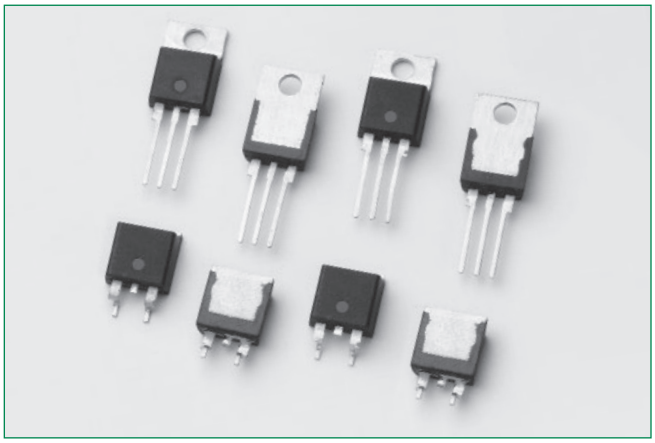
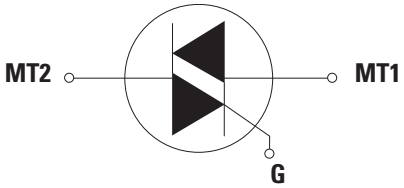
QVxx16xHx Series

16 A High Temperature Alternistor TRIACs

HF RoHS L Package: E71639



Schematic Symbol



Description

This 16 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 200 A I_{TSM} (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 200 A at 60 Hz full cycle
- Mechanically and thermally robust TO-220 clip-attach assembly
- High dv/dt up to 1000 V/µs
- Snubberless TRIACs with high 3Q commutation capability
- Internally-isolated TO-220 package
- Halogen-free and RoHS-compliant
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device

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.

Product Summary

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

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Maximum Ratings — Alternistor TRIAC (3 Quadrants)

Symbol	Characteristic	Conditions		Value	Unit
$I_{T(RMS)}$	Rms On-State Current (Full Sine Wave)	QVxx16LHy	T_C = 105°C	16	A
		QVxx16RHy / QVxx16NHy	T_C = 130°C		
I_{TSM}	Non-Repetitive Surge Peak On-State Current (Full Cycle, T_j Initial = 25°C)	f = 50 Hz, t = 20 ms		167	A
		f = 60 Hz, t = 16.7 ms		200	
I^2t	I^2t Value For Fusing	t_p = 8.3 ms		166	A^2s
di/dt	Critical Rate-of-rise of On-State Current	f = 60 Hz, T_J = 150°C		100	A/µs
I_{GTM}	Peak Gate Trigger Current	$t_p \le 10$ µs, $I_{GT} \le I_{GTM}$, T_J = 150°C		2.0	A
$P_{G(AV)}$	Average Gate Power Dissipation	T_J = 150°C		0.5	W
T_{stg}	Storage Temperature Range	-		-40 to 150	°C
T_J	Operating Junction Temperature Range	-		-40 to 150	°C
V_{DSM}/V_{RSM}	Non Repetitive Surge Peak Off-State Voltage	pulse width = 100 µs; 600 V		V_{DSM}/V_{RSM} + 100	V
		pulse width = 100 µs; 800 V		V_{DSM}/V_{RSM} + 200	

xx = voltage/10; y = sensitivity

Thermal Characteristics

Symbol	Characteristic		Value	Unit
$R_{\theta(JC)}$	Thermal Resistance, Junction-To-Case (AC)	QVxx16RHy / QVxx16NHy	0.90	°C/W
		QVxx16LHy	2.4	
$R_{\theta(JA)}$	Thermal Resistance, Junction-To-Ambient (AC)	QVxx16RHy / QVxx16NHy	45	°C/W
		QVxx16LHy	50	

Electrical Characteristics (T_J = 25°C, unless otherwise specified) — Alternistor TRIAC (3 Quadrants)

Symbol	Description	Conditions		QVxx16xH2			QVxx16xH3			QVxx16xH4			QVxx16xH5			Unit
				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	V_D = 12 V, R_L = 60 Ω	I – II – III	-	-	1.3	-	-	1.3	-	-	1.3	-	-	1.3	V
V_{GD}	Gate Non-trigger Voltage	$V_D = V_{DRM}$, R_L = 3.3k Ω , T_J = 150°C	I – II – III	0.15	-	-	0.15	-	-	0.15	-	-	0.15	-	-	V
I_H	Holding Current	I_T = 100mA		-	-	15	-	-	35	-	-	50	-	-	60	mA
dv/dt	Critical Rate-of-rise of Off-stage Voltage	$V_D = V_{DRM}$ Gate Open, T_J = 150°C		200	-	-	350	-	-	500	-	-	750	-	-	V/µs
		V_D = 2/3 V_{DRM} Gate Open, T_J = 150°C		400	-	-	700	-	-	1000	-	-	1000	-	-	
(dv/dt)c	Critical Rate-of-rise of Commutation Voltage	(di/dt)c = 8.6 A/ms, T_J = 150°C		10	-	-	30	-	-	50	-	-	-	-	-	V/µs
t_{gt}	Turn-on Time	I_G = 2 x I_{GT}, P_W = 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_J = 150°C		-	-	-	-	-	-	-	-	-	28	-	-	A/µs

xx = voltage/10;
x = sensitivity

Static Characteristics

Symbol	Description	Conditions	Maximum Value	Unit
V_{TM}	Peak On-state Voltage	I_T = 22.6 A, t_p = 380 µs	1.60	V
I_{DRM} / I_{RRM}	Off-state Current, Peak Repetitive	$V_D = V_{DRM}/V_{RRM}$, T_J = 25°C	5	µA
		$V_D = V_{DRM}/V_{RRM}$, T_J = 150°C	4	mA
V_{T0}	Threshold Voltage	T_J = 150°C	0.85	V
R_D	Dynamic Resistance	T_J = 150°C	18.5	mΩ

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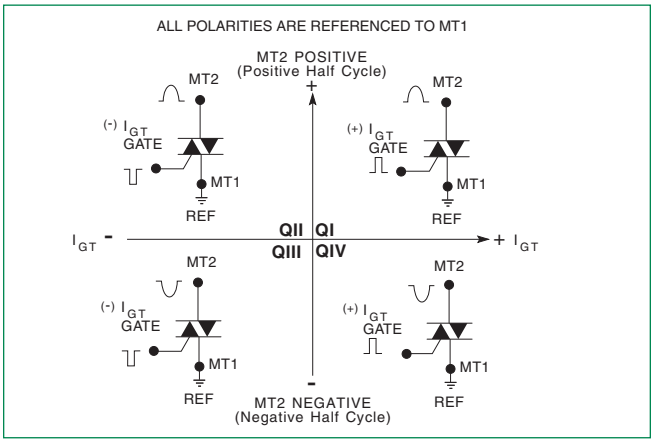
Performance Curves

Figure 1:
Definition of Quadrants



Note: Alternistors will not operate in QIV

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

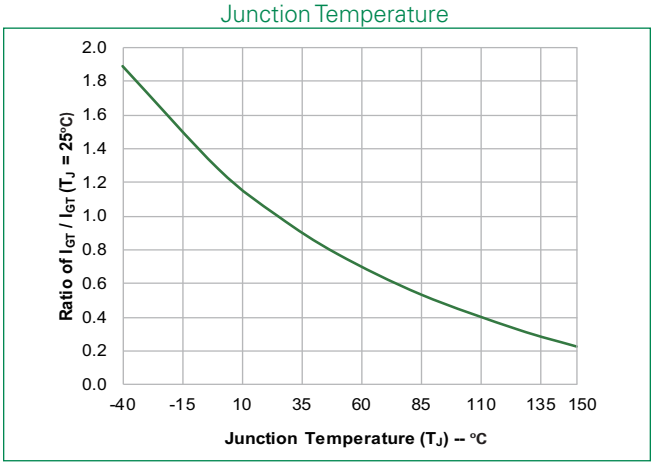


Figure 3:
Normalized DC Holding Current vs. Junction Temperature

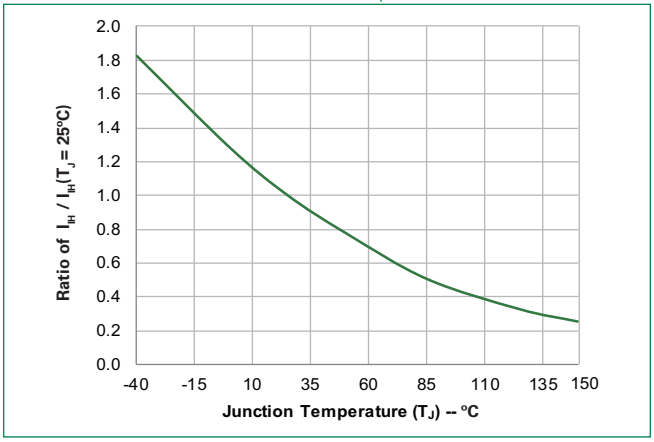


Figure 4:
Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature

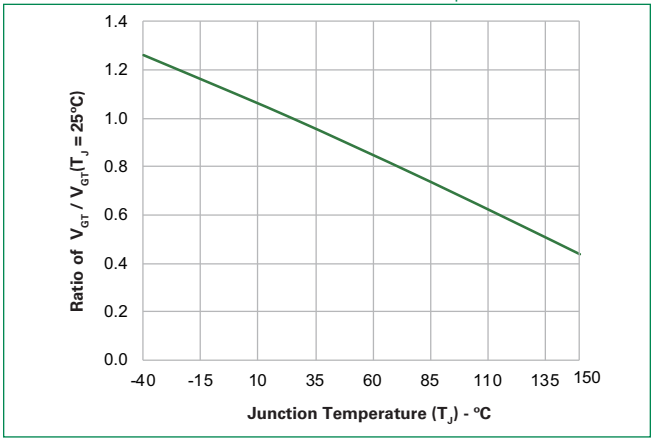


Figure 5:
Power Dissipation (Typical) vs. RMS On-State Current

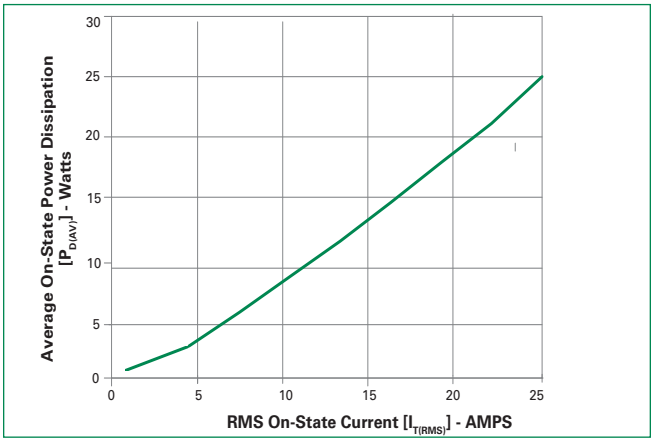


Figure 6:
On-State Current vs. On-State Voltage (Typical)

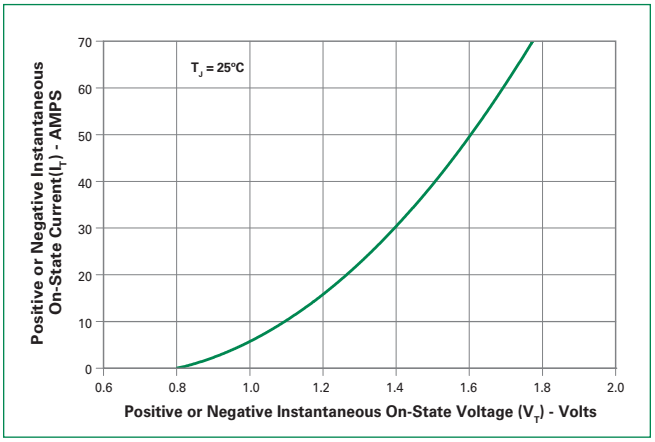


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Figure 7:
Maximum Allowable Case Temperature vs. RMS On-State Current

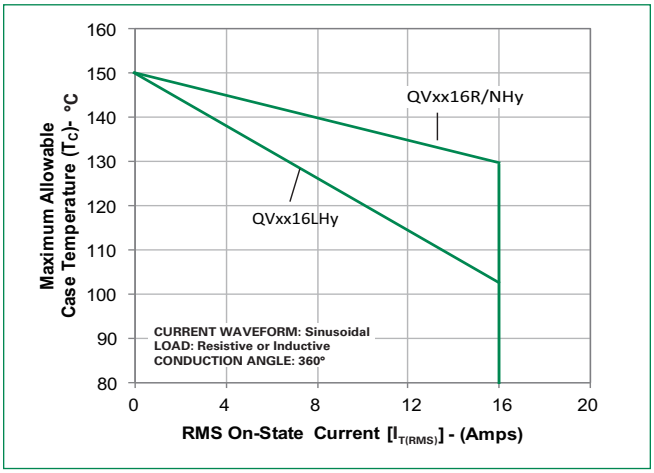
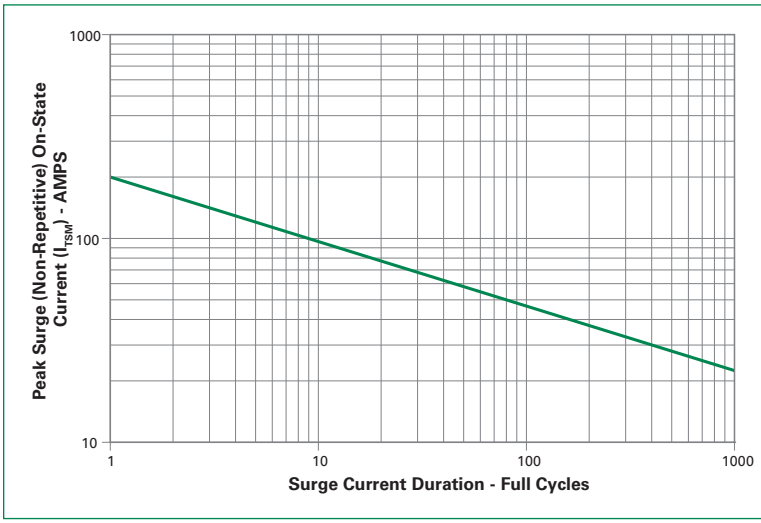


Figure 8: Surge Peak On-State Current vs. Number of Cycles

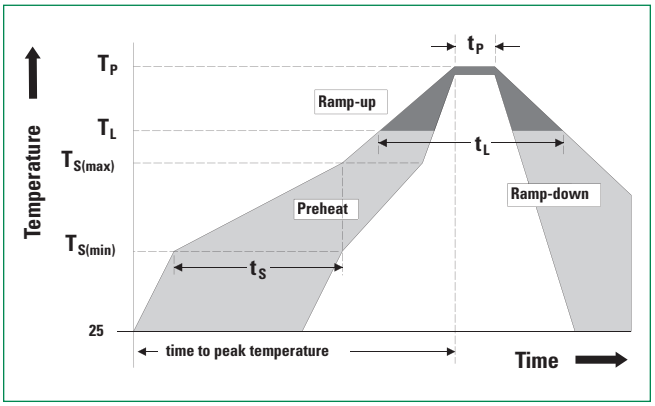


Supply Frequency: 60Hz Sinusoidal
Load: Resistive
RMS On-State [$I_{T(RMS)}$]: Max Rated Value at Specific Case Temperature

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 seconds
Average ramp up rate (Liquidus Temp) (T_L) to peak		5°C/s Max
$T_{S(Max)}$ to T_L - Ramp-up Rate		5°C/s Max
Reflow	**- Temperature (T_L) (Liquidus)**	217°C
	- Time (t_L)	60 – 150 seconds
Peak Temperature (T_P)		260 °C (±5)
Time within 5°C of actual peak Temperature (t_p)		20 – 40 s
Ramp-down Rate		5°C/s Max.
Time 25°C to peak Temperature (T_P)		8 minutes Max.
Do not exceed		260°C



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Physical Specifications

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

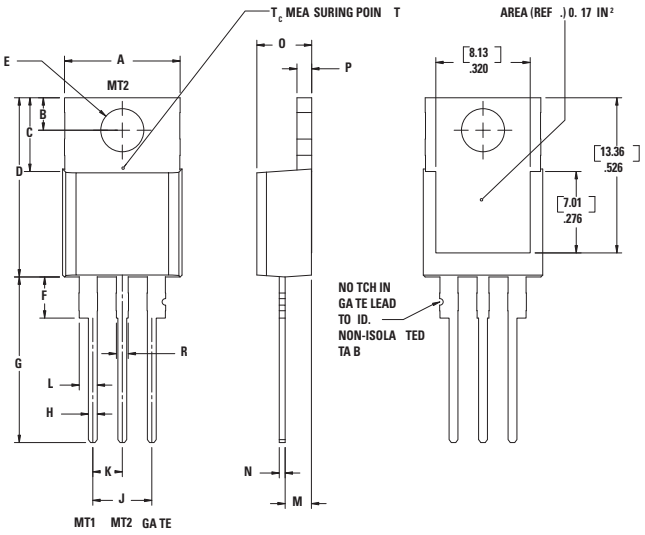
Environmental Specifications

Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell time
Temperature/Humidity	EIA / JEDEC, JESD22-A101, 1008 hours; 160V - DC: 85°C; 85% rel humidity
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

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.

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	2.66	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

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

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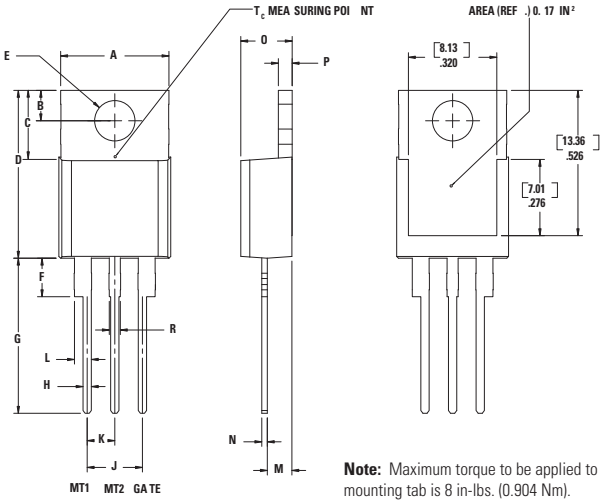
Dimensions - TO-220AB (L-Package) - Isolated Mounting Tab



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

Dimension	Inches		Millimeters	
	Min	Max	Min	Max
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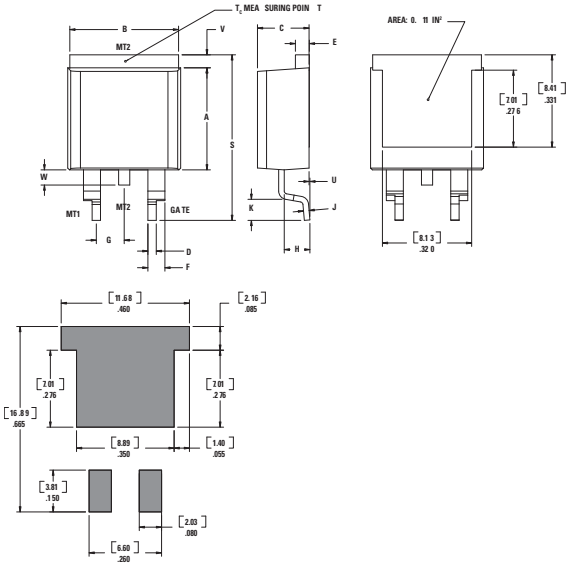
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.60
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	0.075	1.52	1.91
M	0.085	0.095	2.16	2.41
N	0.018	0.024	0.46	0.61
O	0.178	0.188	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		
QVxx16LH2	X	10 mA	Alternistor Triac	TO-220L
QVxx16RH2	X	10 mA	Alternistor Triac	TO-220R
QVxx16NH2	X	10 mA	Alternistor Triac	TO-263 D²-PAK
QVxx16LH3	X	20 mA	Alternistor Triac	TO-220L
QVxx16RH3	X	20 mA	Alternistor Triac	TO-220R
QVxx16NH3	X	20 mA	Alternistor Triac	TO-263 D²-PAK
QVxx16LH4	X	35 mA	Alternistor Triac	TO-220L
QVxx16RH4	X	35 mA	Alternistor Triac	TO-220R
QVxx16NH4	X	35 mA	Alternistor Triac	TO-263 D²-PAK
QVxx16LH5	X	50 mA	Alternistor Triac	TO-220L
QVxx16RH5	X	50 mA	Alternistor Triac	TO-220R
QVxx16NH5	X	50 mA	Alternistor Triac	TO-263 D²-PAK

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Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
QVxx16LHyTP	QVxx16LHy	2.2 g	Tube Pack	1000
QVxx16RHyTP	QVxx16RHy			
QVxx16NHyTP	QVxx16NHy	1.6 g	Tube Pack	1000
QVxx16NHyRP	QVxx16NHy	1.6 g	Embossed Carrier	500

Part Numbering System

QV 60 16 L H4 56

Component Type
QV: High dv/dt TRIAC or Alternistor

Voltage Rating
60: 600V
80: 800V

Current Rating
16: 16A

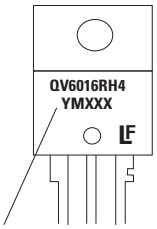
Package Type
L: TO-220 Isolated
R: TO-220 Non-Isolated
N: TO-263 (D^2-Pak

Lead Form Dimensions
xx: Lead Form Option

Sensitivity & Type
Alternistor Triac
H2: 10mA (QI, II, III)
H3: 20mA (QI, II, III)
H4: 35mA (QI, II, III)
H5: 50mA (QI, II, III)

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

TO-263 Embossed Carrier Reel Pack (RP)

Meets all EIA-481-2 Standards