

# 74LVC08

## Quad 2-Input AND Gate

### GENERAL DESCRIPTION

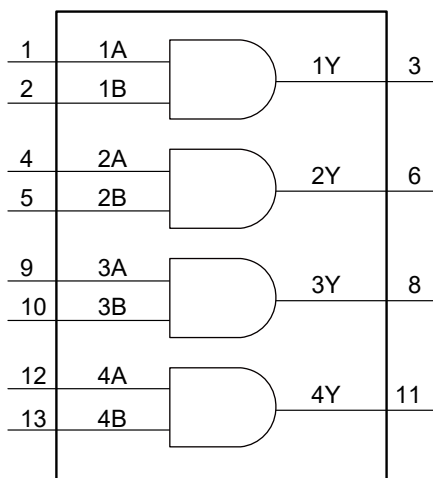
The 74LVC08 provides four 2-input AND gates that is designed for 1.2V to 3.6V  $V_{CC}$  operation. The device performs the Boolean function  $Y = A \cdot B$  or  $Y = \overline{\overline{A} + \overline{B}}$  in positive logic.

Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in mixed 3.3V and 5V applications.

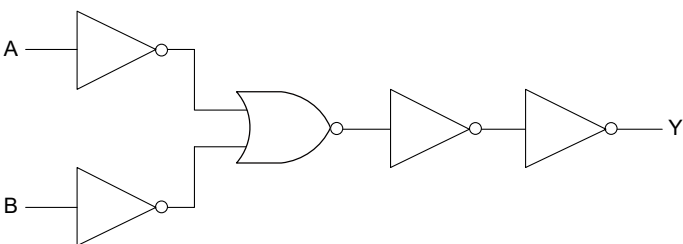
### FEATURES

- 5V Tolerant Inputs for Interfacing with 5V Logic
- Wide Supply Voltage Range: 1.2V to 3.6V
- CMOS Low Power Consumption
- Direct Interface with TTL Levels
- -40°C to +125°C Operating Temperature Range
- Available in Green SOIC-14 and TSSOP-14 Packages

### LOGIC SYMBOL



### LOGIC DIAGRAM



### FUNCTION TABLE

| INPUT |    | OUTPUT |
|-------|----|--------|
| nA    | nB | nY     |
| L     | X  | L      |
| X     | L  | L      |
| H     | H  | H      |

$$Y = A \cdot B \text{ or } Y = \overline{\overline{A} + \overline{B}}$$

H = High Voltage Level

L = Low Voltage Level

X = Don't Care

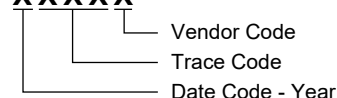
## PACKAGE/ORDERING INFORMATION

| MODEL   | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER  | PACKAGE MARKING           | PACKING OPTION      |
|---------|---------------------|-----------------------------|------------------|---------------------------|---------------------|
| 74LVC08 | SOIC-14             | -40°C to +125°C             | 74LVC08XS14G/TR  | 74LVC08XS14<br>XXXXX      | Tape and Reel, 2500 |
|         | TSSOP-14            | -40°C to +125°C             | 74LVC08XTS14G/TR | 74LVC08<br>XTS14<br>XXXXX | Tape and Reel, 4000 |

## MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

**XXXXX**



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 <sup>(1)</sup>

|                                                                         |                          |
|-------------------------------------------------------------------------|--------------------------|
| Supply Voltage, $V_{CC}$ .....                                          | -0.5V to 6.5V            |
| Input Voltage, $V_I$ <sup>(2)</sup> .....                               | -0.5V to 6.5V            |
| Output Voltage, $V_O$ <sup>(2)</sup> .....                              | -0.5V to $V_{CC} + 0.5V$ |
| Input Clamping Current, $I_{IK}$ ( $V_I < 0V$ ).....                    | -50mA                    |
| Output Clamping Current, $I_{OK}$ ( $V_O > V_{CC}$ or $V_O < 0V$ )..... | ±50mA                    |
| Output Current, $I_O$ ( $V_O = 0V$ to $V_{CC}$ ).....                   | ±50mA                    |
| Supply Current, $I_{CC}$ .....                                          | 100mA                    |
| Ground Current, $I_{GND}$ .....                                         | -100mA                   |
| Junction Temperature <sup>(3)</sup> .....                               | +150°C                   |
| Storage Temperature Range.....                                          | -65°C to +150°C          |
| Lead Temperature (Soldering, 10s).....                                  | +260°C                   |
| ESD Susceptibility                                                      |                          |
| HBM.....                                                                | 6000V                    |
| CDM.....                                                                | 1000V                    |

## RECOMMENDED OPERATING CONDITIONS

|                                                          |                 |
|----------------------------------------------------------|-----------------|
| Supply Voltage, $V_{CC}$ .....                           | 1.65V to 3.6V   |
| Data Retention Only, $V_{CC}$ .....                      | 1.2V to 3.6V    |
| Input Voltage, $V_I$ .....                               | 0V to 5.5V      |
| Output Voltage, $V_O$ .....                              | 0V to $V_{CC}$  |
| Input Transition Rise and Fall Rate, $\Delta t/\Delta V$ |                 |
| $V_{CC} = 1.65V$ to $2.7V$ .....                         | 20ns/V (MAX)    |
| $V_{CC} = 2.7V$ to $3.6V$ .....                          | 10ns/V (MAX)    |
| Operating Temperature Range.....                         | -40°C to +125°C |

## OVERSTRESS CAUTION

1. 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.
2. The input and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.
3. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

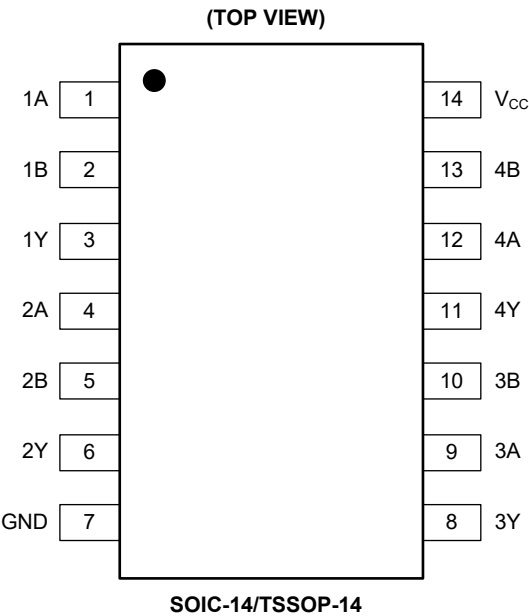
## ESD SENSITIVITY CAUTION

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



PIN DESCRIPTION

| PIN          | NAME            | FUNCTION        |
|--------------|-----------------|-----------------|
| 1, 4, 9, 12  | 1A, 2A, 3A, 4A  | Data Inputs.    |
| 2, 5, 10, 13 | 1B, 2B, 3B, 4B  | Data Inputs.    |
| 3, 6, 8, 11  | 1Y, 2Y, 3Y, 4Y  | Data Outputs.   |
| 7            | GND             | Ground.         |
| 14           | V <sub>CC</sub> | Supply Voltage. |

**ELECTRICAL CHARACTERISTICS**(Full = -40°C to +125°C, all typical values are measured at  $V_{CC} = 3.3V$  and  $T_A = +25^\circ C$ , unless otherwise noted.)

| PARAMETER                 | SYMBOL          | CONDITIONS                                                                       |                                                | TEMP  | MIN                  | TYP              | MAX                  | UNITS   |
|---------------------------|-----------------|----------------------------------------------------------------------------------|------------------------------------------------|-------|----------------------|------------------|----------------------|---------|
| High-Level Input Voltage  | $V_{IH}$        | $V_{CC} = 1.2V$                                                                  |                                                | Full  | 1.08                 |                  |                      | V       |
|                           |                 | $V_{CC} = 1.65V$ to $1.95V$                                                      |                                                | Full  | $0.65 \times V_{CC}$ |                  |                      |         |
|                           |                 | $V_{CC} = 2.3V$ to $2.7V$                                                        |                                                | Full  | 1.7                  |                  |                      |         |
|                           |                 | $V_{CC} = 2.7V$ to $3.6V$                                                        |                                                | Full  | 2                    |                  |                      |         |
| Low-Level Input Voltage   | $V_{IL}$        | $V_{CC} = 1.2V$                                                                  |                                                | Full  |                      |                  | 0.12                 | V       |
|                           |                 | $V_{CC} = 1.65V$ to $1.95V$                                                      |                                                | Full  |                      |                  | $0.35 \times V_{CC}$ |         |
|                           |                 | $V_{CC} = 2.3V$ to $2.7V$                                                        |                                                | Full  |                      |                  | 0.7                  |         |
|                           |                 | $V_{CC} = 2.7V$ to $3.6V$                                                        |                                                | Full  |                      |                  | 0.8                  |         |
| High-Level Output Voltage | $V_{OH}$        | $V_I = V_{IH}$ or $V_{IL}$                                                       | $V_{CC} = 1.65V$ to $3.6V$ , $I_O = -100\mu A$ | Full  | $V_{CC} - 0.05$      | $V_{CC} - 0.005$ |                      | V       |
|                           |                 |                                                                                  | $V_{CC} = 1.65V$ , $I_O = -4mA$                | Full  | 1.45                 | 1.57             |                      |         |
|                           |                 |                                                                                  | $V_{CC} = 2.3V$ , $I_O = -8mA$                 | Full  | 2.05                 | 2.20             |                      |         |
|                           |                 |                                                                                  | $V_{CC} = 2.7V$ , $I_O = -12mA$                | Full  | 2.35                 | 2.57             |                      |         |
|                           |                 |                                                                                  | $V_{CC} = 3.0V$ , $I_O = -18mA$                | Full  | 2.55                 | 2.82             |                      |         |
|                           |                 |                                                                                  | $V_{CC} = 3.0V$ , $I_O = -24mA$                | Full  | 2.45                 | 2.76             |                      |         |
| Low-Level Output Voltage  | $V_{OL}$        | $V_I = V_{IH}$ or $V_{IL}$                                                       | $V_{CC} = 1.65V$ to $3.6V$ , $I_O = 100\mu A$  | Full  |                      | 0.005            | 0.05                 | V       |
|                           |                 |                                                                                  | $V_{CC} = 1.65V$ , $I_O = 4mA$                 | Full  |                      | 0.05             | 0.20                 |         |
|                           |                 |                                                                                  | $V_{CC} = 2.3V$ , $I_O = 8mA$                  | Full  |                      | 0.09             | 0.25                 |         |
|                           |                 |                                                                                  | $V_{CC} = 2.7V$ , $I_O = 12mA$                 | Full  |                      | 0.12             | 0.30                 |         |
|                           |                 |                                                                                  | $V_{CC} = 3.0V$ , $I_O = 24mA$                 | Full  |                      | 0.24             | 0.55                 |         |
| Input Leakage Current     | $I_I$           | $V_{CC} = 3.6V$ , $V_I = 5.5V$ or GND                                            |                                                | Full  |                      | $\pm 0.05$       | $\pm 10$             | $\mu A$ |
| Supply Current            | $I_{CC}$        | $V_{CC} = 3.6V$ , $V_I = V_{CC}$ or GND, $I_O = 0A$                              |                                                | Full  |                      | 0.05             | 20                   | $\mu A$ |
| Additional Supply Current | $\Delta I_{CC}$ | Per input pin, $V_{CC} = 2.7V$ to $3.6V$ ,<br>$V_I = V_{CC} - 0.6V$ , $I_O = 0A$ |                                                | Full  |                      | 0.1              | 4000                 | $\mu A$ |
| Input Capacitance         | $C_I$           | $V_{CC} = 0V$ to $3.6V$ , $V_I = GND$ to $V_{CC}$                                |                                                | +25°C |                      | 6                |                      | pF      |

## DYNAMIC CHARACTERISTICS

(For test circuit, see Figure 1. All typical values are measured at  $T_A = +25^\circ\text{C}$  and  $V_{CC} = 1.2\text{V}, 1.65\text{V}, 1.95\text{V}, 2.3\text{V}, 2.7\text{V}, 3.0\text{V}$  and  $3.6\text{V}$  respectively, unless otherwise noted.)

| PARAMETER                                    | SYMBOL      | CONDITIONS                                  | TEMP                                     | MIN   | TYP | MAX | UNITS |
|----------------------------------------------|-------------|---------------------------------------------|------------------------------------------|-------|-----|-----|-------|
| Propagation Delay <sup>(1)</sup>             | $t_{PD}$    | nA, nB to nY,<br>see Figure 2               | $V_{CC} = 1.2\text{V}$                   | +25°C | 14  |     | ns    |
|                                              |             |                                             | $V_{CC} = 1.65\text{V to } 1.95\text{V}$ | +25°C | 7   |     |       |
|                                              |             |                                             | $V_{CC} = 2.3\text{V to } 2.7\text{V}$   | +25°C | 5   |     |       |
|                                              |             |                                             | $V_{CC} = 2.7\text{V}$                   | +25°C | 4.5 |     |       |
|                                              |             |                                             | $V_{CC} = 3.0\text{V to } 3.6\text{V}$   | +25°C | 4   |     |       |
| Output Skew Time                             | $t_{SK(O)}$ | $V_{CC} = 3.0\text{V to } 3.6\text{V}$      | +25°C                                    |       | 0.5 |     | ns    |
| Power Dissipation Capacitance <sup>(2)</sup> | $C_{PD}$    | Per input,<br>$V_I = \text{GND to } V_{CC}$ | $V_{CC} = 1.65\text{V to } 1.95\text{V}$ | +25°C | 13  |     | pF    |
|                                              |             |                                             | $V_{CC} = 2.3\text{V to } 2.7\text{V}$   | +25°C | 13  |     |       |
|                                              |             |                                             | $V_{CC} = 3.0\text{V to } 3.6\text{V}$   | +25°C | 13  |     |       |

### NOTES:

- $t_{PD}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
- $C_{PD}$  is used to determine the dynamic power dissipation (PD in  $\mu\text{W}$ ).

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

where:

$f_i$  = input frequency in MHz.

$f_o$  = output frequency in MHz.

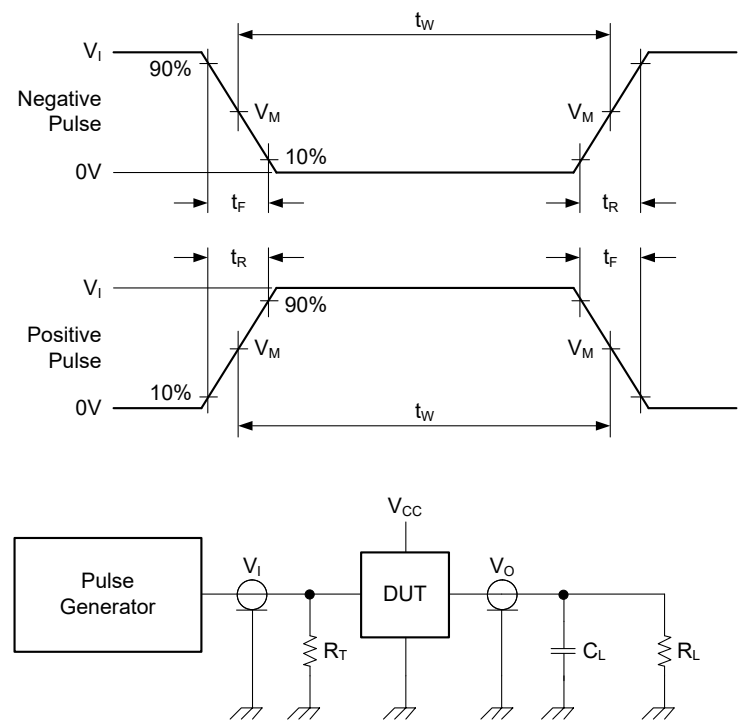
$C_L$  = output load capacitance in pF.

$V_{CC}$  = supply voltage in Volts.

$N$  = number of inputs switching.

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

TEST CIRCUIT



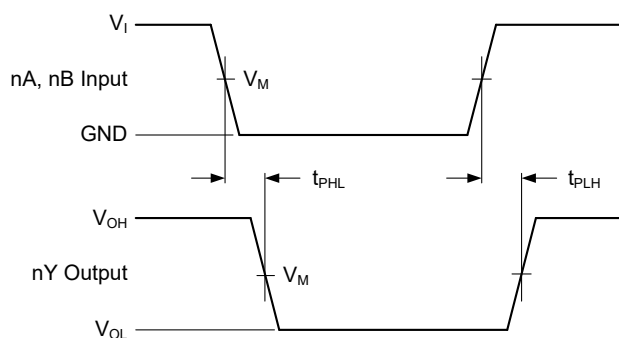
Test conditions are given in Table 1.  
Definitions for test circuit:  
 $R_L$  = Load resistance.  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_O$  of the pulse generator.

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

| SUPPLY VOLTAGE |          | INPUT               |       | LOAD         |  |
|----------------|----------|---------------------|-------|--------------|--|
| $V_{CC}$       | $V_I$    | $t_R, t_F$          | $C_L$ | $R_L$        |  |
| 1.2V           | $V_{CC}$ | $\leq 2\text{ns}$   | 30pF  | 1k $\Omega$  |  |
| 1.65V to 1.95V | $V_{CC}$ | $\leq 2\text{ns}$   | 30pF  | 1k $\Omega$  |  |
| 2.3V to 2.7V   | $V_{CC}$ | $\leq 2\text{ns}$   | 30pF  | 500 $\Omega$ |  |
| 2.7V           | 2.7V     | $\leq 2.5\text{ns}$ | 50pF  | 500 $\Omega$ |  |
| 3.0V to 3.6V   | 2.7V     | $\leq 2.5\text{ns}$ | 50pF  | 500 $\Omega$ |  |

## WAVEFORMS



Test conditions are given in Table 1.

$V_M = 1.5V$  at  $V_{CC} \geq 2.7V$ .

$V_M = 0.5 \times V_{CC}$  at  $V_{CC} < 2.7V$ .

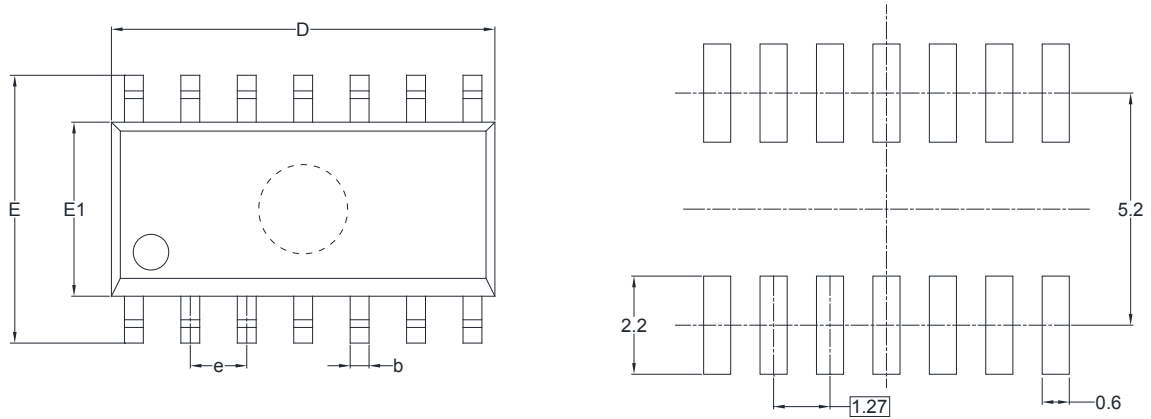
Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

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

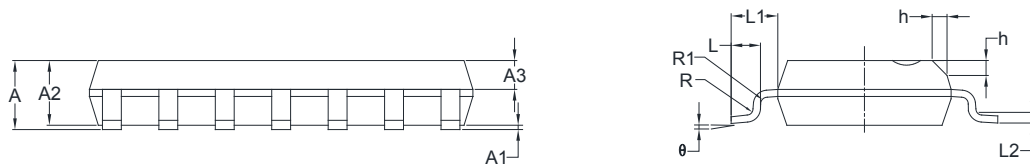
## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

#### SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)



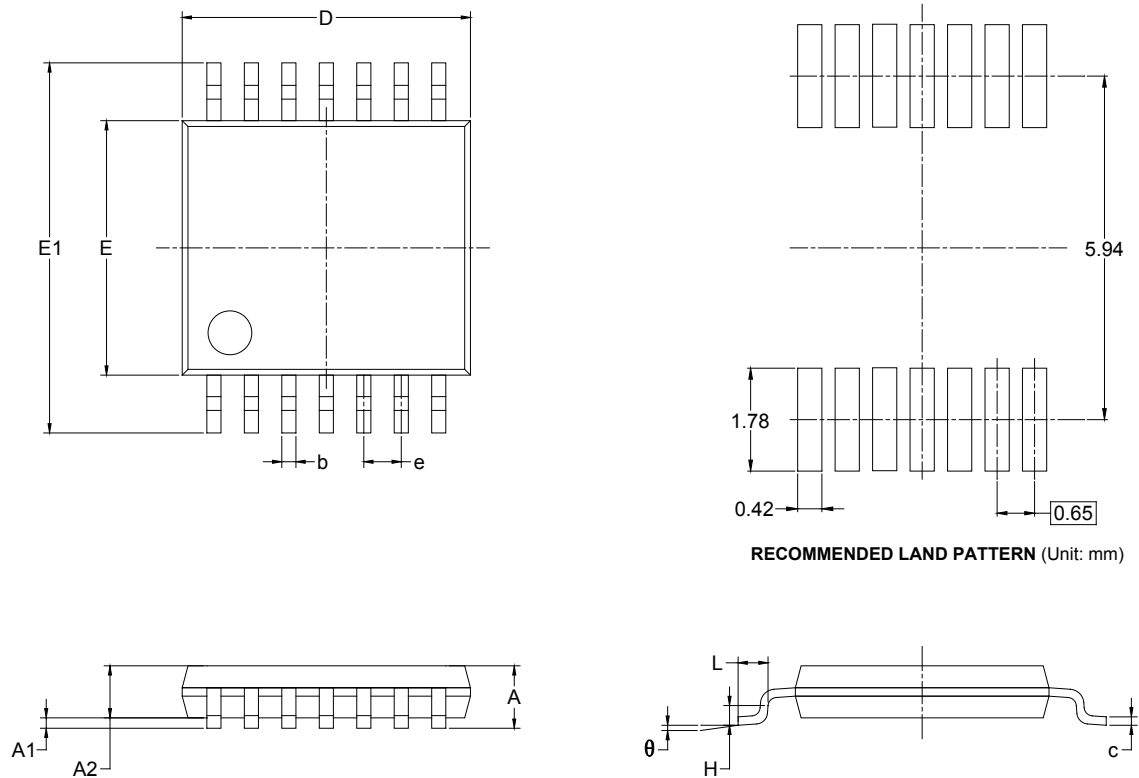
| Symbol | Dimensions<br>In Millimeters |      | Dimensions<br>In Inches |       |
|--------|------------------------------|------|-------------------------|-------|
|        | MIN                          | MAX  | MIN                     | MAX   |
| A      | 1.35                         | 1.75 | 0.053                   | 0.069 |
| A1     | 0.10                         | 0.25 | 0.004                   | 0.010 |
| A2     | 1.25                         | 1.65 | 0.049                   | 0.065 |
| A3     | 0.55                         | 0.75 | 0.022                   | 0.030 |
| b      | 0.36                         | 0.49 | 0.014                   | 0.019 |
| D      | 8.53                         | 8.73 | 0.336                   | 0.344 |
| E      | 5.80                         | 6.20 | 0.228                   | 0.244 |
| E1     | 3.80                         | 4.00 | 0.150                   | 0.157 |
| e      | 1.27 BSC                     |      | 0.050 BSC               |       |
| L      | 0.45                         | 0.80 | 0.018                   | 0.032 |
| L1     | 1.04 REF                     |      | 0.040 REF               |       |
| L2     | 0.25 BSC                     |      | 0.01 BSC                |       |
| R      | 0.07                         |      | 0.003                   |       |
| R1     | 0.07                         |      | 0.003                   |       |
| h      | 0.30                         | 0.50 | 0.012                   | 0.020 |
| θ      | 0°                           | 8°   | 0°                      | 8°    |



## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

#### TSSOP-14

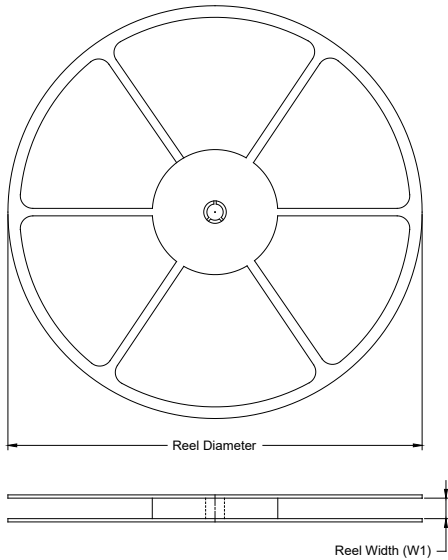


| Symbol   | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|----------|------------------------------|-------|-------------------------|-------|
|          | MIN                          | MAX   | MIN                     | MAX   |
| A        |                              | 1.200 |                         | 0.047 |
| A1       | 0.050                        | 0.150 | 0.002                   | 0.006 |
| A2       | 0.800                        | 1.050 | 0.031                   | 0.041 |
| b        | 0.190                        | 0.300 | 0.007                   | 0.012 |
| c        | 0.090                        | 0.200 | 0.004                   | 0.008 |
| D        | 4.860                        | 5.100 | 0.191                   | 0.201 |
| E        | 4.300                        | 4.500 | 0.169                   | 0.177 |
| E1       | 6.250                        | 6.550 | 0.246                   | 0.258 |
| e        | 0.650 BSC                    |       | 0.026 BSC               |       |
| L        | 0.500                        | 0.700 | 0.02                    | 0.028 |
| H        | 0.25 TYP                     |       | 0.01 TYP                |       |
| $\theta$ | 1°                           | 7°    | 1°                      | 7°    |

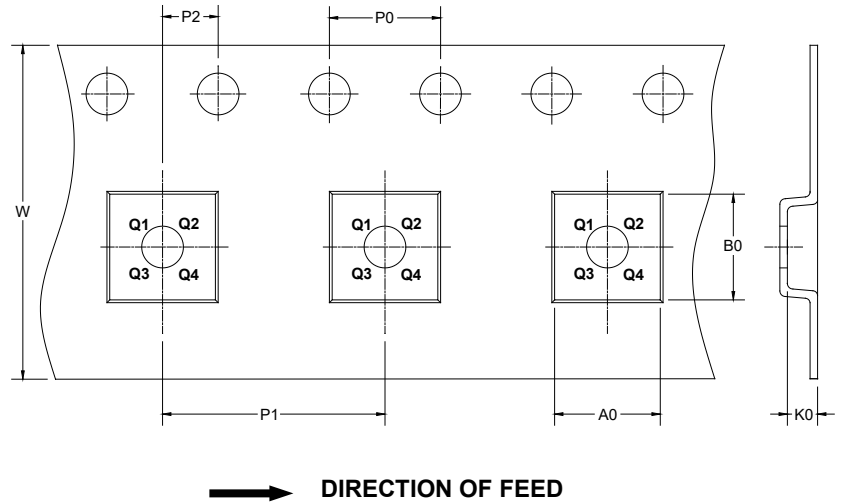
## PACKAGE INFORMATION

### TAPE AND REEL INFORMATION

#### REEL DIMENSIONS



#### TAPE DIMENSIONS



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

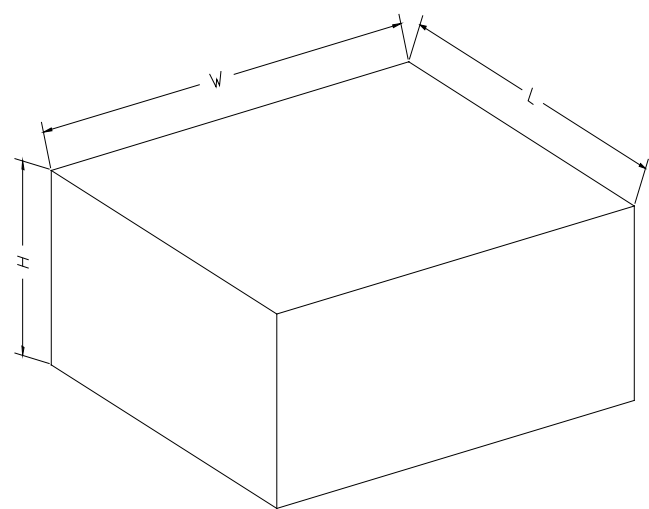
#### KEY PARAMETER LIST OF TAPE AND REEL

| 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               | 6.95    | 5.60    | 1.20    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |

DD0001

# 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 |
|-----------|-------------|------------|-------------|--------------|
| 13"       | 386         | 280        | 370         | 5            |

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