



SGM13005M4

Low Noise Amplifier with Bypass Switch for LTE Middle Band and GNSS L1 Band

GENERAL DESCRIPTION

The SGM13005M4 is a low noise amplifier (LNA) with bypass for LTE middle band receiving application, or for GLONASS, Galileo, Beidou and GPS applications. The device features high gain, low noise figure and high linearity over a supply voltage range from 1.5V to 3.6V. Low noise figure and high gain improve the sensitivity of the SGM13005M4, and high linearity enables the device to provide better immunity to interference signals.

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 SGM13005M4 is available in a Green UTDFN-1.1×0.7-6L package.

APPLICATIONS

LTE Middle Band
GNSS Module L1 Band
Cell Phones
Tablets
Other RF Front-End Modules

FEATURES

- **Operating Frequency Range:**
 - ◆ 1800MHz to 2200MHz
 - ◆ 1550MHz to 1615MHz
- **High Gain:**
 - ◆ 19.4dB at 2000MHz
 - ◆ 19.9dB at 1575.42MHz
- **Low Noise Figure:**
 - ◆ 0.9dB at 2000MHz
 - ◆ 0.8dB at 1575.42MHz
- **Low Operation Current: 11.8mA**
- **Bypass Mode Current: 1µA (MAX)**
- **Single Supply Voltage Range: 1.5V to 3.6V**
- **Input and Output DC Decoupled**
- **Integrated Matching for the Output**
- **Available in a Green UTDFN-1.1×0.7-6L Package**

BLOCK DIAGRAM

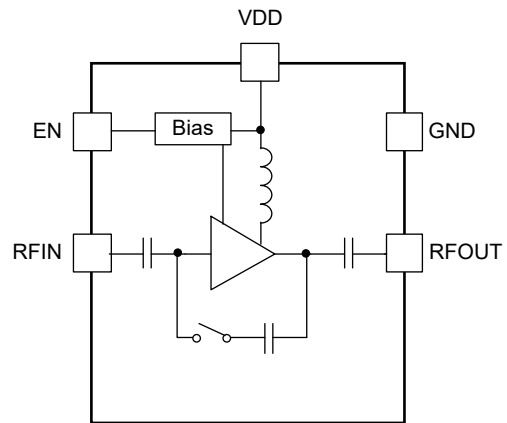


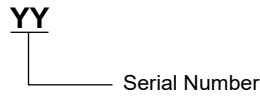
Figure 1. SGM13005M4 Block Diagram

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM13005M4	UTDFN-1.1×0.7-6L	-40°C to +85°C	SGM13005M4YUEC6G/TR	6N	Tape and Reel, 10000

MARKING INFORMATION

NOTE: Fixed character for 6N.



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 3.6V
RFIN, RFOUT to GND.....	-0.3V to 0.3V
Supply Maximum Current, I_{VDD}	30mA
RF Input Power, P_{IN}	10dBm
Junction Temperature.....	+150°C
Storage Temperature Range.....	-55°C to +150°C
Lead Temperature (Soldering, 10s).....	+260°C
ESD Susceptibility	
HBM.....	1500V
CDM.....	2000V

RECOMMENDED OPERATING CONDITIONS

Operating Frequency Range, f_0	1800MHz to 2200MHz
Operating Frequency Range, f_1	1550MHz to 1615MHz
Operating Temperature Range.....	-40°C to +85°C
Supply Voltage, V_{DD}	1.5V to 3.6V
Control High Voltage, V_{CTL_H}	1.35V to V_{DD}
Control Low Voltage, 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

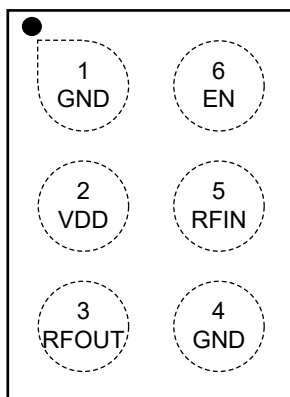
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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, 4	GND	Ground.
2	VDD	Power Supply.
3	RFOUT	LNA Output.
5	RFIN	LNA Input from Antenna.
6	EN	Active High Enable Input for the Device. Pull high to enable, pull low into bypass mode.

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{DD} = 1.5V to 3.6V, frequency = 1800MHz to 2200MHz, typical values are at V_{DD} = 2.8V, input and output resistance = 50Ω, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.5	2.8	3.6	V
Supply Current	I _{VDD}	EN = High		11.8	14.0	mA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
RF Characteristics						
Power Gain	G	f = 1800MHz	18.2	19.0		dB
		f = 2000MHz	18.5	19.4		
		f = 2200MHz	17.8	18.3		
Input Return Loss	RL _I	f = 1800MHz		6.6		dB
		f = 2000MHz		9.9		
		f = 2200MHz		10.8		
Output Return Loss	RL _O	f = 1800MHz		8.3		dB
		f = 2000MHz		13.6		
		f = 2200MHz		8.5		
Reverse Isolation	ISO	f = 1800MHz		32.5		dB
		f = 2000MHz		30.8		
		f = 2200MHz		31.4		
Noise Figure	NF	f = 1800MHz		0.8		dB
		f = 2000MHz		0.9		
		f = 2200MHz		0.9		
Input Power 1dB Compression Point	P _{1dB}	f = 1800MHz		-10.2		dBm
		f = 2000MHz		-9.0		
		f = 2200MHz		-7.9		
Input In-Band IP3	IIP3 _{inb}	f ₁ = 1800MHz, f ₂ = 1801MHz, P ₁ = P ₂ = -25dBm		0.3		dBm
		f ₁ = 2000MHz, f ₂ = 2001MHz, P ₁ = P ₂ = -25dBm		-1.8		
		f ₁ = 2200MHz, f ₂ = 2201MHz, P ₁ = P ₂ = -25dBm		1.9		
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		1.2	2.5	μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.06	0.50	μs
Bypass Mode						
Supply Current	I _{VDD}	V _{EN} < 0.45V		0.2	1	μA
Insertion Loss	IL	f = 1800MHz		4.7	5.5	dB
		f = 2000MHz		4.3	5.1	
		f = 2200MHz		5.2	5.9	
Input Return Loss	RL _I	f = 1800MHz		26.6		dB
		f = 2000MHz		12.8		
		f = 2200MHz		6.7		
Output Return Loss	RL _O	f = 1800MHz		8.1		dB
		f = 2000MHz		10.4		
		f = 2200MHz		7.4		

ELECTRICAL CHARACTERISTICS (Continued)

(T_A = +25°C, V_{DD} = 1.5V to 3.6V, frequency = 1800MHz to 2200MHz, typical values are at V_{DD} = 1.8V, input and output resistance = 50Ω, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.5	1.8	3.6	V
Supply Current	I _{VDD}	EN = High		11.7	14.0	mA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
RF Characteristics						
Power Gain	G	f = 1800MHz	18.1	19.0		dB
		f = 2000MHz	18.3	19.2		
		f = 2200MHz	17.4	18.0		
Input Return Loss	RL _I	f = 1800MHz		6.6		dB
		f = 2000MHz		10.0		
		f = 2200MHz		10.7		
Output Return Loss	RL _O	f = 1800MHz		9.3		dB
		f = 2000MHz		14.0		
		f = 2200MHz		8.0		
Reverse Isolation	ISO	f = 1800MHz		32.0		dB
		f = 2000MHz		30.7		
		f = 2200MHz		30.8		
Noise Figure	NF	f = 1800MHz		0.8		dB
		f = 2000MHz		0.9		
		f = 2200MHz		0.8		
Input Power 1dB Compression Point	P _{1dB}	f = 1800MHz		-13.2		dBm
		f = 2000MHz		-12.0		
		f = 2200MHz		-11.0		
Input In-Band IP3	IIP3 _{inb}	f ₁ = 1800MHz, f ₂ = 1801MHz, P ₁ = P ₂ = -25dBm		-1.8		dBm
		f ₁ = 2000MHz, f ₂ = 2001MHz, P ₁ = P ₂ = -25dBm		1.2		
		f ₁ = 2200MHz, f ₂ = 2201MHz, P ₁ = P ₂ = -25dBm		-1.0		
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		1.3	2.5	μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.09	0.50	μs
Bypass Mode						
Supply Current	I _{VDD}	V _{EN} < 0.45V		0.2	1	μA
Insertion Loss	IL	f = 1800MHz		5.1	5.9	dB
		f = 2000MHz		4.7	5.5	
		f = 2200MHz		5.6	6.3	
Input Return Loss	RL _I	f = 1800MHz		36.8		dB
		f = 2000MHz		13.0		
		f = 2200MHz		7.0		
Output Return Loss	RL _O	f = 1800MHz		8.5		dB
		f = 2000MHz		10.7		
		f = 2200MHz		7.5		

Low Noise Amplifier with Bypass Switch for LTE Middle Band and GNSS L1 Band

SGM13005M4

ELECTRICAL CHARACTERISTICS (Continued)

(T_A = +25°C, V_{DD} = 1.5V to 3.6V, frequency = 1550MHz to 1615MHz, typical values are at V_{DD} = 2.8V, frequency = 1575.42MHz, input and output resistance = 50Ω, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.5	2.8	3.6	V
Supply Current	I _{VDD}	EN = High		11.8	14.0 ⁽¹⁾	mA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
RF Characteristics						
Power Gain	G	f = 1575.42MHz	18.7 ⁽¹⁾	19.9		dB
Input Return Loss	RL _I	f = 1575.42MHz	6.3 ⁽¹⁾	8.3		dB
Output Return Loss	RL _O	f = 1575.42MHz	14.3 ⁽¹⁾	17.3		dB
Reverse Isolation	ISO	f = 1575.42MHz	30.6 ⁽¹⁾	33.6		dB
Noise Figure	NF	f = 1575.42MHz		0.8	1.1 ⁽¹⁾	dB
Input Power 1dB Compression Point	P _{1dB}	f = 1575.42MHz	-17.0 ⁽¹⁾	-13.8		dBm
Input In-Band IP3	IIP3 _{inb}	f ₁ = 1575MHz, f ₂ = 1576MHz, P ₁ = P ₂ = -25dBm	-5.7 ⁽¹⁾	-2.7		dBm
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		1.2	2.5 ⁽¹⁾	μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.06	0.50 ⁽¹⁾	μs
Bypass Mode						
Supply Current	I _{VDD}	V _{EN} < 0.45V		0.2	1.0 ⁽¹⁾	μA
Insertion Loss	IL	f = 1575.42MHz		5.9	6.7 ⁽¹⁾	dB
Input Return Loss	RL _I	f = 1575.42MHz	5.0 ⁽¹⁾	6.3		dB
Output Return Loss	RL _O	f = 1575.42MHz	12.7 ⁽¹⁾	15.7		dB

(T_A = +25°C, V_{DD} = 1.5V to 3.6V, frequency = 1550MHz to 1615MHz, typical values are at V_{DD} = 1.8V, frequency = 1575.42MHz, input and output resistance = 50Ω, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Characteristics						
Supply Voltage	V _{DD}		1.5	1.8	3.6	V
Supply Current	I _{VDD}	EN = High		11.7	14.0 ⁽¹⁾	mA
Control Voltage	V _{CTL_H}	High	1.35	1.8	V _{DD}	V
	V _{CTL_L}	Low	0	0	0.45	
RF Characteristics						
Power Gain	G	f = 1575.42MHz	18.5 ⁽¹⁾	19.7		dB
Input Return Loss	RL _I	f = 1575.42MHz	6.2 ⁽¹⁾	8.2		dB
Output Return Loss	RL _O	f = 1575.42MHz	13.2 ⁽¹⁾	16.2		dB
Reverse Isolation	ISO	f = 1575.42MHz	30.3 ⁽¹⁾	33.3		dB
Noise Figure	NF	f = 1575.42MHz		0.8	1.1 ⁽¹⁾	dB
Input Power 1dB Compression Point	P _{1dB}	f = 1575.42MHz	-17.2 ⁽¹⁾	-14.0		dBm
Input In-Band IP3	IIP3 _{inb}	f ₁ = 1575MHz, f ₂ = 1576MHz, P ₁ = P ₂ = -25dBm	-6.9 ⁽¹⁾	-3.9		dBm
Turn-On Time	t _{ON}	Time from EN on to 90% of the gain		1.2	2.5 ⁽¹⁾	μs
Turn-Off Time	t _{OFF}	Time from EN off to 10% of the gain		0.06	0.50 ⁽¹⁾	μs
Bypass Mode						
Supply Current	I _{VDD}	V _{EN} < 0.45V		0.2	1.0 ⁽¹⁾	μA
Insertion Loss	IL	f = 1575.42MHz		6.2	7.0 ⁽¹⁾	dB
Input Return Loss	RL _I	f = 1575.42MHz	5.5 ⁽¹⁾	6.9		dB
Output Return Loss	RL _O	f = 1575.42MHz	12.8 ⁽¹⁾	15.8		dB

NOTE: 1. Guaranteed by design, not tested in production.

TYPICAL APPLICATION CIRCUIT

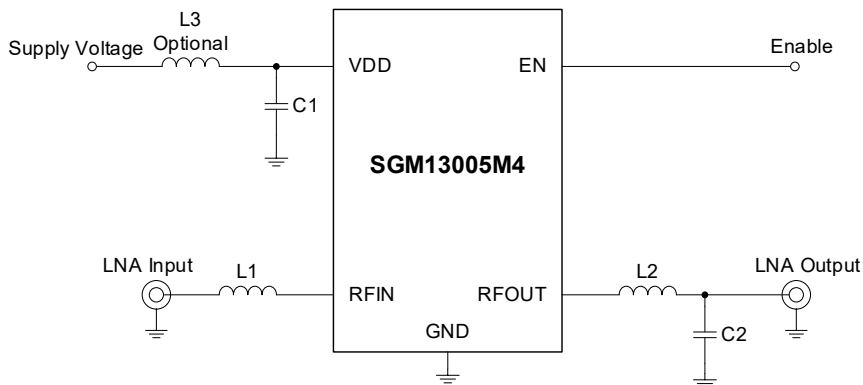


Figure 2. SGM13005M4 Typical Application Circuit

Table 1. Evaluation Board Bill of Material for 1800MHz to 2400MHz

Component	Typical	Size	Description
L1	6.8nH	0402	High Q
L2	0Ω	0402	
C1	1000pF	0201	
C2	NC		

Table 2. Evaluation Board Bill of Material for 1550MHz to 1615MHz

Component	Typical	Size	Description
L1	12nH	0402	High Q
L2	5.8nH	0402	
C1	1000pF	0201	
C2	2.5pF	0402	

EVALUATION BOARD LAYOUT

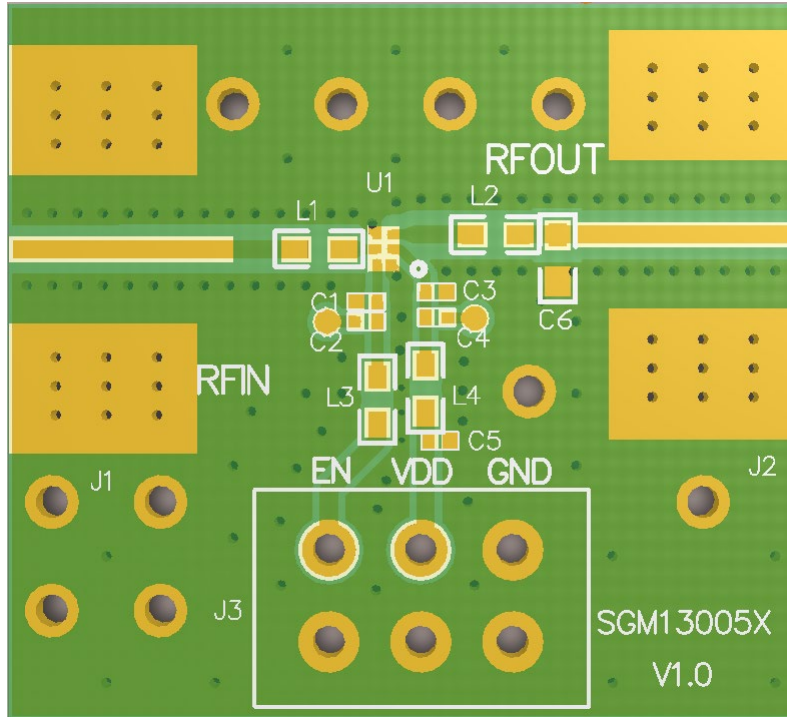


Figure 3. SGM13005M4 Evaluation Board Layout

REVISION HISTORY

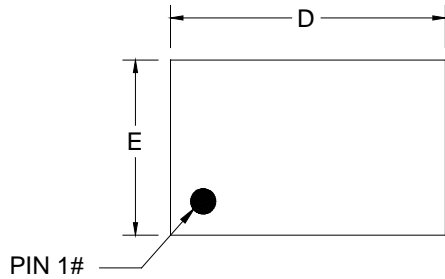
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Revision	Page
MAY 2024 – REV.A.1 to REV.A.2	
Added Frequency Range, Updated Electrical Characteristics section, Typical Application Circuit and Evaluation Board Layout.....	All
APRIL 2024 – REV.A to REV.A.1	
Updated Electrical Characteristics section.....	4, 5
Changes from Original (DECEMBER 2022) to REV.A	
Changed from product preview to production data.....	All

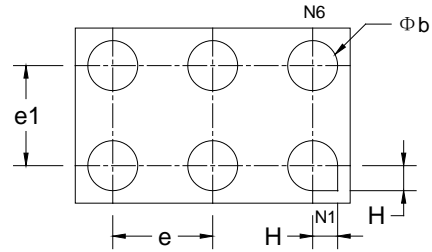
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

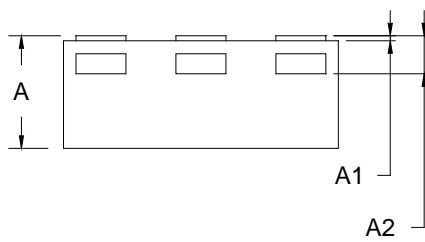
UTDFN-1.1x0.7-6L



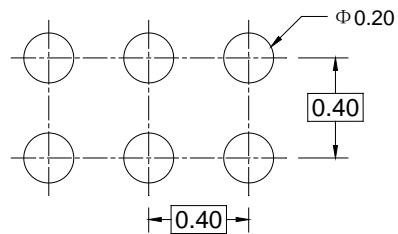
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

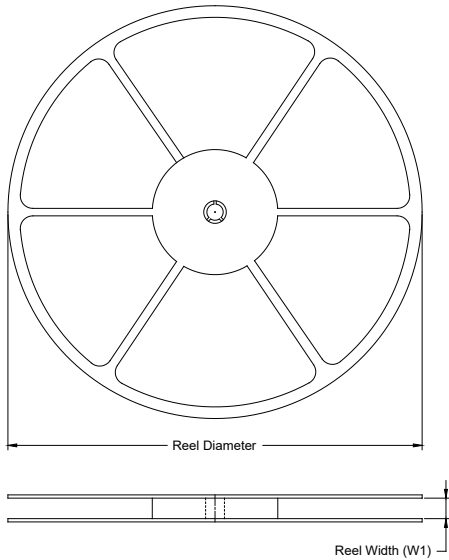
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.400	0.450	0.500
A1	0.000	0.020	0.050
A2	0.152 REF		
D	1.050	1.100	1.150
E	0.650	0.700	0.750
b	0.150	0.200	0.250
e	0.300	0.400	0.500
e1	0.300	0.400	0.500
H	0.100 REF		

NOTE: This drawing is subject to change without notice.

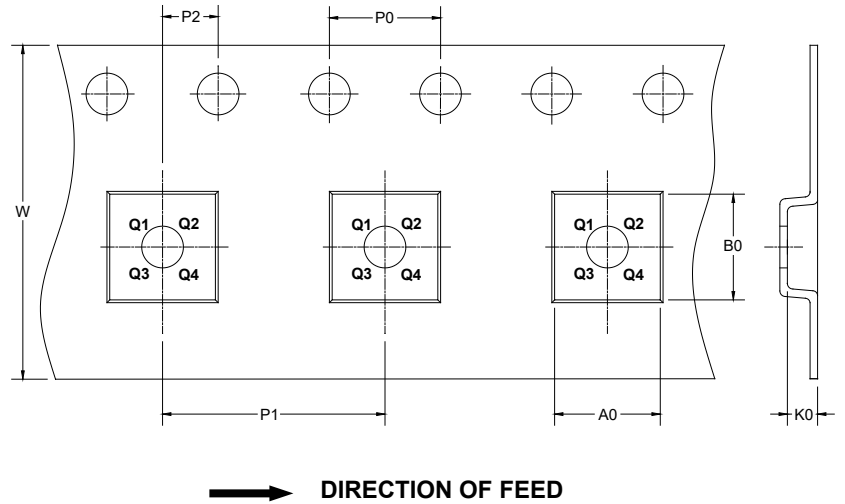
PACKAGE INFORMATION

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
UTDFN-1.1×0.7-6L	7"	9.5	0.80	1.20	0.55	4.0	2.0	2.0	8.0	Q1

DD00001

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

DD0002