



SGM3714

0.18Ω, High Voltage, Soft Turn-On/Off, Rail-to-Rail Negative Signal Passing, Dual, SPST Analog Switch

GENERAL DESCRIPTION

The SGM3714 is a high voltage, dual SPST (single-pole/single-throw) analog switch. It operates from a 2.7V to 9V single power supply and allows rail-to-rail negative signal passing with low distortion.

In addition, the SGM3714 can be used as audio R&L signals or one differential signal switch and power switches because it has two single-pole/single-throw switches.

The SGM3714 features low on-resistance, soft switch turn-on and turn-off to eliminate click-pop noise, high off-isolation and fast switching times. The high performances make it very suitable for multiple applications.

The SGM3714 is available in Green TQFN-3×3-16L and WLCSP-1.62×1.23-12B packages. It operates over an operating temperature range of -40°C to +85°C.

FEATURES

- **Single Supply Voltage Range: 2.7V to 9V**
- **Ultra-Low On-Resistance: 0.18Ω (TYP)**
- **-V_{CC} to +V_{CC} Rail-to-Rail Low Distortion Positive and Negative Signal Passing**
- **Soft Switch Turn-On and Turn-Off**
- **Adjustable Turn-On and Turn-Off Times:**
 - ♦ **t_{ON} = 210ms (V_{CC} = 5V, C_{TC} = 0.1μF)**
 - ♦ **t_{OFF} = 720ms (V_{CC} = 5V, C_{TC} = 0.1μF)**
- **High Off-Isolation: -125dB at 20kHz**
- **Low Crosstalk: -110dB at 20kHz**
- **Low Input Leakage Current**
- **Rail-to-Rail Input and Output Operation**
- **1.8V Logic Compatible Control Pin**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green TQFN-3×3-16L and WLCSP-1.62×1.23-12B Packages**

APPLICATIONS

HiFi Audio Switch
Portable Equipment
Battery-Powered Systems

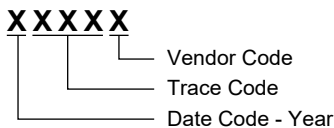
0.18Ω, High Voltage, Soft Turn-On/Off, Rail-to-Rail SGM3714 Negative Signal Passing, Dual, SPST Analog Switch

PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---------|---------------------|-----------------------------|------------------|-----------------|---------------------|
| SGM3714 | TQFN-3×3-16L | -40°C to +85°C | SGM3714YTQ16G/TR | 3714TQ XXXXX | Tape and Reel, 4000 |
| | WLCSP-1.62×1.23-12B | -40°C to +85°C | SGM3714YG/TR | XXXXX 3714 | Tape and Reel, 3000 |

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace 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 10V |
| IN, EN, TC to GND | 0V to 6V |
| Analog Voltage Range ⁽¹⁾ | (-V _{CC} - 0.3V) to (V _{CC} + 0.3V) |
| Continuous Current from Sx to Dx | ±800mA |
| Peak Current from Sx to Dx | ±1000mA |
| I/O Clamp Current (V _I < 0) | -30mA |
| Junction Temperature | +150°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 10s) | +260°C |
| ESD Susceptibility | |
| HBM | 8000V |
| CDM | 1000V |

NOTE:

1. Internal diodes will clamp voltages at Sx and Dx that exceed V_{CC} or GND. Limit the current through the forward diode to the maximum ratings.

RECOMMENDED OPERATING CONDITIONS

| | |
|-----------------------------|----------------|
| Supply Voltage Range | 2.7V to 9V |
| Operating Temperature Range | -40°C to +85°C |

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

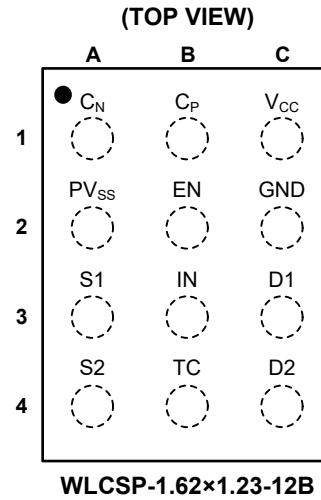
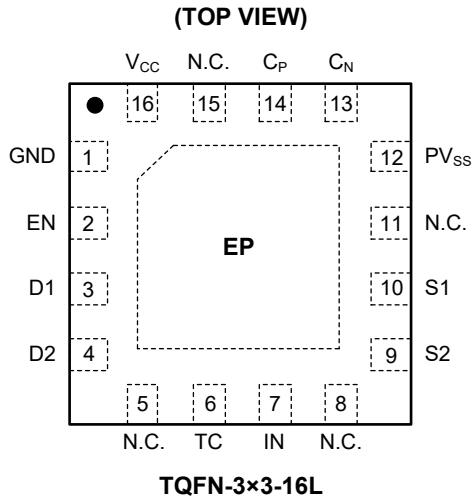
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. 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 even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



PIN DESCRIPTION

| PIN | | NAME | FUNCTION |
|--------------|---------------------|------------------|---|
| TQFN-3×3-16L | WLCSP-1.62×1.23-12B | | |
| 1 | C2 | GND | Ground. |
| 2 | B2 | EN | Enable Control. When EN = "Low", both S _x and D _x are disconnected, negative charge pump does not work and the SGM3714 is in shutdown state. When EN = "High", negative charge pump works, the SGM3714 is in working state, and S _x or D _x is connected or disconnected depending on the logical state of IN. |
| 3 | C3 | D1 | Drain Pin 1. |
| 4 | C4 | D2 | Drain Pin 2. |
| 5, 8, 11, 15 | — | N.C. | No Connection. |
| 6 | B4 | TC | Programming Turn-On and Turn-Off Times Pin. Connect a C _{TC} ceramic capacitor between TC and GND pins to program the turn-on and turn-off times. |
| 7 | B3 | IN | Digital Control Pin of Switch 1 and Switch 2. When IN = "Low", both switches are turned off, and S _x and D _x are disconnected. When IN = "High", both switches are turned on, and S _x and D _x are connected. |
| 9 | A4 | S2 | Source Pin 2. |
| 10 | A3 | S1 | Source Pin 1. |
| 12 | A2 | PV _{SS} | Negative Supply Voltage Output. Connect a 0.1μF ceramic capacitor from PV _{SS} to GND pins. |
| 13 | A1 | C _N | Charge Pump Flying Capacitor Negative Pin. |
| 14 | B1 | C _P | Charge Pump Flying Capacitor Positive Pin. |
| 16 | C1 | V _{CC} | Power Supply Pin. |
| Exposed Pad | — | EP | No Connection. |

NOTE: S1 and D1 pins may be an input or an output of switch 1. S2 and D2 pins may be an input or an output of switch 2.

FUNCTION TABLE

Table 1. Function Table of Switch 1 and Switch 2:

| EN | IN | S1 and D1 | S2 and D2 | Negative Charge Pump |
|----|----|---------------------|---------------------|----------------------|
| 0 | X | Disconnected | Disconnected | Turn off |
| 1 | 0 | Disconnected | Disconnected | Turn on |
| 1 | 1 | Connected (S1 = D1) | Connected (S2 = D2) | Turn on |

0.18Ω, High Voltage, Soft Turn-On/Off, Rail-to-Rail SGM3714 Negative Signal Passing, Dual, SPST Analog Switch

ELECTRICAL CHARACTERISTICS

(V_{CC} = 5V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|---|--|---------------------|--|-------|------------------|-------|
| Analog Switch | | | | | | | |
| Analog Signal Range | V _{ANALOG} | | +25°C | -V _{CC} | | +V _{CC} | V |
| On-Resistance | R _{ON} | -V _{CC} ≤ V _D ≤ +V _{CC} , I _S = 200mA | TQFN-3×3-16L | Full | 0.22 | 0.34 | Ω |
| | | | WLCSP-1.62×1.23-12B | Full | 0.18 | 0.3 | |
| On-Resistance Match between Channels | ΔR _{ON} | -V _{CC} ≤ V _D ≤ +V _{CC} , I _S = 200mA | Full | | 0.001 | 0.016 | Ω |
| On-Resistance Flatness | R _{FLAT(ON)} | -V _{CC} ≤ V _D ≤ +V _{CC} , I _S = 200mA | Full | | 0.001 | 0.005 | Ω |
| Source Off Leakage Current | I _{S(OFF)} | V _S = -4.5V/4.5V, V _D = 4.5V/-4.5V | Full | | 0.01 | 0.3 | μA |
| Channel On Leakage Current | I _{S(ON)} , I _{D(ON)} | V _S = -4.5V/4.5V, V _D = floating, or V _S = floating, V _D = -4.5V/4.5V | Full | | 0.01 | 0.3 | μA |
| Digital Inputs | | | | | | | |
| Input High Voltage | V _{INH} | V _{CC} = 2.7V to 9V | Full | 1.6 | | | V |
| Input Low Voltage | V _{INL} | V _{CC} = 2.7V to 9V | Full | | | 0.4 | V |
| Pull Down Resistor | R _{PULLDOWN} | | +25°C | | 600 | | kΩ |
| Dynamic Characteristics | | | | | | | |
| Turn-On Time | t _{ON} | V _S = 2V, V _{IH} = 1.6V, V _{IL} = 0V, C _{TC} = 0.1μF, R _L = 50Ω, C _L = 35pF, Test Circuit 1 | +25°C | | 210 | | ms |
| Turn-Off Time | t _{OFF} | V _S = 2V, V _{IH} = 1.6V, V _{IL} = 0V, C _{TC} = 0.1μF, R _L = 50Ω, C _L = 35pF, Test Circuit 1 | +25°C | | 720 | | ms |
| Off-Isolation | O _{ISO} | f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 2 | +25°C | | -140 | | dB |
| | | f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 2 | | | -72 | | |
| Channel-to-Channel Crosstalk | X _{TALK} | f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 3 | +25°C | | -116 | | dB |
| | | f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 3 | | | -75 | | |
| -3dB Bandwidth | BW | Signal = 0dBm, R _L = 50Ω, C _L = 5pF, Test Circuit 4 | +25°C | | 220 | | MHz |
| Channel On Capacitance | C _{ON} | | +25°C | | 30 | | pF |
| Charge Injection Select Input to Common I/O | Q | V _G = GND, R _G = 0Ω, C _L = 1nF, Test Circuit 5 | +25°C | | 320 | | pC |
| Total Harmonic Distortion + Noise | THD+N | A-Weighting, Test Circuit 6 | +25°C | V _S = 2V _{RMS} , R _L = 600Ω | | -116 | dB |
| | | | | V _S = 2V _{PP} , R _L = 600Ω | | -114 | |
| | | | | V _S = 2V _{PP} , R _L = 32Ω | | -114 | |
| | | | | V _S = 1V _{PP} , R _L = 600Ω | | -112 | |
| | | | | V _S = 1V _{PP} , R _L = 32Ω | | -110 | |
| Start Up Time | t _{START} | Switch V _{EN} = 0V to V _{EN} = 1.6V | +25°C | | 210 | | ms |
| Power Requirements | | | | | | | |
| Power Supply Current | I _{CC} | V _{IN} = 0V or 1.6V, V _{EN} = 1.6V | Full | | 375 | 480 | μA |
| Power Supply Current in Shutdown State | I _{CC} | V _{IN} = 0V or 1.6V, V _{EN} = 0V | Full | | 0.75 | 2 | μA |

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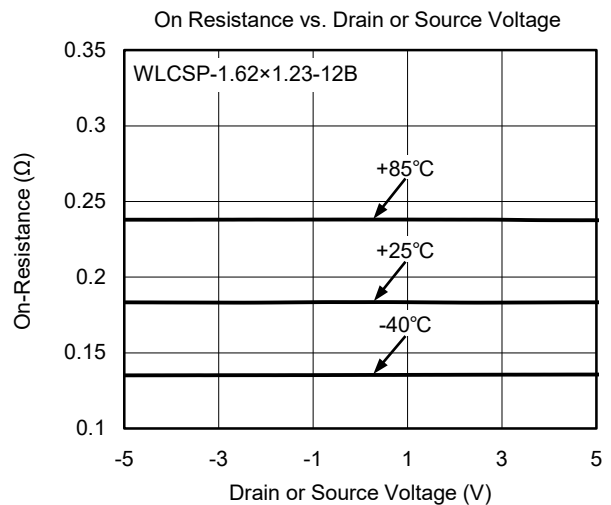
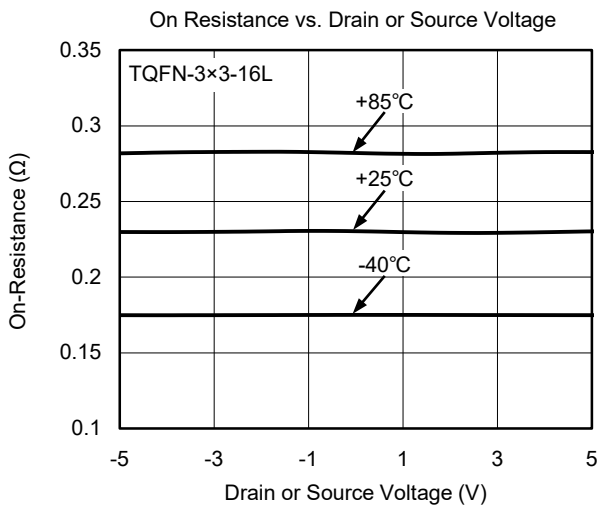
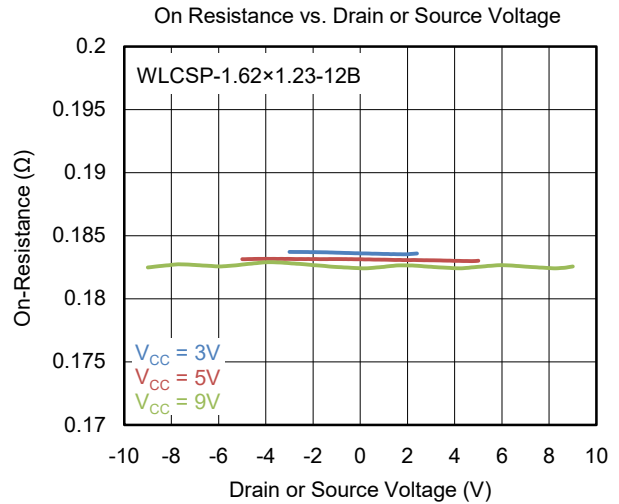
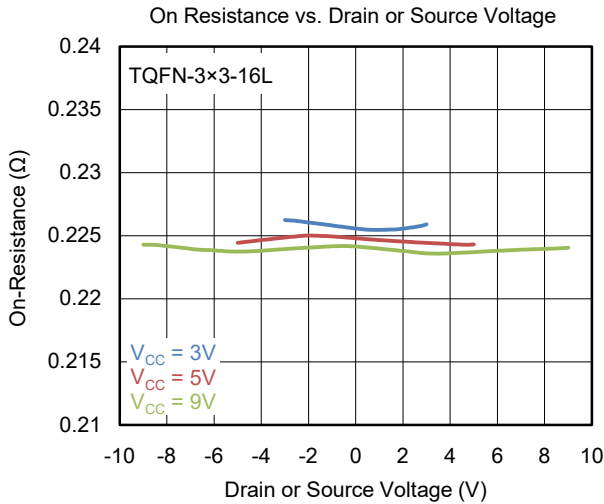
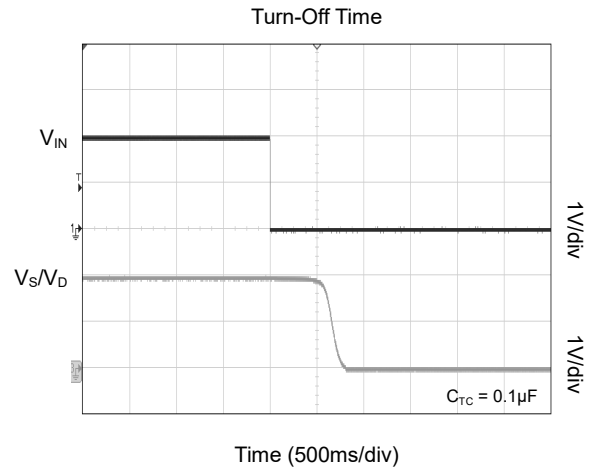
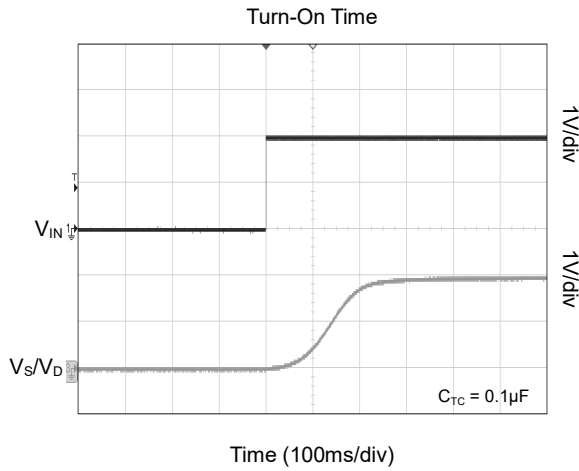
ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 9V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---------------------|---|-------|------------------|-------|
| Analog Switch | | | | | | | |
| Analog Signal Range | V _{ANALOG} | | +25°C | -V _{CC} | | +V _{CC} | V |
| On-Resistance | R _{ON} | -V _{CC} ≤ V _D ≤ +V _{CC} , I _S = 200mA | TQFN-3×3-16L | Full | 0.22 | 0.34 | Ω |
| | | | WLCSP-1.62×1.23-12B | Full | 0.18 | 0.3 | |
| On-Resistance Match between Channels | ΔR _{ON} | -V _{CC} ≤ V _D ≤ +V _{CC} , I _S = 200mA | Full | | 0.001 | 0.016 | Ω |
| On-Resistance Flatness | R _{FLAT(ON)} | -V _{CC} ≤ V _D ≤ +V _{CC} , I _S = 200mA | Full | | 0.001 | 0.005 | Ω |
| Source Off Leakage Current | I _{S(OFF)} | V _S = -8.5V/8.5V, V _D = 8.5V/-8.5V | Full | | 0.01 | 0.3 | μA |
| Channel On Leakage Current | I _{S(ON)} , I _{D(ON)} | V _S = -8.5V/8.5V, V _D = floating, or V _S = floating, V _D = -8.5V/8.5V | Full | | 0.01 | 0.3 | μA |
| Digital Inputs | | | | | | | |
| Input High Voltage | V _{INH} | V _{CC} = 2.7V to 9V | Full | 1.6 | | | V |
| Input Low Voltage | V _{INL} | V _{CC} = 2.7V to 9V | Full | | | 0.4 | V |
| Pull Down Resistor | R _{PULLDOWN} | | +25°C | | 600 | | kΩ |
| Dynamic Characteristics | | | | | | | |
| Turn-On Time | t _{ON} | V _S = 2V, V _{IH} = 1.6V, V _{IL} = 0V, C _{TC} = 0.1μF, R _L = 50Ω, C _L = 35pF, Test Circuit 1 | +25°C | | 210 | | ms |
| Turn-Off Time | t _{OFF} | V _S = 2V, V _{IH} = 1.6V, V _{IL} = 0V, C _{TC} = 0.1μF, R _L = 50Ω, C _L = 35pF, Test Circuit 1 | +25°C | | 720 | | ms |
| Off-Isolation | O _{ISO} | f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 2 | +25°C | | -140 | | dB |
| | | | | f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 2 | | -75 | |
| Channel-to-Channel Crosstalk | X _{TALK} | f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 3 | +25°C | | -116 | | dB |
| | | | | f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 3 | | -75 | |
| -3dB Bandwidth | BW | Signal = 0dBm, R _L = 50Ω, C _L = 5pF, Test Circuit 4 | +25°C | | 270 | | MHz |
| Channel On Capacitance | C _{ON} | | +25°C | | 33 | | pF |
| Charge Injection Select Input to Common I/O | Q | V _G = GND, R _G = 0Ω, C _L = 1nF, Test Circuit 5 | +25°C | | 460 | | pC |
| Total Harmonic Distortion + Noise | THD+N | A-Weighting, Test Circuit 6 | +25°C | V _S = 2V _{RMS} , R _L = 600Ω | -116 | | dB |
| | | | | V _S = 2V _{PP} , R _L = 600Ω | -114 | | |
| | | | | V _S = 2V _{PP} , R _L = 32Ω | -114 | | |
| | | | | V _S = 1V _{PP} , R _L = 600Ω | -112 | | |
| | | | | V _S = 1V _{PP} , R _L = 32Ω | -110 | | |
| Start Up Time | t _{START} | Switch V _{EN} = 0V to V _{EN} = 1.6V | +25°C | | 210 | | ms |
| Power Requirements | | | | | | | |
| Power Supply Current | I _{CC} | V _{IN} = 0V or 1.6V, V _{EN} = 1.6V | Full | | 415 | 520 | μA |
| Power Supply Current in Shutdown State | I _{CC} | V _{IN} = 0V or 1.6V, V _{EN} = 0V | Full | | 0.8 | 2 | μA |

TYPICAL PERFORMANCE CHARACTERISTICS

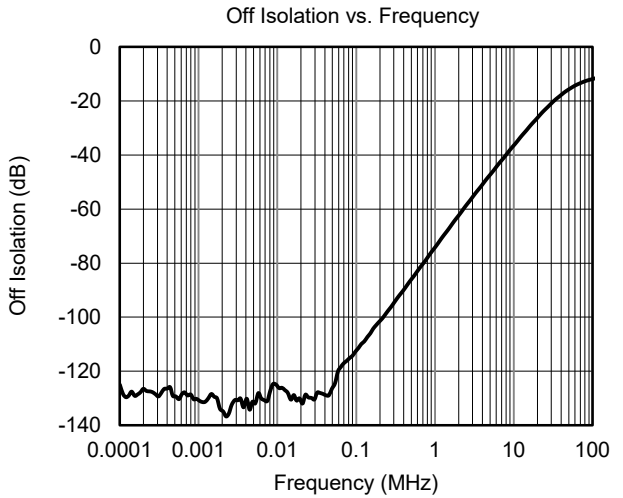
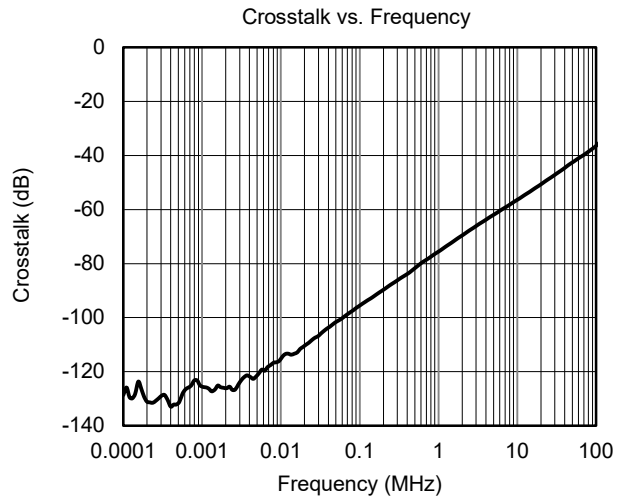
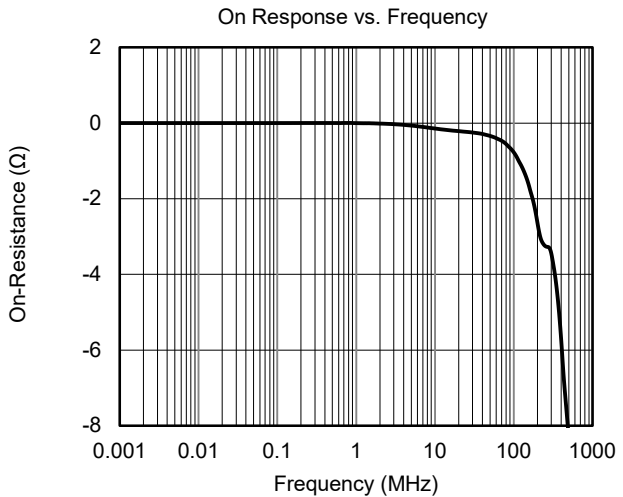
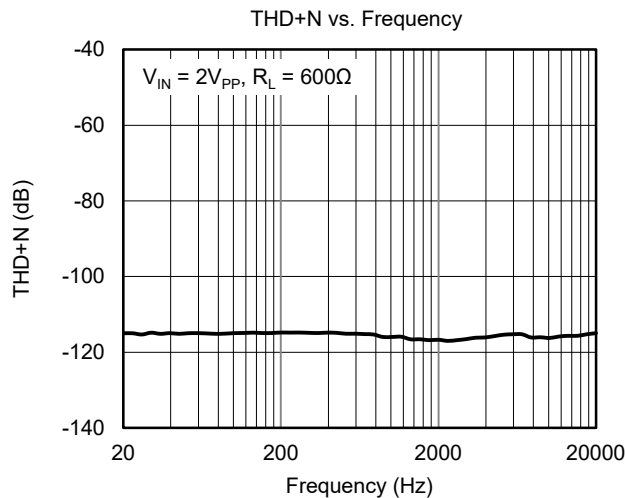
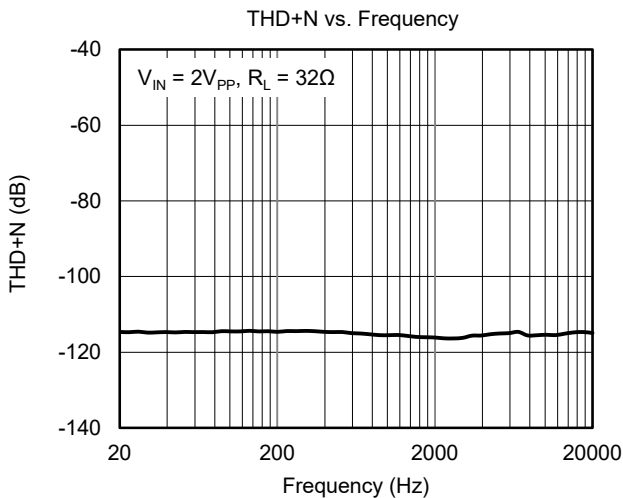
T_A = +25°C, V_{CC} = 5V, unless otherwise noted.



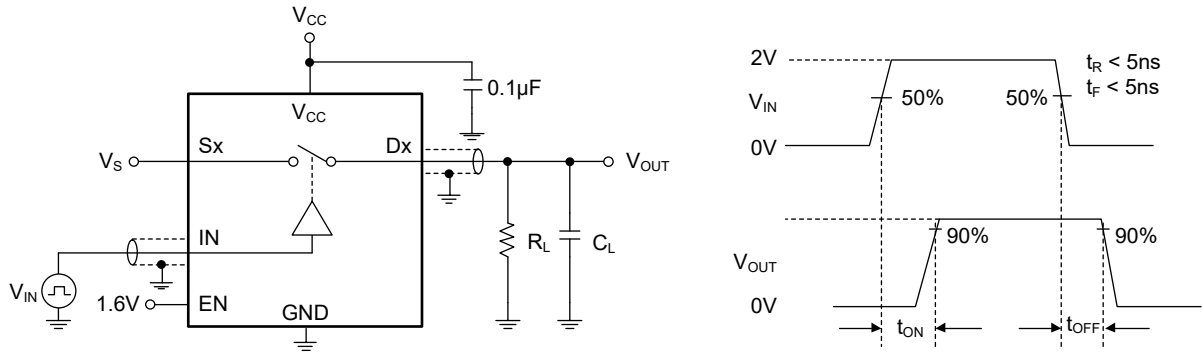
SGM3714 0.18Ω, High Voltage, Soft Turn-On/Off, Rail-to-Rail Negative Signal Passing, Dual, SPST Analog Switch

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

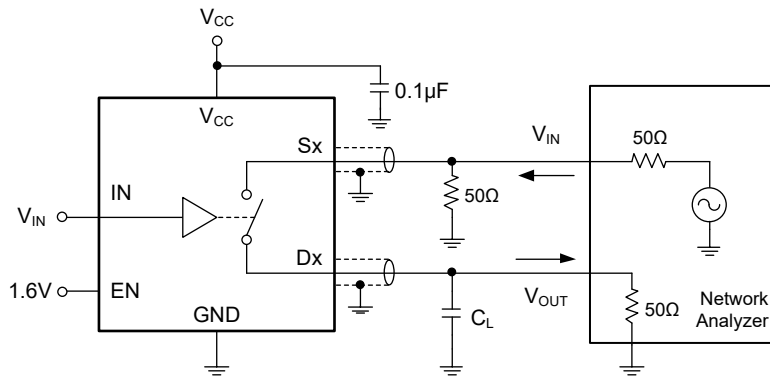
T_A = +25°C, V_{CC} = 5V, unless otherwise noted.



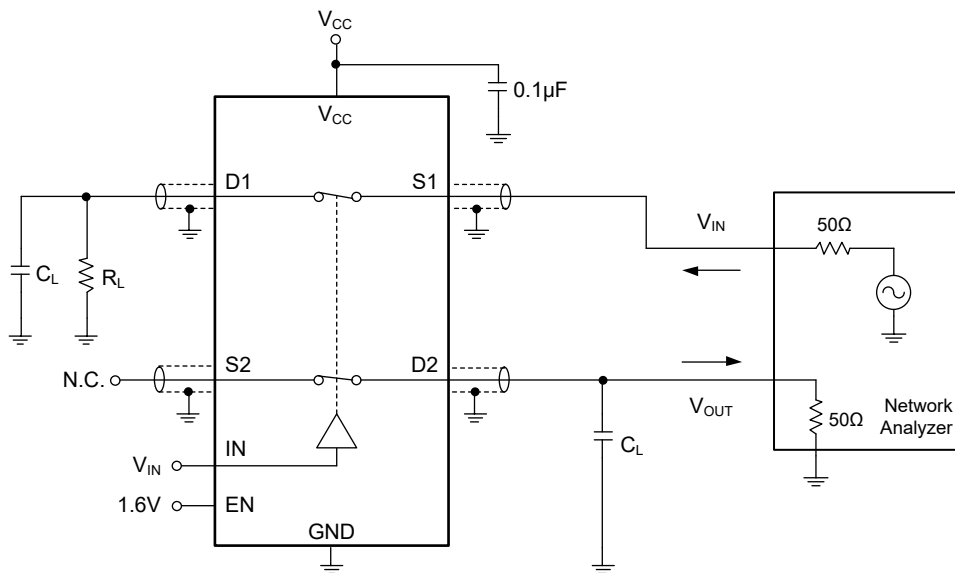
TEST CIRCUITS



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



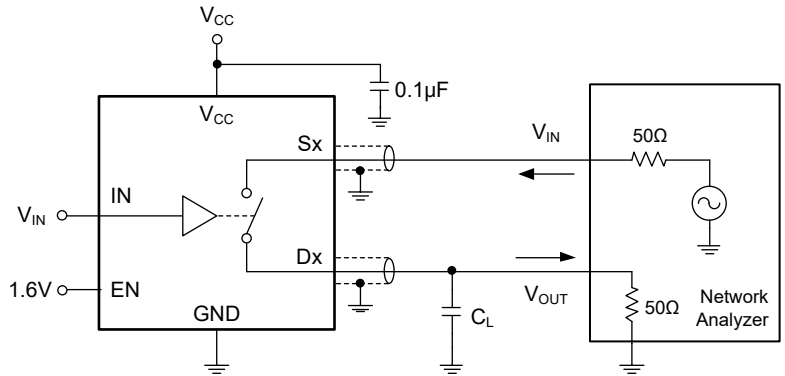
Test Circuit 2. Off-Isolation



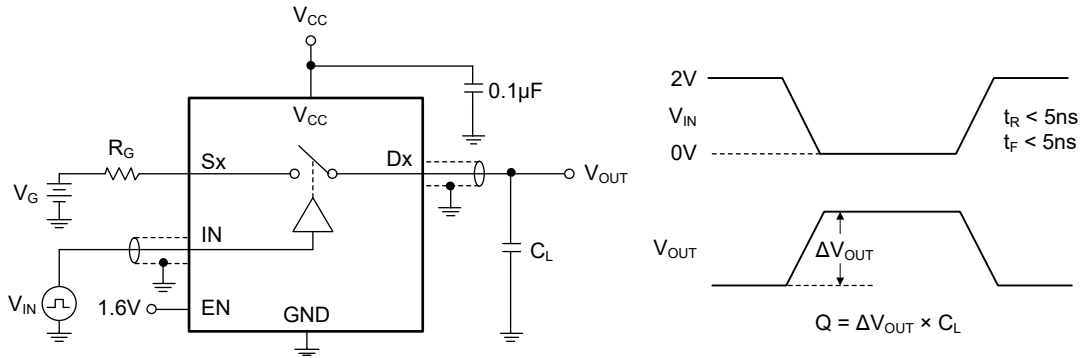
$$\text{Channel-to-Channel Crosstalk} = -20\log(V_{IN}/V_{OUT})$$

Test Circuit 3. Channel-to-Channel Crosstalk

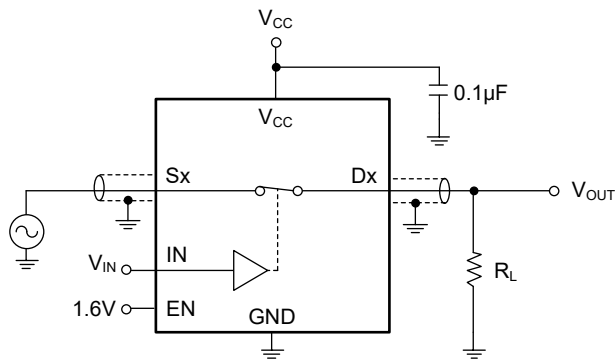
TEST CIRCUITS (continued)



Test Circuit 4. -3dB Bandwidth



Test Circuit 5. Charge Injection (Q)



Test Circuit 6. Total Harmonic Distortion + Noise (THD+N)

APPLICATION INFORMATION

The combination of Speaker and Receiver is always used in portable devices, and high voltage class D speaker driver (smart audio PA) is used to drive speaker in order to provide high audio volume. But the high output voltage of class D speaker driver (10.5V) will damage the receiver driver because receiver driver is designed using low voltage technology. The

SGM3714 can solve this design issue by providing the safe isolation between receiver driver and high voltage class D speaker driver. The SGM3714 provides low R_{ON} channels to pass the positive and negative signals from capless receiver driver and eliminates click-pop noise. The circuit is shown in Figure 1.

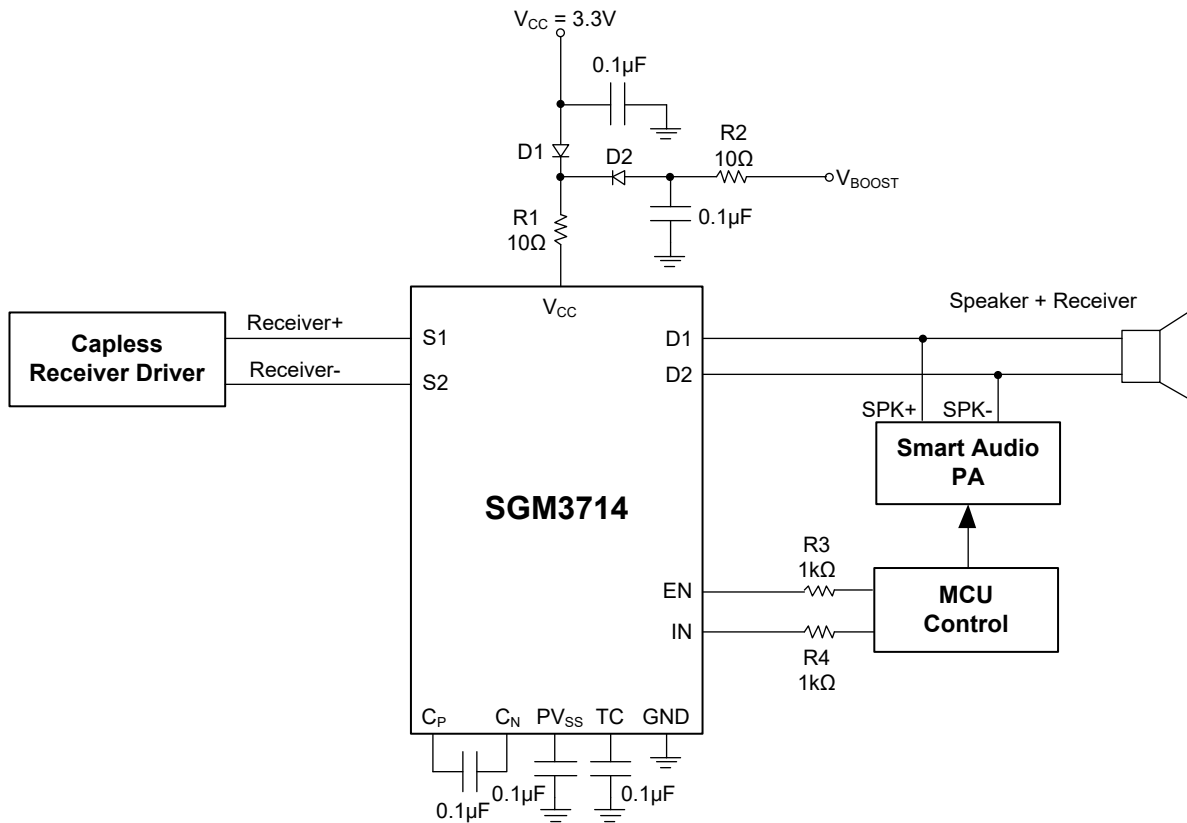


Figure 1. Typical Application Circuit for Speaker + Receiver

APPLICATION INFORMATION (continued)

In order to improve audio performance of portable devices, 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 that of the integrated speaker power amplifier, the audio signal of

line-out or headset driver which is selected as the high performance audio signal source for external speaker power amplifier. High performance SGM3714 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.

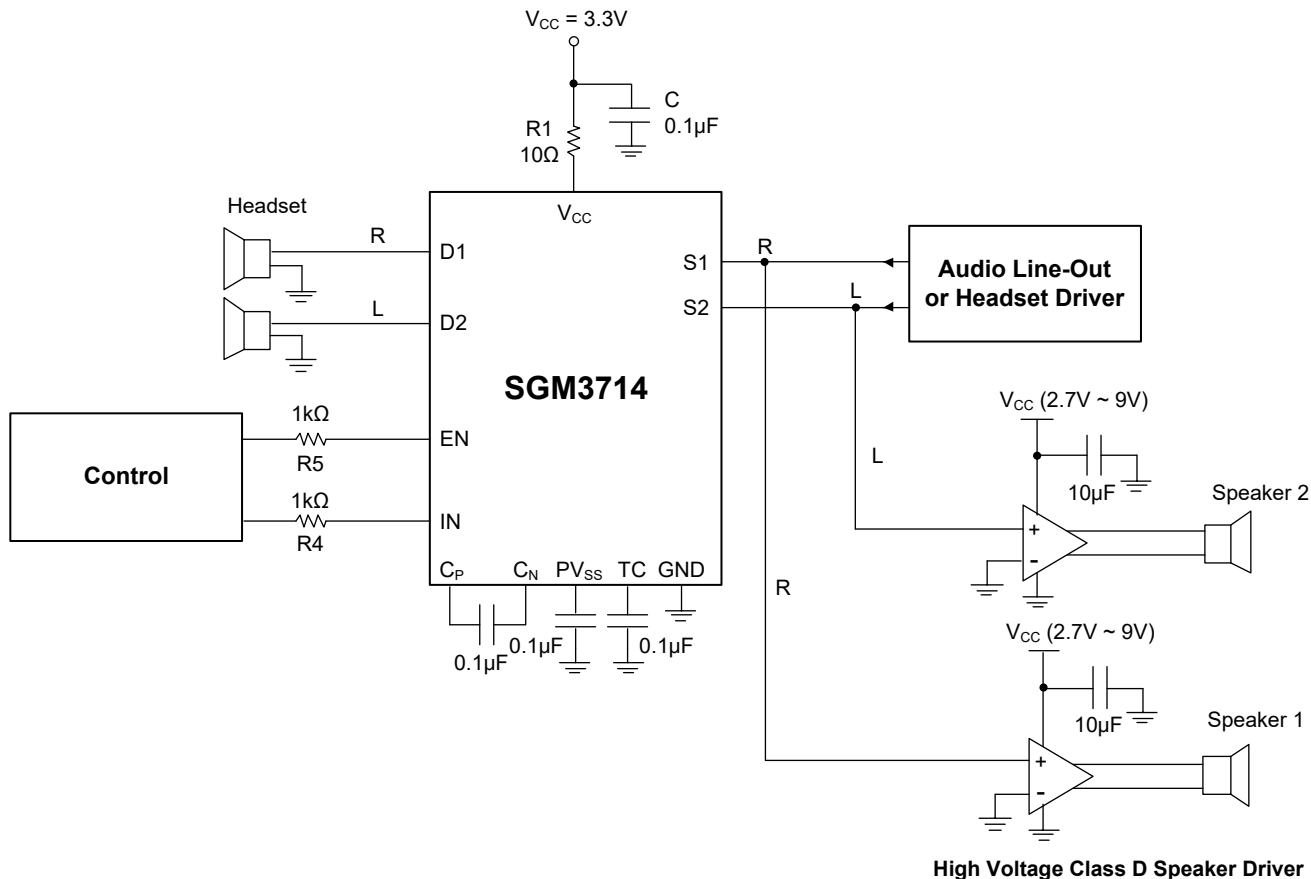


Figure 2. Typical Application Circuit for 1-to-2 HiFi Audio Signal Switch

REVISION HISTORY

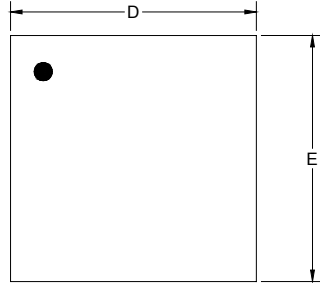
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| NOVEMBER 2020 – REV.A to REV.A.1 | Page |
|--|------|
| Updated Package Outline Dimensions..... | 14 |
| Changes from Original (JULY 2020) to REV.A | Page |
| Changed from product preview to production data..... | All |

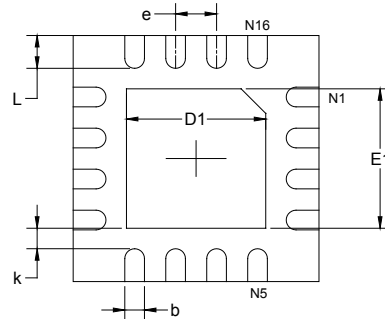
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

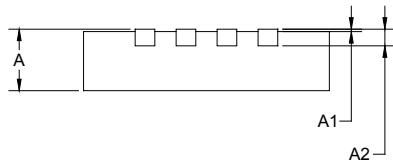
TQFN-3×3-16L



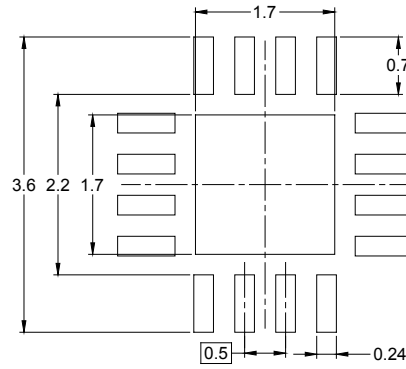
TOP VIEW



BOTTOM VIEW



SIDE VIEW

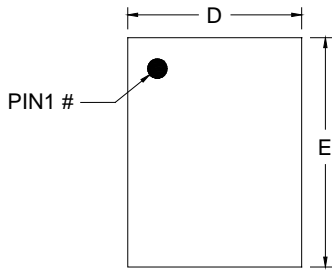


RECOMMENDED LAND PATTERN (Unit: mm)

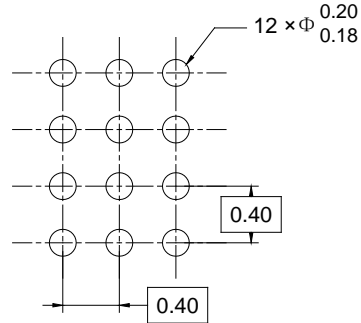
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.700 | 0.800 | 0.028 | 0.031 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A2 | 0.203 REF | | 0.008 REF | |
| D | 2.900 | 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 OUTLINE DIMENSIONS

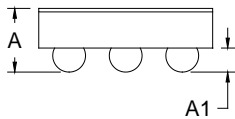
WLCSP-1.62x1.23-12B



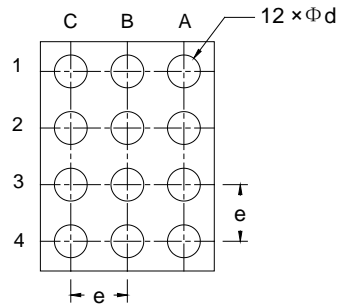
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



BOTTOM VIEW

| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-------|-------|
| | MIN | MOD | MAX |
| A | 0.400 | 0.450 | 0.500 |
| A1 | 0.150 | 0.170 | 0.190 |
| D | 1.215 | 1.230 | 1.245 |
| E | 1.605 | 1.620 | 1.635 |
| d | 0.212 | 0.232 | 0.252 |
| e | 0.400 BSC | | |

NOTE: This drawing is subject to change without notice.

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 | Q2 |
| WLCSP-1.62×1.23-12B | 7" | 9.0 | 1.35 | 1.75 | 0.70 | 4.0 | 4.0 | 2.0 | 8.0 | 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 |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368 | 227 | 224 | 8 |
| 7" | 442 | 410 | 224 | 18 |
| 13" | 386 | 280 | 370 | 5 |

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