



Features

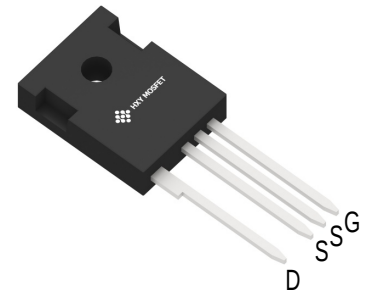
- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant

Benefits

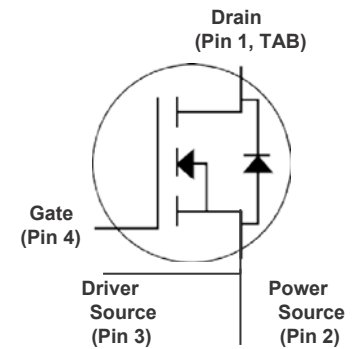
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

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



TO-247-4L



Ordering Part Number	Package	Marking
C2M0045170P	TO-247-4L	HC2M0045170P

Maximum Ratings ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1700	V	$V_{GS} = 0\text{ V}$, $I_D = 100\text{ }\mu\text{A}$	
V_{GSmax}	Gate - Source Voltage	-10/+25	V	Absolute maximum values, AC ($f > 1\text{ Hz}$)	Note: 1
V_{GSop}	Gate - Source Voltage	-5/+20	V	Recommended operational values	Note: 2
I_D	Continuous Drain Current	75	A	$V_{GS} = 20\text{ V}$, $T_C = 25^\circ\text{C}$	Fig. 19
		48		$V_{GS} = 20\text{ V}$, $T_C = 100^\circ\text{C}$	
$I_{D(pulse)}$	Pulsed Drain Current	160	A	Pulse width t_p limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	338	W	$T_C = 25^\circ\text{C}$, $T_J = 150^\circ\text{C}$	Fig. 20
T_J, T_{stg}	Operating Junction and Storage Temperature	-40 to +150	$^\circ\text{C}$		
T_L	Solder Temperature	260	$^\circ\text{C}$	1.6mm (0.063") from case for 10s	



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	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	3.0	4	V	$V_{DS} = V_{GS}, I_D = 18\text{mA}$	Fig. 11
			2.5		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	μA	$V_{DS} = 1700\text{ V}, V_{GS} = 0\text{ V}$	
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		40	70	m Ω	$V_{GS} = 20\text{ V}, I_D = 50\text{ A}$	Fig. 4,5,6
			80			$V_{GS} = 20\text{ V}, I_D = 50\text{ A}, T_J = 150^\circ\text{C}$	
g_{fs}	Transconductance		24.7		S	$V_{DS} = 20\text{ V}, I_{DS} = 50\text{ A}$	Fig. 7
			23.4			$V_{DS} = 20\text{ V}, I_{DS} = 50\text{ A}, T_J = 150^\circ\text{C}$	
C_{iss}	Input Capacitance		3455		pF	$V_{GS} = 0\text{ V}$	Fig. 17,18
C_{oss}	Output Capacitance		171			$V_{DS} = 1200\text{ V}$	
C_{rss}	Reverse Transfer Capacitance		6.7			$f = 1\text{ MHz}$	
E_{oss}	C_{oss} Stored Energy		139		μJ	$V_{AC} = 25\text{ mV}$	Fig 16
$C_{o(er)}$	Effective Output Capacitance (Energy Related)		188		pF	$V_{GS} = 0\text{ V}, V_{DS} = 0 \dots 1200\text{V}$	Note: 3
$C_{o(tr)}$	Effective Output Capacitance (Time Related)		255		pF		
E_{ON}	Turn-On Switching Energy (SiC Diode FWD)		0.52		mJ	$V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V},$ $I_D = 50\text{ A}, R_{G(ext)} = 2.5\Omega, L = 99\text{ }\mu\text{H},$ $T_J = 150^\circ\text{C},$ using SiC Diode as	Fig. 26, 29b Note 2
E_{OFF}	Turn Off Switching Energy (SiC Diode FWD)		0.43				
E_{ON}	Turn-On Switching Energy (Body Diode FWD)		2.0		mJ	FWD $V_{DS} = 1200\text{ V}, V_{GS} = -5/20\text{ V},$ $I_D = 50\text{ A}, R_{G(ext)} = 2.5\Omega, L = 99\text{ }\mu\text{H},$ $T_J = 150^\circ\text{C},$ using MOSFET as	Fig. 26, 29a Note 2
E_{OFF}	Turn Off Switching Energy (Body Diode FWD)		0.31				
$t_{d(on)}$	Turn-On Delay Time		15		ns	FWD $V_{DD} = 1200\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 50\text{ A}, R_{G(ext)} = 2.5\Omega,$ Timing relative to V_{DS} Inductive load	Fig. 27, 29 Note 2
t_r	Rise Time		18				
$t_{d(off)}$	Turn-Off Delay Time		34				
t_f	Fall Time		12				
$R_{G(int)}$	Internal Gate Resistance		1.3		Ω	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	
Q_{gs}	Gate to Source Charge		46		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		71				
Q_g	Total Gate Charge		204				



Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	3.8		V	$V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}$	Fig. 8, 9,10
		3.4		V	$V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}, T_J = 150\text{ }^{\circ}\text{C}$	Note 1
I_S	Continuous Diode Forward Current		76	A	$V_{GS} = -5\text{ V}, T_C = 25\text{ }^{\circ}\text{C}$	Note 1
$I_{S, \text{pulse}}$	Diode pulse Current		160	A	$V_{GS} = -5\text{ V}$, pulse width t_p limited by T_{Jmax}	Note 1
t_{rr}	Reverse Recovery Time	44		ns	$V_{GS} = -5\text{ V}, I_{SD} = 50\text{ A}$, $V_R = 1200\text{ V}$ dif/dt = 3000 A/ μs , $T_J = 150\text{ }^{\circ}\text{C}$	
Q_{rr}	Reverse Recovery Charge	1.9		μC		
I_{rrm}	Peak Reverse Recovery Current	64		A		
t_{rr}	Reverse Recovery Time	25		ns	$V_{GS} = -5\text{ V}, I_{SD} = 50\text{ A}$, $V_R = 1200\text{ V}$ dif/dt = 13450 A/ μs , $T_J = 150\text{ }^{\circ}\text{C}$	
Q_{rr}	Reverse Recovery Charge	2.4		μC		
I_{rrm}	Peak Reverse Recovery Current	166		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.22	0.37	$^{\circ}\text{C/W}$		Fig. 21
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient		40			



Typical Performance

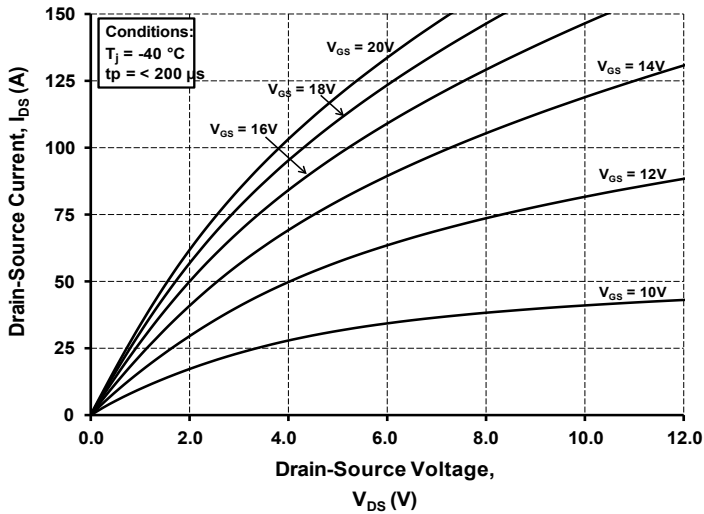


Figure 1. Output Characteristics $T_j = -40^\circ\text{C}$

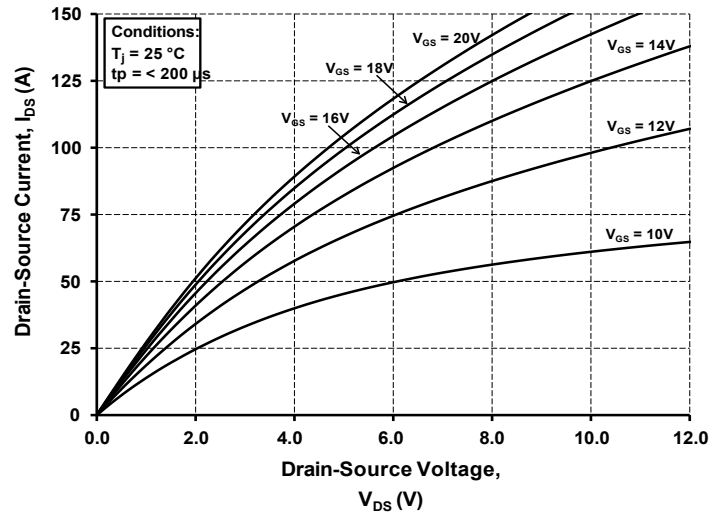


Figure 2. Output Characteristics $T_j = 25^\circ\text{C}$

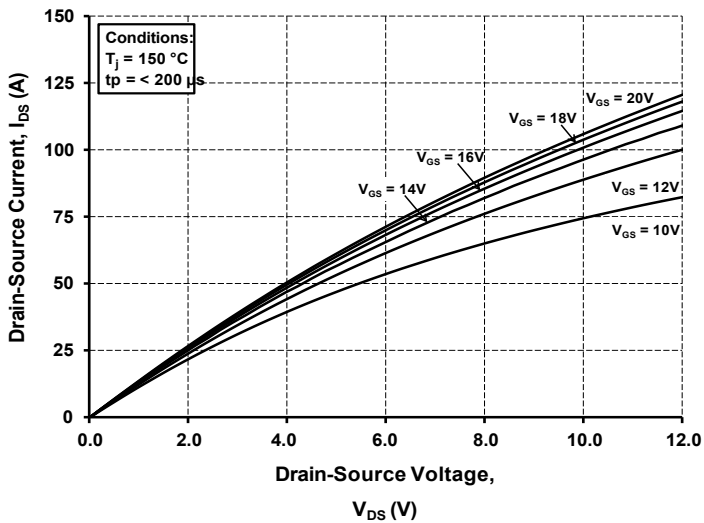


Figure 3. Output Characteristics $T_j = 150^\circ\text{C}$

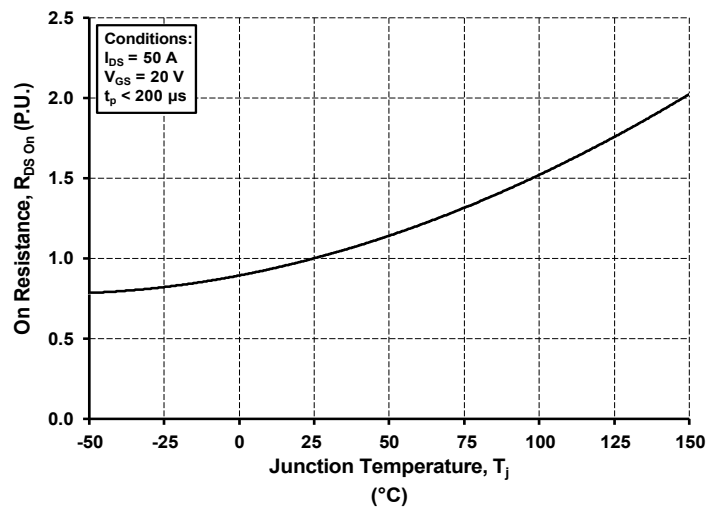
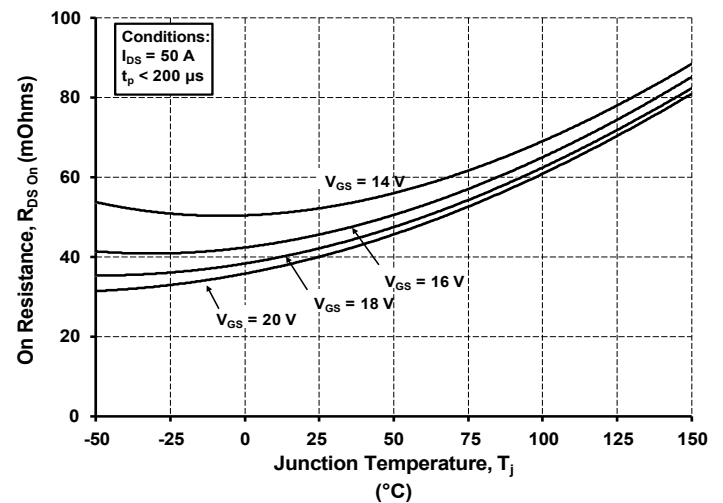
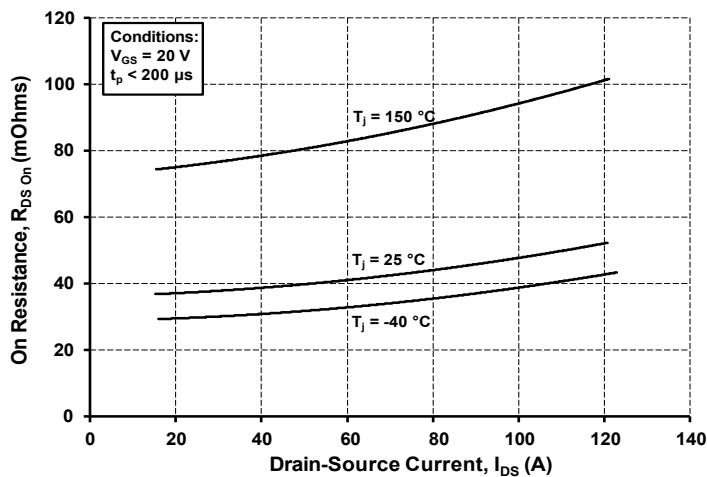


Figure 4. Normalized On-Resistance vs. Temperature



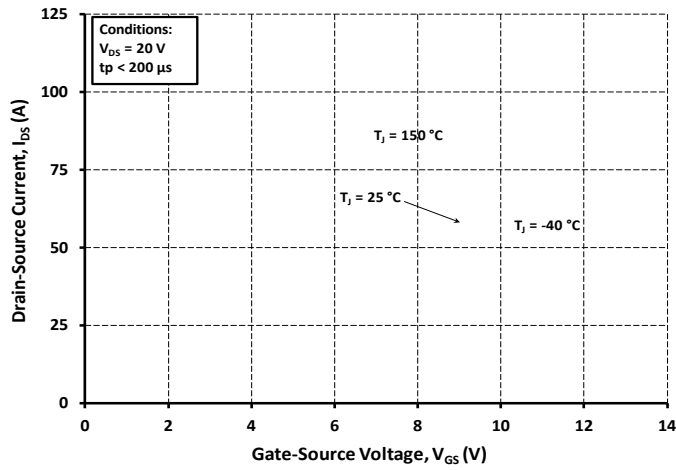


Figure 7. Transfer Characteristic For Various Junction Temperatures

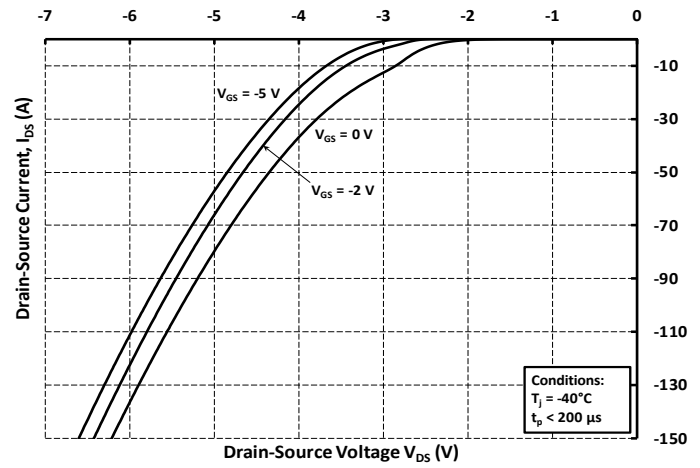


Figure 8. Body Diode Characteristic at $-40\text{ }^{\circ}\text{C}$

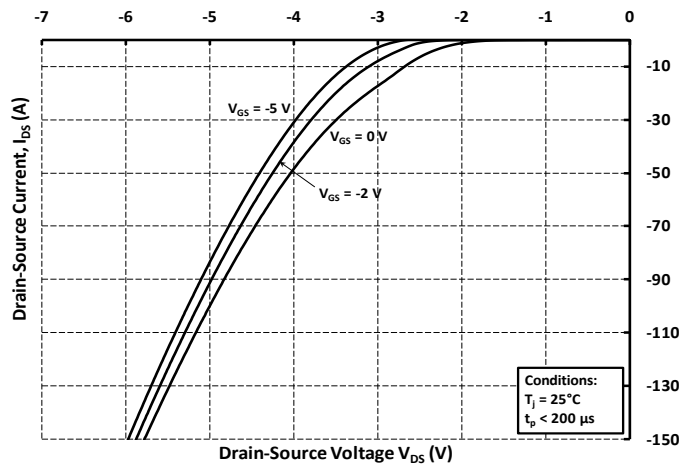


Figure 9. Body Diode Characteristic at $25\text{ }^{\circ}\text{C}$

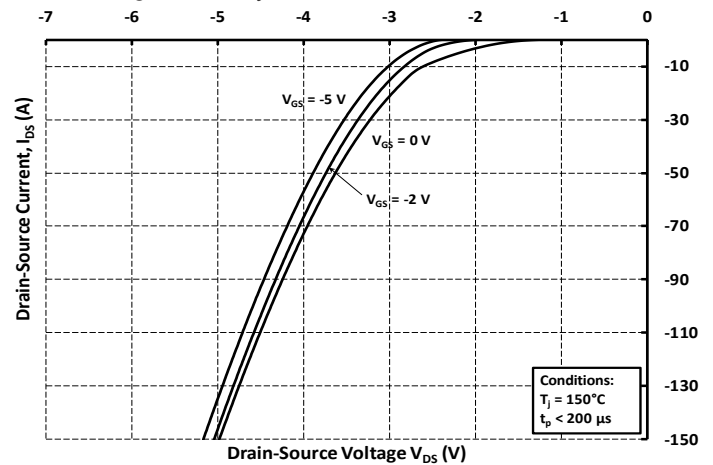
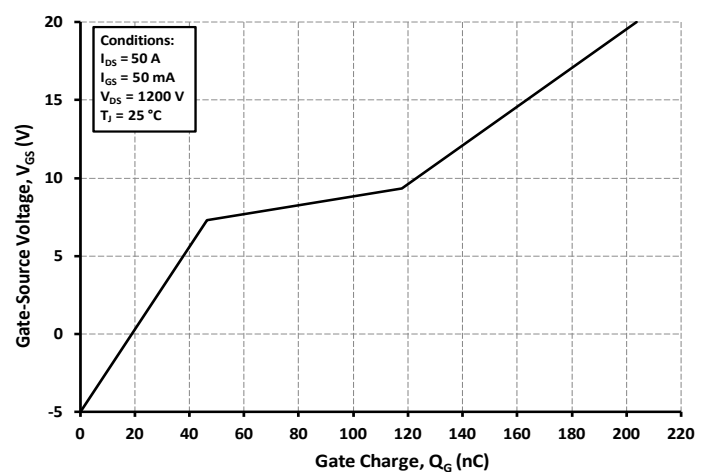
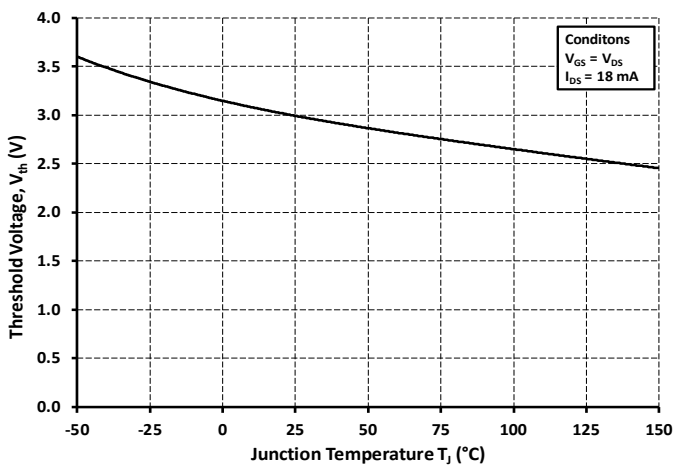


Figure 10. Body Diode Characteristic at $150\text{ }^{\circ}\text{C}$



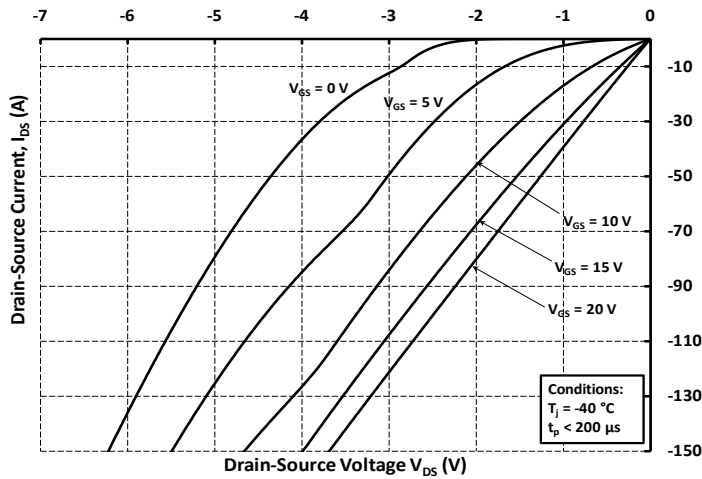


Figure 13. 3rd Quadrant Characteristic at -40 °C

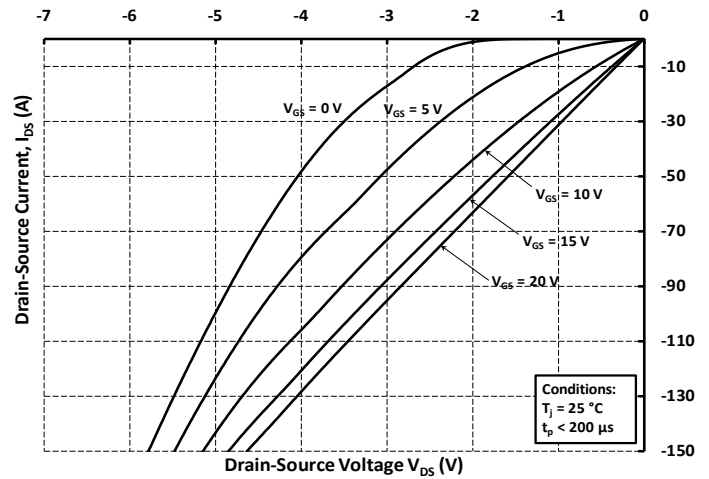


Figure 14. 3rd Quadrant Characteristic at 25 °C

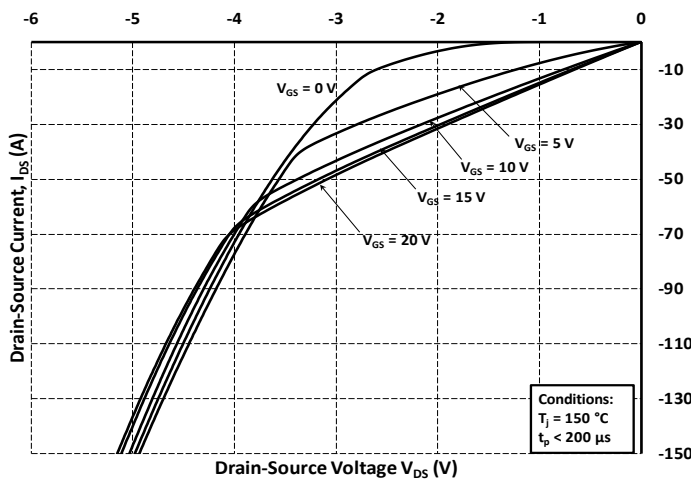


Figure 15. 3rd Quadrant Characteristic at 150 °C

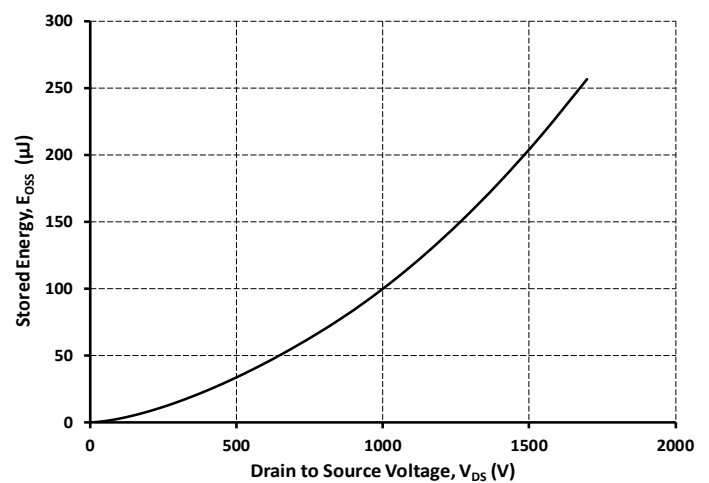
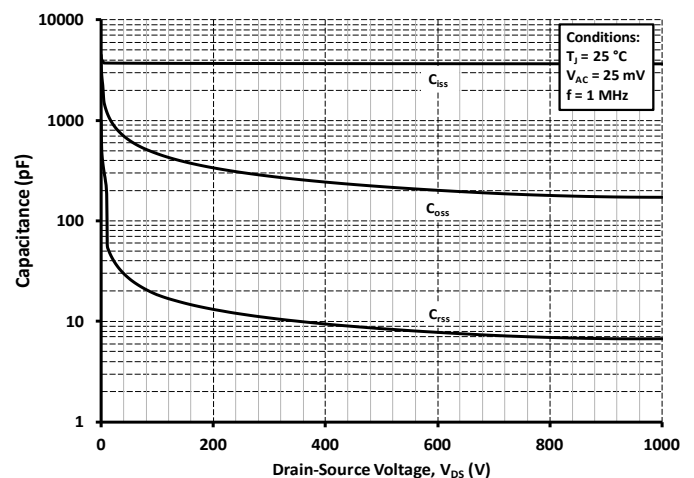
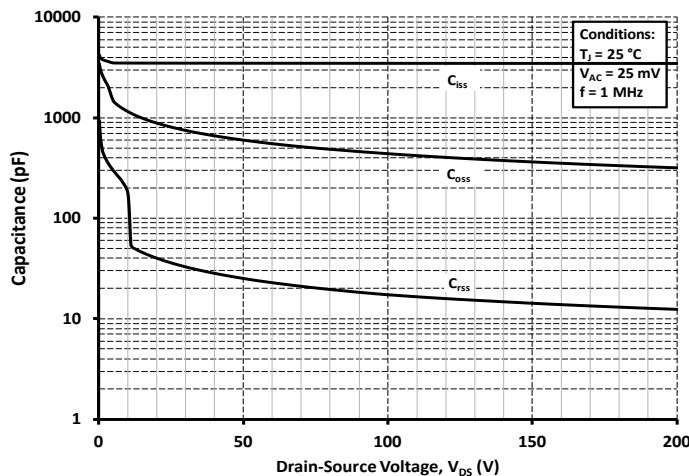


Figure 16. Output Capacitor Stored Energy



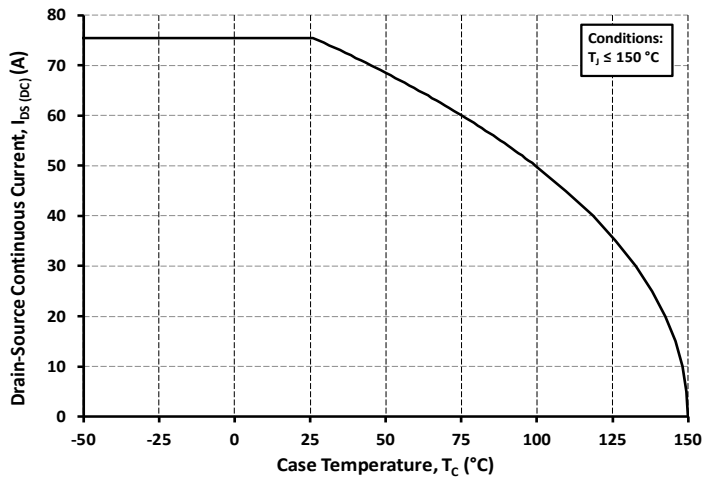


Figure 19. Continuous Drain Current Derating vs. Case Temperature

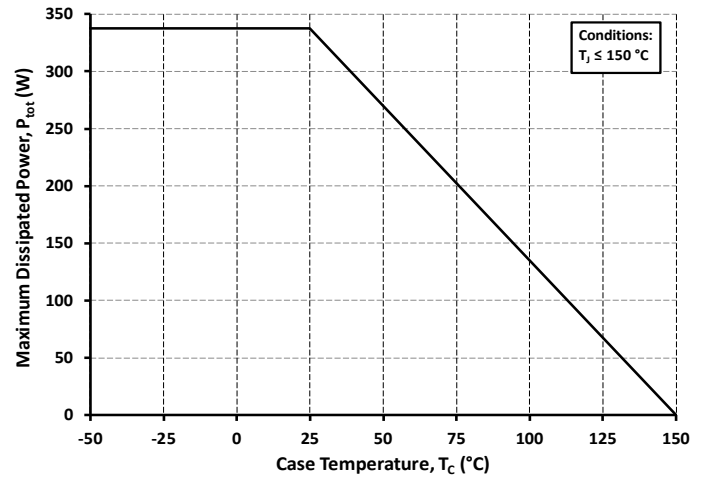


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

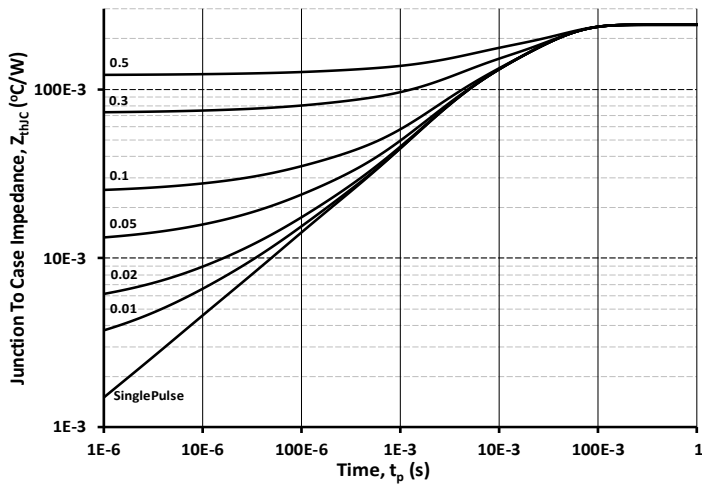


Figure 21. Transient Thermal Impedance (Junction - Case)

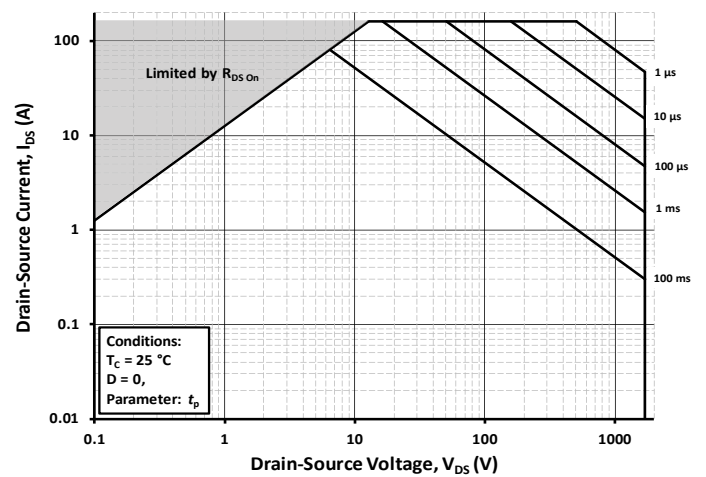
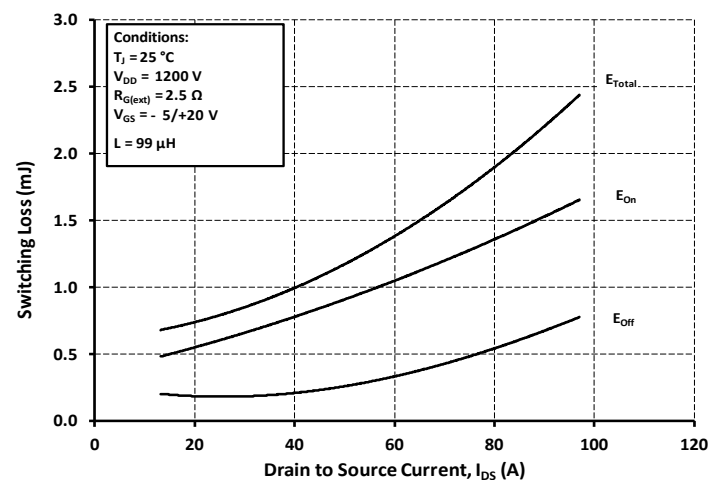
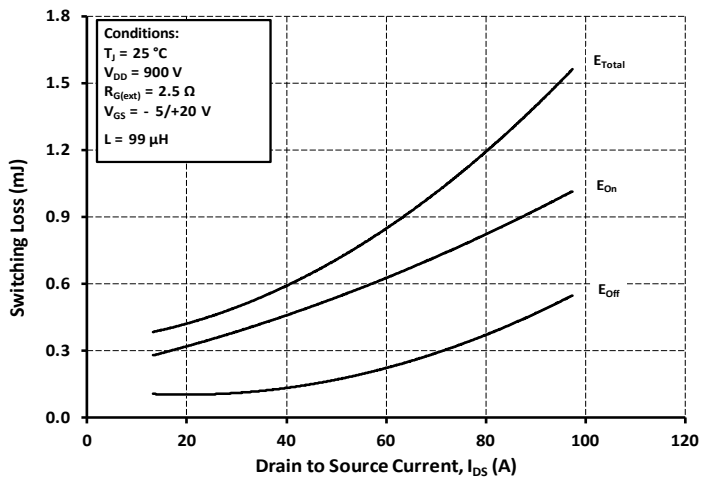


Figure 22. Safe Operating Area



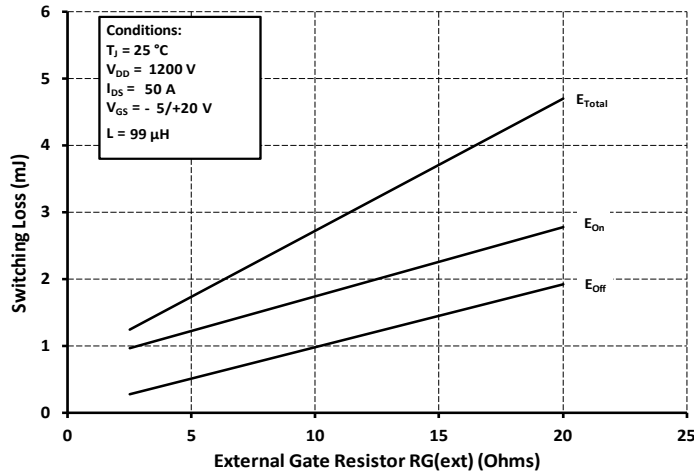


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

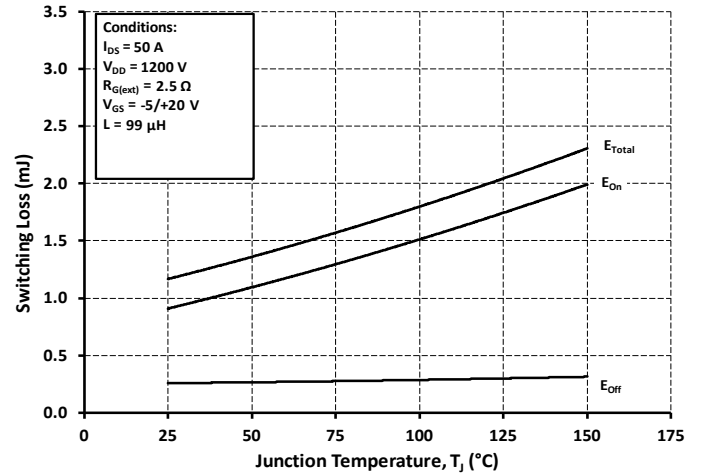


Figure 26. Clamped Inductive Switching Energy vs. Temperature

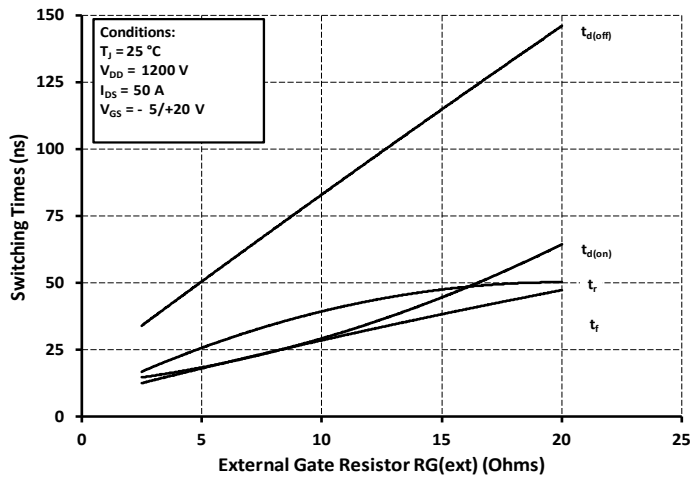


Figure 27. Switching Times vs. $R_{G(ext)}$

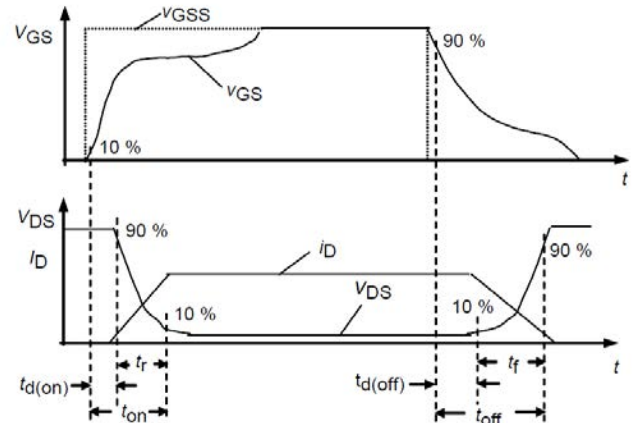


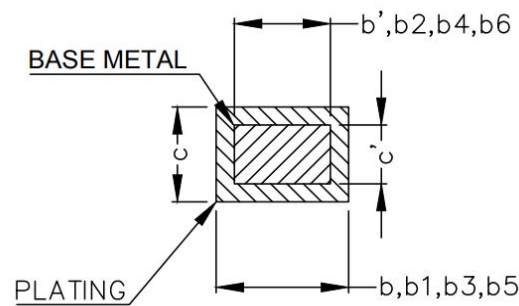
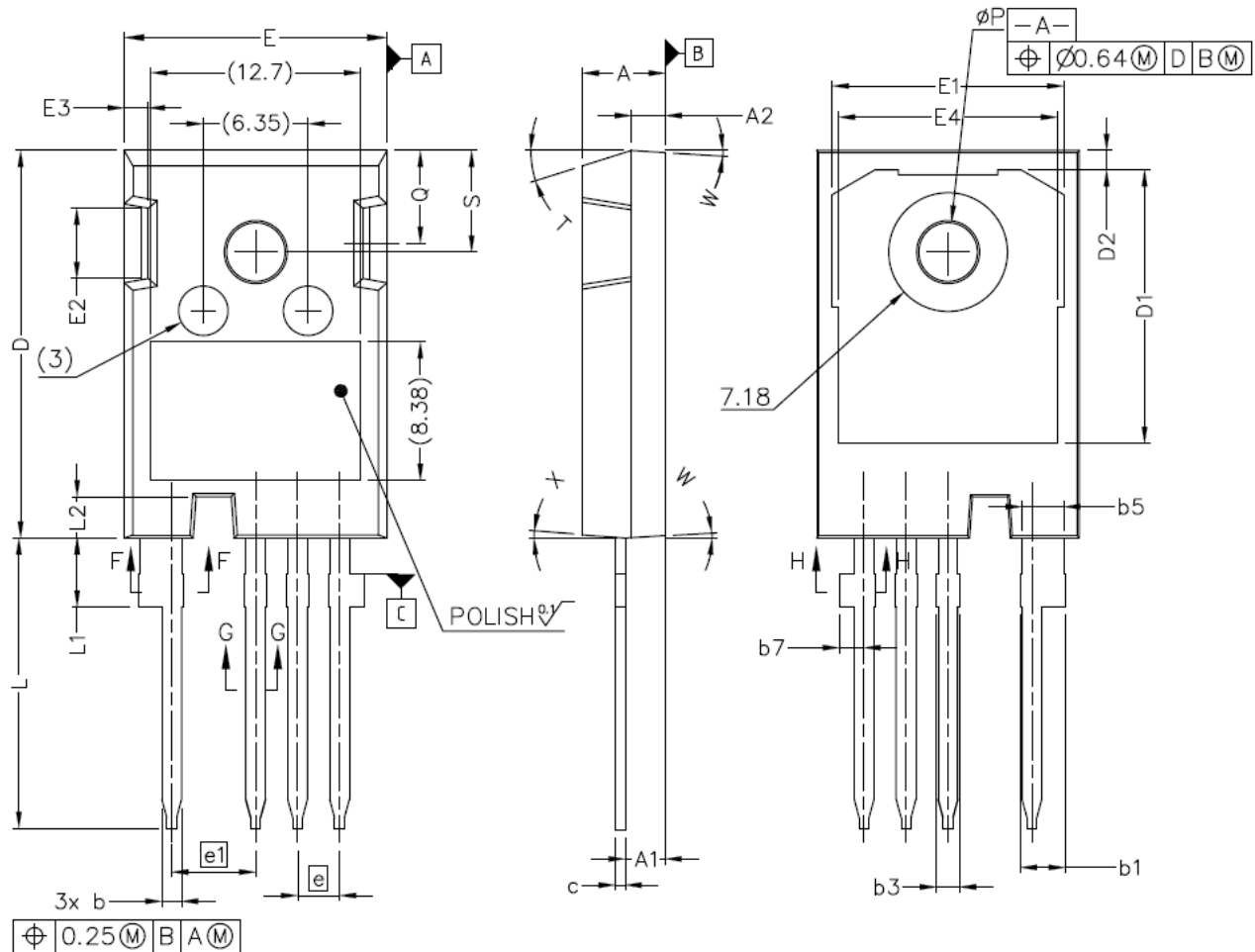
Figure 28. Switching Times Definition

IEC 1161/04



Package Dimensions

Package TO-247-4L



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

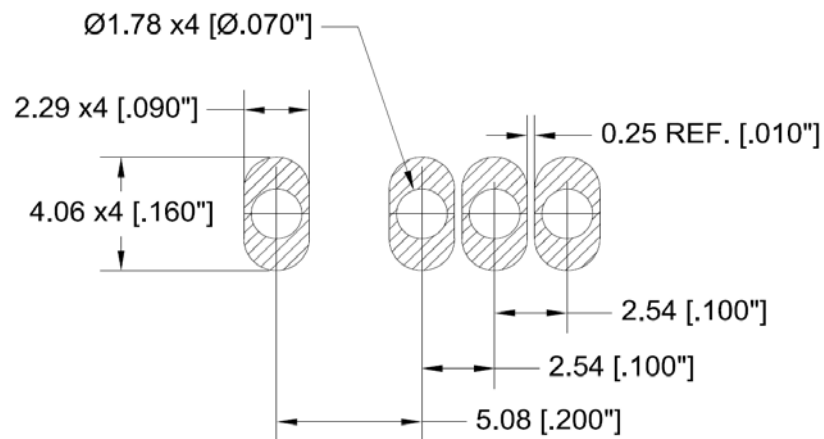


NOTE ;

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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