HCW120N21M1

N-Channel *e*SiC Silicon Carbide Power MOSFET

1200 V, 100 A, 21 mΩ

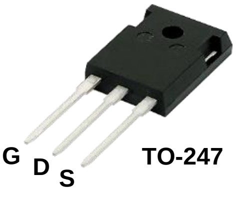
Features

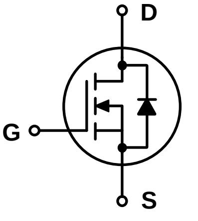
- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant

$BV_{DSS, Tc=25℃}$	$I_{D, Tc=25℃}$	$R_{DS(on),typ}$	$Q_{g,typ}$
1200 V	100 A	21 mΩ	200 nC

Benefits

- System efficiency improvement
- Higher frequency applicability
- Increased power density
- Reduced cooling effort





Applications

- Solar inverter
- EV charging station
- UPS
- Industrial power supply

RoHS compliant

HF

Absolute Maximum Ratings (T_C = 25℃ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		1200	V
V_{GS}	Gate to Source Voltage (DC)		-10 / +22	V
V_{GSop}	Recommended Operation Value		-5 / +18	V
I_D	Drain Current	Continuous (T_C = 25℃)	100	A
		Continuous (T_C = 100℃)	71	
I_{DM}	Drain Current	Pulsed (Note1)	250	A
P_D	Power Dissipation	(T_C = 25℃)	469	W
		Derate Above 25℃	3.1	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	℃
T_L	Maximum Lead Temperature for Soldering, 1/8” from Case for 10 Seconds		260	℃

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{θJC}$	Thermal Resistance, Junction to Case, Max.	0.32	℃/W
$R_{θJA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
HCW120N21M1	HCW120N21M1	TO-247	Tube	30 units

Electrical Characteristics (T_C = 25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200 V, V_{GS} = 0 V		1	100	μA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 175℃		10		
I_{GSS}	Gate-Source Leakage Current	V_{GS} = +22 V, V_{DS} = 0 V			+100	nA
		V_{GS} = -10 V, V_{DS} = 0 V			-100	
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 17 mA (tested after V_{GS} = 22 V, 1 ms pulse)	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 18 V, I_D = 50 A		21	29.4	mΩ
		V_{GS} = 18 V, I_D = 50 A, T_J = 175℃		33.6		
g_{fs}	Transconductance	V_{DS} = 20 V, I_D = 50 A		24.4		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 800 V, V_{GS} = 0V, f = 250 kHz		3741		pF
C_{oss}	Output Capacitance			224		
C_{rss}	Reverse Capacitance			17		
E_{oss}	Stored Energy in Output Capacitance	V_{DS} = 0 V to 800 V, V_{GS} = 0 V		93		μJ
$C_{o(er)}$	Energy Related Output Capacitance			291		pF
$C_{o(tr)}$	Time Related Output Capacitance			456		
$Q_{g(tot)}$	Total Gate Charge	V_{DS} = 800 V, I_D = 50 A, V_{GS} = -5 V / 18 V, Inductive load		200		nC
Q_{gs}	Gate to Source Charge			48		
Q_{gd}	Gate to Drain "Miller" Charge			68		
R_G	Internal Gate Resistance	f = 1 MHz		3.0		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 800 V, I_D = 50 A, V_{GS} = -5 V / 18 V, R_G = 2 Ω, FWD : PCH120S20D1, Inductive load		30		ns
t_r	Turn-On Rise Time			49		
$t_{d(off)}$	Turn-Off Delay Time			62		
t_f	Turn-Off Fall Time			14		
E_{on}	Turn-on Switching Energy			1247		μJ
E_{off}	Turn-off Switching Energy			436		
E_{tot}	Total Switching Energy			1683		
Source-Drain Diode Characteristics						
I_S	Maximum Continuous Diode Forward Current				100	A
I_{SM}	Maximum Pulsed Diode Forward Current				250	
V_{SD}	Diode Forward Voltage	V_{GS} = -5 V, I_{SD} = 50 A		4.1		V
t_{rr}	Reverse Recovery Time	V_{DD} = 800 V, I_{SD} = 50 A, dI_F/dt = 1300 A/μs, Includes Q_{oss}		50		ns
Q_{rr}	Reverse Recovery Charge			531		nC

Typical Performance Characteristics

Figure 1. On-Region Characteristics T_J = -40℃

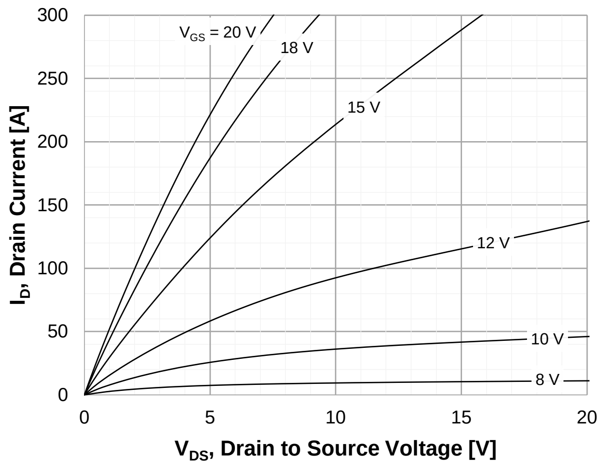


Figure 2. On-Region Characteristics T_J = 25℃

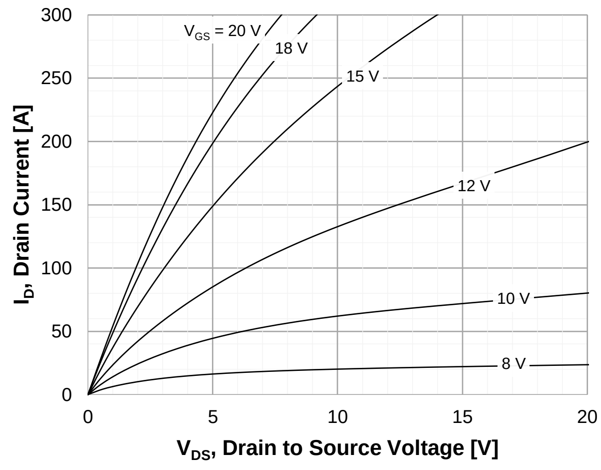


Figure 3. On-Region Characteristics T_J = 175℃

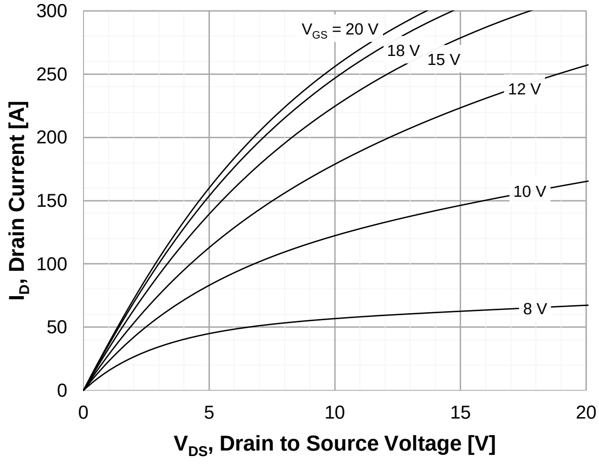


Figure 4. Normalized On-Resistance Characteristics vs. Temperature

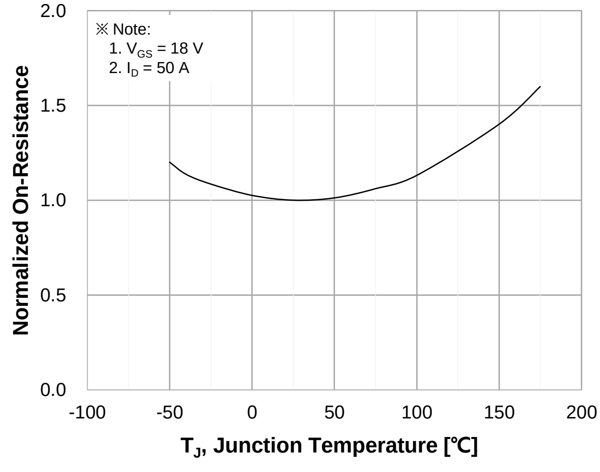


Figure 5. Transfer Characteristics

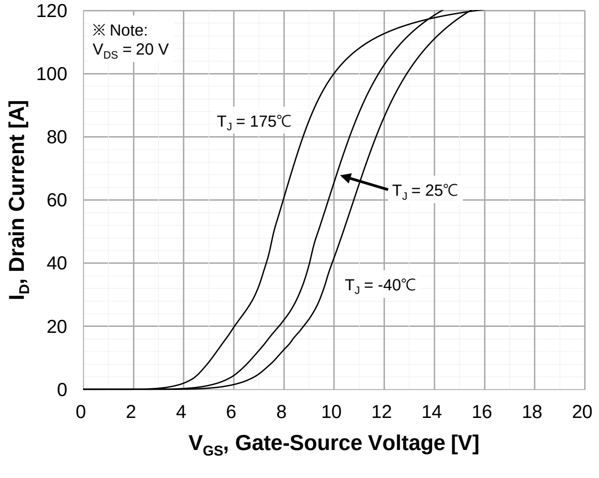
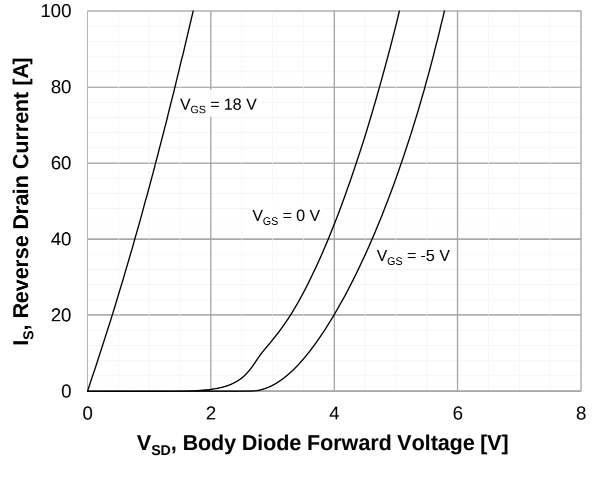


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = -40℃



Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 25℃

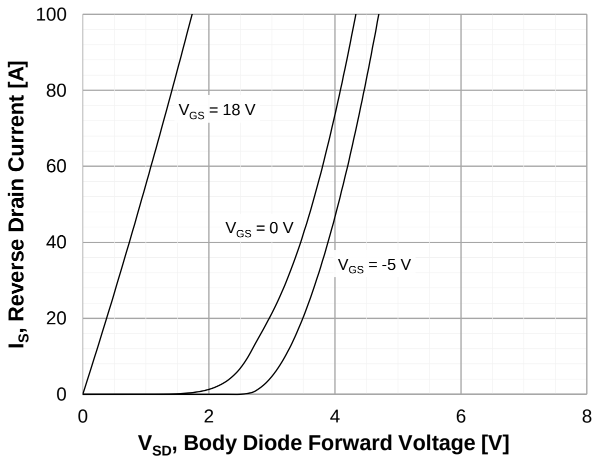


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 175℃

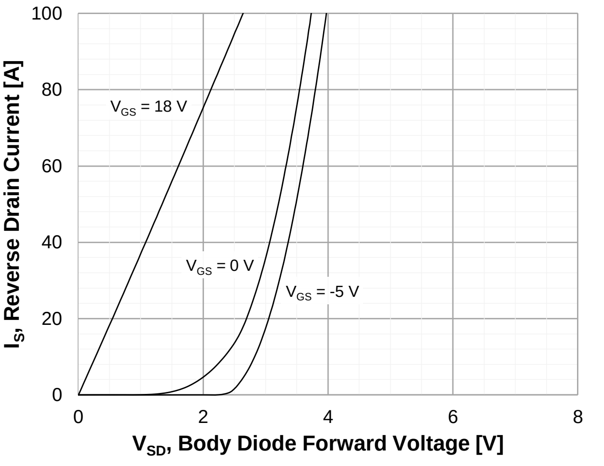


Figure 9. Threshold Voltage vs. Temperature

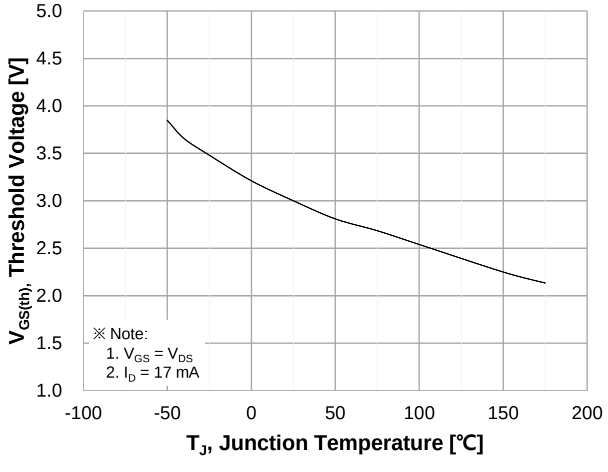


Figure 10. Gate Charge Characteristics

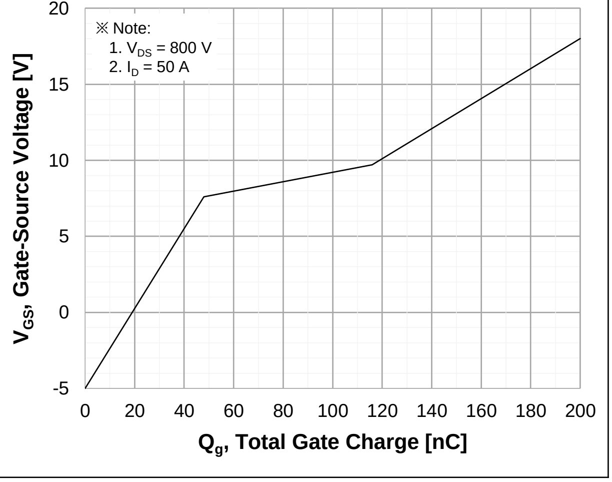


Figure 11. Stored Energy in Output Capacitance

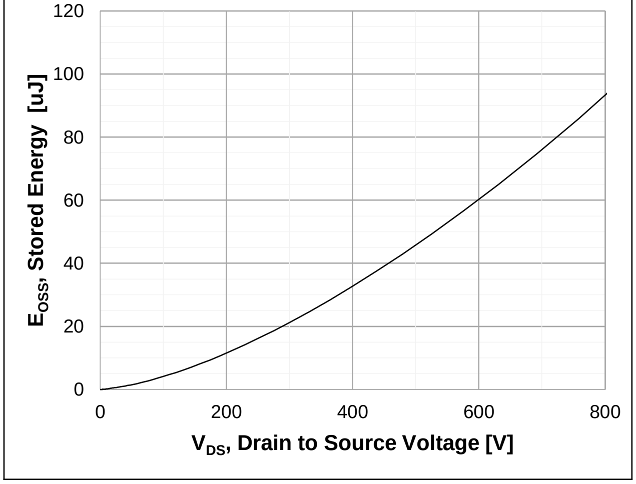
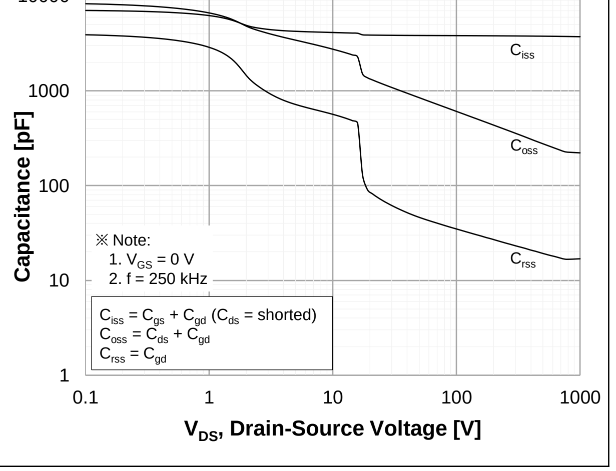


Figure 12. Capacitance Characteristics



Typical Performance Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

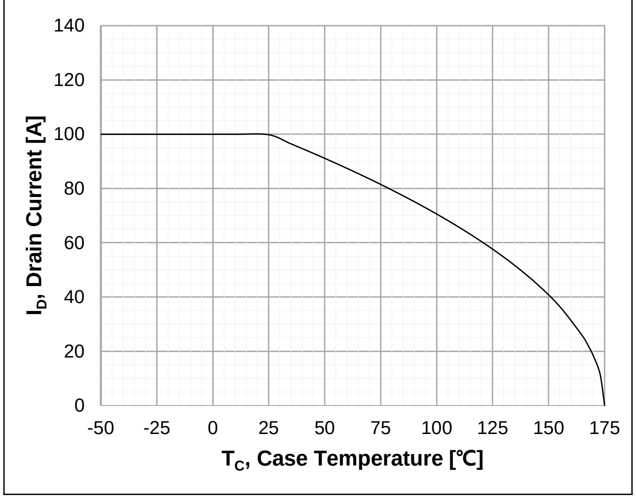


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

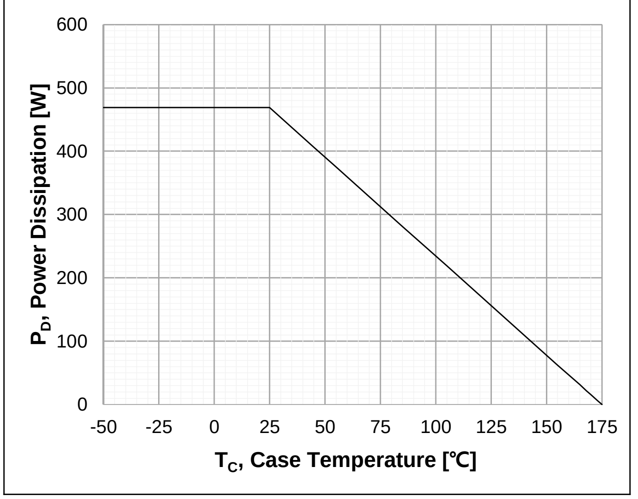


Figure 15. Typ. Switching Losses vs. Drain Current

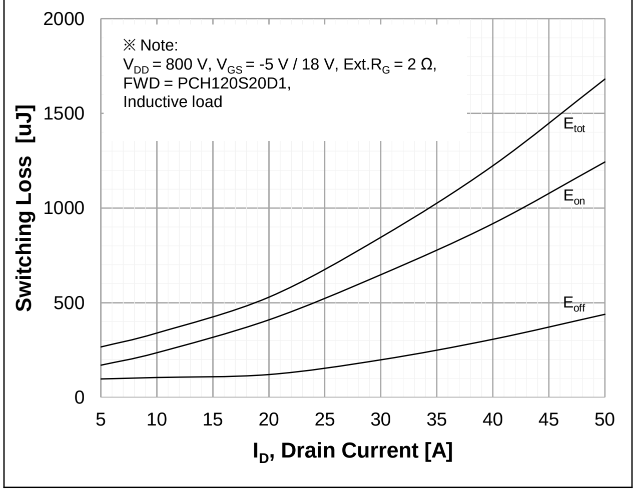


Figure 16. Typ. Switching Losses vs. Gate Resistance

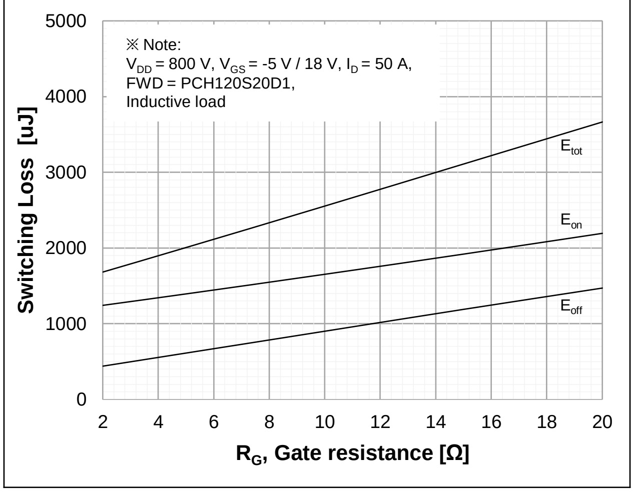


Figure 17. Typ. Switching Losses vs. Drain Current

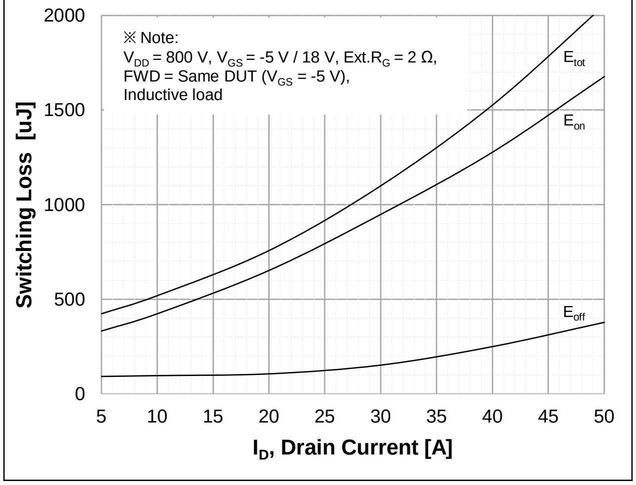
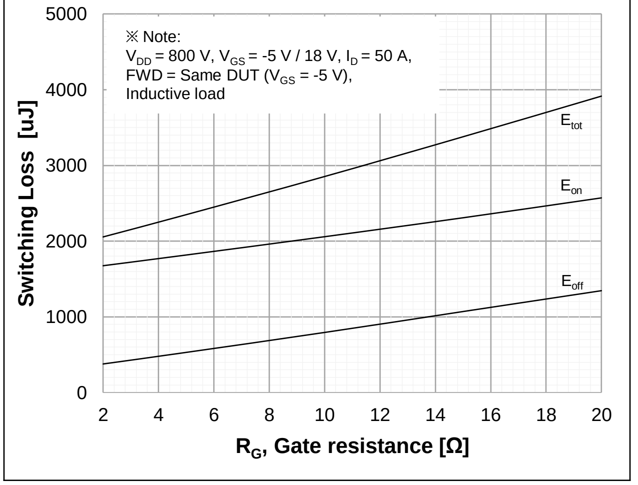


Figure 18. Typ. Switching Losses vs. Gate Resistance



Typical Performance Characteristics

Figure 19. Maximum Safe Operating Area

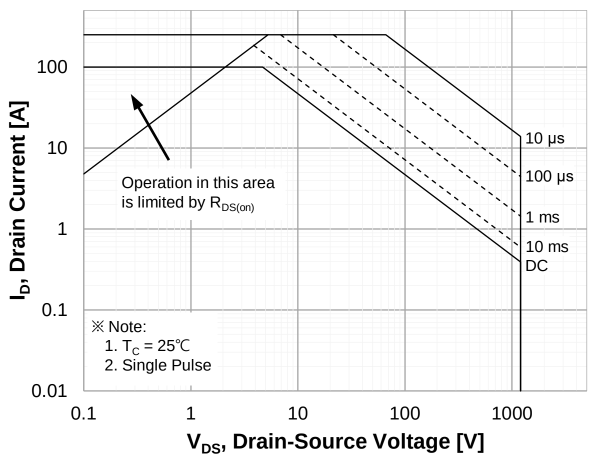


Figure 20. Transient Thermal Response Curve

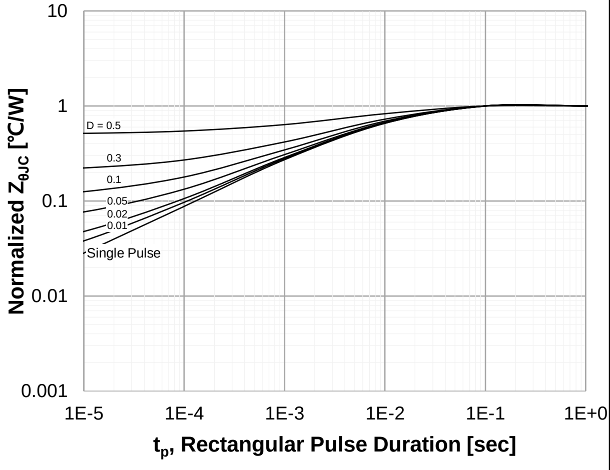


Figure 21. Inductive Load Switching Test Circuit and Waveforms

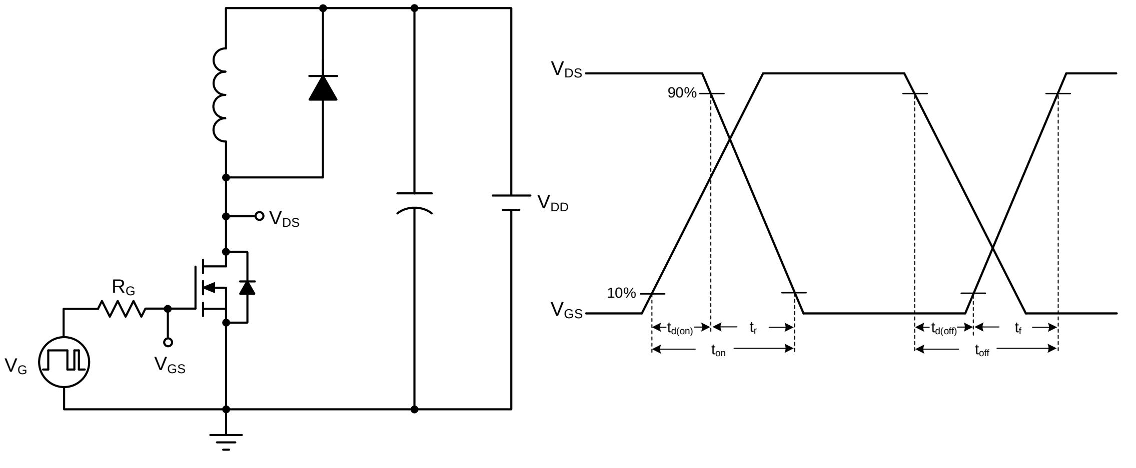
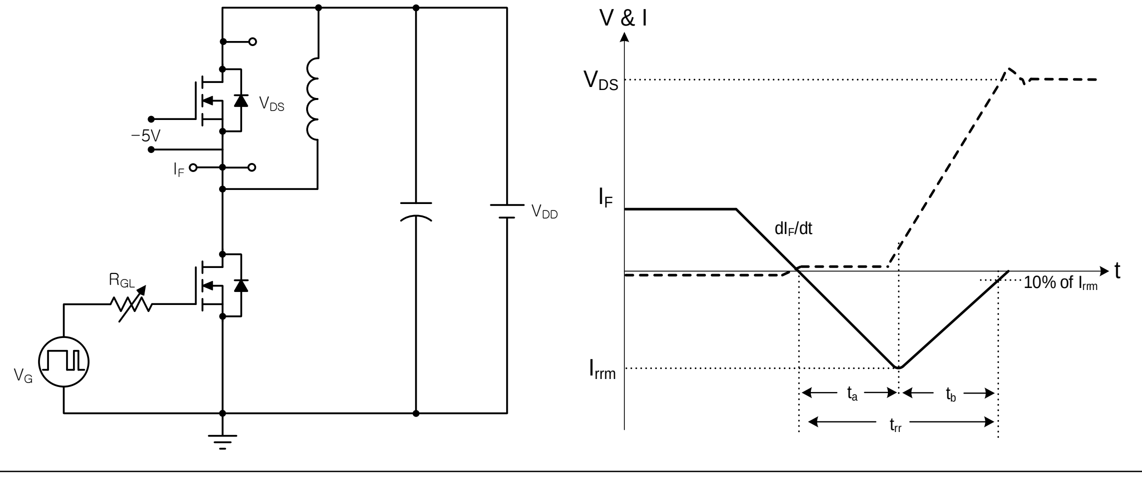
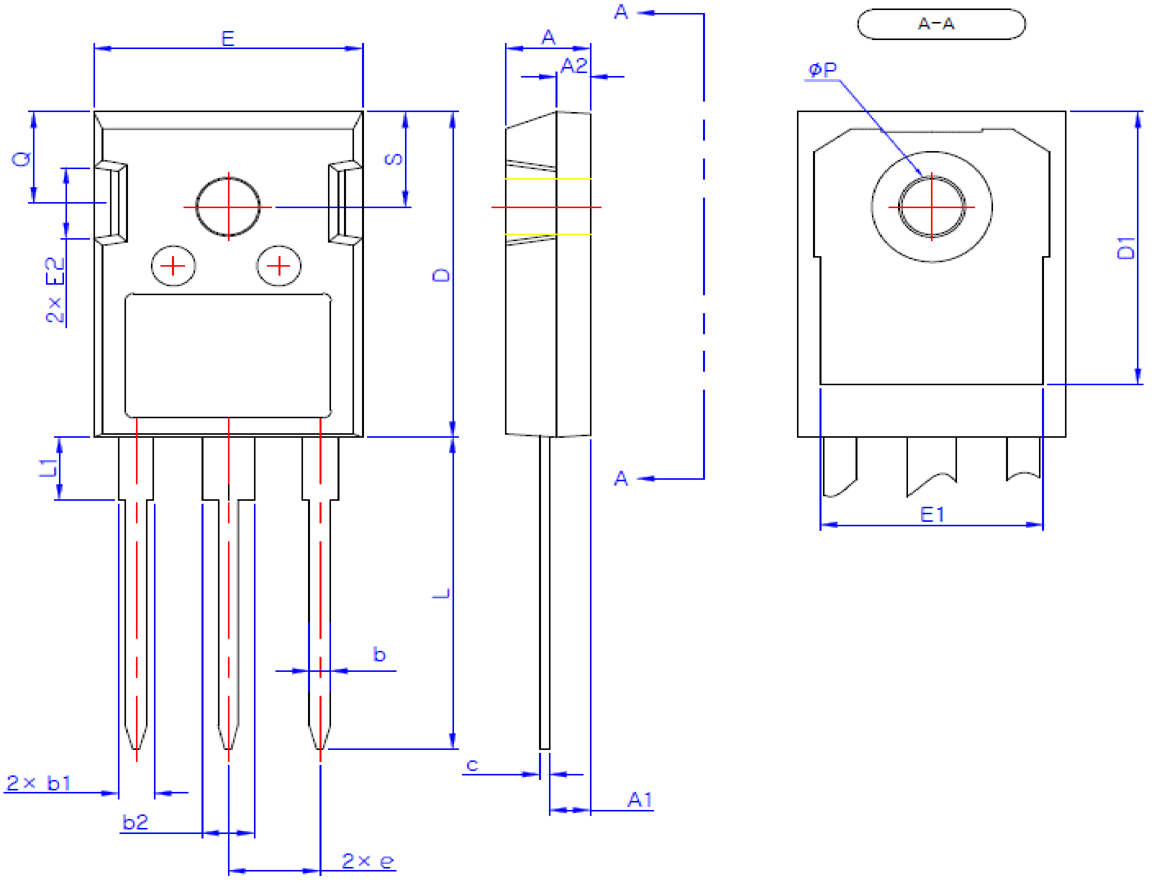


Figure 22. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO-247



SYMBOL	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.29	2.42	2.54
A2	1.90	2.00	2.10
b	1.10	1.20	1.30
b1	1.91	2.06	2.20
b2	2.92	3.06	3.20
c	0.50	0.60	0.70
D	20.80	21.07	21.34
D1	17.43	17.63	17.83
E	15.75	15.94	16.13
E1	13.06	13.26	13.46
E2	4.32	4.58	4.83
e	5.45 BSC		
L	19.85	20.05	20.25
L1	4.05	4.27	4.49
ΦP	3.55	3.60	3.65
Q	5.59	5.89	6.19
S	6.15 BSC		

* Dimensions in millimeters