HCW65N27M1

N-Channel *e*SiC Silicon Carbide Power MOSFET

650 V, 75 A, 27 mΩ

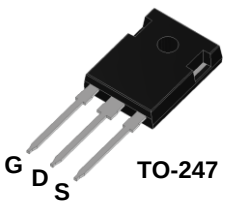
Features

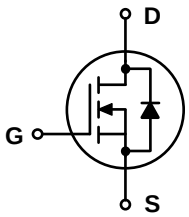
- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant

$BV_{DSS,\ Tc=25℃}$	$I_{D,\ Tc=25℃}$	$R_{DS(on),typ}$	$Q_{g,typ}$
650 V	75 A	27 mΩ	91 nC

Benefits

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





Applications

- Server & Telecom power
- EV charging station
- Solar inverter / ESS / UPS
- Industrial power supply

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

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		650	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℃)	75	A
		Continuous (T_C = 100℃)	53	
I_{DM}	Drain Current	Pulsed (Note1)	200	A
P_D	Power Dissipation	(T_C = 25℃)	273	W
		Derate Above 25℃	1.82	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
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.55	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
HCW65N27M1	HCW65N27M1	TO-247-3L	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	650			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V		1	100	μA
		V_{DS} = 650 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 = 11.7 mA (tested after V_{GS} = 22V, 1 ms pulse)	1.8	2.8	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 18 V, I_D = 35 A		27	38	mΩ
		V_{GS} = 18 V, I_D = 35 A, T_J = 175℃		35		
g_{fs}	Transconductance	V_{DS} = 20 V, I_D = 35 A		25.9		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0V, f = 250 kHz		1853		pF
C_{oss}	Output Capacitance			207		
C_{rss}	Reverse Capacitance			10.5		
E_{oss}	Stored Energy in Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V		20.6		μJ
$C_{o(er)}$	Energy Related Output Capacitance			257		pF
$C_{o(tr)}$	Time Related Output Capacitance			372		
$Q_{g(tot)}$	Total Gate Charge	V_{DS} = 400 V, I_D = 35 A, V_{GS} = -5 V / 18 V, Inductive load		91		nC
Q_{gs}	Gate to Source Charge			25		
Q_{gd}	Gate to Drain “Miller” Charge			21		
R_G	Internal Gate Resistance	f = 1MHz		3.0		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 400 V, I_D = 35 A, V_{GS} = -5 V / 18 V, R_G = 5.6 Ω, FWD : PCH65S20D1, Inductive load		20		ns
t_r	Turn-On Rise Time			37		
$t_{d(off)}$	Turn-Off Delay Time			40		
t_f	Turn-Off Fall Time			9		
E_{on}	Turn-on Switching Energy			274		μJ
E_{off}	Turn-off Switching Energy			134		
E_{tot}	Total Switching Energy			408		
Source-Drain Diode Characteristics						
I_S	Maximum Continuous Diode Forward Current				75	A
I_{SM}	Maximum Pulsed Diode Forward Current				200	
V_{SD}	Diode Forward Voltage	V_{GS} = -5 V, I_{SD} = 35 A		4.2		V
t_{rr}	Reverse Recovery Time	V_{DD} = 400 V, I_{SD} = 35 A, dI_F/dt = 1000 A/μs, Includes Q_{OSS}		20		ns
Q_{rr}	Reverse Recovery Charge			141		nC
I_{rrm}	Peak Reverse Recovery Current			11.5		A

Typical Performance Characteristics

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

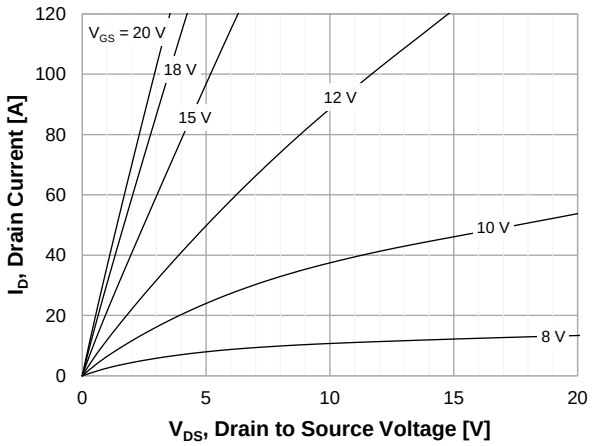


Figure 2. On-Region Characteristics T_J = 25℃

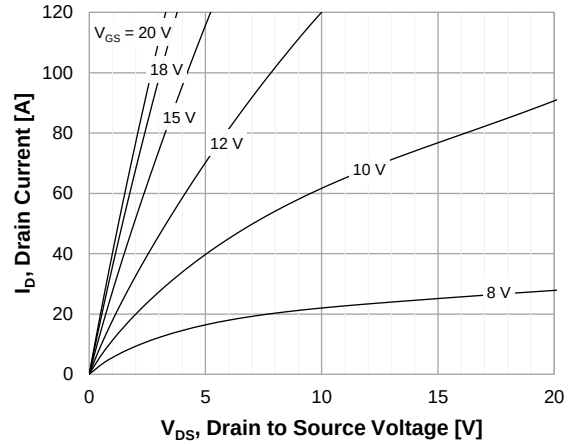


Figure 3. On-Region Characteristics T_J = 125℃

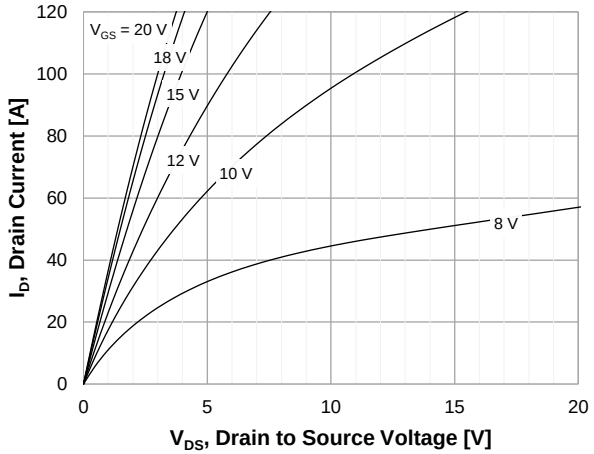


Figure 4. On-Region Characteristics T_J = 175℃

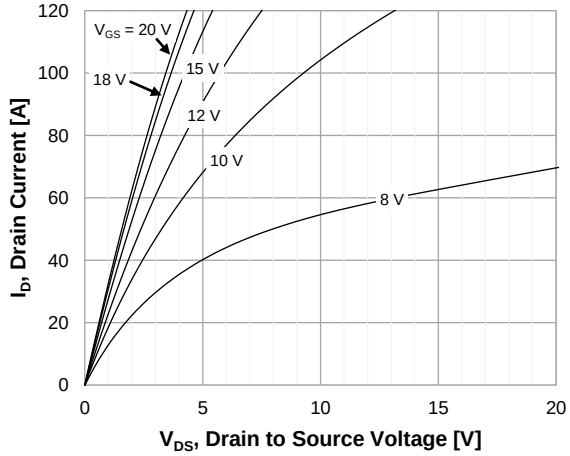


Figure 5. On-Resistance Characteristics vs. Temperature

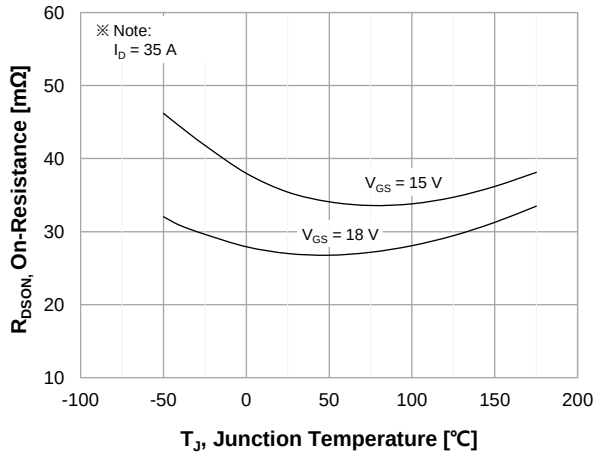
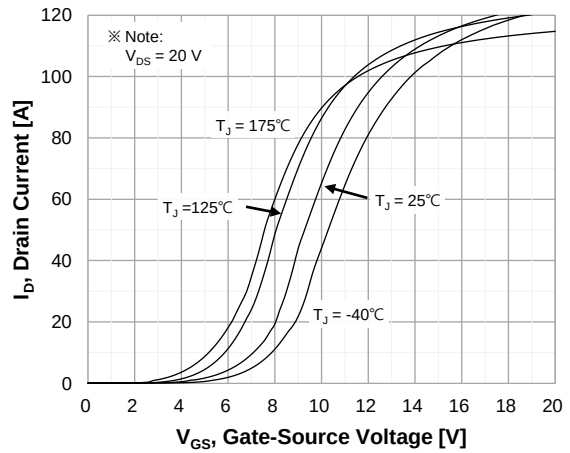


Figure 6. Transfer Characteristics



Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = -40℃

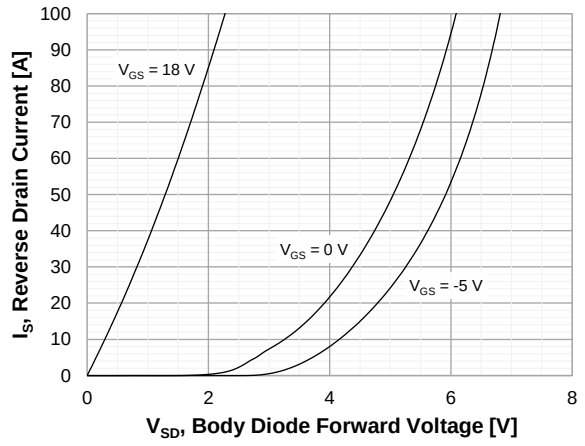


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 25℃

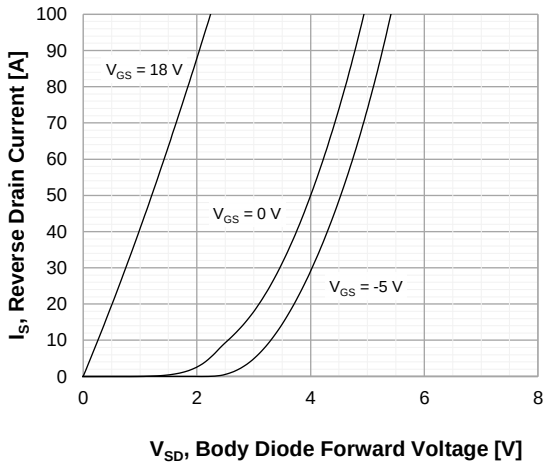


Figure 9. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 125℃

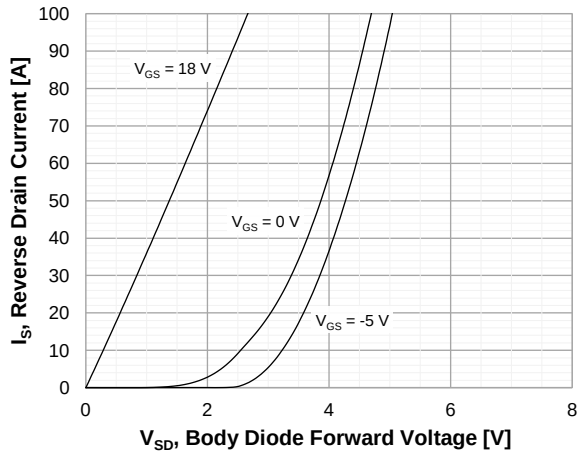


Figure 10. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 175℃

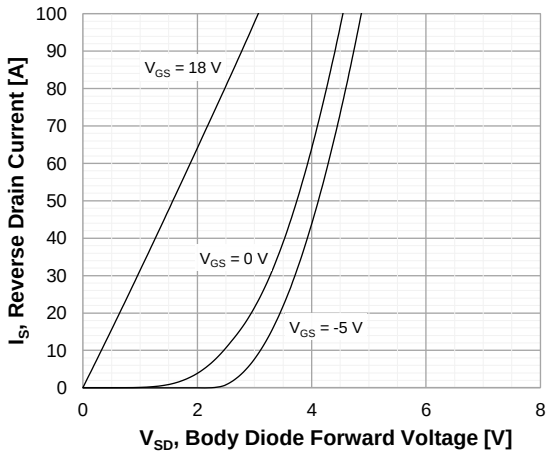


Figure 11. Threshold Voltage vs. Temperature

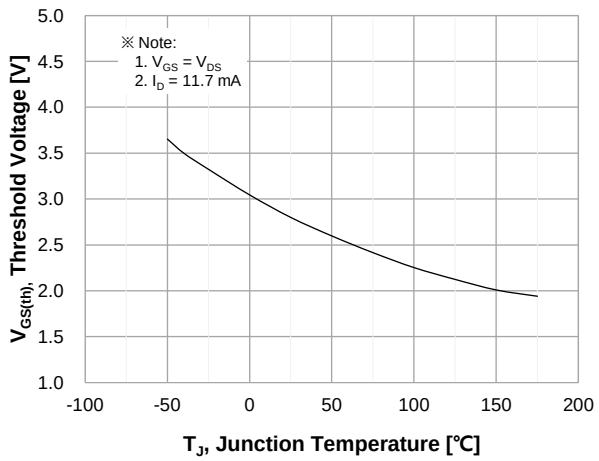
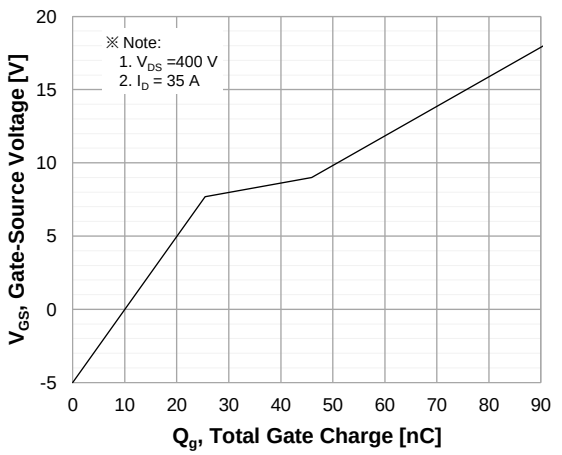


Figure 12. Gate Charge Characteristics



Typical Performance Characteristics

Figure 13. Stored Energy in Output Capacitance

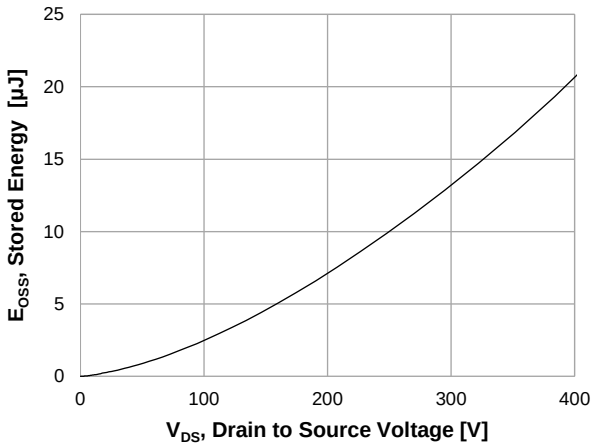


Figure 14. Capacitance Characteristics

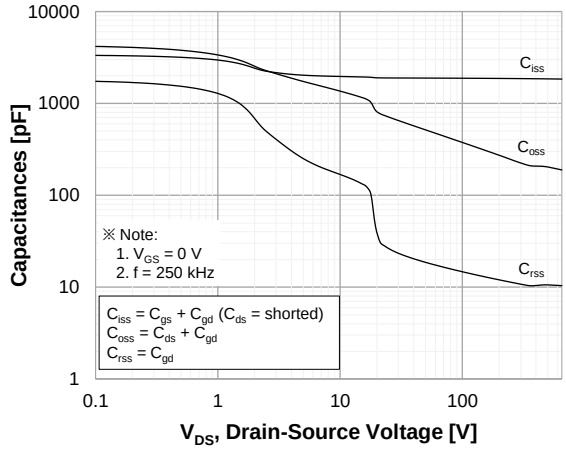


Figure 15. Continuous Drain Current Derating vs. Case Temperature

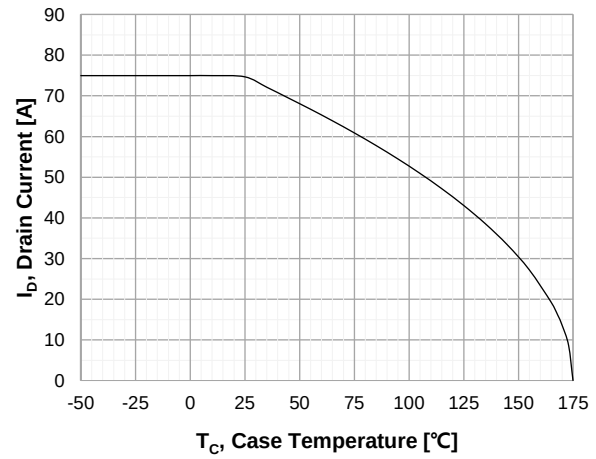


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

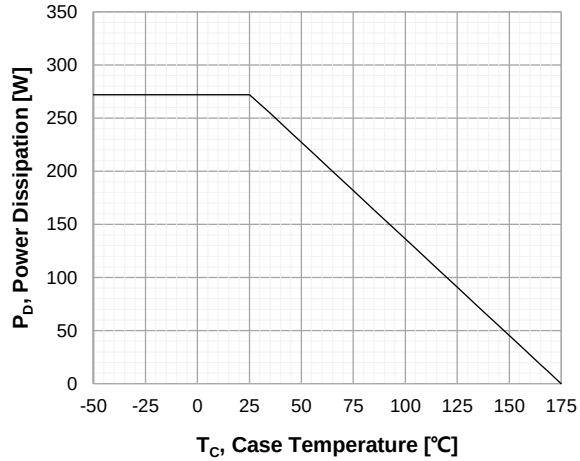


Figure 17. Typ. Switching Losses vs. Drain Current

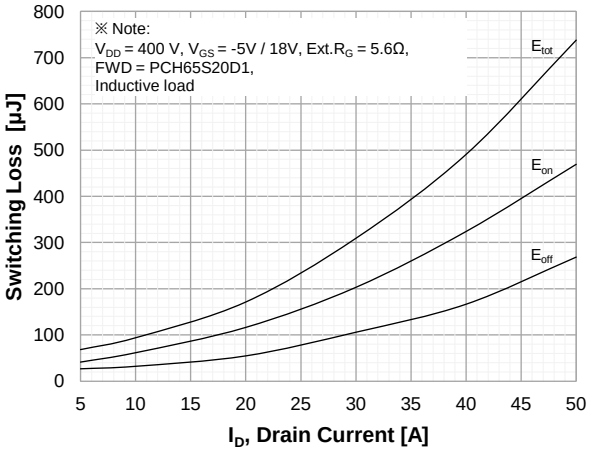
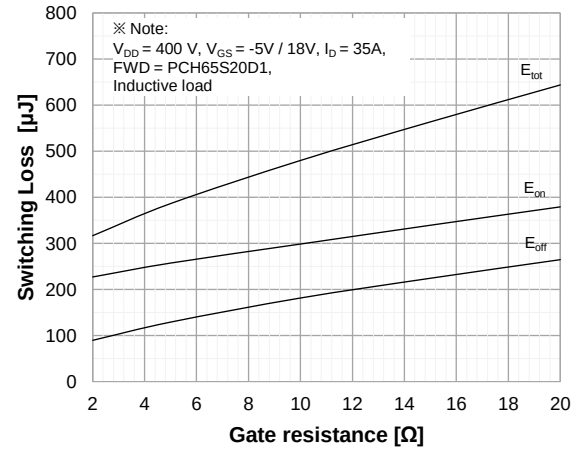


Figure 18. Typ. Switching Losses vs. Gate Resistance



Typical Performance Characteristics

Figure 19. Typ. Switching Losses vs. Drain Current

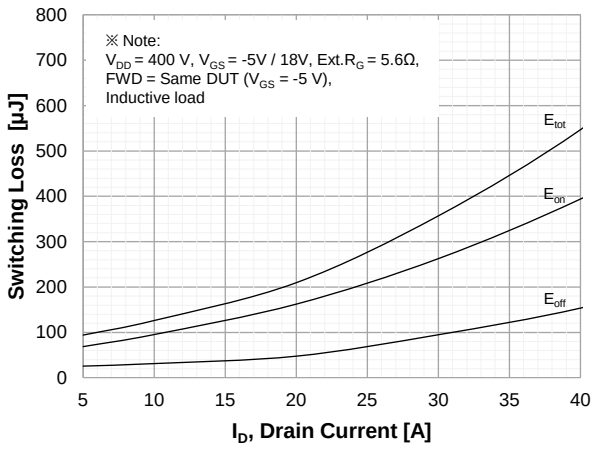


Figure 20. Typ. Switching Losses vs. Gate Resistance

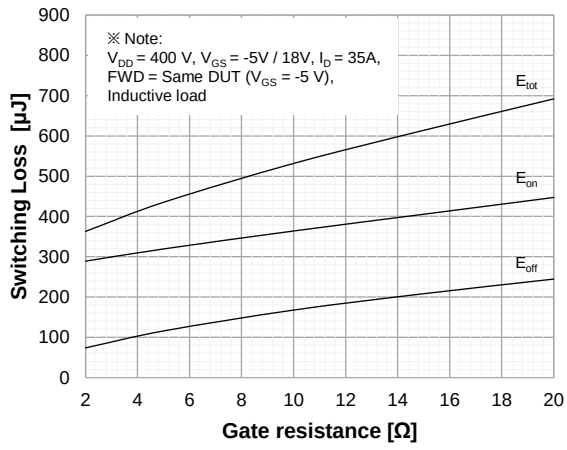


Figure 21. Maximum Safe Operating Area

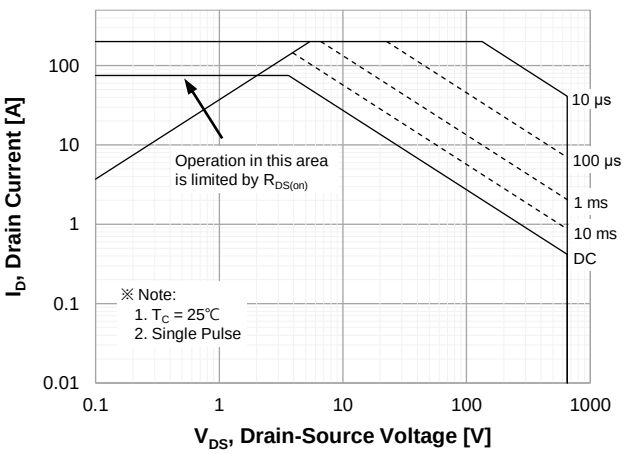
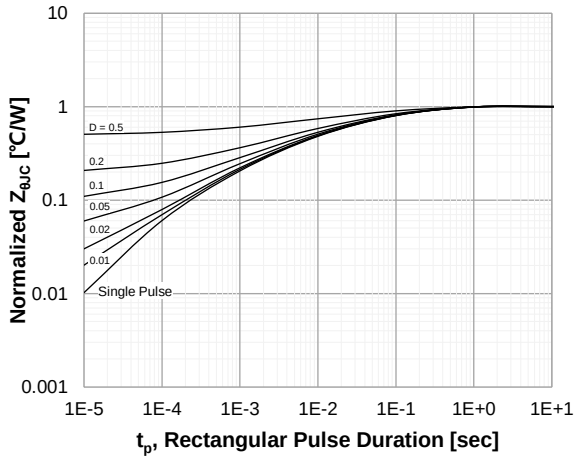


Figure 22. Transient Thermal Response Curve



Typical Performance Characteristics

Figure 23. Inductive Load Switching Test Circuit and Waveforms

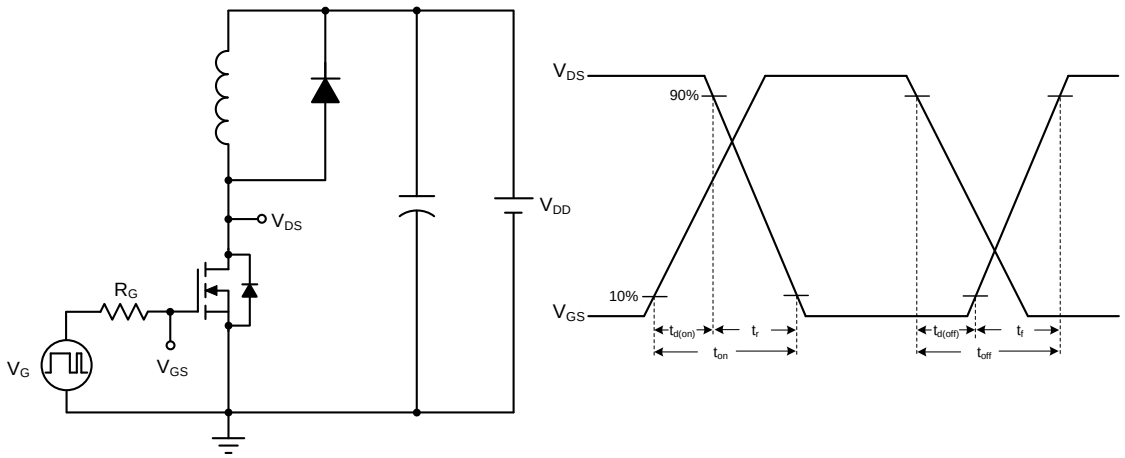
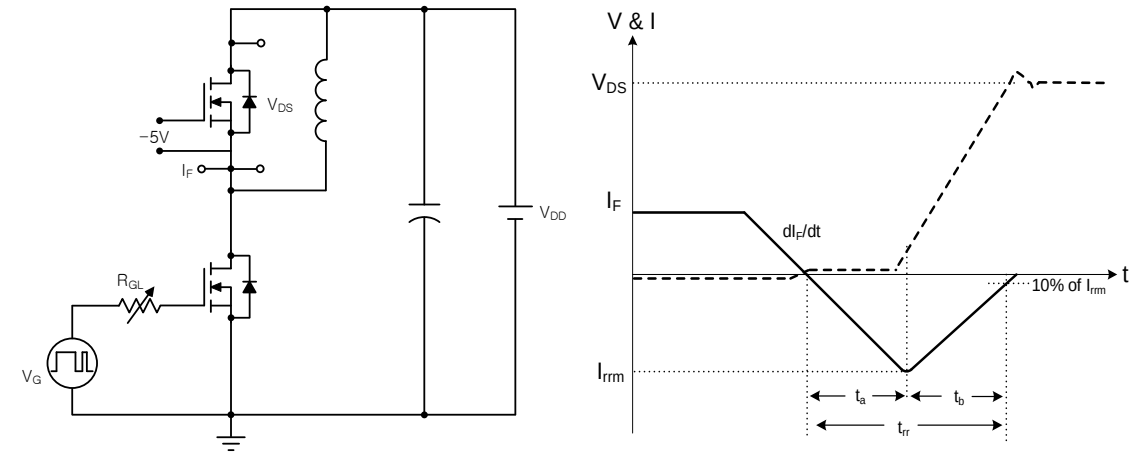
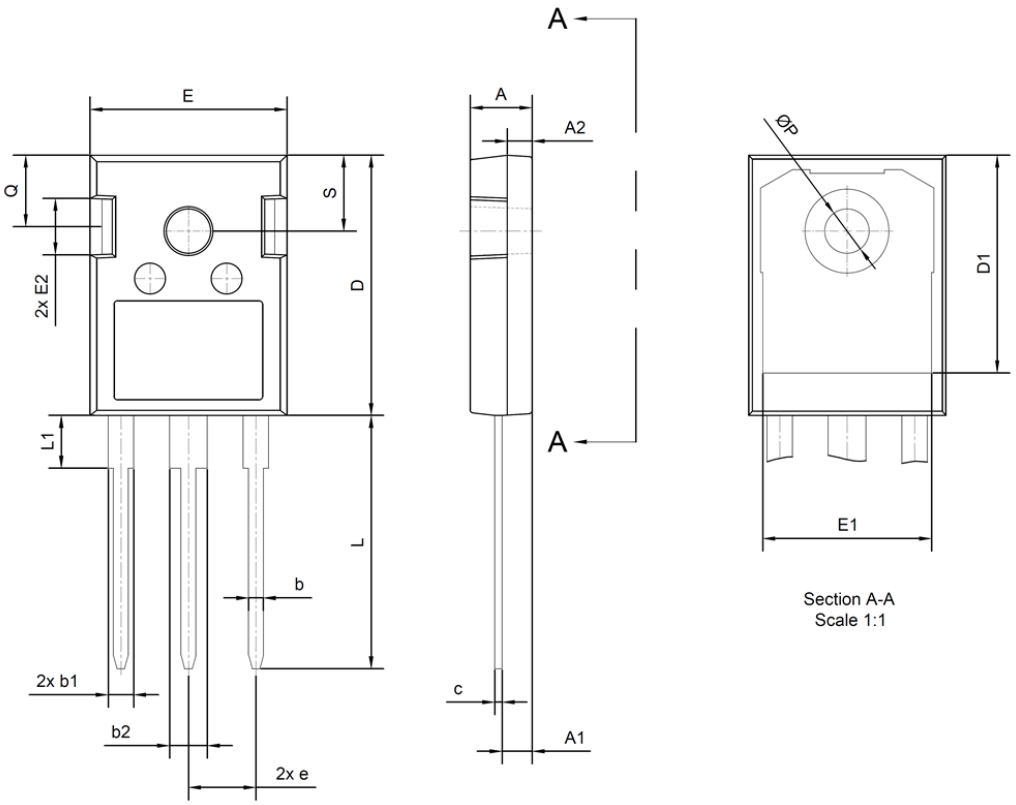


Figure 24. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO-247-3L



SYMBOL	Common		
	DIMENSIONS MILLIMETER		
	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	17.23	17.63	18.03
E	15.75	15.94	16.13
E1	13.46	13.66	13.86
E2	4.32	4.58	4.83
e	5.46 BSC		
L	19.85	20.05	20.25
L1	4.05	4.27	4.48
ØP	3.56	3.61	3.66
Q	5.38	5.79	6.20
S	6.15 BSC		