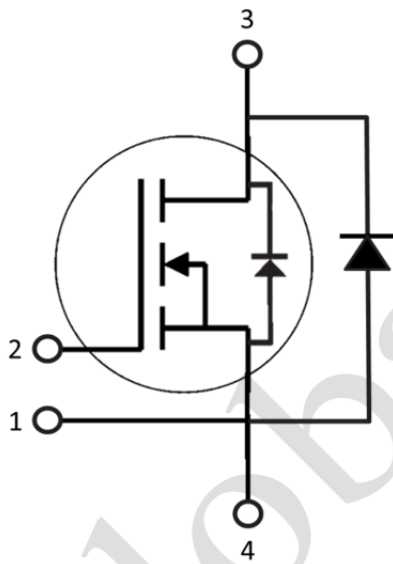


### 1200V/40 mohm SiC MOSFET in SOT-227 Package

$V_{CES} = 1200V$   
 $I_D = 40A @ T_C = 80^{\circ}C$   
 $R_{DS\_ON} = 40 \text{ mohm} @ T_J = 25^{\circ}C$



#### Features

- High speed switching SiC MOSFETs
- Freewheeling diode with zero reverse recovery SiC SBDs
- Low  $R_{DS\_ON}$
- Simple to drive
- 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



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

Parameters	Symbol	Conditions	Specifications	Units
<b>SiC MOSFETs</b>				
Maximum Drain-Source Voltage	$V_{DSS}$	$T_j = 25^{\circ}\text{C} \sim 150^{\circ}\text{C}$	1200	V
Continuous Drain Current	$I_{D(DC)}$	$T_j = 25^{\circ}\text{C}, V_{GS}=20\text{V}$	60	A
		$T_j = 150^{\circ}\text{C}, V_{GS}=20\text{V}$	40	A
Pulse Drain Current	$I_{D(Pulse)}$	Pulse width $t_p$ limited by $T_{jmax}, T_C=25^{\circ}\text{C}$	160	A
Gate-Source Voltage	$V_{GS}$	Absolute max value	-10/+25	V
<b>SiC SBDs</b>				
Maximum Reverse Voltage	$V_{RRM}$		1200	V
Average Forward Current	$I_{DAV}$	$T_j = 25^{\circ}\text{C}$	30	A
		$T_j = 150^{\circ}\text{C}$	15	A
Non-repetitive Forward Surge Current	$I_{FSM}$	Pulse width $t_p$ limited by $T_{jmax}$	60	A
<b>SOT-227 Modules Thermal Properties</b>				
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 ~ 150	$^{\circ}\text{C}$

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

Parameters	Symbol	Conditions	Min	Typ	Max	Units
<b>SiC MOSFETs</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{V}, I_D=100\mu\text{A}$	1200	--	--	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=10\text{V}, I_D=10\text{mA}, T_j = 25^{\circ}\text{C}$	2.4	2.8	--	V
		$V_{DS}=10\text{V}, I_D=10\text{mA}, T_j = 150^{\circ}\text{C}$	1.8	2.0	--	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	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	$R_G$	$f = 1\text{MHz}, V_{AC} = 25\text{mV}$ , per die		1.8		$\Omega$
Drain-Source On-state Resistance	$R_{DS(ON)}$	$V_{GS}=20\text{V}, I_D=40\text{A}, T_j = 25^{\circ}\text{C}$	--	40	52	m $\Omega$
		$V_{GS}=20\text{V}, I_D=40\text{A}, T_j = 150^{\circ}\text{C}$	--	84	100	m $\Omega$
Trans-conductance	$g_{fs}$	$V_{DS}=20\text{V}, I_D=40\text{A}, T_j = 25^{\circ}\text{C}$		15		S
		$V_{DS}=20\text{V}, I_D=40\text{A}, T_j = 150^{\circ}\text{C}$		13		
Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{V}, V_{DS} = 1000\text{V}$ , freq = 1MHz, $V_{AC} = 25\text{mV}$	--	1.9	--	nF
Output Capacitance	$C_{OSS}$		--	150	--	pF
Reverse transfer Capacitance	$C_{RES}$		--	10	--	pF

Turn-on Delay Time	$t_{d(on)}$	$V_{DS} = 800V, V_{GS} = -5/20V$ $I_D = 40A, R_{G(ext)} = 2.5\Omega,$ $L = 85\mu H. Refer to definition$	--	15	--	ns	
Rise Time	$t_r$		--	53	--	ns	
Turn-off Delay Time	$t_{d(off)}$		--	27	--	ns	
Fall Time	$t_f$		--	35	--	ns	
Turn-on Switching Loss	$E_{ON}$				1.0		mJ
Turn-off Switching Loss	$E_{OFF}$				0.4		mJ
Total Gate Charge	$Q_g$	$V_{DS}=800V, V_{GS} = -5/20V$ $I_D = 40A$	--	115	--	nC	
<b>SiC SBDs</b>							
Maximum peak repetitive reverse voltage	$V_{RRM}$		1200	--	--	V	
Maximum Reverse Leakage Current	$I_{RM}$	$V_R = 1200V, T_j = 25^\circ C$	--	4.1	100	$\mu A$	
		$V_R = 1200V, T_j = 150^\circ C$	--	606	--	$\mu A$	
Diode Forward Voltage	$V_F$	$I_F = 15A, T_j = 25^\circ C$	--	1.5	1.7	V	
		$I_F = 15A, T_j = 150^\circ C$	--	2.3	--	V	
Total Capacitive Charge	$Q_C$	$V_R=1200V, I_F < I_{F,max}$	--	52	--	nC	
Switching Time	$t_C$	$di_F/dt = 500A/\mu s, T_j = 25^\circ C$	--	--	10	ns	
Total Capacitance	C	$V_R = 1V, f = 1MHz$	--	895	--	pF	
		$V_R = 600V, f = 1MHz$	--	52	--	pF	
		$V_R = 1200V, f = 1MHz$	--	43	--	pF	

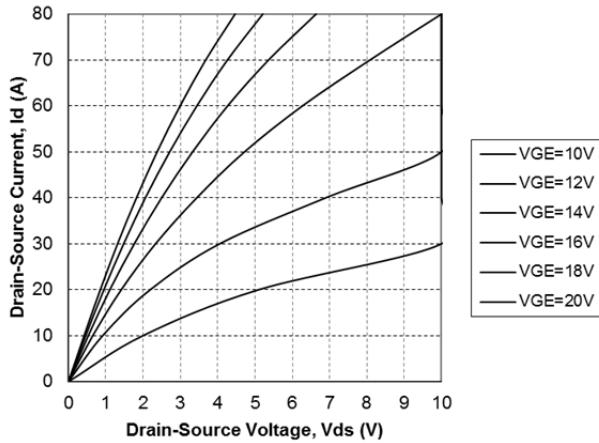
### Thermal and Package Characteristics ( $T_j=25^\circ C$ unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Units
Junction to Case Thermal Resistance	$R_{THJC}$	MOSFET	--	--	0.6	$^\circ C/W$
		SBD	--	--	0.65	$^\circ C/W$
Junction to Ambient Thermal Resistance	$R_{THJA}$	MOSFET	--	--	TBD	$^\circ C/W$
		SBD	--	--	TBD	$^\circ C/W$
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	$V_{ISOL}$	$I_{ISOL} < 1mA, 50/60Hz, t=1min$	2500			V

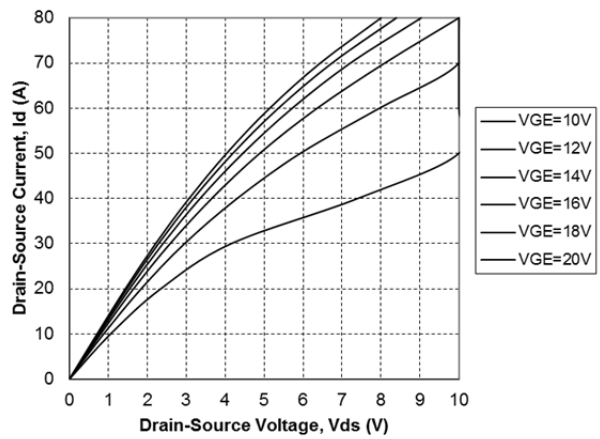
### Part Number and Pin assignment

Part Number	Rating	Pin 1*	Pin 2	Pin 3	Pin 4*
GCMS040A120S1-E1	1200V, $R_{ds\_ON}=40mohm,$ $I_{d\_SBD}=15A$	Source	Gate	Drain	Source

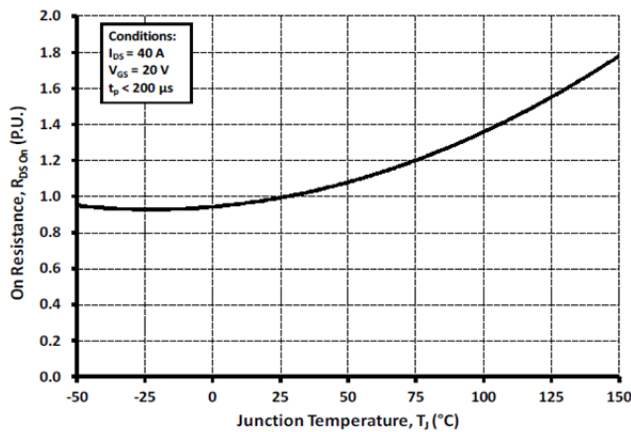
\* pin 1 could be used as a kelvin reference terminal, and pin 4 is assigned for main source power terminal.



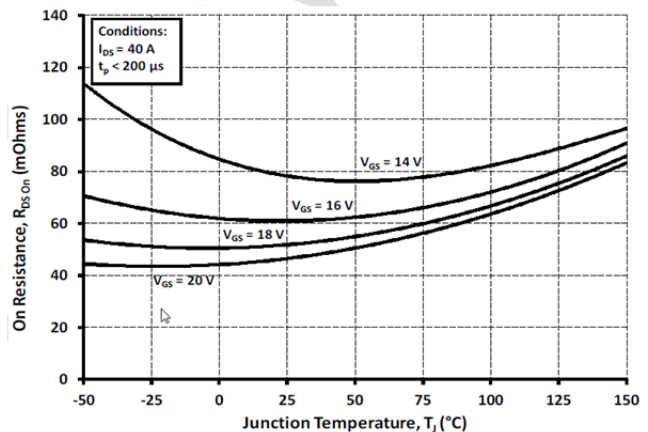
Typical Forward Characteristics  $T_j = 25^\circ\text{C}$



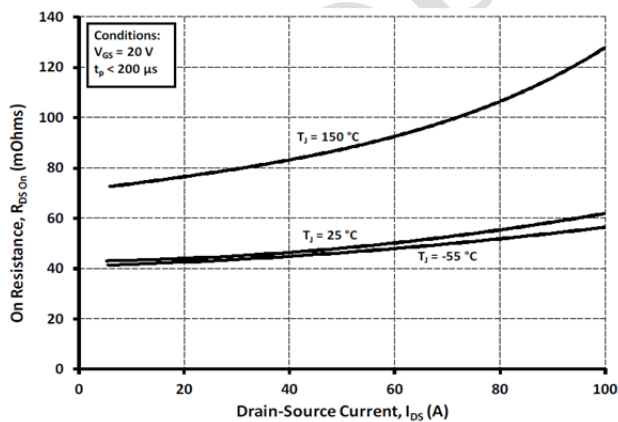
Typical Forward Characteristics  $T_j = 150^\circ\text{C}$



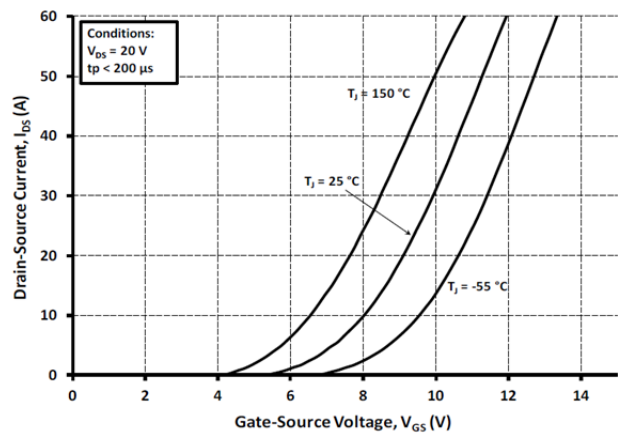
Normalized  $R_{DS(on)}$  vs. Temperature



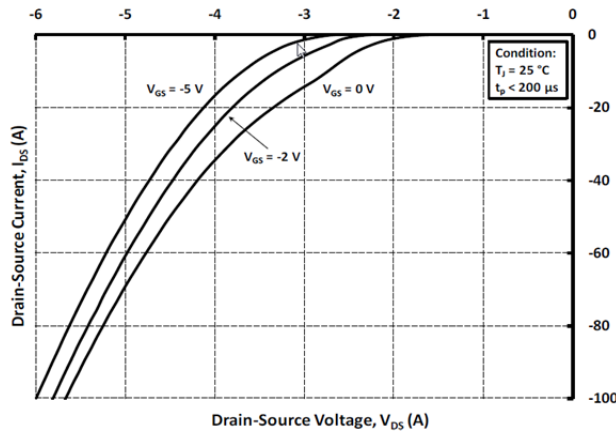
$R_{DS(on)}$  vs. Junction Temperature



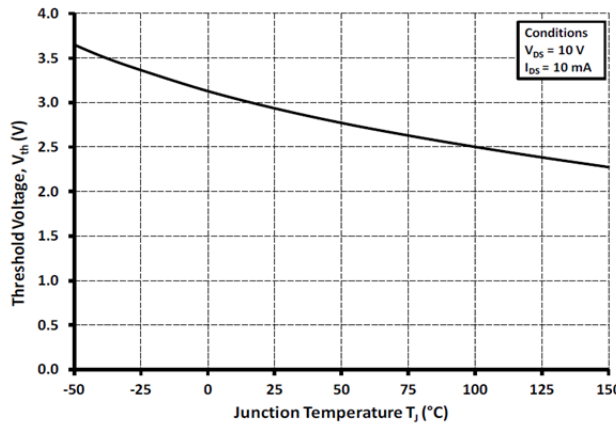
$R_{DS(on)}$  vs. Drain Current



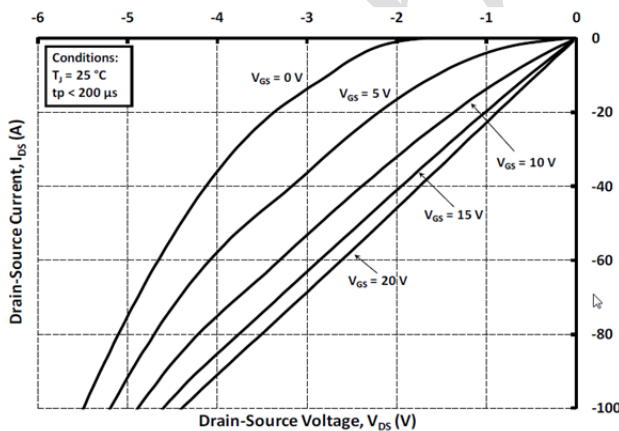
Transfer Characteristics



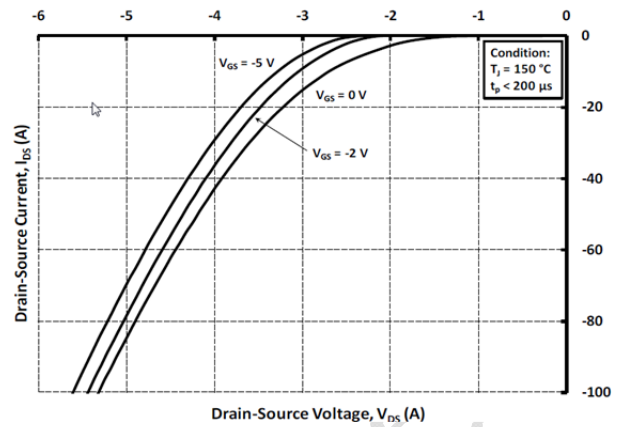
Body Diode Characteristics  $T_j=25\text{ }^\circ\text{C}$



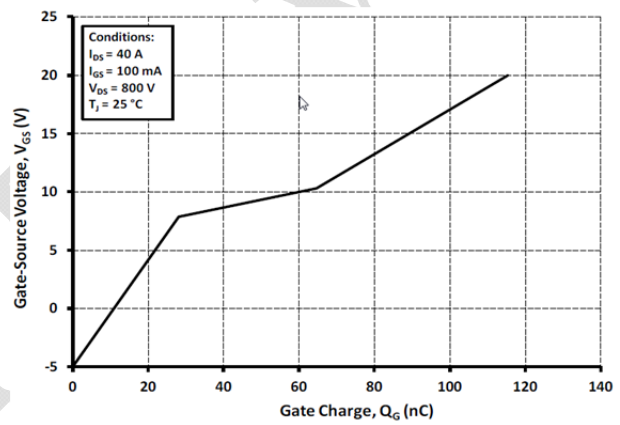
Threshold Voltage vs. Temperature



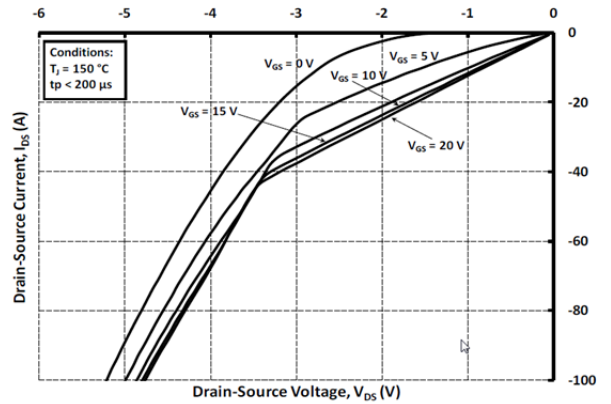
3<sup>rd</sup> Quadrant Characteristics  $T_j=25\text{ }^\circ\text{C}$



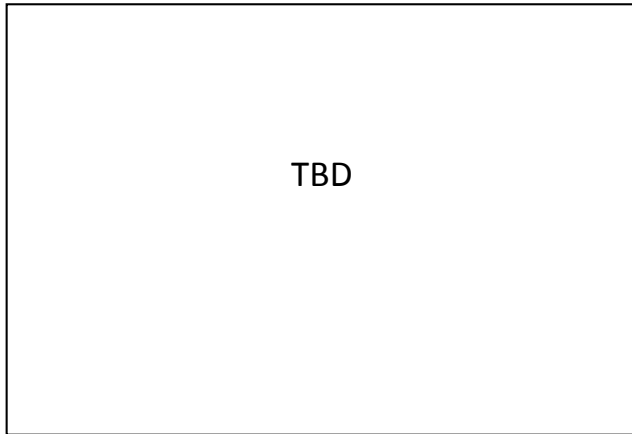
Body Diode Characteristics  $T_j=150\text{ }^\circ\text{C}$



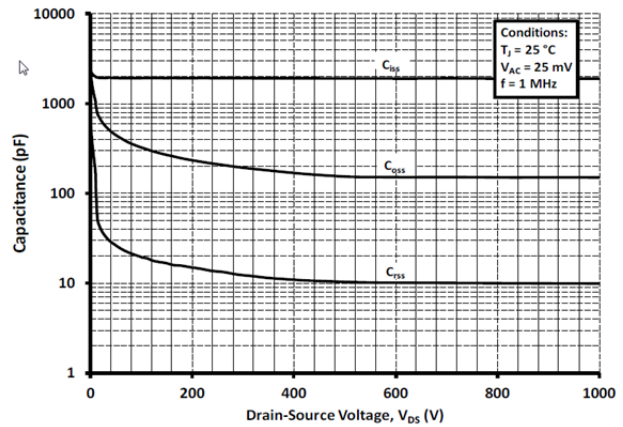
Gate Charge Characteristics



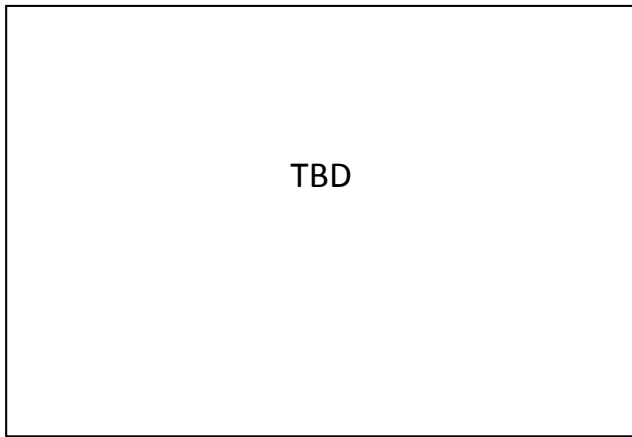
3<sup>rd</sup> Quadrant Characteristics  $T_j=150\text{ }^\circ\text{C}$



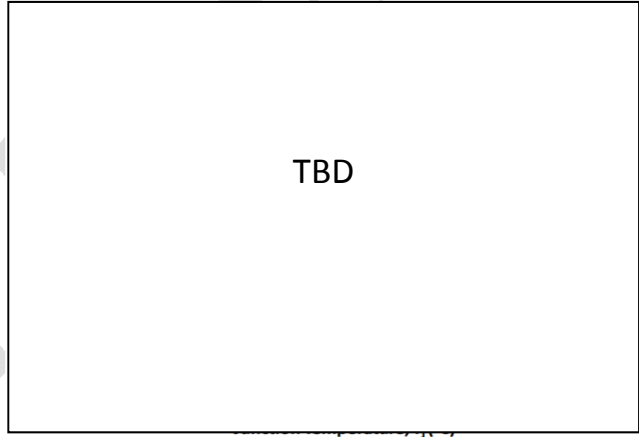
Switching Loss vs. Drain Current



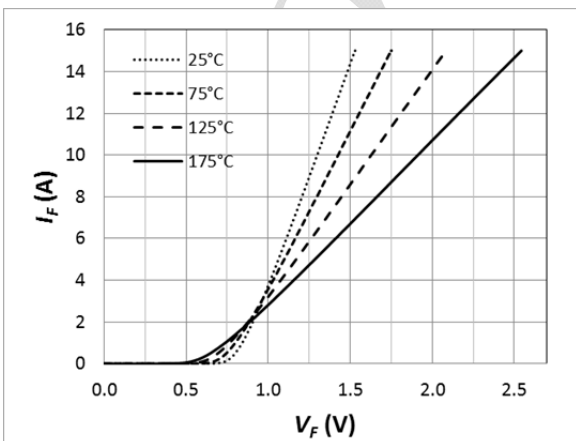
Capacitances vs. Drain-Source Voltage (0~1k V)



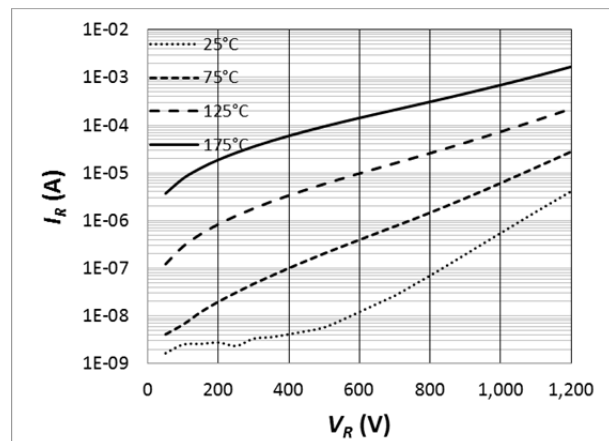
Clamped Inductive Switching Energy vs. R<sub>G(ext)</sub>



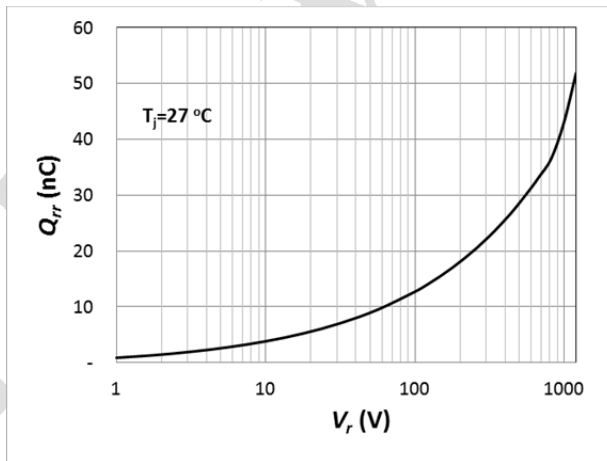
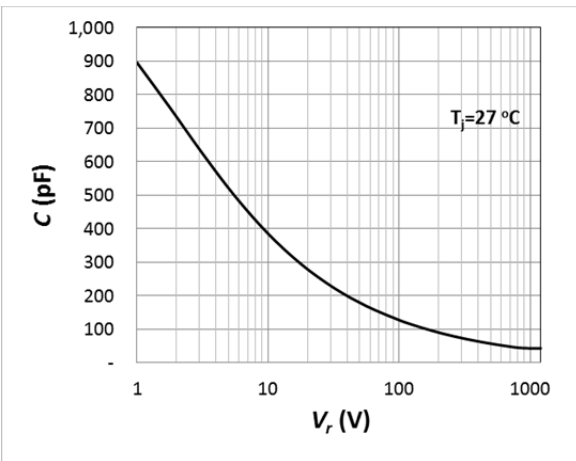
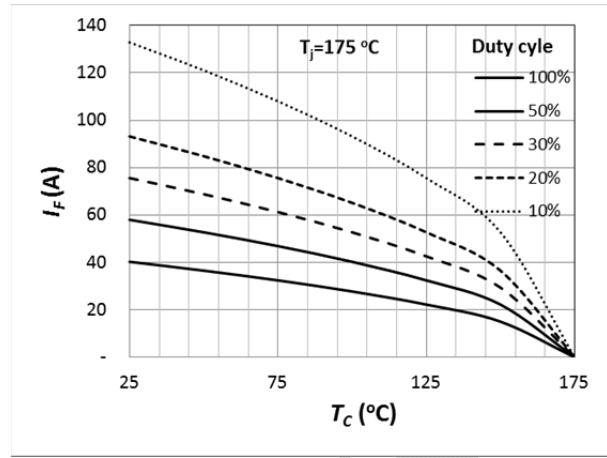
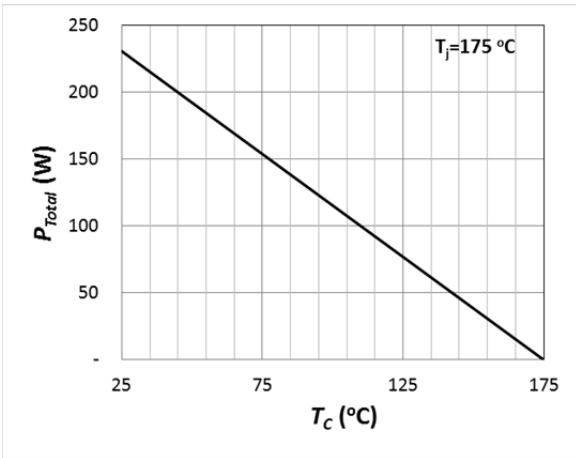
Clamped Inductive Switching Energy vs. Temperature



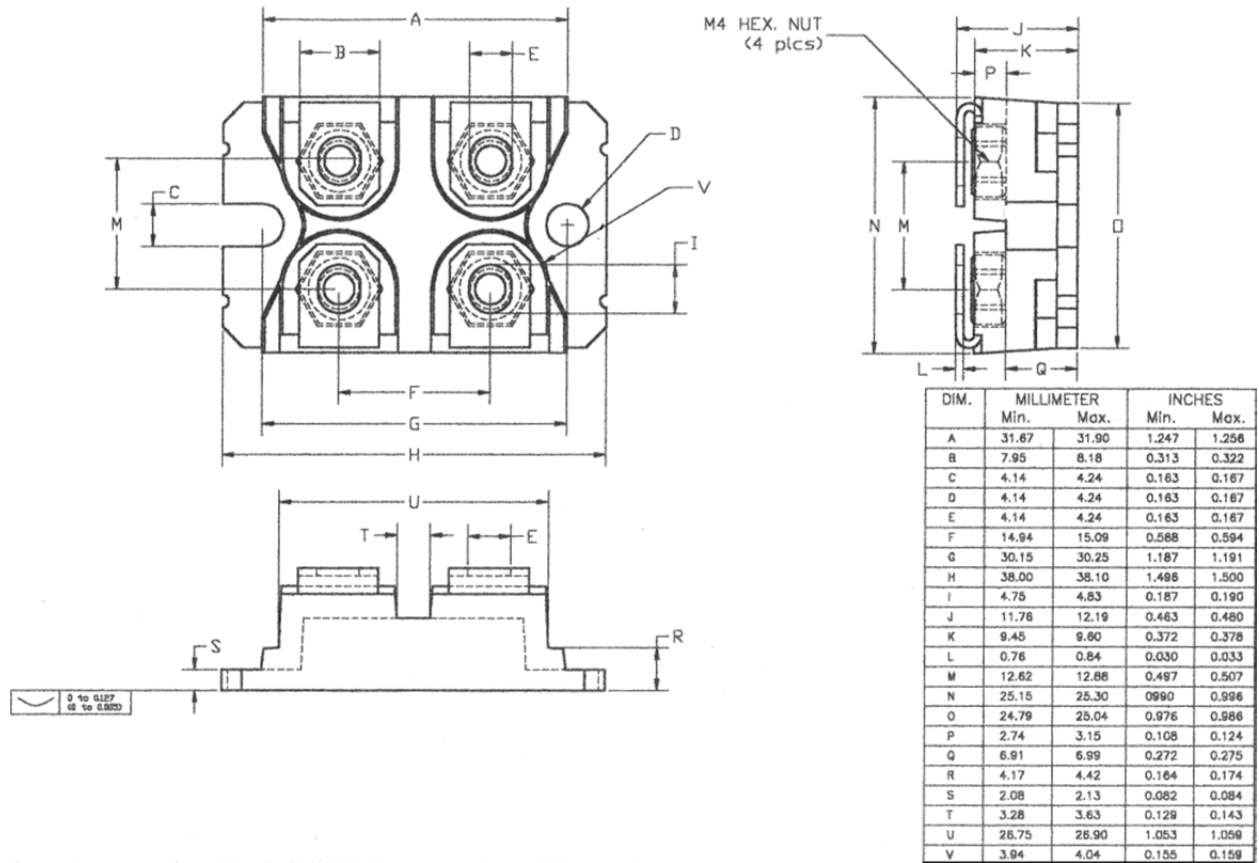
Forward Characteristics (parameterized on T<sub>j</sub>)



Reverse Characteristics (parameterized on T<sub>j</sub>)



**SOT-227 Package Outline and Dimension**



GlobalPower



**Revision History**

Date	Revision	Notes
04/14/2016	0.1	Initial release

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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](http://www.gptechgroup.com).
- REACH Compliance**  
 REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical 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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