SGM3705
0.2Ω, Low THD+N, Wide Positive and Negative Signal Passing, Dual, SPST Analog Switch

GENERAL DESCRIPTION

The SGM3705 is a dual SPST (single-pole/single-throw) analog switch with low distortion. It operates from a 2.7V to 5.5V single power supply. The SGM3705 allows a -18V to +18V wide range positive and negative signal passing for 3.6V to 5.5V power supply range. When the power supply voltage is 3.0V, it can pass -15V to +15V wide range positive and negative signals.

The SGM3705 features ultra-low on-resistance, low voltage and fast switching times. The high performances make it very suitable for multiple applications, such as portable equipment, battery-powered systems, etc. In addition, the SGM3705 can be used as a dual 2-to-1 multiplexer, two single signals or one differential signal switch and power switches.

The SGM3705 is available in Green TQFN-4×4-16L and WLCSP-2.11×2.2-12B packages. It operates over an operating temperature range of -40℃ to +85℃.

FEATURES

- **Single Supply Voltage Range: 2.7V to 5.5V**
- **On-Resistance for Switch 1: 0.2Ω (TYP)**
- **On-Resistance for Switch 2: 0.2Ω (TYP)**
- **-18V to +18V Low Distortion, Analog Signal Passing**
- **Fast Switching Times**
- **High Off-Isolation**
- **Very Low Crosstalk**
- **Low Input Leakage Current**
- **1.2V, 1.8V Logic Compatible Control Pin**
- **Break-Before-Make Switching**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green TQFN-4×4-16L and WLCSP-2.11×2.2-12B Packages**

APPLICATIONS

Portable Equipment
Sample-and-Hold Circuits
Battery-Powered Systems
HiFi Audio Switch

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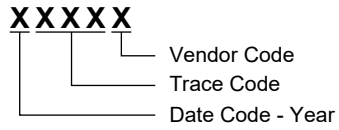
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3705	TQFN-4×4-16L	-40℃ to +85℃	SGM3705YTQE16G/TR	SGM3705 YTQE16 XXXXX	Tape and Reel, 3000
	WLCSP-2.11×2.2-12B	-40℃ to +85℃	SGM3705YG/TR	3705 XXXXX XX#XX	Tape and Reel, 3000

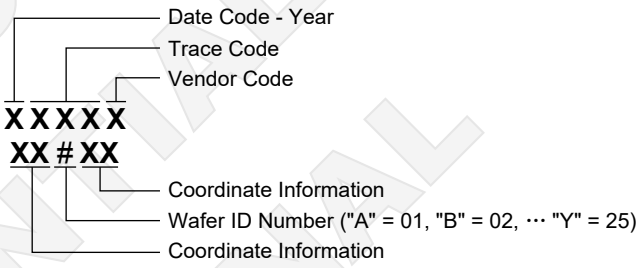
MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code. XX#XX = Coordinate Information and Wafer ID Number.

TQFN-4×4-16L



WLCSP-2.11×2.2-12B



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 6V
IN1, IN2, EN to GND ..... 0V to 6V
Analog Voltage Range ..... -18V to +18V
Continuous Current from Sx to Dx ..... ±800mA
Peak Current from Sx to Dx ..... ±2000mA
I/O Clamp Current (V_I < 0) ..... -30mA
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃

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 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.

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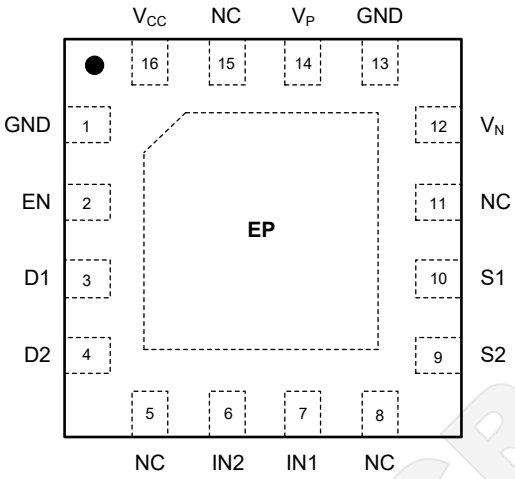
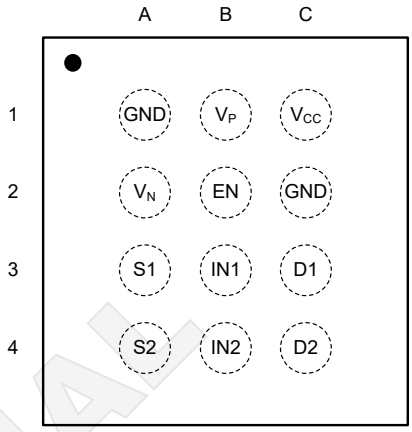
PIN CONFIGURATIONS

(TOP VIEW)



TQFN-4×4-16L

(TOP VIEW)



WLCSP-2.11×2.2-12B

PIN DESCRIPTION

PIN		NAME	FUNCTION
TQFN-4×4-16L	WLCSP-2.11×2.2-12B		
1, 13	A1, C2	GND	Ground.
2	B2	EN	Enable Control. When EN = "Low", both Sx and Dx will be disconnected, negative charge pump doesn't work and the SGM3705 will be in shutdown state. When EN = "High", negative charge pump will work, the SGM3705 will be in working state, and Sx or Dx will be connected or disconnected depending on the logical state of INx.
3	C3	D1	Drain Terminal 1. This pin can be an input or an output of switch 1.
4	C4	D2	Drain Terminal 2. This pin can be an input or an output of switch 2.
5, 8, 11, 15	—	NC	No Connection.
6	B4	IN2	Digital Control Pin of Switch 2. When IN2 = "Low", switch 2 is turned off, and S2 and D2 are disconnected. When IN2 = "High", switch 2 is turned on, and S2 and D2 are connected.
7	B3	IN1	Digital Control Pin of Switch 1. When IN1 = "Low", switch 1 is turned off, and S1 and D1 are disconnected. When IN1 = "High", switch 1 is turned on, and S1 and D1 are connected.
9	A4	S2	Source Terminal 2. This pin can be an input or an output of switch 2.
10	A3	S1	Source Terminal 1. This pin can be an input or an output of switch 1.
12	A2	V_N	Negative Supply Voltage Output. Connect a 10nF ceramic capacitor from V_N pin to GND.
14	B1	V_P	Positive Supply Voltage Output. Connect a 10nF ceramic capacitor from V_P pin to GND.
16	C1	V_{CC}	Positive Power Supply Pin.
Exposed Pad	—	EP	No Connection.

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FUNCTION TABLE

Table 1. Function Table of Switch 1:

EN	IN1	S1 and D1	Negative Charge Pump
0	X	Disconnected	Turn Off
1	0	Disconnected	Turn On
1	1	Connected (S1 = D1)	Turn On

Table 2. Function Table of Switch 2:

EN	IN2	S2 and D2	Negative Charge Pump
0	X	Disconnected	Turn Off
1	0	Disconnected	Turn On
1	1	Connected (S2 = D2)	Turn On

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ELECTRICAL CHARACTERISTICS

(V_{CC} = 3.0V, C_P = C_N = 10nF, 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_{ANALOG}		Full	-15V		+15V	V
On-Resistance	R_{ON}	-15V ≤ V_D ≤ 15V, I_S = -200mA	+25℃		0.2		Ω
On-Resistance Match between Channels	ΔR_{ON}	-15V ≤ V_D ≤ 15V, I_S = -200mA	+25℃		0.005		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	-15V ≤ V_D ≤ 15V, I_S = -200mA	+25℃		0.001		Ω
Source OFF Leakage Current	$I_{S(OFF)}$	V_S = -11V, +11V, V_D = +11V, -11V	+25℃		0.01		μA
Channel ON Leakage Current	$I_{S(ON)}$, $I_{D(ON)}$	V_S = -11V, +11V, V_D = floating, or V_S = floating, V_D = -11V, +11V	+25℃		0.01		μA
Digital Inputs							
Logic High for 1.8V Logic	$V_{INH1.8}$	V_{CC} = 2.7V to 5.5V	+25℃	0.78			V
Logic Low for 1.8V Logic	$V_{INL1.8}$	V_{CC} = 2.7V to 5.5V	+25℃			0.42	V
Logic High for 1.2V Logic	$V_{INH1.2}$	V_{CC} = 2.7V to 5.5V	+25℃	0.78			V
Logic Low for 1.2V Logic	$V_{INL1.2}$	V_{CC} = 2.7V to 5.5V	+25℃			0.42	V
Pull-Down Resistor	$R_{PULL-DOWN}$		+25℃		560		kΩ
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_S = 1.0V, V_{IH} = 1.6V, V_{IL} = 0V, R_L = 50Ω, C_L = 35pF, Test Circuit 1	+25℃		410		ns
Turn-Off Time	t_{OFF}	V_S = 1.0V, V_{IH} = 1.6V, V_{IL} = 0V, R_L = 50Ω, C_L = 35pF, Test Circuit 1	+25℃		1750		ns
Off-Isolation	O_{ISO}	f = 1kHz, R_L = 32Ω, Signal = 0dBm, Test Circuit 2	+25℃		-134		dB
		f = 1MHz, R_L = 50Ω, Signal = 0dBm, C_L = 5pF, Test Circuit 2			-62		
Channel-to-Channel Crosstalk	X_{TALK}	f = 1kHz, R_L = 32Ω, Signal = 0dBm, Test Circuit 3	+25℃		-127		dB
		f = 1MHz, R_L = 50Ω, Signal = 0dBm, C_L = 5pF, Test Circuit 3			-74		
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 4	+25℃		145		MHz
Channel On Capacitance	C_{ON}		+25℃		37		pF
Injection Select Input to Common I/O	Q	V_G = GND, R_G = 0Ω, C_L = 1nF, Test Circuit 5	+25℃		2660		pC
Total Harmonic Distortion + Noise	THD+N	A-Weighting, Test Circuit 6, V_S = $2V_{RMS}$, R_L = 600Ω	+25℃		-118		dB
		A-Weighting, Test Circuit 6, V_S = $2V_{PP}$, R_L = 600Ω			-115		
		A-Weighting, Test Circuit 6, V_S = $2V_{PP}$, R_L = 32Ω			-114		
		A-Weighting, Test Circuit 6, V_S = $1V_{PP}$, R_L = 600Ω			-112		
		A-Weighting, Test Circuit 6, V_S = $1V_{PP}$, R_L = 32Ω			-110		
Start Up Time	t_{START}	Switch V_{EN} = 0V to V_{EN} = 1.6V	+25℃		1.7		ms
Power Requirements							
Power Supply Current	I_{CC}	V_{IN} = 0V or 1.6V, V_{EN} = 1.6V	+25℃		1800		μA
Power Supply Current in Shutdown State	I_{CC}	V_{IN} = 0V or 1.6V, V_{EN} = 0V	+25℃		0.6		μA

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ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 5.0V, C_P = C_N = 10nF, 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_{ANALOG}		Full	-18V		+18V	V
On-Resistance	R_{ON}	-15V ≤ V_D ≤ 15V, I_S = -200mA	+25℃		0.2		Ω
On-Resistance Match between Channels	ΔR_{ON}	-15V ≤ V_D ≤ 15V, I_S = -200mA	+25℃		0.005		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	-15V ≤ V_D ≤ 15V, I_S = -200mA	+25℃		0.001		Ω
Source OFF Leakage Current	$I_{S(OFF)}$	V_S = -11V, +11V, V_D = +11V, -11V	+25℃		0.02		μA
Channel ON Leakage Current	$I_{S(ON)}$, $I_{D(ON)}$	V_S = -11V, +11V, V_D = floating, or V_S = floating, V_D = -11V, +11V	+25℃		0.02		μA
Digital Inputs							
Logic High for 1.8V Logic	$V_{INH1.8}$	V_{CC} = 2.7V to 5.5V	+25℃	0.78			V
Logic Low for 1.8V Logic	$V_{INL1.8}$	V_{CC} = 2.7V to 5.5V	+25℃			0.42	V
Logic High for 1.2V Logic	$V_{INH1.2}$	V_{CC} = 2.7V to 5.5V	+25℃	0.78			V
Logic Low for 1.2V Logic	$V_{INL1.2}$	V_{CC} = 2.7V to 5.5V	+25℃			0.42	V
Pull Down Resistor	$R_{PULL\ DOWN}$		+25℃		560		kΩ
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_S = 1.0V, V_{IH} = 1.6V, V_{IL} = 0V, R_L = 50Ω, C_L = 35pF, Test Circuit 1	+25℃		410		ns
Turn-Off Time	t_{OFF}	V_S = 1.0V, V_{IH} = 1.6V, V_{IL} = 0V, R_L = 50Ω, C_L = 35pF, Test Circuit 1	+25℃		1750		ns
Off-Isolation	O_{ISO}	f = 1kHz, R_L = 32Ω, Signal = 0dBm, Test Circuit 2	+25℃		-134		dB
		f = 1MHz, R_L = 50Ω, Signal = 0dBm, C_L = 5pF, Test Circuit 2			-62		
Channel-to-Channel Crosstalk	X_{TALK}	f = 1kHz, R_L = 32Ω, Signal = 0dBm, Test Circuit 3	+25℃		-127		dB
		f = 1MHz, R_L = 50Ω, Signal = 0dBm, C_L = 5pF, Test Circuit 3			-74		
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 4	+25℃		145		MHz
Channel On Capacitance	C_{ON}		+25℃		36		pF
Injection Select Input to Common I/O	Q	V_G = GND, R_G = 0Ω, C_L = 1nF, Test Circuit 5	+25℃		2660		pC
Total Harmonic Distortion + Noise	THD+N	A-Weighting, Test Circuit 6, V_S = $2V_{RMS}$, R_L = 600Ω	+25℃		-118		dB
		A-Weighting, Test Circuit 6, V_S = $2V_{PP}$, R_L = 600Ω			-115		
		A-Weighting, Test Circuit 6, V_S = $2V_{PP}$, R_L = 32Ω			-114		
		A-Weighting, Test Circuit 6, V_S = $1V_{PP}$, R_L = 600Ω			-112		
		A-Weighting, Test Circuit 6, V_S = $1V_{PP}$, R_L = 32Ω			-107		
Start Up Time	t_{START}	Switch V_{EN} = 0V to V_{EN} = 1.6V	+25℃		1.7		ms
Power Requirements							
Power Supply Current	I_{CC}	V_{IN} = 0V or 1.6V, V_{EN} = 1.6V	+25℃		1800		μA
Power Supply Current in Shutdown State	I_{CC}	V_{IN} = 0V or 1.6V, V_{EN} = 0V	+25℃		0.6		μA

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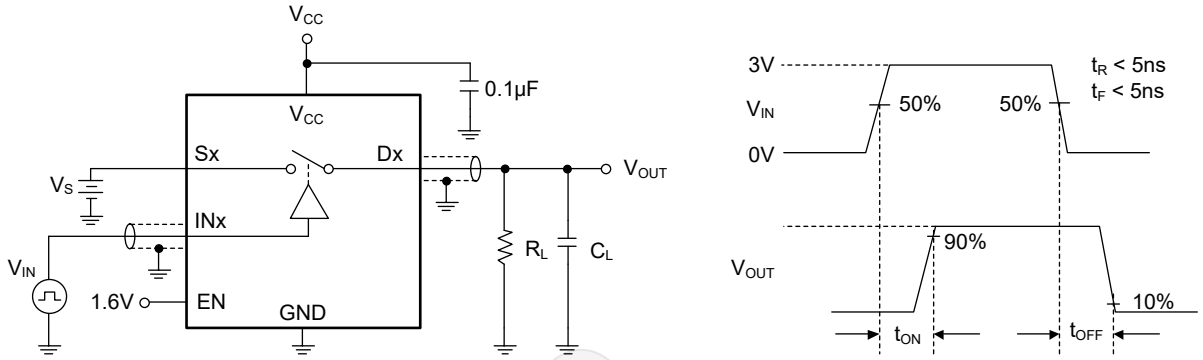
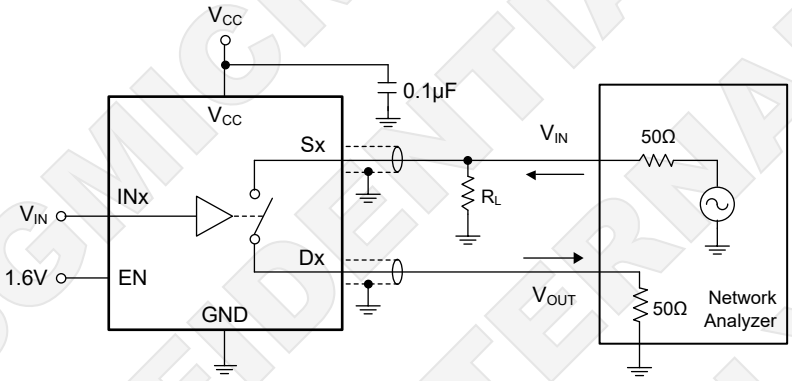
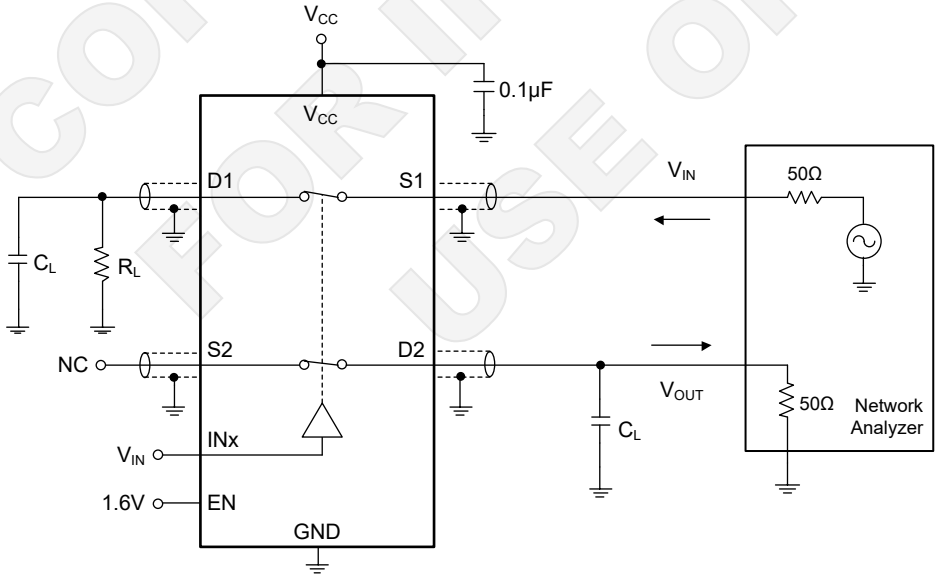
TEST CIRCUITS



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



Test Circuit 2. Off-Isolation



Channel-to-Channel Crosstalk = -20 log (V_S/V_{OUT})

Test Circuit 3. Channel-to-Channel Crosstalk

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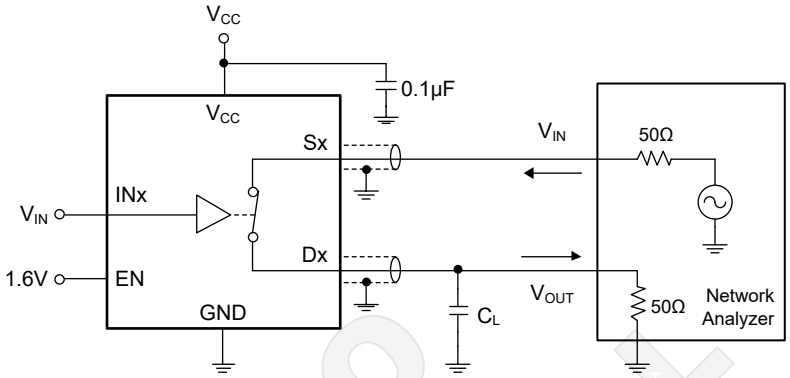
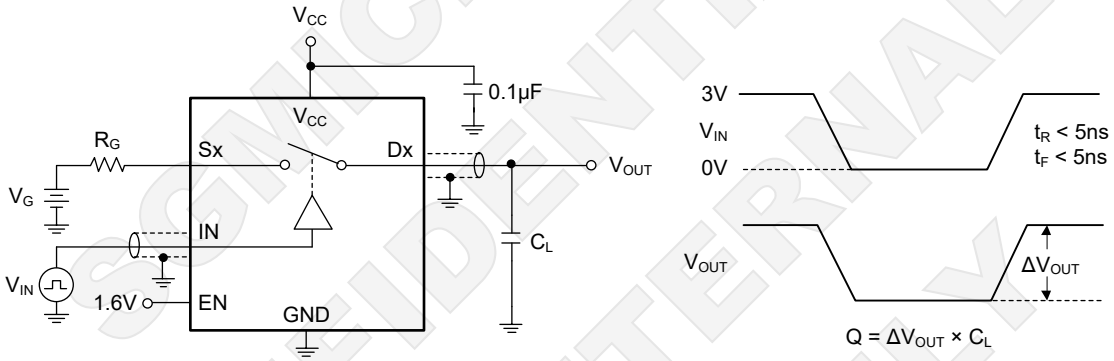
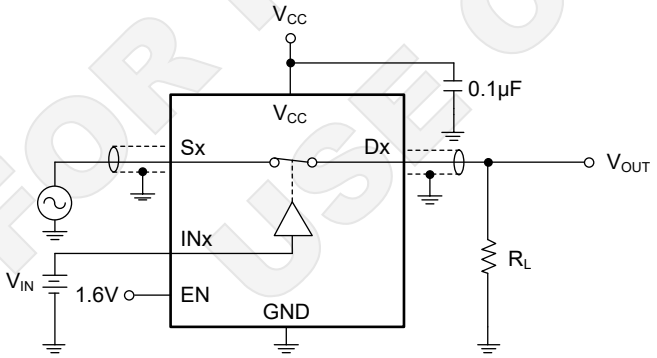
TEST CIRCUITS (continued)



Test Circuit 4. -3dB Bandwidth



Test Circuit 5. Charge Injection (Q)



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

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APPLICATION INFORMATION

Speaker + Receiver is always used in smart phone, and high voltage class D speaker driver (smart audio PA) is used to drive speaker for high volume audio. But the high output voltage of class D speaker driver will damage the receiver driver because receiver driver is designed by low voltage technology. The SGM3705 can solve this design issue by providing the safe isolation between receiver driver and high voltage class D speaker driver. The SGM3705 provides low R_{ON} channels to pass the positive and negative signals from capless receiver driver. The circuit is shown in Figure 1.

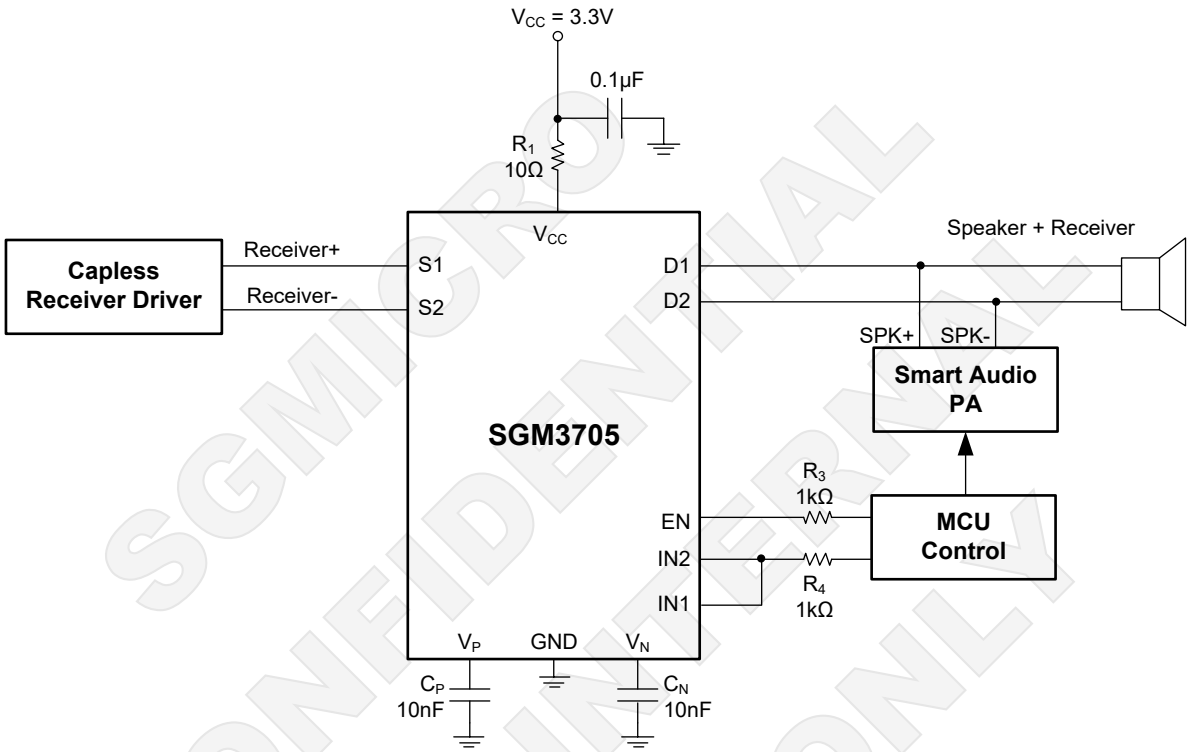

Figure 1. Typical Application Circuit for Speaker + Receiver

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APPLICATION INFORMATION (continued)

To improve audio quality of portable devices, external audio power amplifier is always used to drive speaker, and the integrated speaker power amplifier in PMIC will be ignored. The high performance SGM3705 is used to pass the audio signal in application. The circuit is shown in Figure 2 and a stable 3.3V power supply is required in this circuit.

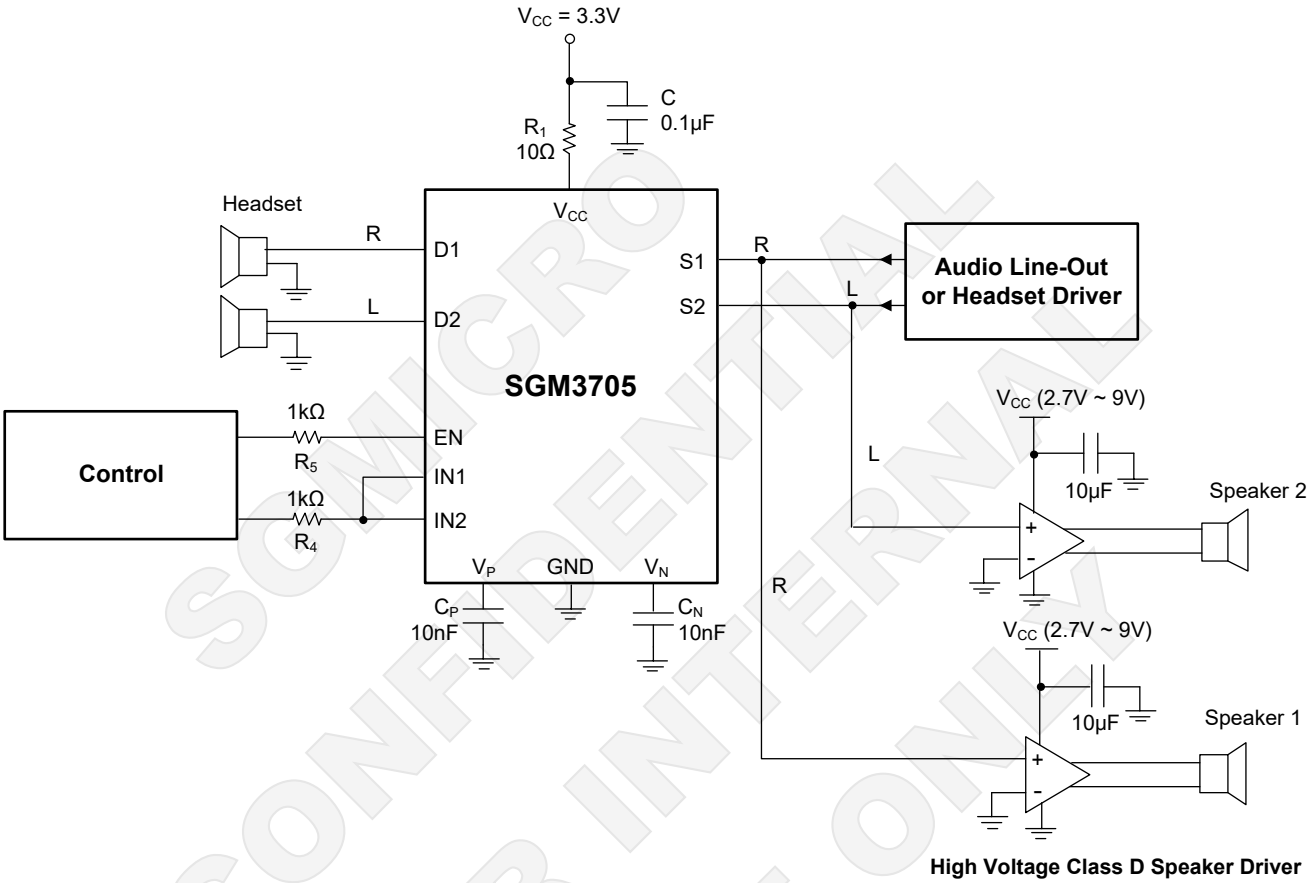

Figure 2. Typical Application Circuit for Audio Signal Switch

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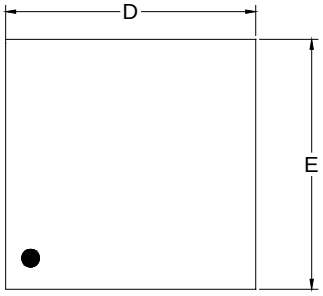
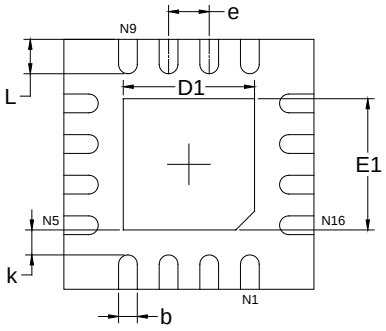
PACKAGE OUTLINE DIMENSIONS

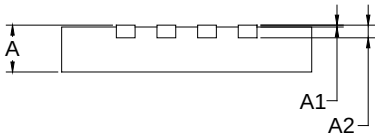
TQFN-4×4-16L



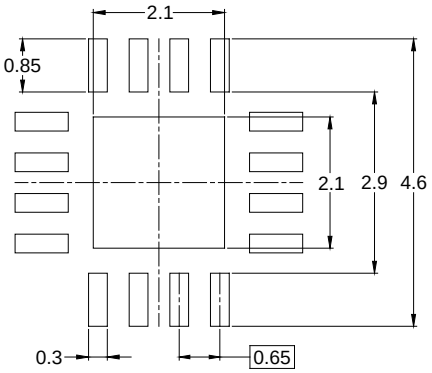
TOP VIEW



BOTTOM VIEW



SIDE VIEW



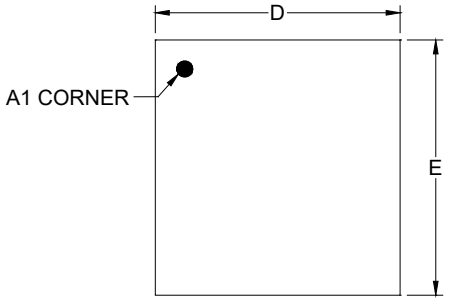
RECOMMENDED LAND PATTERN (Unit: mm)

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	3.900	4.100	0.154	0.161
D1	2.000	2.200	0.079	0.087
E	3.900	4.100	0.154	0.161
E1	2.000	2.200	0.079	0.087
k	0.200 MIN		0.008 MIN	
b	0.250	0.350	0.010	0.014
e	0.650 TYP		0.026 TYP	
L	0.450	0.650	0.018	0.026

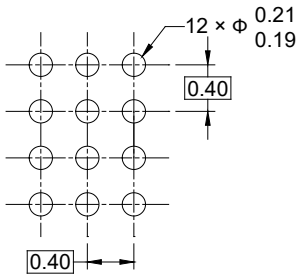
NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

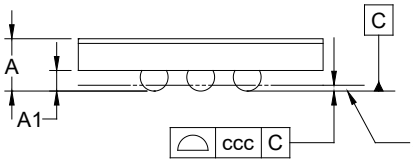
WLCSP-2.11×2.2-12B



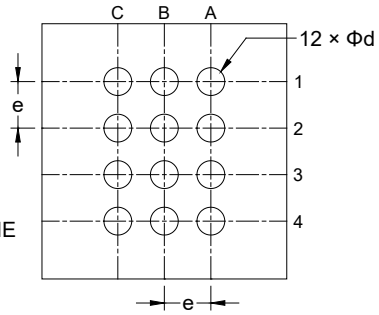
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



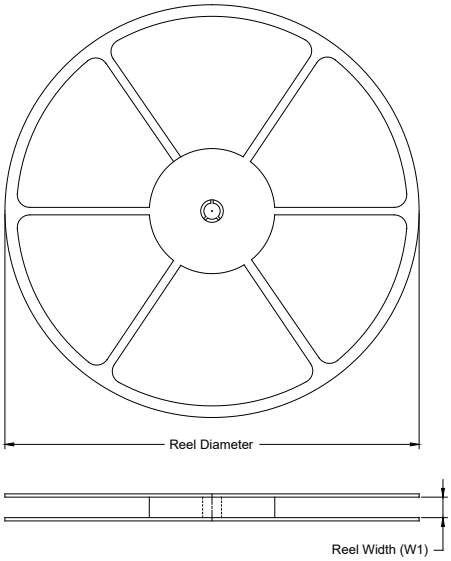
BOTTOM VIEW

Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	0.488
A1	0.157	-	0.197
D	2.075	-	2.135
E	2.165	-	2.225
d	0.209	-	0.269
e	0.400 BSC		
ccc	0.050		

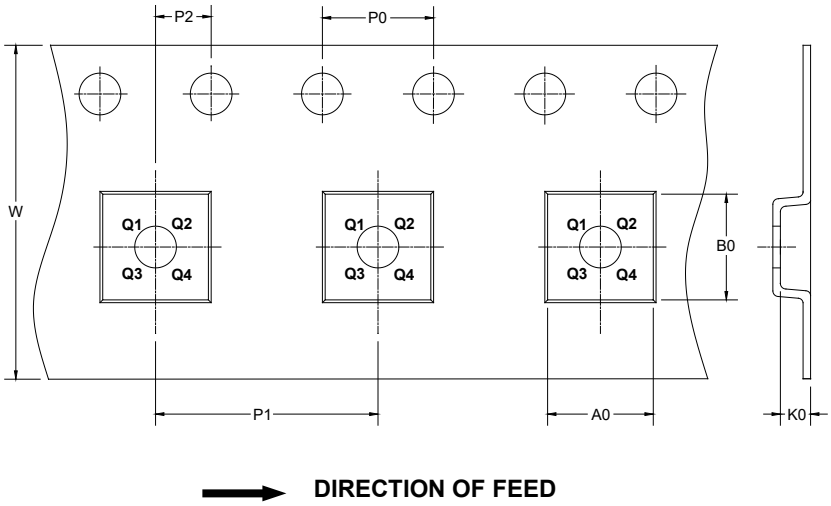
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



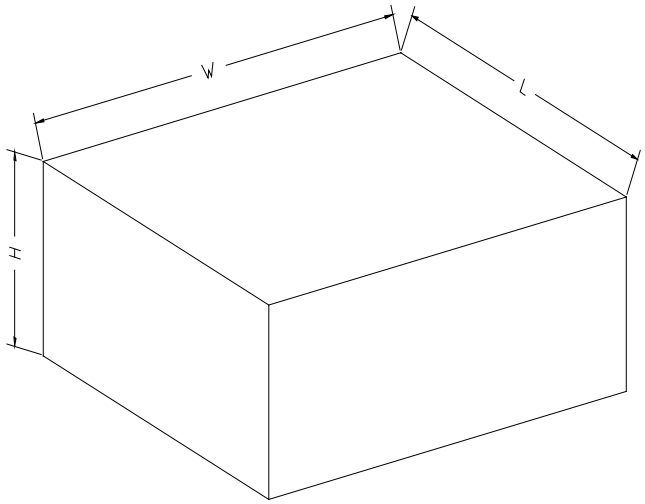
NOTE: The picture is only for reference. Please make the object as the standard.

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-4×4-16L	13″	12.4	4.30	4.30	1.10	4.0	8.0	2.0	12.0	Q2
WLCSP-2.11×2.2-12B	7"	9.5	2.41	2.46	0.77	4.0	4.0	2.0	8.0	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