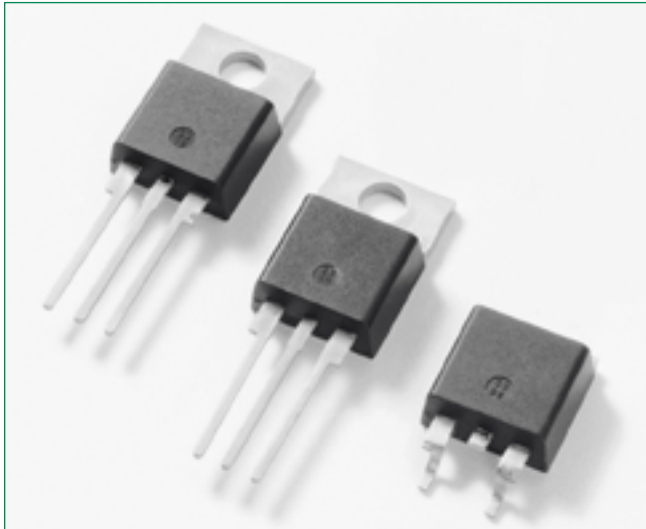



# QVxx12xHx Series

## 12 A High Temperature Alternistor Triacs

HF RoHS

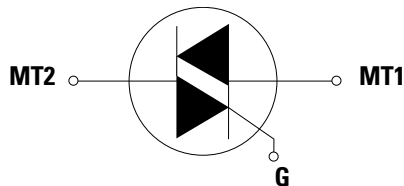
### Agency Approvals and Environmental

Environmental Approvals	Agency Approvals
HF <span style="border: 1px solid black; padding: 2px;">RoHS</span>	 L Package: E71639

### Product Summary

Symbol	Value	Unit
$I_{T(RMS)}$	12	A
$V_{DRM}/V_{RRM}$	600	V
$I_{GT(Q1)}$	35 or 50	mA

### Schematic Symbol



### Description

This 12 A high temperature Alternistor TRIAC, offered in TO-220AB, TO-220 isolated, and TO-263 packages, has 150 °C maximum junction temperature ( $T_j$ ) and 153 A ITSM (60 Hz).

This series enables easier thermal management and higher surge handling capability in AC power control applications such as heater control, motor speed control, lighting controls, and static switching relays. Alternistor TRIAC operates in quadrants I, II, and III, and offers high performance in applications requiring high commutation capability.

### Features & Benefits

- High  $T_j$  of 150°C
- Voltage capability of 600 V
- Surge capability of 153 A at 60Hz half cycle
- Mechanically and thermally robust TO-220 clip-attach assembly
- Internally-isolated TO-220 package
- Halogen-free and RoHS-compliant
- High dv/dt up to 1000 V/μs

### Applications

TRIAC is an excellent AC switch in applications such as heating, lighting, and motor speed controls.

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

Alternistor TRIAC is used with high inductive loads requiring high commutation capability. Internally isolated packages offer better heat sinking with higher isolation voltage.

# QVxx12xHx Series

## 12 A High Temperature Alternistor Triacs

### Maximum Ratings – Alternistor Triac (3 Quadrants)

Symbol	Characteristic	Conditions	Value	Unit
$I_{T(RMS)}$	Rms On-State Current (Full Sine Wave)	QVxx12LHy $T_C = 120\text{ }^\circ\text{C}$	12	A
		QVxx12RHy / QVxx12NHy $T_C = 135\text{ }^\circ\text{C}$		
$I_{TSM}$	Non-Repetitive Surge Peak On-State Current (Single Half Cycle, $T_J$ Initial = $25\text{ }^\circ\text{C}$ )	$f = 50\text{ Hz}$ , $t = 20\text{ ms}$	140	A
		$f = 60\text{ Hz}$ , $t = 16.7\text{ ms}$	153	
$I^2t$	$I^2t$ Value For Fusing	$t_p = 8.3\text{ ms}$	97	$\text{A}^2\text{s}$
$di/dt$	Critical Rate Of Rise Of On-State Current	$f = 60\text{ Hz}$ , $T_J = 150\text{ }^\circ\text{C}$	100	$\text{A}/\mu\text{s}$
$I_{GTM}$	Peak Gate Trigger Current	$t_p \leq 10\text{ }\mu\text{s}$ , $I_{GT} \leq I_{GTM}$ , $T_J = 150\text{ }^\circ\text{C}$	4	A
$P_{G(AV)}$	Average Gate Power Dissipation	$T_J = 150\text{ }^\circ\text{C}$	0.5	W
$T_{stg}$	Storage Temperature Range	-	-40 to 150	$^\circ\text{C}$
$T_{VJ}$	Operating Junction Temperature Range	-	-40 to 150	$^\circ\text{C}$
$V_{DSM} \sqrt{N_{RSM}}$	Non Repetitive Surge Peak Off-State Voltage	pulse width = $100\text{ }\mu\text{s}$ ; $V_{DRM} = 600\text{ V}$	$V_{DSM} \sqrt{N_{RSM}} + 100$	V

xx = voltage/10; y = sensitivity

### Thermal Characteristics

Symbol	Characteristic	Value	Unit
$R_{thJC}$	Thermal Resistance, Junction-To-Case (AC)	QVxx12RHy / QVxx12NHy	0.9
		QVxx12LHy	1.85

### Electrical Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise specified) – Alternistor Triac (3 Quadrants)

Symbol	Description	Conditions	QVxx12xH4			QVxx12xH5			Unit	
			Min	Typ	Max	Min	Typ	Max		
$I_{GT}$	DC Gate Trigger Current	$V_D = 12\text{ V}$ $R_L = 60\Omega$	I – II – III	-	-	35	-	-	50	mA
$V_{GT}$	DC Gate Trigger Voltage		I – II – III	-	-	1.2	-	-	1.2	V
$V_{GD}$	Gate Non-trigger Voltage	$V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $T_J = 150\text{ }^\circ\text{C}$	I – II – III	0.15	-	-	0.15	-	-	V
$I_H$	Holding Current	$I_T = 100\text{ mA}$	-	-	50	-	-	50	mA	
$dv/dt$	Critical Rate-of-rise of Off-stage Voltage	$V_D = V_{DRM}$ Gate Open $T_J = 150\text{ }^\circ\text{C}$	-	500	-	-	750	-	-	$\text{V}/\mu\text{s}$
		$V_D = 2/3 V_{DRM}$ Gate Open $T_J = 150\text{ }^\circ\text{C}$	-	1000	-	-	1000	-	-	
$(dv/dt)_c$	-	$(di/dt)_c = 8.6\text{ A/ms}$ $T_J = 150\text{ }^\circ\text{C}$	-	50	-	-	50	-	-	$\text{V}/\mu\text{s}$
$t_{gt}$	Turn-on Time	$I_G = 2 \times I_{GT}$ $PW = 15\text{ }\mu\text{s}$ $I_T = 22.6\text{ A(pk)}$	I	-	1	-	-	1	-	$\mu\text{s}$
			II	-	2	-	-	2	-	
			III	-	7	-	-	10	-	

xx = voltage/10;  
x = sensitivity

### Static Characteristics

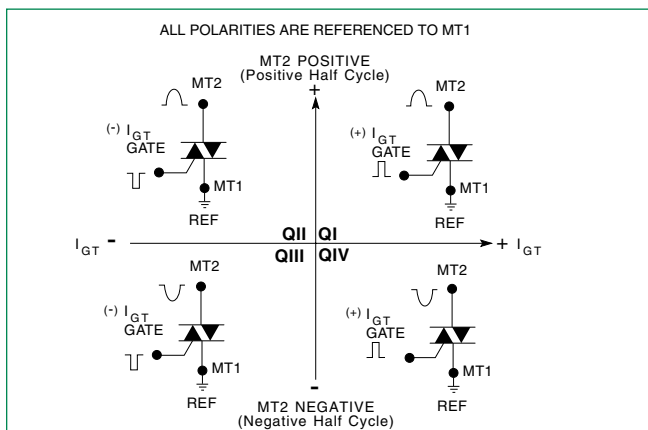
Symbol	Description	Conditions	Maximum Value	Unit
$V_{TM}$	Peak On-state Voltage	$I_T = 17\text{ A}$ $t_p = 380\text{ }\mu\text{s}$	1.60	V
$I_{DRM} / I_{RRM}$	Off-state Current, Peak Repetitive	$V_D = V_{DRM} \sqrt{N_{RRM}}$ $T_J = 25\text{ }^\circ\text{C}$	5	$\mu\text{A}$
		$V_D = V_{DRM} \sqrt{N_{RRM}}$ $T_J = 150\text{ }^\circ\text{C}$ , $V_{DRM} = 600\text{ V}$	4	mA
$V_{TO}$	Threshold Voltage	$T_J = 150\text{ }^\circ\text{C}$	0.85	V
$R_D$	Dynamic Resistance	$T_J = 150\text{ }^\circ\text{C}$	23	$\text{m}\Omega$

# QVxx12xHx Series

## 12 A High Temperature Alternistor Triacs

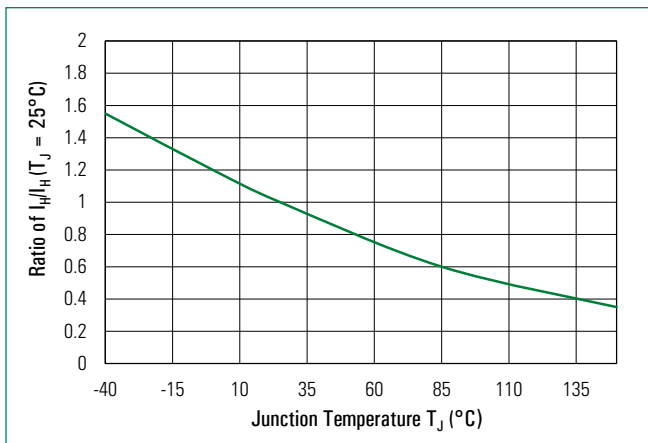
### Performance Curves

**Figure 1:**  
Definition of Quadrants

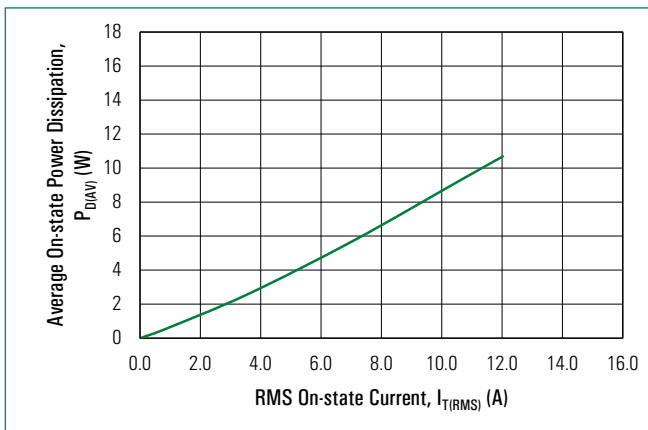


Note: Alternistors will not operate in QIV

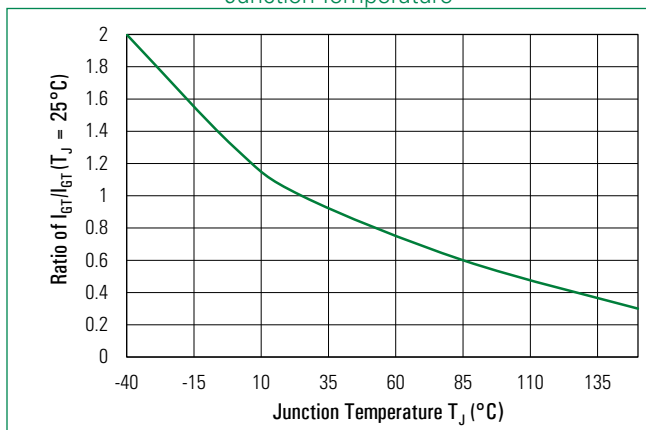
**Figure 3:**  
Normalized DC Holding Current vs. Junction Temperature



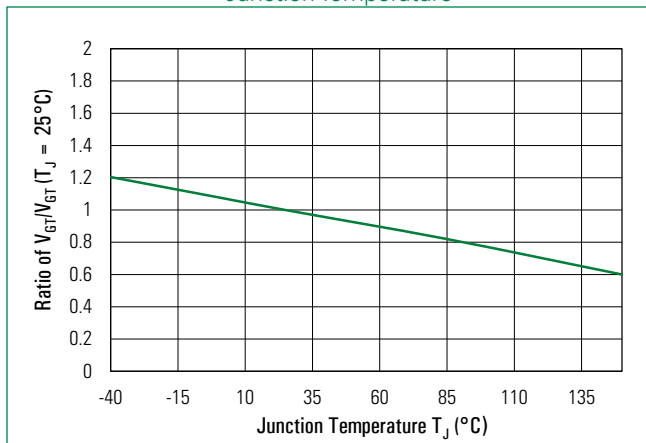
**Figure 5:**  
Power Dissipation (Typical) vs. RMS On-State Current



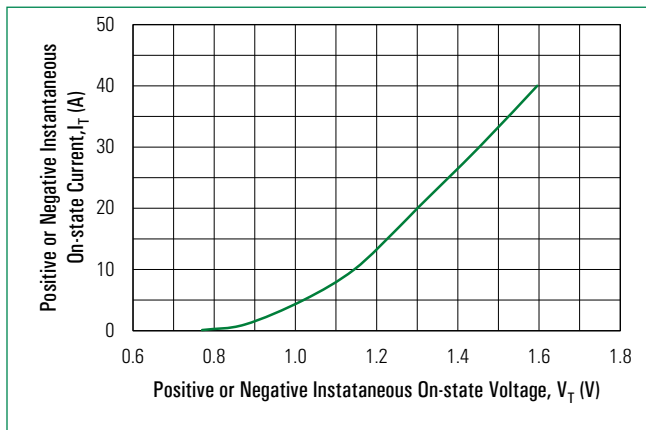
**Figure 2:**  
Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature



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



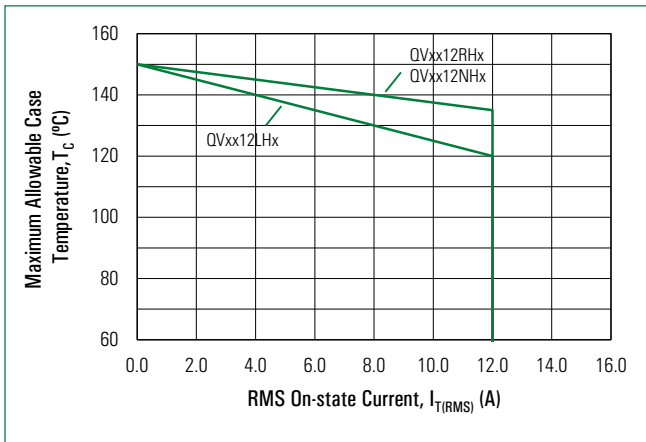
**Figure 6:**  
On-State Current vs. On-State Voltage (Typical)



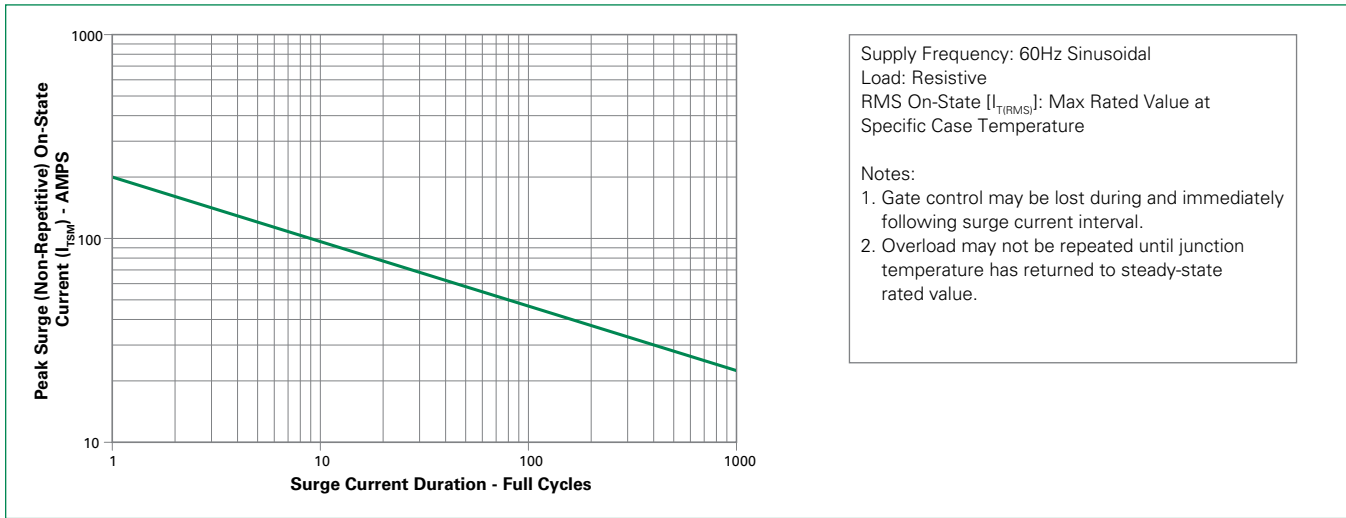
# QVxx12xHx Series

## 12 A High Temperature Alternistor Triacs

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

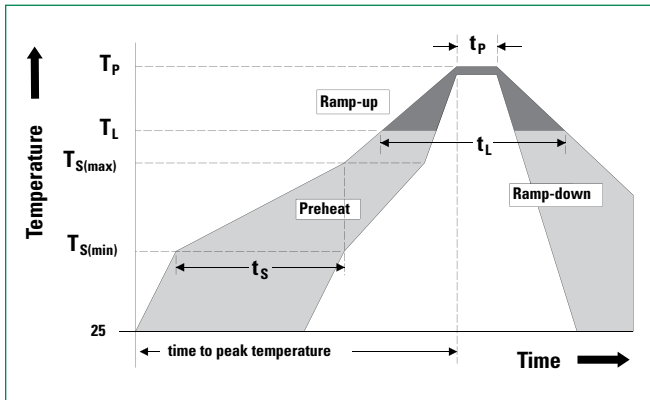


**Figure 8:** Surge Peak On-State Current vs. Number of Cycles



### Soldering Parameters

<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 s
<b>Average ramp up rate (Liquidus Temp) (<math>T_L</math>) to peak</b>		5°C/s (Max)
<b><math>T_{S(Max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		5°C/s (Max)
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Time ( $t_r$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 °C (±5)
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		20 – 40 s
<b>Ramp-down Rate</b>		5°C/s (Max)
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		280°C



# QVxx12xHx Series

## 12 A High Temperature Alternistor Triacs

### Physical Specifications

<b>Terminal Finish</b>	100% Matte Tin-plated
<b>Body Material</b>	UL Recognized compound meeting flammability rating 94V-0
<b>Terminal Material</b>	Copper Alloy

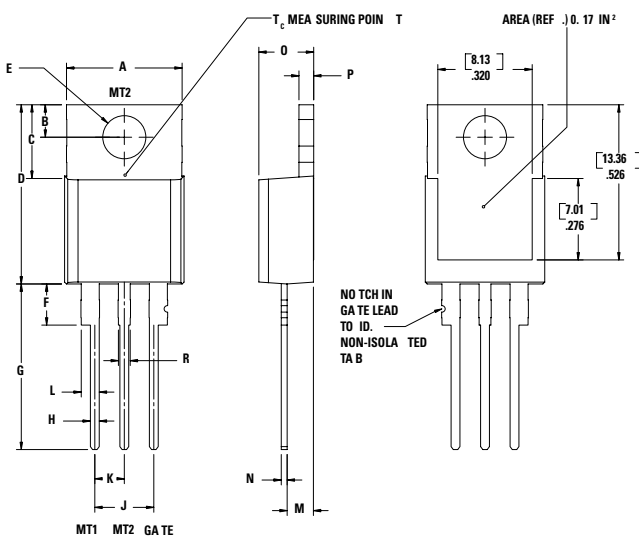
### Design Considerations

Careful selection of the correct component 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 component 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 @ 150°C for 1008 hours
<b>Temperature Cycling</b>	MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell time
<b>Temperature/Humidity</b>	EIA / JEDEC, JESD22-A101, 1008 hours; 160V - DC: 85°C; 85% rel humidity
<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
<b>Moisture Sensitivity Level</b>	Level 1, JEDEC-J-STD-020
<b>UHAST</b>	JESD22A-118, 96 hrs, 130°C/ 85% RH
<b>IOL</b>	MIL-STD-750 Method 1037

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



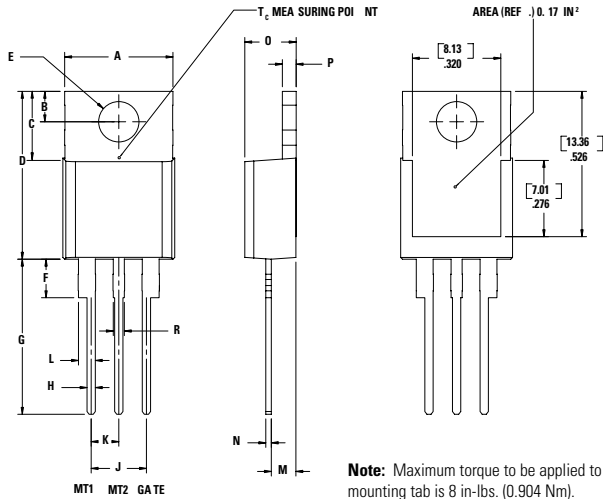
**Note:** Maximum torque to be applied to mounting tab is 8 in.-lbs. (0.904 Nm).

Dimension	Inches		Millimeters	
	Min	Max	Min	Max
<b>A</b>	0.380	0.420	9.65	10.67
<b>B</b>	0.105	0.115	2.66	2.92
<b>C</b>	0.230	0.250	5.84	6.35
<b>D</b>	0.590	0.620	14.99	15.75
<b>E</b>	0.142	0.147	3.61	3.73
<b>F</b>	0.110	0.130	2.79	3.30
<b>G</b>	0.540	0.575	13.72	14.61
<b>H</b>	0.025	0.035	0.64	0.89
<b>J</b>	0.195	0.205	4.95	5.21
<b>K</b>	0.095	0.105	2.41	2.67
<b>L</b>	0.060	0.075	1.52	1.91
<b>M</b>	0.085	0.095	2.16	2.41
<b>N</b>	0.018	0.024	0.46	0.61
<b>O</b>	0.178	0.188	4.52	4.78
<b>P</b>	0.045	0.060	1.14	1.52
<b>R</b>	0.038	0.048	0.97	1.22

# QVxx12xHx Series

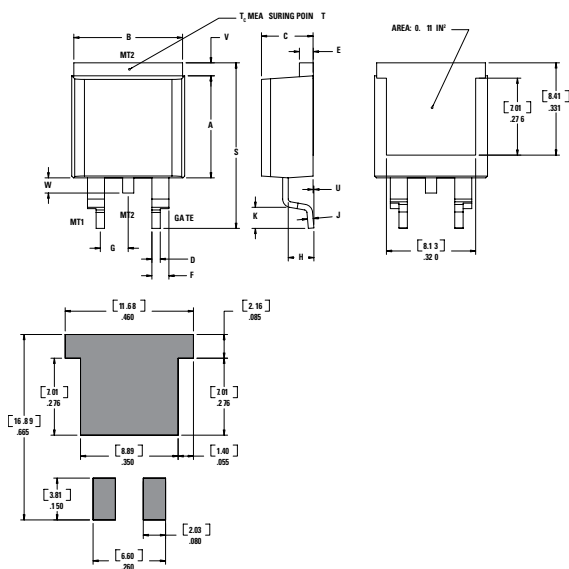
## 12 A High Temperature Alternistor Triacs

### 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	14.60
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) - D2Pak 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	1.02	1.78

### Product Selector

Part Number	Voltage	Gate Sensitivity Quadrants	Type	Package
	600V	I - II - III		
QVxx12LH4	X	35 mA	Alternistor Triac	TO-220L
QVxx12RH4	X	35 mA	Alternistor Triac	TO-220R
QVxx12NH4	X	35 mA	Alternistor Triac	TO-263 D <sup>2</sup> -PAK
QVxx12LH5	X	50 mA	Alternistor Triac	TO-220L
QVxx12RH5	X	50 mA	Alternistor Triac	TO-220R
QVxx12NH5	X	50 mA	Alternistor Triac	TO-263 D <sup>2</sup> -PAK

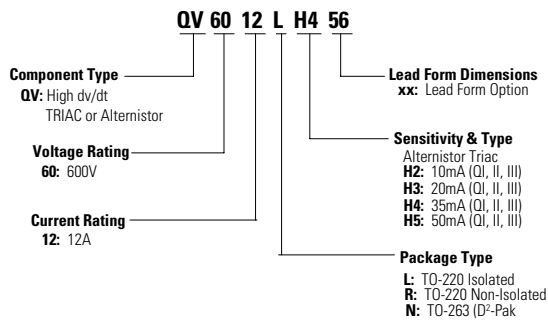
# QVxx12xHx Series

## 12 A High Temperature Alternistor Triacs

### Packing Options

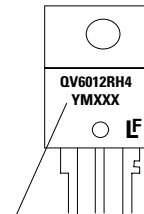
Part Number	Marking	Weight	Packing Mode	Base Quantity
QVxx12LHyTP	QVxx12LHy	2.2 g	Tube Pack	1000
QVxx12RHxTP	QVxx12RHx			
QVxx12NHxTP	QVxx12NHx	1.6 g	Tube Pack	1000
QVxx12NHxRP	QVxx12NHx	1.6 g	Embossed Carrier	500

### Part Numbering System



### Part Marking System

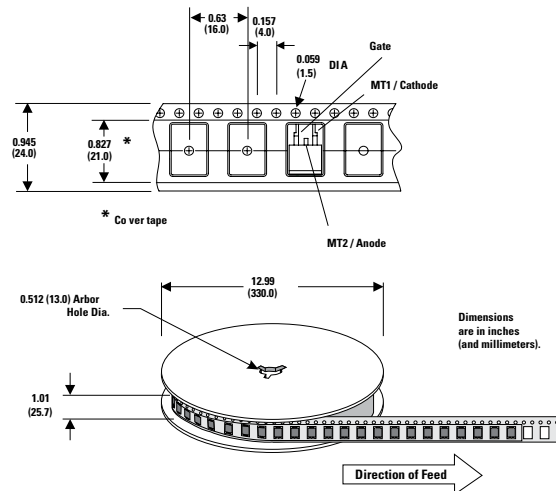
TO-220 AB - (L and R Package)  
TO-263 - (N Package)



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

### TO-263 Embossed Carrier Reel Pack (RP)

Meets all EIA-481-2 Standards



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