SGM3146
8-Channel Charge Pump White LED Driver with Low Dropout Current Source

GENERAL DESCRIPTION

The SGM3146 is a current-regulated white LED driver with integrated low dropout current sources and a high efficiency charge pump. The charge pump has automatically selectable 1×/1.5× fractional operation modes. The SGM3146 is well suited for white LED applications powered by a Li-Ion battery due to small equivalent open-loop resistance in 1× mode.

The supply voltage operates from 2.7V to 5.5V. The SGM3146 supports up to 8 LEDs for 27mA maximum current per string. The LED reference current is set through an internal resistor. The SGM3146 contains a 4-bit digital-to-analog converter for 16-step LED current control. The LED current can be set between 1.65mA and 27mA by a serial pulse input signal into the EN/SET pin. Built-in soft-start circuitry avoids excessive inrush current during startup and mode transition.

The SGM3146 is available in a Green TQFN-3×3-20L package. It operates over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **Input Voltage Range: 2.7V to 5.5V**
- **Support up to 8 LEDs at 27mA Each**
- **16-Step LED Brightness Control through One-Wire Interface**
- **1× and 1.5× Charge Pump for High Conversion Efficiency**
- **Switching Frequency: 0.93MHz**
- **±4.8% Regulated LED Current Matching**
- **Built-in Soft-Start for Reducing Inrush Current**
- **Low Input Ripple and Low EMI**
- **Protection Features**
  - **Over-Current Protection**
  - **Under-Voltage Lockout**
  - **Thermal Shutdown**
- **Operating Temperature Range: -40℃ to +85℃**
- **Available a in Green TQFN-3×3-20L Package**

APPLICATIONS

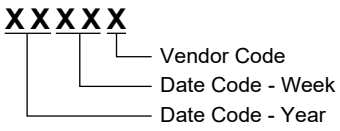
White LED Backlighting
Mobile Phones, MP3s
Digital Still Cameras
LCD Displays

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3146	TQFN-3×3-20L	-40℃ to +85℃	SGM3146YTQG20G/TR	SGM 3146QG XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.



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_{IN} to GND ..... -0.3V to 6V
The Other Pins to GND ..... -0.3V to V_{IN}
Power Dissipation, P_D @ T_A = +25℃
TQFN-3×3-20L 1.48W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature Range (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 2000V
MM 200V

RECOMMENDED OPERATING CONDITIONS

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.

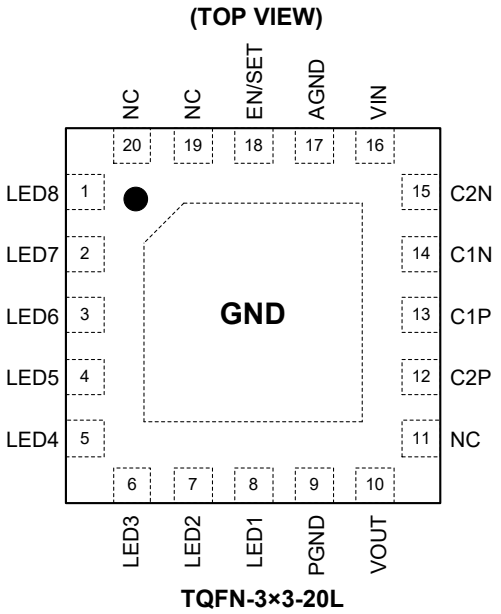
ESD SENSITIVITY CAUTION

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.

PIN CONFIGURATION



TQFN-3×3-20L

PIN DESCRIPTION

PIN	NAME	I/O	FUNCTION
1 - 8	LED8 - LED1	I	Current Sink Input. Connect to the cathode of the corresponding LED.
9	PGND	-	Power Ground Pin.
10	VOUT	O	Output Voltage Source. Connect to the output capacitor and the anodes of the LEDs.
11, 19, 20	NC	-	No Connection.
12	C2P	-	Positive Terminal of the Flying Capacitor 2.
13	C1P	-	Positive Terminal of the Flying Capacitor 1.
14	C1N	-	Negative Terminal of the Flying Capacitor 1.
15	C2N	-	Negative Terminal of the Flying Capacitor 2.
16	VIN	I	Input Supply Pin.
17	AGND	-	Analog Ground Pin.
18	EN/SET	I	Active-High LED Enable Pin and Dimming Control. Connect to the GPIO pin of MCU. In normal operation if V_{IN} ramp-up is slow, it is recommended to connect EN/SET to VIN only after V_{IN} has settled.
Exposed Pad	GND	-	Exposed Pad. It should be soldered to PCB board and connected to GND.

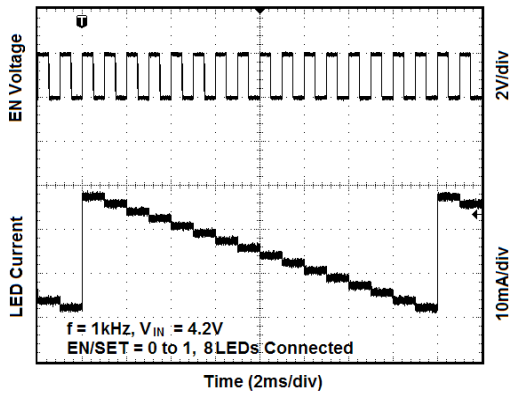
ELECTRICAL CHARACTERISTICS

(V_{IN} = 3.6V, EN/SET = V_{IN}, typical values are at T_A = +25℃, unless otherwise noted.)

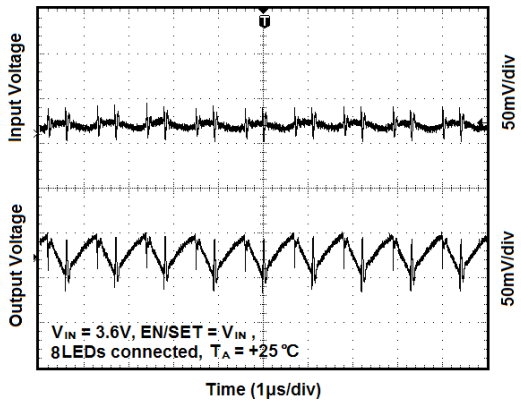
PARAMETER		SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage and Current							
Input Voltage Range		V_{IN}		2.7		5.5	V
Quiescent Power Supply Current		I_Q	V_{IN} = 4.2V, 1× Mode, I_{LEDx} = 0mA		155	240	μA
			1.5× Mode, I_{LEDx} = 0mA		1.35		mA
Shutdown Supply Current		I_{SHDN}	EN/SET = GND, V_{IN} = 4.2V		0.01	2.5	μA
Charge Pump Stage							
Over-Voltage Limit		V_{OUT}			5.4		V
Start-Up Time			C_{OUT} = 1μF, $I_{LEDx} \geq 0.9 \times I_{LEDx\text{-}set}$		280		μs
Soft-Start Duration					150		μs
Switching Frequency		f		0.7	0.93	1.25	MHz
Efficiency		η	At 1× Mode before switching to 1.5× Mode		90		%
Shutdown Temperature			Temperature rising		140		℃
Shutdown Temperature Hysteresis					10		℃
Input Current Limit					300		mA
Current Sinks							
Recommended Maximum Current per Current Sink		I_{LEDx}	3.2V ≤ V_{IN} ≤ 5.5V	24	27	30	mA
Current Matching between Any Two Outputs			V_{LEDx} = 3.2V, I_{LEDx} = 27mA	-4.8	1	4.8	%
Line Regulation			3.3V < V_{IN} < 5.5V, V_{LEDx} = 3.2V		1.4		%
Voltage at LED_X to GND		V_{SOURCE}	V_{IN} = 4.2V		550		mV
EN/SET Logic							
Low Time for Shutdown		T_{SHDN}		3			ms
Low Time for Dimming		T_{LO}		0.5		500	μs
High Time for Dimming		T_{HI}		0.5			μs
Threshold	Logic-High Voltage	V_{IH}		1.2			V
	Logic-Low Voltage	V_{IL}				0.4	V
Threshold of Switching between 1× and 1.5× Mode							
1× Mode to 1.5× Mode			V_{LEDx} = 3.2V		3.48		V
1.5× Mode to 1× Mode			V_{LEDx} = 3.2V		3.65		V

TYPICAL PERFORMANCE CHARACTERISTICS

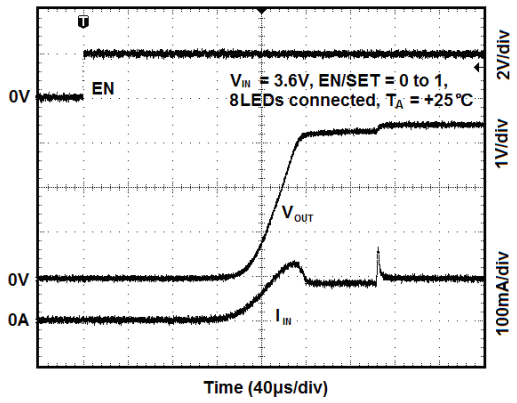
1x Mode Dimming Operation



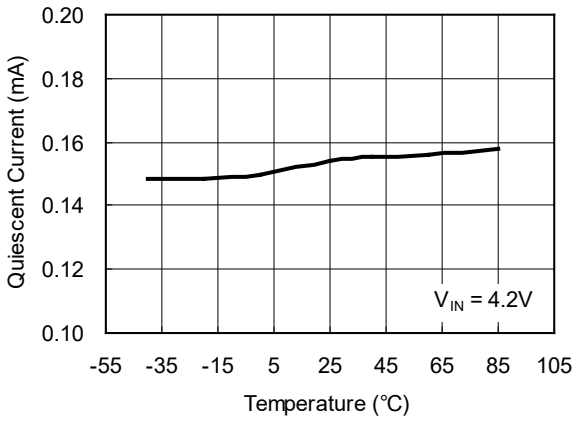
1.5x Mode Input and Output Voltage Ripple



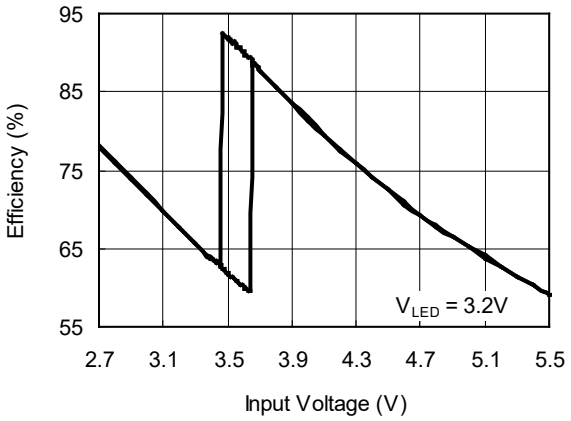
Startup Timing



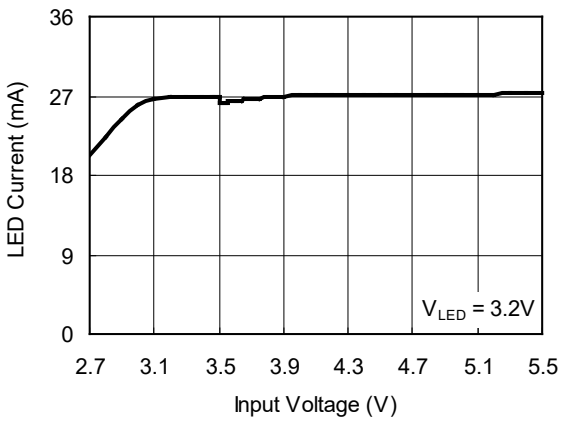
Quiescent Current vs. Temperature



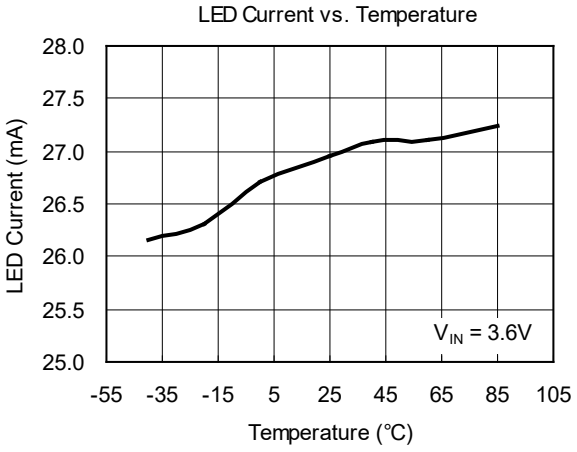
Efficiency vs. Input Voltage

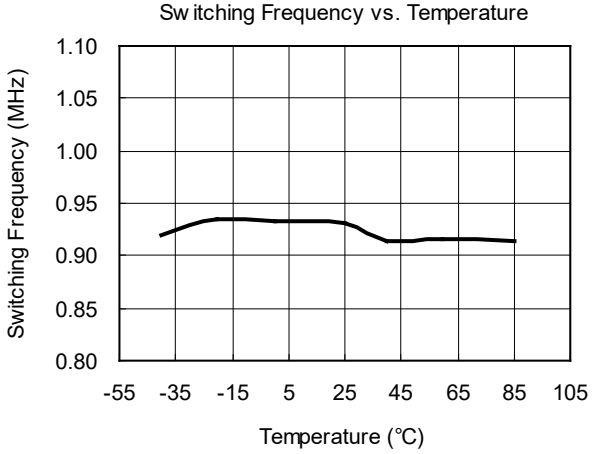


LED Current Regulation vs. Input Voltage



TYPICAL PERFORMANCE CHARACTERISTICS (continued)





TYPICAL APPLICATION

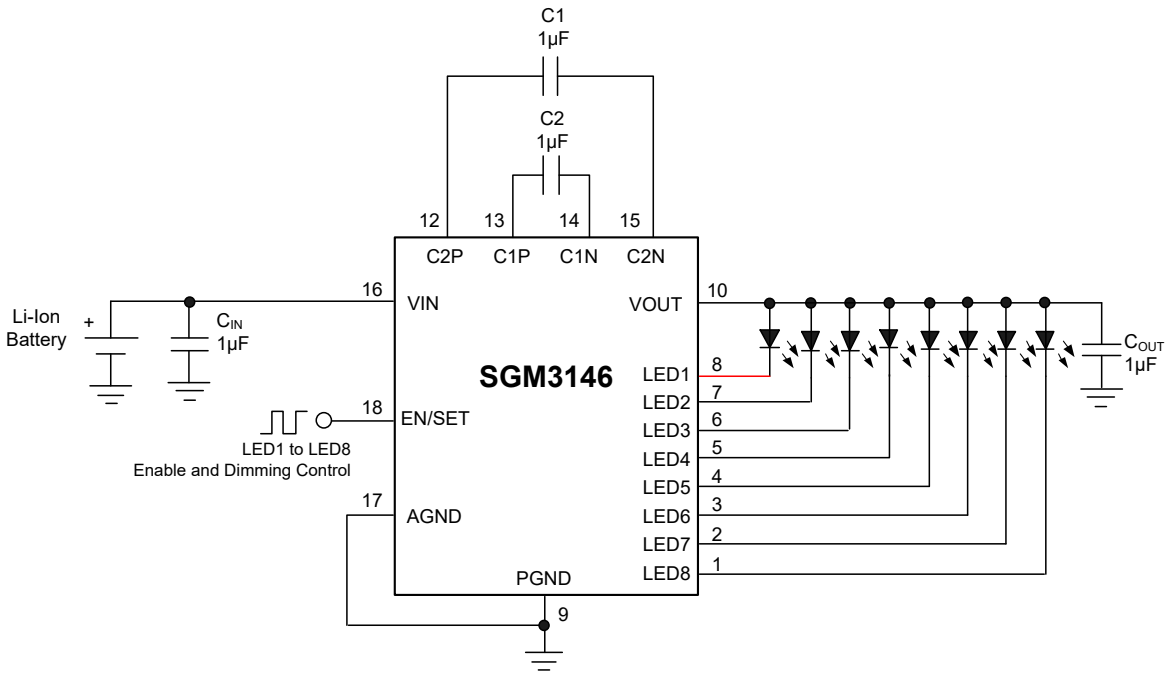


Figure 1. For 8-WLEDs Application Circuit

REVISION HISTORY

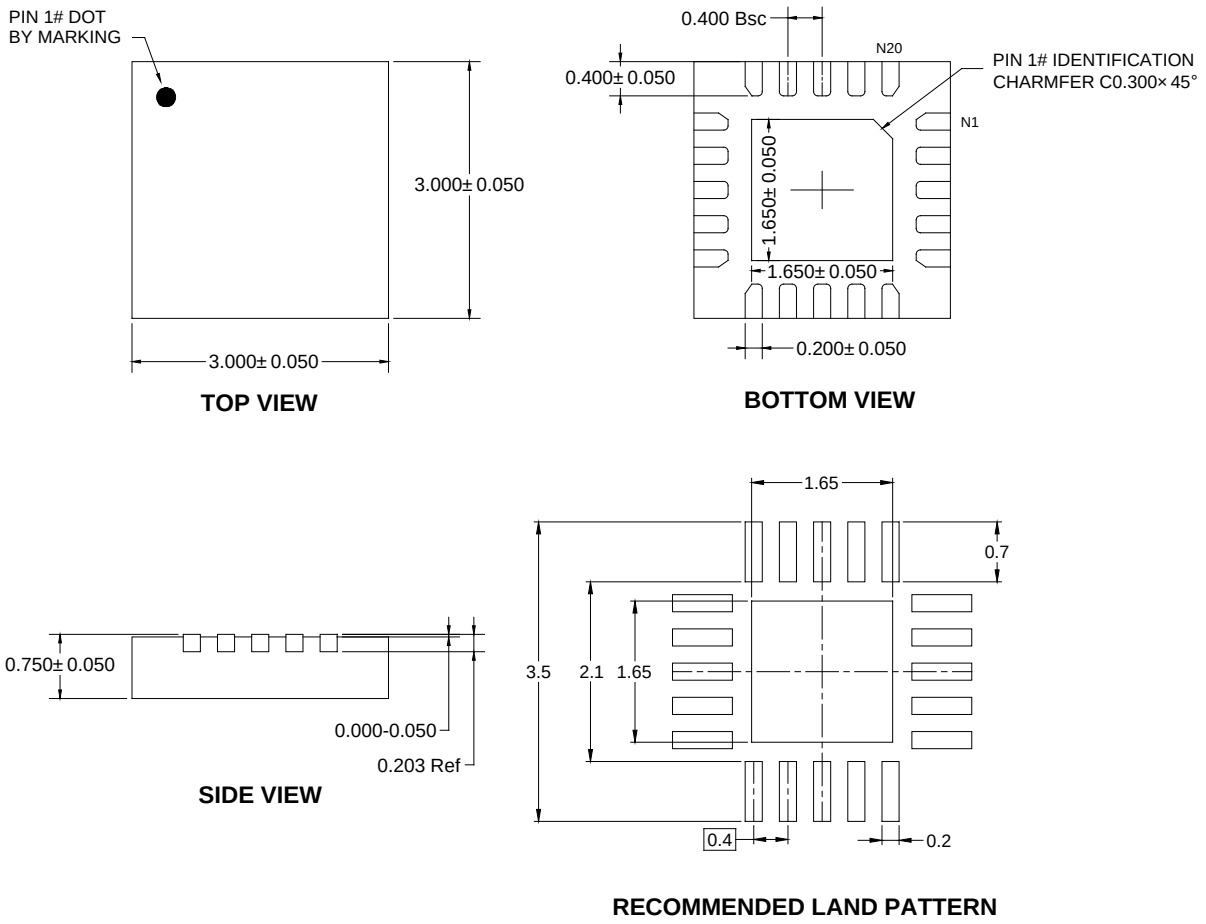
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

JANUARY 2013 – REV.A to REV.A.1	Page
Added Tape and Reel Information section	12, 13

Changes from Original (MAY 2012) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

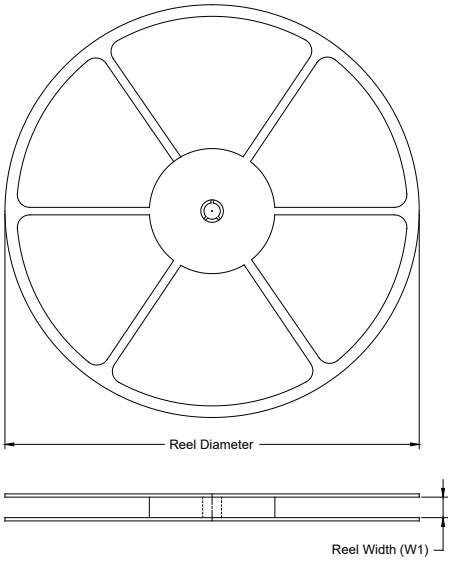
TQFN-3×3-20L



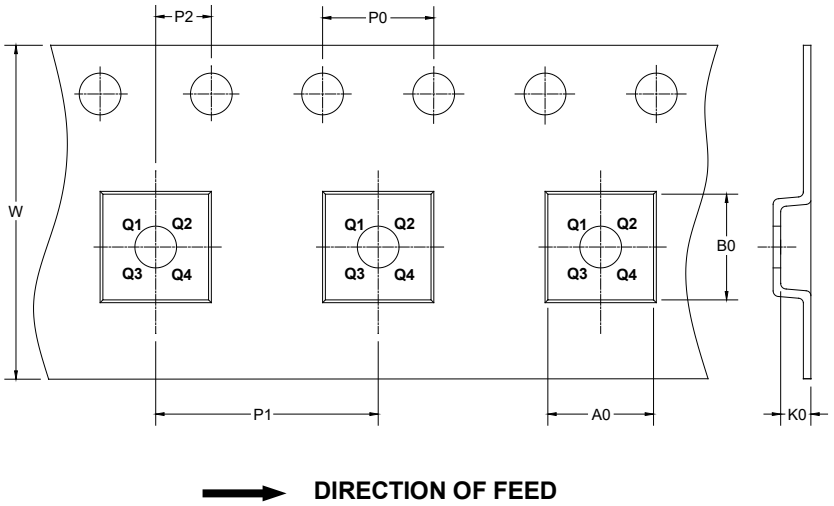
NOTE: All linear dimensions are in millimeters.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



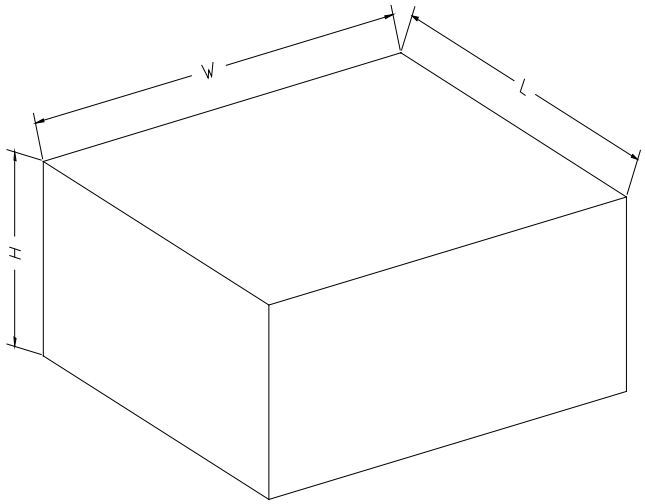
NOTE: The picture is only for reference. Please make the object as the standard.

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-3×3-20L	13″	12.4	3.30	3.30	1.10	4.0	8.0	2.0	12.0	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
13″	386	280	370	5

DD0002