SGM4917
80mW, Capless, Stereo Headphone Amplifier with Shutdown

GENERAL DESCRIPTION

The SGM4917 stereo headphone amplifier is designed for portable equipment where board space is at a premium. The SGM4917 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 SGM4917B, the gain is set internally (-2V/V), further reducing component count. For SGM4917A, the gain can be adjusted by external feedback resistors.

The SGM4917 delivers up to 80mW per channel into a 32Ω load and has low 0.02% THD+N. A -78dB 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 SGM4917 operates from a single 2.7V to 5.5V supply, consumes only 2.7mA supply current, and is specified over the extended -40℃ to +85℃ temperature range. The SGM4917 is available in a Green TQFN-3×3-16L package.

FEATURES

- **SGM4917A: External Feedback Gain Network**
  SGM4917B: Fixed -2V/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**
- **Differential Inputs for Enhanced Noise Cancellation**
- **80mW into 32Ω Load from 5V Power Supply at THD+N = 0.1% (TYP, per Channel)**
- **Low 0.02% THD+N**
- **High PSRR (-78dB 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**
- **Under-Voltage Lockout Function**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in a Green TQFN-3×3-16L Package**

APPLICATIONS

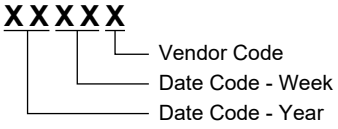
Notebook PCs
Cellular Phones
PDAs
MP3 Players
Smart Phones
Portable Audio Equipment

PACKAGE/ORDERING INFORMATION

MODEL	GAIN (V/V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4917A	ADJ	TQFN-3×3-16L	-40℃ to +85℃	SGM4917AYTQ16G/TR	4917AQ XXXXX	Tape and Reel, 3000
SGM4917B	-2	TQFN-3×3-16L	-40℃ to +85℃	SGM4917BYTQ16G/TR	4917BQ XXXXX	Tape and Reel, 3000

MARKING INFORMATION

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

PV_{SS} to SV_{SS} ..... -0.3V to +0.3V
PGND to SGND ..... -0.3V to +0.3V
PV_{DD} to SV_{DD} ..... -0.3V to +0.3V
PV_{DD} and SV_{DD} to PGND or SGND ..... -0.3V to +6V
PV_{SS} and SV_{SS} to PGND or SGND ..... -6V to +0.3V
IN to SGND ..... (SV_{SS} - 0.3V) to (SV_{DD} + 0.3V)
$\overline{SHDN}$ to SGND ..... -0.3V to (SV_{DD} + 0.3V)
OUT to SGND ..... (SV_{SS} - 0.3V) to (SV_{DD} + 0.3V)
C1P to PGND ..... -0.3V to (PV_{DD} + 0.3V)
C1N to PGND ..... (PV_{SS} - 0.3V) to + 0.3V
Output Short Circuit to GND or V_{DD} ..... Continuous
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 2000V
HBM (Output pins to Supply and Ground pins) 4000V
MM 150V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range ..... 2.7V to 5.5V
Operating Temperature Range ..... -40℃ to +85℃

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

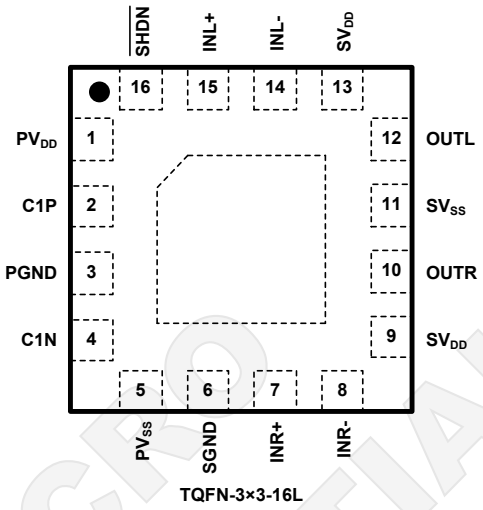
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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, or specifications without prior notice.

PIN CONFIGURATION

(TOP VIEW)



TQFN-3×3-16L

PIN DESCRIPTION

PIN	NAME	DESCRIPTION
1	PV_{DD}	Charge-Pump Power Supply. Powers charge-pump inverter, charge-pump logic, and oscillator. Connect to positive supply (2.7V to 5.5V). Bypass with a 1μF capacitor to PGND as close to the pin as possible.
2	C1P	Flying Capacitor Positive Terminal.
3	PGND	Power Ground. Connect to ground.
4	C1N	Flying Capacitor Negative Terminal.
5	PV_{SS}	Charge-Pump Output. Connect to SV_{SS}.
6	SGND	Signal Ground. Connect to ground.
7	INR+	Noninverting Right-Channel Audio Input.
8	INR-	Inverting Right-Channel Audio Input.
9,13	SV_{DD}	Amplifier Positive Power Supply. Connect to positive supply (2.7V to 5.5V). Bypass with a 1μF capacitor to SGND as close to the pin as possible.
10	OUTR	Right-Channel Output.
11	SV_{SS}	Amplifier Negative Power Supply. Connect to PV_{SS}.
12	OUTL	Left-Channel Output.
14	INL-	Inverting Left-Channel Audio Input.
15	INL+	Noninverting Left-Channel Audio Input.
16	$\overline{SHDN}$	Active-Low Shutdown Input.
Exposed Paddle	–	Exposed Paddle. Can be connected to GND or left floating.

ELECTRICAL CHARACTERISTICS

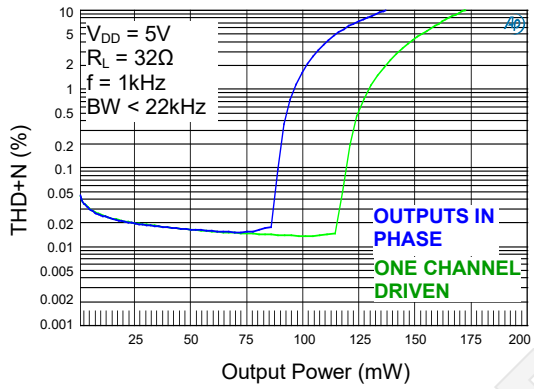
(PV_{DD} = SV_{DD} = 5V, PGND = SGND = 0V, $\overline{SHDN}$ = SV_{DD}, C1 = C2 = 1μF, R_L = ∞, resistive load referenced to ground; for SGM4917A, gain = -1V/V (R_{IN} = R_F = 10kΩ); for SGM4917B, gain = -2V/V (internally set). T_A = +25℃, unless otherwise noted.) (1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
General						
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	μA
$\overline{SHDN}$ 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}			3.2		ms
Amplifiers						
Voltage Gain	A_V	SGM4917B	-2.12	-2	-1.88	V/V
Gain Matching	ΔA_V	SGM4917B, between the right and left channels		0.2		%
Output Offset Voltage	V_{OS}	Between IN+ and IN-, input AC-coupled to ground (SGM4917A)	-5.5	1.1	5.5	mV
Input Impedance	R_{IN}	SGM4917B, measured at INL and INR	12.5	14.6	17	kΩ
Common Mode Rejection Ratio	CMRR	Input referred, SGM4917A		-70		dB
Power Supply Rejection Ratio	PSRR	f = 217Hz, V_{RIPPLE} = 200mV_{P-P}		-78		dB
		f = 10kHz, V_{RIPPLE} = 200mV_{P-P}		-70		
Output Power	P_{OUT}	R_L = 32Ω, THD+N = 0.1%		80		mW
Output Impedance in Shutdown				2		kΩ
Total Harmonic Distortion Plus Noise	THD+N	R_L = 32Ω, P_{OUT} = 55mW, f = 1kHz		0.02		%
Signal-to-Noise Ratio	SNR	R_L = 32Ω, P_{OUT} = 20mW, BW < 20kHz		100		dB
Capacitive Drive	C_L	No sustained oscillation		200		pF
Charge-Pump Oscillator Frequency	f_{OSC}		200	350	500	kHz
Crosstalk		R_L = 32Ω, V_{IN} = 200mV_{P-P}, f = 10kHz A_V = -1V/V		90		dB
Thermal Shutdown Threshold				137		℃
Thermal Shutdown Hysteresis				11		℃

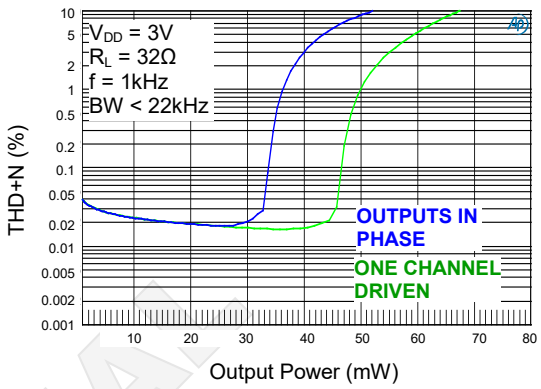
NOTE:
1. For C_{IN}, C1 and etc, please refer to the Functional Diagram and Typical Application on pages 8 and 9.

TYPICAL PERFORMANCE CHARACTERISTICS

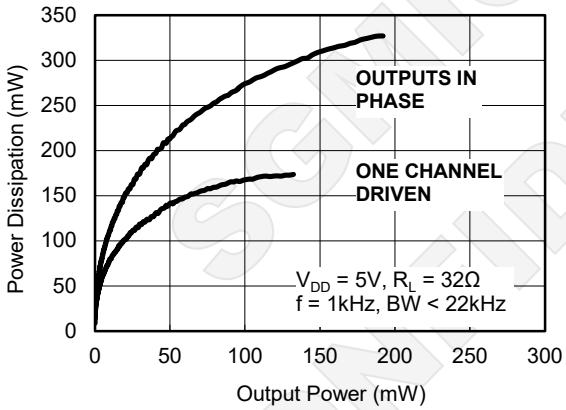
THD+N vs. Output Power



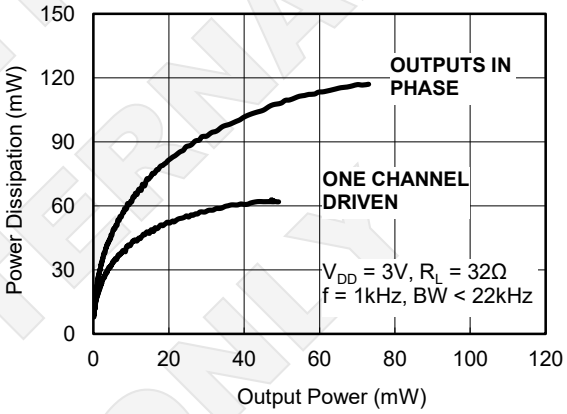
THD+N vs. Output Power



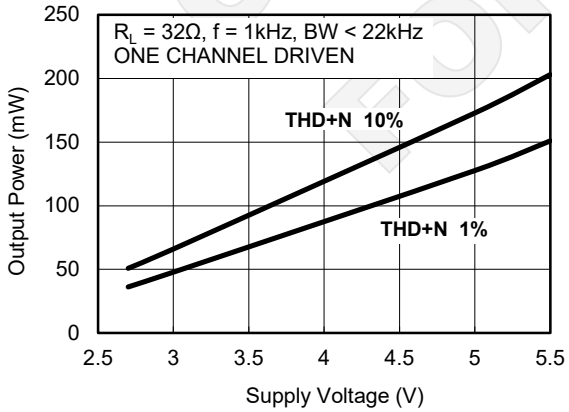
Power Dissipation vs. Output Power



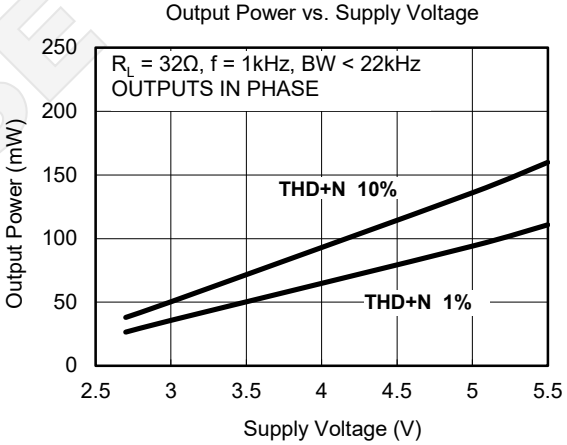
Power Dissipation vs. Output Power



Output Power vs. Supply Voltage

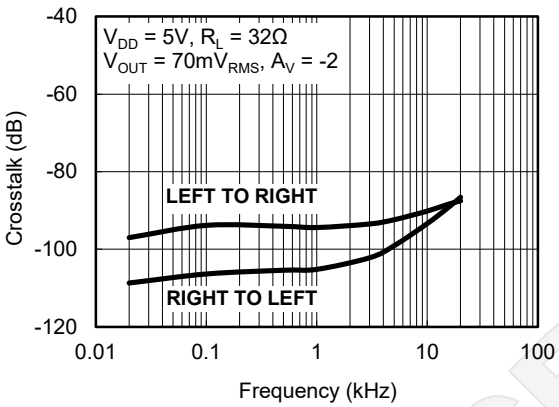


Output Power vs. Supply Voltage

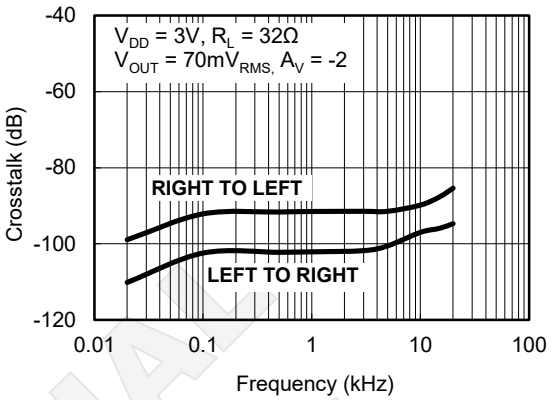


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

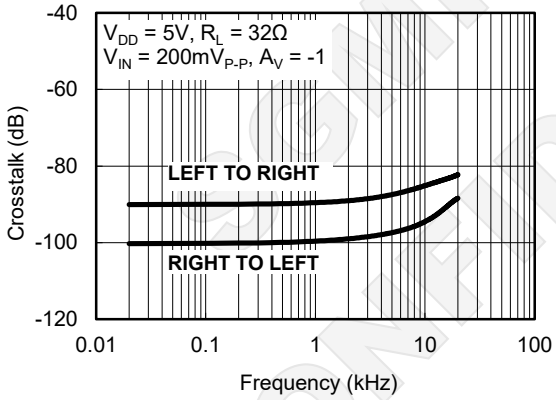
Crosstalk vs. Frequency



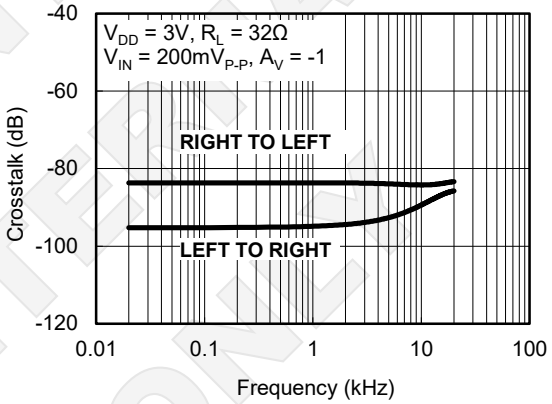
Crosstalk vs. Frequency



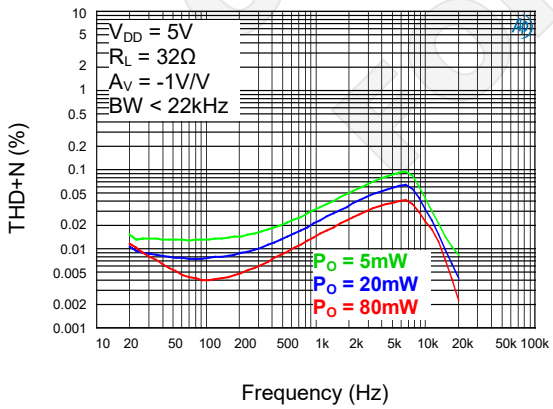
Crosstalk vs. Frequency



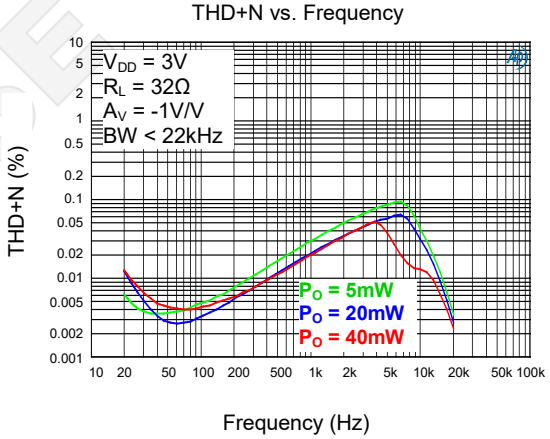
Crosstalk vs. Frequency



THD+N vs. Frequency

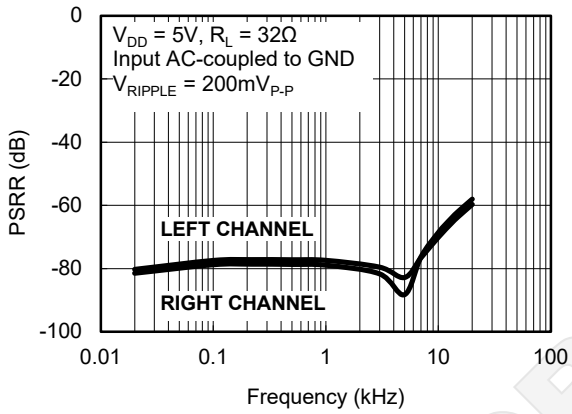


THD+N vs. Frequency

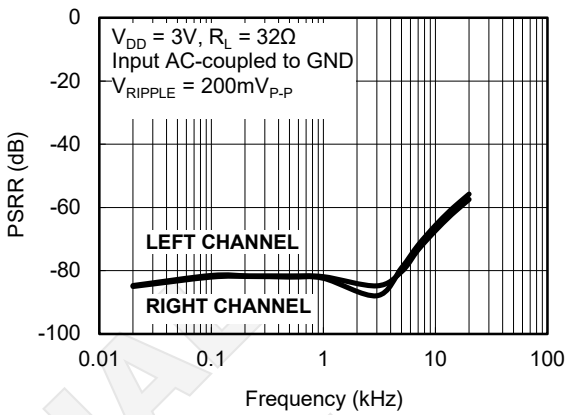


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

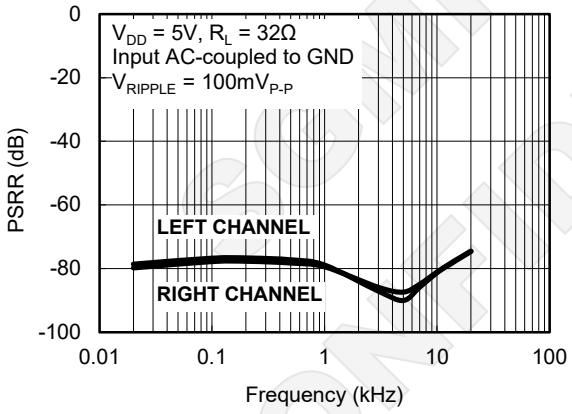
Power Supply Rejection Ratio vs. Frequency



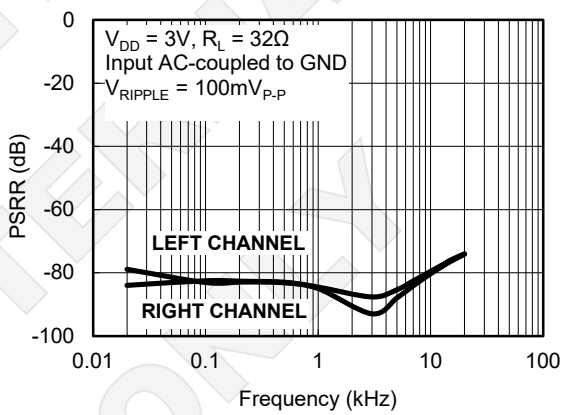
Power Supply Rejection Ratio vs. Frequency



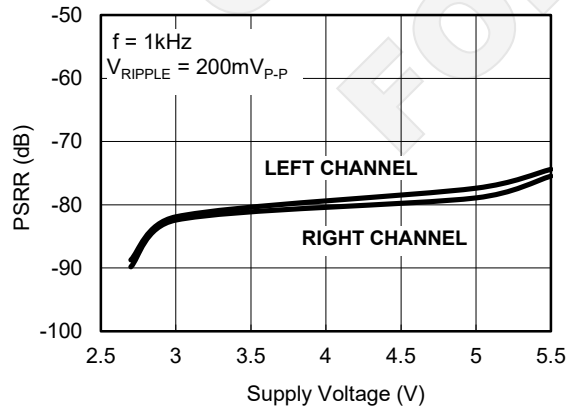
Power Supply Rejection Ratio vs. Frequency



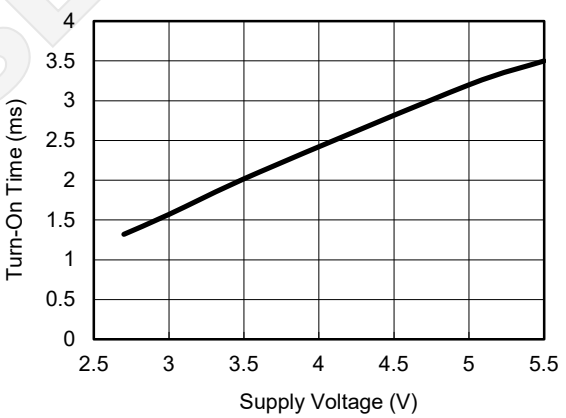
Power Supply Rejection Ratio vs. Frequency



PSRR vs. Supply Voltage



Turn-On Time vs. Supply Voltage



FUNCTIONAL DIAGRAM AND TYPICAL APPLICATION

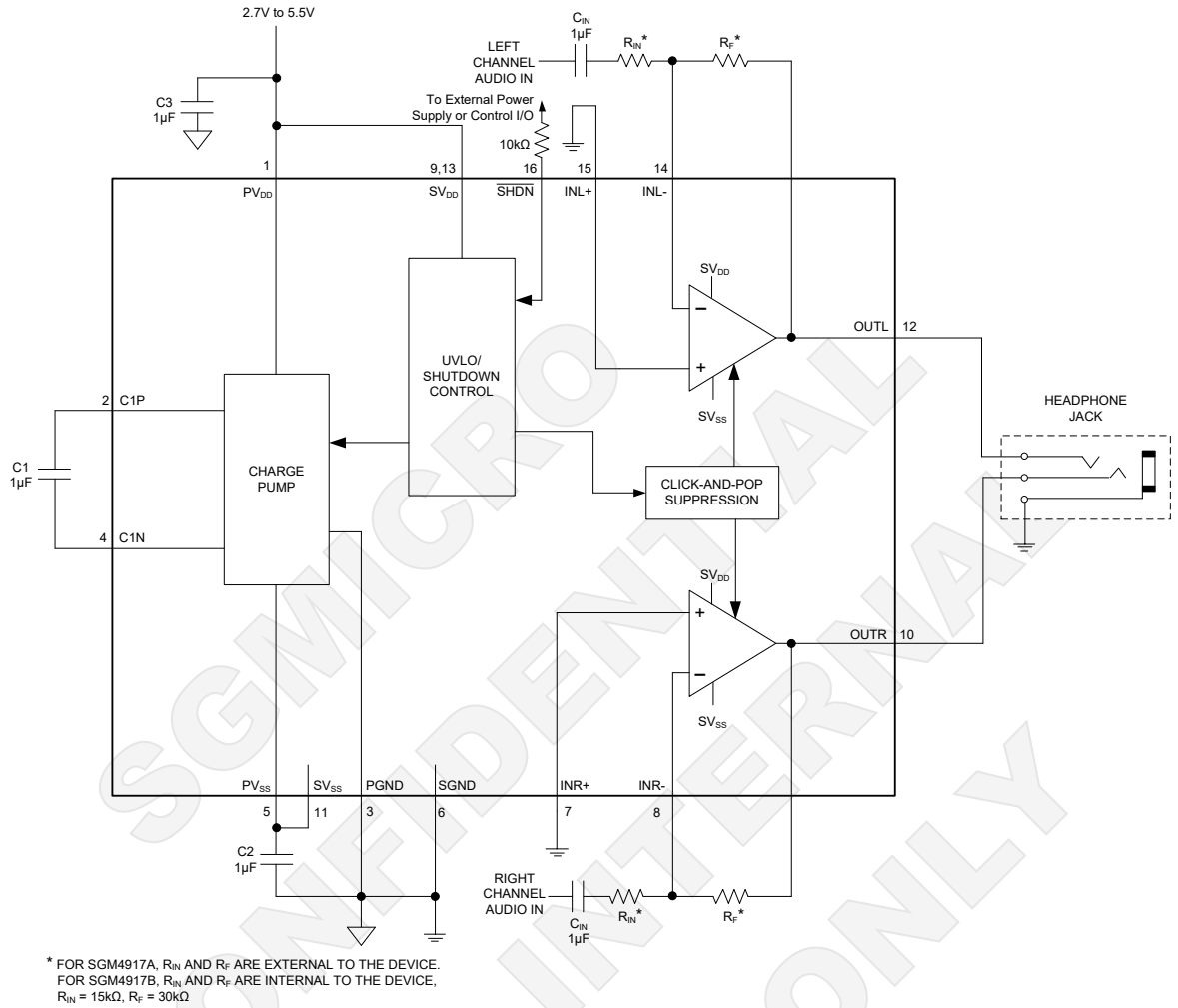


Figure 1. Typical Single-Ended Input Application Circuit

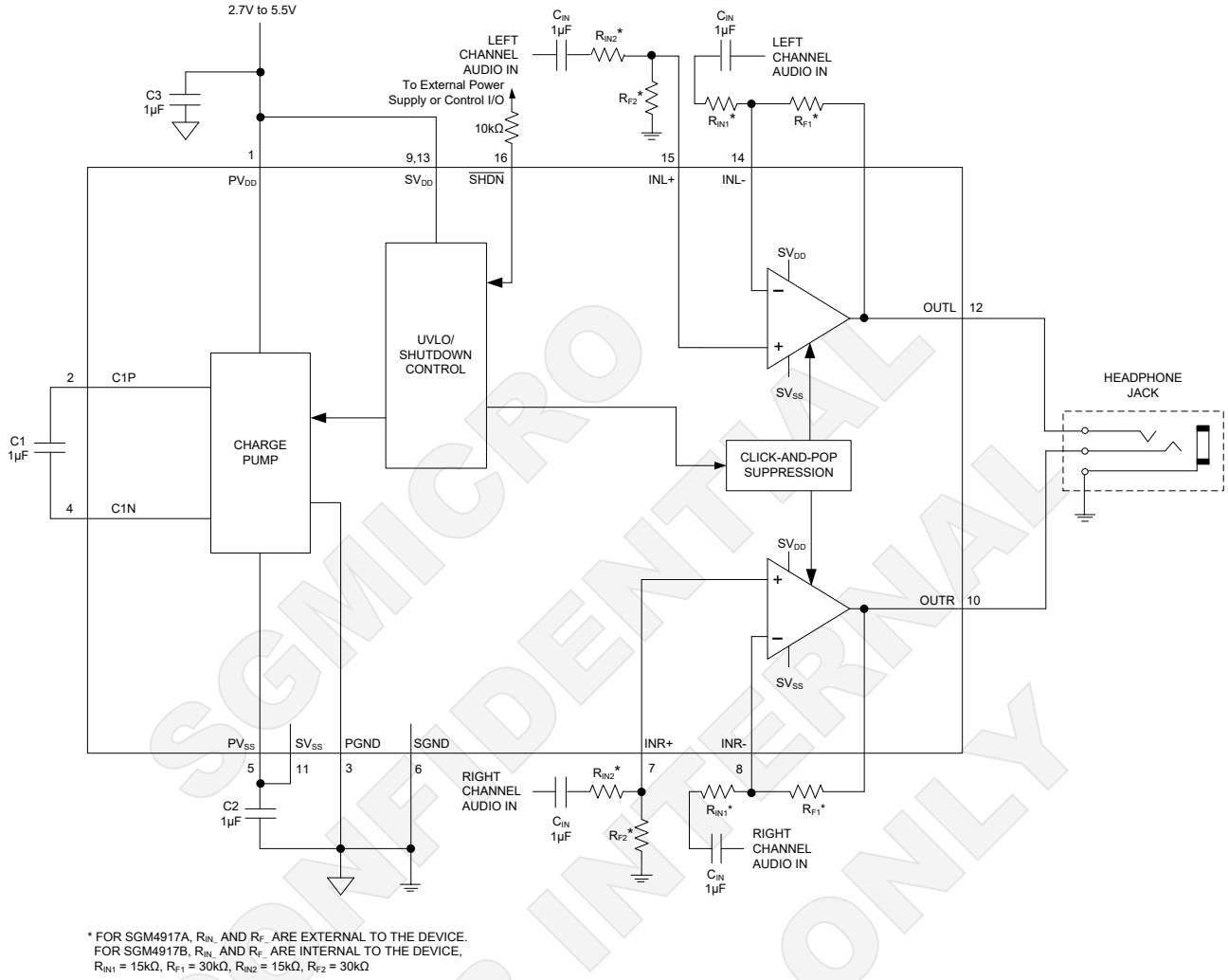
NOTES:

1. To ensure the normal operation of the device, decoupling capacitor (C3) must be placed as close to SGM4917 as possible. The loop length formed by C3, SV_{DD} and GND should be no longer than 1.2cm; 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.

FUNCTIONAL DIAGRAM AND TYPICAL APPLICATION (continued)



* FOR SGM4917A, $R_{IN\_}$ AND $R_{F\_}$ ARE EXTERNAL TO THE DEVICE.
FOR SGM4917B, $R_{IN\_}$ AND $R_{F\_}$ ARE INTERNAL TO THE DEVICE,
R_{IN1} = 15kΩ, R_{F1} = 30kΩ, R_{IN2} = 15kΩ, R_{F2} = 30kΩ

Figure 2. Typical Differential Input Application Circuit

NOTES:

1. To ensure the normal operation of the device, decoupling capacitor (C3) must be placed as close to SGM4917 as possible. The loop length formed by C3, SV_{DD} and GND should be no longer than 1.2cm; 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.

REVISION HISTORY

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

JULY 2017 – REV.A.2 to REV.A.3

Updated Typical Application Circuit 8-9

DECEMBER 2012 – REV.A.1 to REV.A.2

Added note for Typical Application Circuit 8-9

SEPTEMBER 2012 – REV.A to REV.A.1

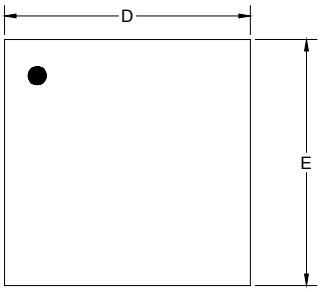
Added Tape and Reel Information 11-12

Changes from Original (FEBRUARY 2012) to REV.A

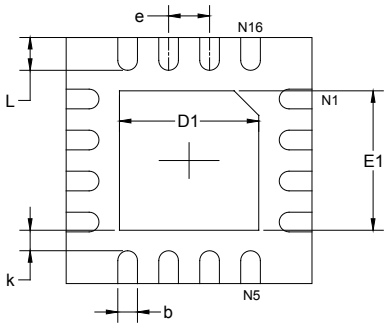
Changed from product preview to production data ..... All

PACKAGE OUTLINE DIMENSIONS

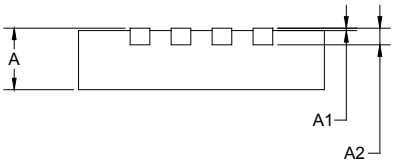
TQFN-3×3-16L



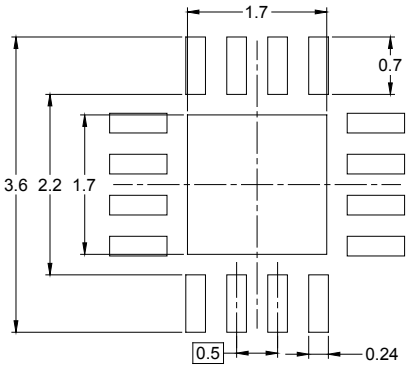
TOP VIEW



BOTTOM VIEW



SIDE VIEW

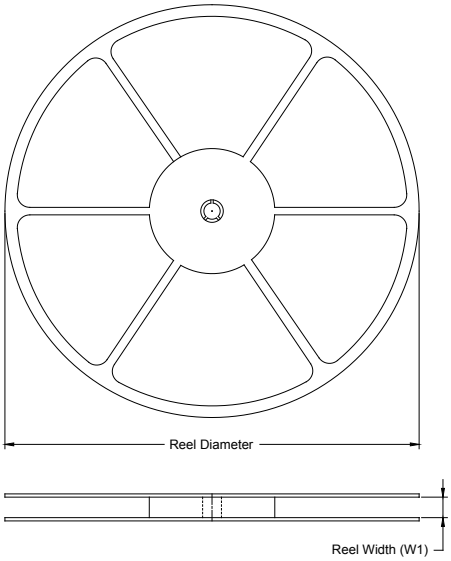


RECOMMENDED LAND PATTERN (Unit: mm)

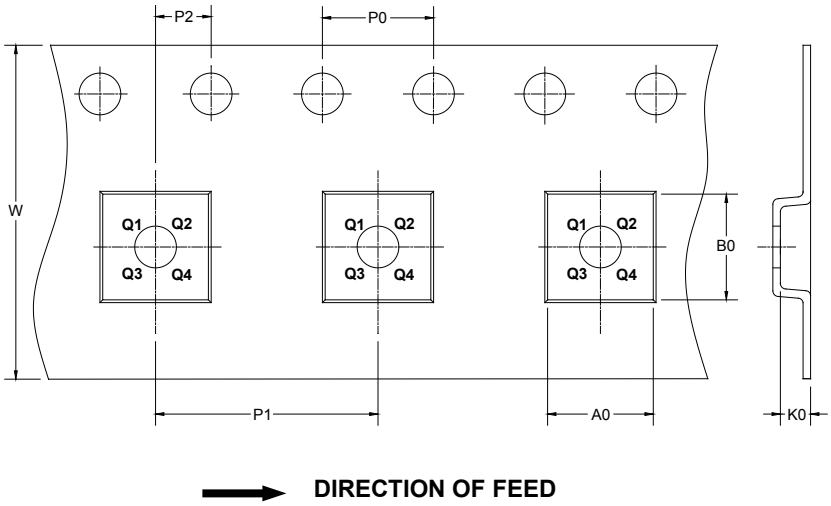
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E	2.900	3.100	0.114	0.122
E1	1.600	1.800	0.063	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



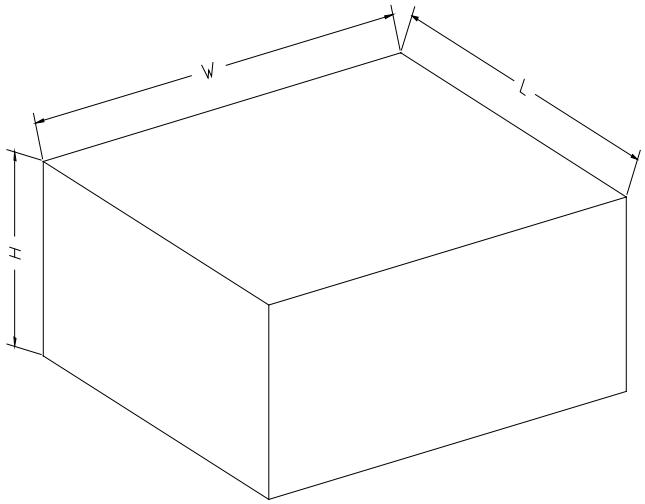
NOTE: The picture is only for reference. Please make the object as the standard.

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	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
13″	386	280	370	5

DD0002