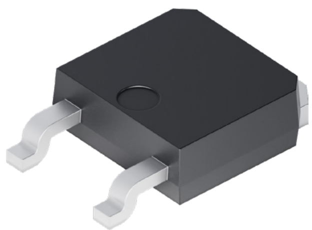
QS8004xHx

4 A Over Voltage Self-protection TRIACs

RoHS



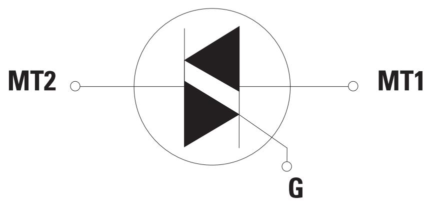
Description

This 4 A over-voltage switch integrates a TRIAC structure with high voltage clamping function to ensure capability of withstanding high over-voltage events, such as line transients described in the IEC 61000-4-5 standards.

This 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 gate TRIACs can be directly driven by microprocessor or popular opto-couplers/isolators.

Schematic Symbol



Features

- Glass-passivated junctions
- Surge capability up to 55 A
- No contacts to wear out from reaction of switching events
- Voltage capability up to 800 V
- Requires only a short gate activation pulse in each half-cycle

Applications

- Fridge or air conditioner compressor control
- Industrial AC switching control
- Motor control
- White goods and household appliances

Product Summary

Characteristic	Value	Unit
$I_{T(RMS)}$	4	A
I_{GT}	35	mA

Maximum Ratings

Symbol	Characteristics	Conditions	Value	Unit
$I_{T(RMS)}$	RMS On-state Current (Full Sine Wave)	T_c = 118 °C	4	A
I_{TSM}	Non-repetitive Surge On-state Current (Full Cycle, T_{vj} Initial = 25 °C)	f = 50 Hz, t = 20 ms	46	A
		f = 60 Hz, t = 16.7 ms	55	
I^2t	I^2t Value	t_p = 8.3 ms	12.5	A^2s
$di/dt_{(cr)}$	Critical Rate of Rise of On-state Current	I_G = 50 mA with ≤ 0.1 µs rise time, f = 60 Hz, T_{vj} =125 °C	100	A/µs
I_{GTM}	Peak Gate Trigger Current	t_p = 20 µs, T_{vj} =125 °C	4	A
$P_{G(AV)}$	Average Gate Power Dissipation	T_{vj} =125 °C	0.3	W
T_{stg}	Storage Temperature Range	–	-40 to 150	°C
T_{vj}	Virtual Junction Temperature Range	–	-40 to 125	°C
V_{PP}	Non-repetitive Line Peak Mains Voltage[1]	T_{vj} =25 °C	2	kV

Note 1: According to the test described in IEC 61000-4-5 standard and Figure 12

Electrical Characteristics (T_{vj} = 25°C unless otherwise specified)

Symbol	Characteristics	Conditions	Quadrant	QS8004DH2			QS8004DH4			Unit
				Min.	Typ.	Max.	Min.	Typ.	Max.	
I_{GT}	Gate Trigger Current	V_D = 12 V, R_L = 60 Ω	I – II – III	–	–	10	–	–	35	mA
V_{GT}	Gate Trigger Voltage	V_D = 12 V, R_L = 60 Ω	I – II – III	–	–	1.3	–	–	1.3	V
V_{GD}	Gate Non-trigger Voltage	$V_D = V_{DRM}$, R_L = 3.3 kΩ, T_{vj} = 125 °C	All	0.2	–	–	0.2	–	–	V
I_H	Holding Current	I_T = 200 mA	–	–	–	20	–	–	30	mA
$dv/dt_{(com)}$	Critical rate of rise of commutating voltage	$di/dt_{(cr)}$ = 2.16 A/ms, T_{vj} = 125 °C	–	2	–	–	5	–	–	V/µs
t_{gt}	Gate-controlled turn-on time	$I_G = 2 \times I_{GT}$, P_W = 15 µs, I_T = 5.6 A_{PK}	–	–	2.5	–	–	3.0	–	µs
$dv/dt_{(cr)}$	Critical Rate-of-rise of Off-stage Voltage	V_D = 2/3 V_{DRM}, Gate Open, T_{vj} = 125 °C	All	–	200	–	–	400	–	V/µs
V_{CL}		I_{CL} = 0.1 mA, t_p = 1 ms	All	850	–	–	850	–	–	V

Thermal Characteristics

Symbol	Characteristics	Value	Unit
$R_{th(j-c)}$	Thermal Resistance, junction-to-case (AC)	1.5	K/W
$R_{th(j-a)}$	Thermal Resistance, junction-to-ambient	70	K/W

Static Characteristics

Symbol	Characteristics	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{TM}	Peak Sinusoidal On-state Voltage	I_{TM} = 5.6 A, t_p = 380 µs	–	–	1.4	V
I_{DRM} / I_{RRM}	Peak Repetitive Off-state Current	$V_{DRM} = V_{RRM}$, T_{vj} = 25 °C	–	–	5	µA
		$V_{DRM} = V_{RRM}$, T_{vj} = 125 °C	–	–	2	mA

Characteristic Curves

Figure 1: Definition of Quadrants

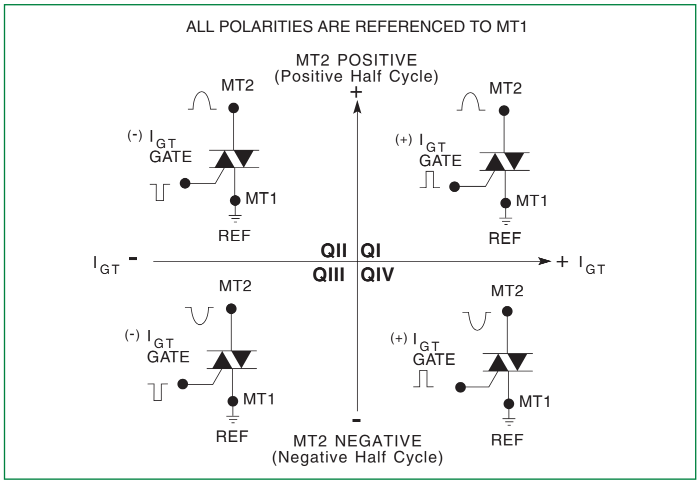


Figure 2: Normalized DC Gate Trigger Current for all Quadrants vs. Junction Temperature

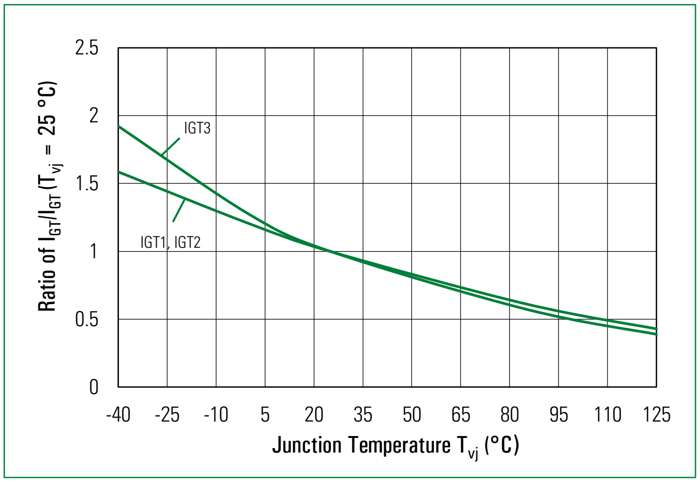


Figure 3: Normalized DC Holding Current vs. Junction Temperature

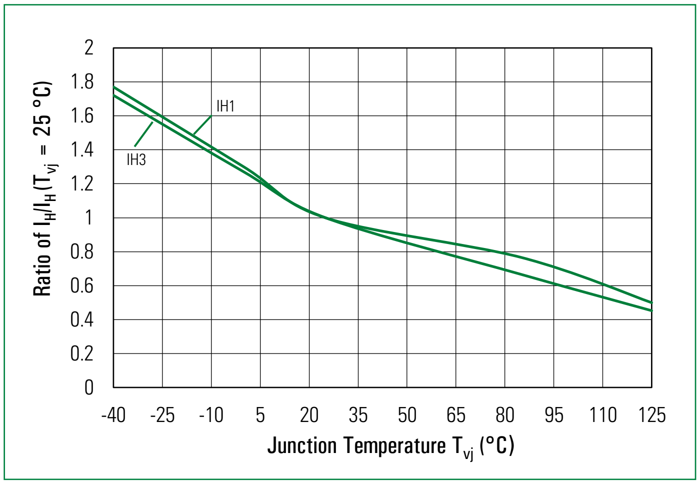


Figure 4: Normalized DC Gate Trigger Voltage for all Quadrants vs. Junction Temperature

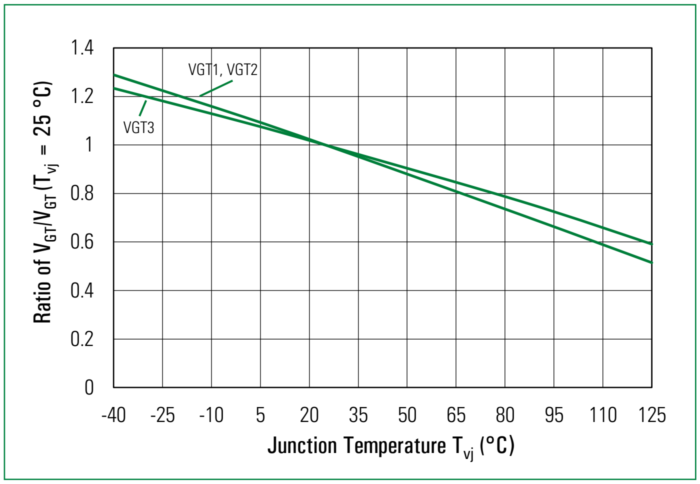


Figure 5: Typical Power Dissipation vs. RMS On-State Current

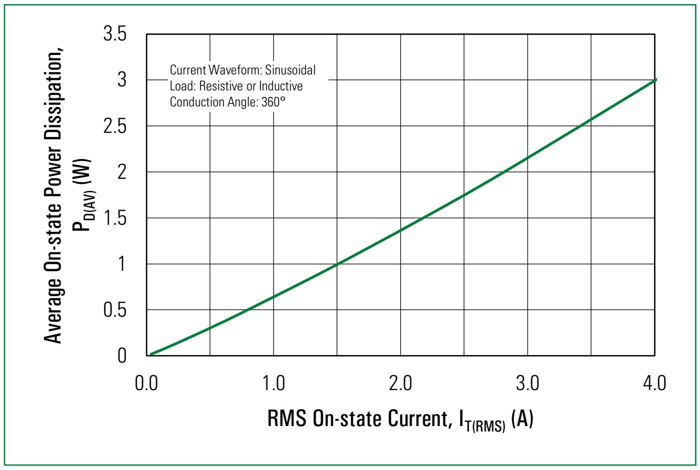


Figure 6: Maximum Allowable Case Temperature vs. On-State Current

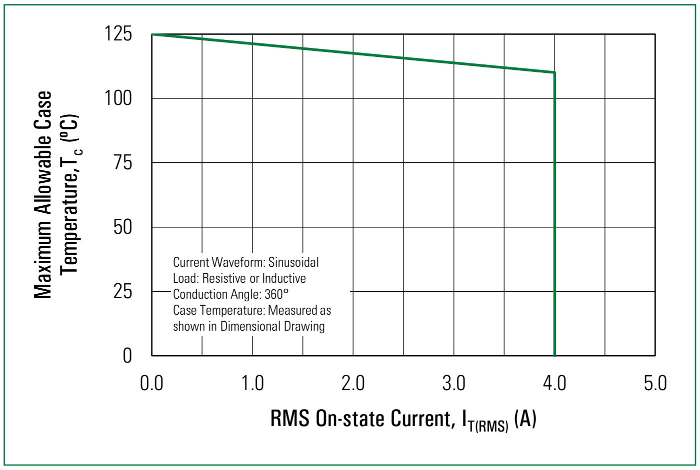


Figure 7: Maximum Allowable Ambient Temperature vs. On-State Current

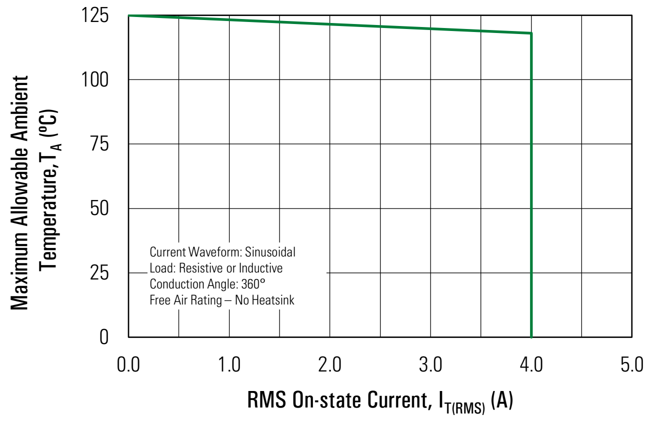


Figure 8: Typical On-State Current vs. On-State Voltage

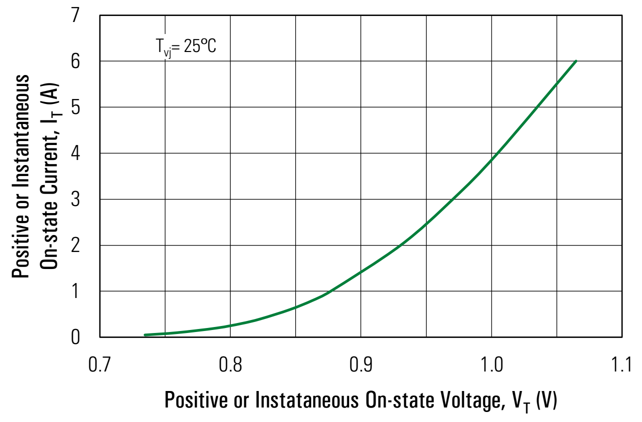


Figure 9: Normalized Clamping Voltage vs. Junction Temperature

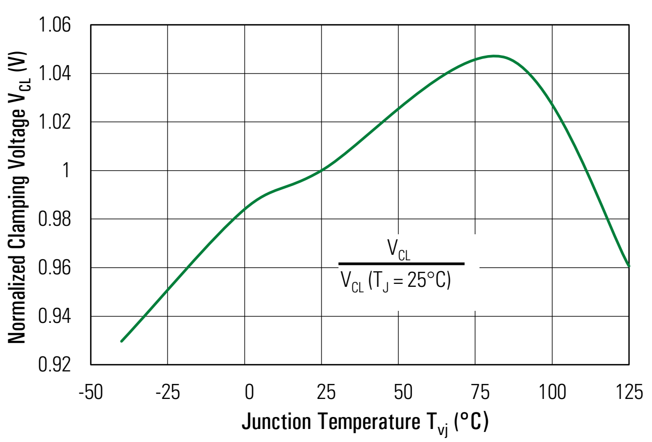
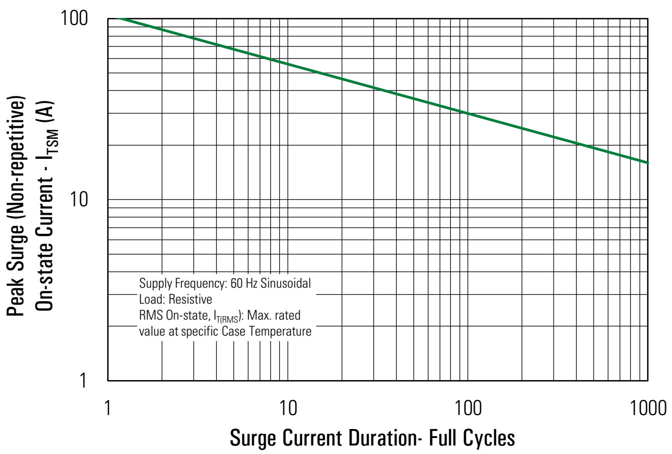
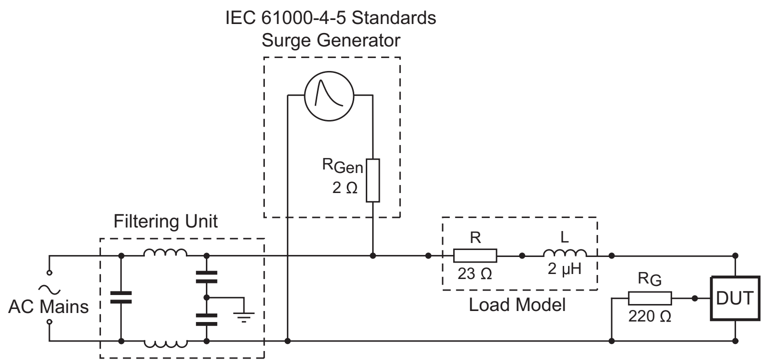


Figure 10: Surge Peak On-State Current vs. Number of Cycles



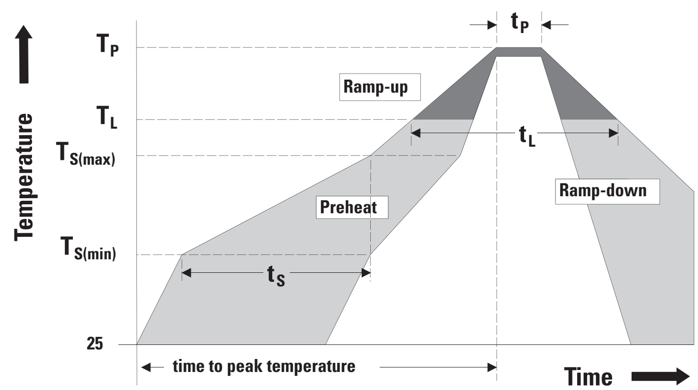
Notes:
1. Gate control may be lost during and immediately following surge current interval.
2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

Fig. 11. Test Circuit for Inductive and Resistive Loads with Conditions Equivalent to IEC 61000-4-5



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 – 120 seconds
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		6 °C/second max.
Time 25°C to peak Temperature (T_P)		8 minutes max.
Do not exceed		260 °C



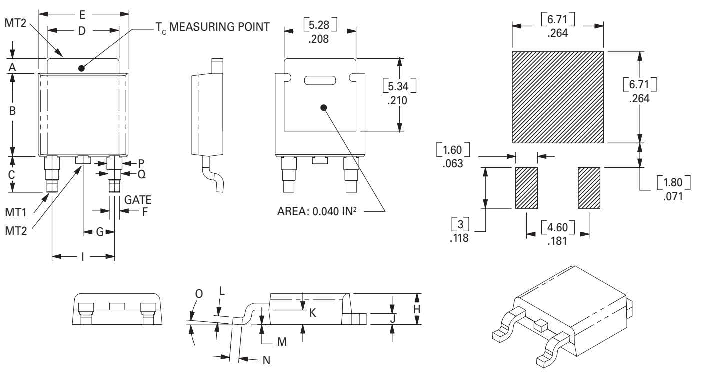
Physical Specifications

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

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-1051,1000 cycles; -55 °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
Moisture Sensitivity Level	MSL Level 1

Package Dimensions TO - 252AA (D-package)



Dimension	Inches			Millimeters		
	Min	Typ	Max	Min	Typ	Max
A	0.040	0.043	0.050	1.02	1.09	1.27
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	0.038	0.040	0.044	0.97	1.02	1.12
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

Part Selector

Part Number	Voltage	Gate Sensitivity		Type	Package
	800V	I-II-III	IV		
QS8004DH2	X	10 mA	–	OV Triac	TO-252 D-PAK
QS8004DH4	X	35 mA	–	OV Triac	TO-252 D-PAK

Part Number and Marking

QS 80 04 D H4 xx

DEVICE TYPE
QS: OV Triac

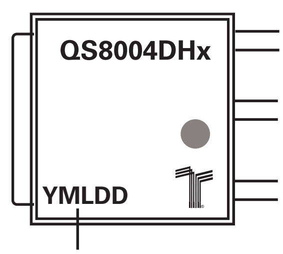
VOLTAGE RATING
80 : 800V

CURRENT RATING
04 : 4A

LEAD FORM DIMENSIONS
xx : Lead Form Option

TYPE
Standard Triac:
H2 : 10 mA (QI, II, III)
H4 : 35 mA (QI, II, III)

PACKAGE TYPE
D :TO-252 (D-Pak)



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

Packing Options

Part Number	Marking	Weight	Packing Mode	M.O.Q.
QS8004DHxTP	QS8004DHx	0.335 g	Tube Pack	750 (75 per tube)
QS8004DHxRP	QS8004DHx	0.335 g	EmbossedCarrier	2500

Packing Specifications

Meets all EIA-481-2 Standards