

RoHS Qxx30xHx & Qxx35xx & Qxx35xHx Series



Description

30 Amp / 35 Amp bi-directional solid state switch series is designed for AC switching and phase control applications such as motor speed and temperature modulation controls, lighting controls, and static switching relays.

Standard type devices normally operate in Quadrants I & III triggered from AC line.

Alternistor type devices only operate in quadrants I, II, & III and are used in circuits requiring high dv/dt capability.

Features & Benefits

- RoHS Compliant
- Glass – passivated junctions
- Voltage capability up to 800V
- Surge capability up to 350A
- Electrically isolated package “FASTPAK” & “L - Package” are UL recognized for 2500Vrms

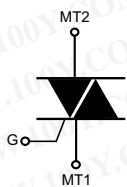
Agency Approval

Agency	Agency File Number
	FASTPAK & L Package: E71639

Main Features

Symbol	Value	Unit
$I_{T(RMS)}$	30 & 35	A
V_{DRM}/V_{RRM}	400 to 800	V
$I_{GT(Q1)}$	50	mA

Schematic Symbol



Applications

Excellent for AC switching and phase control applications such as heating, lighting, and motor speed controls.

Typical applications are AC solid-state switches, industrial power tools, exercise equipment, white goods and commercial appliances.

Alternistor Triacs (no snubber required) are used in applications with extremely inductive loads requiring highest commutation performance.

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

Absolute Maximum Ratings – Standard Triac

Symbol	Parameter	Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	Qxx35P5 $T_C = 55^\circ\text{C}$	35 A
I_{TSM}	Non repetitive surge peak on-state current (full cycle, T_J initial = 25°C)	f = 50 Hz t = 20 ms	300 A
		f = 60 Hz t = 16.7 ms	350 A
I^2t	I^2t Value for fusing	$t_p = 8.3$ ms	508 A^2s
di/dt	Critical rate of rise of on-state current ($I_G = 200\text{mA}$ with $\leq 0.1\mu\text{s}$ rise time)	f = 120 Hz $T_J = 125^\circ\text{C}$	100 $\text{A}/\mu\text{s}$
I_{GTM}	Peak gate trigger current	$t_p \leq 10 \mu\text{s}$ $I_{GT} \leq I_{GTM}$ $T_J = 125^\circ\text{C}$	2 A
$P_{G(AV)}$	Average gate power dissipation	$T_J = 125^\circ\text{C}$	0.5 W
T_{stg}	Storage temperature range		-40 to 125 $^\circ\text{C}$
T_J	Operating junction temperature range		-25 to 125 $^\circ\text{C}$

Note: xx = voltage

Absolute Maximum Ratings — Alternistor Triac (3 Quadrants)

Symbol	Parameter	Value	Unit	
$I_{T(RMS)}$	RMS on-state current (full sine wave)	Qxx35RH5/Qxx35NH5 $T_C = 90^\circ\text{C}$	35	A
		Qxx30LH5 $T_C = 50^\circ\text{C}$	30	
I_{TSM}	Non repetitive surge peak on-state current (full cycle, T_J initial = 25°C)	f = 50 Hz t = 20 ms	290	A
		f = 60 Hz t = 16.7 ms	350	
I^2t	I^2t Value for fusing	$t_p = 8.3$ ms	508	A^2s
di/dt	Critical rate of rise of on-state current ($I_G = 200\text{mA}$ with $\leq 0.1\mu\text{s}$ rise time)	f = 120 Hz $T_J = 125^\circ\text{C}$	100	$\text{A}/\mu\text{s}$
I_{GTM}	Peak gate trigger current	$t_p \leq 10 \mu\text{s}$ $I_{GT} \leq I_{GTM}$ $T_J = 125^\circ\text{C}$	2	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	$^\circ\text{C}$
T_J	Operating junction temperature range		-25 to 125	$^\circ\text{C}$

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

Symbol	Test Conditions	Quadrant	Qxx35P5	Unit
I_{GT}	$V_D = 12\text{V}$ $R_L = 30 \Omega$	I – II – III MAX.	50	mA
		IV TYP.	120	
V_{GT}		I – II – III MAX.	2.75	V
V_{GD}	$V_D = V_{DRM}$ $R_L = 3.3 \text{ k}\Omega$ $T_J = 110^\circ\text{C}$	ALL MIN.	0.2	V
I_H	$I_T = 400\text{mA}$	MAX.	50	mA
dv/dt	$V_D = V_{DRM}$ Gate Open $T_J = 125^\circ\text{C}$	600V MIN.	475	$\text{V}/\mu\text{s}$
		800V	400	
(dv/dt)c	(di/dt)c = 18.9 A/ms $T_J = 125^\circ\text{C}$	TYP.	5	$\text{V}/\mu\text{s}$
t_{gt}	$I_G = 2 \times I_{GT}$ PW = 15 μs $I_T = 49.5\text{A(pk)}$	TYP.	3	μs

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

Symbol	Test Conditions	Quadrant	Qxx35RH5 Qxx35NH5 Qxx30LH5	Unit
I_{GT}	$V_D = 12\text{V}$ $R_L = 30 \Omega$	I – II – III MAX.	50	mA
		I – II – III MAX.	2	
V_{GT}		I – II – III MAX.	2	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.	75	mA
dv/dt	$V_D = V_{DRM}$ Gate Open $T_J = 125^\circ\text{C}$	400V MIN.	475	$\text{V}/\mu\text{s}$
		600V	400	
(dv/dt)c	(di/dt)c = 18.9 A/ms $T_J = 125^\circ\text{C}$	MIN.	20	$\text{V}/\mu\text{s}$
t_{gt}	35A device $I_G = 2 \times I_{GT}$ PW = 15 μs $I_T = 49.5\text{A(pk)}$	TYP.	3	μs
	30A device $I_G = 2 \times I_{GT}$ PW = 15 μs $I_T = 42.4\text{A(pk)}$			

Note: xx = voltage

Static Characteristics

Symbol	Test Conditions			Value	Unit		
V_{TM}	35A device $I_{TM} = 49.5A$ $t_p = 380 \mu s$			MAX.	1.5	V	
	30A device $I_{TM} = 42.4A$ $t_p = 380 \mu s$				1.4		
I_{DRM} I_{RRM}	$V_D = V_{DRM} / V_{RRM}$	Qxx35P5	$T_J = 25^\circ C$	600 - 800V	MAX.	100	μA
			$T_J = 125^\circ C$	600 - 800V		5	mA
		Qxx35R/NH5 Qxx30LH5	$T_J = 25^\circ C$	400 - 600V	MAX.	10	μA
			$T_J = 125^\circ C$	400 - 600V		2	mA

Thermal Resistances

Symbol	Parameter	Value	Unit	
$R_{\theta(J-C)}$	Junction to case (AC)	Qxx35P5	1.50	$^\circ C/W$
		Qxx35RH5 / Qxx35NH5	0.85	
		Qxx30LH5	2.30	
$R_{\theta(J-A)}$	Junction to ambient	Qxx35RH5	45	$^\circ C/W$
		Qxx30LH5	50	

Note: xx = voltage

Figure 1: Definition of Quadrants

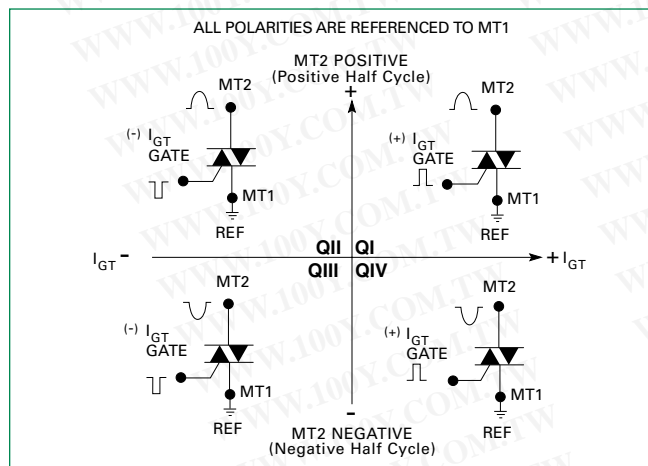
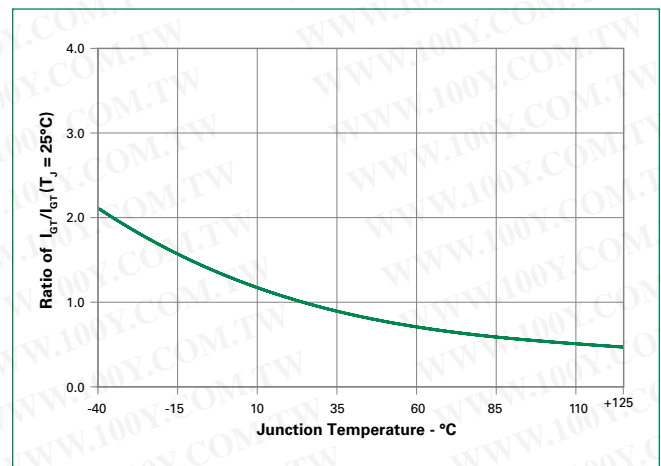


Figure 2: Normalized DC Gate Trigger Current for All Quadrants vs. Junction Temperature



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Figure 3: Normalized DC Holding Current vs. Junction Temperature

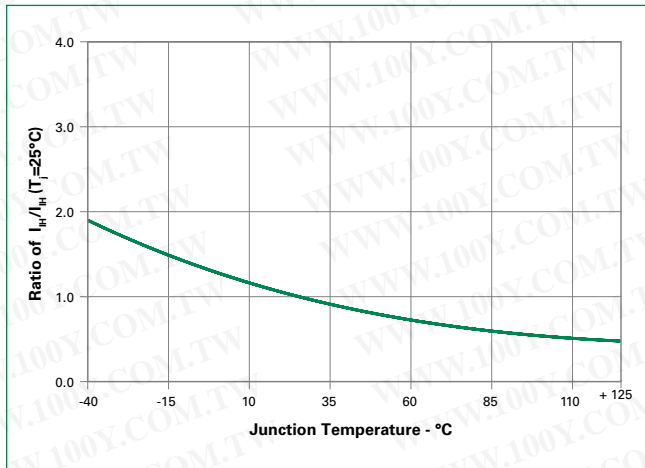


Figure 4: Normalized DC Gate Trigger Voltage for All Quadrants vs. Junction Temperature

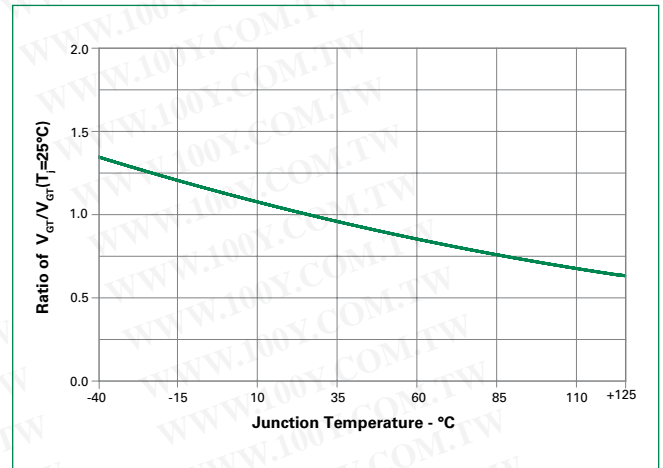
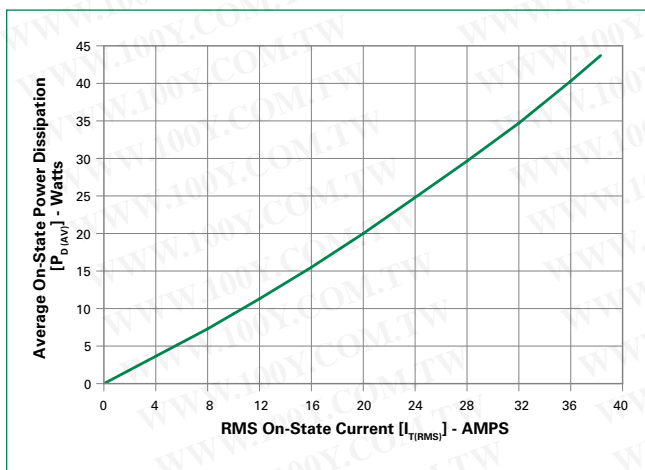


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current



Note: xx = voltage

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

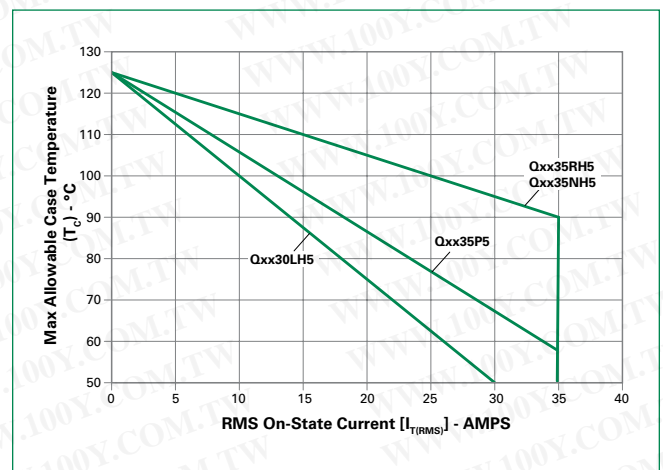
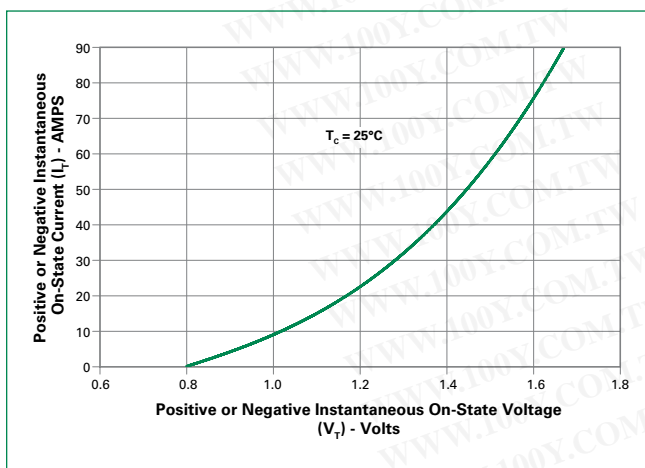
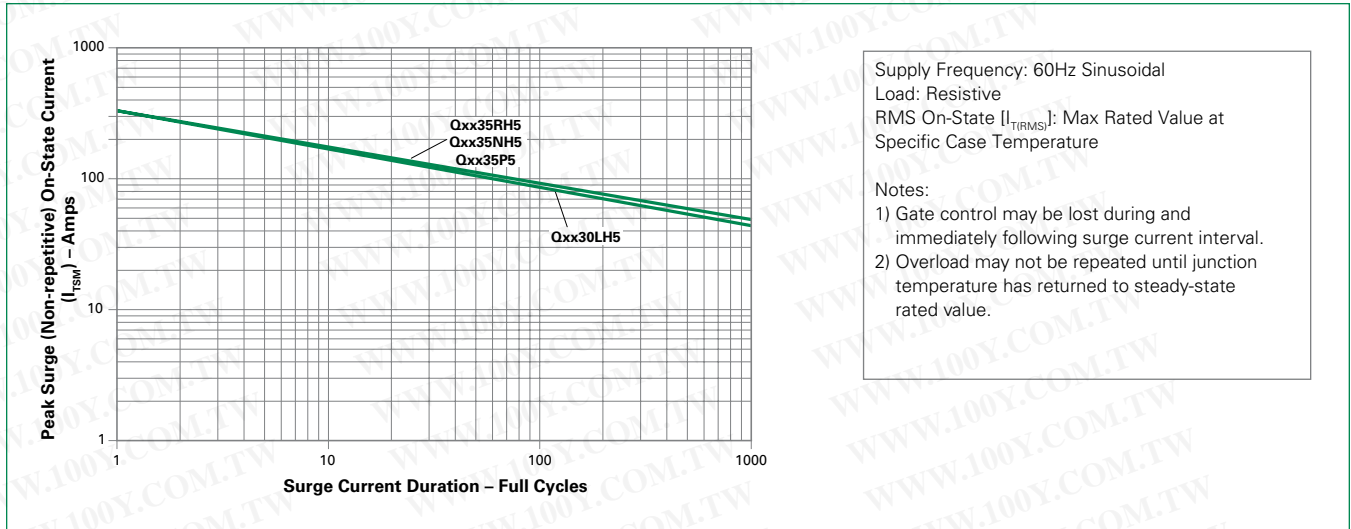


Figure 7: On-State Current vs. On-State Voltage (Typical)



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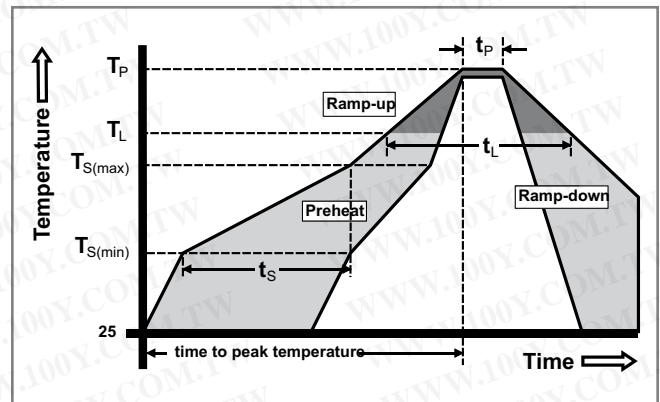
Figure 8: Surge Peak On-State Current vs. Number of Cycles



Note: xx = voltage

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



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Physical Specifications

Terminal Finish	100% Matte Tin-plated.
Body Material	UL recognized epoxy meeting flammability classification 94V-0.
Terminal Material	Copper Alloy

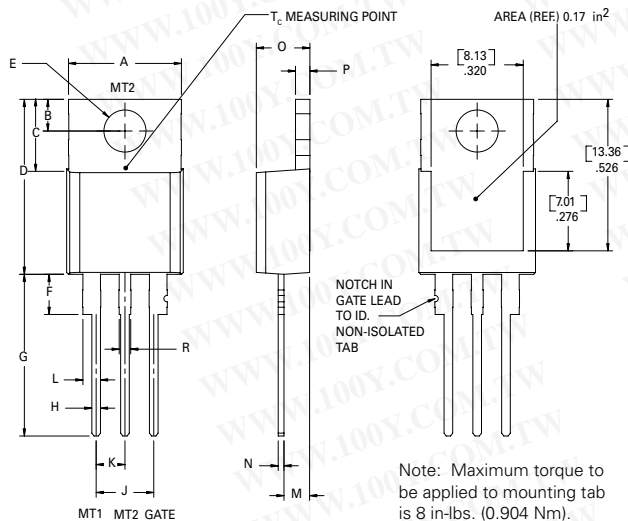
Design Considerations

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
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
Thermal Shock	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
Autoclave	EIA / JEDEC, JESD22-A102 168 hours (121°C at 2 ATMs) and 100% R/H
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

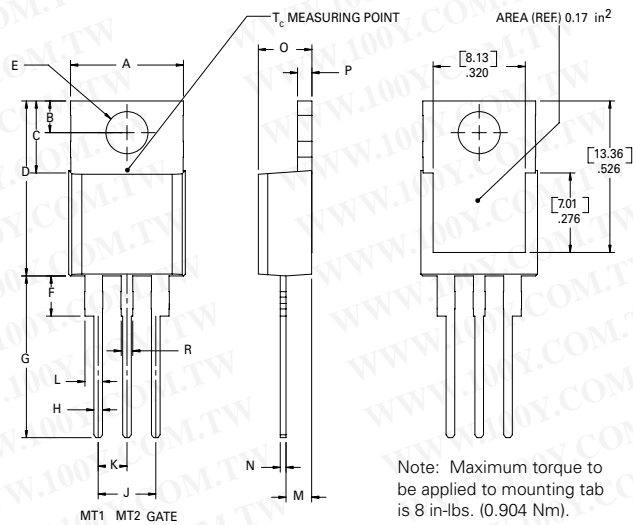
Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	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

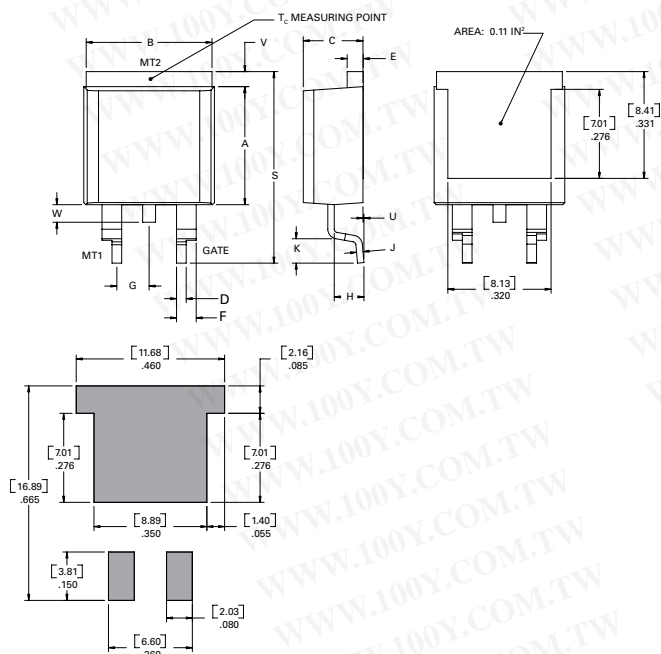
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Dimensions — TO-220AB (L-Package) — Isolated Mounting Tab



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

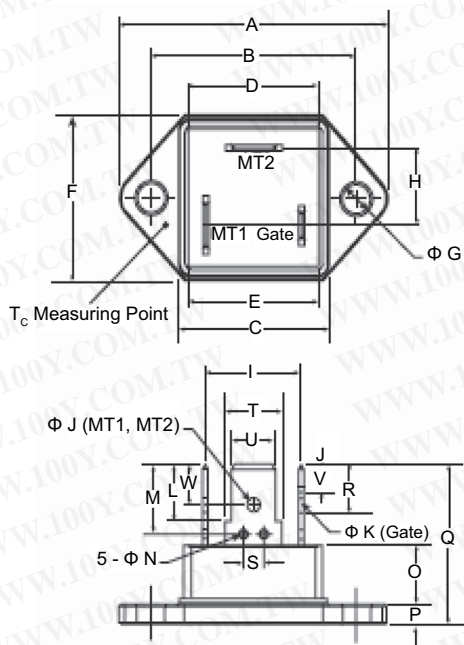
Dimensions — TO-263 (N-Package) — D² Pak Surface Mount



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	1.016	1.78

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Dimensions — TO-3 Fastpak (P Package) — Isolated Mounting Tab



Thickness of all three copper-alloy terminals is .032"(0.81mm)

Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	1.531	1.543	38.90	39.20
B	1.177	1.185	29.90	30.10
C	0.843	0.850	21.40	21.60
D	0.780	0.795	19.80	20.20
E	0.783	0.791	19.90	20.10
F	0.874	0.906	22.20	23.00
G	0.161	0.169	4.10	4.30
H	0.386	0.465	9.80	11.80
I	0.508	0.587	12.90	14.90
J	0.079	0.087	2.00	2.20
K	0.047	0.055	1.20	1.40
L	0.307	0.319	7.80	8.10
M	0.372	0.396	9.45	10.05
N	0.043	0.059	1.10	1.50
O	0.315	0.331	8.00	8.40
P	0.098	0.106	2.50	2.70
Q	0.846	0.886	21.50	22.50
R	0.244	0.256	6.20	6.50
S	0.106	0.130	2.70	3.30
T(MT1)	0.321	0.329	8.15	8.35
T(MT2)	0.321	0.329	8.15	8.35
T(Gate)	0.220	0.228	5.60	5.80
U(MT1)	0.246	0.254	6.25	6.45
U(MT2)	0.246	0.254	6.25	6.45
U(Gate)	0.183	0.191	4.65	4.85
V	0.120	0.130	3.05	3.30
W	0.175	0.185	4.45	4.70

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

Product Selector

Part Number	Voltage			Gate Sensitivity Quadrants		$I_{T(RMS)}$	Type	Package
	400V	600V	800V	I – II – III	IV			
Qxx35P5		X	X	50 mA	120 mA (TYP)	35A	Standard Triac	FASTPACK
Qxx35RH5	X	X		50 mA		35A	Alternistor Triac	TO-220R
Qxx35NH5	X	X		50 mA		35A	Alternistor Triac	TO-263 D ² -PAK
Qxx30LH5	X	X		50 mA		30A	Alternistor Triac	TO-220L

Note: xx = Voltage

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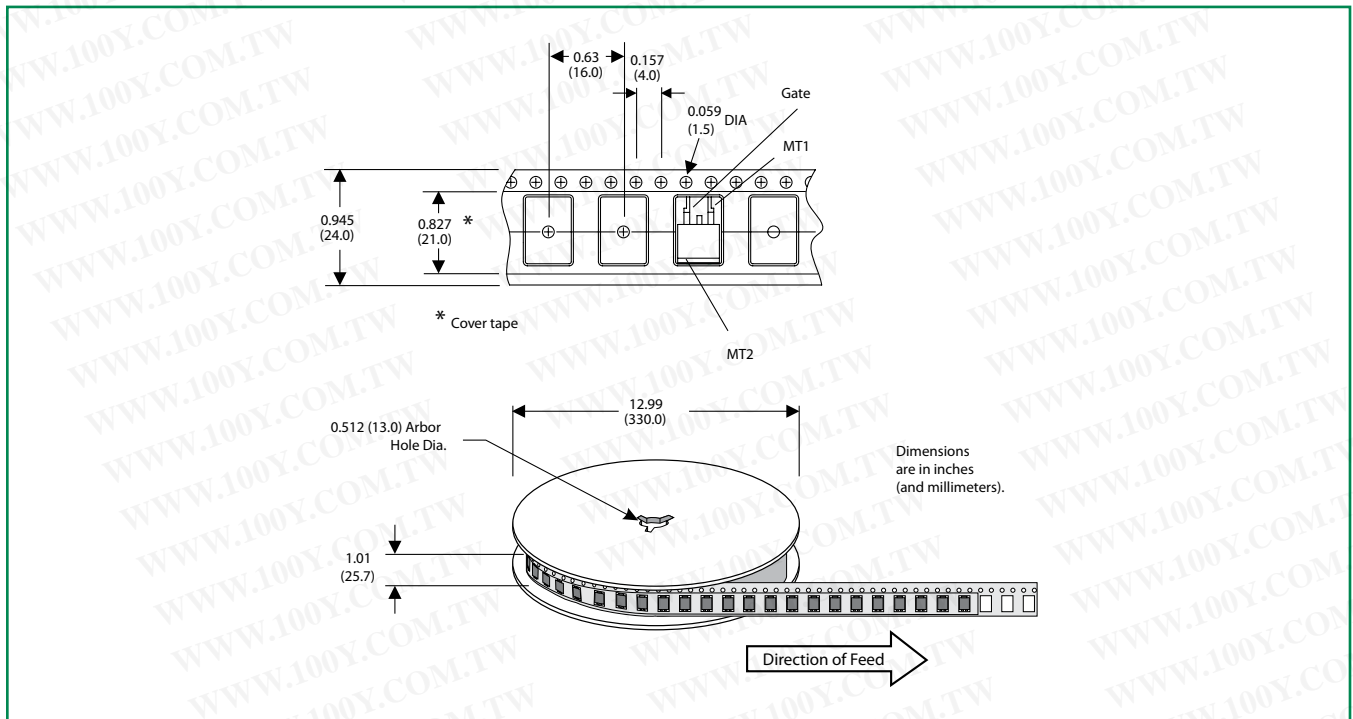
Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
Qxx30LH5	Qxx30LH5	2.20 g	Bulk	500
Qxx30LH5TP	Qxx30LH5	2.20 g	Tube	500 (50 per tube)
Qxx35RH5	Qxx35RH5	2.20 g	Bulk	500
Qxx35RH5TP	Qxx35RH5	2.20 g	Tube	500 (50 per tube)
Qxx35NH5TP	Qxx35NH5	1.60 g	Tube	500 (50 per tube)
Qxx35NH5RP	Qxx35NH5	1.60 g	Embossed Carrier	500
Qxx35P5	Qxx35P5	21.4 g	Bulk	200

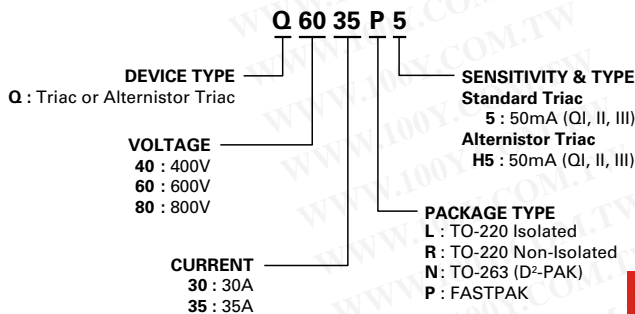
Note: xx = Voltage

TO-263 Embossed Carrier Reel Pack (RP) Specifications

Meets all EIA-481-2 Standards



Part Numbering System



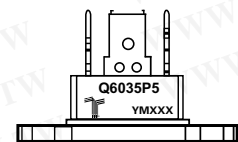
Part Marking System

TO-220 AB – (R Package)
 TO-263 AB – (N Package)



TO-220 AB – (L Package)

FASTPAK (P Package)



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