

**Q2L Series - 3x3 QFN**



**Description**

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

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

**Agency Approvals**

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

**Schematic Symbol**



**Features and Benefits**

- Low voltage overshoot
- Low on-state voltage
- Low capacitance
- Does not degrade surge capability after multiple surge events within limit.
- Small footprint
- Fails short circuit when surged in excess of ratings
- RoHS Compliant and Halogen-Free
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)
- Recognized to UL 497B as an Isolated Loop Circuit Protector

**Additional Information**



**Datasheet**



**Resources**



**Samples**

**Applicable Global Standards**

- TIA-968-A
- TIA-968-B
- ITU K.20/21/45 Enhanced Level\*
- ITU K.20/21/45 Basic Level
- IEC 61000-4-5 2nd edition
- 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 <sub>DRM</sub><br>@ I <sub>DRM</sub> = 5μA<br>V min | V <sub>S</sub><br>@ 100V/μs<br>V max | I <sub>H</sub><br>mA min | I <sub>S</sub><br>mA max | I <sub>T</sub><br>A max | V <sub>T</sub> @ I <sub>T</sub> =<br>2.2Amps<br>V max | Capacitance<br>@ 1MHz, 2V bias |        |
|--------------|---------|---|--------------------------------------|--------------------------|--------------------------|-------------------------|---|--------------------------------|--------|
|              |         |   |                                      |                          |                          |                         |   | 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     |
| P1200Q12ALRP | P12A    | 100   | 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     |
| P2000Q12ALRP | P20A    | 180   | 220                                  | 150                      | 800                      | 2.2                     | 5   | 25                             | 35     |
| P2300Q12ALRP | P23A    | 190   | 260                                  | 150                      | 800                      | 2.2                     | 5   | 25                             | 35     |
| P2500Q12ALRP | P25A    | 230   | 290                                  | 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   | 450                                  | 150                      | 800                      | 2.2                     | 5   | 20                             | 30     |
| 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     |
| P1200Q12BLRP | P12B    | 100   | 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     |
| P2000Q12BLRP | P20B    | 180   | 220                                  | 150                      | 800                      | 2.2                     | 5   | 25                             | 35     |
| P2300Q12BLRP | P23B    | 190   | 260                                  | 150                      | 800                      | 2.2                     | 5   | 25                             | 35     |
| P2500Q12BLRP | P25B    | 230   | 290                                  | 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<sub>A</sub> = 25°C (unless otherwise noted).
- Components are bi-directional.

### Surge Ratings

| Series | I <sub>PP</sub> |                 |          |          |           | I <sub>TSM</sub> | di/dt    |
|--------|-----------------|-----------------|----------|----------|-----------|------------------|----------|
|        | 2/10μs          | 1.2/50μs/8/20μs | 10/160μs | 10/560μs | 10/1000μs | 50 / 60 Hz       |          |
|        | A min           | A min           | A min    | A min    | A min     | A min            | A/μs max |
| A      | 150             | 150             | 90       | 50       | 45        | 20               | 500      |
| B      | 250             | 250             | 150      | 100      | 80        | 25               | 500      |

**Notes:**

- Peak pulse current rating (I<sub>pp</sub>) is repetitive and guaranteed for the life of the product.
- I<sub>pp</sub> ratings applicable over temperature range of -40°C to +85°C
- The component must initially be in thermal equilibrium with -40°C ≤ T<sub>J</sub> ≤ +150°C

### Thermal Considerations

| Package  | Symbol           | Parameter                               | Value       | Unit |
|--|------------------|---|-------------|------|
| 3x3 QFN<br> | T <sub>J</sub>   | Operating Junction Temperature Range    | -40 to +150 | °C   |
|  | T <sub>S</sub>   | Storage Temperature Range               | -65 to +150 | °C   |
|  | R <sub>θJA</sub> | Thermal Resistance: Junction to Ambient | 120         | °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 |
| <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.     |
| <b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak)</b> |                                     | 3°C/sec. Max.    |
| <b><math>T_{s(\max)}</math> to <math>T_L</math> - Ramp-up Rate</b>     |                                     | 3°C/sec. Max.    |
| <b>Reflow</b>  | - Temperature ( $T_L$ ) (Liquidus)  | +217°C           |
|  | - Temperature ( $t_t$ )             | 60-150 secs.     |
| <b>Peak Temp (<math>T_p</math>)</b>                                    |                                     | +260(+0/-5)°C    |
| <b>Time within 5°C of actual Peak Temp (<math>t_p</math>)</b>          |                                     | 30 secs. Max.    |
| <b>Ramp-down Rate</b>  |                                     | 6°C/sec. Max.    |
| <b>Time 25°C to Peak Temp (<math>T_p</math>)</b>                       |                                     | 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 V-0 |

### Environmental Specifications

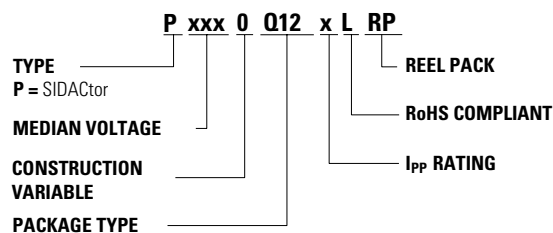
|                                   |   |
|-----------------------------------|---|
| <b>High Temp Voltage Blocking</b> | 80% Rated $V_{DRM}$ ( $V_{AC, Peak}$ ) +125°C or +150°C, 504 or 1008 hrs. MIL-STD-750 (Method 1040) JEDEC, JESD22-A-101 |
| <b>Temp Cycling</b>               | -65°C to +150°C, 15 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

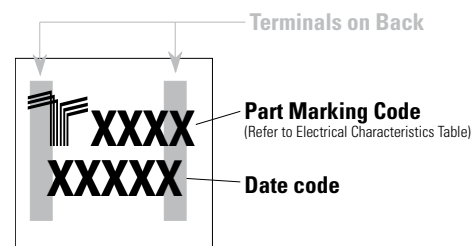


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| <b>A</b>   | 0.114  | 0.122 | 2.900       | 3.100 |
| <b>B</b>   | 0.114  | 0.122 | 2.900       | 3.100 |
| <b>C</b>   | 0.075  | 0.083 | 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  |

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