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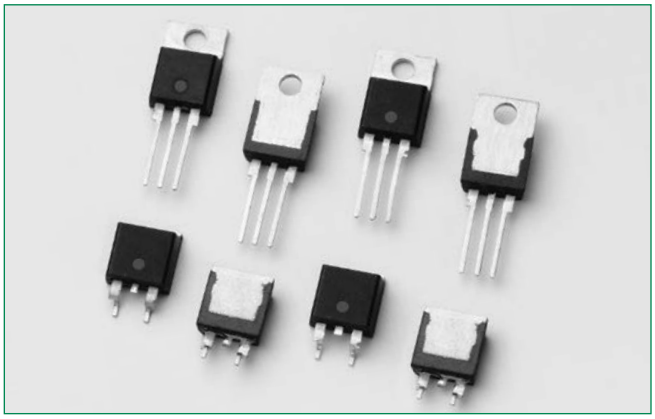
Thyristors

16 Amp High Temperature Alternistor Triacs

QVxx16xHx Series

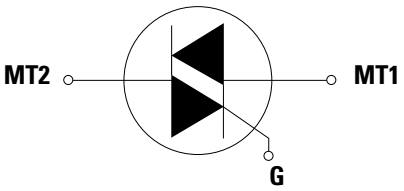
HF RoHS



Main Features

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

Schematic Symbol



Description

This 16A high temperature Alternistor TRIAC is designed with extremely high dv/dt capability for AC switching and phase control applications, especially for inductive loads applications.

Alternistor devices only operate in quadrants I, II, & III and are used in circuits requiring highest commutation performance.

Features & Benefits

- High T_J of 150°C
- Voltage capability of 600V
- Surge capability of 200A 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 1000V/µs

Applications

Typical applications are AC solid-state switches, motor controls, light dimmers, power tools, kitchen and home appliances.

Internally isolated packages offer better heat sinking with higher isolation voltage.

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Absolute Maximum Ratings — Alternistor Triac (3 Quadrants)

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	QVxx16LHy	T_C = 115 °C	16	A
		QVxx16RHy / QVxx16NHy	T_C = 130 °C		
I_{TSM}	Non repetitive surge peak on-state current (Single half cycle, T_J initial = 25°C)	f = 50Hz	t = 20 ms	167	A
		f = 60Hz	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 = 60Hz	T_J = 150 °C	100	A/µs
I_{GTM}	Peak gate trigger current	$t_p \leq 10µs$; $I_{GT} \leq I_{GTM}$	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		700	V

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

Symbol	Test Conditions	Quadrant		QVxx16xH2	QVxx16xH4	Unit
I_{GT}	V_D = 12V R_L = 60Ω	I – II – III	MAX.	10	35	mA
V_{GT}		I – II – III	MAX.	1.3	1.3	V
V_{GD}	$V_D = V_{DRM}$ R_L = 3.3kΩ T_J = 150°C	I – II – III	MIN.	0.15	0.15	V
I_H	I_T = 100mA		MAX.	15	50	mA
dv/dt	$V_D = V_{DRM}$ Gate Open T_J = 150°C		MIN.	150	500	V/µs
	V_D = 2/3 V_{DRM} Gate Open T_J = 150°C		MIN.	400	1000	
(dv/dt)c	(di/dt)c = 8.6 A/ms T_J = 150°C		MIN.	5	50	V/µs
t_{gt}	I_G = 2 x I_{GT} PW = 15µs I_T = 22.6 A(pk)	I	TYP.	0.9	0.9	µs
		II	TYP.	2.1	2.1	
		III	TYP.	8.5	8.5	

xx = voltage/10;
x = sensitivity

Static Characteristics

Symbol	Test Conditions			Value	Unit
V_{TM}	I_T = 22.6A t_p = 380µs		MAX	1.60	V
I_{DRM} / I_{RRM}	$V_D = V_{DRM}/V_{RRM}$	T_J = 25°C	MAX	5	µA
		T_J = 150°C		4	mA
V_{T0}	Threshold voltage	T_J = 150°C	MAX	0.85	V
R_D	Dynamic resistance	T_J = 150°C	MAX	27	mΩ

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(JC)}$	Junction to case	QVxx16RHy / QVxx16NHy	0.90	°C/W
		QVxx16LHy	1.8	
$R_{\theta(J-A)}$	Junction to ambient	QVxx16RHy / QVxx16NHy	45	°C/W
		QVxx16LHy	50	

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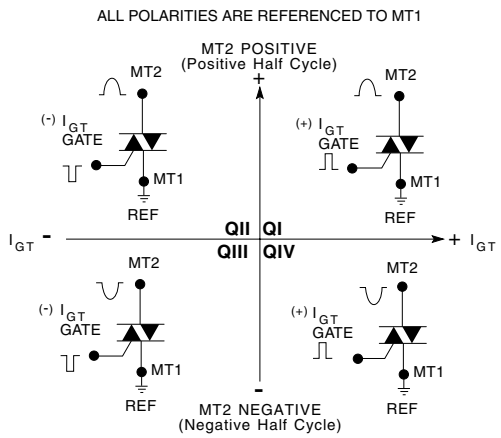
Figure 1: Definition of Quadrants



Note: Alternistors will not operate in QIV

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

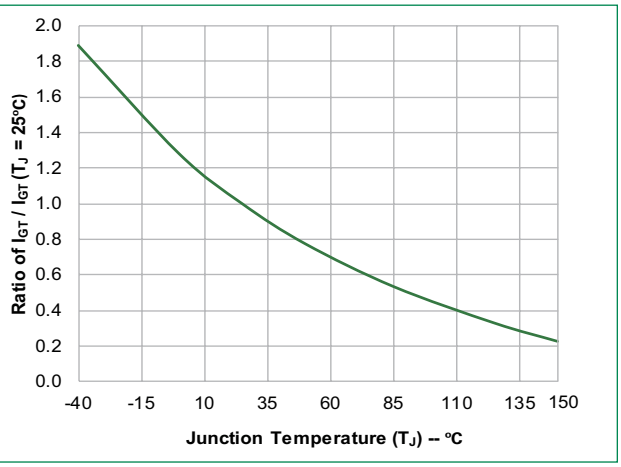


Figure 3: Normalized DC Holding Current vs. Junction Temperature

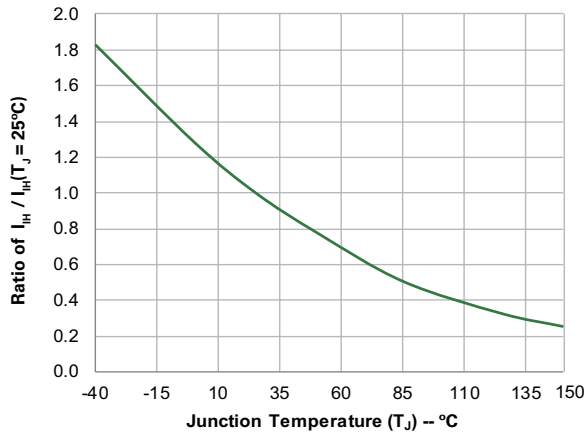


Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature

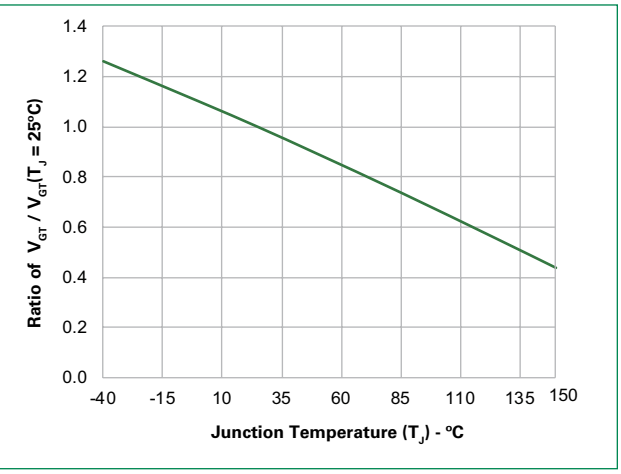


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

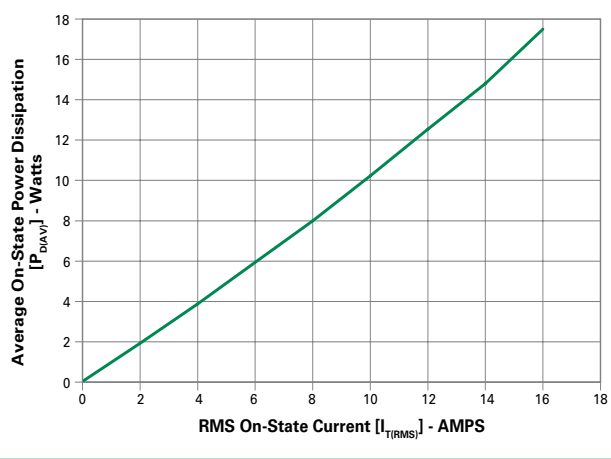


Figure 6: On-State Current vs. On-State Voltage (Typical)

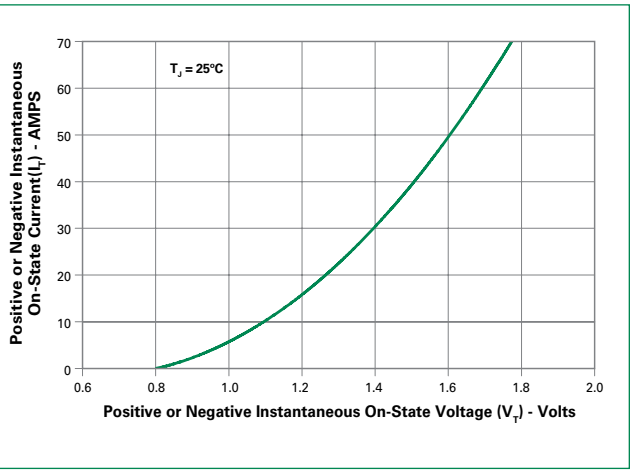


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Figure 7: Maximum Allowable Case Temperature vs. RMS On-State Current

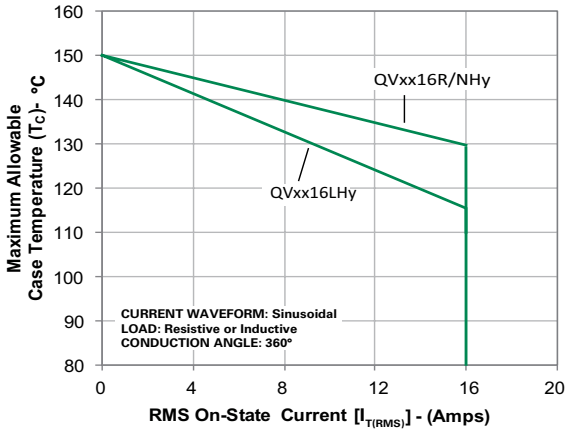
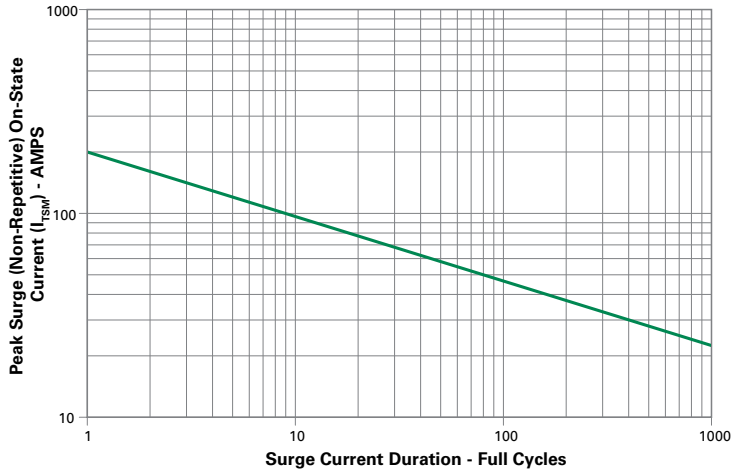


Figure 9: Surge Peak On-State Current vs. Number of Cycles

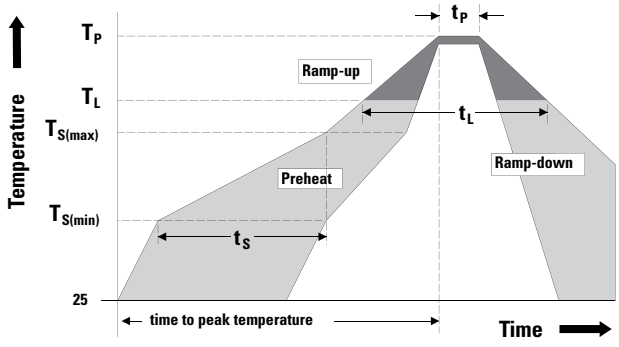


Supply Frequency: 60Hz Sinusoidal
Load: Resistive
RMS On-State [$I_{T(RMS)}$]: Max Rated Value at Specific Case Temperature

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 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 (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



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Physical Specifications

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

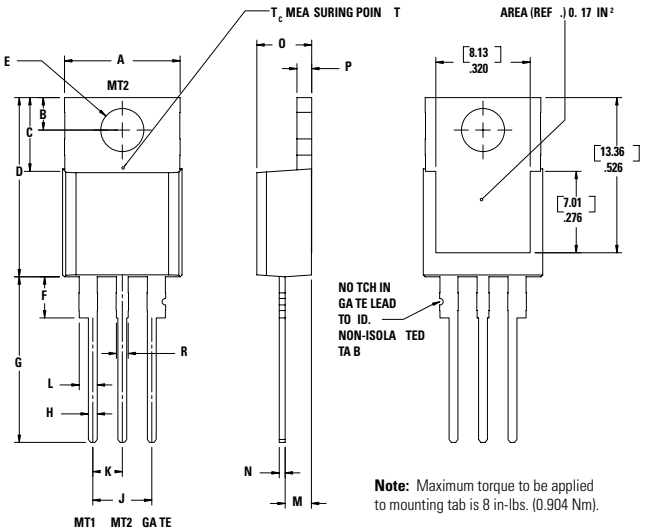
Design Considerations

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
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
High Temp Storage	MIL-STD-750, M-1031, 1008 hours; 150°C
Low-Temp Storage	1008 hours; -40°C
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

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	2.66	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

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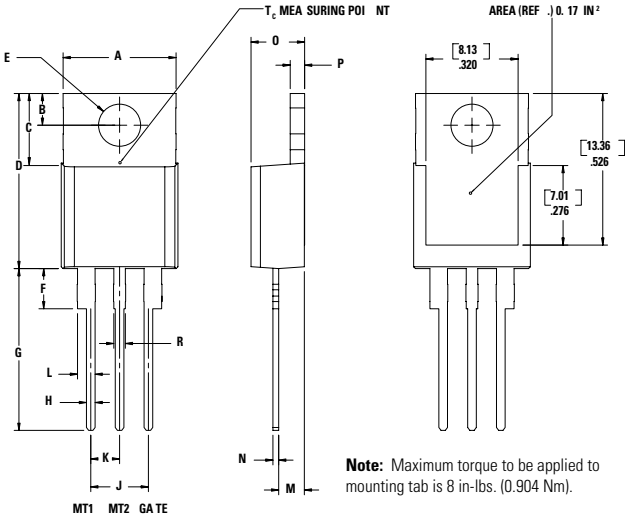
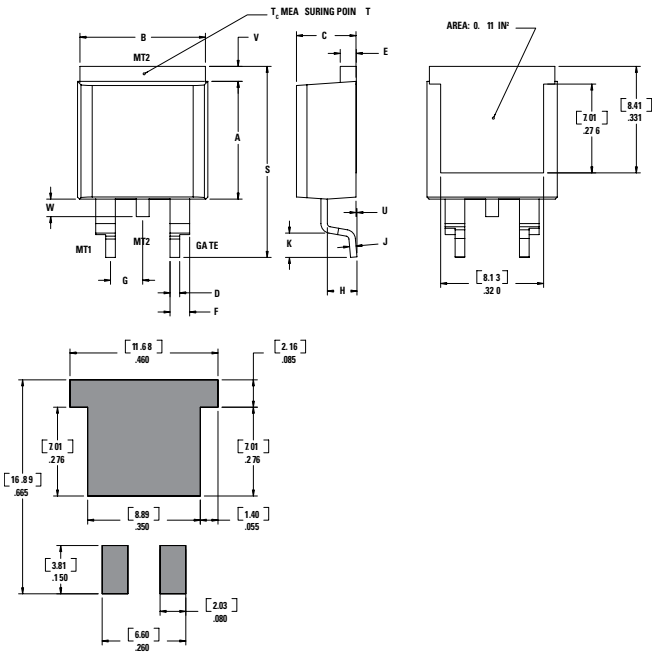
Dimensions — TO-220AB (L-Package) — Isolated Mounting Tab



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

Dimension	Inches		Millimeters	
	Min	Max	Min	Max
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

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Product Selector

Part Number	Voltage	Gate Sensitivity Quadrants	Type	Package
	600V	I – II – III		
QV6016LH2	X	10 mA	Alternistor Triac	TO-220L
QV6016RH2	X	10 mA	Alternistor Triac	TO-220R
QV6016NH2	X	10 mA	Alternistor Triac	TO-263 D²-PAK
QV6016LH4	X	35 mA	Alternistor Triac	TO-220L
QV6016RH4	X	35 mA	Alternistor Triac	TO-220R
QV6016NH4	X	35 mA	Alternistor Triac	TO-263 D²-PAK

Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
QV6016L/RH2TP	QV6016L/RH2	2.2 g	Tube Pack	1000
QV6016NH2TP	QV6016NH2	1.6 g	Tube Pack	1000
QV6016NH2RP	QV6016NH2	1.6 g	Embossed Carrier	500
QV6016L/RH4TP	QV6016L/RH4	2.2 g	Tube Pack	1000
QV6016NH4TP	QV6016NH4	1.6 g	Tube Pack	1000
QV6016NH4RP	QV6016NH4	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

Current Rating
16: 16A

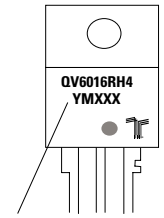
Package Type
L: TO-220 Isolated
R: TO-220 Non-Isolated
N: TO-263 (D²-Pak

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

Lead Form Dimensions
xx: Lead Form Option

Part Marking System

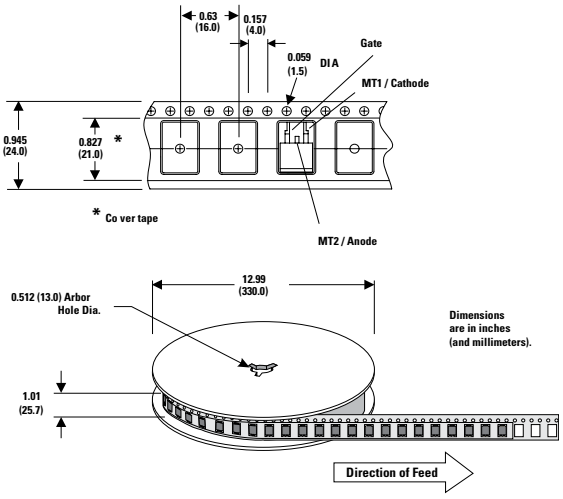
TO-220 AB - (L and R Package)
TO-263 AB - (N Package)



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



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