IV1Q12030T4G

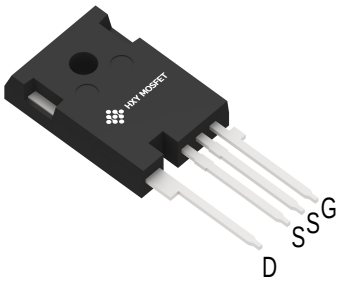
SiC Power MOSFET N-Channel Enhancement Mode

Features

- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- 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

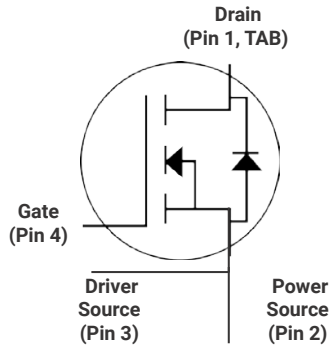
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency



TO-247H-4L

Applications

- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



Ordering Part Number	Package	Qty(PCS)
IV1Q12030T4G	TO-247H-4L	30

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	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
		48		V_{GS} = 15 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	120	A	Pulse width t_P limited by T_{jmax}	
P_D	Power Dissipation	283	W	T_C=25˚C, T_J = 175 ˚C	Fig. 20
T_J , T_{stg}	Operating Junction and Storage Temperature	-40 to +175	˚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	1200			V	V_{GS} = 0 V, I_D = 100 µA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.5	3.6	V	V_{DS} = V_{GS}, I_D = 11.5 mA	Fig. 11
			2.0		V	V_{DS} = V_{GS}, I_D = 11.5 mA, T_J = 175ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	µA	V_{DS} = 1200 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	23	32	43	mΩ	V_{GS} = 15 V, I_D = 40 A	Fig. 4, 5, 6
			57.6			V_{GS} = 15 V, I_D = 40 A, T_J = 175ºC	
g_{fs}	Transconductance		27		S	V_{DS}= 20 V, I_{DS}= 40 A	Fig. 7
			22			V_{DS}= 20 V, I_{DS}= 40 A, T_J = 175ºC	
C_{iss}	Input Capacitance		3357		pF	V_{GS} = 0 V, V_{DS} = 1000 V f = 100 kHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		129				
C_{rss}	Reverse Transfer Capacitance		8				
E_{oss}	C_{oss} Stored Energy		76		µJ		Fig. 16
E_{ON}	Turn-On Switching Energy (SiC Diode FWD)		367		µJ	V_{DS} = 800 V, V_{GS} = -4 V/+15 V, I_D = 40 A, $R_{G(ext)}$ = 2.5Ω, L= 65.7 µH, Tj = 175ºC	Fig. 26
E_{OFF}	Turn Off Switching Energy (SiC Diode FWD)		123				
E_{ON}	Turn-On Switching Energy (Body Diode FWD)		955		µJ	V_{DS} = 800 V, V_{GS} = -4 V/+15 V, I_D = 40 A, $R_{G(ext)}$ = 2.5Ω, L= 65.7 µH, Tj = 175ºC	Fig. 26
E_{OFF}	Turn Off Switching Energy (Body Diode FWD)		107				
$t_{d(on)}$	Turn-On Delay Time		25		ns	V_{DD} = 800 V, V_{GS} = -4 V/15 V $R_{G(ext)}$ = 2.5 Ω, I_D = 40 A, L= 65.7 Timing relative to V_{DS}, Inductive load	Fig. 27
t_r	Rise Time		18				
$t_{d(off)}$	Turn-Off Delay Time		32				
t_f	Fall Time		9				
$R_{G(int)}$	Internal Gate Resistance		1.7		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		40		nC	V_{DS} = 800 V, V_{GS} = -4 V/15 V I_D = 40 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		34				
Q_g	Total Gate Charge		118				

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

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.6		V	V_{GS} = -4 V, I_{SD} = 20 A, T_J = 25 °C	Fig. 8, 9, 10
		4.2		V	V_{GS} = -4 V, I_{SD} = 20 A, T_J = 175 °C	
I_S	Continuous Diode Forward Current		62	A	V_{GS} = -4 V, T_C = 25˚C	Note 1
$I_{S,\,pulse}$	Diode pulse Current		120	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	Note 1
t_{rr}	Reverse Recover time	27		ns	V_{GS} = -4 V, I_{SD} = 40 A, V_R = 800 V dif/dt = 2250 A/µs, T_J = 175 °C	Note 1
Q_{rr}	Reverse Recovery Charge	478		nC		
I_{rrm}	Peak Reverse Recovery Current	27		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.45	°C/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40			

Typical Performance

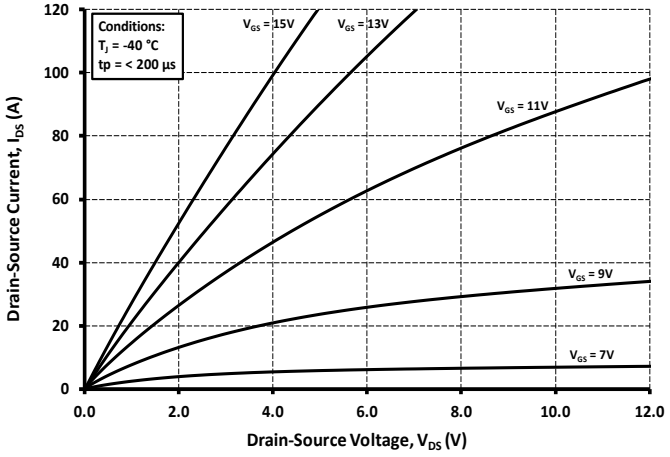


Figure 1. Output Characteristics T_J = -40 ºC

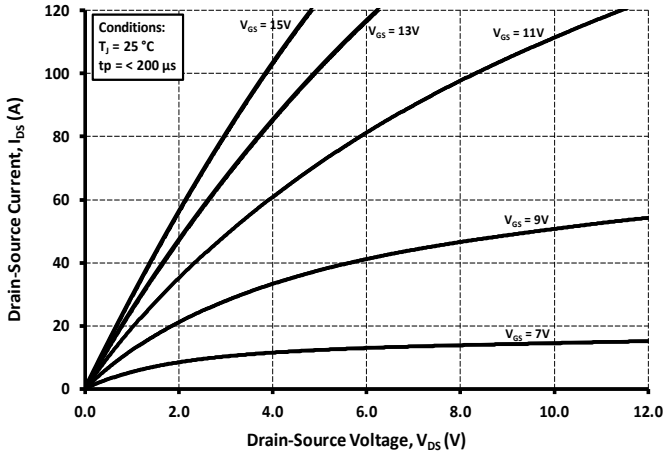


Figure 2. Output Characteristics T_J = 25 ºC

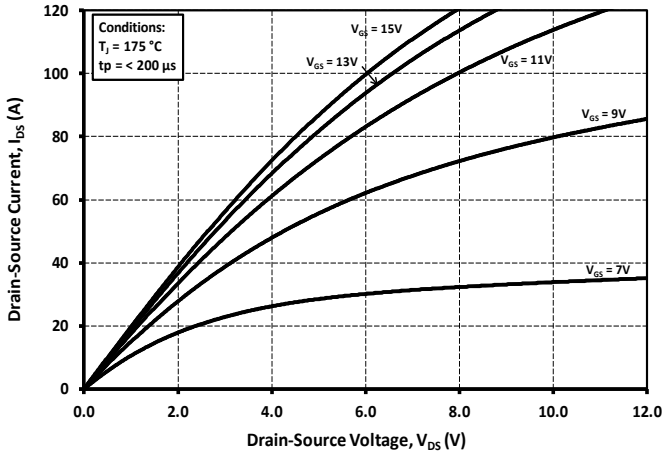


Figure 3. Output Characteristics T_J = 175 ºC

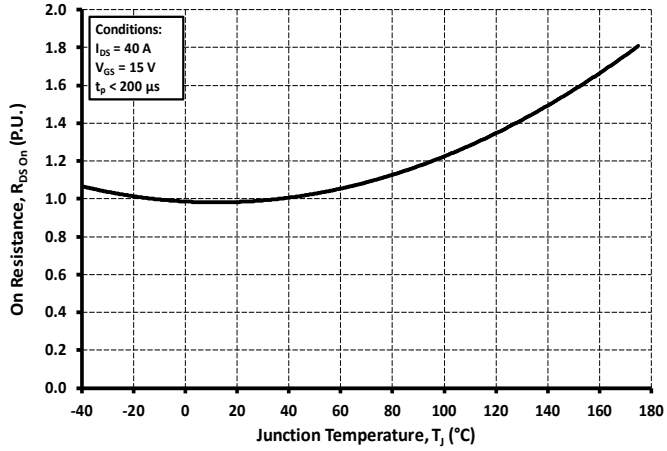


Figure 4. Normalized On-Resistance vs. Temperature

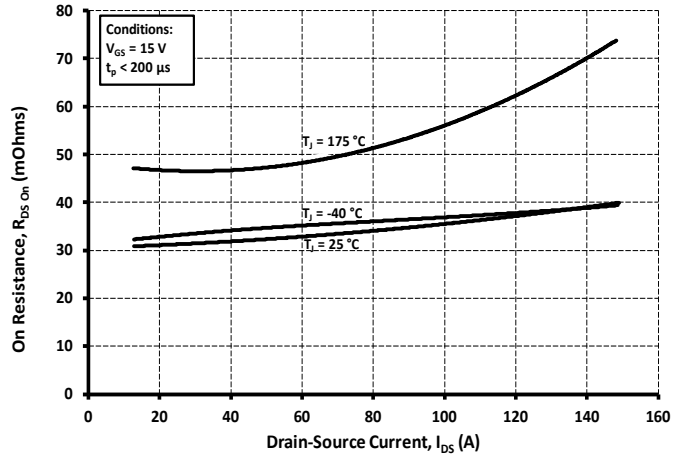


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

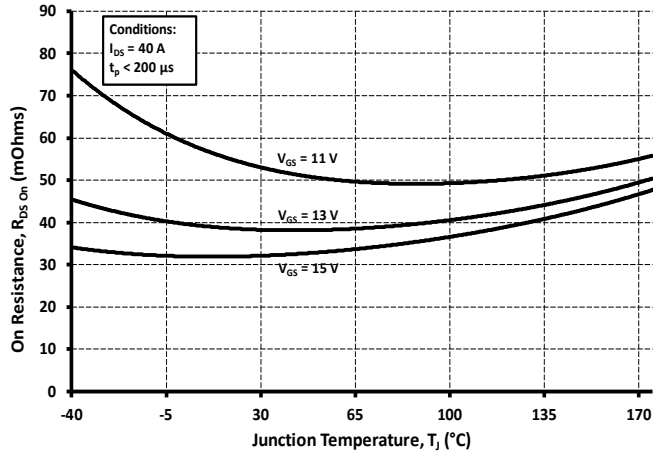


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

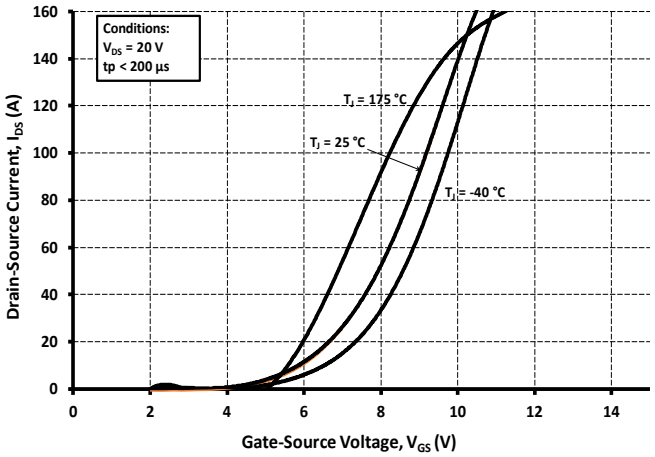


Figure 7. Transfer Characteristic for Various Junction Temperatures

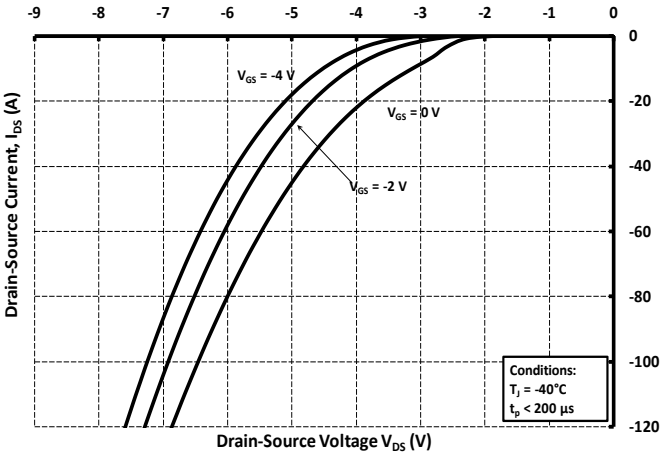


Figure 8. Body Diode Characteristic at -40 °C

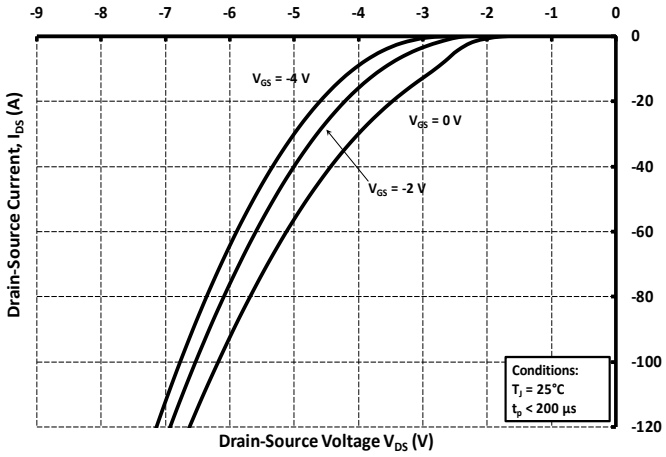


Figure 9. Body Diode Characteristic at 25 °C

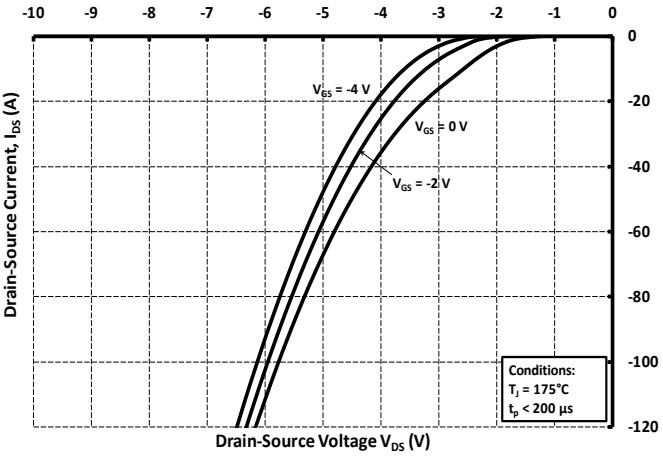


Figure 10. Body Diode Characteristic at 175 °C

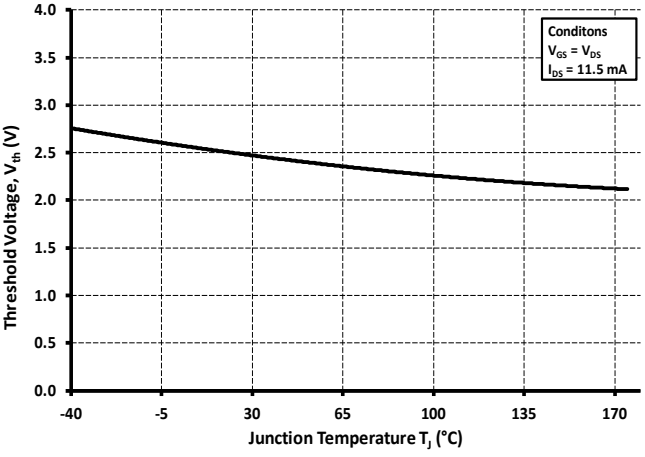


Figure 11. Threshold Voltage vs. Temperature

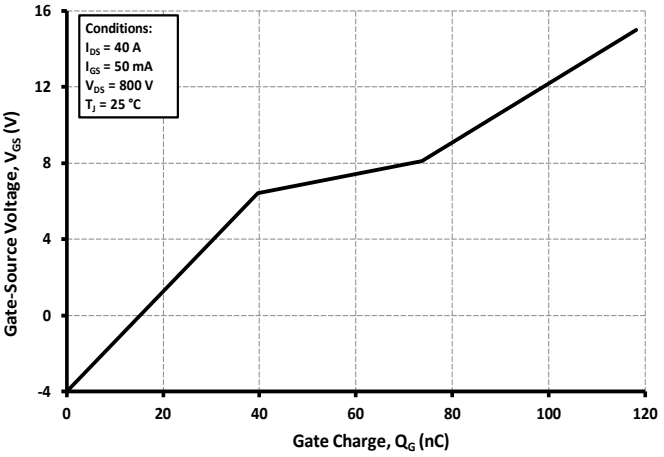


Figure 12. Gate Charge Characteristics

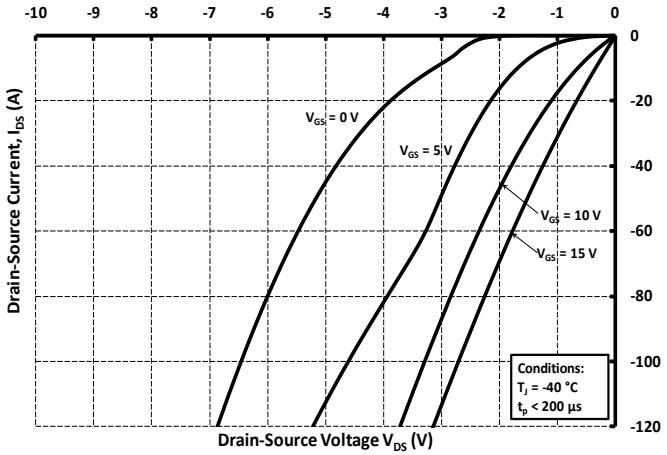


Figure 13. 3rd Quadrant Characteristic at -40 °C

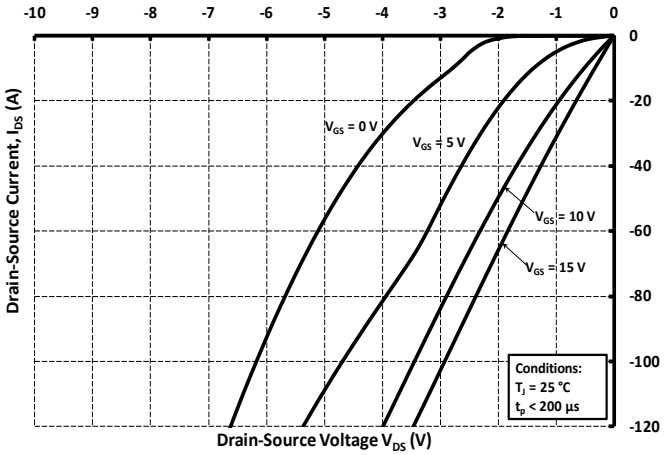


Figure 14. 3rd Quadrant Characteristic at 25 °C

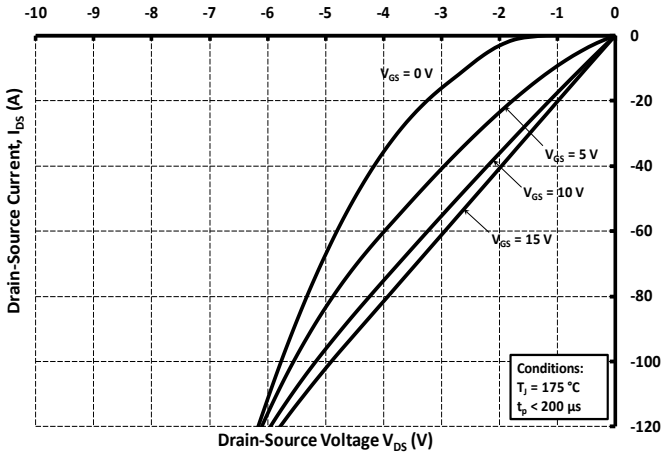


Figure 15. 3rd Quadrant Characteristic at 175 °C

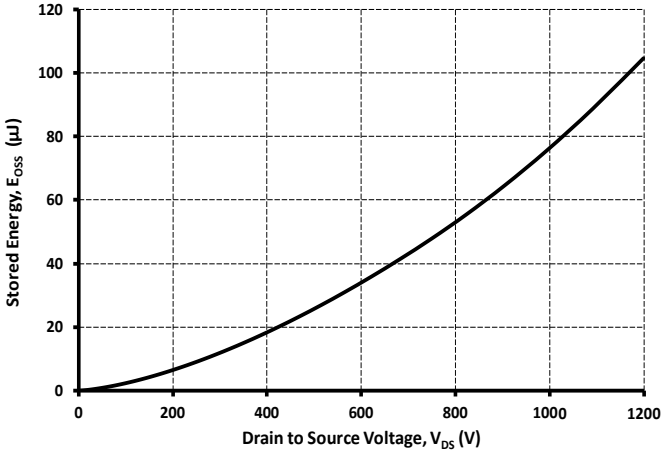


Figure 16. Output Capacitor Stored Energy

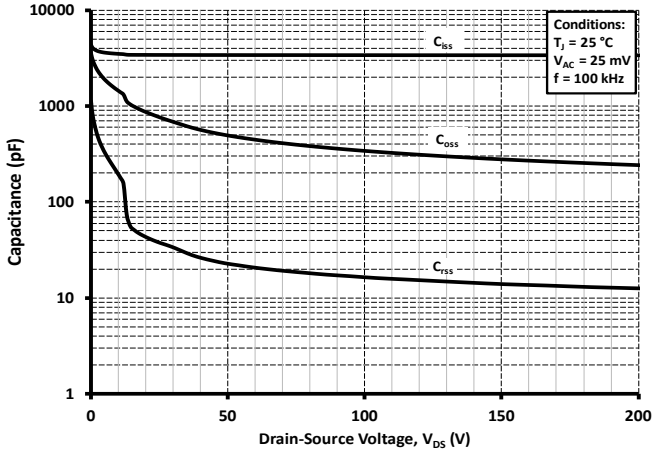


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

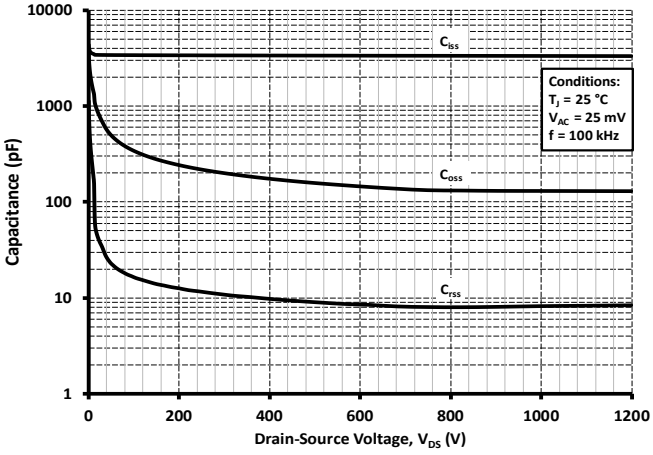


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1200V)

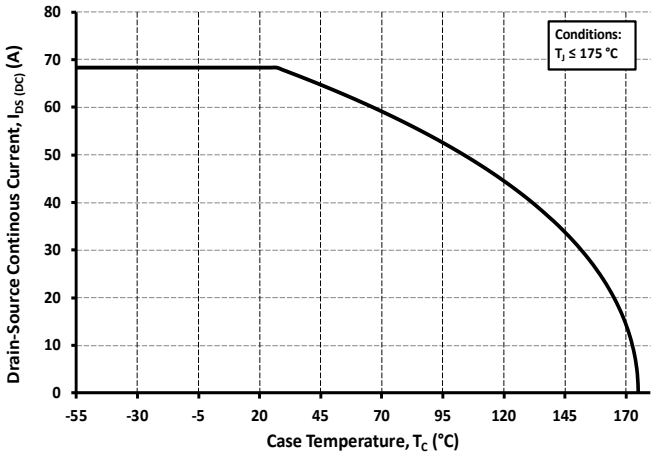


Figure 19. Continuous Drain Current Derating vs. Case Temperature

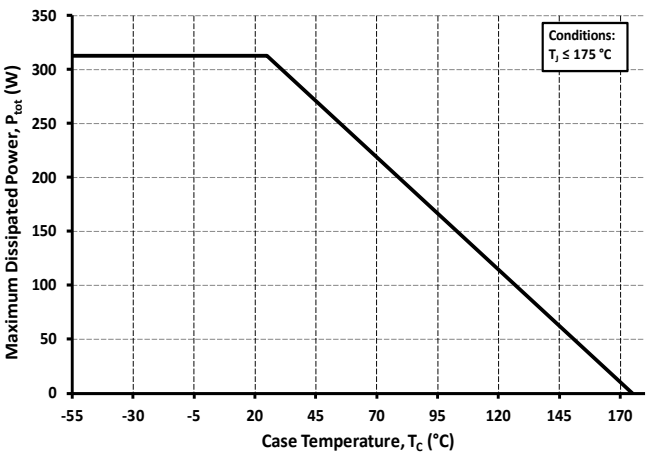


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

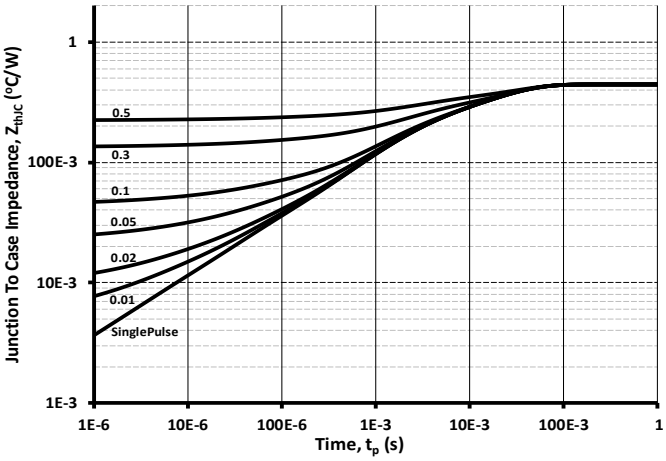


Figure 21. Transient Thermal Impedance (Junction - Case)

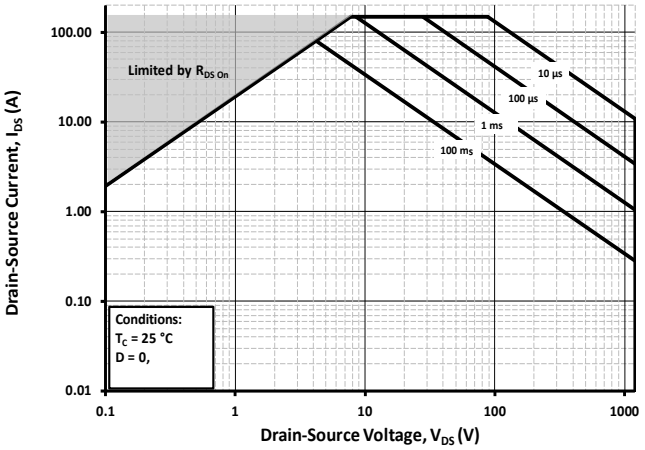


Figure 22. Safe Operating Area

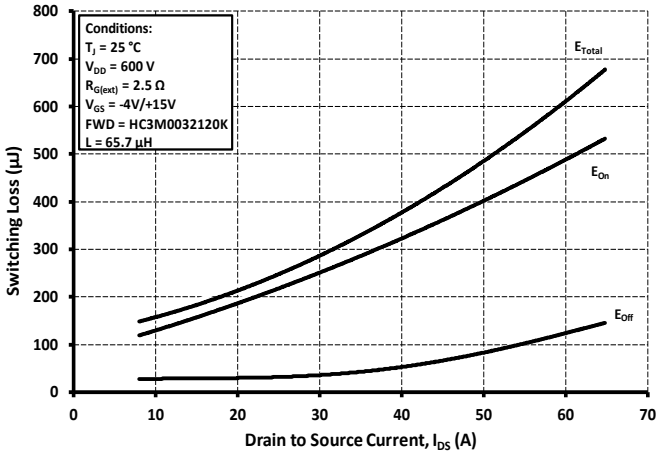


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

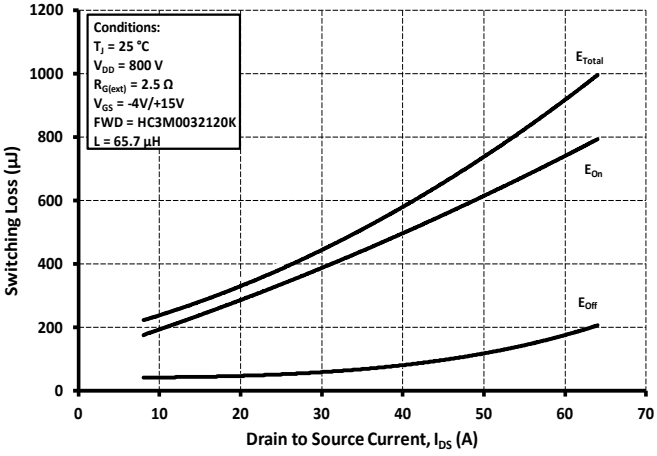


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800V)

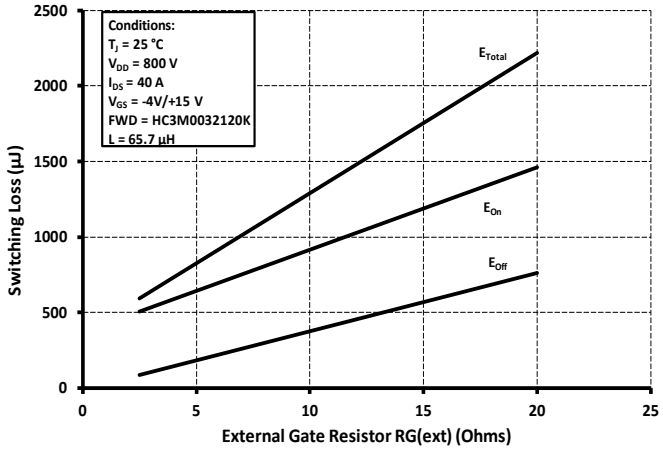


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

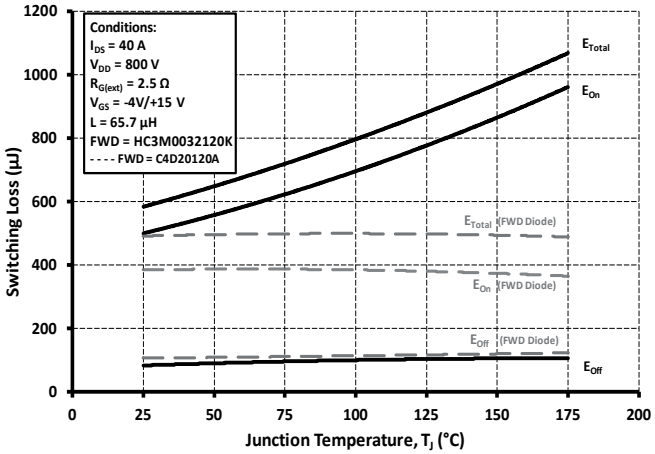


Figure 26. Clamped Inductive Switching Energy vs. Temperature

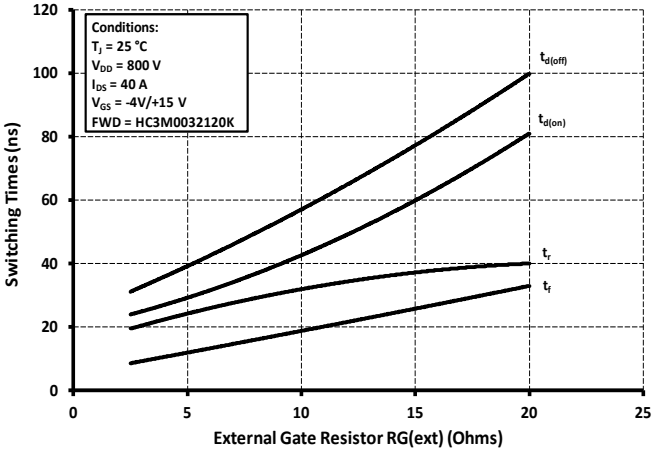


Figure 27. Switching Times vs. $R_{G(ext)}$

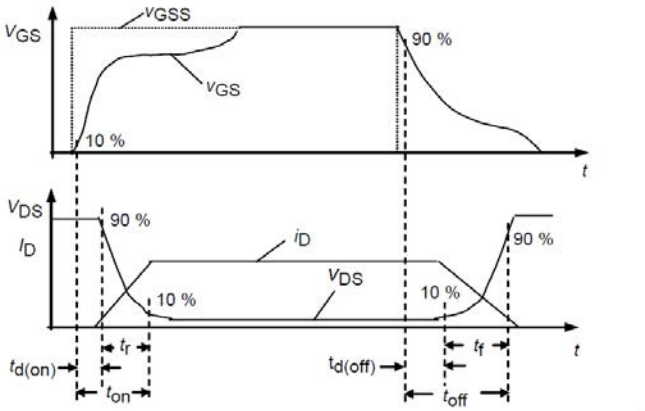


Figure 28. Switching Times Definition

Test Circuit Schematic

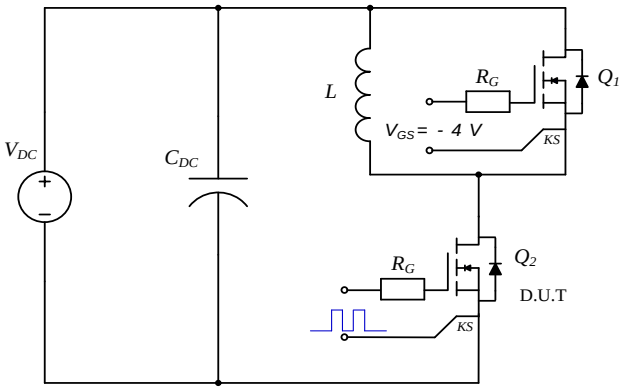
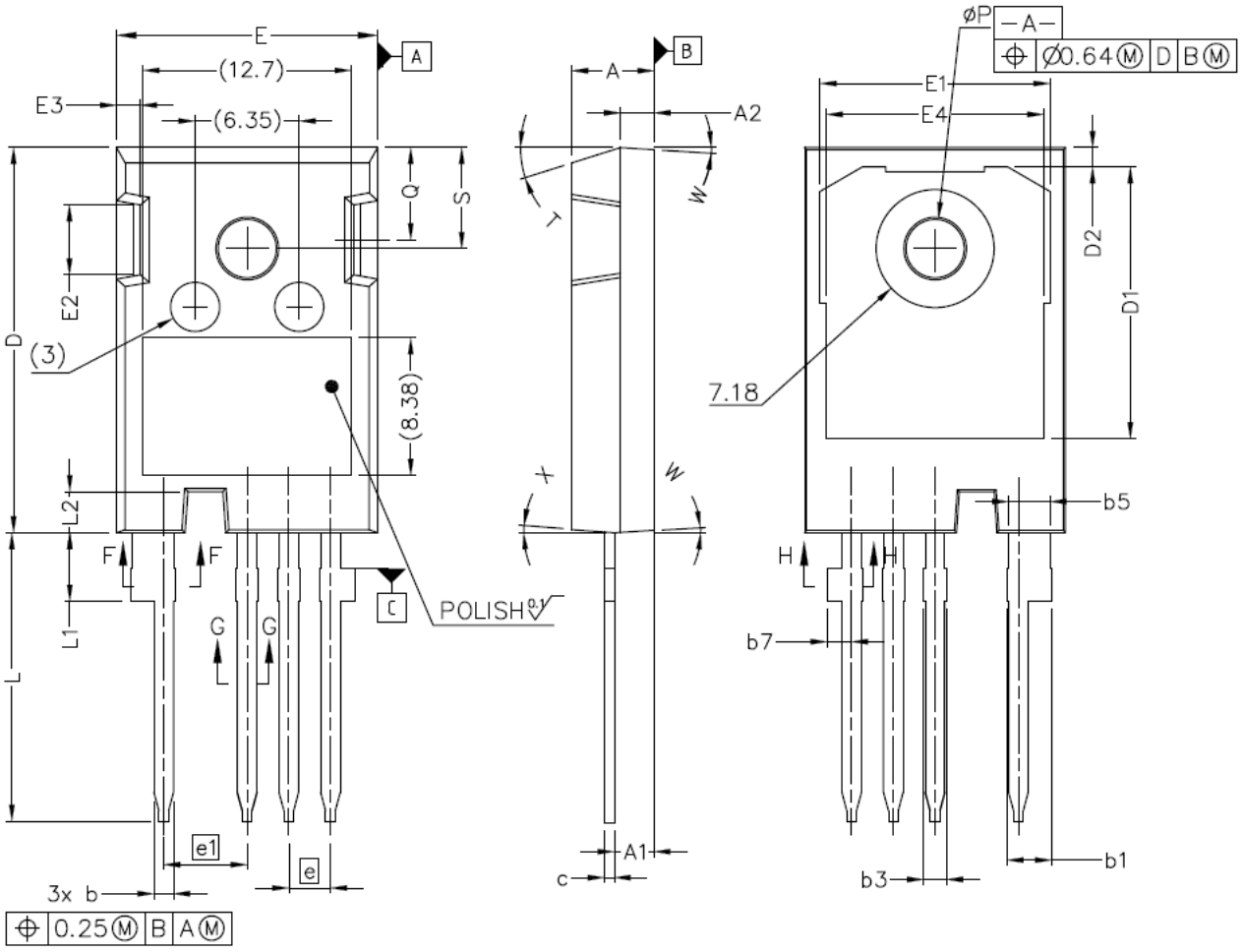


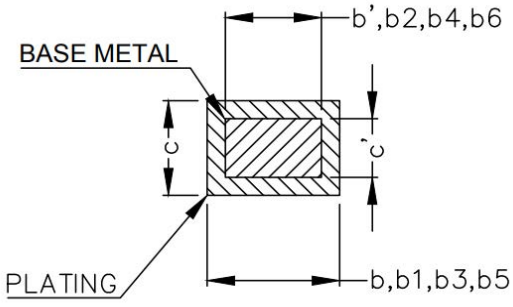
Figure 29. Clamped Inductive Switching
Waveform Test Circuit

Note (3): Turn-off and Turn-on switching energy and timing values measured using SiC MOSFET Body Diode as shown above.

Package Dimensions

Package TO-247H-4L





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

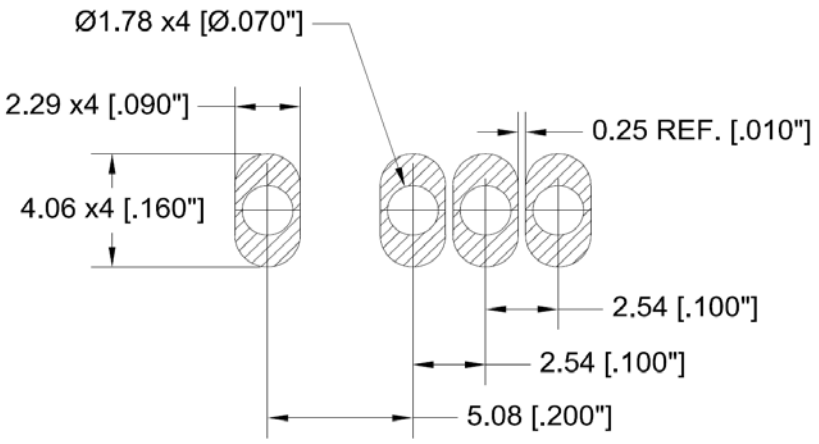
Package Dimensions

Package TO-247H-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.
4. 'N' IS THE NUMBER OF TERMINAL POSITIONS

SYM	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b`	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
b7	1.30	1.70
c`	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13

SYM	MILLIMETERS	
	MIN	MAX
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
N*	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
Ø P	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	



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give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.

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PESDLC2FD3V3BH PESDNC2XD5VBF HAZ4007-01H HESD36VD3B HPTVSUC3D5VB HSEN2411D3 HSTS521050B331 PESDNC2XD5VBL BV05C-H ESD5L5.0C-HXY HSG3D15B3.3MA 60N06 HLY323BC1524L HSEN3611D3 TPSMB28A-VR PESDSC2FD5VU PJSD24CW_R1 HACPDQC5V0-HF PJEC5V0M1FN2 RLSD32A121V LM393DR-HXY AQ15C-01FTG AZ4836-01L HESDSLC3V3D3B HRCLAMP3371ZCTFT HSD15C.TCT TPSMB100CA-VR ESD5LM5.0C-HXY HCEZ36V,L3F AZ4007-01H