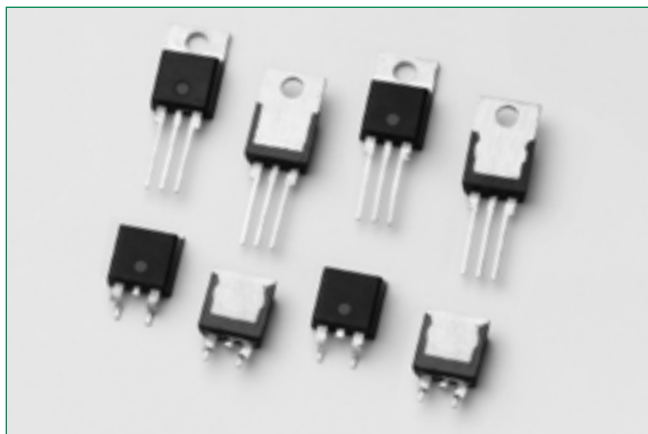


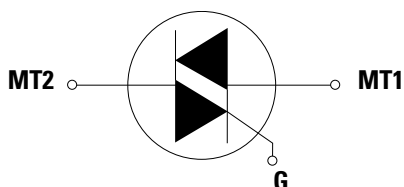
# QVxx16xHx Series

## 16 A High Temperature Alternistor Triacs

HF RoHS L Package: E71639



### Schematic Symbol



### Description

This 16 A high temperature Alternistor TRIAC, offered in TO-220AB, TO-220 isolated, and TO-263 packages, has 150°C maximum junction temperature ( $T_J$ ) and 200 A  $I_{TSM}$  (60 Hz).

This series enables easier thermal management and higher surge handling capability in AC power control applications such as heater control, motor speed control, lighting controls, and static switching relays. Alternistor TRIAC operates in quadrants I, II, and III, and offers high performance in applications requiring high commutation capability.

### Features & Benefits

- High  $T_J$  of 150°C
- Voltage capability of 600 V
- Surge capability of 200 A at 60 Hz full cycle
- Mechanically and thermally robust TO-220 clip-attach assembly
- High  $dv/dt$  up to 1000 V/ $\mu$ s
- Internally-isolated TO-220 package
- Halogen-free and RoHS-compliant
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device

### Applications

TRIAC is an excellent AC switch in applications such as heating, lighting, and motor speed controls.

Typical applications are:

- Heater control such as coffee brewer, tankless water heater, and infrared heater
- AC solid-state relays
- Light dimmers including incandescent and LED lighting
- Motor speed control in kitchen appliances, power tools, home/brow/white goods and light industrial applications such as compressor motor control

Alternistor TRIAC is used with high inductive loads requiring high commutation capability. Internally isolated packages offer better heat sinking with higher isolation voltage.

### Product Summary

| Characteristic    | Value                | Unit |
|-------------------|----------------------|------|
| $I_{T(RMS)}$      | 16                   | A    |
| $V_{DRM}/V_{RRM}$ | 600                  | V    |
| $I_{GT(Q1)}$      | 10 or 20 or 35 or 50 | mA   |

# QVxx16xHx Series

## 16 A High Temperature Alternistor Triacs

### Maximum Ratings — Alternistor Triac (3 Quadrants)

| Symbol            | Characteristic                                                                               | Conditions                                                                                                         | Value                                              | Unit                   |
|-------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------|
| $I_{T(RMS)}$      | Rms On-State Current (Full Sine Wave)                                                        | QVxx16LHy $T_C = 105^\circ\text{C}$<br>QVxx16RHy / QVxx16NHx $T_C = 130^\circ\text{C}$                             | 16                                                 | A                      |
| $I_{TSM}$         | Non-Repetitive Surge Peak On-State Current (Full Cycle, $T_J$ Initial = $25^\circ\text{C}$ ) | $f = 50\text{ Hz}$ , $t = 20\text{ ms}$<br>$f = 60\text{ Hz}$ , $t = 16.7\text{ ms}$                               | 167<br>200                                         | A                      |
| $I^2t$            | $I^2t$ Value For Fusing                                                                      | $t_p = 8.3\text{ ms}$                                                                                              | 166                                                | $\text{A}^2\text{s}$   |
| $di/dt$           | Critical Rate-of-rise of On-State Current                                                    | $f = 60\text{ Hz}$ , $T_J = 150^\circ\text{C}$                                                                     | 100                                                | $\text{A}/\mu\text{s}$ |
| $I_{GTM}$         | Peak Gate Trigger Current                                                                    | $t_p \leq 10\text{ }\mu\text{s}$ , $I_{GT} \leq I_{GTM}$ , $T_J = 150^\circ\text{C}$                               | 2.0                                                | A                      |
| $P_{G(AV)}$       | Average Gate Power Dissipation                                                               | $T_J = 150^\circ\text{C}$                                                                                          | 0.5                                                | W                      |
| $T_{stg}$         | Storage Temperature Range                                                                    | -                                                                                                                  | -40 to 150                                         | $^\circ\text{C}$       |
| $T_J$             | Operating Junction Temperature Range                                                         | -                                                                                                                  | -40 to 150                                         | $^\circ\text{C}$       |
| $V_{DSM}/V_{RSM}$ | Non Repetitive Surge Peak Off-State Voltage                                                  | pulse width = $100\text{ }\mu\text{s}$ ; $600\text{ V}$<br>pulse width = $100\text{ }\mu\text{s}$ ; $800\text{ V}$ | $V_{DSM}/V_{RSM} + 100$<br>$V_{DSM}/V_{RSM} + 200$ | V                      |

xx = voltage/10; y = sensitivity

### Thermal Characteristics

| Symbol           | Characteristic                               | Value                                         | Unit                      |
|------------------|----------------------------------------------|-----------------------------------------------|---------------------------|
| $R_{\theta(JC)}$ | Thermal Resistance, Junction-To-Case (AC)    | QVxx16RHy / QVxx16NHx: 0.90<br>QVxx16LHy: 2.4 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta(JA)}$ | Thermal Resistance, Junction-To-Ambient (AC) | QVxx16RHy / QVxx16NHx: 45<br>QVxx16LHy: 50    | $^\circ\text{C}/\text{W}$ |

### Electrical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified) — Alternistor Triac (3 Quadrants)

| Symbol      | Description                                  | Conditions                                                                                                       | QVxx16xH2    |      |     | QVxx16xH3 |      |     | QVxx16xH4 |      |     | QVxx16xH5 |      |     | Unit                   |
|-------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------|--------------|------|-----|-----------|------|-----|-----------|------|-----|-----------|------|-----|------------------------|
|             |                                              |                                                                                                                  | Min          | Typ  | Max | Min       | Typ  | Max | Min       | Typ  | Max | Min       | Typ  | Max |                        |
| $I_{GT}$    | DC Gate Trigger Current                      | $V_D = 12\text{ V}$ , $R_L = 60\text{ }\Omega$                                                                   | I – II – III | -    | -   | 10        | -    | -   | 20        | -    | -   | 35        | -    | -   | mA                     |
| $V_{GT}$    | DC Gate Trigger Voltage                      | I – II – III                                                                                                     | -            | -    | 1.3 | -         | -    | 1.3 | -         | -    | 1.3 | -         | -    | 1.3 | V                      |
| $V_{GD}$    | Gate Non-trigger Voltage                     | $V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$ , $T_J = 150^\circ\text{C}$                                         | I – II – III | 0.15 | -   | -         | 0.15 | -   | -         | 0.15 | -   | -         | 0.15 | -   | V                      |
| $I_H$       | Holding Current                              | $I_T = 100\text{ mA}$                                                                                            | -            | -    | 15  | -         | -    | 35  | -         | -    | 50  | -         | -    | 60  | mA                     |
| $dv/dt$     | Critical Rate-of-rise of Off-stage Voltage   | $V_D = V_{DRM}$ Gate Open, $T_J = 150^\circ\text{C}$<br>$V_D = 2/3 V_{DRM}$ Gate Open, $T_J = 150^\circ\text{C}$ |              | 200  | -   | -         | 350  | -   | -         | 500  | -   | -         | 750  | -   | $\text{V}/\mu\text{s}$ |
| $(dv/dt)_c$ | Critical Rate-of-rise of Commutation Voltage | $(di/dt)_c = 8.6\text{ A/ms}$ , $T_J = 150^\circ\text{C}$                                                        |              | 10   | -   | -         | 30   | -   | -         | 50   | -   | -         | -    | -   | $\text{V}/\mu\text{s}$ |
| $t_{gt}$    | Turn-on Time                                 | $I_G = 2 \times I_{GT}$ , $P_W = 15\text{ }\mu\text{s}$ ,<br>$I_T = 22.6\text{ A(pk)}$                           | I            | -    | 3   | -         | -    | 3   | -         | -    | 3   | -         | -    | 3   | $\mu\text{s}$          |
|             |                                              |                                                                                                                  | II           | -    | 4   | -         | -    | 5   | -         | -    | 6   | -         | -    | 6   |                        |
|             |                                              |                                                                                                                  | III          | -    | 8   | -         | -    | 14  | -         | -    | 15  | -         | -    | 17  |                        |
| $(di/dt)_c$ | Without snubber                              | $T_J = 150^\circ\text{C}$                                                                                        |              | -    | -   | -         | -    | -   | -         | -    | -   | -         | -    | 28  | $\text{A}/\mu\text{s}$ |

xx = voltage/10;

x = sensitivity

### Static Characteristics

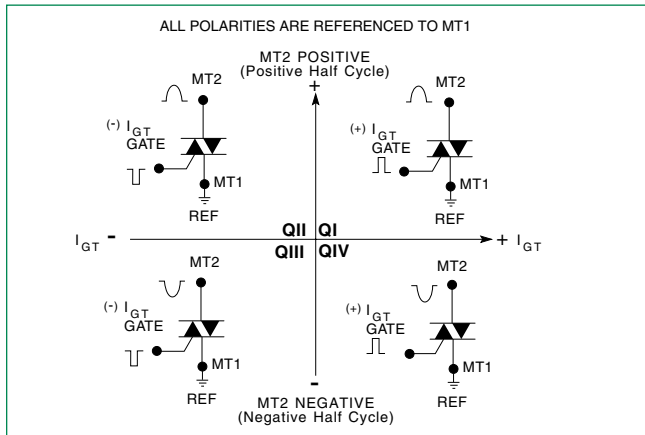
| Symbol            | Description                        | Conditions                                                                                                | Maximum Value | Unit                |
|-------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------|---------------------|
| $V_{TM}$          | Peak On-state Voltage              | $I_T = 22.6\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$                                                    | 1.60          | V                   |
| $I_{DRM}/I_{RRM}$ | Off-state Current, Peak Repetitive | $V_D = V_{DRM}/V_{RRM}$ , $T_J = 25^\circ\text{C}$<br>$V_D = V_{DRM}/V_{RRM}$ , $T_J = 150^\circ\text{C}$ | 5<br>4        | $\mu\text{A}$<br>mA |
| $V_{T0}$          | Threshold Voltage                  | $T_J = 150^\circ\text{C}$                                                                                 | 0.85          | V                   |
| $R_D$             | Dynamic Resistance                 | $T_J = 150^\circ\text{C}$                                                                                 | 18.5          | $\text{m}\Omega$    |

# QVxx16xHx Series

## 16 A High Temperature Alternistor Triacs

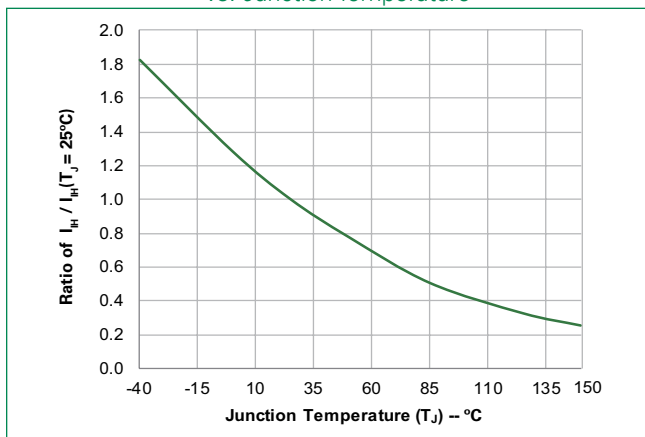
### Performance Curves

**Figure 1:**  
Definition of Quadrants

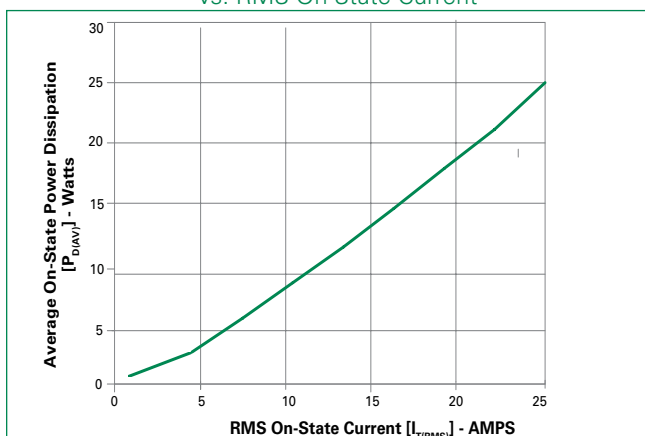


Note: Alternistors will not operate in QIV

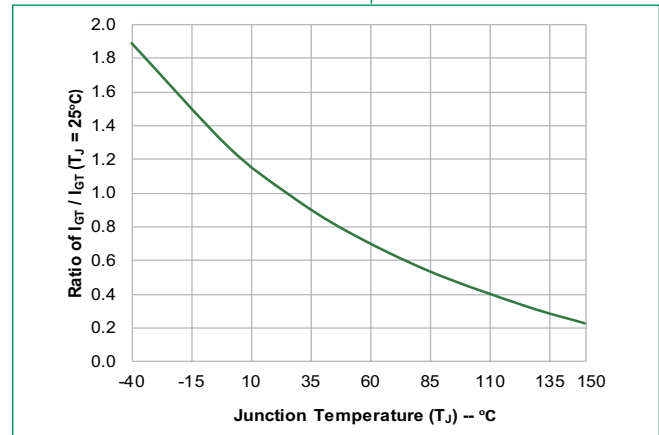
**Figure 3:**  
Normalized DC Holding Current  
vs. Junction Temperature



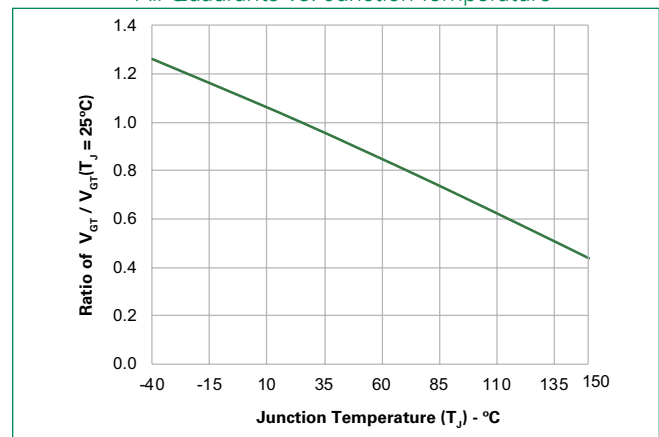
**Figure 5:**  
Power Dissipation (Typical)  
vs. RMS On-State Current



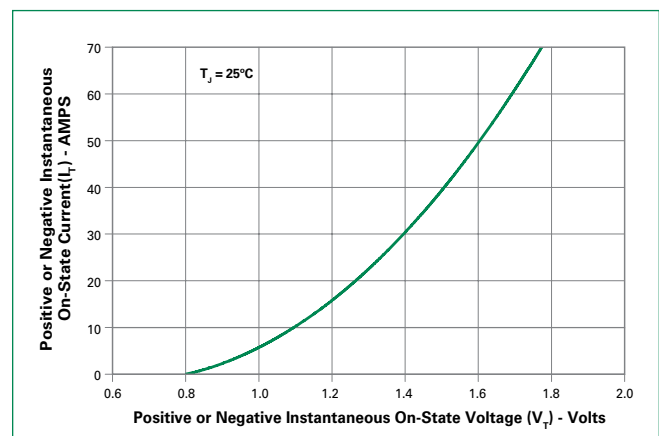
**Figure 2:**  
Normalized DC Gate Trigger Current for All Quadrants vs.  
Junction Temperature



**Figure 4:**  
Normalized DC Gate Trigger Voltage for  
All Quadrants vs. Junction Temperature



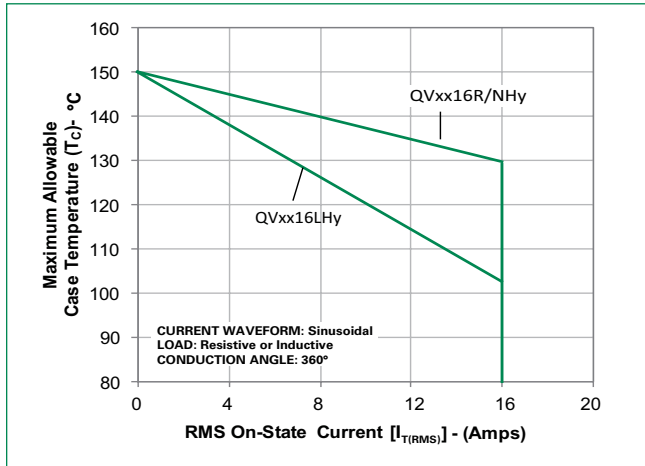
**Figure 6:**  
On-State Current vs. On-State Voltage (Typical)



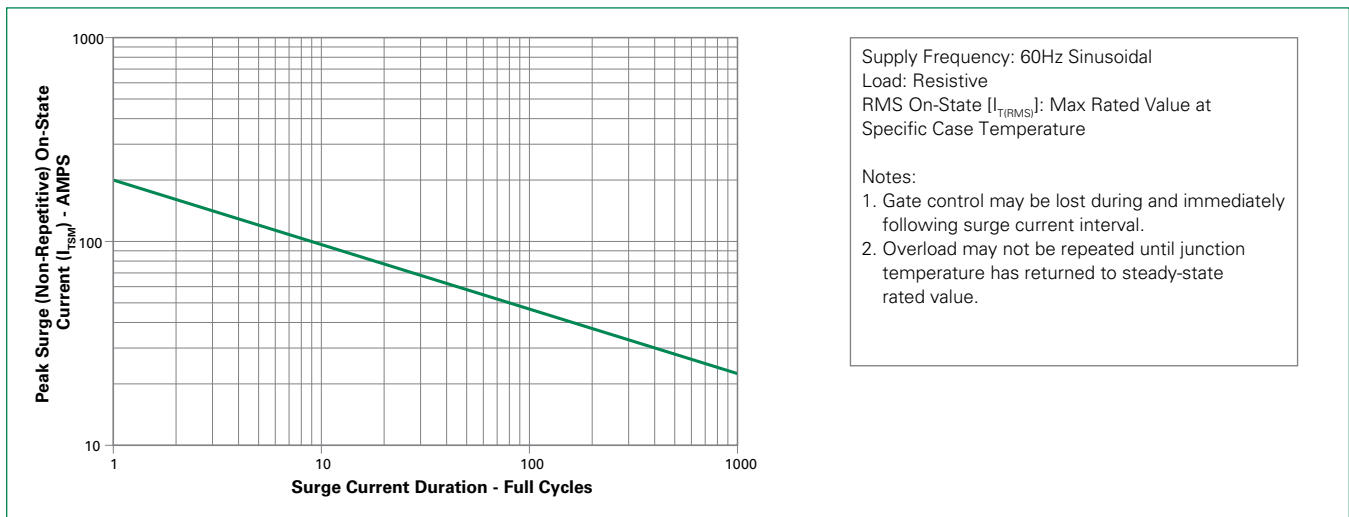
# QVxx16xHx Series

## 16 A High Temperature Alternistor Triacs

**Figure 7:**  
Maximum Allowable Case Temperature  
vs. RMS On-State Current

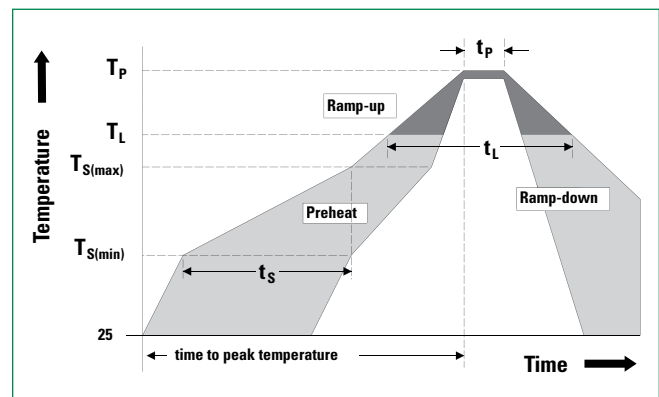


**Figure 8:** Surge Peak On-State Current vs. Number of Cycles



## 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 seconds   |
| <b>Average ramp up rate (Liquidus Temp) (<math>T_L</math>) to peak</b> |                                    | 5°C/s Max.         |
| <b><math>T_{S(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>      |                                    | 5°C/s Max.         |
| <b>Reflow</b>                                                          | - Temperature ( $T_L$ ) (Liquidus) | 217°C              |
|                                                                        | - Time ( $t_L$ )                   | 60 – 150 seconds   |
| <b>Peak Temperature (<math>T_p</math>)</b>                             |                                    | 260 °C ( $\pm 5$ ) |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 20 – 40 s          |
| <b>Ramp-down Rate</b>                                                  |                                    | 5°C/s Max.         |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>                |                                    | 8 minutes Max.     |
| <b>Do not exceed</b>                                                   |                                    | 280°C              |



# QVxx16xHx Series

## 16 A High Temperature Alternistor Triacs

### Physical Specifications

|                          |                                                          |
|--------------------------|----------------------------------------------------------|
| <b>Terminal Finish</b>   | 100% Matte Tin-plated                                    |
| <b>Body Material</b>     | UL Recognized compound meeting flammability rating 94V-0 |
| <b>Terminal Material</b> | Copper Alloy                                             |

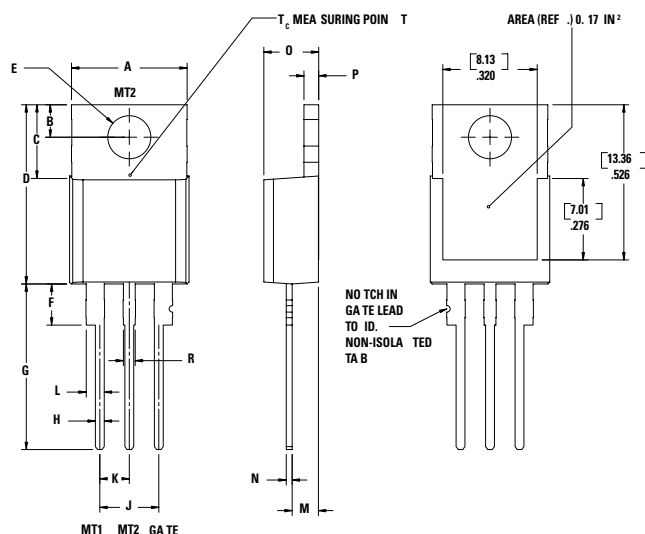
### Design Considerations

Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other ways to ensure long life for a power discrete semiconductor are proper heat sinking and selection of voltage ratings for worst case conditions. Overheating, overvoltage (including dv/dt), and surge currents are the main killers of semiconductors. Correct mounting, soldering, and forming of the leads also help protect against component damage.

### Environmental Specifications

| Test                              | Specifications and Conditions                                              |
|-----------------------------------|----------------------------------------------------------------------------|
| <b>AC Blocking</b>                | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours |
| <b>Temperature Cycling</b>        | MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell time       |
| <b>Temperature/Humidity</b>       | EIA / JEDEC, JESD22-A101, 1008 hours; 160V - DC: 85°C; 85% rel humidity    |
| <b>Resistance to Solder Heat</b>  | MIL-STD-750 Method 2031                                                    |
| <b>Solderability</b>              | ANSI/J-STD-002, category 3, Test A                                         |
| <b>Lead Bend</b>                  | MIL-STD-750, M-2036 Cond E                                                 |
| <b>Moisture Sensitivity Level</b> | Level 1, JEDEC-J-STD-020                                                   |
| <b>UHAFT</b>                      | JESD22A-118, 96 hrs, 130°C/ 85% RH                                         |
| <b>IOL</b>                        | MIL-STD-750 Method 1037                                                    |

### Dimensions - TO-220AB (R-Package) - Non-Isolated Mounting Tab Common with Center Lead



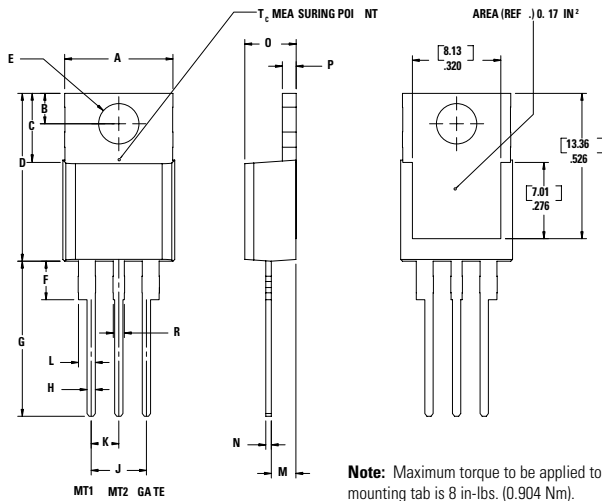
**Note:** Maximum torque to be applied to mounting tab is 8 in-lbs. (0.904 Nm).

| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| <b>A</b>  | 0.380  | 0.420 | 9.65        | 10.67 |
| <b>B</b>  | 0.105  | 0.115 | 2.66        | 2.92  |
| <b>C</b>  | 0.230  | 0.250 | 5.84        | 6.35  |
| <b>D</b>  | 0.590  | 0.620 | 14.99       | 15.75 |
| <b>E</b>  | 0.142  | 0.147 | 3.61        | 3.73  |
| <b>F</b>  | 0.110  | 0.130 | 2.79        | 3.30  |
| <b>G</b>  | 0.540  | 0.575 | 13.72       | 14.61 |
| <b>H</b>  | 0.025  | 0.035 | 0.64        | 0.89  |
| <b>J</b>  | 0.195  | 0.205 | 4.95        | 5.21  |
| <b>K</b>  | 0.095  | 0.105 | 2.41        | 2.67  |
| <b>L</b>  | 0.060  | 0.075 | 1.52        | 1.91  |
| <b>M</b>  | 0.085  | 0.095 | 2.16        | 2.41  |
| <b>N</b>  | 0.018  | 0.024 | 0.46        | 0.61  |
| <b>O</b>  | 0.178  | 0.188 | 4.52        | 4.78  |
| <b>P</b>  | 0.045  | 0.060 | 1.14        | 1.52  |
| <b>R</b>  | 0.038  | 0.048 | 0.97        | 1.22  |

# QVxx16xHx Series

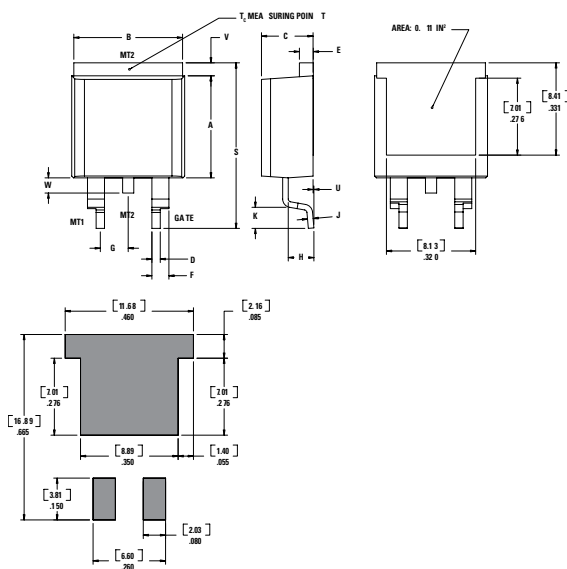
## 16 A High Temperature Alternistor Triacs

### Dimensions - TO-220AB (L-Package) - Isolated Mounting Tab



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.67        | 2.92  |
| C         | 0.230  | 0.250 | 5.84        | 6.35  |
| D         | 0.590  | 0.620 | 14.99       | 15.75 |
| E         | 0.142  | 0.147 | 3.61        | 3.73  |
| F         | 0.110  | 0.130 | 2.79        | 3.30  |
| G         | 0.540  | 0.575 | 13.72       | 14.60 |
| H         | 0.025  | 0.035 | 0.64        | 0.89  |
| J         | 0.195  | 0.205 | 4.95        | 5.21  |
| K         | 0.095  | 0.105 | 2.41        | 2.67  |
| L         | 0.060  | 0.075 | 1.52        | 1.91  |
| M         | 0.085  | 0.095 | 2.16        | 2.41  |
| N         | 0.018  | 0.024 | 0.46        | 0.61  |
| O         | 0.178  | 0.188 | 4.52        | 4.78  |
| P         | 0.045  | 0.060 | 1.14        | 1.52  |
| R         | 0.038  | 0.048 | 0.97        | 1.22  |

### Dimensions - TO-263AB (N-Package) - D2Pak Surface Mount



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.360  | 0.370 | 9.14        | 9.40  |
| B         | 0.380  | 0.420 | 9.65        | 10.67 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.025  | 0.035 | 0.64        | 0.89  |
| E         | 0.045  | 0.060 | 1.14        | 1.52  |
| F         | 0.060  | 0.075 | 1.52        | 1.91  |
| G         | 0.095  | 0.105 | 2.41        | 2.67  |
| H         | 0.092  | 0.102 | 2.34        | 2.59  |
| J         | 0.018  | 0.024 | 0.46        | 0.61  |
| K         | 0.090  | 0.110 | 2.29        | 2.79  |
| S         | 0.590  | 0.625 | 14.99       | 15.88 |
| V         | 0.035  | 0.045 | 0.89        | 1.14  |
| U         | 0.002  | 0.010 | 0.05        | 0.25  |
| W         | 0.040  | 0.070 | 1.02        | 1.78  |

### Product Selector

| Part Number | Voltage | Gate Sensitivity Quadrants | Type              | Package                    |
|-------------|---------|----------------------------|-------------------|----------------------------|
|             | 600V    | I - II - III               |                   |                            |
| QVxx16LH2   | X       | 10 mA                      | Alternistor Triac | TO-220L                    |
| QVxx16RH2   | X       | 10 mA                      | Alternistor Triac | TO-220R                    |
| QVxx16NH2   | X       | 10 mA                      | Alternistor Triac | TO-263 D <sup>2</sup> -PAK |
| QVxx16LH3   | X       | 20 mA                      | Alternistor Triac | TO-220L                    |
| QVxx16RH3   | X       | 20 mA                      | Alternistor Triac | TO-220R                    |
| QVxx16NH3   | X       | 20 mA                      | Alternistor Triac | TO-263 D <sup>2</sup> -PAK |
| QVxx16LH4   | X       | 35 mA                      | Alternistor Triac | TO-220L                    |
| QVxx16RH4   | X       | 35 mA                      | Alternistor Triac | TO-220R                    |
| QVxx16NH4   | X       | 35 mA                      | Alternistor Triac | TO-263 D <sup>2</sup> -PAK |
| QVxx16LH5   | X       | 50 mA                      | Alternistor Triac | TO-220L                    |
| QVxx16RH5   | X       | 50 mA                      | Alternistor Triac | TO-220R                    |
| QVxx16NH5   | X       | 50 mA                      | Alternistor Triac | TO-263 D <sup>2</sup> -PAK |

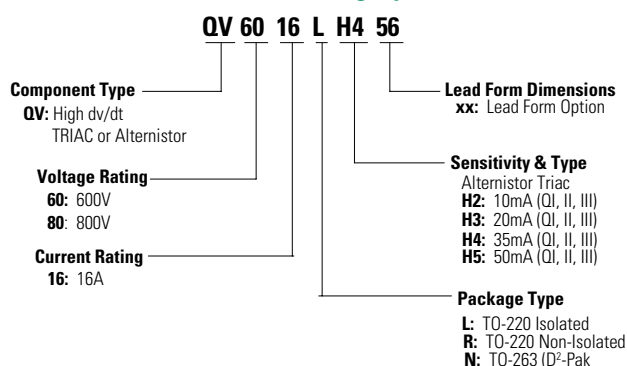
# QVxx16xHx Series

## 16 A High Temperature Alternistor Triacs

### Packing Options

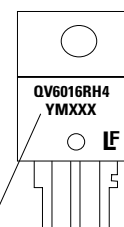
| Part Number | Marking   | Weight | Packing Mode     | Base Quantity |
|-------------|-----------|--------|------------------|---------------|
| QVxx16LHyTP | QVxx16LHy | 2.2 g  | Tube Pack        | 1000          |
| QVxx16RHxTP | QVxx16RHx |        |                  |               |
| QVxx16NHxTP | QVxx16NHx | 1.6 g  | Tube Pack        | 1000          |
| QVxx16NHxRP | QVxx16NHx | 1.6 g  | Embossed Carrier | 500           |

### Part Numbering System



### Part Marking System

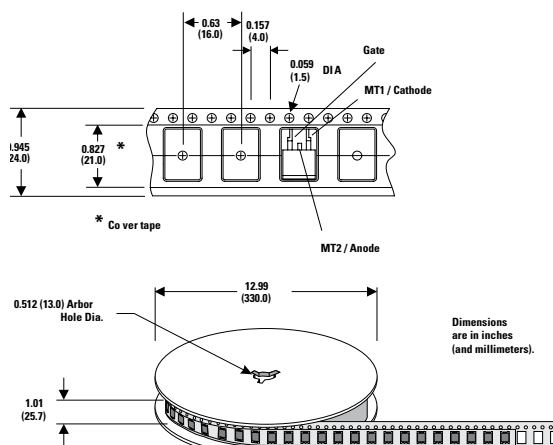
TO-220 AB - (L and R Package)  
TO-263 AB - (N Package)



**Date Code Marking**  
Y: Year Code  
M: Month Code  
XXX: Lot Trace Code

### TO-263 Embossed Carrier Reel Pack (RP)

Meets all EIA-481-2 Standards



#### Disclaimer Notice

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Part of:

