

## AQ3102 Series, 1pF, ±30kV Diode Array

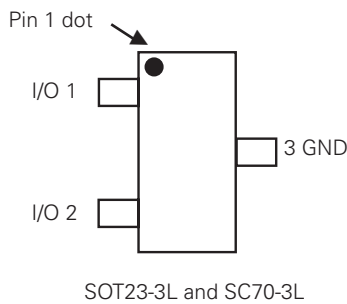


### Description

The AQ3102 Series integrates 2 channels of low capacitance steering diodes and an additional zener diode to provide protection for automotive electronics equipment that may experience destructive electrostatic discharges (ESD). The AQ3102 Series can safely absorb repetitive ESD strikes above the maximum contact level specified in IEC 61000-4-2 international standard (Level 4, ±8kV contact discharge) without performance degradation.

The low off-state capacitance makes it ideal for protecting high-speed signal lines such as USB2.0 or USB 3.0 and 1Gb Ethernet with an extremely low dynamic resistance to protect the most sensitive, state of the art chipsets against ESD transients.

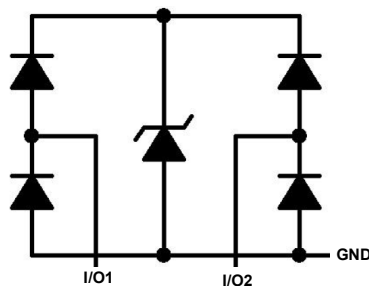
### Pinout



### Features

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- ESD, ISO 10605, 330pF 330Ω, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 80A ( $t_p=5/50ns$ )
- Lightning, 8A (8/20μs as defined in IEC 61000-4-5 2<sup>nd</sup> Edition)
- Low capacitance of 1pF (TYP) per I/O
- Low leakage current of 0.01μA (TYP) at 5V
- AEC-Q101 qualified
- Moisture Sensitivity Level(MSL -1)
- Halogen-Free, Lead-Free and RoHS-Compliant
- PPAP capable

### Functional Block Diagram



### Applications

- LCD/PDP TVs
- External Storages
- DVD/Blu-ray Players
- Set Top Boxes
- Smartphones
- Ultrabooks/Notebooks
- Digital Cameras
- Portable Medical
- Automotive Electronics
- Wearable Technology

Life Support Note:

**Not Intended for Use in Life Support or Life Saving Applications**

The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

**Absolute Maximum Ratings**

| Symbol     | Parameter                        | Value      | Units |
|------------|----------------------------------|------------|-------|
| $I_{PP}$   | Peak Current ( $t_p=8/20\mu s$ ) | 8          | A     |
| $T_{OP}$   | Operating Temperature            | -40 to 150 | °C    |
| $T_{STOR}$ | Storage Temperature              | -55 to 150 | °C    |

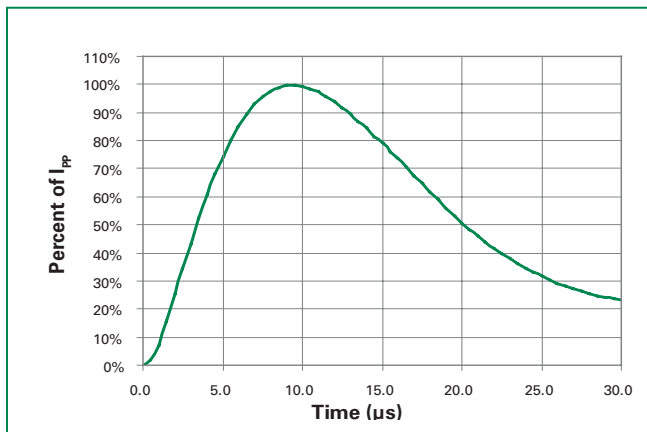
CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

**Electrical Characteristics ( $T_{OP}=25^\circ C$ )**

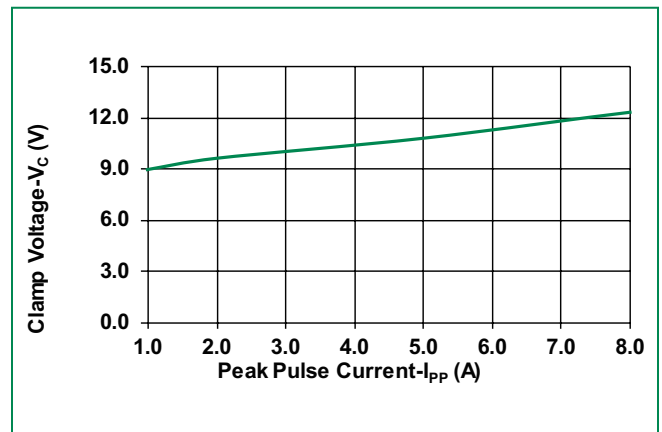
| Parameter                          | Symbol        | Test Conditions                     | Min      | Typ  | Max | Units    |
|------------------------------------|---------------|-------------------------------------|----------|------|-----|----------|
| Reverse Standoff Voltage           | $V_{RWM}$     | $I_R = 1\mu A$                      |          |      | 6.0 | V        |
| Breakdown Voltage                  | $V_{BR}$      | $I_R = 1mA$                         | 6.5      | 7.8  |     | V        |
| Reverse Leakage Current            | $I_{LEAK}$    | $V_R=5V$ , Any I/O to GND           |          | 0.01 | 0.5 | $\mu A$  |
| Clamp Voltage <sup>1</sup>         | $V_C$         | $I_{PP}=1A$ , $t_p=8/20\mu s$ , Fwd |          | 9.2  | 12  | V        |
|                                    |               | $I_{PP}=8A$ , $t_p=8/20\mu s$ , Fwd |          | 13   | 16  | V        |
| Dynamic Resistance <sup>2</sup>    | $R_{DYN}$     | TLP; $t_p=100ns$ , I/O to GND       |          | 0.24 |     | $\Omega$ |
| ESD Withstand Voltage <sup>1</sup> | $V_{ESD}$     | IEC 61000-4-2 (Contact)             | $\pm 30$ |      |     | kV       |
|                                    |               | IEC 61000-4-2 (Air)                 | $\pm 30$ |      |     | kV       |
| Diode Capacitance <sup>3</sup>     | $C_{I/O-GND}$ | Reverse Bias=0V, $f=3GHz$           |          | 1    |     | $\mu F$  |
|                                    | $C_{I/O-I/O}$ |                                     |          | 0.5  |     |          |

- Note: 1. Parameter is guaranteed by design and/or component characterization.  
 2. Transmission Line Pulse (TLP) with 100ns width, 0.2ns rise time, and average window  $t_1=70ns$  to  $t_2=90ns$ .  
 3. Package sizes larger than 0201 can add parasitic capacitance, inductance and resistance.

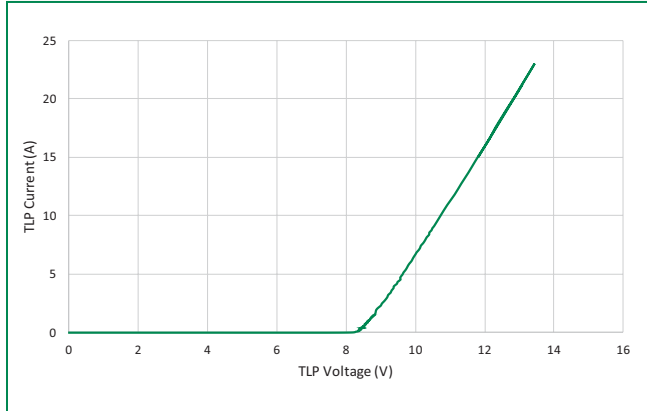
**8/20 $\mu s$  Pulse Waveform**



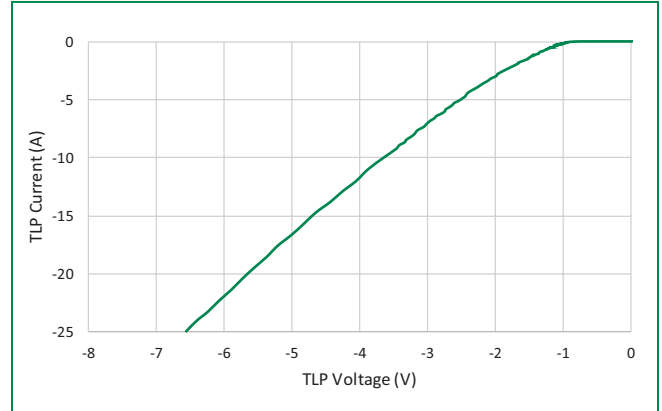
**Clamping voltage vs.  $I_{PP}$  for 8/20 $\mu s$  waveshape**



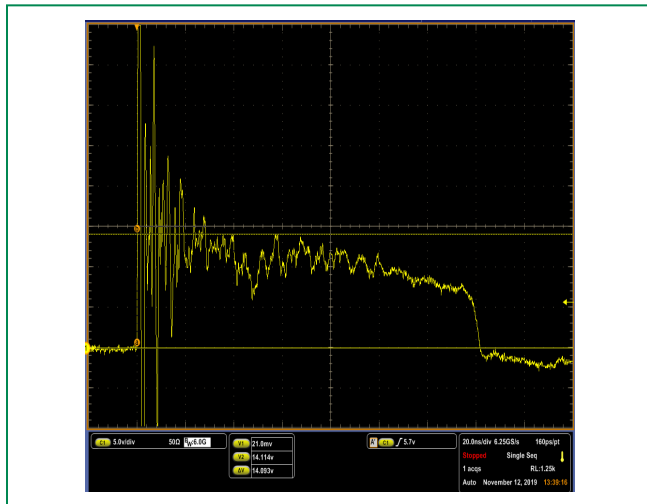
**Positive Transmission Line Pulsing (TLP) Plot**



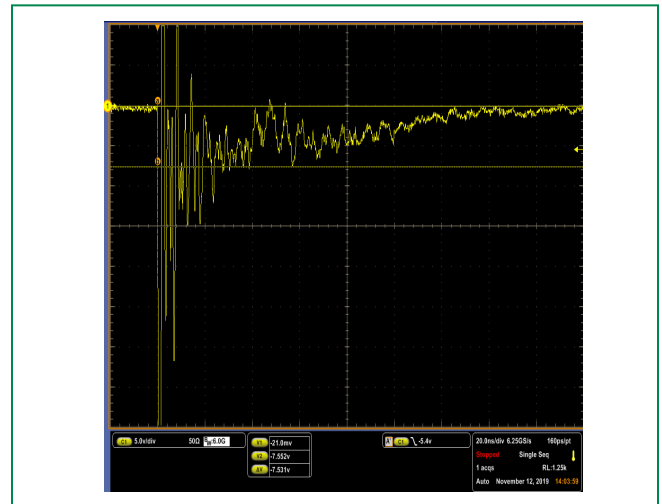
**Negative Transmission Line Pulsing (TLP) Plot**



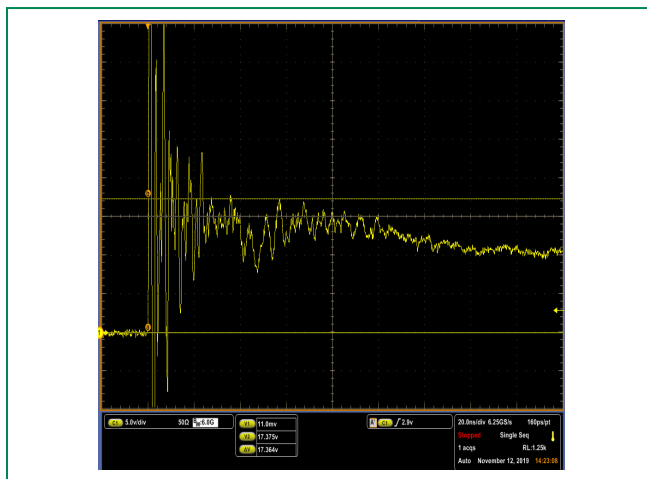
**IEC 61000-4-2 +8 kV Contact ESD Clamping Voltage**



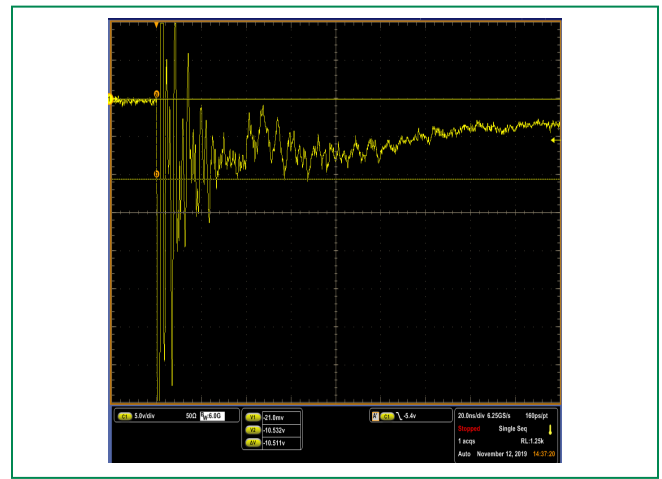
**IEC 61000-4-2 -8 kV Contact ESD Clamping Voltage**



**ISO 10605 (C:330pF, R:330Ω) contact discharge plot at +8KV**

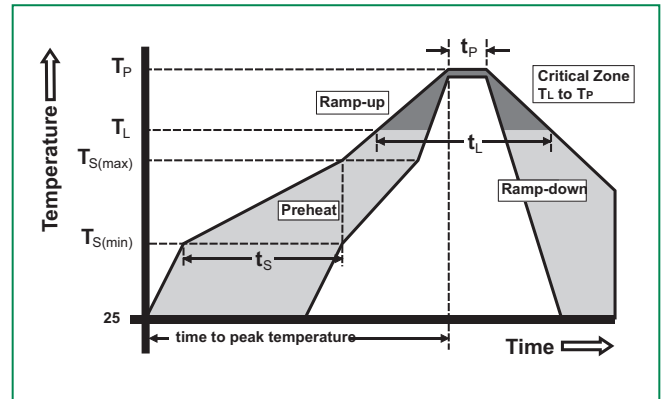


**ISO 10605 (C:330pF, R:330Ω) contact discharge plot at -8KV**



### Soldering Parameters

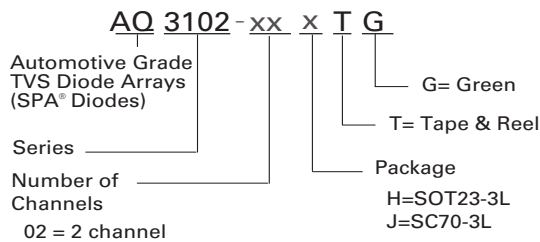
|  |                                    |                  |
|--|------------------------------------|------------------|
| Reflow Condition                                       | Pb – Free assembly                 |                  |
| Pre Heat   | - Temperature Min ( $T_{s(min)}$ ) | 150°C            |
|  | - Temperature Max ( $T_{s(max)}$ ) | 200°C            |
|  | - Time (min to max) ( $t_s$ )      | 60 – 180 secs    |
| Average ramp up rate (Liquidus) Temp ( $T_L$ ) to peak | 3°C/second max                     |                  |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   | 3°C/second max                     |                  |
| Reflow   | - Temperature ( $T_L$ ) (Liquidus) | 217°C            |
|  | - Temperature ( $t_L$ )            | 60 – 150 seconds |
| Peak Temperature ( $T_p$ )                             | 260 <sup>+0/-5</sup> °C            |                  |
| Time within 5°C of actual peak Temperature ( $t_p$ )   | 20 – 40 seconds                    |                  |
| Ramp-down Rate   | 6°C/second max                     |                  |
| Time 25°C to peak Temperature ( $T_p$ )                | 8 minutes Max.                     |                  |
| Do not exceed  | 260°C                              |                  |



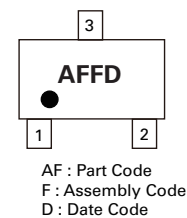
### Product Characteristics

|                    |  |
|--------------------|--|
| Lead Plating       | Matte Tin  |
| Lead Material      | Copper Alloy   |
| Lead Coplanarity   | 0.004 inches (0.102mm)                                 |
| Substrate Material | Silicon  |
| Body Material      | Molded Compound  |
| Flammability       | UL Recognized compound meeting flammability rating V-0 |

### Part Numbering System



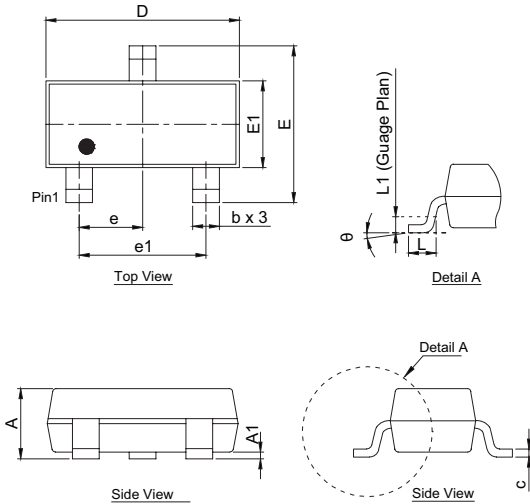
### Part Marking System



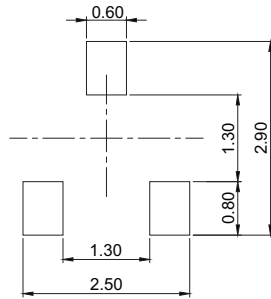
### Ordering Information

| Part Number  | Package  | Min. Order Qty. |
|--------------|----------|-----------------|
| AQ3102-02HTG | SOT23-3L | 3000            |
| AQ3102-02JTG | SC70-3L  | 3000            |

**Package Dimensions — SOT23-3L**



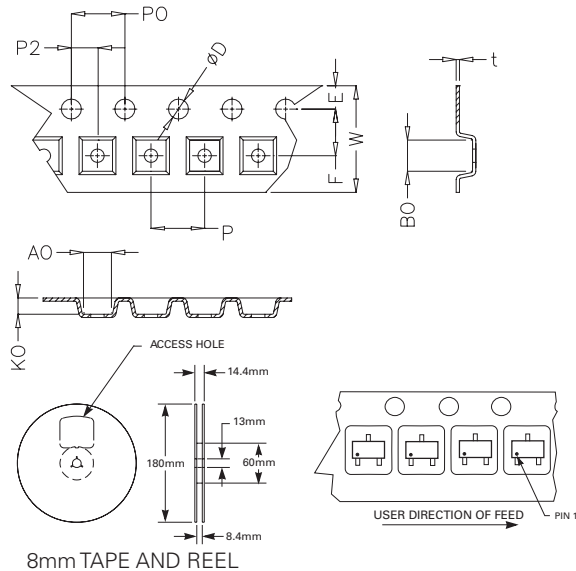
| Package   | SOT23-3L    |      |      |           |        |       |
|-----------|-------------|------|------|-----------|--------|-------|
| Pins      | 3           |      |      |           |        |       |
| JEDEC     | TO-236      |      |      |           |        |       |
|           | Millimeters |      |      | Inches    |        |       |
|           | Min         | Nom  | Max  | Min       | Nom    | Max   |
| <b>A</b>  | 0.90        | 1.00 | 1.15 | 0.035     | 0.039  | 0.045 |
| <b>A1</b> | 0.00        | -    | 0.10 | 0.000     | -      | 0.004 |
| <b>b</b>  | 0.30        | 0.40 | 0.51 | 0.012     | 0.0157 | 0.020 |
| <b>c</b>  | 0.08        | -    | 0.20 | 0.003     | -      | 0.008 |
| <b>D</b>  | 2.80        | 2.95 | 3.04 | 0.110     | 0.116  | 0.120 |
| <b>E</b>  | 2.10        | 2.40 | 2.64 | 0.083     | 0.094  | 0.104 |
| <b>E1</b> | 1.20        | 1.30 | 1.40 | 0.047     | 0.051  | 0.055 |
| <b>e</b>  | 0.95 BSC    |      |      | 0.037 BSC |        |       |
| <b>e1</b> | 1.90 BSC    |      |      | 0.075 BSC |        |       |
| <b>L</b>  | 0.30        | 0.45 | 0.55 | 0.012     | 0.018  | 0.022 |
| <b>L1</b> | 0.25 BSC    |      |      | 0.010 BSC |        |       |
| $\theta$  | 0°          | -    | 8°   | 0°        | -      | 8°    |



Recommended soldering pad layout (unit :mm)

Drawing# : H03-B

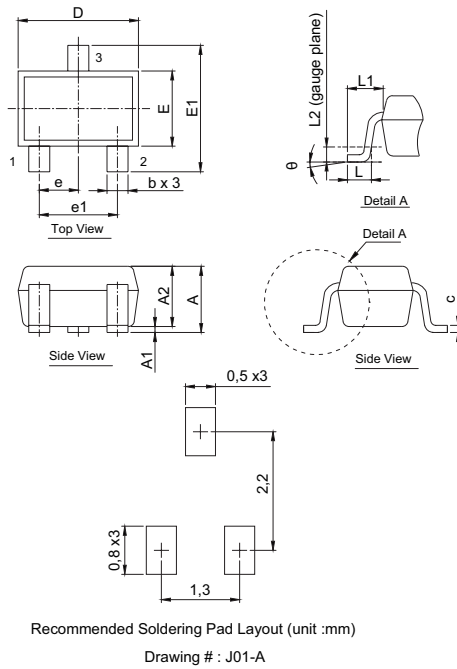
**Embossed Carrier Tape & Reel Specification — SOT23-3L**



8mm TAPE AND REEL

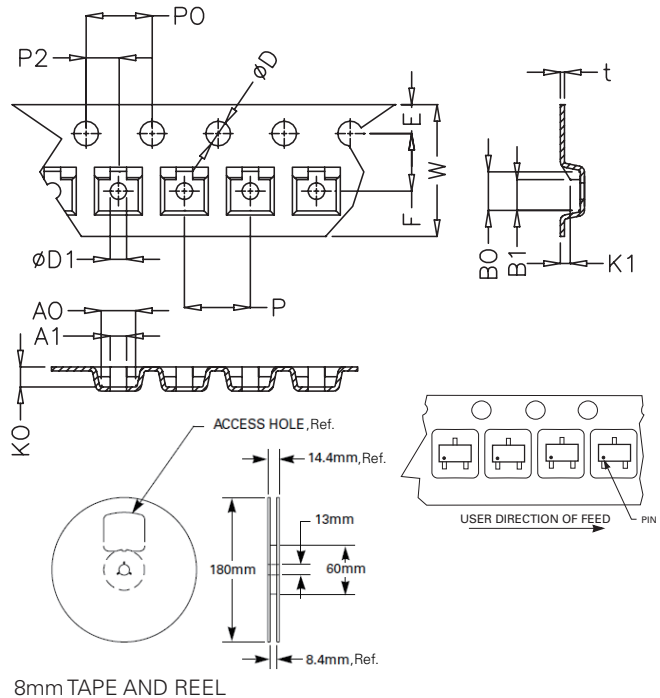
| Symbol    | Millimeters |      | Inches |       |
|-----------|-------------|------|--------|-------|
|           | Min         | Max  | Min    | Max   |
| <b>E</b>  | 1.65        | 1.85 | 0.065  | 0.073 |
| <b>F</b>  | 3.40        | 3.60 | 0.134  | 0.142 |
| <b>P2</b> | 1.90        | 2.10 | 0.075  | 0.083 |
| <b>D</b>  | 1.40        | 1.60 | 0.055  | 0.063 |
| <b>P0</b> | 3.90        | 4.10 | 0.154  | 0.161 |
| <b>W</b>  | 7.70        | 8.30 | 0.303  | 0.327 |
| <b>P</b>  | 3.90        | 4.10 | 0.154  | 0.161 |
| <b>A0</b> | 3.05        | 3.25 | 0.120  | 0.128 |
| <b>B0</b> | 2.67        | 2.87 | 0.105  | 0.113 |
| <b>K0</b> | 1.12        | 1.32 | 0.044  | 0.052 |
| <b>t</b>  | 0.22        | 0.24 | 0.009  | 0.009 |

**Package Dimensions – SC70-3L**



| Package   | SC70-3L     |      |           |       |
|-----------|-------------|------|-----------|-------|
| Pins      | 3           |      |           |       |
| JEDEC     | MO-203      |      |           |       |
|           | Millimeters |      | Inches    |       |
|           | Min         | Max  | Min       | Max   |
| <b>A</b>  | 0.80        | 1.10 | 0.031     | 0.043 |
| <b>A1</b> | 0.00        | 0.10 | 0.000     | 0.004 |
| <b>A2</b> | 0.80        | 1.00 | 0.031     | 0.039 |
| <b>b</b>  | 0.15        | 0.40 | 0.006     | 0.016 |
| <b>c</b>  | 0.08        | 0.22 | 0.003     | 0.009 |
| <b>D</b>  | 1.80        | 2.20 | 0.071     | 0.087 |
| <b>E</b>  | 1.15        | 1.35 | 0.045     | 0.053 |
| <b>E1</b> | 2.10        | 2.45 | 0.083     | 0.096 |
| <b>e</b>  | 0.65 TYP    |      | 0.026 TYP |       |
| <b>e1</b> | 1.20        | 1.40 | 0.047     | 0.055 |
| <b>L</b>  | 0.26        | 0.46 | 0.010     | 0.018 |
| <b>L1</b> | 0.525 REF   |      | 0.021     |       |
| <b>L2</b> | 0.20 BSC    |      | 0.008     |       |
| <b>θ</b>  | 0°          | 8°   | 0°        | 8°    |

**Embossed Carrier Tape & Reel Specification – SC70-3L**



| Dimensions  |               |      |                 |       |
|-------------|---------------|------|-----------------|-------|
|             | Millimeters   |      | Inches          |       |
|             | Min           | Max  | Min             | Max   |
| <b>E</b>    | 1.65          | 1.85 | 0.065           | 0.073 |
| <b>F</b>    | 3.45          | 3.55 | 0.135           | 0.139 |
| <b>P2</b>   | 1.95          | 2.05 | 0.077           | 0.081 |
| <b>D</b>    | 1.40          | 1.60 | 0.055           | 0.063 |
| <b>D1</b>   | 1.00          | 1.25 | 0.039           | 0.049 |
| <b>P0</b>   | 3.90          | 4.10 | 0.154           | 0.161 |
| <b>10P0</b> | 40.0 +/- 0.20 |      | 1.574 +/- 0.008 |       |
| <b>W</b>    | 7.70          | 8.10 | 0.303           | 0.318 |
| <b>P</b>    | 3.90          | 4.10 | 0.153           | 0.161 |
| <b>A0</b>   | 2.30          | 2.50 | 0.090           | 0.098 |
| <b>A1</b>   | 1.00 Ref      |      | 0.039 Ref       |       |
| <b>B0</b>   | 2.30          | 2.50 | 0.090           | 0.098 |
| <b>B1</b>   | 1.90 Ref      |      | 0.074           |       |
| <b>K0</b>   | 1.10          | 1.30 | 0.043           | 0.051 |
| <b>K1</b>   | 0.60 Ref      |      | 0.023 Ref       |       |
| <b>t</b>    | 0.27 max      |      | 0.010           |       |

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