C3M0030090K

Silicon Carbide Power MOSFET
C3M™ MOSFET Technology

N-Channel Enhancement Mode

V_{DS}	900 V
I_D @ 25˚C	63 A
$R_{DS(on)}$	30 mΩ

Features

- C3M™ SiC MOSFET technology
- Optimized package with separate driver source pin
- 8mm of creepage distance between drain and source
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant

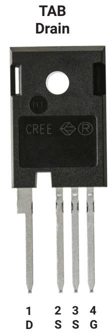
Benefits

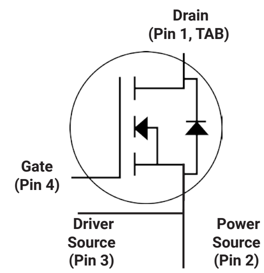
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

- Solar inverters
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies

Package





Part Number	Package	Marking
C3M0030090K	TO 247-4	C3M0030090K

Maximum Ratings (T_C = 25 ˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	900	V	V_{GS} = 0 V, I_D = 100 μA	
V_{GSmax}	Gate - Source Voltage (dynamic)	-8/+19	V	AC (f >1 Hz)	Note: 1
V_{GSop}	Gate - Source Voltage (static)	-4/+15	V	Static	Note: 2
I_D	Continuous Drain Current	63	A	V_{GS} = 15 V, T_C = 25˚C	Fig. 19
		40		V_{GS} = 15 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	200	A	Pulse width t_P limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	149	W	T_C=25˚C, T_J = 150 ˚C	Fig. 20
T_J , T_{stg}	Operating Junction and Storage Temperature	-55 to +150	˚C		
T_L	Solder Temperature	260	˚C	1.6mm (0.063”) from case for 10s	

Note (1): When using MOSFET Body Diode V_{GSmax} = -4V/+19V
Note (2): MOSFET can also safely operate at 0/+15 V

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	900			V	V_{GS} = 0 V, I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage	1.7	2.4	3.5	V	V_{DS} = V_{GS}, I_D = 11 mA	Fig. 11
			1.7		V	V_{DS} = V_{GS}, I_D = 11 mA, T_J = 150ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	100	μA	V_{DS} = 900 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current		10	250	nA	V_{GS} = 15 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance		30	39	mΩ	V_{GS} = 15 V, I_D = 35 A	Fig. 4, 5, 6
			37			V_{GS} = 15 V, I_D = 35 A, T_J = 150ºC	
g_{fs}	Transconductance		22		S	V_{DS}= 20 V, I_{DS}= 35 A	Fig. 7
			21			V_{DS}= 20 V, I_{DS}= 35 A, T_J = 150ºC	
C_{iss}	Input Capacitance		1864		pF	V_{GS} = 0 V, V_{DS} = 600 V f = 1 MHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		131				
C_{rss}	Reverse Transfer Capacitance		4				
E_{oss}	C_{oss} Stored Energy		33		μJ		Fig. 16
E_{ON}	Turn-On Switching Energy (SiC Diode FWD)		0.22		mJ	V_{DS} = 600 V, V_{GS} = -4 V/15 V, I_D = 35 A, $R_{G(ext)}$ = 2.5Ω, L= 56 μH, T_J = 150ºC	Fig. 26, 29b
E_{OFF}	Turn Off Switching Energy (SiC Diode FWD)		0.12				
E_{ON}	Turn-On Switching Energy (Body Diode FWD)		0.40		mJ	V_{DS} = 600 V, V_{GS} = -4 V/15 V, I_D = 35 A, $R_{G(ext)}$ = 2.5Ω, L= 56 μH, T_J = 150ºC	Fig. 26, 29a
E_{OFF}	Turn Off Switching Energy (Body Diode FWD)		0.09				
$t_{d(on)}$	Turn-On Delay Time		15		ns	V_{DD} = 600 V, V_{GS} = -4 V/15 V I_D = 35 A, $R_{G(ext)}$ = 2.5 Ω, Timing relative to V_{DS} Inductive load	Fig. 27
t_r	Rise Time		22				
$t_{d(off)}$	Turn-Off Delay Time		32				
t_f	Fall Time		9				
$R_{G(int)}$	Internal Gate Resistance		3		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		19		nC	V_{DS} = 600 V, V_{GS} = -4 V/15 V I_D = 35 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		30				
Q_g	Total Gate Charge		87				

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

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.8		V	V_{GS} = -4 V, I_{SD} = 17.5 A	Fig. 8, 9, 10
		4.5		V	V_{GS} = -4 V, I_{SD} = 17.5 A, T_J = 150 °C	
I_S	Continuous Diode Forward Current		30	A	V_{GS} = -4 V, T_C = 25 °C	Note 1
$I_{S, pulse}$	Diode pulse Current		200	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	Note 1
t_{rr}	Reverse Recover time	62		ns	V_{GS} = -4 V, I_{SD} = 35 A, V_R = 600 V dif/dt = 2680 A/μs, T_J = 150 °C	Note 1
Q_{rr}	Reverse Recovery Charge	545		nC		
I_{rrm}	Peak Reverse Recovery Current	28		A		

Thermal Characteristics

Symbol	Parameter	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.84	˚C/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40			

Typical Performance

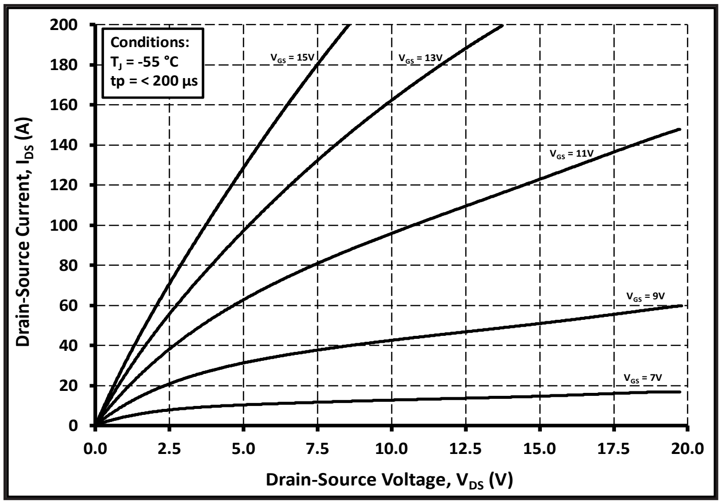


Figure 1. Output Characteristics T_J = -55 °C

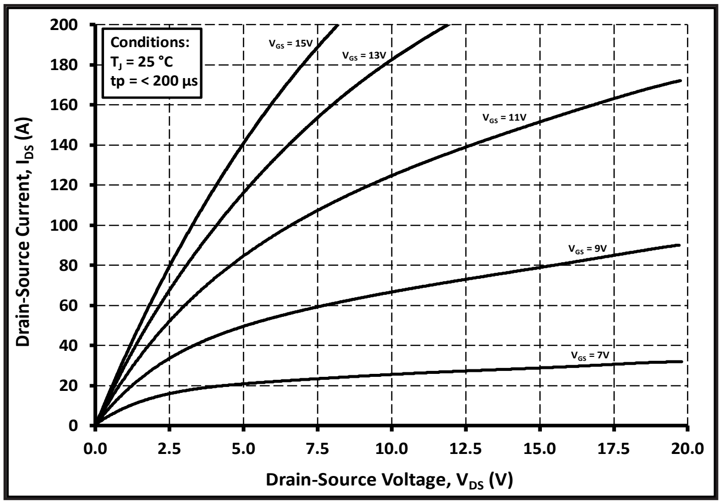


Figure 2. Output Characteristics T_J = 25 °C

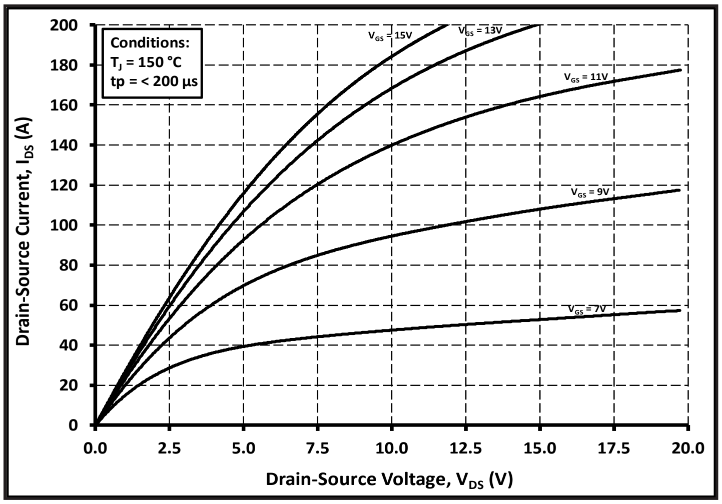


Figure 3. Output Characteristics T_J = 150 °C

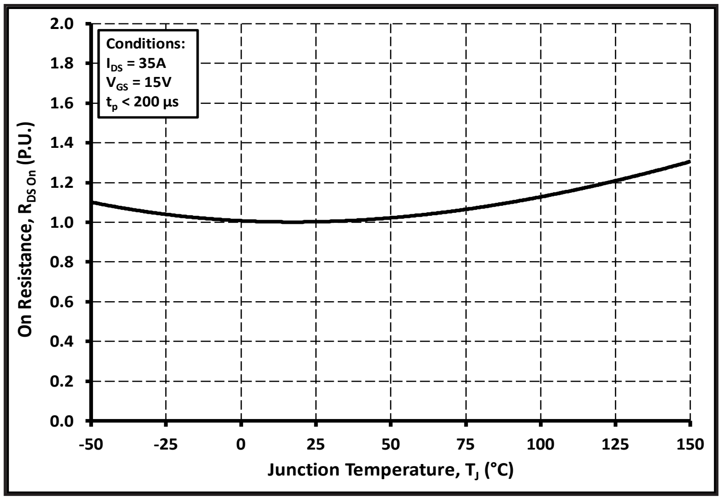


Figure 4. Normalized On-Resistance vs. Temperature

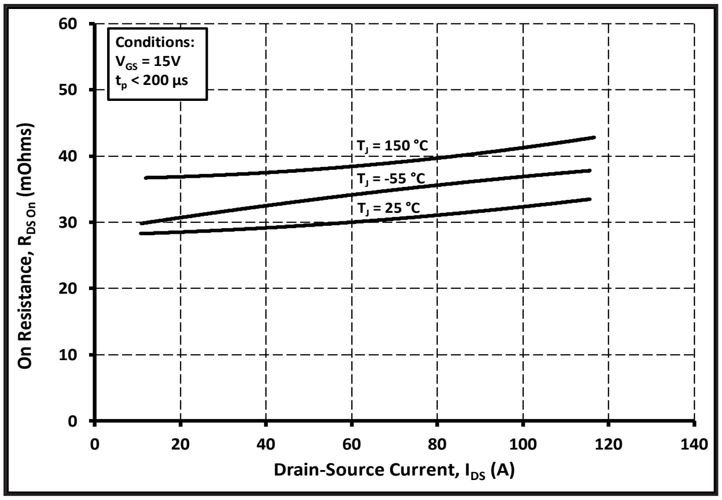


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

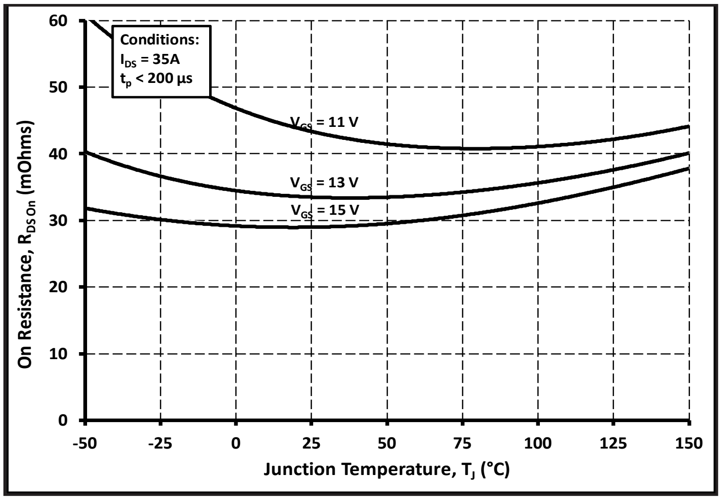


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

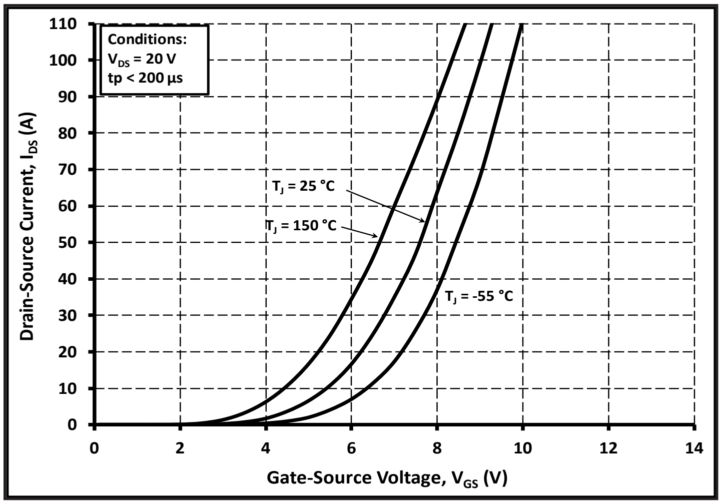


Figure 7. Transfer Characteristic for Various Junction Temperatures

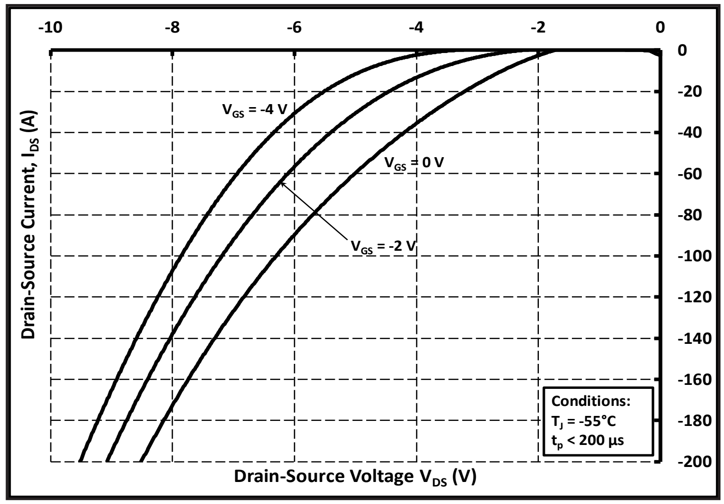


Figure 8. Body Diode Characteristic at -55 °C

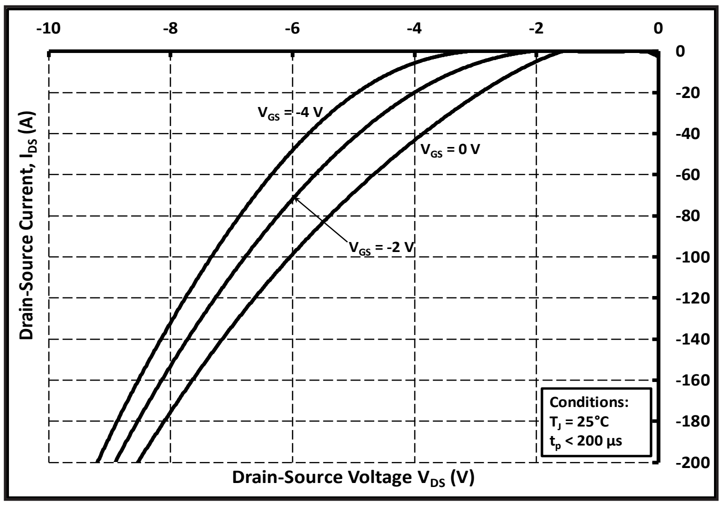


Figure 9. Body Diode Characteristic at 25 °C

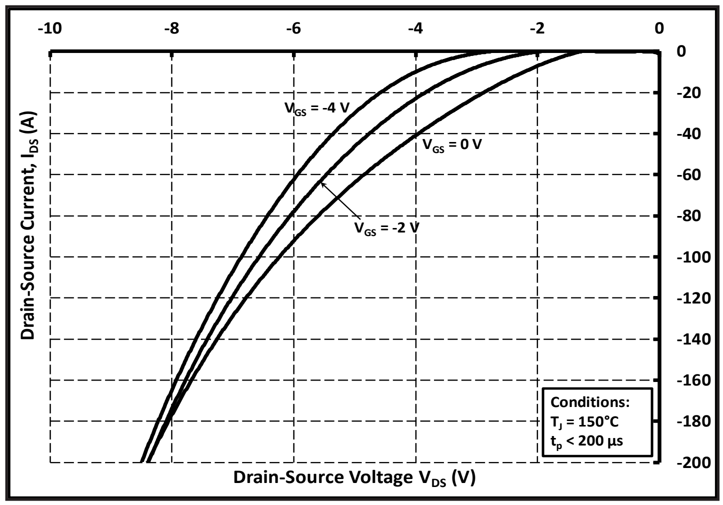


Figure 10. Body Diode Characteristic at 150 °C

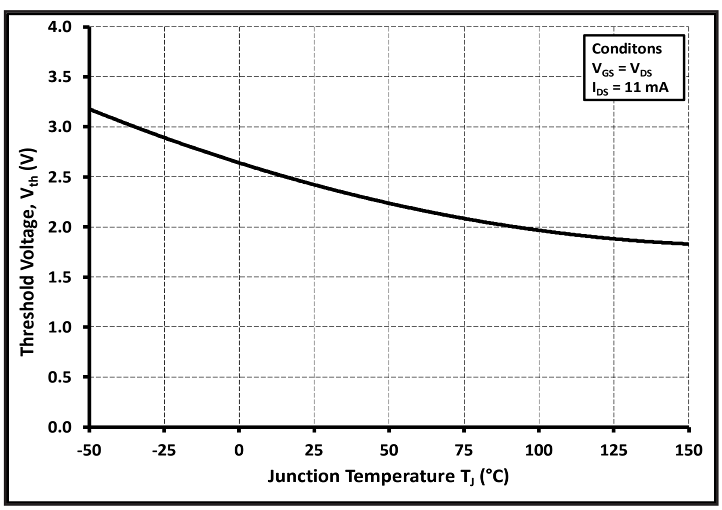


Figure 11. Threshold Voltage vs. Temperature

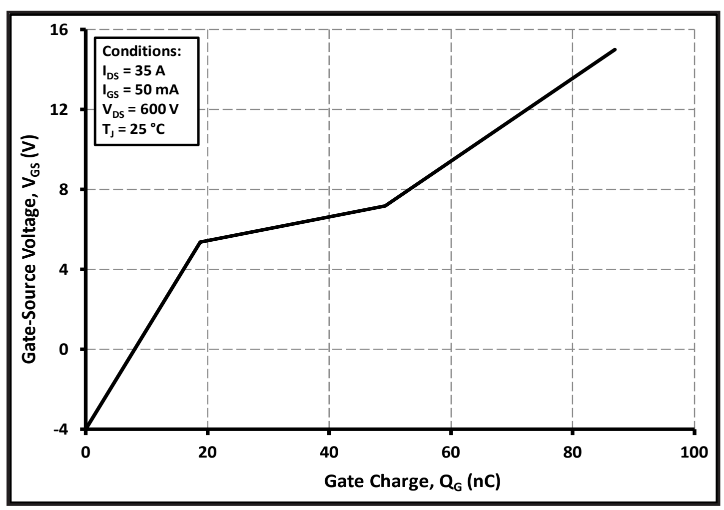


Figure 12. Gate Charge Characteristics

Typical Performance

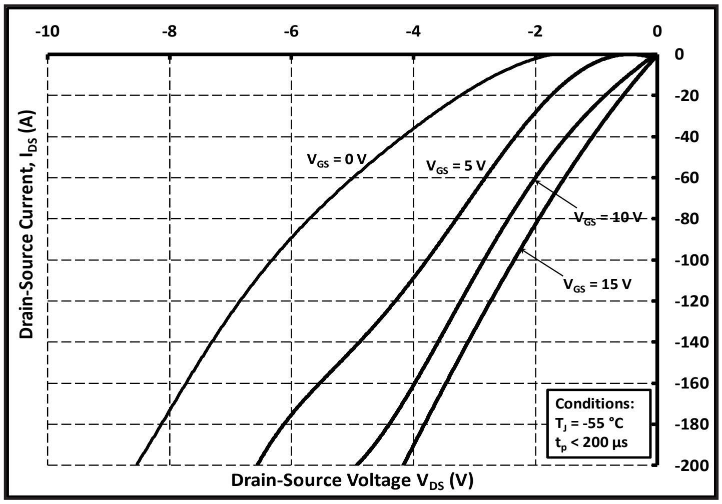


Figure 13. 3rd Quadrant Characteristic at -55 °C

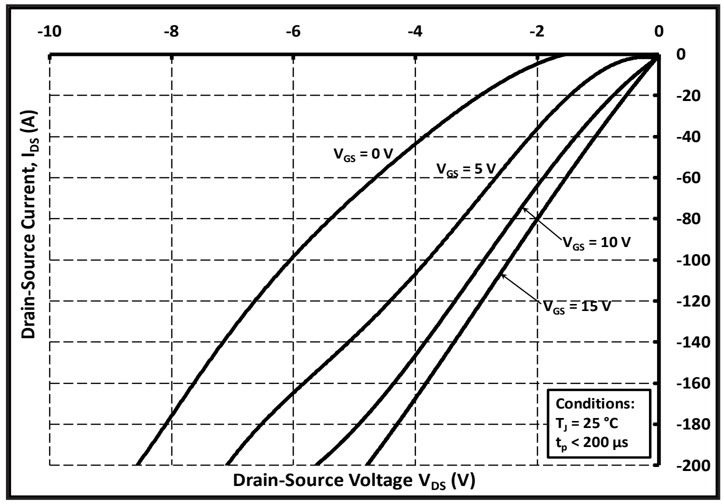


Figure 14. 3rd Quadrant Characteristic at 25 °C

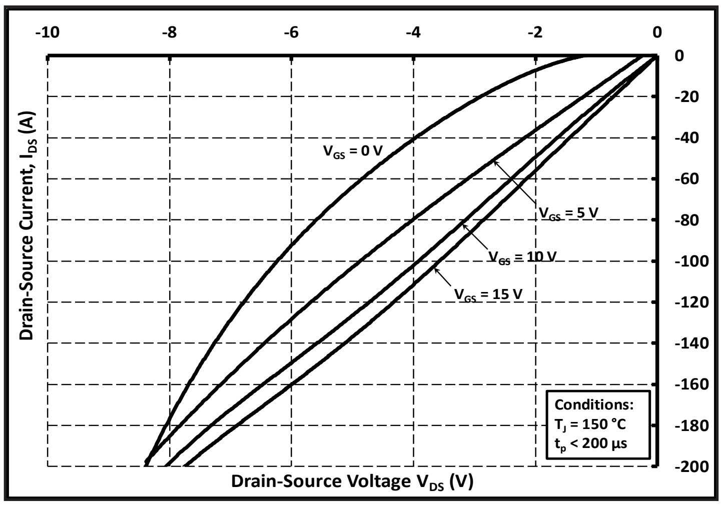


Figure 15. 3rd Quadrant Characteristic at 150 °C

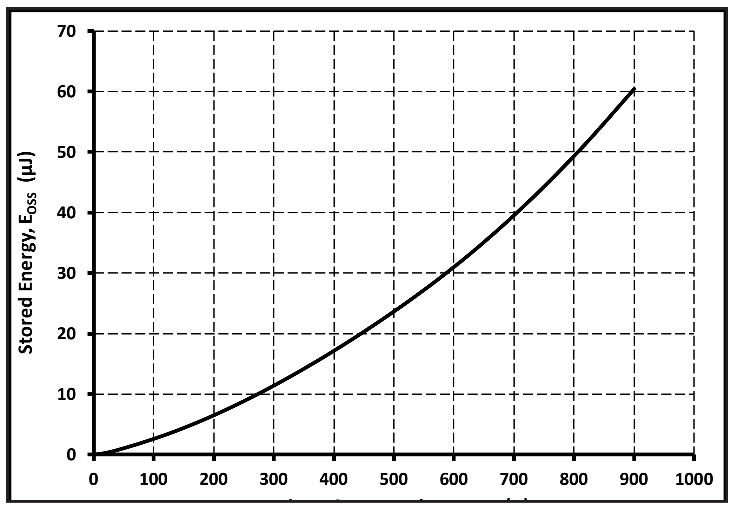


Figure 16. Output Capacitor Stored Energy

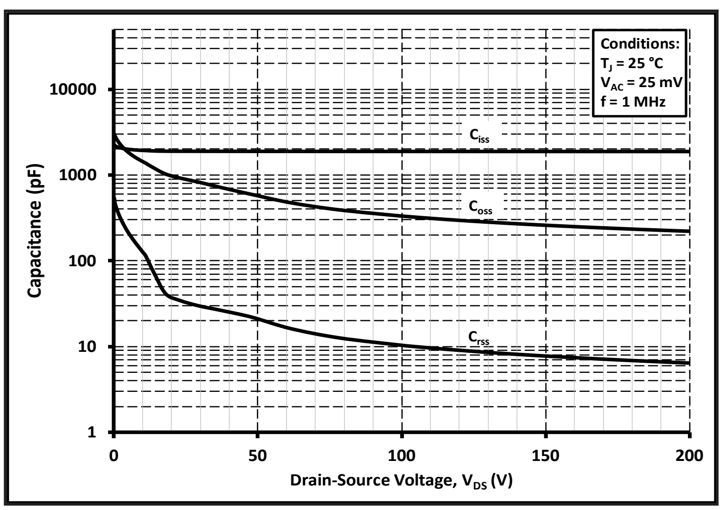


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

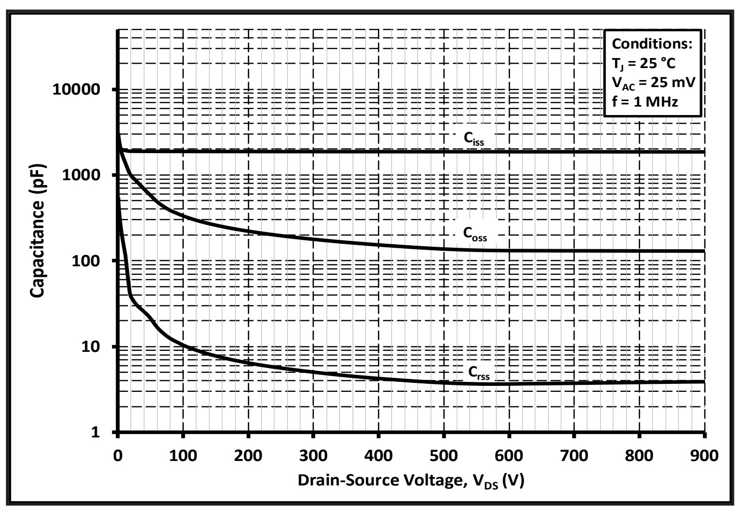


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 900V)

CREE

Typical Performance

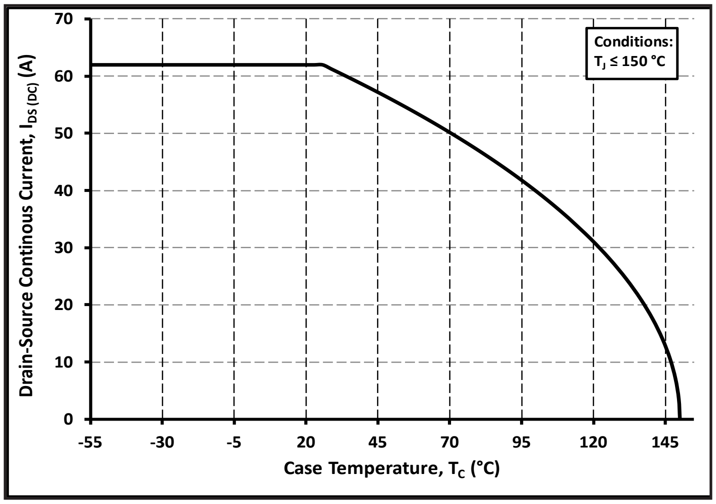


Figure 19. Continuous Drain Current Derating vs. Case Temperature

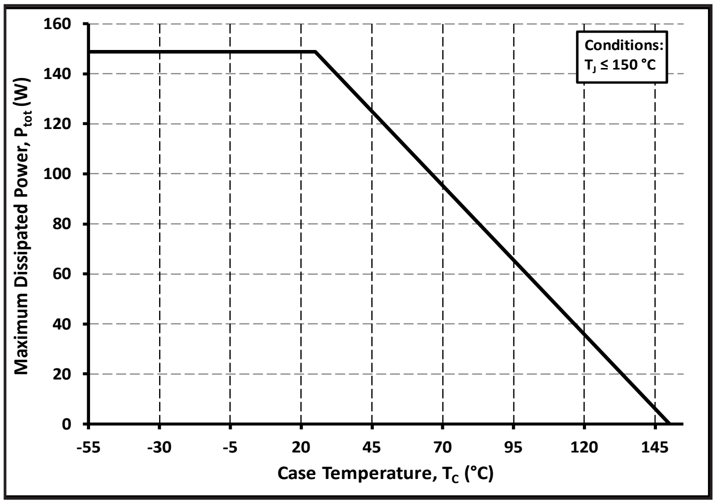


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

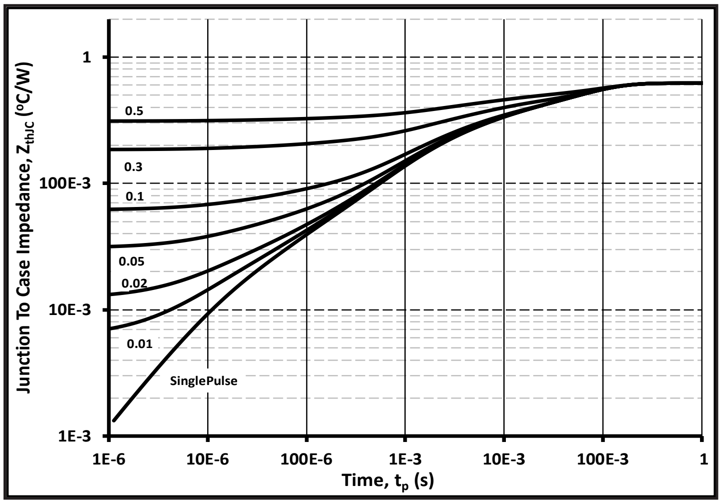


Figure 21. Transient Thermal Impedance (Junction - Case)

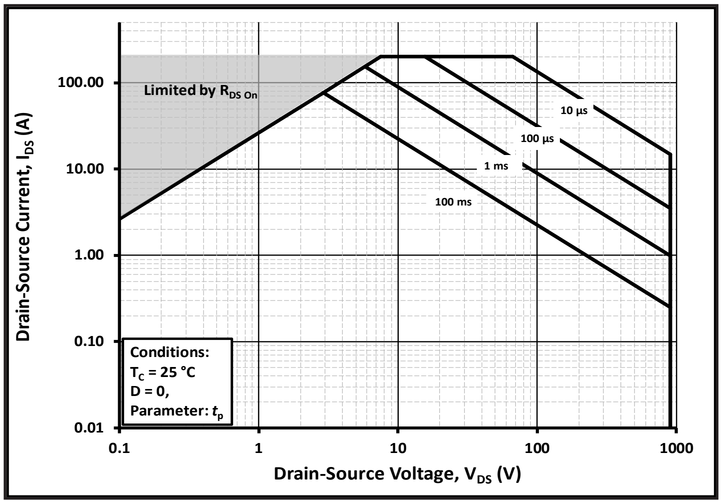


Figure 22. Safe Operating Area

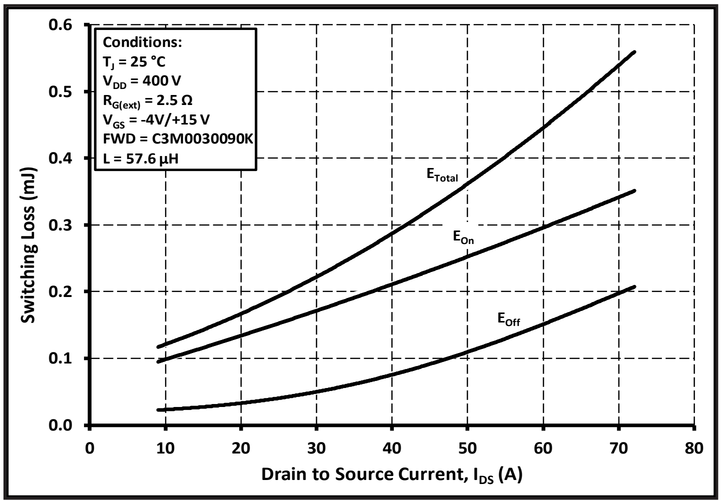


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 400V)

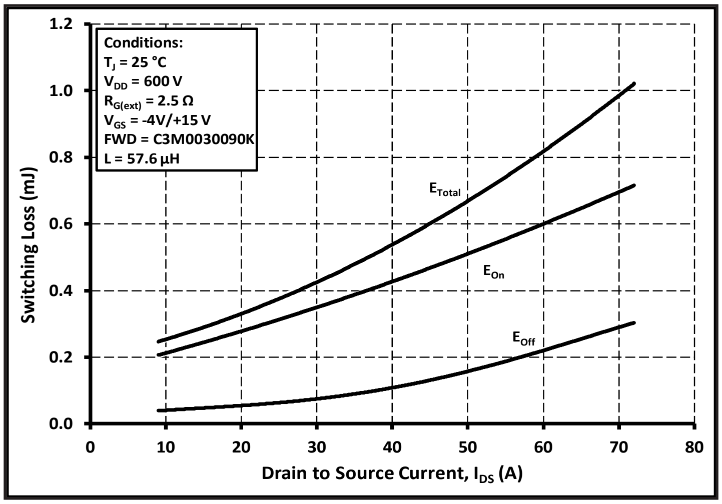


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

Typical Performance

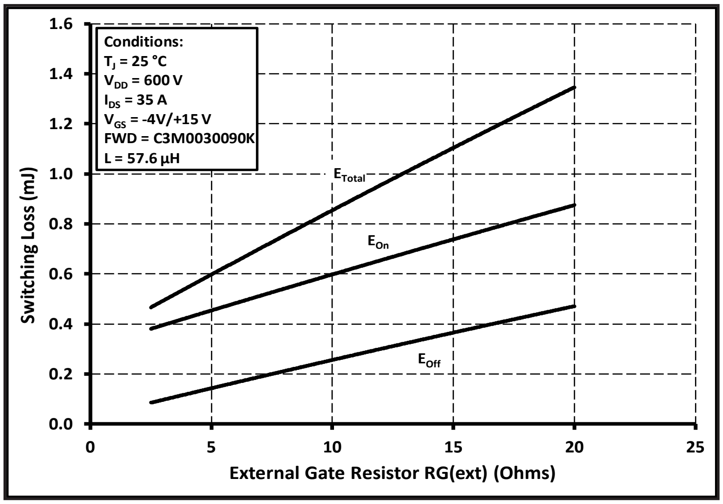


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

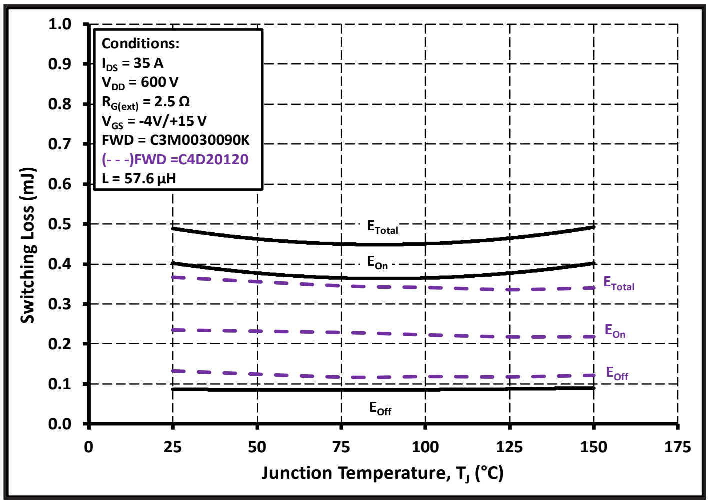


Figure 26. Clamped Inductive Switching Energy vs. Temperature

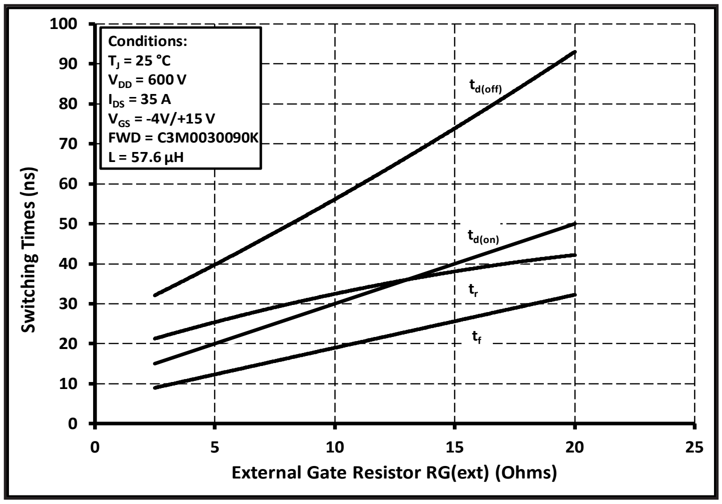


Figure 27. Switching Times vs. $R_{G(ext)}$

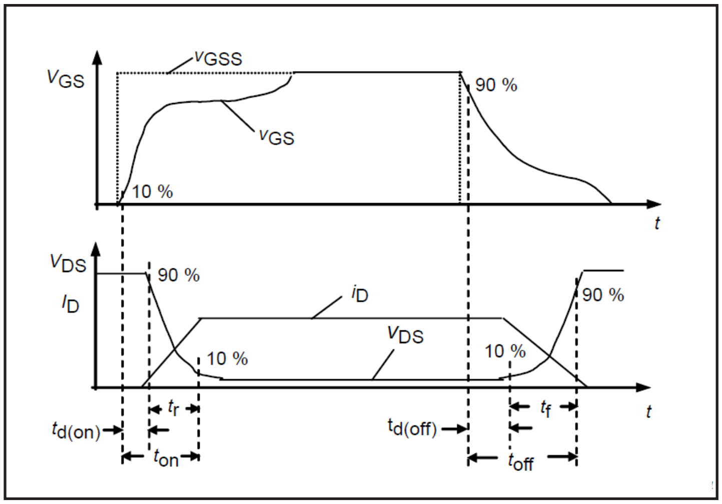


Figure 28. Switching Times Definition

Test Circuit Schematic

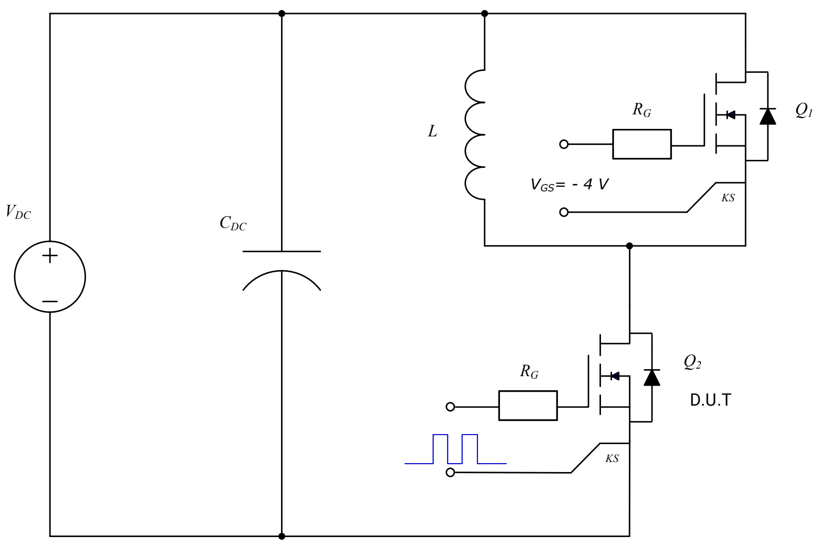


Figure 29a. Clamped Inductive Switching Test Circuit Using
MOSFET Intrinsic Body Diode

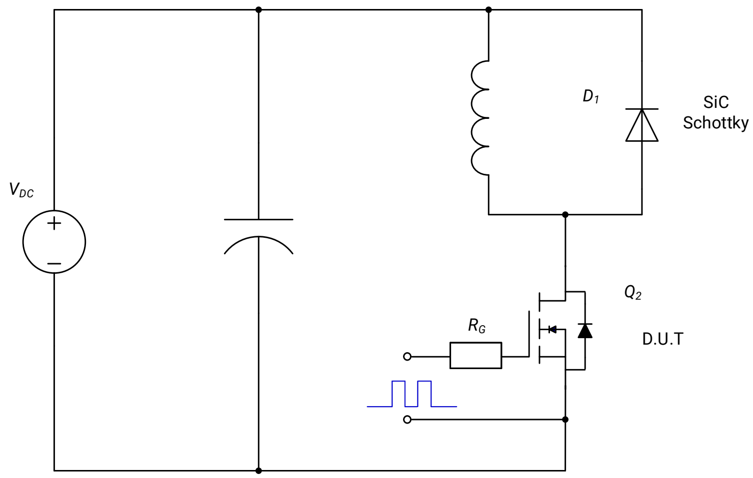
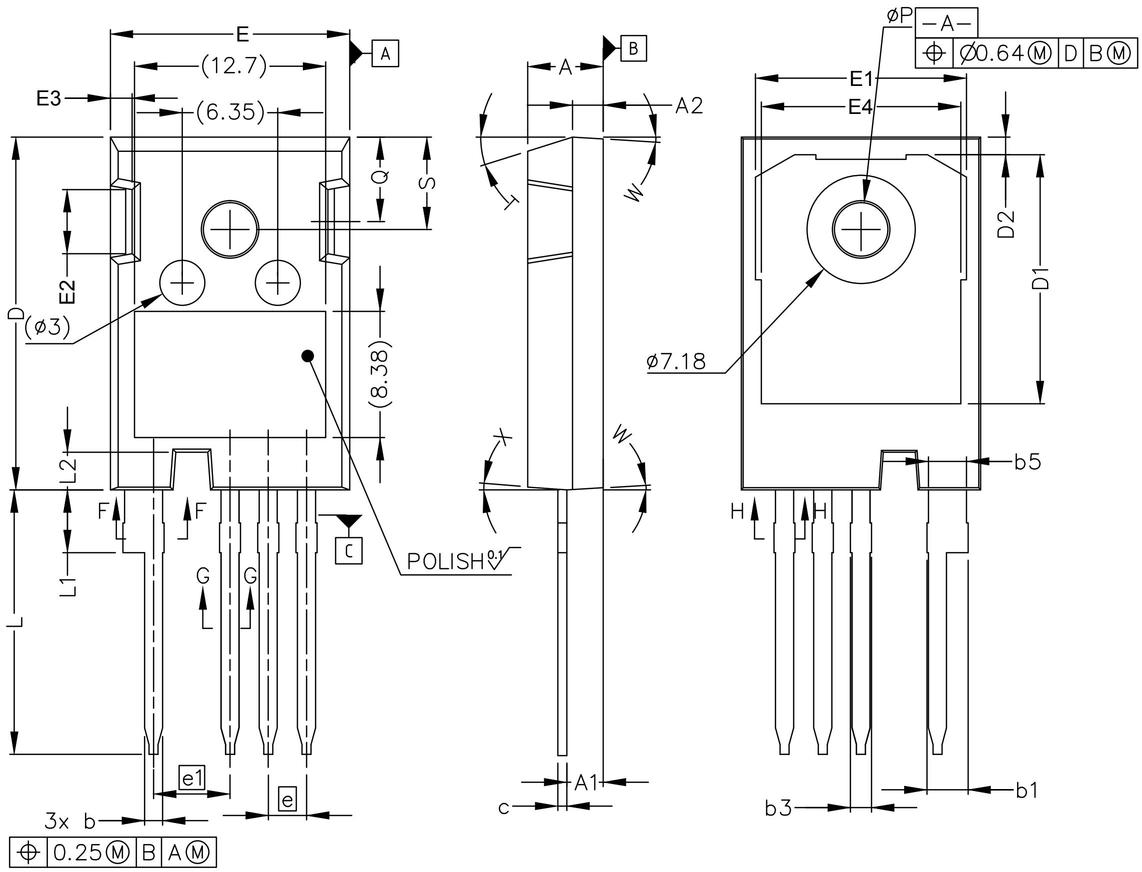
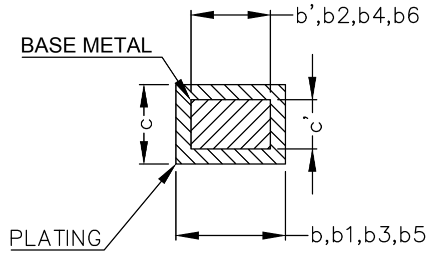


Figure 29b. Clamped Inductive Switching Test Circuit Using
SiC Schottky Diode

Package Dimensions

Package TO-247-4L





SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

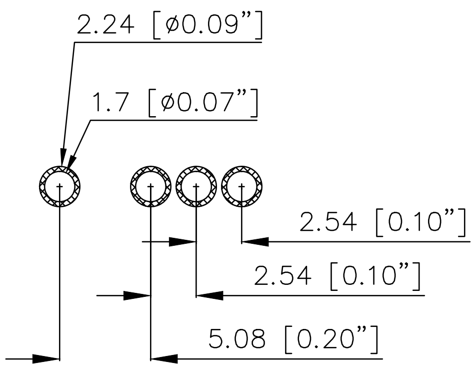
Package Dimensions

Package TO-247-4L

NOTE ;
1. ALL METAL SURFACES: TIN PLATED,EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCEING CONFIRM TO
ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS.
ANGLES ARE IN DEGREES.

SYM	MILLIMETERS		SYM	MILLIMETERS	
	MIN	MAX		MIN	MAX
A	4.83	5.21	E1	13.10	14.15
A1	2.29	2.54	E2	3.68	5.10
A2	1.91	2.16	E3	1.00	1.90
b'	1.07	1.28	E4	12.38	13.43
b	1.07	1.33	e	2.54 BSC	
b1	2.39	2.94	e1	5.08 BSC	
b2	2.39	2.84	N	4	
b3	1.07	1.60	L	17.31	17.82
b4	1.07	1.50	L1	3.97	4.37
b5	2.39	2.69	L2	2.35	2.65
b6	2.39	2.64	øP	3.51	3.65
c'	0.55	0.65	Q	5.49	6.00
c	0.55	0.68	S	6.04	6.30
D	23.30	23.60	T	17.5° REF.	
D1	16.25	17.65	W	3.5 ° REF.	
D2	0.95	1.25	X	4° REF.	
E	15.75	16.13			

Recommended Solder Pad Layout



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

- **SPICE Models: http://wolfspeed.com/power/tools-and-support**
- **SiC MOSFET Isolated Gate Driver reference design: http://wolfspeed.com/power/tools-and-support**
- **SiC MOSFET Evaluation Board: http://wolfspeed.com/power/tools-and-support**

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