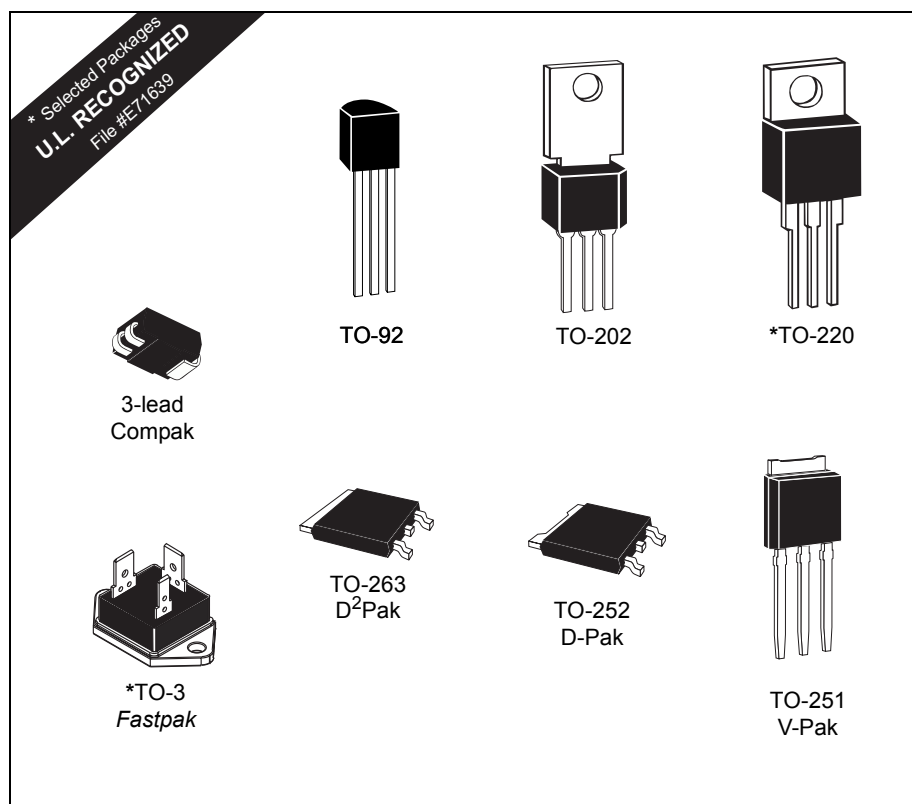


Triacs

(0.8 A to 35 A) RoHS

General Description

These gated triacs from Teccor Electronics are part of a broad line of bidirectional semiconductors. The devices range in current ratings from 0.8 A to 35 A and in voltages from 200 V to 1000 V.

The triac may be gate triggered from a blocking to conduction state for either polarity of applied voltage and is designed for AC switching and phase control applications such as speed and temperature modulation controls, lighting controls, and static switching relays. The triggering signal is normally applied between the gate and MT1.

Isolated packages are offered with internal construction, having the case or mounting tab electrically isolated from the semiconductor chip. This feature facilitates the use of low-cost assembly and convenient packaging techniques. Tape-and-reel capability is available. See "Packing Options" section of this catalog.

All Teccor triacs have glass-passivated junctions to ensure long-term device reliability and parameter stability. Teccor's glass-passivated junctions offer a rugged, reliable barrier against junction contamination.

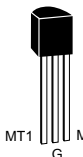
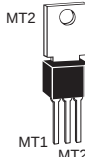
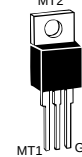
Variations of devices covered in this data sheet are available for custom design applications. Consult factory for more information.

Features

- RoHS Compliant
- Electrically-isolated packages
- Glass-passivated junctions
- Voltage capability — up to 1000 V
- Surge capability — up to 200 A

Compak Package

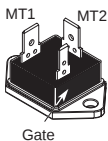
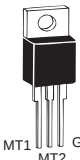
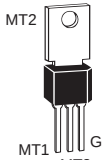
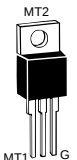
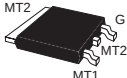
- Surface mount package — 0.8 A and 1 A series
- New small profile three-leaded Compak package
- Packaged in embossed carrier tape with 2,500 devices per reel
- Can replace SOT-223

I _{T(RMS)} (4)	Part Number								V _{DRM} (1)	I _{GT} (3) (7) (15)				
	Isolated			Non-isolated										
	 TO-92	 TO-220	 Compak	 TO-202	 TO-220	 TO-252 D-Pak	 TO-251 V-Pak	 TO-263 D²Pak		Volts	mAmps			
										QI	QII	QIII	QIV	QIV
MAX	See "Package Dimensions" section for variations. (11)								MIN	MAX				TYP
0.8 A	Q2X8E3		Q2X3						200	10	10	10		25
	Q4X8E3		Q4X3						400	10	10	10		25
	Q6X8E3		Q6X3						600	10	10	10		25
	Q2X8E4		Q2X4						200	25	25	25		50
	Q4X8E4		Q4X4						400	25	25	25		50
	Q6X8E4		Q6X4						600	25	25	25		50
1 A	Q201E3		Q2N3						200	10	10	10		25
	Q401E3		Q4N3						400	10	10	10		25
	Q601E3		Q6N3						600	10	10	10		25
	Q201E4		Q2N4						200	25	25	25		50
	Q401E4		Q4N4						400	25	25	25		50
	Q601E4		Q6N4						600	25	25	25		50
4 A		Q2004L3		Q2004F31		Q2004D3	Q2004V3		200	10	10	10		25
		Q4004L3		Q4004F31		Q4004D3	Q4004V3		400	10	10	10		25
		Q6004L3		Q6004F31		Q6004D3	Q6004V3		600	10	10	10		25
		Q2004L4		Q2004F41		Q2004D4	Q2004V4		200	25	25	25		50
		Q4004L4		Q4004F41		Q4004D4	Q4004V4		400	25	25	25		50
		Q6004L4		Q6004F41		Q6004D4	Q6004V4		600	25	25	25		50
		Q8004L4				Q8004D4	Q8004V4		800	25	25	25		50
		QK004L4				QK004D4	QK004V4		1000	25	25	25		50
6 A		Q2006L4		Q2006F41	Q2006R4		Q2006N4	200	25	25	25		50	
		Q4006L4		Q4006F41	Q4006R4		Q4006N4	400	25	25	25		50	
		Q6006L5		Q6006F51	Q6006R5		Q6006N5	600	50	50	50		75	
		Q8006L5			Q8006R5		Q8006N5	800	50	50	50		75	
		QK006L5			QK006R5		QK006N5	1000	50	50	50		75	
8 A		Q2008L4		Q2008F41	Q2008R4		Q2008N4	200	25	25	25		50	
		Q4008L4		Q4008F41	Q4008R4		Q4008N4	400	25	25	25		50	
		Q6008L5		Q6008F51	Q6008R5		Q6008N5	600	50	50	50		75	
		Q8008L5			Q8008R5		Q8008N5	800	50	50	50		75	
		QK008L5			QK008R5		QK008N5	1000	50	50	50		75	

See "General Notes" on page E2 - 4 and "Electrical Specification Notes" on page E2 - 5.

I_{DRM}			V_{TM}	V_{GT}	I_H	I_{GTM}	P_{GM}	$P_{G(AV)}$	I_{TSM}	$dv/dt(c)$	dv/dt		t_{gt}	I^2t	di/dt
(1) (16)			(1) (5)	(2) (6) (15) (18) (19)	(1) (8) (12)	(14)	(14)		(9) (13)	(1) (4) (13)	(1)		(10)		
mAmps			Volts	Volts					Amps		Volts/ μ Sec				
$T_C = 25^\circ C$	$T_C = 100^\circ C$	$T_C = 125^\circ C$	$T_C = 25^\circ C$	$T_C = 25^\circ C$	mAmps	Amps	Watts	Watts	60/50 Hz	Volts/ μ Sec	$T_C = 100^\circ C$	$T_C = 125^\circ C$	μ Sec	Amp ² Sec	Amps/ μ Sec
MAX			MAX	MAX	MAX					TYP	MIN		TYP		
0.02	0.5	1	1.6	2	15	1	10	0.2	10/8.3	1	40	30	2.5	0.41	20
0.02	0.5	1	1.6	2	15	1	10	0.2	10/8.3	1	35	25	2.5	0.41	20
0.02	0.5	1	1.6	2	15	1	10	0.2	10/8.3	1	25	15	2.5	0.41	20
0.02	0.5	1	1.6	2.5	25	1	10	0.2	10/8.3	1	50	40	3	0.41	20
0.02	0.5	1	1.6	2.5	25	1	10	0.2	10/8.3	1	45	35	3	0.41	20
0.02	0.5	1	1.6	2.5	25	1	10	0.2	10/8.3	1	35	25	3	0.41	20
0.02	0.5	1	1.6	2	15	1	10	0.2	20/16.7	1	40	30	2.5	1.6	30
0.02	0.5	1	1.6	2	15	1	10	0.2	20/16.7	1	40	30	2.5	1.6	30
0.02	0.5	1	1.6	2	15	1	10	0.2	20/16.7	1	30	20	2.5	1.6	30
0.02	0.5	1	1.6	2.5	25	1	10	0.2	20/16.7	1	50	40	3	1.6	30
0.02	0.5	1	1.6	2.5	25	1	10	0.2	20/16.7	1	50	40	3	1.6	30
0.02	0.5	1	1.6	2.5	25	1	10	0.2	20/16.7	1	40	30	3	1.6	30
0.05	0.5	2	1.6	2	20	1.2	15	0.3	55/46	2	50	40	2.5	12.5	50
0.05	0.5	2	1.6	2	20	1.2	15	0.3	55/46	2	50	40	2.5	12.5	50
0.05	0.5	2	1.6	2	20	1.2	15	0.3	55/46	2	40	30	2.5	12.5	50
0.05	0.5	2	1.6	2.5	30	1.2	15	0.3	55/46	2	100	75	3	12.5	50
0.05	0.5	2	1.6	2.5	30	1.2	15	0.3	55/46	2	100	75	3	12.5	50
0.05	0.5	2	1.6	2.5	30	1.2	15	0.3	55/46	2	75	50	3	12.5	50
0.05	0.5	2	1.6	2.5	30	1.2	15	0.3	55/46	2	60	40	3	12.5	50
0.05	3		1.6	2.5	30	1.2	15	0.3	55/46	2	50		3	12.5	50
0.05	0.5	2	1.6	2.5	50	1.6	18	0.5	80/65	4	200	120	3	26.5	70
0.05	0.5	2	1.6	2.5	50	1.6	18	0.5	80/65	4	200	120	3	26.5	70
0.05	0.5	2	1.6	2.5	50	1.6	18	0.5	80/65	4	150	100	3	26.5	70
0.05	0.5	2	1.6	2.5	50	1.6	18	0.5	80/65	4	125	85	3	26.5	70
0.05	3		1.6	2.5	50	1.6	18	0.5	80/65	4	100		3	26.5	70
0.05	0.5	2	1.6	2.5	50	1.8	20	0.5	100/83	4	250	150	3	41	70
0.05	0.5	2	1.6	2.5	50	1.8	20	0.5	100/83	4	250	150	3	41	70
0.05	0.5	2	1.6	2.5	50	1.8	20	0.5	100/83	4	220	125	3	41	70
0.05	0.5	2	1.6	2.5	50	1.8	20	0.5	100/83	4	150	100	3	41	70
0.05	3		1.6	2.5	50	1.8	20	0.5	100/83	4	100		3	41	70

See "General Notes" on page E2 - 4 and "Electrical Specification Notes" on page E2 - 5.

I _{T(RMS)} (4) (16)	Part Number					V _{DRM} (1)	I _{GT} (3) (7) (15)					I _{DRM} (1) (16)		
	Isolated		Non-isolated				mAmps					mAmps		
 TO-3 Fastpak	 TO-220	 TO-202	 TO-220	 TO-263 D ² Pak	Volts	QI	QII	QIII	QIV	QIV	T _C = 25 °C	T _C = 100 °C	T _C = 125 °C	
MAX	See "Package Dimensions" section for variations. (11)					MIN	MAX				TYP	MAX		
10 A		Q2010L4		Q2010R4	Q2010N4	200	25	25	25	50		0.05	1	
		Q4010L4		Q4010R4	Q4010N4	400	25	25	25	50		0.05	1	
		Q6010L4		Q6010R4	Q6010N4	600	25	25	25	50		0.05	1	
		Q8010L4		Q8010R4	Q8010N4	800	25	25	25	50		0.1	1	
		QK010L4		QK010R4	QK010N4	1000	25	25	25	50		0.1	3	
		Q2010L5	Q2010F51	Q2010R5	Q2010N5	200	50	50	50		75	0.05	0.5	2
		Q4010L5	Q4010F51	Q4010R5	Q4010N5	400	50	50	50		75	0.05	0.5	2
		Q6010L5	Q6010F51	Q6010R5	Q6010N5	600	50	50	50		75	0.05	0.5	2
15 A						800	50	50	50		75	0.1	0.5	2
						1000	50	50	50		75	0.1	3	
		Q2015L5		Q2015R5	Q2015N5	200	50	50	50			0.05	0.5	2
		Q4015L5		Q4015R5	Q4015N5	400	50	50	50			0.05	0.5	2
		Q6015L5		Q6015R5	Q6015N5	600	50	50	50			0.05	0.5	2
25 A						800	50	50	50			0.1	1	3
						1000	50	50	50			0.1	3	
				Q2025R5	Q2025N5	200	50	50	50			0.1	1	3
				Q4025R5	Q4025N5	400	50	50	50			0.1	1	3
				Q6025R5	Q6025N5	600	50	50	50			0.1	1	3
				Q8025R5	Q8025N5	800	50	50	50			0.1	1	3
				QK025R5	QK025N5	1000	50	50	50			0.1	3	
35 A	Q6025P5					600	50	50	50		120	0.1		5
	Q8025P5					800	50	50	50		120	0.1		5
35 A	Q6035P5					600	50	50	50		120	0.1		5
	Q8035P5					800	50	50	50		120	0.1		5

Specific Test Conditions

di/dt — Maximum rate-of-change of on-state current; $I_{GT} = 200$ mA with ≤ 0.1 μ s rise time

dv/dt — Critical rate-of-rise of off-state voltage at rated V_{DRM} gate open

$dv/dt(c)$ — Critical rate-of-rise of commutation voltage at rated V_{DRM} and $I_{T(RMS)}$ commutating $di/dt = 0.54$ rated $I_{T(RMS)}$ /ms; gate unenergized

I^2t — RMS surge (non-repetitive) on-state current for period of 8.3 ms for fusing

I_{DRM} — Peak off-state current, gate open; $V_{DRM} =$ maximum rated value

I_{GT} — DC gate trigger current in specific operating quadrants; $V_D = 12$ V dc

I_{GTM} — Peak gate trigger current

I_H — Holding current (DC); gate open

$I_{T(RMS)}$ — RMS on-state current conduction angle of 360°

I_{TSM} — Peak one-cycle surge

$P_{G(AV)}$ — Average gate power dissipation

P_{GM} — Peak gate power dissipation; $I_{GT} \leq I_{GTM}$

t_{gt} — Gate controlled turn-on time; $I_{GT} = 200$ mA with 0.1 μ s rise time

V_{DRM} — Repetitive peak blocking voltage

V_{GT} — DC gate trigger voltage; $V_D = 12$ V dc; $R_L = 60$ Ω

V_{TM} — Peak on-state voltage at maximum rated RMS current

General Notes

- All measurements are made at 60 Hz with a resistive load at an ambient temperature of $+25^\circ C$ unless specified otherwise.
- Operating temperature range (T_J) is $-65^\circ C$ to $+125^\circ C$ for TO-92, $-25^\circ C$ to $+125^\circ C$ for Fastpak, and $-40^\circ C$ to $+125^\circ C$ for all other devices.
- Storage temperature range (T_S) is $-65^\circ C$ to $+150^\circ C$ for TO-92, $-40^\circ C$ to $+150^\circ C$ for TO-202, and $-40^\circ C$ to $+125^\circ C$ for all other devices.
- Lead solder temperature is a maximum of $230^\circ C$ for 10 seconds, maximum; $\geq 1/16"$ (1.59 mm) from case.
- The case temperature (T_C) is measured as shown on the dimensional outline drawings. See "Package Dimensions" section of this catalog.

V_{TM}	V_{GT}	I_H	I_{GTM}	P_{GM}	$P_{G(AV)}$	I_{TSM}	$dv/dt(c)$	dv/dt		t_{gt}	I^2t	di/dt
(1) (5)	(2) (6) (15) (18) (19)	(1) (8) (12)	(14)	(14)		(9) (13)	(1) (4) (13)	(1)		(10) (17)		
Volts	Volts					Amps		Volts/ μ Sec				
$T_C = 25^\circ C$	$T_C = 25^\circ C$	mAmps	Amps	Watts	Watts	60/50 Hz	Volts/ μ Sec	$T_C = 100^\circ C$	$T_C = 125^\circ C$	μ Sec	Amps ² Sec	Amps/ μ Sec
MAX	MAX	MAX					TYP	MIN		TYP		
1.6	2.5	35	1.8	20	0.5	120/100	2	150		3	60	70
1.6	2.5	35	1.8	20	0.5	120/100	2	150		3	60	70
1.6	2.5	35	1.8	20	0.5	120/100	2	100		3	60	70
1.6	2.5	35	1.8	20	0.5	120/100	2	75		3	60	70
1.6	2.5	35	1.8	20	0.5	120/100	2	50		3	60	70
1.6	2.5	50	1.8	20	0.5	120/100	4	350	225	3	60	70
1.6	2.5	50	1.8	20	0.5	120/100	4	350	225	3	60	70
1.6	2.5	50	1.8	20	0.5	120/100	4	300	200	3	60	70
1.6	2.5	50	1.8	20	0.5	120/100	4	250	175	3	60	70
1.6	2.5	50	1.8	20	0.5	120/100	4	150		3	60	70
1.6	2.5	70	2	20	0.5	200/167	4	400	275	4	166	100
1.6	2.5	70	2	20	0.5	200/167	4	400	275	4	166	100
1.6	2.5	70	2	20	0.5	200/167	4	350	225	4	166	100
1.6	2.5	70	2	20	0.5	200/167	4	300	200	4	166	100
1.6	2.5	70	2	20	0.5	200/167	4	200		4	166	100
1.8	2.5	100	2	20	0.5	200/167	5	400	275	4	166	100
1.8	2.5	100	2	20	0.5	200/167	5	400	275	4	166	100
1.8	2.5	100	2	20	0.5	200/167	5	350	225	4	166	100
1.8	2.5	100	2	20	0.5	200/167	5	300	200	4	166	100
1.8	2.5	100	2	20	0.5	200/167	5	200		4	166	100
1.4	2.75	50	2	20	0.5	250/220	5	550	475	3	260	100
1.4	2.75	50	2	20	0.5	250/220	5	450	400	3	260	100
1.5	2.75	50	2	20	0.5	350/300	5	550	475	3	508	100
1.5	2.75	50	2	20	0.5	350/300	5	450	400	3	508	100

Electrical Specification Notes

- (1) For either polarity of MT2 with reference to MT1 terminal
- (2) For either polarity of gate voltage (V_{GT}) with reference to MT1 terminal
- (3) See Gate Characteristics and Definition of Quadrants.
- (4) See Figure E2.1 through Figure E2.7 for current rating at specific operating temperature.
- (5) See Figure E2.8 through Figure E2.10 for i_T versus v_T .
- (6) See Figure E2.12 for V_{GT} versus T_C .
- (7) See Figure E2.11 for I_{GT} versus T_C .
- (8) See Figure E2.14 for I_H versus T_C .
- (9) See Figure E2.13 for surge rating with specific durations.
- (10) See Figure E2.15 for t_{gt} versus I_{GT} .
- (11) See package outlines for lead form configurations. When ordering special lead forming, add type number as suffix to part number.
- (12) Initial on-state current = 200 mA dc for 0.8 A to 10 A devices, 400 mA dc for 15 A to 35 A devices
- (13) See Figure E2.1 through Figure E2.6 for maximum allowable case temperature at maximum rated current.
- (14) Pulse width $\leq 10 \mu s$; $I_{GT} \leq I_{GTM}$

(15) $R_L = 60 \Omega$ for 0.8 A to 10 A triacs; $R_L = 30 \Omega$ for 15 A to 35 A triacs

(16) $T_C = T_J$ for test conditions in off state

(17) $I_{GT} = 300$ mA for 25 A and 35 A devices

(18) Quadrants I, II, III only

(19) Minimum non-trigger V_{GT} at 125 °C is 0.2 V for all except 50 mA MAX QIV devices which are 0.2 V at 110 °C.

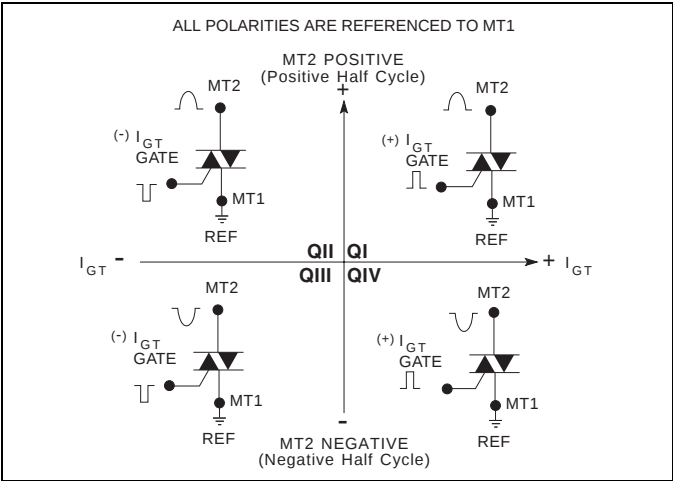
Gate Characteristics

Teccor triacs may be turned on between gate and MT1 terminals in the following ways:

- In-phase signals (with standard AC line) using Quadrants I and III
- Application of unipolar pulses (gate always positive or negative), using Quadrants II and III with negative gate pulses and Quadrants I and IV with positive gate pulses

However, due to higher gate requirements for Quadrant IV, it is recommended that only negative pulses be applied. If positive pulses are required, see "Sensitive Triacs" section of this catalog or contact the factory. Also, see Figure AN1002.8, "Amplified Gate" Thyristor Circuit.

In all cases, if maximum surge capability is required, pulses should be a minimum of one magnitude above I_{GT} rating with a steep rising waveform ($\leq 1 \mu s$ rise time).



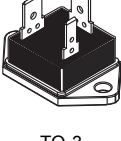
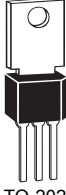
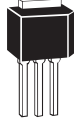
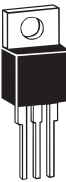
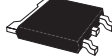
Definition of Quadrants

Electrical Isolation

Teccor's isolated triac packages will withstand a minimum high potential test of 2500 V ac rms from leads to mounting tab or base, over the operating temperature range of the device. The following isolation table shows standard and optional isolation ratings.

Electrical Isolation from Leads to Mounting Tab *		
V AC RMS	TO-220 Isolated	Fastpak Isolated
2500	Standard	Standard
4000	Optional **	N/A

* UL Recognized File E71639
** For 4000 V isolation, use V suffix in part number.

Thermal Resistance (Steady State) $R_{\theta JC}$ [$R_{\theta JA}$] (TYP.) °C/W										
Package Code	P	E	C	F	F2	L	R	D	V	N
Type	 TO-3 Fastpak	 TO-92	 Compak	 TO-202 Type 1	 TO-202 Type 2	 TO-220 Isolated	 TO-220 Non-isolated	 TO-252 D-Pak	 TO-251 V-Pak	 TO-263 D²Pak
0.8 A		60 [135]	60 *							
1 A		50 [95]	40 *							
4 A				3.5 [45]	6 [70]	3.6 [50]		3.5	6.0 [70]	
6 A				3.8		3.3	1.8 [45]			1.8
8 A				3.3		2.8	1.5			1.5
10 A				3.5		2.6	1.3			1.3
15 A						2.1	1.1			1.1
25 A	1.6						0.89			0.89
35 A	1.5									

* Mounted on 1 cm² copper foil surface; two-ounce copper foil

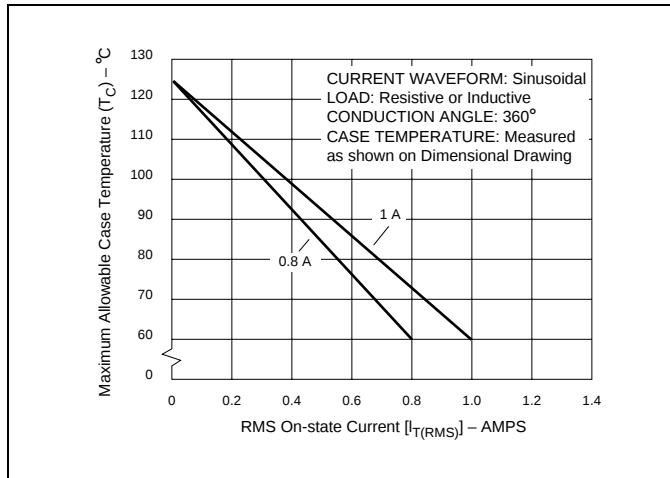


Figure E2.1 Maximum Allowable Case Temperature versus On-state Current (0.8 A and 1 A)

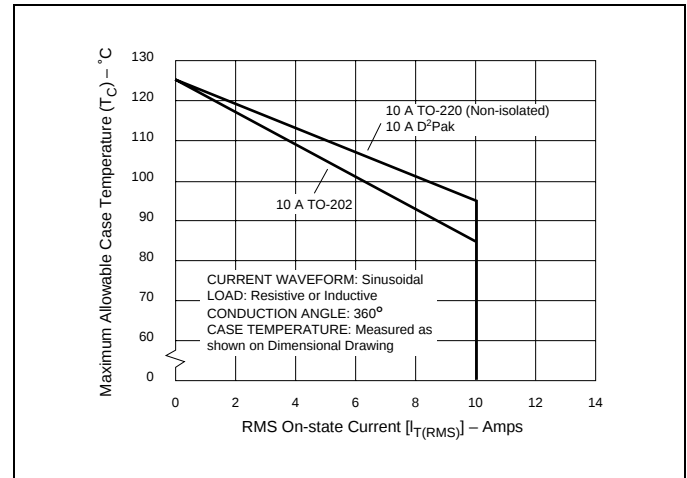


Figure E2.4 Maximum Allowable Case Temperature versus On-state Current (10 A)

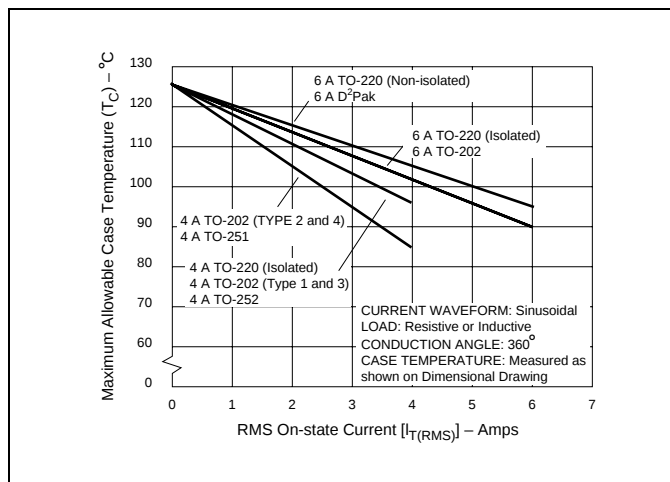


Figure E2.2 Maximum Allowable Case Temperature versus On-state Current (4 A and 6 A)

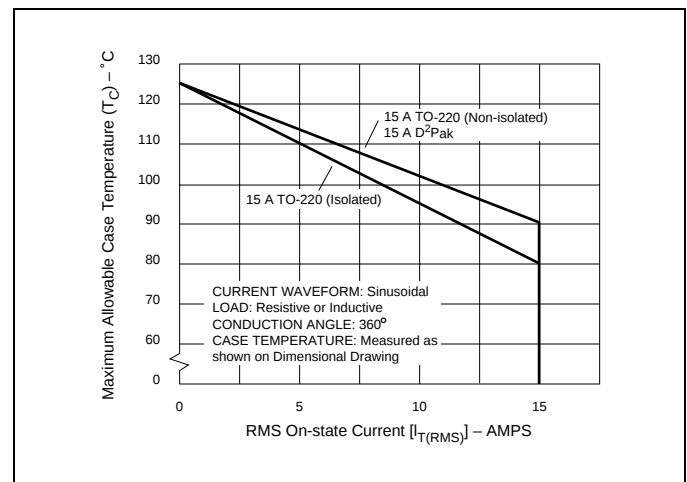


Figure E2.5 Maximum Allowable Case Temperature versus On-state Current (15 A)



Figure E2.3 Maximum Allowable Case Temperature versus On-state Current (8 A and 10 A)



Figure E2.6 Maximum Allowable Case Temperature versus On-state Current (25 A and 35 A)



Figure E2.7 Maximum Allowable Ambient Temperature versus On-state Current

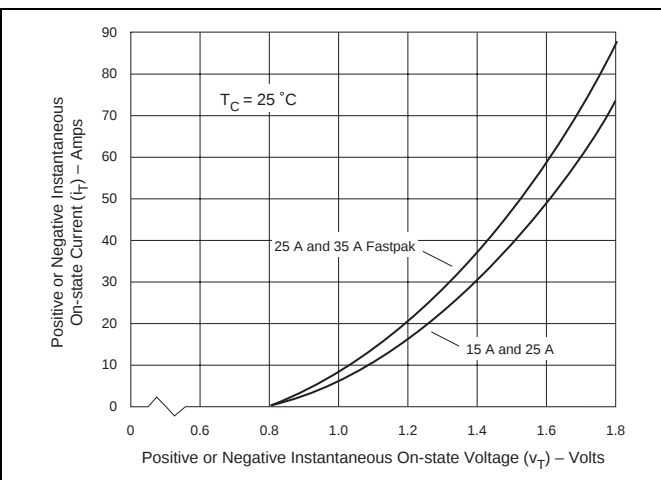


Figure E2.10 On-state Current versus On-state Voltage (Typical) (15 A and 25 A)

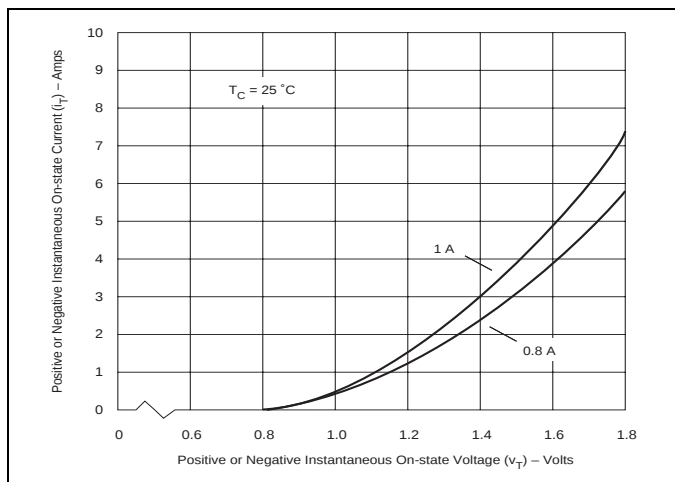


Figure E2.8 On-state Current versus On-state Voltage (Typical) (0.8 A and 1 A)

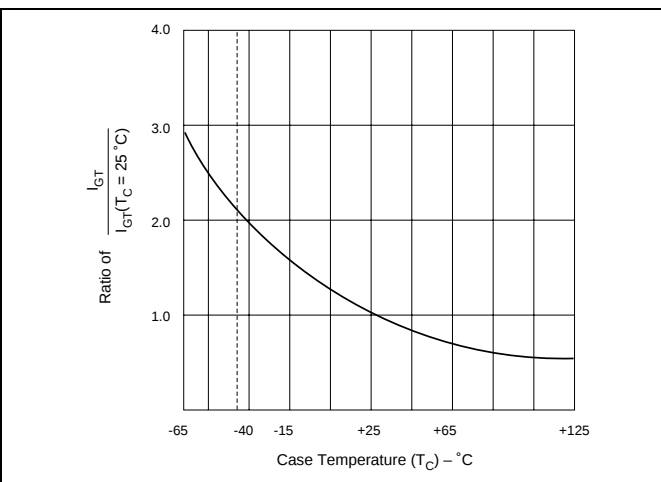


Figure E2.11 Normalized DC Gate Trigger Current for All Quadrants versus Case Temperature



Figure E2.9 On-state Current versus On-state Voltage (Typical) (4 A, 6 A, 8 A, and 10 A)

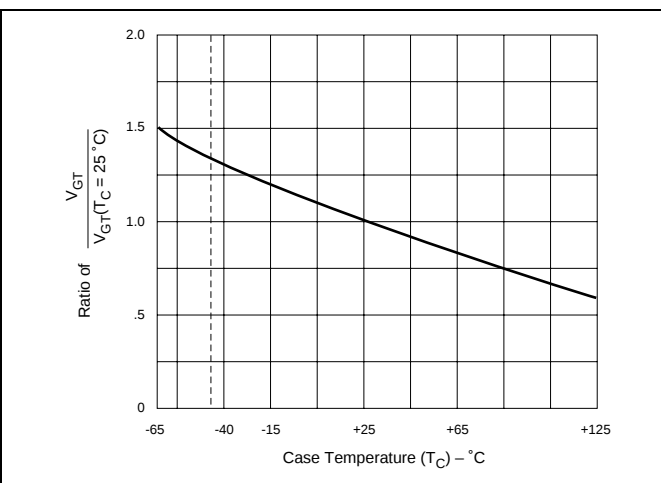


Figure E2.12 Normalized DC Gate Trigger Voltage for All Quadrants versus Case Temperature

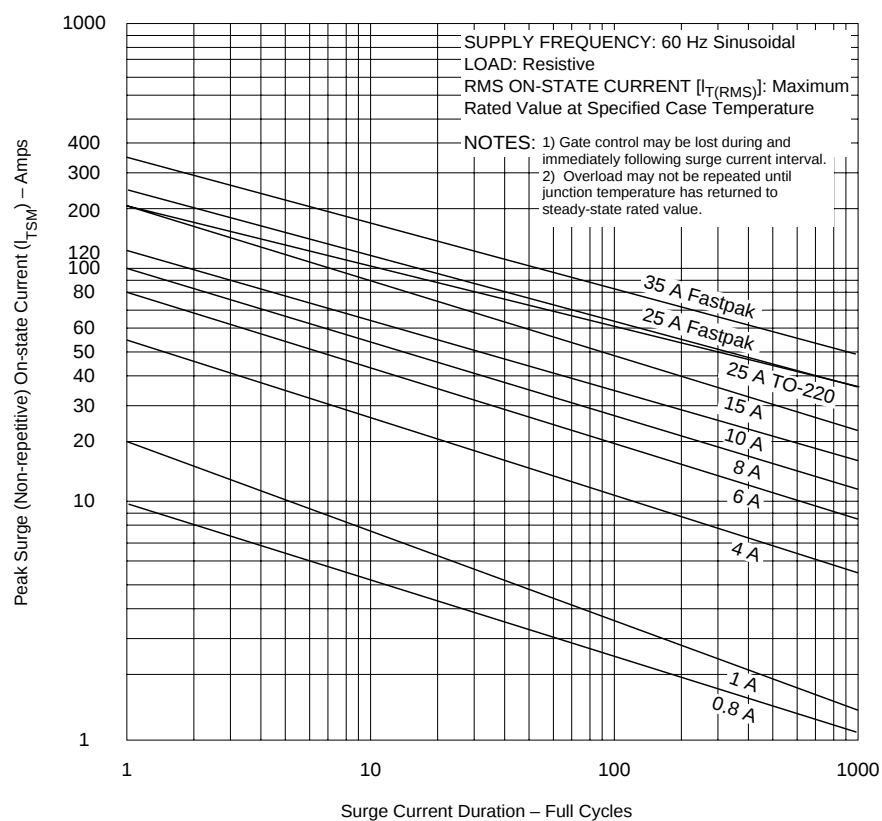


Figure E2.13 Peak Surge Current versus Surge Current Duration

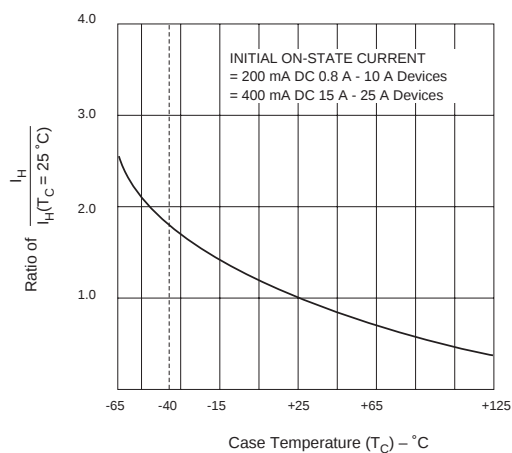


Figure E2.14 Normalized DC Holding Current versus Case Temperature

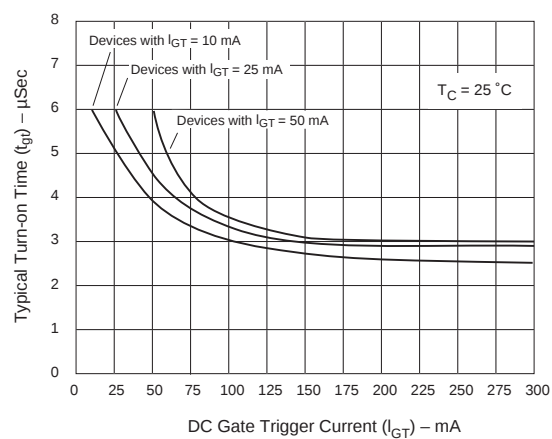


Figure E2.15 Turn-on Time versus Gate Trigger Current (Typical)

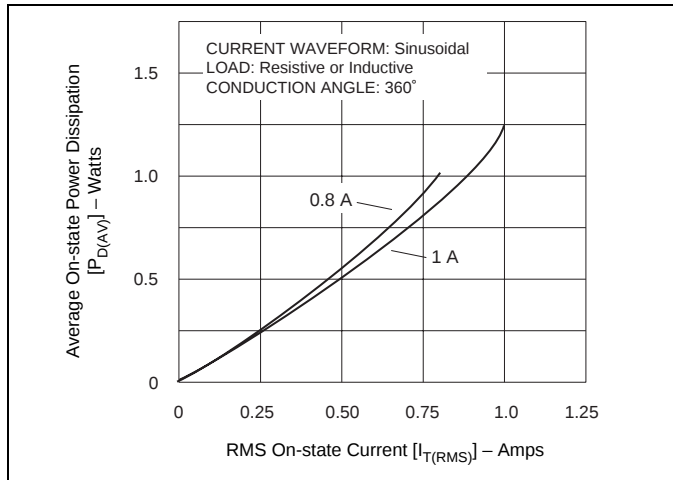


Figure E2.16 Power Dissipation (Typical) versus On-state Current (0.8 A and 1 A)

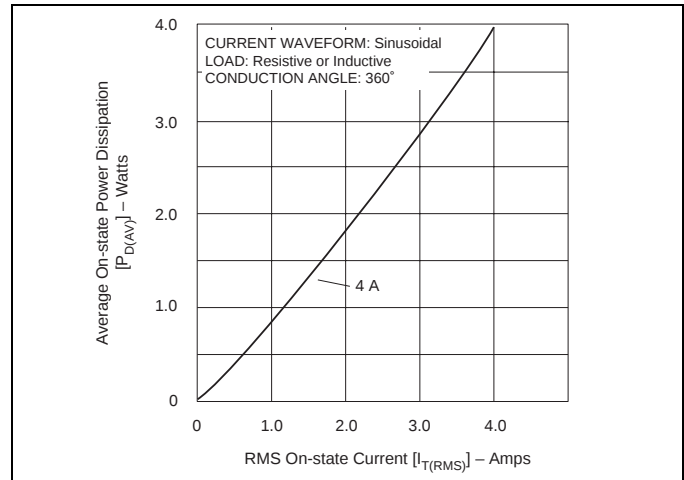


Figure E2.19 Power Dissipation (Typical) versus RMS On-state Current (4 A)

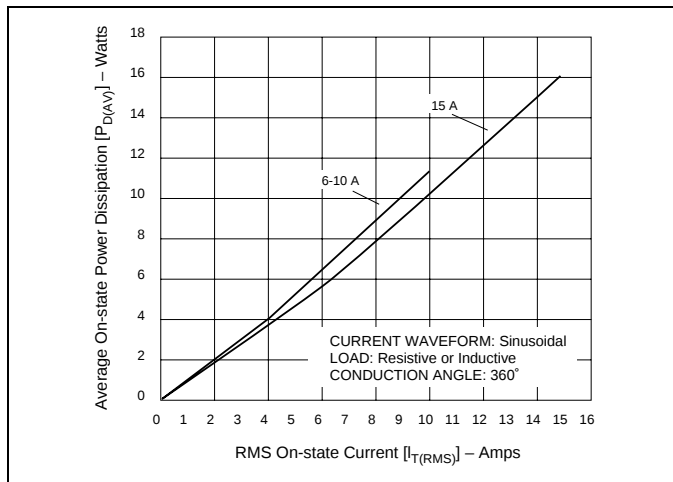


Figure E2.17 Power Dissipation (Typical) versus On-state Current (6 A to 10 A and 15 A)

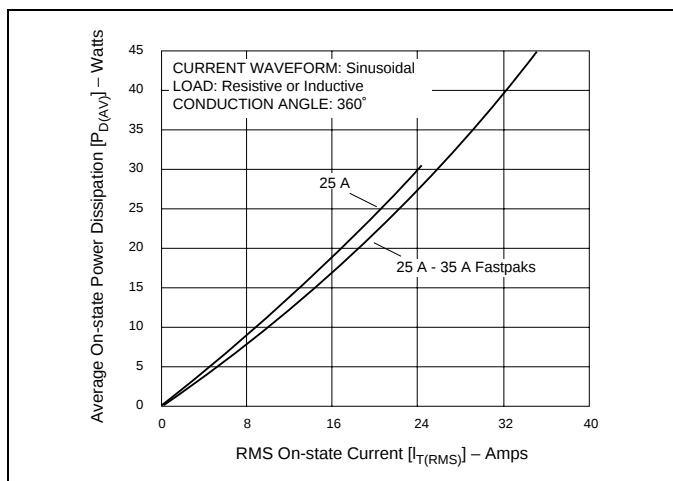


Figure E2.18 Power Dissipation (Typical) versus On-state Current (25 A to 35 A)

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

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Разъемы специального, военного и аэрокосмического назначения:

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«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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