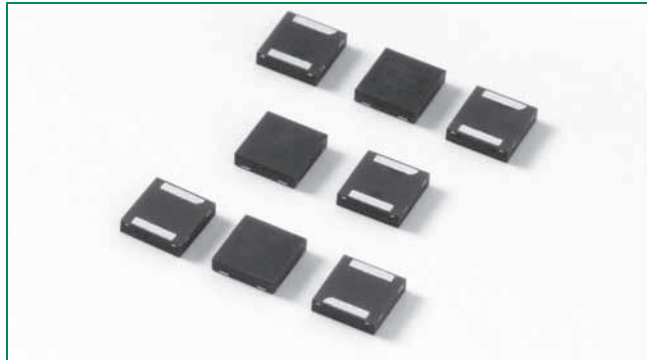


**HF RoHS Q2L Series - 3x3 QFN**



**Agency Approvals**

| Agency | Agency File Number |
|--------|--------------------|
|        | E133083            |

**Pinout Designation**

Not Applicable

**Schematic Symbol**



**Description**

Q2L Series 3x3 QFN are low capacitance SIDACTor® devices designed to protect high density broadband equipment from damaging overvoltage transients.

The series provides a low profile, chip scale surface mount solution that enables broadband equipment to comply with global regulatory standards while limiting the impact to broadband signals and board space.

**Features and Benefits**

- Low voltage overshoot
- Low on-state voltage
- Low capacitance
- Does not degrade with use
- Small SO-8 footprint
- Fails short circuit when surged in excess of ratings

**Applicable Global Standards**

- TIA-968-A
- TIA-968-B
- ITU K.20/21 Enhanced Level\*
- ITU K.20/21 Basic Level
- IEC 61000-4-5
- GR 1089 Inter-building\*
- GR 1089 Intra-building
- YD/T 1082
- YD/T 993
- YD/T 950

\* A/B-Rated parts require series resistance

**Electrical Characteristics**

| Part Number  | Marking | $V_{DRM}$            | $V_s$           | $I_H$  | $I_s$  | $I_T$ | $V_T @ I_T = 2.2Amps$ | Capacitance @ 1MHz, 2V bias |        |
|--------------|---------|----------------------|-----------------|--------|--------|-------|-----------------------|-----------------------------|--------|
|              |         | @ $I_{DRM} = 5\mu A$ | @ 100V/ $\mu s$ | mA min | mA max | A max | V max                 | pF min                      | pF max |
| P0080Q12ALRP | P-8A    | 6                    | 25              | 50     | 800    | 2.2   | 5                     | 25                          | 55     |
| P0300Q12ALRP | P03A    | 25                   | 40              | 50     | 800    | 2.2   | 5                     | 15                          | 35     |
| P0640Q12ALRP | P06A    | 58                   | 77              | 150    | 800    | 2.2   | 5                     | 40                          | 60     |
| P0720Q12ALRP | P07A    | 65                   | 88              | 150    | 800    | 2.2   | 5                     | 40                          | 60     |
| P0900Q12ALRP | P09A    | 75                   | 98              | 150    | 800    | 2.2   | 5                     | 35                          | 55     |
| P1100Q12ALRP | P11A    | 90                   | 130             | 150    | 800    | 2.2   | 5                     | 30                          | 50     |
| P1300Q12ALRP | P13A    | 120                  | 160             | 150    | 800    | 2.2   | 5                     | 25                          | 45     |
| P1500Q12ALRP | P15A    | 140                  | 180             | 150    | 800    | 2.2   | 5                     | 25                          | 40     |
| P1800Q12ALRP | P18A    | 170                  | 220             | 150    | 800    | 2.2   | 5                     | 25                          | 35     |
| P2300Q12ALRP | P23A    | 190                  | 260             | 150    | 800    | 2.2   | 5                     | 25                          | 35     |
| P2600Q12ALRP | P26A    | 220                  | 300             | 150    | 800    | 2.2   | 5                     | 25                          | 35     |
| P3100Q12ALRP | P31A    | 275                  | 350             | 150    | 800    | 2.2   | 5                     | 20                          | 35     |
| P3500Q12ALRP | P35A    | 320                  | 400             | 150    | 800    | 2.2   | 5                     | 20                          | 30     |

Notes:  
- Absolute maximum ratings measured at  $T_A = 25^\circ C$  (unless otherwise noted).  
- Devices are bi-directional (unless otherwise noted).

Table continues on next page.

**Electrical Characteristics** (continued)

| Part Number  | Marking | $V_{DRM}$<br>@ $I_{DRM} = 5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $I_H$  | $I_S$  | $I_T$ | $V_T$ @ $I_T = 2.2Amps$ | Capacitance<br>@ 1MHz, 2V bias |        |
|--------------|---------|-----------------------------------|--------------------------|--------|--------|-------|-------------------------|--------------------------------|--------|
|              |         | V min                             | V max                    | mA min | mA max | A max | V max                   | pF min                         | pF max |
| P0080Q12BLRP | P-8B    | 6                                 | 25                       | 50     | 800    | 2.2   | 5                       | 25                             | 55     |
| P0300Q12BLRP | P03B    | 25                                | 40                       | 50     | 800    | 2.2   | 5                       | 15                             | 35     |
| P0640Q12BLRP | P06B    | 58                                | 77                       | 150    | 800    | 2.2   | 5                       | 40                             | 60     |
| P0720Q12BLRP | P07B    | 65                                | 88                       | 150    | 800    | 2.2   | 5                       | 40                             | 60     |
| P0900Q12BLRP | P09B    | 75                                | 98                       | 150    | 800    | 2.2   | 5                       | 35                             | 55     |
| P1100Q12BLRP | P11B    | 90                                | 130                      | 150    | 800    | 2.2   | 5                       | 30                             | 50     |
| P1300Q12BLRP | P13B    | 120                               | 160                      | 150    | 800    | 2.2   | 5                       | 25                             | 45     |
| P1500Q12BLRP | P15B    | 140                               | 180                      | 150    | 800    | 2.2   | 5                       | 25                             | 40     |
| P1800Q12BLRP | P18B    | 170                               | 220                      | 150    | 800    | 2.2   | 5                       | 25                             | 35     |
| P2300Q12BLRP | P23B    | 190                               | 260                      | 150    | 800    | 2.2   | 5                       | 25                             | 35     |
| P2600Q12BLRP | P26B    | 220                               | 300                      | 150    | 800    | 2.2   | 5                       | 25                             | 35     |
| P3100Q12BLRP | P31B    | 275                               | 350                      | 150    | 800    | 2.2   | 5                       | 20                             | 35     |
| P3500Q12BLRP | P35B    | 320                               | 400                      | 150    | 800    | 2.2   | 5                       | 20                             | 30     |


Notes:  
 - Absolute maximum ratings measured at  $T_A = 25^\circ C$  (unless otherwise noted).  
 - Devices are bi-directional (unless otherwise noted).

**Surge Ratings**

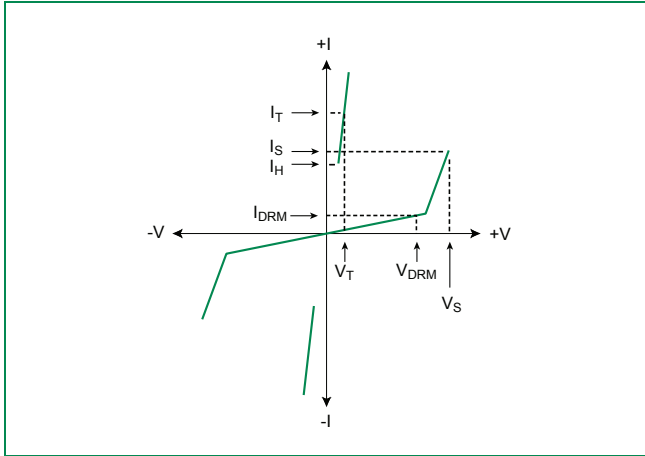
| Series | $I_{pp}$     |                              |                |                |                 | $I_{TSM}$  | di/dt          |
|--------|--------------|------------------------------|----------------|----------------|-----------------|------------|----------------|
|        | 2x10 $\mu s$ | 1.2x50 $\mu s$ /8x20 $\mu s$ | 10x160 $\mu s$ | 10x560 $\mu s$ | 10x1000 $\mu s$ | 50 / 60 Hz |                |
|        | A min        | A min                        | A min          | A min          | A min           | A min      | A/ $\mu s$ max |
| A      | 150          | 150                          | 90             | 50             | 45              | 20         | 500            |
| B      | 250          | 250                          | 150            | 100            | 80              | 25         | 500            |

Notes:  
 - Peak pulse current rating ( $I_{pp}$ ) is repetitive and guaranteed for the life of the product.  
 -  $I_{pp}$  ratings applicable over temperature range of  $-40^\circ C$  to  $+85^\circ C$   
 - The device must initially be in thermal equilibrium with  $-40^\circ C \leq T_J \leq +150^\circ C$

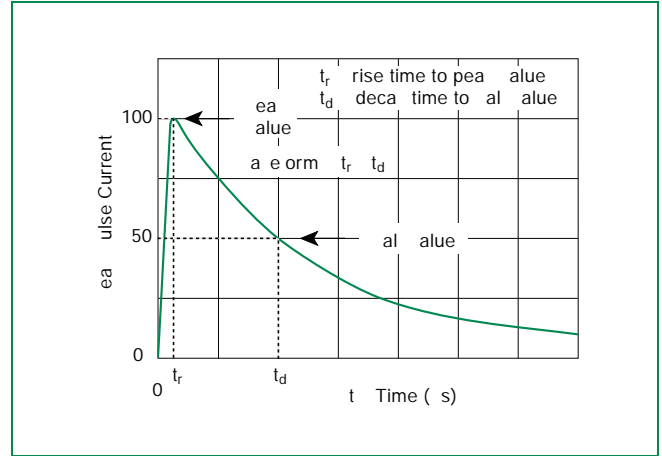
**Thermal Considerations**

| Package  | Symbol          | Parameter                               | Value       | Unit         |
|--|-----------------|---|-------------|--------------|
| 3x3 QFN<br> | $T_J$           | Operating Junction Temperature Range    | -40 to +150 | $^\circ C$   |
|  | $T_S$           | Storage Temperature Range               | -65 to +150 | $^\circ C$   |
|  | $R_{\theta JA}$ | Thermal Resistance: Junction to Ambient | 120         | $^\circ C/W$ |

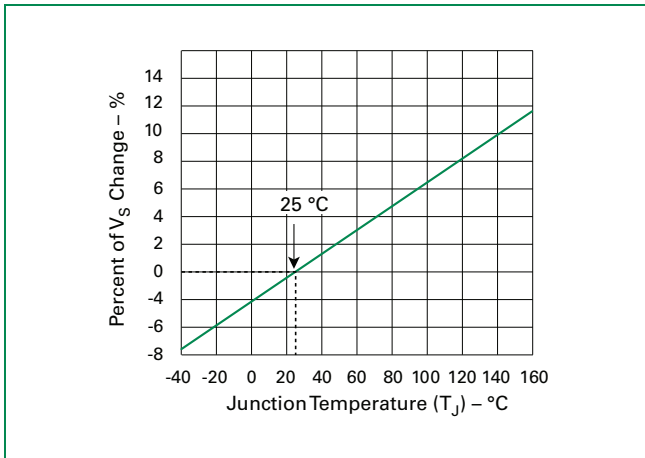
**V-I Characteristics**



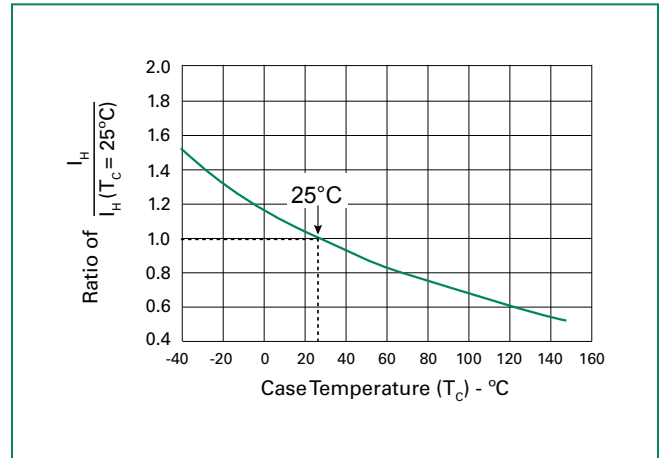
**$t_r \times t_d$  Pulse Waveform**



**Normalized  $V_s$  Change vs. Junction Temperature**

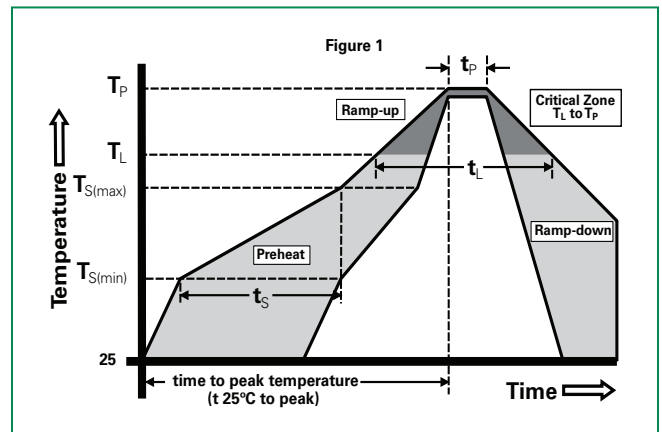


**Normalized DC Holding Current vs. Case Temperature**



**Soldering Parameters**

|   |                                   |                               |
|---|-----------------------------------|-------------------------------|
| <b>Reflow Condition</b>                               |                                   | Pb-Free assembly (see Fig. 1) |
| <b>Pre Heat</b>                                       | -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 (LiquidusTemp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max.                 |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                  |                                   | 3°C/sec. Max.                 |
| <b>Reflow</b>   | -Temperature ( $T_L$ ) (Liquidus) | +217°C                        |
|   | -Temperature ( $t_L$ )            | 60-150 secs.                  |
| <b>Peak Temp (<math>T_p</math>)</b>                   |                                   | +260(+0/-5)°C                 |
| Time within 5°C of actual PeakTemp ( $t_p$ )          |                                   | 30 secs. Max.                 |
| <b>Ramp-down Rate</b>                                 |                                   | 6°C/sec. Max.                 |
| Time 25°C to Peak Temp ( $T_p$ )                      |                                   | 8 min. Max.                   |
| <b>Do not exceed</b>                                  |                                   | +260°C                        |



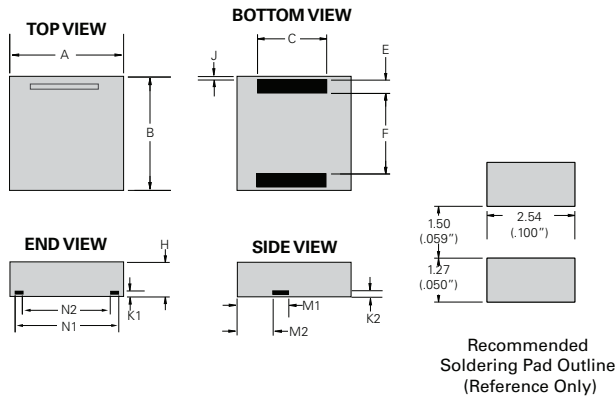
**Physical Specifications**

|                        |   |
|------------------------|---|
| <b>Lead Material</b>   | Copper Alloy  |
| <b>Terminal Finish</b> | 100% Matte-Tin Plated   |
| <b>Body Material</b>   | UL recognized epoxy meeting flammability classification 94V-0 |

**Environmental Specifications**

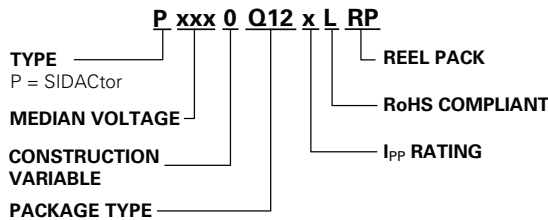
|                                   |   |
|-----------------------------------|---|
| <b>High Temp Voltage Blocking</b> | 80% Rated $V_{DRM}$ ( $V_{AC}$ Peak) +125°C or +150°C, 504 or 1008 hrs. MIL-STD-750 (Method 1040) JEDEC, JESD22-A-101 |
| <b>Temp Cycling</b>               | -65°C to +150°C, 15 min. dwell, 10 up to 100 cycles. MIL-STD-750 (Method 1051) EIA/JEDEC, JESD22-A104                 |
| <b>Biased Temp &amp; Humidity</b> | 52 $V_{DC}$ (+85°C) 85%RH, 504 up to 1008 hrs. EIA/JEDEC, JESD22-A-101  |
| <b>High Temp Storage</b>          | +150°C 1008 hrs. MIL-STD-750 (Method 1031) JEDEC, JESD22-A-101  |
| <b>Low Temp Storage</b>           | -65°C, 1008 hrs.  |
| <b>Thermal Shock</b>              | 0°C to +100°C, 5 min. dwell, 10 sec. transfer, 10 cycles. MIL-STD-750 (Method 1056) JEDEC, JESD22-A-106               |
| <b>Resistance to Solder Heat</b>  | +260°C, 30 secs. MIL-STD-750 (Method 2031)  |
| <b>Moisture Sensitivity Level</b> | 85%RH, +85°C, 168 hrs., 3 reflow cycles (+260°C Peak). JEDEC-J-STD-020, Level 1                                       |

**Dimensions — 3x3 QFN**

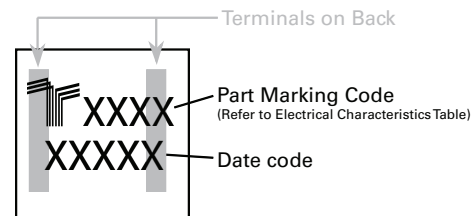


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| <b>A</b>   | 0.114  | 0.122 | 2.900       | 3.100 |
| <b>B</b>   | 0.114  | 0.122 | 2.900       | 3.100 |
| <b>C</b>   | 0.075  | 0.083 | 1.900       | 2.100 |
| <b>E</b>   | 0.011  | 0.019 | 0.285       | 0.485 |
| <b>F</b>   | 0.076  | 0.084 | 1.930       | 2.130 |
| <b>H</b>   | 0.035  | 0.043 | 0.900       | 1.100 |
| <b>J</b>   | 0.000  | 0.008 | 0.000       | 0.200 |
| <b>K1</b>  | 0.004  | 0.012 | 0.100       | 0.300 |
| <b>K2</b>  | 0.004  | 0.012 | 0.100       | 0.300 |
| <b>M1</b>  | 0.056  | 0.064 | 1.430       | 1.630 |
| <b>M2</b>  | 0.038  | 0.046 | 0.970       | 1.170 |
| <b>N1</b>  | 0.096  | 0.104 | 2.440       | 2.640 |
| <b>N2</b>  | 0.082  | 0.090 | 2.080       | 2.280 |

**Part Numbering**



**Part Marking**

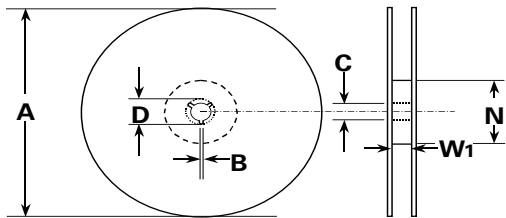


**Packing Options**

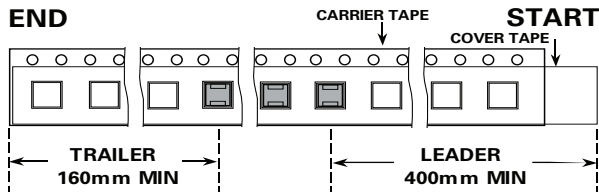
| Package Type | Description                | Quantity | Added Suffix | Industry Standard |
|--------------|----------------------------|----------|--------------|-------------------|
| Q12          | 3x3 QFN Tape and Reel Pack | 5000     | RP           | EIA-481-D         |

**Tape and Reel Dimensions — 3x3 QFN**

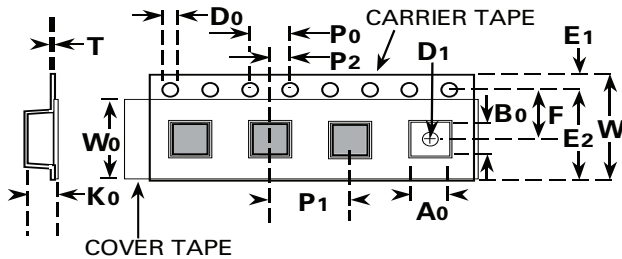
Reel Dimension



Tape Leader and Trailer Dimensions



Tape Dimension Items



| Symbols        | Description                  | Inches |        | Millimeters |       |
|----------------|------------------------------|--------|--------|-------------|-------|
|                |                              | Min    | Max    | Min         | Max   |
| A              | Reel Diameter                | N/A    | 12.992 | N/A         | 330.0 |
| B              | Drive Spoke Width            | 0.059  | N/A    | 1.50        | N/A   |
| C              | Arbor Hole Diameter          | 0.504  | 0.531  | 12.80       | 13.50 |
| D              | Drive Spoke Diameter         | 0.795  | N/A    | 20.20       | N/A   |
| N              | Hub Diameter                 | 1.969  | N/A    | 50.00       | N/A   |
| W <sub>1</sub> | Reel Inner Width at Hub      | 0.488  | 0.567  | 12.40       | 14.40 |
| A <sub>0</sub> | Pocket Width at bottom       | 0.126  | 0.134  | 3.20        | 3.40  |
| B <sub>0</sub> | Pocket Length at bottom      | 0.126  | 0.134  | 3.20        | 3.40  |
| D <sub>0</sub> | Feed Hole Diameter           | 0.059  | 0.063  | 1.50        | 1.60  |
| D <sub>1</sub> | Pocket Hole Diameter         | 0.059  | N/A    | 1.50        | N/A   |
| E <sub>1</sub> | Feed hole position 1         | 0.065  | 0.073  | 1.65        | 1.85  |
| E <sub>2</sub> | Feed hole position 2         | 0.400  | 0.408  | 10.15       | 10.35 |
| F              | Feed hole center-Pocket hole | 0.215  | 0.219  | 5.45        | 5.55  |
| K <sub>0</sub> | Pocket Depth                 | 0.039  | 0.051  | 1.00        | 1.30  |
| P <sub>0</sub> | Feed Hole Pitch              | 0.153  | 0.161  | 3.90        | 4.10  |
| P <sub>1</sub> | Component Spacing            | 0.311  | 0.319  | 7.90        | 8.10  |
| P <sub>2</sub> | Feed hole center-Pocket hole | 0.077  | 0.081  | 1.95        | 2.05  |
| T              | Carrier Tape Thickness       | 0.010  | 0.014  | 0.25        | 0.35  |
| W              | Embossed Carrier Tape Width  | 0.453  | 0.484  | 11.50       | 12.30 |
| W <sub>0</sub> | Cover Tape Width             | 0.358  | 0.366  | 9.10        | 9.30  |