

# GCMS2P0B120S4B1

## QSiC™ 1200V SiC Half-Bridge Module

$V_{DS}$	1200 V
$R_{DS,on}$	2.0 m $\Omega$
$I_D (T_C=25^\circ C)$	579 A
$T_{J,max}$	175 $^\circ C$

### Features

- 62mm x 152mm industry standard footprint
- High speed switching SiC MOSFETs
- Freewheeling SiC SBD with zero reverse recovery
- All parts tested to greater than 1,350V
- Kelvin reference for stable operation

### Benefits

- Low switching losses
- Low junction to case thermal resistance
- Very rugged and easy mounting
- Direct mounting to heatsink (isolated package)
- Lower  $Q_{RR}$  at high temperature

### Applications

- Motor drives
- EV applications
- Smart-grid
- Uninterruptible power supply (UPS)

### Package



Part #	Package	Marking
GCMS2P0B120S4B1	S4	GCMS2P0B120S4B1



### Absolute Maximum Ratings, at $T_J=25^\circ C$ , unless otherwise specified

Characteristics	Symbol	Conditions	Values	Unit
Drain-Source Voltage	$V_{rated}$	$V_{GS}=0V, I_{DS}=700\mu A$	1200	V
Continuous Drain Current	$I_{DS}$	$T_C=25^\circ C, V_{GS}=18V, T_J=175^\circ C$	579	A
		$T_C=65^\circ C, V_{GS}=18V, T_J=175^\circ C$	498	
Body Diode Drain Current	$I_{SD}$	$T_C=25^\circ C, V_{GS}=-4.5V, T_J=175^\circ C$	432	
Pulsed Drain Current	$I_{DS,pulse}$	$T_C=25^\circ C, V_{GS}=18V$	1400	
Gate Source Voltage	$V_{GSmax}$		-8/22	V
	$V_{GSop}$	Recommended operational	-4.5/18	
Power Dissipation	$P_{tot}$	$T_C=25^\circ C, T_J=175^\circ C$	1181	W
Junction Temperature	$T_J$	Continuous	-40...175	$^\circ C$
Case & Storage Temperature	$T_C, T_{storage}$	Continuous	-40...150	$^\circ C$

Static Electrical Characteristics, at T<sub>J</sub>=25°C, unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>DS</sub> =11uA	1200	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V	-	0.01	0.7	mA
		V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C	-	0.18	7	
Gate-Source Leakage Current	I <sub>GSS+</sub>	V <sub>GS</sub> =22V, V <sub>DS</sub> =0V	-	70	2000	nA
	I <sub>GSS-</sub>	V <sub>GS</sub> =-8V, V <sub>DS</sub> =0V	-	-70	-2000	
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>DS</sub> =140mA	1.8	2.8	4	V
		V <sub>GS</sub> =V <sub>DS</sub> , I <sub>DS</sub> =140mA, T <sub>J</sub> =150°C	-	2	-	
Drain-Source On-Resistance	R <sub>DS(on)</sub> *	V <sub>GS</sub> =18V, I <sub>DS</sub> =350A	-	2.0	3.2	mΩ
		V <sub>GS</sub> =18V, I <sub>DS</sub> =350A, T <sub>J</sub> =150°C	-	3.1	-	
Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =20V, I <sub>DS</sub> =350A	-	146	-	S
		V <sub>DS</sub> =20V, I <sub>DS</sub> =350A, T <sub>J</sub> =150°C	-	160	-	
Internal Gate Resistance	R <sub>G(int)</sub>	f=1MHz, V <sub>AC</sub> =25mV, D-S Short, including internal 0.51 ohm series gate resistor**	-	1.0	-	Ω

\*R<sub>DS(on)</sub> measured at kelvin and sense pins (pin #7-8 and pin #8-5), typical 2mΩ chip only

\*\*Internal series gate resistor limits maximum switching frequency defined by Figure 35

AC Electrical Characteristics, at T<sub>J</sub>=25°C, unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =800V, f=100kHz, V <sub>AC</sub> =25mV	-	52.3	-	nF
Output Capacitance	C <sub>OSS</sub>		-	2.89	-	
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	0.12	-	
Coss Stored Energy	E <sub>OSS</sub> ***		-	1161	-	
Turn-On Switching Energy	E <sub>ON</sub>	T <sub>J</sub> =25°C	-	4.9	-	mJ
		T <sub>J</sub> =125°C	-	4.3	-	
		T <sub>J</sub> =150°C	-	4.3	-	
Turn-Off Switching Energy	E <sub>OFF</sub>	T <sub>J</sub> =25°C	-	5.6	-	
		T <sub>J</sub> =125°C	-	6.1	-	
		T <sub>J</sub> =150°C	-	6.2	-	
Turn-On Delay Time	t <sub>D(on)</sub>	V <sub>DD</sub> =600V, I <sub>DS</sub> =350A, R <sub>G(ext)</sub> =1Ω, V <sub>GS</sub> =-4.5/+18V, L=9μH,	-	72	-	ns
Rise Time	t <sub>R</sub>		-	36	-	
Turn-Off Delay Time	t <sub>D(off)</sub>		-	175	-	
Fall Time	t <sub>F</sub>		-	69	-	
Total Gate Charge	Q <sub>G</sub>		-	1825	-	
Gate to Source Charge	Q <sub>GS</sub>	V <sub>DD</sub> =800V, I <sub>DS</sub> =350A, V <sub>GS</sub> =-4.5/+18V	-	564	-	nC
Gate to Drain Charge	Q <sub>GD</sub>	-	322	-		

\*\*\*E<sub>OSS</sub> is calculated from C<sub>OSS</sub> curve

Freewheeling Diode Characteristics, at  $T_j=25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Diode Forward Voltage	$V_{SD}$	$V_{GS}=-5\text{V}, I_{SD}=350\text{A}$	-	1.5	1.9	V
		$V_{GS}=-5\text{V}, I_{SD}=350\text{A}, T_j=150^\circ\text{C}$	-	2.1	-	
Reverse Recovery Time	$t_{RR}$	$T_j=25^\circ\text{C}$ $I_S=350\text{A},$ $V_R=600\text{V},$ $V_{GS}=-4.5\text{V},$ $di/dt=10.5\text{A/ns}$	-	19	-	ns
Reverse Recovery Charge	$Q_{RR}$		-	0.7	-	$\mu\text{C}$
Peak Reverse Recovery Current	$I_{RRM}$		-	56	-	A
Reverse Recovery Energy	$E_{RR}$	$T_j=25^\circ\text{C}$	-	0.22	-	mJ
		$T_j=125^\circ\text{C}$	-	0.29	-	
		$T_j=150^\circ\text{C}$ $R_{G(\text{ext})}=1\Omega$	-	0.31	-	

Thermal and Package Characteristics, at  $T_j=25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal resistance, junction-case	$R_{thJC,MOSFET}$		-	0.115	0.127	$^\circ\text{C/W}$
	$R_{thJC,DIODE}$		-	0.120	0.132	
Thermal resistance, junction-heatsink	$R_{thJH,MOSFET}$	Thermal grease, Thickness=75 $\mu\text{m}$ , $k = 4.0 \text{ W/mK}$	-	0.140	-	$^\circ\text{C/W}$
	$R_{thJH,DIODE}$		-	0.143	-	
Material of module baseplate	-		-	Cu	-	-
Creepage distance	$d_{Creep}$	terminal to heatsink	-	14.5	-	mm
	$d_{Creep}$	terminal to terminal	-	13.0	-	mm
Clearance	$d_{Clear}$	terminal to heatsink	-	12.5	-	mm
	$d_{Clear}$	terminal to terminal	-	10.0	-	mm
Comparative tracking index	CTI		250	-	400	-
Mounting torque	$M_d$	M5-0.8 screws	3	-	6	N-m
Terminal connection torque	$M_{dt}$	M6-1.0 screws	3	-	6	N-m
Package weight	$W_t$		-	382	-	g
Isolation voltage	$V_{ISOL}$	$I_{ISOL} < 1\text{mA}, 50/60 \text{ Hz}, 1 \text{ min}$	3400	-	-	V

NTC Characteristics, at  $T_j=25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Rated resistance	$R_{NTC}$	$T_{NTC} = 25^\circ\text{C}$	-	5.0	-	k $\Omega$
Resistance tolerance	$\Delta R/R$		-5	-	5	%
Beta Value ( $T_2 = 50^\circ\text{C}$ )	$\beta_{25/50}$	$R_2 = R_{25} \cdot \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3375	-	k
Power dissipation	$P_{MAX}$	$T_{NTC} = 25^\circ\text{C}$	-	-	50	mW

Typical Performance

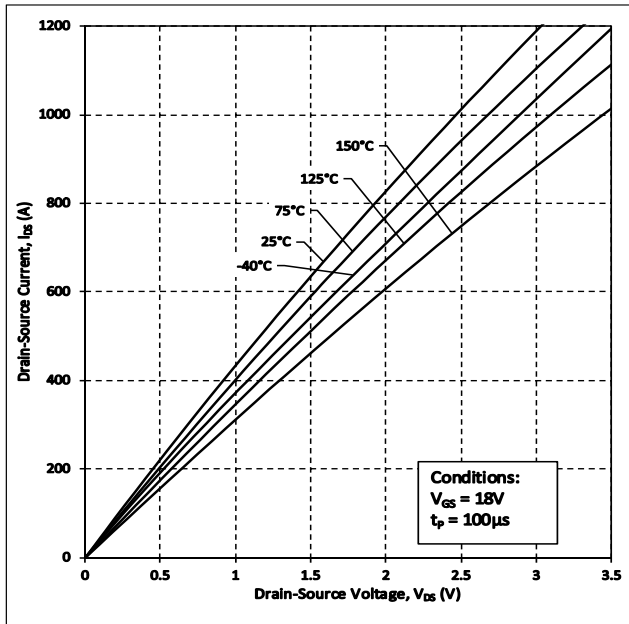


Figure 1. Output Characteristics for Various Temperatures

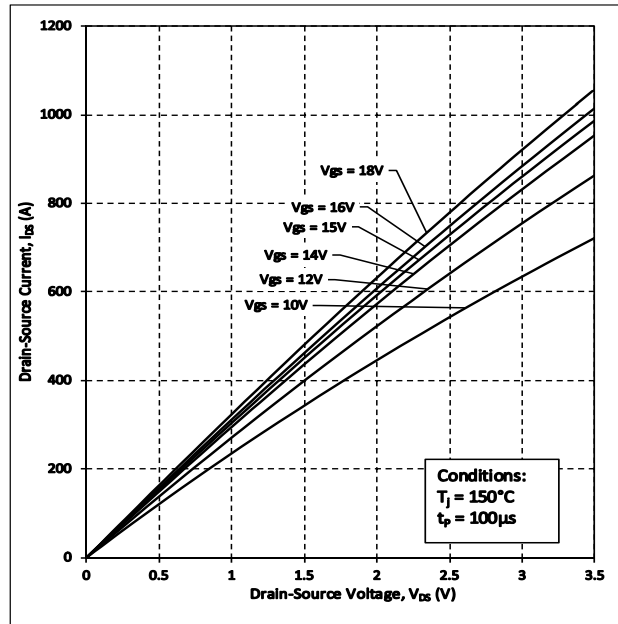


Figure 2. Output Characteristics  $T_J = 150^\circ C$

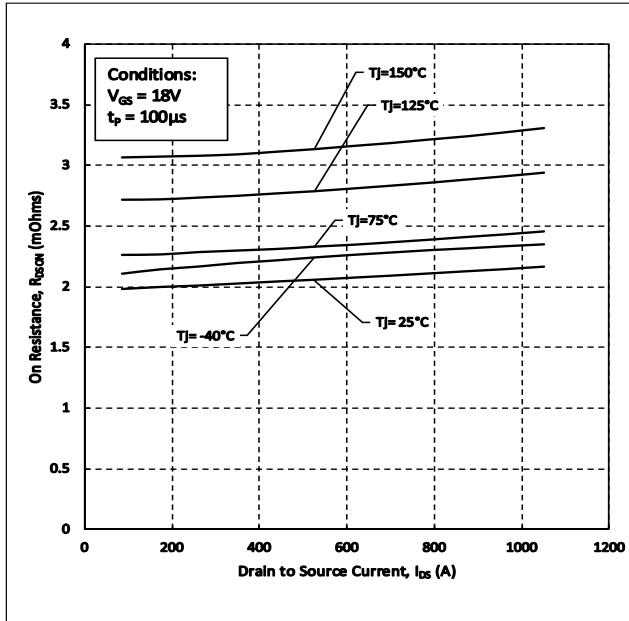


Figure 3. On-Resistance vs. Drain Current For Various Temperatures

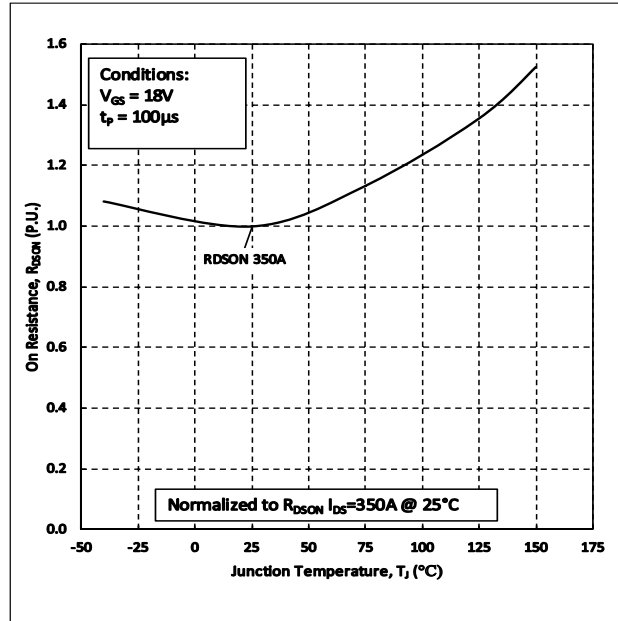


Figure 4. Normalized On-Resistance vs. Temperature

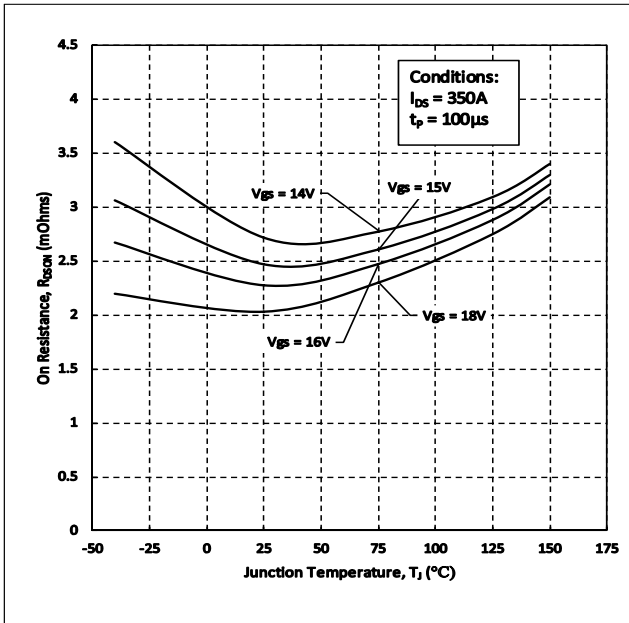


Figure 5. On-Resistance vs. Temperature For Various Gate Voltages

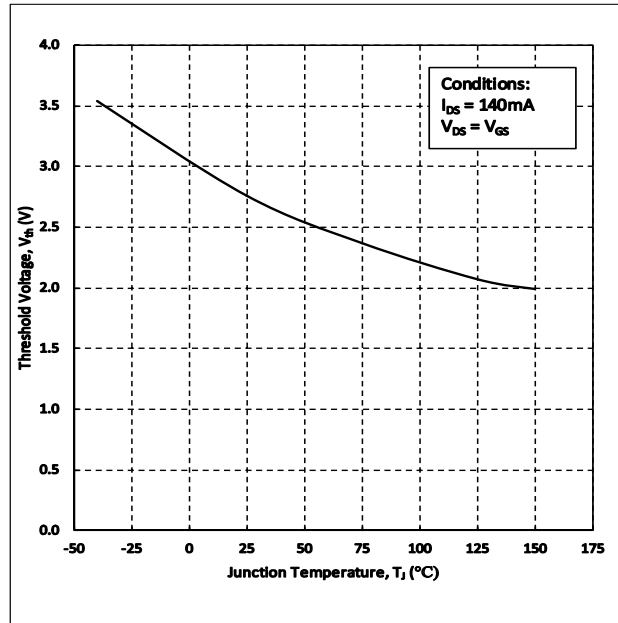


Figure 6. Threshold Voltage vs. Temperature

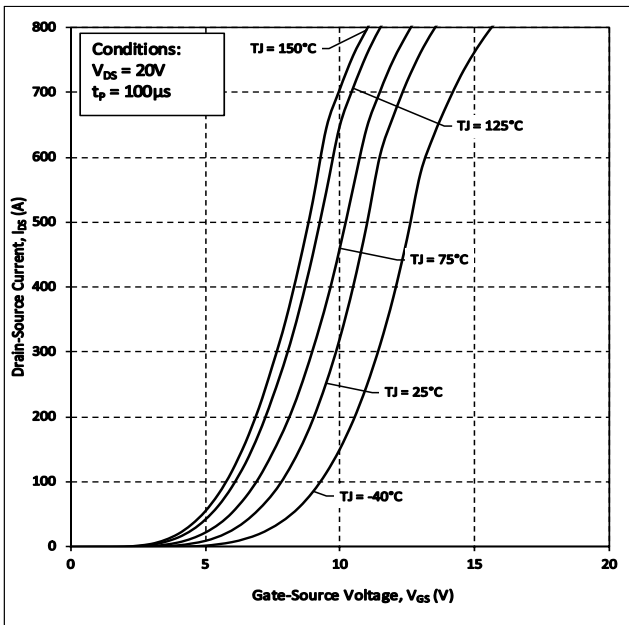


Figure 7. Transfer Characteristic for Various Junction Temperatures

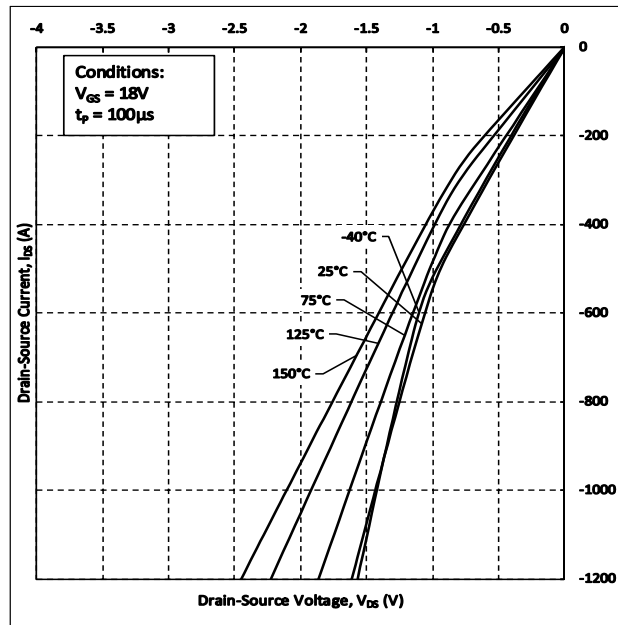


Figure 8. 3rd Quadrant Characteristics at  $V_{GS} = 18V$

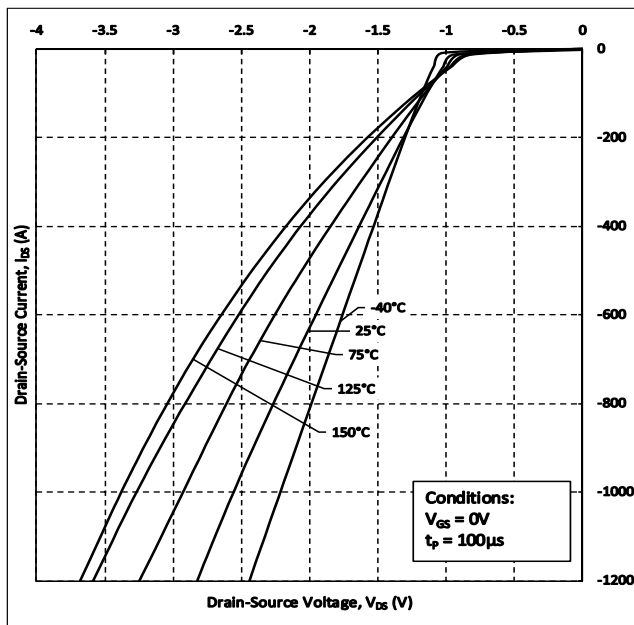


Figure 9. Body Diode Characteristics at  $V_{GS} = 0V$

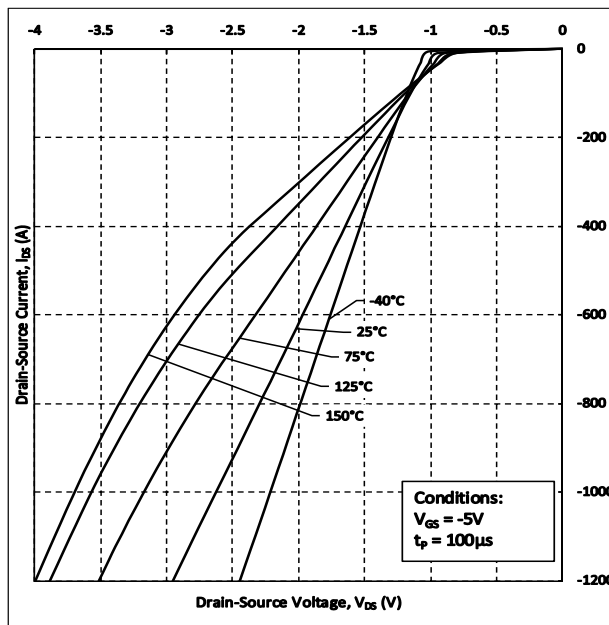


Figure 10. Body Diode Characteristics at  $V_{GS} = -5V$

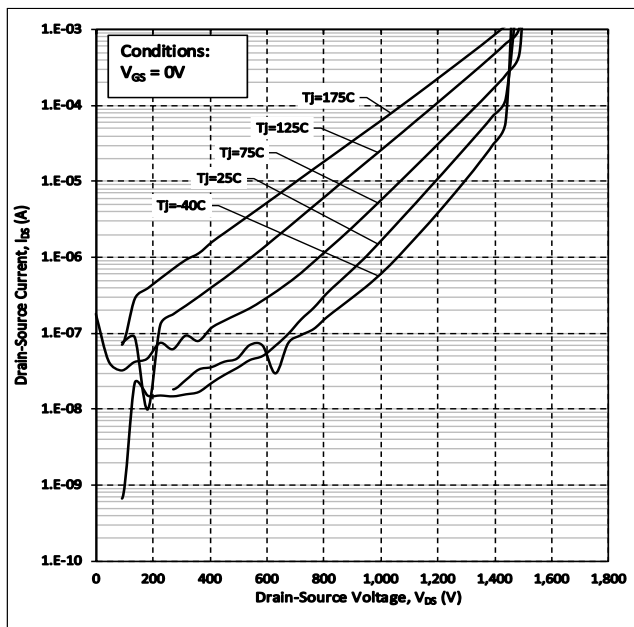


Figure 11.  $I_{DSS}$  vs Temperature

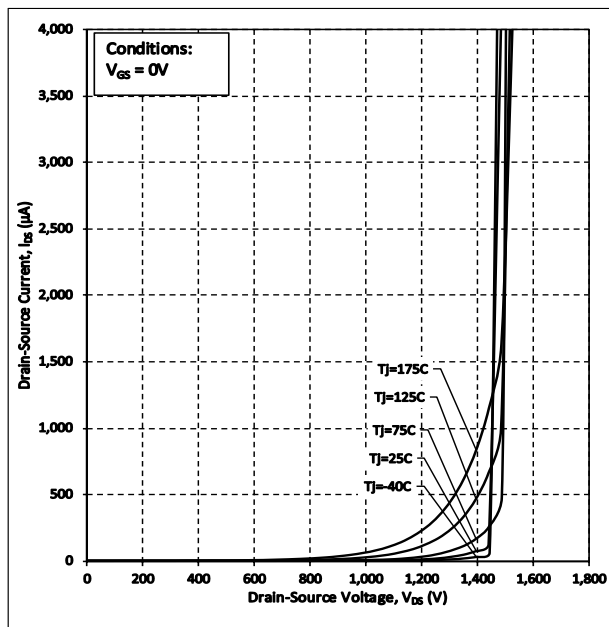


Figure 12.  $BVDSS$  vs Temperature

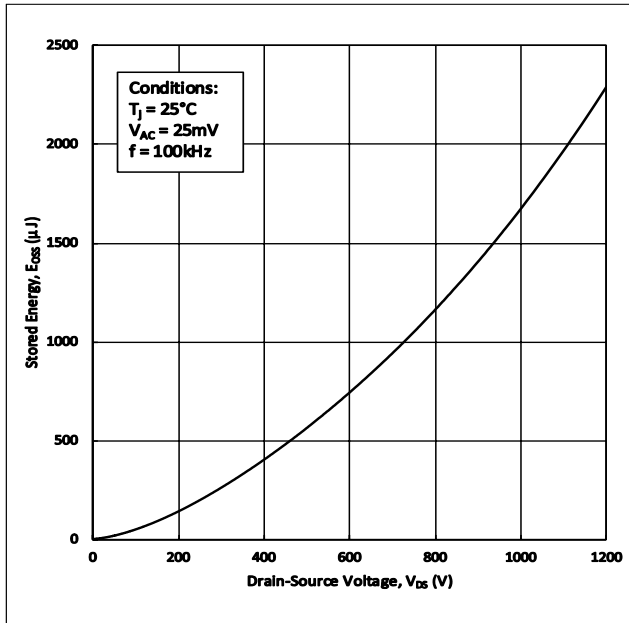


Figure 13. Output Capacitor Stored Energy

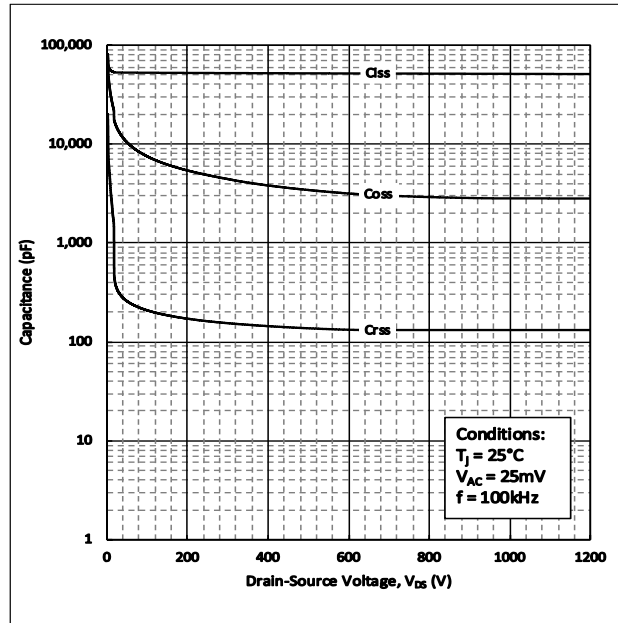


Figure 14. Capacitance vs. Drain-Source Voltage

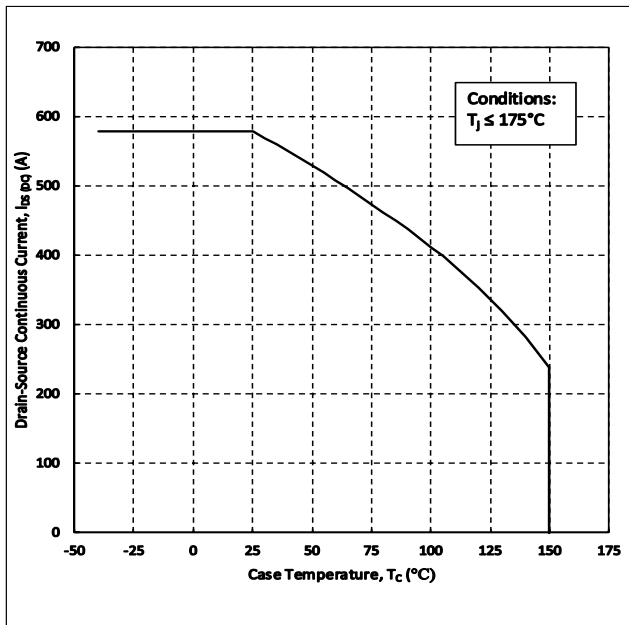


Figure 15. Continuous Drain Current Derating vs. Case Temperature

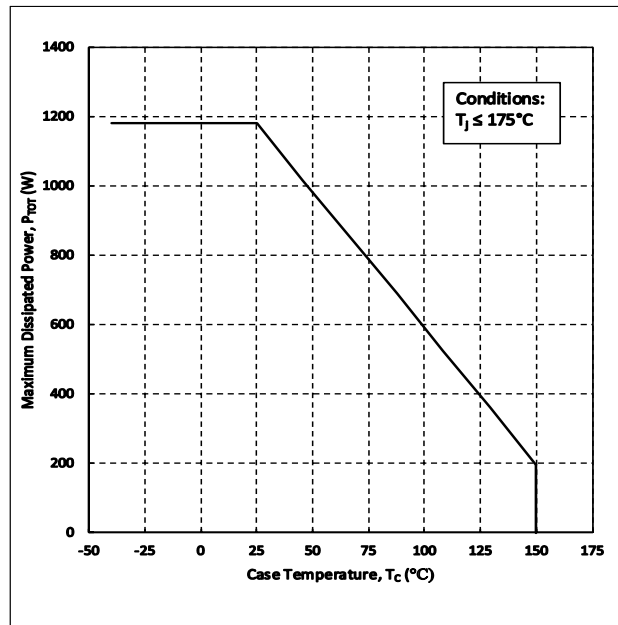


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

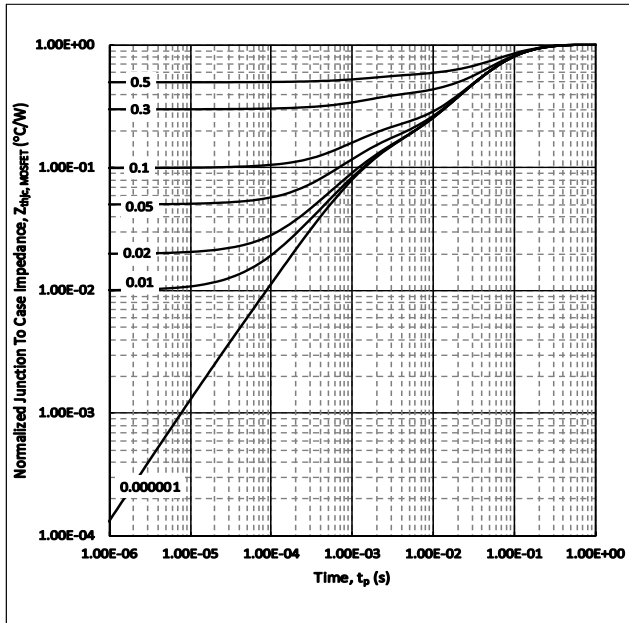


Figure 17. MOSFET Transient Thermal impedance (Junction to Case)

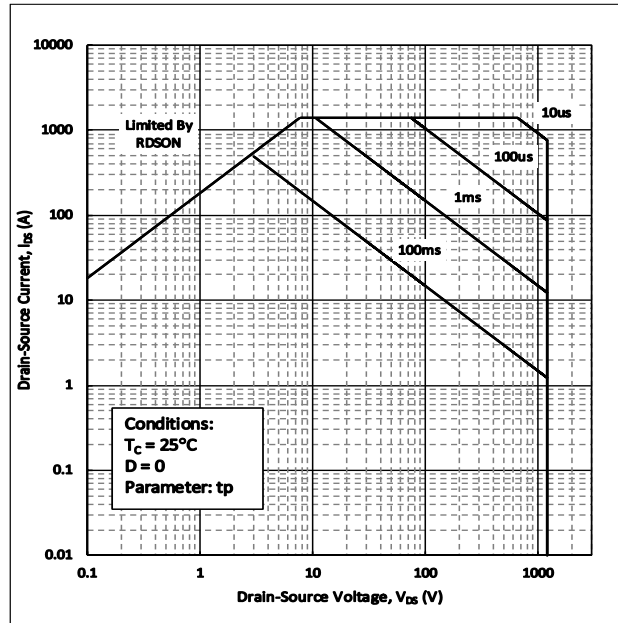


Figure 18. Safe Operating Area

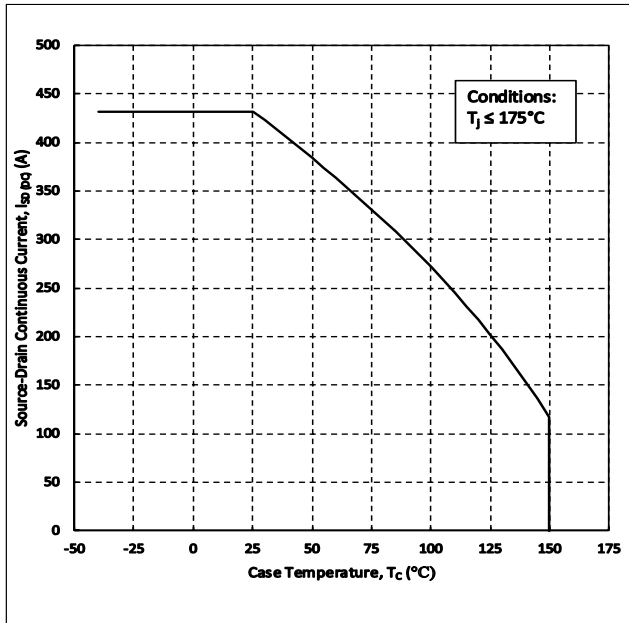


Figure 19. Continuous Source Current Derating vs. Case Temperature

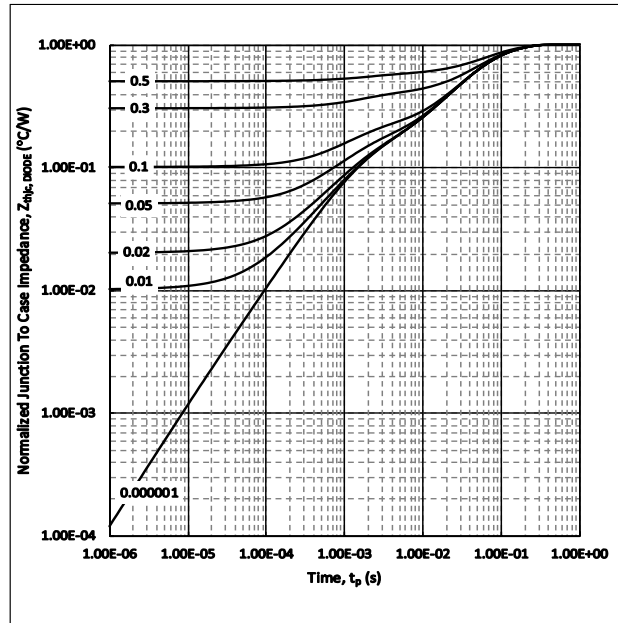


Figure 20. Diode Transient Thermal impedance (Junction to Case)

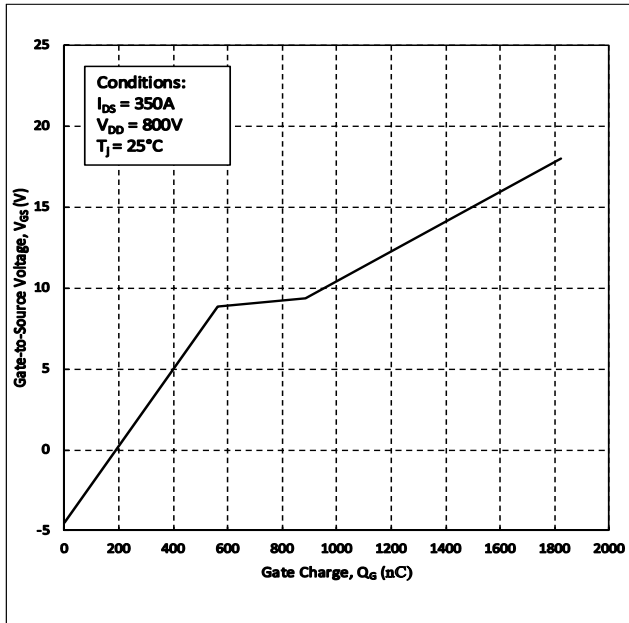


Figure 21. Gate Charge Characteristics

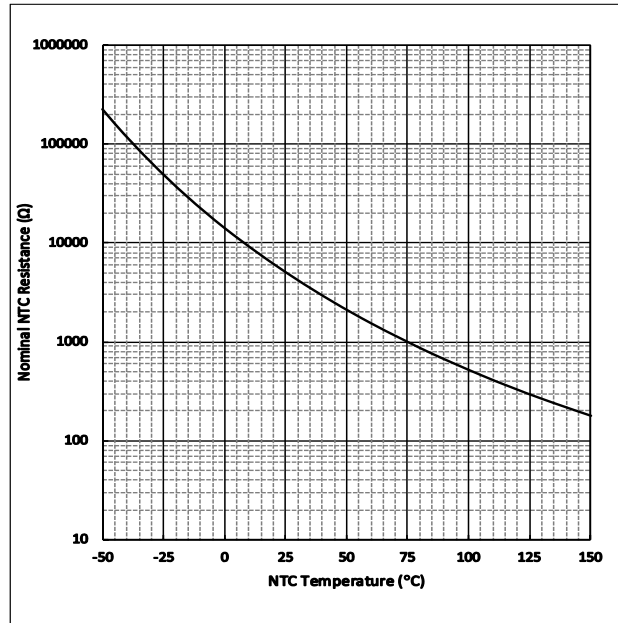


Figure 22. Nominal NTC Resistance vs. Temperature

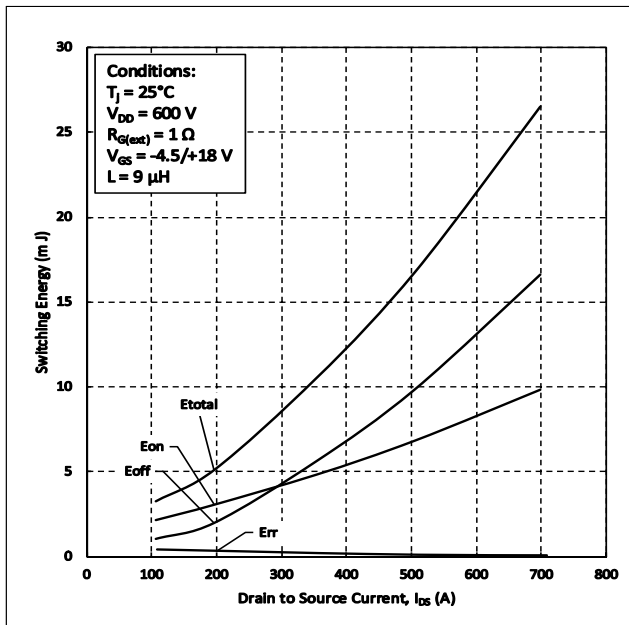


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (600V)

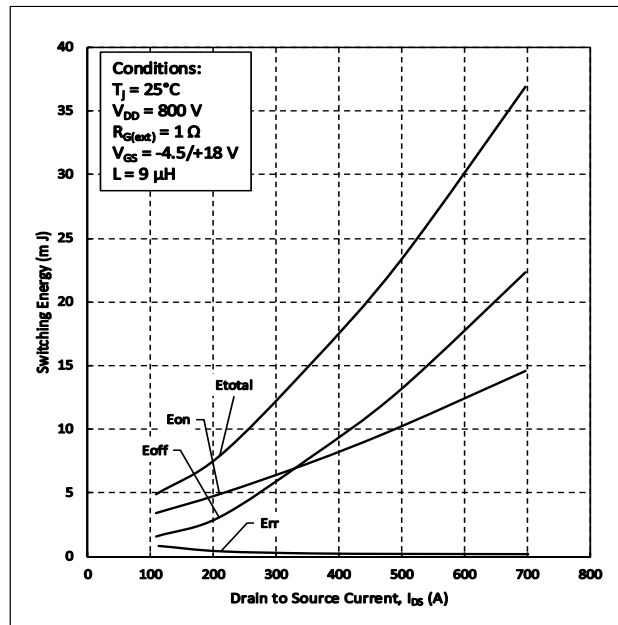


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (800V)

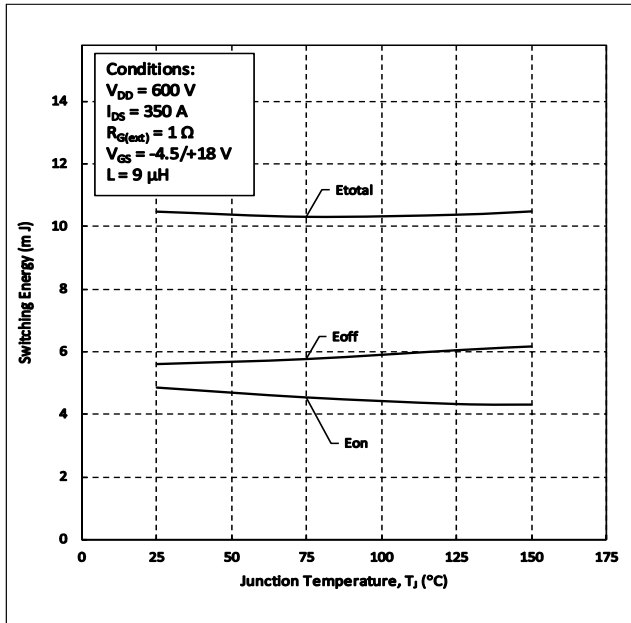


Figure 25. Clamped Inductive Switching Energy vs. Temperature

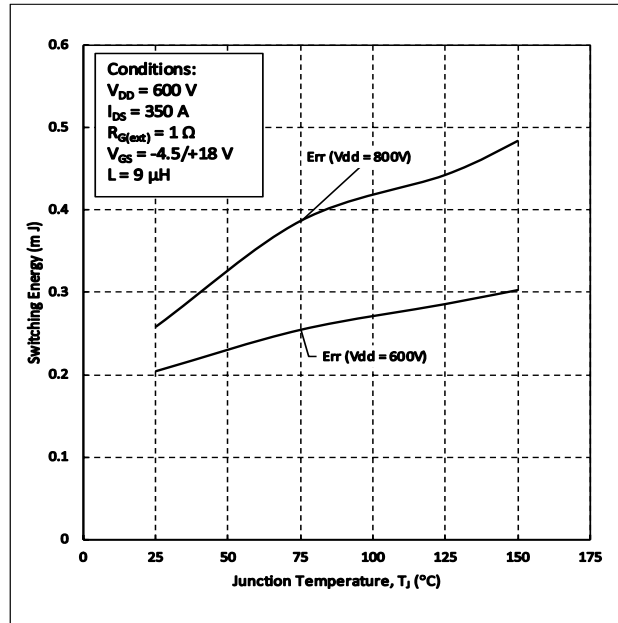


Figure 26. Reverse Recovery Energy vs. Temperature

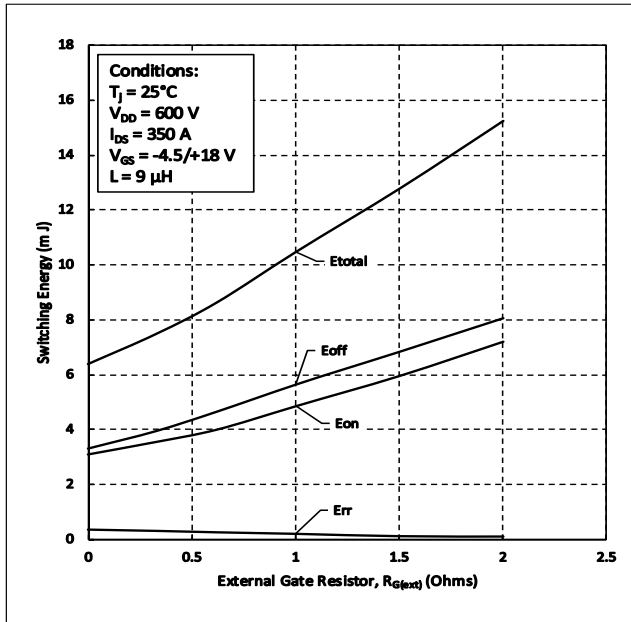


Figure 27. Clamped Inductive Switching Energy vs.  $R_{G(ext)}$

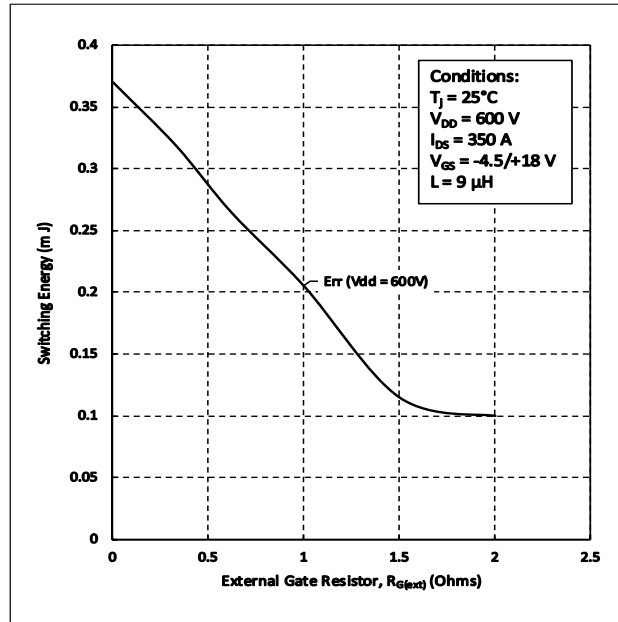


Figure 28. Reverse Recovery Energy vs.  $R_{G(ext)}$

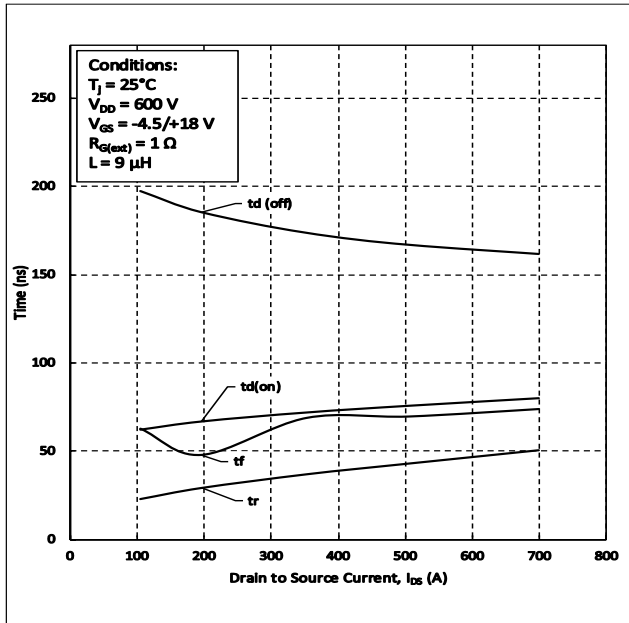


Figure 29. Switching Times vs. Drain Current

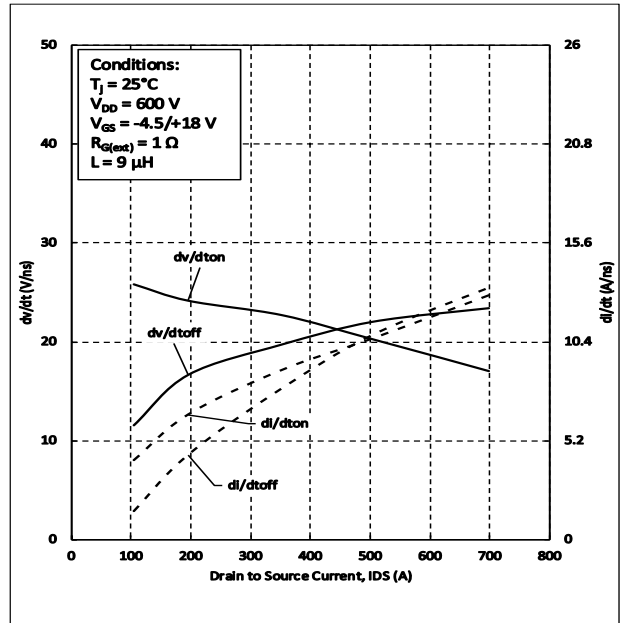


Figure 30.  $dv/dt$  and  $di/dt$  vs. Source Current

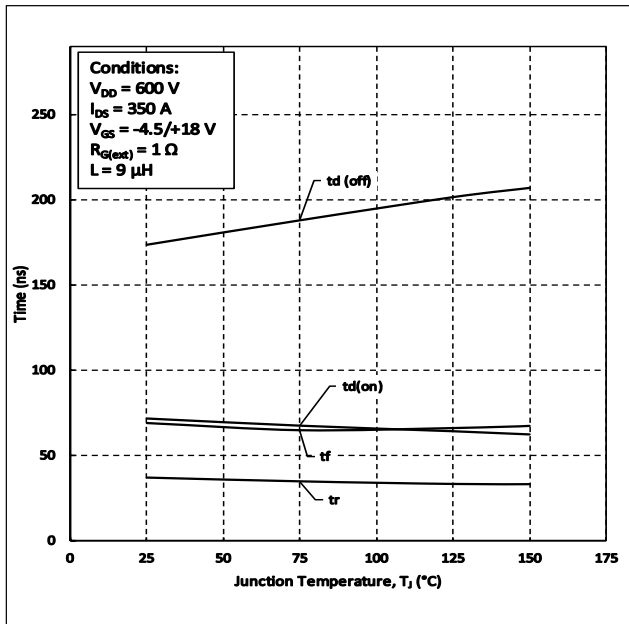


Figure 31. Switching Times vs. Temperature

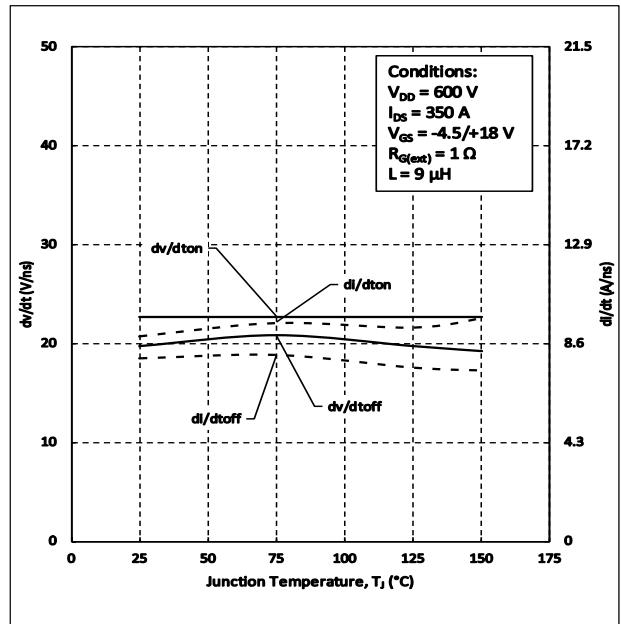


Figure 32.  $dv/dt$  and  $di/dt$  vs. Temperature

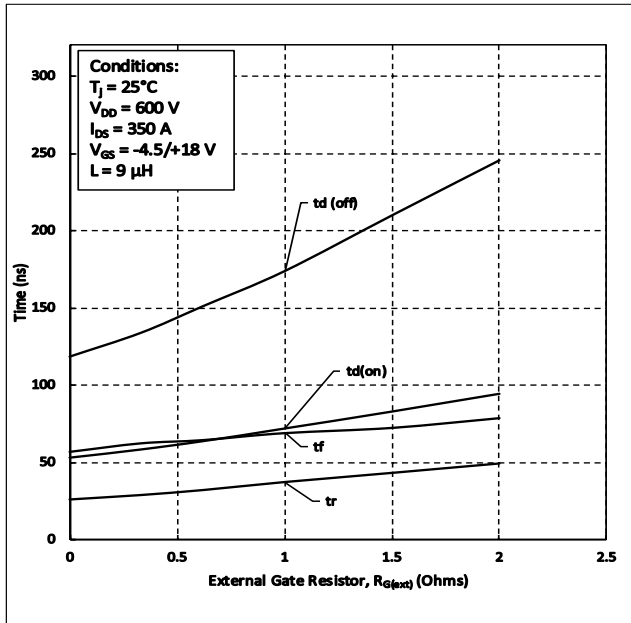


Figure 33. Switching Times vs.  $R_{G(ext)}$

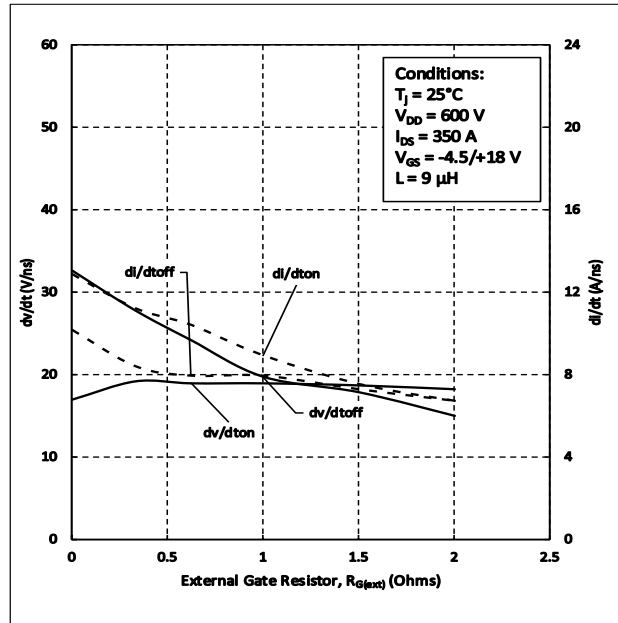


Figure 34.  $dv/dt$  and  $di/dt$  vs.  $R_{G(ext)}$

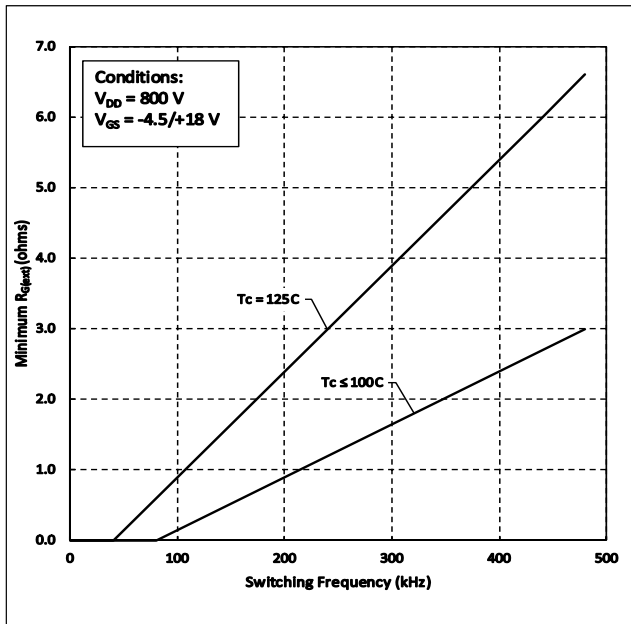


Figure 35. Frequency vs. Minimum  $R_{G(ext)}$

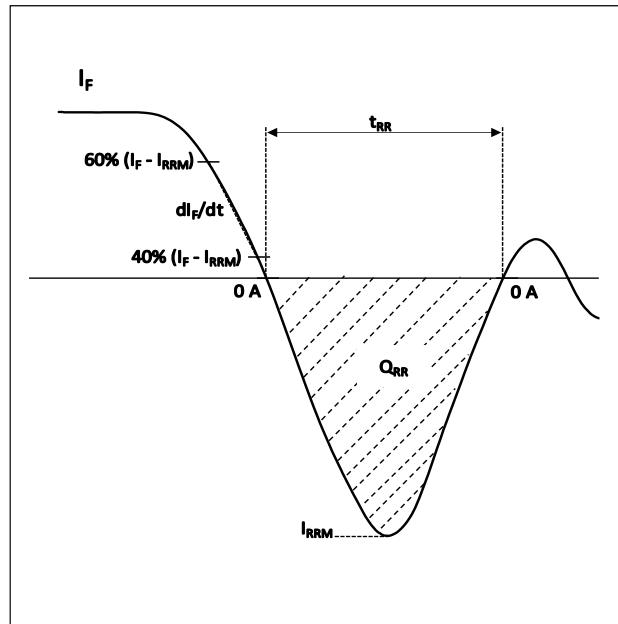


Figure 36. Reverse Recovery Definitions

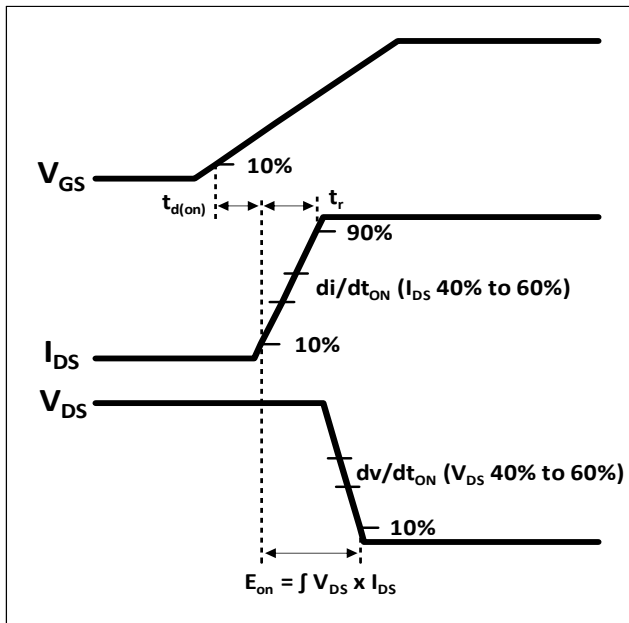


Figure 37. Turn-on Transient Definitions

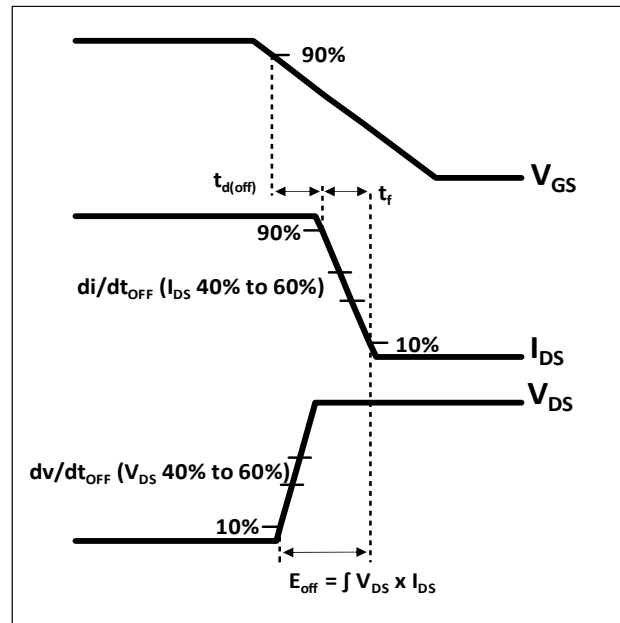
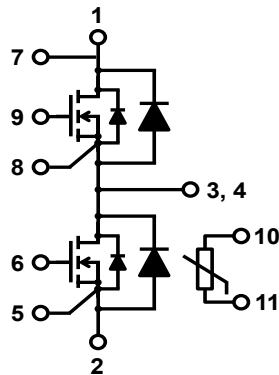


Figure 38. Turn-off Transient Definitions

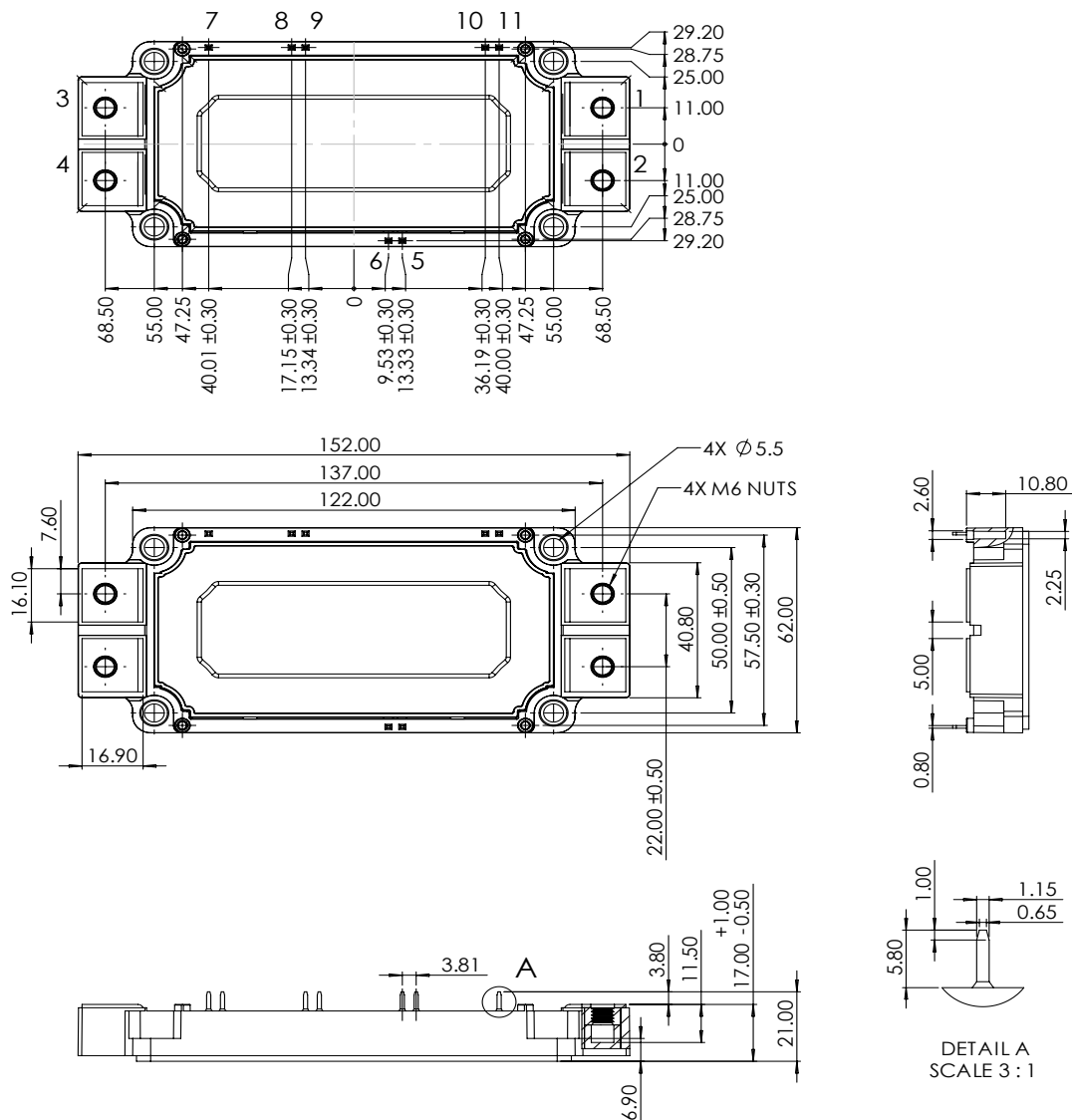
# QSiC™ 1200V SiC Half-Bridge Module

GCMS2P0B120S4B1

## Pinout and Circuit Diagram



## Package Dimensions (mm)



# 1200V SiC Half-Bridge Module

**GCMS2P0B120S4B1**

Revision History		
Date	Revision	Notes
4/2/2026	1.0	Initial release

## **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 2015/863 (RoHS3), as implemented July, 2019. RoHS Declarations for this product can be obtained from the Product Documentation sections of [www.SemiQ.com](http://www.SemiQ.com).

### **REACH Compliance**

REACH substances of high concern (SVHC) information is available for this product. Since the European Chemicals Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact our office at SemiQ 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. SemiQ Inc., reserves the right to make changes to the product specifications and data in this document without notice. SemiQ products are sold pursuant to SemiQ's terms and conditions of sale in place at the time of order acknowledgement.

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