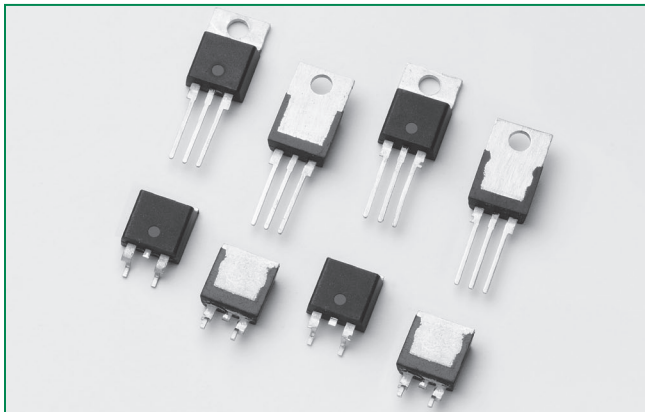


Q6008xH1LED Series



Description

Q6008xH1LED series is designed to meet low load current characteristics typical in LED lighting applications.

By keeping holding current at 6mA maximum, this Triac series is characterized and specified to perform best with LED loads. The Q6008xH1LED series is best suited for LED dimming controls to obtain the lowest levels of light output with a minimum probability of flickering.

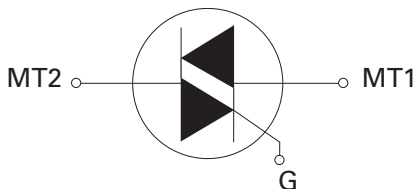
Agency Approval

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

Main Features

| Symbol | Value | Unit |
|-------------------|-------|------|
| $I_{T(RMS)}$ | 8 | A |
| V_{DRM}/V_{RRM} | 600 | V |
| I_{GT} | 10 | mA |

Schematic Symbol



Features

- As low as 6mA max holding current
- L-Package is UL recognized for 2500Vrms
- 110°C rated junction temperature
- di/dt performance of 70A/μs
- QUADRAC version includes intergrated DIAC

Benefits

- Provides full control of light out put at the extreme low end of load conditions.
- 2500V_{AC} min isolation between mounting tab and active terminals
- Improves margin of safe operation with less heat sinking required
- Enable survivability of typically LED load operating characteristics
- Simplicity of circuit design & layout

Applications

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

Typical applications are AC solid-state switches, lighting controls with LED lamp loads, small low current motor in power tools, and low current motors in home/brown goods appliances.

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

Absolute Maximum Ratings

| Symbol | Parameter | Test Conditions | | Value | Unit |
|--------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------|------------|------------------------|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | Q6008LH1LED | $T_C = 80^\circ\text{C}$ | 8 | A |
| | | Q6008RH1LED | $T_C = 95^\circ\text{C}$ | | |
| | | Q6008NH1LED | | | |
| I_{TSM} | Non repetitive surge peak on-state current (full cycle, T_J initial = 25°C) | f = 50 Hz | t = 20 ms | 80 | A |
| | | f = 60 Hz | t = 16.7 ms | 85 | |
| I^2t | I^2t Value for fusing | | $t_p = 8.3$ ms | 30 | A^2s |
| di/dt | Critical rate of rise of on-state current | f = 120 Hz | $T_J = 110^\circ\text{C}$ | 70 | $\text{A}/\mu\text{s}$ |
| I_{GTM} | Peak gate trigger current | $t_p \leq 10 \mu\text{s};$ $I_{GT} \leq I_{GTM}$ | $T_J = 110^\circ\text{C}$ | 1.6 | A |
| $P_{G(AV)}$ | Average gate power dissipation | $T_J = 110^\circ\text{C}$ | $I_{GT} = 35\text{mA}$ | 0.5 | W |
| T_{stg} | Storage temperature range | | | -40 to 150 | $^\circ\text{C}$ |
| T_J | Operating junction temperature range | | | -40 to 110 | $^\circ\text{C}$ |

Electrical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified)

| Symbol | Test Conditions | Quadrant | | Value | Unit |
|----------|-----------------------------------------------------------------------------|--------------|------|-------|------------------------|
| I_{GT} | $V_D = 12\text{V}$ $R_L = 60 \Omega$ | I – II – III | MAX. | 10 | mA |
| V_{GT} | | I – II – III | | 1.3 | V |
| V_{GD} | $V_D = V_{DRM}$ $R_L = 3.3 \text{ k}\Omega$ $T_J = 110^\circ\text{C}$ | I – II – III | MIN. | 0.2 | V |
| I_H | $I_T = 15\text{mA}$ | | MAX. | 6 | mA |
| dv/dt | $V_D = V_{DRM}$ Gate Open $T_J = 110^\circ\text{C}$ | | MIN. | 50 | $\text{V}/\mu\text{s}$ |
| (dv/dt)c | (di/dt)c = 4.3 A/ms $T_J = 110^\circ\text{C}$ | | MIN. | 10 | $\text{V}/\mu\text{s}$ |
| t_{gt} | $I_G = 100\text{mA}$ $\text{PW} = 15\mu\text{s}$ $I_T = 11.3 \text{ A(pk)}$ | | TYP. | 4.0 | μs |

Static Characteristics

| Symbol | Test Conditions | | Value | Unit | |
|------------------------|-------------------------------------------------|---------------------------|-------|------|---------------|
| V_{TM} | $I_{TM} = 11.3\text{A}$ $t_p = 380 \mu\text{s}$ | | MAX. | 1.60 | V |
| I_{DRM} I_{RRM} | $V_{DRM} = V_{RRM}$ | $T_J = 110^\circ\text{C}$ | MAX. | 500 | μA |

Thermal Resistances

| Symbol | Parameter | Value | Unit |
|-------------------|-----------------------|-------------|------|
| $R_{\theta(J-C)}$ | Junction to case (AC) | Q6008LH1LED | 2.8 |
| | | Q6008RH1LED | 1.5 |
| | | Q6008NH1LED | |

Figure 1: Definition of Quadrants

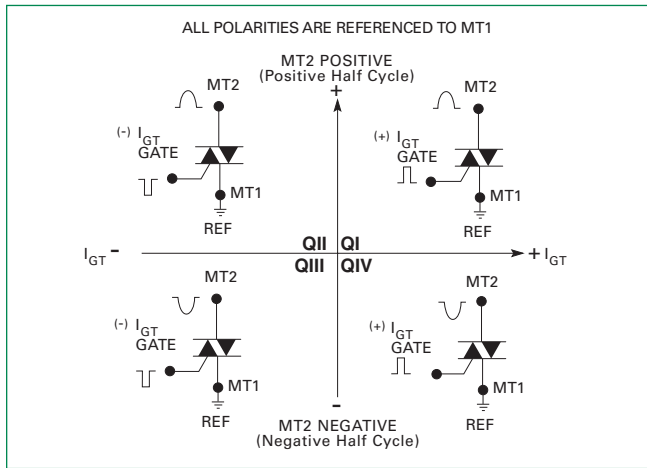


Figure 2: Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature

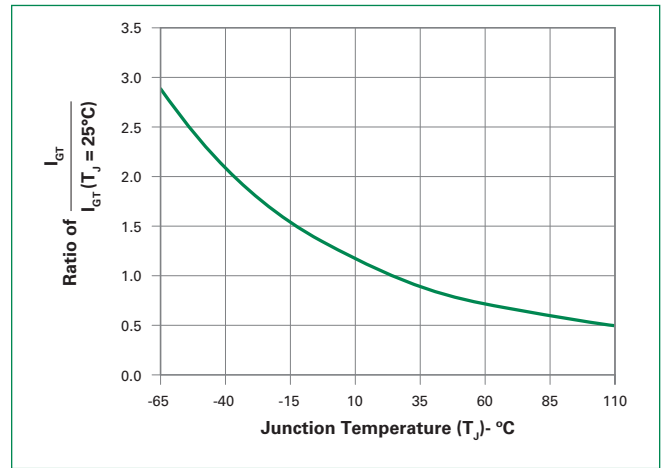


Figure 3: Normalized DC Holding Current vs. Junction Temperature

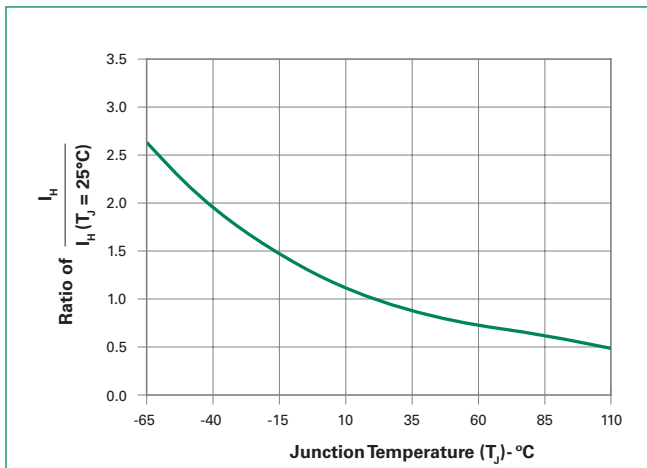


Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature

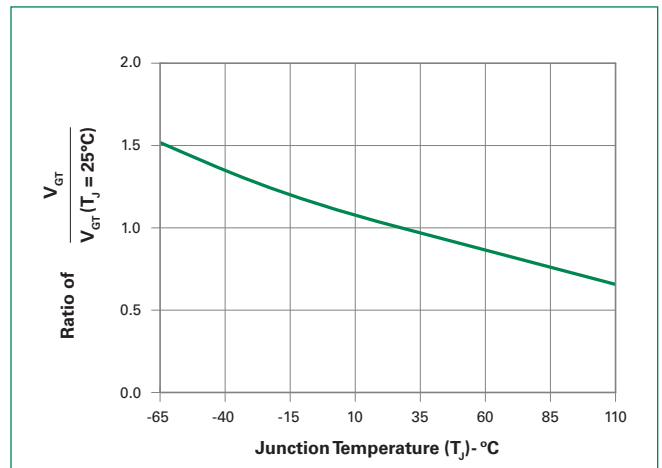


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

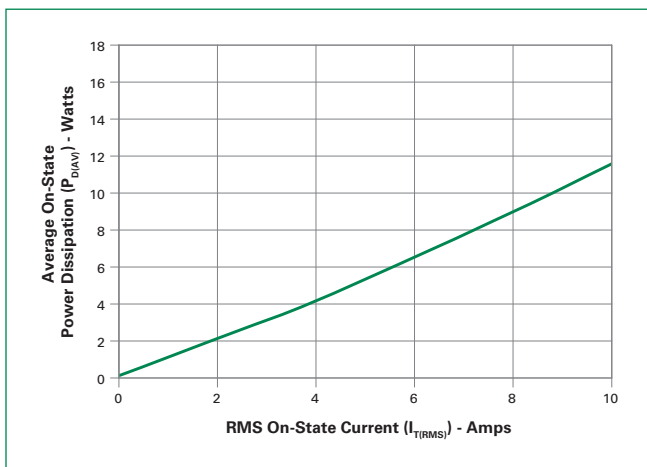


Figure 6: Maximum Allowable Case Temperature vs. On-State Current (Standard / Alternistor Triac)

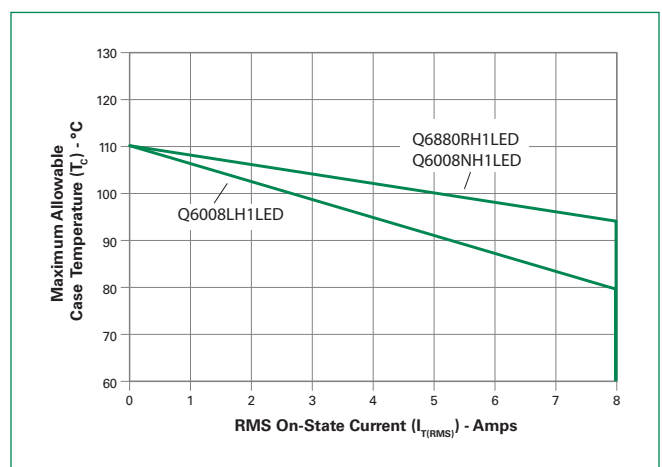


Figure 7: On-State Current vs. On-State Voltage (Typical)

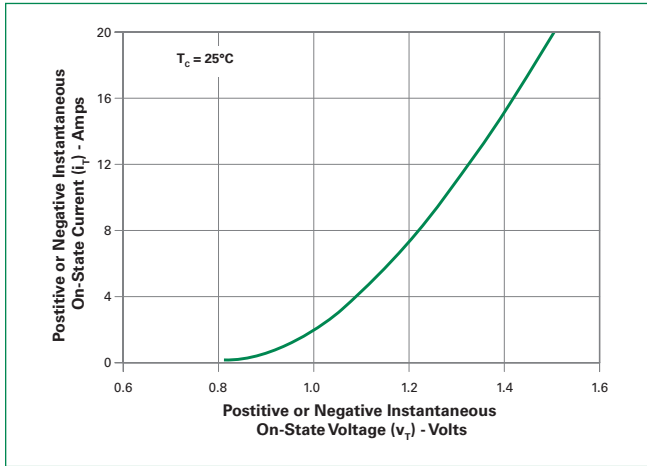
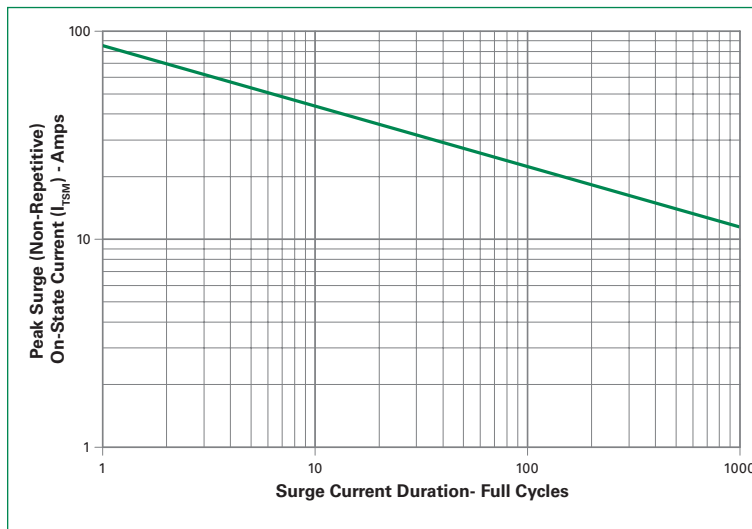


Figure 8: Surge Peak On-State Current vs. Number of Cycles

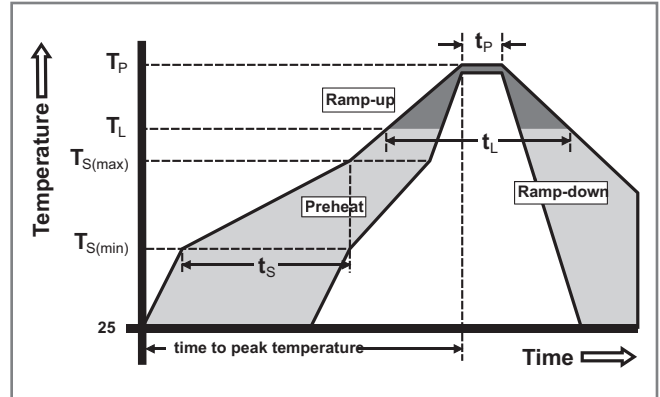


SUPPLY FREQUENCY: 60 Hz Sinusoidal
LOAD: Resistive
RMS On-State Current: [I_{TRMS}]: Maximum Rated Value at Specified Case Temperature

- 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 ^{+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 flammability classification 94V-0 |
| Terminal Material | Copper Alloy |

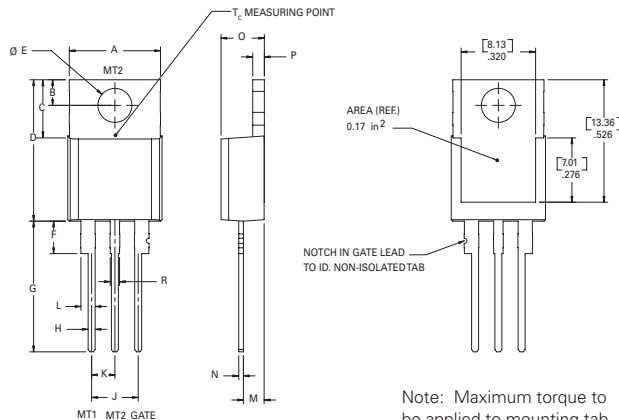
Design Considerations

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 (V_{DRM}) | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 110°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 |
| 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 |

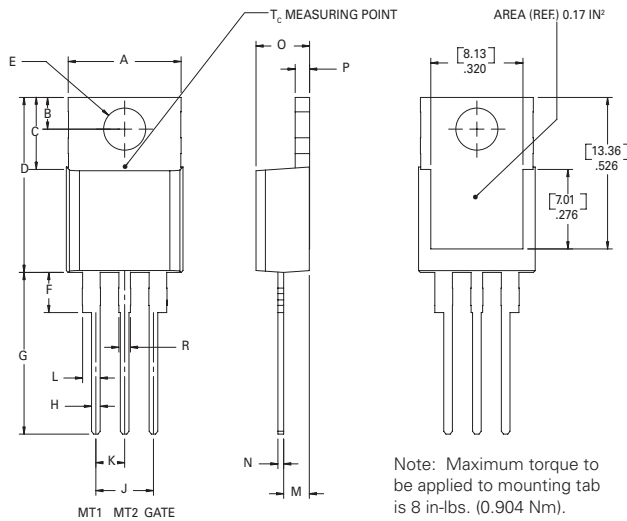
Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



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 |

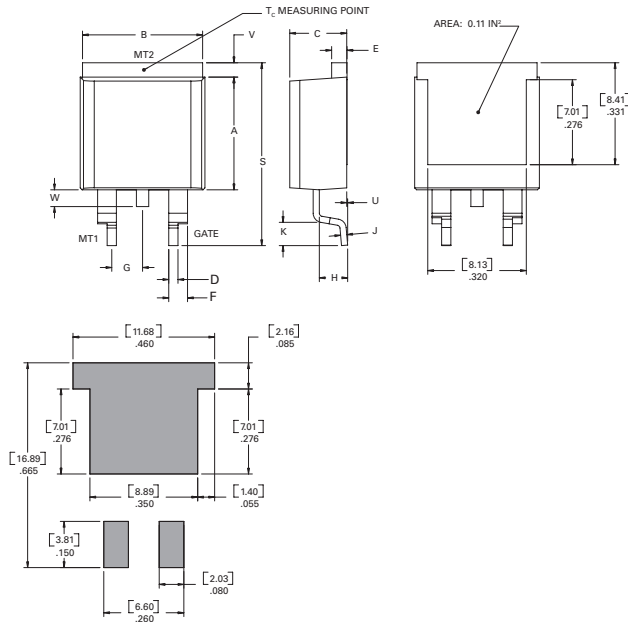
Dimensions — TO-220AB (L-Package) — Isolated Mounting Tab



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 | 0.97 | 1.22 |

Dimensions — TO-263AB (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

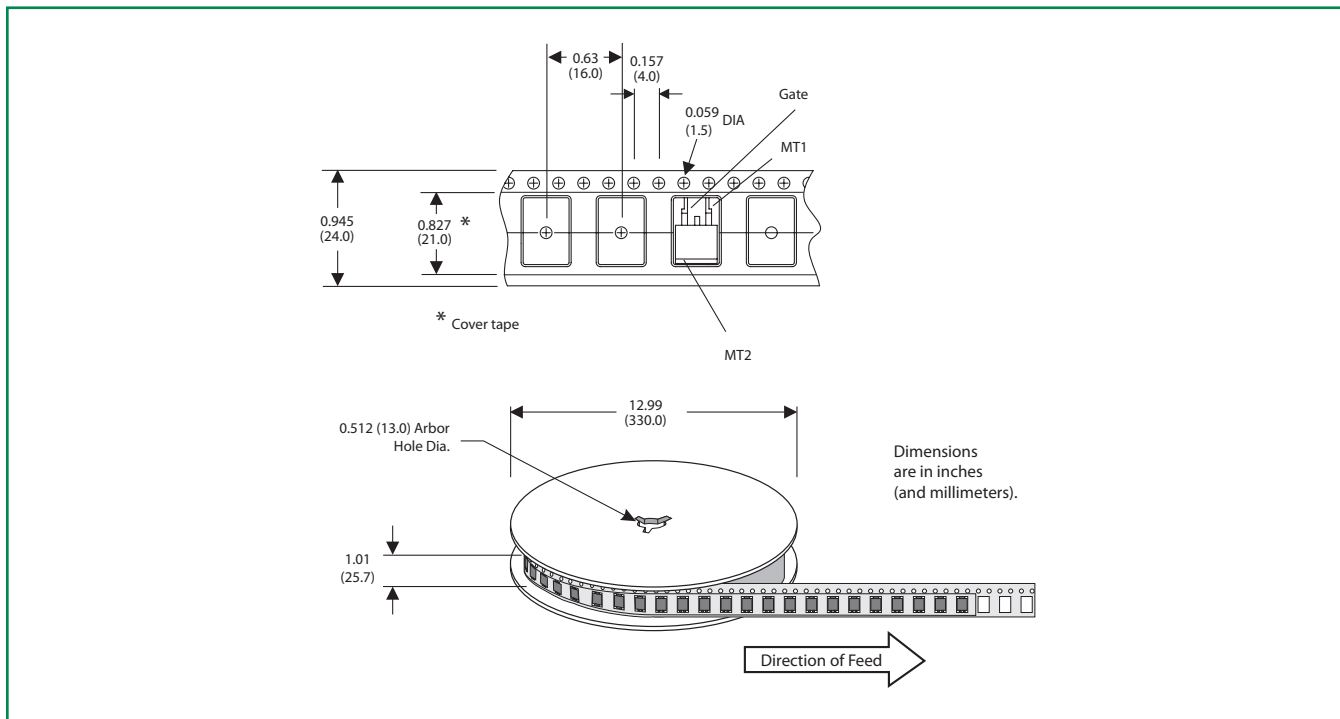
| Part Number | Gate Sensitivity Quadrants | Type | Package |
|-------------|----------------------------|-------------------|----------------------------|
| | I – II – III | | |
| Q6008LH1LED | 10 mA | Alternistor Triac | TO-220L |
| Q6008RH1LED | 10 mA | Alternistor Triac | TO-220R |
| Q6008NH1LED | 10 mA | Alternistor Triac | TO-263 D ² -PAK |

Packing Options

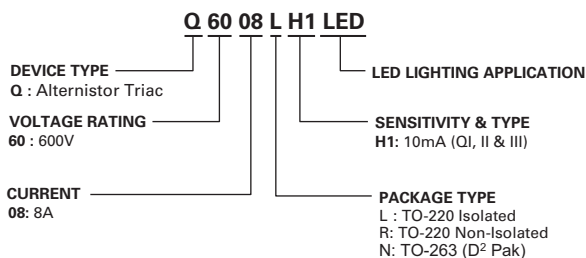
| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|---------------|----------|--------|------------------|-------------------|
| Q6008LH1LED | Q6008LH1 | 2.2 g | Bulk | 500 |
| Q6008LH1LEDTP | Q6008LH1 | 2.2 g | Tube Pack | 500 (50 per tube) |
| Q6008RH1LED | Q6008RH1 | 2.2 g | Bulk | 500 |
| Q6008RH1LEDTP | Q6008RH1 | 2.2 g | Tube Pack | 500 (50 per tube) |
| Q6008NH1LED | Q6008NH1 | 1.6g | Tube | 500 (50 per tube) |
| Q6008NH1LED | Q6008NH1 | 1.6g | Embossed Carrier | 500 (50 per tube) |

TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards

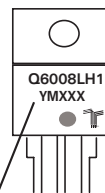


Part Numbering System



Part Marking System

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

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