

HCZN120N21M2

N-Channel SiC Silicon Carbide Power MOSFET

1200 V, 90 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

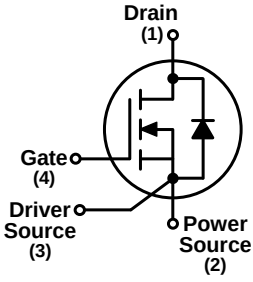
Benefits

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

Applications

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

$BV_{DSS, Tc=25^{\circ}C}$	$I_D, Tc=25^{\circ}C$	$R_{DS(on),typ}$	$Q_{g,typ}$
1200 V	90 A	21 mΩ	111 nC



Absolute Maximum Ratings ($T_C = 25^{\circ}C$ 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...-3 / +18	V
I_D	Drain Current	Continuous ($T_C = 25^{\circ}C$)	90	A
		Continuous ($T_C = 100^{\circ}C$)	63	
I_{DM}	Drain Current	Pulsed (Note1)	223	A
P_D	Power Dissipation	($T_C = 25^{\circ}C$)	375	W
		Derate Above 25°C	2.5	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	°C
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds		260	°C

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
HCZN120N21M2	HCZN120N21M2	TO-247-4L Notch	Tube	30 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$		1	100	μA
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175^\circ\text{C}$		10		
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +22\text{ V}, V_{DS} = 0\text{ V}$			+100	nA
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$			-100	

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 17\text{ mA}$ (tested after $V_{GS} = 22\text{ V}, 1\text{ ms pulse}$)	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 18\text{ V}, I_D = 45\text{ A}$		21.0	29.4	$\text{m}\Omega$
		$V_{GS} = 18\text{ V}, I_D = 45\text{ A}, T_J = 175^\circ\text{C}$		33.6		
		$V_{GS} = 15\text{ V}, I_D = 45\text{ A}$		27.5		
g_{fs}	Transconductance	$V_{DS} = 20\text{ V}, I_D = 45\text{ A}$		31.6		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$		2949		pF
C_{oss}	Output Capacitance			170		
C_{rss}	Reverse Capacitance			5		
E_{oss}	Stored Energy in Output Capacitance	$V_{DS} = 0\text{ V to } 800\text{ V}, V_{GS} = 0\text{ V}$		71		μJ
$C_{o(er)}$	Energy Related Output Capacitance			221		pF
$C_{o(tr)}$	Time Related Output Capacitance			367		
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 800\text{ V}, I_D = 45\text{ A},$ $V_{GS} = -3\text{ V} / 18\text{ V},$ Inductive load		111		nC
Q_{gs}	Gate to Source Charge			33		
Q_{gd}	Gate to Drain "Miller" Charge			31		
R_G	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 30\text{ mV}$		2.3		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 800\text{ V}, I_D = 45\text{ A},$ $V_{GS} = -3\text{ V} / 18\text{ V}, R_G = 4.7\text{ }\Omega,$ FWD : HCH120S20D1, Inductive load		25		ns
t_r	Turn-On Rise Time			17		
$t_{d(off)}$	Turn-Off Delay Time			54		
t_f	Turn-Off Fall Time			8		
E_{on}	Turn-on Switching Energy			287		μJ
E_{off}	Turn-off Switching Energy			199		
E_{tot}	Total Switching Energy			486		

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Source-Drain Diode Characteristics						
I _S	Continuous Diode Forward Current	V _{GS} = -3 V			90	A
I _{SM}	Pulsed Diode Forward Current	V _{GS} = -3 V (Note 1)			223	
V _{SD}	Diode Forward Voltage	V _{GS} = -3 V, I _{SD} = 45 A		4.0		V
t _{rr}	Reverse Recovery Time	V _{DD} = 800 V, I _{SD} = 45 A, dI _F /dt = 3000 A/μs, Includes Q _{oss}		20		ns
Q _{rr}	Reverse Recovery Charge			396		nC
I _{rrm}	Peak Reverse Recovery Current			32		A

※ Note 1 : Limited by maximum junction temperature.

Typical Performance Characteristics

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

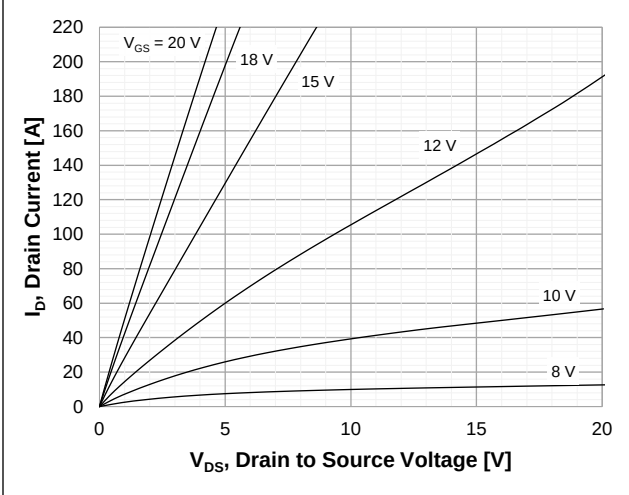


Figure 2. On-Region Characteristics $T_J = 25^{\circ}\text{C}$

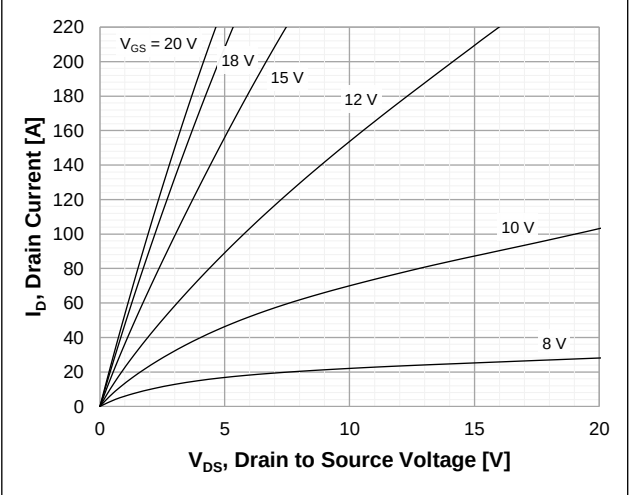


Figure 3. On-Region Characteristics $T_J = 175^{\circ}\text{C}$

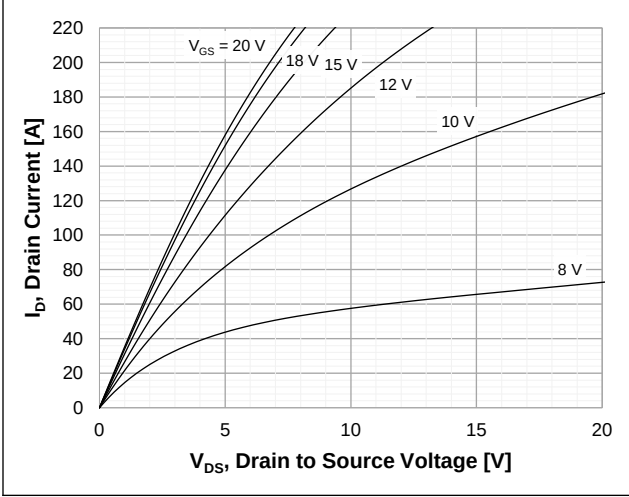


Figure 4. Normalized On-Resistance Characteristics vs. Temperature

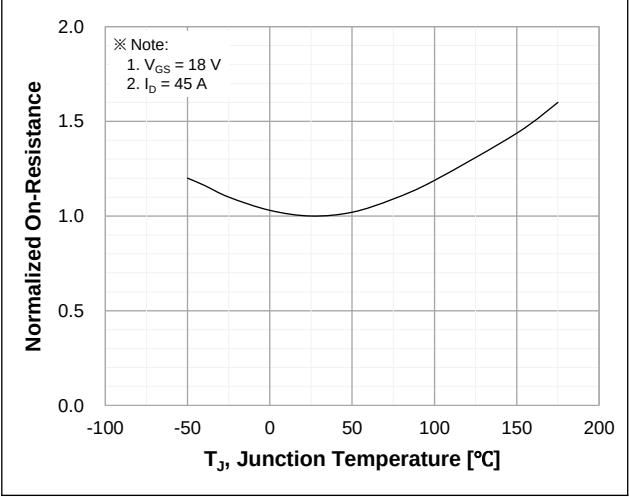


Figure 5. Transfer Characteristics

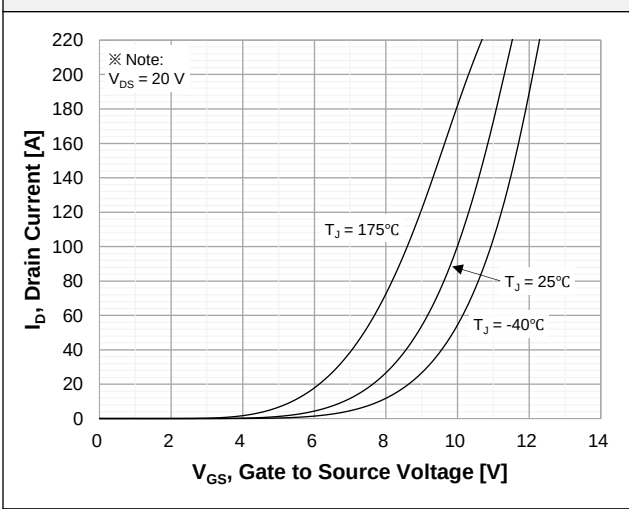
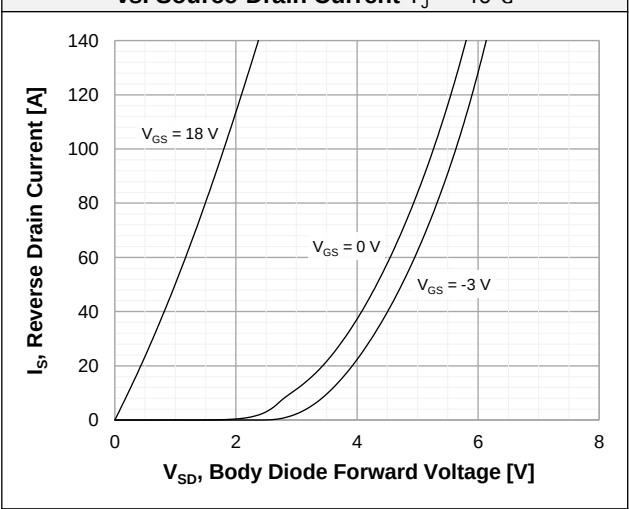


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = -40^{\circ}\text{C}$



Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 25^{\circ}\text{C}$

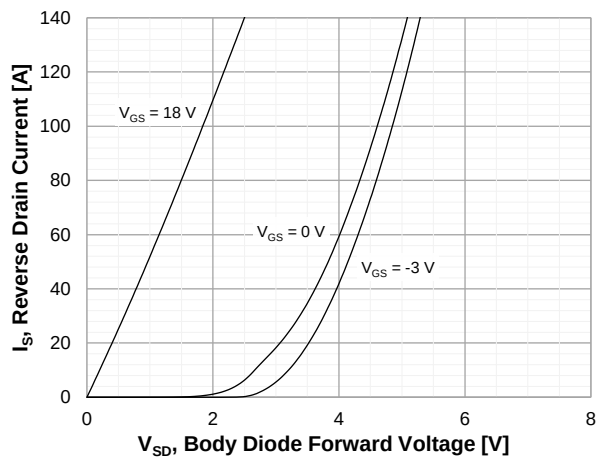


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 175^{\circ}\text{C}$

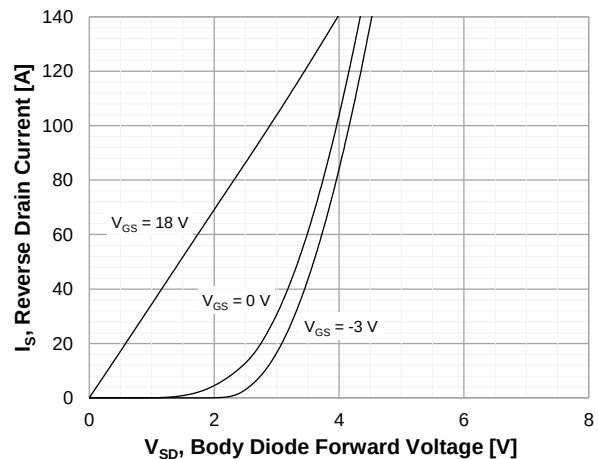


Figure 9. Threshold Voltage vs. Temperature

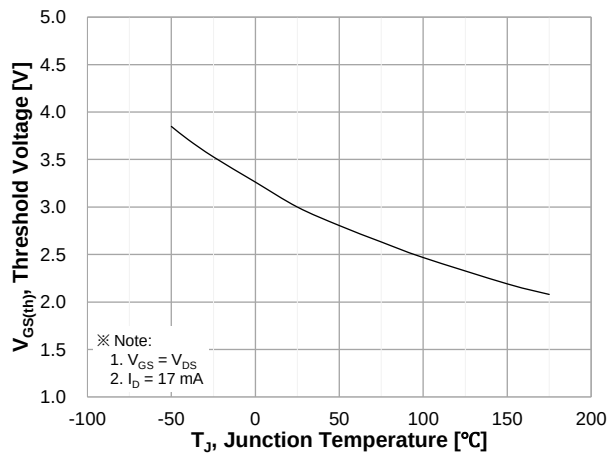


Figure 10. Gate Charge Characteristics

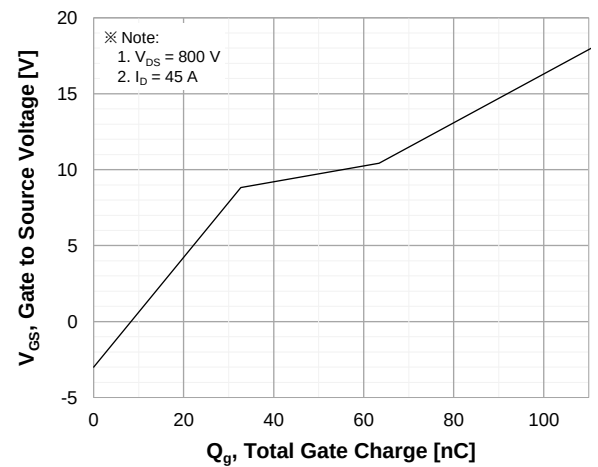


Figure 11. Stored Energy in Output Capacitance

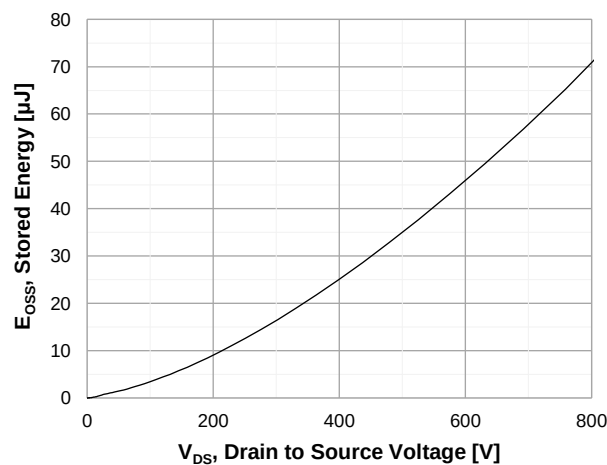
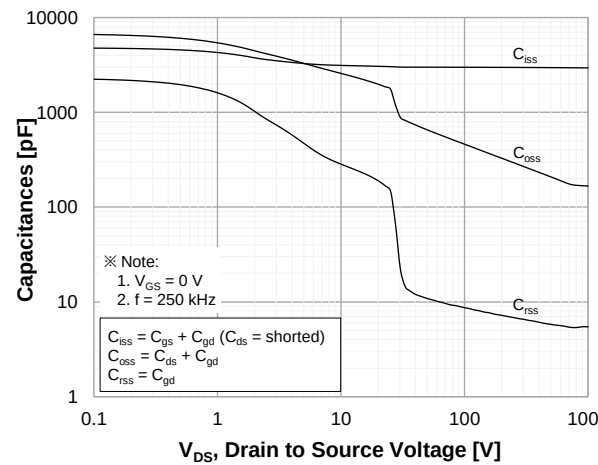


Figure 12. Capacitance Characteristics



Typical Performance Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

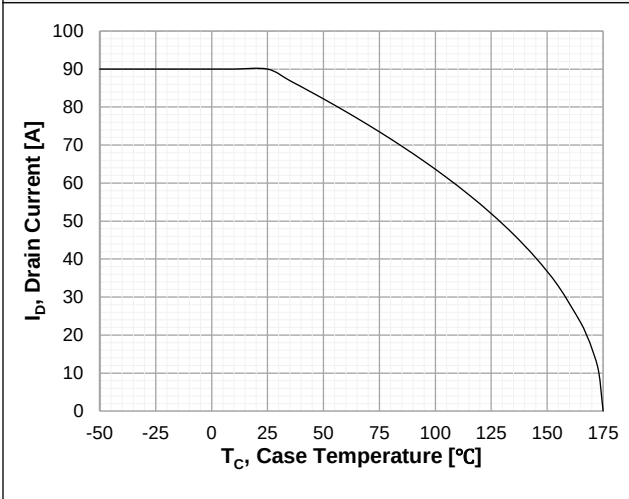


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

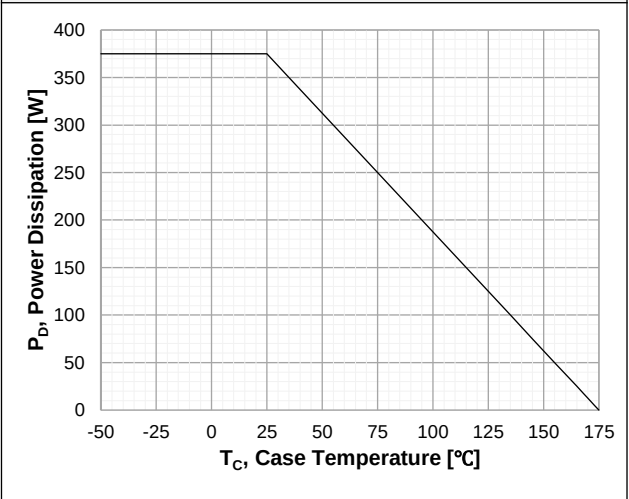


Figure 15. Typ. Switching Losses vs. Drain Current

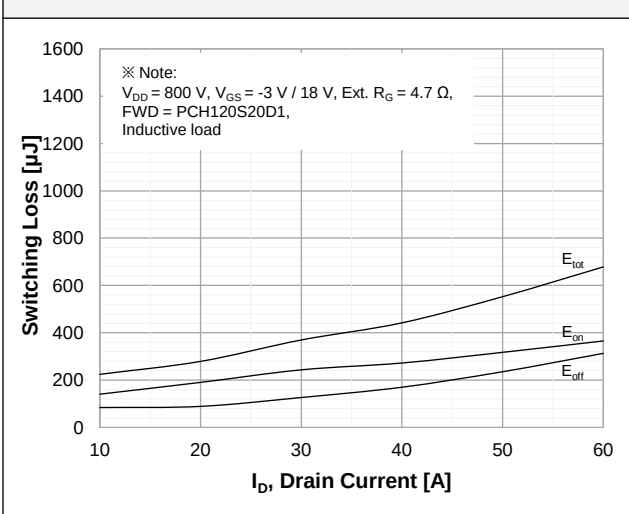


Figure 16. Typ. Switching Losses vs. Gate Resistance

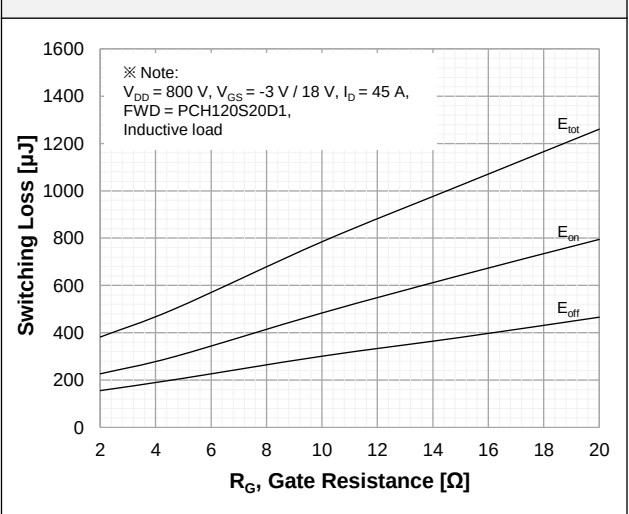


Figure 17. Typ. Switching Losses vs. Drain Current

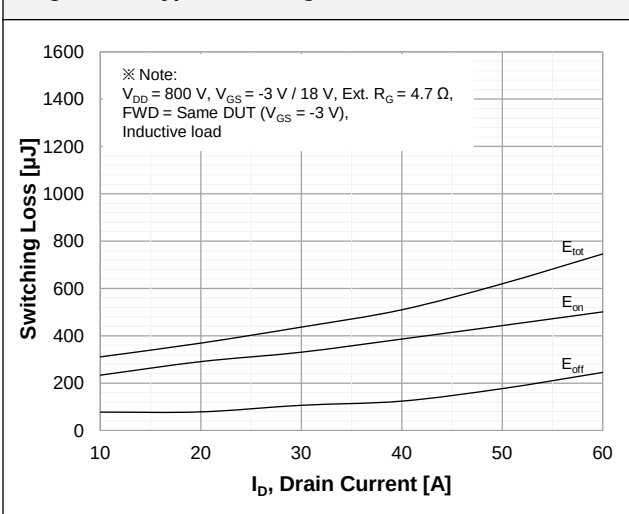
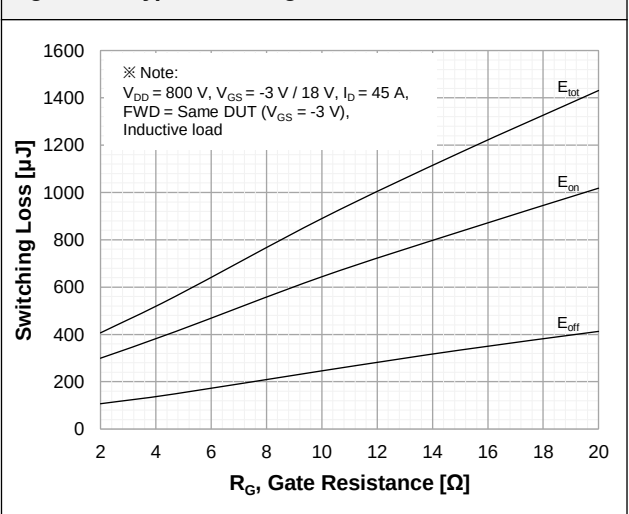


Figure 18. Typ. Switching Losses vs. Gate Resistance



Typical Performance Characteristics

Figure 19. Maximum Safe Operating Area

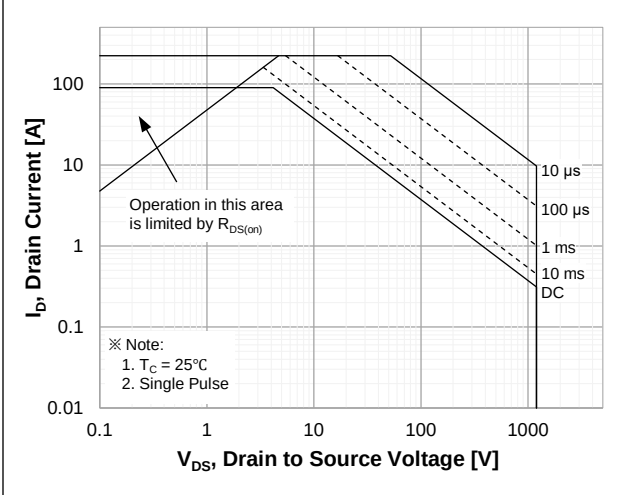


Figure 20. Transient Thermal Response Curve

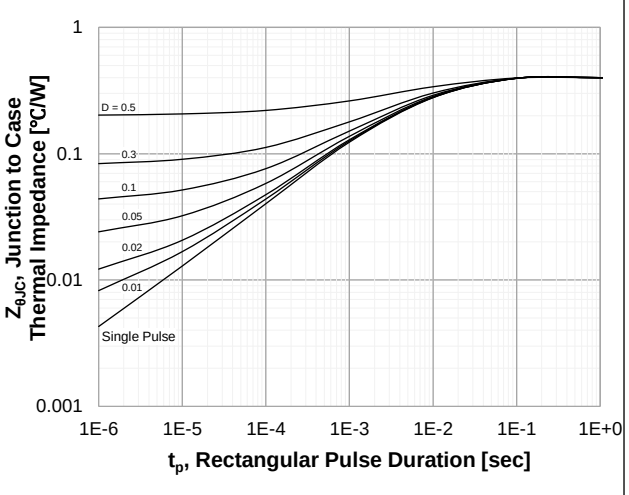


Figure 21. Inductive Load Switching Test Circuit and Waveforms

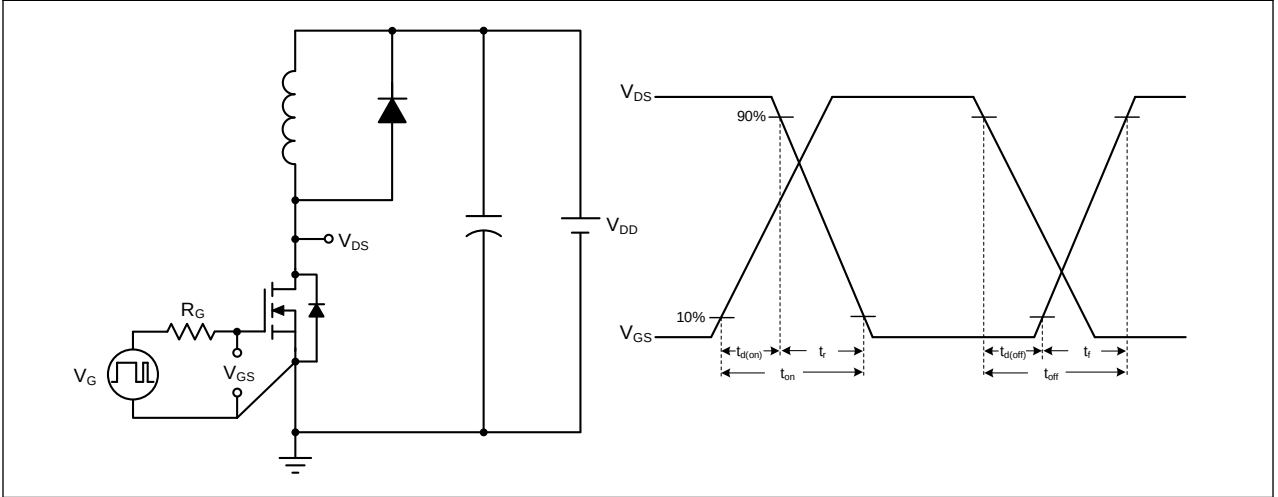
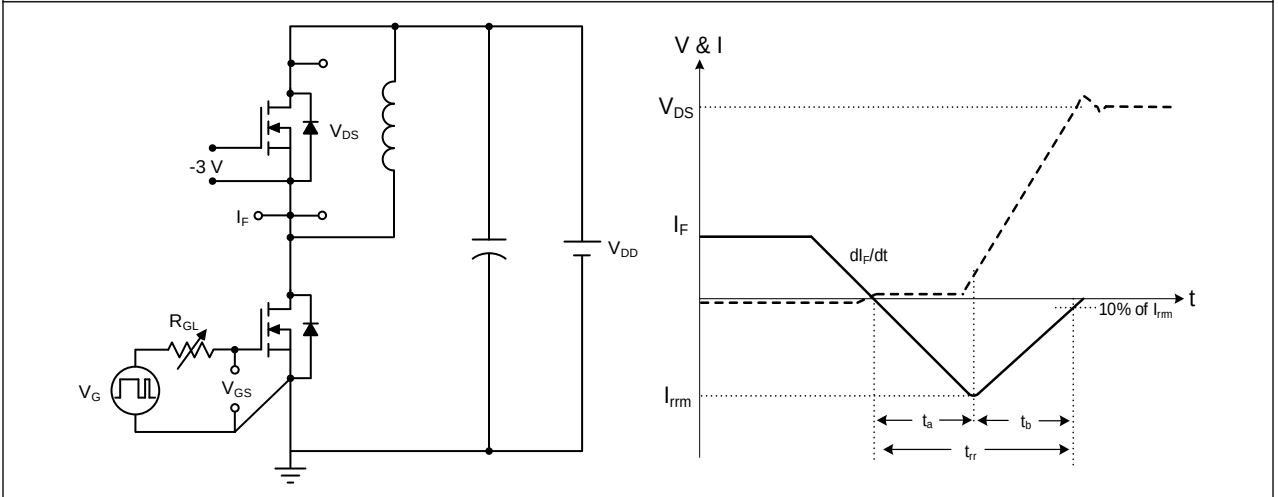
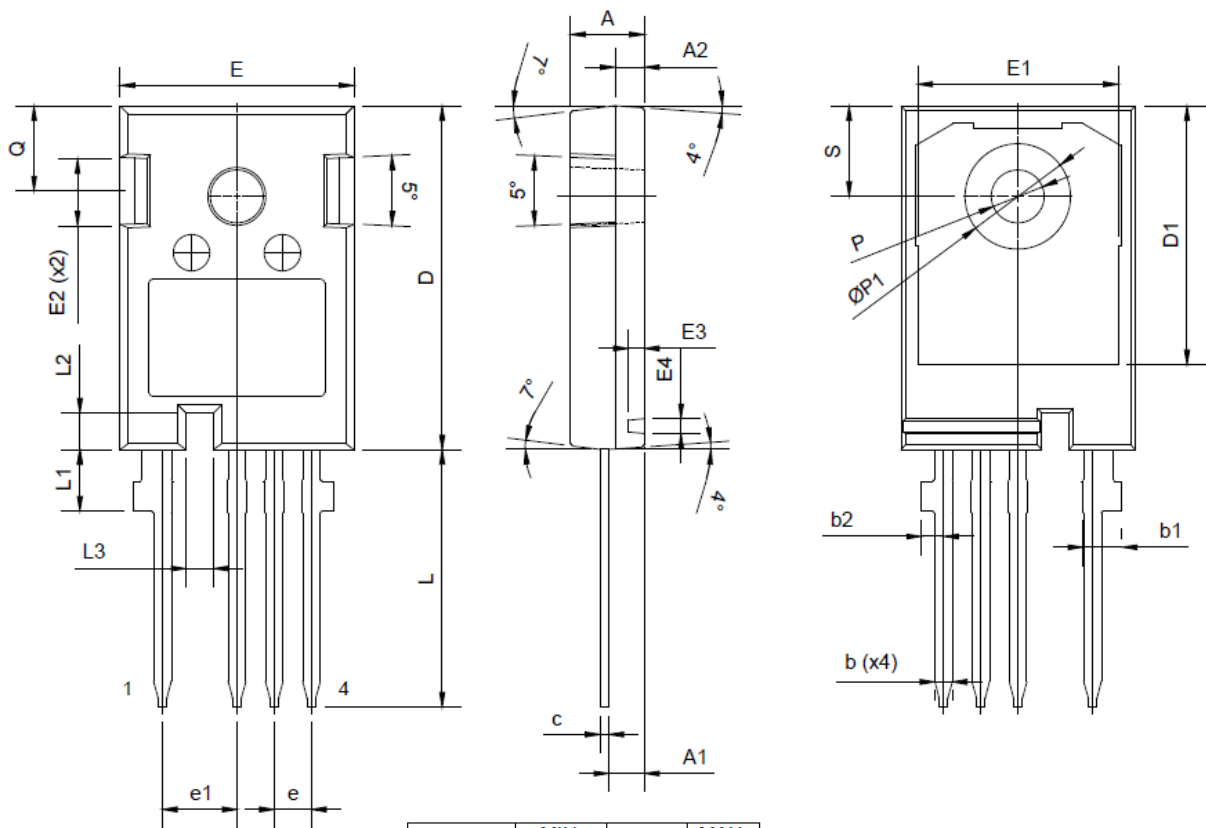


Figure 22. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO-247-4L Notch



SYMBOL	MIN.	NOM.	MAX.
A	4.82	5.02	5.22
A1	2.29	2.42	2.54
A2	1.90	2.00	2.10
b	1.10	1.20	1.30
b1	2.52	2.67	2.81
b2	1.40	1.50	1.60
c	0.50	0.60	0.70
D	23.35	23.45	23.55
D1	17.45	17.65	17.85
E	15.75	15.94	16.13
E1	13.46	13.66	13.86
E2	4.32	4.58	4.78
E3	1.05	1.10	1.25
E4	0.95	1.00	1.15
e	2.54 BSC		
e1	5.08 BSC		
L	17.37	17.57	17.72
L1	3.97	4.19	4.41
L2	2.35	2.50	2.65
L3	1.73	1.88	2.03
P	3.56	3.61	3.66
P1	7.15	7.20	7.25
Q	5.49	5.79	6.09
S	6.17 BSC		

* Dimensions in millimeters