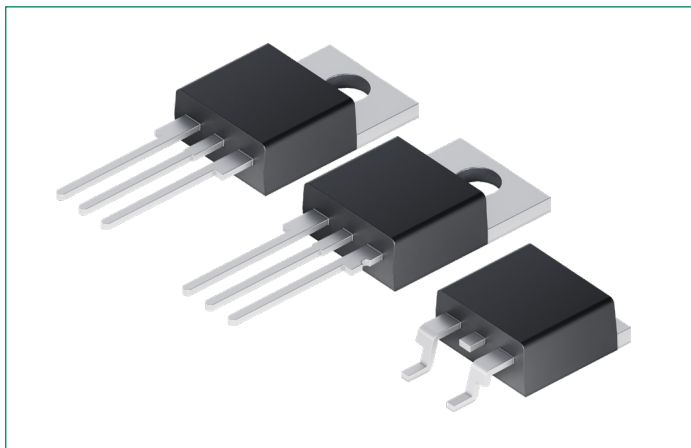


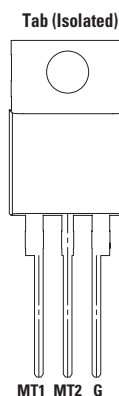
QVxx16xHx Series

16 A High-Temperature Alternistor TRIACs

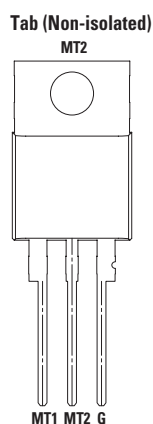


Pinout Diagram

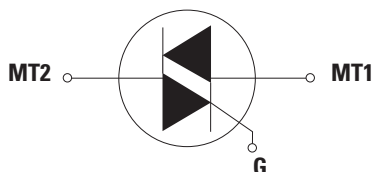
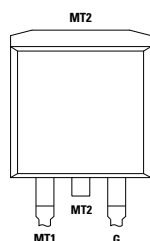
TO-220 (L-Package)



TO-220 (R-Package)



TO-263



MT1: Main Terminal 1; **MT2:** Main Terminal 2; **G:** Gate

Description

This 16 A high temperature Alternistor TRIAC, offered in TO-220AB, TO-220 isolated, and TO-263 packages, has rated 150 °C maximum junction temperature, $T_{vj(max)}$ and 200 A non-repetitive surge peak on-state current, I_{TSM} (60 Hz).

This series enables easier thermal management and increases surge handling capability in AC power control applications such as heater control, motor speed control, lighting controls, and static switching relays.

This QV series TRIAC operates in quadrants I, II, and III, and offers high performance in applications requiring high commutation capability without a snubber circuit.

Features

- Voltage capability of up to 800 V
- Surge current capability of 200 A at 60 Hz half cycle
- Mechanically and thermally robust TO-220 clip-attach assembly
- Maximum virtual junction temperature, $T_{vj(max)}$ of 150 °C
- Internally-isolated TO-220 package
- Halogen-free and RoHS-compliant
- UL 1557 recognized as an Electrically Isolated Semiconductor Device (L package: file number E71639)

Benefits

- High dv/dt up to 1500 V/μs for improved noise immunity
- 3Q technology for high commutation capability, resulting in smoother switching transitions and reduced EMI
- Internally isolated TRIAC packages offer improved thermal management and high electrical isolation, simplifying mounting and enhancing safety.

Applications

TRIAC is an excellent AC switch in heating, lighting, and motor speed control applications.

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, white goods, home electronics, power tools, and light industrial applications such as compressor motor control

Product Summary

| Characteristic | Value | Unit |
|-------------------|----------------------|------|
| $I_{T(RMS)}$ | 16 | A |
| V_{DRM}/V_{RRM} | 600 or 800 | V |
| $I_{GT(Q1)}$ | 10 or 20 or 35 or 50 | mA |

Maximum Ratings - Alternistor TRIAC (3 Quadrants)

| Symbol | Characteristics | Conditions | | | Value | Units |
|------------------------------------|---|---|---|----------------|--|------------------|
| | | QVxx16LHy | T _c = 115 °C | full sine wave | | |
| I _{TI(RMS)} | On-state RMS Current | QVxx16RH _y / QVxx16NH _y | T _c = 130 °C | | | 16 |
| | | | | | | |
| I _{TSM} | Non-repetitive Surge Peak On-state Current | f = 50 Hz, t = 20 ms | single half-cycle, T _{vj} initial = 25 °C | | 167 | A |
| | | f = 60 Hz, t = 16.7 ms | | | 200 | |
| I ² t | I ² t Value for Fusing | t _p = 8.3 ms | | | 166 | A ² s |
| di/dt | Critical Rate of Rise of On-state Current | f = 60 Hz, T _{vj} = 150 °C | | | 100 | A/μs |
| I _{GTM} | Peak Gate Trigger Current | t _p ≤ 10 μs, I _{GT} ≤ I _{GTM} , T _{vj} = 150 °C | | | 4 | A |
| P _{G(AV)} | Average Gate Power Dissipation | T _{vj} = 150 °C | | | 0.5 | W |
| T _{stg} | Storage Temperature Range | - | | | -40 to 150 | °C |
| T _{vj} | Virtual Junction Temperature Range | - | | | -40 to 150 | °C |
| V _{DSM} /V _{RSM} | Non-repetitive Surge Peak Off-state Voltage | V _{DRM} = 600 V, pulse width = 100 μs | | | V _{DRM} /V _{RRM} + 100 | V |
| | | V _{DRM} = 800 V, pulse width = 100 μs | | | V _{DRM} /V _{RRM} + 200 | V |

xx = voltage/10; y = sensitivity

Electrical Characteristics (T_{vj} = 25 °C, unless otherwise specified) — **Alternistor TRIAC** (3 Quadrants)

| Symbol | Characteristics | Conditions | QVxx16xH2 | | | QVxx16xH3 | | | QVxx16xH4 | | | QVxx16xH5 | | | Units | | | |
|------------------------|--|--|--------------|------|------|-----------|------|------|-----------|------|------|-----------|------|------|-------|----|-----|------|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | | | |
| I _{GT} | DC Gate Trigger Current | V _D = 12 V, R _L = 60 Ω | I – II – III | | | - | - | 10 | - | - | 20 | - | - | 35 | - | - | 50 | 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 kΩ, T _{vj} = 150 °C | I – II – III | | | 0.15 | - | - | 0.15 | - | - | 0.15 | - | - | 0.15 | - | - | V |
| I _H | Holding Current | I _T = 100 mA | | | | - | - | 15 | - | - | 35 | - | - | 50 | - | - | 60 | mA |
| dv/dt _(cr) | Critical Rate-of-rise of Off-state Voltage | V _D = V _{DRM} , Gate Open, T _{vj} = 150 °C | | | | 200 | - | - | 350 | - | - | 500 | - | - | 750 | - | - | V/μs |
| | | V _D = 2/3 V _{DRM} , Gate Open, T _{vj} = 150 °C | | | | 400 | - | - | 700 | - | - | 1000 | - | - | 1500 | - | - | |
| dv/dt _(com) | Critical Rate-of-rise of Commutation Voltage | (di/dt) _c = 8.6 A/ms, T _{vj} = 150 °C | | | | 10 | - | - | 30 | - | - | 50 | - | - | - | - | - | V/μs |
| t _{gt} | Turn-on Time | I _G = 2 · I _{GT} , t _p = 15 μs, I _T = 22.6 A _{pk} | I | | | - | 3 | - | - | 3 | - | - | 3 | - | - | 3 | - | μs |
| | | | II | | | - | 4 | - | - | 5 | - | - | 6 | - | - | 6 | - | |
| | | | III | | | - | 8 | - | - | 14 | - | - | 15 | - | - | 17 | - | |
| (di/dt) _c | Without Snubber | T _{vj} = 150 °C | | | | - | - | - | - | - | - | - | - | - | 28 | - | - | A/μs |

xx = voltage/10; y = sensitivity

Thermal Characteristics

| Symbol | Characteristics | Value | Units | |
|---------------|---|---|-------|-----|
| $R_{th(j-c)}$ | Thermal Resistance, Junction to Case | QVxx16RH _y / QVxx16NH _y | 0.9 | K/W |
| | | QVxx16LH _y | 1.8 | |
| $R_{th(j-a)}$ | Thermal Resistance, Junction to Ambient | QVxx16RH _y / QVxx16NH _y | 45 | K/W |
| | | QVxx16LH _y | 50 | |

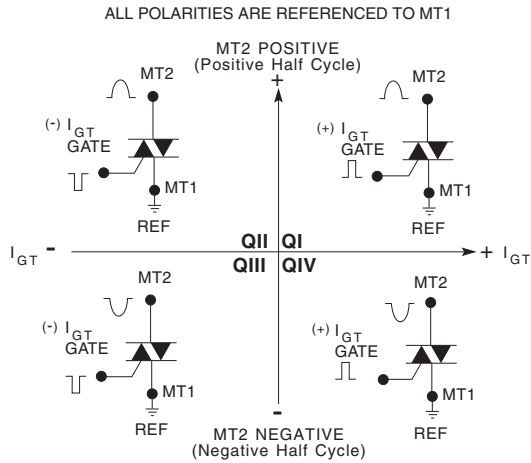
xx = voltage/10; y = sensitivity

Static Characteristics

| Symbol | Characteristics | Conditions | Value | Units |
|-------------------|-----------------------------------|---|-------|------------------|
| V_{TM} | Peak On-state Voltage | $I_T = 22.6 \text{ A}$ $t_p = 380 \mu\text{s}$ | 1.55 | V |
| I_{DRM}/I_{RRM} | Peak Repetitive Off-state Current | $V_D = V_{DRM}/V_{RRM}$, $T_{vj} = 25 \text{ }^\circ\text{C}$ | 5 | μA |
| | | $V_D = V_{DRM}/V_{RRM}$, $T_{vj} = 150 \text{ }^\circ\text{C}$ | 4 | mA |
| V_{TO} | Threshold Voltage | $T_{vj} = 150 \text{ }^\circ\text{C}$ | 0.85 | V |
| R_D | Slope Resistance | $T_{vj} = 150 \text{ }^\circ\text{C}$ | 18.5 | $\text{m}\Omega$ |

Characteristic Curves

Figure 1. Definition of Quadrants



Note: Alternistors will not operate in QIV

Fig. 2. Normalized DC Gate Trigger Current for all Quadrants vs. Junction Temperature

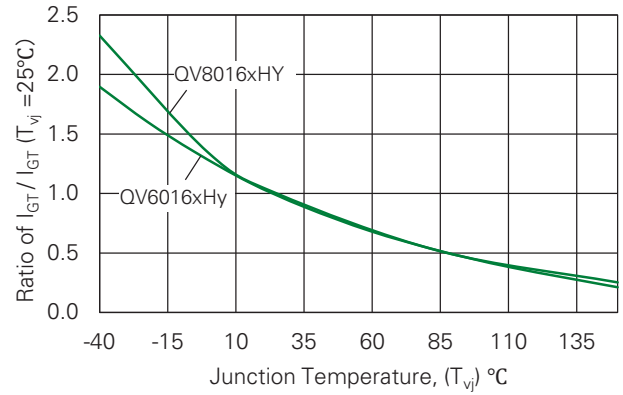


Fig. 3. Normalized DC Holding Current vs. Junction Temperature

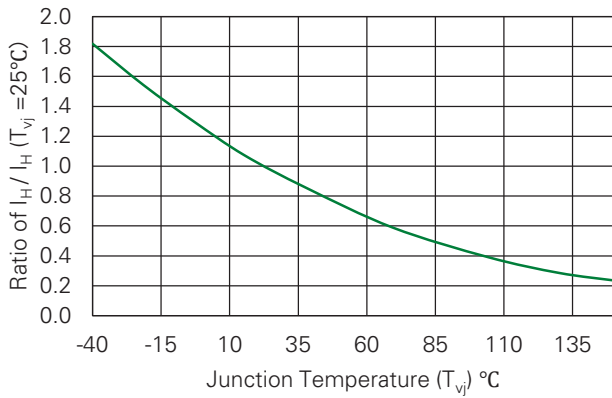


Fig. 4. Normalized DC Gate Trigger Voltage for all Quadrants vs. Junction Temperature

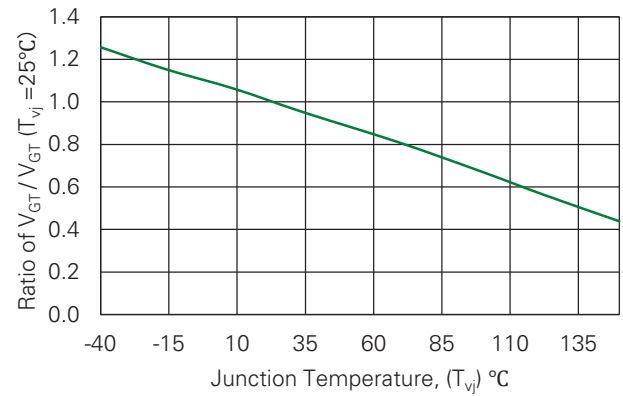


Fig. 5. Typical Power Dissipation vs. RMS On-state Current

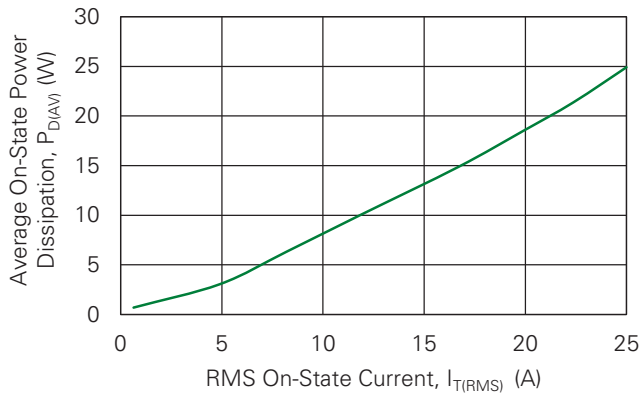


Fig. 6. Typical On-state Current vs. On-state Voltage

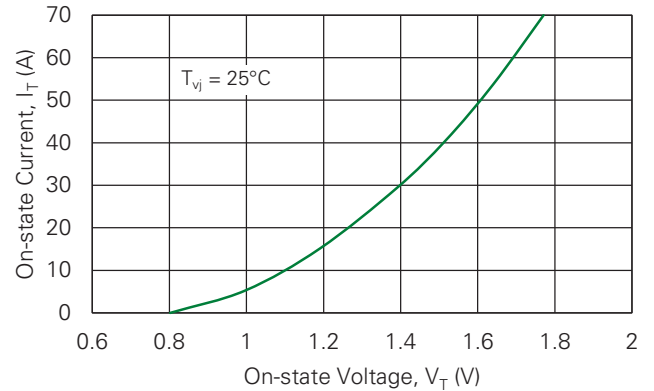


Fig. 7. Maximum Allowable Case Temperature vs. RMS On-state Current

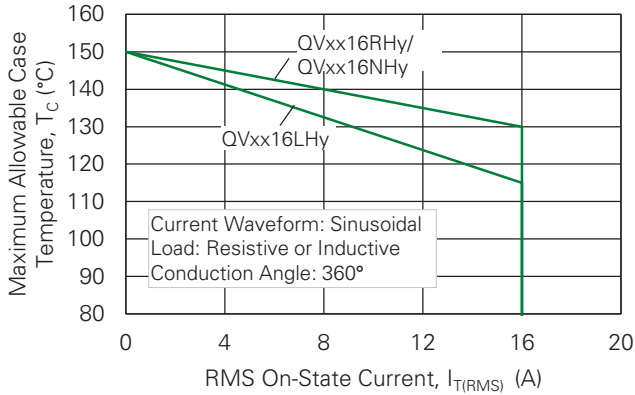
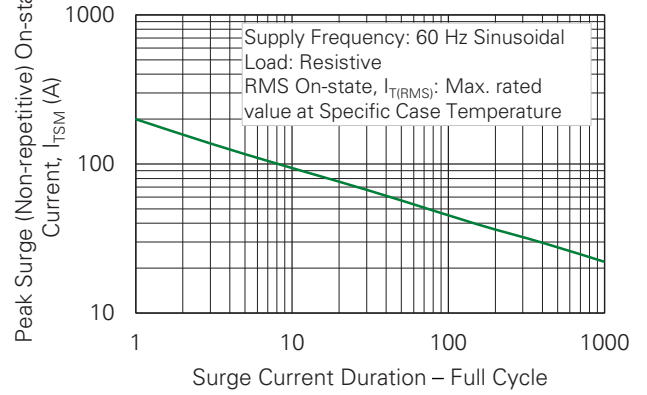


Fig. 8. Surge Peak On-state Current vs. Number of Cycles

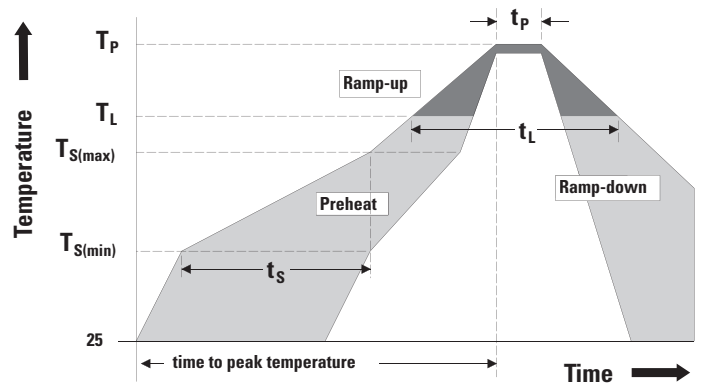


Notes:

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

Soldering Parameters

| Characteristic | | Value |
|---|----------------------------------|------------------------|
| 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 (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 |



Environmental Specifications

| Test | Specifications and Conditions |
|----------------------------|---|
| AC Blocking | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150 °C for 1008 hours |
| Temperature/Humidity | EIA / JEDEC, JESD22-A101, 1008 hours; 160 V - DC: 85 °C; 85 % relative humidity |
| Temperature Cycling | MIL-STD-750, M-1051, 1000 cycles; -55 °C to +150 °C; 15-min dwell-time |
| 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 |
| Moisture Sensitivity Level | Level 1, JEDEC-J-STD-020 |
| UHAST | JESD22A-118, 96 hrs, 130 °C/ 85 % RH |
| IOL | MIL-STD-750 Method 1037 |

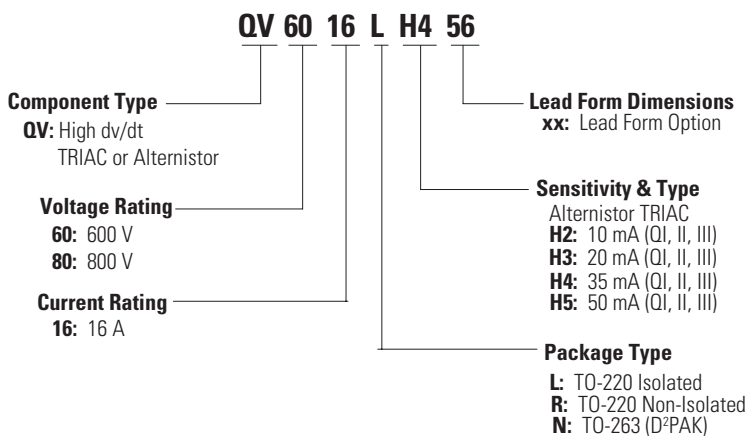
Product Selector

| Part Number | Voltage | | Gate Sensitivity Quadrants | Type | Package |
|-------------|---------|-------|----------------------------|-------------------|-----------------------------|
| | 600 V | 800 V | I-II-III | | |
| QVxx16LH2 | X | – | 10 mA | Alternistor TRIAC | TO-220AB (L package) |
| QVxx16RH2 | X | – | 10 mA | Alternistor TRIAC | TO-220AB (R package) |
| QVxx16NH2 | X | – | 10 mA | Alternistor TRIAC | TO-263 (D ² PAK) |
| QVxx16LH3 | X | – | 20 mA | Alternistor TRIAC | TO-220AB (L package) |
| QVxx16RH3 | X | – | 20 mA | Alternistor TRIAC | TO-220AB (R package) |
| QVxx16NH3 | X | – | 20 mA | Alternistor TRIAC | TO-263 (D ² PAK) |
| QVxx16LH4 | X | X | 35 mA | Alternistor TRIAC | TO-220AB (L package) |
| QVxx16RH4 | X | X | 35 mA | Alternistor TRIAC | TO-220AB (R package) |
| QVxx16NH4 | X | X | 35 mA | Alternistor TRIAC | TO-263 (D ² PAK) |
| QVxx16LH5 | X | X | 50 mA | Alternistor TRIAC | TO-220AB (L package) |
| QVxx16RH5 | X | X | 50 mA | Alternistor TRIAC | TO-220AB (R package) |
| QVxx16NH5 | X | X | 50 mA | Alternistor TRIAC | TO-263 (D ² PAK) |

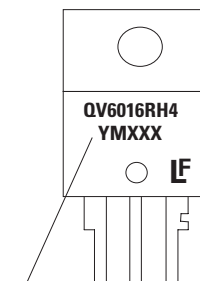
Packing Options

| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|--------------|------------|--------|------------------|---------------|
| QVxx16LHyTP | QVxx16LHy | 2.2 g | Tube Pack | 1000 |
| QVxx16RHypTP | QVxx16RHyp | 2.2 g | Tube Pack | 1000 |
| QVxx16NHypTP | QVxx16NHyp | 1.6 g | Tube Pack | 1000 |
| QVxx16NHypRP | QVxx16NHyp | 1.6 g | Embossed Carrier | 500 |

Part Numbering and Marking

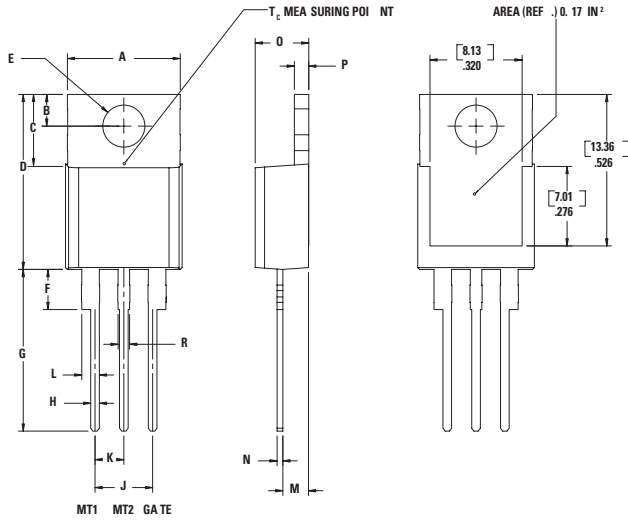


TO-220 AB - (L and R Package)
TO-263 AB - (N Package)



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

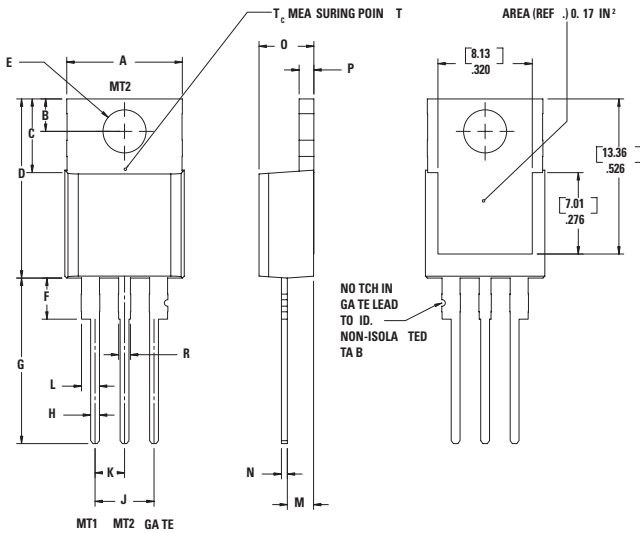
Package Dimensions TO-220AB (L-Package) – Isolated Mounting Tab



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

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

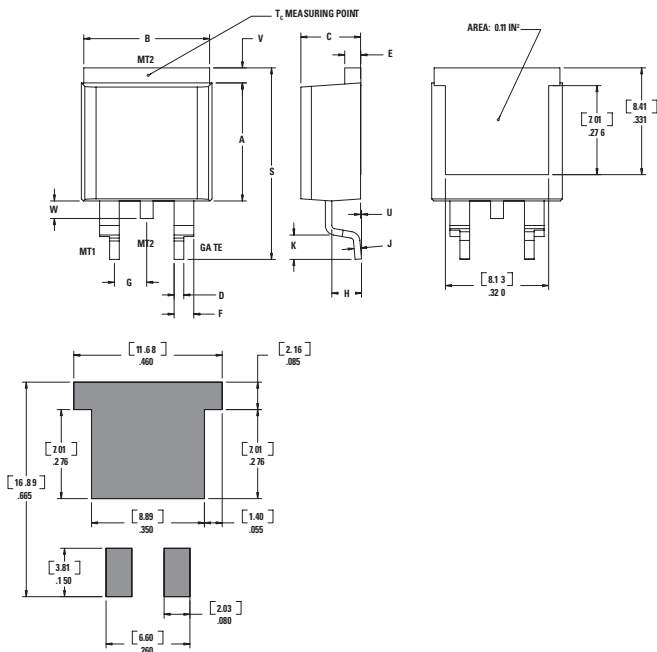
Package Dimensions TO-220AB (R Package) – Non-isolated Mounting Tab Common with Center Lead



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

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

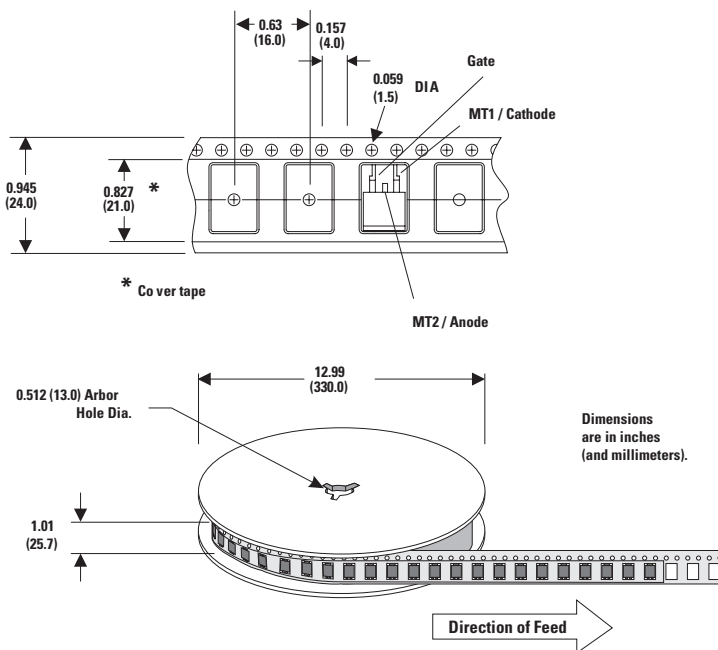
Package Dimensions TO-263 (N Package) – D²PAK Surface Mount



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

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

Meets all EIA-481-2 Standards



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