



**THE DATASHEET OF  
GCMS080A120S1-E1**



**1200V/80 mohm SiC MOSFET  
in SOT-227 Package**

$$V_{RRM} = 1200V$$

$$I_D = 20A @ T_C = 80^{\circ}C$$

$$R_{DS\_ON} = 80 \text{ mohm} @ T_J = 25^{\circ}C$$

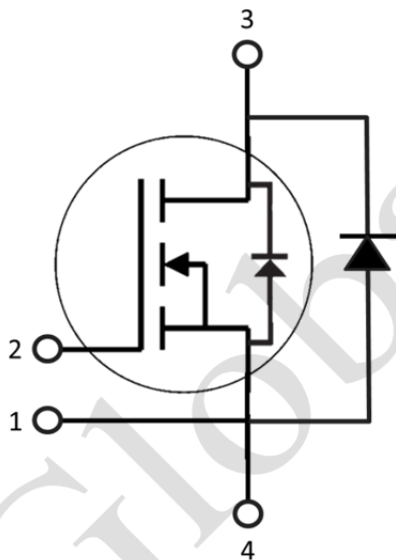


**Features**

- High speed switching SiC MOSFET
- Freewheeling diode with zero reverse recovery SiC SBDs
- Low  $R_{DS\_ON}$
- Simple to drive
- Low stray inductance
- High junction temperature operation
- Easy to parallel and mounting

**Applications**

- Photo Voltaic Inverter
- Motor Driver
- Multi-level Converter
- High voltage AC/DC Converter



**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  $V_f$
- Reduced cooling requirement
- RoHS Compliant

**Absolute Maximum Ratings** ( $T_j=25^{\circ}\text{C}$  unless otherwise specified)

Parameters	Symbol	Conditions	Specifications	Units
<b>SiC MOSFET</b>				
Maximum Drain-Source Voltage	$V_{DSS}$	$T_j = 25^{\circ}\text{C} \sim 150^{\circ}\text{C}$	1200	V
Continuous Drain Current	$I_D$	$T_j = 25^{\circ}\text{C}, V_{GS}=20\text{V}$	40	A
		$T_j = 150^{\circ}\text{C}, V_{GS}=20\text{V}$	20	A
Pulsed Drain Current	$I_{DS}$	Limited by $T_{j\_max}$	60	A
Gate-Source Voltage	$V_{GS}$		-10/+25	V
Maximum Power Dissipation	$P_D$	$T_C = 25^{\circ}\text{C}$	TBD	W
		$T_C = 100^{\circ}\text{C}$	TBD	W
Operating Junction Temperature	$T_j$		-40 ~ 150	$^{\circ}\text{C}$
Storage Temperature	$T_{STG}$		-40 ~ 125	$^{\circ}\text{C}$
<b>SiC SBDs</b>				
Maximum Reverse Voltage	$V_{RRM}$		1200	V
Average Forward Current	$I_{DAV}$	$T_j = 25^{\circ}\text{C}$	10	A
		$T_j = 150^{\circ}\text{C}$	5	A
Non-repetitive Forward Surge Current	$I_{FSM}$	Pulse width $t_p$ limited by $T_{jmax}$	20	A

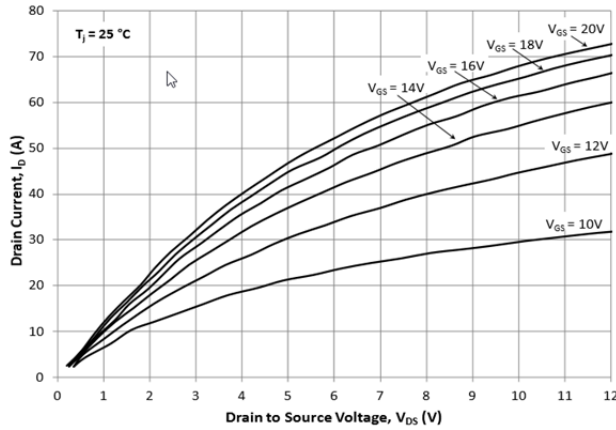
**Electrical Characteristics** ( $T_j=25^{\circ}\text{C}$  unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{V}, I_D=100\mu\text{A}$	1200	--	--	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=2.5\text{mA}, T_j = 25^{\circ}\text{C}$	1.7	2.2	--	V
		$V_{GS}=V_{DS}, I_D=2.5\text{mA}, T_j = 150^{\circ}\text{C}$	--	1.6	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}, T_j = 25^{\circ}\text{C}$	--	1	100	$\mu\text{A}$
		$V_{DS}=1200\text{V}, V_{GS}=0\text{V}, T_j = 150^{\circ}\text{C}$	--	TBD	--	$\mu\text{A}$
Gate Source Leakage Current	$I_{GSS}$	$V_{GS}=20\text{V}, V_{DS}=0\text{V}$	--	--	250	nA
Internal Gate Resistance	$R_G$	$f = 1\text{MHz}, V_{AC} = 25\text{mV}$ , ESR of $C_{ISS}$		1.5		$\Omega$
Drain-Source On-state Resistance	$R_{DS(ON)}$	$V_{GS} = 20\text{V}, I_D=20\text{A}, T_j = 25^{\circ}\text{C}$	--	80	--	m $\Omega$
		$V_{GS} = 20\text{V}, I_D=20\text{A}, T_j = 150^{\circ}\text{C}$	--	150	--	m $\Omega$
Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{V}, V_{DS} = 800\text{V}$ , freq = 1MHz, $V_{AC} = 25\text{mV}$ , measured at one MOSFET.	--	950	--	pF
Output Capacitance	$C_{OSS}$		--	80	--	pF
Reverse transfer Capacitance	$C_{RSS}$		--	6.5	--	pF
Turn-on Delay Time	$t_{d(on)i}$	$V_{DS} = 800\text{V}, V_{GS} = -5/20\text{V}$	--	15	--	ns
Rise Time	$t_{ri}$	$I_D = 20\text{A}, R_{G(ext)} = 2.5\Omega$ , $L = 856\mu\text{H}$ . Refer to definition.	--	35	--	ns
Turn-off Delay Time	$t_{d(off)i}$		--	32	--	ns

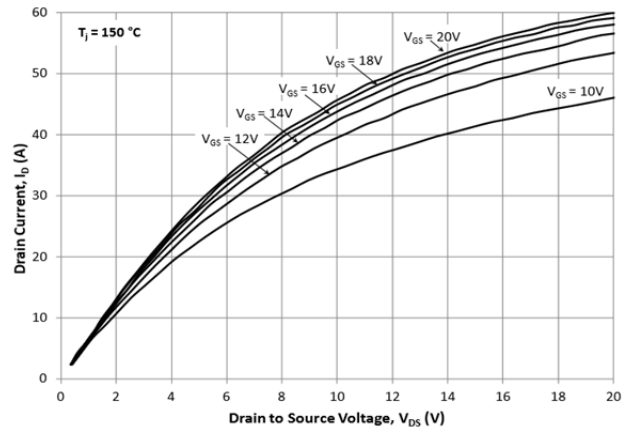
Fall Time	$t_{fi}$		--	26	--	ns
Turn-on Switching Loss	$E_{ON}$			0.4		mJ
Turn-off Switching Loss	$E_{OFF}$			0.25		mJ
Body Diode Forward Voltage	$V_{SD}$	$I_F = 10A, T_j = 25^\circ C$	--	3.3	--	V
		$I_F = 10A, T_j = 150^\circ C$	--	TBD	--	V
Total Gate Charge	$Q_g$	$V_{DS}=800V, V_{GS} = -5/20V$	--	49.2	--	nC
Gate-Source Charge	$Q_{GS}$	$I_D = 20A$	--	10.8	--	nC
Gate-Drain Charge	$Q_{GD}$		--	18	--	nC
<b>SiC SBDs</b>						
Maximum peak repetitive reverse voltage	$V_{RRM}$		1200	--	--	V
Maximum Reverse Leakage Current	$I_{RM}$	$V_R = 1200V, T_j = 25^\circ C$	--	1	10	$\mu A$
		$V_R = 1200V, T_j = 150^\circ C$	--	30	300	$\mu A$
Diode Forward Voltage	$V_F$	$I_F = 5A, T_j = 25^\circ C$	--	1.6	1.8	V
		$I_F = 5A, T_j = 150^\circ C$	--	2.2	2.7	V
Total Capacitive Charge	$Q_C$	$V_R=1200V, I_F < I_{F,max}$	--	22	--	nC
Switching Time	$t_C$	$di_F/dt = 500 A/\mu s, T_j = 25^\circ C$	--	--	10	ns
Total Capacitance	C	$V_R = 1V, f = 1 MHz$	--	317	--	pF
		$V_R = 600V, f = 1 MHz$	--	19	--	pF
		$V_R = 1200V, f = 1 MHz$	--	18	--	pF

**Thermal and Package Characteristics ( $T_j=25^\circ C$  unless otherwise specified)**

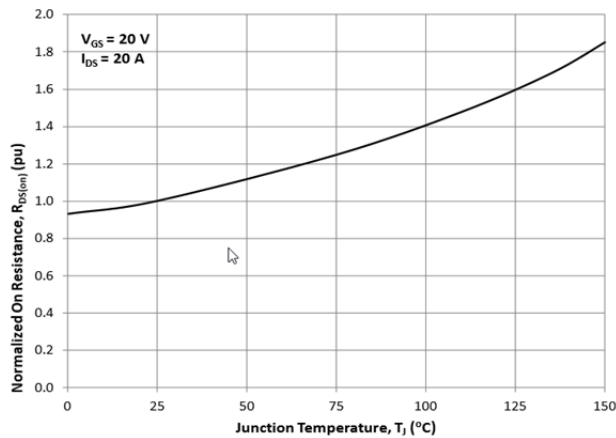
Parameters	Symbol	Conditions	Min	Typ	Max	Units
Junction to Case Thermal Resistance	$R_{THJC}$	Per MOSFET	--	--	0.6	$^\circ C/W$
		Per SBD			1.5	$^\circ C/W$
Mounting Torque	$M_d$				1.5	N-m
Terminal Connection Torque	$M_{dt}$		1.3	--	1.5	N-m
Package Weight	$W_t$			32		g
Isolation Voltage	$V_{ISOL}$	$I_{ISOL} < 1mA, 50/60Hz, t=1 min$	2500			V



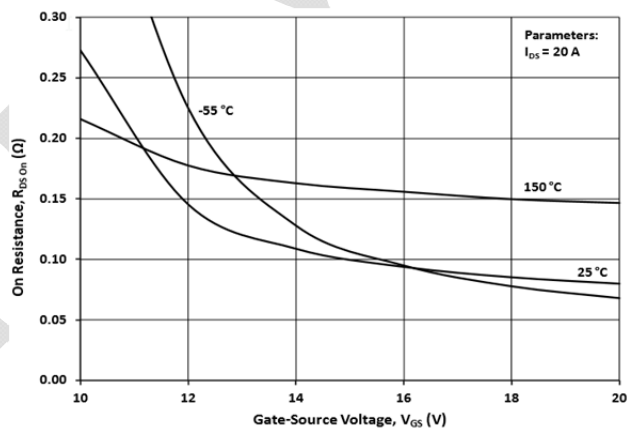
Typical Forward Characteristics  $T_j=25\text{ }^\circ\text{C}$



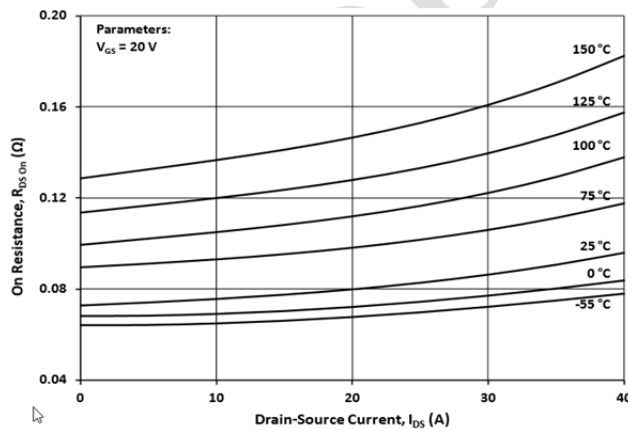
Typical Forward Characteristics  $T_j=150\text{ }^\circ\text{C}$



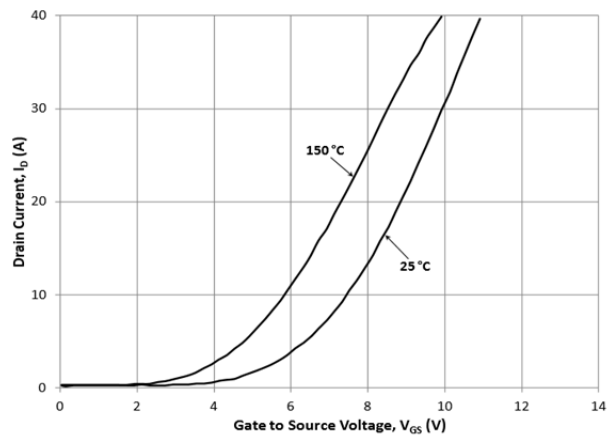
Normalized  $R_{DS\_ON}$  vs. Temperature



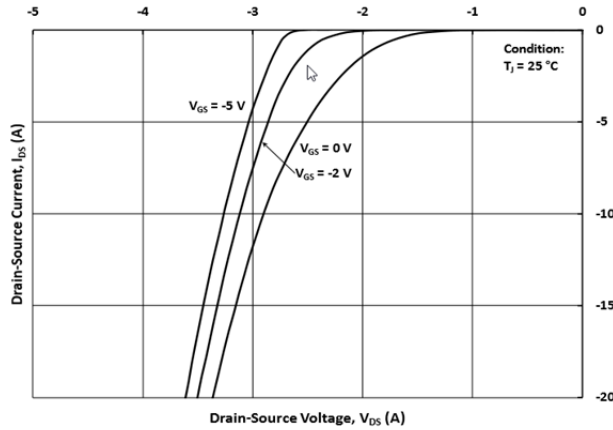
$R_{DS\_ON}$  vs. Gate Voltage



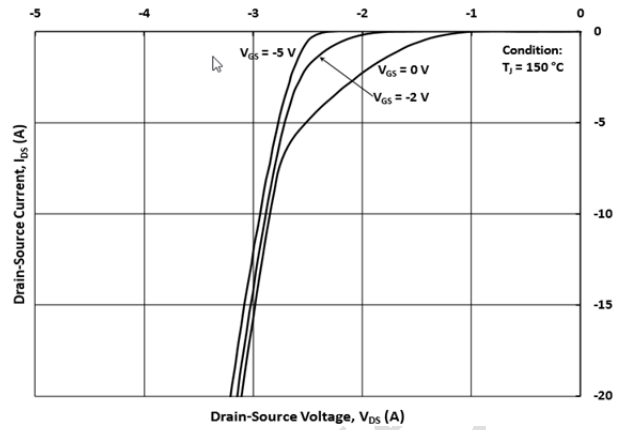
$R_{DS\_ON}$  vs. Drain Current



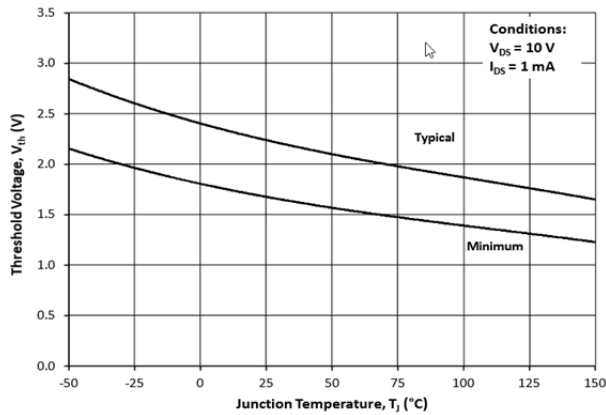
Transfer Characteristics



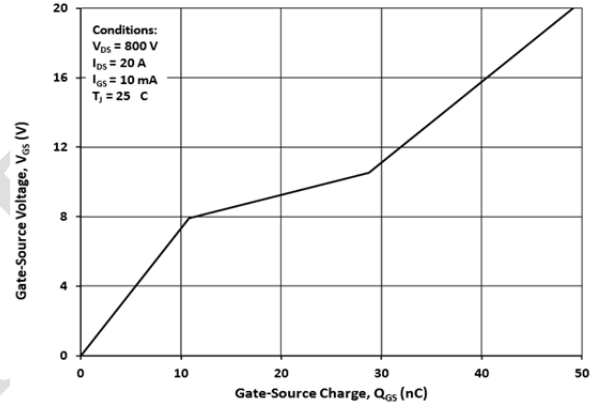
Body Diode Characteristics  $T_j=25\text{ }^\circ\text{C}$



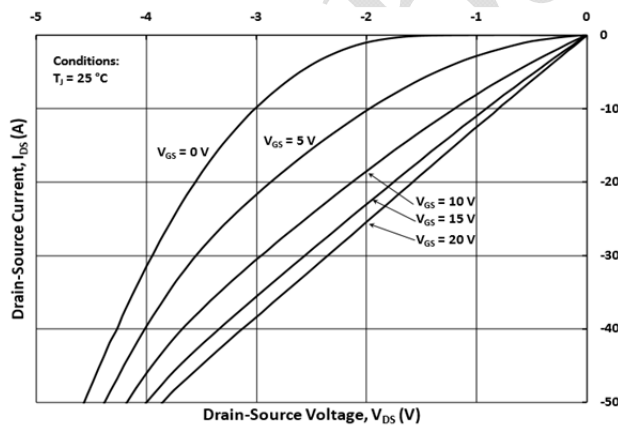
Body Diode Characteristics  $T_j=150\text{ }^\circ\text{C}$



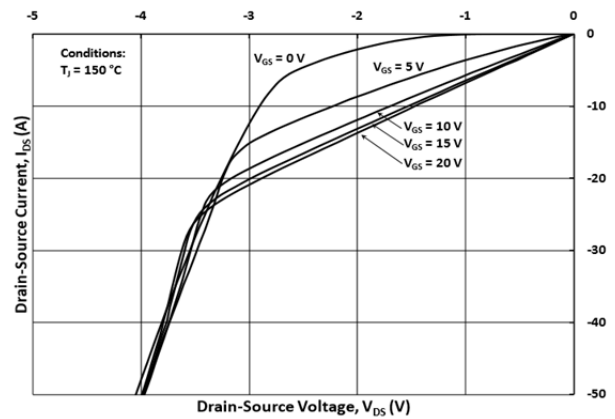
Threshold Voltage vs. Temperature



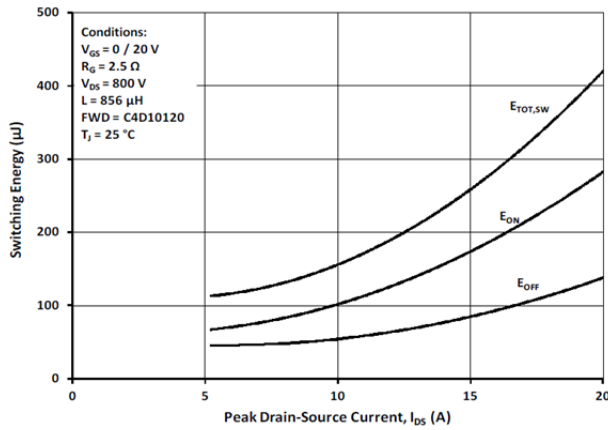
Gate Charge Characteristics



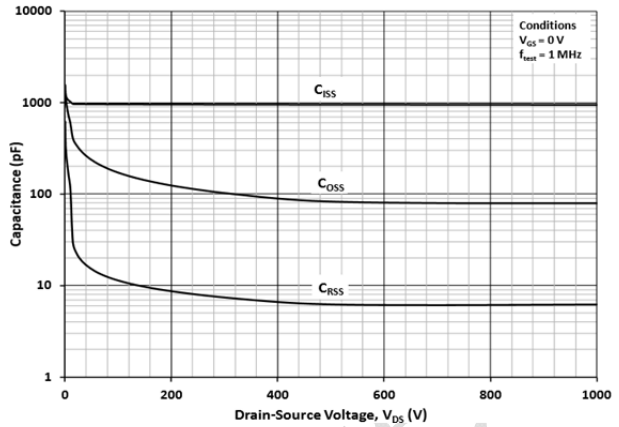
3<sup>rd</sup> Quadrant Characteristics  $T_j=25\text{ }^\circ\text{C}$



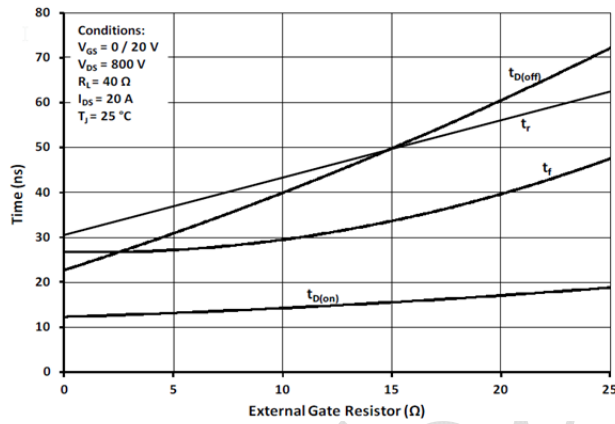
3<sup>rd</sup> Quadrant Characteristics  $T_j=150\text{ }^\circ\text{C}$



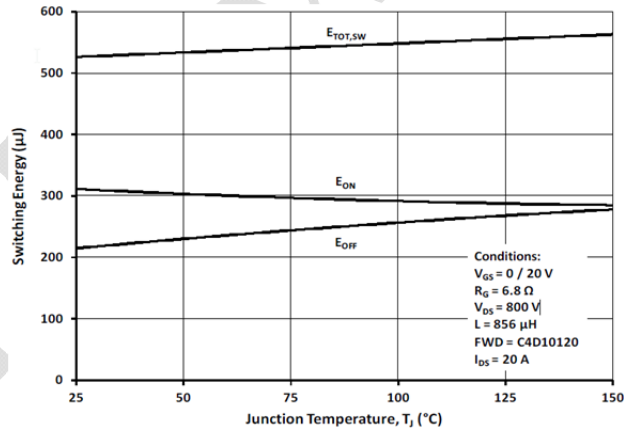
**Switching Loss vs. Drain Current ( $V_{DD}=800V$ )**



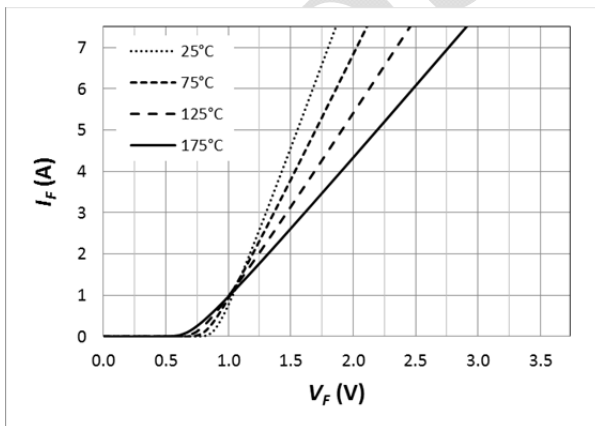
**Capacitances vs. Drain-Source Voltage (0~1k V)**



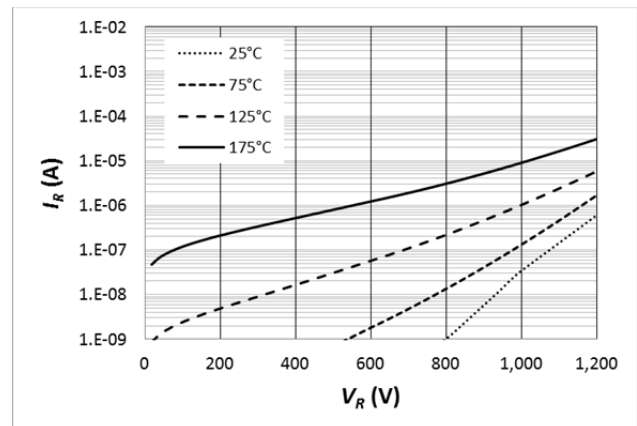
**Resistive Switching Time vs.  $R_{G(ext)}$**



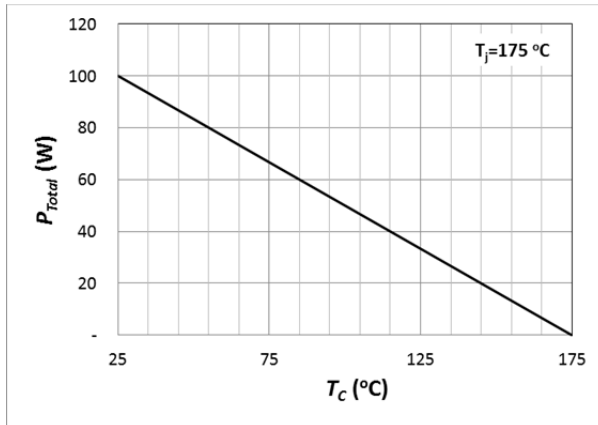
**Clamped Inductive Switching Energy vs. Temperature**



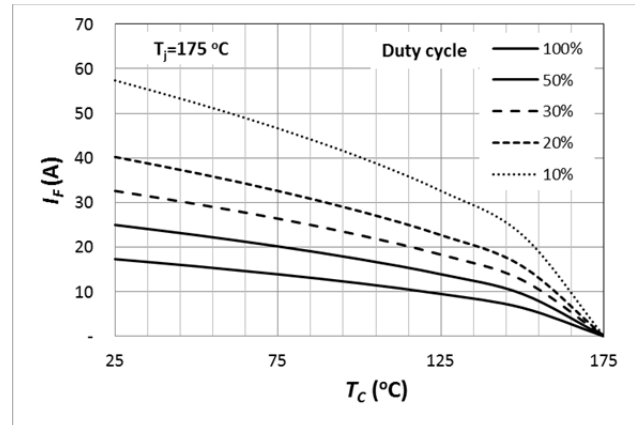
**Forward Characteristics (parameterized on  $T_J$ )**



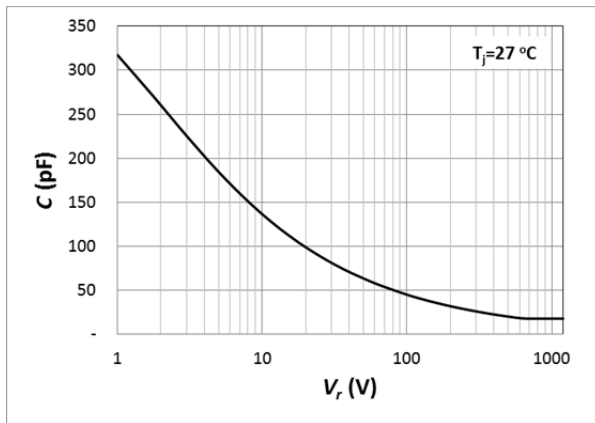
**Reverse Characteristics (parameterized on  $T_J$ )**



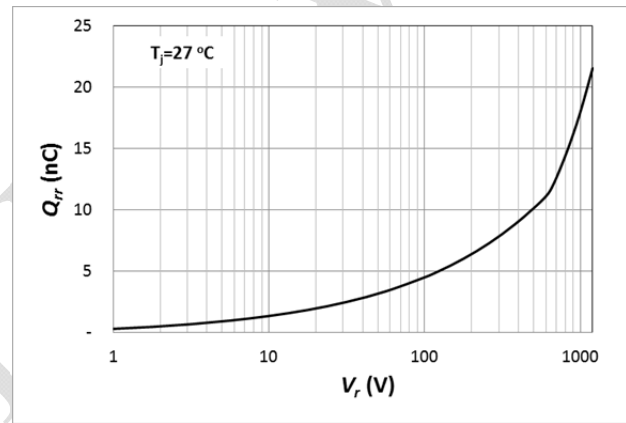
Power Derating



Current Derating

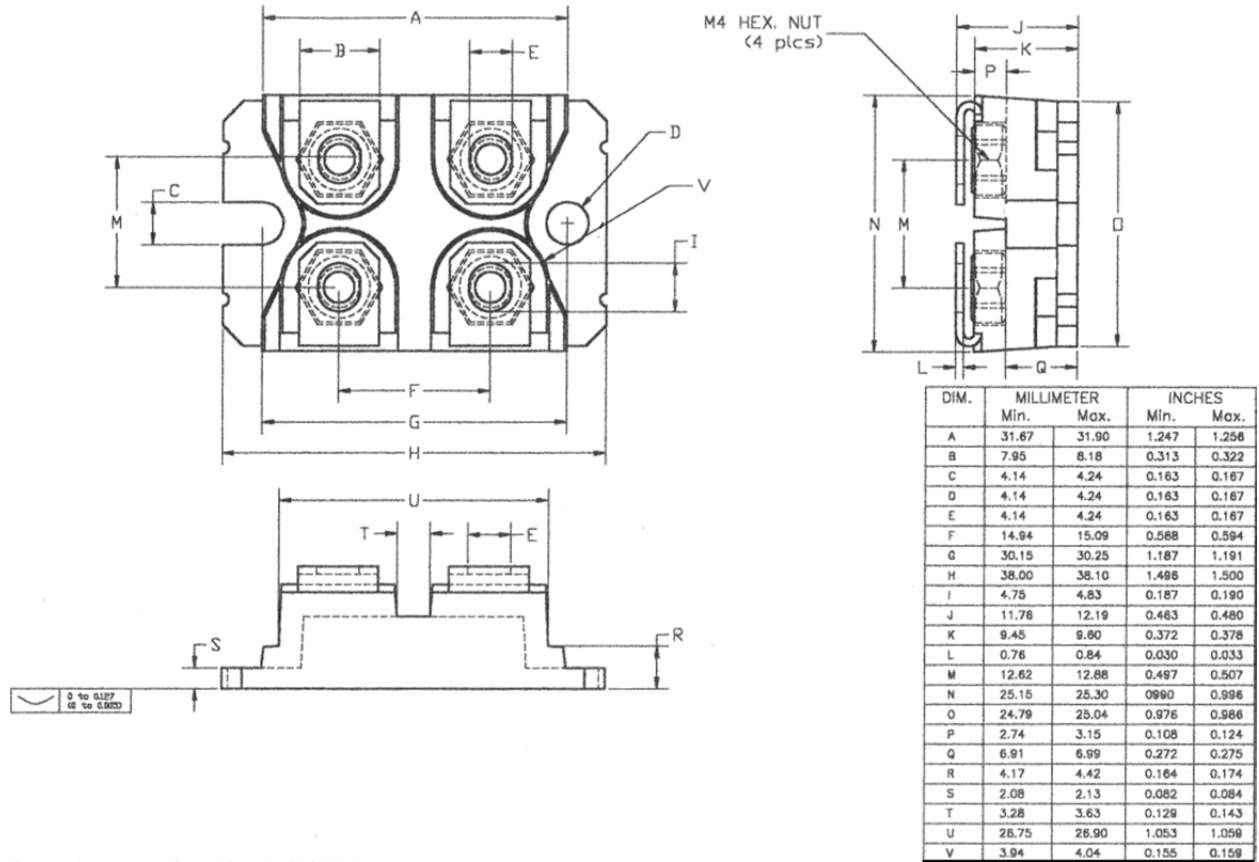


Capacitance



Recovery Charge

SOT-227 Package Outline and Dimension



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**Revision History**

Date	Revision	Notes
10/3/2016	0.1	Initial release

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**Global Power Technologies Group**

20692 Prism Place  
Lake Forest, CA 92630  
TEL (949) 207-7500  
FAX (949) 613-7600  
E-mail: [info@gptechgroup.com](mailto:info@gptechgroup.com)  
Web site: [www.gptechgroup.com](http://www.gptechgroup.com)





**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](http://www.gptechgroup.com).
- REACH Compliance**  
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REACH banned substance information (REACH Article 67) is also available upon request.
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