74AHC14Q
Automotive, Hex Inverter with Schmitt-Trigger Inputs

GENERAL DESCRIPTION

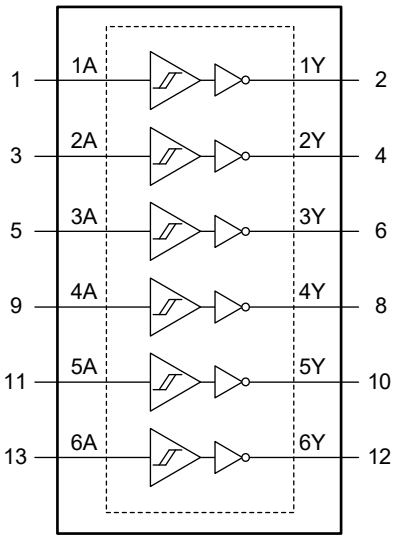
The 74AHC14Q is a hex inverter with Schmitt-Trigger inputs that is designed for 2.0V to 5.5V V_{CC} operation. The device implments the Boolean function Y = $\overline{A}$.

Each circuit can achieve the function of an independent inverter, but due to the influence of Schmitt-Trigger action, the inverters can provide different positive-going threshold voltage (V_{T+}) and negative-going threshold voltage (V_{T-}).

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

The 74AHC14Q is available in Green SOIC-14 and TSSOP-14 packages. It operates over an operating temperature range of -40℃ to +125℃.

LOGIC DIAGRAM



FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  Device Temperature Grade 1
  T_A = -40℃ to +125℃
- **Wide Operating Voltage Range: 2.0V to 5.5V**
- **Inputs Accept Voltages Higher than the Supply Voltage and up to 5.5V**
- **+8mA/-8mA Output Current**
- **All Inputs with Schmitt-Trigger**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOIC-14 and TSSOP-14 Packages**

APPLICATIONS

Automotive Applications
Synchronize Inverted Clock Inputs
Debounce Switches
Invert Digital Signals

FUNCTION TABLE

INPUT	OUTPUT
nA	nY
L	H
H	L

Y = $\overline{A}$

H = High Voltage Level

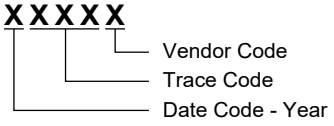
L = Low Voltage Level

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE TOP MARKING	PACKING OPTION
74AHC14Q	SOIC-14	-40℃ to +125℃	74AHC14QS14G/TR	16MS14 XXXXX	Tape and Reel, 2500
	TSSOP-14	-40℃ to +125℃	74AHC14QTS14G/TR	16H TS14 XXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace 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

Supply Voltage Range, V_{CC} ..... -0.5V to 7.0V
Input Voltage Range, V_I (1) ..... -0.5V to 7.0V
Output Voltage Range, V_O (1) -0.5V to MIN(7.0V, V_{CC} + 0.5V)
Input Clamp Current, I_{IK} (V_I < 0V) .....-20mA
Output Clamp Current, I_{OK} (V_O < 0V or V_O > V_{CC}).....±20mA
Continuous Output Current, I_O (V_O = 0V to V_{CC}) .....±25mA
Continuous Current through V_{CC} or GND.....±50mA
Junction Temperature (2) .....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....+260℃
ESD Susceptibility (3) (4)
HBM.....±4000V
CDM .....±1000V

NOTES:

1. The 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.

5. Unused input pins must be held at V_{CC} or GND to guarantee the device in normal operation.

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{CC}.....2.0V to 5.5V
Input Voltage Range, V_I (5) .....0V to 5.5V
Output Voltage Range, V_O.....0V to V_{CC}
Output Current, I_O..... ±8mA
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.

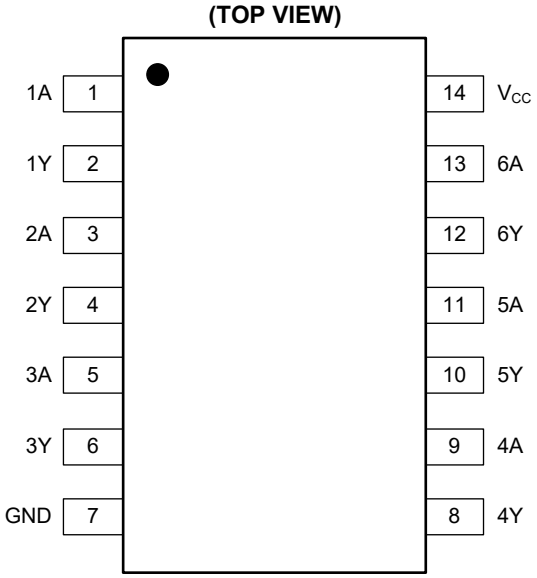
ESD SENSITIVITY CAUTION

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



PIN DESCRIPTION

PIN	NAME	FUNCTION
1, 3, 5, 9, 11, 13	1A, 2A, 3A, 4A, 5A, 6A	Data Inputs.
2, 4, 6, 8, 10, 12	1Y, 2Y, 3Y, 4Y, 5Y, 6Y	Data Outputs.
7	GND	Ground.
14	V_{CC}	Supply Voltage.

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
High-Level Output Voltage	V_{OH}	V_{CC} = 2.0V, I_{OH} = -50μA	Full	1.9	1.995		V
		V_{CC} = 3.0V, I_{OH} = -50μA	Full	2.9	2.995		
		V_{CC} = 4.5V, I_{OH} = -50μA	Full	4.4	4.495		
		V_{CC} = 3.0V, I_{OH} = -4mA	Full	2.6	2.850		
		V_{CC} = 4.5V, I_{OH} = -8mA	Full	4.0	4.250		
Low-Level Output Voltage	V_{OL}	V_{CC} = 2.0V, I_{OL} = 50μA	Full		0.005	0.1	V
		V_{CC} = 3.0V, I_{OL} = 50μA	Full		0.005	0.1	
		V_{CC} = 4.5V, I_{OL} = 50μA	Full		0.005	0.1	
		V_{CC} = 3.0V, I_{OL} = 4mA	Full		0.15	0.4	
		V_{CC} = 4.5V, I_{OL} = 8mA	Full		0.25	0.5	
Input Leakage Current	I_I	V_{CC} = 0V to 5.5V, V_I = 5.5V or GND	Full		±0.02	±1	μA
Supply Current	I_{CC}	V_{CC} = 5.5V, V_I = V_{CC} or GND, I_O = 0A	Full		0.02	20	μA
Input Capacitance	C_I	V_{CC} = 5.0V, V_I = V_{CC} or GND	+25℃		4		pF

DYNAMIC CHARACTERISTICS

(See Figure 1 for test circuit. Full = -40℃ to +125℃, all typical values are measured at V_{CC} = 3.3V and 5.0V respectively, T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN (1)	TYP	MAX (1)	UNITS
Low-to-High Propagation Delay	t_{PLH}	V_{CC} = 3.3V ± 0.3V, see Figure 2	C_L = 15pF	Full	0.5	4.4	8.7	ns
			C_L = 50pF	Full	1.0	6.7	14.1	
		V_{CC} = 5.0V ± 0.5V, see Figure 2	C_L = 15pF	Full	0.5	3.2	6.0	
			C_L = 50pF	Full	0.5	4.6	9.0	
High-to-Low Propagation Delay	t_{PHL}	V_{CC} = 3.3V ± 0.3V, see Figure 2	C_L = 15pF	Full	0.5	4.1	8.1	ns
			C_L = 50pF	Full	1.0	5.7	10.5	
		V_{CC} = 5.0V ± 0.5V, see Figure 2	C_L = 15pF	Full	0.5	3.1	5.7	
			C_L = 50pF	Full	0.5	4.3	7.6	
Power Dissipation Capacitance (2)	C_{PD}	V_{CC} = 5.0V, no load, f_i = 1MHz		+25℃		8		pF

NOTES:

1. Specified by design and characterization, not production tested.

2. C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$

where:

f_i = Input frequency in MHz.

f_o = Output frequency in MHz.

C_L = Output load capacitance in pF.

V_{CC} = Supply voltage in Volts.

N = Number of inputs switching.

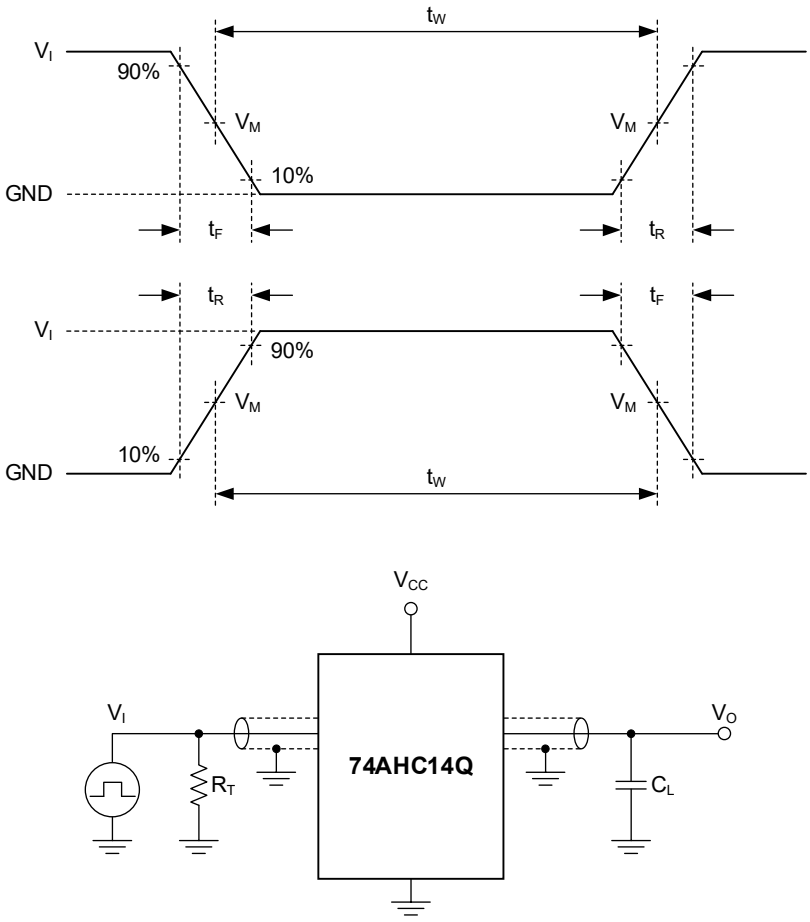
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = Sum of the outputs.

TRANSFER CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Positive-Going Threshold Voltage	V_{T+}	V_{CC} = 3.0V	Full	1.20	1.85	2.20	V
		V_{CC} = 4.5V	Full	1.75	2.65	3.15	
		V_{CC} = 5.5V	Full	2.15	3.15	3.85	
Negative-Going Threshold Voltage	V_{T-}	V_{CC} = 3.0V	Full	0.90	1.25	1.90	V
		V_{CC} = 4.5V	Full	1.35	1.90	2.75	
		V_{CC} = 5.5V	Full	1.65	2.30	3.35	
Hysteresis Voltage	V_H	V_{CC} = 3.0V	Full	0.25	0.60	1.20	V
		V_{CC} = 4.5V	Full	0.35	0.75	1.40	
		V_{CC} = 5.5V	Full	0.45	0.85	1.60	

TEST CIRCUIT



Test conditions are given in Table 1.

Definitions for test circuit:

C_L: Load capacitance (includes jig and probe).

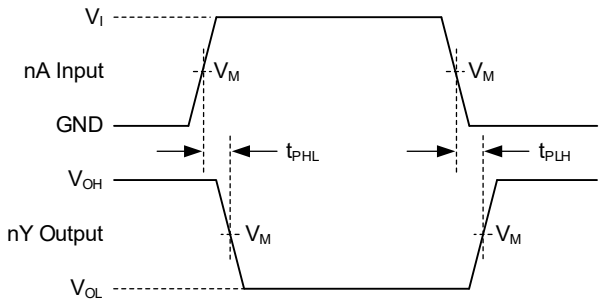
R_T: Termination resistance (equals to output impedance Z_O of the pulse generator).

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

SUPPLY VOLTAGE	INPUT		LOAD	TEST
V_{CC}	V_I	t_R, t_F	C_L	
2.0V to 5.5V	V_{CC}	≤ 3.0ns	15pF, 50pF	t_{PHL}, t_{PLH}

WAVEFORMS



Test conditions are given in Table 1.

Measurement points are given in Table 2.

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

Figure 2. Input (nA) to Output (nY) Propagation Delay Times

Table 2. Measurement Points

SUPPLY VOLTAGE	INPUT		OUTPUT
V_{CC}	V_I	V_M (1)	V_M
2.0V to 5.5V	V_{CC}	0.5 × V_{CC}	0.5 × V_{CC}

NOTE:

1. The measurement points should be V_{IH} or V_{IL} when the input rising or falling time exceeds 3.0ns.

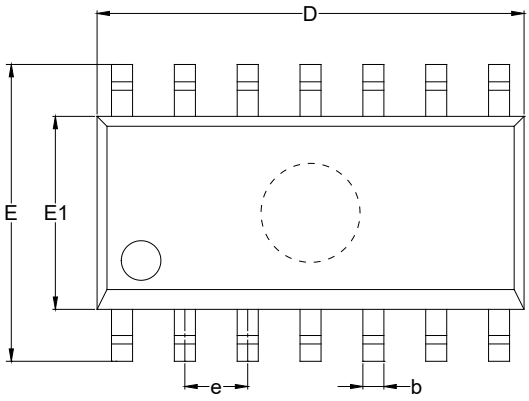
REVISION HISTORY

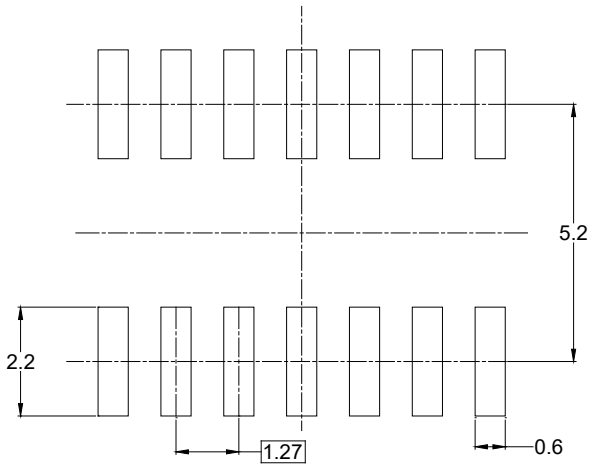
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (DECEMBER 2024) to REV.A	Page
Changed from product preview to production data	All

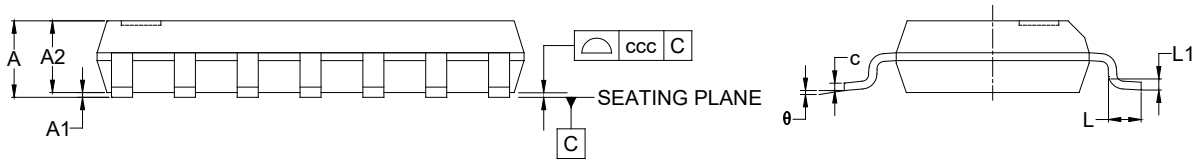
PACKAGE OUTLINE DIMENSIONS

SOIC-14





RECOMMENDED LAND PATTERN (Unit: mm)

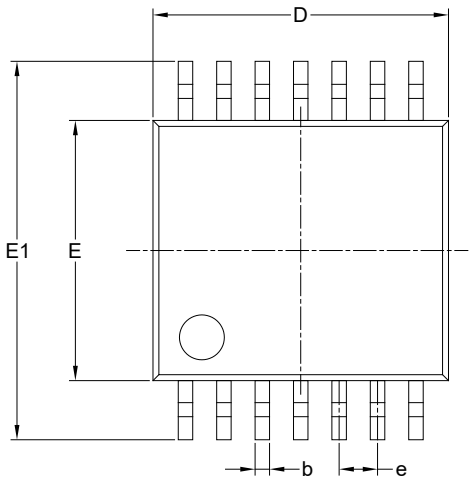


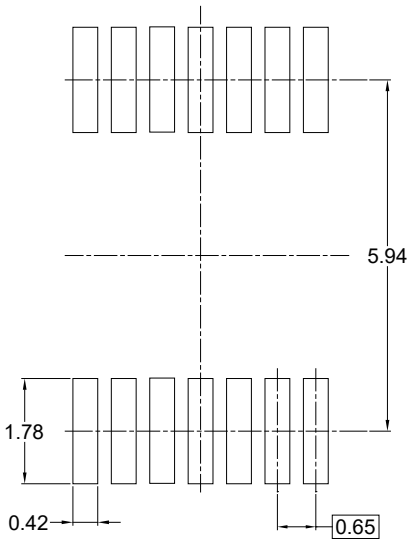
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.750
A1	0.100	-	0.250
A2	1.250	-	-
b	0.310	-	0.510
c	0.100	-	0.250
D	8.450	-	8.850
E	5.800	-	6.200
E1	3.800	-	4.000
e	1.270 BSC		
L	0.400	-	1.270
L1	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

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 MS-012.

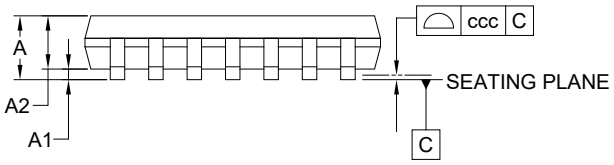
PACKAGE OUTLINE DIMENSIONS

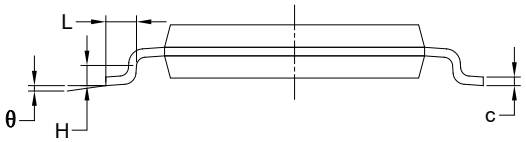
TSSOP-14





RECOMMENDED LAND PATTERN (Unit: mm)



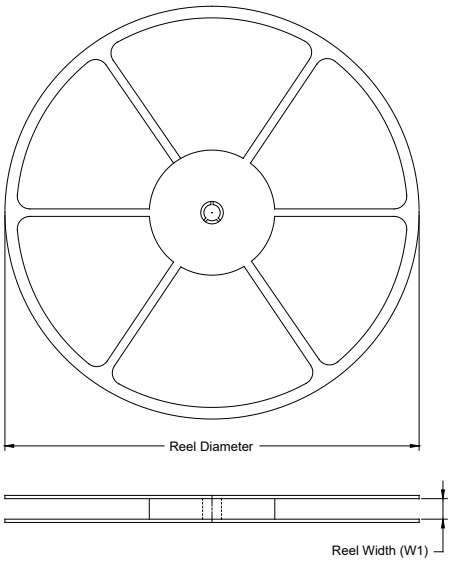


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	4.860	-	5.100
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

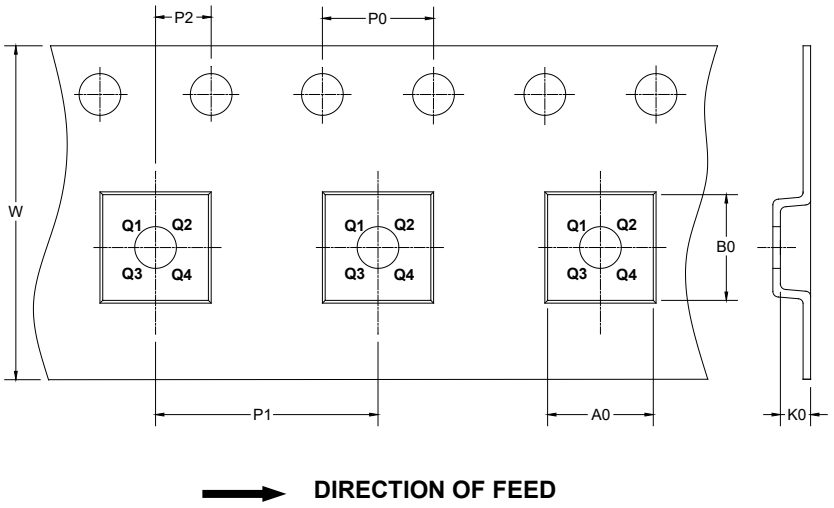
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



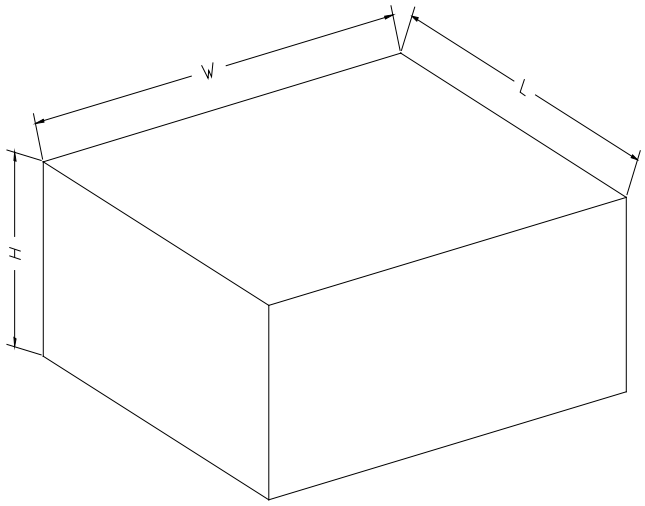
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOIC-14	13″	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP-14	13″	12.4	6.80	5.40	1.50	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