



# SGM457

## Low Power, Low Supply Voltage, SOT Package, Digital Temperature Sensor

### GENERAL DESCRIPTION

The SGM457 is a low power, low supply voltage, SOT package, serial control interface and digital output temperature sensor with an accuracy of  $\pm 0.5^{\circ}\text{C}$  in the temperature range of  $-25^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and  $\pm 1^{\circ}\text{C}$  in the temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . The serial two-wire interface supports SMBus, two-wire and I<sup>2</sup>C interface. Multiple device access instruction is used in this serial bus, so multiple SGM457 devices (up to four) can share one serial bus. The micro-controller will communicate with these devices on the bus without sending separate instructions which increases the efficiency of software. In multiple hot points monitoring systems such as computing platform, the design can be realized by connecting one serial bus with multiple temperature sensors. It also has an SMBus alert function.

The SGM457 is ideal for extended temperature measurement in a variety of communication, computer, consumer, environmental, industrial, and instrumentation applications.

The SGM457 is available in a Green SOT-563-6 package and operates over an ambient temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

### FEATURES

- **1.6V to 5.5V Supply Voltage Range**
- **Temperature Accuracy:**
  - 25°C to +85°C:  $\pm 0.5^{\circ}\text{C}$  (TYP)
  - 40°C to +125°C:  $\pm 1^{\circ}\text{C}$  (TYP)
- **Operating Supply Current: 17 $\mu\text{A}$  (TYP)**
- **Shutdown Mode Current: 0.5 $\mu\text{A}$  (TYP)**
- **Resolution: 12 Bits**
- **Serial Control Bus is Compatible with Two-Wire, I<sup>2</sup>C and SMBus Interface**
- **Available in a Green SOT-563-6 Package**

### APPLICATIONS

Smart Phone  
 Temperature monitor in Computing Platform  
 Industrial Control  
 Temperature monitor in Power System

### TYPICAL APPLICATION

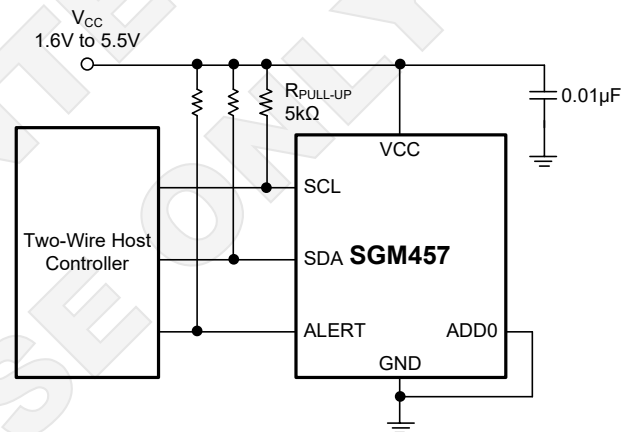
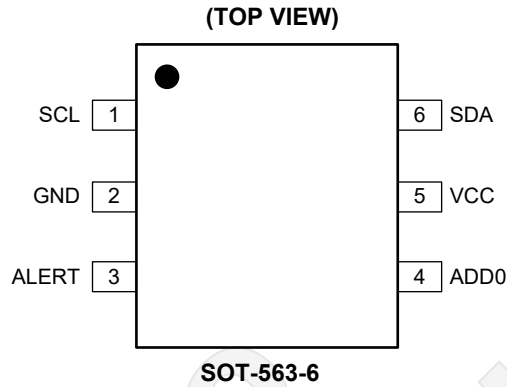


Figure 1. Typical Application Circuit



**PIN CONFIGURATION**



**PIN DESCRIPTION**

PIN	NAME	I/O	FUNCTION
1	SCL	I	Clock Input Pin. Open-drain output. Pull up a 5kΩ resistor to VCC.
2	GND	—	Ground.
3	ALERT	O	Over-Temperature Alert Pin. Open-drain output. Pull up a 5kΩ resistor to VCC.
4	ADD0	I	Address Selecting Pin. Connect it to VCC or ground.
5	VCC	I	Power Supply Pin.
6	SDA	I/O	Data Input/Output Pin. Open-drain output. Pull up a 5kΩ resistor to VCC.

NOTE: I: Input; O: Output.

**Slave Address of SGM457**

The SGM457 has an address pin for correctly connecting up to four devices as shown in Table 1.

Table 1. Different Slave Addresses of Address Pin

Slave Address	ADD0 Pin Connection
1001000	Ground
1001001	VCC
1001010	SDA
1001011	SCL

FUNCTIONAL BLOCK DIAGRAM

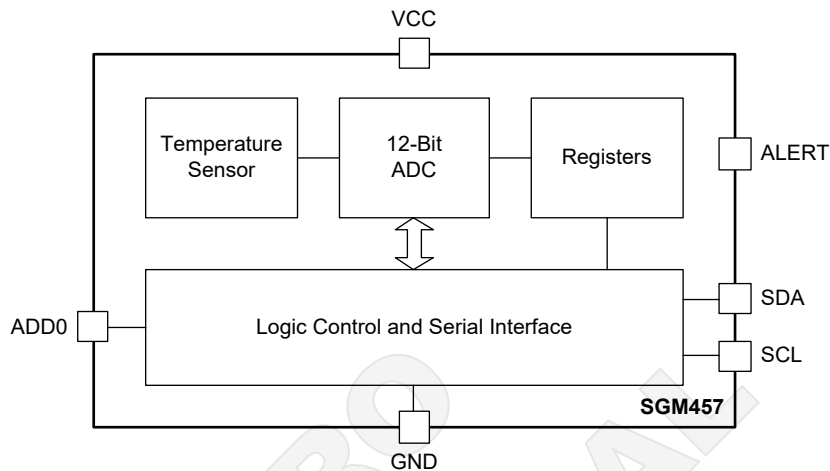


Figure 2. Functional Block Diagram

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**ELECTRICAL CHARACTERISTICS**(V<sub>CC</sub> = 1.6V to 5.5V, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Temperature Input</b>					
Range		-40		+125	°C
Accuracy (Temperature Error)	-25°C to +85°C		±0.5		°C
	-40°C to +125°C		±1		
vs. Supply			0.5		°C/V
Resolution			0.0625		°C
<b>Digital Input/Output</b>					
Input Capacitance			3		pF
Input Logic High (V <sub>IH</sub> )		0.7 × V <sub>CC</sub>			V
Input Logic Low (V <sub>IL</sub> )				0.3 × V <sub>CC</sub>	V
Input Current (I <sub>IN</sub> )	0 < V <sub>IN</sub> < 5.5V		0.05		μA
Output Logic (V <sub>OL</sub> )	SDA, ALERT, I <sub>OL</sub> = 3mA		0.06		V
Resolution			12		Bits
Conversion Time			26		ms
Conversion Modes	CR1 = 0, CR0 = 0		0.25		Conv/s
	CR1 = 0, CR0 = 1		1		
	CR1 = 1, CR0 = 0 (default)		4		
	CR1 = 1, CR0 = 1		8		
Timeout Time			30		ms
<b>Power Supply</b>					
Operating Supply Range		1.6		5.5	V
Average Quiescent Current (I <sub>Q</sub> )	Serial bus inactive, CR1 = 1, CR0 = 0 (default)		17		μA
Shutdown Current (I <sub>SD</sub> )	Serial bus inactive		0.5		μA
<b>Temperature</b>					
Specified Range		-40		+125	°C
Operating Range		-55		+150	°C

SERIAL INTERFACE

Table 2. The First Byte after START (Address of Slave Device)

MSB							LSB
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	0	0	1	0	A1	A0	R/W

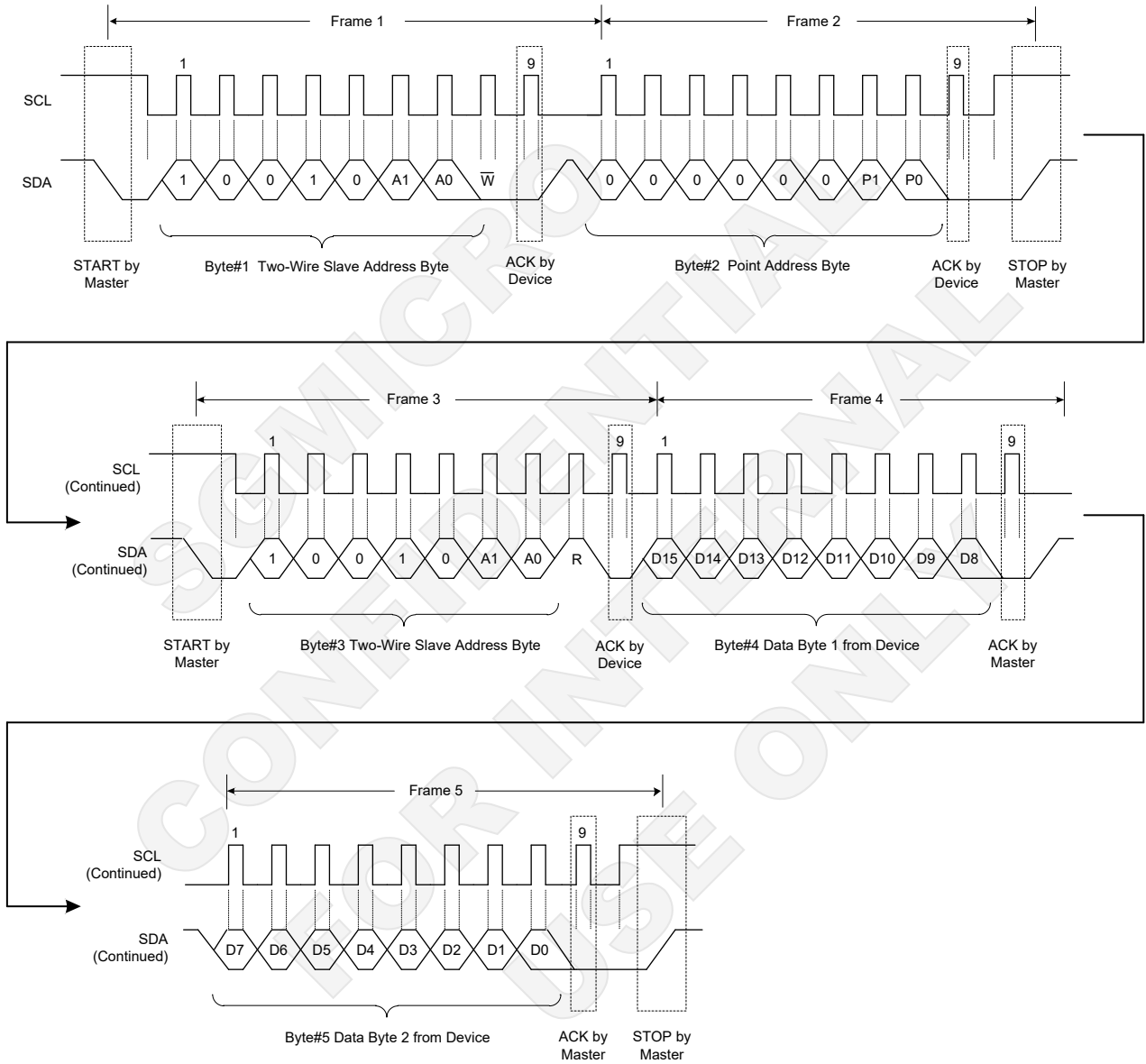


Figure 3. Register Read Word Format

SERIAL INTERFACE (continued)

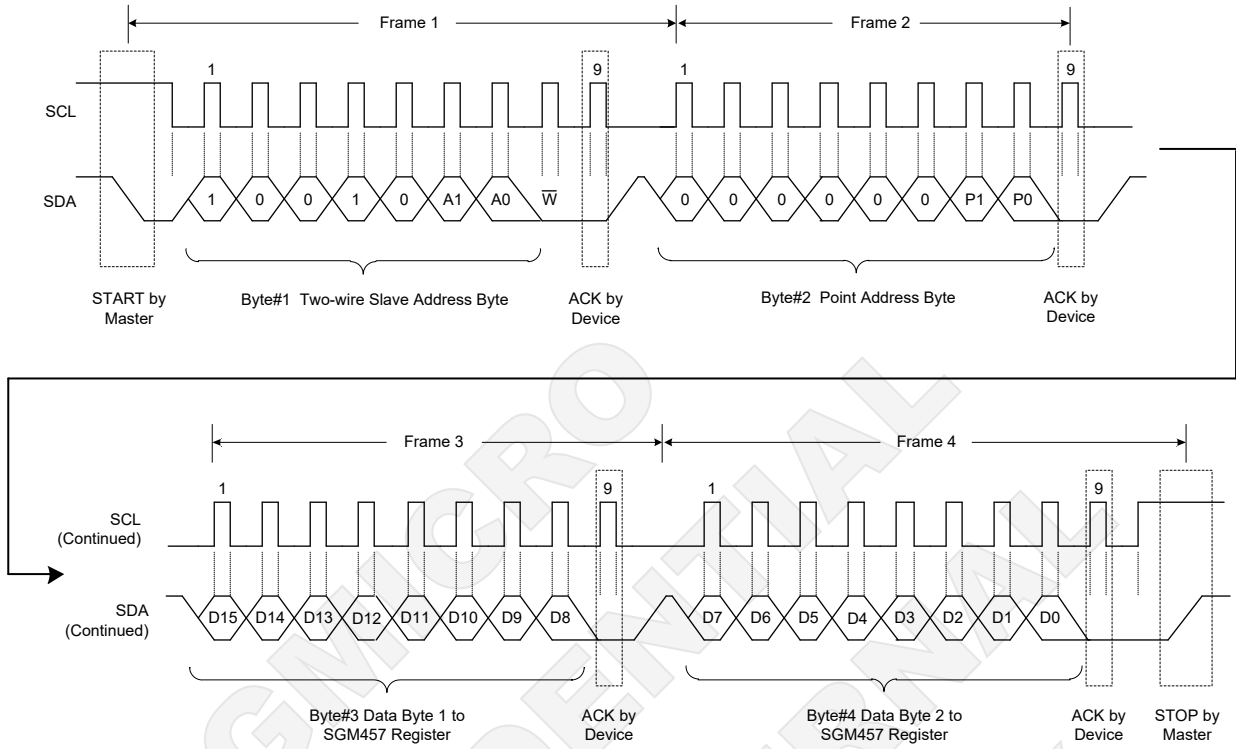


Figure 4. Register Write Word Format

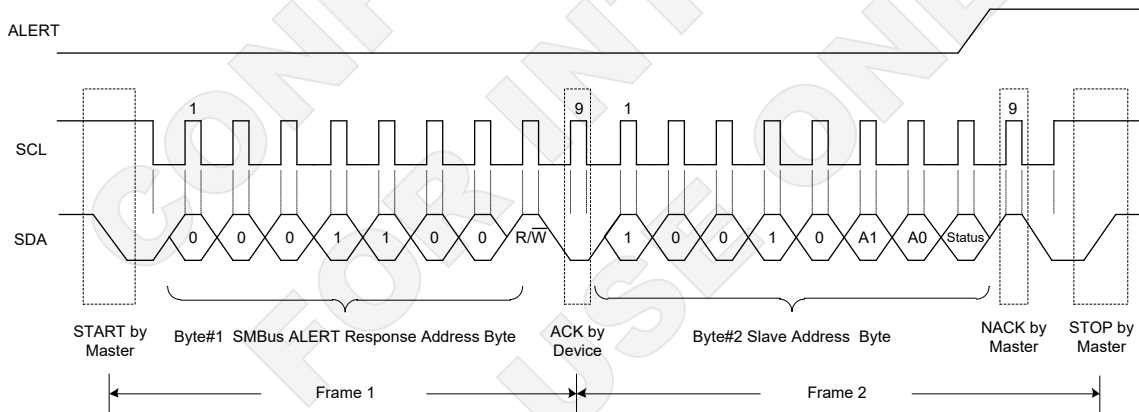


Figure 5. Data Frame for SMBus Alert Response

NOTES:

- 1. R: read,  $\bar{W}$ : write.
- 2. ACK: acknowledge, NACK: not acknowledge.

REGISTER DESCRIPTION

Pointer Register

Table 3. Pointer Register

MSB						LSB	
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	0	0	0	P1	P0
						Pointer Select Bits	

Table 4. Register Pointers Selection:

POINTER VALUE	P1	P0	DESCRIPTION	TYPE
0x00	0	0	Temperature Register	R
0x01	0	1	Configuration Register	R/W
0x02	1	0	T <sub>LOW</sub> Register (Low-Side Threshold of Temperature Limit)	R/W
0x03	1	1	T <sub>HIGH</sub> Register (High-Side Threshold of Temperature Limit)	R/W

Temperature Register

Table 5. Byte 1 of Temperature Register

SMB						LSB	
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
TD11 (TD12)	TD10 (TD11)	TD9 (TD10)	TD8 (TD9)	TD7 (TD8)	TD6 (TD7)	TD5 (TD6)	TD4 (TD5)

Table 6. Byte 2 of Temperature Register

SMB						LSB	
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
TD3 (TD4)	TD2 (TD3)	TD1 (TD2)	TD0 (TD1)	0 (TD0)	0 (0)	0 (0)	0 (1)

Table 7. 12-Bit Temperature Data Format

The resolution for the temp ADC in internal temperature mode is 0.0625°C/count.

Temperature (°C)	Digital Output (Binary)	Hex
+128	011111111111	7FF
+127.9375	011111111111	7FF
+100	011001000000	640
+80	010100000000	500
+75	010010110000	4B0
+50	001100100000	320
+25	000110010000	190
0.25	000000000100	004
0	000000000000	000
-0.25	111111111100	FFC
-25	111001110000	E70
-55	110010010000	C90

Table 8. 13-Bit Temperature Data Format

The resolution for the temp ADC in internal temperature mode is 0.0625°C/count.

Temperature (°C)	Digital Output (Binary)	Hex
+150	0100101100000	0960
+128	0100000000000	0800
+127.9375	0011111111111	07FF
+100	0011001000000	0640
+80	0010100000000	0500
+75	0010010110000	04B0
+50	0001100100000	0320
+25	0000110010000	0190
+0.25	0000000000100	0004
0	0000000000000	0000
-0.25	1111111111100	1FFC
-25	1111001110000	1E70
-55	1110010010000	1C90



## REGISTER DESCRIPTION (continued)

## Configuration Register

Table 9. Byte 1 of Configuration Register

SMB							LSB
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
OS (0)	R1 (1)	R0 (1)	F1 (0)	F0 (0)	POL (0)	TM (0)	SD (0)

Table 10. Byte 2 of Configuration Register

SMB							LSB
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
CR1 (1)	CR0 (0)	AL (1)	EM (0)	0 (0)	0 (0)	0 (0)	0 (0)

T<sub>HIGH</sub> RegisterTable 11. Byte 1 T<sub>HIGH</sub> Register

SMB							LSB
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
HD11 (HD12)	HD10 (HD11)	HD9 (HD10)	HD8 (HD9)	HD7 (HD8)	HD6 (HD7)	HD5 (HD6)	HD4 (HD5)

Table 12. Byte 2 T<sub>HIGH</sub> Register

SMB							LSB
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
HD3 (HD4)	HD2 (HD3)	HD1 (HD2)	HD0 (HD1)	0 (HD0)	0 (0)	0 (0)	0 (1)

T<sub>LOW</sub> RegistersTable 13. Byte 1 T<sub>LOW</sub> Register

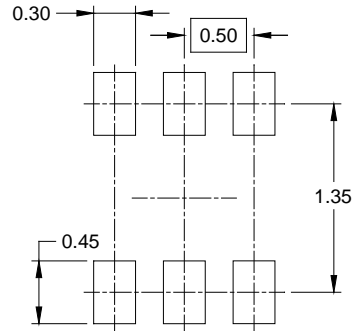
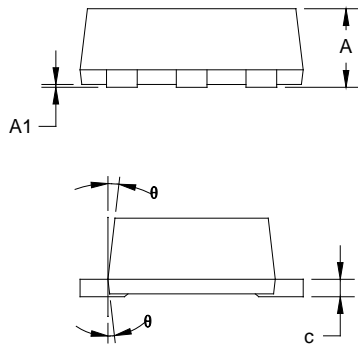
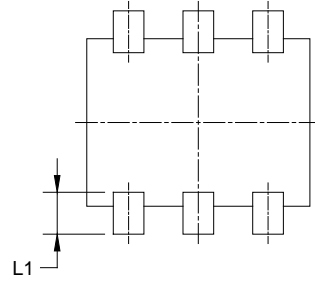
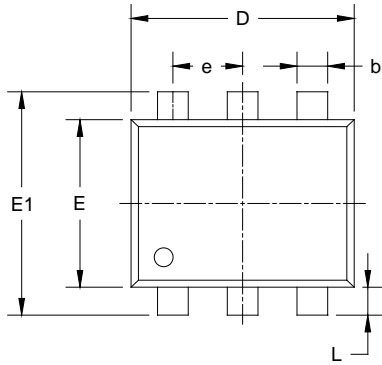
SMB							LSB
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
LD11 (LD12)	LD10 (LD11)	LD9 (LD10)	LD8 (LD9)	LD7 (LD8)	LD6 (LD7)	LD5 (LD6)	LD4 (LD5)

Table 14. Byte 2 T<sub>LOW</sub> Register

SMB							LSB
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
LD3 (LD4)	LD2 (LD3)	LD1 (LD2)	LD0 (LD1)	0 (LD0)	0 (0)	0 (0)	0 (1)

PACKAGE OUTLINE DIMENSIONS

SOT-563-6



RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.525	0.600	0.021	0.024
A1	0.000	0.050	0.000	0.002
b	0.170	0.270	0.007	0.011
c	0.090	0.180	0.004	0.007
D	1.500	1.700	0.059	0.067
E	1.100	1.300	0.043	0.051
E1	1.500	1.700	0.059	0.067
e	0.450	0.550	0.018	0.022
L	0.100	0.300	0.004	0.012
L1	0.200	0.400	0.008	0.016
$\theta$	9° REF		9° REF	

NOTES:

1. Body dimensions do not include mode flash or protrusion.
2. 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
SOT-563-6	7"	9.5	1.78	1.78	0.69	4.0	4.0	2.0	8.0	Q3

000001

# 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