

### GENERAL DESCRIPTION

The SGM2549D senses ground pole and automatically selects switches accordingly in either the driver side or the headset side, with no need of any external control input. If a plug-in of the earphone is misplaced, it will keep SGM2549D trying periodically until a correct microphone pole is found. It consumes 1.3µA when a microphone is identified.

SGM2549D is available in Green UTDFN-1.5×2-6L and SOT-23-6 packages. It is rated over the -40°C to +85°C temperature range.

### FEATURES

- Simple and Dedicated for One Purpose
- SGMICRO’s Patented Circuit w/o IP Conflict
- Autonomous Fixing CTIA/OMTP Ground Path
- Keep MIC Low When a 3-Pole Headset Identified
- Applicable to Both Driver Side and Earphone Side
- Low Ground Path Impedance
- Ground Path Voltage Drop Sensing
- Powered by Local Source or External Parasitics
- Ground Pin FM Antenna Path
- -40°C to +85°C Operating Temperature Range
- SGM2549D is Available in Green  
UTDFN-1.5×2-6L and SOT-23-6 Packages

### APPLICATIONS

Phones/Pads/Computers/Media Players  
Earphones/Phone-Jack Key/Phone-Jack Button

### TYPICAL APPLICATION

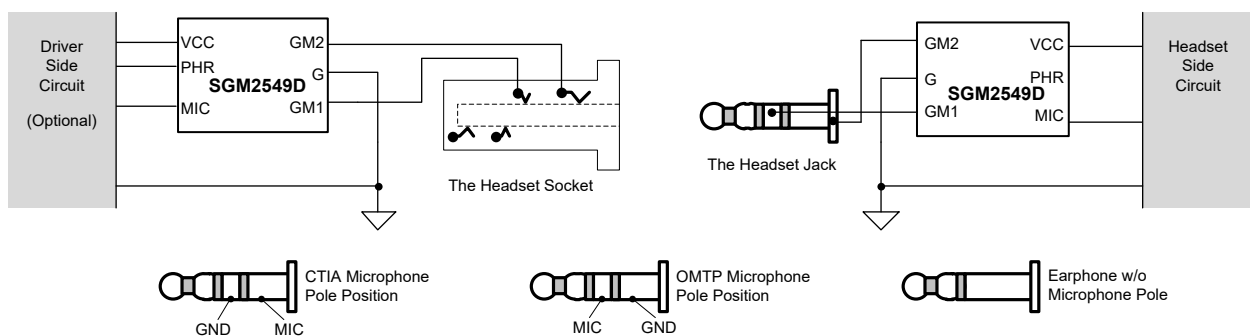
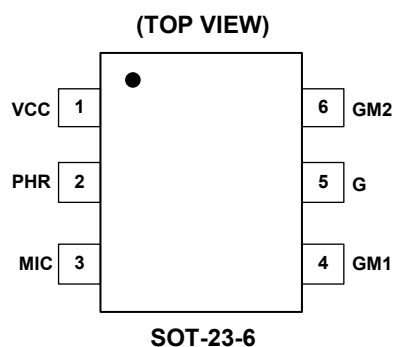
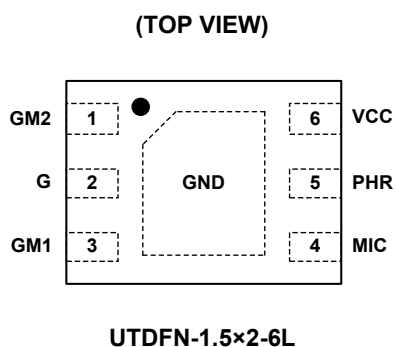


Figure 1. Typical Application Circuits for the Driver Side and the Earphone Side



PIN CONFIGURATIONS



PIN DESCRIPTION

| PIN            |          | NAME | TYPE | FUNCTION  |
|----------------|----------|------|------|---|
| UTDFN-1.5x2-6L | SOT-23-6 |      |      |   |
| 6              | 1        | VCC  | P    | Power input to circuit in this IC.  |
| 5              | 2        | PHR  | I/O  | The output of voltage drop along the earphone returning ground path. Signal picked at this node is used to suppress cross talk between 2 channels and between earphone driving and microphone output in either analog domain or digital domain. |
| 4              | 3        | MIC  | P    | Microphone bias and input switch node and parasitic power to internal circuit if using microphone bias to power this IC. Connect to the microphone bias of the circuit that this circuit works for.   |
| 3              | 4        | GM1  | IO   | One possible grounding node. It is connected to MIC by default at power up.   |
| 2              | 5        | G    | G    | Ground of the internal circuit and ground for the earphone.   |
| 1              | 6        | GM2  | IO   | Another possible grounding node. It is connected to G by default at power up.   |

NOTE: I/O: Input or Output, G: Ground, P: Power for the circuit.

**ELECTRICAL CHARACTERISTICS**(T<sub>A</sub> = +25°C, V<sub>CC</sub> = 3.6V, unless otherwise noted.)

| PARAMETER                         | SYMBOL             | CONDITIONS  | MIN        | TYP           | MAX | UNITS |
|-----------------------------------|--------------------|---|------------|---------------|-----|-------|
| Supply Voltage                    | V <sub>CC</sub>    |   | 1.7        |               | 5.5 | V     |
| Supply Voltage                    | V <sub>MIC</sub>   | Pull up through 2.5kΩ ~ 2.7kΩ resistor.   | 1.7        |               | 2.4 | V     |
| Parasitical Power from GM1/GM2    | V <sub>PPSGM</sub> | With no V <sub>CC</sub> power supply.   | 2.6        | 3.3           | 5.5 | V     |
| Parasitical Power from R/L Driver | V <sub>PPSRC</sub> | With no V <sub>CC</sub> power supply.   | 2.2        | 3.3           | 5.5 | V     |
| Operation Current                 | I <sub>OP</sub>    | V <sub>CC</sub> = 3.6V, V <sub>MIC</sub> = 2.1V, when an earphone w/MIC plugged in, or when nothing plugged in.                 |            | 1.3           | 2.1 | μA    |
|                                   |                    | V <sub>CC</sub> = 1.7V to 5.5V, V <sub>MIC</sub> = 1.7V to 2.4V, when an earphone w/MIC plugged in, or when nothing plugged in. |            |               | 2.2 |       |
|                                   | I <sub>OP1</sub>   | V <sub>CC</sub> = 3.6V, V <sub>MIC</sub> = 2.1V, when an earphone w/o MIC plugged in.   |            | 1.5           |     |       |
| <b>Switch Paths</b>               |                    |   |            |               |     |       |
| Path Set Time                     | t <sub>DECT</sub>  | V <sub>CC</sub> = 3.6V  |            | 7.5           |     | ms    |
| Path Detection Period             | t                  | V <sub>CC</sub> = 3.6V  |            | 1.9           |     | s     |
| GM1/GM2 to G Path Impedance       | R <sub>ON1</sub>   | V <sub>CC</sub> = 3.6V, V <sub>MIC</sub> = 2.1V   |            | 70            | 100 | mΩ    |
| MIC to GM1/GM2 Path Impedance     | R <sub>ON2</sub>   | V <sub>CC</sub> = 3.6V, V <sub>MIC</sub> = 2.1V   |            | 10            |     | Ω     |
| PHR to G Path Impedance           | R <sub>ON3</sub>   | V <sub>CC</sub> = 3.6V, V <sub>MIC</sub> = 2.1V   |            | 46            |     | Ω     |
| Open Path Isolation               | R <sub>ISO</sub>   | V <sub>CC</sub> = 5V, any of GM1/GM2 to G, to MIC, to PHR.  |            | 56            |     | MΩ    |
| LR Crosstalk                      | CC <sub>1k</sub>   | V <sub>CC</sub> = 3.6V, 1kHz 1V <sub>PP</sub> , 32Ω load.   |            | -52           |     | dB    |
|                                   | CC <sub>10k</sub>  | V <sub>CC</sub> = 3.6V, 10kHz 1V <sub>PP</sub> , 32Ω load.  |            | -53           |     | dB    |
| THD+N <sup>(1)</sup>              |                    | V <sub>CC</sub> = 3.6V, 1kHz 1V <sub>PP</sub> , 32Ω load.   | See NOTE 1 |               |     |       |
|                                   |                    | V <sub>CC</sub> = 3.6V, 10kHz 1V <sub>PP</sub> , 32Ω load.  |            |               |     |       |
| LR to PHR Crosstalk               | SC <sub>1k</sub>   | V <sub>CC</sub> = 3.6V, 1kHz 1V <sub>RMS</sub> , feeding R/L through 32Ω.   |            | -55           |     | dB    |
|                                   | SC <sub>10k</sub>  | V <sub>CC</sub> = 3.6V, 10kHz 1V <sub>RMS</sub> , feeding R/L through 32Ω.  |            | -55           |     | dB    |
| FM Band Insertion Loss            | IL                 | 100MHz, G connected 50Ω//4.7pF to GND.  |            | -0.40         |     | dB    |
| FM Impedance                      | Z <sub>GM</sub>    | 100MHz, -10dBm, from GM to G.   |            | 0.05 + 4.4j   |     | Ω     |
|                                   | Z <sub>G</sub>     | 100MHz, -10dBm, see Figure 6 for test circuit.  |            | 50.36 - 1.98j |     | Ω     |

NOTE 1: See no difference by insertion of the SGM2549D in test load, checked with an audio tester, SYS-2722.

TYPICAL APPLICATION CIRCUITS

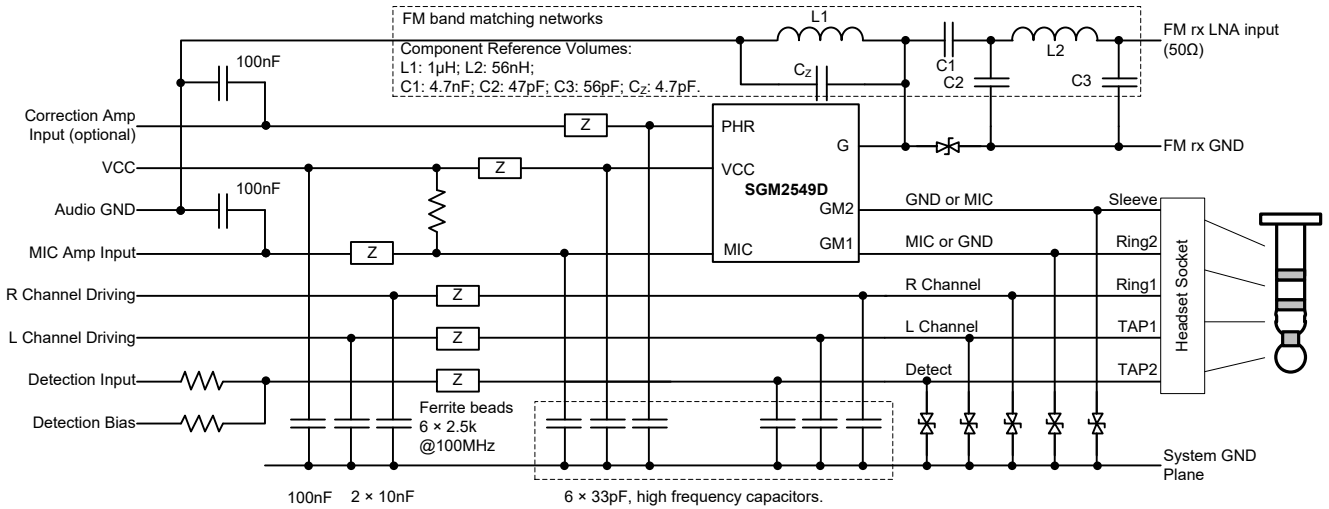


Figure 2. The SGM2549D in the Headset-Antenna Circuit with ESD Strengthening

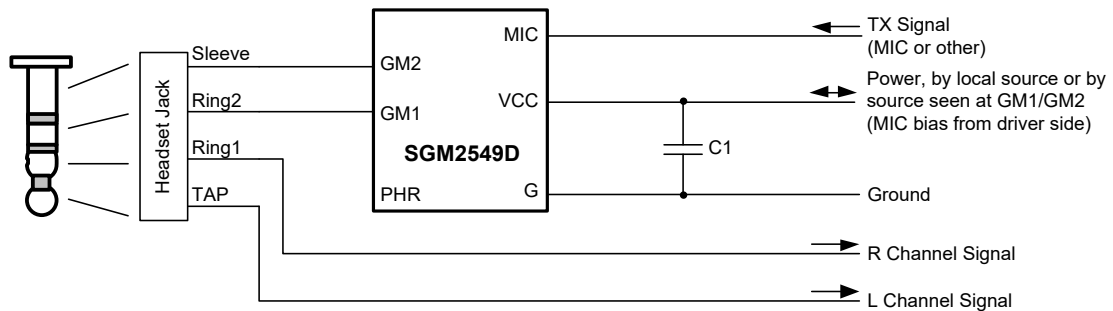


Figure 3. The Headset or Peripheral Side Application Circuit with Local Power or Parasitically Powered by Bias Input

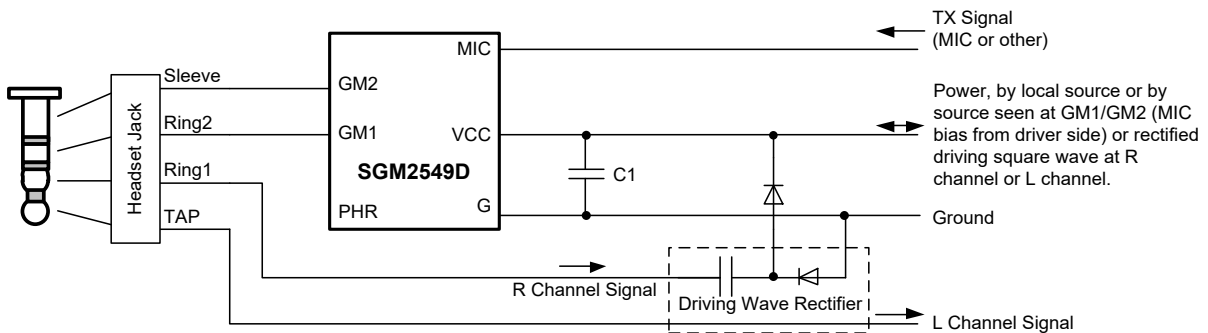


Figure 4. The Headset or Peripheral Side Application Circuit Powered by Driving Output of Source

FUNCTIONAL BLOCK DIAGRAM

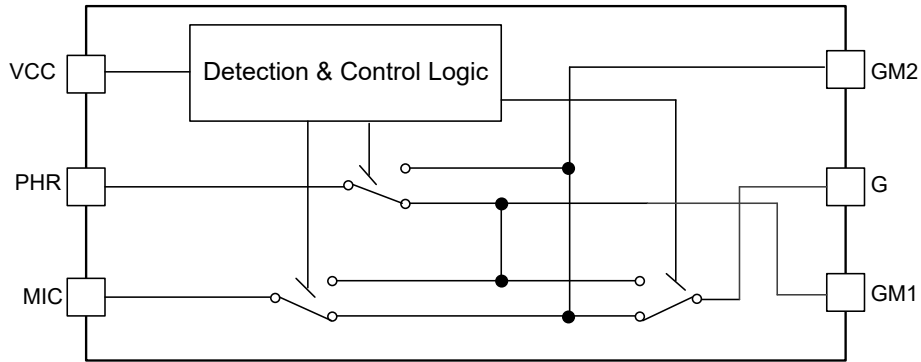


Figure 5. Functional Block Diagram

TEST CIRCUIT

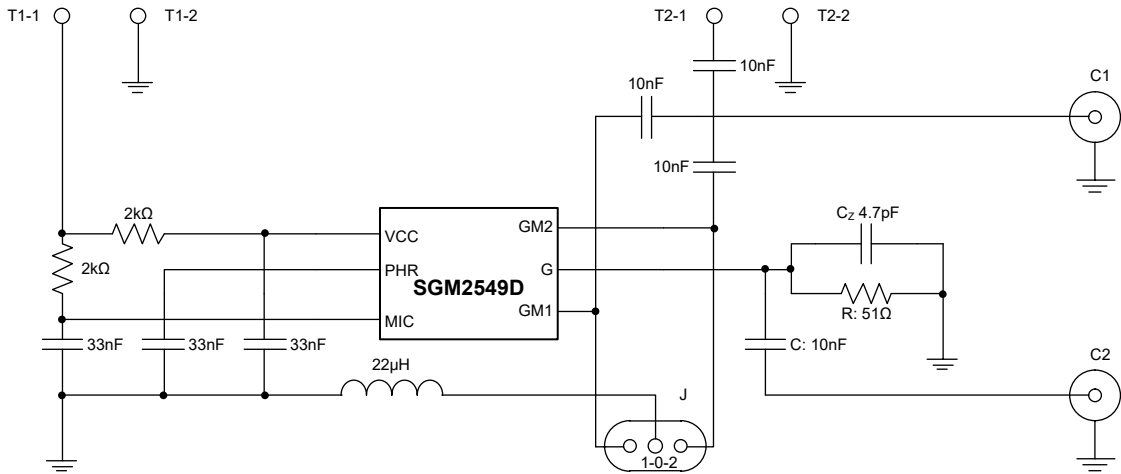
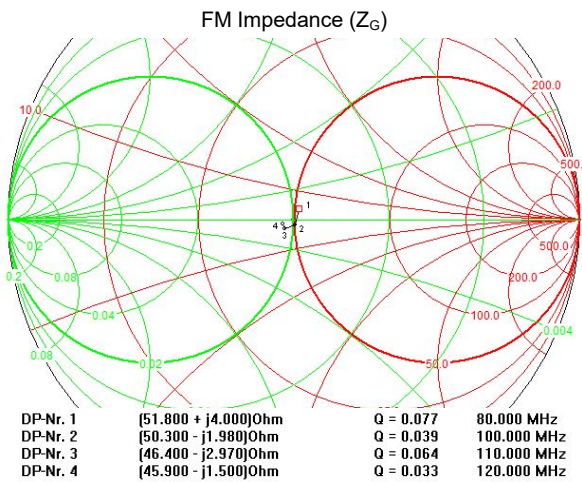
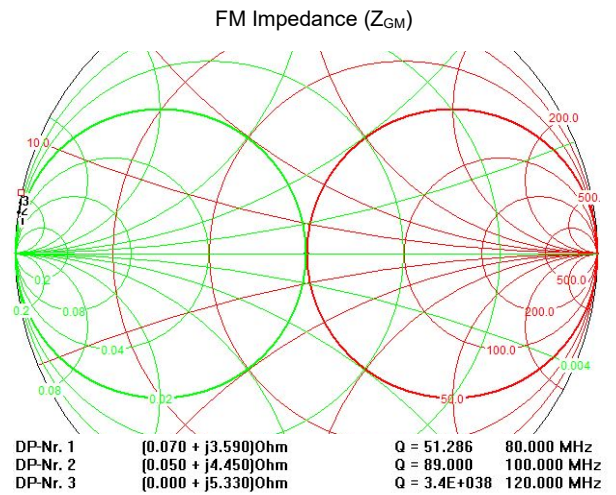
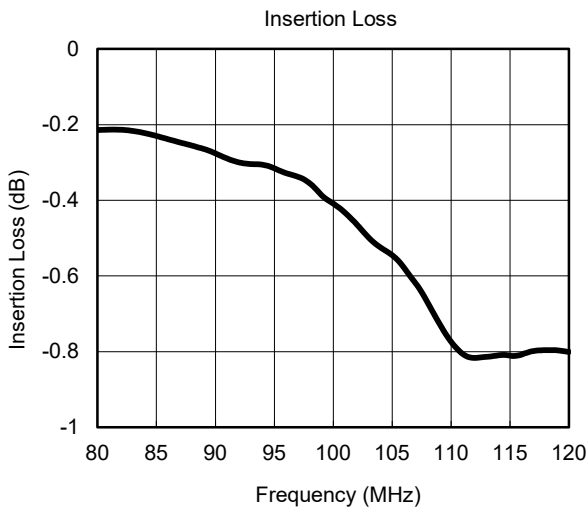
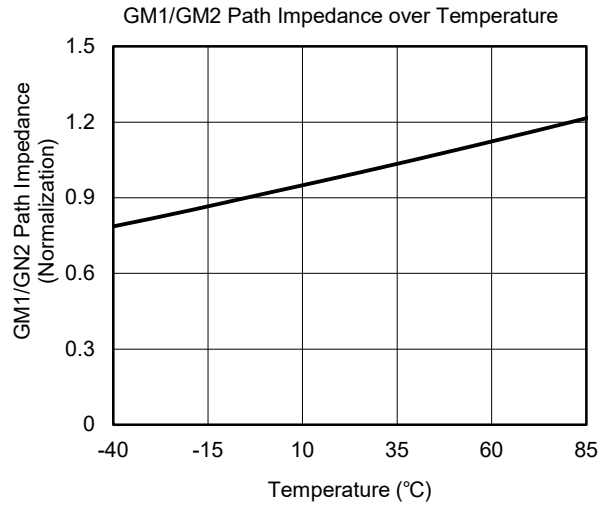
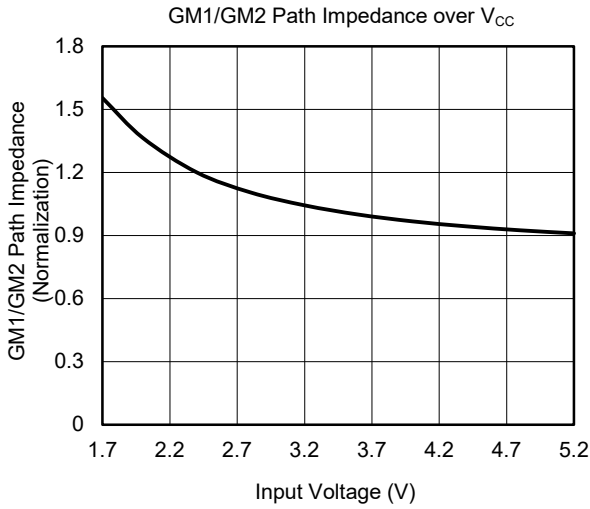


Figure 6. FM Band Parameters Test Circuit

**TYPICAL PERFORMANCE CHARACTERISTICS**

T<sub>A</sub> = +25°C, unless otherwise noted.



### FUNCTIONAL DESCRIPTION AND APPLICATIONS

The CTIA and the OMTP define different ground pole and MIC pole positions for the headset socket. The SGM2549D continuously monitors poles' states and makes right path selection for the ground pole and the MIC pole. If no pole stays high long enough, the SGM2549D will stop switching.

The SGM2549D works at both driver (the phone side) and the peripheral side (the earphone side) with no external devices needed, as showed in Figure 1. Diagrams showed in Figure 2 to Figure 4 are application circuits for making an earphone antenna, for strengthening ESD protection, and etc.

The SGM2549D could be powered by a power rail or by an external rectifier, as the Figure 3 or Figure 4 shows.

#### Making an Earphone Cable a Wipe Antenna

As showed in Figure 2, the LC networks composed of L2, C2 and C3 is essential for matching receiver input impedance, which is normally  $50\Omega$  and the impedance of a wipe antenna,  $110\Omega$  normally. The inductor L1 is to isolate the FM receiver ground from the ground of audio driver and ground plane of the whole circuit, which could be shorted if the ground of FM receiver is properly placed. The 6 units of 33pF caps provide current reflection terminations of rest wires in the earphone cable and make them a single string wipe antenna.

#### Strengthening ESD Protection

With its ESD cells on each GM1 pin and GM2 pin, and isolation effect of those ferrite beads, most of those transient voltage suppression diodes (TVS) showed in Figure 2 may not be necessary, except the one to protect the FM receiver input. However, those bond to socket contact always help in strengthening ESD protection.

#### Parasitic Power and MIC Bias

As in Figure 3 and Figure 4, the SGM2549D is possibly powered by MIC bias, or audio signal from driver when it is used in peripheral side.

The C1 stores power extracted from the MIC bias input or the driving waves of the R channel or L channel. The C1 could be eliminated if a true microphone is used at peripheral, as the microphone output only swings in several tens mV, which does not affect the circuitry much.

#### Crosstalk and Side-Tone Suppression

Figure 7 illustrates how the ground path inserts crosstalk between L and R channels and side-tone into the output of a microphone inherently. If the current in L channel speaker creates a voltage drop on the  $R_{ON}$ , then the R channel sees the drop as crosstalk. The sum of drops created by both L and R channels makes the ground reference to microphone, and then it adds into  $S_{MIC}$  and causes the side-tone.

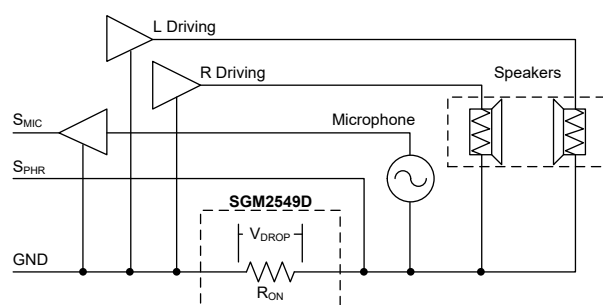


Figure 7. The Ground Path Impedance Drop

The conventional Howland is designed to correct the  $V_{DROP}$  that is sensed at the PHR of the SGM2549D, here the recommended method is to sense the  $S_{PHR}$  at the PHR pin and correct it digitally.

# CTIA/OMTP Headset Ground Pole Switch Autonomous Pole Position Fixing

## SGM2549D

### FUNCTIONAL DESCRIPTION AND APPLICATIONS (continued)

#### An Evaluation Board

There are 2 sockets for connecting once to one kind of source with a 2-heads cable, 1 socket for connecting a headset or another 2-heads cable on the EVB170304 evaluation board, where the J1 is for connecting a CTIA source, the J2 for an OMTP source, and J3 for a headset or for a source. The EVB170304 is designed to demonstrate following cases:

1. Use VCC input at the J1 and R1 to simulate a microphone biasing, to demonstrate the ground pole fixing. Headsets or earphones without any microphone are plugged in the J3. Fixing is observed by checking voltages at the TP5 and the TP6. The voltage at the TP5 is high for a CTIA type headset, high at the TP6 is for an OMTP type headset. None of them high is for an earphone without any microphone.
2. Connect one of CTIA type or OMTP type source at the J1 or the J2 correspondingly through a 2-heads

cable, with or without a VCC power input at the I1 and the I2, to demonstrate the fixing by plugging in different types of headsets in the J3. Keep the JP2 open for this demonstration; close the JP1 if not using a VCC input.

3. Connect to any of the CTIA type or the OMTP type source at the J3 through a 2-heads cable, to demonstrate a headset or a circuit in headset side to plug in any source type, with a VCC input at I1 and I2, or parasitically powered by microphone biasing. Keep the JP1 and the JP2 open for this demonstration.

4. Input a square wave at the R channel from a CTIA or an OMTP source at the J3 through a 2-heads cable, to demonstrate how power is extracted from it. Keep the JP1 open, the JP2 close for this demonstration.

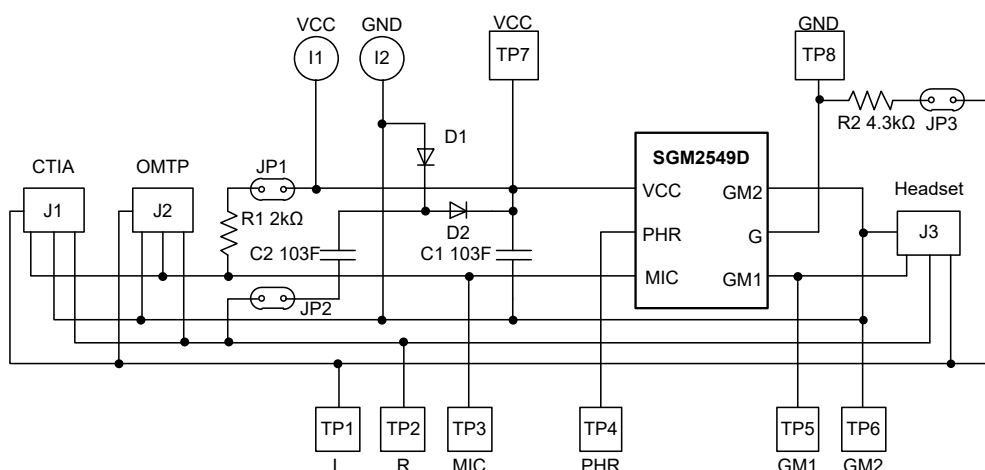


Figure 8. The EVB170304 Circuit

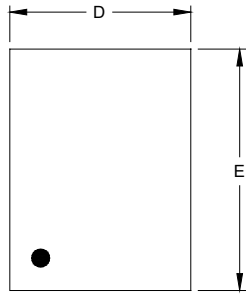
## REVISION HISTORY

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

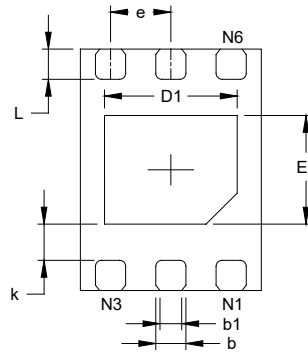
| APRIL 2026 – REV.A to REV.A.1                         | Page |
|---|------|
| Added CDM, Package Thermal Resistance .....           | 2    |
| Updated Package Outline Dimensions .....              | 11   |
| <b>Changes from Original to REV.A (DECEMBER 2018)</b> |      |
| Changed from product preview to production data ..... | All  |

PACKAGE OUTLINE DIMENSIONS

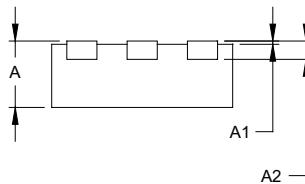
UTDFN-1.5×2-6L



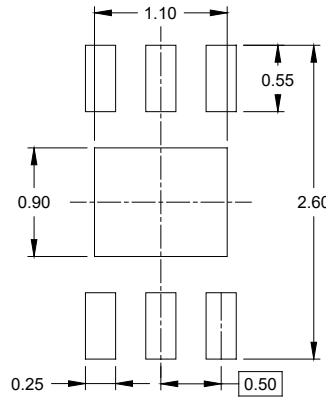
TOP VIEW



BOTTOM VIEW



SIDE VIEW



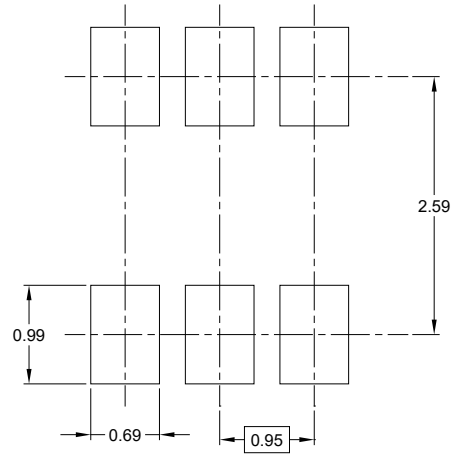
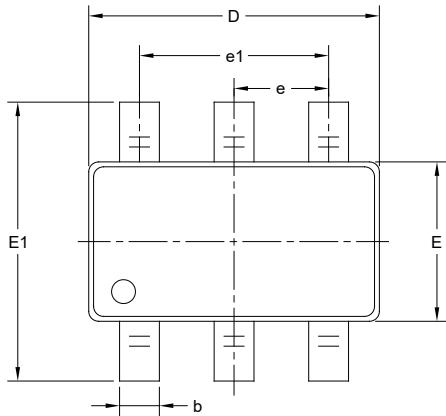
RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.500                        | 0.600 | 0.020                   | 0.024 |
| A1     | 0.000                        | 0.050 | 0.000                   | 0.002 |
| A2     | 0.152 REF                    |       | 0.006 REF               |       |
| D      | 1.400                        | 1.600 | 0.055                   | 0.063 |
| D1     | 1.000                        | 1.200 | 0.039                   | 0.047 |
| E      | 1.900                        | 2.100 | 0.075                   | 0.083 |
| E1     | 0.800                        | 1.000 | 0.031                   | 0.039 |
| k      | 0.300 REF                    |       | 0.012 REF               |       |
| b      | 0.200                        | 0.300 | 0.008                   | 0.012 |
| b1     | 0.180 REF                    |       | 0.007 REF               |       |
| e      | 0.500 BSC                    |       | 0.020 BSC               |       |
| L      | 0.200                        | 0.300 | 0.008                   | 0.012 |

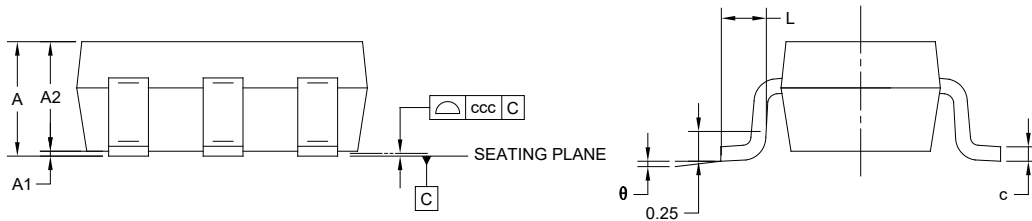
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

SOT-23-6



RECOMMENDED LAND PATTERN (Unit: mm)



| Symbol   | Dimensions In Millimeters |     |       |
|----------|---------------------------|-----|-------|
|          | MIN                       | NOM | MAX   |
| A        | -                         | -   | 1.450 |
| A1       | 0.000                     | -   | 0.150 |
| A2       | 0.900                     | -   | 1.300 |
| b        | 0.300                     | -   | 0.500 |
| c        | 0.080                     | -   | 0.220 |
| D        | 2.750                     | -   | 3.050 |
| E        | 1.450                     | -   | 1.750 |
| E1       | 2.600                     | -   | 3.000 |
| e        | 0.950 BSC                 |     |       |
| e1       | 1.900 BSC                 |     |       |
| L        | 0.300                     | -   | 0.600 |
| $\theta$ | 0°                        | -   | 8°    |
| ccc      | 0.100                     |     |       |

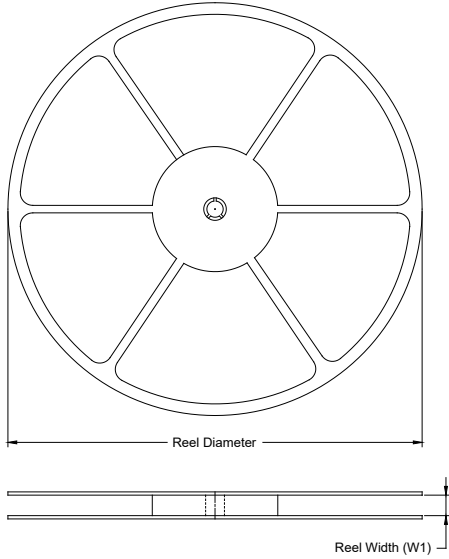
NOTES:

1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

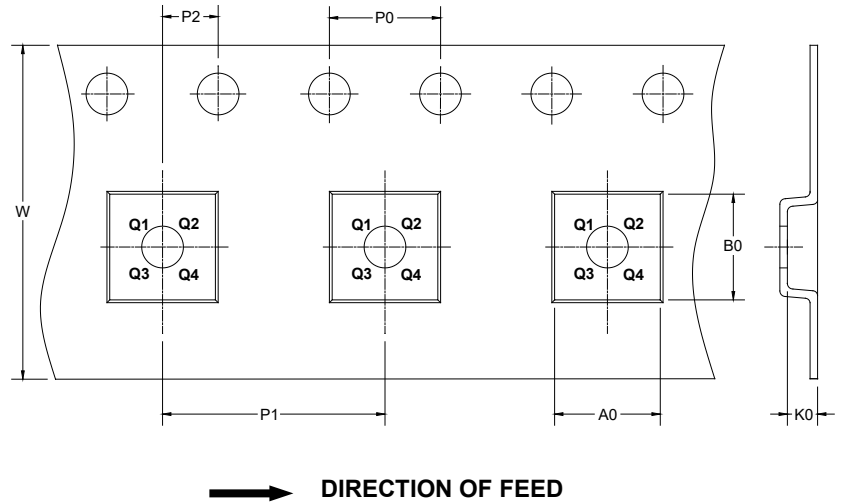
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



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

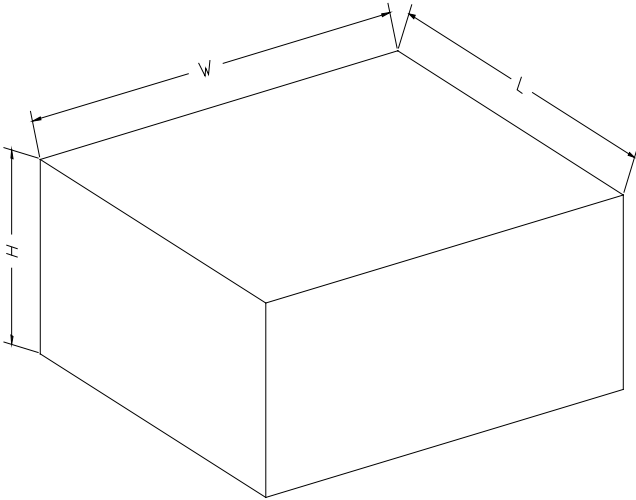
### KEY PARAMETER LIST OF TAPE AND REEL

| Package Type   | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|----------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| UTDFN-1.5×2-6L | 7"            | 9.5                | 1.70    | 2.30    | 0.75    | 4.0     | 4.0     | 2.0     | 8.0    | Q2            |
| SOT-23-6       | 7"            | 9.5                | 3.17    | 3.23    | 1.37    | 4.0     | 4.0     | 2.0     | 8.0    | Q3            |

DD0001

# 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 |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368         | 227        | 224         | 8            |
| 7"          | 442         | 410        | 224         | 18           |

DD0002