



SGM3712

0.9Ω, High Voltage, Rail-to-Rail Negative Signal Passing, Dual, SPDT Analog Switch

GENERAL DESCRIPTION

The SGM3712 is a dual SPDT (single-pole/double-throw) analog switch. It operates from a 2.7V to 12V single power supply and allows negative signal passing with low distortion.

The SGM3712 features low on-resistance, high voltage and fast switching times. The high performances make it very suitable for multiple applications. In addition, the SGM3712 can be used as a dual 2-to-1 multiplexer because it has two normally open and close switches, respectively.

The SGM3712 is available in Green SOIC-14 and WLCSP-1.27×2.13-15B packages. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- **Single Supply Voltage Range: 2.7V to 12V**
- **Low On-Resistance: 0.9Ω (TYP)**
- **-V_{CC} to +V_{CC} Positive and Negative Signal Passing**
- **Low Distortion**
- **Fast Switching Times**
- **High Off-Isolation**
- **Low Crosstalk: -90dB at 1MHz**
- **1.8V Logic Control**
- **Break-Before-Make Switching**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green WLCSP-1.27×2.13-15B and SOIC-14 Packages**

APPLICATIONS

Portable Equipment
Battery-Powered Systems

PACKAGE/ORDERING INFORMATION

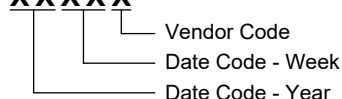
MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3712	WLCSP-1.27×2.13-15B	-40°C to +85°C	SGM3712YG/TR	XXXXX 3712	Tape and Reel, 3000
	SOIC-14	-40°C to +85°C	SGM3712YS14G/TR	SGM3712YS14 XXXXX	Tape and Reel, 2500

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.

WLCSP-1.27×2.13-15B/SOIC-14

XXXXX



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 13.2V
IN1, IN2, EN to GND	0V to 6V
Analog Voltage Range ⁽¹⁾	(-V _{CC} - 0.3V) to (V _{CC} + 0.3V)
Continuous Current from NO to COM	±350mA
Continuous Current from NC to COM	±350mA
Peak Current from NO to COM	±400mA
Peak Current from NC to COM	±400mA
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
MM	400V
CDM	1000V

NOTE:

1. Internal diodes will clamp voltages at NC, NO, or COM 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 12V
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.

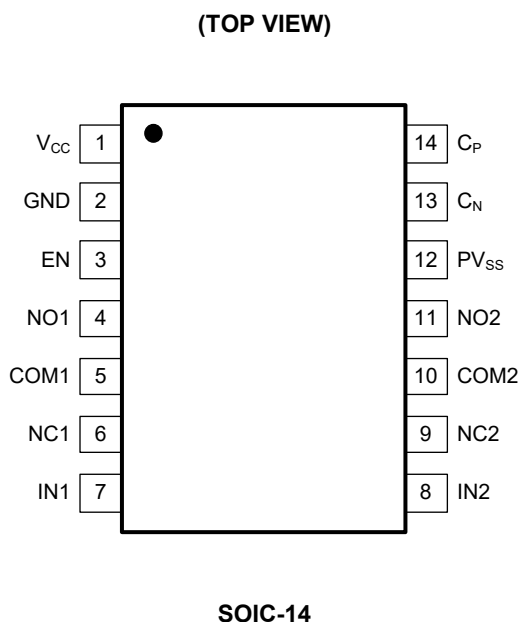
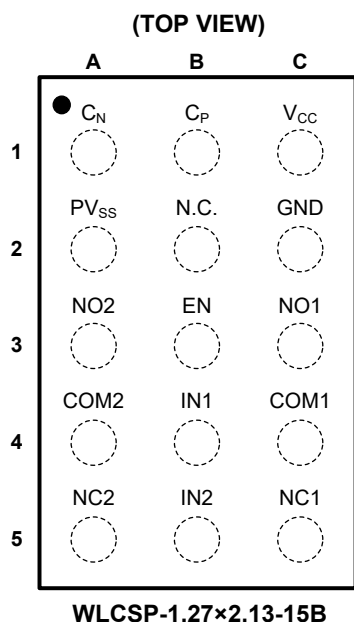
ESD SENSITIVITY CAUTION

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
WLCSP-1.27×2.13-15B	SOIC-14		
A1	13	C _N	Charge Pump Flying Capacitor Negative Pin.
B1	14	C _P	Charge Pump Flying Capacitor Positive Pin.
C1	1	V _{CC}	Power Supply Pin.
A2	12	PV _{SS}	Negative Supply Voltage Output Pin. Connect one 0.1μF ceramic capacitor from PV _{SS} to GND.
B2	–	N.C.	No Connection.
C2	2	GND	Ground.
A3	11	NO2	Normally-Open Pin.
B3	3	EN	Enable Control Pin. When EN = “Low”, both NC and NO are disconnected with COM, negative charge pump does not work and the SGM3712 is in shutdown state. When EN = “High”, negative charge pump works, the SGM3712 is in working state, and NC or NO is connected with COM depending on the logical state of IN.
C3	4	NO1	Normally-Open Pin.
A4	10	COM2	Common Pin.
B4	7	IN1	Digital Control Pin. It is used to connect COM1 to NO1 or NC1.
C4	5	COM1	Common Pin.
A5	9	NC2	Normally-Closed Pin.
B5	8	IN2	Digital Control Pin. It is used to connect COM2 to NO2 or NC2.
C5	6	NC1	Normally-Closed Pin.

NOTE: NO, NC and COM pins may be an input or output.

FUNCTION TABLE

Table 1. Function Table of Switch 1:

EN	IN1	COM1	NEGATIVE CHARGE PUMP
0	X	COM1 is disconnected with NO1 and NC1	Turn off
1	0	COM1 = NC1	Turn on
1	1	COM1 = NO1	Turn on

Table 2. Function Table of Switch 2:

EN	IN2	COM2	NEGATIVE CHARGE PUMP
0	X	COM2 is disconnected with NO2 and NC2	Turn off
1	0	COM2 = NC2	Turn on
1	1	COM2 = NO2	Turn on

ELECTRICAL CHARACTERISTICS

(V_{CC} = 3.3V, 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 _{NO} , V _{NC} , V _{COM}			Full	-V _{CC}		+V _{CC}	V
On-Resistance	R _{ON}	-V _{CC} ≤ V _{NO} , V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1	SOIC-14	+25°C		1	1.2	Ω
				Full			1.8	
		WLCSP-1.27×2.13-15B	+25°C		0.9	1.1	Ω	
			Full					1.7
On-Resistance Match between Channels	ΔR _{ON}	-V _{CC} ≤ V _{NO} or V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1		+25°C		0.01	0.15	Ω
				Full				
On-Resistance Flatness	R _{FLAT(ON)}	-V _{CC} ≤ V _{NO} or V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1		+25°C		0.05	0.15	Ω
				Full				
Source Off Leakage Current	I _{NC(OFF)} , I _{NO(OFF)}	V _{NO} or V _{NC} = -2.8V, 2.8V, V _{COM} = 2.8V, -2.8V		+25°C	-0.5	0.01	0.5	μA
				Full				
Channel On Leakage Current	I _{NC(ON)} , I _{NO(ON)} , I _{COM(ON)}	V _{NO} or V _{NC} = -2.8V, 2.8V, V _{COM} = floating, or V _{NO} or V _{NC} = floating, V _{COM} = -2.8V, 2.8V		+25°C	-0.5	0.01	0.5	μA
				Full				
Digital Inputs								
Input High Voltage	V _{INH}	V _{CC} = 2.7V to 12V		Full	1.5		5.5	V
Input Low Voltage	V _{INL}	V _{CC} = 2.7V to 12V		Full	0		0.5	V
Pull Down Resistor	R _{PULL DOWN}			+25°C		600		kΩ
Dynamic Characteristics								
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 2		+25°C		400		ns
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 2		+25°C		100		ns
Break-Before-Make Delay Time	t _D	V _{NO1} or V _{NC1} = V _{NO2} or V _{NC2} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 3		+25°C		300		ns
Off-Isolation	O _{ISO}	f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 4		+25°C		-135		dB
		f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 4				-70		
Channel-to-Channel Crosstalk	X _{TALK}	f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 5		+25°C		-120		dB
		f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 5				-90		
-3dB Bandwidth	BW	Signal = 0dBm, R _L = 50Ω, C _L = 5pF, Test Circuit 6		+25°C		100		MHz
Channel On Capacitance	C _{ON}			+25°C		50		pF
Charge Injection	Q	V _G = GND, R _G = 0Ω, C _L = 1nF, Test Circuit 7		+25°C		300		pC
Total Harmonic Distortion	THD	A-Weighting, Test Circuit 8	V _{NO} , V _{NC} = 2V _{RMS} , R _L = 600Ω	+25°C		-113		dB
			V _{NO} , V _{NC} = 2V _{PP} , R _L = 600Ω			-115		
			V _{NO} , V _{NC} = 2V _{PP} , R _L = 32Ω			-113		
			V _{NO} , V _{NC} = 1V _{PP} , R _L = 600Ω			-112		
			V _{NO} , V _{NC} = 1V _{PP} , R _L = 32Ω			-110		
			V _{NO} , V _{NC} = 0.5V _{PP} , R _L = 600Ω			-108		
			V _{NO} , V _{NC} = 0.5V _{PP} , R _L = 32Ω			-104		
Start-Up Time	t _{START}	Switch V _{EN} = 0V to V _{EN} = 1.5V		+25°C		0.5		ms

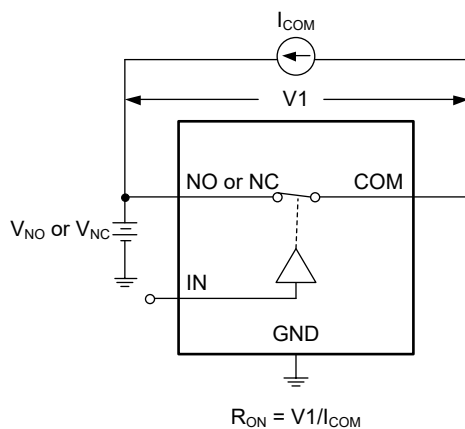
ELECTRICAL CHARACTERISTICS (continued)(V_{CC} = 5V, Full = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Analog Switch								
Analog Signal Range	V _{NO} , V _{NC} , V _{COM}			Full	-V _{CC}		+V _{CC}	V
On-Resistance	R _{ON}	-V _{CC} ≤ V _{NO} , V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1	SOIC-14	+25°C		1	1.2	Ω
				Full			1.8	
		WLCSP-1.27×2.13-15B	+25°C		0.9	1.1	Ω	
			Full					1.7
On-Resistance Match between Channels	ΔR _{ON}	-V _{CC} ≤ V _{NO} or V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1		+25°C		0.01	0.15	Ω
				Full				
On-Resistance Flatness	R _{FLAT(ON)}	-V _{CC} ≤ V _{NO} or V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1		+25°C		0.01	0.15	Ω
				Full				
Source Off Leakage Current	I _{NC(OFF)} , I _{NO(OFF)}	V _{NO} or V _{NC} = -4.5V, 4.5V, V _{COM} = 4.5V, -4.5V		+25°C	-0.5	0.01	0.5	μA
				Full				
Channel On Leakage Current	I _{NC(ON)} , I _{NO(ON)} , I _{COM(ON)}	V _{NO} or V _{NC} = -4.5V, 4.5V, V _{COM} = floating, or V _{NO} or V _{NC} = floating, V _{COM} = -4.5V, 4.5V		+25°C	-0.5	0.01	0.5	μA
				Full				
Dynamic Characteristics								
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 2		+25°C		400		ns
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 2		+25°C		100		ns
Break-Before-Make Delay Time	t _D	V _{NO1} or V _{NC1} = V _{NO2} or V _{NC2} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 3		+25°C		300		ns
Off-Isolation	O _{ISO}	f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 4		+25°C		-135		dB
		f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 4				-70		
Channel-to-Channel Crosstalk	X _{TALK}	f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 5		+25°C		-120		dB
		f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 5				-90		
-3dB Bandwidth	BW	Signal = 0dBm, R _L = 50Ω, C _L = 5pF, Test Circuit 6		+25°C		100		MHz
Channel On Capacitance	C _{ON}			+25°C		50		pF
Charge Injection	Q	V _G = GND, R _G = 0Ω, C _L = 1nF, Test Circuit 7		+25°C		500		pC
Total Harmonic Distortion	THD	A-Weighting, Test Circuit 8	V _{NO} , V _{NC} = 2V _{RMS} , R _L = 600Ω	+25°C		-117		dB
			V _{NO} , V _{NC} = 2V _{PP} , R _L = 600Ω			-115		
			V _{NO} , V _{NC} = 2V _{PP} , R _L = 32Ω			-113		
			V _{NO} , V _{NC} = 1V _{PP} , R _L = 600Ω			-112		
			V _{NO} , V _{NC} = 1V _{PP} , R _L = 32Ω			-110		
			V _{NO} , V _{NC} = 0.5V _{PP} , R _L = 600Ω			-108		
			V _{NO} , V _{NC} = 0.5V _{PP} , R _L = 32Ω			-104		
Start-Up Time	t _{START}	Switch V _{EN} = 0V to V _{EN} = 1.5V		+25°C		0.5		ms
Power Requirements								
Power Supply Current	I _{CC}	V _{IN} = 0V or 1.5V, V _{EN} = 1.5V		+25°C		600	750	μA
				Full			800	
Power Supply Current in Shutdown State	I _{CC}	V _{IN} = 0V or 1.5V, V _{EN} = 0V		+25°C		0.4	1	μA
				Full			1.5	

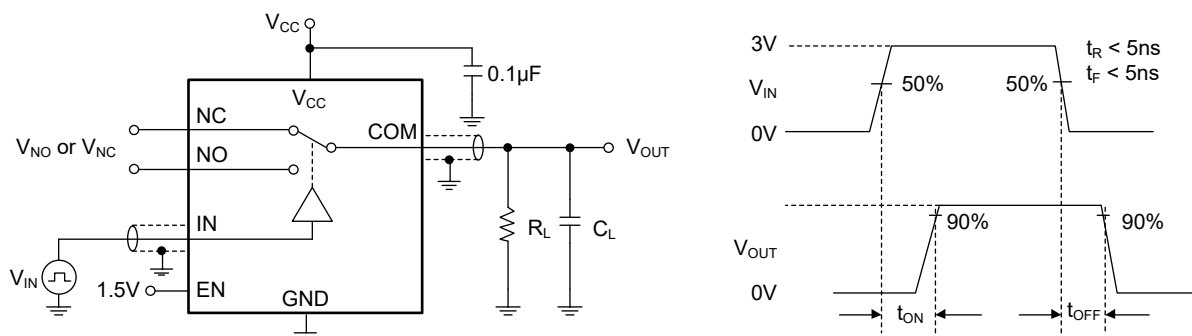
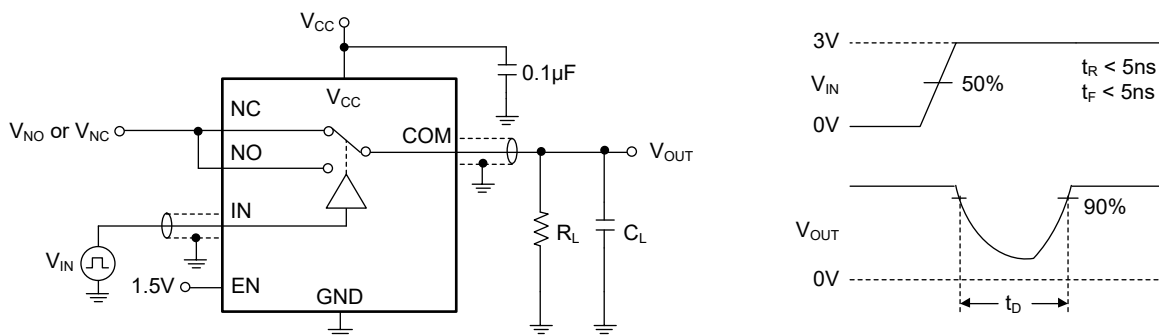
ELECTRICAL CHARACTERISTICS (continued)(V_{CC} = 12V, Full = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Analog Switch								
Analog Signal Range	V _{NO} , V _{NC} , V _{COM}			Full	-V _{CC}		+V _{CC}	V
On-Resistance	R _{ON}	-V _{CC} ≤ V _{NO} , V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1	SOIC-14	+25°C		1	1.2	Ω
				Full			1.8	
		WLCSP-1.27×2.13-15B	+25°C		0.9	1.1	Ω	
			Full					1.7
On-Resistance Match between Channels	ΔR _{ON}	-V _{CC} ≤ V _{NO} or V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1		+25°C		0.01	0.15	Ω
				Full				
On-Resistance Flatness	R _{FLAT(ON)}	-V _{CC} ≤ V _{NO} or V _{NC} ≤ V _{CC} , I _{COM} = -50mA, Test Circuit 1		+25°C		0.01	0.15	Ω
				Full				
Source Off Leakage Current	I _{NC(OFF)} , I _{NO(OFF)}	V _{NO} or V _{NC} = -11.5V, 11.5V, V _{COM} = 11.5V, -11.5V		+25°C	-1.5	0.05	1.5	μA
				Full				
Channel On Leakage Current	I _{NC(ON)} , I _{NO(ON)} , I _{COM(ON)}	V _{NO} or V _{NC} = -11.5V, 11.5V, V _{COM} = floating, or V _{NO} or V _{NC} = floating, V _{COM} = -11.5V, 11.5V		+25°C	-1.5	0.05	1.5	μA
				Full				
Dynamic Characteristics								
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 2		+25°C		400		ns
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 2		+25°C		100		ns
Break-Before-Make Time Delay	t _D	V _{NO1} or V _{NC1} = V _{NO2} or V _{NC2} = 1V, R _L = 50Ω, C _L = 35pF, Test Circuit 3		+25°C		300		ns
Off Isolation	O _{ISO}	f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 4		+25°C		-135		dB
		f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 4				-70		
Channel-to-Channel Crosstalk	X _{TALK}	f = 1kHz, R _L = 32Ω, Signal = 0dBm, Test Circuit 5		+25°C		-120		dB
		f = 1MHz, R _L = 50Ω, Signal = 0dBm, C _L = 5pF, Test Circuit 5				-90		
-3dB Bandwidth	BW	Signal = 0dBm, R _L = 50Ω, C _L = 5pF, Test Circuit 6		+25°C		100		MHz
Channel On Capacitance	C _{ON}			+25°C		50		pF
Charge Injection	Q	V _G = GND, R _G = 0Ω, C _L = 1nF, Test Circuit 7		+25°C		600		pC
Total Harmonic Distortion	THD	A-Weighting, Test Circuit 8	V _{NO} , V _{NC} = 2V _{RMS} , R _L = 600Ω	+25°C		-117		dB
			V _{NO} , V _{NC} = 2V _{PP} , R _L = 600Ω			-115		
			V _{NO} , V _{NC} = 2V _{PP} , R _L = 32Ω			-113		
			V _{NO} , V _{NC} = 1V _{PP} , R _L = 600Ω			-112		
			V _{NO} , V _{NC} = 1V _{PP} , R _L = 32Ω			-110		
			V _{NO} , V _{NC} = 0.5V _{PP} , R _L = 600Ω			-108		
			V _{NO} , V _{NC} = 0.5V _{PP} , R _L = 32Ω			-104		
Start-Up Time	t _{START}	Switch V _{EN} = 0V to V _{EN} = 1.5V		+25°C		0.5		ms
Power Requirements								
Power Supply Current	I _{CC}	V _{IN} = 0V or 1.5V, V _{EN} = 1.5V		+25°C		730	920	μA
				Full			950	
Power Supply Current in Shutdown State	I _{CC}	V _{IN} = 0V or 1.5V, V _{EN} = 0V		+25°C		0.5	1.5	μA
				Full			2	

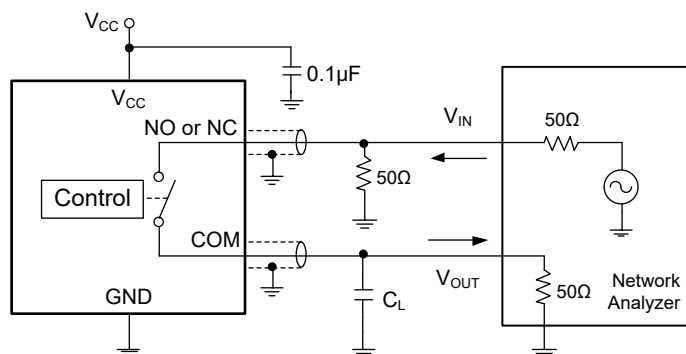
TEST CIRCUITS



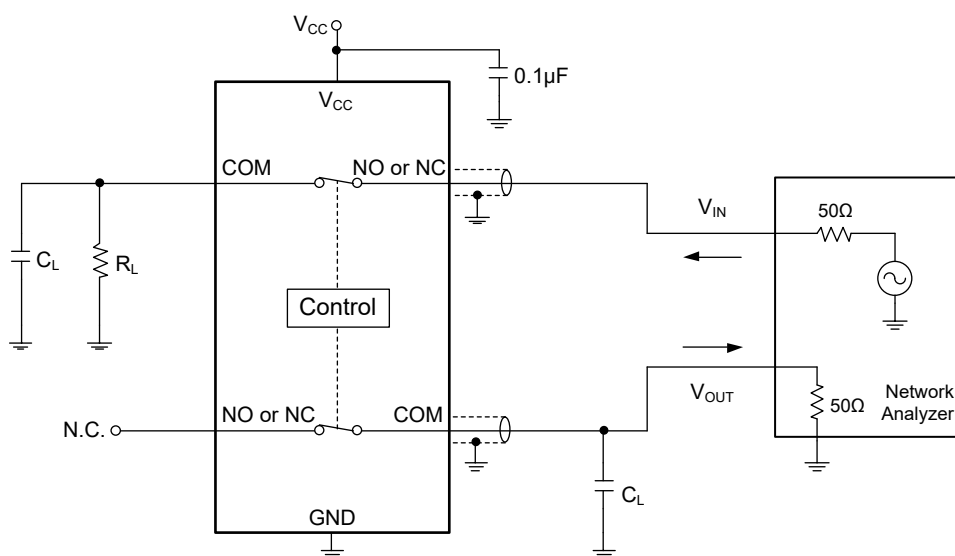
Test Circuit 1. On-Resistance

Test Circuit 2. Switching Times (t_{ON} , t_{OFF})Test Circuit 3. Break-Before-Make Delay Time (t_D)

TEST CIRCUITS (continued)

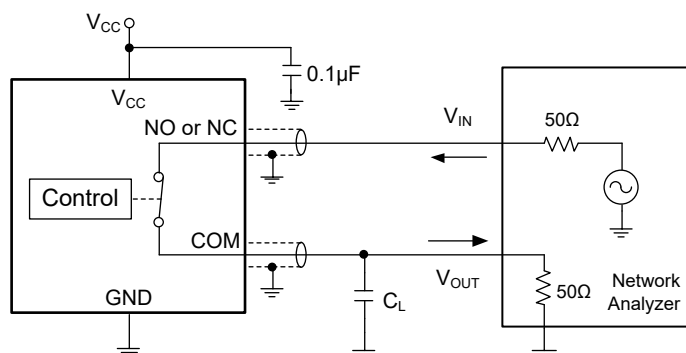


Test Circuit 4. Off-Isolation



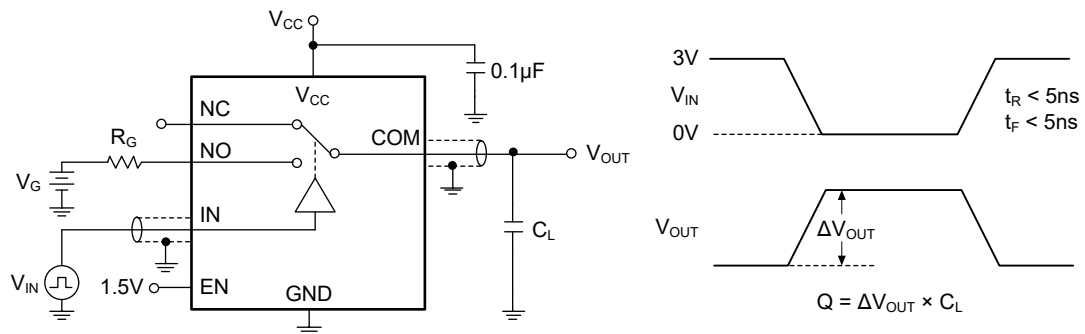
$$\text{Channel-to-Channel Crosstalk} = -20\log(V_{IN}/V_{OUT})$$

Test Circuit 5. Channel-to-Channel Crosstalk

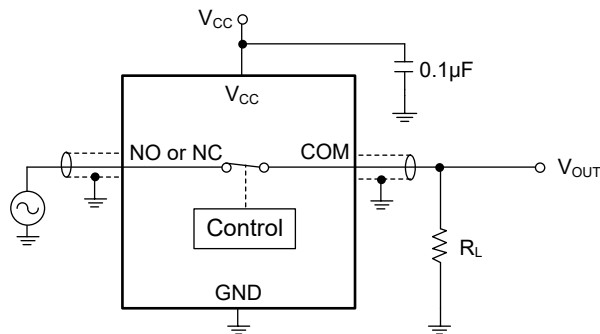


Test Circuit 6. -3dB Bandwidth

TEST CIRCUITS (continued)



Test Circuit 7. Charge Injection (Q)



Test Circuit 8. Total Harmonic Distortion (THD)

APPLICATION INFORMATION

The combination of Speaker and Receiver is always used in portable devices, and high voltage class D speaker driver is used to drive speaker in order to provide high audio volume. But the high output voltage of class D speaker driver will damage the receiver driver. The SGM3712 provides the safe isolation between receiver driver and high voltage class D speaker driver. The SGM3712 provides low R_{ON} channels to pass the positive and negative signals from capless receiver driver. The circuit is shown in Figure 1.

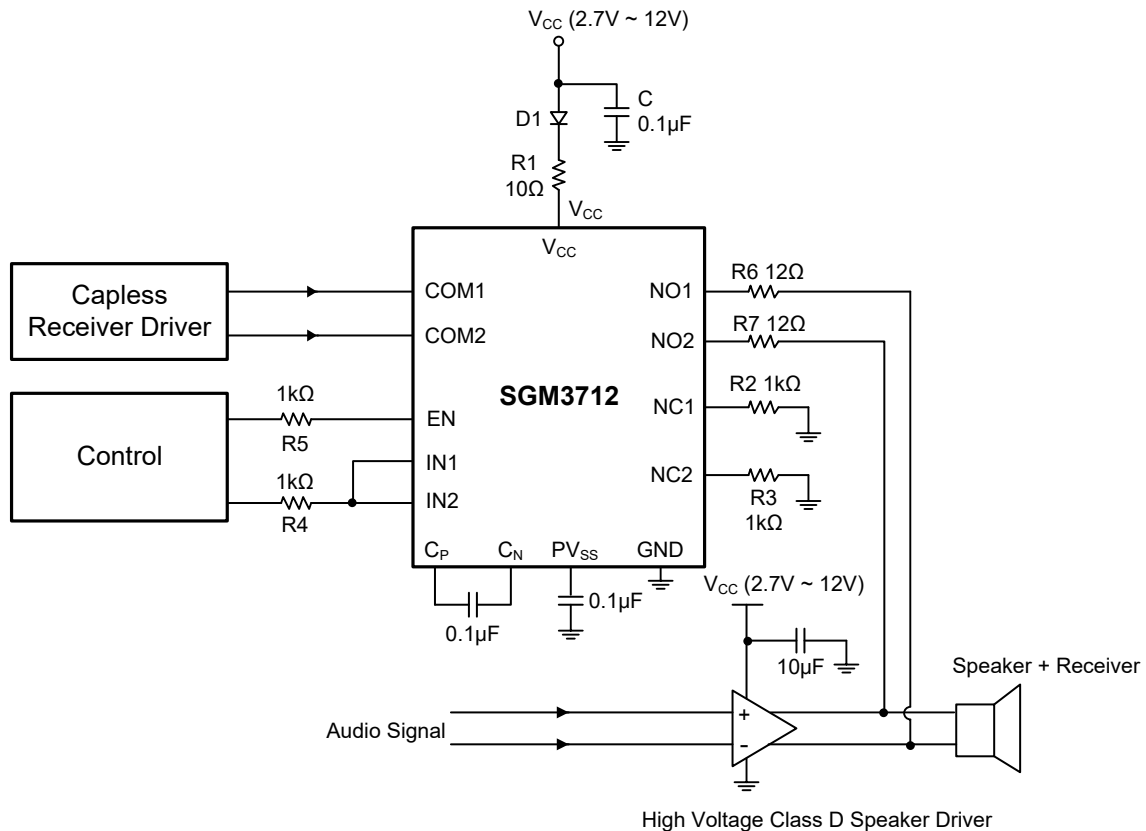


Figure 1. Typical Application Circuit for Speaker + Receiver

APPLICATION INFORMATION (continued)

In order to improve audio performance of portable equipment, 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 is selected as the high performance audio signal source for external speaker power amplifier. High performance SGM3712 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.

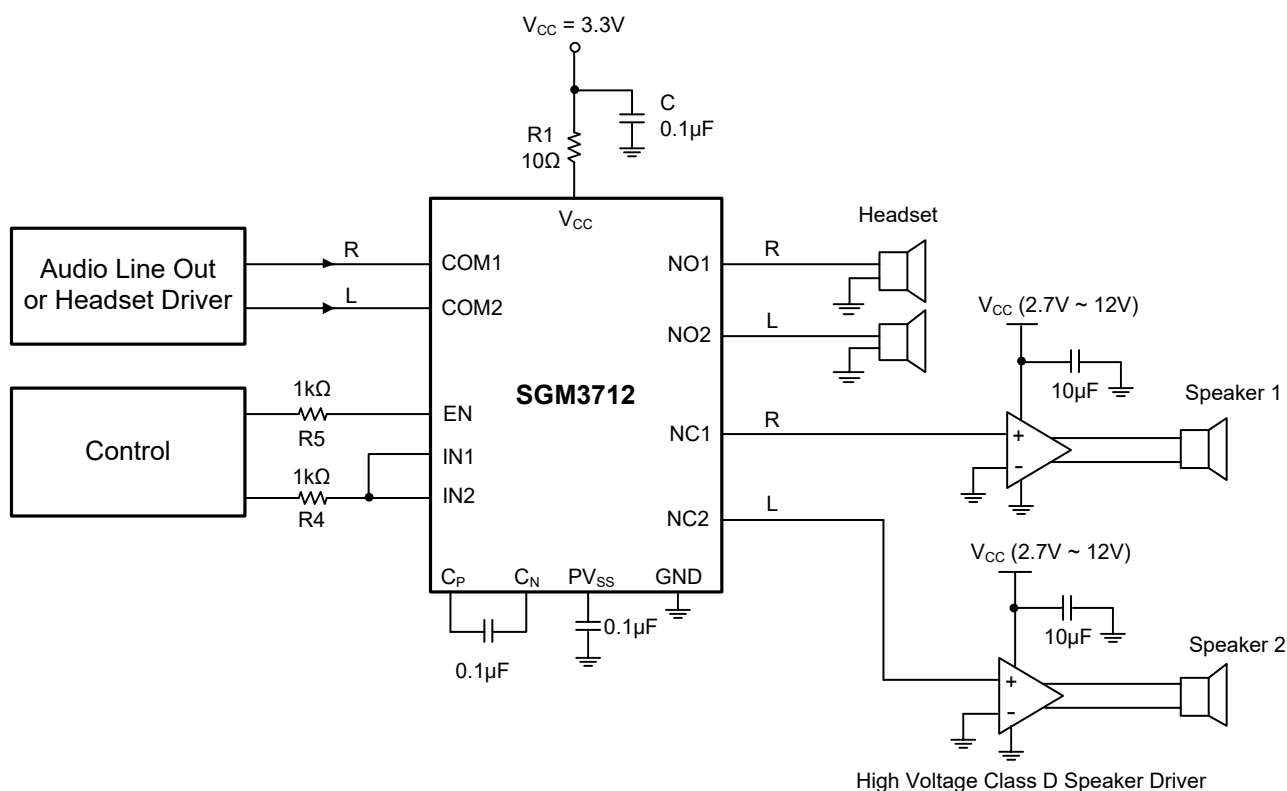


Figure 2. Typical Application Circuit for 1-to-2 HiFi Audio Signal Switch

REVISION HISTORY

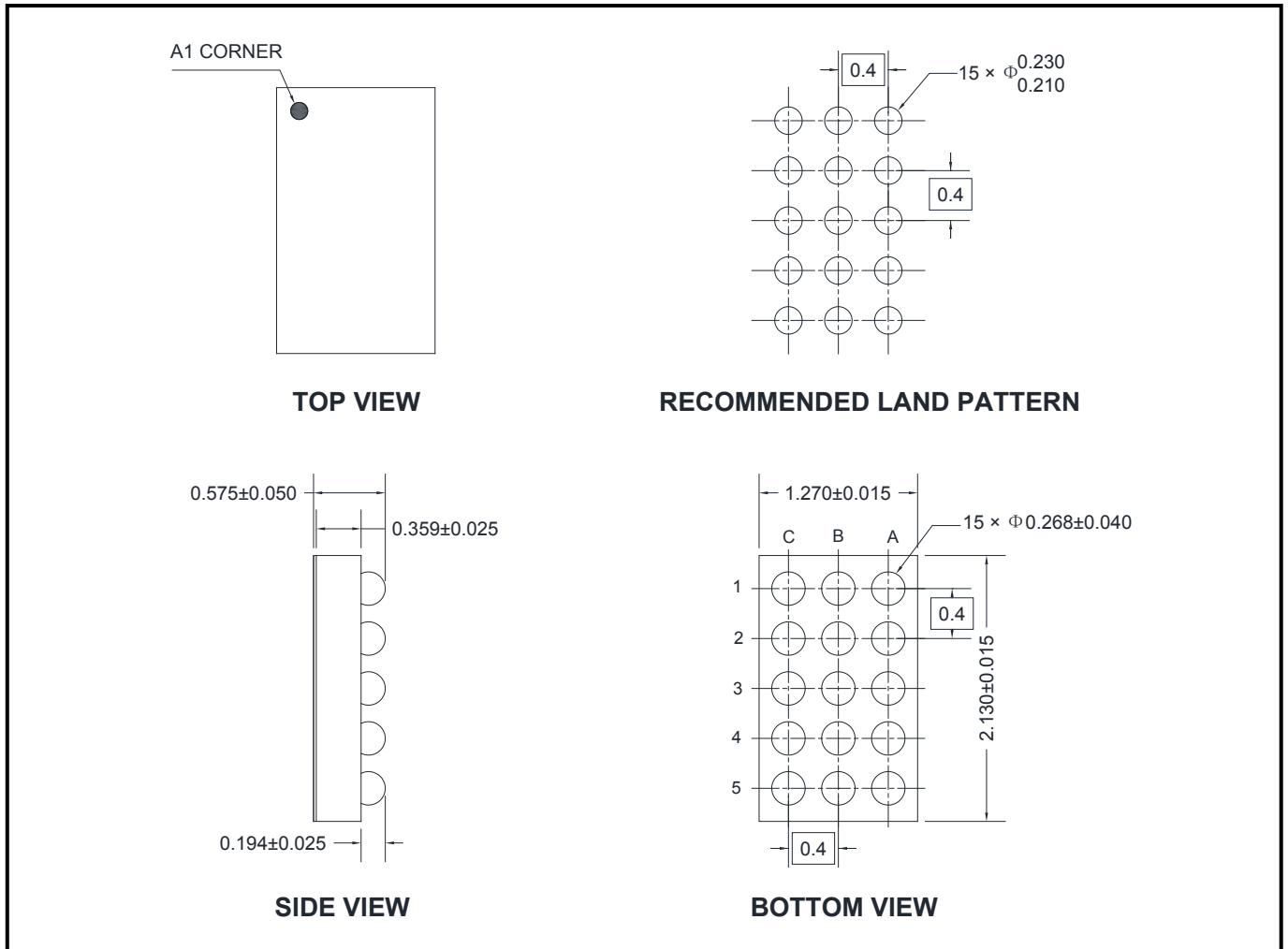
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (NOVEMBER 2017) to REV.A

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

PACKAGE OUTLINE DIMENSIONS

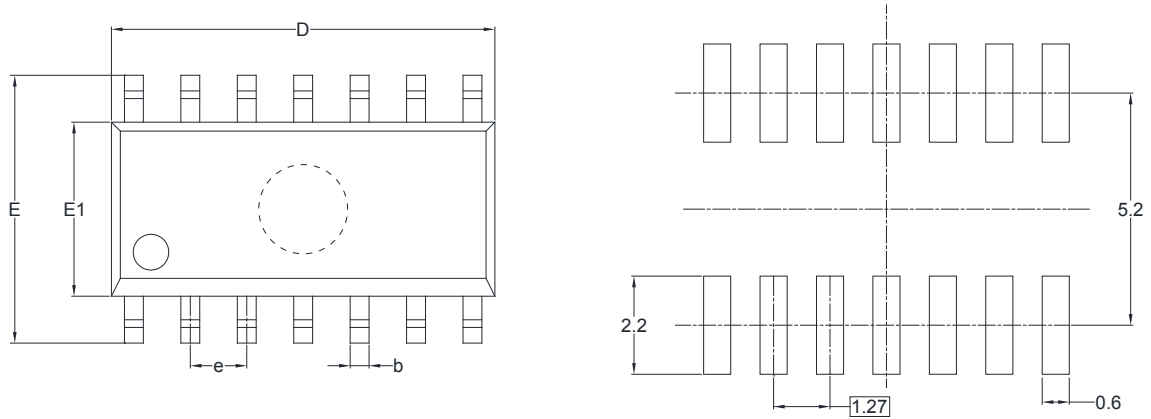
WLCSP-1.27×2.13-15B



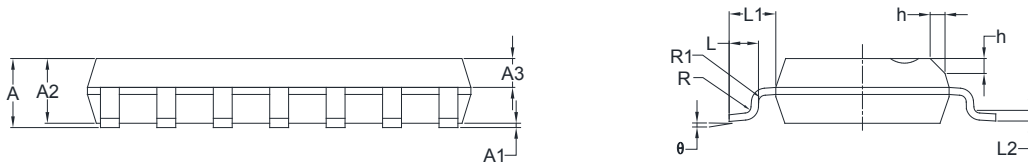
NOTE: All linear dimensions are in millimeters.

PACKAGE OUTLINE DIMENSIONS

SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)

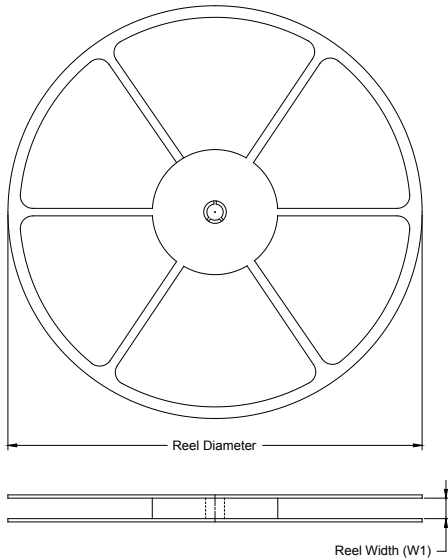


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80	0.018	0.032
L1	1.04 REF		0.040 REF	
L2	0.25 BSC		0.01 BSC	
R	0.07		0.003	
R1	0.07		0.003	
h	0.30	0.50	0.012	0.020
θ	0°	8°	0°	8°

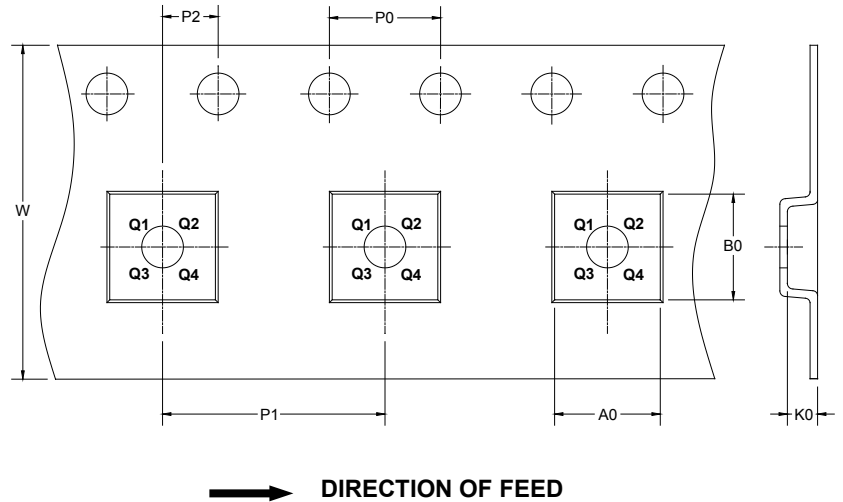
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

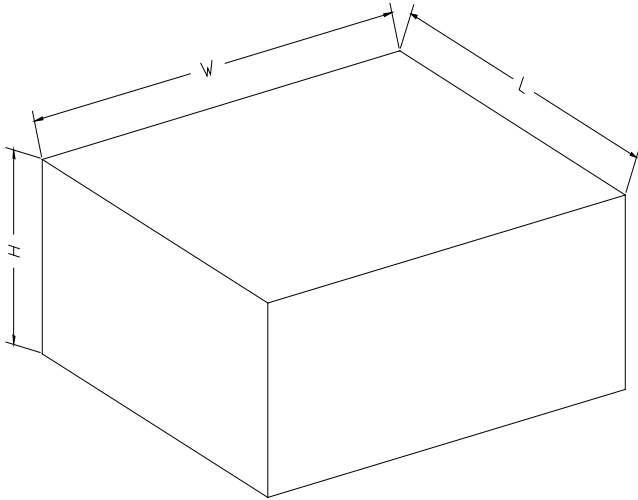
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
WLCSP-1.27×2.13-15B	7"	9.5	1.47	2.37	0.78	4.0	4.0	2.0	8.0	Q1
SOIC-14	13"	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1

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
13"	386	280	370	5

DD0002