ESH120N80R1V

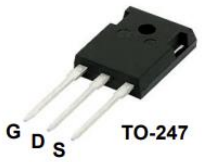
ev™ Automotive Grade Silicon Carbide Power MOSFET

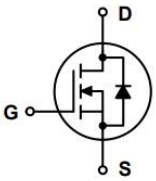
1200V, 30A, 80mΩ

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

$BV_{DSS,\ Tc=25℃}$	$I_{D,\ Tc=25℃}$	$R_{DS(on),typ.}$	$Q_{g,typ.}$
1200V	30A	80mΩ	50nC





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
ESH120N80R1V	TO-247	Tube	30 units

■ Absolute Maximum Ratings (T_J=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 Value		-5/+18	
I_D	Continuous Drain Current	T_C=25℃	30	A
		T_C=100℃	21	
I_{DM}	Pulsed Drain Current (Note1)	T_C=25℃	80	
P_D	Power Dissipation	T_C=25℃	150	W
		T_C=100℃	75	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	1.00	℃/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						
BV_{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℃		5		
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=5.0mA	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS}=18V, I_D=15A		80	104	mΩ
		V_{GS}=18V, I_D=15A, T_J=175℃		128		
g_{fs}	Transconductance	V_{DS}=20V, I_D=15A		11.4		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS}=800V, V_{GS}=0V, f=1MHz		885		pF
C_{oss}	Output Capacitance			65		
C_{rss}	Reverse Capacitance			5		
E_{oss}	Stored Energy in Output Capacitance			26		μJ
$Q_{g(tot)}$	Total Gate Charge	V_{DS}=800V, I_D=15A, V_{GS}=-5V/18V, Inductive load		50		nC
Q_{gs}	Gate to Source Charge			13		
Q_{gd}	Gate to Drain “Miller” Charge			17		
R_G	Internal Gate Resistance	f=1MHz		4.0		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=800V, I_D =15A, V_{GS}=-5V/18V, R_G=2Ω, Inductive load		14		ns
t_r	Turn-On Rise Time			21		
$t_{d(off)}$	Turn-Off Delay Time			24		
t_f	Turn-Off Fall Time			9		
E_{on}	Turn-On Switching Energy			250		μJ
E_{off}	Turn-Off Switching Energy			42		
E_{tot}	Total Switching Energy			292		

■ 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			30	A
I_{SM}	Pulsed Diode Forward Current	V_{GS}=-5V			80	
V_{SD}	Diode Forward Voltage	V_{GS}=-5V, I_{SD}=15A		4.1		V
		V_{GS}=-5V, I_{SD}=15A, T_J=175℃		3.6		
t_{rr}	Reverse Recovery Time	V_{DD}=800V, I_{SD}=15A, V_{GS}=-5V, dI_S/dt=1000A/μs		32		ns
Q_{rr}	Reverse Recovery Charge			112		nC
E_{rec}	Reverse Recovery Energy			6.5		μJ
I_{rrm}	Peak Reverse Recovery Current			8.0		A

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

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

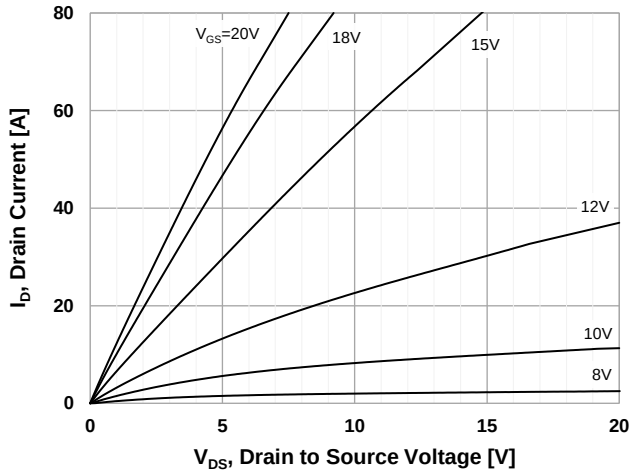


Figure 2. On-Region Characteristics T_J=25℃

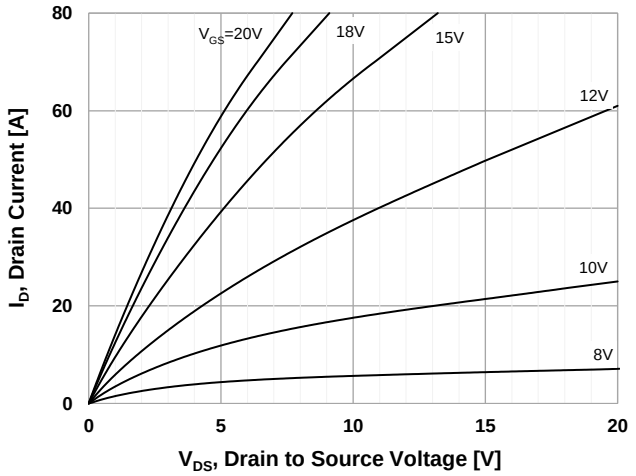


Figure 3. On-Region Characteristics T_J=125℃

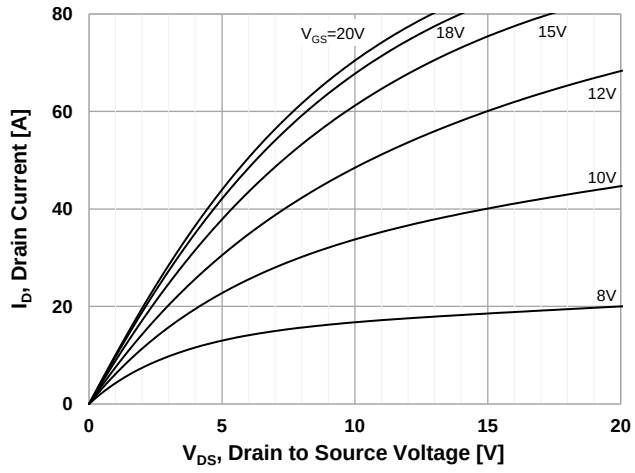


Figure 4. Normalized On-Region Characteristics vs. Temperature

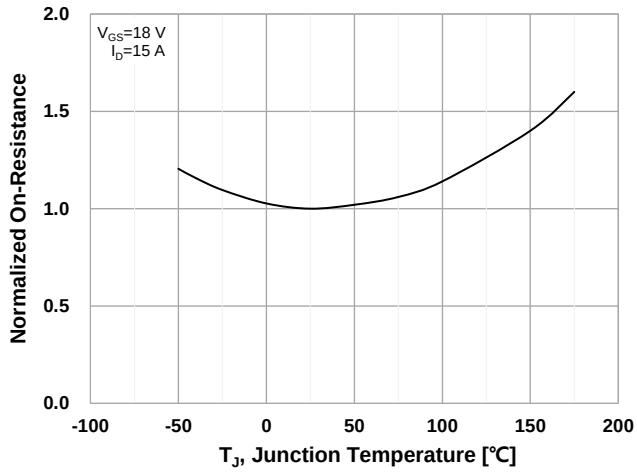


Figure 5. Transfer Characteristics

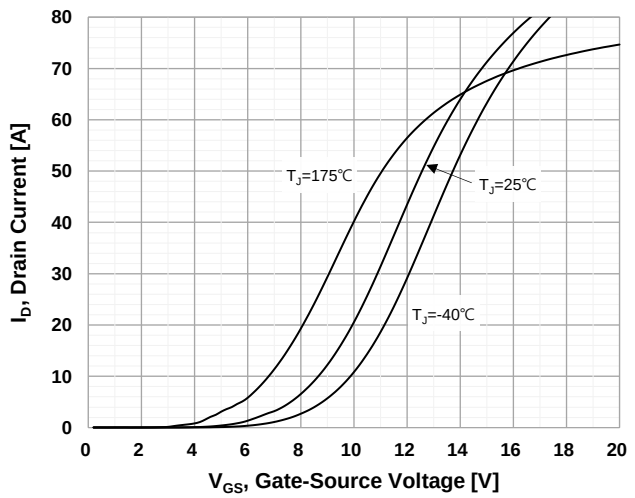
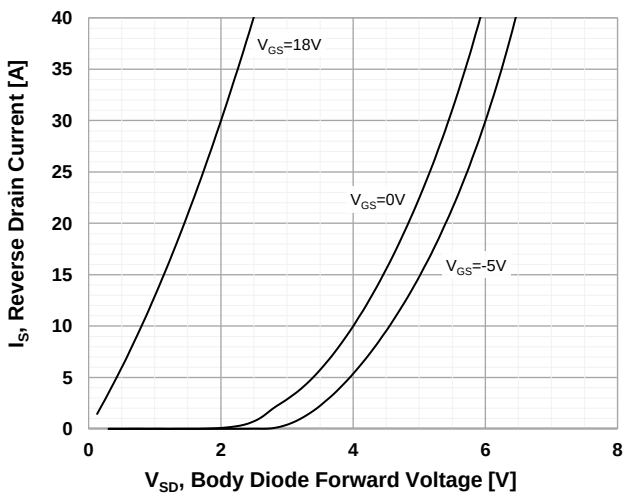


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = -40℃



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

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

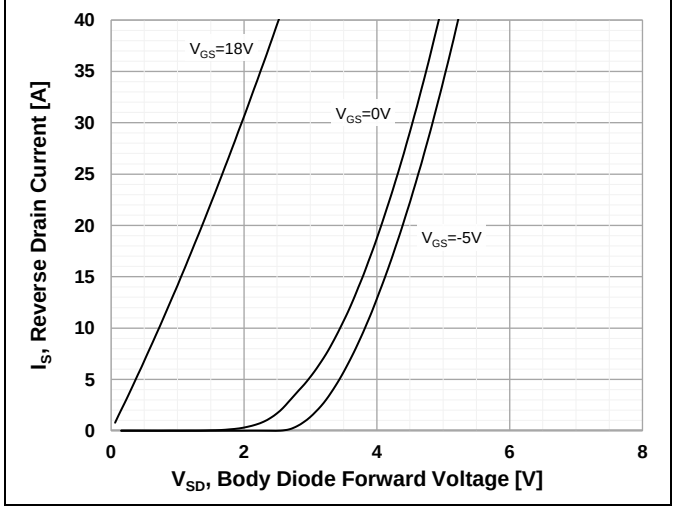


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J=175℃

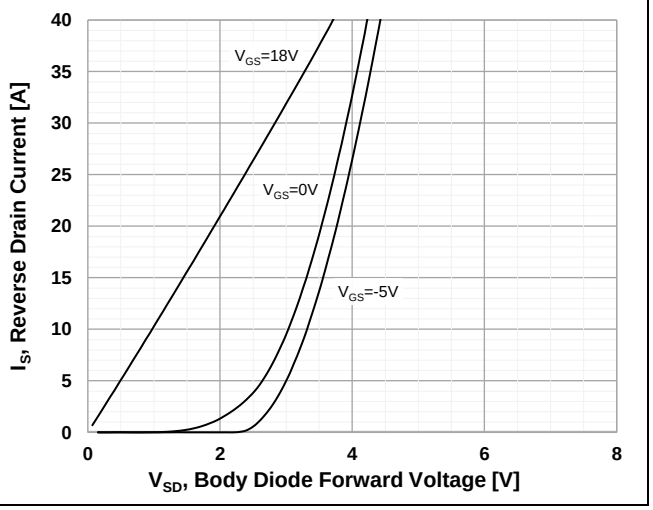


Figure 9. Threshold Voltage vs. Temperature

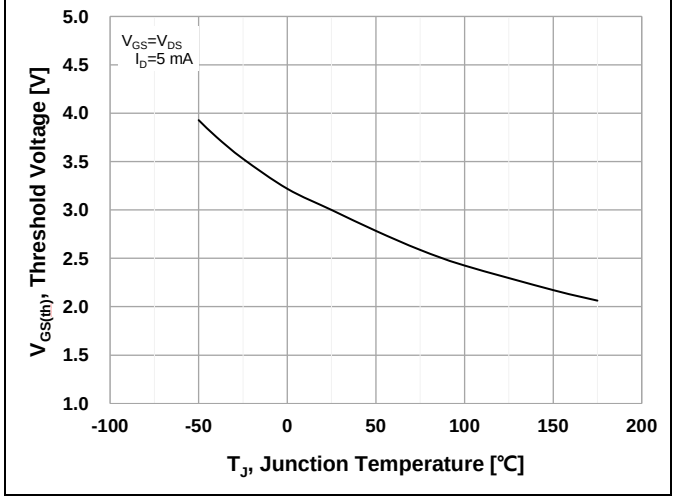


Figure 10. Gate Charge Characteristics

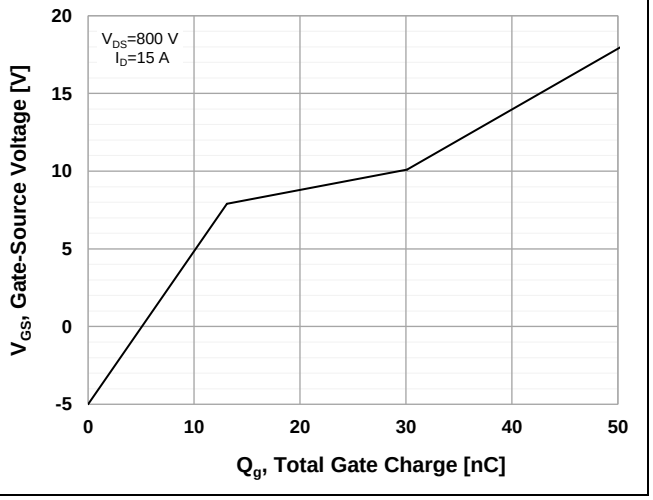


Figure 11. Stored Energy in Output Capacitance

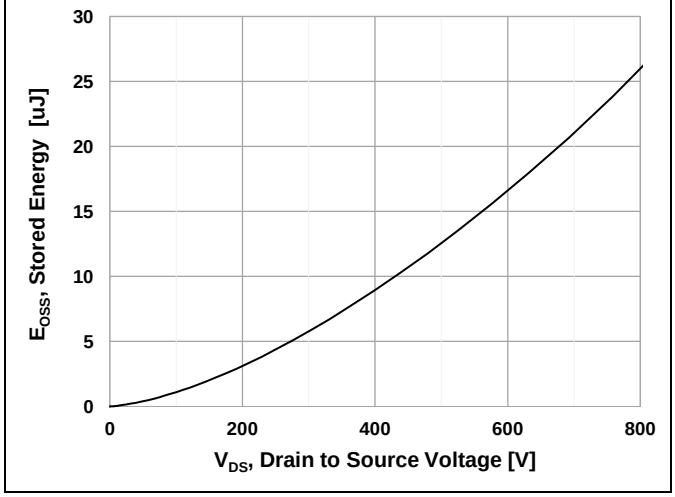
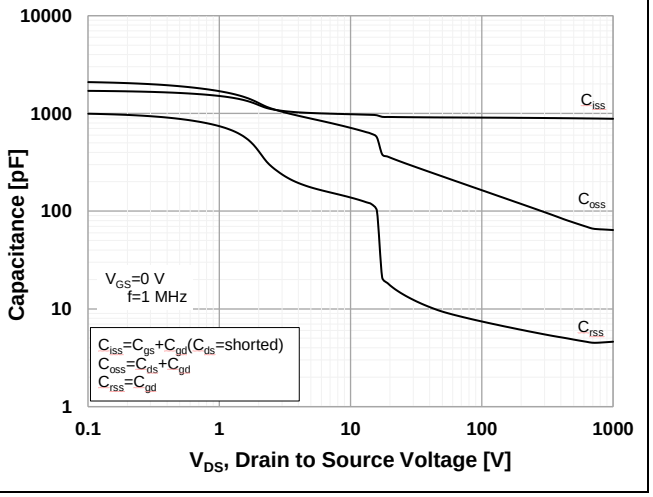


Figure 12. Capacitance Characteristics



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

Figure 13. Continuous Drain Current Derating vs. Case Temperature

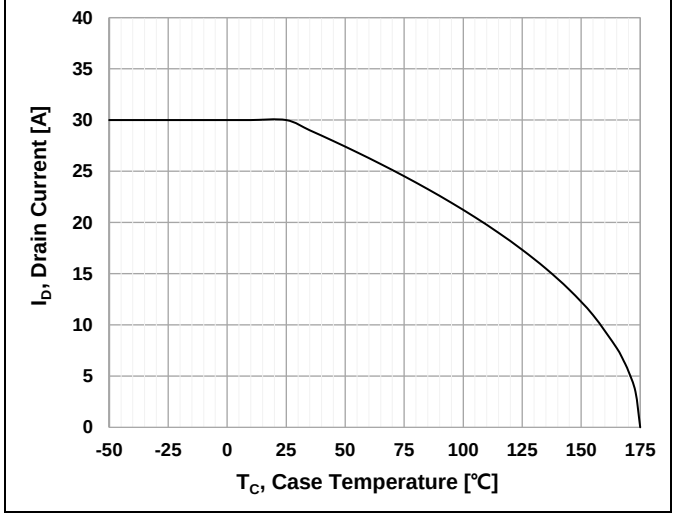


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

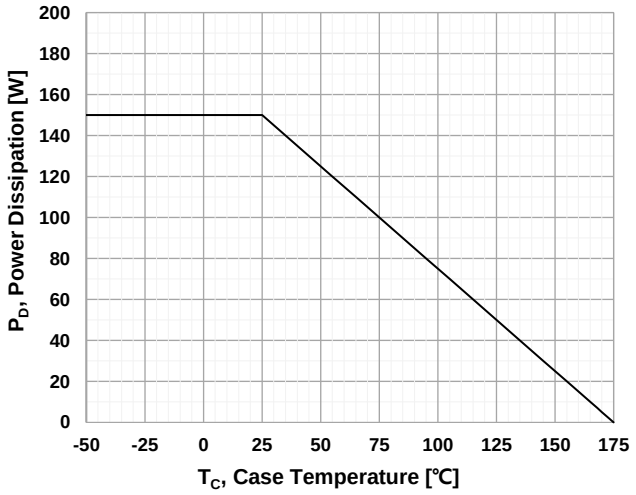


Figure 15. Typ. Switching loss vs. Drian current

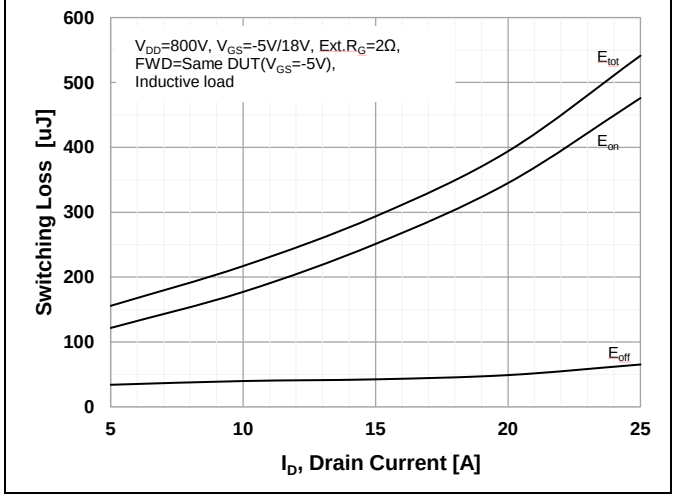


Figure 16. Typ. Switching loss vs. Gate resistance

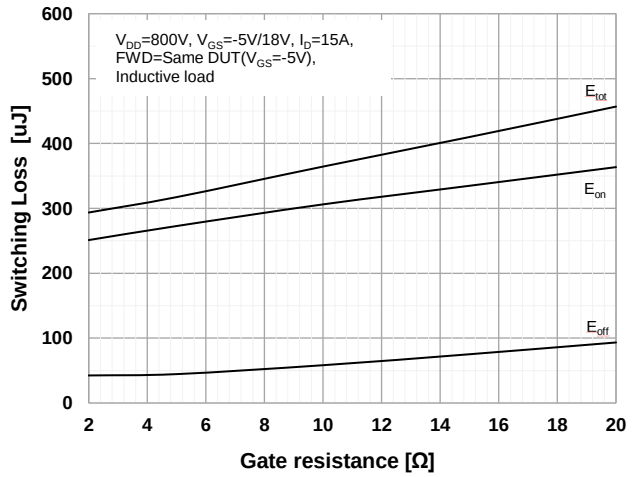


Figure 17. Maximum Safe Operating Area

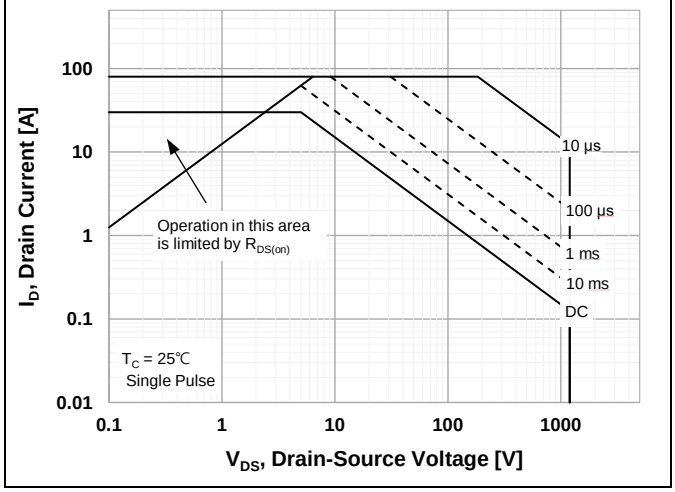
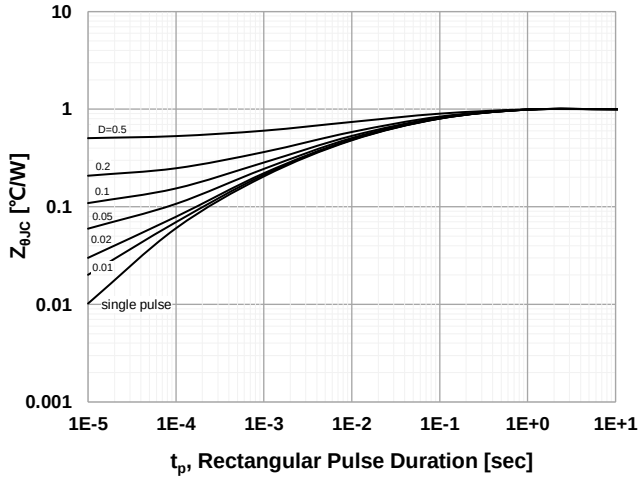


Figure 18. Transient Thermal Response Curve



■ Test Conditions

Figure 19. Inductive Load Switching Test Circuit and Waveforms

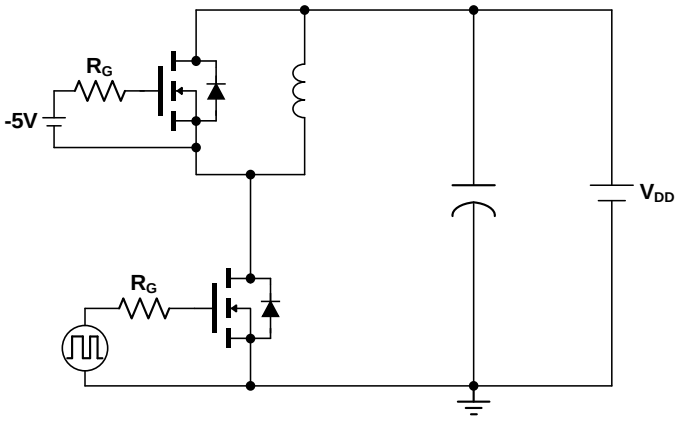


Figure A. Inducive Switching Test Circuit

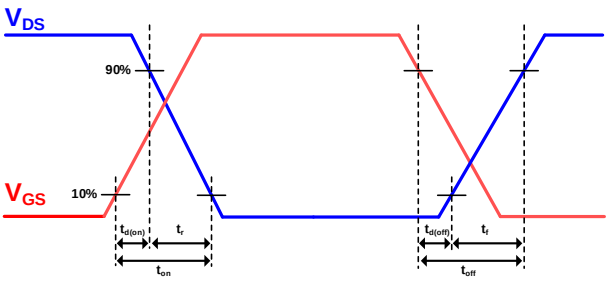


Figure B. Inducive Switching Waveforms

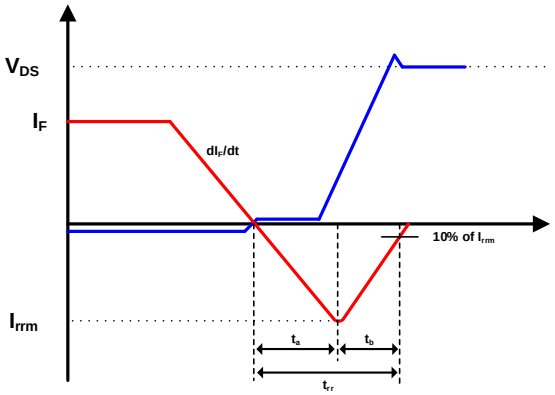
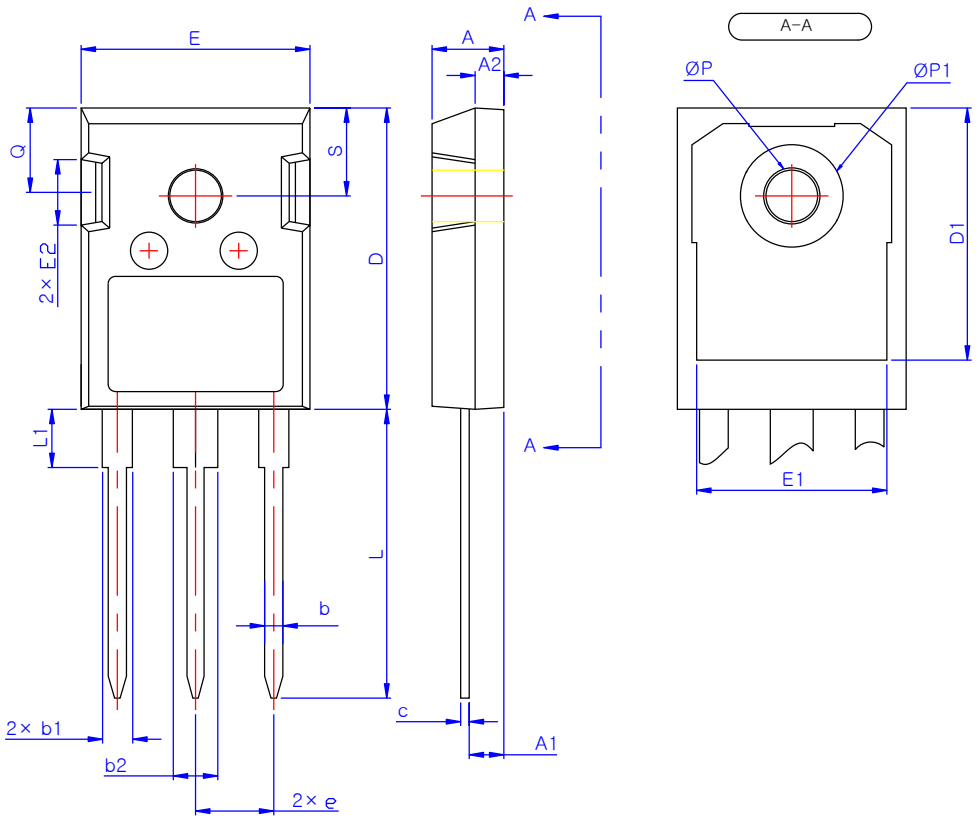


Figure C. Diode Switching Waveforms

Package Outlines
TO-247



SYMBOL	MIN	MAX
A	4.80	5.20
A1	2.29	2.54
A2	1.90	2.10
b	1.10	1.30
b1	1.91	2.20
b2	2.92	3.20
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	5.45 BSC	
L	19.85	20.25
L1	–	4.49
ØP	3.55	3.65
ØP1	7.08	7.28
Q	5.59	6.19
S	6.15 BSC	

*Dimensions in millimeters

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