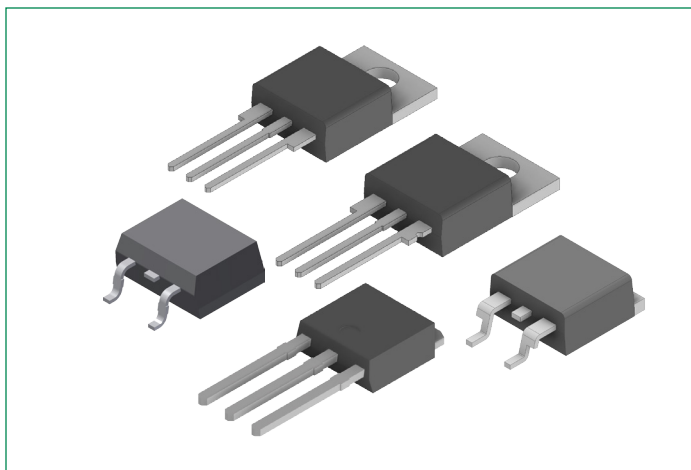


QVxx12xHx Series

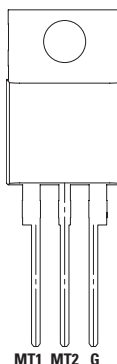
12 A High Temperature Alternistor TRIACs



Pinout Diagram

TO-220 (L-Package)

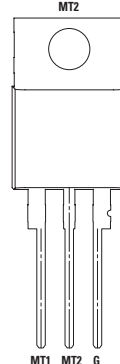
Tab (Isolated)



MT1 MT2 G

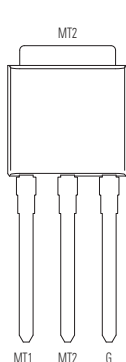
TO-220 (R-Package)

Tab (Non-isolated)



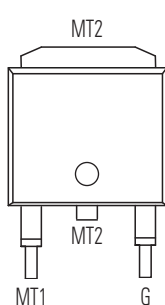
MT1 MT2 G

TO-251



MT1 MT2 G

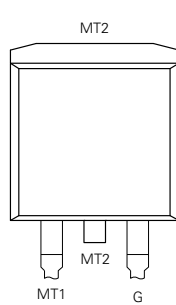
TO-252



MT1

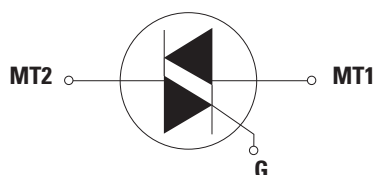
G

TO-263



MT1

G



MT1: Main Terminal 1; **MT2:** Main Terminal 2; **G:** Gate

Description:

This 12 A high temperature Alternistor TRIAC, offered in TO-220AB, TO-220 isolated, TO-251, TO-252, and TO-263 packages, has 150 °C maximum junction temperature (T_{vj}) and 153 A I_{TSM} at 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, and lighting controls.

This QV series TRIAC operates in quadrants I, II, and III, and offers high performance in applications requiring high commutation capability without a snubber circuit.

Features:

- Voltage capability up to 800 V
- Surge capability of 153 A at 60 Hz half cycle
- Mechanically and thermally robust clip-attach assembly
- Internally-isolated TO-220 package
- Maximum T_{vj} of 150 °C
- Halogen-free and RoHS-compliant
- Recognized to UL 1557 as an Electrically Isolated Semiconductor Device (L package: file number E71639)

Benefits:

- High dv/dt up to 2000 V/ μ s for improved noise immunity
- 3Q technology for high commutation capability
- Internally isolated packages offer better heat sinking with higher isolation voltage.

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/brown/white goods, and light industrial applications such as compressor motor control

Product Summary

Characteristic	Value	Unit
$I_{T(RMS)}$	12	A
V_{DRM}/V_{RRM}	600 or 800	V
$I_{GT(Q1)}$	20, 35, or 50	mA

Maximum Ratings - Alternistor TRIAC (3 Quadrants)

Symbol	Characteristics	Conditions			Value	Units
V_{DSM}/V_{RSM}	Non-repetitive Surge Peak Off-state Voltage	QVxx12RHy/ QVxx12NHy/ QVxx12LHy	$V_{DRM}/V_{RRM} = 600\text{ V}$	$P_W = 100\text{ }\mu\text{s}$	$V_{DSM}/V_{RSM} + 100$	V
		QVxx12DHy/ QVxx12VHy	$T_{vj} = 25\text{ }^\circ\text{C}$		960	
$I_{T(RMS)}$	On-state RMS Current (Full Sine Wave)	QVxx12LHy		$T_C = 120\text{ }^\circ\text{C}$	12	A
		QVxx12RHy / QVxx12NHy		$T_C = 135\text{ }^\circ\text{C}$		
		QVxx12DHy / QVxx12VHy		$T_C = 130\text{ }^\circ\text{C}$		
I_{TSM}	Non-repetitive Surge Peak On-state Current	QVxx12RHy/ QVxx12NHy/ QVxx12LHy	f = 50 Hz, t = 20 ms	full cycle; T_{vj} initial = 25 °C	140	A
			f = 60 Hz, t = 16.7 ms		153	
		QVxx12DHy/ QVxx12VHy	f = 50 Hz, t = 20 ms		105	
			f = 60 Hz, t = 16.7 ms		125	
I^2t	I^2t Value for Fusing	QVxx12RHy/ QVxx12NHy/ QVxx12LHy		$t_p = 8.3\text{ ms}$	97	A^2s
		QVxx12DHy/ QVxx12VHy			64	
di/dt	Critical Rate of Rise of On-state Current	$I_G = 50\text{ mA}$ with 0.1 μs rise time	$f = 60\text{ Hz}, T_{vj} = 150\text{ }^\circ\text{C}$		100	A/ μs
I_{GTM}	Peak Gate Trigger Current	QVxx12RHy/ QVxx12NHy/QVxx12LHy	$t_p \leq 10\text{ }\mu\text{s}; I_{GT} \leq I_{GTM}, T_{vj} = 150\text{ }^\circ\text{C}$		4	A
		QVxx12DHy / QVxx12VHy			2	
$P_{G(AV)}$	Average Gate Power Dissipation	QVxx12RHy/ QVxx12NHy/QVxx12LHy	$T_{vj} = 150\text{ }^\circ\text{C}$		0.5	W
		QVxx12DHy / QVxx12VHy			0.1	
T_{stg}	Storage Temperature Range	–			–40 to 150	°C
T_{vj}	Operating Junction Temperature Range	–			–40 to 150	°C

xx = voltage/10; y = sensitivity

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

Symbol	Characteristics	Conditions		QVxx12xH3			QVxx12xH4			QVxx12xH5			Units
				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	–	–	20	–	–	35	–	–	50	mA
V _{GT}	DC Gate Trigger Voltage		I – II – III	–	–	1.3	–	–	1.2	–	–	1.2	V
V _{GD}	Gate Non-trigger Voltage	V _D = V _{DRM} , R _L = 3.3 kΩ, T _{vj} = 150 °C	I – II – III	0.2	–	–	0.15	–	–	0.15	–	–	V
I _H	Holding Current	I _T = 100 mA Initial		–	–	30	–	–	50	–	–	60	mA
I _L	Latching Current	V _D = 12 V; I _G = 24 mA		–	–	80	–	–	–	–	–	–	mA
dv/dt	Critical Rate-of-rise of Off-stage Voltage	V _D = V _{DRM} , Gate Open, T _{vj} = 150 °C		–	–	–	500	–	–	750	–	–	V/μs
		V _D = 2/3 V _{DRM} , Gate Open, T _{vj} = 150 °C		1000	–	–	1000	–	–	1000	–	–	
(dv/dt) _c	Critical Rate-of-rise of Commutation Voltage	T _{vj} = 150°C, (di/dt) _c = 8.6 A/ms		25	–	–	50	–	–	50	–	–	V/μs
t _{gt}	Turn-on Time	I _G = 2 × I _{GT} , P _W = 15 μs, I _T = 22.6 A _{pk}	I	–	1	–	–	1	–	–	1	–	μs
			II	–	1.3	–	–	2	–	–	2	–	
			III	–	3	–	–	7	–	–	10	–	

xx = voltage/10; y = sensitivity

Thermal Characteristics

Symbol	Characteristics		Value	Units
R_{thJC}	Thermal Resistance, Junction to Case	QVxx12RHy/ QVxx12NH _y	0.9	K/W
		QVxx12LHy	1.85	
		QVxx12DHy/ QVxx12VHy	1.4	
R_{thJA}	Thermal Resistance, Junction to Ambient	QVxx12DHy/ QVxx12VHy	70	K/W

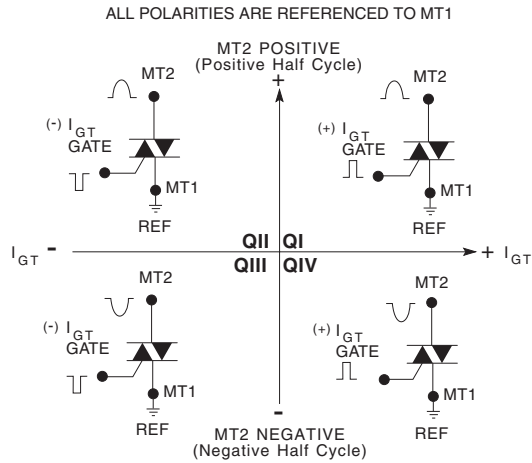
xx = voltage/10; y = sensitivity

Static Characteristics

Symbol	Characteristics	Conditions		Value			Units
				Min.	Typ.	Max.	
V _{TM}	Peak On-state Voltage	I _T = 17 A t _p = 380 μs		–	–	1.6	V
I _{DRM} /I _{RRM}	Off-state Current, Peak Repetitive	V _D = V _{DRM} /V _{RRM} , T _{vj} = 25 °C		–	–	5	μA
		V _D = V _{DRM} /V _{RRM} , T _{vj} = 150 °C		–	–	3	mA
V _{T0}	Threshold Voltage	T _{vj} = 150 °C		–	–	0.85	V
R _D	Slope Resistance	T _{vj} = 150 °C	600 V	–	–	23	mΩ
			800 V	–	–	38	

Characteristic Curves

Figure 1. Definition of Quadrants



Note: Alternistors will not operate in QIV

Fig. 2. Normalized DC Gate Trigger Current for all Quadrants vs. Junction Temperature

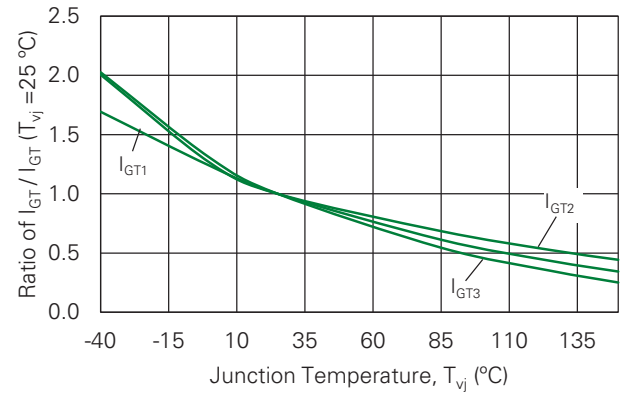


Fig. 3. Normalized DC Holding Current vs. Junction Temperature

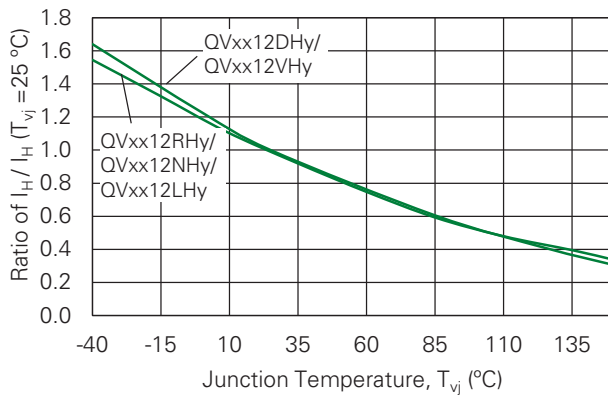


Fig. 4. Normalized DC Gate Trigger Voltage for all Quadrants vs. Junction Temperature

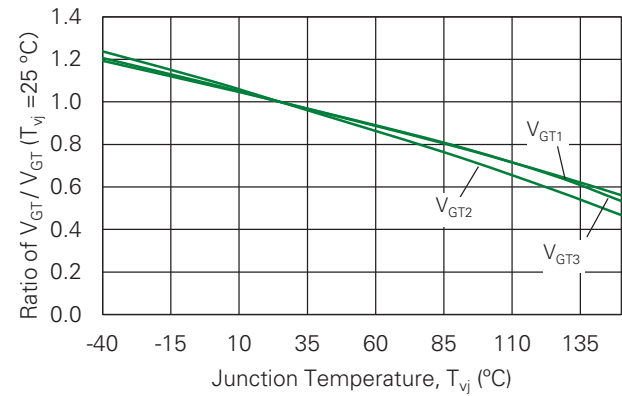


Fig. 5. Typical Power Dissipation vs. RMS On-state Current

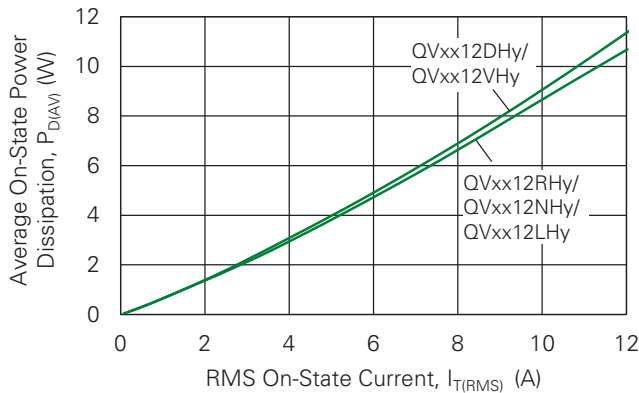


Fig. 6. Typical On-state Current vs. On-state Voltage

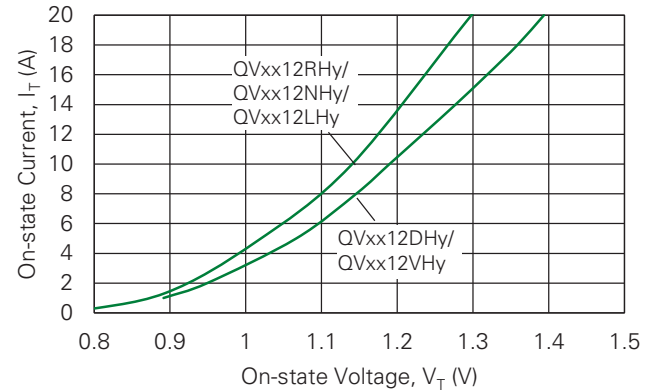


Fig. 7. Maximum Allowable Case Temperature vs. RMS On-state Current

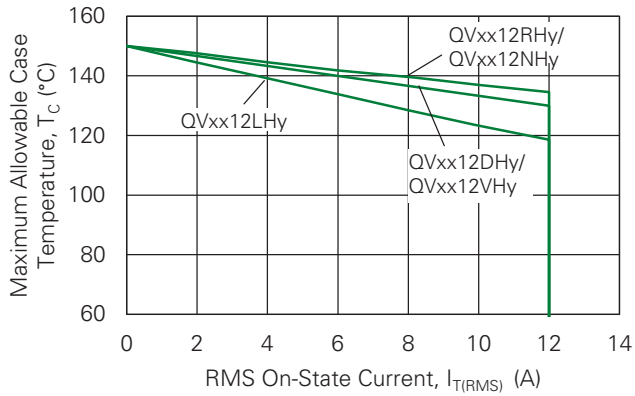


Figure 8. Junction to Case Transient Thermal Impedance (only for QVxx12DHx/QVxx12VHy)

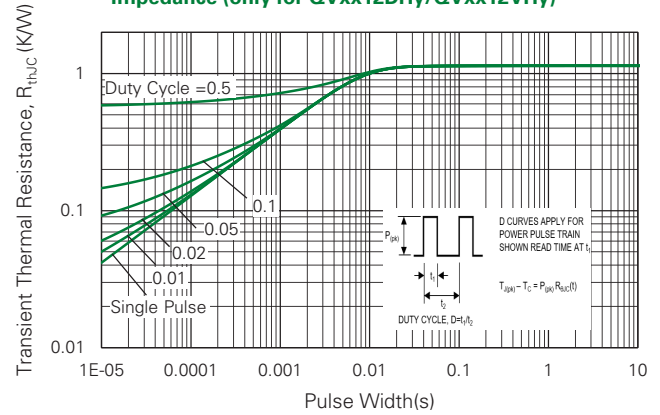


Figure 9. Junction to Ambient Transient Thermal Impedance (only for QVxx12DHx/QVxx12VHy)

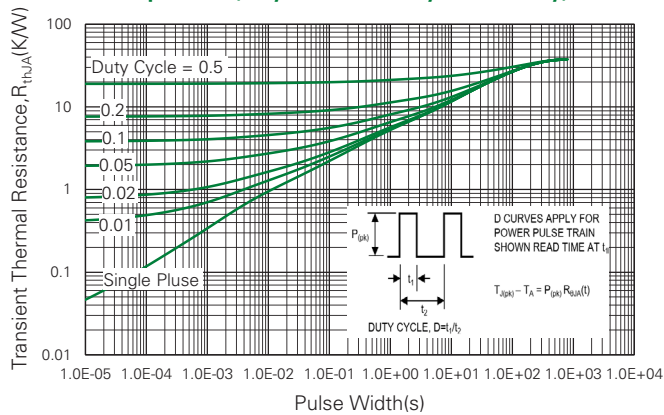
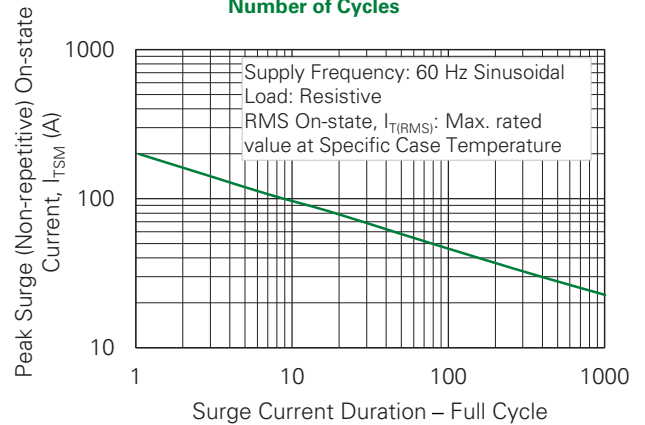


Fig. 10. Surge Peak On-state Current vs. Number of Cycles



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

Characteristic		Value
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 – 120 secs
Average ramp up rate (Liquidus Temp)(T_L) to peak		3°C/second max
$T_{S(max)}$ to T_L - Ramp-up Rate		3°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)		30 seconds max.
Ramp-down Rate		5°C/second max
Time 25°C to peak Temperature (T_P)		6 minutes max
Do Not Exceed		260°C

Physical Specifications

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

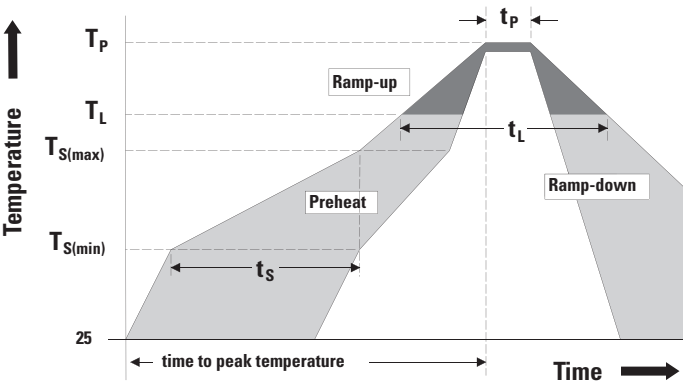
Design Considerations

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.

Product Selector

Part Number	Voltage		Gate Sensitivity Quadrants	Type	Package
	600 V	800 V	I-II-III		
QVxx12DH3	–	X	20 mA	Alternistor TRIAC	TO-252 (DPAK)
QVxx12VH3	–	X	20 mA	Alternistor TRIAC	TO-251 (VPAK)
QVxx12LH4	X	–	35 mA	Alternistor TRIAC	TO-220AB (L package)
QVxx12RH4	X	–	35 mA	Alternistor TRIAC	TO-220AB (R package)
QVxx12NH4	X	–	35 mA	Alternistor TRIAC	TO-263 (D ² PAK)
QVxx12LH5	X	–	50 mA	Alternistor TRIAC	TO-220AB (L package)
QVxx12RH5	X	–	50 mA	Alternistor TRIAC	TO-220AB (R package)
QVxx12NH5	X	–	50 mA	Alternistor TRIAC	TO-263 (D ² PAK)

xx = voltage/10; y = sensitivity



Environmental Specifications

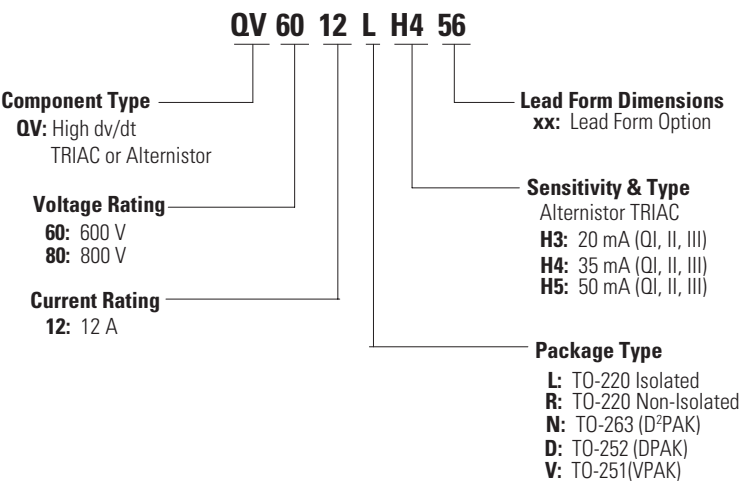
Test	Specifications and Conditions
AC Blocking	MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours
Temperature/Humidity	EIA / JEDEC, JESD22-A101, 1008 hours; 160 V - DC: 85°C; 85% relative humidity
Temperature Cycling	MIL-STD-750, M-1051, 1000 cycles; -55°C to +150°C; 15-min dwell-time
UHASt	JESD22A-118, 96 hrs, 130°C/ 85% RH
IOL	MIL-STD-750 Method 1037
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

Packing Options

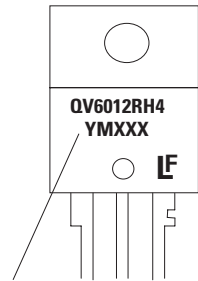
Part Number	Marking	Weight	Packing Mode	Base Quantity
QVxx12LHyTP	QVxx12LHy	2.2 g	Tube Pack	1000
QVxx12RHypTP	QVxx12RHyp	2.2 g	Tube Pack	1000
QVxx12NHypTP	QVxx12NHyp	1.6 g	Tube Pack	1000
QVxx12NHypRP	QVxx12NHyp	1.6 g	Embossed Carrier	500
QVxx12DHyTP	QVxx12DHy	0.3 g	Tube Pack	750 (75 per tube)
QVxx12DHyRP	QVxx12DHy	0.3 g	Embossed Carrier	2500
QVxx12VHyTP	QVxx12VHy	0.4 g	Tube Pack	750 (75 per tube)

xx = voltage/10; y = sensitivity

Part Numbering and Marking

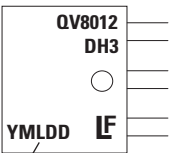


TO-220 AB - (L and R Package)
TO-263 - (N Package)



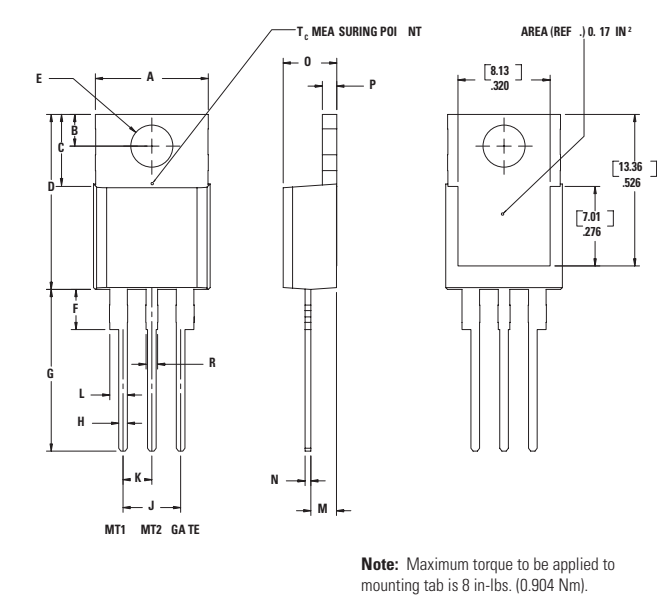
Date Code Marking
Y: Year Code
M: Month Code
XXX: Lot Trace Code

TO-252 (DPAK)
TO-251 (VPAK)



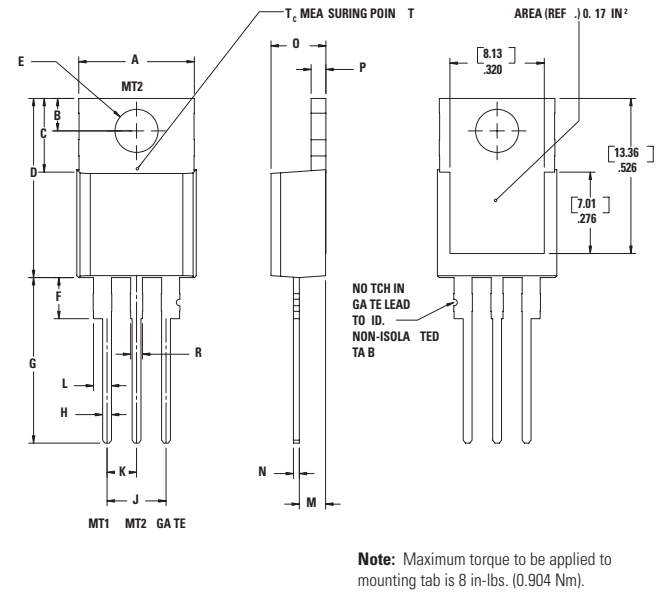
Date Code Marking
Y: Year Code
M: Month Code
L: Location Code
DD: Calendar Code

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



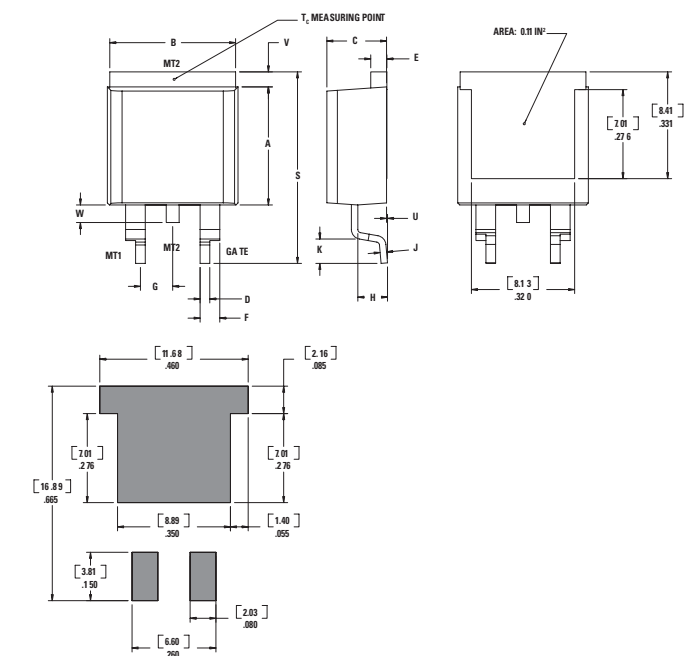
Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max
A	9.65	10.67	0.380	0.420
B	2.67	2.92	0.105	0.115
C	5.84	6.35	0.230	0.250
D	14.99	15.75	0.590	0.620
E	3.61	3.73	0.142	0.147
F	2.79	3.30	0.110	0.130
G	13.72	14.60	0.540	0.575
H	0.64	0.89	0.025	0.035
J	4.95	5.21	0.195	0.205
K	2.41	2.67	0.095	0.105
L	1.52	1.91	0.060	0.075
M	2.16	2.41	0.085	0.095
N	0.46	0.61	0.018	0.024
O	4.52	4.78	0.178	0.188
P	1.14	1.52	0.045	0.060
R	0.97	1.22	0.038	0.048

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



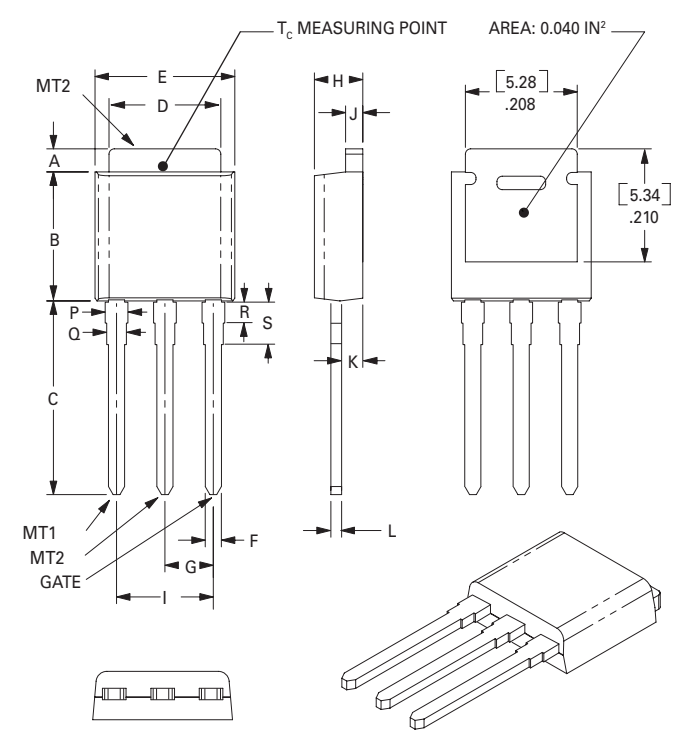
Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max
A	9.65	10.67	0.380	0.420
B	2.67	2.92	0.105	0.115
C	5.84	6.35	0.230	0.250
D	14.99	15.75	0.590	0.620
E	3.61	3.73	0.142	0.147
F	2.79	3.30	0.110	0.130
G	13.72	14.60	0.540	0.575
H	0.64	0.89	0.025	0.035
J	4.95	5.21	0.195	0.205
K	2.41	2.67	0.095	0.105
L	1.52	1.91	0.060	0.075
M	2.16	2.41	0.085	0.095
N	0.46	0.61	0.018	0.024
O	4.52	4.78	0.178	0.188
P	1.14	1.52	0.045	0.060
R	0.97	1.22	0.038	0.048

Package Dimensions TO-263 (N Package) – D²PAK Surface Mount



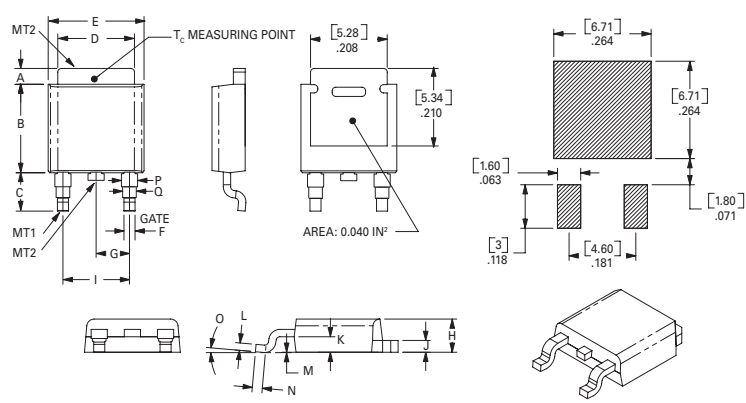
Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max
A	9.14	9.40	0.360	0.370
B	9.65	10.67	0.380	0.420
C	4.52	4.78	0.178	0.188
D	0.64	0.89	0.025	0.035
E	1.14	1.52	0.045	0.060
F	1.52	1.91	0.060	0.075
G	2.41	2.67	0.095	0.105
H	2.34	2.59	0.092	0.102
J	0.46	0.61	0.018	0.024
K	2.29	2.79	0.090	0.110
S	14.99	15.88	0.590	0.625
V	0.89	1.14	0.035	0.045
U	0.05	0.25	0.002	0.010
W	1.02	1.78	0.040	0.070

Package Dimensions TO-251AA (V Package) – VPAK Through Hole



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max
A	0.94	1.09	0.037	0.043
B	5.97	6.22	0.235	0.245
C	8.89	9.53	0.350	0.375
D	5.21	5.41	0.205	0.213
E	6.48	6.73	0.255	0.265
F	0.69	0.84	0.027	0.033
G	2.21	2.36	0.087	0.093
H	2.16	2.41	0.085	0.095
I	4.47	4.67	0.176	0.184
J	0.46	0.58	0.018	0.023
K	0.90	1.00	0.035	0.039
L	0.46	0.58	0.018	0.023
P	1.06	1.32	0.042	0.052
Q	0.86	1.11	0.034	0.044
R	0.86	1.11	0.034	0.044
S	1.86	2.11	0.074	0.084

Package Dimensions TO-252AA (D Package) – DPAK Surface Mount



Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max
A	0.94	1.09	0.037	0.043
B	5.97	6.22	0.235	0.245
C	2.69	2.87	0.106	0.113
D	5.21	5.41	0.205	0.213
E	6.48	6.73	0.255	0.265
F	0.69	0.84	0.027	0.033
G	2.21	2.36	0.087	0.093
H	2.16	2.41	0.085	0.095
I	4.47	4.67	0.176	0.184
J	0.46	0.58	0.018	0.023
K	0.90	1.00	0.035	0.039
L	0.46	0.58	0.018	0.023
M	0.00	0.10	0.000	0.004
N	0.53	0.69	0.021	0.027
O	0°	5°	0°	5°
P	1.06	1.32	0.042	0.052
Q	0.86	1.11	0.034	0.039

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

Meets all EIA-481-2 Standards

