

30V N-Channel MOSFET

PRODUCT SUMMARY

V_{DS}	30V
I_D (at $V_{GS}=10V$)	40A
$R_{DS(ON)}$ (at $V_{GS}=10V$)	< 4.5m Ω
$R_{DS(ON)}$ (at $V_{GS} = 4.5V$)	< 5.3m Ω

100% UIS Tested

100% R_g Tested

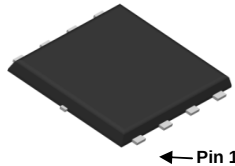
- Trench Power aMOS Technology
- Low $R_{DS(ON)}$
- Low Gate Charge
- High Current Capability
- RoHS and Halogen-Free Compliant

Applications

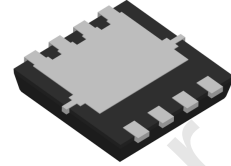
- DC/DC Converters in Computing
- Isolated DC/DC Converters in Telecom and Industrial

DFN 3x3_EP

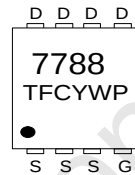
Top View



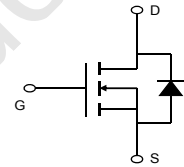
Bottom View



Top View



Equivalent Circuit



Y :year code W :week code

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
7788	7788	PDFN3x3-8	Ø330mm	12mm	4000 units

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	V_{DS}	30	V
Gate-Source Voltage	V_{GS}	± 12	V
Continuous Drain Current ^G	I_D	40	A
Pulsed Drain Current ^C	I_{DM}	150	A
Continuous Drain Current	I_{DSM}	20	A
		16	A
Avalanche Current ^C	I_{AS}, I_{AR}	35	A
Avalanche energy $L=0.1\text{mH}$ ^C	E_{AS}, E_{AR}	61	mJ
Power Dissipation ^B	P_D	36	W
Power Dissipation ^A	P_{DSM}	3.1	W
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	30	40	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A D}	$R_{\theta JA}$	60	75	$^\circ\text{C/W}$
Maximum Junction-to-Case	$R_{\theta JC}$	2.8	3.4	$^\circ\text{C/W}$

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =10mA, V _{GS} =0V	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V			0.5	uA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±12V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.2	1.6	2	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	150			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =20A		4.5	5.5	mΩ
		V _{GS} =4.5V, I _D =20A		6.5	7.5	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		115		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.4	0.7	V
I _S	Maximum Body-Diode Continuous Current ^G				40	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz	2730	3415	4100	pF
C _{oss}	Output Capacitance		240	340	440	pF
C _{rss}	Reverse Transfer Capacitance		140	232	325	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	0.6	1.2	1.8	Ω
SWITCHING PARAMETERS						
Q _g (4.5V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =20A	19	24	29	nC
Q _{gs}	Gate Source Charge			6.6		nC
Q _{gd}	Gate Drain Charge			10		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω		9		ns
t _r	Turn-On Rise Time			4.5		ns
t _{D(off)}	Turn-Off DelayTime			47		ns
t _f	Turn-Off Fall Time			5.5		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, dI/dt=500A/μs	8	10	12	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, dI/dt=500A/μs	12	15	18	nC

A. The value of R_{θJA} is measured with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The Power dissipation P_{DSM} is based on R_{θJA} t ≤ 10s value and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design, and the maximum temperature of 150°C may be used if the PCB allows it.

B. The power dissipation P_D is based on T_{J(MAX)}=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150°C. Ratings are based on low frequency and duty cycles to keep initial T_J=25°C.

D. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_{J(MAX)}=150°C. The SOA curve provides a single pulse rating.

G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

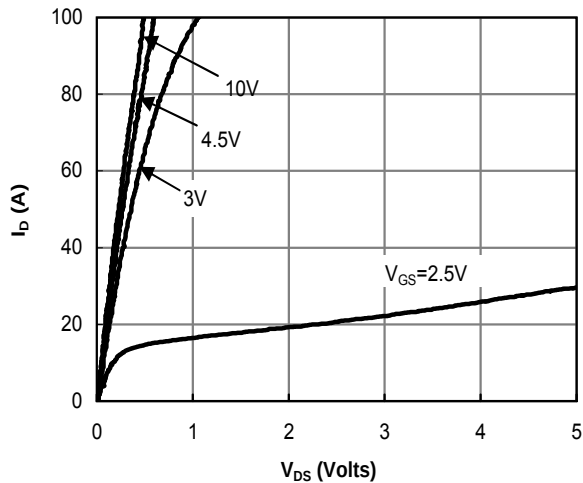


Fig 1: On-Region Characteristics (Note E)

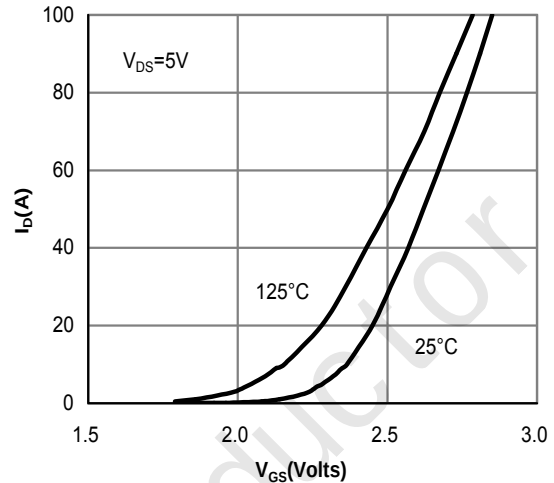


Figure 2: Transfer Characteristics (Note E)

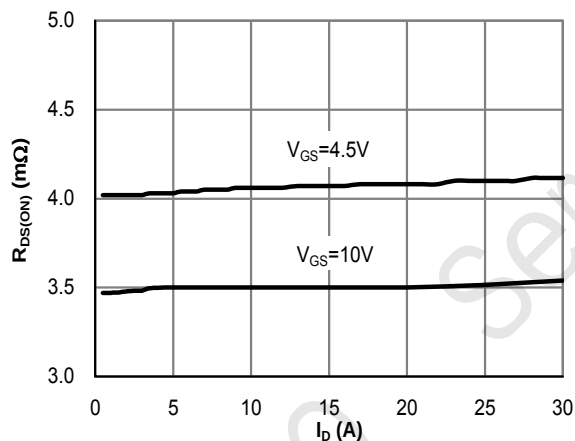


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

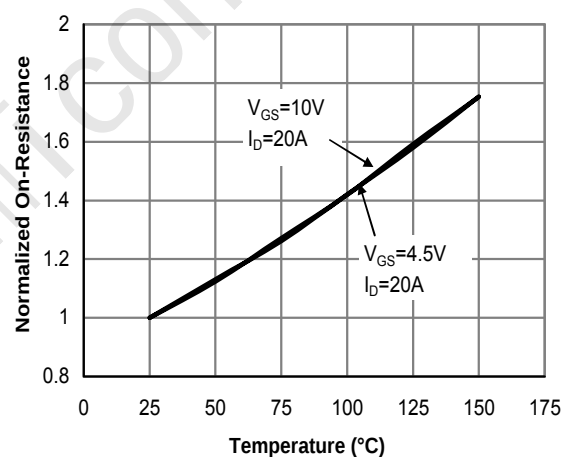


Figure 4: On-Resistance vs. Junction Temperature (Note E)

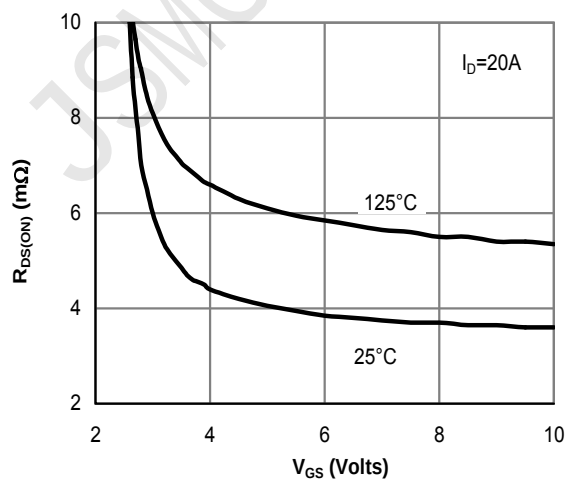


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

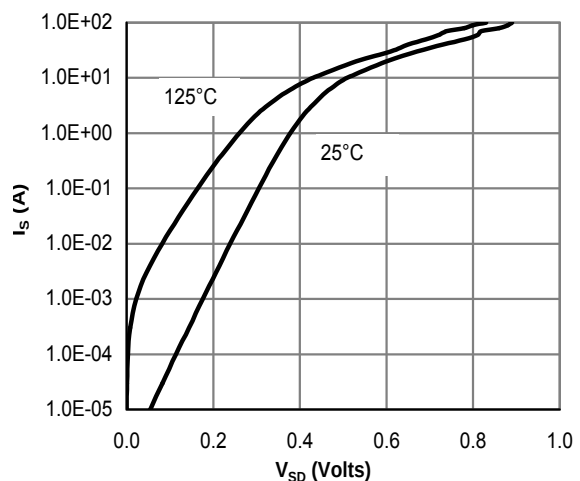
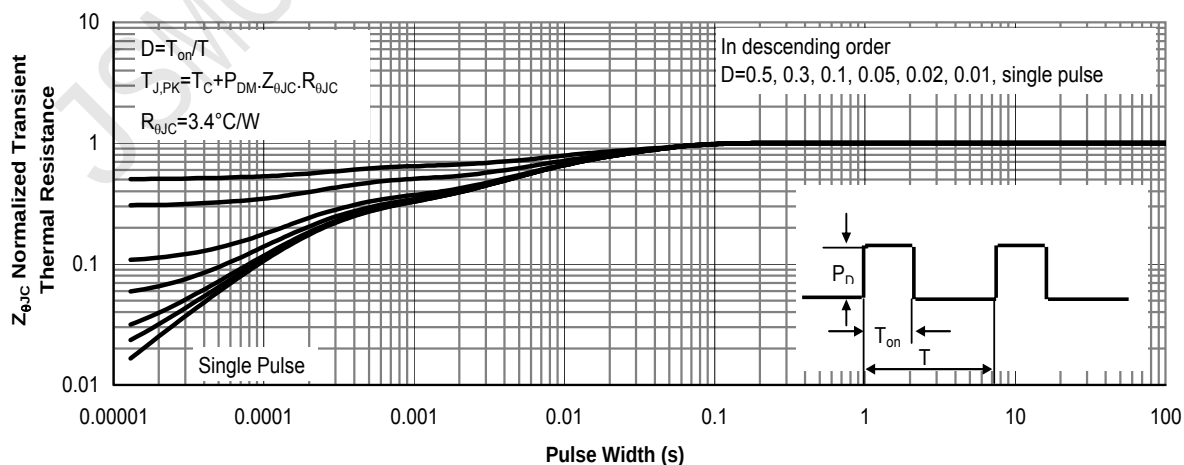
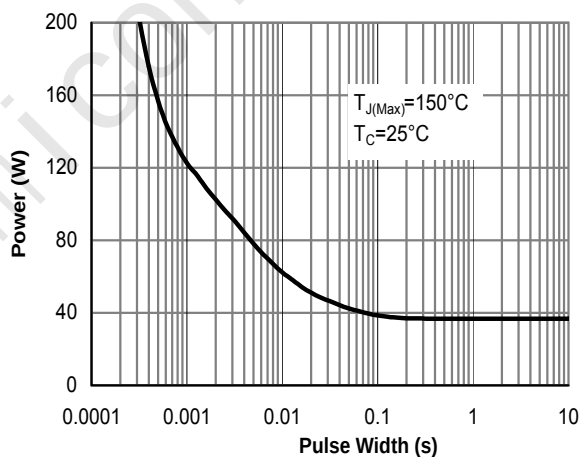
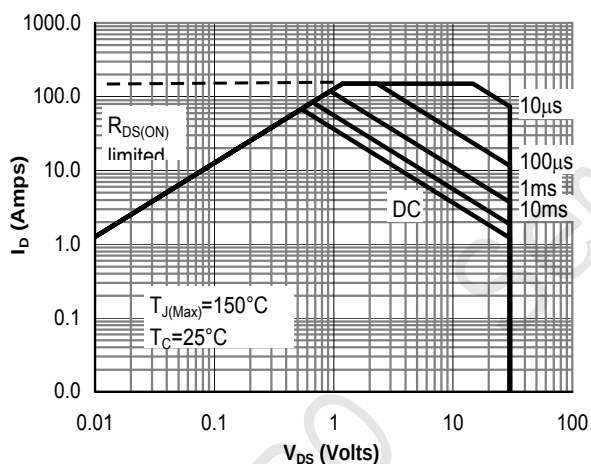
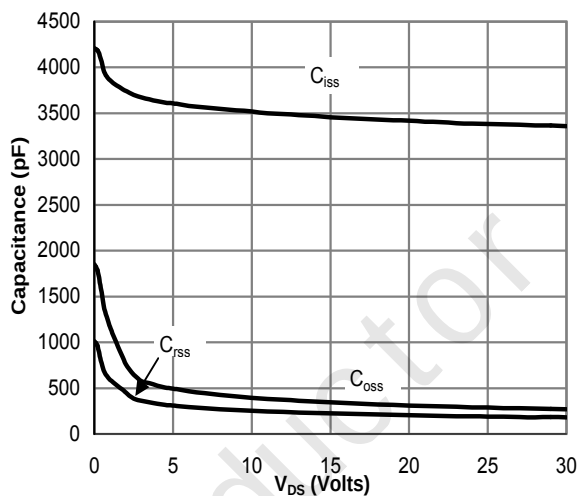
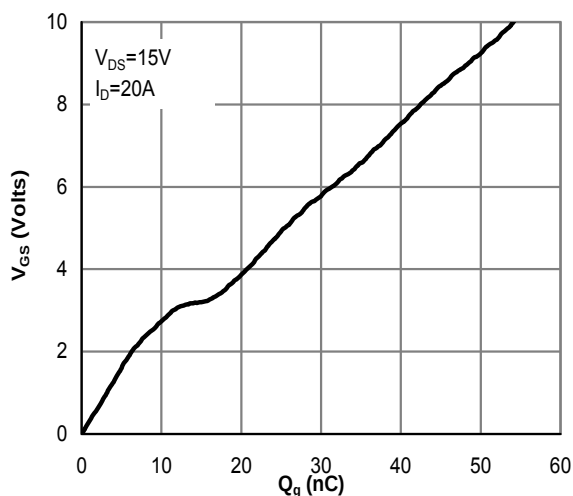


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

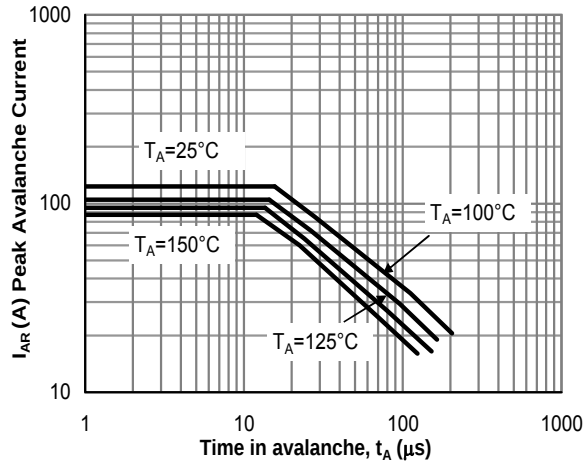


Figure 12: Single Pulse Avalanche capability (Note C)

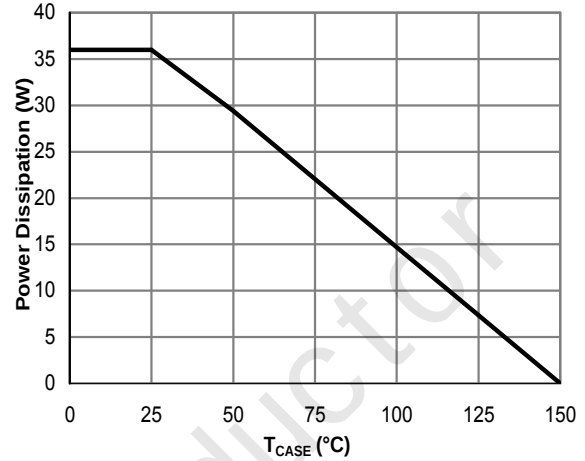


Figure 13: Power De-rating (Note F)

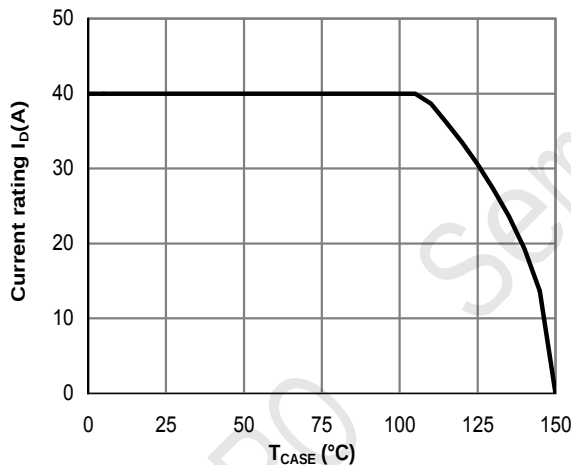


Figure 14: Current De-rating (Note F)

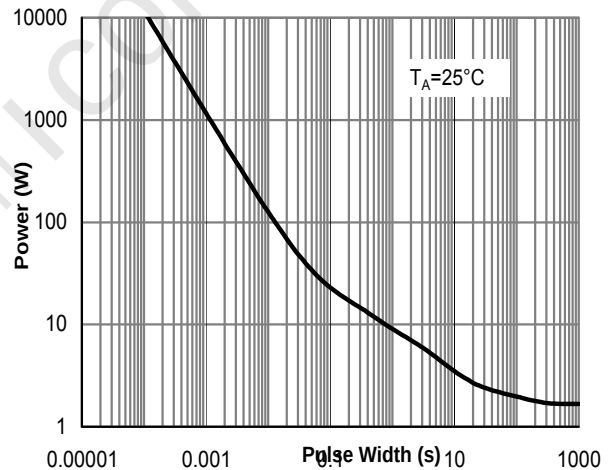


Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)

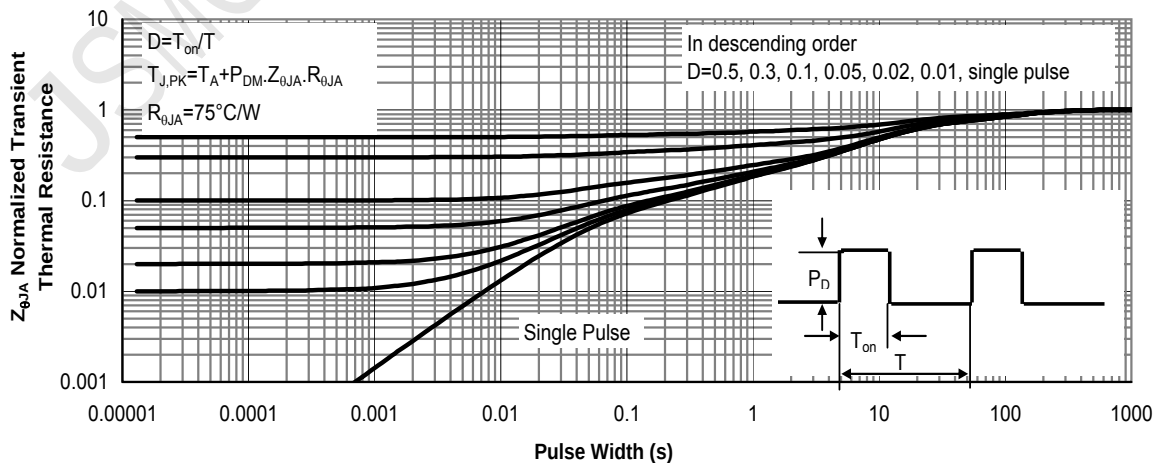


Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)

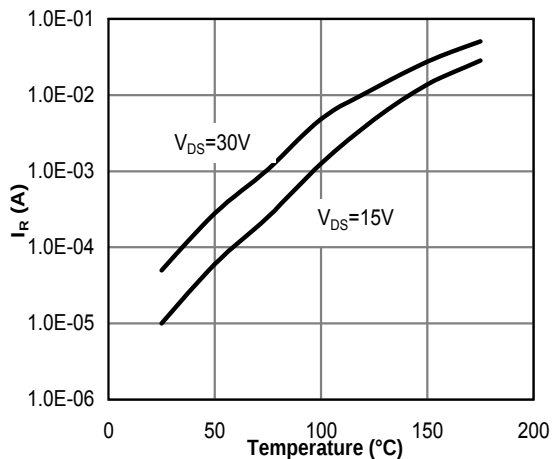
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS


Figure 17: Diode Reverse Leakage Current vs. Junction Temperature

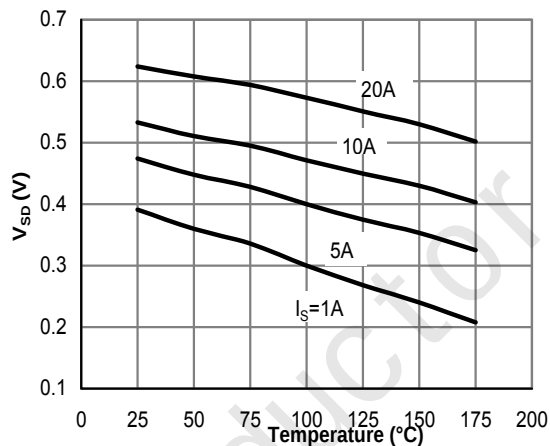


Figure 18: Diode Forward voltage vs. Junction Temperature

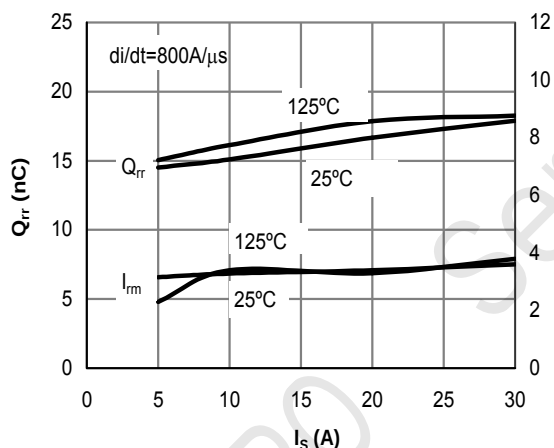


Figure 19: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

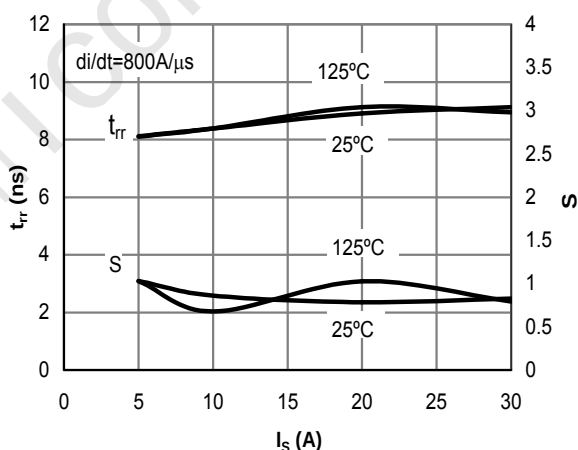


Figure 20: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current

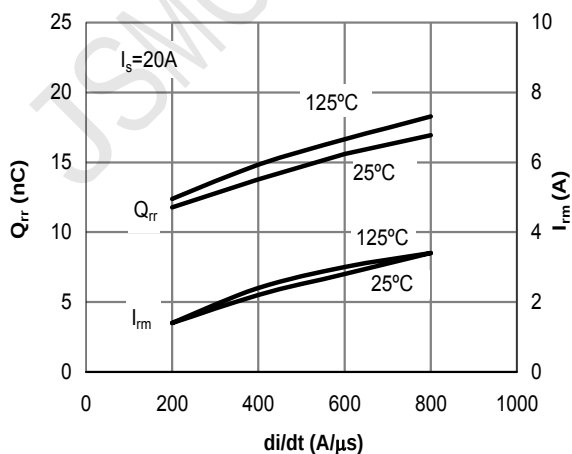


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. di/dt

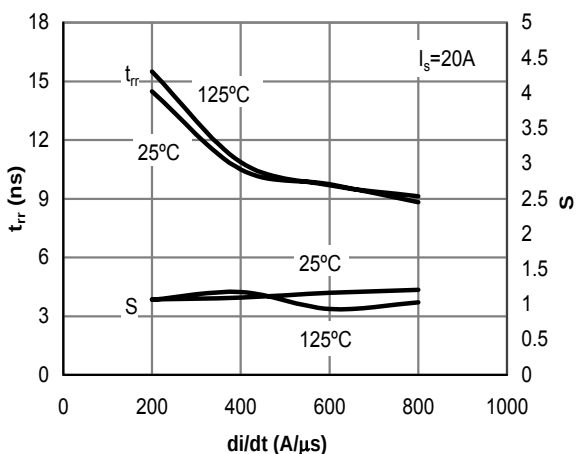
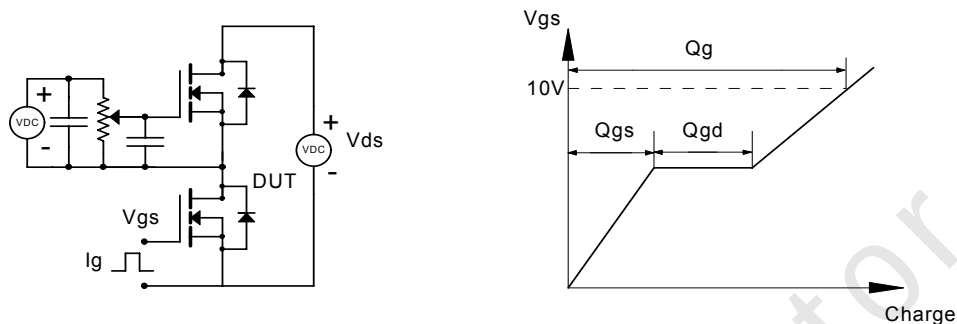
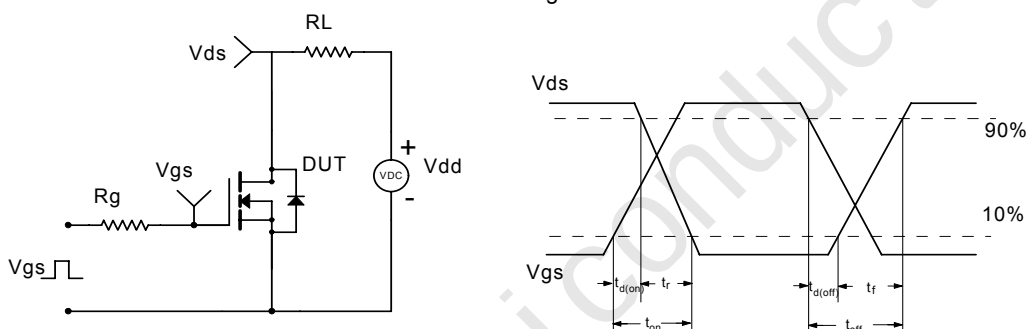


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. di/dt

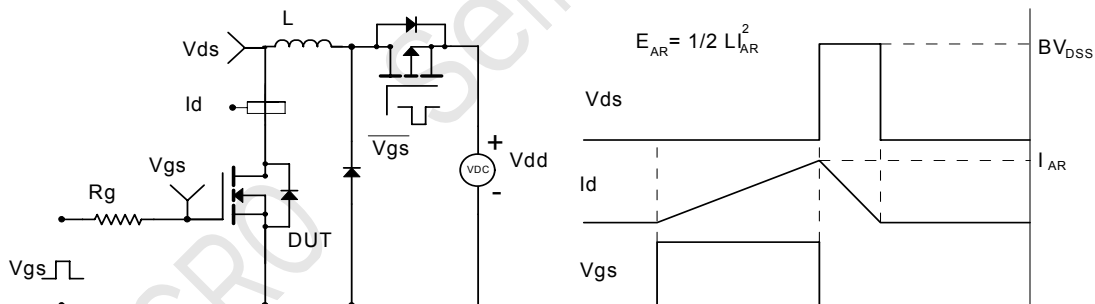
Gate Charge Test Circuit & Waveform



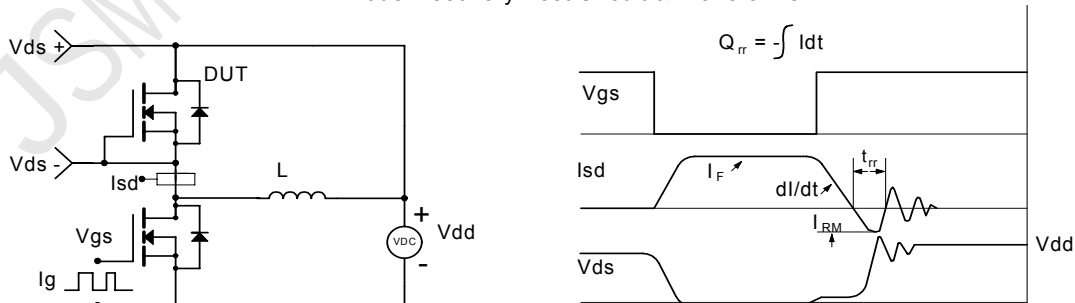
Resistive Switching Test Circuit & Waveforms



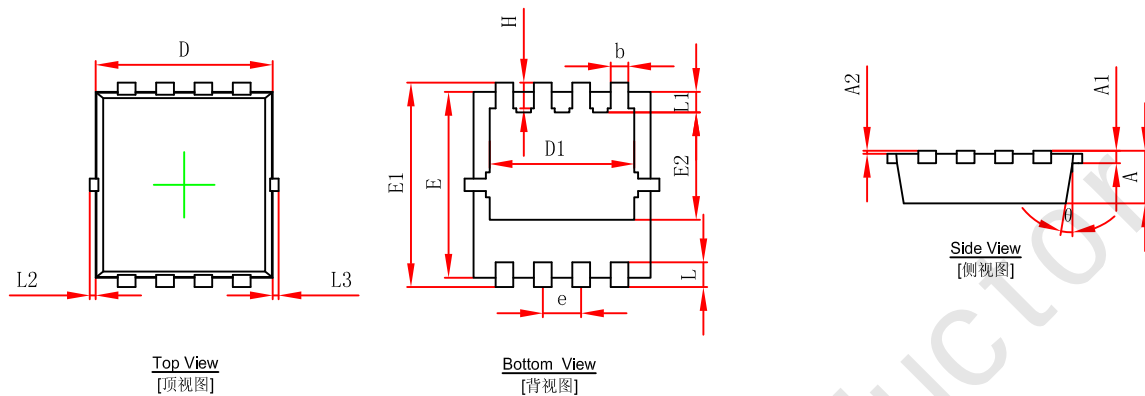
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

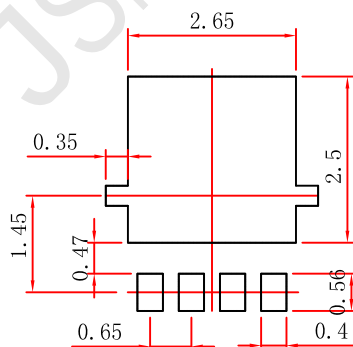


PDFN 3x3-8L Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.650	0.850	0.026	0.033
A1	0.152 REF.		0.006 REF.	
A2	0~0.05		0~0.002	
D	2.900	3.100	0.114	0.122
D1	2.300	2.600	0.091	0.102
E	2.900	3.100	0.114	0.122
E1	3.150	3.450	0.124	0.136
E2	1.535	1.935	0.060	0.076
b	0.200	0.400	0.008	0.016
e	0.550	0.750	0.022	0.030
L	0.300	0.500	0.012	0.020
L1	0.180	0.480	0.007	0.019
L2	0~0.100		0~0.004	
L3	0~0.100		0~0.004	
H	0.315	0.515	0.012	0.020
θ	9°	13°	9°	13°

PDFNWB3.3x3.3-8L Suggested Pad Layout



- Note:
1. Controlling dimension: in millimeters.
 2. General tolerance: $\pm 0.05\text{mm}$.
 3. The pad layout is for reference purposes only.