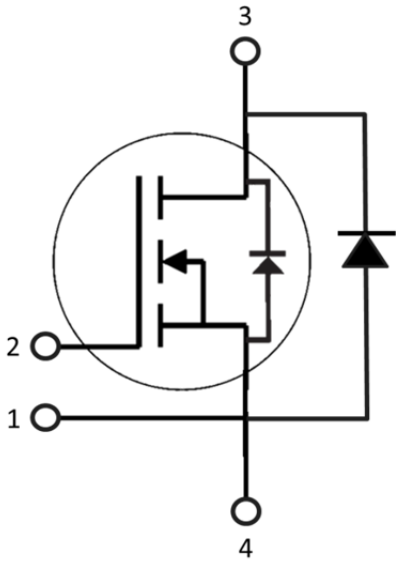
1200V/40 mΩ SiC MOSFET in SOT-227 Package

V_{CES} = 1200V
I_D = 40A @T_C= 80^{0}C
R_{DS_ON}= 40 mohm @ T_J= 25^{0}C



RoHS

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°C unless otherwise specified)

Parameters	Symbol	Conditions	Specifications	Units
SiC MOSFETs				
Maximum Drain-Source Voltage	V_{DSS}	T_j = 25 °C~150 °C	1200	V
Continuous Drain Current	$I_{D\ (DC)}$	T_j = 25 °C, V_{GS}=20V	60	A
		T_j = 150 °C, V_{GS}=20V	40	A
Pulse Drain Current	$I_{D(Pulse)}$	Pulse width t_P limited by T_{jmax}, T_C=25 °C	160	A
Gate-Source Voltage	V_{GS}	Absolute max value	-10/+25	V
SiC SBDs				
Maximum Reverse Voltage	V_{RRM}		1200	V
Average Forward Current	I_{DAV}	T_j = 25 °C	30	A
		T_j = 150 °C	15	A
Non-repetitive Forward Surge Current	I_{FSM}	Pulse width t_P limited by T_{jmax}	60	A
SOT-227 Modules Thermal Properties				
Maximum Power Dissipation	P_D	T_C = 25 °C	TBD	W
		T_C = 100 °C	TBD	W
Operating Junction Temperature	T_j		-40 ~ 150	°C
Storage Temperature	T_{STG}		-40 ~ 150	°C

Electrical Characteristics (T_j=25°C unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Units
SiC MOSFETs						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=100μA	1200	--	--	V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}= 10V, I_D=10mA, T_j = 25 °C	2.4	2.8	--	V
		V_{DS}= 10V, I_D=10mA, T_j = 150 °C	1.8	2.0	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V, T_j = 25 °C	--	1	100	μA
		V_{DS}=1200V, V_{GS}=0V, T_j = 150 °C	--	TBD	TBD	μA
Gate Source Leakage Current	I_{GSS}	V_{GS}=20V, V_{DS}=0V	--	--	250	nA
Internal Gate Resistance	R_G	f = 1MHz, V_{AC} = 25mV, per die		1.8		Ω
Drain-Source On-state Resistance	$R_{DS(ON)}$	V_{GS}= 20V, I_D=40A, T_j = 25 °C	--	40	52	mΩ
		V_{GS}= 20V, I_D=40A, T_j = 150 °C	--	84	100	mΩ
Trans-conductance	g_{fs}	V_{DS}= 20V, I_D=40A, T_j = 25 °C		15		S
		V_{DS}= 20V, I_D=40A, T_j = 150 °C		13		
Input Capacitance	C_{ISS}	V_{GS} = 0V, V_{DS} = 1000V, freq = 1MHz, V_{AC} = 25mV	--	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, $R_{G(ext)}$ = 2.5Ω, L = 85µH. 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}=800 V, V_{GS} = -5/20V I_D = 40A	--	115	--	nC
SiC SBDs						
Maximum peak repetitive reverse voltage	V_{RRM}		1200	--	--	V
Maximum Reverse Leakage Current	I_{RM}	V_R = 1200V, T_j = 25 ^{0}C	--	4.1	100	µA
		V_R = 1200V, T_j = 150 ^{0}C	--	606	--	µA
Diode Forward Voltage	V_F	I_F = 15A, T_j = 25 ^{0}C	--	1.5	1.7	V
		I_F = 15A, T_j = 150 ^{0}C	--	2.3	--	V
Total Capacitive Charge	Q_C	V_R=1200 V, I_F<$I_{F,max}$	--	52	--	nC
Switching Time	t_C	dI_F/dt = 500 A/µs, T_j = 25 ^{0}C	--	--	10	ns
Total Capacitance	C	V_R = 1V, f = 1 MHz	--	895	--	pF
		V_R = 600V, f = 1 MHz	--	52	--	pF
		V_R = 1200V, f = 1 MHz	--	43	--	pF

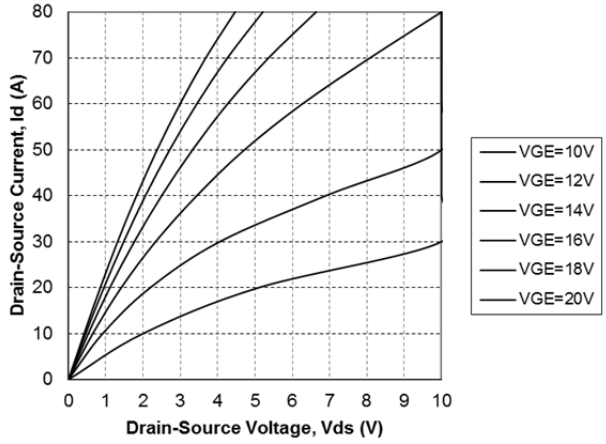
Thermal and Package Characteristics (T_j=25^{o}C unless otherwise specified)

Parameters	Symbol	Conditions	Min	Typ	Max	Units
Junction to Case Thermal Resistance	R_{THJC}	MOSFET	--	--	0.6	^{0}C /W
		SBD	--	--	0.65	^{0}C /W
Junction to Ambient Thermal Resistance	R_{THJA}	MOSFET	--	--	TBD	^{0}C /W
		SBD	--	--	TBD	^{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			32		g
Isolation Voltage	V_{ISOL}	I_{ISOL} < 1mA, 50/60Hz, t=1 min	2500			V

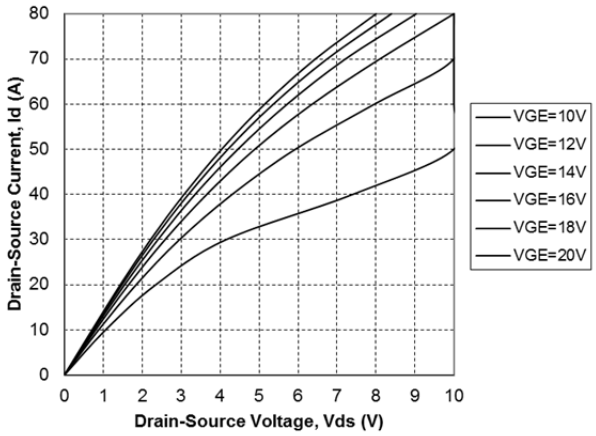
Part Number and Pin assignment

Part Number	Rating	Pin 1*	Pin 2	Pin 3	Pin 4*
GCMS040A120S1-E1	1200V, R_{ds_ON}=40 mohm, I_{d_SBD}=15A	Source	Gate	Drain	Source

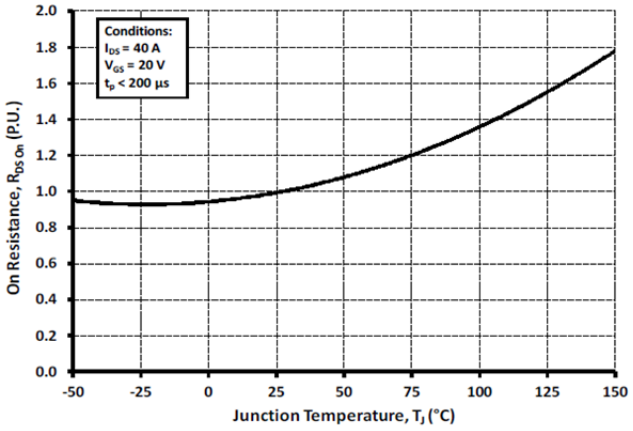
* pin 1 could be used as a kelvin reference terminal, and pin 4 is assigned for main source power terminal.



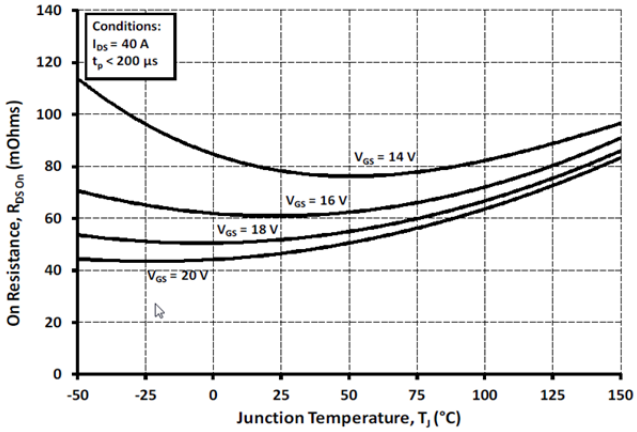
Typical Forward Characteristics T_j=25 °C



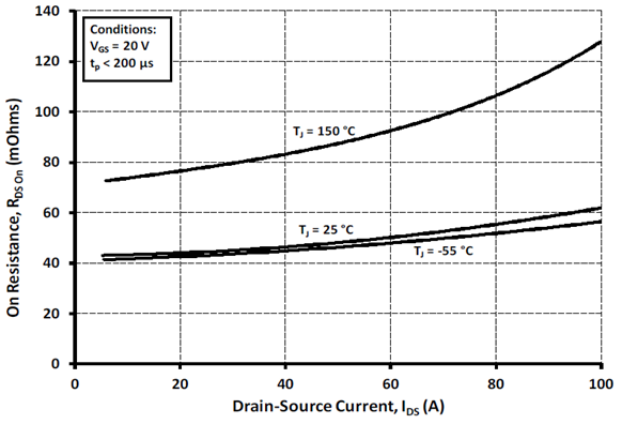
Typical Forward Characteristics T_j=150 °C



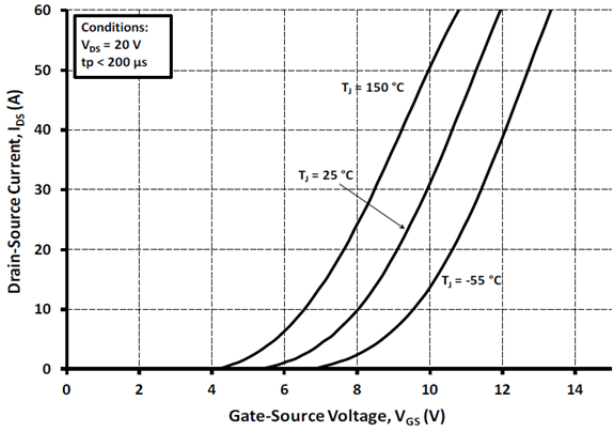
Normalized R_{DS_ON} vs. Temperature



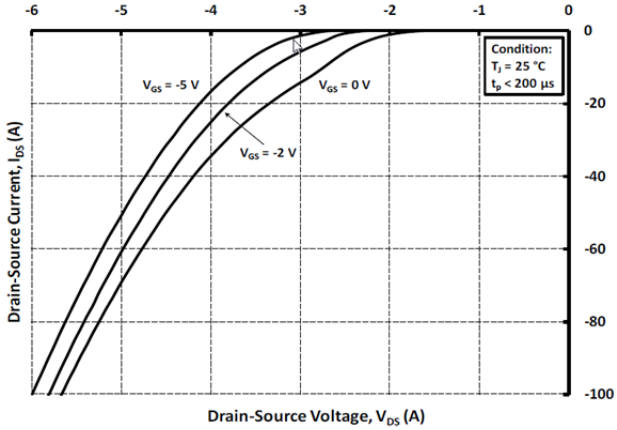
R_{DS_ON} vs. Junction Temperature



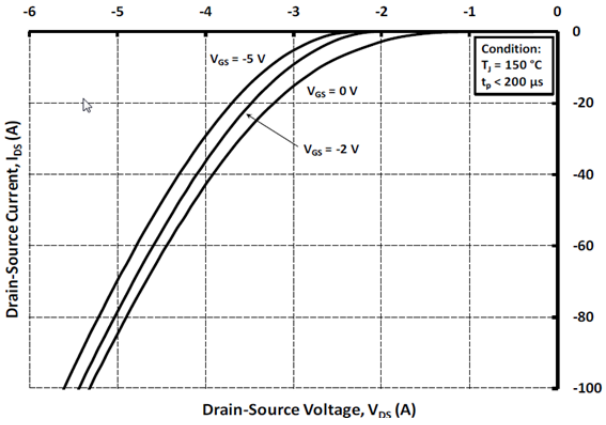
R_{DS_ON} vs. Drain Current



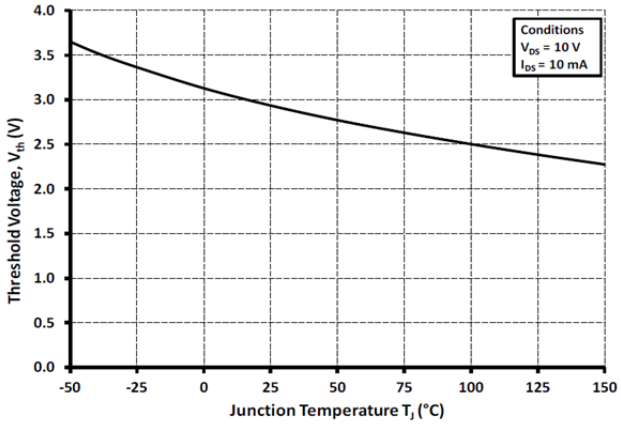
Transfer Characteristics



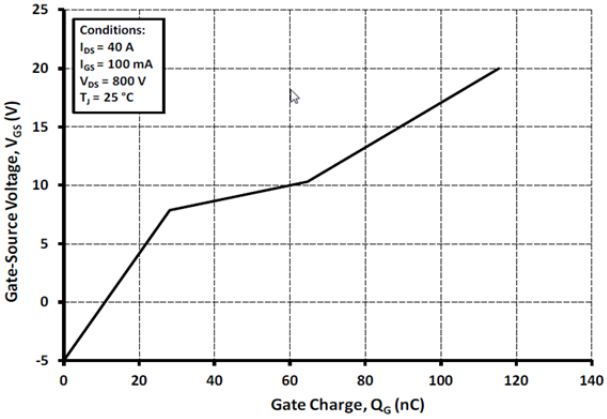
Body Diode Characteristics T_j=25 °C



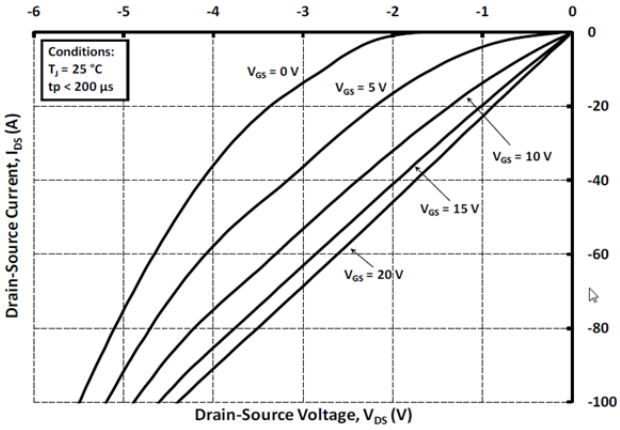
Body Diode Characteristics T_j=150 °C



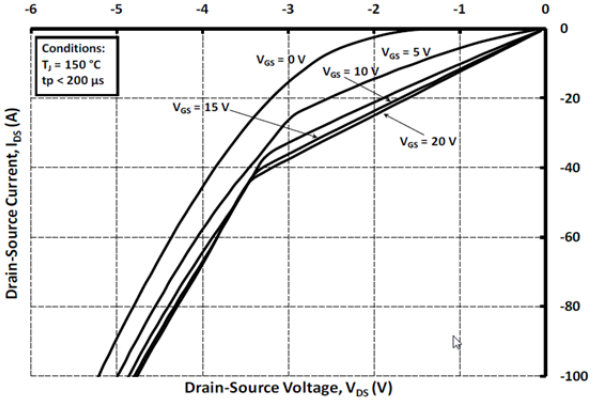
Threshold Voltage vs. Temperature



Gate Charge Characteristics



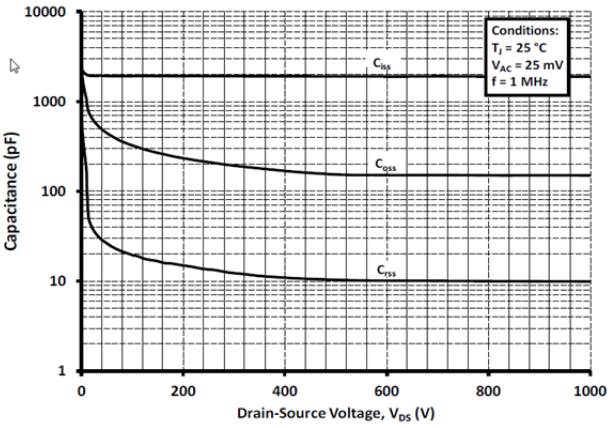
3rd Quadrant Characteristics T_j=25 °C



3rd Quadrant Characteristics T_j=150 °C

TBD

Switching Loss vs. Drain Current



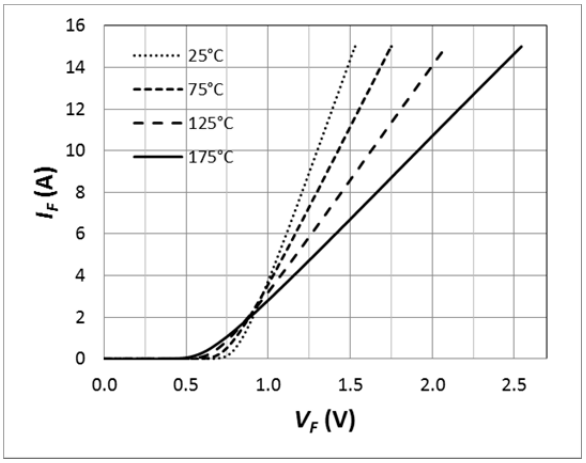
Capacitances vs. Drain-Source Voltage (0~1k V)

TBD

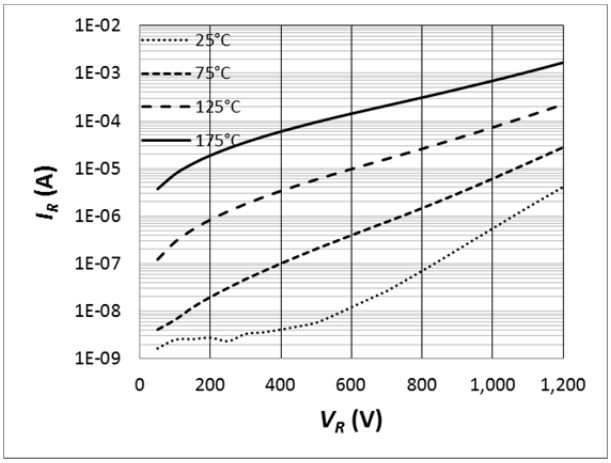
Clamped Inductive Switching Energy vs. $R_{G(ext)}$

TBD

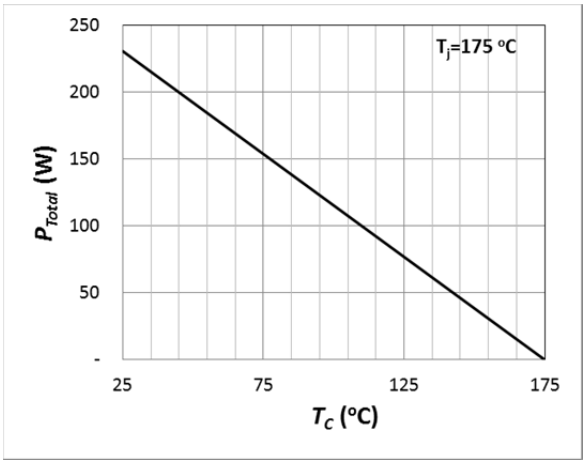
Clamped Inductive Switching Energy vs. Temperature



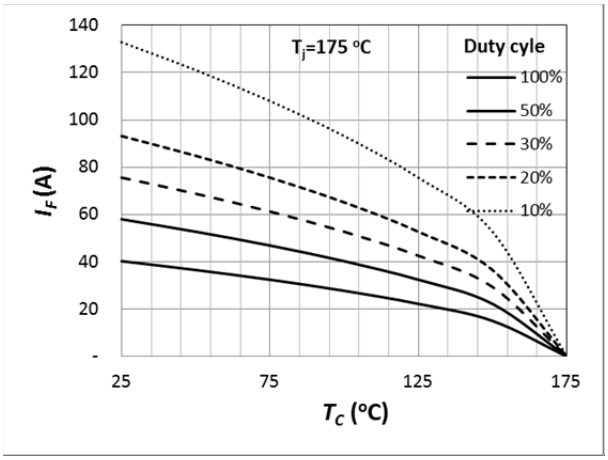
Forward Characteristics (parameterized on Tj)



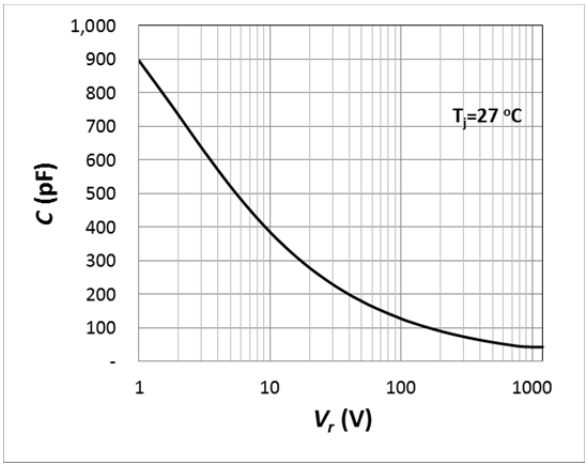
Reverse Characteristics (parameterized on Tj)



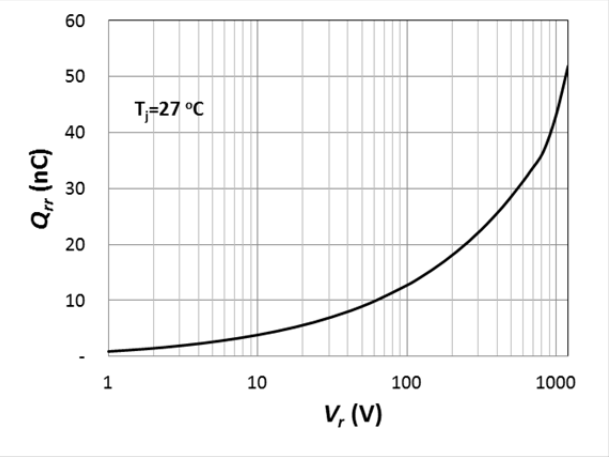
Power Derating



Current Derating

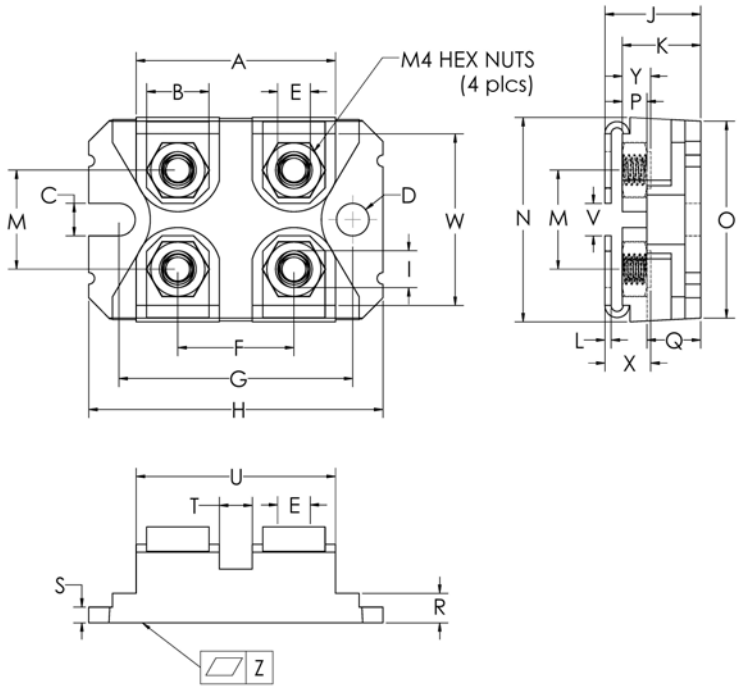


Capacitance Curve



Recovery Charge

SOT-227 Package Outline and Dimension



Sym	Millimeters		Inches	
	Min	Max	Min	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	11.68	12.19	0.460	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	0.990	0.996
O	24.79	25.04	0.976	0.986
P	3.02	3.15	0.119	0.124
Q	6.71	6.96	0.264	0.274
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	3.86	4.24	0.152	0.167
W	20.55	26.90	0.809	0.814
X	5.45	5.85	0.215	0.230
Y	3.15	3.66	0.124	0.144
Z	0.00	0.13	0.000	0.005