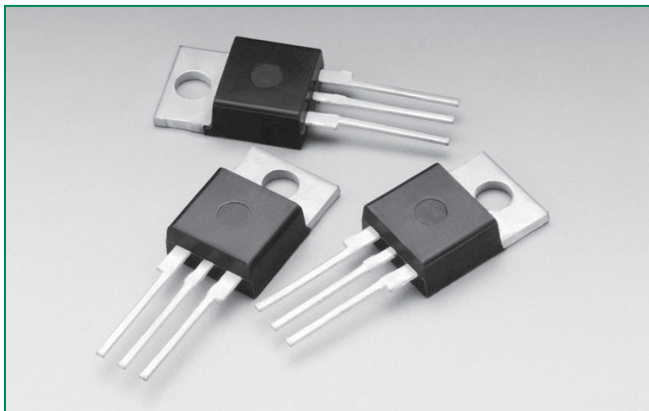


## Q6012LH1LED Series



### Description

Q6012LH1LED series is designed to meet low load current characteristics typical in LED lighting applications.

By keeping holding current at 8mA maximum, this Triac series is characterized and specified to perform best with LED loads. The Q6008LH1LED series is best suited for LED dimming controls to obtain the lowest levels of light output with a minimum probability of flickering.

Q6012LH1LED series is offered in the industry standard TO-220AB package with an isolated mounting tab that makes it best suited for adding an external heat sink.

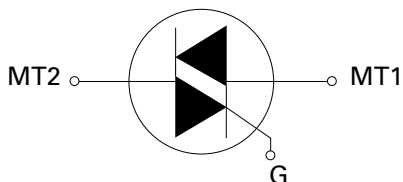
### Agency Approval

Agency	Agency File Number
	L Package: E71639

### Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	12	A
$V_{DRM}/V_{RRM}$	600	V
$I_{GT}$	10	mA

### Schematic Symbol



### Features

- As low as 8mA max holding current
- UL recognized TO-220AB package
- 110°C rated junction temperature
- di/dt performance of 70A/μs
- QUADRAC version includes integrated 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, lower current motor in home/brown goods appliances.

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

### Additional Information



**Datasheet**



**Resources**



**Samples**

**Absolute Maximum Ratings**

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)			$T_C = 90^\circ\text{C}$	A
$I_{TSM}$	Non repetitive surge peak on-state current (full cycle, $T_J$ initial = $25^\circ\text{C}$ )	$f = 50\text{ Hz}$	$t = 20\text{ ms}$	110	A
		$f = 60\text{ Hz}$	$t = 16.7\text{ ms}$	120	
$I^2t$	$I^2t$ Value for fusing			$t_p = 8.3\text{ ms}$	$\text{A}^2\text{s}$
$di/dt$	Critical rate of rise of on-state current	$f = 120\text{ Hz}$	$T_J = 110^\circ\text{C}$	70	$\text{A}/\mu\text{s}$
$I_{GTM}$	Peak gate trigger current	$t_p \leq 10\text{ }\mu\text{s};$ $I_{GT} \leq I_{GTM}$	$T_J = 110^\circ\text{C}$	2.0	A
$P_{G(AV)}$	Average gate power dissipation			$T_J = 110^\circ\text{C}$	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		Qxx12LH1	Unit
$I_{GT}$	$V_D = 12\text{ V}$ $R_L = 60\text{ }\Omega$	I – II – III	MAX.	10	mA
$V_{GT}$		I – II – III	MAX.	1.3	V
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $T_J = 110^\circ\text{C}$	I – II – III	MIN.	0.2	V
$I_H$	$I_T = 20\text{ mA}$		MAX.	8	mA
$dv/dt$	$V_D = V_{DRM}$ Gate Open $T_J = 110^\circ\text{C}$		MIN.	45	$\text{V}/\mu\text{s}$
$(dv/dt)_c$	$(di/dt)_c = 6.5\text{ A/ms}$ $T_J = 110^\circ\text{C}$		MIN.	2	$\text{V}/\mu\text{s}$
$t_{gt}$	$I_G = 2 \times I_{GT}$ $PW = 15\text{ }\mu\text{s}$ $I_T = 17.0\text{ A(pk)}$		TYP.	4	$\mu\text{s}$

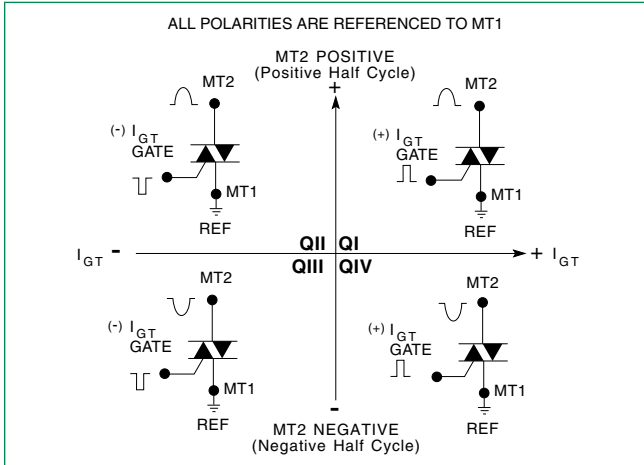
**Static Characteristics**

Symbol	Test Conditions			Value	Unit
$V_{TM}$	$I_{TM} = 17.0\text{ A}$ $t_p = 380\text{ }\mu\text{s}$			MAX.	V
$I_{DRM}$ $I_{RRM}$	$V_D = V_{DRM} / V_{RRM}$	$T_J = 25^\circ\text{C}$	MAX.	10	$\mu\text{A}$
		$T_J = 110^\circ\text{C}$		1	mA

**Thermal Resistances**

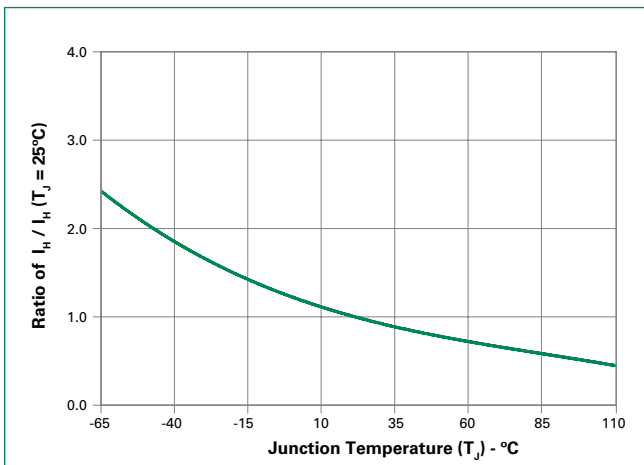
Symbol	Parameter	Value	Unit
$R_{\theta(J-C)}$	Junction to case (AC)	2.3	$^\circ\text{C}/\text{W}$
$R_{\theta(J-A)}$	Junction to ambient	55	$^\circ\text{C}/\text{W}$

**Figure 1: Definition of Quadrants**

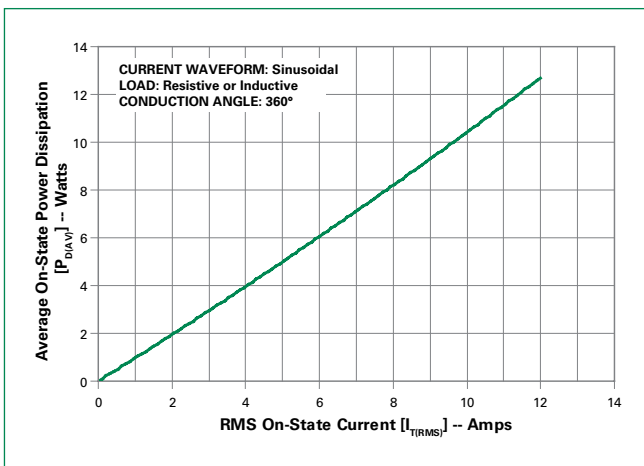


Note: Alternistors will not operate in QIV

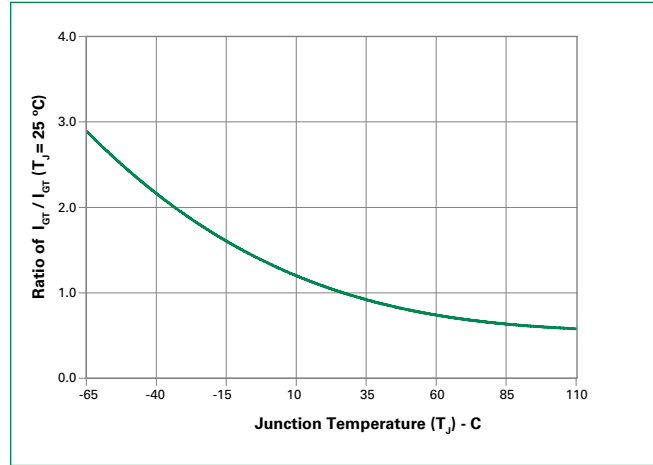
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



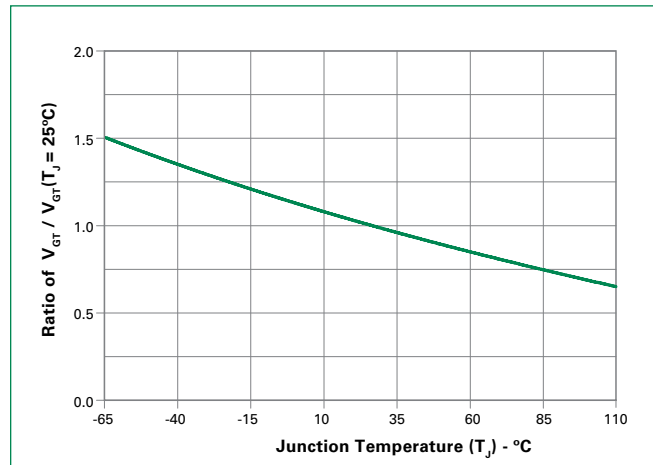
**Figure 5: Power Dissipation (Typical) vs. RMS On-State Current**



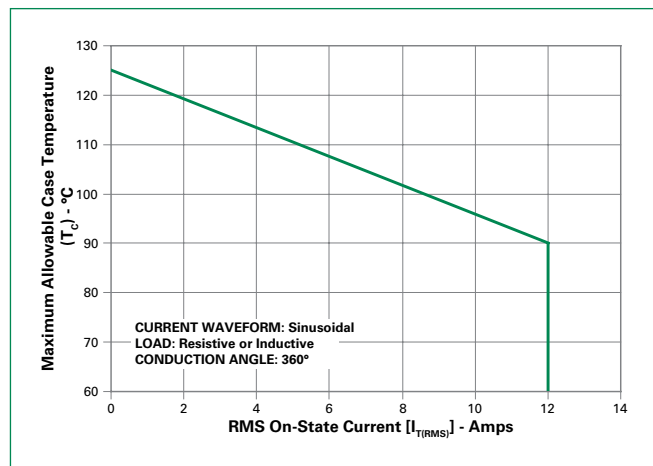
**Figure 2: Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature**



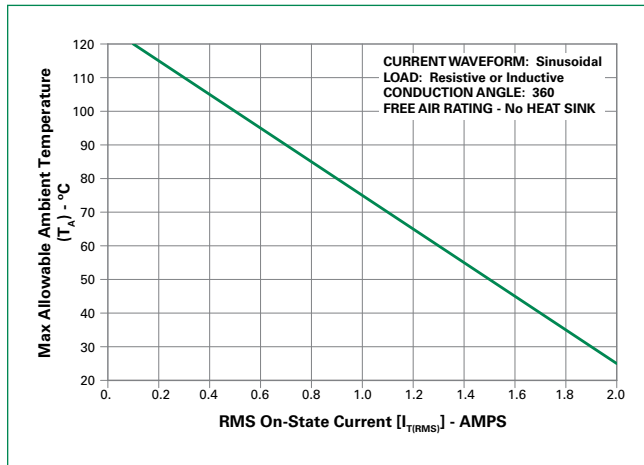
**Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature**



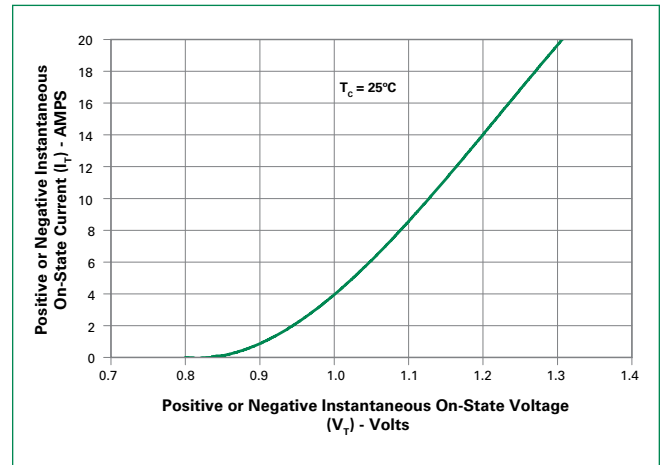
**Figure 6: Maximum Allowable Case Temperature vs. On-State Current**



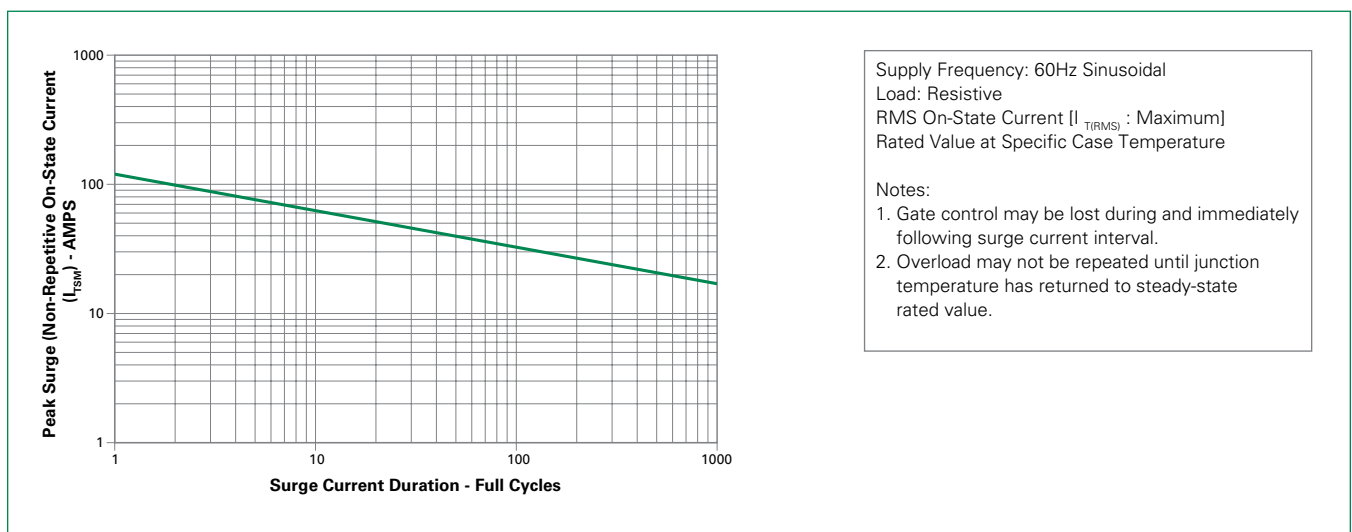
**Figure 7: Maximum Allowable Ambient Temperature vs. On-State Current**



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

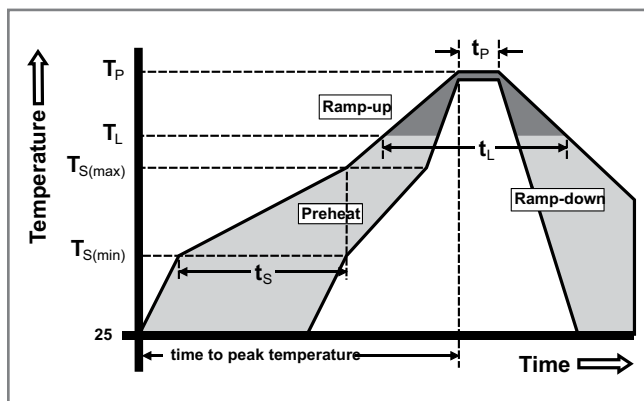


**Figure 9: Surge Peak On-State Current vs. Number of Cycles**



## 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
	- Time (min to max) ( $t_s$ )	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

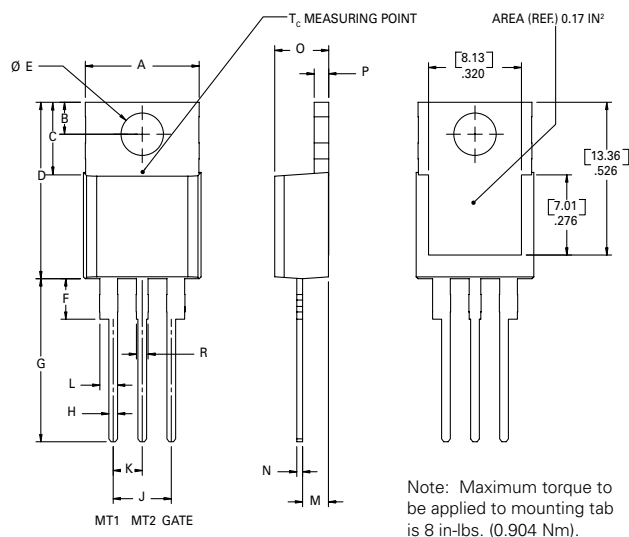
## Design Considerations

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</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>Thermal Shock</b>	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
<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 (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

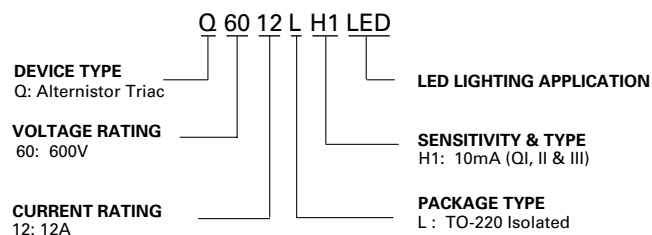
### Product Selector

Part Number	Gate Sensitivity Quadrants	Type	Package
	I – II – III		
Q6012LH1LED	10 mA	Alternistor Triac	TO-220L

### Packing Options

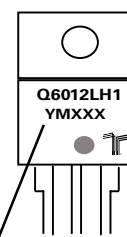
Part Number	Marking	Weight	Packing Mode	Base Quantity
Q6012LH1LED	Q6012LH1	2.2 g	Bulk	500
Q6012LH1LEDTP	Q6012LH1	2.2 g	Tube Pack	500 (50 per tube)

### Part Numbering System



### Part Marking System

TO-220 AB - (L Package)



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