



# SGM4916

## 88mW, Capless, Stereo Headphone Amplifier with Shutdown

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### GENERAL DESCRIPTION

The SGM4916 stereo headphone amplifier is designed for portable equipment where board space is at a premium. The SGM4916 uses capless architecture to produce a ground-referenced output from a single power supply, eliminating the need for large DC-blocking capacitors for output, saving cost, board space, and component height. Additionally, for SGM4916B, the gain is set internally (-1.5V/V), further reducing component count. For SGM4916A, the gain can be adjusted by external feedback resistors.

The SGM4916 delivers up to 88mW per channel into a 32Ω load and has low 0.034% THD+N. A -70dB power supply rejection ratio (PSRR) at 217Hz allows this device to operate from noisy digital supplies without an additional linear regulator. Comprehensive click-and-pop circuitry suppresses audible clicks and pops on startup and shutdown.

The SGM4916 operates from a single 2.7V to 5.5V supply, consumes only 2.7mA supply current, has short-circuit and thermal-overload protections, and is specified over the extended -40°C to +85°C temperature range. The SGM4916 is available in a Green TQFN-3×3-12L package.

### FEATURES

- **SGM4916A: External Feedback Gain Network**  
**SGM4916B: Fixed -1.5V/V Gain**
- **No Bulky DC-Blocking Capacitors Required**
- **Ground-Referenced Outputs Eliminate DC-Bias Voltage on Headphone Ground Pin**
- **No Degradation of Low-Frequency Response Due to Output Capacitors**
- **88mW into 32Ω Load from 5V Power Supply at THD+N = 0.1% (TYP, per Channel)**
- **Low 0.034% THD+N**
- **High PSRR (-70dB at 217Hz)**
- **Integrated Click-and-Pop Suppression**
- **2.7V to 5.5V Single Supply Operation**
- **Low Quiescent Current (2.7mA at  $V_{DD} = 5V$ )**
- **Shutdown Control**
- **Short-Circuit and Thermal-Overload Protections**
- **Undervoltage Lockout Function**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green TQFN-3×3-12L Package**

### APPLICATIONS

Notebook PCs  
Cellular Phones  
PDAs  
MP3 Players  
Smart Phones  
Portable Audio Equipment



## PACKAGE/ORDERING INFORMATION

MODEL	ORDER NUMBER	GAIN (V/V)	PACKAGE DESCRIPTION	MARKING INFORMATION	PACKAGE OPTION
SGM4916A	SGM4916AYTQJ12G/TR	ADJ	TQFN-3×3-12L	4916AQ XXXXX	Tape and Reel, 3000
SGM4916B	SGM4916BYTQJ12G/TR	-1.5	TQFN-3×3-12L	4916BQ XXXXX	Tape and Reel, 3000

NOTE: XXXXX = Date Code and Vendor Code.

## ABSOLUTE MAXIMUM RATINGS

PV <sub>SS</sub> to SV <sub>SS</sub>	-0.3V to +0.3V
PGND to SGND	-0.3V to +0.3V
V <sub>DD</sub> to PGND or SGND	-0.3V to +6V
PV <sub>SS</sub> and SV <sub>SS</sub> to PGND or SGND	-6V to +0.3V
IN to SGND	(SV <sub>SS</sub> - 0.3V) to (V <sub>DD</sub> + 0.3V)
$\overline{\text{SHDN}}$ to SGND	-0.3V to (V <sub>DD</sub> + 0.3V)
OUT to SGND	(SV <sub>SS</sub> - 0.3V) to (V <sub>DD</sub> + 0.3V)
C1P to PGND	-0.3V to (V <sub>DD</sub> + 0.3V)
C1N to PGND	(PV <sub>SS</sub> - 0.3V) to +0.3V
Output Short Circuit to GND or V <sub>DD</sub>	Continuous
Junction Temperature	150°C
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	260°C
ESD Susceptibility	
HBM (Output pins to Supply and Ground pins)	3000V
MM	200V

## NOTE:

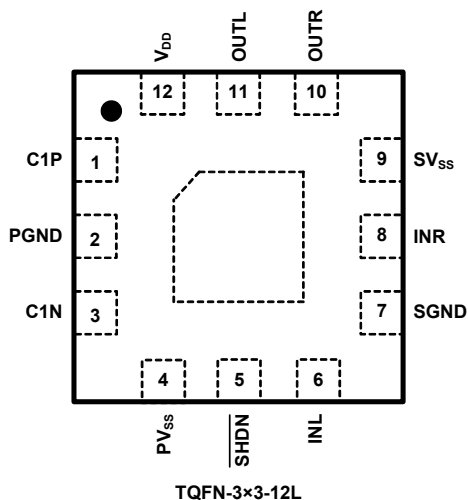
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure 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 CONFIGURATION (TOP VIEW)



## PIN DESCRIPTIONS

PIN	NAME	DESCRIPTION
1	C1P	Flying Capacitor Positive Terminal. Connect a 1 $\mu$ F ceramic capacitor from C1P to C1N.
2	PGND	Power Ground. Connect to SGND.
3	C1N	Flying Capacitor Negative Terminal. Connect a 1 $\mu$ F ceramic capacitor from C1P to C1N.
4	PV <sub>SS</sub>	Charge-Pump Output. Connect to SV <sub>SS</sub> and bypass with a 1 $\mu$ F ceramic capacitor to PGND.
5	SHDN	Active-Low Shutdown Input.
6	INL	Left-Channel Input.
7	SGND	Signal Ground. Connect to PGND.
8	INR	Right-Channel Input.
9	SV <sub>SS</sub>	Amplifier Negative Supply. Connect to PV <sub>SS</sub> .
10	OUTR	Right-Channel Output.
11	OUTL	Left-Channel Output.
12	V <sub>DD</sub>	Positive Power-Supply Input. Bypass with a 1 $\mu$ F capacitor to SGND.
Exposed Paddle	—	Exposed Paddle. Can be connected to GND or left floating.

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### ELECTRICAL CHARACTERISTICS

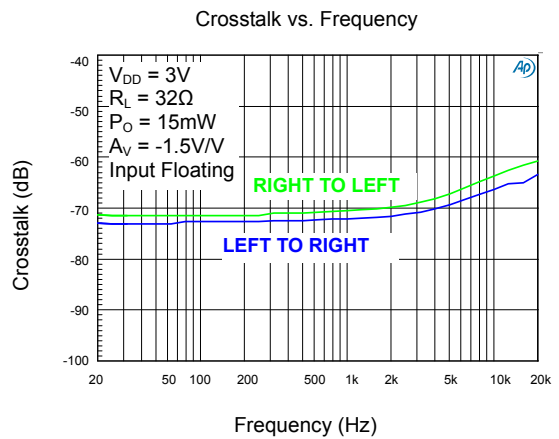
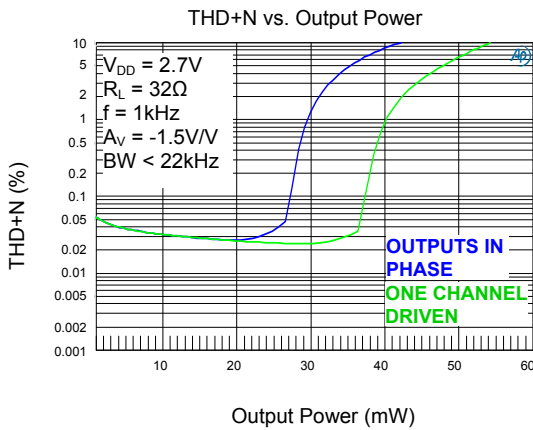
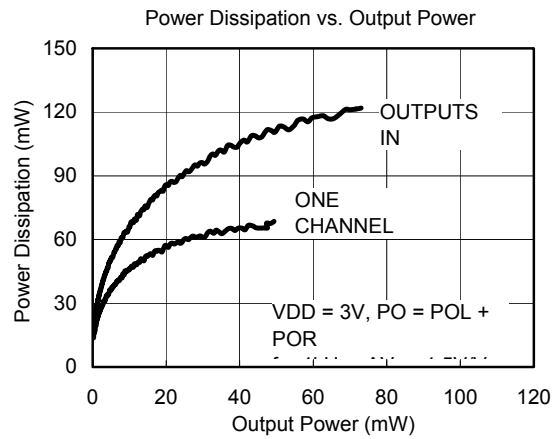
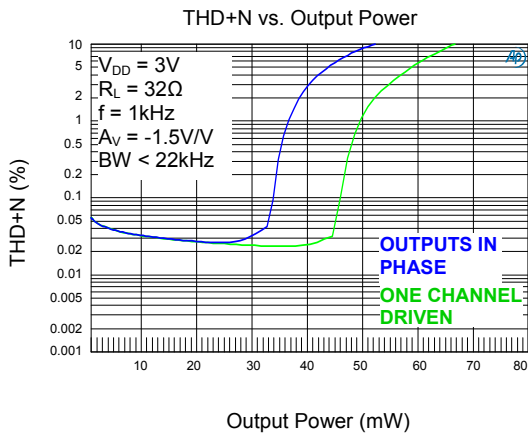
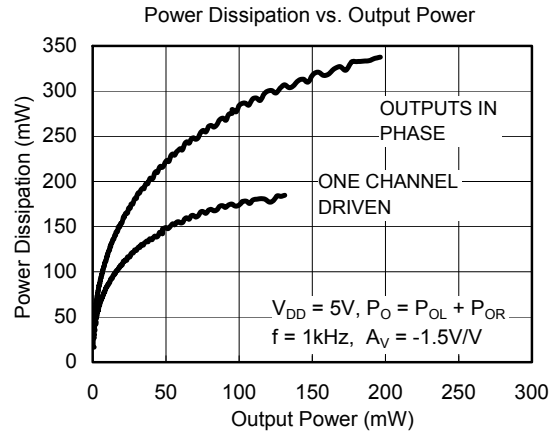
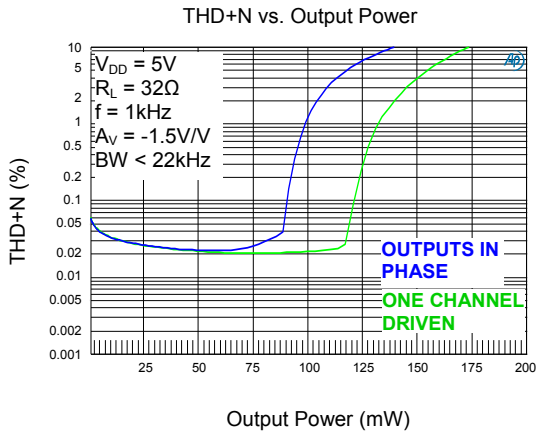
( $V_{DD} = 5V$ ,  $PGND = SGND = 0V$ ,  $\overline{SHDN} = 5V$ ,  $C1 = C2 = 1\mu F$ ,  $R_L = \infty$ ; for SGM4916A, gain =  $-1.5V/V$  ( $R_{IN} = 20k\Omega$ ,  $R_F = 30k\Omega$ ); for SGM4916B, gain =  $-1.5V/V$  (internally set).  $T_A = +25^\circ C$ , unless otherwise noted.)<sup>(1)</sup>

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
<b>GENERAL</b>							
Supply Voltage Range	$V_{DD}$		2.7		5.5	V	
Quiescent Supply Current	$I_{DD}$			2.7	3.7	mA	
Shutdown Supply Current	$I_{SHDN}$	$\overline{SHDN} = SGND = PGND$		0.01	8	$\mu A$	
$\overline{SHDN}$ Input Logic High	$V_{IH}$		1.2			V	
$\overline{SHDN}$ Input Logic Low	$V_{IL}$				0.4	V	
$\overline{SHDN}$ to Full Operation Time	$t_{SON}$			3.1		ms	
<b>AMPLIFIERS</b>							
Voltage Gain	$A_V$	SGM4916B	-1.57	-1.5	-1.43	V/V	
Gain Matching	$\Delta A_V$	SGM4916B		0.23		%	
Output Offset Voltage	$V_{OS}$	Input AC-coupled to ground	-6	1.2	6	mV	
Input Impedance	$R_{IN}$	SGM4916B, measured at INL and INR	12.5	14.3	16.5	k $\Omega$	
Power Supply Rejection Ratio	PSRR	SGM4916B, $C3 = 0.1\mu F$	$f = 217Hz$ , $V_{RIPPLE} = 200mV_{P-P}$		-70		dB
			$f = 1kHz$ , $V_{RIPPLE} = 200mV_{P-P}$		-71		
			$f = 20kHz$ , $V_{RIPPLE} = 200mV_{P-P}$		-70		
Output Power	$P_{OUT}$	$R_L = 32\Omega$ , $f = 1kHz$	$V_{DD} = 5.0V$	THD+N = 0.1%	88		mW
				THD+N = 1%	98		
			$V_{DD} = 3.0V$	THD+N = 0.1%	33		
				THD+N = 1%	36		
			$V_{DD} = 2.7V$	THD+N = 0.1%	26		
				THD+N = 1%	29		
Total Harmonic Distortion Plus Noise	THD+N	$R_L = 32\Omega$ , $P_{OUT} = 30mW$ , $f_{IN} = 1kHz$		0.034		%	
			$R_L = 32\Omega$ , $P_{OUT} = 50mW$ , $f_{IN} = 1kHz$		0.025		
Signal-to-Noise Ratio	SNR	$R_L = 32\Omega$ , $P_{OUT} = 50mW$ , BW = 20Hz to 22kHz		103		dB	
Capacitive Drive	$C_L$	No sustained oscillations		200		pF	
Charge-Pump Oscillator Frequency	$f_{OSC}$		215	340	495	kHz	
Crosstalk		$V_{DD} = 3.0V$ , L to R, R to L, $f = 10kHz$ , $R_L = 32\Omega$ , $P_{OUT} = 15mW$		63		dB	
Thermal Shutdown Threshold				142		$^\circ C$	
Thermal Shutdown Hysteresis				15		$^\circ C$	

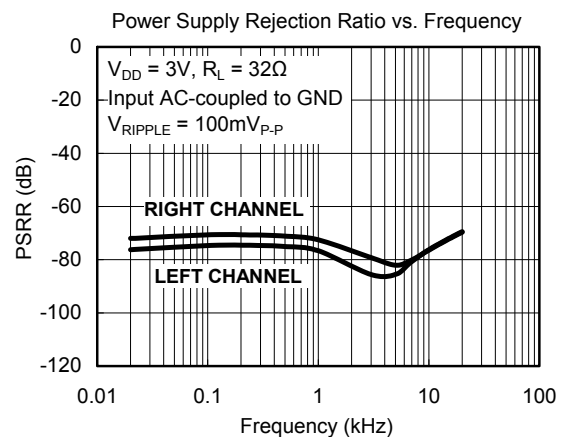
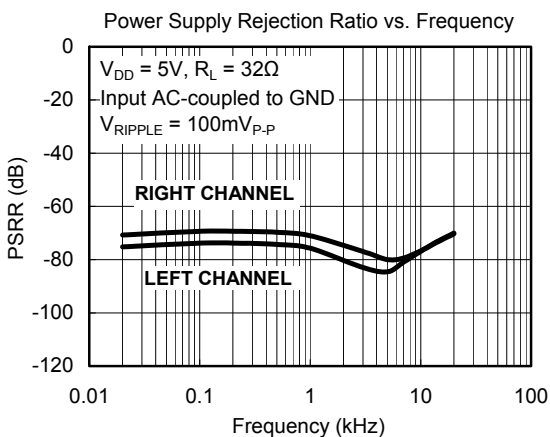
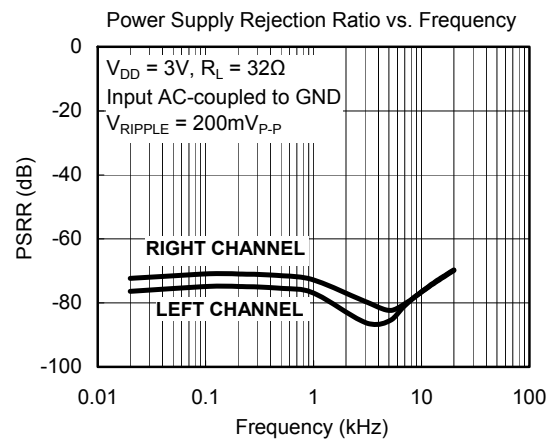
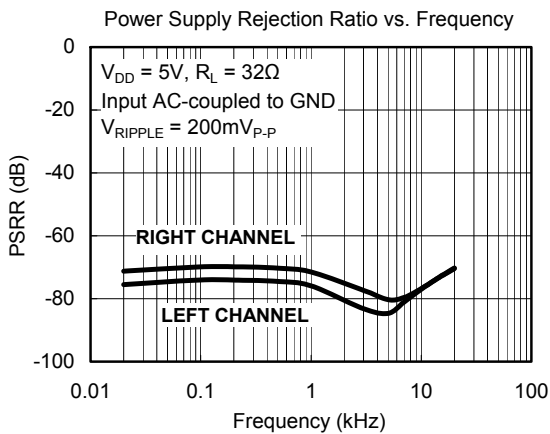
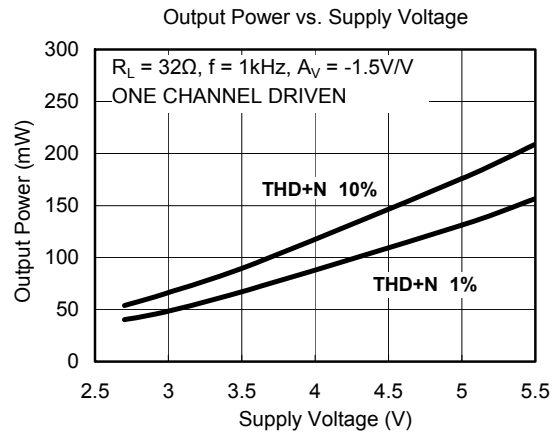
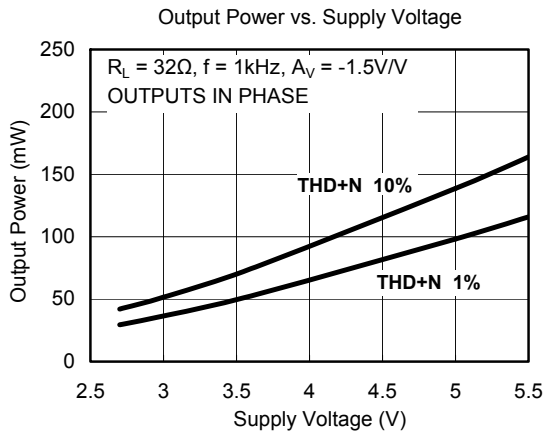
**NOTE:**

1. For  $C_{IN}$ ,  $C1$  and etc, please refer to the FUNCTIONAL DIAGRAM/TYPICAL APPLICATION CIRCUIT on page 8.

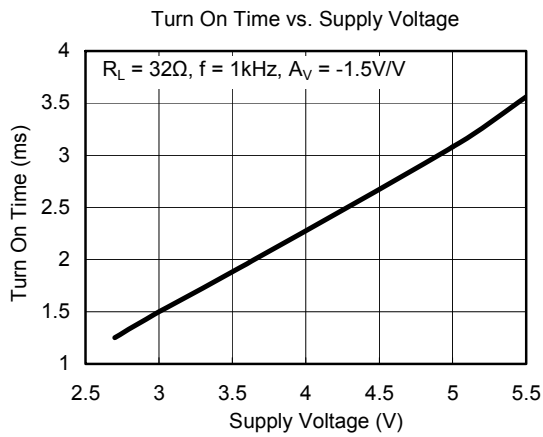
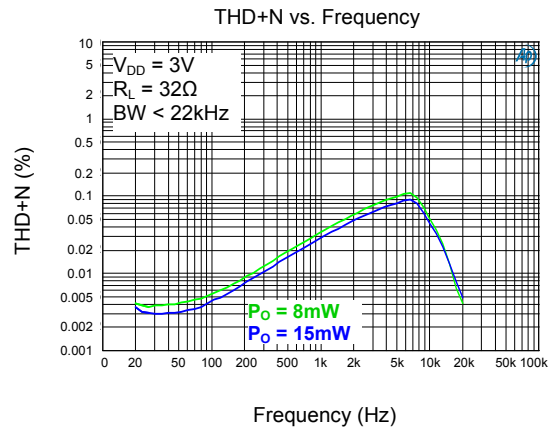
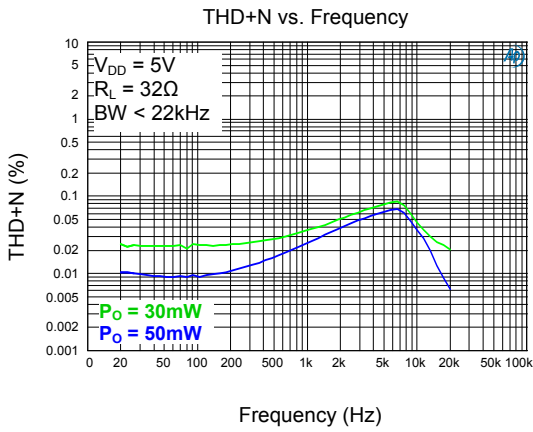
TYPICAL PERFORMANCE CHARACTERISTICS



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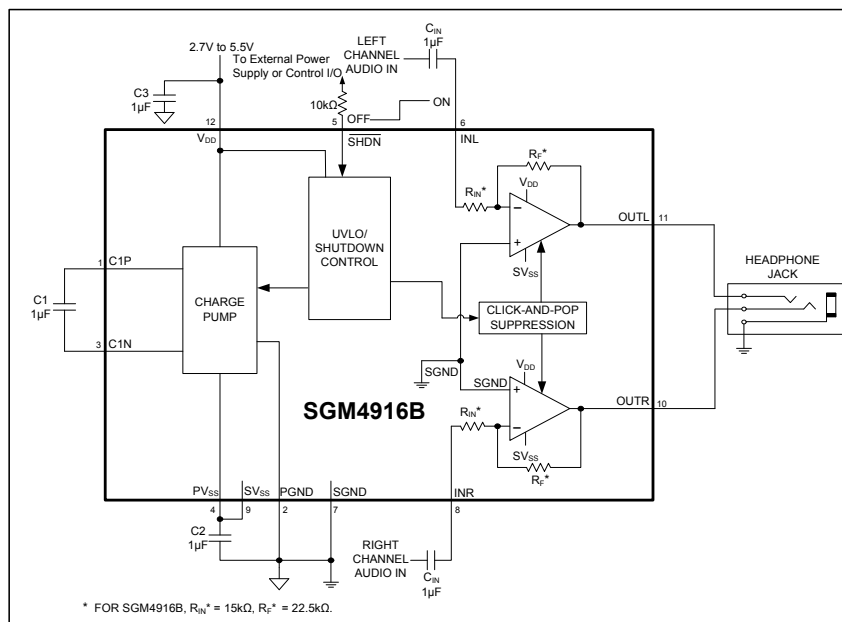
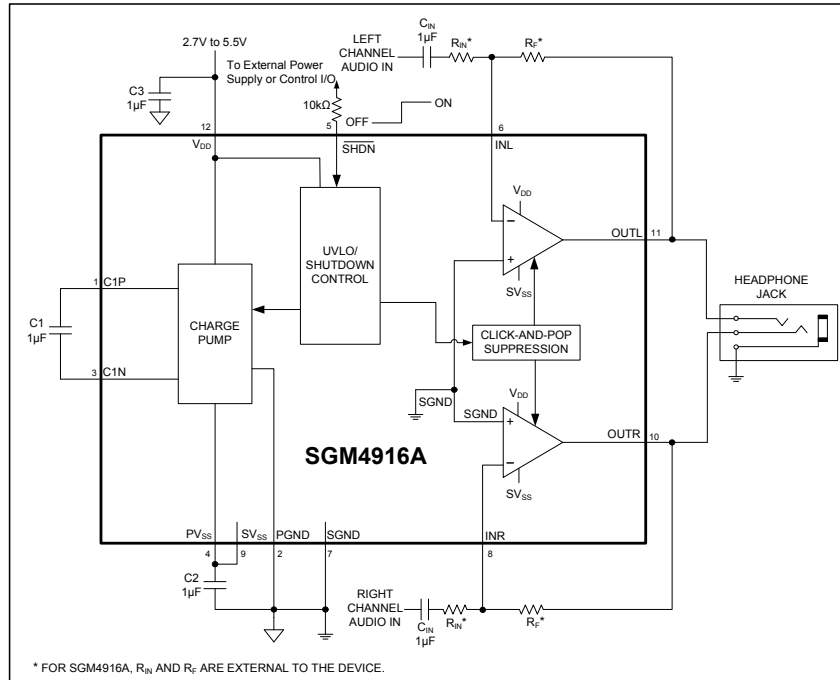
TYPICAL PERFORMANCE CHARACTERISTICS



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## FUNCTIONAL DIAGRAM/TYPICAL APPLICATION CIRCUIT



### NOTES:

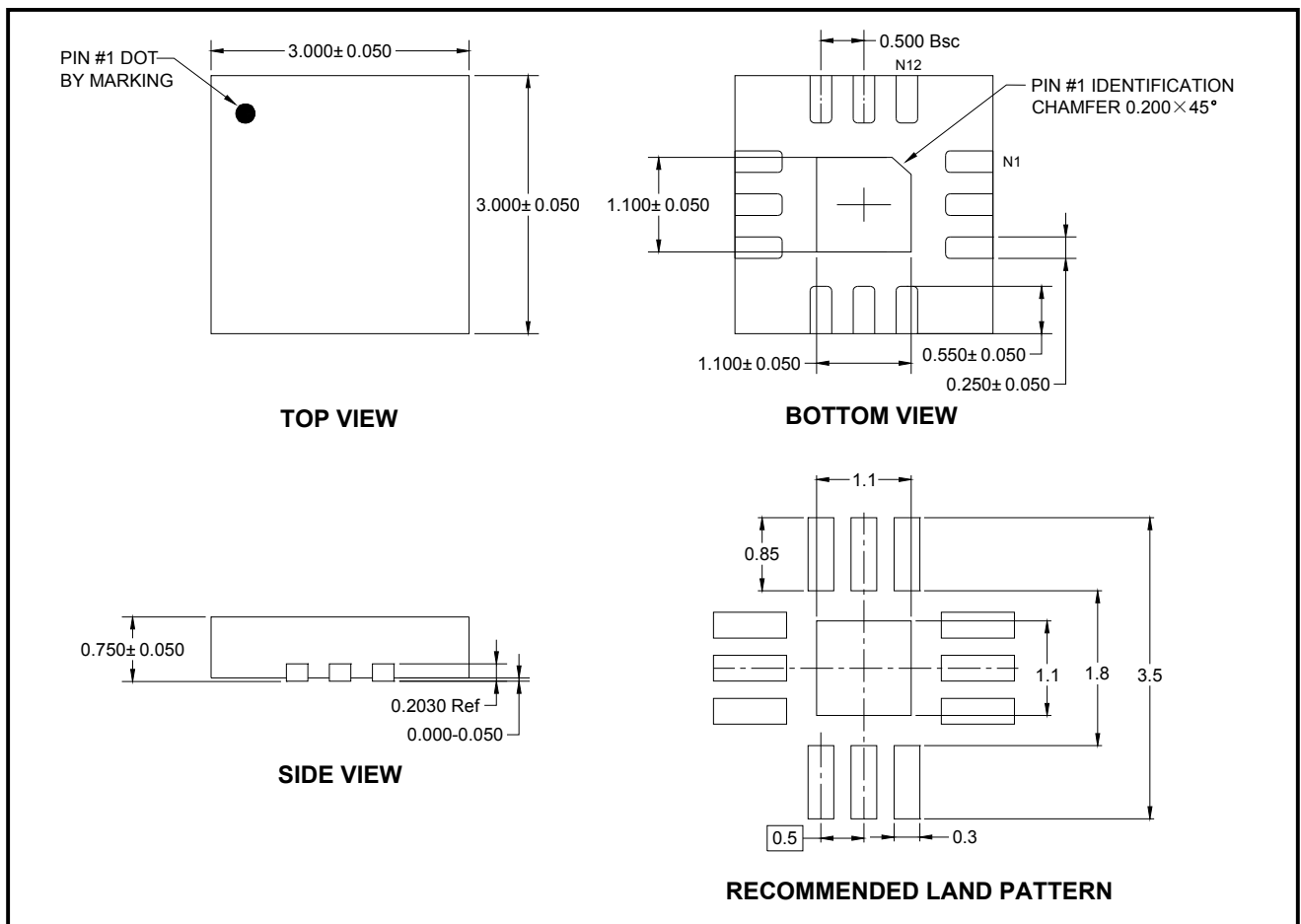
1. To ensure the normal operation of the device, decoupling capacitor (C3) must be placed as close to SGM4916 as possible. The loop length formed by C3,  $V_{DD}$  and GND should be no longer than 5mm, otherwise the device will not start up at high supply voltage.
2. In order to get good performance, it's important to select the right C1, C2 and C3 in application. All tests are performed with circuit set up with X5R and X7R capacitors. Capacitors having high dissipative loss, such as Y5V capacitor, may cause performance degradation and unexpected system behavior.
3. A 10kΩ resistor must be serially connected to  $\overline{SHDN}$  pin.





PACKAGE OUTLINE DIMENSIONS

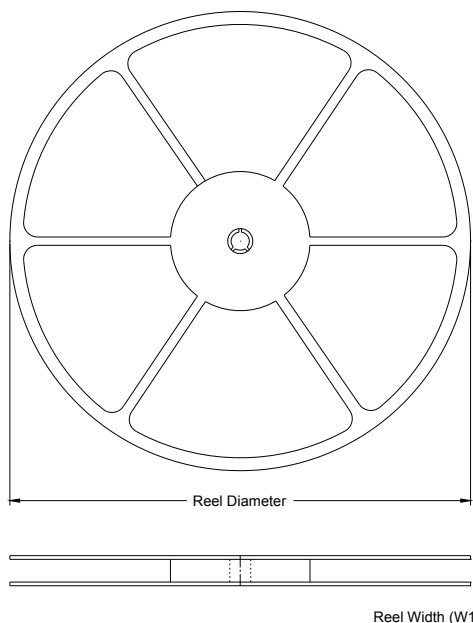
TQFN-3x3-12L



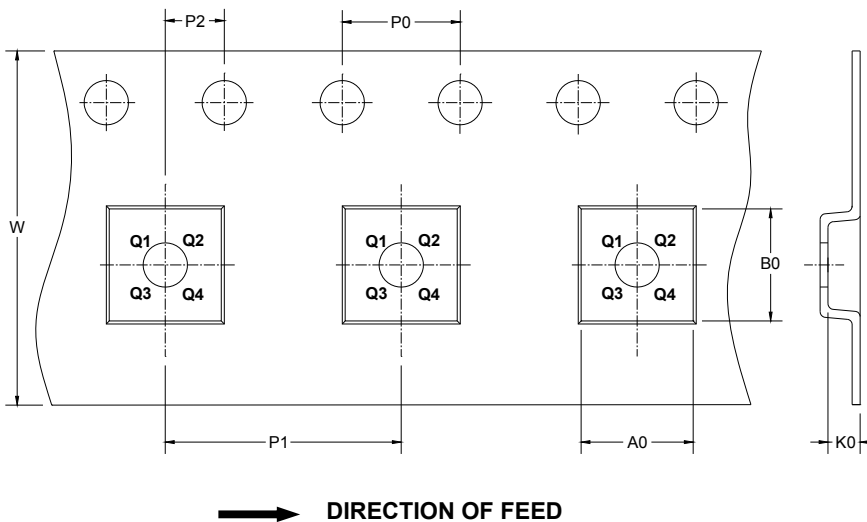
NOTE: All linear dimensions are in millimeters.

**TAPE AND REEL INFORMATION**

**REEL DIMENSIONS**



**TAPE DIMENSIONS**



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

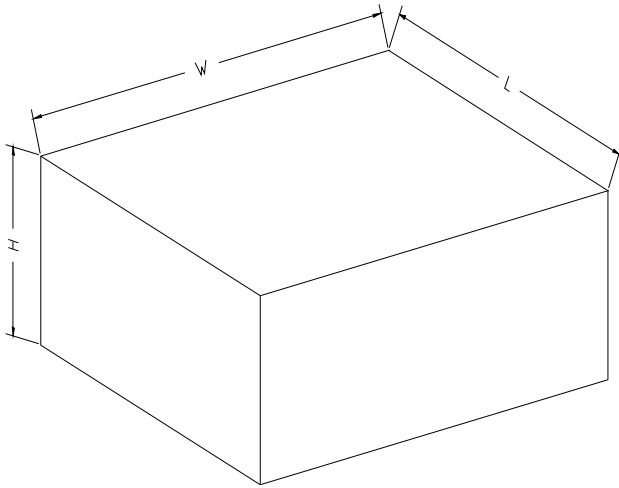
**KEY PARAMETER LIST OF TAPE AND REEL**

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-3×3-12L	13"	12.4	3.30	3.30	1.10	4.00	8.00	2.00	12.00	Q1

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## 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
13"	386	280	370	5