# 74LVC157
# Quad 2-Input Multiplexer

## GENERAL DESCRIPTION

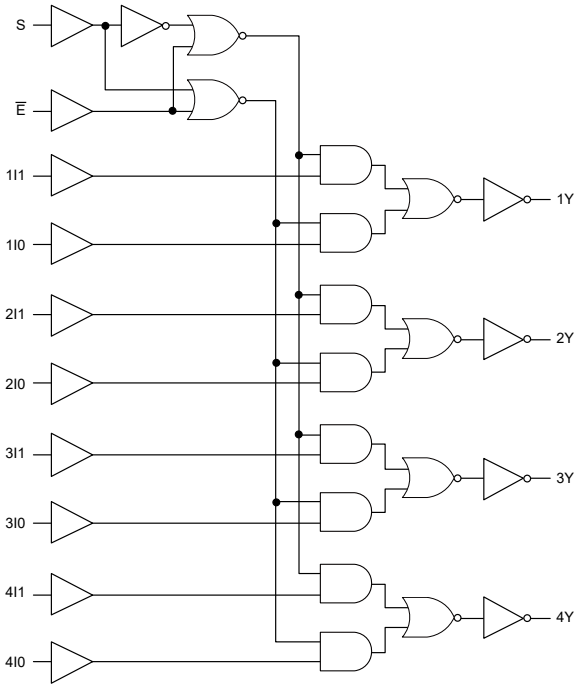
The 74LVC157 is a quad 2-input multiplexer designed for 1.2V to 3.6V operating voltage. The enable input ($\overline{E}$) is active low. When pin $\overline{E}$ is high, all of the outputs (1Y to 4Y) are forced low regardless of all the other input conditions. When pin $\overline{E}$ is low, four bits of data are selected from one of two sources that are determined by the state of the common data selection input (S), and are routed to the four outputs. The S input can also be used as function generator. The four outputs present the true (non-inverting) selected data.

It is useful for implementing highly irregular logic by generating any 4 of the 16 different functions of two variables with one variable common.

The device is the logic implementation of a 4-pole, 2-position switch, where the position of the switch is determined by the logic levels applied to pin S.

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

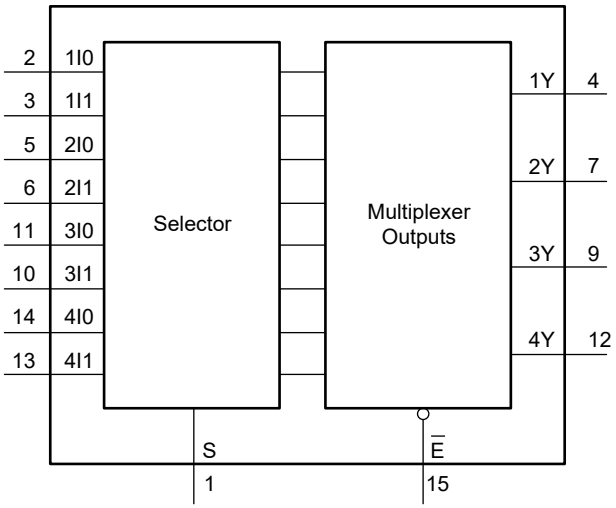
## LOGIC SYMBOL




## 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℃ to +125℃ Operating Temperature Range**
- **Available in a Green TQFN-2.5×3.5-16L Package**

## LOGIC DIAGRAM




## FUNCTION TABLE

| CONTROL INPUT | | INPUT | | OUTPUT |
|---|---|---|---|---|
| $\overline{E}$ | S | nI0 | nI1 | nY |
| H | *X* | *X* | *X* | L |
| L | L | L | *X* | L |
| L | L | H | *X* | H |
| L | H | *X* | L | L |
| L | H | *X* | H | H |

H = High Voltage Level

L = Low Voltage Level

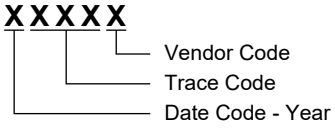
*X* = Don't Care

# PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| 74LVC157 | TQFN-2.5×3.5-16L | -40℃ to +125℃ | 74LVC157XTRG16G/TR | R5ARG<br>XXXXX | Tape and Reel, 6000 |

## 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 (1)

Supply Voltage, $V_{CC}$ ..... -0.5V to 6.5V
Input Voltage, $V_I$ (2) ..... -0.5V to 6.5V
Output Voltage, $V_O$ (2) ..... -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 (3) ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
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, Δt/ΔV
$V_{CC}$ = 1.65V to 2.7V ..... 20ns/V (MAX)
$V_{CC}$ = 2.7V to 3.6V ..... 10ns/V (MAX)
Operating Temperature Range ..... -40℃ to +125℃

## 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

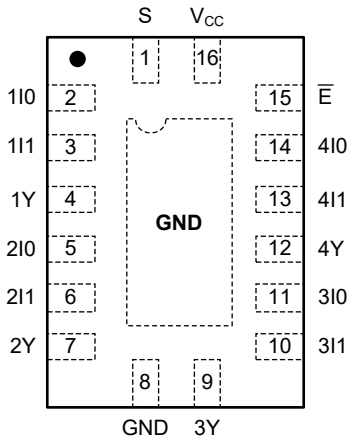
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

**(TOP VIEW)**




**TQFN-2.5×3.5-16L**

## PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|---|---|---|
| 1 | S | Common Data Selection Input. |
| 2, 5, 11, 14 | 1I0, 2I0, 3I0, 4I0 | Source 0 Data Inputs. |
| 3, 6, 10, 13 | 1I1, 2I1, 3I1, 4I1 | Source 1 Data Inputs. |
| 4, 7, 9, 12 | 1Y, 2Y, 3Y, 4Y | Multiplexer Outputs. |
| 8 | GND | Ground. |
| 15 | $\overline{E}$ | Enable Input (Active Low). |
| 16 | $V_{CC}$ | Supply Voltage. |
| Exposed Pad | GND | This is not a supply pin. The exposed pad can be left floating or soldered to the ground. |

# ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at $V_{CC}$ = 3.3V and $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | $V_{CC}$ = 1.2V | | Full | 1.05 | | | V |
| | | $V_{CC}$ = 1.65V to 1.95V | | Full | 0.65 × $V_{CC}$ | | | |
| | | $V_{CC}$ = 2.3V to 2.7V | | Full | 1.5 | | | |
| | | $V_{CC}$ = 2.7V to 3.6V | | Full | 1.8 | | | |
| Low-Level Input Voltage | $V_{IL}$ | $V_{CC}$ = 1.2V | | Full | | | 0.4 | V |
| | | $V_{CC}$ = 1.65V to 1.95V | | Full | | | 0.35 × $V_{CC}$ | |
| | | $V_{CC}$ = 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, $I_O$ = -100μA | Full | $V_{CC}$ - 0.05 | $V_{CC}$ - 0.005 | | V |
| | | | $V_{CC}$ = 1.65V, $I_O$ = -4mA | Full | 1.45 | 1.55 | | |
| | | | $V_{CC}$ = 2.3V, $I_O$ = -8mA | Full | 2.05 | 2.15 | | |
| | | | $V_{CC}$ = 2.7V, $I_O$ = -12mA | Full | 2.4 | 2.55 | | |
| | | | $V_{CC}$ = 3.0V, $I_O$ = -18mA | Full | 2.55 | 2.75 | | |
| | | | $V_{CC}$ = 3.0V, $I_O$ = -24mA | Full | 2.45 | 2.7 | | |
| Low-Level Output Voltage | $V_{OL}$ | $V_I$ = $V_{IH}$ or $V_{IL}$ | $V_{CC}$ = 1.65V to 3.6V, $I_O$ = 100μA | Full | | 0.005 | 0.05 | V |
| | | | $V_{CC}$ = 1.65V, $I_O$ = 4mA | Full | | 0.1 | 0.2 | |
| | | | $V_{CC}$ = 2.3V, $I_O$ = 8mA | Full | | 0.15 | 0.25 | |
| | | | $V_{CC}$ = 2.7V, $I_O$ = 12mA | Full | | 0.15 | 0.3 | |
| | | | $V_{CC}$ = 3.0V, $I_O$ = 24mA | Full | | 0.3 | 0.55 | |
| Input Leakage Current | $I_I$ | $V_{CC}$ = 3.6V, $V_I$ = 5.5V or GND | | Full | | ±0.05 | ±10 | μA |
| Supply Current | $I_{CC}$ | $V_{CC}$ = 3.6V, $V_I$ = $V_{CC}$ or GND, $I_O$ = 0A | | Full | | 0.05 | 10 | μA |
| Additional Supply Current | $\Delta I_{CC}$ | Per input pin, $V_{CC}$ = 2.7V to 3.6V, $V_I$ = $V_{CC}$ - 0.6V, $I_O$ = 0A | | Full | | 0.05 | 20 | μA |
| Input Capacitance | $C_I$ | $V_{CC}$ = 0V to 3.6V, $V_I$ = GND to $V_{CC}$ | | +25℃ | | 7 | | pF |

# DYNAMIC CHARACTERISTICS

(For test circuit, see Figure 1. Full = -40℃ to +125℃, all typical values are measured at $T_A$ = +25℃ and $V_{CC}$ = 1.2V, 1.8V, 2.5V, 2.7V and 3.3V respectively, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN (1) | TYP | MAX (1) | UNITS |
|---|---|---|---|---|---|---|---|---|
| Propagation Delay (2) | $t_{PD}$ | nI0, nI1 to nY, see Figure 2 | $V_{CC}$ = 1.2V | +25℃ | | 15.0 | | ns |
| | | | $V_{CC}$ = 1.65V to 1.95V | Full | 0.5 | 7.0 | 16.5 | |
| | | | $V_{CC}$ = 2.3V to 2.7V | Full | 0.5 | 4.0 | 10.0 | |
| | | | $V_{CC}$ = 2.7V | Full | 0.5 | 4.0 | 10.0 | |
| | | | $V_{CC}$ = 3.0V to 3.6V | Full | 0.5 | 4.0 | 8.5 | |
| | | $\overline{E}$ to nY, see Figure 3 | $V_{CC}$ = 1.2V | +25℃ | | 12.0 | | ns |
| | | | $V_{CC}$ = 1.65V to 1.95V | Full | 0.5 | 6.0 | 19.0 | |
| | | | $V_{CC}$ = 2.3V to 2.7V | Full | 0.5 | 4.0 | 11.0 | |
| | | | $V_{CC}$ = 2.7V | Full | 0.5 | 4.0 | 11.0 | |
| | | | $V_{CC}$ = 3.0V to 3.6V | Full | 0.5 | 4.0 | 9.5 | |
| | | S to nY, see Figure 2 | $V_{CC}$ = 1.2V | +25℃ | | 14.0 | | ns |
| | | | $V_{CC}$ = 1.65V to 1.95V | Full | 0.5 | 8.0 | 18.0 | |
| | | | $V_{CC}$ = 2.3V to 2.7V | Full | 0.5 | 4.0 | 10.5 | |
| | | | $V_{CC}$ = 2.7V | Full | 0.5 | 4.0 | 10.5 | |
| | | | $V_{CC}$ = 3.0V to 3.6V | Full | 0.5 | 4.0 | 9.0 | |
| Output Skew Time | $t_{SK(O)}$ | $V_{CC}$ = 3.0V to 3.6V | | Full | | 0.5 | 1.5 | ns |
| Power Dissipation Capacitance (3) | $C_{PD}$ | Per input, $V_I$ = GND to $V_{CC}$ | $V_{CC}$ = 1.65V to 1.95V | +25℃ | | 15 | | pF |
| | | | $V_{CC}$ = 2.3V to 2.7V | +25℃ | | 16 | | |
| | | | $V_{CC}$ = 3.0V to 3.6V | +25℃ | | 17 | | |

NOTES:

1. Specified by design and characterization; not production tested.
2. $t_{PD}$ is the same as $t_{PLH}$ and $t_{PHL}$.
3. $C_{PD}$ 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.

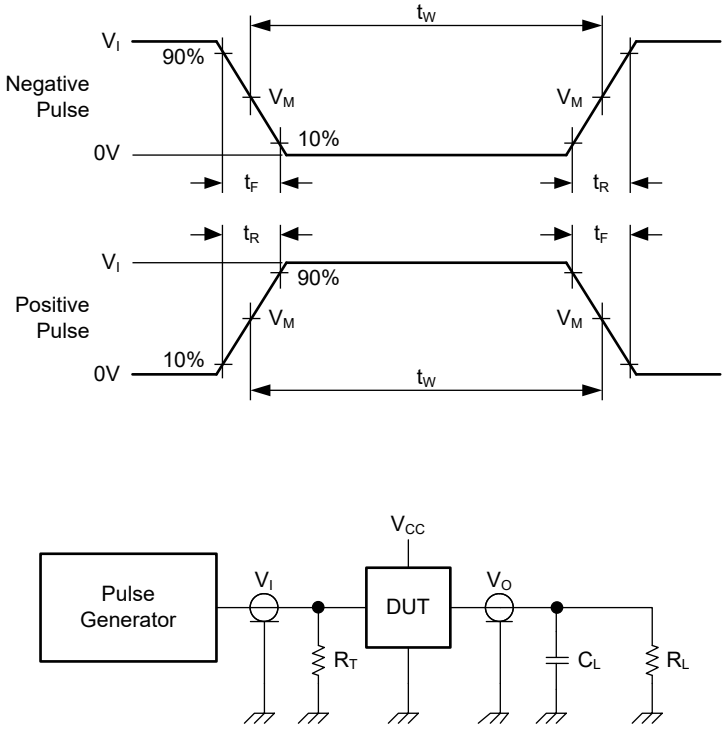
   $C_L$ = Output load capacitance in pF.

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

   N = Number of inputs switching.

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

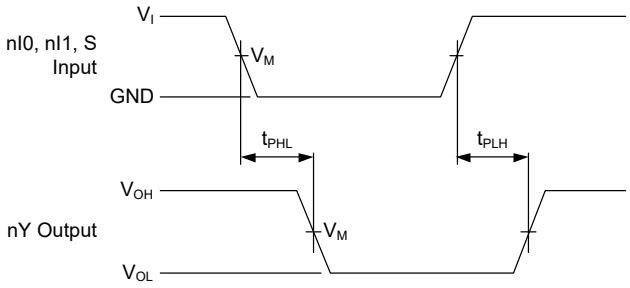
$R_T$ = Termination resistance should be equal to output impedance $Z_O$ of the pulse generator.

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

**Table 1. Test Conditions**

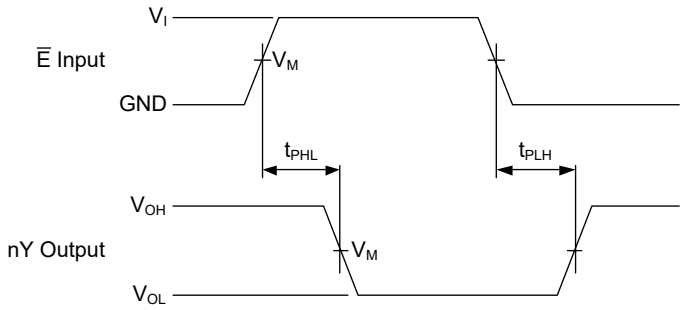
| SUPPLY VOLTAGE | INPUT | | LOAD | |
|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $t_R$, $t_F$ | $C_L$ | $R_L$ |
| 1.2V | $V_{CC}$ | ≤ 2ns | 30pF | 1kΩ |
| 1.65V to 1.95V | $V_{CC}$ | ≤ 2ns | 30pF | 1kΩ |
| 2.3V to 2.7V | $V_{CC}$ | ≤ 2ns | 30pF | 500Ω |
| 2.7V | 2.7V | ≤ 2.5ns | 50pF | 500Ω |
| 3.0V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

# 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. Data Inputs (nI0, nI1) and Common Data Selection Input (S) to Output (nY) 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 Input ($\overline{E}$) to Output (nY) Propagation Delays**

**Table 2. Measurement Points**

| SUPPLY VOLTAGE | INPUT | | OUTPUT |
|---|---|---|---|
| $V_{CC}$ | $V_I$ | $V_M$ (1) | $V_M$ |
| 1.2V | $V_{CC}$ | 0.5 × $V_{CC}$ | 0.5 × $V_{CC}$ |
| 1.65V to 1.95V | $V_{CC}$ | 0.5 × $V_{CC}$ | 0.5 × $V_{CC}$ |
| 2.3V to 2.7V | $V_{CC}$ | 0.5 × $V_{CC}$ | 0.5 × $V_{CC}$ |
| 2.7V | 2.7V | 1.5V | 1.5V |
| 3.0V to 3.6V | 2.7V | 1.5V | 1.5V |

NOTE:
1. The measurement points should be $V_{IH}$ or $V_{IL}$ when the input rising or falling time exceeds 2.5ns.

# REVISION HISTORY

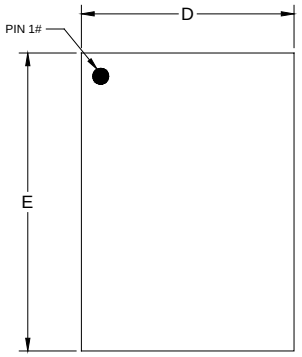
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| OCTOBER 2021 – REV.A to REV.A.1 | Page |
|---|---|
| Updated Dynamic Characteristics section | 5 |
| Added Table 2 and note in Waveforms section | 7 |

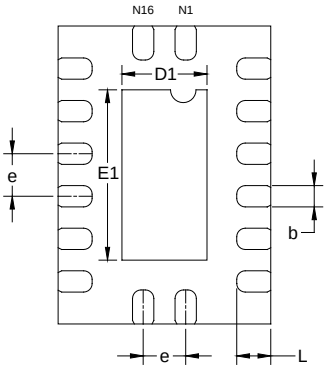
| Changes from Original (FEBRUARY 2021) to REV.A | Page |
|---|---|
| Changed from product preview to production data | All |

# PACKAGE OUTLINE DIMENSIONS

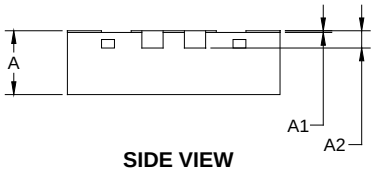
## TQFN-2.5×3.5-16L



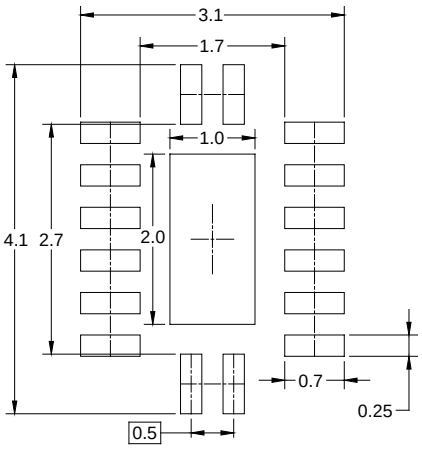

TOP VIEW




BOTTOM VIEW




SIDE VIEW

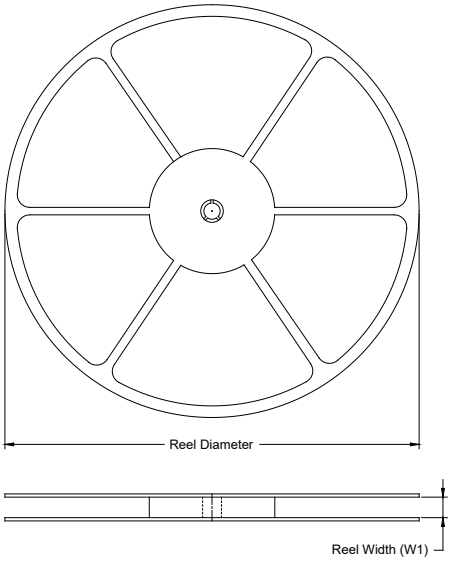



**RECOMMENDED LAND PATTERN** (Unit: mm)

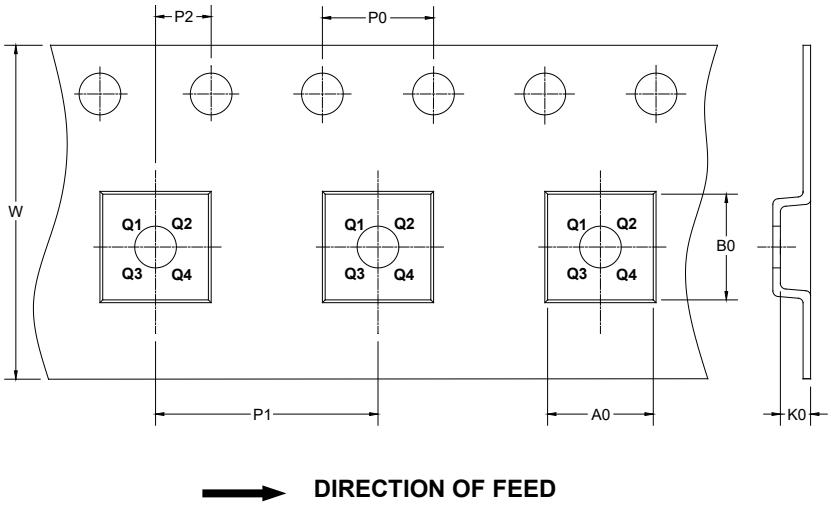
| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | MOD | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | 0.203 REF | | |
| b | 0.20 | 0.25 | 0.30 |
| D | 2.40 | 2.50 | 2.60 |
| D1 | 0.85 | 1.00 | 1.15 |
| E | 3.40 | 3.50 | 3.60 |
| E1 | 1.85 | 2.00 | 2.15 |
| e | 0.45 | 0.50 | 0.55 |
| L | 0.30 | 0.40 | 0.50 |

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



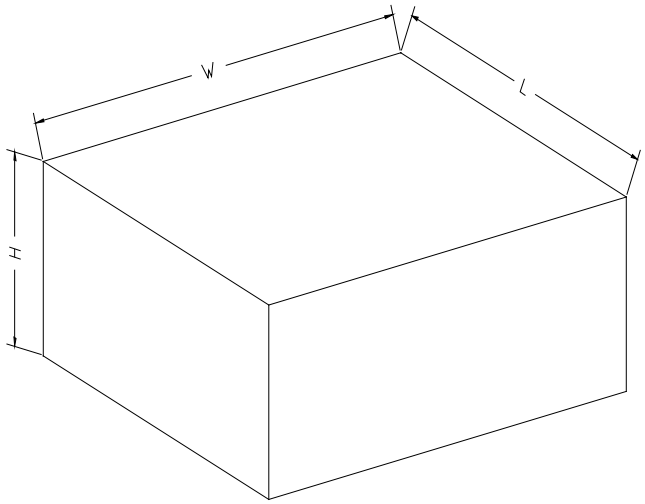

NOTE: The picture is only for reference. Please make the object as the standard.

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| TQFN-2.5×3.5-16L | 13″ | 12.4 | 2.80 | 3.80 | 0.95 | 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