# SGM4570AQ

# Automotive, Open-Drain, Dual-Supply Translating Transceiver with Auto Direction Sensing

## GENERAL DESCRIPTION

The SGM4570AQ is a 4-bit, dual-supply translating transceiver. The auto direction sensing function allows a bidirectional voltage level translation for the device. The nA and nB are 4-bit data input-output ports and OE is an output enable input. $V_{CCA}$ and $V_{CCB}$ are two supply pins that accept the voltage from 1.65V to 3.6V and 2.3V to 5.5V respectively. This makes the translation among voltage nodes of 1.8V, 2.5V, 3.3V and 5V. OE and nA pins track the $V_{CCA}$ supply, and nB pins track the $V_{CCB}$ supply. When OE pin is held low, the outputs enter a high-impedance state.

The device is AEC-Q100 qualified (Automotive Electronics Council (AEC) standard Q100 Grade 1) and it is suitable for automotive applications.

The SGM4570AQ is available in Green TSSOP-14 and UTQFN-1.7×2-12L packages. It operates over a temperature range of -40℃ to +125℃.

## FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  **Device Temperature Grade 1**
  **$T_A$ = -40℃ to +125℃**
- **$V_{CCA}$ Supply Voltage Range: 1.65V to 3.6V**
- **$V_{CCB}$ Supply Voltage Range: 2.3V to 5.5V ($V_{CCA}$ ≤ $V_{CCB}$)**
- **Inputs Accept Voltages up to 5.5V**
- **Maximum Data Rates:**
  - **Push-Pull: 24Mbps**
  - **Open-Drain: 2Mbps**
- **Support Partial Power-Down Mode**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TSSOP-14 and UTQFN-1.7×2-12L Packages**

## APPLICATIONS

Automotive Applications
Computers
Mobile Phones

## FUNCTION TABLE

| SUPPLY VOLTAGE | | CONTROL INPUT | INPUT/OUTPUT | |
|---|---|---|---|---|
| $V_{CCA}$ (1) | $V_{CCB}$ | OE | nA | nB |
| 1.65V to 3.6V | 2.3V to 5.5V | L | Z | Z |
| 1.65V to 3.6V | 2.3V to 5.5V | H | Input or Output | Output or Input |
| GND (2) | GND (2) | *X* | Z | Z |

H = High Voltage Level

L = Low Voltage Level

Z = High-Impedance State

*X* = Don't Care

NOTES:

1. $V_{CCA}$ ≤ $V_{CCB}$ and $V_{CCA}$ ≤ 3.6V.
2. The device enters power-down mode when either $V_{CCA}$ or $V_{CCB}$ is at GND.

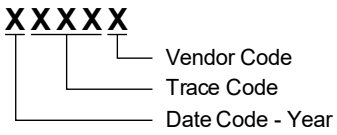
# PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE TOP MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| SGM4570AQ | TSSOP-14 | -40℃ to +125℃ | SGM4570AQTS14G/TR | 2E4<br>TS14<br>XXXXX | Tape and Reel, 4000 |
| | UTQFN-1.7×2-12L | -40℃ to +125℃ | SGM4570AQURF12G/TR | 2E3<br>XXXYY | Tape and Reel, 3000 |

## MARKING INFORMATION

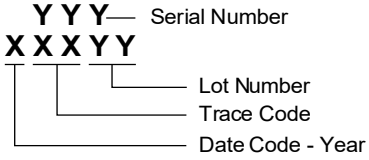
**TSSOP-14**

(1) XXXXX = Date Code, Trace Code and Vendor Code.




**UTQFN-1.7×2-12L**

(2) XXX = Date Code and Trace 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

Supply Voltage Range, $V_{CCA}$ ..... -0.5V to 6.5V
Supply Voltage Range, $V_{CCB}$ ..... -0.5V to 6.5V
Input Voltage Range, $V_I$ (1) ..... -0.5V to 6.5V
Output Voltage Range, $V_O$ (1)
Active Mode, A or B Ports ..... -0.5V to $V_{CCO}$ + 0.5V
Power-Down Mode or 3-State Mode
A Ports ..... -0.5V to 4.6V
B Ports ..... -0.5V to 6.5V
Input Clamp Current, $I_{IK}$ ($V_I$ < 0V) ..... -50mA
Output Clamp Current, $I_{OK}$ ($V_O$ < 0V) ..... -50mA
Output Current, $I_O$ ($V_O$ = 0V to $V_{CC}$)
High-State ..... -50mA
Low-State ..... 50mA
Supply Current, $I_{CCA}$ or $I_{CCB}$ ..... 100mA
Ground Current, $I_{GND}$ ..... -100mA
Junction Temperature (2) ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (3) (4)
HBM ..... ±6000V
CDM ..... ±1000V

NOTES:

1. The minimum input and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.

2. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

3. For human body model (HBM), all pins comply with AEC-Q100-002 specification.

4. For charged device model (CDM), all pins comply with AEC-Q100-011 specification.

## RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, $V_{CCA}$ ..... 1.65V to 3.6V
Supply Voltage Range, $V_{CCB}$ ..... 2.3V to 5.5V
Input Transition Rise or Fall Rate, Δt/ΔV
A or B Ports, Push-Pull Driving
$V_{CCA}$ = 1.65V to 3.6V, $V_{CCB}$ = 2.3V to 5.5V .... 10ns/V (MAX)
OE Input
$V_{CCA}$ = 1.65V to 3.6V, $V_{CCB}$ = 2.3V to 5.5V .... 10ns/V (MAX)
Operating Temperature Range ..... -40℃ to +125℃

## 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

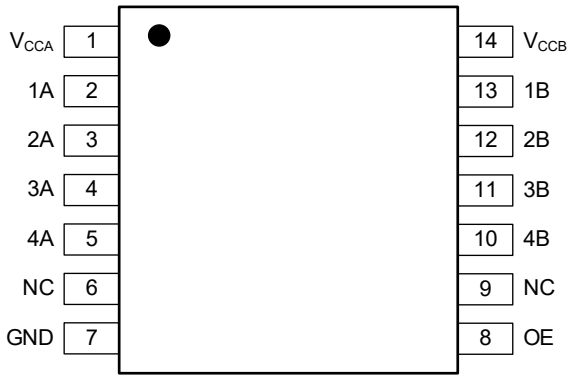
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

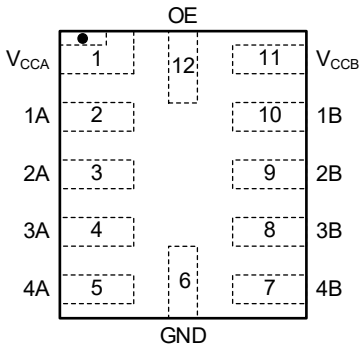
## PIN CONFIGURATIONS

(TOP VIEW)




TSSOP-14

(TOP VIEW)

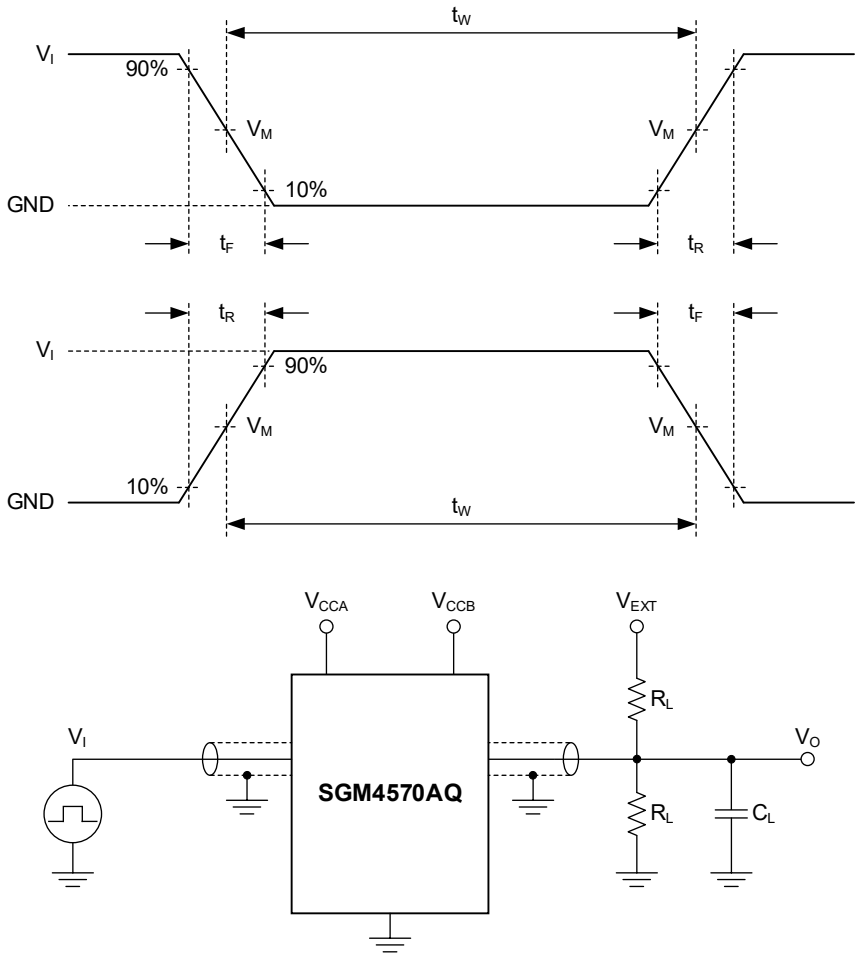



UTQFN-1.7×2-12L

## PIN DESCRIPTION

| PIN | | NAME | FUNCTION |
|---|---|---|---|
| TSSOP-14 | UTQFN-1.7×2-12L | | |
| 1 | 1 | $V_{CCA}$ | Supply Voltage on A Ports. |
| 2, 3, 4, 5 | 2, 3, 4, 5 | 1A, 2A, 3A, 4A | Data Inputs/Outputs. They track the $V_{CCA}$ supply. |
| 6, 9 | - | NC | No Connection. |
| 7 | 6 | GND | Ground. |
| 8 | 12 | OE | Output Enable Input (Active-High). It tracks the $V_{CCA}$ supply. |
| 10, 11, 12, 13 | 7, 8, 9, 10 | 4B, 3B, 2B, 1B | Data Inputs/Outputs. They track the $V_{CCB}$ supply. |
| 14 | 11 | $V_{CCB}$ | Supply Voltage on B Ports. |

## TEST CIRCUIT




Test conditions are given in Table 1.

Definitions for test circuit:

$R_L$: Load resistance.

$C_L$: Load capacitance (includes jig and probe).

$V_{EXT}$: External voltage is used to measure switching time.

**Figure 1. Test Circuit for Measuring Switching Times**

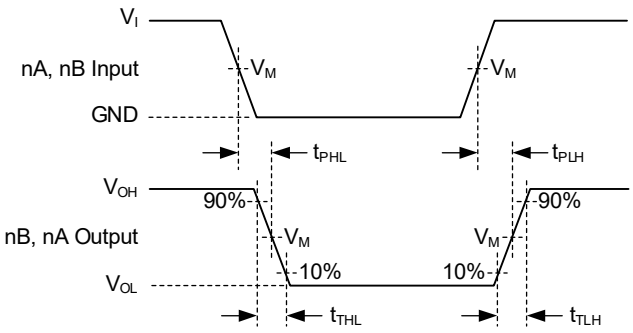
**Table 1. Test Conditions**

| SUPPLY VOLTAGE | | INPUT | | LOAD | | $V_{EXT}$ | | |
|---|---|---|---|---|---|---|---|---|
| $V_{CCA}$ | $V_{CCB}$ | $V_I$ | $t_R$, $t_F$ | $C_L$ | $R_L$ (2) | $t_{PLH}$, $t_{PHL}$ | $t_{PLZ}$, $t_{PZL}$ | $t_{PHZ}$, $t_{PZH}$ |
| 1.65V to 3.6V | 2.3V to 5.5V | $V_{CCI}$ (1) | ≤ 1ns | 15pF | 50kΩ, 1MΩ | Open | 2 × $V_{CCO}$ (3) | Open |

NOTES:

1. $V_{CCI}$ is the supply voltage associated with the data input ports.
2. $R_L$ = 50kΩ is used for the measurements of enable and disable times.
   $R_L$ = 1MΩ is used for the measurements of pulse width, propagation delay, data rate and output rise and fall times.
3. $V_{CCO}$ is the supply voltage associated with the data output ports.

## WAVEFORMS

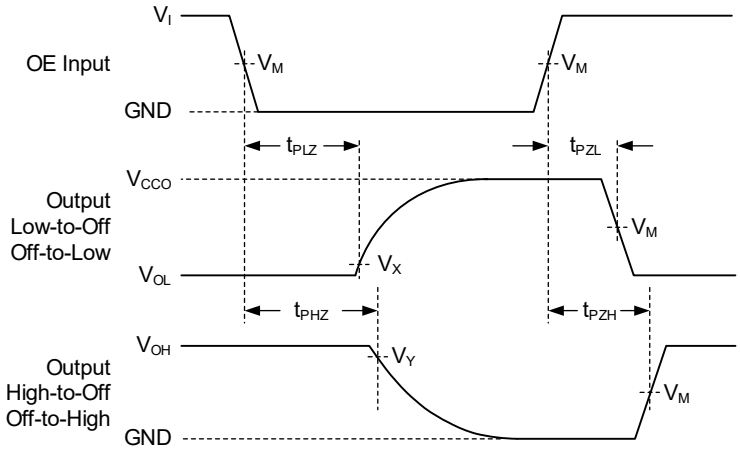



Test conditions are given in Table 1.

Measurement points are given in Table 2.

Logic levels: $V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load.

**Figure 2. Input (nA, nB) to Output (nB, nA) Propagation Delays**




Test conditions are given in Table 1.

Measurement points are given in Table 2.

Logic levels: $V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load.

**Figure 3. Enable and Disable Times**

**Table 2. Measurement Points**

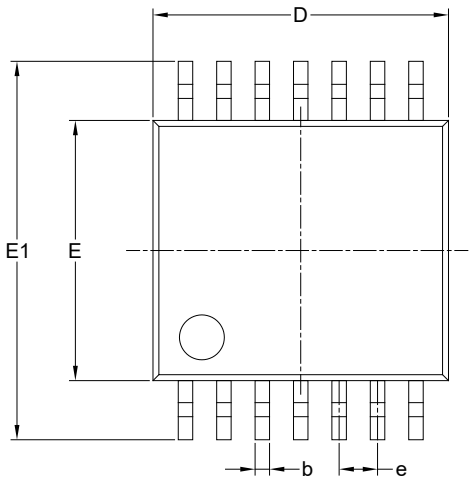
| SUPPLY VOLTAGE | INPUT | | OUTPUT | | |
|---|---|---|---|---|---|
| $V_{CCO}$ (2) | $V_I$ | $V_M$ (3) | $V_M$ | $V_X$ | $V_Y$ |
| 1.8V | $V_{CCI}$ (1) | 0.5 × $V_{CCI}$ | 0.5 × $V_{CCO}$ | $V_{OL}$ + 0.15V | $V_{OH}$ - 0.15V |
| 2.5V | $V_{CCI}$ | 0.5 × $V_{CCI}$ | 0.5 × $V_{CCO}$ | $V_{OL}$ + 0.15V | $V_{OH}$ - 0.15V |
| 3.3V | $V_{CCI}$ | 0.5 × $V_{CCI}$ | 0.5 × $V_{CCO}$ | $V_{OL}$ + 0.3V | $V_{OH}$ - 0.3V |
| 5.0V | $V_{CCI}$ | 0.5 × $V_{CCI}$ | 0.5 × $V_{CCO}$ | $V_{OL}$ + 0.3V | $V_{OH}$ - 0.3V |

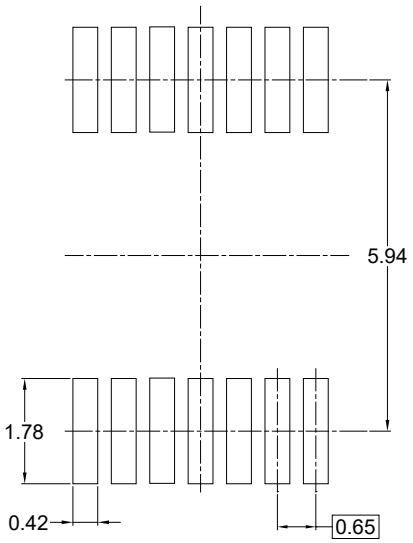
NOTES:

1. $V_{CCI}$ is the supply voltage associated with the data input ports.
2. $V_{CCO}$ is the supply voltage associated with the data output ports.
3. The measurement points should be $V_{IH}$ or $V_{IL}$ when the input rising or falling time exceeds 1ns.

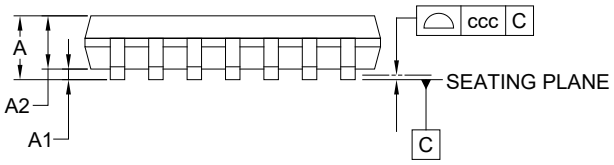
# PACKAGE OUTLINE DIMENSIONS

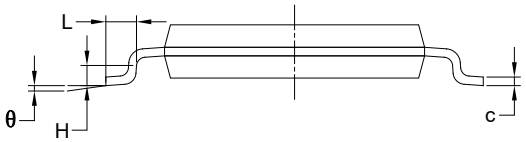
## TSSOP-14




**RECOMMENDED LAND PATTERN** (Unit: mm)



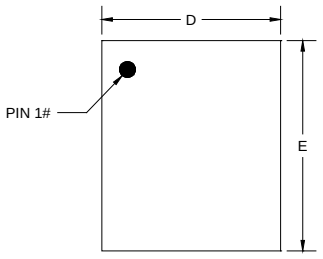




| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | - | - | 1.200 |
| A1 | 0.050 | - | 0.150 |
| A2 | 0.800 | - | 1.050 |
| b | 0.190 | - | 0.300 |
| c | 0.090 | - | 0.200 |
| D | 4.860 | - | 5.100 |
| E | 4.300 | - | 4.500 |
| E1 | 6.200 | - | 6.600 |
| e | 0.650 BSC | | |
| L | 0.450 | - | 0.750 |
| H | 0.250 TYP | | |
| θ | 0° | - | 8° |
| ccc | 0.100 | | |

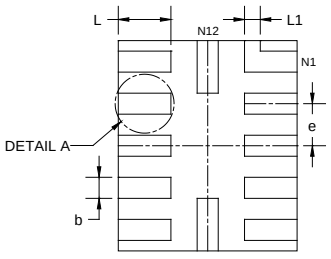
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

# PACKAGE OUTLINE DIMENSIONS

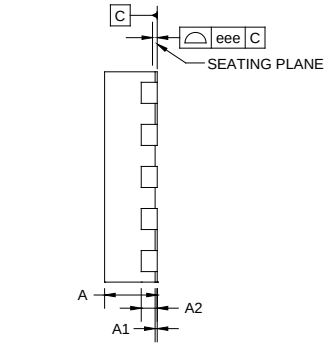
## UTQFN-1.7×2-12L



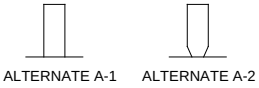

TOP VIEW



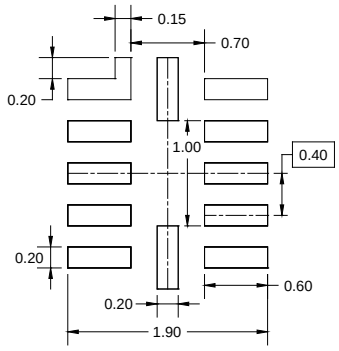

BOTTOM VIEW




SIDE VIEW




**DETAIL A**
ALTERNATE TERMINAL CONSTRUCTION



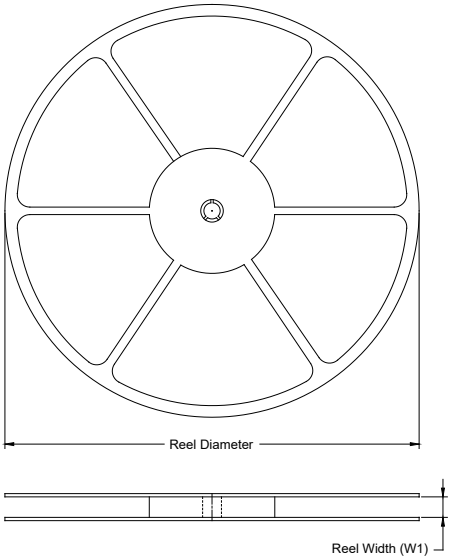

**RECOMMENDED LAND PATTERN** (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.450 | - | 0.550 |
| A1 | 0.000 | - | 0.050 |
| A2 | | 0.152 REF | |
| b | 0.150 | - | 0.250 |
| D | 1.600 | - | 1.800 |
| E | 1.900 | - | 2.100 |
| e | | 0.400 BSC | |
| L | 0.400 | - | 0.600 |
| L1 | 0.050 | | 0.250 |
| eee | | 0.080 | |

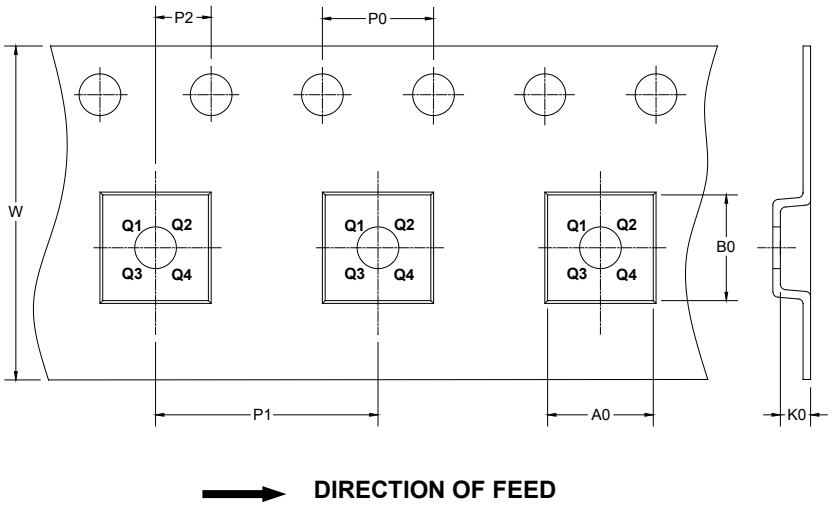
NOTE: This drawing is subject to change without notice.

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



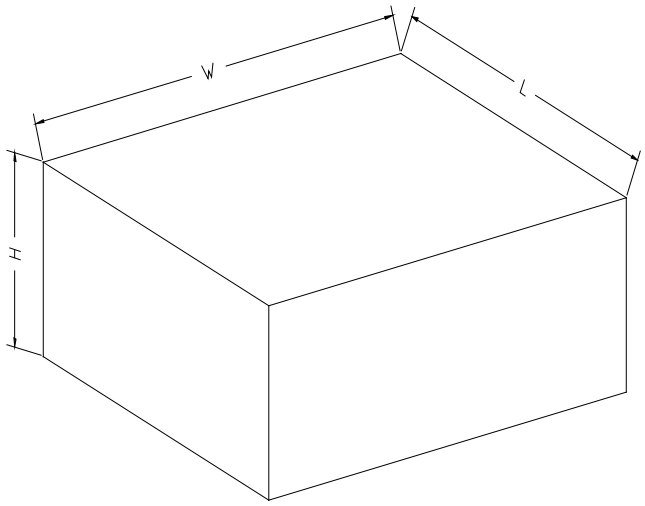

NOTE: The picture is only for reference. Please make the object as the standard.

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| TSSOP-14 | 13" | 12.4 | 6.80 | 5.40 | 1.50 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |
| UTQFN-1.7×2-12L | 7" | 9.5 | 1.90 | 2.30 | 0.75 | 4.0 | 4.0 | 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 |
| 13″ | 386 | 280 | 370 | 5 |

DD0002