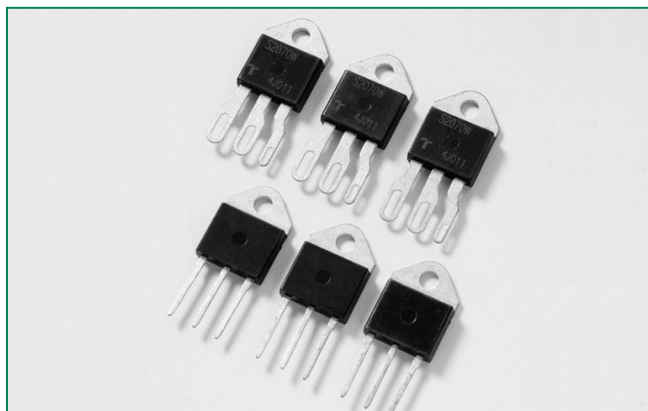


### QJxx40xx Series



#### Agency Recognitions

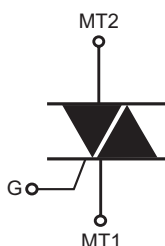
| Agency | Agency File Number |
|--------|--------------------|
|        | E71639*            |

\* - K and J Packages

#### Main Features

| Symbol            | Value      | Unit |
|-------------------|------------|------|
| $I_{T(RMS)}$      | 40         | A    |
| $V_{DRM}/V_{RRM}$ | 400 to 800 | V    |
| $I_{GT(Q1)}$      | 35 to 100  | mA   |

#### Schematic Symbol



#### Description

The 40 Amp bi-directional solid state switch series is designed for AC switching and phase control applications such as motor speed, temperature modulation controls, lighting controls, and static switching relays.

Alternistor type components only operate in quadrants I, II, & III and are used in circuits requiring high dv/dt capability.

Standard type devices operate in quadrants I,II,III & IV.

#### Features & Benefits

- RoHS Compliant
- High  $T_j$  of 150°C
- Voltage capability up to 800V
- Surge capability up to 500A
- Electrically isolated for 2500Vrms
- UL Recognized to UL 1557 as an Electrically Isolated Semiconductor Device

#### 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 extremely inductive loads requiring highest commutation performance.

Internally constructed isolated packages are offered for ease of heat sinking with highest isolation voltage.

### Absolute Maximum Ratings – Alternistor Triac (3 Quadrants)

| Symbol            | Parameter                                                                                           |                                     |                                     | Value                   | Unit                   |
|-------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|-------------------------|------------------------|
| $I_{T(RMS)}$      | RMS on-state current (full sine wave)                                                               | QJxx40xH5<br>QJxx40xH7<br>QJxx40xH6 | $T_c = 100\text{ }^{\circ}\text{C}$ | 40                      | A                      |
| $I_{TSM}$         | Non repetitive surge peak on-state current<br>(full cycle, $T_J$ initial = $25^{\circ}\text{C}$ )   | $f = 50\text{ Hz}$                  | $t = 20\text{ ms}$                  | 420                     | A                      |
|                   |                                                                                                     | $f = 60\text{ Hz}$                  | $t = 16.7\text{ ms}$                | 500                     |                        |
| $I^2t$            | $I^2t$ Value for fusing                                                                             |                                     | $t_p = 8.3\text{ ms}$               | 1037                    | $\text{A}^2\text{s}$   |
| $di/dt$           | Critical rate of rise of on-state current<br>( $I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$ ) | $f = 120\text{ Hz}$                 | $T_J = 150\text{ }^{\circ}\text{C}$ | 150                     | $\text{A}/\mu\text{s}$ |
| $I_{GTM}$         | Peak gate trigger current                                                                           | $t_p = 20\text{ }\mu\text{s}$       | $T_J = 150\text{ }^{\circ}\text{C}$ | 4                       | A                      |
| $P_{G(AV)}$       | Average gate power dissipation                                                                      |                                     | $T_J = 150\text{ }^{\circ}\text{C}$ | 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                                                                |                                     | 400-600V                            | $V_{DRM}/V_{RRM} + 100$ | V                      |
|                   |                                                                                                     |                                     | 800V                                | $V_{DRM}/V_{RRM} + 200$ |                        |

### Absolute Maximum Ratings – Standard Triac (4 Quadrants)

| Symbol       | Parameter                                 | Test Conditions                                        |                                     | Value      | Unit                   |
|--------------|-------------------------------------------|--------------------------------------------------------|-------------------------------------|------------|------------------------|
| $I_{T(RMS)}$ | RMS on-state current                      | QJxx40x3<br>QJxx40x4                                   | $T_c = 100\text{ }^{\circ}\text{C}$ | 40         | A                      |
| $I_{TSM}$    | Peak non-repetitive surge current         | $f = 50\text{ Hz}$                                     | $t = 20\text{ ms}$                  | 420        | A                      |
|              |                                           | $f = 60\text{ Hz}$                                     | $t = 16\text{ ms}$                  | 500        |                        |
| $I^2t$       | $I^2t$ Value for fusing                   |                                                        | $t_p = 8.3\text{ ms}$               | 1037       | $\text{A}^2\text{s}$   |
| $di/dt$      | Critical rate-of-rise of on-state current | $f = 120\text{ Hz}; T_J = 150\text{ }^{\circ}\text{C}$ |                                     | 150        | $\text{A}/\mu\text{s}$ |
| $I_{GTM}$    | Peak gate current                         | $t_p = 20\text{ }\mu\text{s}$                          | $T_J = 150\text{ }^{\circ}\text{C}$ | 4          | A                      |
| $P_{G(AV)}$  | Average gate power dissipation            | $T_J = 150\text{ }^{\circ}\text{C}$                    |                                     | 0.5        | W                      |
| $T_{stg}$    | Storage temperature range                 |                                                        |                                     | -40 to 150 | $^{\circ}\text{C}$     |
| $T_J$        | Operating junction temperature range      |                                                        |                                     | -40 to 150 | $^{\circ}\text{C}$     |

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

| Symbol   | Test Conditions                                                         | Quadrant     |      | Value     |           |           | Unit             |
|----------|-------------------------------------------------------------------------|--------------|------|-----------|-----------|-----------|------------------|
|          |                                                                         |              |      | QJxx40xH6 | QJxx40xH5 | QJxx40xH7 |                  |
| $I_{GT}$ | $V_D = 12\text{V}$ $R_L = 60\ \Omega$                                   | I – II – III | MAX. | 80        | 50        | 100       | mA               |
| $V_{GT}$ | $V_D = 12\text{V}$ $R_L = 60\ \Omega$                                   | I – II – III | MAX. | 1.3       | 1.3       | 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. | 0.2       |           |           | V                |
| $I_H$    | $I_T = 400\text{mA}$                                                    |              | MAX. | 80        | 75        | 100       | mA               |
| dv/dt    | $V_D = V_{DRM}$ Gate Open $T_J = 150^\circ\text{C}$                     | 400V         | MIN. | 1800      | 1300      | 2500      | V/ $\mu\text{s}$ |
|          |                                                                         | 600V         |      | 1600      | 1200      | 2200      |                  |
|          |                                                                         | 800V         |      | 1500      | 1000      | 2000      |                  |
| (dv/dt)c | (di/dt)c = 21.6 A/ms $T_J = 150^\circ\text{C}$                          |              | MIN. | 30        | 20        | 40        | V/ $\mu\text{s}$ |
| $t_{gt}$ | $I_G = 2 \times I_{GT}$ $PW = 15\ \mu\text{s}$ $I_T = 56.6\text{A(pk)}$ |              | TYP. | 5         |           |           | $\mu\text{s}$    |

### Electrical Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified) — Standard Triac (4 Quadrants)

| Symbol   | Test Conditions                                                           | Quadrant     |      | Value    |          | Unit             |
|----------|---------------------------------------------------------------------------|--------------|------|----------|----------|------------------|
|          |                                                                           |              |      | QJxx40x3 | QJxx40x4 |                  |
| $I_{GT}$ | $V_D = 12\text{V}$ ; $R_L = 60\ \Omega$                                   | I – II – III | MAX. | 35       | 50       | mA               |
|          |                                                                           | IV           | MAX. | 70       | 100      |                  |
| $V_{GT}$ | $V_D = 12\text{V}$ ; $R_L = 60\ \Omega$                                   | ALL          | MAX. | 1.3      |          | V                |
| $V_{GD}$ | $V_D = V_{DRM}$ ; $R_L = 3.3\ \text{k}\Omega$ ; $T_J = 150^\circ\text{C}$ | ALL          | MIN. | 0.2      |          | V                |
| $I_H$    | $I_T = 400\text{mA}$ (initial)                                            |              | MAX. | 60       | 80       | mA               |
| dv/dt    | $V_D = V_{DRM}$ ; Gate Open; $T_J = 150^\circ\text{C}$                    | 400V         | MIN. | 800      | 1500     | V/ $\mu\text{s}$ |
|          |                                                                           | 600V         |      | 600      | 1200     |                  |
|          |                                                                           | 800V         |      | 500      | 1000     |                  |
| (dv/dt)c | (di/dt)c = 4.3 A/ms; $T_J = 150^\circ\text{C}$                            |              | MIN. | 10       |          | V/ $\mu\text{s}$ |
| $t_{gt}$ | $I_G = 2 \times I_{GT}$ ; $PW = 15\ \mu\text{s}$ ; $I_T = 35.4\text{A}$   |              | TYP. | 5        |          | $\mu\text{s}$    |

### Static Characteristics

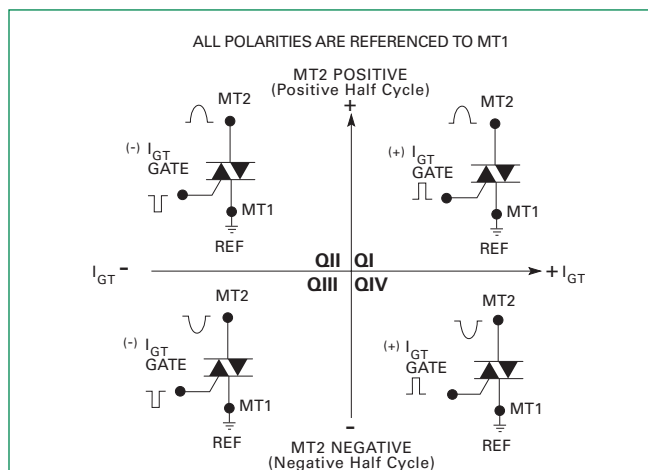
| Symbol                    | Test Conditions                                  |                           |            | Value | Unit |
|---------------------------|--------------------------------------------------|---------------------------|------------|-------|------|
| $V_{TM}$                  | $I_{TM} = 56.6\text{A}$ $t_p = 380\ \mu\text{s}$ | $T_J = 25^\circ\text{C}$  | MAX.       | 1.6   | V    |
| $\frac{I_{DRM}}{I_{RRM}}$ | $V_D = V_{DRM} / V_{RRM}$                        | $T_J = 25^\circ\text{C}$  | 400 – 800V | MAX.  | 20   |
|                           |                                                  | $T_J = 125^\circ\text{C}$ | 400 – 800V | MAX.  | 2    |
|                           |                                                  | $T_J = 150^\circ\text{C}$ | 800V       | MAX.  | 6    |

### Thermal Resistances

| Symbol           | Parameter             | Value                                                | Unit                 |
|------------------|-----------------------|------------------------------------------------------|----------------------|
| $R_{\theta(JC)}$ | Junction to case (AC) | QJxx40KH6<br>QJxx40KH5/H7<br>QJxx40K3<br>QJxx40K4/J4 | $^{\circ}\text{C/W}$ |
|                  |                       | QJxx40JH6<br>QJxx40JH7                               |                      |

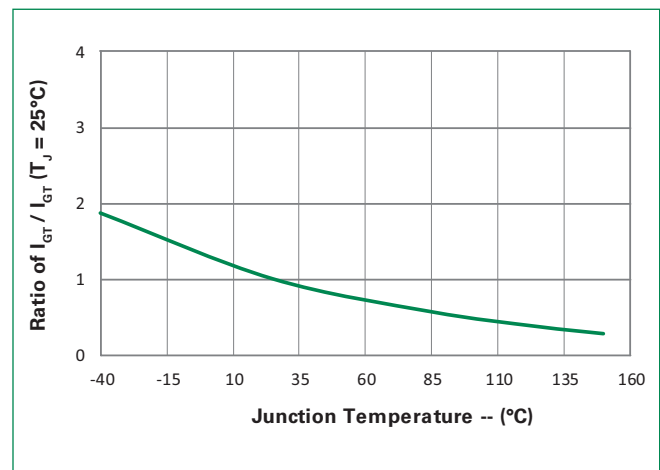
Note: xx = voltage

**Figure 1: Definition of Quadrants**

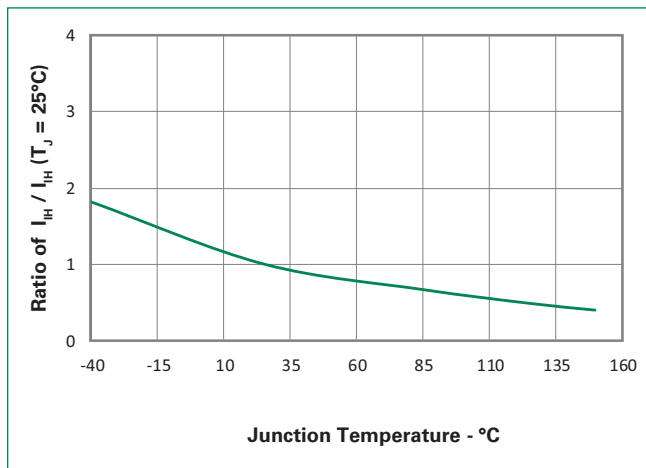


Note: Alternistors will not operate in QIV

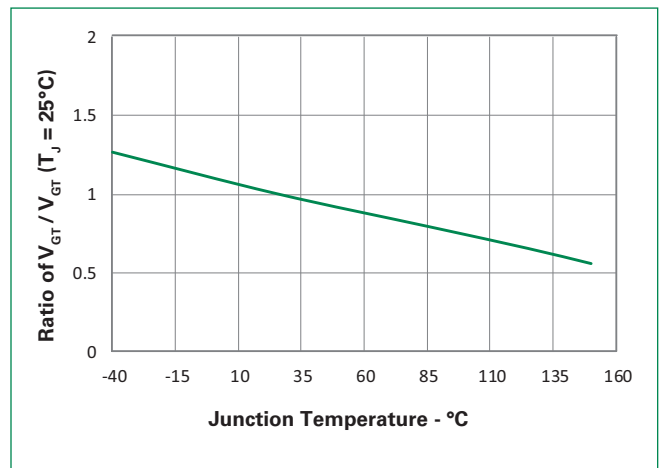
**Figure 2: Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature**



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

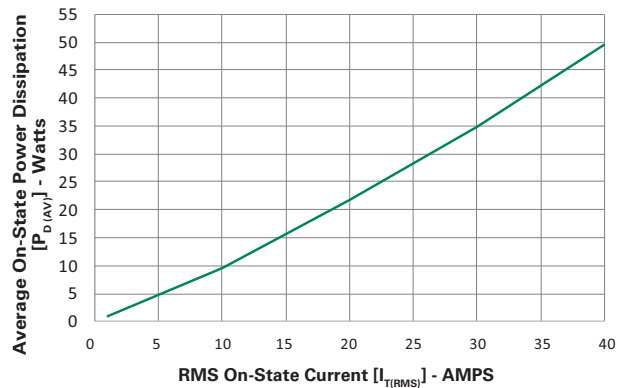


**Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature**

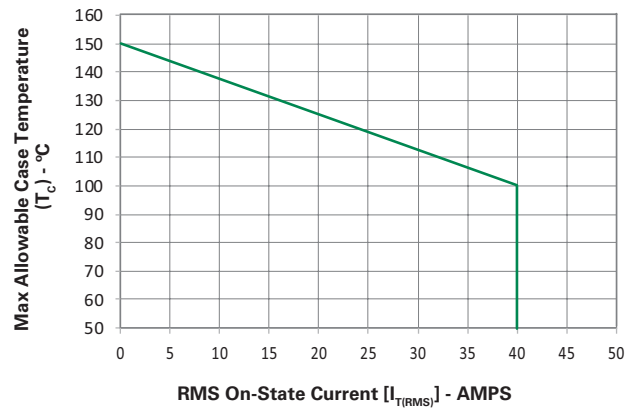




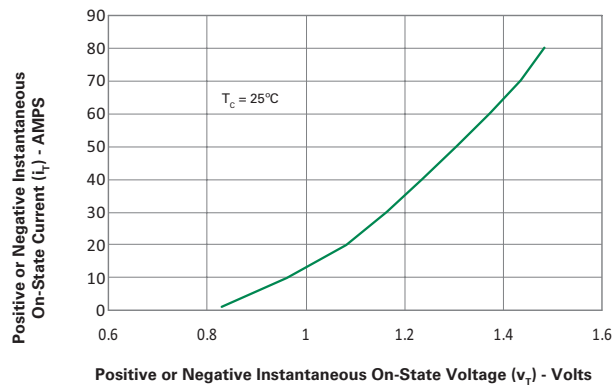
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



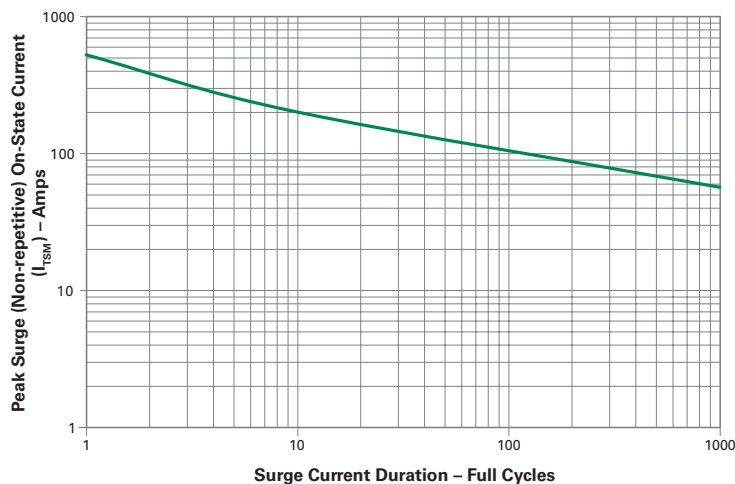
**Figure 6: Maximum Allowable Case Temperature vs. On-State Current**



**Figure 7: On-State Current vs. On-State Voltage (Typical)**



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



Supply Frequency: 60Hz Sinusoidal  
Load: Resistive  
RMS On-State  $[I_{T(RMS)}]$ : Max Rated Value at Specific 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

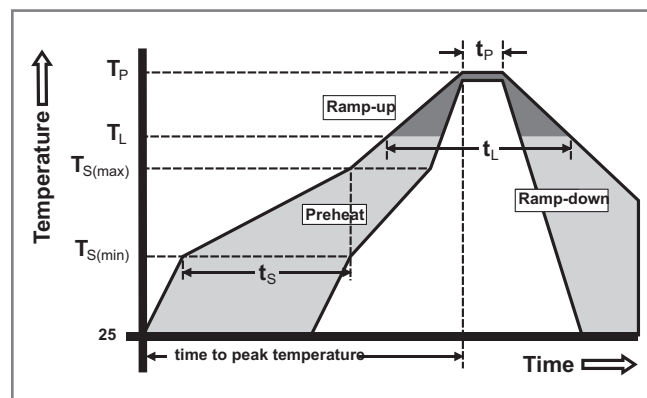
|                                                        |                                    |                         |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | 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                   |
|                                                        | - Time (min to max) ( $t_s$ )      | 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

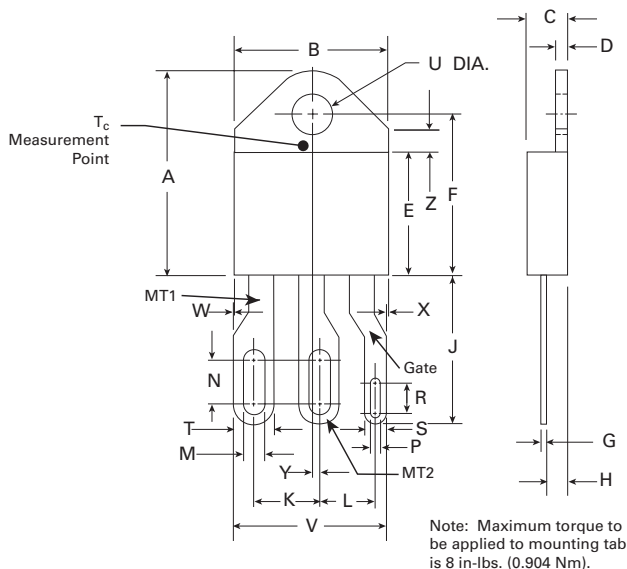
Careful selection of the correct component for the application's operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other 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

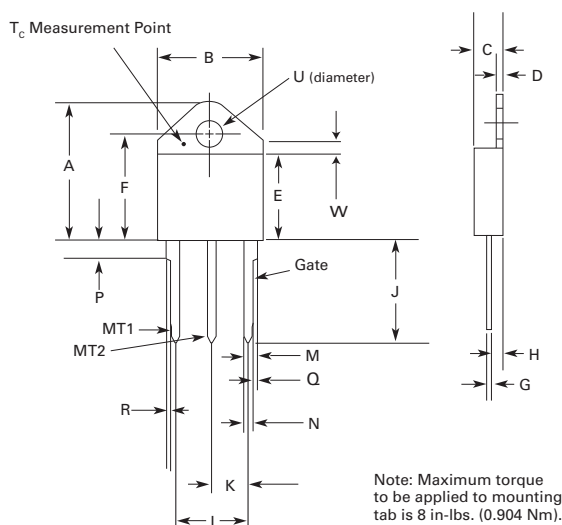
| Test                             | Specifications and Conditions                                              |
|----------------------------------|----------------------------------------------------------------------------|
| <b>AC Blocking</b>               | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours |
| <b>Temperature Cycling</b>       | MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time        |
| <b>Temperature/Humidity</b>      | EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity     |
| <b>High Temp Storage</b>         | MIL-STD-750, M-1031, 1008 hours; 150°C                                     |
| <b>Low-Temp Storage</b>          | 1008 hours; -40°C                                                          |
| <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                                                 |

### 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         | 0.161  | 0.165 | 4.10        | 4.20  |
| 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  |

### 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         | 0.161  | 0.165 | 4.10        | 4.20  |
| W         | 0.085  | 0.095 | 2.17        | 2.42  |

### Product Selector

| Part Number | Voltage |      |      | Gate Sensitivity Quadrants |        | $I_{T(RMS)}$ | Type              | Package  |
|-------------|---------|------|------|----------------------------|--------|--------------|-------------------|----------|
|             | 400V    | 600V | 800V | I – II – III               | IV     |              |                   |          |
| QJxx40KH6   | X       | X    | X    | 80 mA                      |        | 40 A         | Alternistor Triac | TO-218AC |
| QJxx40JH6   | X       | X    | X    | 80 mA                      |        | 40 A         | Alternistor Triac | TO-218X  |
| QJxx40KH5   | X       | X    | X    | 50 mA                      |        | 40 A         | Alternistor Triac | TO-218AC |
| QJxx40KH7   | X       | X    | X    | 100 mA                     |        | 40 A         | Alternistor Triac | TO-218AC |
| QJxx40JH7   | X       | X    | X    | 100 mA                     |        | 40 A         | Alternistor Triac | TO-218X  |
| QJxx40K3    | X       | X    | X    | 35 mA                      | 70 mA  | 40 A         | Standard Triac    | TO-218AC |
| QJxx40K4    | X       | X    | X    | 50 mA                      | 100 mA | 40 A         | Standard Triac    | TO-218AC |

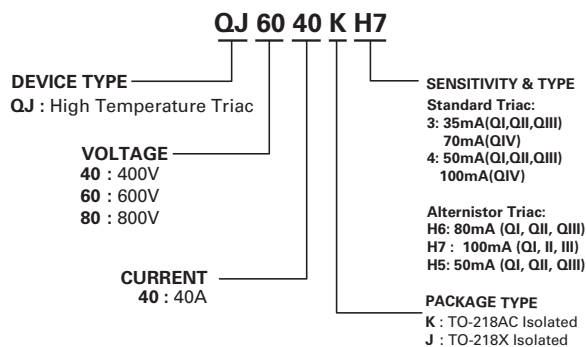
Note: xx = Voltage

### Packing Options

| Part Number | Marking   | Weight | Packing Mode | Base Quantity     |
|-------------|-----------|--------|--------------|-------------------|
| QJxx40KH6TP | QJxx40KH6 | 4.40 g | Tube Pack    | 250 (25 per tube) |
| QJxx40JH6TP | QJxx40JH6 | 5.23 g | Tube Pack    | 250 (25 per tube) |
| QJxx40KH5TP | QJxx40KH5 | 4.40 g | Tube Pack    | 250 (25 per tube) |
| QJxx40KH7TP | QJxx40KH7 | 4.40 g | Tube Pack    | 250 (25 per tube) |
| QJxx40JH7TP | QJxx40JH7 | 5.23 g | Tube Pack    | 250 (25 per tube) |
| QJxx40K3TP  | QJxx40K3  | 4.40 g | Tube Pack    | 250 (25 per tube) |
| QJxx40K4TP  | QJxx40K4  | 4.40 g | Tube Pack    | 250 (25 per tube) |

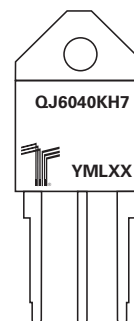
Note: xx = Voltage

### Part Numbering System



### Part Marking System

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



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