

# 74LV1T08

## Single 2-Input Translating AND Gate

### GENERAL DESCRIPTION

The 74LV1T08 is a single level translating 2-input AND gate that is designed for 1.6V to 5.5V  $V_{CC}$  operation. The input is designed with a low threshold circuit to match 1.8V input logic at  $V_{CC} = 3.3V$  and can be used in 1.8V to 3.3V level up translation. In addition, the 5V tolerant input pins enable level down translation (for example, 3.3V to 2.5V output at  $V_{CC} = 2.5V$ ). The output level is referenced to the supply voltage and supports 1.8V, 2.5V, 3.3V and 5.0V CMOS levels. The wide  $V_{CC}$  range allows the generation of output levels to connect to controllers or processors.

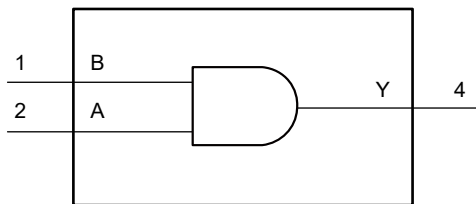
### APPLICATIONS

Portable Applications  
PC and Notebooks  
Automotive  
Industrial Controllers  
Telecom

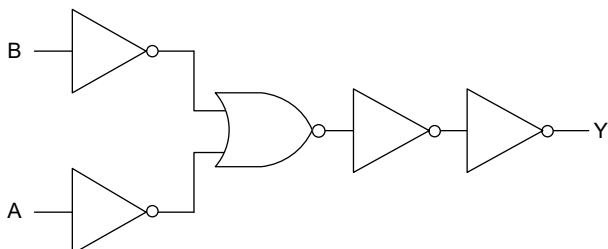
### FEATURES

- Single Supply Voltage Translator at 1.8V, 2.5V, 3.3V and 5.0V
- Up Translation:
  - 1.2V to 1.8V at  $V_{CC} = 1.8V$
  - 1.5V to 2.5V at  $V_{CC} = 2.5V$
  - 1.8V to 3.3V at  $V_{CC} = 3.3V$
  - 3.3V to 5.0V at  $V_{CC} = 5.0V$
- Down Translation:
  - 3.3V to 1.8V at  $V_{CC} = 1.8V$
  - 3.3V to 2.5V at  $V_{CC} = 2.5V$
  - 5.0V to 3.3V at  $V_{CC} = 3.3V$
- 5V Tolerant Inputs
- -40°C to +125°C Operating Temperature Range
- Available in a Green SC70-5 Package

### LOGIC SYMBOL



### LOGIC DIAGRAM



### FUNCTION TABLE

| INPUT |   | OUTPUT |
|-------|---|--------|
| A     | B | Y      |
| L     | L | L      |
| L     | H | L      |
| H     | 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

## PACKAGE/ORDERING INFORMATION

| MODEL    | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION      |
|----------|---------------------|-----------------------------|-----------------|-----------------|---------------------|
| 74LV1T08 | SC70-5              | -40°C to +125°C             | 74LV1T08XC5G/TR | R59XX           | Tape and Reel, 3000 |

## MARKING INFORMATION

NOTE: XX = Date Code.

YYY X X

Date Code - Week

Date Code - Year

Serial Number

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 7V              |
| Input Voltage, $V_I$ <sup>(2)</sup> .....                                | -0.5V to 7V              |
| Output Voltage, $V_O$ <sup>(2)</sup> .....                               |                          |
| Output in High-State or Low-State <sup>(3)</sup> .....                   | -0.5V to $V_{CC} + 0.5V$ |
| Output in Power-Off State .....                                          | -0.5V to 0.5V            |
| Input Clamping Current, $I_{IK}$ ( $V_I < 0V$ ).....                     | -20mA                    |
| Output Clamping Current, $I_{OK}$ ( $V_O > V_{CC}$ or $V_O < 0V$ ) ..... | $\pm 20mA$               |
| Output Current, $I_O$ ( $V_O = 0V$ to $V_{CC}$ ) .....                   | $\pm 25mA$               |
| Supply Current, $I_{CC}$ .....                                           | 25mA                     |
| Ground Current, $I_{GND}$ .....                                          | -25mA                    |
| Junction Temperature <sup>(4)</sup> .....                                | +150°C                   |
| Storage Temperature Range .....                                          | -65°C to +150°C          |
| Lead Temperature (Soldering, 10s) .....                                  | +260°C                   |
| ESD Susceptibility                                                       |                          |
| HBM.....                                                                 | 4000V                    |
| CDM .....                                                                | 1000V                    |

## RECOMMENDED OPERATING CONDITIONS

|                                                          |                 |
|----------------------------------------------------------|-----------------|
| Supply Voltage, $V_{CC}$ .....                           | 1.6V to 5.5V    |
| Input Voltage, $V_I$ .....                               | 0V to 5.5V      |
| Output Voltage, $V_O$                                    |                 |
| Output in High-State or Low-State .....                  | 0V to $V_{CC}$  |
| Input Transition Rise and Fall Rate, $\Delta t/\Delta V$ |                 |
| $V_{CC} = 1.8V$ to 5.5V .....                            | 20ns/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. This value is limited to 7V maximum.
4. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

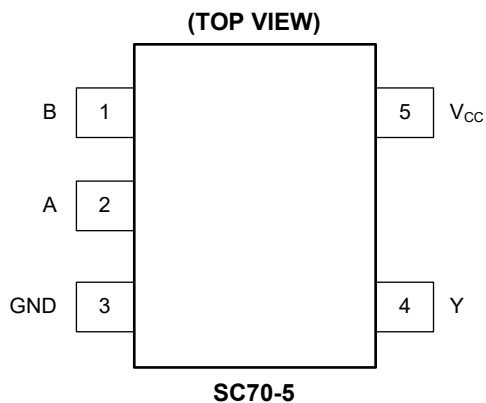
## ESD SENSITIVITY CAUTION

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, 2 | B, A            | Data Inputs.    |
| 3    | GND             | Ground.         |
| 4    | Y               | Data Output.    |
| 5    | V <sub>CC</sub> | Supply Voltage. |

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

| PARAMETER                 | SYMBOL          | CONDITIONS                                                                                                               |                                                              | TEMP | MIN             | TYP             | MAX     | UNITS         |
|---------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------|-----------------|-----------------|---------|---------------|
| High-Level Input Voltage  | $V_{IH}$        | $V_{CC} = 1.65\text{V to }1.8\text{V}$                                                                                   |                                                              | Full | 1               |                 |         | V             |
|                           |                 | $V_{CC} = 2.0\text{V}$                                                                                                   |                                                              | Full | 1.03            |                 |         |               |
|                           |                 | $V_{CC} = 2.25\text{V to }2.5\text{V}$                                                                                   |                                                              | Full | 1.18            |                 |         |               |
|                           |                 | $V_{CC} = 2.75\text{V}$                                                                                                  |                                                              | Full | 1.23            |                 |         |               |
|                           |                 | $V_{CC} = 3.0\text{V to }3.3\text{V}$                                                                                    |                                                              | Full | 1.37            |                 |         |               |
|                           |                 | $V_{CC} = 3.6\text{V}$                                                                                                   |                                                              | Full | 1.48            |                 |         |               |
|                           |                 | $V_{CC} = 4.5\text{V to }5.0\text{V}$                                                                                    |                                                              | Full | 2.03            |                 |         |               |
|                           |                 | $V_{CC} = 5.5\text{V}$                                                                                                   |                                                              | Full | 2.11            |                 |         |               |
| Low-Level Input Voltage   | $V_{IL}$        | $V_{CC} = 1.65\text{V to }2.0\text{V}$                                                                                   |                                                              | Full |                 |                 | 0.55    | V             |
|                           |                 | $V_{CC} = 2.25\text{V to }2.75\text{V}$                                                                                  |                                                              | Full |                 |                 | 0.71    |               |
|                           |                 | $V_{CC} = 3.0\text{V to }3.6\text{V}$                                                                                    |                                                              | Full |                 |                 | 0.65    |               |
|                           |                 | $V_{CC} = 4.5\text{V to }5.5\text{V}$                                                                                    |                                                              | Full |                 |                 | 0.8     |               |
| High-Level Output Voltage | $V_{OH}$        | $V_I = V_{IH} \text{ or } V_{IL}$                                                                                        | $V_{CC} = 1.65\text{V to }5.5\text{V}, I_O = -20\mu\text{A}$ | Full | $V_{CC} - 0.05$ | $V_{CC} - 0.01$ |         | V             |
|                           |                 |                                                                                                                          | $V_{CC} = 1.65\text{V}, I_O = -2\text{mA}$                   | Full | 1.39            | 1.53            |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 1.8\text{V}, I_O = -2\text{mA}$                    | Full | 1.56            | 1.7             |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 2.3\text{V}, I_O = -2.3\text{mA}$                  | Full | 2.08            | 2.22            |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 2.3\text{V}, I_O = -3\text{mA}$                    | Full | 2.06            | 2.18            |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 2.5\text{V}, I_O = -3\text{mA}$                    | Full | 2.28            | 2.4             |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 3.0\text{V}, I_O = -3\text{mA}$                    | Full | 2.8             | 2.92            |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 3.0\text{V}, I_O = -5.5\text{mA}$                  | Full | 2.7             | 2.85            |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 3.3\text{V}, I_O = -5.5\text{mA}$                  | Full | 3.02            | 3.16            |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 4.5\text{V}, I_O = -4\text{mA}$                    | Full | 4.3             | 4.42            |         |               |
|                           |                 |                                                                                                                          | $V_{CC} = 4.5\text{V}, I_O = -8\text{mA}$                    | Full | 4.2             | 4.35            |         |               |
| Low-Level Output Voltage  | $V_{OL}$        | $V_I = V_{IH} \text{ or } V_{IL}$                                                                                        | $V_{CC} = 1.65\text{V to }5.5\text{V}, I_O = 20\mu\text{A}$  | Full |                 | 0.01            | 0.05    | V             |
|                           |                 |                                                                                                                          | $V_{CC} = 1.65\text{V}, I_O = 2\text{mA}$                    | Full |                 | 0.08            | 0.2     |               |
|                           |                 |                                                                                                                          | $V_{CC} = 2.3\text{V}, I_O = 2.3\text{mA}$                   | Full |                 | 0.06            | 0.15    |               |
|                           |                 |                                                                                                                          | $V_{CC} = 2.3\text{V}, I_O = 3\text{mA}$                     | Full |                 | 0.08            | 0.2     |               |
|                           |                 |                                                                                                                          | $V_{CC} = 3.0\text{V}, I_O = 3\text{mA}$                     | Full |                 | 0.06            | 0.15    |               |
|                           |                 |                                                                                                                          | $V_{CC} = 3.0\text{V}, I_O = 5.5\text{mA}$                   | Full |                 | 0.12            | 0.24    |               |
|                           |                 |                                                                                                                          | $V_{CC} = 4.5\text{V}, I_O = 4\text{mA}$                     | Full |                 | 0.08            | 0.2     |               |
|                           |                 |                                                                                                                          | $V_{CC} = 4.5\text{V}, I_O = 8\text{mA}$                     | Full |                 | 0.14            | 0.35    |               |
| Input Leakage Current     | $I_I$           | $V_{CC} = 0\text{V to }5.5\text{V}, V_I = V_{CC} \text{ or GND}$                                                         |                                                              | Full |                 | $\pm 0.01$      | $\pm 1$ | $\mu\text{A}$ |
| Supply Current            | $I_{CC}$        | $V_{CC} = 1.8\text{V}, 2.5\text{V}, 3.3\text{V}, 5.0\text{V}, V_I = V_{CC} \text{ or GND}, I_O = 0\text{A}$              |                                                              | Full |                 | 0.01            | 2       | $\mu\text{A}$ |
| Additional Supply Current | $\Delta I_{CC}$ | Per input pin, $V_{CC} = 1.8\text{V}, V_I = 0.3\text{V or }1.1\text{V}, I_O = 0\text{A}$ , other pins at $V_{CC}$ or GND |                                                              | Full |                 | 0.1             | 5       | $\mu\text{A}$ |
|                           |                 | Per input pin, $V_{CC} = 5.5\text{V}, V_I = 0.3\text{V or }3.4\text{V}, I_O = 0\text{A}$ , other pins at $V_{CC}$ or GND |                                                              | Full |                 | 0.4             | 1       | $\text{mA}$   |

**DYNAMIC CHARACTERISTICS**(For test circuit, see Figure 1. Full = -40°C to +125°C, all typical values are measured at T<sub>A</sub> = +25°C, unless otherwise noted.)

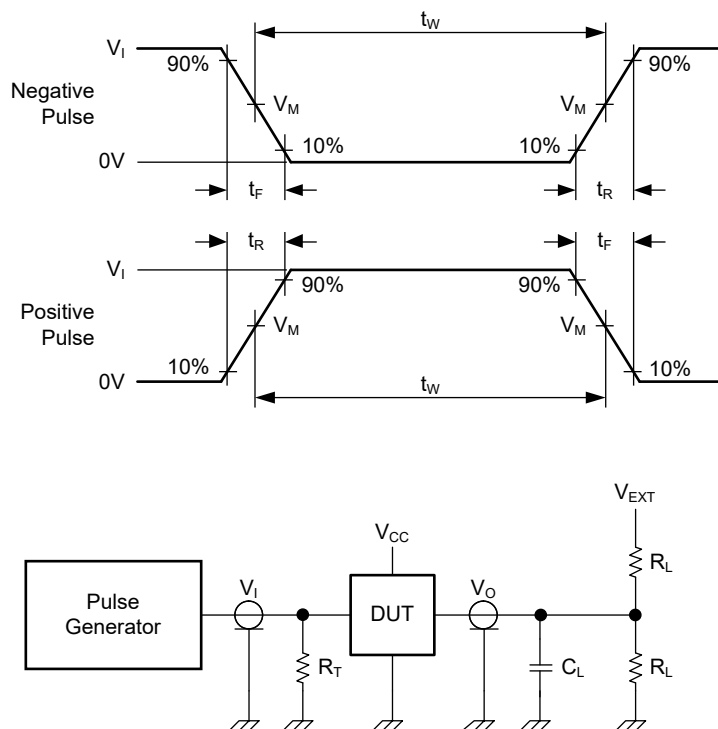
| PARAMETER                                    | SYMBOL          | CONDITIONS                                                                                   | TEMP                                          | MIN <sup>(1)</sup> | TYP | MAX <sup>(1)</sup> | UNITS |
|----------------------------------------------|-----------------|----------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------|-----|--------------------|-------|
| Propagation Delay <sup>(2)</sup>             | t <sub>PD</sub> | A, B to Y,<br>see Figure 2                                                                   | V <sub>CC</sub> = 1.8V, C <sub>L</sub> = 15pF | Full               | 0.5 | 7.9                | ns    |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 1.8V, C <sub>L</sub> = 30pF | Full               | 0.5 | 8.7                |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 2.5V, C <sub>L</sub> = 15pF | Full               | 0.5 | 5                  |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 2.5V, C <sub>L</sub> = 30pF | Full               | 0.5 | 5.3                |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 3.3V, C <sub>L</sub> = 15pF | Full               | 0.1 | 3.9                |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 3.3V, C <sub>L</sub> = 30pF | Full               | 0.1 | 4                  |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 5.0V, C <sub>L</sub> = 15pF | Full               | 0.1 | 2.9                |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 5.0V, C <sub>L</sub> = 30pF | Full               | 0.1 | 3.2                |       |
| Input Capacitance                            | C <sub>I</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND,<br>V <sub>CC</sub> = 3.3V                           | +25°C                                         |                    | 4   |                    | pF    |
| Output Capacitance                           | C <sub>O</sub>  | V <sub>CC</sub> = 0V, V <sub>O</sub> = GND                                                   | +25°C                                         |                    | 9   |                    | pF    |
| Power Dissipation Capacitance <sup>(3)</sup> | C <sub>PD</sub> | Per buffer,<br>V <sub>I</sub> = GND to V <sub>CC</sub> ,<br>C <sub>L</sub> = 30pF, f = 10MHz | V <sub>CC</sub> = 1.8V                        | +25°C              | 6   |                    | pF    |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 2.5V                        | +25°C              | 5.5 |                    |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 3.3V                        | +25°C              | 5.5 |                    |       |
|                                              |                 |                                                                                              | V <sub>CC</sub> = 5.0V                        | +25°C              | 6   |                    |       |

**NOTES:**

- Specified by design and characterization; not production tested.
- t<sub>PD</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> 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<sub>i</sub> = Input frequency in MHz.  
 f<sub>o</sub> = Output frequency in MHz.  
 C<sub>L</sub> = Output load capacitance in pF.  
 V<sub>CC</sub> = Supply voltage in Volts.  
 N = Number of inputs switching.  
 Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = Sum of the outputs.

## TEST CIRCUIT



Test conditions are given in Table 1.

Definitions 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.

$V_{EXT}$  = External voltage for measuring switching times.

Figure 1. Test Circuit for Measuring Switching Times

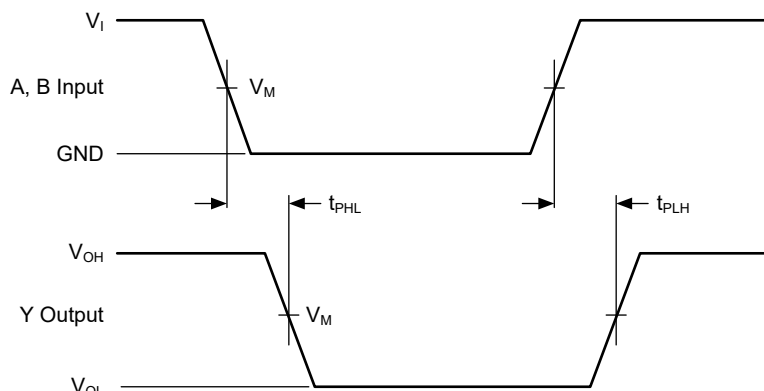
Table 1. Test Conditions

| SUPPLY VOLTAGE | INPUT    |                                    |           | LOAD       |             | $V_{EXT}$             |
|----------------|----------|------------------------------------|-----------|------------|-------------|-----------------------|
| $V_{CC}$       | $V_I$    | $\Delta t/\Delta V$ <sup>(1)</sup> | $f_{MAX}$ | $C_L$      | $R_L$       | $t_{PLH}$ , $t_{PHL}$ |
| 1.8V           | $V_{CC}$ | $\leq 1.0\text{ns/V}$              | 15MHz     | 15pF, 30pF | 1M $\Omega$ | GND                   |
| 2.5V           | $V_{CC}$ | $\leq 1.0\text{ns/V}$              | 25MHz     | 15pF, 30pF | 1M $\Omega$ | GND                   |
| 3.3V           | 3V       | $\leq 1.0\text{ns/V}$              | 50MHz     | 15pF, 30pF | 1M $\Omega$ | GND                   |
| 5.0V           | 3V       | $\leq 1.0\text{ns/V}$              | 50MHz     | 15pF, 30pF | 1M $\Omega$ | GND                   |

NOTE:

1.  $dV/dt \geq 1.0\text{V/ns}$ .

## WAVEFORMS



Test conditions are given in Table 1.

Measurement points are given in Table 2.

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

Figure 2. The Input A, B to Output Y Propagation Delays

Table 2. Measurement Points

| INPUT            | OUTPUT              |
|------------------|---------------------|
| $V_M^{(1)}$      | $V_M$               |
| $0.5 \times V_I$ | $0.5 \times V_{CC}$ |

NOTE:

1. The measurement points should be  $V_{IH}$  or  $V_{IL}$  when the input rising or falling time exceeds 1.0ns.

## REVISION HISTORY

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

NOVEMBER 2021 – REV.A to REV.A.1

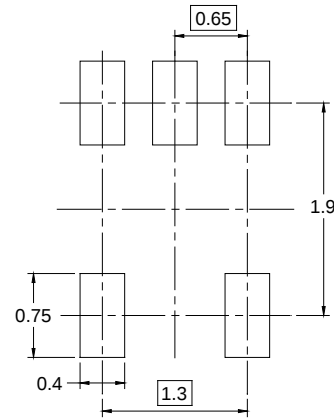
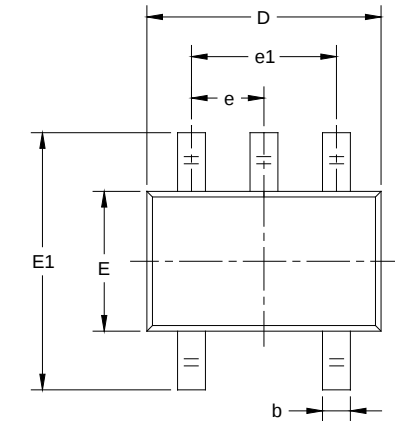
|                                              | Page |
|----------------------------------------------|------|
| Updated Dynamic Characteristics section..... | 5    |
| Added note of Table 2 .....                  | 7    |

Changes from Original (FEBRUARY 2021) to REV.A

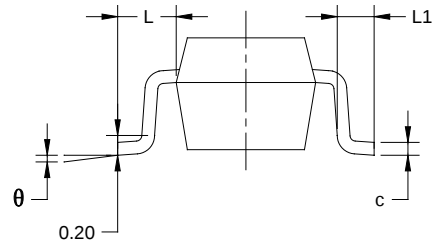
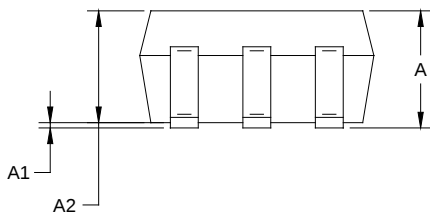
|                                                      | Page |
|------------------------------------------------------|------|
| Changed from product preview to production data..... | All  |

## PACKAGE OUTLINE DIMENSIONS

### SC70-5



RECOMMENDED LAND PATTERN (Unit: mm)



| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.800                        | 1.100 | 0.031                   | 0.043 |
| A1     | 0.000                        | 0.100 | 0.000                   | 0.004 |
| A2     | 0.800                        | 1.000 | 0.031                   | 0.039 |
| b      | 0.150                        | 0.350 | 0.006                   | 0.014 |
| c      | 0.080                        | 0.220 | 0.003                   | 0.009 |
| D      | 2.000                        | 2.200 | 0.079                   | 0.087 |
| E      | 1.150                        | 1.350 | 0.045                   | 0.053 |
| E1     | 2.150                        | 2.450 | 0.085                   | 0.096 |
| e      | 0.65 TYP                     |       | 0.026 TYP               |       |
| e1     | 1.300 BSC                    |       | 0.051 BSC               |       |
| L      | 0.525 REF                    |       | 0.021 REF               |       |
| L1     | 0.260                        | 0.460 | 0.010                   | 0.018 |
| θ      | 0°                           | 8°    | 0°                      | 8°    |

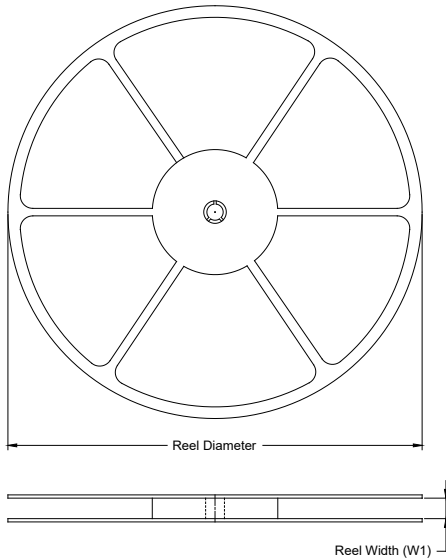
#### NOTES:

1. Body dimensions do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

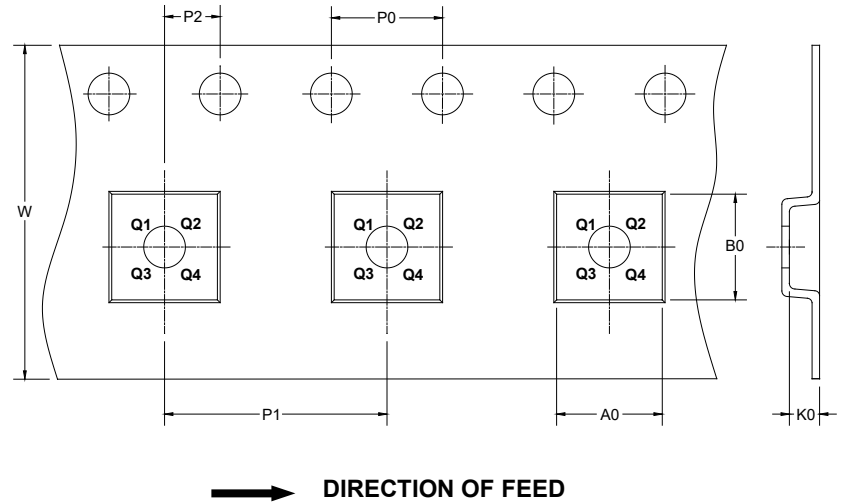
## PACKAGE INFORMATION

### TAPE AND REEL INFORMATION

#### REEL DIMENSIONS



#### TAPE DIMENSIONS



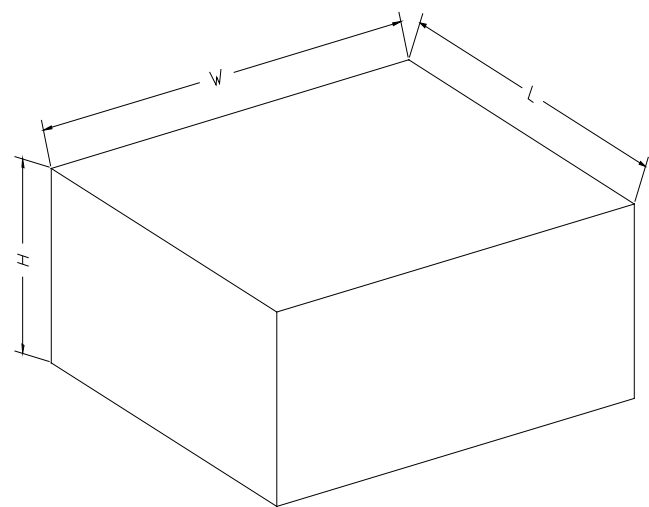
NOTE: The picture is only for reference. Please make the object as the standard.

#### 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 |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| SC70-5       | 7"            | 9.5                | 2.25    | 2.55    | 1.20    | 4.0     | 4.0     | 2.0     | 8.0    | Q3            |

DD00001

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