SGM13001A
Low Noise Amplifier for GNSS

GENERAL DESCRIPTION

The SGM13001A is a low noise amplifier (LNA) for GLONASS, Galileo, Beidou and GPS applications. The device delivers 18.2dB gain at an extremely low noise figure of 0.9dB. It also features high gain and excellent linearity performance that operates from 1160MHz to 1300MHz and 1550MHz to 1615MHz.

The device requires 6.5mA from a single 1.6V to 3.6V supply, dropping to below 2.2μA in power down mode.

No external DC blocking capacitors are required on the RF paths as long as no external DC voltage is applied, which can save PCB area and cost.

The SGM13001A is available in a Green UTDFN-1.1×0.7-6L package.

APPLICATIONS

Car Navigation
Personal Navigation Equipment
Mobile Phone with GPS
RF Front End Modules
Digital Video Camera, Digital Camera

FEATURES

- **High Gain:**
  - **19.2dB at 1176.45MHz**
  - **18.6dB at 1227.6MHz**
  - **18.2dB at 1575.42MHz**
- **Low Noise Figure:**
  - **0.78dB at 1176.45MHz**
  - **0.89dB at 1227.6MHz**
  - **0.90dB at 1575.42MHz**
- **Low Operation Current: 6.5mA**
- **Current Less than 2.2μA in Power Down Mode**
- **Operating Frequency Range:**
  - **1160MHz to 1300MHz**
  - **1550MHz to 1615MHz**
- **Single Supply Voltage Range: 1.6V to 3.6V**
- **Low Cost BOM**
- **Lead-Free and RoHS Compliant**
- **Available in a Green UTDFN-1.1×0.7-6L Package**

BLOCK DIAGRAM

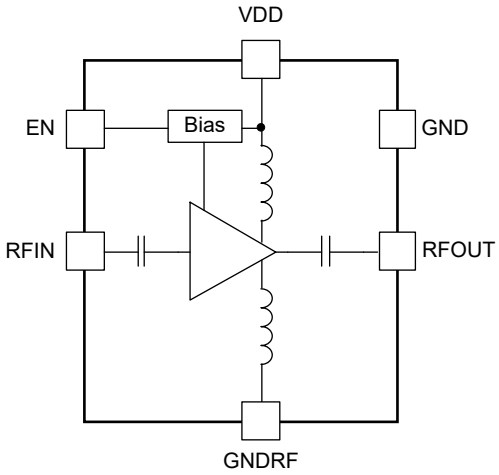


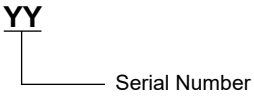
Figure 1. SGM13001A Block Diagram

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM13001A	UTDFN-1.1×0.7-6L	-40℃ to +85℃	SGM13001AYUEC6G/TR	ZY	Tape and Reel, 10000

MARKING INFORMATION

NOTE: Fixed character for ZY.



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

Supply Voltage, V_{DD} ..... -0.3V to 4.0V
EN to GND ..... -0.3V to 4.0V
RFIN, RFOUT to GND ..... -0.3V to 0.3V
RF Input Power, P_{IN} 10dBm
Junction Temperature ..... +150℃
Storage Temperature Range ..... -55℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±4000V
CDM ..... ±2000V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.

2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +85℃
Supply Voltage Range, V_{DD} ..... 1.6V to 3.6V
Operating Frequency Range,
f_0 ..... 1160MHz to 1300MHz
f_1 ..... 1550MHz to 1615MHz
Control Voltage High, V_{CTL_H} ..... 1.35V to V_{DD}
Control Voltage Low, V_{CTL_L} ..... 0V to 0.45V

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

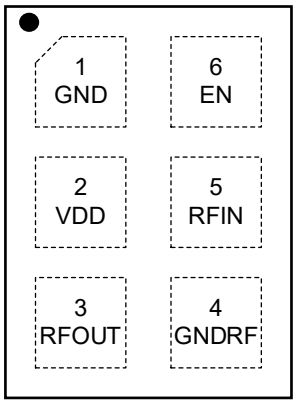
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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 CONFIGURATION

(TOP VIEW)



UTDFN-1.1×0.7-6L

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	GND	Analog Ground.
2	VDD	Power Supply.
3	RFOUT	LNA Output.
4	GNDRF	RF Ground.
5	RFIN	LNA Input from Antenna.
6	EN	Active High Enable Input for the Device. Pull high enable, pull low into power down mode.

ELECTRICAL CHARACTERISTICS

(T_A = +25℃, V_{DD} = 1.6V to 3.6V, f = 1160MHz to 1215MHz, typical values are at V_{DD} = 2.8V, f = 1176.45MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V_{DD}		1.6		3.6	V
Supply Current	I_{VDD}	EN = High		6.5	10.3	mA
	I_{SD}	EN = Low	0	0.16	2.2	μA
Control Voltage	V_{CTL_H}	High	1.35	1.8	V_{DD}	V
	V_{CTL_L}	Low	0	0	0.45	
Turn-On Time	t_{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t_{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f_0	None		1176.45		MHz
Power Gain	S21			19.2		dB
Noise Figure	NF			0.78		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-11		dB
Reverse Isolation	S12			-33		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P_{1dB}			-12		dBm
Input In-Band IP3	IIP3_inb	f_1 = 1176MHz, f_2 = 1177MHz, -30dBm		-6		dBm
Input Out-Band IP3	IIP3_outb	f_1 = 1785MHz, -20dBm, f_2 = 2400MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1170MHz - IM3)/2		7		dBm

(T_A = +25℃, V_{DD} = 1.6V to 3.6V, f = 1160MHz to 1215MHz, typical values are at V_{DD} = 1.8V, f = 1176.45MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V_{DD}		1.6		3.6	V
Supply Current	I_{VDD}	EN = High		6.3	10.3	mA
	I_{SD}	EN = Low	0	0.10	2.2	μA
Control Voltage	V_{CTL_H}	High	1.35	1.8	V_{DD}	V
	V_{CTL_L}	Low	0	0	0.45	
Turn-On Time	t_{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t_{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f_0	None		1176.45		MHz
Power Gain	S21			18.8		dB
Noise Figure	NF			0.78		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-11		dB
Reverse Isolation	S12			-32		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P_{1dB}			-15		dBm
Input In-Band IP3	IIP3_inb	f_1 = 1176MHz, f_2 = 1177MHz, -30dBm		-6		dBm
Input Out-Band IP3	IIP3_outb	f_1 = 1785MHz, -20dBm, f_2 = 2400MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain1170MHz - IM3)/2		7		dBm

ELECTRICAL CHARACTERISTICS (continued)

(T_A = +25℃, V_{DD} = 1.6V to 3.6V, f = 1215MHz to 1300MHz, typical values are at V_{DD} = 2.8V, f = 1227.6MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V_{DD}		1.6		3.6	V
Supply Current	I_{VDD}	EN = High		6.5	10.3	mA
	I_{SD}	EN = Low	0	0.16	2.2	μA
Control Voltage	V_{CTL_H}	High	1.35	1.8	V_{DD}	V
	V_{CTL_L}	Low	0	0	0.45	
Turn-On Time	t_{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t_{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f_0	None		1227.6		MHz
Power Gain	S21			18.6		dB
Noise Figure	NF			0.89		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-12		dB
Reverse Isolation	S12			-34		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P_{1dB}			-11		dBm
Input In-Band IP3	IIP3_inb	f_1 = 1227MHz, f_2 = 1228MHz, -30dBm		-2		dBm
Input Out-Band IP3	IIP3_outb	f_1 = 1850MHz, -20dBm, f_2 = 2480MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1220MHz - IM3)/2		7		dBm

(T_A = +25℃, V_{DD} = 1.6V to 3.6V, f = 1215MHz to 1300MHz, typical values are at V_{DD} = 1.8V, f = 1227.6MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V_{DD}		1.6		3.6	V
Supply Current	I_{VDD}	EN = High		6.3	10.3	mA
	I_{SD}	EN = Low	0	0.10	2.2	μA
Control Voltage	V_{CTL_H}	High	1.35	1.8	V_{DD}	V
	V_{CTL_L}	Low	0	0	0.45	
Turn-On Time	t_{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t_{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f_0	None		1227.6		MHz
Power Gain	S21			18.1		dB
Noise Figure	NF			0.89		dB
Input Return Loss	S11			-3		dB
Output Return Loss	S22			-12		dB
Reverse Isolation	S12			-33		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P_{1dB}			-15		dBm
Input In-Band IP3	IIP3_inb	f_1 = 1227MHz, f_2 = 1228MHz, -30dBm		-2		dBm
Input Out-Band IP3	IIP3_outb	f_1 = 1850MHz, -20dBm, f_2 = 2480MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1220MHz - IM3)/2		7		dBm

ELECTRICAL CHARACTERISTICS (continued)

(T_A = +25℃, V_{DD} = 1.6V to 3.6V, f = 1550MHz to 1615MHz, typical values are at V_{DD} = 2.8V, f = 1575.42MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V_{DD}		1.6		3.6	V
Supply Current	I_{VDD}	EN = High		6.5	10.3	mA
	I_{SD}	EN = Low	0	0.16	2.2	μA
Control Voltage	V_{CTL_H}	High	1.35	1.8	V_{DD}	V
	V_{CTL_L}	Low	0	0	0.45	
Turn-On Time	t_{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t_{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f_0	None		1575.42		MHz
Power Gain	S21		17.0	18.2	19.8	dB
Noise Figure	NF			0.90		dB
Input Return Loss	S11			-4		dB
Output Return Loss	S22			-16		dB
Reverse Isolation	S12			-31		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P_{1dB}			-10		dBm
Input In-Band IP3	IIP3_inb	f_1 = 1574.5MHz, f_2 = 1575.5MHz, -30dBm		0		dBm
Input Out-Band IP3	IIP3_outb	f_1 = 1712.7MHz, -30dBm, f_2 = 1850MHz, -30dBm, IP3 = (2 × P1 + P2 + Gain 1575MHz - IM3)/2		0		dBm

(T_A = +25℃, V_{DD} = 1.6V to 3.6V, f = 1550MHz to 1615MHz, typical values are at V_{DD} = 1.8V, f = 1575.42MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V_{DD}		1.6		3.6	V
Supply Current	I_{VDD}	EN = High		6.3	10.3	mA
	I_{SD}	EN = Low	0	0.10	2.2	μA
Control Voltage	V_{CTL_H}	High	1.35	1.8	V_{DD}	V
	V_{CTL_L}	Low	0	0	0.45	
Turn-On Time	t_{ON}	Time from EN on to 90% of the gain		0.5		μs
Turn-Off Time	t_{OFF}	Time from EN off to 10% of the gain		0.1		μs
RF Characteristics						
RF Frequency Range	f_0	None		1575.42		MHz
Power Gain	S21		16.7	17.7	19.2	dB
Noise Figure	NF			0.90		dB
Input Return Loss	S11			-4		dB
Output Return Loss	S22			-15		dB
Reverse Isolation	S12			-30		dB
Stability	Kf	Frequency range from 500MHz to 5GHz	1			
Input Power 1dB Compression Point	P_{1dB}			-14		dBm
Input In-Band IP3	IIP3_inb	f_1 = 1574.5MHz, f_2 = 1575.5MHz, -30dBm		-2		dBm
Input Out-Band IP3	IIP3_outb	f_1 = 1712.7MHz, -30dBm, f_2 = 1850MHz, -30dBm, IP3 = (2 × P1 + P2 + Gain1575MHz - IM3)/2		-1		dBm

TYPICAL APPLICATION CIRCUIT

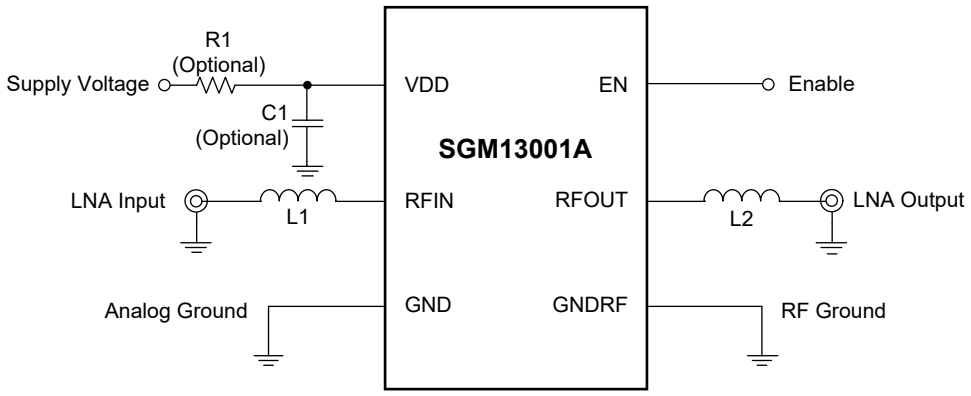


Figure 2. SGM13001A Typical Application Circuit

Table 1. SGM13001A Function Table

Component	Matching Band	Vendor	Type	Part Number & Value
L1	1160MHz to 1300MHz	Murata	Wired inductor, high Q	LQW15AN20N, 20nH
L2	1160MHz to 1300MHz	Murata	Wired inductor, high Q	LQW15AN5N6, 5.6nH
L1	1550MHz to 1615MHz	Murata	Wired inductor, high Q	LQW15AN9N1, 9.1nH
L2	1550MHz to 1615MHz	NC	NC	0

EVALUATION BOARD LAYOUT

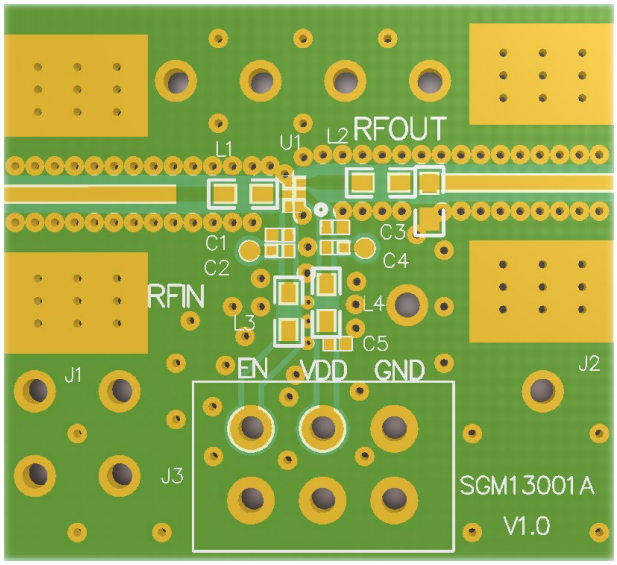


Figure 3. SGM13001A Evaluation Board Layout

REVISION HISTORY

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

APRIL 2025 – REV.A.2 to REV.A.3	Page
Updated ESD Susceptibility	2

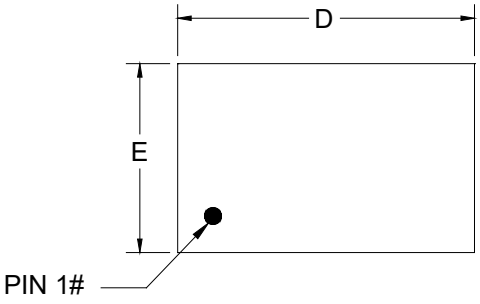
MARCH 2025 – REV.A.1 to REV.A.2	Page
Updated Package Outline Dimensions	9

MARCH 2023 – REV.A to REV.A.1	Page
Updated General Description, Features, Absolute Maximum Ratings and Electrical Characteristics sections	1, 2, 4, 5, 6

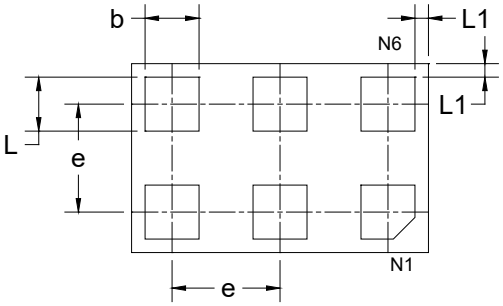
Changes from Original (MARCH 2022) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

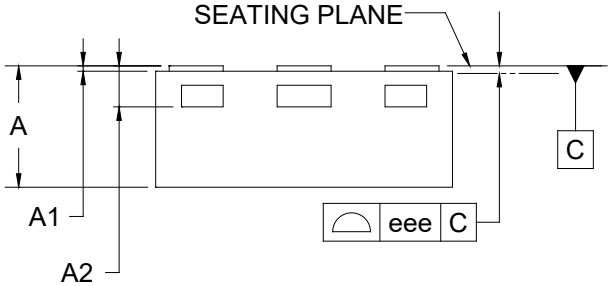
UTDFN-1.1×0.7-6L



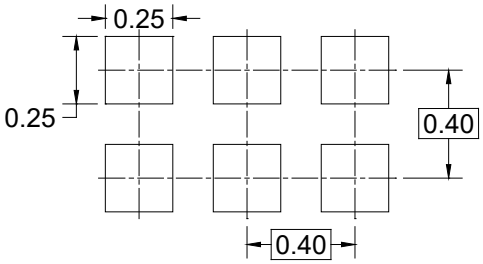
TOP VIEW



BOTTOM VIEW



SIDE VIEW



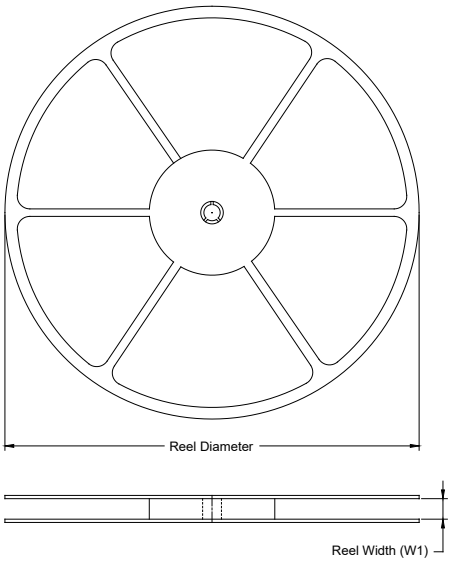
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.400	-	0.500
A1	0.000	-	0.050
A2	0.152 REF		
b	0.150	-	0.250
D	1.050	-	1.150
E	0.650	-	0.750
e	0.400 BSC		
H	0.080 REF		
L	0.150	-	0.250
L1	0.000	-	0.100
eee	0.080		

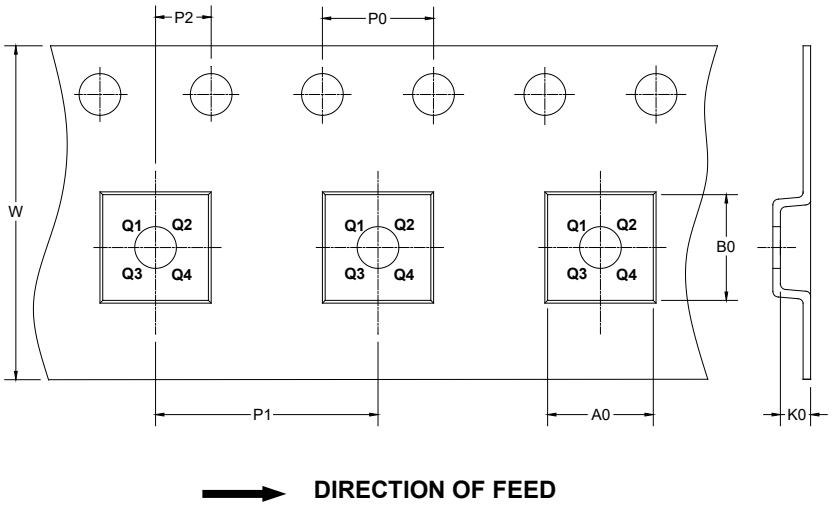
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



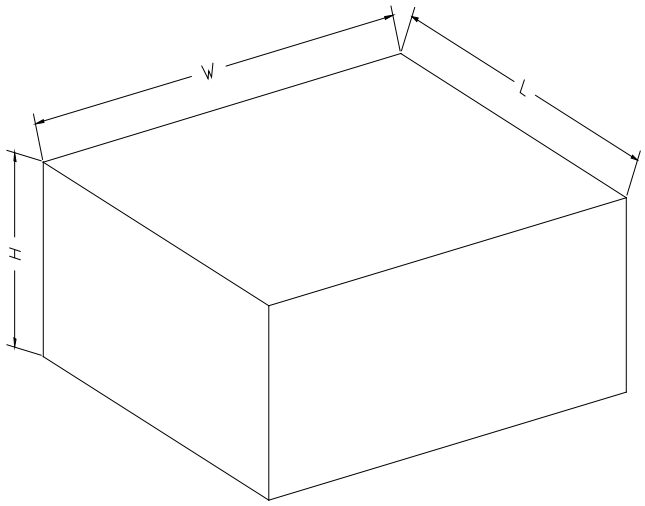
NOTE: The picture is only for reference. Please make the object as the standard.

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
UTDFN-1.1×0.7-6L	7"	9.5	0.80	1.20	0.55	4.0	2.0	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

DD0002