

## QJxx25xHx Series



### Description

This 25A alternistor triac solid state switch series is designed for AC switching and phase control applications such as motor speed and temperature modulation controls, lighting controls, and static switching relays.

Standard alternistor triac components operate with in-phase signals in quadrants I or III and only unipolar negative gate pulses for quadrant II or III. The alternistor triac will not operate in quadrant IV.

### Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
|        | E71639*            |

\* - J, K and L Packages

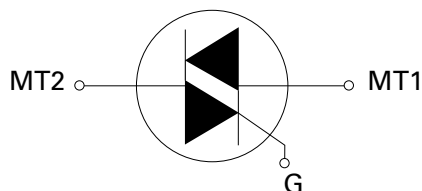
### Features & Benefits

- Voltage capability up to 600V
- Surge capability of 250A at 60Hz half cycle
- Halogen free and RoHS compliant

### Main Features

| Symbol            | Value      | Unit |
|-------------------|------------|------|
| $I_{T(RMS)}$      | 25         | A    |
| $V_{DRM}/V_{RRM}$ | 400 or 600 | V    |
| $I_{GT}$          | 50 or 80   | mA   |

### Schematic Symbol



### Applications

Excellent for AC switching and phase control applications such as heating, lighting, and motor speed controls.

Typical applications are AC solid-state switches, industrial power tools, exercise equipment, white goods and commercial appliances.

Alternistor Triacs (no snubber required) are used in applications with high inductive loads requiring the highest commutation performance.

Isolated packages offered for ease of heat sinking.

### Absolute Maximum Ratings – Alternistor Triac

| Symbol            | Parameter                                 | Test Conditions                                                                |                           | Value                   | Unit                   |
|-------------------|-------------------------------------------|--------------------------------------------------------------------------------|---------------------------|-------------------------|------------------------|
| $I_{T(RMS)}$      | RMS on-state current                      | QJxx25LH5<br>QJxx25LH6                                                         | $T_c = 90^\circ\text{C}$  | 25                      | A                      |
|                   |                                           | QJxx25KH6<br>QJxx25JH6                                                         | $T_c = 110^\circ\text{C}$ |                         |                        |
|                   |                                           | QJxx25RH5<br>QJxx25NH5<br>QJxx25RH6<br>QJxx25NH6                               | $T_c = 120^\circ\text{C}$ |                         |                        |
| $I_{TSM}$         | Peak non-repetitive surge current         | Single half cycle; $f = 50\text{Hz}$ ;<br>$T_j$ (initial) = $25^\circ\text{C}$ |                           | 208                     | A                      |
|                   |                                           | Single half cycle; $f = 60\text{Hz}$ ;<br>$T_j$ (initial) = $25^\circ\text{C}$ |                           | 250                     |                        |
| $I^2t$            | $I^2t$ Value for fusing                   | $t_p = 8.3\text{ms}$                                                           |                           | 260                     | $\text{A}^2\text{s}$   |
| $di/dt$           | 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 current                         | $t_p = 20\mu\text{s}$ , $T_j = 150^\circ\text{C}$                              |                           | 4                       | 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              | $^\circ\text{C}$       |
| $V_{DSM}/V_{RSM}$ | Peak non-repetitive blocking voltage      | $P_w = 100\mu\text{s}$                                                         |                           | $V_{DRM}/V_{RRM} + 100$ | V                      |

xx = voltage/10

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

| Symbol      | Test Conditions                                                         | Quadrant     |      | Value     |           | Unit                   |
|-------------|-------------------------------------------------------------------------|--------------|------|-----------|-----------|------------------------|
|             |                                                                         |              |      | QJxx25xH5 | QJxx25xH6 |                        |
| $I_{GT}$    | $V_D = 12\text{V}$ ; $R_L = 60\Omega$                                   | I – II – III | MAX. | 50        | 80        | mA                     |
| $V_{GT}$    |                                                                         | I – II – III | MAX. | 1.3       |           | V                      |
| $V_{GD}$    | $V_D = V_{DRM}$ ; $R_L = 3.3\text{k}\Omega$ ; $T_j = 150^\circ\text{C}$ | I – II – III | MIN. | 0.15      |           | V                      |
| $I_H$       | $I_T = 400\text{mA}$ (initial)                                          |              | MAX. | 50        | 100       | mA                     |
| $dv/dt$     | $V_D = V_{DRM}$ ; Gate Open; $T_j = 150^\circ\text{C}$                  | 400V         | MIN. | 575       | 600       | $\text{V}/\mu\text{s}$ |
|             |                                                                         | 600V         |      | 500       | 600       |                        |
| $(dv/dt)_c$ | $(di/dt)_c = 13.3\text{ A/ms}$ ; $T_j = 150^\circ\text{C}$              |              | MIN. | 20        | 30        | $\text{V}/\mu\text{s}$ |
| $t_{gt}$    | $I_G = 2 \times I_{GT}$ ; $PW = 15\mu\text{s}$ ; $I_T = 35.4\text{A}$   |              | TYP. | 3         | 5         | $\mu\text{s}$          |

### Static Characteristics

| Symbol            | Test Conditions                               |                           |      | Value | Unit          |
|-------------------|-----------------------------------------------|---------------------------|------|-------|---------------|
| $V_{TM}$          | $I_T = 35.4\text{A}$ ; $t_p = 380\mu\text{s}$ |                           | MAX. | 1.8   | V             |
| $I_{DRM}/I_{RRM}$ | $V_{DRM}/V_{RRM}$                             | $T_j = 25^\circ\text{C}$  | MAX. | 10    | $\mu\text{A}$ |
|                   |                                               | $T_j = 125^\circ\text{C}$ |      | 2000  |               |
|                   |                                               | $T_j = 150^\circ\text{C}$ |      | 4000  |               |

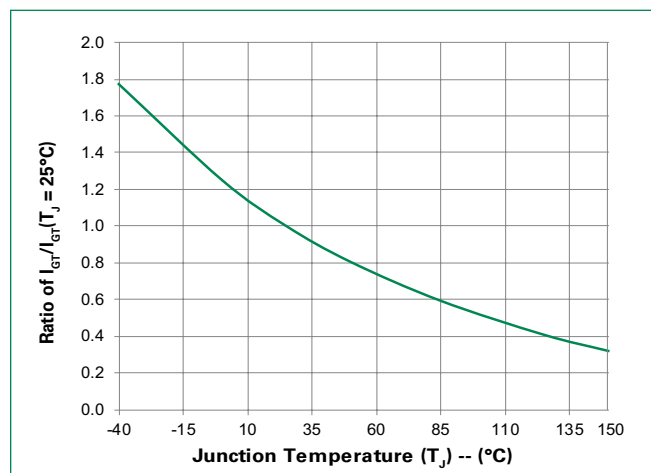
xx = voltage/10, x = package

### Thermal Resistances

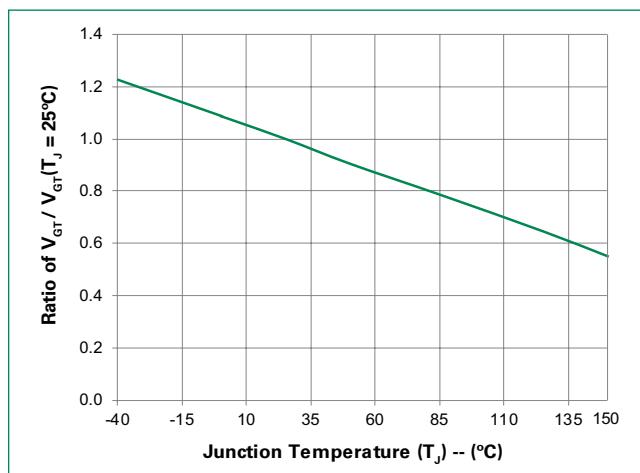
| Symbol            | Parameter             |                                                | Value | Unit |
|-------------------|-----------------------|------------------------------------------------|-------|------|
| $R_{\theta(J-C)}$ | Junction to case (AC) | QJxx25RH6 / QJxx25NH6<br>QJxx25RH5 / QJxx25NH5 | 0.90  | °C/W |
|                   |                       | QJxx25LH6 / QJxx25LH5                          | 1.80  |      |
|                   |                       | QJxx25KH6 / QJxx25JH6                          | 1.25  |      |
| $R_{\theta(J-A)}$ | Junction to ambient   | QJxx25RHy                                      | 45    | °C/W |
|                   |                       | QJxx25LH6 / QJxx25LH5                          | 50    |      |

xx = voltage/10, y = sensitivity

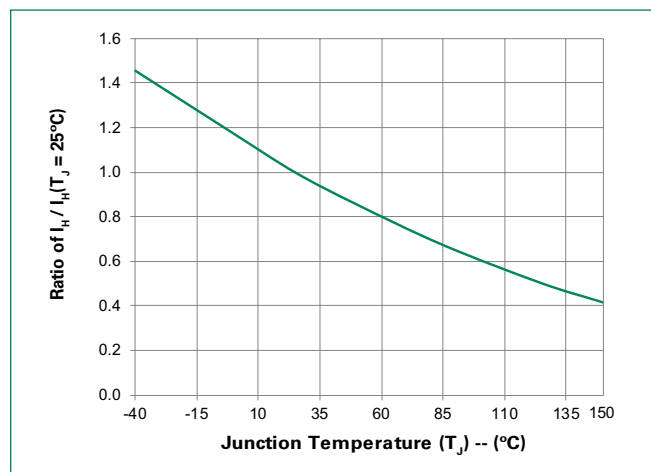
**Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature**



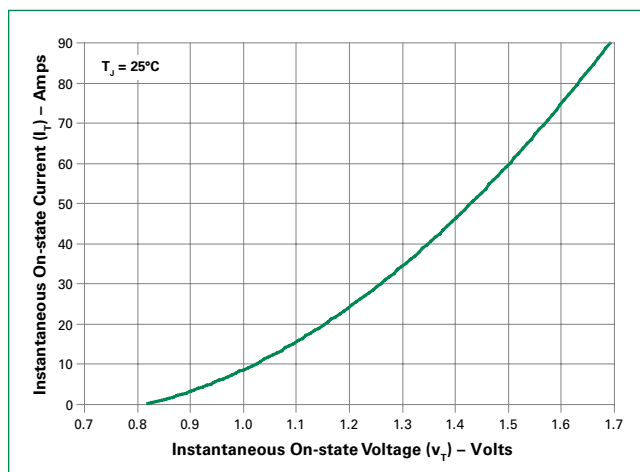
**Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature**



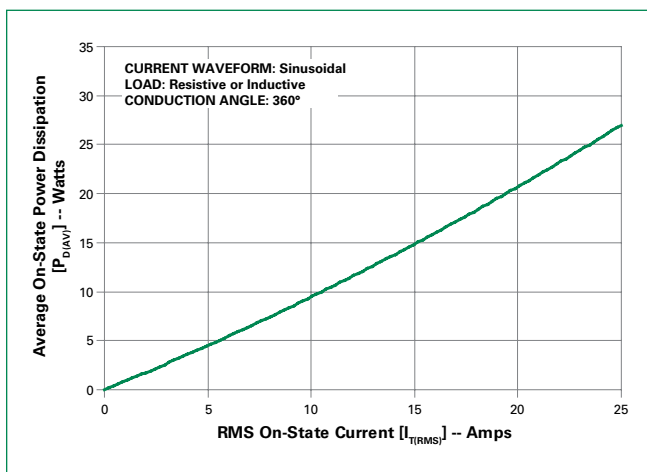
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



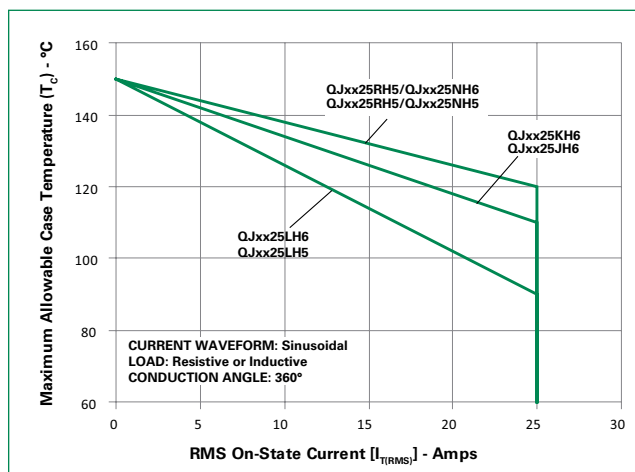
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



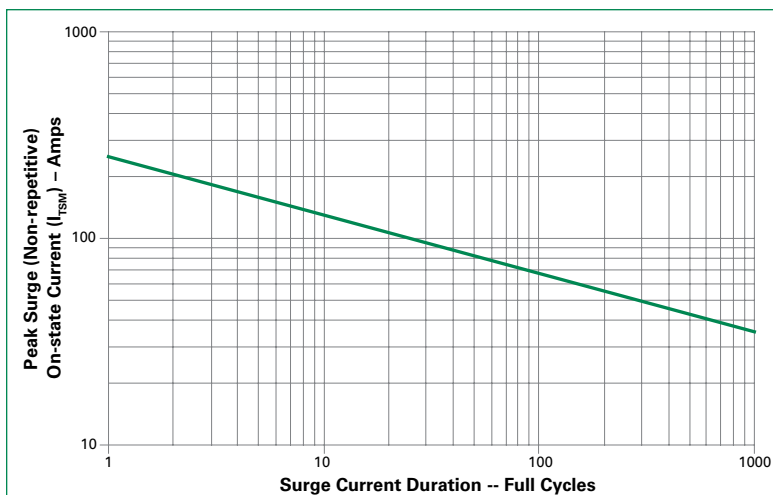
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



**Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current**



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



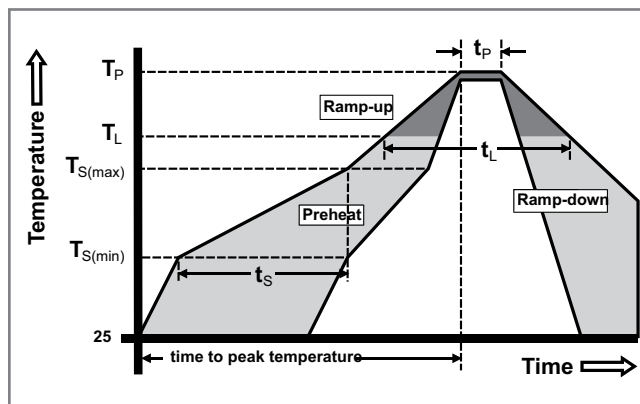
SUPPLY FREQUENCY: 60 Hz Sinusoidal  
LOAD: Resistive  
RMS On-State Current:  $[I_{T(RMS)}]$ : Maximum Rated Value at Specified Case Temperature

**Notes:**

1. Gate control may be lost during and immediately following surge current interval.
2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

### 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 |                                    | 5°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 5°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                                         |                                    | 5°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes Max.          |
| Do not exceed                                          |                                    | 280°C                   |



### Physical Specifications

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

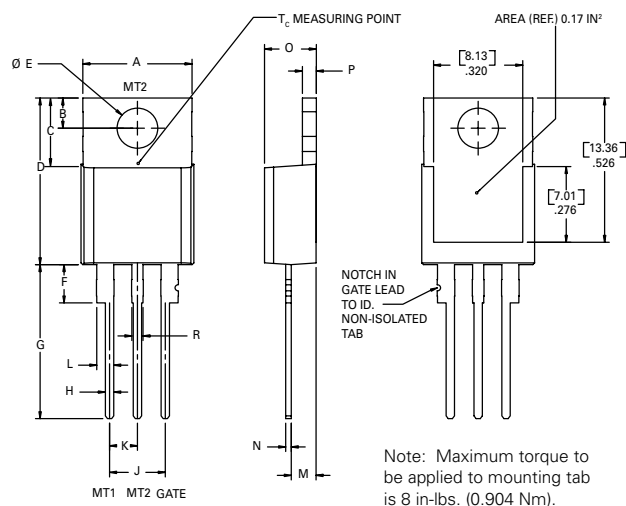
### Design Considerations

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

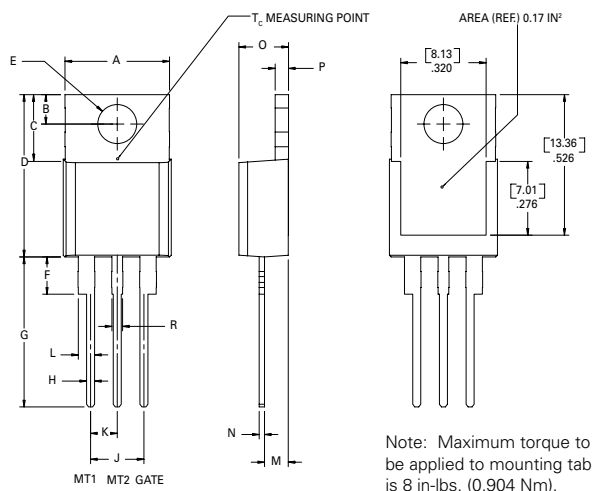
| Test                                     | Specifications and Conditions                                                |
|------------------------------------------|------------------------------------------------------------------------------|
| <b>High Temperature Voltage Blocking</b> | MIL-STD-750: Method 1040, Condition A<br>Rated $V_{RRM}$ , 150°C, 1008 hours |
| <b>Temperature Cycling</b>               | MIL-STD-750: Method 1051<br>-40°C to 150°C, 15-minute dwell, 100 cycles      |
| <b>Biased Temp &amp; Humidity</b>        | EIA/JEDEC: JESD22-A101<br>160VDC, 85°C, 85%RH, 1008 hours                    |
| <b>High Temp. Storage</b>                | MIL-STD-750: Method 1031<br>150°C, 1008 hours                                |
| <b>Low-Temp Storage</b>                  | -40°C, 1008 hours                                                            |
| <b>Resistance to Solder Heat</b>         | MIL-STD-750: Method 2031<br>260°C, 10 seconds                                |
| <b>Solderability</b>                     | ANSI/J-STD-002, Category 3, Test A                                           |
| <b>Lead Bend</b>                         | MIL-STD-750: Method 2036, Condition E                                        |
| <b>Moisture Sensitivity Level</b>        | Level 1, JEDEC-J-STD-020                                                     |

### Dimensions — TO-220AB (R Package) — Non-isolated Mounting Tab



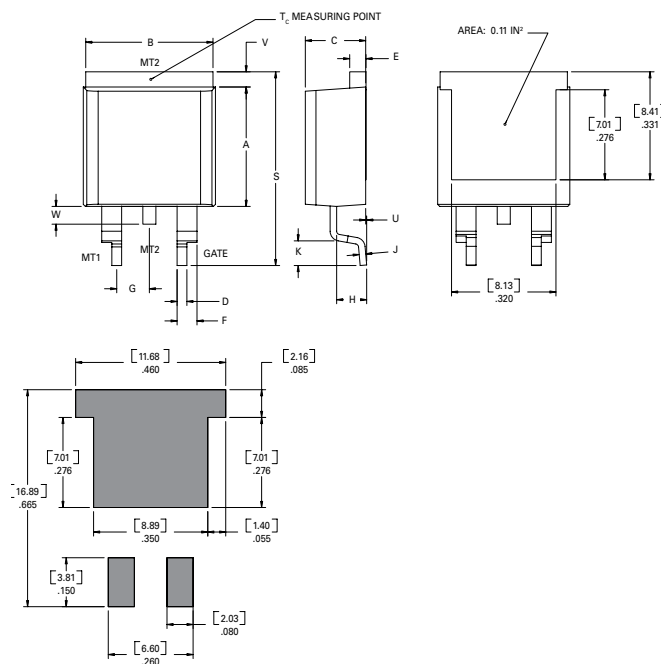
| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.67        | 2.92  |
| C         | 0.230  | 0.250 | 5.84        | 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       | 14.61 |
| 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-220AB (L Package) — Isolated Mounting Tab



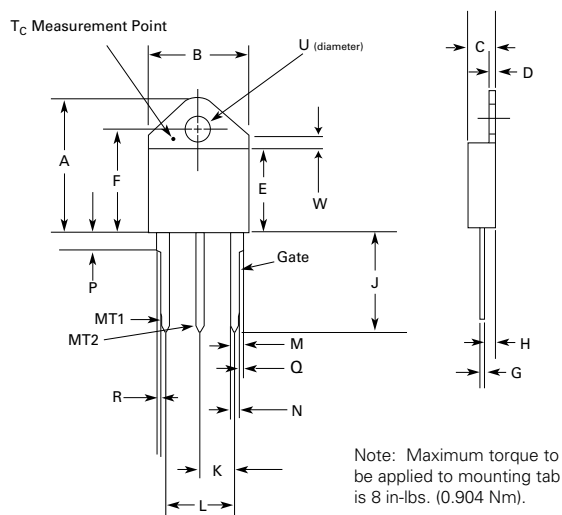
| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.66        | 2.92  |
| C         | 0.230  | 0.250 | 5.85        | 6.35  |
| D         | 0.590  | 0.620 | 14.98       | 15.75 |
| E         | 0.142  | 0.147 | 3.61        | 3.73  |
| F         | 0.110  | 0.130 | 2.80        | 3.30  |
| G         | 0.540  | 0.575 | 13.71       | 14.60 |
| H         | 0.025  | 0.035 | 0.63        | 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 | 1.78        | 2.16  |
| N         | 0.018  | 0.024 | 0.45        | 0.61  |
| O         | 0.178  | 0.188 | 4.52        | 4.78  |
| P         | 0.045  | 0.060 | 1.14        | 1.53  |
| R         | 0.038  | 0.048 | 0.97        | 1.22  |

### Dimensions — TO-263 (N Package) — D<sup>2</sup>Pak Surface Mount



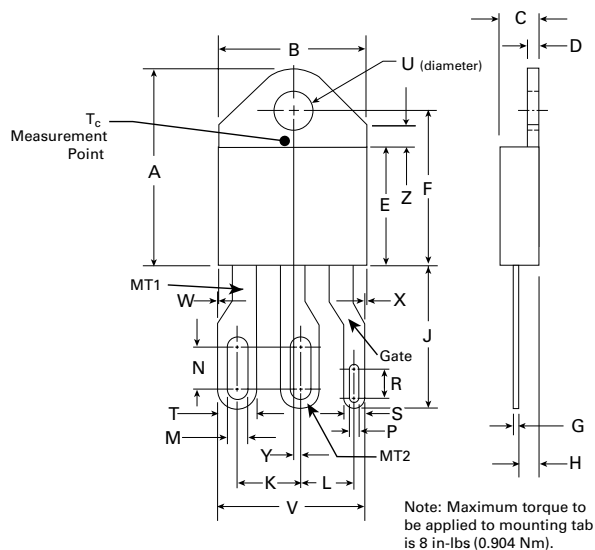
| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.360  | 0.370 | 9.14        | 9.40  |
| B         | 0.380  | 0.420 | 9.65        | 10.67 |
| C         | 0.178  | 0.188 | 4.52        | 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  |

### Dimensions — TO-218AC (K Package) — Isolated Mounting Tab



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.810  | 0.835 | 20.57       | 21.21 |
| B         | 0.610  | 0.630 | 15.49       | 16.00 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.055  | 0.070 | 1.40        | 1.78  |
| E         | 0.487  | 0.497 | 12.37       | 12.62 |
| F         | 0.635  | 0.655 | 16.13       | 16.64 |
| G         | 0.022  | 0.029 | 0.56        | 0.74  |
| H         | 0.075  | 0.095 | 1.91        | 2.41  |
| J         | 0.575  | 0.625 | 14.61       | 15.88 |
| K         | 0.211  | 0.219 | 5.36        | 5.56  |
| L         | 0.422  | 0.437 | 10.72       | 11.10 |
| M         | 0.058  | 0.068 | 1.47        | 1.73  |
| N         | 0.045  | 0.055 | 1.14        | 1.40  |
| P         | 0.095  | 0.115 | 2.41        | 2.92  |
| Q         | 0.008  | 0.016 | 0.20        | 0.41  |
| R         | 0.008  | 0.016 | 0.20        | 0.41  |
| U         | 0.164  | 0.165 | 4.10        | 4.20  |
| W         | 0.085  | 0.095 | 2.17        | 2.42  |

### Dimensions — TO-218X (J Package) — Isolated Mounting Tab



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.810  | 0.835 | 20.57       | 21.21 |
| B         | 0.610  | 0.630 | 15.49       | 16.00 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.055  | 0.070 | 1.40        | 1.78  |
| E         | 0.487  | 0.497 | 12.37       | 12.62 |
| F         | 0.635  | 0.655 | 16.13       | 16.64 |
| G         | 0.022  | 0.029 | 0.56        | 0.74  |
| H         | 0.075  | 0.095 | 1.91        | 2.41  |
| J         | 0.575  | 0.625 | 14.61       | 15.88 |
| K         | 0.256  | 0.264 | 6.50        | 6.71  |
| L         | 0.220  | 0.228 | 5.58        | 5.79  |
| M         | 0.080  | 0.088 | 2.03        | 2.24  |
| N         | 0.169  | 0.177 | 4.29        | 4.49  |
| P         | 0.034  | 0.042 | 0.86        | 1.07  |
| R         | 0.113  | 0.121 | 2.87        | 3.07  |
| S         | 0.086  | 0.096 | 2.18        | 2.44  |
| T         | 0.156  | 0.166 | 3.96        | 4.22  |
| U         | 0.164  | 0.165 | 0.410       | 0.420 |
| V         | 0.603  | 0.618 | 15.31       | 15.70 |
| W         | 0.000  | 0.005 | 0.00        | 0.13  |
| X         | 0.003  | 0.012 | 0.07        | 0.30  |
| Y         | 0.028  | 0.032 | 0.71        | 0.81  |
| Z         | 0.085  | 0.095 | 2.17        | 2.42  |

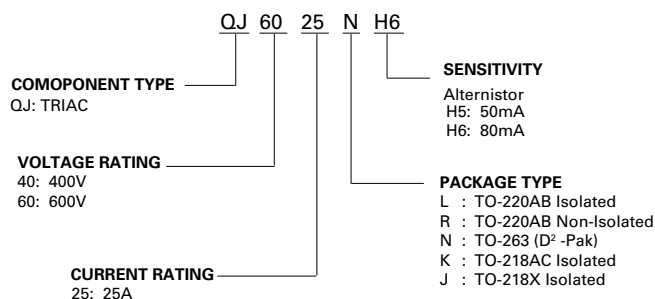
### Product Selector

| Part Number | Voltage |      | Gate Sensitivity Quadrants | Package                    |
|-------------|---------|------|----------------------------|----------------------------|
|             | 400V    | 600V | I - II - III               |                            |
| QJxx25RH5   | X       | X    | 50 mA                      | TO-220R                    |
| QJxx25LH5   | X       | X    | 50 mA                      | TO-220L                    |
| QJxx25NH5   | X       | X    | 50 mA                      | TO-263 D <sup>2</sup> -Pak |
| QJxx25NH6   | X       | X    | 80 mA                      | TO-263 D <sup>2</sup> -Pak |
| QJxx25JH6   | X       | X    | 80 mA                      | TO-218X                    |
| QJxx25KH6   | X       | X    | 80 mA                      | TO-218AC                   |
| QJxx25LH6   | X       | X    | 80 mA                      | TO-220L                    |
| QJxx25RH6   | X       | X    | 80 mA                      | TO-220R                    |

### Packing Options

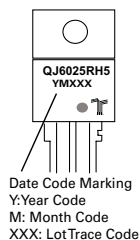
| Part Number | Marking   | Weight | Packing Mode     | Base Quantity     |
|-------------|-----------|--------|------------------|-------------------|
| QJxx25RH5TP | QJxx25RH5 | 2.20g  | Tube Pack        | 500 (50 per tube) |
| QJxx25LH5TP | QJxx25LH5 | 2.20g  | Tube Pack        | 500 (50 per tube) |
| QJxx25NH5TP | QJxx25NH5 | 1.60g  | Tube Pack        | 500 (50 per tube) |
| QJxx25NH5RP | QJxx25NH5 | 1.60g  | Embossed Carrier | 500               |
| QJxx25NH6TP | QJxx25NH6 | 1.60g  | Tube Pack        | 500 (50 per tube) |
| QJxx25NH6RP | QJxx25NH6 | 1.60g  | Embossed Carrier | 500               |
| QJxx25JH6TP | QJxx25JH6 | 5.23g  | Tube Pack        | 250 (25 per tube) |
| QJxx25KH6TP | QJxx25KH6 | 4.40g  | Tube Pack        | 250 (25 per tube) |
| QJxx25LH6TP | QJxx25LH6 | 2.20g  | Tube Pack        | 500 (50 per tube) |
| QJxx25RH6TP | QJxx25RH6 | 2.20g  | Tube Pack        | 500 (50 per tube) |

### Part Numbering System

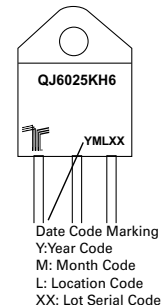


### Part Marking System

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

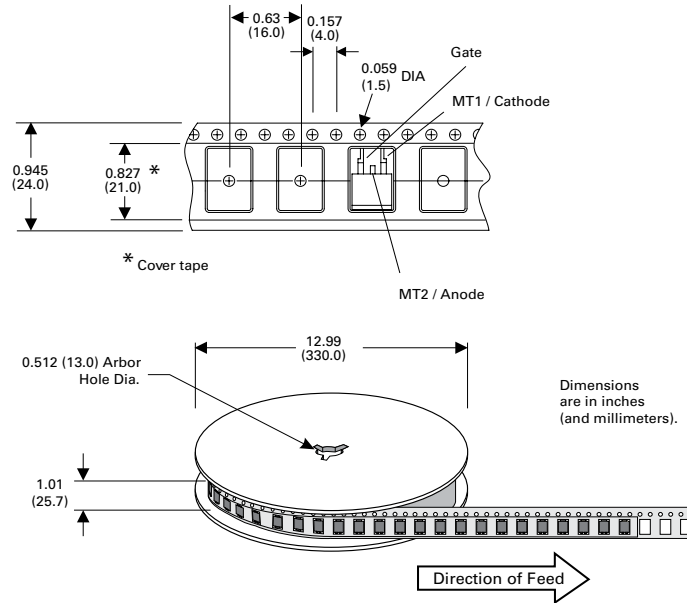


TO-218AC - (K Package)  
TO-218X - (J Package)



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

Meets all EIA-481-2 Standards



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