COPACK (Si IGBT/SiC SBD) SOT-227 Power Module

V_{CES} =1200V
I_C = 80A @T_C= 100^{0}C
$V_{CE(SAT)}$ = 2.0V

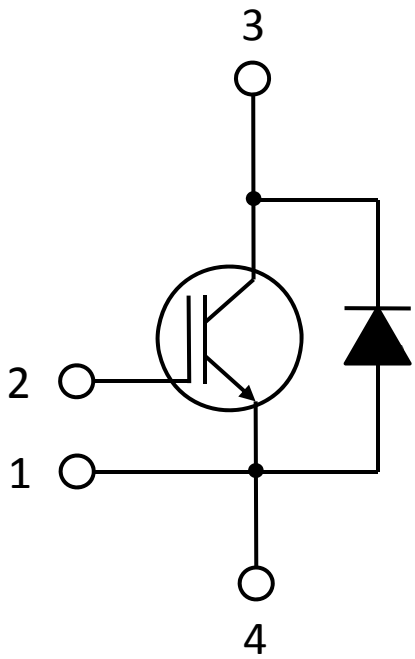
Features

- **High speed switching IGBT**
- Freewheeling diode with zero reverse recovery SiC SBDs
- **Low collector to emitter saturation voltage**
- Short circuit withstanding s time (10 μs min.)
- Kelvin reference for stable gate driving
- High junction temperature operation
- Positive temperature coefficient for easy to parallel mounting

Applications

- Photo Voltaic Inverter
- Aerospace actuators
- Server Power supplies
- High voltage AC/DC Converter
- Inductive heating and welding machine

RoHS



Benefits

- Outstanding power conversion efficiency at high switching frequency operation
- Low switching losses and Low EMI noises
- Very rugged and easy mount
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Easy paralleling due to positive T_C of V_F
- RoHS Compliant

Absolute Maximum Ratings (T_j=25^{o}C unless otherwise specified)

Parameters	Symbol	Conditions	Specifications	Units
Si IGBT				
Collector - Emitter Breakdown Voltage	V_{CES}		1200	V
Continuous Collector Current	I_C	T_C = 25 ^{0}C	160	A
		T_C = 100 ^{0}C	80	A

Gate-Emitter Voltage	V_{GES}		±20	V
Pulsed Collector Current	ICM		240	A
SiC SBDs				
Maximum Reverse Voltage	V_{RRM}		1200	V
Average Forward Current	I_{DAV}	T_j = 25 ^{0}C	30	A
		T_j = 150 ^{0}C	60	A
Non-repetitive Forward Surge Current	I_{FSM}	t=10 ms	TBD	A
		T=10 µs	TBD	A
COPACK Modules Thermal Properties				
Maximum Power Dissipation	P_D	T_C = 25 ^{0}C	480	W
		T_C = 100 ^{0}C	200	W
Operating Junction Temperature	T_j		-55 ~ 150	^{0}C
Storage Temperature	T_{STG}		-55 ~ 150	^{0}C

Electrical Characteristics (T_j=25^{o}C unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Units
OFF						
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V	--	--	2	mA
Gate-Emitter Leakage Current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	--	--	±500	nA
ON						
Gate-Emitter Threshold Voltage	$V_{GE(TH)}$	V_{GE} = V_{CE}, I_C = 80mA	4.5	6.5	8.5	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	V_{CE} = 15V, I_C = 80A, T_J= 25 ^{0}C	--	2.0	2.6	V
		V_{CE} = 15V, I_C = 80A, T_J= 125 ^{0}C	--	2.45	--	V
DYNAMIC						
Input Capacitance	C_{IES}	V_{CE} = 30V, V_{GE} = 0V, f = 1 MHz	--	10.3	--	nF
Output Capacitance	C_{OES}		--	300	--	pF
Reverse Transfer Capacitance	C_{RES}		--	200	--	pF
SWITCHING						
Turn-On Delay Time	$t_{d(on)}$	V_{CE}= 600V, I_C =80A R_G= 10Ω, V_{GE}= 15V Inductive Load, T_J=25 ^{0}C	--	60	--	ns
Rise Time	t_r		--	85	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	200	--	ns
Fall Time	t_f		--	60	--	ns
Turn-On Switching Energy Loss	E_{ON}		--	7.1	--	mJ
Turn-Off Switching Energy Loss	E_{OFF}		--	1.2	--	mJ
Turn-On Delay Time	$t_{d(on)}$		--	50	--	ns

Rise Time	t_r	V_{CE}= 600V, I_C =80A R_G= 10Ω, V_{GE}= 15V Inductive Load, T_J=125 ^{0}C	--	80	--	ns
Turn-Off Delay Time	$t_{d(off)}$		--	210	--	ns
Fall Time	t_f		--	120	--	ns
Turn-On Switching Energy Loss	E_{ON}		--	7.6	--	mJ
Turn-Off Switching Energy Loss	E_{OFF}		--	2.4	--	mJ
Total Gate Charge	Q_g	V_{CE}= 600V, I_C =80A V_{GE}= 15V	--	640	960	nC
Gate-Emitter Charge	Q_{ge}		--	80	120	nC
Gate-Collector Charge	Q_{gc}		--	300	450	nC
Short Circuit Withstanding Time	t_{sc}	V_{CE}= 600V, V_{GE}= 15V T_J=125 ^{0}C	--	--	10	μs

SiC Diode Rating and Characteristics (T_j=25^{o}C unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Units
Maximum peak repetitive reverse voltage	V_{RRM}		1200	--	--	V
Maximum Reverse Leakage Current	I_{RM}	V_R = 1200V, T_j = 25 ^{0}C	--	20	200	μA
		V_R = 1200V, T_j = 150 ^{0}C	--	2424	--	μA
Diode Forward Voltage	V_F	I_F = 40A, T_j = 25 ^{0}C	--	1.5	1.7	V
		I_F = 40A, T_j = 150 ^{0}C	--	2.3	--	V
Total Capacitive Charge	Q_C	V_R=1200 V, I_F<$I_{F,max}$	--	208	--	nC
Switching Time	t_C	dI_F/dt = 200 A/μs, T_j = 175 ^{0}C	--	--	20	ns
Total Capacitance	C	V_R = 1V, f = 1 MHz	--	3600	--	pF
		V_R = 600V, f = 1 MHz	--	228	--	pF
		V_R = 1200V, f = 1 MHz	--	172	--	pF

Thermal and Package Characteristics (T_j=25^{o}C unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Units
Junction to Case Thermal Resistance	R_{THJC}	IGBT chip	--	--	0.26	^{0}C/W
		SiC SBD chip	--	--	0.49	^{0}C/W
Mounting Torque	M_d				1.5	N-m
Terminal Connection Torque	M_{dt}		1.3	--	1.5	N-m
Package Weight	W_t			29		g
Isolation Voltage	V_{ISOL}	I_{ISOL} < 1mA, 50/60 Hz, t=1 min	2500	V		

IGBT Characteristics (2*40A dies in parallel)

Fig. 1 Output characteristics

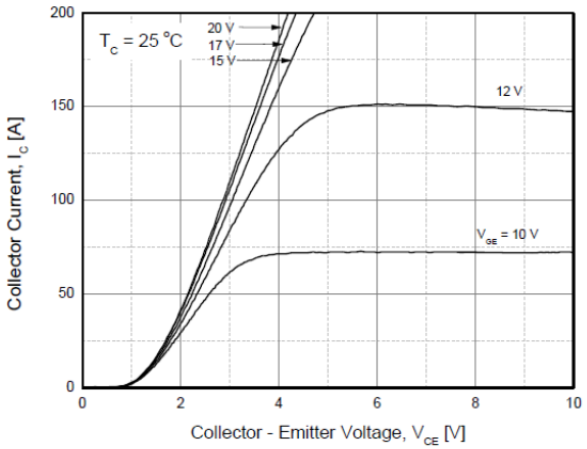


Fig. 2 Saturation voltage characteristics

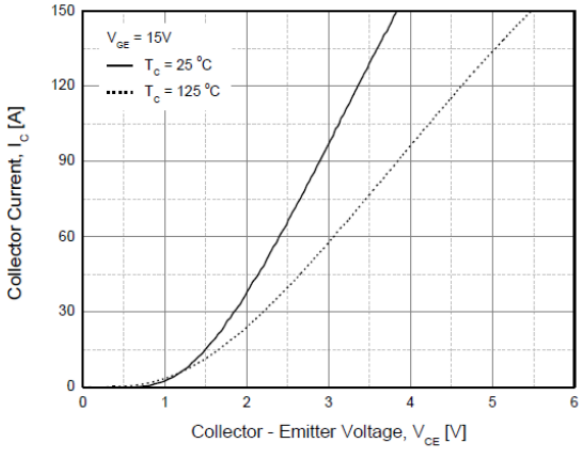


Fig. 3 Saturation voltage vs. collector current

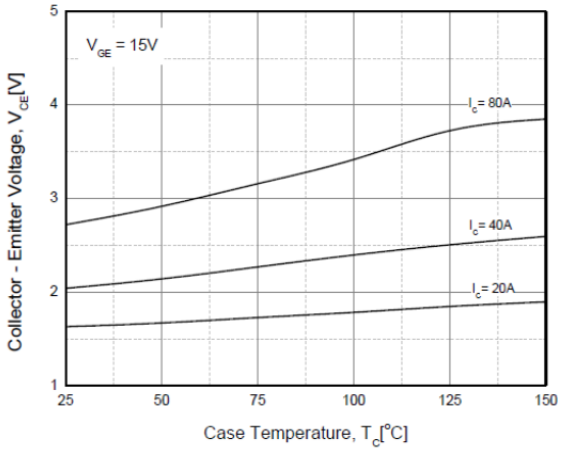


Fig. 4 Saturation voltage vs. gate bias

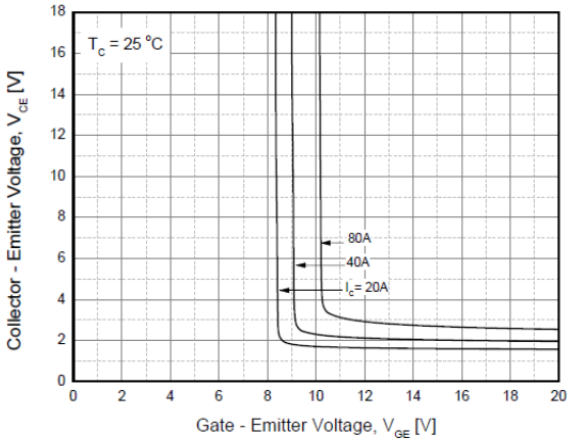


Fig. 5 Saturation voltage vs. gate bias

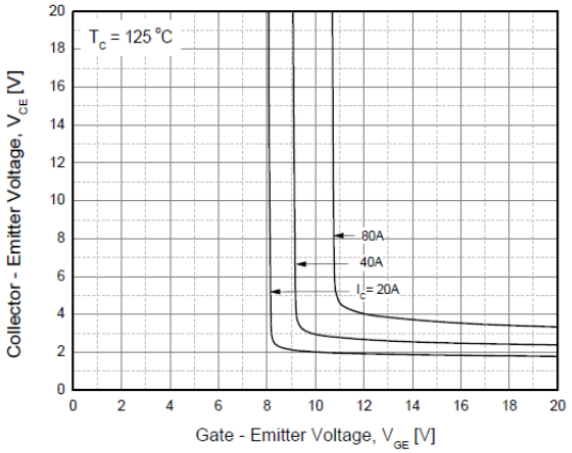


Fig. 6 Capacitance characteristics

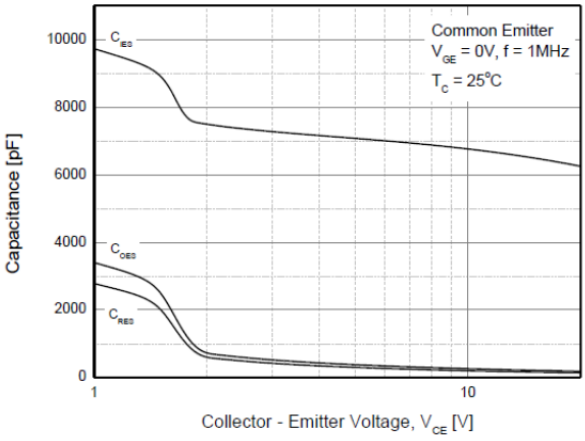


Fig. 7 Turn-on time vs. gate resistor

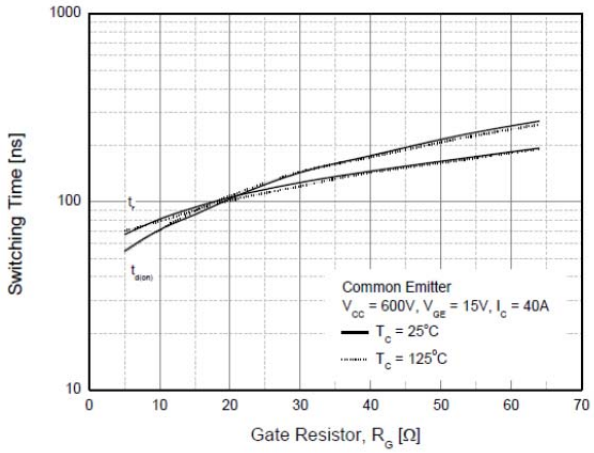


Fig. 8 Turn-off time vs. gate resistor

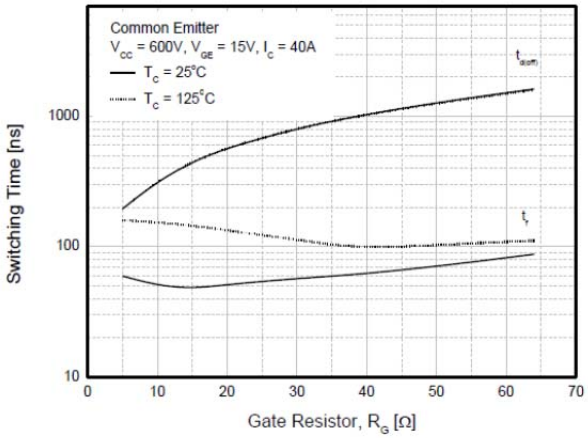


Fig. 9 Switching loss vs. gate resistor

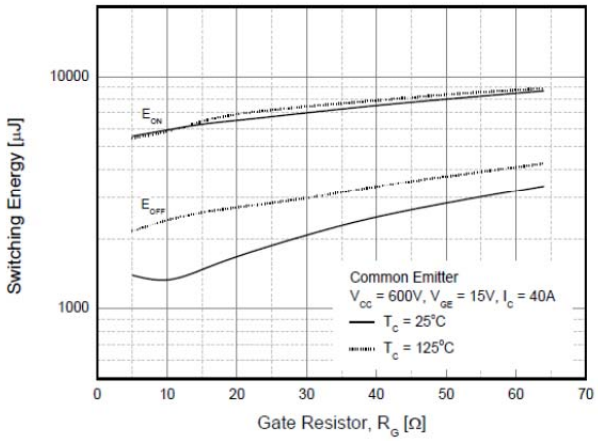


Fig. 10 Turn-on time vs. collector current

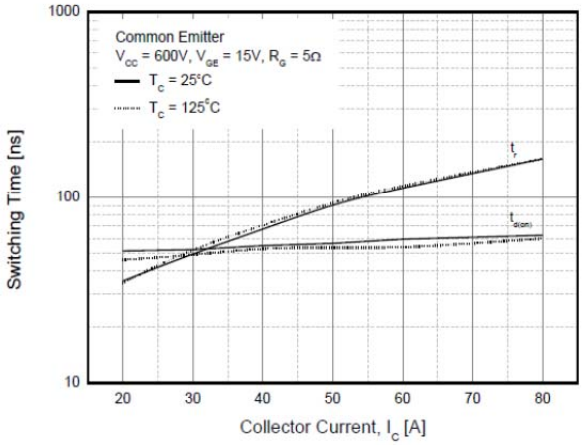


Fig. 11 Turn-off time vs. collector current

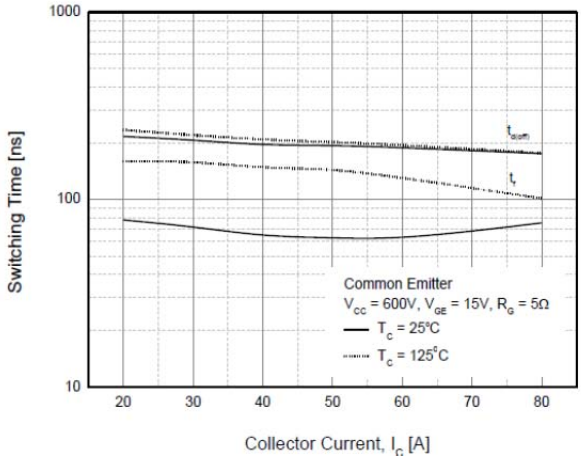


Fig. 12 Switching loss vs. collector current

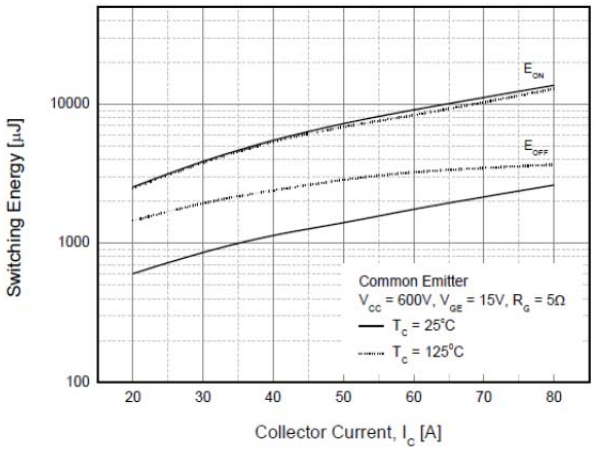


Fig. 13 Gate charge characteristics

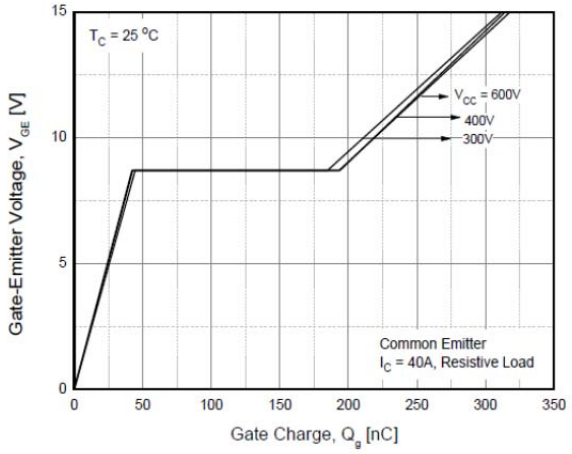


Fig. 14 SOA

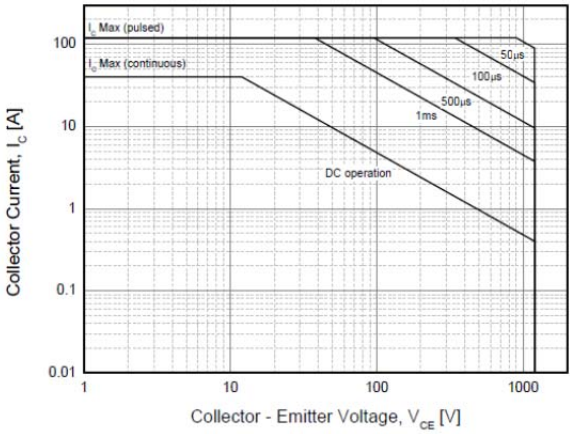


Fig. 15 RBSOA

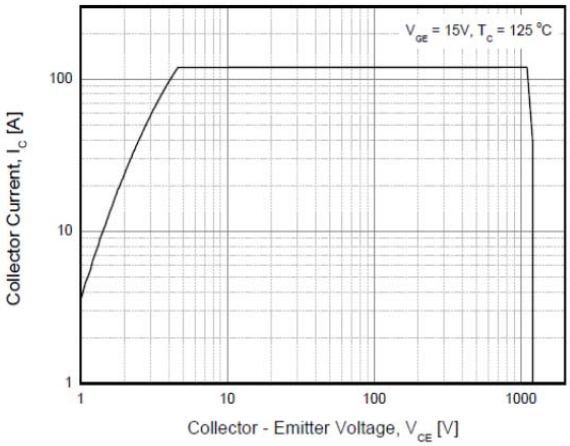
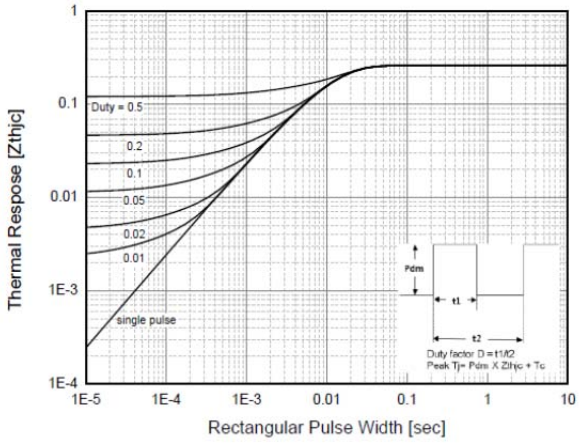


Fig. 16 Transient thermal impedance of IGBT



SiC Diode Characteristics (2*20A dies in parallel)

Fig. 17 Forward Characteristics

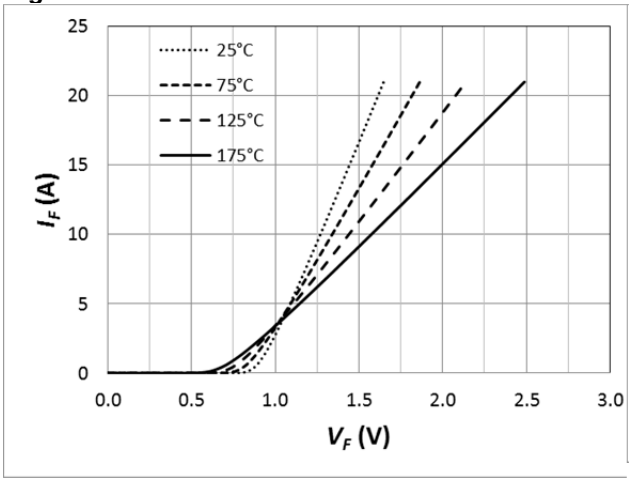


Fig. 18 Reverse Characteristics

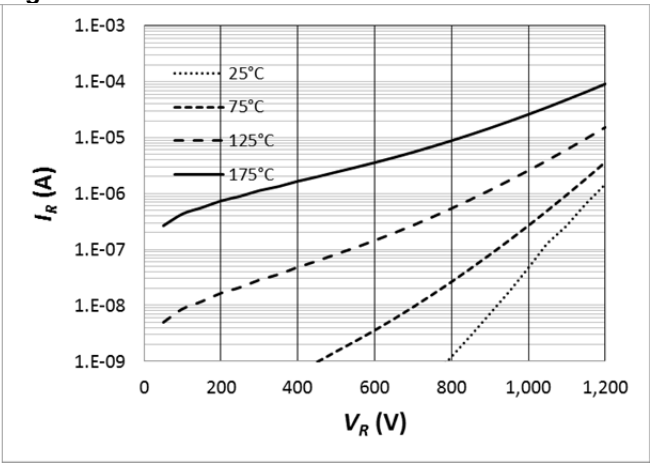


Fig. 19 Power Derating

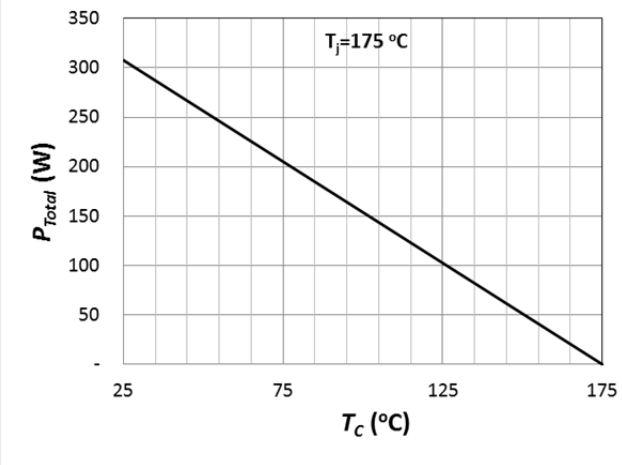


Fig. 20 Current Derating

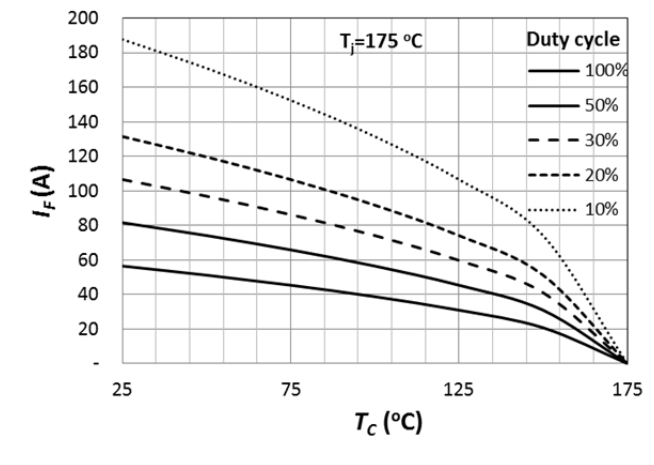


Fig. 21 Capacitance Curve

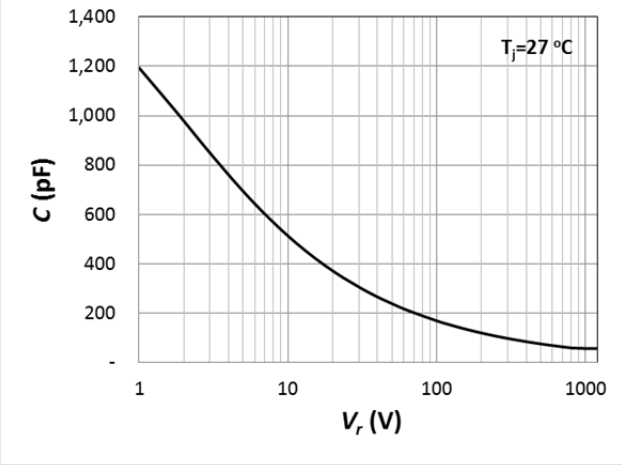
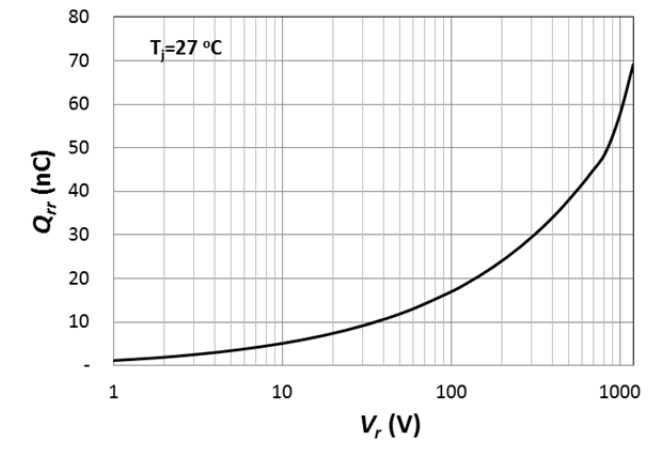
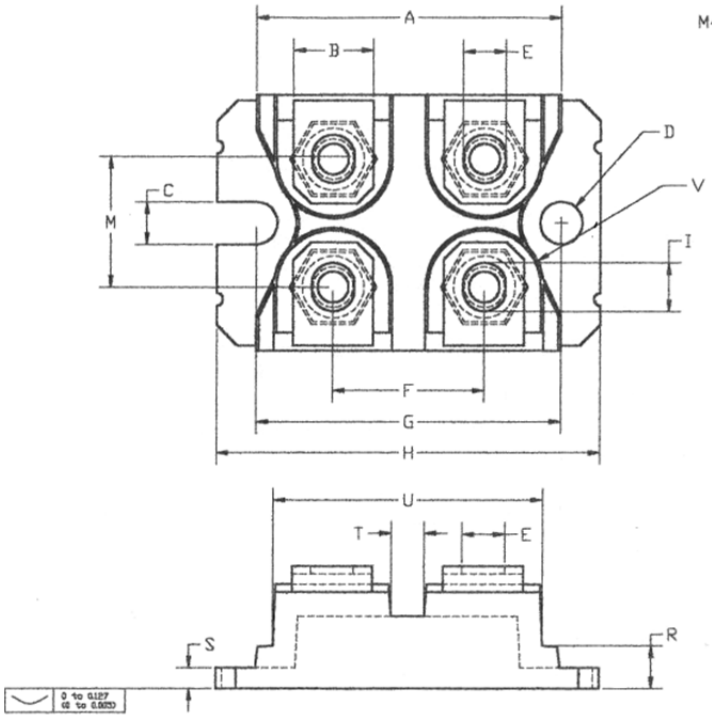


Fig. 22 Recovery Charge



SOT-227 Package Outline



DIM.	MILLIMETER Min.	MILLIMETER Max.	INCHES Min.	INCHES Max.
A	31.67	31.90	1.247	1.256
B	7.95	8.18	0.313	0.322
C	4.14	4.24	0.163	0.167
D	4.14	4.24	0.163	0.167
E	4.14	4.24	0.163	0.167
F	14.94	15.09	0.588	0.594
G	30.15	30.25	1.187	1.191
H	38.00	38.10	1.496	1.500
I	4.75	4.83	0.187	0.190
J	11.76	12.19	0.463	0.480
K	9.45	9.60	0.372	0.378
L	0.76	0.84	0.030	0.033
M	12.62	12.88	0.497	0.507
N	25.15	25.30	0990	0.996
O	24.79	25.04	0.976	0.986
P	2.74	3.15	0.108	0.124
Q	6.91	6.99	0.272	0.275
R	4.17	4.42	0.164	0.174
S	2.08	2.13	0.082	0.084
T	3.28	3.63	0.129	0.143
U	26.75	26.90	1.053	1.059
V	3.94	4.04	0.155	0.159

Revision History

Date	Revision	Notes
01/28/2016	1.0	Initial release

To obtain additional technical information or to place an order for this product, please contact us. The information in this datasheet is provided by Global Power Electronics, Inc. GPE reserves the right to make changes, corrections, modifications, and improvements without notice.

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Notes

- **RoHS Compliance**
  The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented March, 2013. RoHS Declarations for this product can be obtained from the Product Documentation sections of www.gptechgroup.com.

- **REACh Compliance**
  REACh substances of high concern (SVHCs) information is available for this product. Since the European Chemi- cal Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact our office at GPTG Headquarters in Lake Forest, California to insure you get the most up-to-date REACh SVHC Declaration.
  REACh banned substance information (REACh Article 67) is also available upon request.

- This product has not been designed or tested for use in, and is not intended for use in, applications implanted into the human body nor in applications in which failure of the product could lead to death, personal injury or property damage, including but not limited to equipment used in the operation of nuclear facilities, life-support machines, cardiac defibrillators or similar emergency medical equipment, aircraft navigation or communication or control systems, or air traffic control.

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