

Lxx08xx & Qxx08xx & Qxx08xHx Series



**Description**

This 8 Amp bidirectional 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.

**Sensitive** type components guarantee gate control in Quadrants I & IV as needed for digital control circuitry.

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

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

**Agency Approval**

Agency	Agency File Number
	E71639*

\* - L Package Only

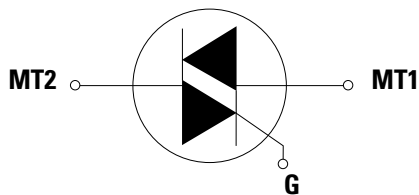
**Main Features**

Symbol	Value	Unit
$I_{T(RMS)}$	8	A
$V_{DRM}/V_{RRM}$	400, 600, 800 or 1000	V
$I_{GT (Q1)}$	5 to 50	mA

**Features & Benefits**

- RoHS-compliant
- Glass – passivated junctions
- Voltage capability up to 1000 V
- Surge capability up to 100 A
- The L-package has an isolation rating of 2500V<sub>RMS</sub>
- Solid-state switching eliminates arcing or contact bounce that create voltage transients
- No contacts to wear out from reaction of switching events
- Restricted (or limited) RFI generation, depending on activation point of sine wave
- Requires a short gate activation pulse during each half-cycle

**Schematic Symbol**



**Additional Information**



Datasheet



Resources



Samples

**Applications**

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

Typical applications are AC solid-state switches, light dimmers, power tools, home/brown goods and white goods 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 — Sensitive Triac (4 Quadrants)

Symbol	Parameter		Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	Lxx08Ly Lxx08Ry / Lxx08Vy / Lxx08Dy	$T_c = 80^\circ\text{C}$ $T_c = 85^\circ\text{C}$	8 A
$I_{TSM}$	Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25^\circ\text{C}$ )	f = 50 Hz f = 60 Hz	t = 20 ms t = 16.7 ms	65 85 A
$I^2t$	$I^2t$ Value for fusing	$t_p = 8.3$ ms		26.5 $\text{A}^2\text{s}$
di/dt	Critical rate of rise of on-state current $I_G = 50\text{mA}$ with $0.1\mu\text{s}$ rise time	f = 120 Hz	$T_j = 110^\circ\text{C}$	70 $\text{A}/\mu\text{s}$
$I_{GTM}$	Peak gate trigger current	$t_p = 20\mu\text{s}$	$T_j = 110^\circ\text{C}$	4 A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 110^\circ\text{C}$	0.4 W
$T_{stg}$	Storage temperature range			-40 to 150 $^\circ\text{C}$
$T_j$	Operating junction temperature range			-40 to 110 $^\circ\text{C}$

Note: xx = voltage/10, y = sensitivity

### Absolute Maximum Ratings — Standard Triac

Symbol	Parameter		Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	Qxx08Ry / Qxx08Ny Qxx08Ly	$T_c = 95^\circ\text{C}$ $T_c = 90^\circ\text{C}$	8 A
$I_{TSM}$	Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25^\circ\text{C}$ )	f = 50 Hz f = 60 Hz	t = 20 ms t = 16.7 ms	83 100 A
$I^2t$	$I^2t$ Value for fusing	$t_p = 8.3$ ms		41 $\text{A}^2\text{s}$
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	$T_j = 125^\circ\text{C}$	70 $\text{A}/\mu\text{s}$
$I_{GTM}$	Peak gate trigger current	$t_p = 20\mu\text{s}$	$T_j = 125^\circ\text{C}$	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 $^\circ\text{C}$
$T_j$	Operating junction temperature range	-	-	-40 to 125 $^\circ\text{C}$

Note: xx = voltage/10, y = sensitivity

### Absolute Maximum Ratings — Alternistor (3 Quadrants)

Symbol	Parameter	Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	Qxx08LHy Qxx08RHx / Qxx08NHx Qxx08VHy / Qxx08DHx $T_C = 90^\circ\text{C}$ $T_C = 95^\circ\text{C}$	8 A
$I_{TSM}$	Non repetitive surge peak on-state current (full cycle, $T_J$ initial = $25^\circ\text{C}$ )	f = 50 Hz      t = 20 ms f = 60 Hz      t = 16.7 ms Qxx08VHy / Qxx08DHx Qxx08LHy / Qxx08RHx / Qxx08NHx Qxx08VHy / Qxx08DHx Qxx08LHy / Qxx08RHx / Qxx08NHx	80 A 83 A 85 A 100 A
$I^2t$	$I^2t$ Value for fusing	$t_p = 8.3$ ms	Qxx08VHy / Qxx08DHx Qxx08LHy / Qxx08RHx / Qxx08NHx 30 A <sup>2</sup> s 41 A <sup>2</sup> s
di/dt	Critical rate of rise of on-state current	f = 120 Hz	$T_J = 125^\circ\text{C}$ 70 A/ $\mu\text{s}$
$I_{GTM}$	Peak gate trigger current	$t_p = 20\mu\text{s}$ $T_J = 125^\circ\text{C}$	Qxx08VHy / Qxx08DHx Qxx08LHy / Qxx08RHx / Qxx08NHx 4 A 4 A
$P_{G(AV)}$	Average gate power dissipation	$T_J = 125^\circ\text{C}$	$I_{GT} = 10\text{mA}$ $I_{GT} = 35\text{mA}$ Qxx08VHy / Qxx08DHx Qxx08LHy / Qxx08RHx / Qxx08NHx 0.4 W 0.5 W
$T_{stg}$	Storage temperature range		-40 to 150 $^\circ\text{C}$
$T_J$	Operating junction temperature range		-40 to 125 $^\circ\text{C}$

Note: xx = voltage/10, y = sensitivity

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

Symbol	Test Conditions	Quadrant	Lxx08x6	Lxx08x8	Unit
$I_{GT}$	$V_D = 12\text{V}$ $R_L = 60\ \Omega$	I – II – III IV	5 10	10 20	mA
$V_{GT}$	$V_D = 12\text{V}$ $R_L = 60\ \Omega$	ALL	1.3		V
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 110^\circ\text{C}$	ALL	0.2		V
$I_H$	$I_T = 100\text{mA}$		10	20	mA
dv/dt	$V_D = V_{DRM}$ Gate Open $T_J = 100^\circ\text{C}$	400V 600V	30 20	40 30	V/ $\mu\text{s}$
(dv/dt)c	(di/dt)c = 4.3 A/ms $T_J = 110^\circ\text{C}$		2	2	V/ $\mu\text{s}$
$t_{gt}$	$I_G = 100\text{mA}$ PW = 15 $\mu\text{s}$ $I_T = 11.3\ \text{A(pk)}$		3.0	3.2	$\mu\text{s}$

Note: xx = voltage/10, x = package, y = sensitivity

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

Symbol	Test Conditions	Quadrant		Qxx08x4	Qxx08x5	Unit
$I_{GT}$	$V_D = 12V$ $R_L = 60 \Omega$	I – II – III IV	MAX. TYP.	25 50	50 75	mA
$V_{GT}$	$V_D = 12V$ $R_L = 60 \Omega$	I – II – III	MAX.	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		V
$I_H$	$I_T = 200\text{mA}$		MAX.	50	50	mA
dv/dt	$V_D = V_{DRM}$ Gate Open $T_J = 125^\circ\text{C}$	400V 600V 800V 1000V	MIN.	150 - - -	- 125 100 80	V/ $\mu\text{s}$
(dv/dt)c	(di/dt)c = 4.3 A/ms $T_J = 125^\circ\text{C}$		TYP.	4	4	V/ $\mu\text{s}$
$t_{gt}$	$I_G = 100\text{mA}$ $PW = 15\mu\text{s}$ $I_T = 11.3 \text{ A(pk)}$		TYP.	3.0	3.0	$\mu\text{s}$

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

Symbol	Test Conditions	Quadrant		Qxx08xH3	Qxx08xH4	Unit
$I_{GT}$	$V_D = 12V$ $R_L = 60 \Omega$	I – II – III	MAX.	10	35	mA
$V_{GT}$	$V_D = 12V$ $R_L = 60 \Omega$	I – II – III	MAX.	1.3		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
$I_H$	$I_T = 100\text{mA}$		MAX.	15	35	mA
dv/dt	$V_D = V_{DRM}$ Gate Open $T_J = 125^\circ\text{C}$	Qxx08LHy / Qxx08RHx / Qxx08NHx  Qxx08VHy / Qxx08DHx	MIN.	400V 600V 800V 1000V 400V 600V 800V 1000V	75 50  75 50  150	V/ $\mu\text{s}$
(dv/dt)c	(di/dt)c = 4.3 A/ms $T_J = 125^\circ\text{C}$		MIN.	-	20	V/ $\mu\text{s}$
$t_{gt}$	$I_G = 100\text{mA}$ $PW = 15\mu\text{s}$ $I_T = 11.3 \text{ A(pk)}$		TYP.	-	4.0	$\mu\text{s}$

Note: xx = voltage/10, x = package, y = sensitivity

### Static Characteristics

Symbol	Test Conditions				Value	Unit	
$V_{TM}$	$I_{TM} = 11.3A$ $t_p = 380 \mu s$				MAX.	1.60	V
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$	Lxx08xy	$T_J = 25^\circ C$	400 - 600V	MAX.	10	$\mu A$
			$T_J = 110^\circ C$	400 - 600V		0.5	mA
			$T_J = 25^\circ C$	400 - 1000V		20	$\mu A$
		Qxx08xy	$T_J = 125^\circ C$	400 - 800V		2	mA
			$T_J = 100^\circ C$	1000V		3	
			$T_J = 25^\circ C$	400 - 800V		10	$\mu A$
Qxx08xHy	$T_J = 25^\circ C$	1000V	20				
	$T_J = 125^\circ C$	400 - 800V	2	mA			
	$T_J = 100^\circ C$	1000V	3				

### Thermal Resistances

Symbol	Parameter	Value	Unit
$R_{\theta(J-C)}$	Junction to case (AC)	L/Qxx08Ryy / L/Qxx08Nyy	1.5
		L/Qxx08Lyy	2.8
		L/Qxx08Vyy	2.1
		L/Qxx08Ryy	45
$R_{\theta(J-A)}$	Junction to ambient	L/Qxx08Lyy	50
		L/Qxx08Vyy	64

Note: xx = voltage/10, x = package, y = sensitivity, yy = type & sensitivity

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: Maximum Allowable Case Temperature vs. On-State Current (Sensitive Triac)**



**Figure 7: Maximum Allowable Case Temperature vs. On-State Current (Standard / Alternistor Triac)**



**Figure 8: On-State Current vs. On-State Voltage (Typical)**



Note: xx = voltage/10, x = package, yy = type & sensitivity

**Figure 9: Maximum Allowable Ambient Temperature vs. On-State Current**



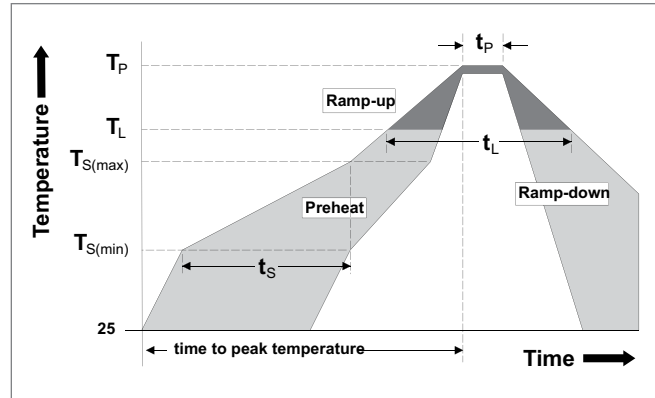
**Figure 10: Surge Peak On-State Current vs. Number of Cycles**



Note: xx = voltage/10, x = package, y = sensitivity, yy = type & sensitivity

### 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
	- Temperature ( $t_L$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °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

<b>Terminal Finish</b>	100% Matte Tin-plated
<b>Body Material</b>	UL Recognized compound meeting flammability rating V-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 (<math>V_{DRM}</math>)</b>	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours
<b>Temperature Cycling</b>	MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time
<b>Temperature/Humidity</b>	EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC: 85°C; 85% rel humidity
<b>High Temp Storage</b>	MIL-STD-750, M-1031, 1008 hours; 150°C
<b>Low-Temp Storage</b>	1008 hours; -40°C
<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



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



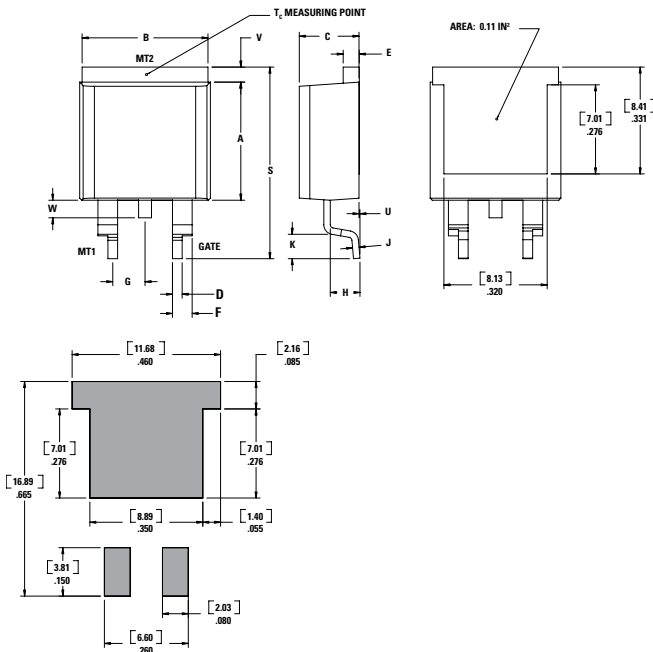
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	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

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



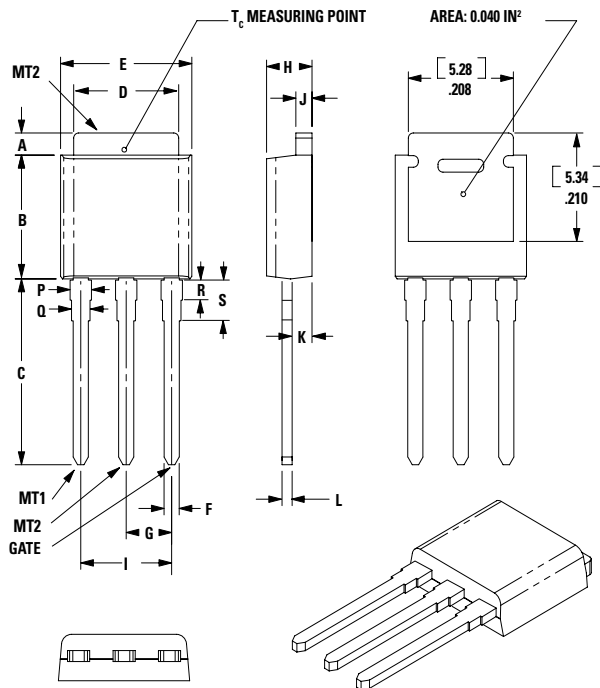
Dimension	Inches		Millimeters	
	Min	Max	Min	Max
A	0.380	0.420	9.65	10.67
B	0.105	0.115	2.67	2.92
C	0.230	0.250	5.84	6.35
D	0.590	0.620	14.99	15.75
E	0.142	0.147	3.61	3.73
F	0.110	0.130	2.79	3.30
G	0.540	0.575	13.72	14.61
H	0.025	0.035	0.64	0.89
J	0.195	0.205	4.95	5.21
K	0.095	0.105	2.41	2.67
L	0.060	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-263AB (N-Package) — D<sup>2</sup>-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	1.02	1.78

### Dimensions — TO-251AA (V-Package) — V-PAK Through Hole



Dimension	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.037	0.040	0.043	0.94	1.01	1.09
B	0.235	0.242	0.245	5.97	6.15	6.22
C	0.350	0.361	0.375	8.89	9.18	9.53
D	0.205	0.208	0.213	5.21	5.29	5.41
E	0.255	0.262	0.265	6.48	6.66	6.73
F	0.027	0.031	0.033	0.69	0.80	0.84
G	0.087	0.090	0.093	2.21	2.28	2.36
H	0.085	0.092	0.095	2.16	2.34	2.41
I	0.176	0.180	0.184	4.47	4.57	4.67
J	0.018	0.020	0.023	0.46	0.51	0.58
K	0.035	0.037	0.039	0.90	0.95	1.00
L	0.018	0.020	0.023	0.46	0.52	0.58
P	0.042	0.047	0.052	1.06	1.20	1.32
Q	0.034	0.039	0.044	0.86	1.00	1.11
R	0.034	0.039	0.044	0.86	1.00	1.11
S	0.074	0.079	0.084	1.86	2.00	2.11

### Dimensions — TO-252AA (D-Package) — D-PAK Surface Mount



Dimension	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.037	0.040	0.043	0.94	1.01	1.09
B	0.235	0.243	0.245	5.97	6.16	6.22
C	0.106	0.108	0.113	2.69	2.74	2.87
D	0.205	0.208	0.213	5.21	5.29	5.41
E	0.255	0.262	0.265	6.48	6.65	6.73
F	0.027	0.031	0.033	0.69	0.80	0.84
G	0.087	0.090	0.093	2.21	2.28	2.36
H	0.085	0.092	0.095	2.16	2.33	2.41
I	0.176	0.179	0.184	4.47	4.55	4.67
J	0.018	0.020	0.023	0.46	0.51	0.58
K	0.035	0.037	0.039	0.90	0.95	1.00
L	0.018	0.020	0.023	0.46	0.51	0.58
M	0.000	0.000	0.004	0.00	0.00	0.10
N	0.021	0.026	0.027	0.53	0.67	0.69
O	0°	0°	5°	0°	0°	5°
P	0.042	0.047	0.052	1.06	1.20	1.32
Q	0.034	0.039	0.044	0.86	1.00	1.11

### Product Selector

Part Number	Voltage (xx)				Gate Sensitivity Quadrants		Type	Package
	400V	600V	800V	1000V	I – II – III	IV		
Lxx08L6	X	X	-	-	5 mA	10 mA	Sensitive Triac	TO-220L
Lxx08D6	X	X	-	-	5 mA	10 mA	Sensitive Triac	TO-252 D-PAK
Lxx08R6	X	X	-	-	5mA	10mA	Sensitive Triac	TO-220R
Lxx08V6	X	X	-	-	5 mA	10 mA	Sensitive Triac	TO-251 V-PAK
Lxx08L8	X	X	-	-	10 mA	20 mA	Sensitive Triac	TO-220L
Lxx08D8	X	X	-	-	10 mA	20 mA	Sensitive Triac	TO-252 D-PAK
Lxx08R8	X	X	-	-	10mA	20mA	Sensitive Triac	TO-220R
Lxx08V8	X	X	-	-	10 mA	20 mA	Sensitive Triac	TO-251 V-PAK
Qxx08NH3	X	X	-	-	10mA	-	Alternistor Triac	TO-263 D <sup>2</sup> -PAK
Qxx08RH3	X	X	-	-	10 mA	-	Alternistor Triac	TO-220R
Qxx08VH3	X	X	-	-	10 mA	-	Alternistor Triac	TO-251 V-PAK
Qxx08DH3	X	X	-	-	10 mA	-	Alternistor Triac	TO-252 D-PAK
Qxx08L4	X	-	-	-	25 mA	-	Triac	TO-220L
Qxx08R4	X	-	-	-	25 mA	-	Triac	TO-220R
Qxx08N4	X	-	-	-	25 mA	-	Triac	TO-263 D <sup>2</sup> -PAK
Qxx08LH4	X	X	X	X	35 mA	-	Alternistor Triac	TO-220L
Qxx08RH4	X	X	X	X	35 mA	-	Alternistor Triac	TO-220R
Qxx08VH4	X	X	X	X	35 mA	-	Alternistor Triac	TO-251 V-PAK
Qxx08DH4	X	X	X	X	35 mA	-	Alternistor Triac	TO-252 D-PAK
Qxx08NH4	X	X	X	X	35 mA	-	Alternistor Triac	TO-263 D <sup>2</sup> -PAK
Qxx08L5	-	X	X	X	50 mA	-	Triac	TO-220L
Qxx08R5	-	X	X	X	50 mA	-	Triac	TO-220R
Qxx08N5	-	X	X	X	50 mA	-	Triac	TO-263 D <sup>2</sup> -PAK

### Packing Options

Part Number	Marking	Weight	Packing Mode	Base Quantity
L/Qxx08L/RyyTP	L/Qxx08L/Ryy	2.2 g	Tube Pack	1000 (50 per tube)
Qxx08NyyTP	Qxx08Nyy	1.6 g	Tube	1000 (50 per tube)
Qxx08NyyRP	Qxx08Nyy	1.6 g	Embossed Carrier	500
L/Qxx08DyyTP	L/Qxx08Dyy	0.3 g	Tube	750 (75 per tube)
L/Qxx08DyyRP	L/Qxx08Dyy	0.3 g	Embossed Carrier	2500
L/Qxx08VyyTP	L/Qxx08Vyy	0.4 g	Tube	750 (75 per tube)

Note: xx = voltage, x = package, y = sensitivity, yy = type & sensitivity

**TO-252 Embossed Carrier Reel Pack (RP) Specifications**

Meets all EIA-481-2 Standards



**TO-263 Embossed Carrier Reel Pack (RP) Specifications**

Meets all EIA-481-2 Standards

