NC(OFF)}$, $I_{NO(OFF)}$ | $V_{NO}$ or $V_{NC}$ = -11.5V, 11.5V, $V_{COM}$ = 11.5V, -11.5V | +25℃ | | 0.05 | | µA |
| Channel ON Leakage Current | $I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$ | $V_{NO}$ or $V_{NC}$ = -11.5V, 11.5V, $V_{COM}$ = floating, or $V_{NO}$ or $V_{NC}$ = floating, $V_{COM}$ = -11.5V, 11.5V | +25℃ | | 0.05 | | µA |
| **DIGITAL INPUTS** | | | | | | | |
| Input High Voltage | $V_{INH}$ | $V_{CC}$ = 2.7V to 12V | +25℃ | 1.6 | | | V |
| Input Low Voltage | $V_{INL}$ | $V_{CC}$ = 2.7V to 12V | +25℃ | | | 0.3 | V |
| Pull Down Resistor | $R_{PULL\ DOWN}$ | | +25℃ | | 600 | | kΩ |
| **DYNAMIC CHARACTERISTICS** | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{NO}$ or $V_{NC}$ = 1.0V, $V_{IH}$ = 1.6V, $V_{IL}$ = 0V, $R_L$ = 50Ω, $C_L$ = 35pF, Test Circuit 2 | +25℃ | | 400 | | ns |
| Turn-Off Time | $t_{OFF}$ | $V_{NO}$ or $V_{NC}$ = 1.0V, $V_{IH}$ = 1.6V, $V_{IL}$ = 0V, $R_L$ = 50Ω, $C_L$ = 35pF, Test Circuit 2 | +25℃ | | 100 | | ns |
| Break-Before-Make Time Delay | $t_D$ | $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 1.0V, $R_L$ = 50Ω, $C_L$ = 35pF, Test Circuit 3 | +25℃ | | 300 | | ns |
| Off Isolation | $O_{ISO}$ | f = 1kHz, $R_L$ = 32Ω, Signal = 0dBm, Test Circuit 4 | +25℃ | | -135 | | dB |
| | | f = 1MHz, $R_L$ = 50Ω, Signal = 0dBm, $C_L$ = 5pF, Test Circuit 4 | | | -70 | | |
| Channel-to-Channel Crosstalk | $X_{TALK}$ | f = 1kHz, $R_L$ = 32Ω, Signal = 0dBm, Test Circuit 5 | +25℃ | | -120 | | dB |
| | | f = 1MHz, $R_L$ = 50Ω, Signal = 0dBm, $C_L$ = 5pF, Test Circuit 5 | | | -90 | | |
| -3dB Bandwidth | BW | Signal = 0dBm, $R_L$ = 50Ω, $C_L$ = 5pF, Test Circuit 6 | +25℃ | | 100 | | MHz |
| Channel ON Capacitance | $C_{ON}$ | | +25℃ | | 50 | | pF |
| Injection Select Input to Common I/O | Q | $V_G$ = GND, $R_G$ = 0Ω, $C_L$ = 1.0nF, Test Circuit 7 | +25℃ | | 600 | | pC |
| Total Harmonic Distortion + Noise | THD+N | A-Weighting, Test Circuit 8 — $V_{NO}$, $V_{NC}$ = 2$V_{RMS}$, $R_L$ = 600Ω | +25℃ | | -116 | | dB |
| | | $V_{NO}$, $V_{NC}$ = 2$V_{PP}$, $R_L$ = 600Ω | | | -115 | | |
| | | $V_{NO}$, $V_{NC}$ = 2$V_{PP}$, $R_L$ = 32Ω | | | -112 | | |
| | | $V_{NO}$, $V_{NC}$ = 1$V_{PP}$, $R_L$ = 600Ω | | | -111 | | |
| | | $V_{NO}$, $V_{NC}$ = 1$V_{PP}$, $R_L$ = 32Ω | | | -108 | | |
| Start Up Time | $t_{start}$ | Switch $V_{EN}$ = 0V to $V_{EN}$ = 1.6V | +25℃ | | 0.5 | | ms |
| **POWER REQUIREMENTS** | | | | | | | |
| Power Supply Current | $I_{CC}$ | $V_{IN}$ = 0V or 1.6V, $V_{EN}$ = 1.6V | +25℃ | | 730 | | µA |
| Power Supply Current in Shutdown State | $I_{CC}$ | $V_{IN}$ = 0V or 1.6V, $V_{EN}$ = 0V | +25℃ | | 0.5 | | µA |

# TEST CIRCUITS



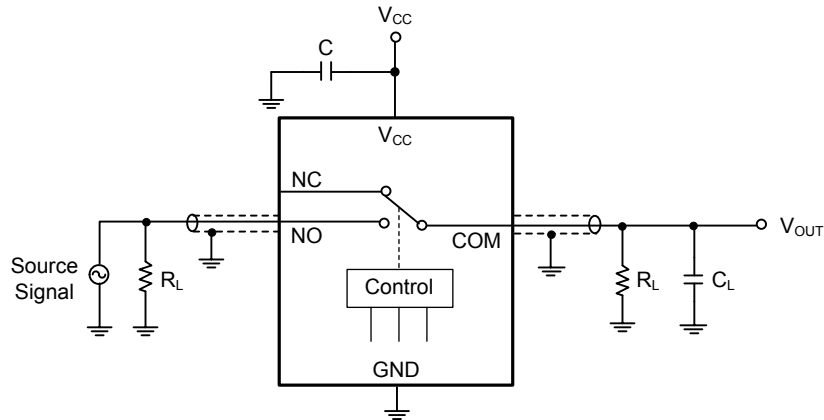**Test Circuit 1. On Resistance**



**Test Circuit 2. Switching Times (t$_{ON}$, t$_{OFF}$)**
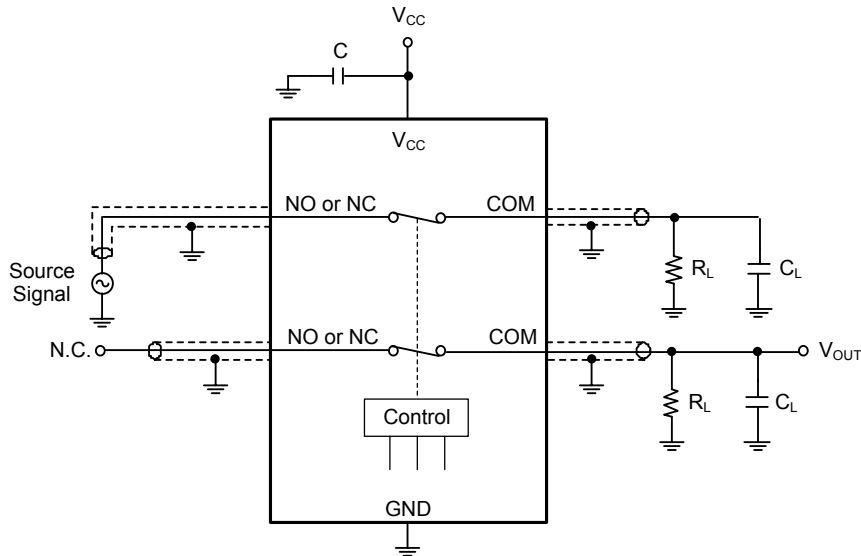


**Test Circuit 3. Break-Before-Make Time Delay (t$_D$)**

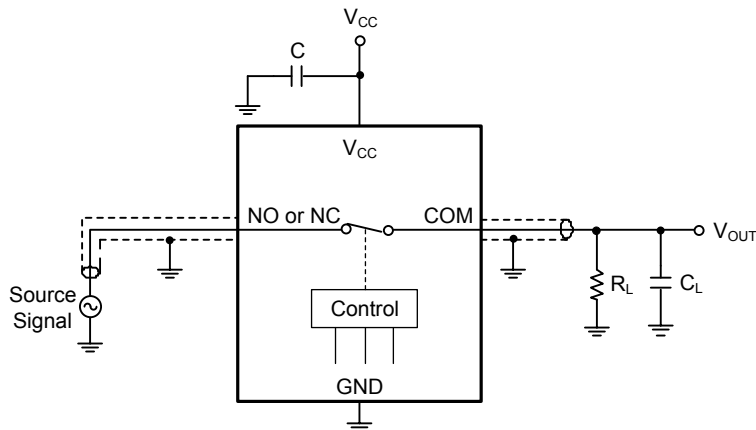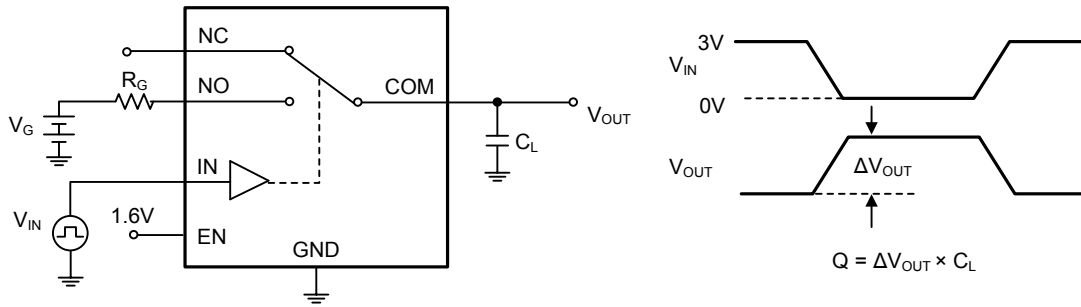## TEST CIRCUITS (continued)



**Test Circuit 4. Off Isolation**



$$\text{Channel-to-Channel Crosstalk} = -20 \times \log \frac{V_{NO} \text{ or } V_{NC}}{V_{OUT}}$$
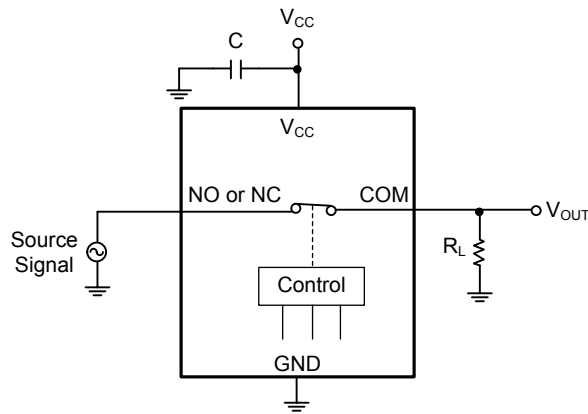
**Test Circuit 5. Channel-to-Channel Crosstalk**



**Test Circuit 6. -3dB Bandwidth**

## TEST CIRCUITS (continued)



**Test Circuit 7. Charge Injection (Q)**



**Test Circuit 8. Total Harmonic Distortion + Noise (THD+N)**

# APPLICATION INFORMATION

Speaker + Receiver is always used in portable devices, and high voltage class D speaker driver is used to drive speaker in order to provide high audio volume. But the high output voltage of class D speaker driver will damage the receiver driver. The SGM3712 provides the safe isolation between receiver driver and high voltage class D speaker driver. The SGM3712 provides low $R_{ON}$ channels to pass the positive and negative signals from capless receiver driver. The circuit is shown in Figure 1.



**Figure 1. Typical Application Circuit for Speaker + Receiver**

# APPLICATION INFORMATION (continued)

In order to improve audio performance of portable equipment, external speaker power amplifier is always selected to replace the internal integrated speaker power amplifier. Because the audio signal quality of audio line out or headset driver is better than the integrated speaker power amplifier, the audio signal of line out or headset driver is selected as the high performance audio signal source for external speaker power amplifier. High performance SGM3712 is used as the 1-to-2 HiFi signal switch in this application. The circuit is shown in Figure 2, and a stable 3.3V power supply is required in this circuit.
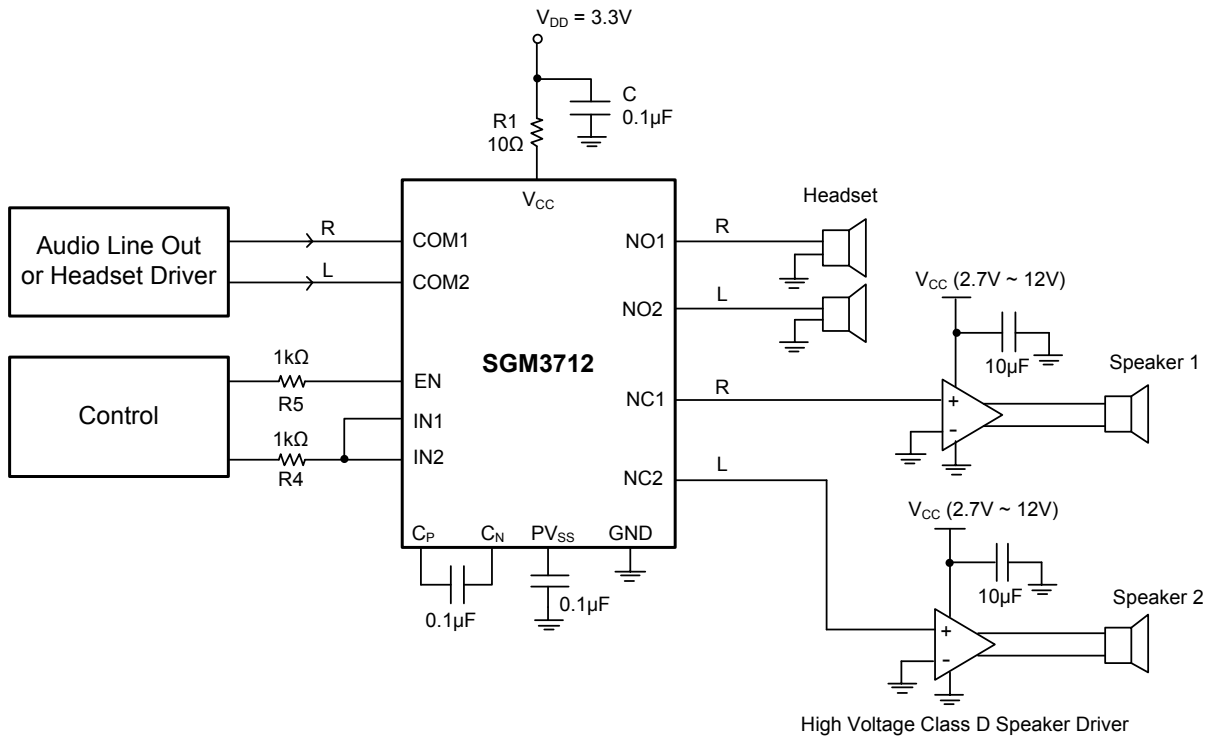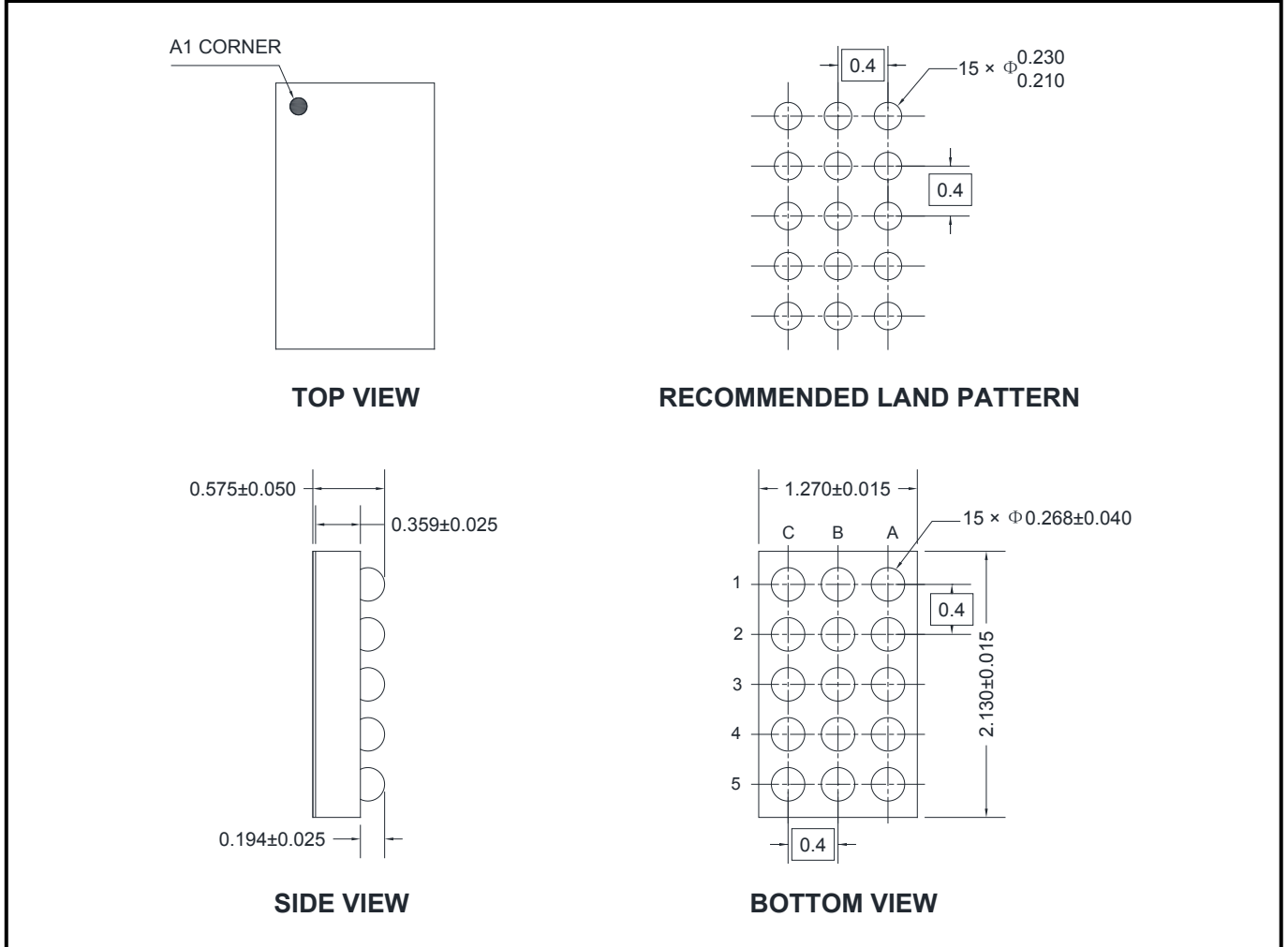


**Figure 2. Typical Application Circuit for 1-to-2 HiFi Audio Signal Switch**

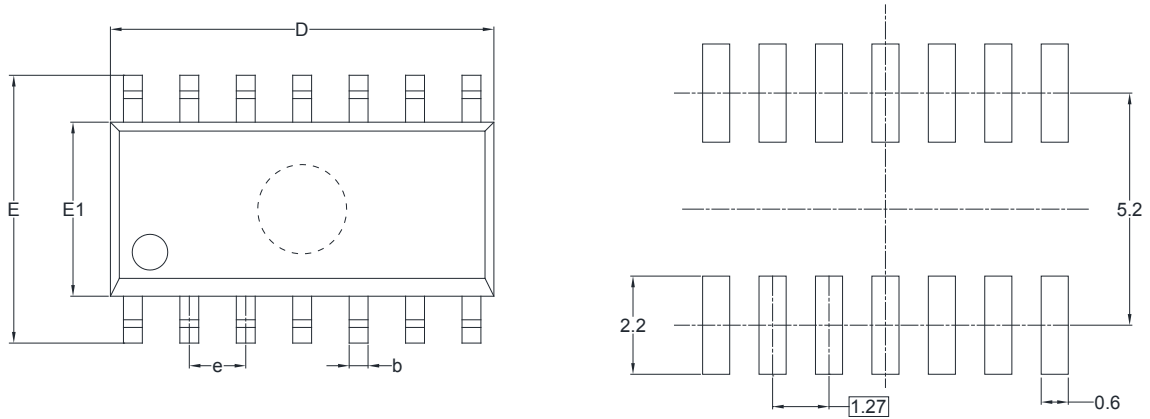## PACKAGE OUTLINE DIMENSIONS

### WLCSP-1.27×2.13-15B

A1 CORNER

**TOP VIEW**

15 × Φ0.230/0.210

0.4

0.4

**RECOMMENDED LAND PATTERN**

0.575±0.050

0.359±0.025

0.194±0.025

**SIDE VIEW**

1.270±0.015

15 × Φ0.268±0.040

C  B  A

1
2
3
4
5

0.4

2.130±0.015

0.4

**BOTTOM VIEW**
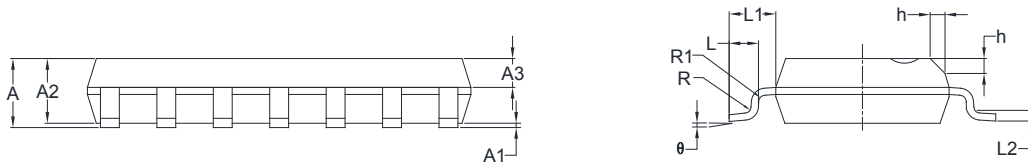
NOTE: All linear dimensions are in millimeters.

# PACKAGE OUTLINE DIMENSIONS
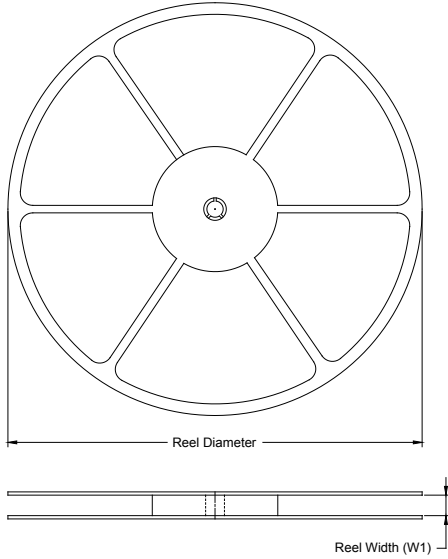
## SOIC-14



**RECOMMENDED LAND PATTERN** (Unit: mm)



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A2 | 1.25 | 1.65 | 0.049 | 0.065 |
| A3 | 0.55 | 0.75 | 0.022 | 0.030 |
| b | 0.36 | 0.49 | 0.014 | 0.019 |
| D | 8.53 | 8.73 | 0.336 | 0.344 |
| E | 5.80 | 6.20 | 0.228 | 0.244 |
| E1 | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 0.45 | 0.80 | 0.018 | 0.032 |
| L1 | 1.04 REF | | 0.040 REF | |
| L2 | 0.25 BSC | | 0.01 BSC | |
| R | 0.07 | | 0.003 | |
| R1 | 0.07 | | 0.003 | |
| h | 0.30 | 0.50 | 0.012 | 0.020 |
| θ | 0° | 8° | 0° | 8° |

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS



Reel Diameter

Reel Width (W1)

### TAPE DIMENSIONS



**DIRECTION OF FEED**

NOTE: The picture is only for reference. Please make the object as the standard.
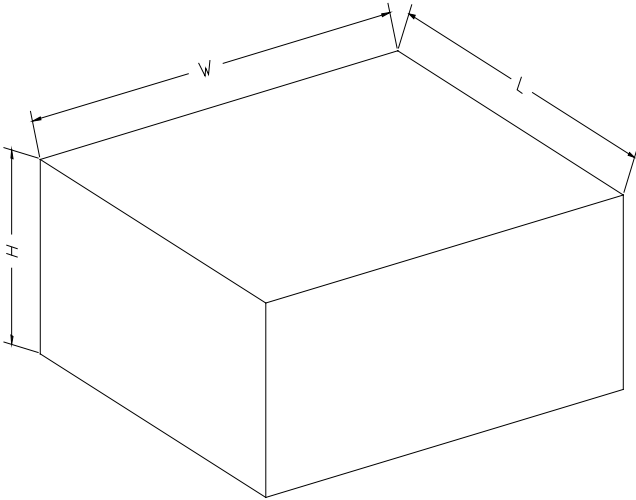
## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| WLCSP-1.27×2.13-15B | 7″ | 9.5 | 1.47 | 2.37 | 0.78 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |
| SOIC-14 | 13″ | 16.4 | 6.60 | 9.30 | 2.10 | 4.0 | 8.0 | 2.0 | 16.0 | Q1 |

DD0001

## 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 |

DD0002