ESI120N21R1V

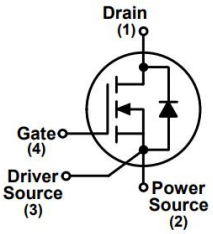
ev™ Automotive Grade Silicon Carbide Power MOSFET
1200V, 100A, 21mΩ

Features

- High switching speed with a low gate charge
- Very fast diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Easy to Parallel and Simple to Drive
- Pb-free, Halogen Free, and RoHS Compliant
- Qualified to AEC-Q101

V_{DSS}	$I_{D,\ Tc=25℃}$	$R_{DS(on),\ Typ.}$	$Q_{g,\ Typ.}$
1200V	100A	21mΩ	198nC

TO-247-4L



Benefits

- Higher System Efficiency
- Higher Frequency Applicability
- Increased Power Density
- Reduced Cooling Requirements

Applications

- On-board Charger/PFC
- DC-DC Converter
- Auxiliary Inverter

Ordering Information

Part Number	Package	Shipping	Quantity
ESI120N21R1V	TO-247-4L	Tube	30 units

■ Absolute Maximum Ratings (T_C=25℃, unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		1200	V
V_{GS}	Gate to Source Voltage (DC)		-10/+22	
V_{GSop}	Recommended Operation Values of Gate to Source Voltage		-5/+18	
I_D	Continuous Drain Current	T_C=25℃	100	A
		T_C=100℃	71	
I_{DM}	Pulsed Drain Current (Note1)	T_C=25℃	250	
P_D	Power Dissipation	T_C=25℃	469	W
		T_C=100℃	234	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	℃

Note1: Limited by maximum junction temperature.

■ Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Maximum Thermal Resistance, Junction to Case	0.32	℃/W
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	40	

■ Electrical Characteristics (T_C=25℃, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
V_{DSS}	Drain to Source Breakdown Voltage	V_{GS}=0V, I_D =1mA	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=1200V, V_{GS}=0V		1	100	μA
		V_{DS}=1200V, V_{GS}=0V, T_J=175℃		10		
I_{GSS}	Gate-Source Leakage Current	V_{GS}=+22V, V_{DS}=0V			+100	nA
		V_{GS}=-10V, V_{DS}=0V			-100	
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS}=V_{DS}, I_D=17mA	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS}=18V, I_D=50A		21	29.4	mΩ
		V_{GS}=18V, I_D=50A, T_J=175℃		33.6		
g_{fs}	Transconductance	V_{DS}=20V, I_D=50A		24.4		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS}=800V, V_{GS}=0V, f=250kHz		3741		pF
C_{oss}	Output Capacitance			224		
C_{rss}	Reverse Capacitance			17		
E_{oss}	Stored Energy in Output Capacitance	V_{DS}=0V to 800V, V_{GS}=0V		93		μJ
$Q_{g(tot)}$	Total Gate Charge	V_{DS}=800V, I_D=50A, V_{GS}=-5V/18V, 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=1MHz		3.0		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=800V, I_D =50A, V_{GS}=-5V/18V, R_G=2Ω, 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			452		μJ
E_{off}	Turn-Off Switching Energy			345		
E_{tot}	Total Switching Energy			797		

■ Reverse Diode Characteristics (T_C=25℃, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Diode Forward Current	V_{GS}=-5V			100	A
I_{SM}	Pulsed Diode Forward Current	V_{GS}=-5V			250	
V_{SD}	Diode Forward Voltage	V_{GS}=-5V, I_{SD}=50A		4.2		V
		V_{GS}=-5V, I_{SD}=50A, T_J=175℃		3.7		
t_{rr}	Reverse Recovery Time	V_{DD}=800V, I_{SD}=50A, V_{GS}=-5V, dI_S/dt=1000A/μs		76		ns
Q_{rr}	Reverse Recovery Charge			530		nC
E_{rec}	Reverse Recovery Energy			26		μJ
I_{rrm}	Peak Reverse Recovery Current			24		A

■ Typical Characteristics (T_J=25℃ unless otherwise noted)

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

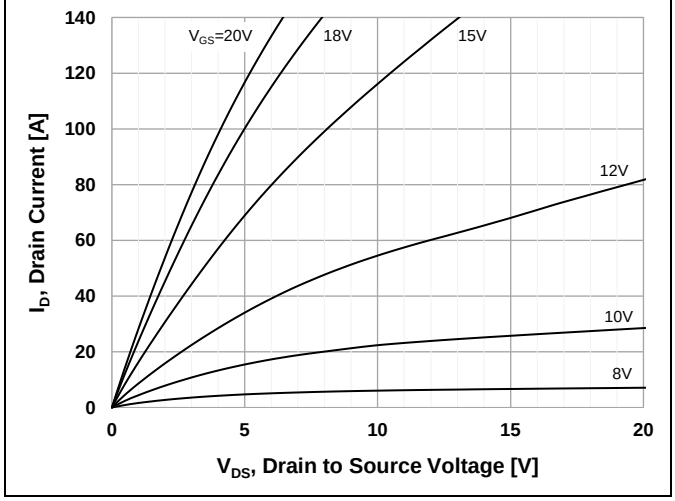


Figure 2. On-Region Characteristics T_J=25℃

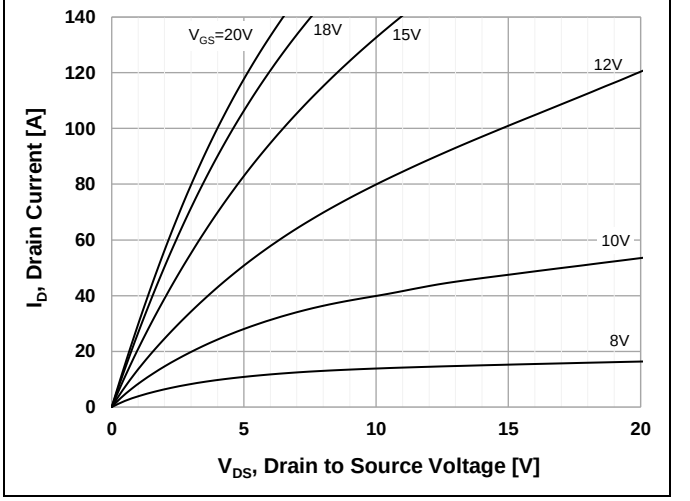


Figure 3. On-Region Characteristics T_J=125℃

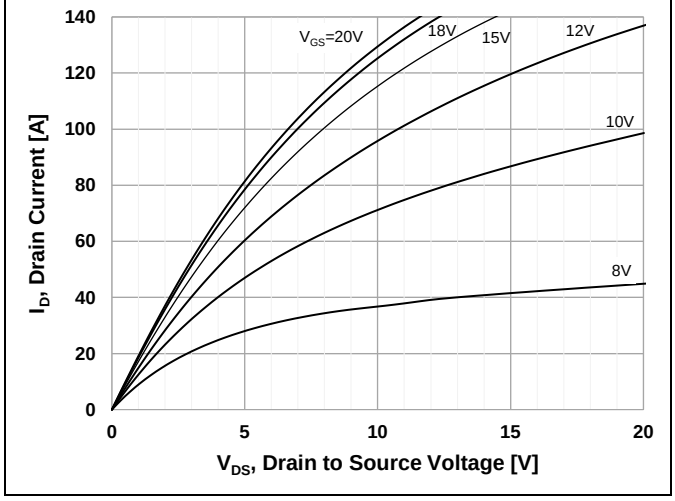


Figure 4. Normalized On-Region Characteristics vs. Temperature

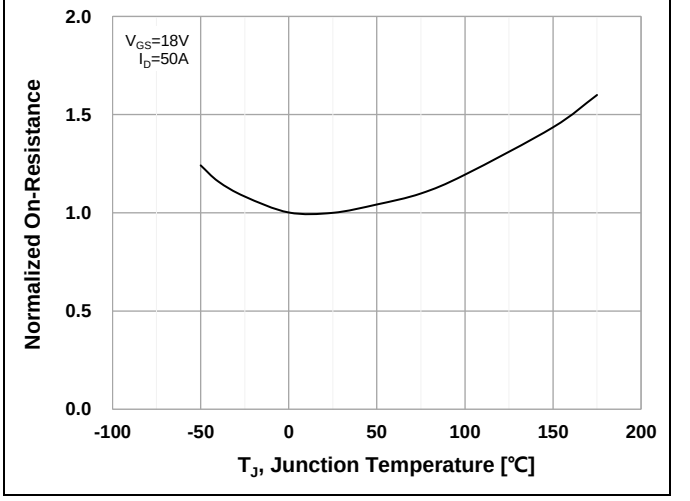


Figure 5. Transfer Characteristics

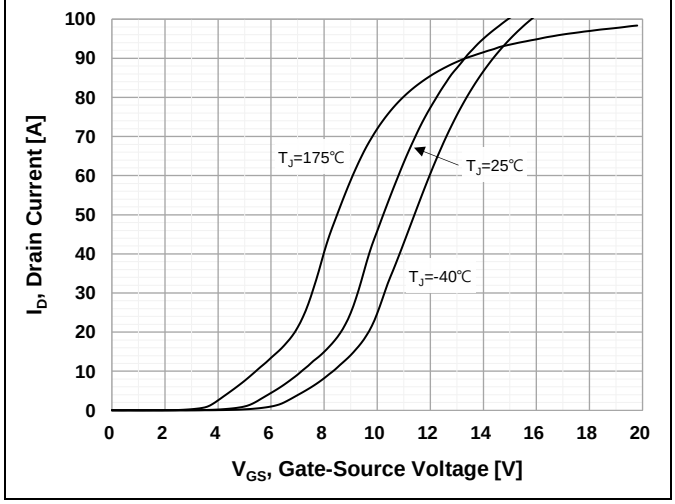
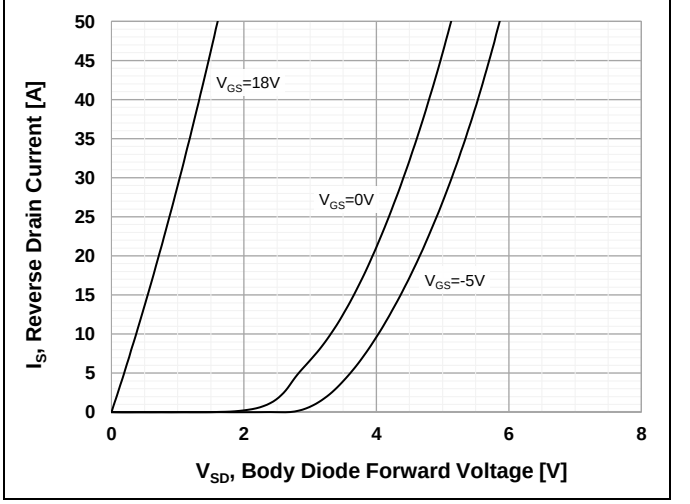


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J=-40℃



■ Typical Characteristics

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

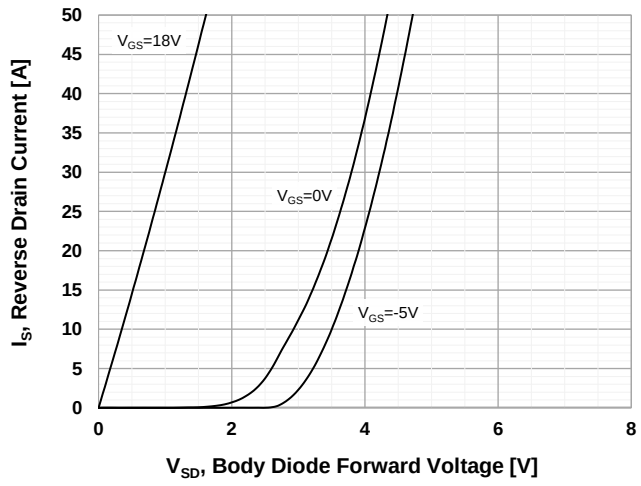


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J=175℃

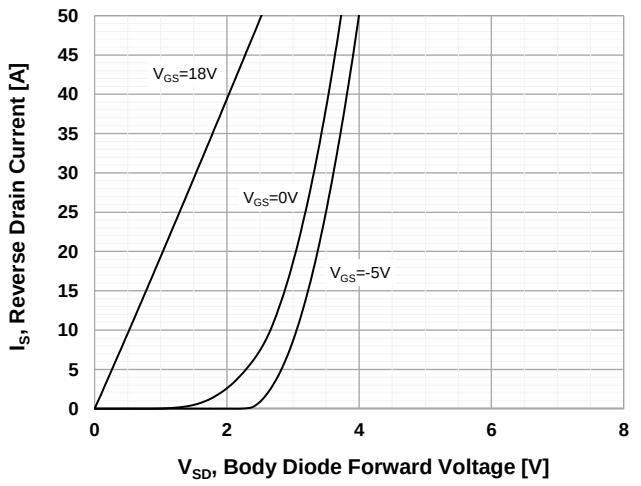


Figure 9. Threshold Voltage vs. Temperature

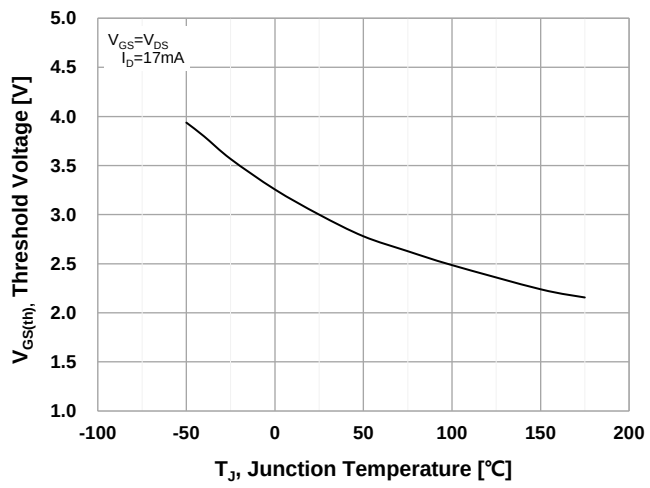


Figure 10. Gate Charge Characteristics

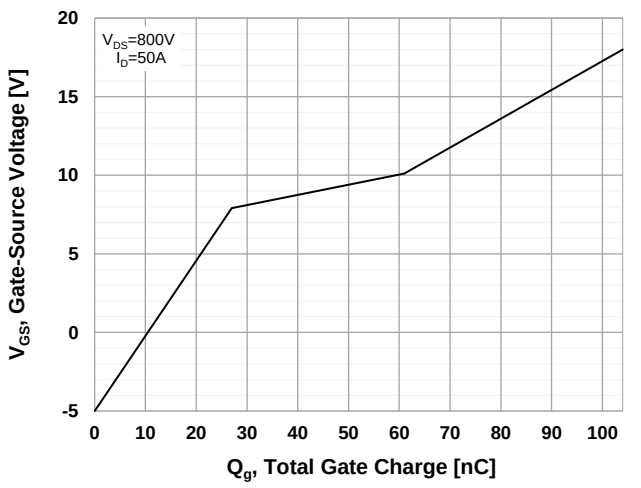


Figure 11. Stored Energy in Output Capacitance

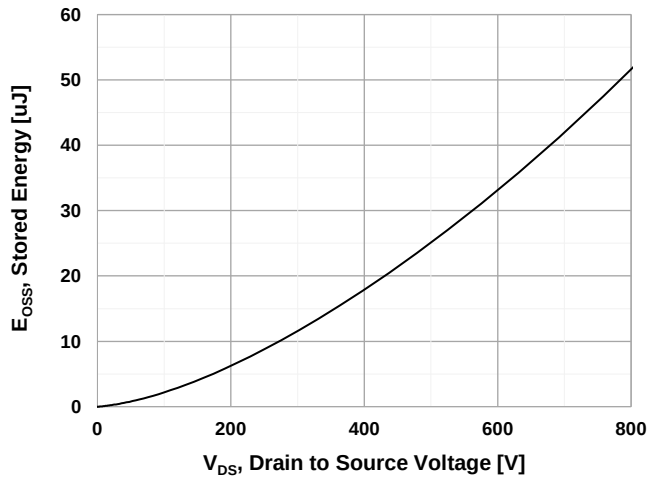
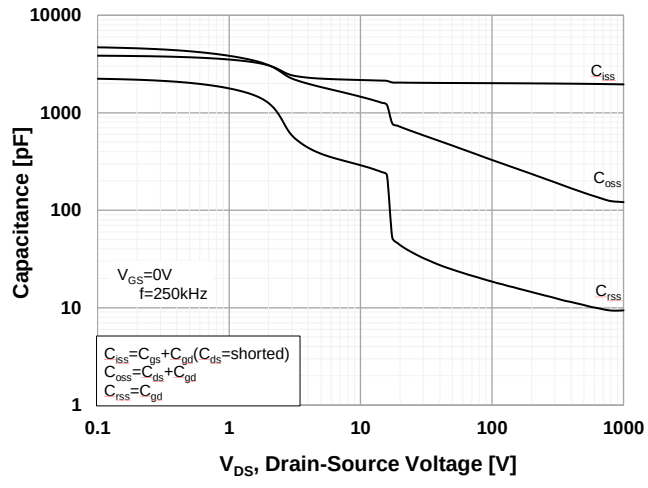


Figure 12. Capacitance Characteristics



■ Typical Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

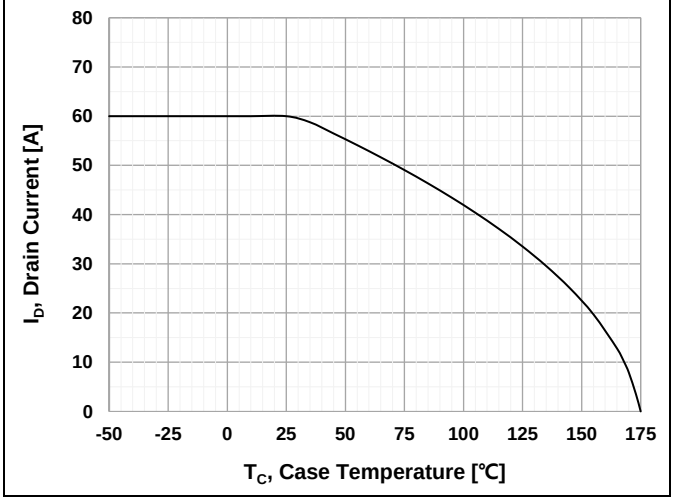


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

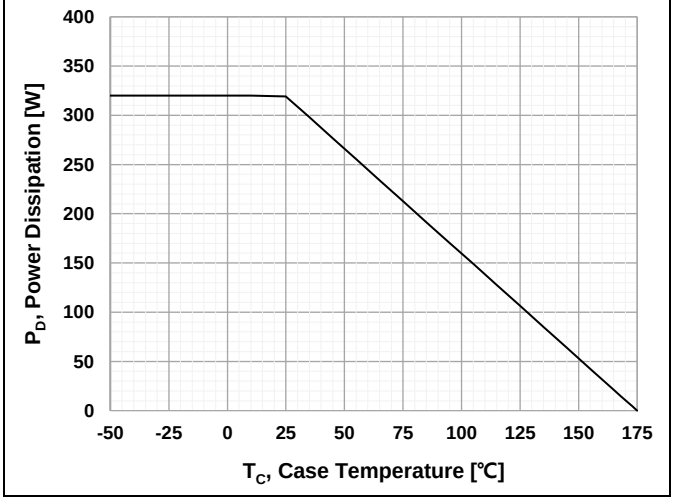


Figure 15. Typ. Switching loss vs. Drian current

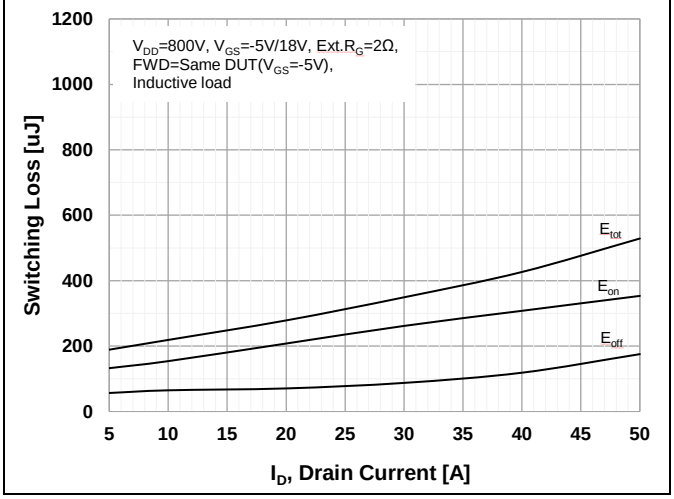


Figure 16. Typ. Switching loss vs. Gate resistance

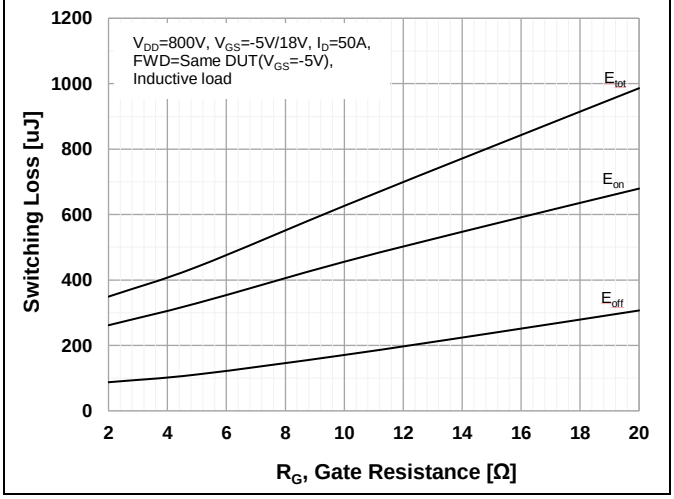


Figure 17. Maximum Safe Operating Area

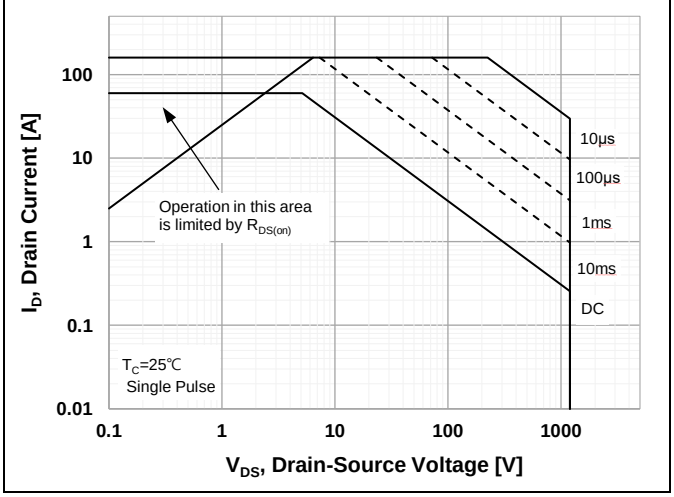
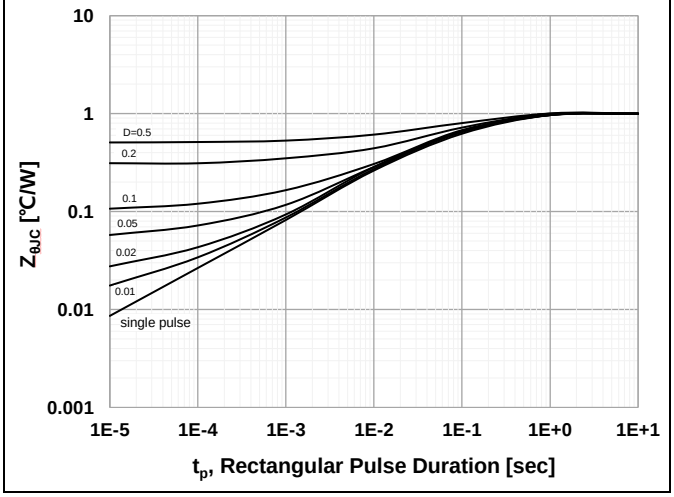


Figure 18. Transient Thermal Response Curve



■ Test Conditions

Figure 19. Inductive Load Switching Test Circuit and Waveforms

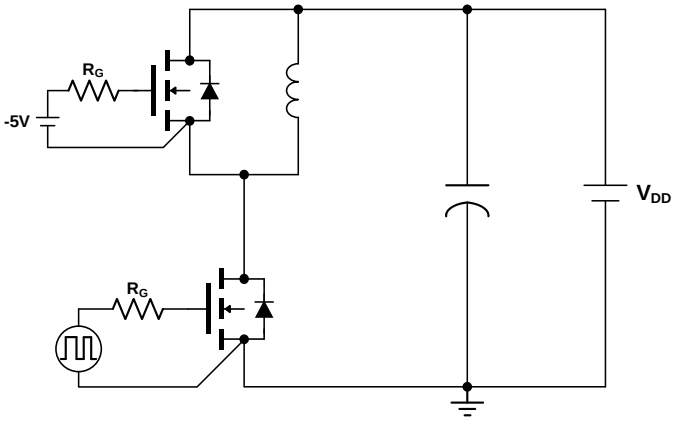


Figure A. Inducive Switching Test Circuit

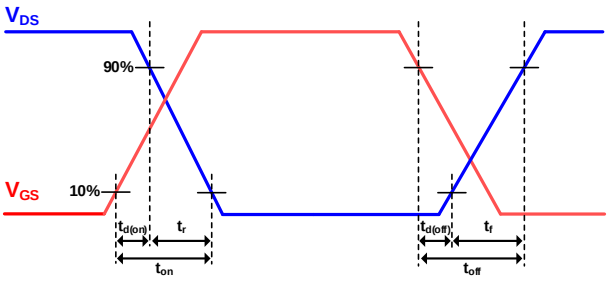


Figure B. Inducive Switching Waveforms

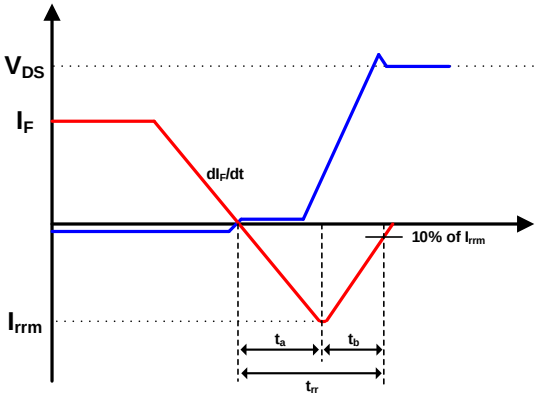
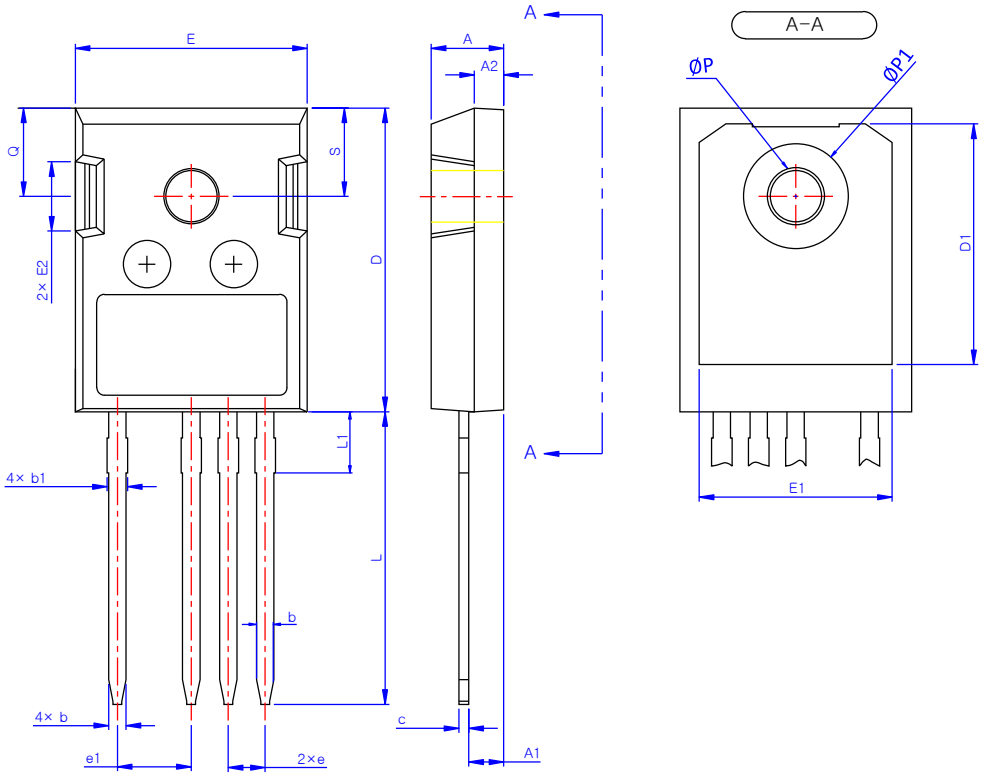


Figure C. Diode Switching Waveforms

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	21.34
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

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