# 74AHC14Q
# Automotive, Hex Inverter with Schmitt-Trigger Inputs

## GENERAL DESCRIPTION

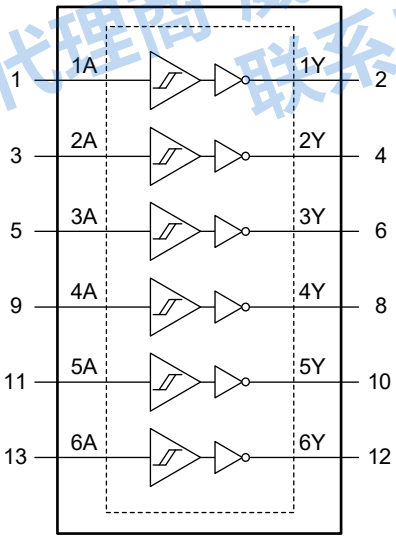
The 74AHC14Q is a hex inverter with Schmitt-Trigger inputs that is designed for 2.0V to 5.5V $V_{CC}$ operation. The device implments the Boolean function Y = $\overline{A}$.

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

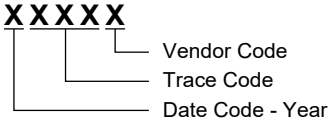
代理商 威尔迈 www.viavie.com 联系电话 138 2526 5270

# 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<br>XXXXX | Tape and Reel, 2500 |
| | TSSOP-14 | -40℃ to +125℃ | 74AHC14QTS14G/TR | 16H<br>TS14<br>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.

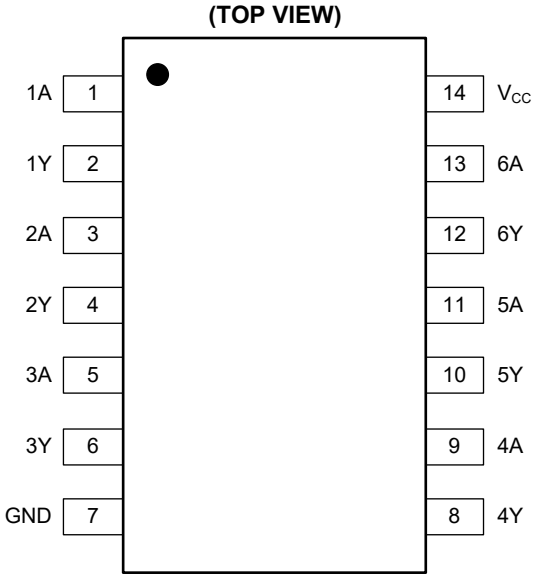
## ESD SENSITIVITY CAUTION

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.

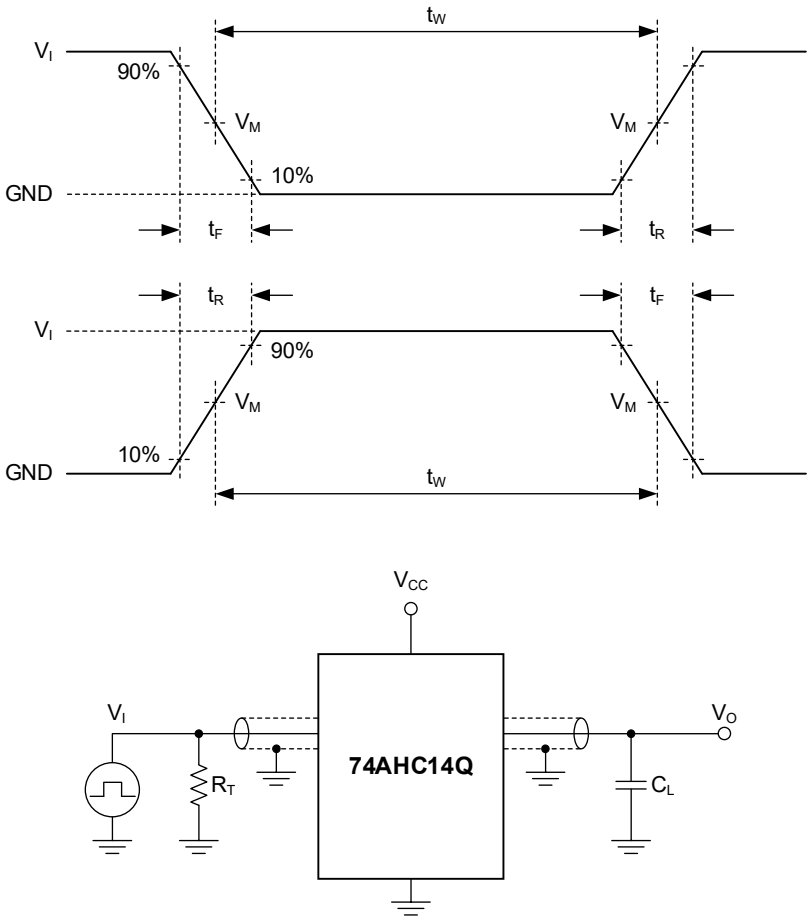
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = Sum of the outputs.

## 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).

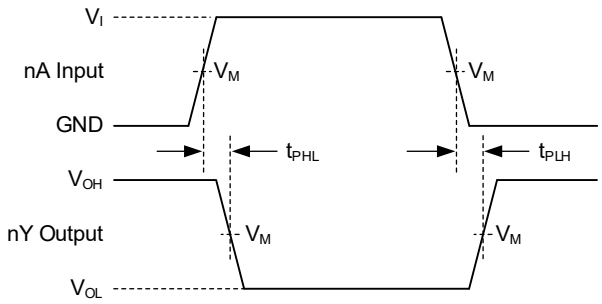
$R_T$: Termination resistance (equals to output impedance $Z_O$ of the pulse generator).

**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.

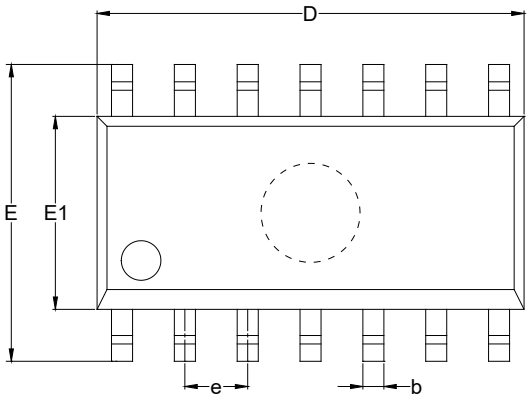
## REVISION HISTORY

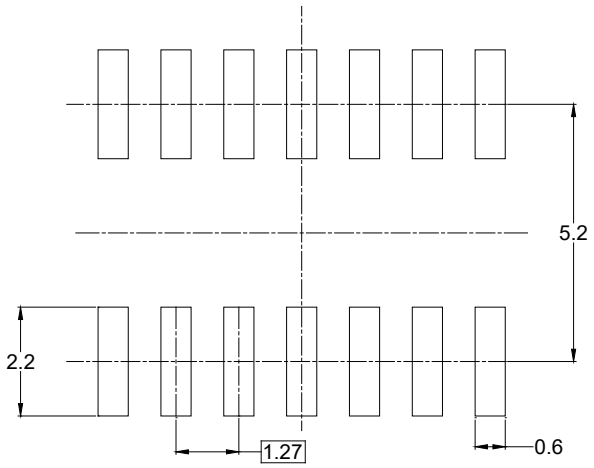
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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

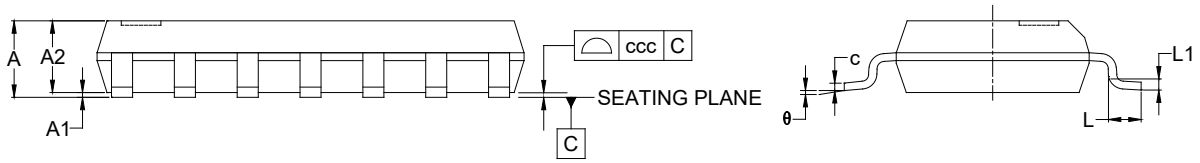
# PACKAGE OUTLINE DIMENSIONS

## SOIC-14




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

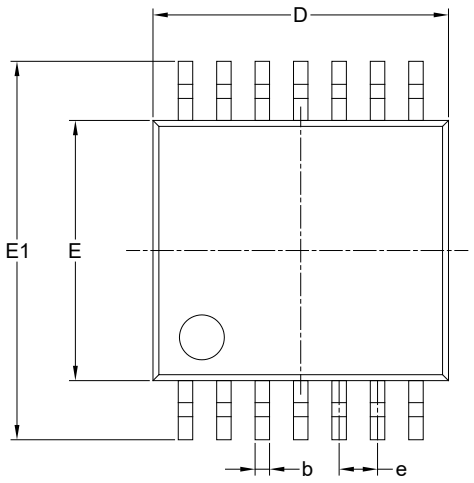


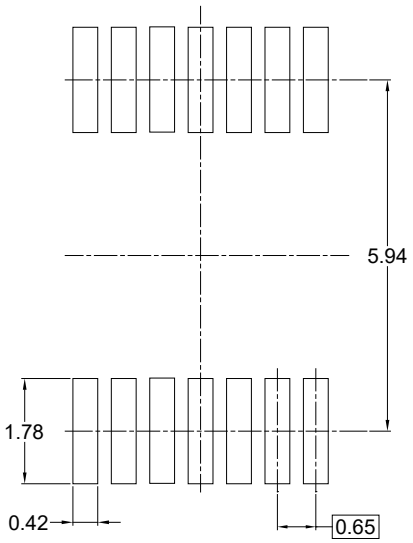

| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | - | - | 1.750 |
| A1 | 0.100 | - | 0.250 |
| A2 | 1.250 | - | - |
| b | 0.310 | - | 0.510 |
| c | 0.100 | - | 0.250 |
| D | 8.450 | - | 8.850 |
| E | 5.800 | - | 6.200 |
| E1 | 3.800 | - | 4.000 |
| e | 1.270 BSC | | |
| 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.

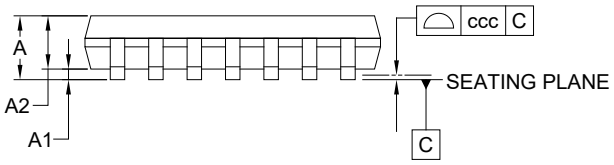
# PACKAGE OUTLINE DIMENSIONS

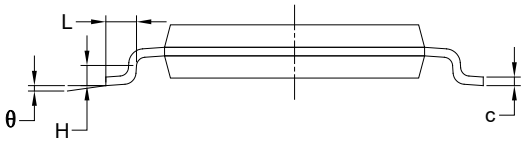
## TSSOP-14




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



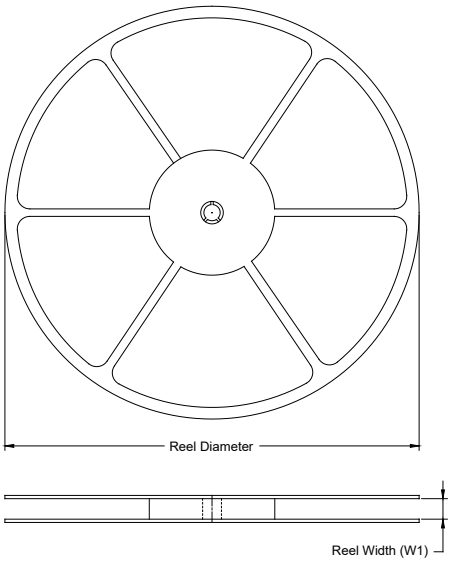




| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | - | - | 1.200 |
| A1 | 0.050 | - | 0.150 |
| A2 | 0.800 | - | 1.050 |
| b | 0.190 | - | 0.300 |
| c | 0.090 | - | 0.200 |
| D | 4.860 | - | 5.100 |
| E | 4.300 | - | 4.500 |
| E1 | 6.200 | - | 6.600 |
| e | 0.650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

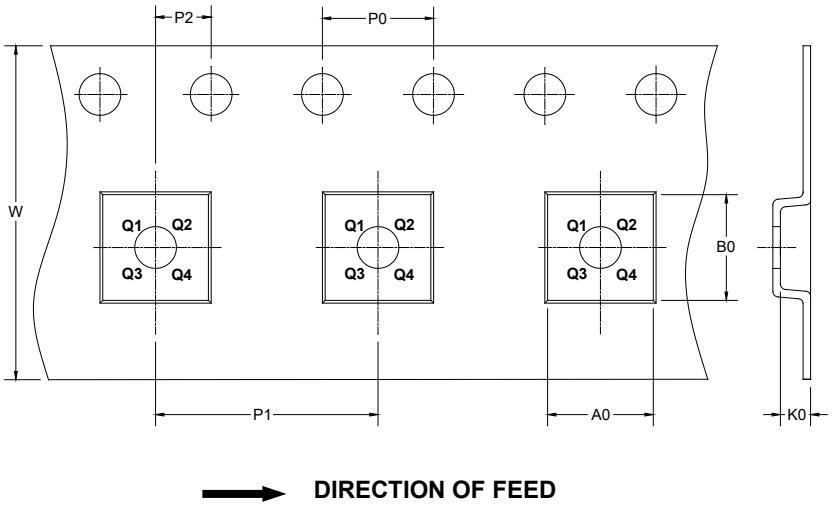
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

# TAPE AND REEL INFORMATION

## REEL DIMENSIONS




## TAPE DIMENSIONS



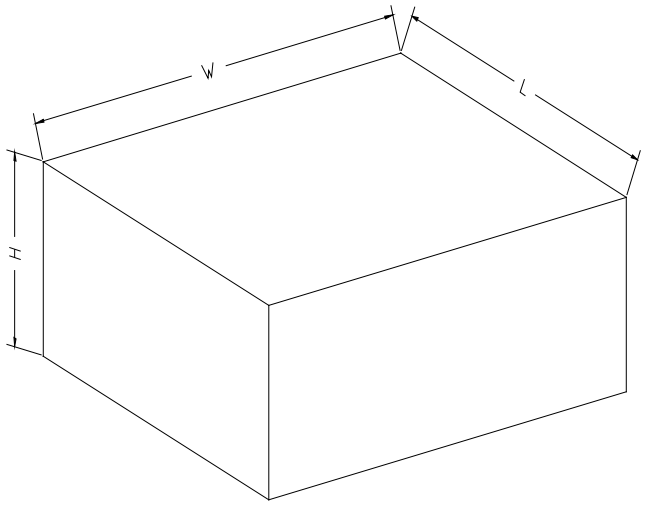

NOTE: The picture is only for reference. Please make the object as the standard.

## 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