

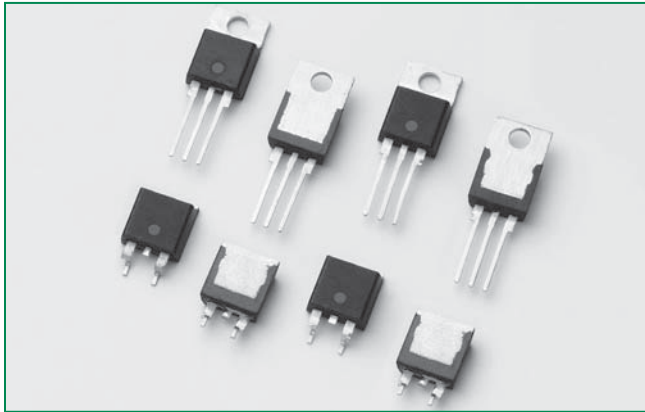
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## Q6008xH1LED Series



### 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.

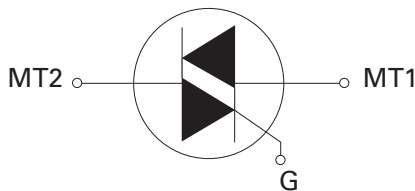
### Agency Approval

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<sub>AC</sub> 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 = $25^\circ\text{C}$ )	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	$\text{A}^2\text{s}$
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	$\mu\text{s}$

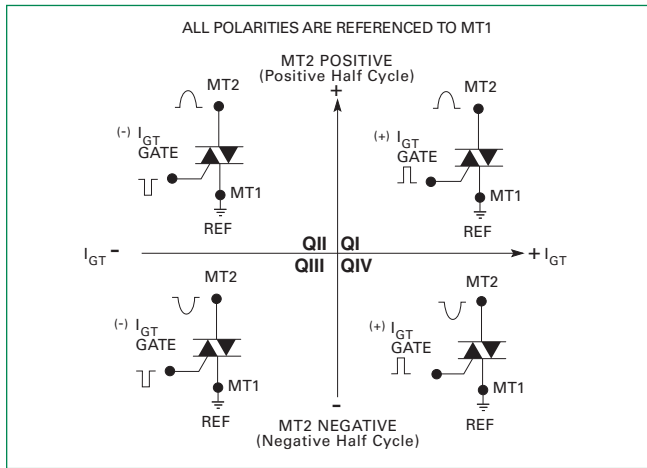
### Static Characteristics

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	$\mu\text{A}$

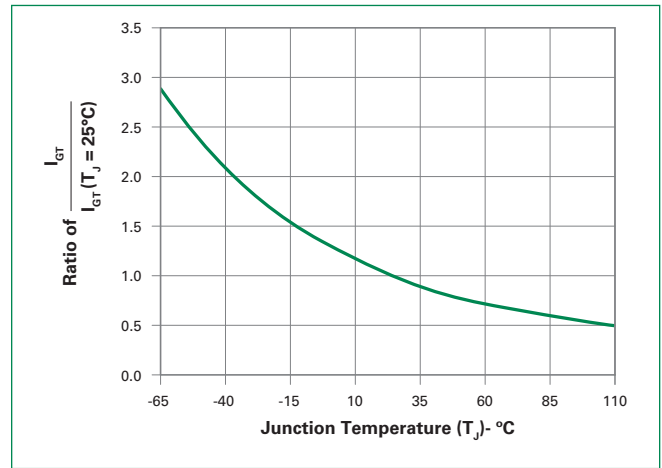
### Thermal Resistances

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

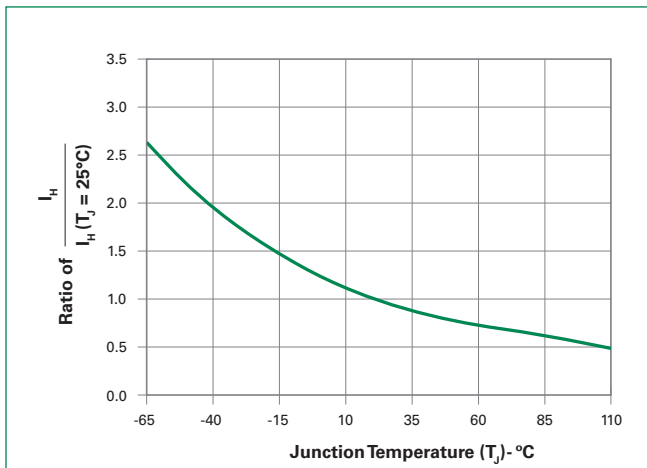
**Figure 1: Definition of Quadrants**



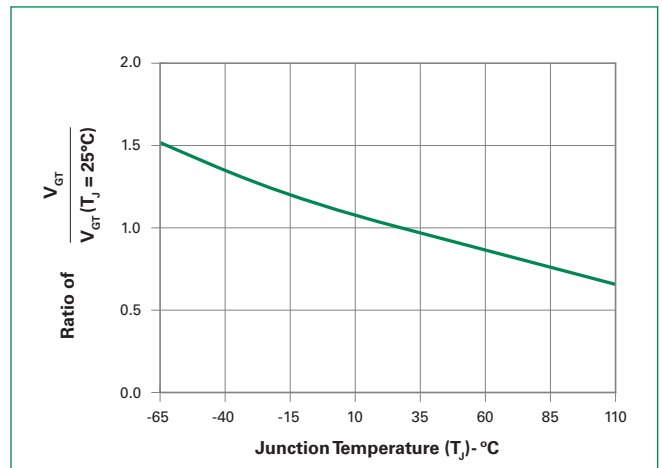
**Figure 2: Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature**



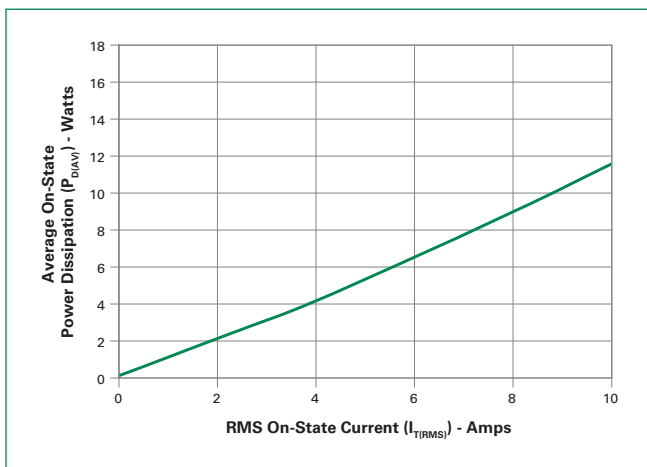
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



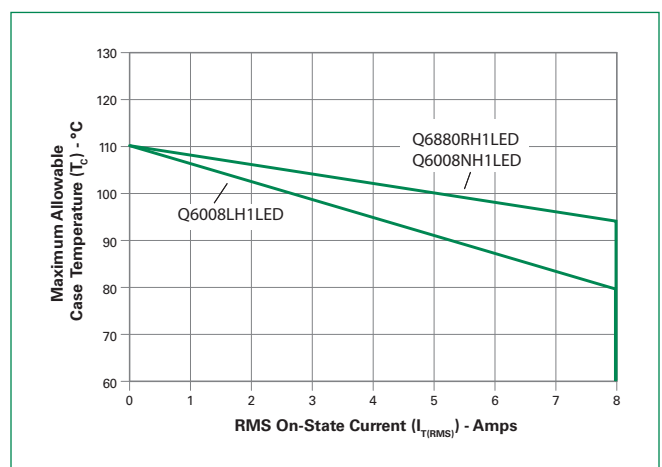
**Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature**



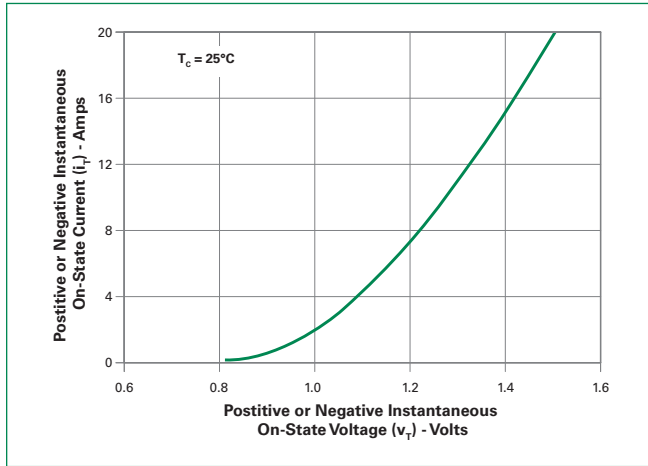
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



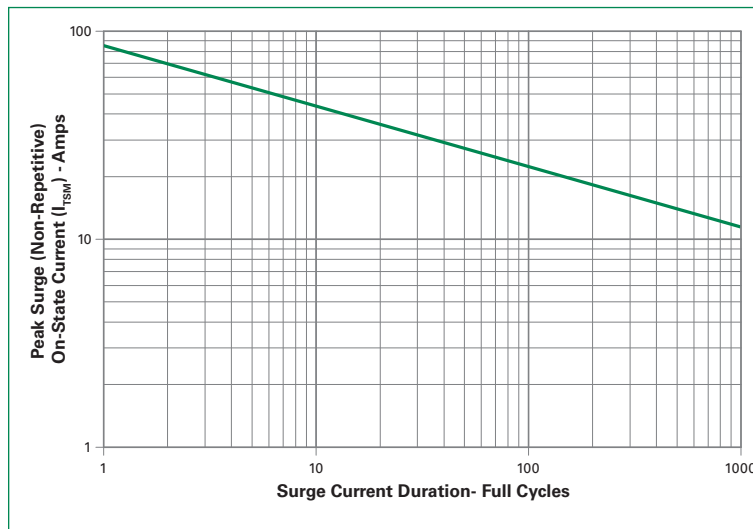
**Figure 6: Maximum Allowable Case Temperature vs. On-State Current (Standard / Alternistor Triac)**



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



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

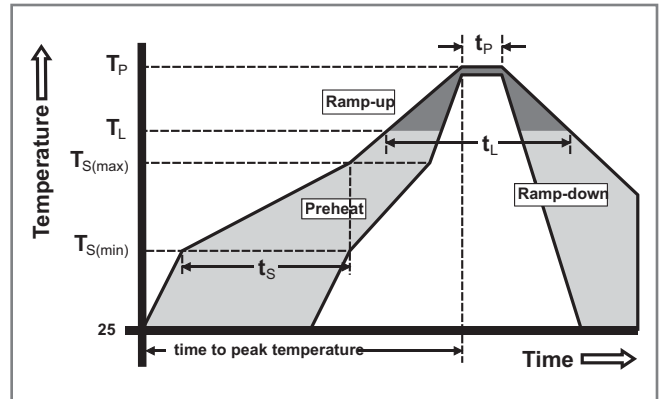


SUPPLY FREQUENCY: 60 Hz Sinusoidal  
LOAD: Resistive  
RMS On-State Current: [ $I_{TRMS}$ ]: Maximum Rated Value at Specified Case Temperature

- 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 <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 epoxy meeting flammability classification 94V-0
<b>Terminal Material</b>	Copper Alloy

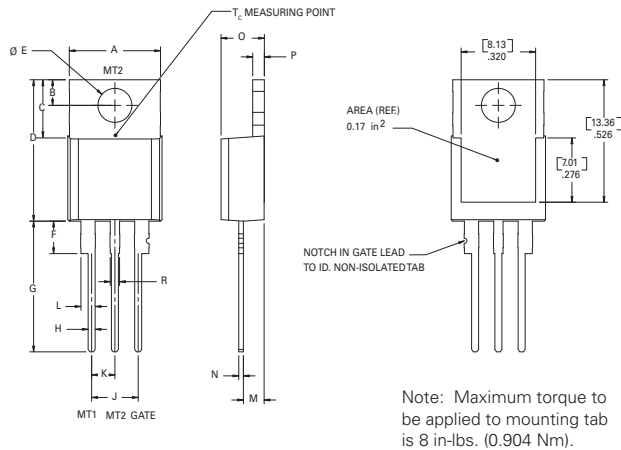
**Design Considerations**

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**

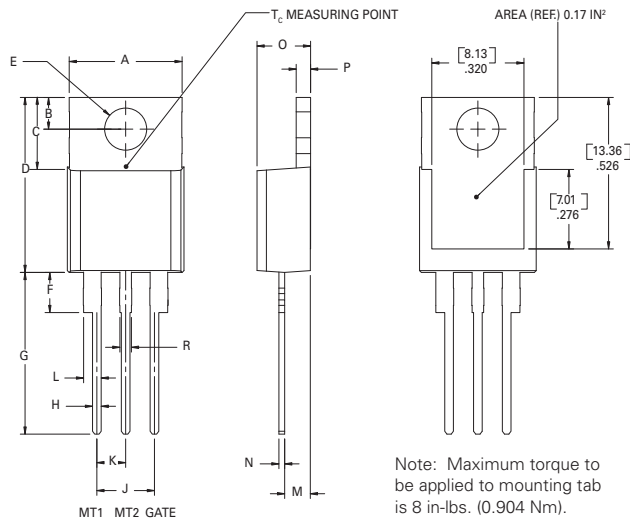
Test	Specifications and Conditions
<b>AC Blocking (<math>V_{DRM}</math>)</b>	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 110°C for 1008 hours
<b>Temperature Cycling</b>	MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time
<b>Temperature/Humidity</b>	EIA / JEDEC, JESD22-A101 1008 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>Autoclave</b>	EIA / JEDEC, JESD22-A102 168 hours (121°C at 2 ATMs) and 100% R/H
<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-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead**



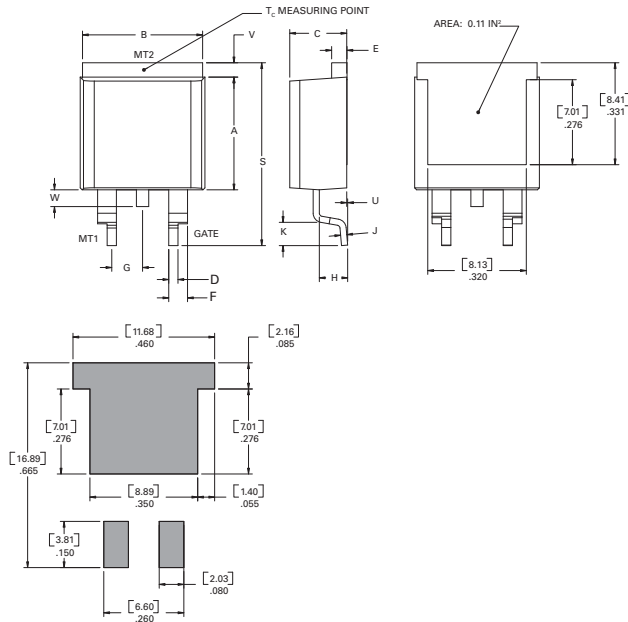
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	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**



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) — D<sup>2</sup>-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 <sup>2</sup> -PAK

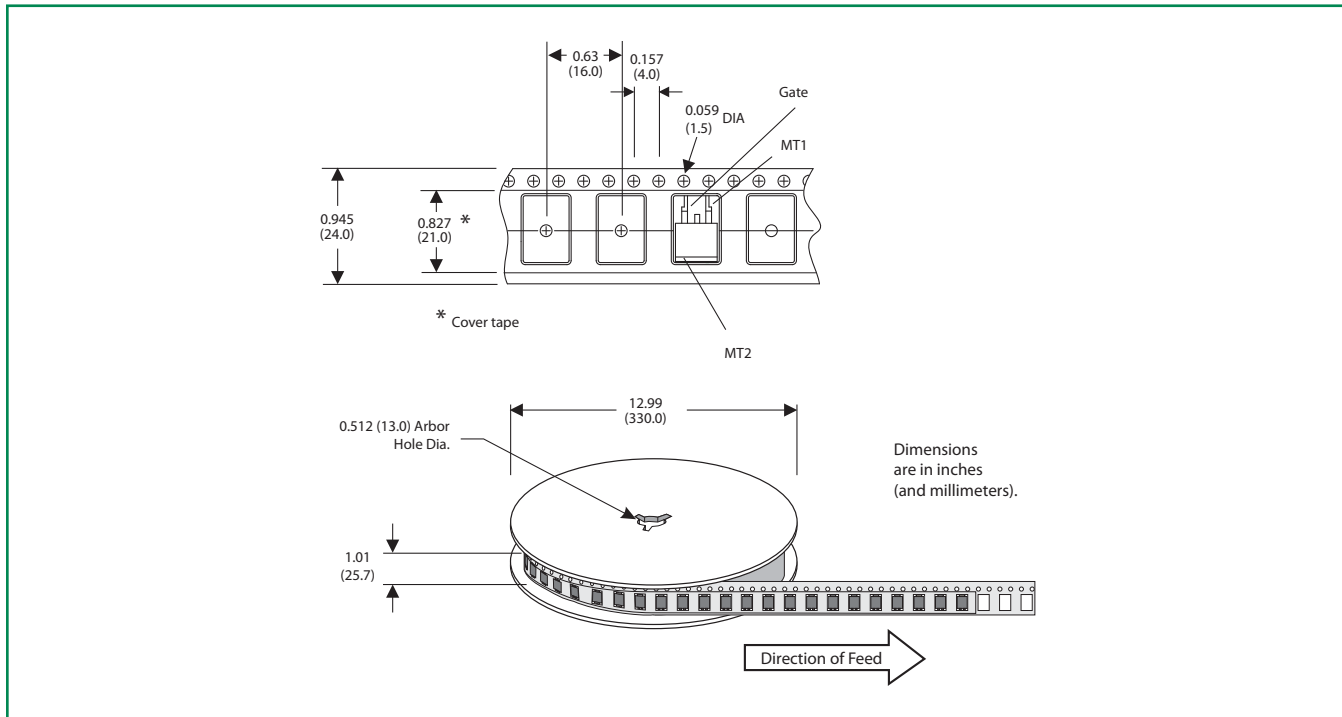
**Packing Options**

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)

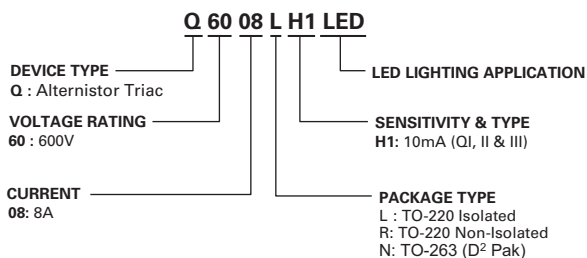


**TO-263 Embossed Carrier Reel Pack (RP) Specifications**

Meets all EIA-481-2 Standards

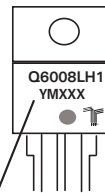


**Part Numbering System**



**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