

FCZ120N21M1

N-Channel eSiC 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

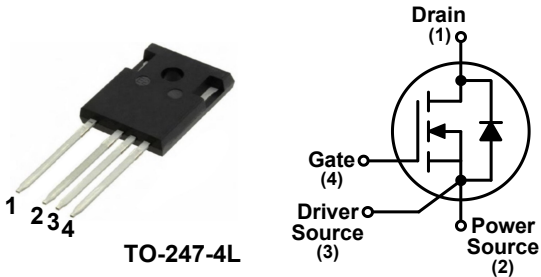
$BV_{DSS}, T_C=25^{\circ}C$	$I_D, T_C=25^{\circ}C$	$R_{DS(on),typ}$	$Q_{g,typ}$
1200 V	100 A	21 mΩ	198 nC

Benefits

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

Applications

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



Absolute Maximum Ratings (T_C = 25°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 / +18	V
I _D	Drain Current	Continuous (T _C = 25°C)	100	A
		Continuous (T _C = 100°C)	71	
I _{DM}	Drain Current	Pulsed (Note1)	250	A
P _D	Power Dissipation	(T _C = 25°C)	469	W
		Derate Above 25°C	3.1	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

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	0.32	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
FCZ120N21M1	FCZ120N21M1	TO-247-4L	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	$V_{GS} = 18\text{ V}, I_D = 50\text{ A}$		21	29.4	m Ω
		$V_{GS} = 18\text{ V}, I_D = 50\text{ A}, T_J = 175^\circ\text{C}$		33.6		
g_{fs}	Transconductance	$V_{DS} = 20\text{ V}, I_D = 50\text{ A}$		24.4		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$		3741		pF
C_{oss}	Output Capacitance			224		
C_{rss}	Reverse Capacitance			17		
E_{oss}	Stored Energy in Output Capacitance	$V_{DS} = 0\text{ V to } 800\text{ V}, V_{GS} = 0\text{ V}$		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	$V_{DS} = 800\text{ V}, I_D = 50\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V},$ Inductive load		198		nC
Q_{gs}	Gate to Source Charge			48		
Q_{gd}	Gate to Drain "Miller" Charge			65		
R_G	Internal Gate Resistance	$f = 1\text{ MHz}$		3.0		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 800\text{ V}, I_D = 50\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V}, R_G = 2\text{ }\Omega,$ FWD : PCH120S20D1, Inductive load		29		ns
t_r	Turn-On Rise Time			29		
$t_{d(off)}$	Turn-Off Delay Time			62		
t_f	Turn-Off Fall Time			12		
E_{on}	Turn-on Switching Energy			477		μJ
E_{off}	Turn-off Switching Energy			342		
E_{tot}	Total Switching Energy			819		

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	$V_{GS} = -5\text{ V}, I_{SD} = 50\text{ A}$		4.2	V
t_{rr}	Reverse Recovery Time	$V_{DD} = 800\text{ V}, I_{SD} = 50\text{ A},$ $di_F/dt = 3000\text{ A}/\mu\text{s}$, Includes Q_{oss}		22	ns
Q_{rr}	Reverse Recovery Charge			482	nC

Typical Performance Characteristics

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

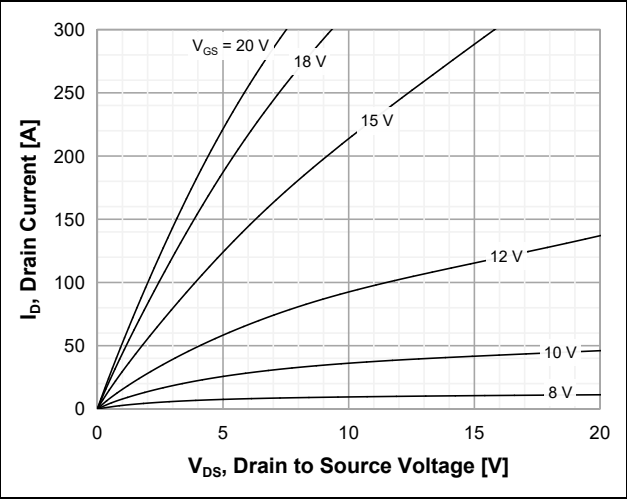


Figure 2. On-Region Characteristics $T_J = 25^{\circ}\text{C}$

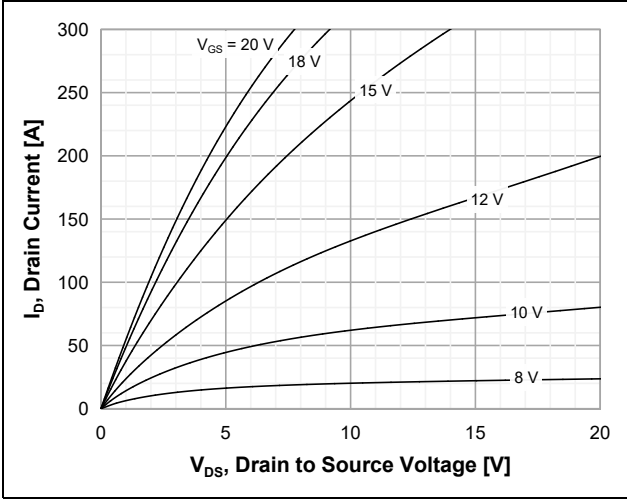


Figure 3. On-Region Characteristics $T_J = 175^{\circ}\text{C}$

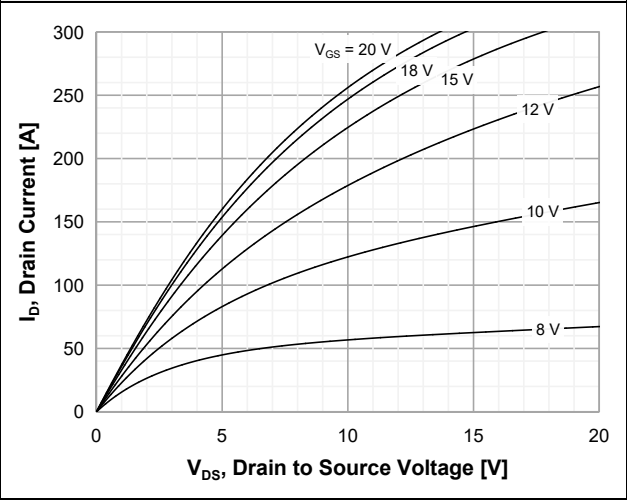


Figure 4. Normalized On-Resistance Characteristics v s. Temperature

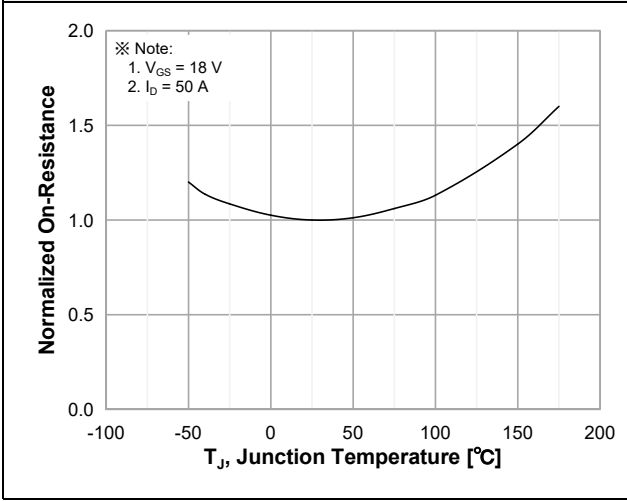


Figure 5. Transfer Characteristics

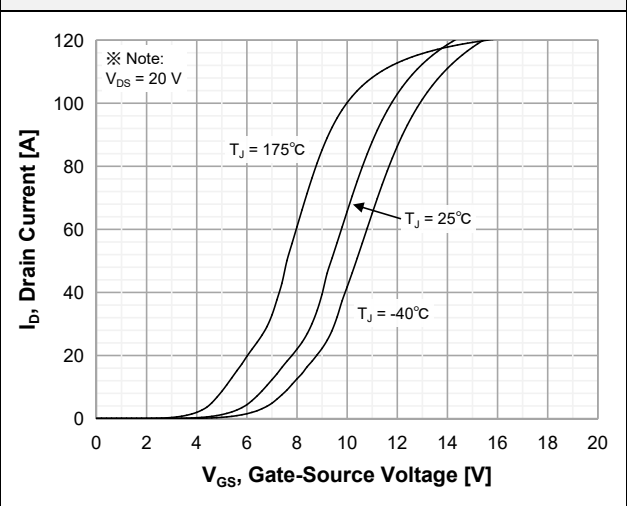
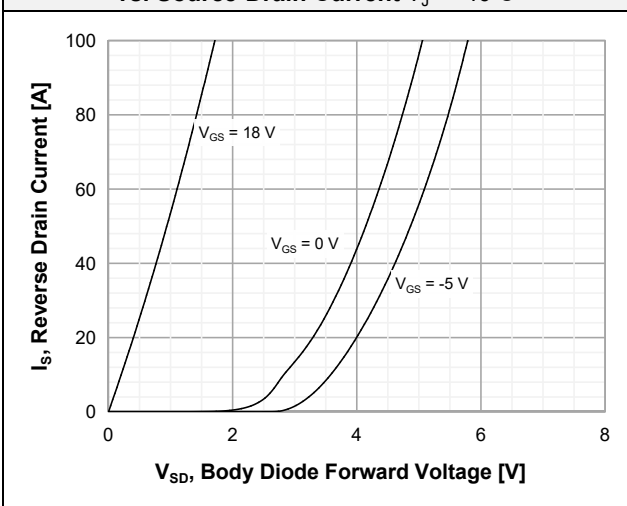
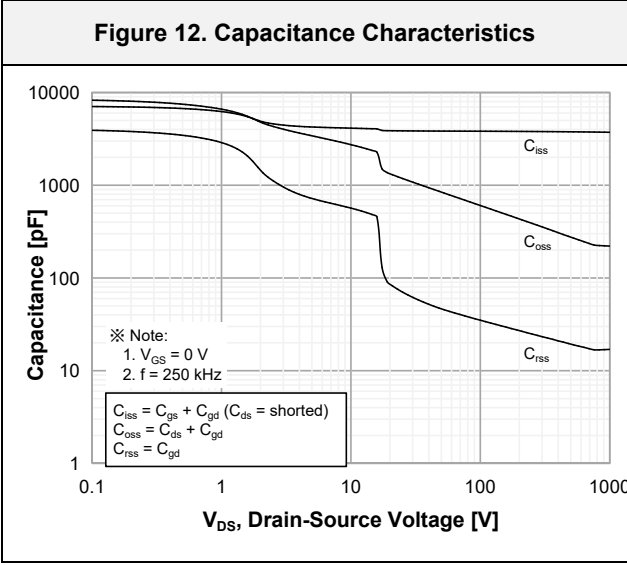
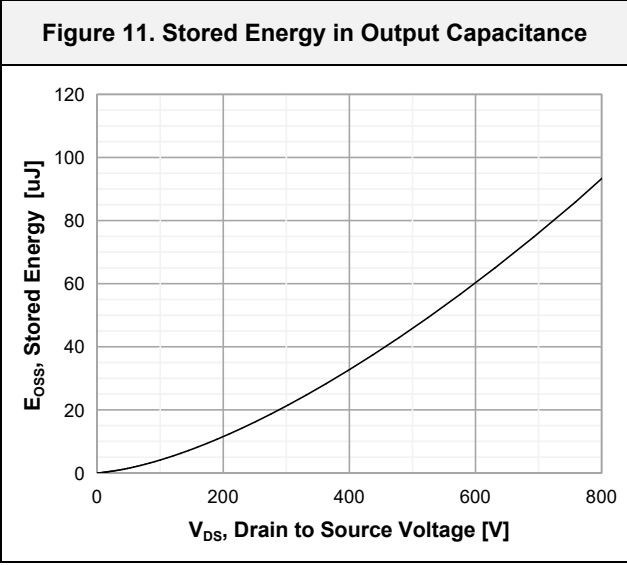
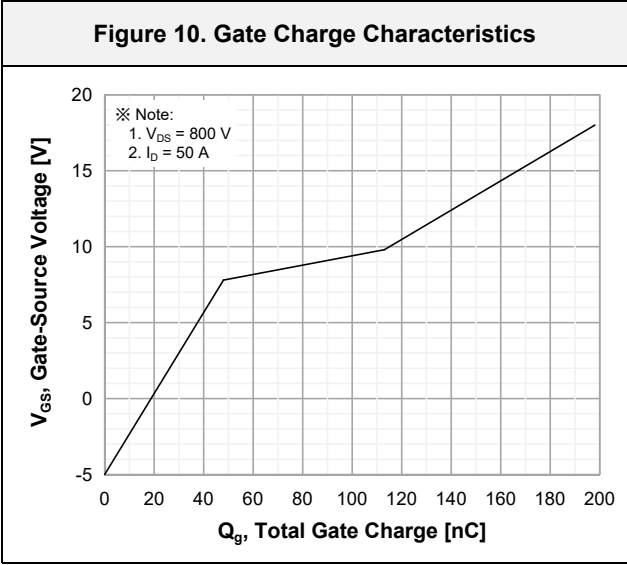
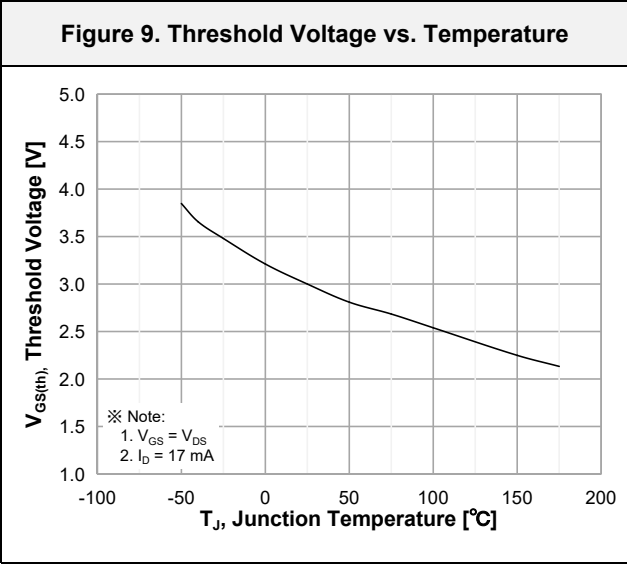
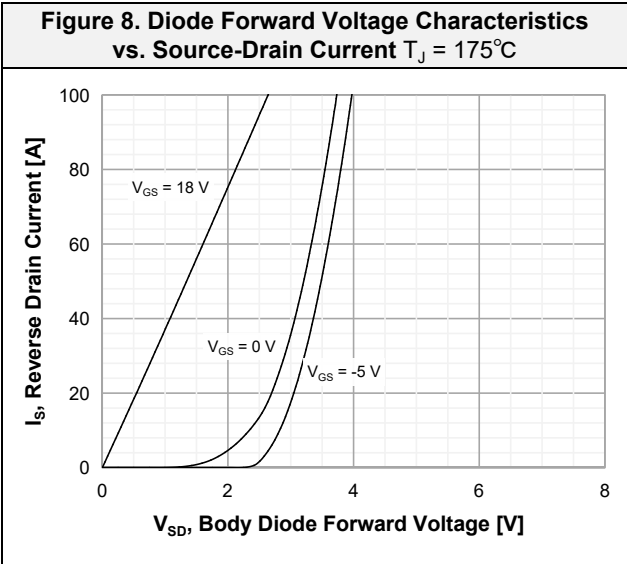
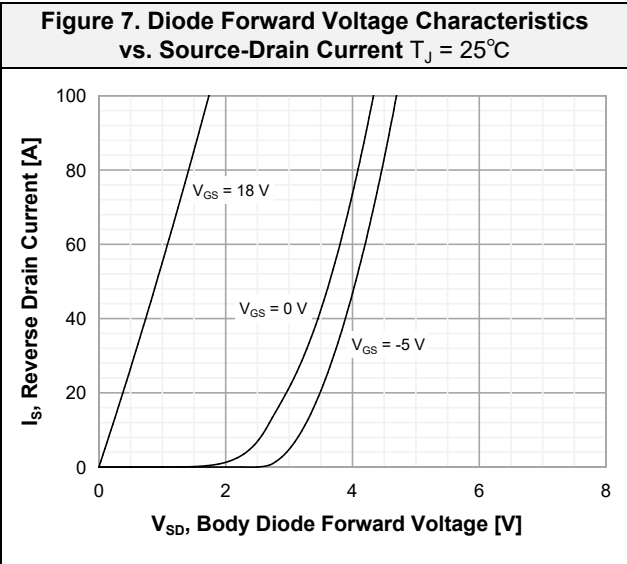


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = -40^{\circ}\text{C}$



Typical Performance Characteristics



Typical Performance Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

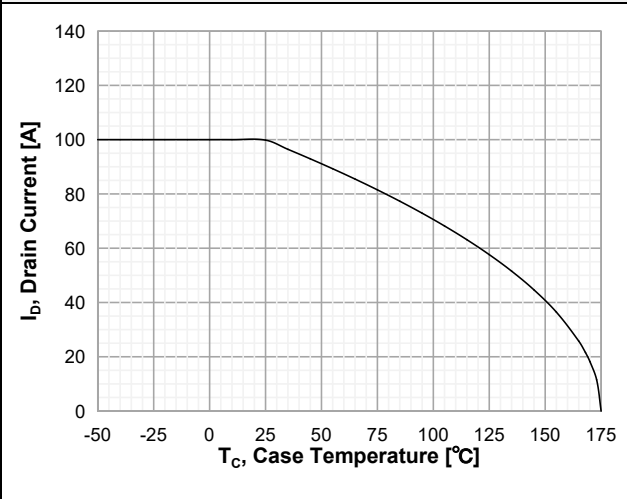


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

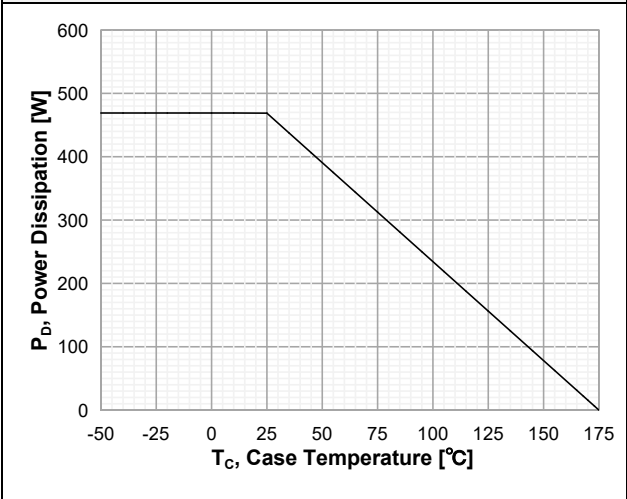


Figure 15. Typ. Switching Losses vs. Drain Current

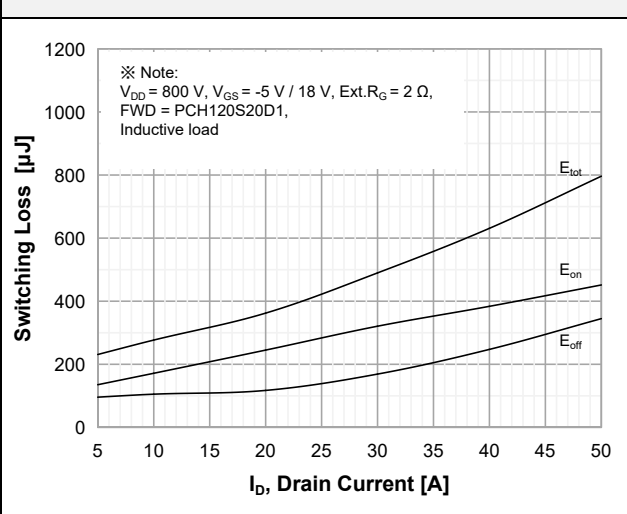


Figure 16. Typ. Switching Losses vs. Gate Resistance

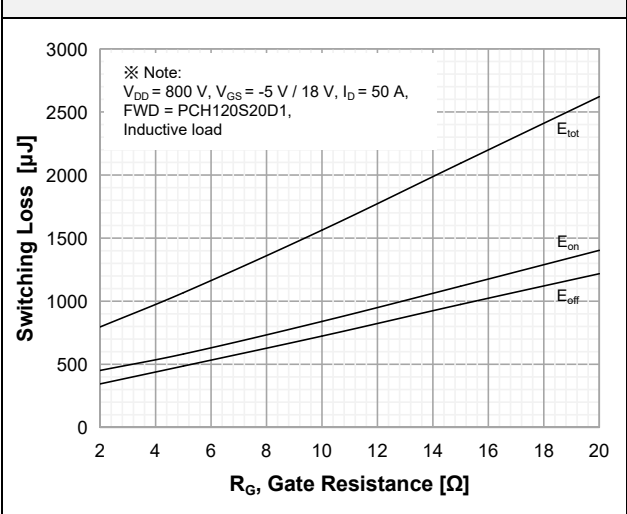


Figure 17. Typ. Switching Losses vs. Drain Current

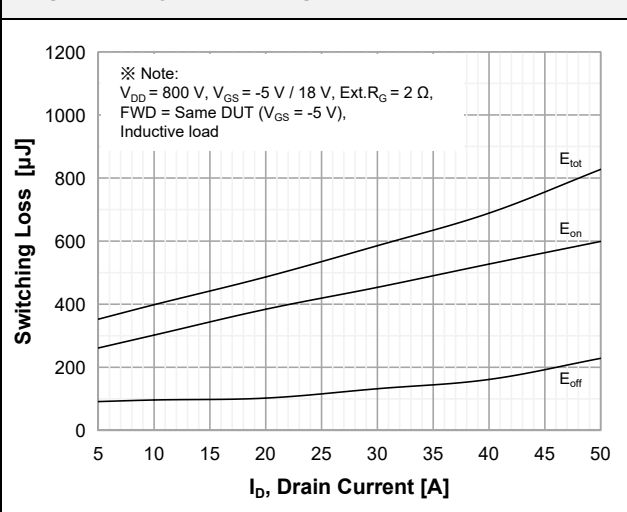
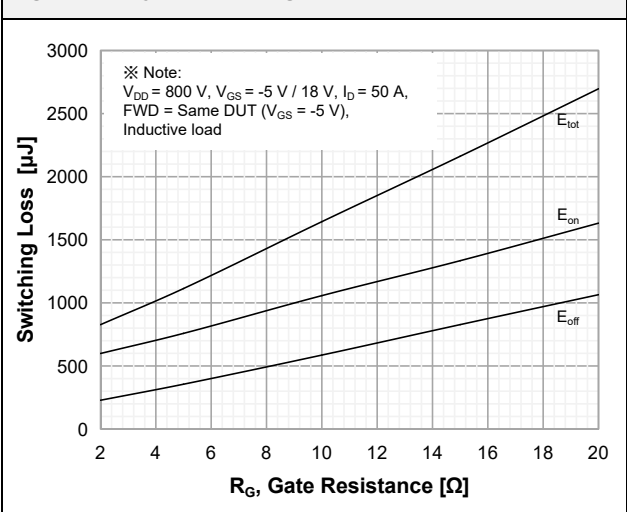


Figure 18. Typ. Switching Losses vs. Gate Resistance



Typical Performance Characteristics

Figure 19. Maximum Safe Operating Area

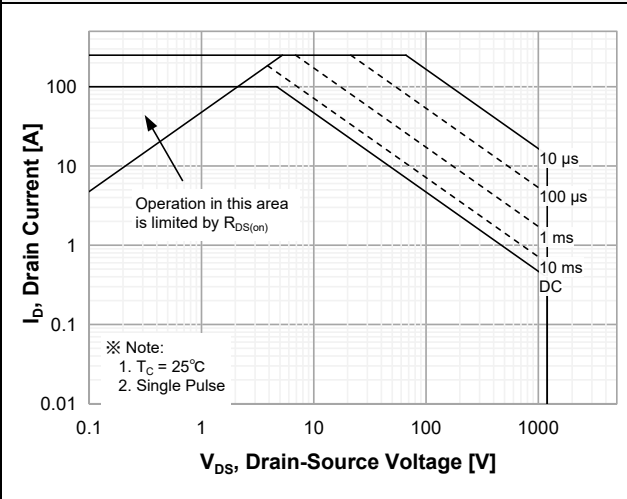


Figure 20. Transient Thermal Response Curve

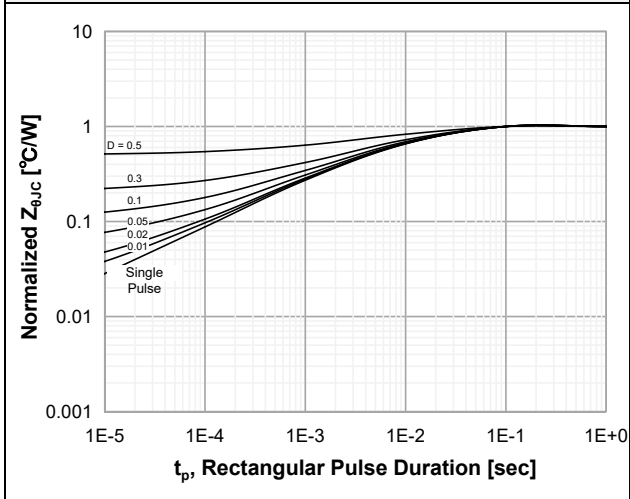


Figure 21. Inductive Load Switching Test Circuit and Waveforms

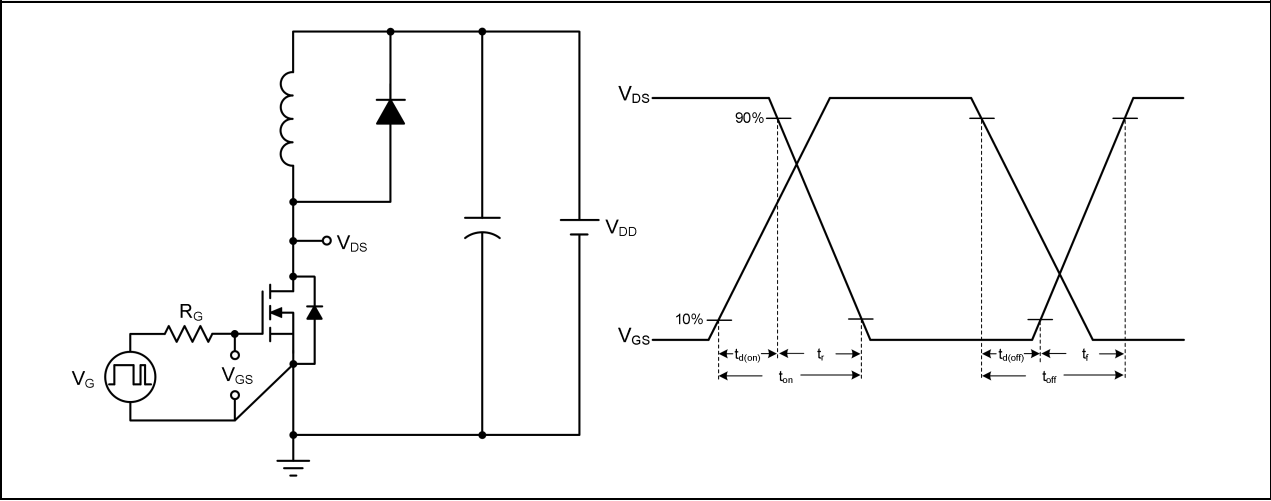
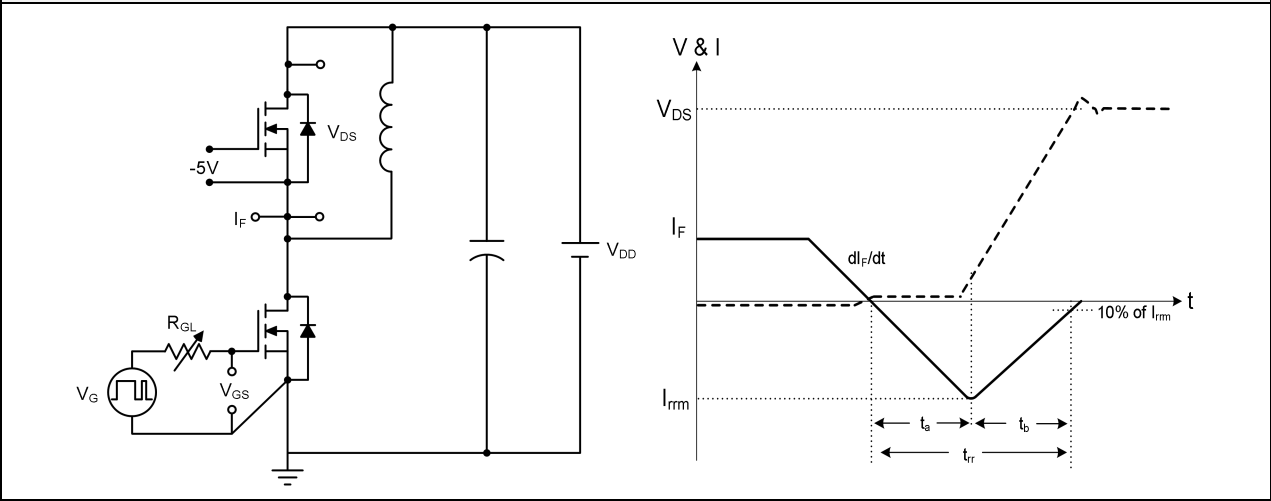
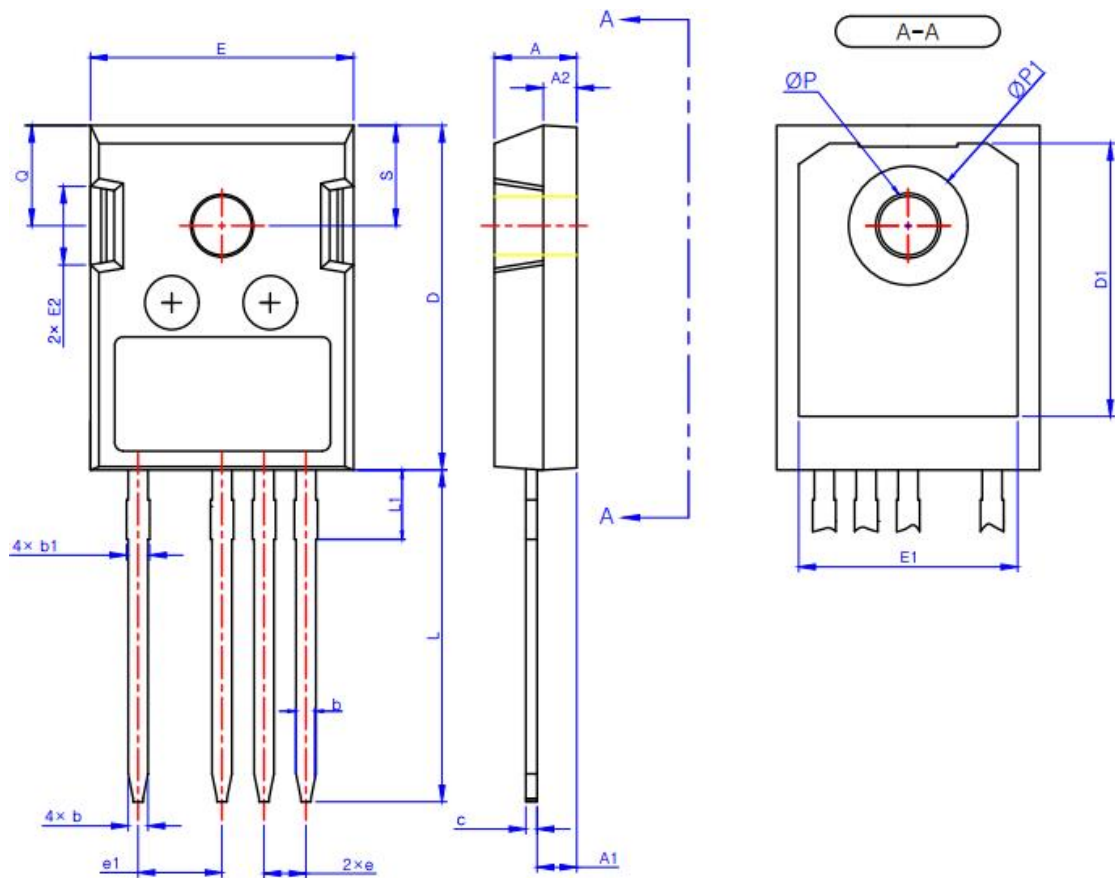


Figure 22. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO-247-4L



SYMBOL	MIN	MAX
A	4.80	5.20
A1	2.29	2.54
A2	1.90	2.10
b	1.10	1.30
b1	1.30	1.50
c	0.50	0.70
D	20.80	21.10
D1	17.43	17.83
E	15.75	16.13
E1	13.06	13.46
E2	4.32	4.83
e	2.54 BSC	
e1	5.08 BSC	
L	19.85	20.25
L1	-	4.49
ØP	3.55	3.65
ØP1	7.00	7.40
Q	5.59	6.19
S	6.15 BSC	

* Dimensions in millimeters