CPM3-1700-R020E

Silicon Carbide Power MOSFET
C3M™ MOSFET Technology

N-Channel Enhancement Mode

V_{DS}	1700 V
$I_{D\ @\ 25^\circ C}$	120 A
$R_{DS(on)}$	18 mΩ

Features

- C3M SiC MOSFET technology
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to parallel and simple to drive
- Resistant to Latch-up

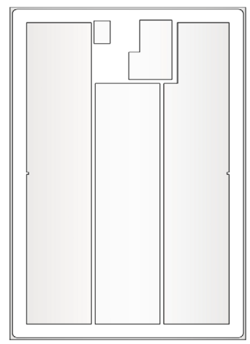
Benefits

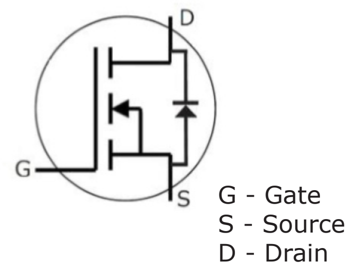
- Higher System Efficiency
- Low Conduction Losses over Temperature
- Reduced Cooling Requirements
- Increased System Switching Frequency

Applications

- Solid-state Circuit Breaker
- Industrial Inverters / Converters
- Uninterruptible Power Supply

Chip Outline





Part Number	Die Size (mm)
CPM3-1700-R020E	Please contact your sales representative to get die size and layout information

Maximum Ratings

Stress beyond those listed under absolute maximum ratings may cause permanent damage to the device. Exposure to absolute maximum rated conditions for an extended period may affect device reliability.

Symbol	Parameter		Value	Unit
V_{DSmax}	Drain - Source Voltage, $T_{vj} \geq -55\ ^\circ C$		1700	V
V_{GSmax}	Max Gate - Source Voltage		-8/+19	V
$V_{GS,\ DC}$	Recommended Static Gate - Source Voltage		-4/+15	V
I_D [1]	Continuous Drain Current, limited by T_{vjmax}, V_{GS} = 15V, assumes $R_{th(j-c)}$ < 0.275 K/W	$T_C = 25\ ^\circ C$	120	A
		$T_C = 100\ ^\circ C$	86	
$I_{D(pulse)}$ [1]	Pulsed Drain Current, t_p limited by T_{vjmax}		249	A
T_{VJ} , T_{stg} [1]	Virtual Junction and Storage Temperature		-55 to +175	˚C
T_{Proc}	Maximum Processing Temperature, in non-reactive ambient environment		325	˚C

[1] Verified by design

Electrical Characteristics (T_C = 25˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1700			V	V_{GS} = 0 V, I_D = 40 μA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.5	3.6	V	V_{DS} = V_{GS}, I_D = 25.4 mA	Fig. 11
			2.0		V	V_{DS} = V_{GS}, I_D = 25.4 mA, T_J = 175ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	40	μA	V_{DS} = 1700 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current		1	250	nA	V_{GS} = 15 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance	12.3	17.5	22.8	mΩ	V_{GS} = 15 V, I_D = 92.2 A	Fig. 4, 5, 6
			40.3			V_{GS} = 15 V, I_D = 92.2 A, T_J = 175ºC	
g_{fs}	Transconductance		63		S	V_{DS}= 20 V, I_{DS}= 92.2 A	Fig. 7
			61			V_{DS}= 20 V, I_{DS}= 92.2 A, T_J = 175ºC	
C_{iss}	Input Capacitance		7667		pF	V_{GS} = 0 V, V_{DS} = 1000 V f = 100 kHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		188				
C_{rss}	Reverse Transfer Capacitance		10				
E_{oss}	C_{oss} Stored Energy		292		μJ		Fig. 16
$R_{G(total)}$	Total Internal Gate Resistance	5.2	7.4	9.6	Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		80		nC	V_{DS} = 1200 V, V_{GS} = -4 V/15 V I_D = 92.2 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		70				
Q_g	Total Gate Charge		249				

Reverse Diode Characteristics (T_C = 25˚C unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.9		V	V_{GS} = -4 V, I_{SD} = 46.1 A, T_J = 25 °C	Fig. 8, 9, 10
		4.3		V	V_{GS} = -4 V, I_{SD} = 46.1 A, T_J = 175 °C	
t_{rr}	Reverse Recovery time	43		ns	V_{GS} = -4 V, I_F = 92.2 A, V_R = 1200 V dif/dt = 4000 A/μs, T_J = 175 °C	
Q_{rr}	Reverse Recovery Charge	2557		nC		
I_{rrm}	Peak Reverse Recovery Current	87		A		

Note: When using SiC Body Diode the maximum recommended V_{GS} = -4V
Specifications at -55ºC and +175ºC are not tested and are guaranteed by design and characterization

Typical Performance

All the graphs are based on the TO-247-4L (which has higher thermal resistance than most packages)

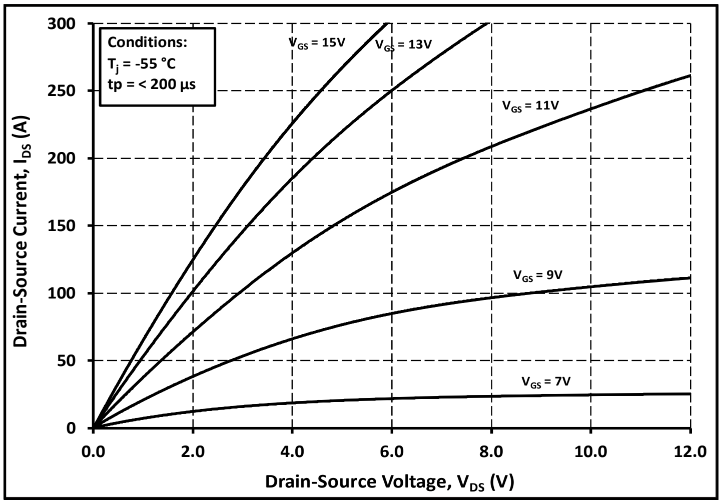


Figure 1. Output Characteristics T_J = -55 °C

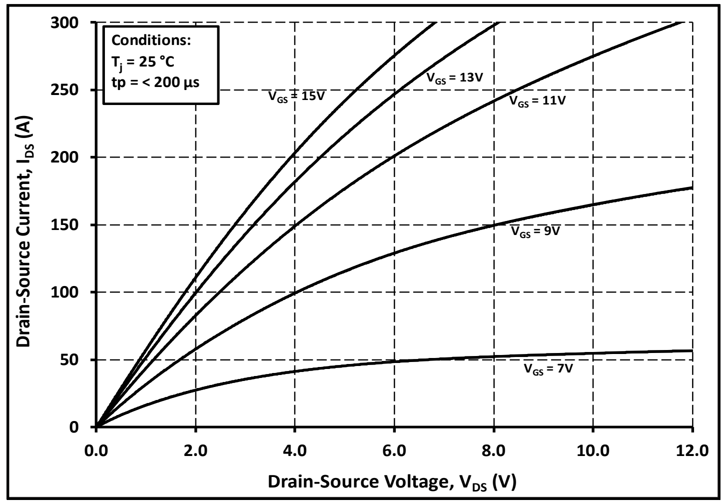


Figure 2. Output Characteristics T_J = 25 °C

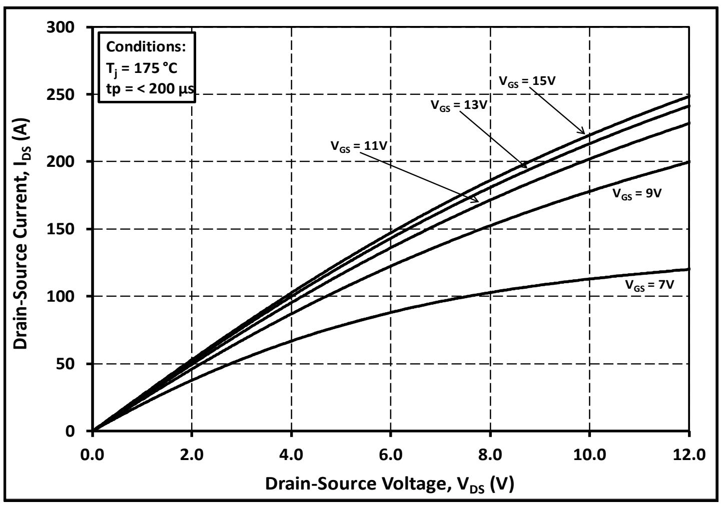


Figure 3. Output Characteristics T_J = 175 °C

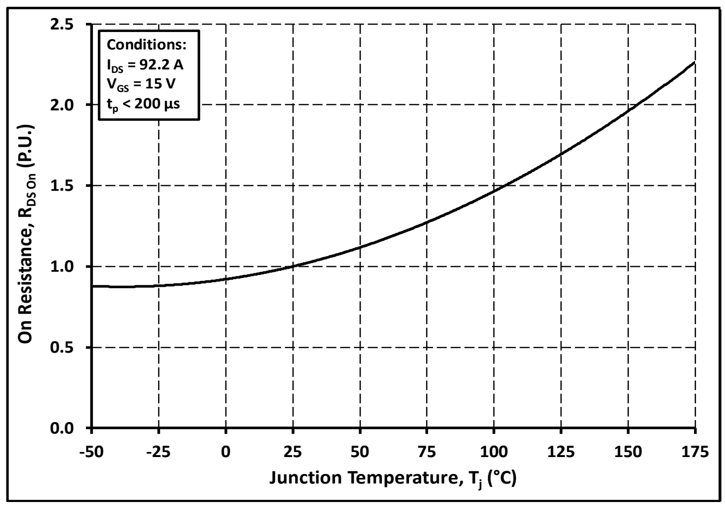


Figure 4. Normalized On-Resistance vs. Temperature

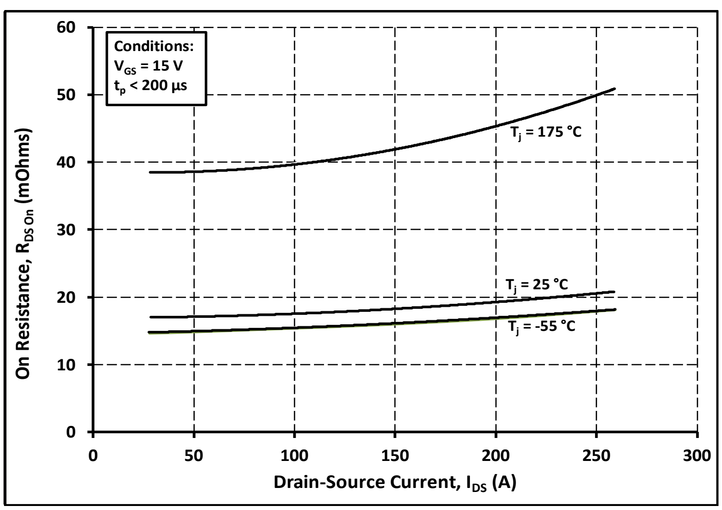


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

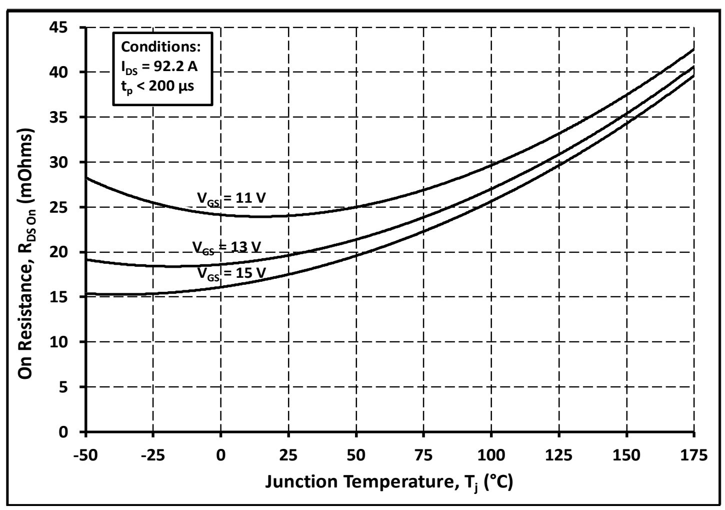


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

All the graphs are based on the TO-247-4L (which has higher thermal resistance than most packages)

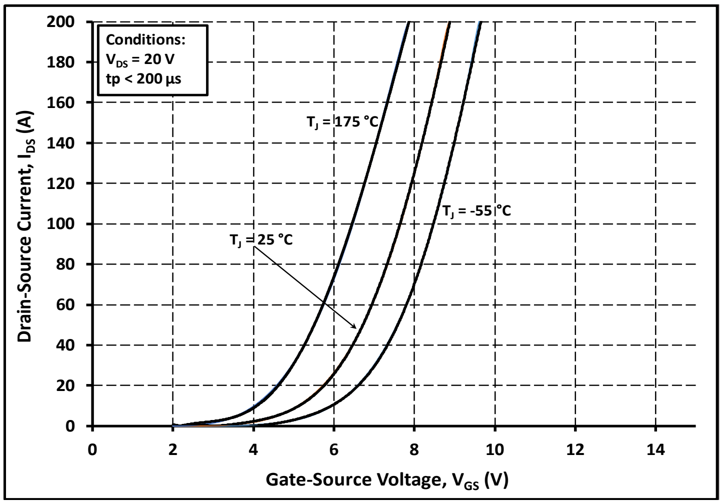


Figure 7. Transfer Characteristic for Various Junction Temperatures

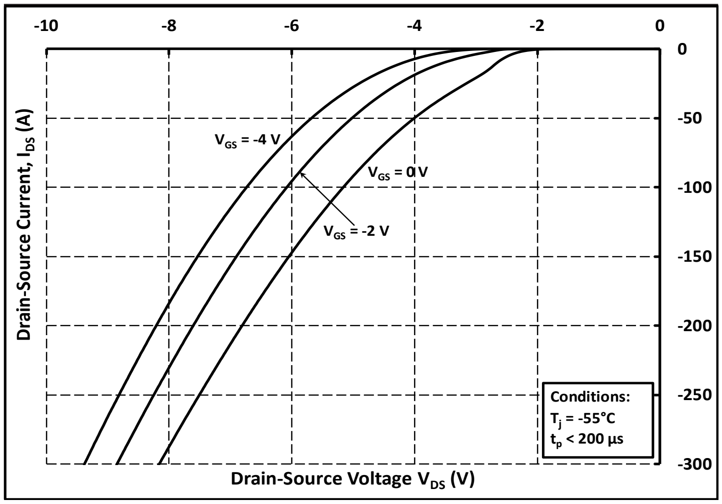


Figure 8. Body Diode Characteristic at -55 °C

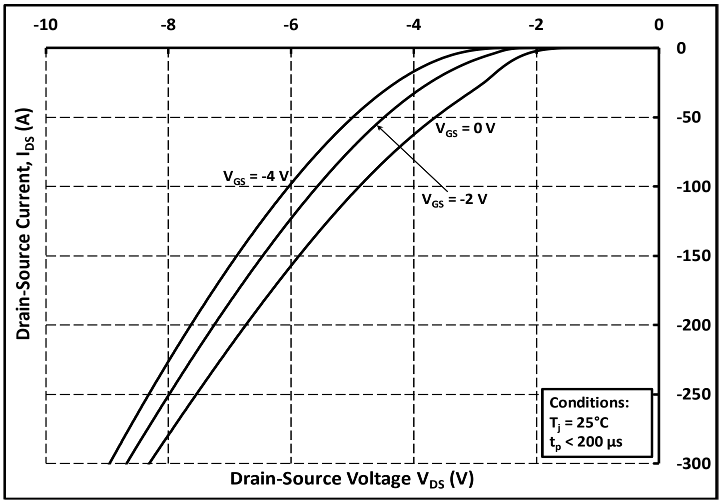


Figure 9. Body Diode Characteristic at 25 °C

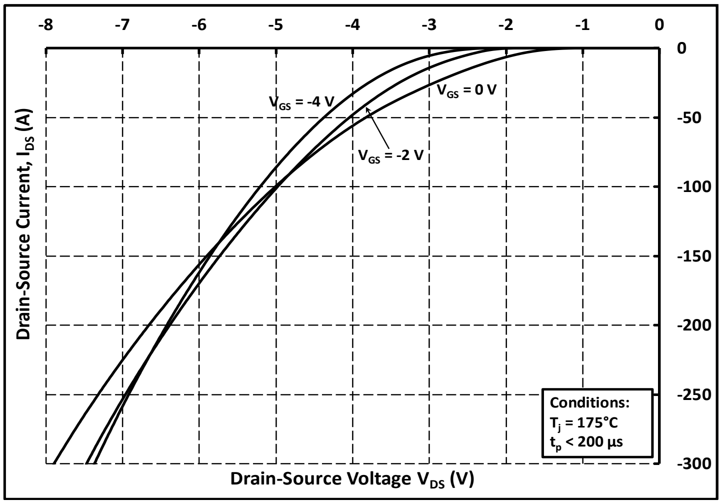


Figure 10. Body Diode Characteristic at 175 °C

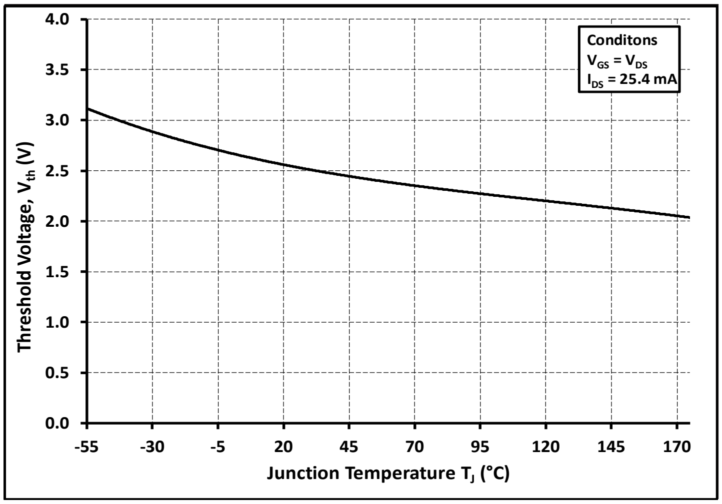


Figure 11. Threshold Voltage vs. Temperature

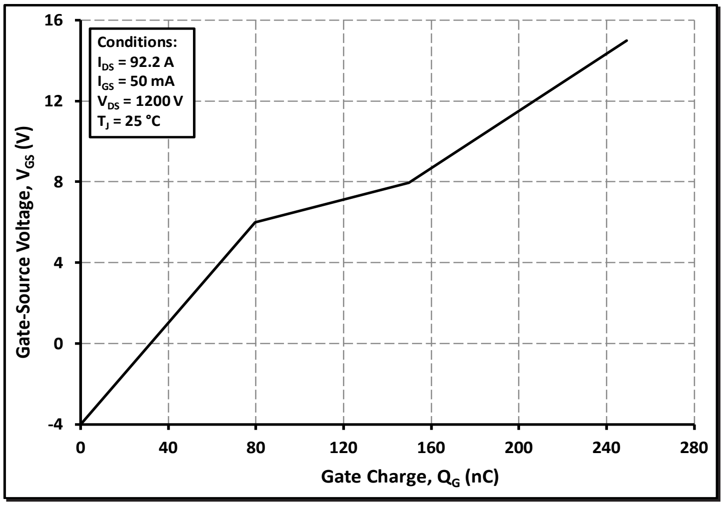


Figure 12. Gate Charge Characteristics

Typical Performance

All the graphs are based on the TO-247-4L (which has higher thermal resistance than most packages)

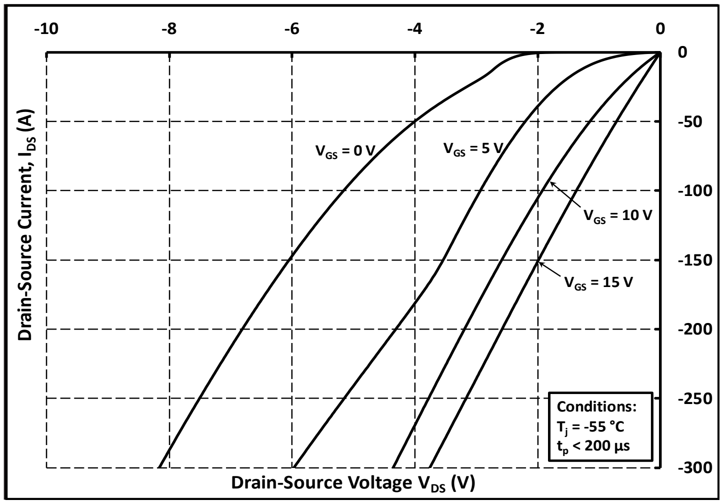


Figure 13. 3rd Quadrant Characteristic at -55 °C

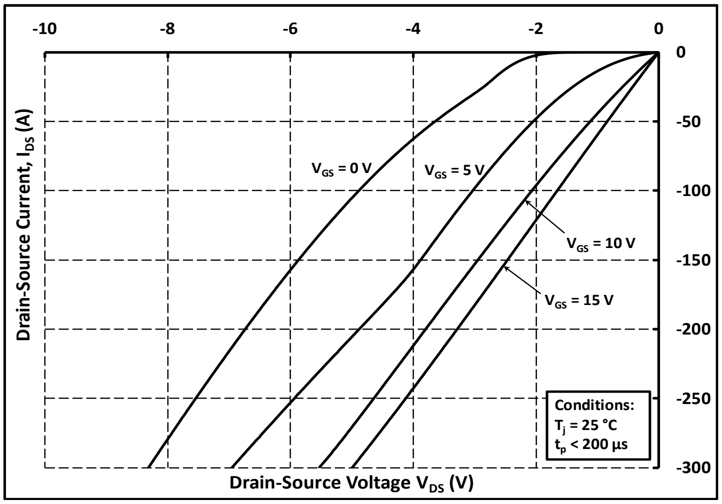


Figure 14. 3rd Quadrant Characteristic at 25 °C

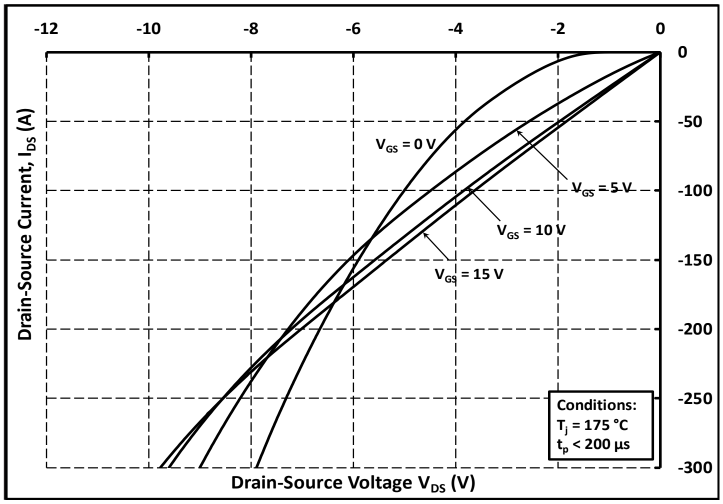


Figure 15. 3rd Quadrant Characteristic at 175 °C

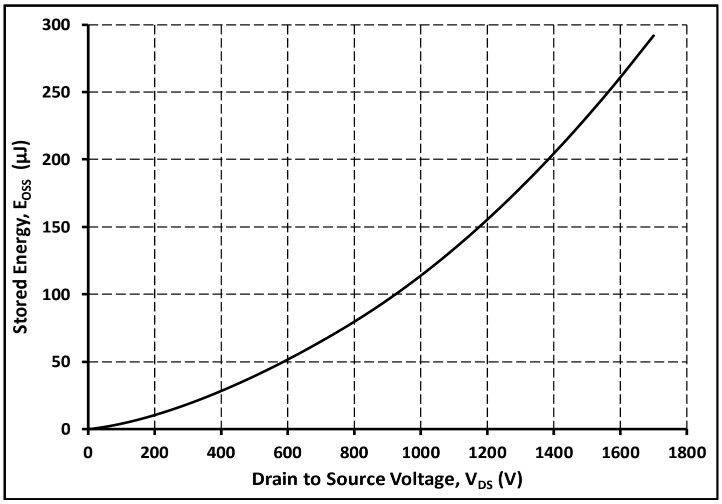


Figure 16. Output Capacitor Stored Energy

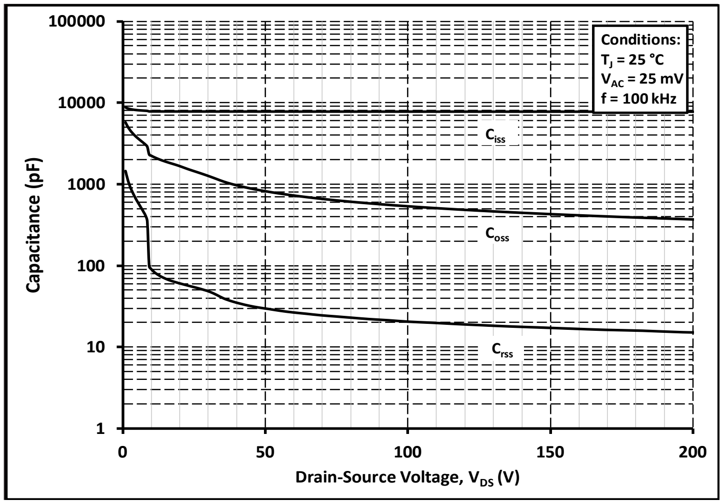


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

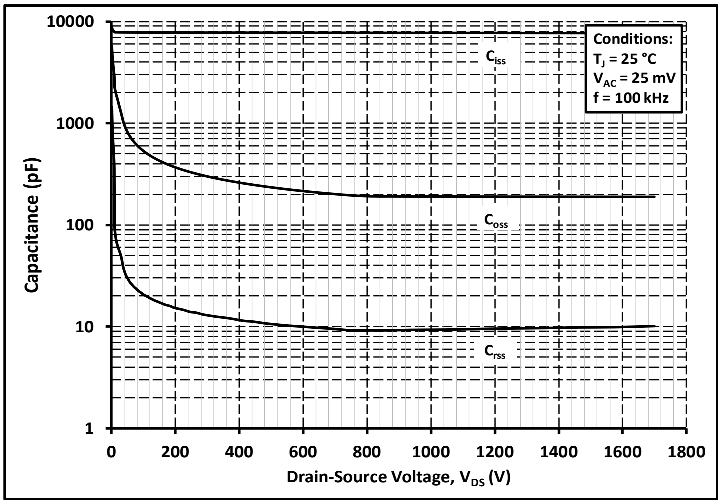


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1800V)

Revision History

Revision Number	Date of Change	Brief Summary
1	09/09/2021	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 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Cree representative or from the Product Documentation sections of www.cree.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 a Cree representative 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, air traffic control systems.

Related Links

- SiC MOSFET Isolated Gate Driver reference design: www.wolfspeed.com/power/Tools-and-Support
- Application Considerations for Silicon-Carbide MOSFETs: www.wolfspeed.com/power/Tools-and-Support

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