



### Features

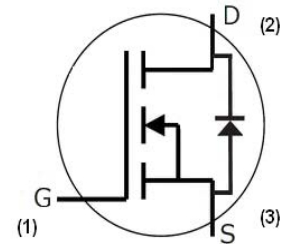
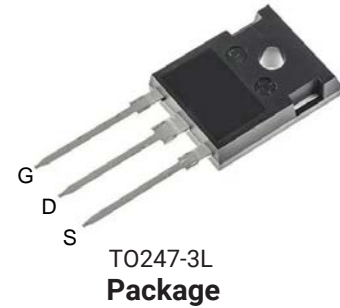
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

### Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

### Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC converters
- Motor Drive
- Pulsed Power Applications



Part Number	Package	Marking
HC2M0045170D	TO247-3L	HC2M0045170D

### Maximum Ratings (T<sub>c</sub> = 25 °C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V <sub>DSmax</sub>	Drain - Source Voltage	1700	V	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μA	
V <sub>GSmx</sub>	Gate - Source Voltage	-10/+25	V	Absolute maximum values, AC (f > 1 Hz)	
V <sub>GSop</sub>	Gate - Source Voltage	-5/+20	V	Recommended operational values	
I <sub>D</sub>	Continuous Drain Current	72	A	V <sub>GS</sub> = 20 V, T <sub>C</sub> = 25 °C	Fig. 19
		48		V <sub>GS</sub> = 20 V, T <sub>C</sub> = 100 °C	
I <sub>D(pulse)</sub>	Pulsed Drain Current	160	A	Pulse width t <sub>p</sub> limited by T <sub>jmax</sub>	Fig. 22
P <sub>D</sub>	Power Dissipation	520	W	T <sub>c</sub> = 25 °C, T <sub>J</sub> = 150 °C	Fig. 20
T <sub>J</sub> , T <sub>stg</sub>	Operating Junction and Storage Temperature	-40 to +150	°C		
T <sub>L</sub>	Solder Temperature	260	°C	1.6mm (0.063") from case for 10s	
M <sub>d</sub>	Mounting Torque	1	Nm lbf-in	M3 or 6-32 screw	
		8.8			



**Electrical Characteristics** ( $T_C = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1700			V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.6	4	V	$V_{DS} = V_{GS}, I_D = 18\text{mA}$	Fig. 11
			1.8		V	$V_{DS} = V_{GS}, I_D = 18\text{mA}, T_J = 150^\circ\text{C}$	
$I_{DSS}$	Zero Gate Voltage Drain Current		2	100	$\mu\text{A}$	$V_{DS} = 1700\text{ V}, V_{GS} = 0\text{ V}$	
$I_{GSS}$	Gate-Source Leakage Current			600	nA	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	
$R_{DS(on)}$	Drain-Source On-State Resistance		45	70	m $\Omega$	$V_{GS} = 20\text{ V}, I_D = 50\text{ A}$	Fig. 4,5,6
			90			$V_{GS} = 20\text{ V}, I_D = 50\text{ A}, T_J = 150^\circ\text{C}$	
$g_{fs}$	Transconductance		21.7		S	$V_{DS} = 20\text{ V}, I_{DS} = 50\text{ A}$	Fig. 7
			24.4			$V_{DS} = 20\text{ V}, I_{DS} = 50\text{ A}, T_J = 150^\circ\text{C}$	
$C_{iss}$	Input Capacitance		3672		pF	$V_{GS} = 0\text{ V}$	Fig. 17,18
$C_{oss}$	Output Capacitance		171			$V_{DS} = 1000\text{ V}$	
$C_{rss}$	Reverse Transfer Capacitance		6.7			$f = 1\text{ MHz}$	
$E_{oss}$	$C_{oss}$ Stored Energy		105			$V_{AC} = 25\text{ mV}$	
$E_{ON}$	Turn-On Switching Energy (SiC Diode FWD)		2.1		mJ	$V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V},$ $I_D = 50\text{A}, R_{G(ext)} = 2.5\Omega, L = 105\ \mu\text{H},$ $T_J = 150^\circ\text{C},$ using SiC Diode as FWD	Fig. 26, 29b Note 2
$E_{OFF}$	Turn Off Switching Energy (SiC Diode FWD)		0.86				
$E_{ON}$	Turn-On Switching Energy (Body Diode FWD)		4.7		mJ	$V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V},$ $I_D = 50\text{A}, R_{G(ext)} = 2.5\Omega, L = 105\ \mu\text{H},$ $T_J = 150^\circ\text{C},$ using MOSFET as FWD	Fig. 26, 29a Note 2
$E_{OFF}$	Turn Off Switching Energy (Body Diode FWD)		0.93				
$t_{d(on)}$	Turn-On Delay Time		65		ns	$V_{DD} = 1200\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 50\text{ A},$ $R_{G(ext)} = 2.5\ \Omega,$ Timing relative to $V_{DS}$ Inductive load	Fig. 27, 29 Note 2
$t_r$	Rise Time		20				
$t_{d(off)}$	Turn-Off Delay Time		48				
$t_f$	Fall Time		18				
$R_{G(int)}$	Internal Gate Resistance		1.3		$\Omega$	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	
$Q_{gs}$	Gate to Source Charge		44		nC	$V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 50\text{ A}$ Per IEC60747-8-4 pg 21	Fig. 12
$Q_{gd}$	Gate to Drain Charge		57				
$Q_g$	Total Gate Charge		188				

**Reverse Diode Characteristics**

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$V_{SD}$	Diode Forward Voltage	4.1		V	$V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}$	Fig. 8, 9, 10 Note 1
		3.6		V	$V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}, T_J = 150^\circ\text{C}$	
$I_S$	Continuous Diode Forward Current		72	A	$T_C = 25^\circ\text{C}, V_{GS} = -5\text{ V}$	Note 1
$t_{rr}$	Reverse Recovery Time	70		ns	$V_{GS} = -5\text{ V}, I_{SD} = 50\text{ A}, V_R = 1200\text{ V}$ $dI/dt = 1400\text{ A}/\mu\text{s}$	Note 1
$Q_{rr}$	Reverse Recovery Charge	530		nC		
$I_{rrm}$	Peak Reverse Recovery Current	14		A		

Note (1): When using SiC Body Diode the maximum recommended  $V_{GS} = -5\text{V}$

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.22	0.24	$^\circ\text{C}/\text{W}$		Fig. 21
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient		40			



### Typical Performance

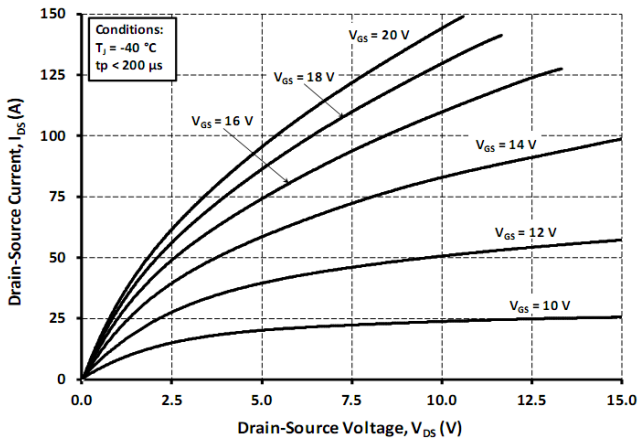


Figure 1. Output Characteristics  $T_J = -40\text{ }^\circ\text{C}$

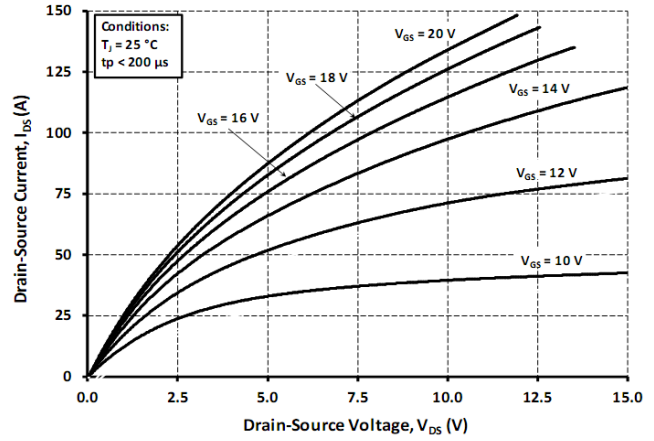


Figure 2. Output Characteristics  $T_J = 25\text{ }^\circ\text{C}$

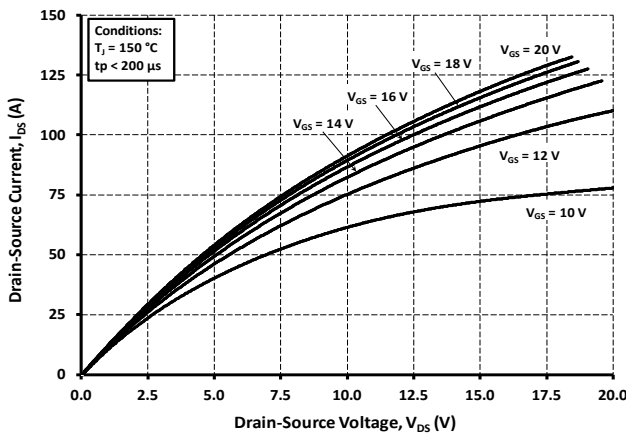


Figure 3. Output Characteristics  $T_J = 150\text{ }^\circ\text{C}$

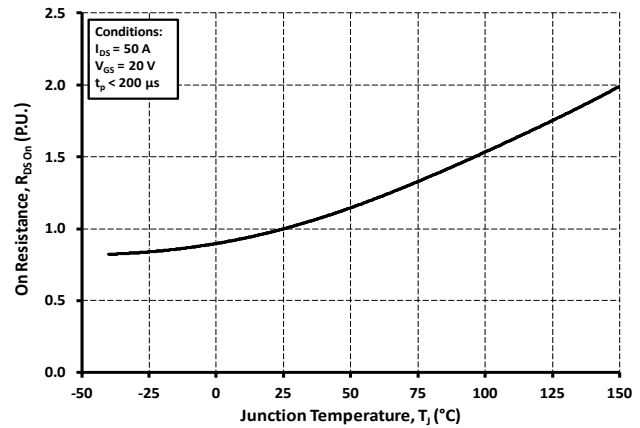


Figure 4. Normalized On-Resistance vs. Temperature

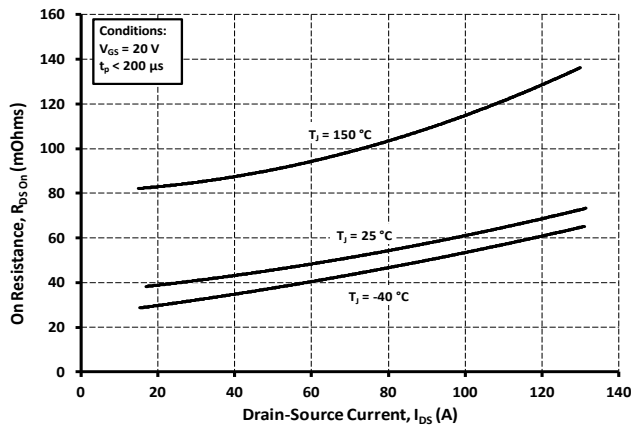


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

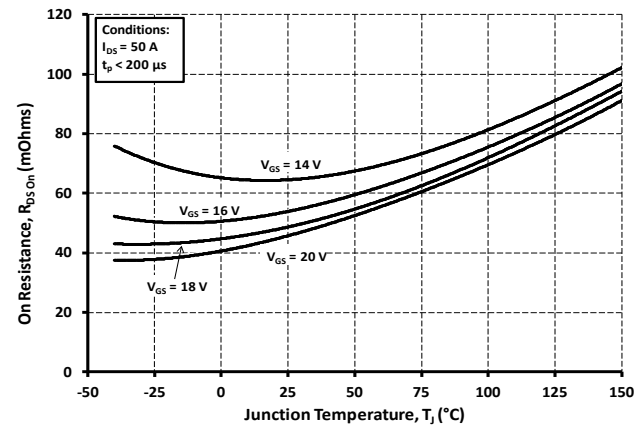


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage



### Typical Performance

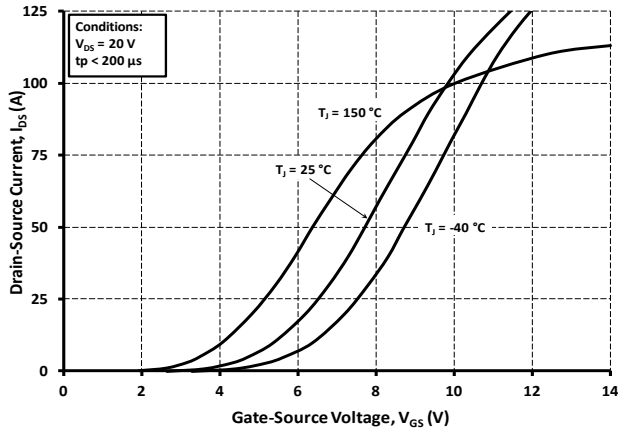


Figure 7. Transfer Characteristic For Various Junction Temperatures

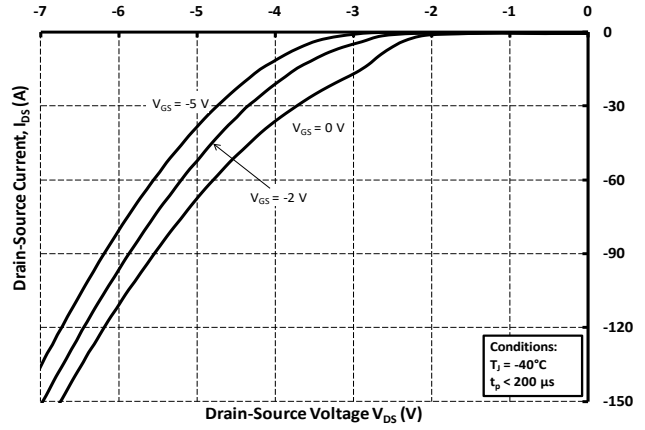


Figure 8. Body Diode Characteristic at -40 °C

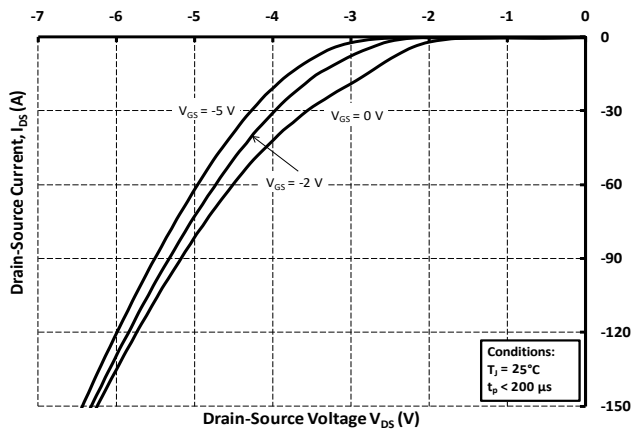


Figure 9. Body Diode Characteristic at 25 °C

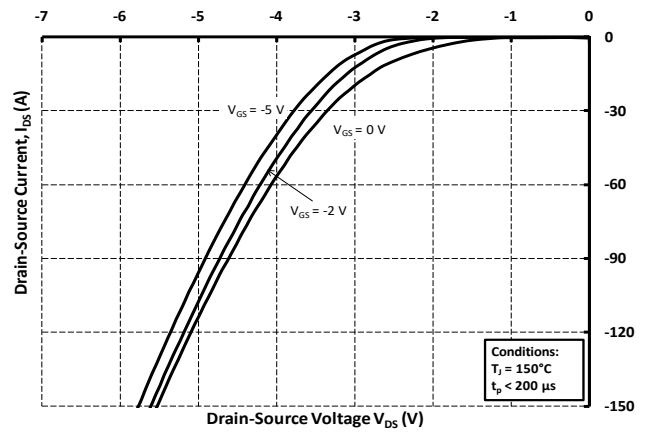


Figure 10. Body Diode Characteristic at 150 °C

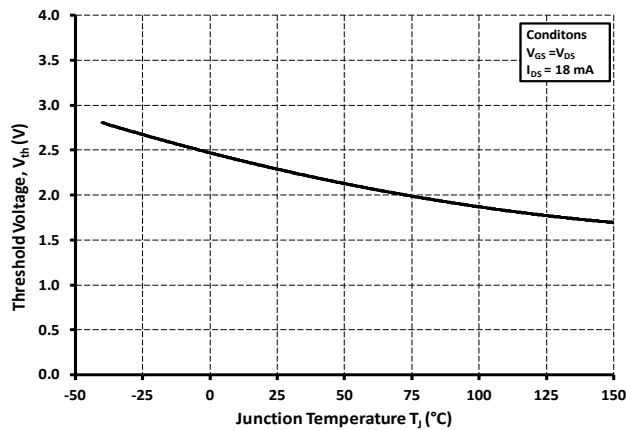


Figure 11. Threshold Voltage vs. Temperature

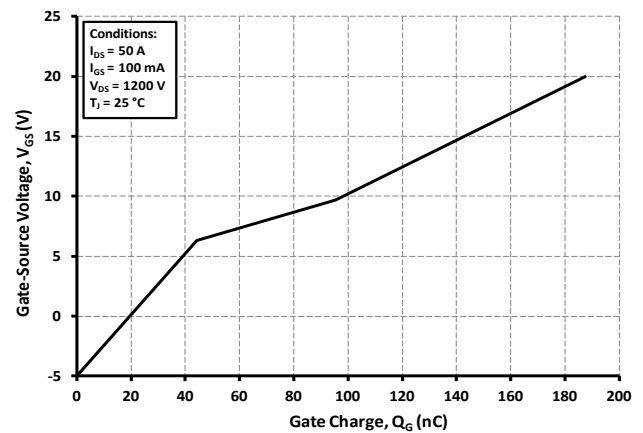


Figure 12. Gate Charge Characteristic



### Typical Performance

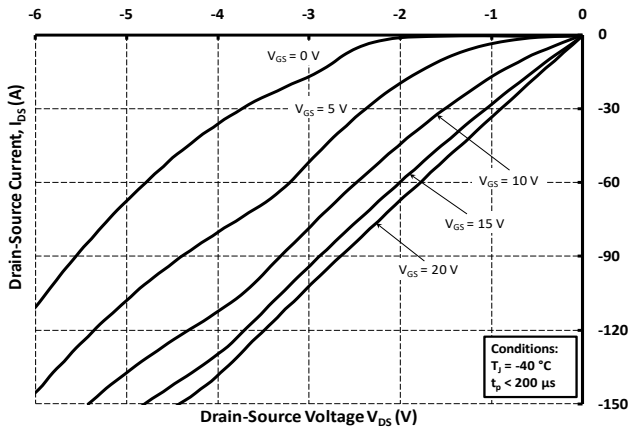


Figure 13. 3rd Quadrant Characteristic at -40 °C

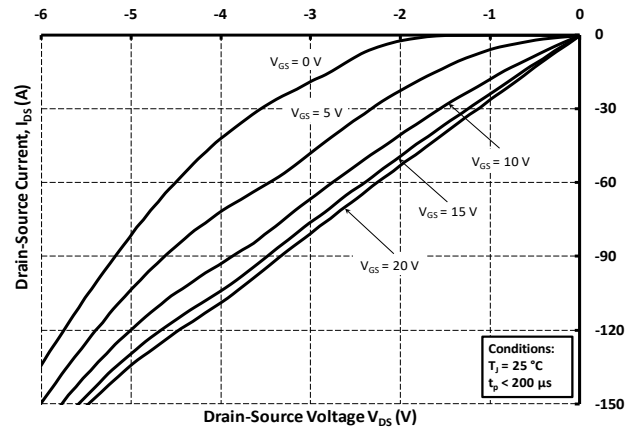


Figure 14. 3rd Quadrant Characteristic at 25 °C

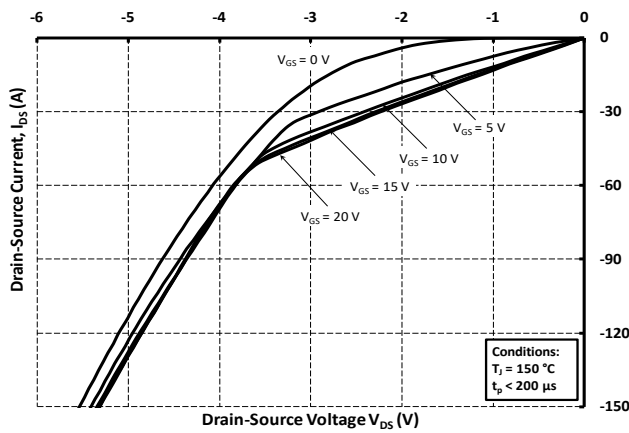


Figure 15. 3rd Quadrant Characteristic at 150 °C

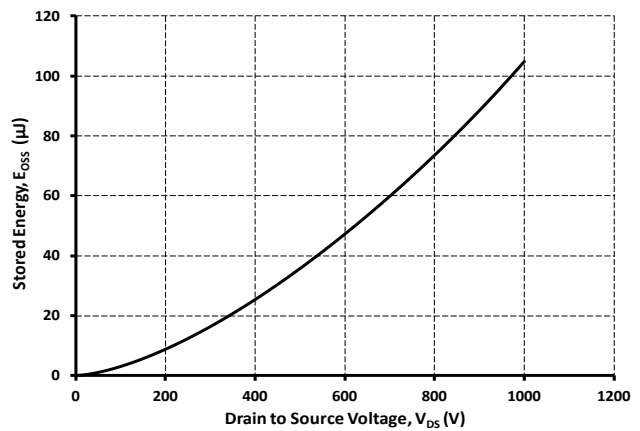


Figure 16. Output Capacitor Stored Energy

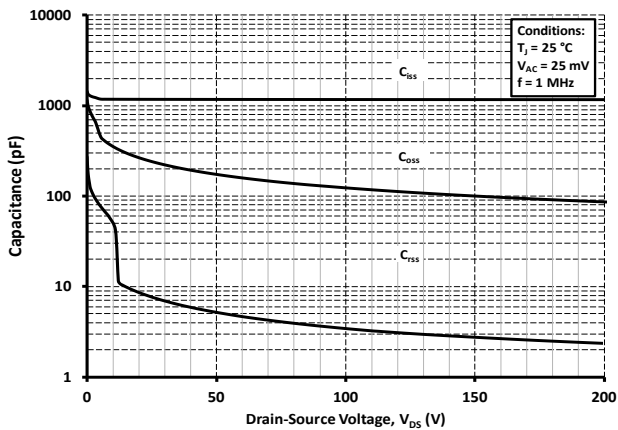


Figure 17. Capacitances vs. Drain-Source Voltage (0-200 V)

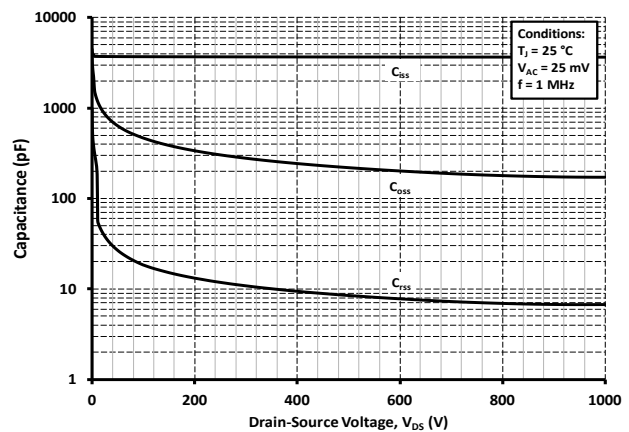


Figure 18. Capacitances vs. Drain-Source Voltage (0-1000 V)



Typical Performance

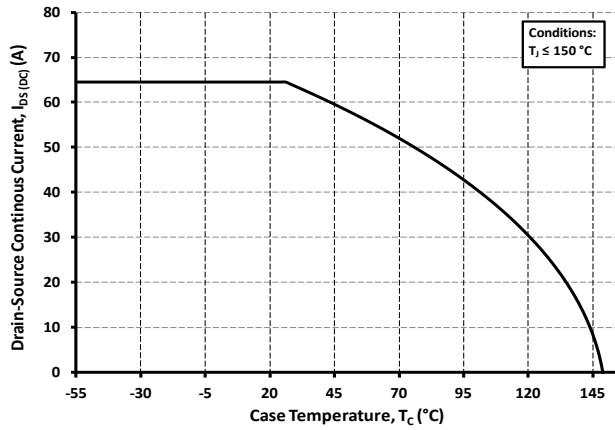


Figure 19. Continuous Drain Current Derating vs. Case Temperature

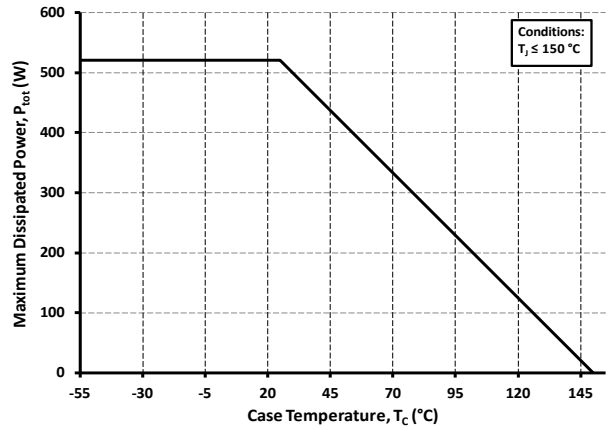


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

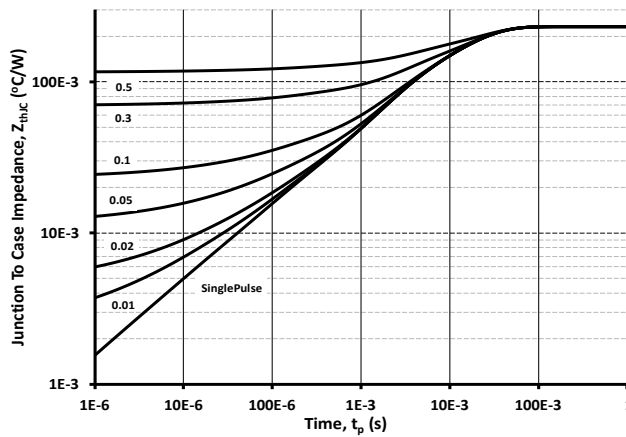


Figure 21. Transient Thermal Impedance (Junction - Case)

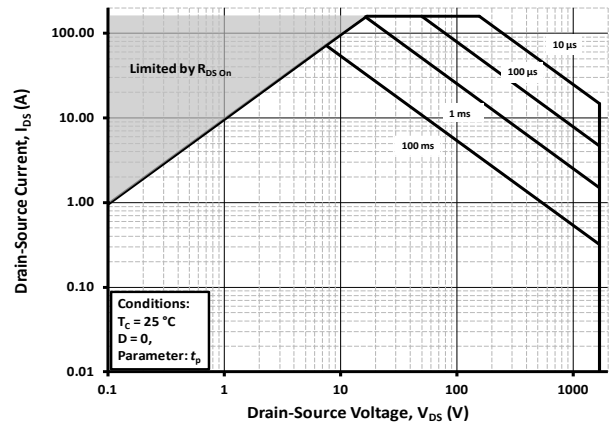


Figure 22. Safe Operating Area

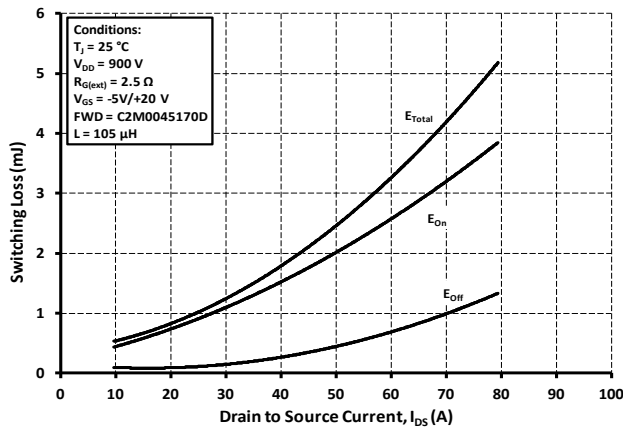


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ( $V_{GS} = 900V$ )

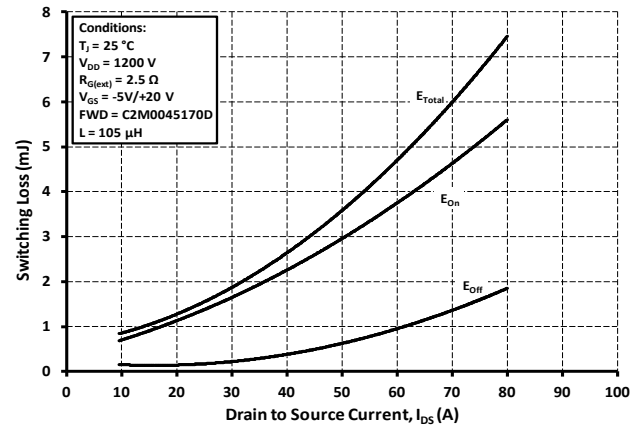


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ( $V_{GS} = 1200V$ )



Typical Performance

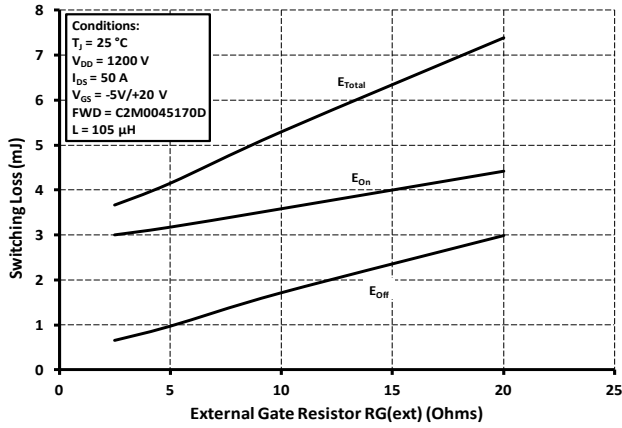


Figure 25. Clamped Inductive Switching Energy vs.  $R_{G(ext)}$

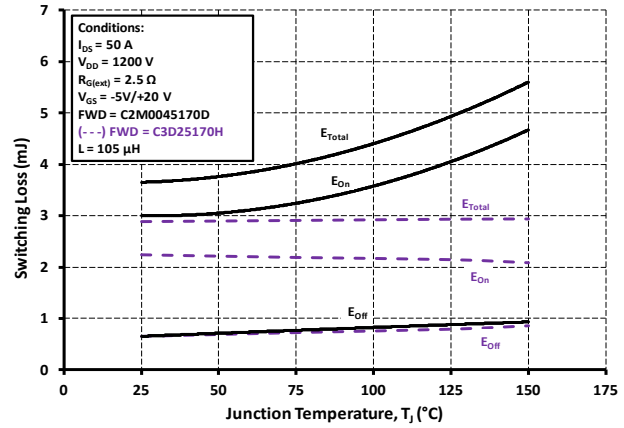


Figure 26. Clamped Inductive Switching Energy vs. Temperature

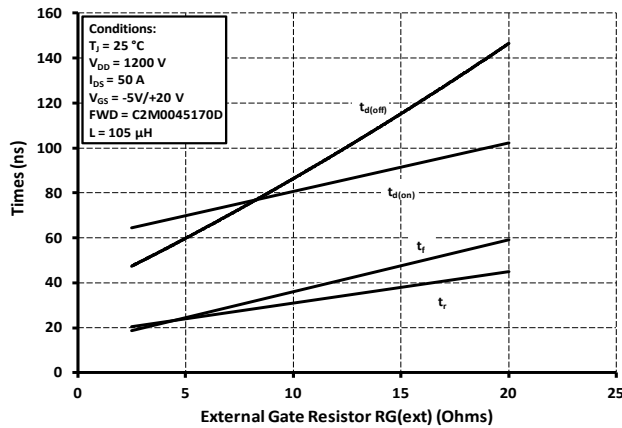


Figure 27. Switching Times vs.  $R_{G(ext)}$

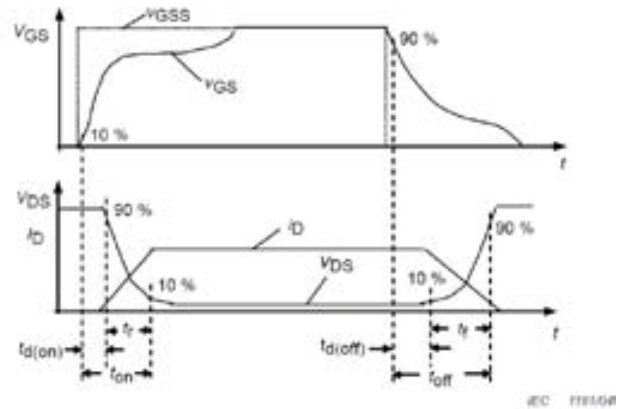


Figure 28. Switching Times Definition



### Test Circuit Schematic

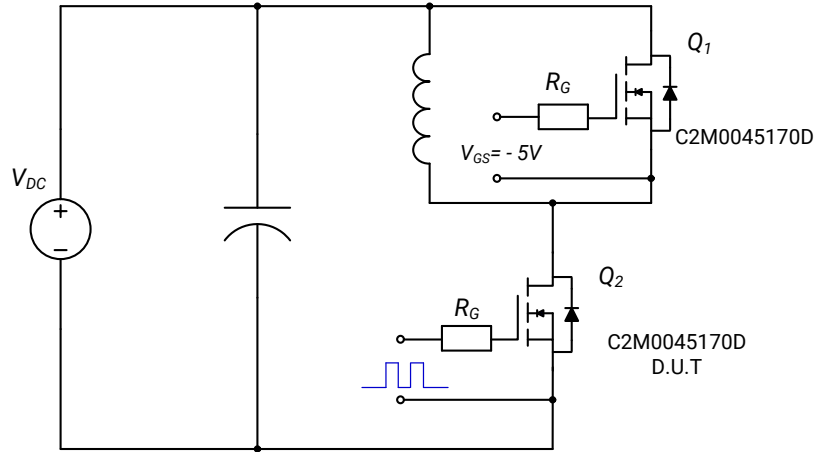


Figure 29a. Clamped Inductive Switching Test Circuit using MOSFET intrinsic body diode

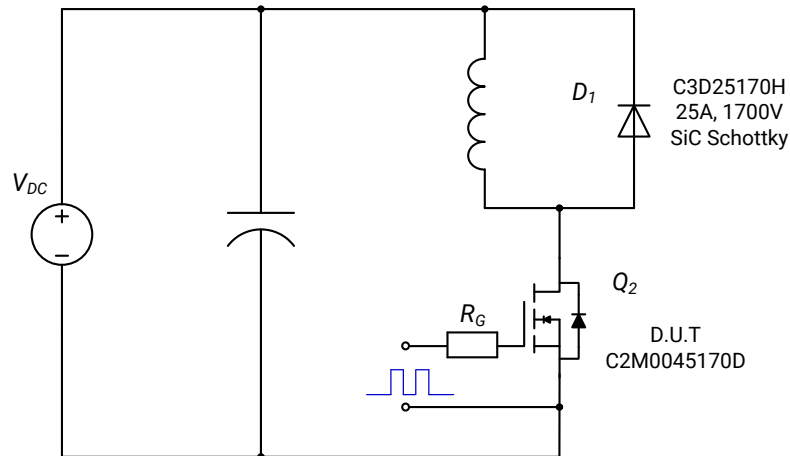


Figure 29b. Clamped Inductive Switching Test Circuit using SiC Schottky diode

### ESD Ratings

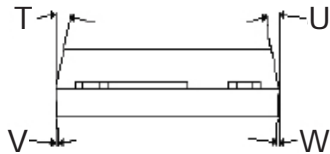
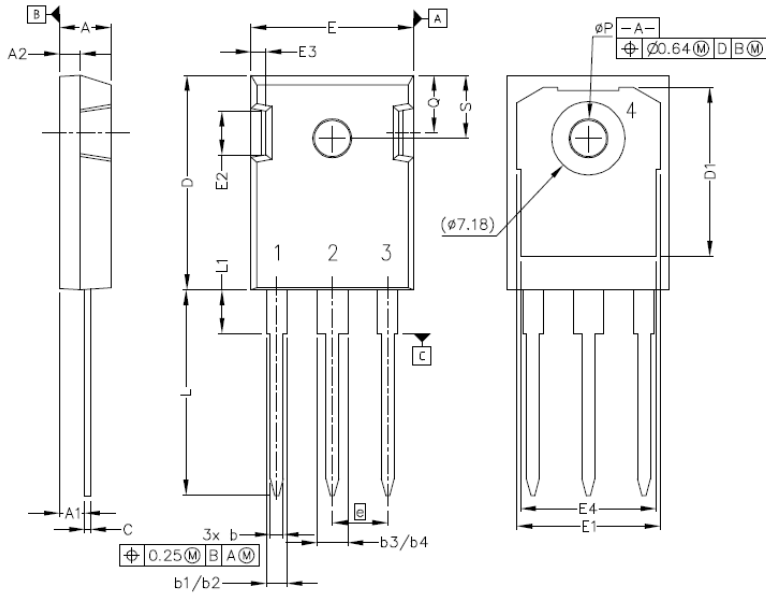
ESD Test	Total Devices Sampled	Resulting Classification
ESD-HBM	All Devices Passed 4000V	3A (>4000V)
ESD-CDM	All Devices Passed 1000V	IV (>1000V)





## Package Dimensions

### Package T0247-3L

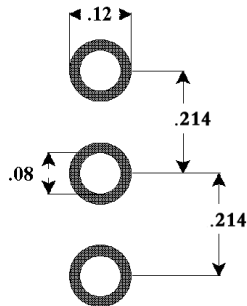


#### Pinout Information:

- Pin 1 = Gate
- Pin 2, 4 = Drain
- Pin 3 = Source

POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037	.049	0.95	1.25
E	.620	.635	15.75	16.13
E1	.516	.557	13.10	14.15
E2	.145	.201	3.68	5.10
E3	.039	.075	1.00	1.90
E4	.487	.529	12.38	13.43
e	.214 BSC		5.44 BSC	
N	3		3	
L	.780	.800	19.81	20.32
L1	.161	.173	4.10	4.40
ØP	.138	.144	3.51	3.65
Q	.216	.236	5.49	6.00
S	.238	.248	6.04	6.30
T	9°	11°	9°	11°
U	9°	11°	9°	11°
V	2°	8°	2°	8°
W	2°	8°	2°	8°

### Recommended Solder Pad Layout



T0247-3L



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