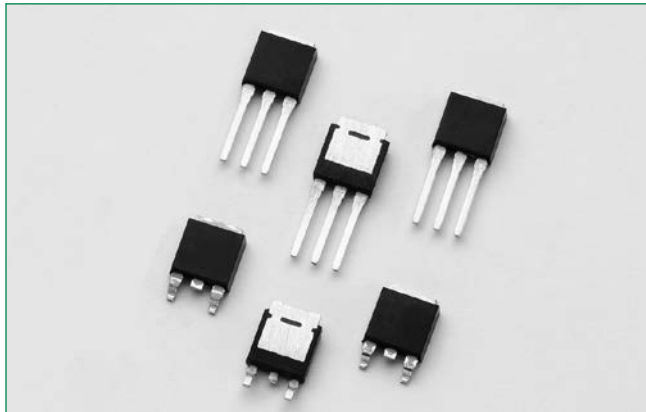


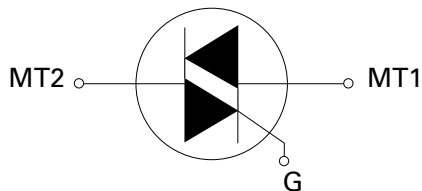
### LJxx06xx & QJxx06xHx series



#### Main Features

| Symbol            | Value      | Unit |
|-------------------|------------|------|
| $I_{T(RMS)}$      | 6          | A    |
| $V_{DRM}/V_{RRM}$ | 400 or 600 | V    |
| $I_{GT(Q1)}$      | 10 to 35   | mA   |

#### Schematic Symbol



#### Description

This 6 A High Temperature 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.

**Sensitive** type components guarantee gate control in Quadrants I & IV as needed for digital control circuitry.

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

#### Features & Benefits

- 150°C maximum junction temperature
- Voltage capability up to 600V
- Surge capability up to 72A at 60Hz half cycle
- Solid-state switching eliminates arcing or contact bounce that create voltage transients
- No contacts to wear out from reaction of switching events
- Restricted (or limited) RFI generation, depending on activation point of sine wave
- Requires only a short gate activation pulse in each half-cycle
- Halogen free and RoHS compliant

#### Applications

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

Typical applications are AC solid-state switches, light dimmers, power tools, home/brown goods and white goods appliances.

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

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

#### Absolute Maximum Ratings — Sensitive Triac (4 Quadrants)

| Symbol            | Parameter   | Value                     | Unit                                       |
|-------------------|---|---------------------------|--|
| $V_{DSM}/V_{RSM}$ | Peak non-repetitive blocking voltage  | PW=100 $\mu$ s            | 700 V                                      |
| $I_{T(RMS)}$      | RMS on-state current (full sine wave)   | LJxx06Vy/LJxx06Dy         | $T_c = 125^\circ\text{C}$<br>6 A           |
| $I_{TSM}$         | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = 25°C)         | f = 50 Hz<br>t = 20 ms    | 60 A                                       |
|                   |   | f = 60 Hz<br>t = 16.7 ms  | 72 A                                       |
| $I^2t$            | $I^2t$ Value for fusing   | $t_p = 8.3$ ms            | 21.5 A <sup>2</sup> s                      |
| di/dt             | Critical rate of rise of on-state current<br>$I_g = 50$ mA with 0.1 $\mu$ s rise time | f = 60 Hz                 | $T_j = 150^\circ\text{C}$<br>70 A/ $\mu$ s |
| $I_{GTM}$         | Peak gate trigger current   | $t_p = 20$ $\mu$ s        | $T_j = 150^\circ\text{C}$<br>4 A           |
| $P_{G(AV)}$       | Average gate power dissipation  | $T_j = 150^\circ\text{C}$ | 0.4 W                                      |
| $T_{stg}$         | Storage temperature range   |                           | -40 to 150 °C                              |
| $T_j$             | Operating junction temperature range  |                           | -40 to 150 °C                              |

Note: xx=voltage/10,  $\gamma$  = sensitivity

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

| Symbol            | Parameter  |                    | Value                     | Unit                      |                  |   |
|-------------------|--|--------------------|---------------------------|---------------------------|------------------|---|
| $V_{DSM}/N_{RSM}$ | Peak non-repetitive blocking voltage   |                    | PW=100 $\mu$ s            | 700                       | V                |   |
| $I_{T(RMS)}$      | RMS on-state current (full sine wave)  |                    | QJxx06VHy/QJxx06DHy       | $T_C = 130^\circ\text{C}$ | 6                | A |
| $I_{TSM}$         | Non repetitive surge peak on-state current (full cycle, $T_J$ initial = $25^\circ\text{C}$ ) | f = 50 Hz          | t = 20 ms                 | QJxx06VHy<br>QJxx06DHy    | 60               | A |
|                   |  | f = 60 Hz          | t = 16.7 ms               | QJxx06VHy<br>QJxx06DHy    | 72               |   |
| $I^2t$            | $I^2t$ Value for fusing  | $t_p = 8.3$ ms     | QJxx06VHy<br>QJxx06DHy    | 21.5                      | A <sup>2</sup> s |   |
| di/dt             | Critical rate of rise of on-state current  | f = 60 Hz          | $T_J = 150^\circ\text{C}$ | 70                        | A/ $\mu$ s       |   |
| $I_{GTM}$         | Peak gate trigger current  | $t_p = 20$ $\mu$ s | $T_J = 150^\circ\text{C}$ | 4                         | A                |   |
| $P_{G(AV)}$       | Average gate power dissipation   |                    | $T_J = 150^\circ\text{C}$ | 0.3                       | W                |   |
| $T_{stg}$         | Storage temperature range  |                    |                           | -40 to 150                | $^\circ\text{C}$ |   |
| $T_J$             | Operating junction temperature range   |                    |                           | -40 to 150                | $^\circ\text{C}$ |   |

Note: xx=voltage/10, y = sensitivity

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

| Symbol   | Test Conditions   | Quadrant           |      | Value    | Unit       |
|----------|---|--------------------|------|----------|------------|
|          |   |                    |      | LJxx06x8 |            |
| $I_{GT}$ | $V_D = 12\text{V}$ $R_L = 60\ \Omega$                                 | I – II – III<br>IV | MAX. | 10<br>20 | mA         |
| $V_{GT}$ |   | ALL                | MAX. | 1.2      | V          |
| $V_{GD}$ | $V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 150^\circ\text{C}$ | ALL                | MIN. | 0.15     | V          |
| $I_H$    | $I_T = 100\text{mA}$  |                    | MAX. | 25       | mA         |
| dv/dt    | $V_D = V_{DRM}$ Gate Open $T_J = 150^\circ\text{C}$                   | 400V               | TYP. | 80       | V/ $\mu$ s |
|          |   | 600V               |      | 50       |            |
| (dv/dt)c | (di/dt)c = 3.2 A/ms $T_J = 150^\circ\text{C}$                         |                    | TYP. | 2        | V/ $\mu$ s |
| $t_{gt}$ | $I_G = 2 \times I_{GT}$ PW = 15 $\mu$ s $I_T = 8.5\ \text{A(pk)}$     |                    | TYP. | 12       | $\mu$ s    |

Note: xx=voltage/10, x = package

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

| Symbol   | Test Conditions   | Quadrant                |      | Value     |           |           | Unit       |            |
|----------|---|-------------------------|------|-----------|-----------|-----------|------------|------------|
|          |   |                         |      | QJxx06xH2 | QJxx06xH3 | QJxx06xH4 |            |            |
| $I_{GT}$ | $V_D = 12\text{V}$ $R_L = 60\ \Omega$                                 | I – II – III            | MAX. | 10        | 20        | 35        | 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          |            |
| $I_H$    | $I_T = 100\text{mA}$  |                         | MAX. | 25        | 30        | 35        | mA         |            |
| dv/dt    | $V_D = V_{DRM}$ Gate Open $T_J = 150^\circ\text{C}$                   | QJxx06VHY/<br>QJxx06DHy | MIN. | 400V      | 150       | 250       | 350        | V/ $\mu$ s |
|          |   |                         |      | 600V      | 100       | 200       | 250        |            |
| (dv/dt)c | (di/dt)c = 3.2 A/ms $T_J = 150^\circ\text{C}$                         |                         | MIN. | 15        | 18        | 20        | V/ $\mu$ s |            |
| $t_{gt}$ | $I_G = 2 \times I_{GT}$ PW = 15 $\mu$ s $I_T = 8.5\ \text{A(pk)}$     |                         | TYP. | 10        | 10        | 10        | $\mu$ s    |            |

Note: xx=voltage/10, x = package

### Static Characteristics

| Symbol              | Test Conditions                                  |           | Value                     | Unit       |      |     |               |
|---------------------|--|-----------|---------------------------|------------|------|-----|---------------|
| $V_{TM}$            | $I_{TM} = 8.4 \text{ A}$ $t_p = 380 \mu\text{s}$ |           | MAX.                      | 1.40       | V    |     |               |
| $I_{DRM} / I_{RRM}$ | $V_{DRM} = V_{RRM}$                              | LJxx06xy  | $T_j = 25^\circ\text{C}$  | 400 - 600V | MAX. | 10  | $\mu\text{A}$ |
|                     |  |           | $T_j = 125^\circ\text{C}$ | 400 - 600V |      | 0.5 | mA            |
|                     |  |           | $T_j = 150^\circ\text{C}$ | 400 - 600V |      | 3   |               |
|                     |  | QJxx06xHy | $T_j = 25^\circ\text{C}$  | 400 - 600V | MAX. | 10  | $\mu\text{A}$ |
|                     |  |           | $T_j = 125^\circ\text{C}$ | 400 - 600V |      | 0.5 | mA            |
|                     |  |           | $T_j = 150^\circ\text{C}$ | 400 - 600V |      | 3   |               |

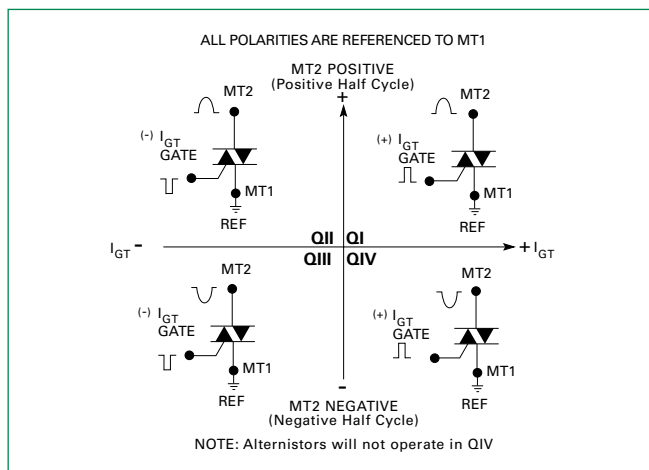
Note: xx=voltage/10, x = package, y = sensitivity

### Thermal Resistances

| Symbol          | Parameter   | Value | Unit               |
|-----------------|---|-------|--------------------|
| $R_{\theta UC}$ | Junction to case (AC)<br>LJ/QJxx06Vyy<br>LJ/QJxx06Dyy | 1.3   | $^\circ\text{C/W}$ |
| $R_{\theta UA}$ | Junction to ambient<br>LJ/QJxx06Vyy<br>LJ/QJxx06Dyy   | 70    | $^\circ\text{C/W}$ |

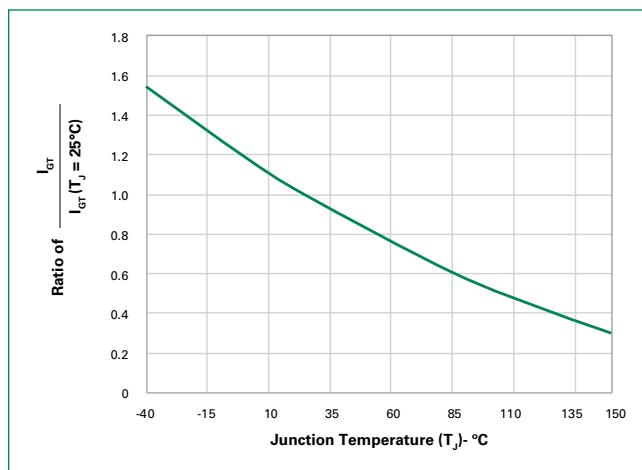
Note: xx=voltage/10, y = sensitivity

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**



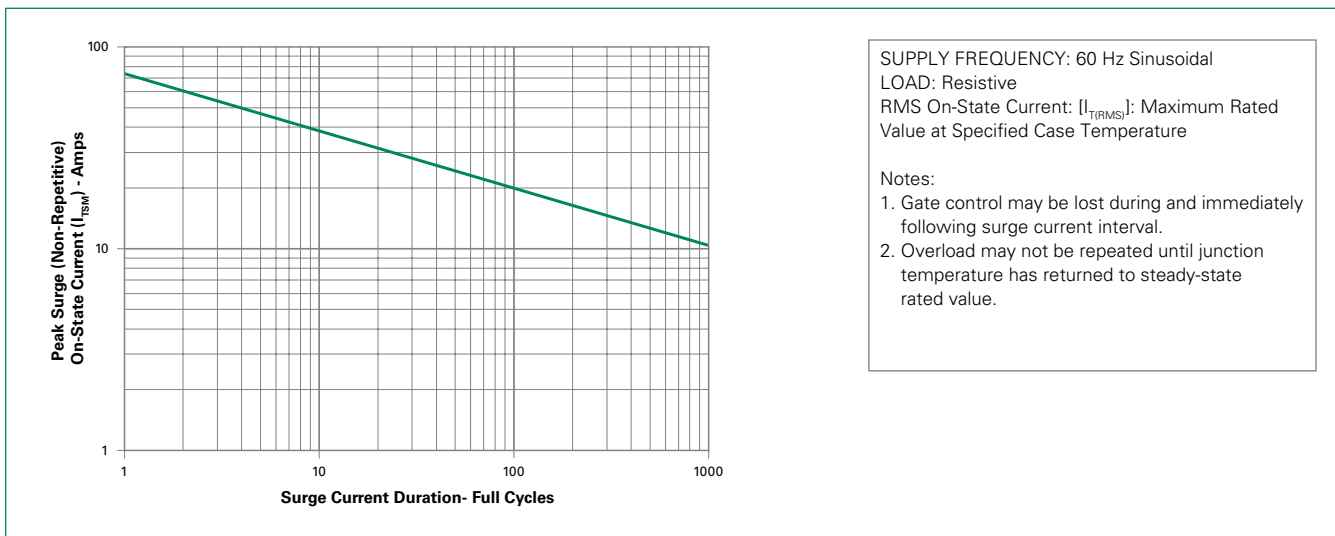
**Figure 6: Maximum Allowable Case Temperature vs. On-State Current**



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

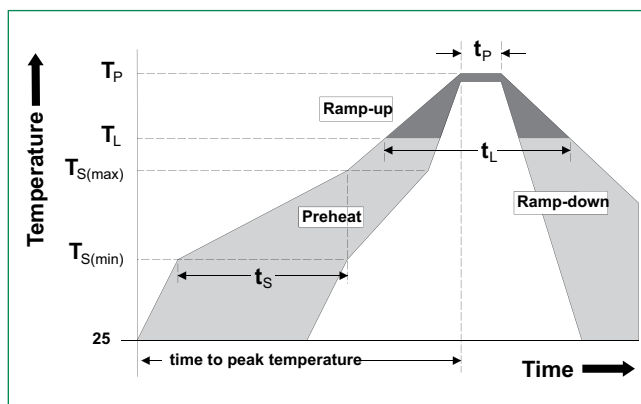


**Figure 8: Surge Peak On-State Current vs. Number of Cycles**



**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> |                                    | 5°C/second max          |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>      |                                    | 5°C/second 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 <sup>+0/-5</sup> °C |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 20 – 40 seconds         |
| <b>Ramp-down Rate</b>  |                                    | 5°C/second max          |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>                |                                    | 8 minutes Max.          |
| <b>Do not exceed</b>   |                                    | 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>Terminal Material</b> | Copper Alloy  |

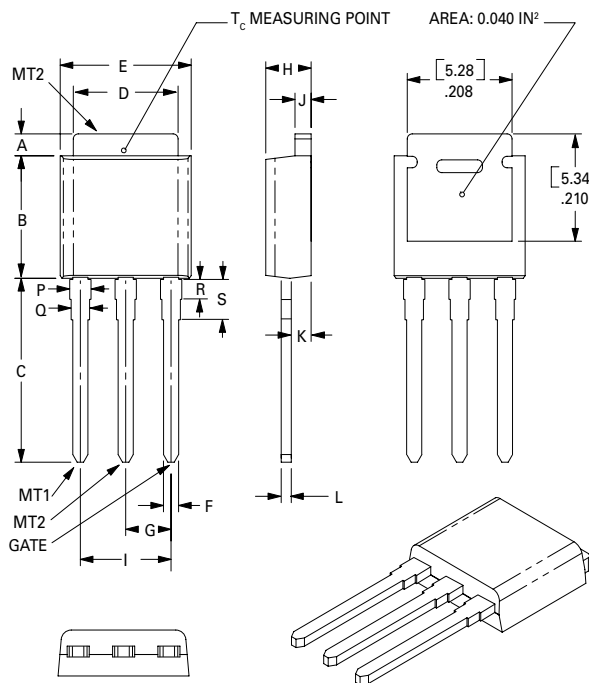
### Design Considerations

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

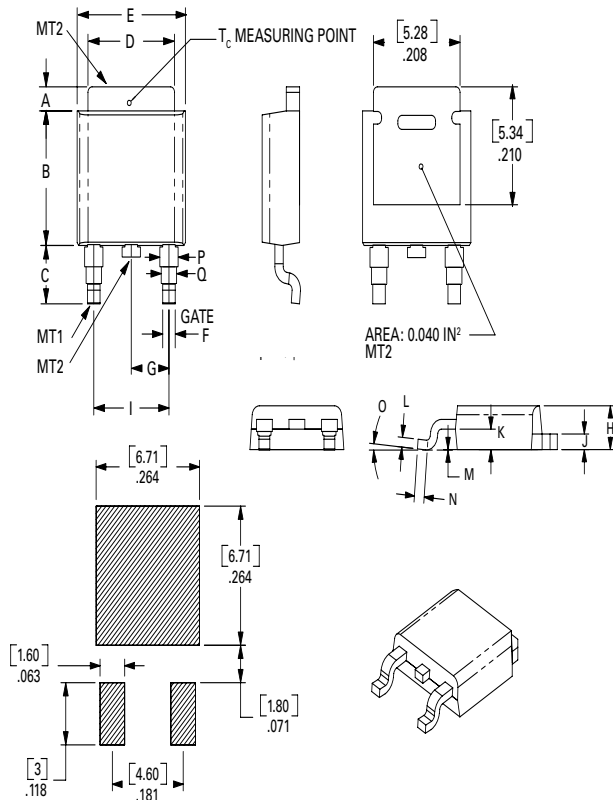
| Test                                      | Specifications and Conditions  |
|---|--|
| <b>AC Blocking (<math>V_{DRM}</math>)</b> | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours |
| <b>Temperature Cycling</b>                | MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell-time       |
| <b>Temperature/Humidity</b>               | EIA / JEDEC, JESD22-A101 1008 hours; 160V - DC: 85°C; 85% rel humidity     |
| <b>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-251AA (V-Package) – V-PAK Through Hole



| Dimension | Inches |       |       | Millimeters |      |      |
|-----------|--------|-------|-------|-------------|------|------|
|           | Min    | Typ   | Max   | Min         | Typ  | Max  |
| A         | 0.037  | 0.040 | 0.043 | 0.94        | 1.01 | 1.09 |
| B         | 0.235  | 0.242 | 0.245 | 5.97        | 6.15 | 6.22 |
| C         | 0.350  | 0.361 | 0.375 | 8.89        | 9.18 | 9.53 |
| D         | 0.205  | 0.208 | 0.213 | 5.21        | 5.29 | 5.41 |
| E         | 0.255  | 0.262 | 0.265 | 6.48        | 6.66 | 6.73 |
| F         | 0.027  | 0.031 | 0.033 | 0.69        | 0.80 | 0.84 |
| G         | 0.087  | 0.090 | 0.093 | 2.21        | 2.28 | 2.36 |
| H         | 0.085  | 0.092 | 0.095 | 2.16        | 2.34 | 2.41 |
| I         | 0.176  | 0.180 | 0.184 | 4.47        | 4.57 | 4.67 |
| J         | 0.018  | 0.020 | 0.023 | 0.46        | 0.51 | 0.58 |
| K         | 0.035  | 0.037 | 0.039 | 0.90        | 0.95 | 1.00 |
| L         | 0.018  | 0.020 | 0.023 | 0.46        | 0.52 | 0.58 |
| P         | 0.042  | 0.047 | 0.052 | 1.06        | 1.20 | 1.32 |
| Q         | 0.034  | 0.039 | 0.044 | 0.86        | 1.00 | 1.11 |
| R         | 0.034  | 0.039 | 0.044 | 0.86        | 1.00 | 1.11 |
| S         | 0.074  | 0.079 | 0.084 | 1.86        | 2.00 | 2.11 |

### Dimensions — TO-252AA (D-Package) — D-PAK Surface mount



| Dimension | Inches |       |       | Millimeters |      |      |
|-----------|--------|-------|-------|-------------|------|------|
|           | Min    | Typ   | Max   | Min         | Typ  | Max  |
| A         | 0.037  | 0.040 | 0.043 | 0.94        | 1.01 | 1.09 |
| B         | 0.235  | 0.243 | 0.245 | 5.97        | 6.16 | 6.22 |
| C         | 0.106  | 0.108 | 0.113 | 2.69        | 2.74 | 2.87 |
| D         | 0.205  | 0.208 | 0.213 | 5.21        | 5.29 | 5.41 |
| E         | 0.255  | 0.262 | 0.265 | 6.48        | 6.65 | 6.73 |
| F         | 0.027  | 0.031 | 0.033 | 0.69        | 0.80 | 0.84 |
| G         | 0.087  | 0.090 | 0.093 | 2.21        | 2.28 | 2.36 |
| H         | 0.085  | 0.092 | 0.095 | 2.16        | 2.33 | 2.41 |
| I         | 0.176  | 0.179 | 0.184 | 4.47        | 4.55 | 4.67 |
| J         | 0.018  | 0.020 | 0.023 | 0.46        | 0.51 | 0.58 |
| K         | 0.035  | 0.037 | 0.039 | 0.90        | 0.95 | 1.00 |
| L         | 0.018  | 0.020 | 0.023 | 0.46        | 0.51 | 0.58 |
| M         | 0.000  | 0.000 | 0.004 | 0.00        | 0.00 | 0.10 |
| N         | 0.021  | 0.026 | 0.027 | 0.53        | 0.67 | 0.69 |
| O         | 0°     | 0°    | 5°    | 0°          | 0°   | 5°   |
| P         | 0.042  | 0.047 | 0.052 | 1.06        | 1.20 | 1.32 |
| Q         | 0.034  | 0.039 | 0.044 | 0.86        | 1.00 | 1.11 |

### Product Selector

| Part Number | Voltage |      | Gate Sensitivity Quadrants |    | Type              | Package      |
|-------------|---------|------|----------------------------|----|-------------------|--------------|
|             | 400V    | 600V | I - II - III               | IV |                   |              |
| LJxx06D8    | x       | x    | 10                         | 20 | Sensitive Triac   | TO-252 D-PAK |
| LJxx06V8    | x       | x    | 10                         | 20 | Sensitive Triac   | TO-251 V-PAK |
| QJxx06DH2   | x       | x    | 10                         | -  | Alternistor Triac | TO-252 D-PAK |
| QJxx06VH2   | x       | x    | 10                         | -  | Alternistor Triac | TO-251 V-PAK |
| QJxx06DH3   | x       | x    | 20                         | -  | Alternistor Triac | TO-252 D-PAK |
| QJxx06VH3   | x       | x    | 20                         | -  | Alternistor Triac | TO-251 V-PAK |
| QJxx06DH4   | x       | x    | 35                         | -  | Alternistor Triac | TO-252 D-PAK |
| QJxx06VH4   | x       | x    | 35                         | -  | Alternistor Triac | TO-251 V-PAK |

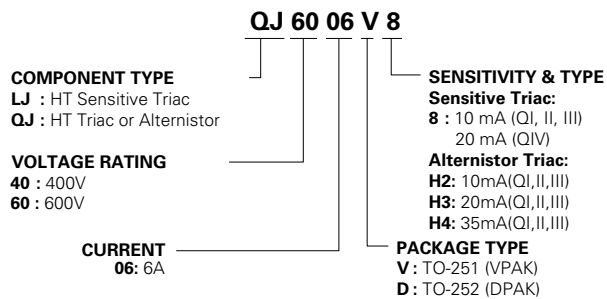
Note: xx = voltage/10

### Packing Options

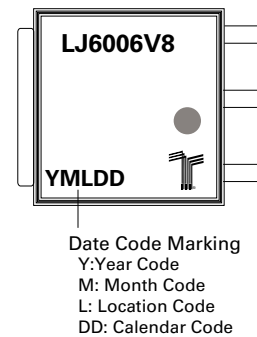
| Part Number | Marking   | Weight | Packing Mode     | Base Quantity    |
|-------------|-----------|--------|------------------|------------------|
| LJxx06D8TP  | LJxx06D8  | 0.3g   | Tube Pack        | 750(75 per tube) |
| LJxx06D8RP  | LJxx06D8  | 0.3g   | Embossed Carrier | 2500             |
| QJxx06DH2TP | QJxx06DH2 | 0.3g   | Tube Pack        | 750(75 per tube) |
| QJxx06DH2RP | QJxx06DH2 | 0.3g   | Embossed Carrier | 2500             |
| QJxx06VH2TP | QJxx06VH2 | 0.3g   | Tube Pack        | 750(75 per tube) |
| LJxx06V8TP  | LJxx06V8  | 0.4g   | Tube Pack        | 750(75 per tube) |
| QJxx06DH3TP | QJxx06DH3 | 0.3g   | Tube Pack        | 750(75 per tube) |
| QJxx06DH3RP | QJxx06DH3 | 0.3g   | Embossed Carrier | 2500             |
| QJxx06VH3TP | QJxx06VH3 | 0.4g   | Tube Pack        | 750(75 per tube) |
| QJxx06DH4TP | QJxx06DH4 | 0.3g   | Tube Pack        | 750(75 per tube) |
| QJxx06DH4RP | QJxx06DH4 | 0.3g   | Embossed Carrier | 2500             |
| QJxx06VH4TP | QJxx06VH4 | 0.4g   | Tube Pack        | 750(75 per tube) |

Note: xx = voltage/10

### Part Numbering System

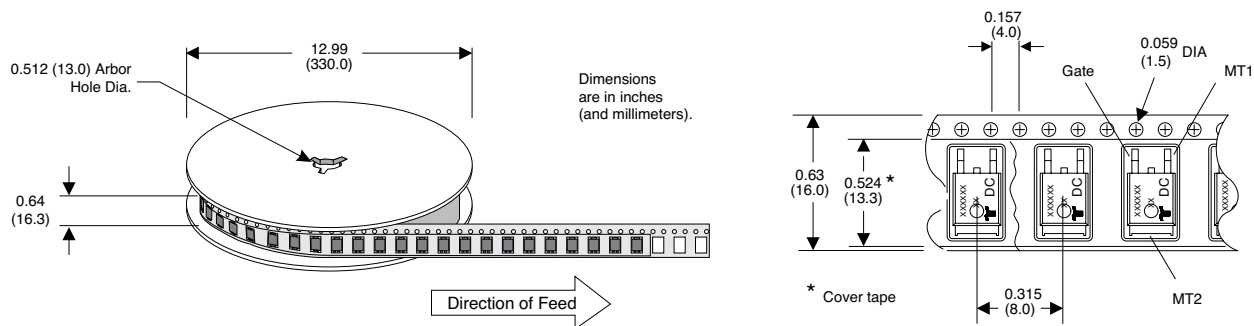


### Part Marking System



### TO-252 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



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