

GENERAL DESCRIPTION

The SGM2222 is an ultra-low noise, ultra-high PSRR and low dropout voltage linear regulator for noise-sensitive applications such as RF power supply. It is capable of supplying 200mA output current with typical dropout voltage V_{DROP} of 260mV. The operating input voltage range is from 2V to 20V and output voltage range is from 0V to $(V_{IN} - V_{DROP})$. It requires an output capacitor with an effective capacitance of 2.2 μ F or larger to ensure stability.

The SGM2222 uses a high-precision 100 μ A current source as the reference and a high performance buffer with unit gain for output voltage. Therefore, the SGM2222 supports parallel connection for better noise performance as well as output current capability. And its PSRR, bandwidth, transient response and noise performance are basically not affected by the output voltage.

The SGM2222 opens multiple programmable pins for users to program the current limit, Enable/UVLO threshold, and Power-Good threshold on demand. It also supports fast start-up function. In addition, the SGM2222 integrates the reverse voltage protection, the reverse current protection, the internal current limit protection with foldback and thermal overload protection.

The SGM2222 is available in Green MSOP-10 (Exposed Pad) and TDFN-3 $\times$ 3-10L packages. It operates over an operating temperature range of -40 $^{\circ}$ C to +125 $^{\circ}$ C.

APPLICATIONS

Radio Frequency (RF) Power Supply
Power Noise Sensitive Equipment
Precision Measuring Instruments
Medical Equipment
Precision Power Supply
Filter for Switching Power Supply
High Speed/High-Precision ADC/DAC

FEATURES

- Wide Input Voltage Range: 2V to 20V
- Enable Pin Accept Voltages Higher than the Supply Voltage and up to 20V
- Output Voltage Range: 0V to $(V_{IN} - V_{DROP})$
- SET Pin Current Accuracy: $\pm 1\%$ at +25 $^{\circ}$ C
- Output Current: 200mA
- Low Dropout Voltage: 260mV (TYP)
- Ultra-Low RMS Noise: 0.9 μ V_{RMS} (10Hz to 100kHz)
- Ultra-Low Spot Noise: 2.6nV/ $\sqrt{\text{Hz}}$ at 10kHz
- Ultra-High PSRR: 83dB (TYP) at 1MHz
- Optimizable Noise and PSRR through a Single Capacitor
- Programmable Output Voltage through a Single Resistor
- Programmable Current Limit
- Programmable Power Good Threshold
- Fast Start-Up Function
- Programmable Enable/UVLO Threshold
- Parallelable for Better Noise Performance and Current Capability
- Current Limit Foldback Protection
- Reverse Voltage and Reverse Current Protection
- -40 $^{\circ}$ C to +125 $^{\circ}$ C Operating Temperature Range
- Available in Green MSOP-10 (Exposed Pad) and TDFN-3 $\times$ 3-10L Packages

TYPICAL APPLICATION

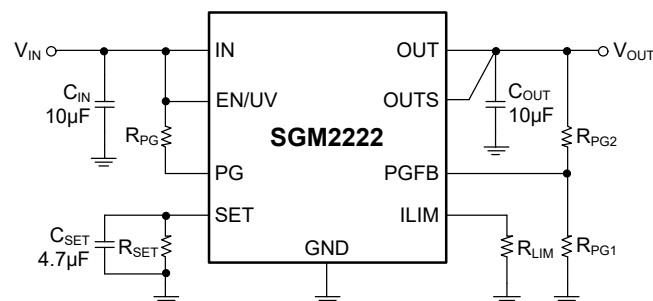


Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

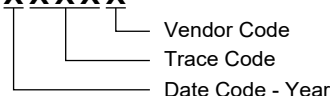
MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2222	MSOP-10 (Exposed Pad)	-40°C to +125°C	SGM2222XPMS10G/TR	SGM2222 XPMS10 XXXXX	Tape and Reel, 4000
SGM2222	TDFN-3×3-10L	-40°C to +125°C	SGM2222XTD10G/TR	SGM 2222D XXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

MSOP-10 (Exposed Pad)/TDFN-3×3-10L

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

IN, EN/UV, PGFB to GND.....	±22V
PG, SET, ILIM, OUT, OUTS to GND	-0.3V to 22V
IN to EN/UV	±22V
IN to OUT.....	±22V
IN to OUTS	±22V
OUT to OUTS	±22V
Package Thermal Resistance	
MSOP-10 (Exposed Pad), θ_{JA}	40.1°C/W
MSOP-10 (Exposed Pad), θ_{JB}	16.4°C/W
MSOP-10 (Exposed Pad), $\theta_{JC(TOP)}$	45.2°C/W
MSOP-10 (Exposed Pad), $\theta_{JC(BOT)}$	1.5°C/W
TDFN-3×3-10L, θ_{JA}	37.1°C/W
TDFN-3×3-10L, θ_{JB}	13.5°C/W
TDFN-3×3-10L, $\theta_{JC(TOP)}$	41.4°C/W
TDFN-3×3-10L, $\theta_{JC(BOT)}$	1.1°C/W
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility ^{(1) (2)}	
HBM.....	±5000V
CDM	±1000V

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

Input Voltage Range.....	2V to 20V
Enable Input Voltage Range.....	0V to 20V
Input Effective Capacitance, C_{IN}	2.2μF (MIN)
Output Effective Capacitance, C_{OUT}	2.2μF to 200μF
Operating Junction Temperature Range	-40°C to +125°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.

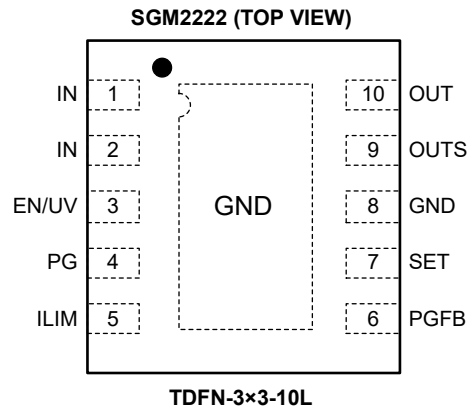
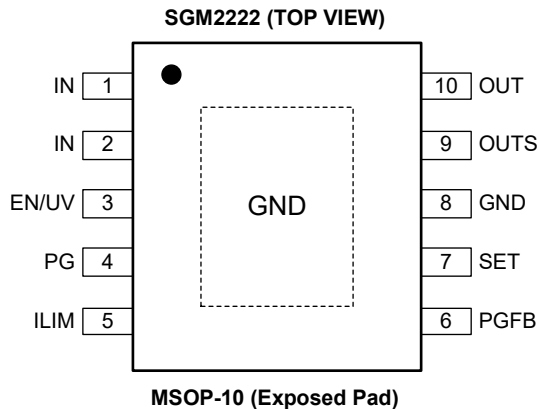
ESD SENSITIVITY CAUTION

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
1, 2	IN	Input Voltage Pin. It is recommended to use a 4.7μF or larger ceramic capacitor from IN pin to ground to get good power supply decoupling. The SGM2222 has reverse voltage protection function, which means that even if the GND, OUT or OUTS voltage is higher than the IN voltage, the SGM2222 can remain undamaged. Moreover, the SGM2222 also has reverse current protection to prevent current flow from the output to the input.
3	EN/UV	Enable and Input Supply Under-voltage Lockout (UVLO) Threshold $V_{EN/UV}$ Set Pin. Drive the EN/UV pin low to turn off the SGM2222 and the output will be pulled low by a 1.6mA current. Drive the EN/UV pin high to turn on the SGM2222. Driving the EN pin with a voltage higher than the IN voltage is allowed. The EN/UV pin programs the $V_{EN/UV}$ by adding a resistive divider between IN, EN/UV and GND pins. $V_{EN/UV} = 1.23V (TYP) \times (1 + R_{EN2} / R_{EN1})$, where R_{EN1} is the resistor between the EN/UV pin and the GND pin, and R_{EN2} is the resistor between the IN pin and the EN/UV pin. The EN/UV pin cannot float. Connect it to the IN pin if not used.
4	PG	Power-Good Indicator Output Pin. An open-drain, active-high output that indicates the OUT pin status. The PG voltage is low when the PGFB voltage is below 300mV (TYP). Additionally, the PG voltage is also pulled low when the SGM2222 is in disabled, thermal shutdown or UVLO. The PG pin can float if not in use.
5	ILIM	Current limit Setting Pin. The ILIM pin programs the external current limit threshold I_{EXT_LIMIT} by adding a resistor R_{LIMIT} between ILIM and GND pins. $I_{EXT_LIMIT} = 125mA \times k\Omega / R_{LIMIT}$, where $125mA \times k\Omega$ is the programming scale factor. The ILIM pin can be used as a current monitoring pin, as the current sourced from it is proportional to the output current in a ratio of approximately 1:400. The ILIM pin cannot float. Connect it to the GND pin if not used.
6	PGFB	Power Good Feedback Pin. The PGFB pin programs the power good threshold V_{PGFB} by adding a resistive divider between OUT, PGFB and GND pins. $V_{PGFB} = 300mV (TYP) \times (1 + R_{PG2} / R_{PG1})$, where R_{PG1} is the resistor between the PGFB pin and the GND pin, and R_{PG2} is the resistor between the OUT pin and the PGFB pin. The fast start-up function is active when the PGFB voltage is below 300mV (TYP). The PGFB pin cannot float. Connect it to the IN pin if not used.
7	SET	Output Voltage Setting Pin. The SET pin programs the output voltage V_{OUT} by adding a resistor R_{SET} between SET and GND pins. $V_{OUT} = R_{SET} \times I_{SET}$, where $I_{SET} = 100\mu A (TYP)$. A capacitor C_{SET} between SET and GND pins can improve PSRR, transient response and noise performance, but it will increase start-up time.
8	GND	Ground Pin.
9	OUTS	Output Sense Pin. The OUTS pin supports the Kelvin sense connection at the output. To achieve the expected transient response, phase/gain margin, and PSRR performance, Kelvin connect OUTS pin directly to the OUT side of out capacitor C_{OUT} , while connect the GND sides of the C_{SET} and C_{OUT} directly. And reduce the distance between the GND sides of C_{IN} and C_{OUT} . In addition, the direct connection of the OUTS pin and the OUT pin does not affect the normal function of the regulator.
10	OUT	Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 2.2μF to 200μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin.
Exposed Pad	GND	Exposed Pad. Connect it to GND internally. Connect it to a large ground plane to maximize thermal performance. This pad is not an electrical connection point.

FUNCTIONAL BLOCK DIAGRAM

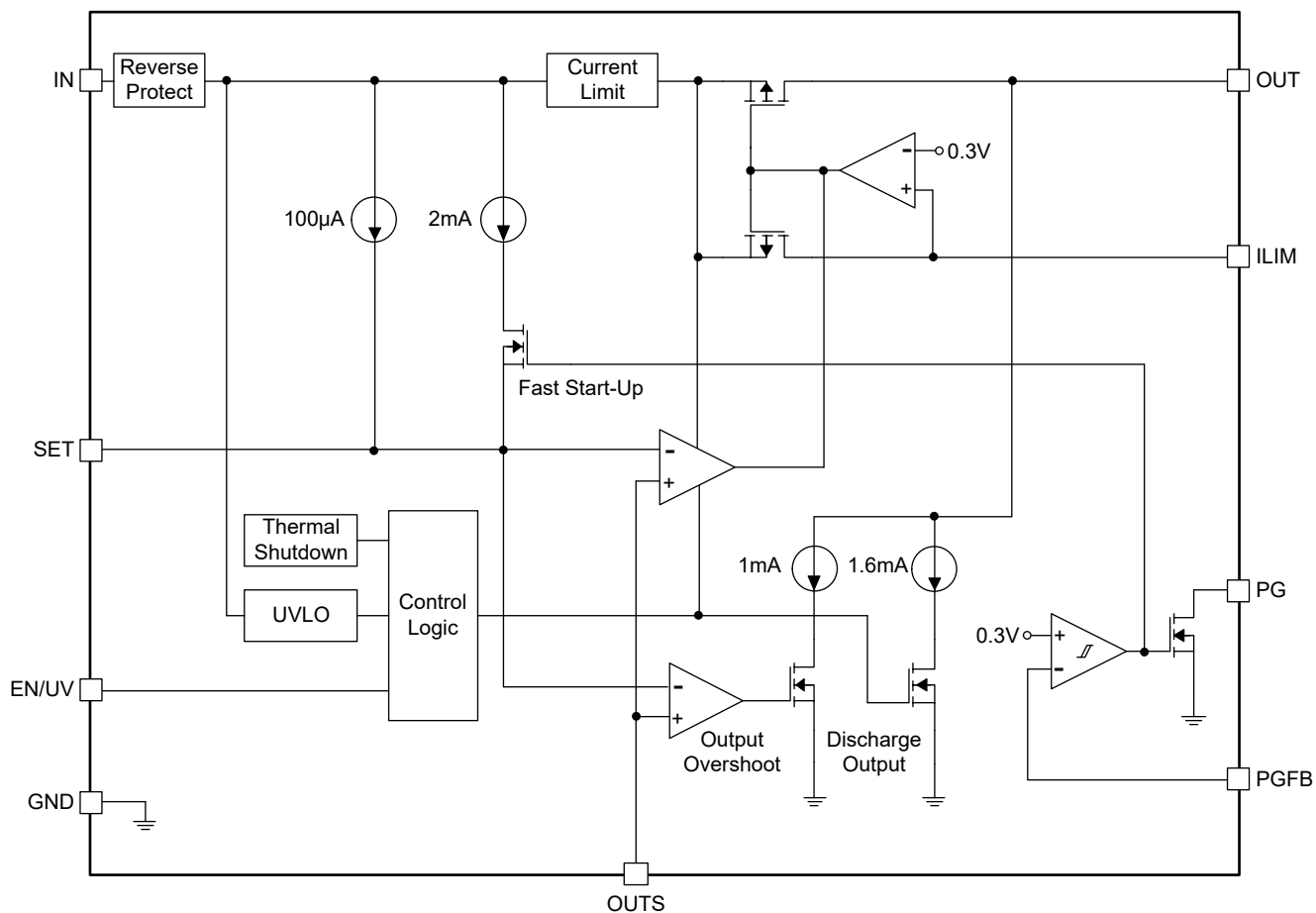
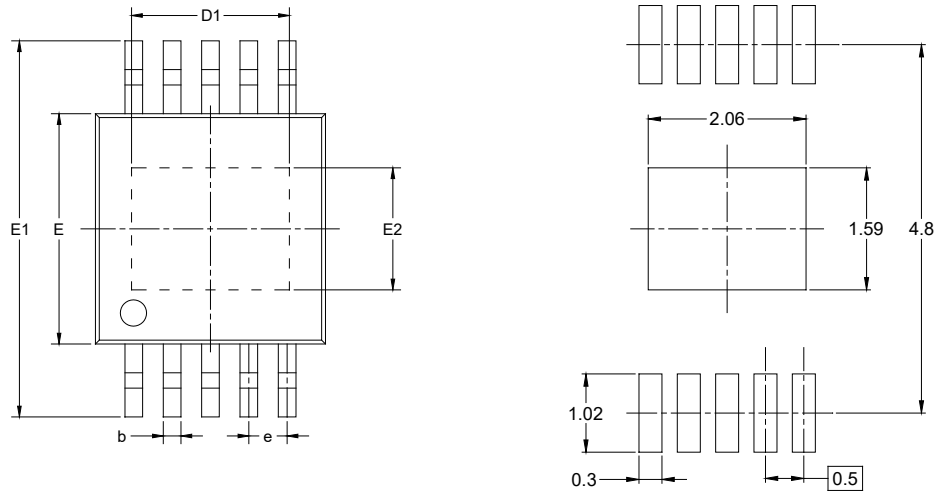


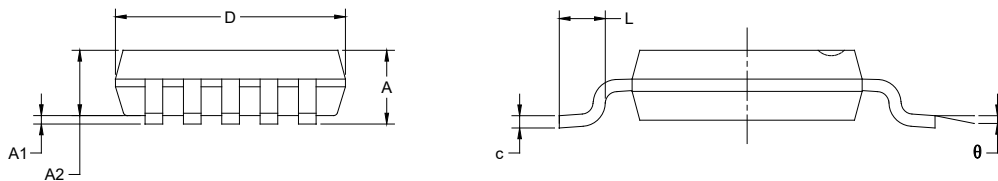
Figure 2. Block Diagram

PACKAGE OUTLINE DIMENSIONS

MSOP-10 (Exposed Pad)



RECOMMENDED LAND PATTERN (Unit: mm)



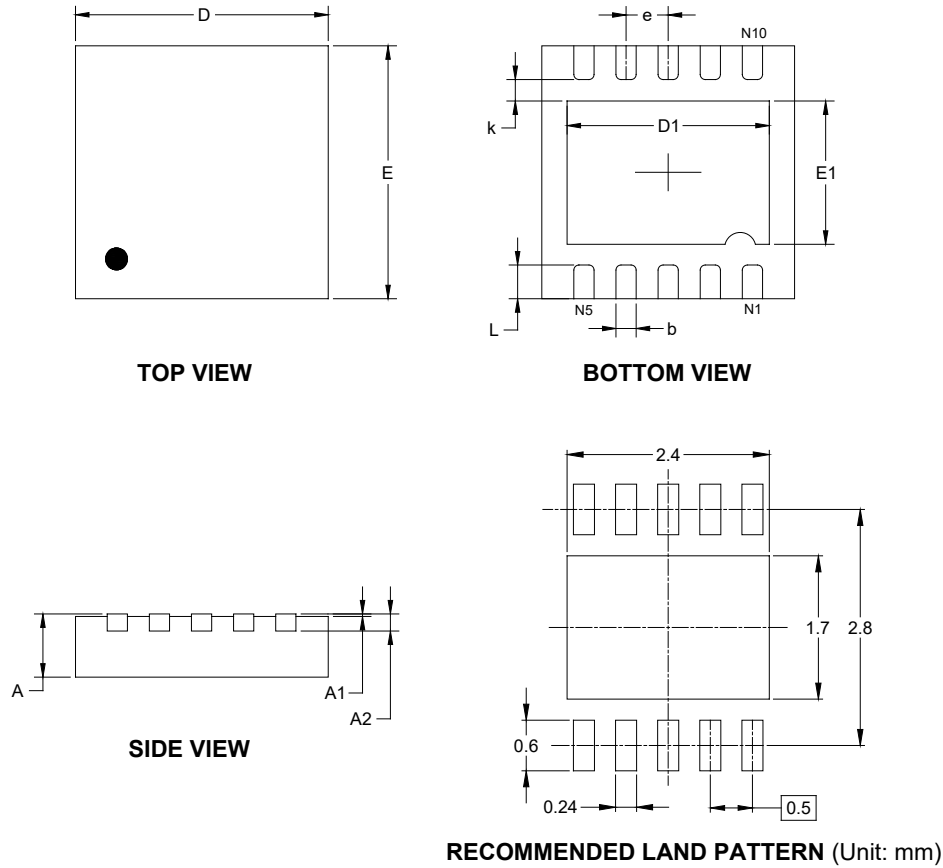
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.820	-	1.100
A1	0.020	-	0.150
A2	0.750	-	0.950
b	0.170	-	0.280
c	0.080	-	0.230
D	2.900	-	3.100
D1	1.700	-	2.416
E	2.900	-	3.100
E1	4.750	-	5.050
E2	1.450	-	1.730
e	0.500 BSC		
L	0.400	-	0.800
θ	0°	-	8°

NOTES:

1. Body dimensions do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

TDFN-3×3-10L



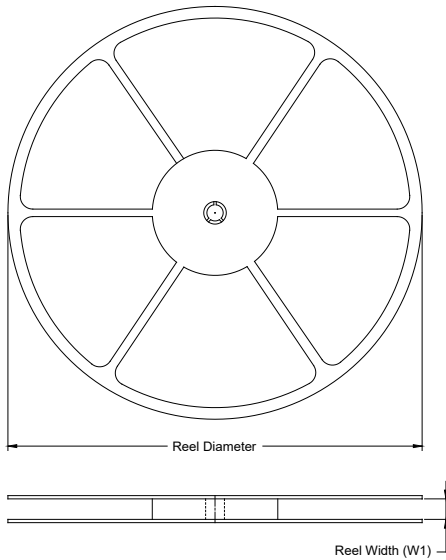
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	2.300	2.600	0.091	0.103
E	2.900	3.100	0.114	0.122
E1	1.500	1.800	0.059	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

NOTE: This drawing is subject to change without notice.

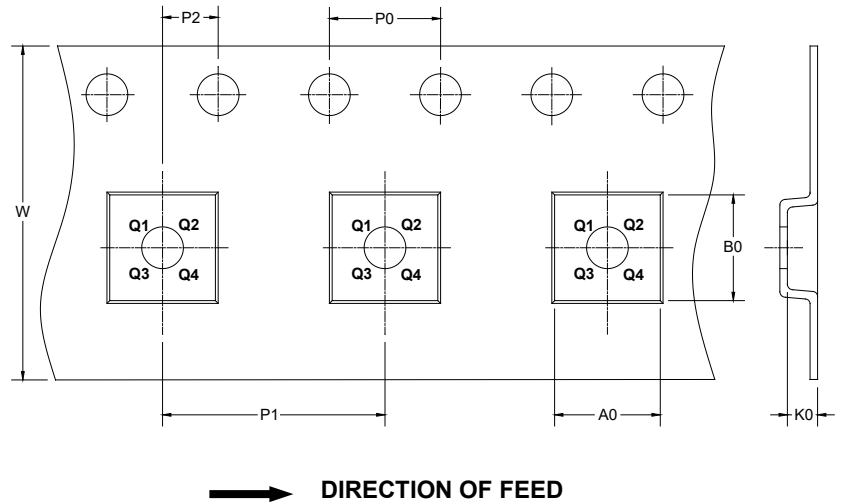
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

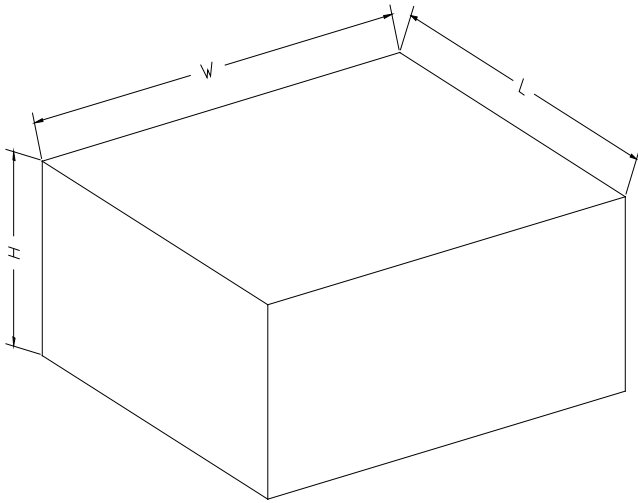
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
MSOP-10 (Exposed Pad)	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
TDFN-3×3-10L	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	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
13"	386	280	370	5

DD0002