

Absolute Maximum Ratings – Alternistor Triac (3 Quadrants)

Symbol	Parameter	Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	Qxx40x7 Qxx40xH6 $T_C = 75^\circ\text{C}$	40 A
I_{TSM}	Non repetitive surge peak on-state current (full cycle, T_J initial = 25°C)	f = 50 Hz t = 20 ms	335 A
		f = 60 Hz t = 16.7 ms	400 A
I^2t	I^2t Value for fusing	$t_p = 8.3$ ms	664 A ² s
di/dt	Critical rate of rise of on-state current (IG = 2 x IGT, tr ≤ 100 ns)	f = 120 Hz $T_J = 125^\circ\text{C}$	150 A/μs
I_{GTM}	Peak gate trigger current	$t_p = 20$ μs $T_J = 125^\circ\text{C}$	4 A
$P_{G(AV)}$	Average gate power dissipation	$T_J = 125^\circ\text{C}$	0.5 W
T_{stg}	Storage temperature range		-40 to 150 °C
T_J	Operating junction temperature range		-40 to 125 °C

Absolute Maximum Ratings – Standard Triac (4 Quadrants)

Symbol	Parameter	Test Conditions	Value	Unit
$I_{T(RMS)}$	RMS on-state current	Qxx40x3/Qxx40x4 $T_C = 75^\circ\text{C}$	40	A
I_{TSM}	Peak non-repetitive surge current	f = 50 Hz t = 20 ms	335	A
		f = 60 Hz t = 16 ms	400	
I^2t	I^2t Value for fusing	$t_p = 8.3$ ms	664	A ² s
di/dt	Critical rate-of-rise of on-state current	f = 120 Hz; $T_J = 125^\circ\text{C}$	150	A/μs
I_{GTM}	Peak gate current	$t_p = 20$ μs $T_J = 125^\circ\text{C}$	4	A
$P_{G(AV)}$	Average gate power dissipation	$T_J = 125^\circ\text{C}$	0.5	W
T_{stg}	Storage temperature range		-40 to 150	°C
T_J	Operating junction temperature range		-40 to 125	°C

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

Symbol	Test Conditions	Quadrant	Value			Unit	
			Qxx40xH6	Qxx40K5	Qxx40x7		
I_{GT}	$V_D = 12\text{V}$ $R_L = 60\ \Omega$	I – II – III	MAX.	80	50	100	mA
V_{GT}	$V_D = 12\text{V}$ $R_L = 60\ \Omega$	I – II – III	MAX.	1.3	1.3	2.0	V
V_{GD}	$V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 125^\circ\text{C}$	I – II – III	MIN.	0.2			V
I_H	$I_T = 400\text{mA}$		MAX.	80	75	100	mA
dv/dt	$V_D = V_{DRM}$ Gate Open $T_J = 125^\circ\text{C}$	400V	MIN.	600	500	700	V/μs
		600V		500	475	625	
		800V		475	400	575	
		1000V		1000	800	1200	
(dv/dt)c	(di/dt)c = 21.6 A/ms $T_J = 125^\circ\text{C}$		MIN.	30	20	50	V/μs
t_{gt}	$I_G = 2 \times I_{GT}$ PW = 15 μs $I_T = 56.6\text{A(pk)}$		TYP.	5			μs

Electrical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified) — Standard Triac (4 Quadrants)

Symbol	Test Conditions	Quadrant		Qxx40x3	Value		Unit
					Qxx40x4		
I_{GT}	$V_D = 12\text{ V}; R_L = 60\ \Omega$	I – II – III	MAX.	35	50	mA	
		IV	MAX.	70	100		
V_{GT}	$V_D = 12\text{ V}; R_L = 60\ \Omega$	ALL	MAX.	1.3	1.3	V	
V_{GD}	$V_D = V_{DRM}; R_L = 3.3\text{ k}\Omega; T_J = 125^\circ\text{C}$	ALL	MIN.	0.2	0.2	V	
I_H	$I_T = 400\text{mA (initial)}$		MAX.	80	80	mA	
dv/dt	$V_D = V_{DRM}; \text{Gate Open}; T_J = 125^\circ\text{C}$	400V	MIN.	400	400	V/ μs	
		600V		400	400		
		800V		400	400		
(dv/dt)c	(di/dt)c = 4.3 A/ms; $T_J = 125^\circ\text{C}$		MIN.	10	10	V/ μs	
t_{gt}	$I_G = 2 \times I_{GT}; PW = 15\ \mu\text{s}; I_T = 35.4\text{ A}$		TYP.	5	5	μs	
dv/dt	$VD=V_{DRM}, \text{Gate Open}, T_J=100^\circ\text{C}$		-	-	300	V/ μs	

Static Characteristics

Symbol	Test Conditions			Value	Unit	
V_{TM}	$I_{TM} = 56.6\text{ A}; t_p = 380\ \mu\text{s}$	$T_J = 25^\circ\text{C}$	MAX.	1.8	V	
I_{DRM} I_{RRM}	$V_D = V_{DRM} / V_{RRM}$	$T_J = 25^\circ\text{C}$	400 – 1000V	MAX.	20	μA
		$T_J = 125^\circ\text{C}$	400 – 800V	MAX.	5	mA
		$T_J = 100^\circ\text{C}$	1000V	MAX.	5	mA

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{\theta(J-C)}$	Junction to case (AC)	Qxx40KH6 Qxx40K5/7 Qxx40K4/J4 Qxx40K3	0.97	$^\circ\text{C/W}$
		Qxx40JH6 Qxx40J7	0.95	

Note: xx = voltage

Figure 1: Definition of Quadrants

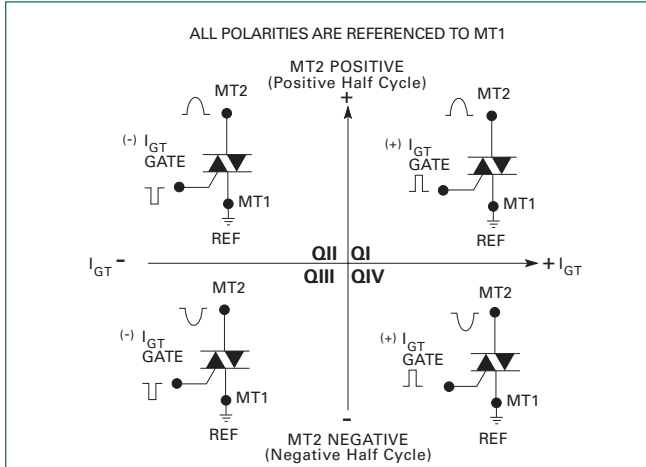


Figure 2: Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature

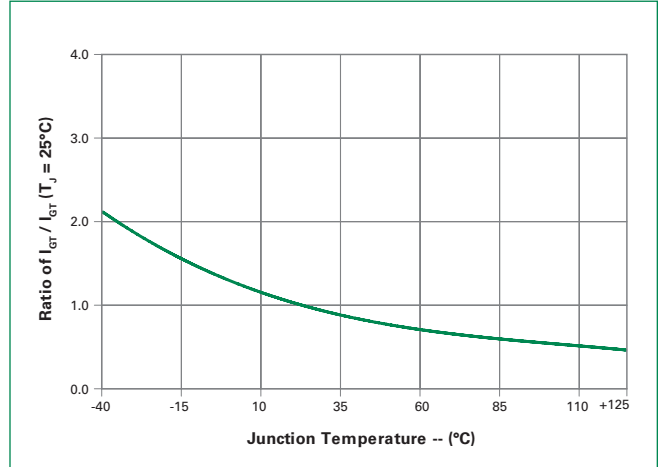


Figure 3: Normalized DC Holding Current vs. Junction Temperature

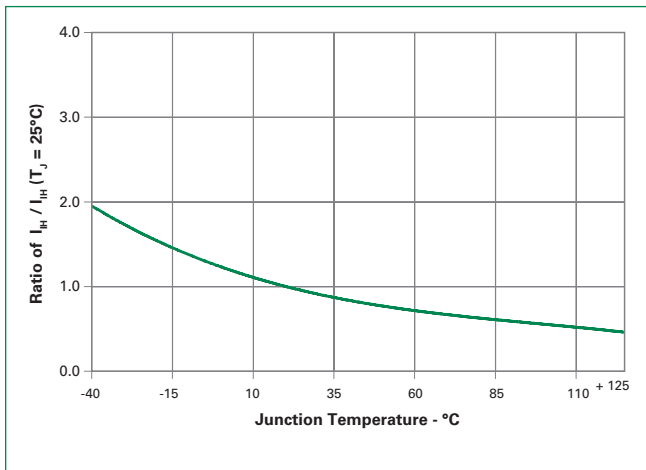


Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature

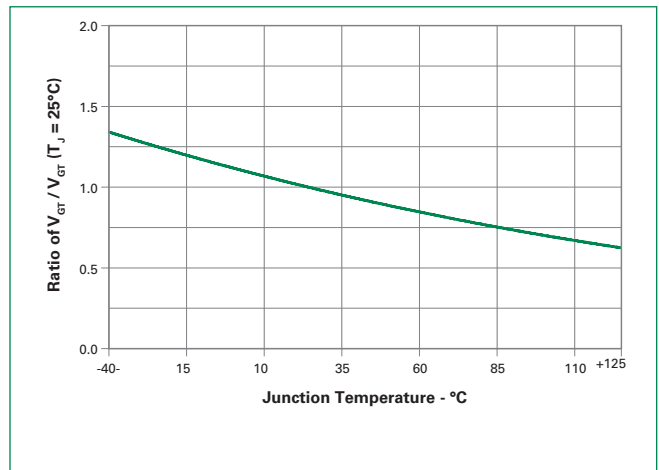


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

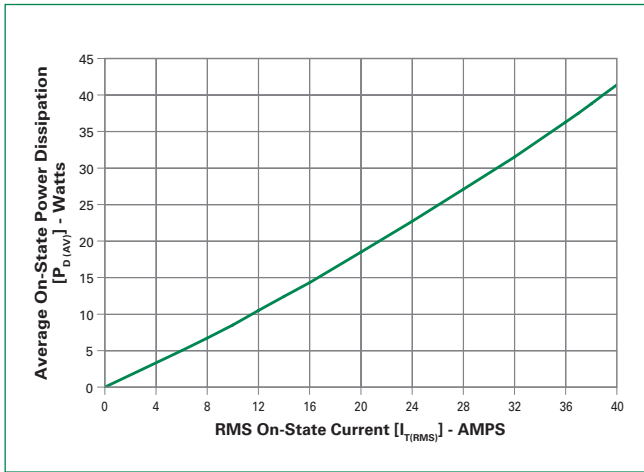


Figure 6: Maximum Allowable Case Temperature vs. On-State Current

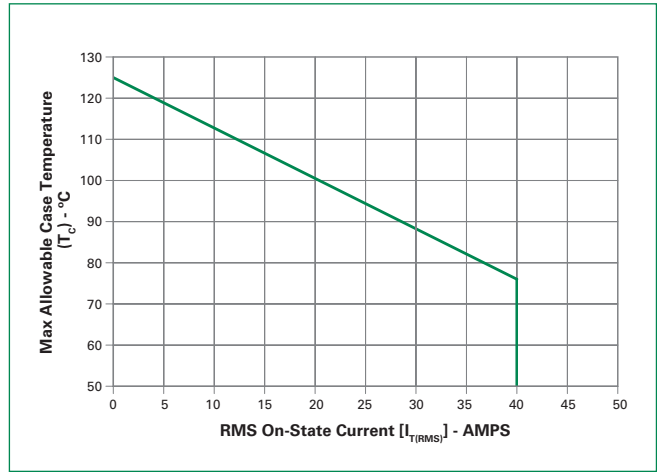


Figure 7: On-State Current vs. On-State Voltage (Typical)

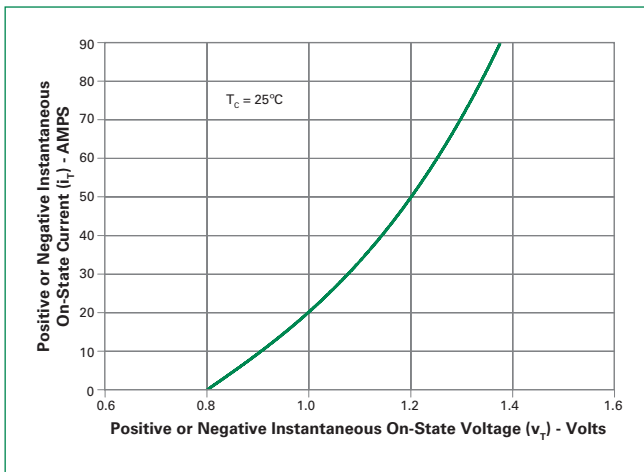
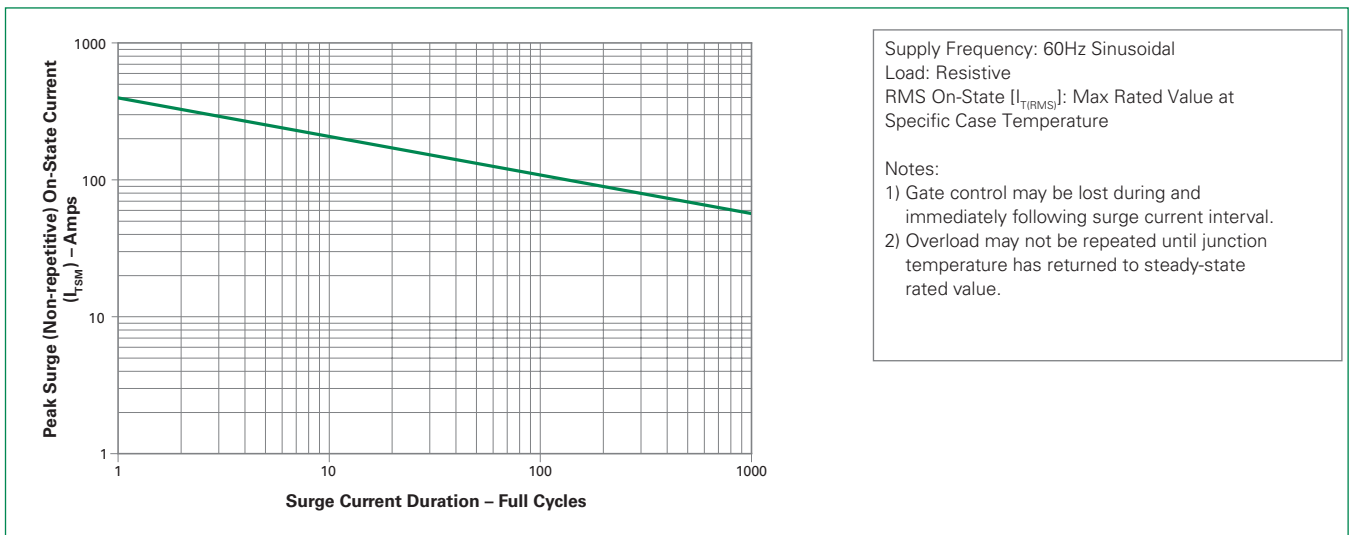


Figure 8: Surge Peak On-State Current vs. Number of Cycles

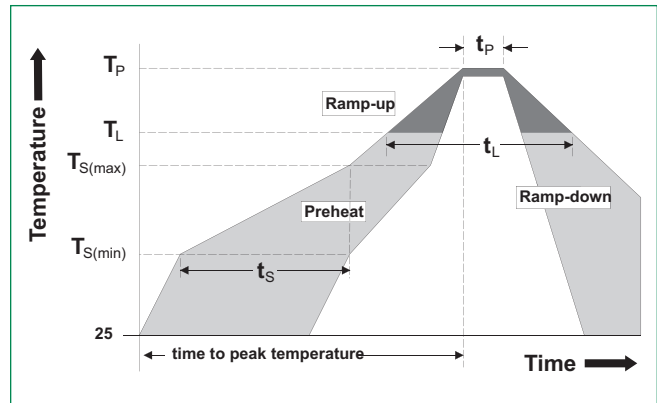


Supply Frequency: 60Hz Sinusoidal
Load: Resistive
RMS On-State [I_{T(RMS)}]: Max Rated Value at Specific Case Temperature

- 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 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 ^{+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



Physical Specifications

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

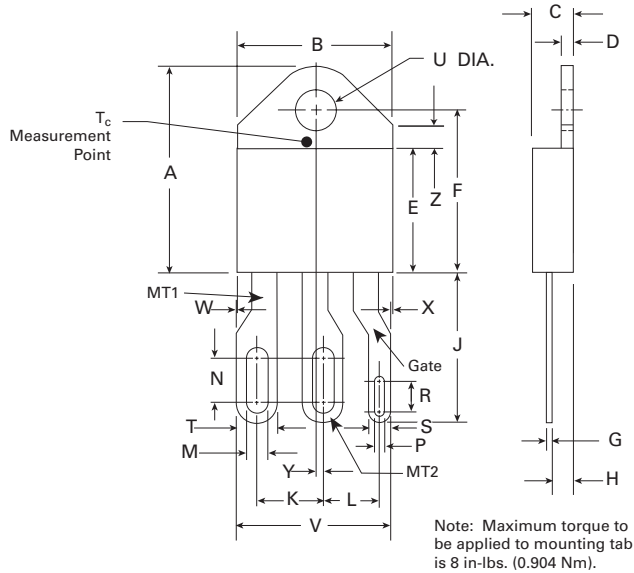
Design Considerations

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

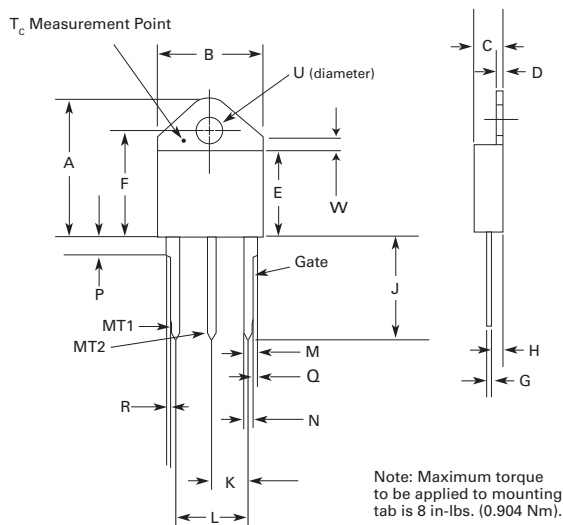
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours
Temperature Cycling	MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time
Temperature/Humidity	EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity
High Temp Storage	MIL-STD-750, M-1031, 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

Dimensions — TO-218X (J Package) — Isolated Mounting Tab



Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.810	0.835	20.57	21.21
B	0.610	0.630	15.49	16.00
C	0.178	0.188	4.52	4.78
D	0.055	0.070	1.40	1.78
E	0.487	0.497	12.37	12.62
F	0.635	0.655	16.13	16.64
G	0.022	0.029	0.56	0.74
H	0.075	0.095	1.91	2.41
J	0.575	0.625	14.61	15.88
K	0.256	0.264	6.50	6.71
L	0.220	0.228	5.58	5.79
M	0.080	0.088	2.03	2.24
N	0.169	0.177	4.29	4.49
P	0.034	0.042	0.86	1.07
R	0.113	0.121	2.87	3.07
S	0.086	0.096	2.18	2.44
T	0.156	0.166	3.96	4.22
U	0.161	0.165	4.10	4.20
V	0.603	0.618	15.31	15.70
W	0.000	0.005	0.00	0.13
X	0.003	0.012	0.07	0.30
Y	0.028	0.032	0.71	0.81
Z	0.085	0.095	2.17	2.42

Dimensions — TO-218AC (K Package) — Isolated Mounting Tab



Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.810	0.835	20.57	21.21
B	0.610	0.630	15.49	16.00
C	0.178	0.188	4.52	4.78
D	0.055	0.070	1.40	1.78
E	0.487	0.497	12.37	12.62
F	0.635	0.655	16.13	16.64
G	0.022	0.029	0.56	0.74
H	0.075	0.095	1.91	2.41
J	0.575	0.625	14.61	15.88
K	0.211	0.219	5.36	5.56
L	0.422	0.437	10.72	11.10
M	0.058	0.068	1.47	1.73
N	0.045	0.055	1.14	1.40
P	0.095	0.115	2.41	2.92
Q	0.008	0.016	0.20	0.41
R	0.008	0.016	0.20	0.41
U	0.161	0.165	4.10	4.20
W	0.085	0.095	2.17	2.42

Product Selector

Part Number	Voltage				Gate Sensitivity Quadrants		I _{T(RMS)}	Type	Package
	400V	600V	800V	1000V	I – II – III	IV			
Qxx40KH6	X	X	X	X	80 mA	-	40 A	Alternistor Triac	TO-218AC
Qxx40JH6	X	X	X	-	80 mA	-	40 A	Alternistor Triac	TO-218X
Qxx40K5	X	X	X	X	50 mA	-	40 A	Alternistor Triac	TO-218AC
Qxx40K7	X	X	X	X	100 mA	-	40 A	Alternistor Triac	TO-218AC
Qxx40J7	X	X	X	-	100 mA	-	40 A	Alternistor Triac	TO-218X
Qxx40K4	X	X	X	X	50 mA	100 mA	40 A	Standard Triac	TO-218AC
Qxx40K3	-	-	X	-	35 mA	70 mA	40 A	Standard Triac	TO-218AC
Qxx40J4	-	-	-	X	50mA	100mA	40 A	Standard Triac	TO-218X

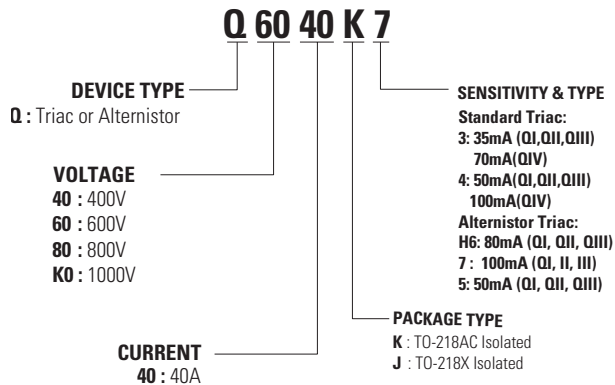
Note: xx = Voltage

Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
Qxx40KH6TP	Qxx40KH6	4.40 g	Tube Pack	250 (25 per tube)
Qxx40JH6TP	Qxx40JH6	5.23 g	Tube Pack	250 (25 per tube)
Qxx40K5TP	Qxx40K5	4.40 g	Tube Pack	250 (25 per tube)
Qxx40K7TP	Qxx40K7	4.40 g	Tube Pack	250 (25 per tube)
Qxx40J7TP	Qxx40J7	5.23 g	Tube Pack	250 (25 per tube)
Qxx40K4TP	Qxx40K4	4.40 g	Tube Pack	250 (25 per tube)
Qxx40K3TP	Qxx40K3	4.40g	Tube Pack	250(25 per tube)
Qxx40J4TP	Qxx40J4	5.23g	Tube Pack	250(25 per tube)

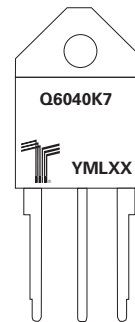
Note: xx = Voltage

Part Numbering System



Part Marking System

TO-218 AC - (K Package)
TO-218 X - (J Package)



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