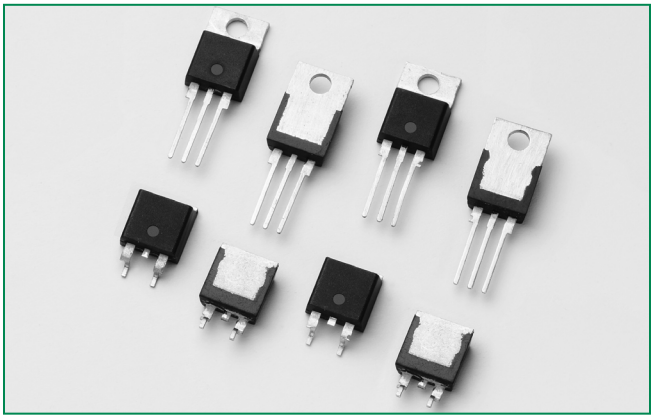
# RoHS Qxx10xx & Qxx10xHx Series



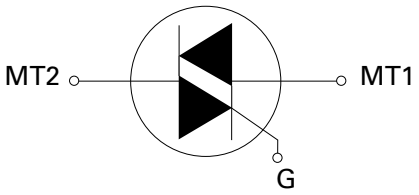
## Agency Approval

| Agency | Agency File Number |
|---|---|
| ®RU | L Package: E71639 |

## Main Features

| Symbol | Value | Unit |
|---|---|---|
| $I_{T(RMS)}$ | 10 | A |
| $V_{DRM}/V_{RRM}$ | 400 to 1000 | V |
| $I_{GT\ (Q1)}$ | 25 to 50 | mA |

## Schematic Symbol




## Description

10 Amp bi-directional 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 type devices normally operate in Quadrants I & III triggered from AC line.

## Features & Benefits

- RoHS Compliant
- Glass – passivated junctions
- Voltage capability up to 1000 V
- Surge capability up to 120 A
- Electrically isolated package "L - Package" and UL recognized for 2500Vrms
- 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 sine wave

## Applications

Alternistor type devices are used in applications requiring high commutation performance such as controlling inductive loads. Isolated packages are offered with internal construction, having the case or mounting tab electrically isolated from the semiconductor chip.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## Absolute Maximum Ratings — Standard Triac

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | Qxx10Ry/ Qxx10Ny | $T_C$ = 95°C | 10 | A |
| | | Qxx10Ly | $T_C$ = 90°C | | |
| $I_{TSM}$ | Non repetitive surge peak on-state current (full cycle, $T_J$ initial = 25°C) | f = 50 Hz | t = 20 ms | 100 | A |
| | | f = 60 Hz | t = 16.7 ms | 120 | |
| $I^2t$ | $I^2t$ Value for fusing | $t_p$ = 8.3 ms | | 60 | $A^2s$ |
| di/dt | Critical rate of rise of on-state current $I_G$ = 200mA with ≤ 0.1µs rise time | f = 120 Hz | $T_J$ = 125°C | 70 | A/µs |
| $I_{GTM}$ | Peak gate trigger current | $t_p$ ≤ 10 µs $I_{GT}$ ≤ $I_{GTM}$ | $T_J$ = 125°C | 1.8 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_J$ = 125°C | 0.5 | W |
| $T_{stg}$ | Storage temperature range | | | -40 to 150 | °C |
| $T_J$ | Operating junction temperature range | | | -40 to 125 | °C |

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

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | Qxx10LHy | $T_C$ = 90°C | 10 | A |
| | | Qxx10RHy/ Qxx10NHy | $T_C$ = 95°C | | |
| $I_{TSM}$ | Non repetitive surge peak on-state current (full cycle, $T_J$ initial = 25°C) | f = 50 Hz | t = 20 ms | 110 | A |
| | | f = 60 Hz | t = 16.7 ms | 120 | |
| $I^2t$ | $I^2t$ Value for fusing | $t_p$ = 8.3 ms | | 60 | $A^2s$ |
| di/dt | Critical rate of rise of on-state current | f = 120 Hz | $T_J$ = 125°C | 70 | A/µs |
| $I_{GTM}$ | Peak gate trigger current | $t_p$ ≤ 10 µs $I_{GT}$ ≤ $I_{GTM}$ | $T_J$ = 125°C | 2.0 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_J$ = 125°C | 0.5 | W |
| $T_{stg}$ | Storage temperature range | | | -40 to 150 | °C |
| $T_J$ | Operating junction temperature range | | | -40 to 125 | °C |

## Electrical Characteristics ($T_J$ = 25°C, unless otherwise specified) — Standard Triac

| Symbol | Test Conditions | Quadrant | | Qxx10x4 | Qxx10x5 | Unit |
|---|---|---|---|---|---|---|
| $I_{GT}$ | $V_D$ = 12V $R_L$ = 60 Ω | I – II – III IV | MAX. | 25 50 | 50 75 (TYP) | mA |
| $V_{GT}$ | | I – II – III | MAX. | 1.3 | | V |
| $V_{GD}$ | $V_D$ = $V_{DRM}$ $R_L$ = 3.3 kΩ $T_J$ = 125°C | ALL | MIN. | 0.2 | | V |
| $I_H$ | $I_T$ = 200mA | | MAX. | 35 | 50 | mA |
| dv/dt | $V_D$ = $V_{DRM}$ Gate Open $T_J$ = 125°C | 400V | MIN. | 150 | 225 | V/µs |
| | | 600V | | 100 | 200 | |
| | | 800V | | 75 | 175 | |
| | $V_D$ = $V_{DRM}$ Gate Open $T_J$ = 100°C | 1000V | | 50 | 150 | |
| (dv/dt)c | (di/dt)c = 5.4 A/ms $T_J$ = 125°C | | TYP. | 2 | 4 | V/µs |
| $t_{gt}$ | $I_G$ = 2 x IGT PW = 15µs $I_T$ = 14.1 A(pk) | | TYP. | 3.0 | 3.0 | µs |

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


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## Electrical Characteristics ($T_J$ = 25°C, unless otherwise specified) — Alternistor Triac (3 Quadrants)

| Symbol | Test Conditions | Quadrant | | Value | Unit |
|---|---|---|---|---|---|
| $I_{GT}$ | $V_D$ = 12V $R_L$ = 60 Ω | I – II – III | MAX. | 50 | mA |
| $V_{GT}$ | | I – II – III | MAX. | 1.3 | V |
| $V_{GD}$ | $V_D = V_{DRM}$ $R_L$ = 3.3 kΩ $T_J$ = 125°C | I – II – III | MIN. | 0.2 | V |
| $I_H$ | $I_T$ = 100mA | | MAX. | 50 | mA |
| dv/dt | $V_D = V_{DRM}$ Gate Open $T_J$ = 125°C | 400V | MIN. | 750 | V/µs |
| | | 600V | | 650 | |
| | | 800V | | 500 | |
| | $V_D = V_{DRM}$ Gate Open $T_J$ = 100°C | 1000V | | 300 | |
| (dv/dt)c | (di/dt)c = 5.4 A/ms $T_J$ = 125°C | | TYP. | 30 | V/µs |
| $t_{gt}$ | $I_G$ = 2 x IGT PW = 15µs $I_T$ = 14.1 A(pk) | | TYP. | 4.0 | µs |

## Static Characteristics

| Symbol | Test Conditions | | | | Value | Unit |
|---|---|---|---|---|---|---|
| $V_{TM}$ | $I_{TM}$ = 14.1A $t_p$ = 380 µs | | | MAX. | 1.60 | V |
| $I_{DRM}$ $I_{RRM}$ | $V_{DRM} = V_{RRM}$ | $T_J$ = 25°C | 400 - 600V | MAX. | 10 | µA |
| | | $T_J$ = 125°C | 400 - 800V | | 2 | mA |
| | | $T_J$ = 100°C | 1000V | | 3 | |

## Thermal Resistances

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{\theta(J-C)}$ | Junction to case (AC) | Qxx10Ryy/ Qxx10Nyy | 1.3 | °C/W |
| | | Qxx10Lyy | 2.6 | |
| $R_{\theta(J-A)}$ | Junction to ambient (AC) | Qxx10Ryy | 45 | °C/W |
| | | Qxx10Lyy | 50 | |

Note: xx = voltage, x = package, y = sensitivity, yy = type & sensitivity



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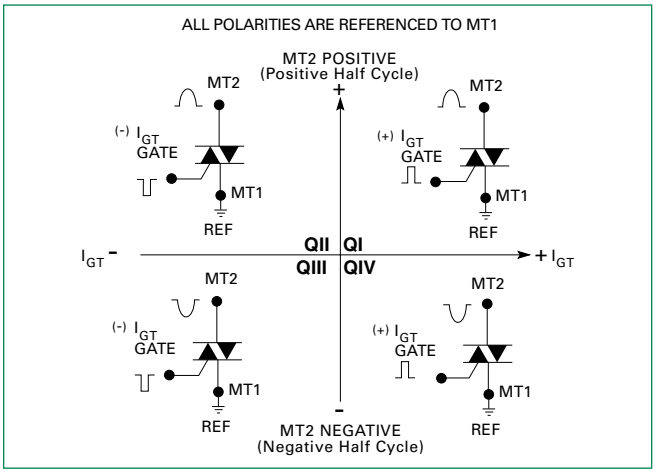
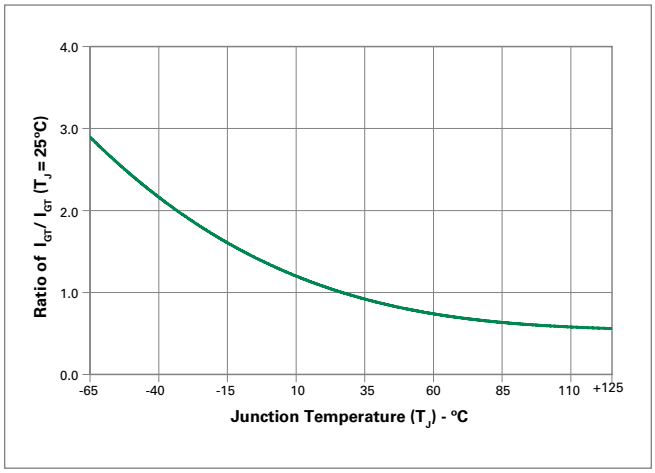
## Figure 1: Definition of Quadrants

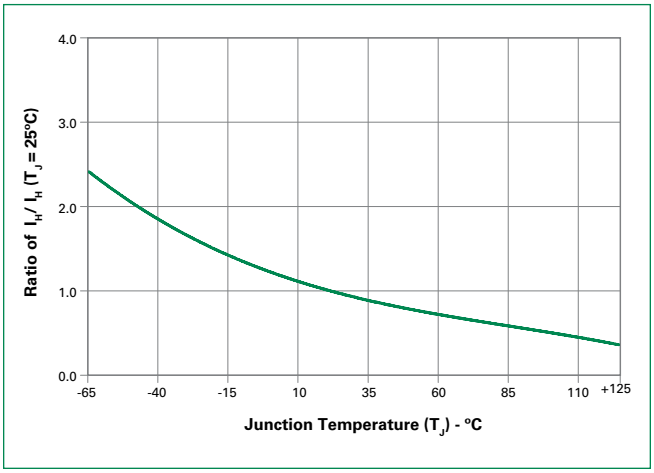



Note: Alternistors will not operate in QIV

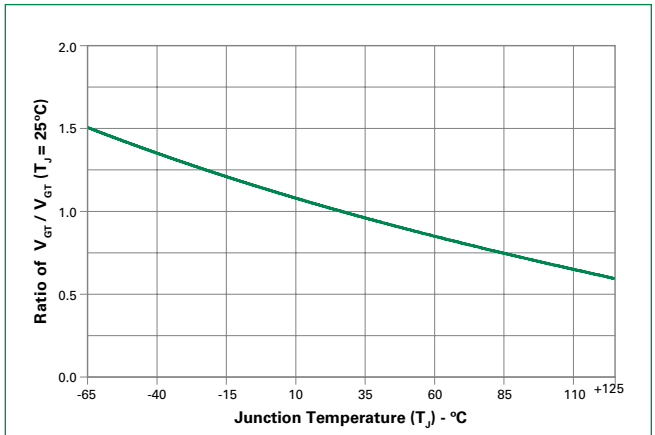
## Figure 2: Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature



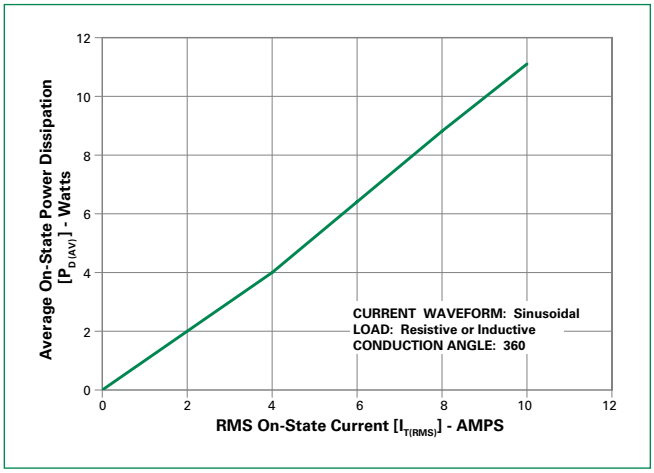

## Figure 3: Normalized DC Holding Current vs. Junction Temperature



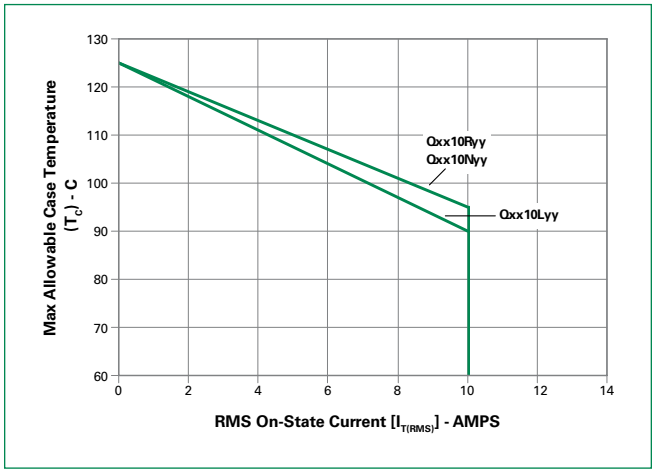

## Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature




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




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





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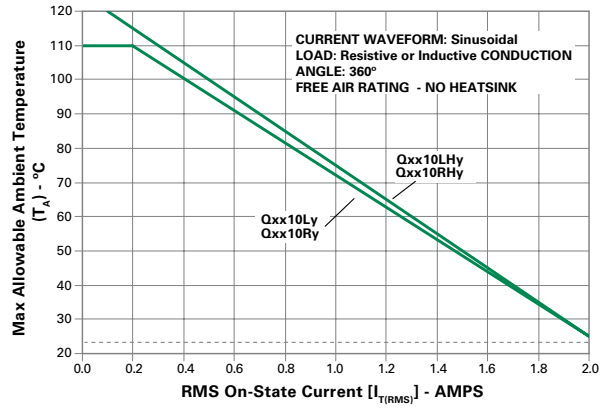
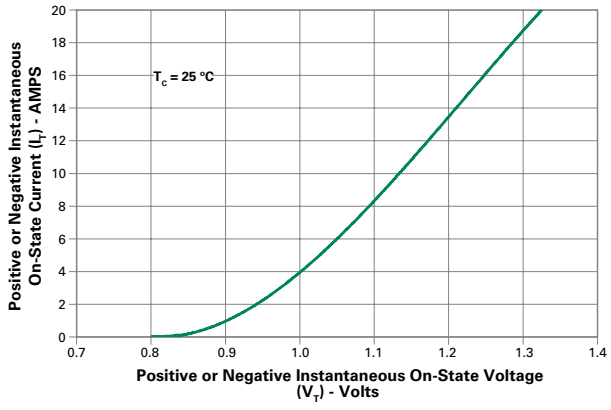
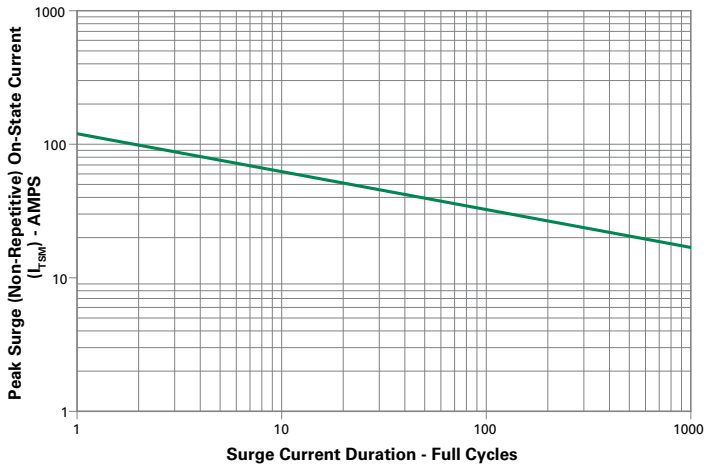
## Figure 7: Maximum Allowable Ambient Temperature vs. On-State Current




## Figure 8: On-State Current vs. On-State Voltage (Typical)




## Figure 9: 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.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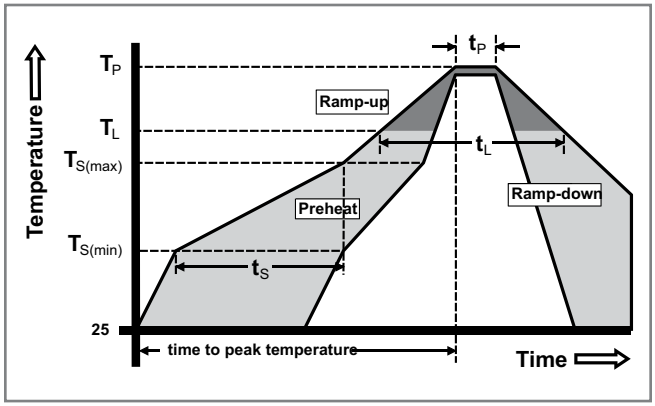
## Soldering Parameters

| | | |
|---|---|---|
| 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 ($T_P$) | | $260^{+0/-5}$ °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

| | |
|---|---|
| **Terminal Finish** | 100% Matte Tin-plated |
| **Body Material** | UL recognized epoxy meeting flammabilty classification 94V-0. |
| **Terminal Material** | Copper Alloy |

## Design Considerations

Careful selection of the correct device 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 device 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 |
|---|---|
| **AC Blocking** | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours |
| **Temperature Cycling** | MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C, 15-min dwell-time |
| **Temperature/ Humidity** | EIA/JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity |
| **High Temp Storage** | MIL-STD-750, M-1031, 1008 hours; 150°C |
| **Low-Temp Storage** | 1008 hours; -40°C |
| **Thermal Shock** | MIL-STD-750, M-1056 10 cycles; 0°C to 100°C; 5-min dwell time at each temperature; 10 sec (max) transfer time between temperature |
| **Autoclave** | EIA/JEDEC, JESD22-A102 168 hours (121°C at 2 ATMs) and 100% R/H |
| **Resistance to Solder Heat** | MIL-STD-750 Method 2031 |
| **Solderability** | ANSI/J-STD-002, category 3 Test A |
| **Lead Bend** | MIL-STD-750, M-2036 Cond E |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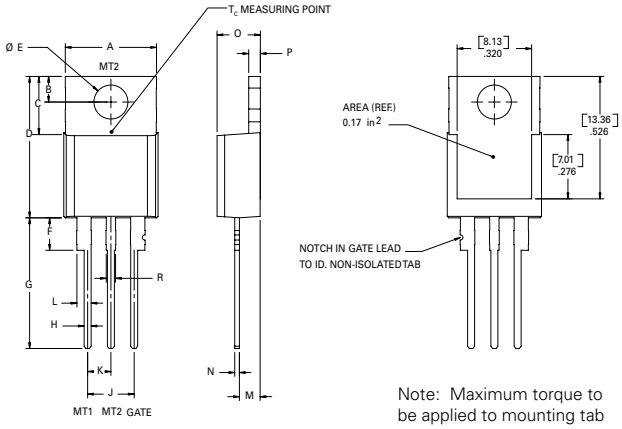
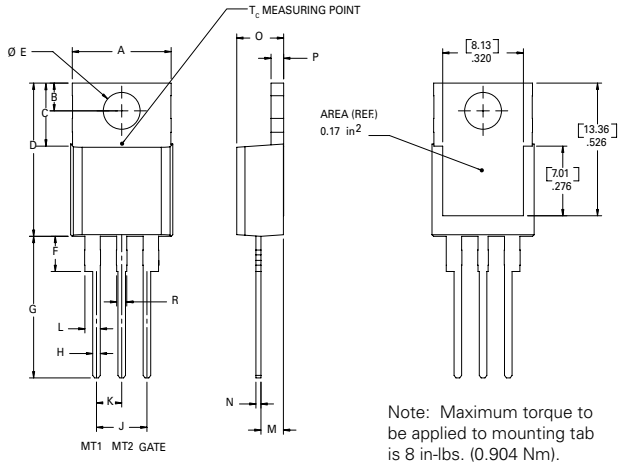
## Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead




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

| Dimension | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| 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 | 0.965 | 1.22 |

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




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

| 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 | 0.965 | 1.22 |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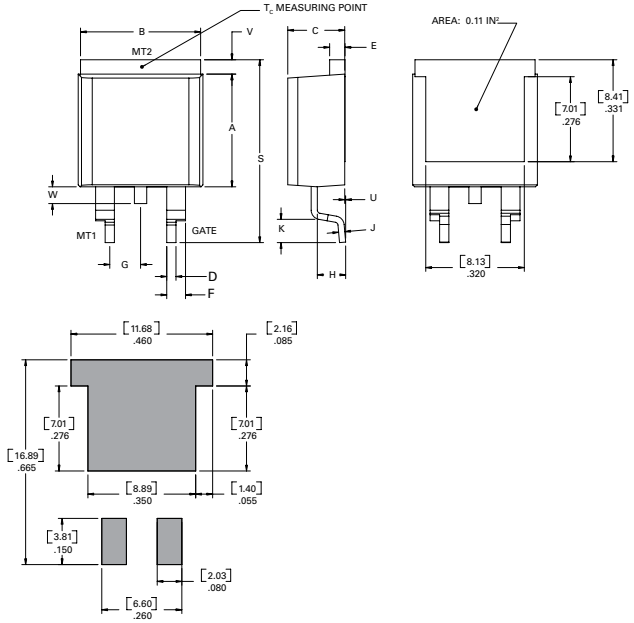
## Dimensions — TO-263AA (N-Package) — D²-PAK Surface Mount




| 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 | 1.016 | 1.78 |

## Product Selector

| Part Number | Voltage (xx) | | | | Gate Sensitivity Quadrants | | Type | Package |
|---|---|---|---|---|---|---|---|---|
| | 400V | 600V | 800V | 1000V | I – II – III | IV | | |
| Qxx10L4 | X | X | X | X | 25 mA | 50 mA | Standard Triac | TO-220L |
| Qxx10R4 | X | X | X | X | 25 mA | 50 mA | Standard Triac | TO-220R |
| Qxx10N4 | X | X | X | X | 25 mA | 50 mA | Standard Triac | TO-263 D²-PAK |
| Qxx10L5 | X | X | X | X | 50 mA | | Standard Triac | TO-220L |
| Qxx10R5 | X | X | X | X | 50 mA | | Standard Triac | TO-220R |
| Qxx10N5 | X | X | X | X | 50 mA | | Standard Triac | TO-263 D²-PAK |
| Qxx10LH5 | X | X | X | X | 50 mA | | Alternistor Triac | TO-220L |
| Qxx10RH5 | X | X | X | X | 50 mA | | Alternistor Triac | TO-220R |
| Qxx10NH5 | X | X | X | X | 50 mA | | Alternistor Triac | TO-263 D²-PAK |

## Packing Options

| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|---|---|---|---|---|
| Qxx10L/Ryy | Qxx10L/Ryy | 2.2 g | Bulk | 500 |
| Qxx10L/RyyTP | Qxx10L/Ryy | 2.2 g | Tube Pack | 500 (50 per tube) |
| Qxx10NyyTP | Qxx10Nyy | 1.6 g | Tube | 500 (50 per tube) |
| Qxx10NyyRP | Qxx10Nyy | 1.6 g | Embossed Carrier | 500 |

Note: xx = voltage, yy = type & sensitivity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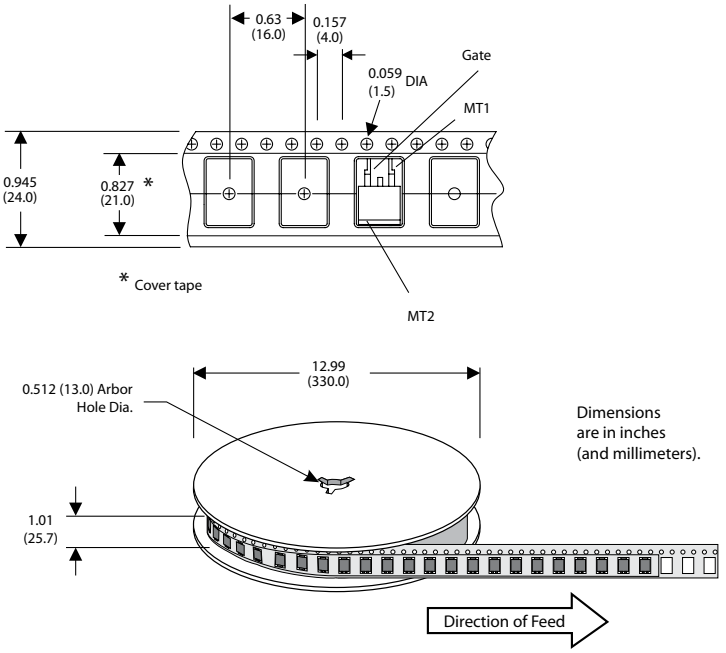
## TO-263 Embossed Carrier Reel Pack (RP) Specifications

### Meets all EIA-481-2 Standards




## Part Numbering System

Q 60 10 L H5 56

**DEVICE TYPE**
Q: Triac or Alternistor

**VOLTAGE RATING**
40: 400V
60: 600V
80: 800V
K0: 1000V

**CURRENT RATING**
10: 10A

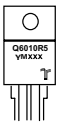
**PACKAGE TYPE**
L: TO-220 Isolated
R: TO-220 Non-Isolated
N: TO-263 ($D^2$ Pak)

**SENSITIVITY**
Standard Triac:
4: 25 mA (QI, II, III)
50 mA (QIV)
5: 50 mA (QI, II, III)
Alternistor Triac:
H5: 50mA (QI, II, III)

**LEAD FORM DIMENSIONS**
xx: Lead Form Option

## Part Marking System

TO-220 AB – (R Package)
TO-263 AB – (N Package)




TO-220 AB – (L Package)





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Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

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