FSW20N9P7G1

N-Channel *e*MOS Power Trench MOSFET

200 V, 130 A, 9.7 mΩ

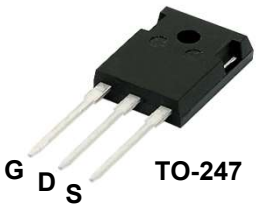
Features

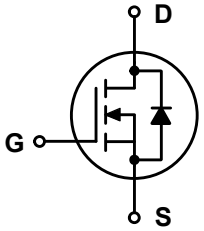
- Reduced switching and conduction losses
- Enhanced body diode dV/dt and dI/dt capability
- Robust avalanche capability
- 100% avalanche tested
- Pb-free, Halogen free, and RoHS compliant

BV_{DSS}	I_D	$R_{DS(on),\ max}$	$Q_{g,\ typ}$
200 V	130 A	9.7 mΩ	223 nC

Benefits

- High system reliability
- System efficiency improvement
- Higher frequency applicability
- Increased power density





Applications

- Motor control
- EV DC-DC & traction inverter
- Battery protection & power tool
- Synchronous rectification
- Micro solar Inverter & UPS

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

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		200	V
V_{GSS}	Gate to Source Voltage		±30	V
I_D	Drain Current	Continuous (T_C = 25℃)	130	A
		Continuous (T_C = 100℃)	92	
I_{DM}	Drain Current	Pulsed (Note1)	520	A
E_{AS}	Single Pulsed Avalanche Energy	(Note2)	800	mJ
I_{AS}	Avalanche Current	(Note2)	40	A
dv/dt	MOSFET dv/dt		100	V/ns
	Peak Diode Recovery dv/dt	(Note3)	50	
P_D	Power Dissipation	(T_C = 25℃)	520	W
		Derate Above 25℃	3.45	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	℃

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.29	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
FSW20N9P7G1	FSW20N9P7G1	TO-247	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	200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 200 V, V_{GS} = 0 V			20	μA
		V_{DS} = 200 V, V_{GS} = 0 V, T_J = 125℃			250	
I_{GSS}	Gate-Source Forward Leakage Current	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
	Gate-Source Reverse Leakage Current	V_{GS} = -20 V, V_{DS} = 0 V			-100	
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250 μA	3.0		5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 81 A			9.7	mΩ
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 50 V, V_{GS} = 0V, f = 250 kHz		12000		pF
C_{oss}	Output Capacitance			850		pF
C_{rss}	Reverse Transfer Capacitance			370		pF
$C_{o(tr)}$	Time Related Output Capacitance	V_{DS} = 0 V to 160 V, V_{GS} = 0 V		928		pF
$C_{o(er)}$	Energy Related Output Capacitance			648		pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	V_{DS} = 100 V, I_D = 81 A, V_{GS} = 10 V		223		nC
Q_{gs}	Gate to Source Charge			72		nC
Q_{gd}	Gate to Drain “Miller” Charge			73		nC
R_G	Gate Resistance	f = 1MHz		1		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 130 V, I_D = 81 A, V_{GS} = 10 V, R_G = 2.7 Ω		50		ns
t_r	Turn-On Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			87		ns
t_f	Turn-Off Fall Time			22		ns
Source-Drain Diode Characteristics						
I_S	Maximum Continuous Diode Forward Current				130	A
I_{SM}	Maximum Pulsed Diode Forward Current				520	A
V_{SD}	Diode Forward Voltage	V_{GS} = 0 V, I_{SD} = 81 A			1.3	V
t_{rr}	Reverse Recovery Time	V_{DD} = 100 V, I_{SD} = 81 A, dI_F/dt = 100 A/μs		124		ns
Q_{rr}	Reverse Recovery Charge			616		nC

※Notes:
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I_{AS} = 40 A, R_G = 25 Ω, starting T_J = 25℃.
3. I_{SD} ≤ 81 A, di/dt ≤ 520 A/μs, V_{DD} ≤ 200 V.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

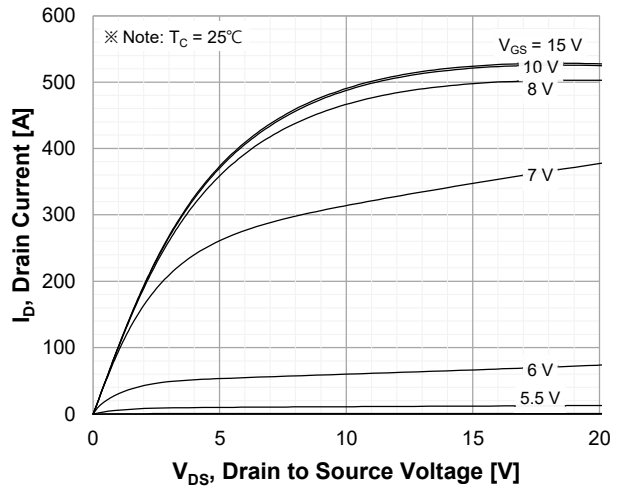


Figure 2. Transfer Characteristics

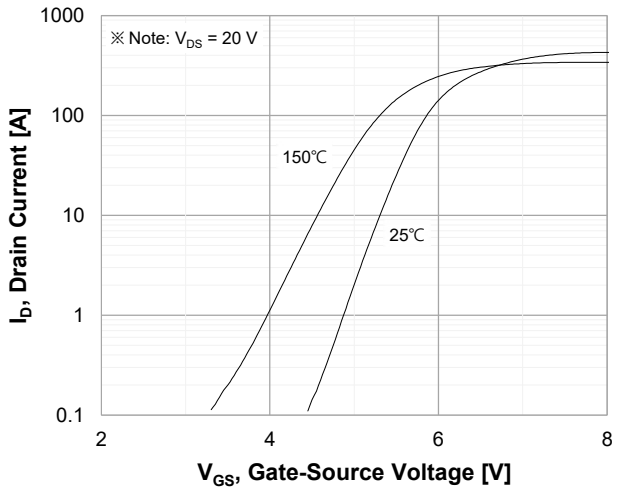


Figure 3. On-Resistance Characteristics vs. Drain Current and Gate Voltage

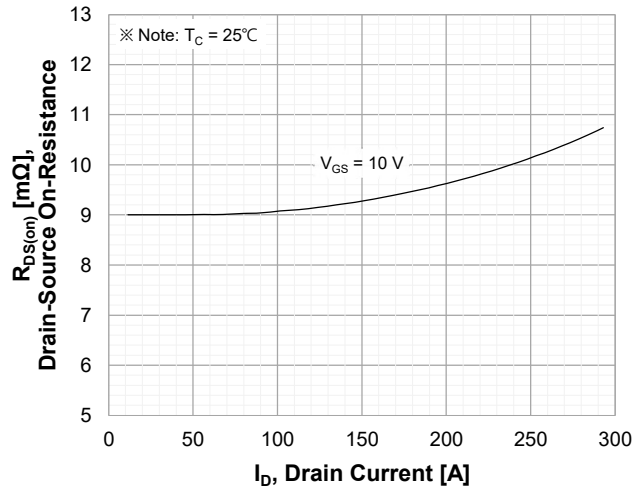


Figure 4. Diode Forward Voltage Characteristics vs. Source-Drain Current and Temperature

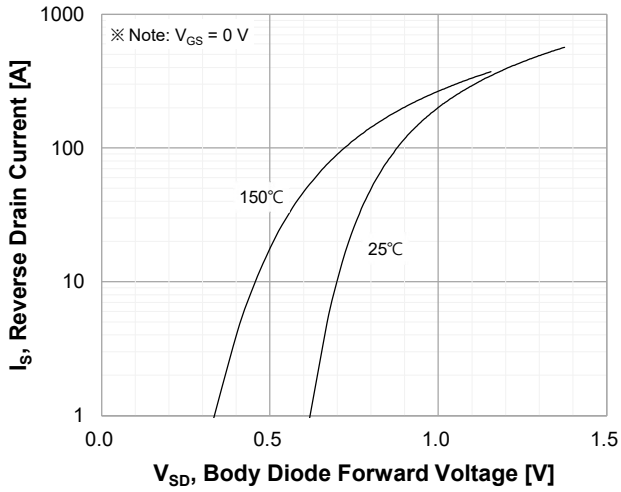


Figure 5. Capacitance Characteristics

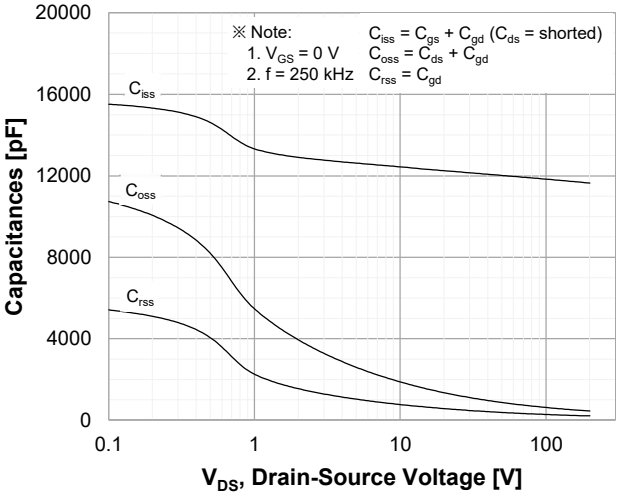
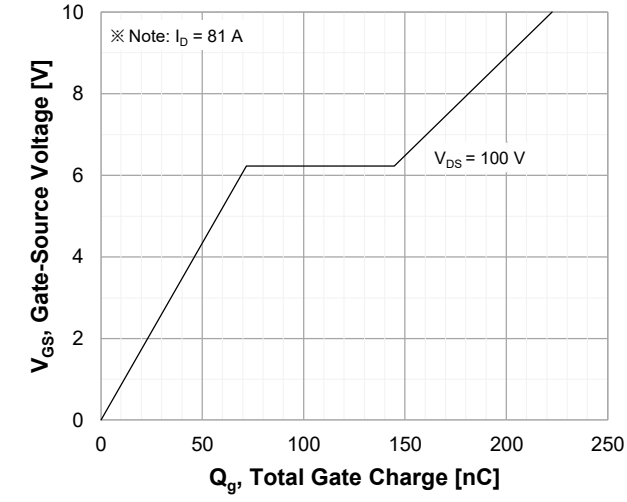


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics

Figure 7. Breakdown Voltage Characteristics vs. Temperature

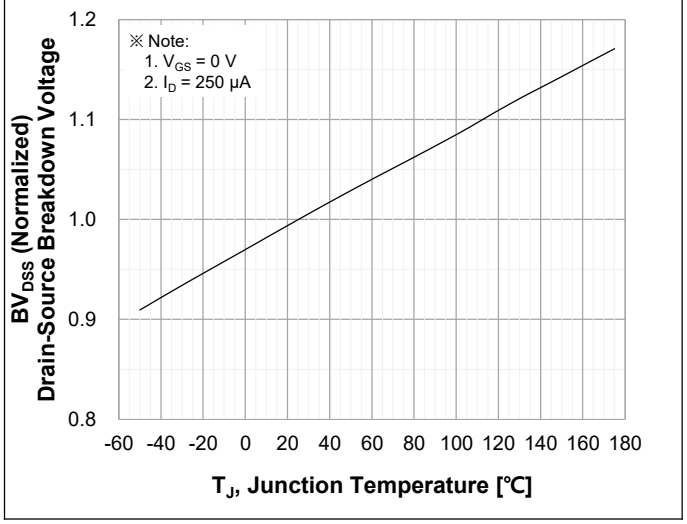


Figure 8. On-Resistance Characteristics vs. Temperature

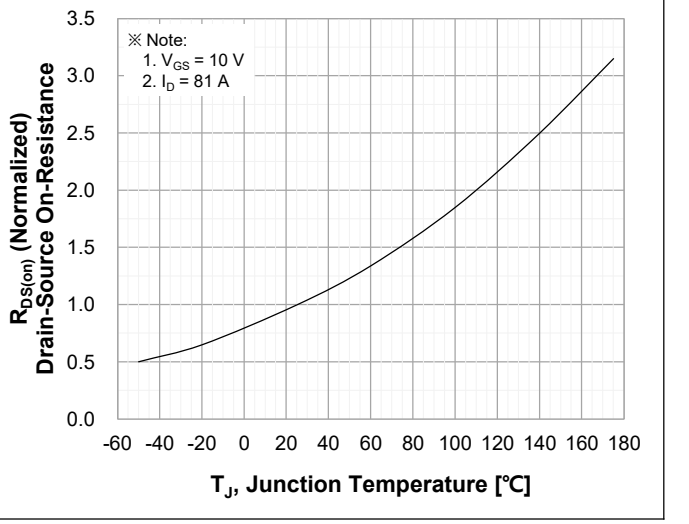


Figure 9. Maximum Safe Operating Area

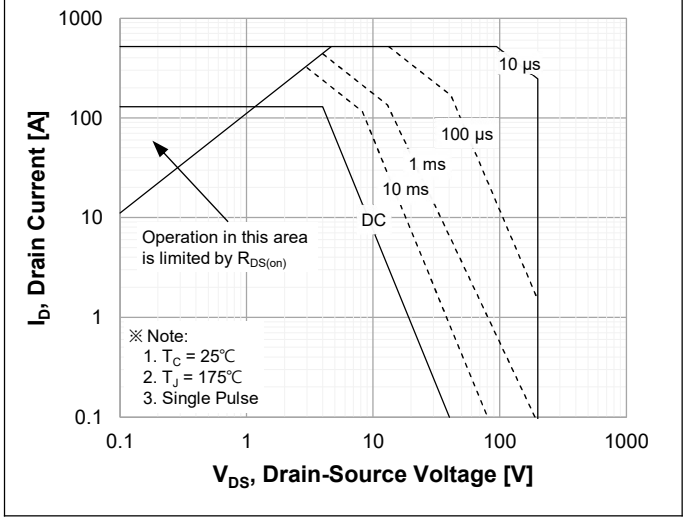


Figure 10. Maximum Drain Current vs. Case Temperature

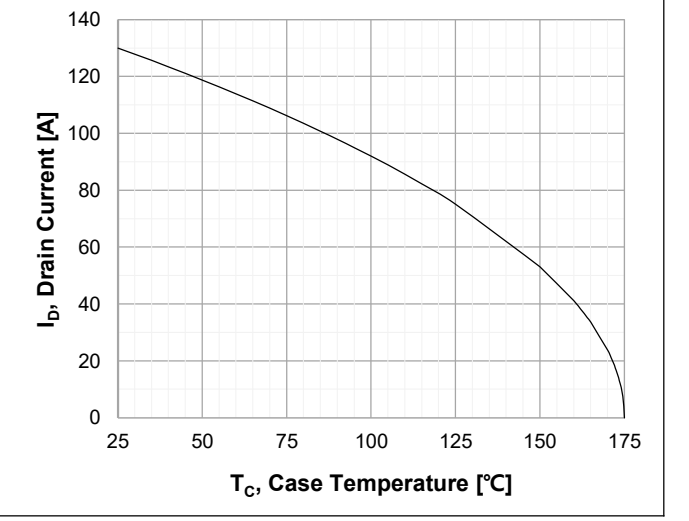


Figure 11. E_{oss} vs. Drain to Source Voltage

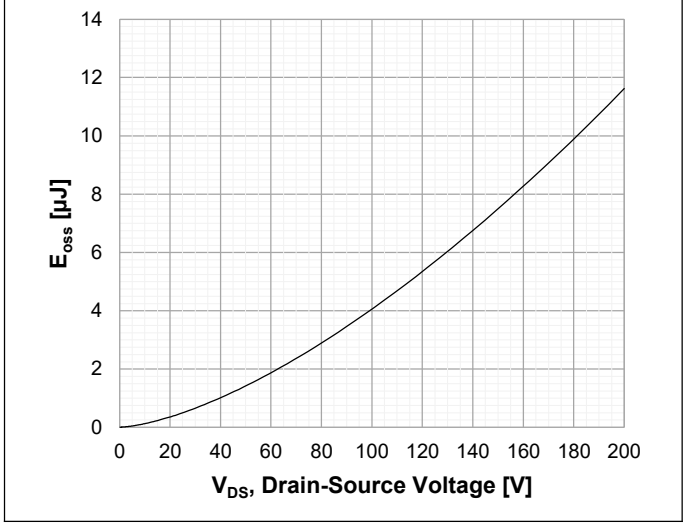
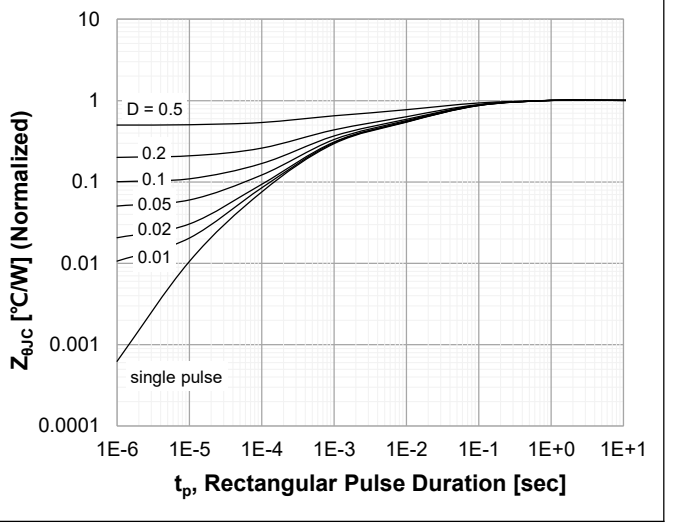


Figure 12. Transient Thermal Response Curve



Test Circuits

Figure 13. Resistive Load Switching Test Circuit and Waveforms

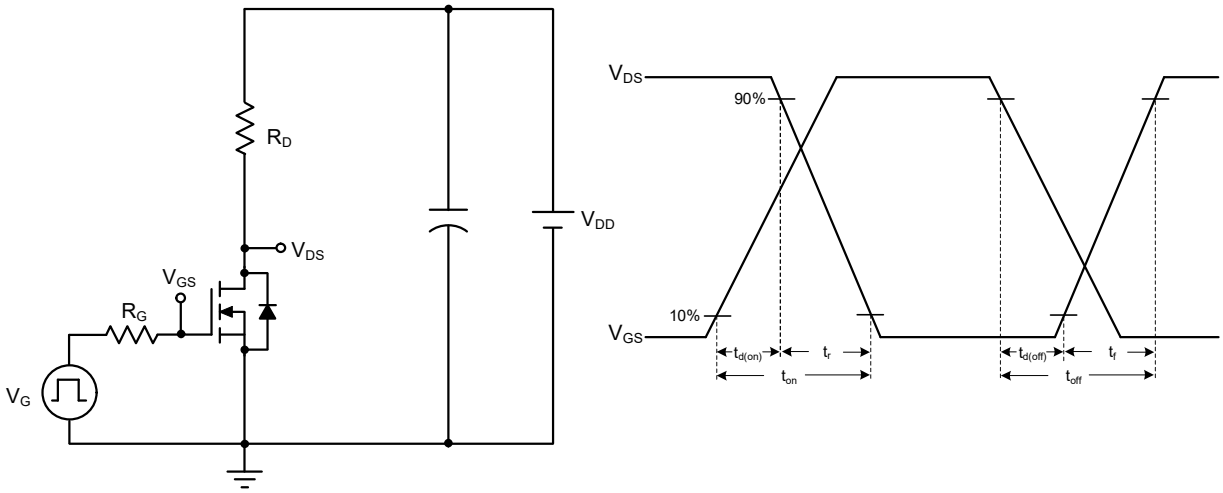


Figure 14. Unclamped Inductive Switching Test Circuit and Waveforms

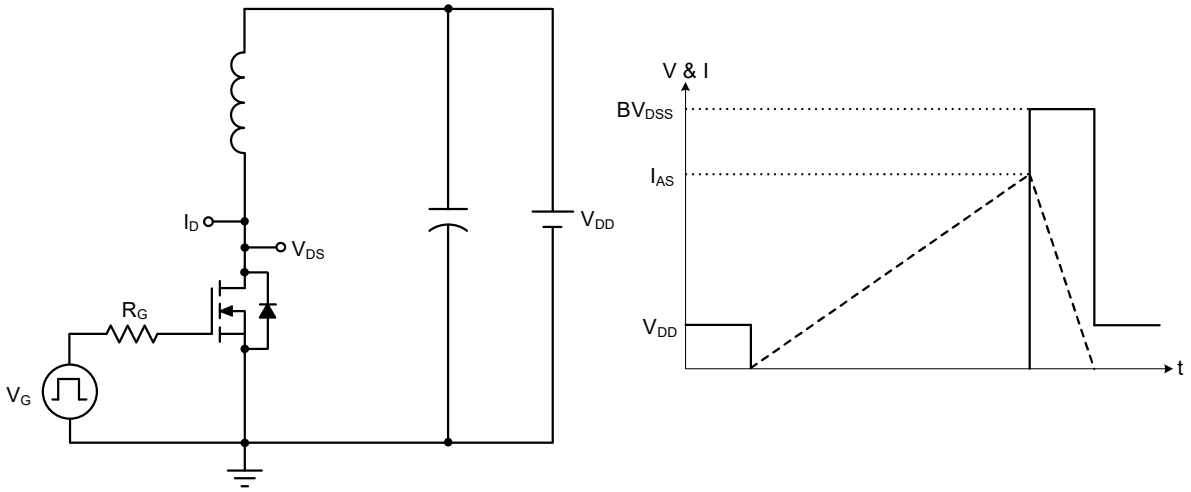
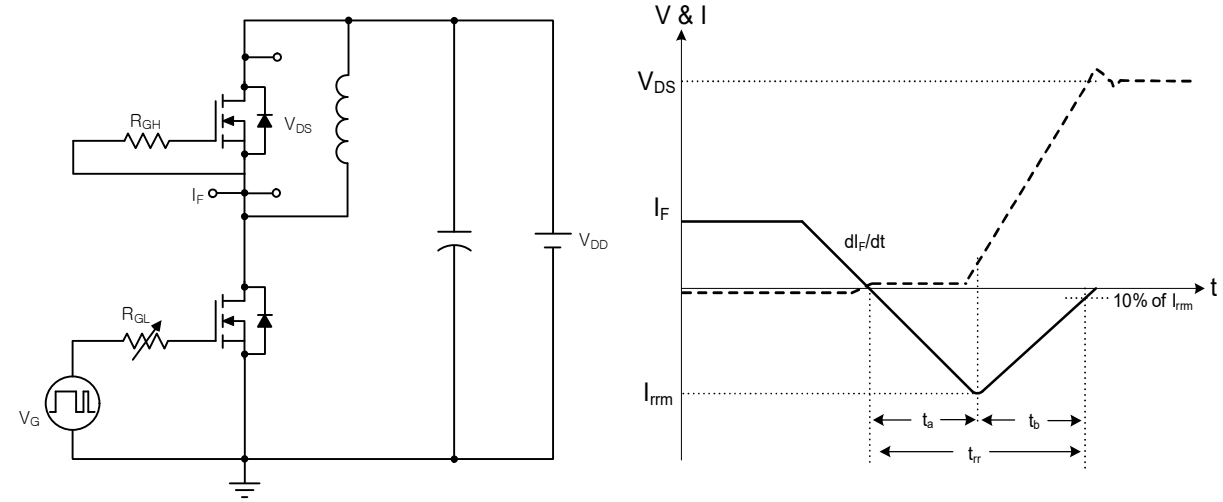
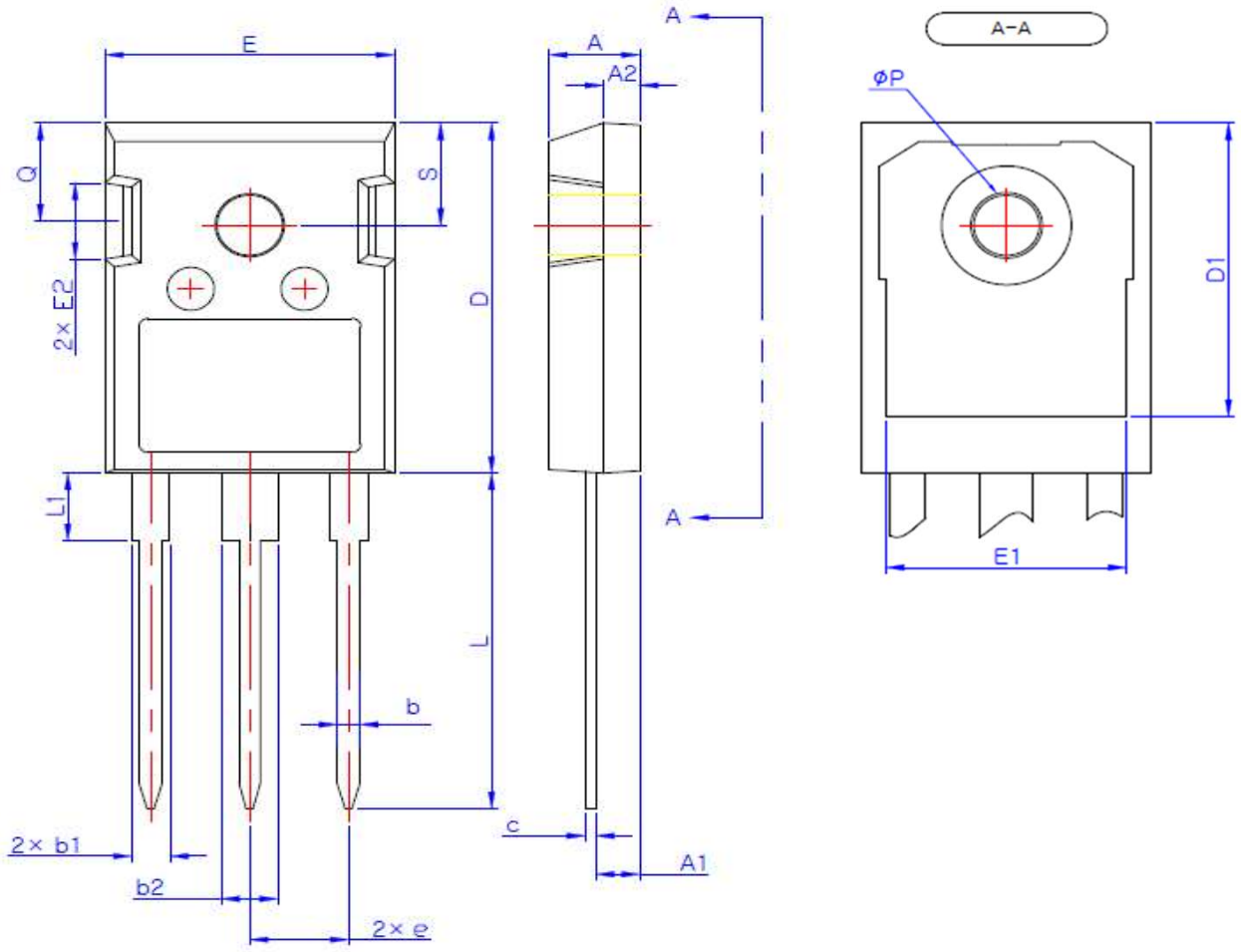


Figure 15. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO-247 (S)



SYMBOL	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	17.43	17.63	17.83
E	15.75	15.94	16.13
E1	13.06	13.26	13.46
E2	4.32	4.58	4.83
e	5.45 BSC		
L	19.85	20.05	20.25
L1	4.05	4.27	4.49
ΦP	3.55	3.60	3.65
Q	5.59	5.89	6.19
S	6.15 BSC		

* Dimensions in millimeters