

## Description

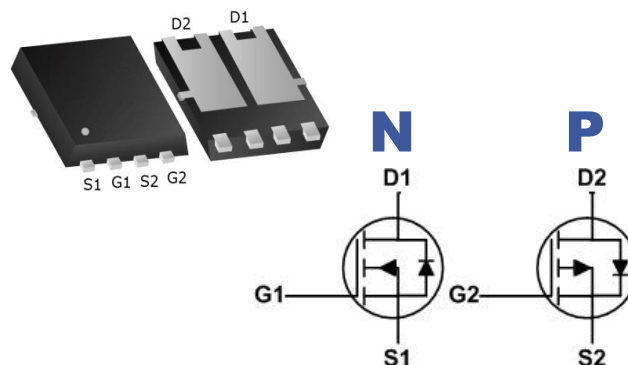
The LX33F20NP30 is the high performance complementary N-ch and P-ch MOSFETs with high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The LX33F20NP30 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

## Feature

- 100% EAS Guaranteed
- Green Device Available
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- Advanced high cell density Trench technology

## PDFN3333-8L Pin Configuration



## Product Summary

BVDSS	RDSON	ID
30V	9.5mΩ	20A
-30V	16mΩ	-20A

## Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Ch	P-Ch	
V <sub>DS</sub>	Drain-Source Voltage	30	-30	V
V <sub>GS</sub>	Gate-Source Voltage	±20	±20	V
I <sub>b</sub> @Ta=25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup>	20	-20	A
I <sub>b</sub> @Ta=100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup>	10	-10	A
I <sub>DM</sub>	Pulsed Drain Current <sup>2</sup>	72	-48	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	48	66	mJ
P <sub>D</sub> @T <sub>C</sub> =25°C	Total Power Dissipation <sup>4</sup>	15	15.3	W
T <sub>STG</sub>	Storage Temperature Range	-55 to 150	-55 to 150	°C
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150	-55 to 150	°C

## Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJA</sub>	Thermal Resistance Junction-Ambient <sup>1</sup>	---	48	°C/W
R <sub>θJC</sub>	Thermal Resistance Junction-Case <sup>1</sup>	---	5	°C/W



**N-Channel Electrical Characteristics T =25°C unless otherwise specified**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=30V, V_{GS}=0V,$	-	-	1.0	$\mu A$
$I_{GSS}$	Gate to Body Leakage Current	$V_{DS}=0V, V_{GS}=\pm 20V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.5	2.5	V
$R_{DS(on)}$	Static Drain-Source on-Resistance <small>note3</small>	$V_{GS}=10V, I_D=10A$	-	9.5	13	m $\Omega$
		$V_{GS}=4.5V, I_D=5A$	-	16	22.5	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=15V, V_{GS}=0V,$ $f=1.0MHz$	-	633	-	pF
$C_{oss}$	Output Capacitance		-	120	-	pF
$C_{rss}$	Reverse Transfer Capacitance		-	99	-	pF
$Q_g$	Total Gate Charge	$V_{DS}=15V, I_D=10A,$ $V_{GS}=10V$	-	15	-	nC
$Q_{gs}$	Gate-Source Charge		-	4.7	-	nC
$Q_{gd}$	Gate-Drain(“Miller”) Charge		-	3.6	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DS}=30V, I_D=18A,$ $R_{GEN}=3\Omega, V_{GS}=10V$	-	5	-	ns
$t_r$	Turn-on Rise Time		-	8	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	21	-	ns
$t_f$	Turn-off Fall Time		-	7	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_s$	Maximum Continuous Drain to Source Diode Forward Current		-	-	20	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current		-	-	72	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS}=0V, I_s=18A$	-	-	1.2	V
$t_{rr}$	Body Diode Reverse Recovery Time	$I_f=18A, di/dt=100A/\mu s$	-	7	-	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	5.9	-	nC

Note :

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
2. The data tested by pulsed , pulse width  $\cong 300\mu s$  , duty cycle  $\cong 2\%$
3. The EAS data shows Max. rating . The test condition is  $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=20A$
4. The power dissipation is limited by 150°C junction temperature
5. The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.



**P-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise specified)**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA	-30	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -30V, V <sub>GS</sub> =0V	-	-	-1	μA
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V	-	-	±100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1.0	-1.6	-2.5	V
R <sub>DS(on)</sub>	Static Drain-Source on-Resistance <small>note3</small>	V <sub>GS</sub> = -10V, I <sub>D</sub> = -10A	-	16	25	mΩ
		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -5A	-	29	40	
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = -15V, V <sub>GS</sub> =0V, f=1.0MHz	-	1240	-	pF
C <sub>oss</sub>	Output Capacitance		-	151	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	138	-	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = -15V, I <sub>D</sub> = -6A, V <sub>GS</sub> = -10V	-	24	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	3.7	-	nC
Q <sub>gd</sub>	Gate-Drain("Miller") Charge		-	4.8	-	nC
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> = -15V, I <sub>D</sub> = -10A, V <sub>GS</sub> = -10V, R <sub>GEN</sub> =3Ω	-	11	-	ns
t <sub>r</sub>	Turn-on Rise Time		-	5.5	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time		-	3.5	-	ns
t <sub>f</sub>	Turn-off Fall Time		-	4.6	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	-20	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-48	A
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> = -10A	-	-	-1.2	V

- Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature  
 2. EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=-15V, V<sub>G</sub>=-10V, R<sub>G</sub>=25Ω, L=0.1mH, I<sub>AS</sub>= -27A  
 3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

Typical Performance Characteristics-N

Figure 1: Output Characteristics

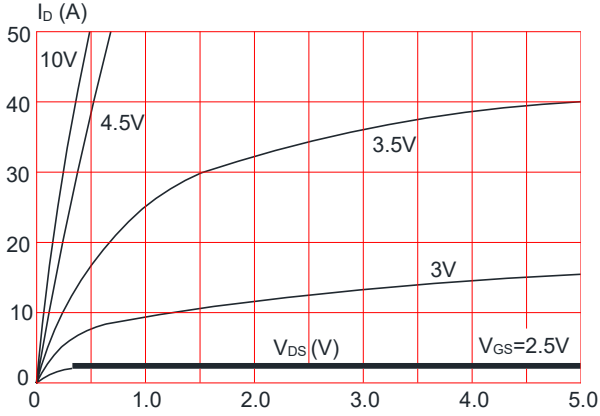


Figure 2: Typical Transfer Characteristics

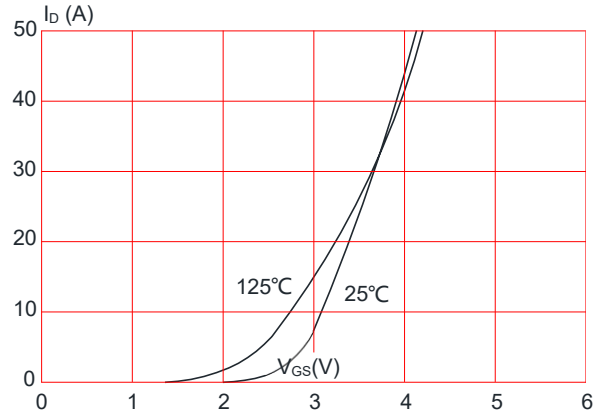


Figure 3: On-resistance vs. Drain Current

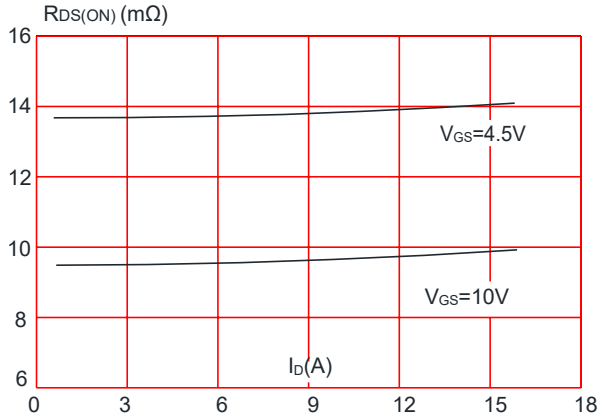


Figure 4: Body Diode Characteristics

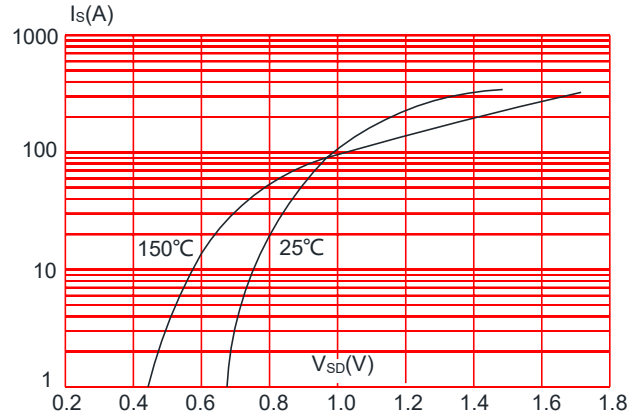


Figure 5: Gate Charge Characteristics

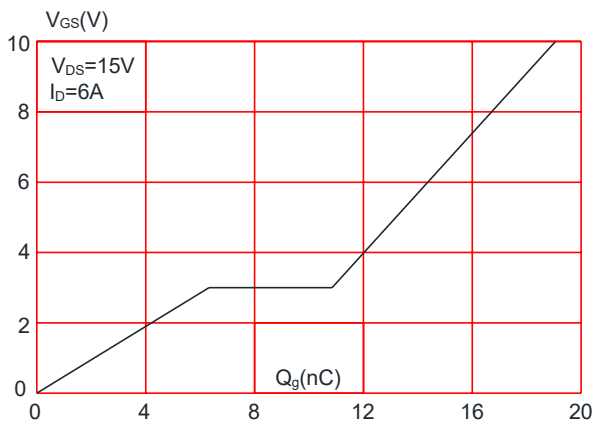
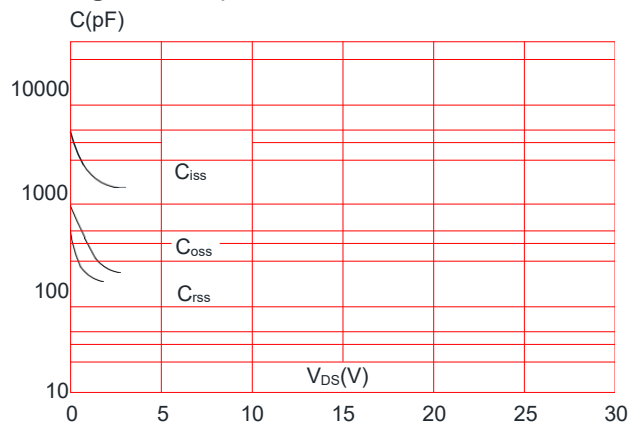
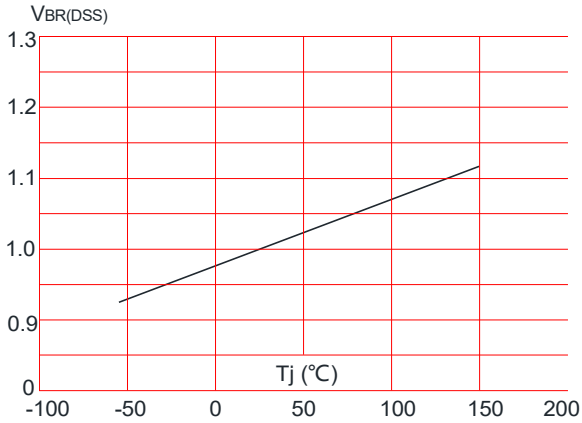


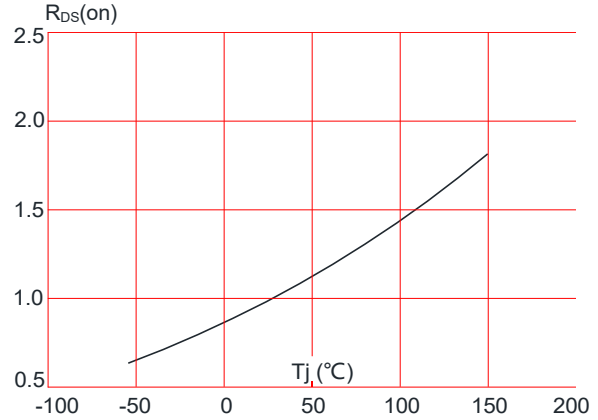
Figure 6: Capacitance Characteristics



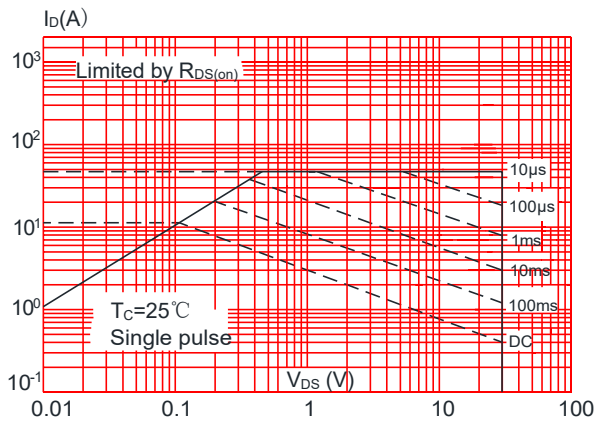
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



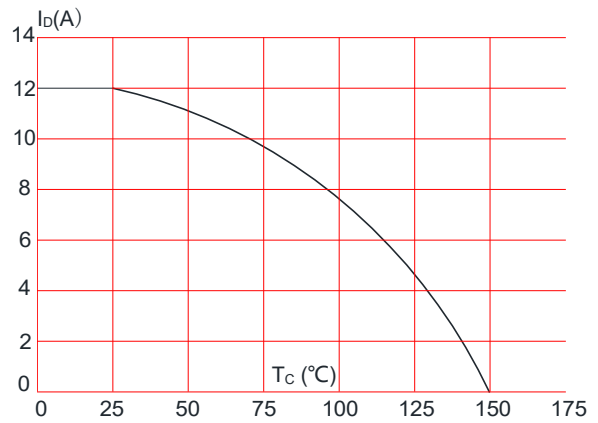
**Figure 8:** Normalized on Resistance vs. Junction Temperature



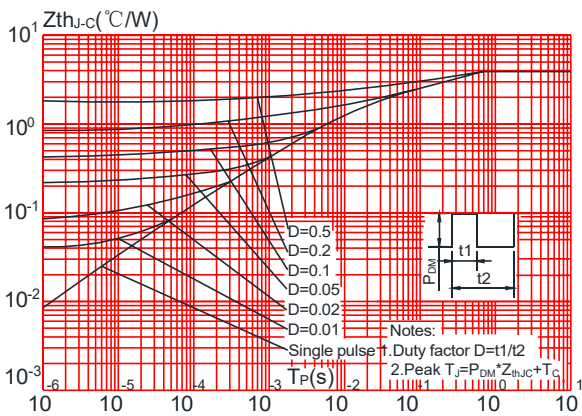
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case



Test Circuit-N

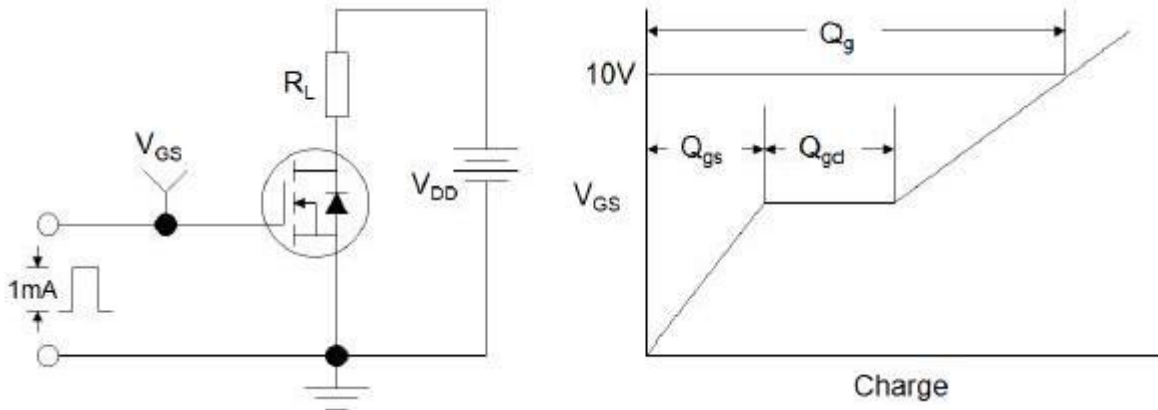


Figure1:Gate Charge Test Circuit & Waveform

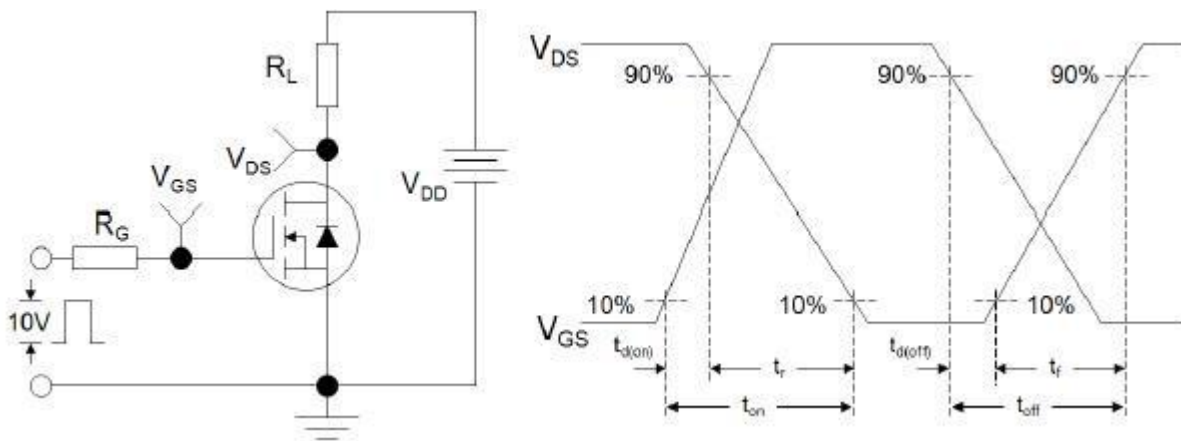


Figure 2: Resistive Switching Test Circuit & Waveforms

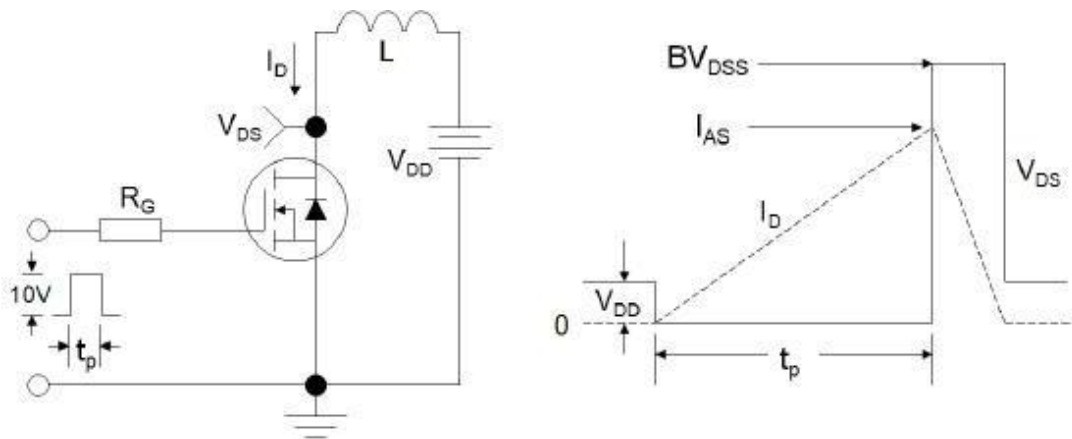


Figure 3:Unclamped Inductive Switching Test Circuit & Wavefor

Typical Performance Characteristics-P

Figure 1: Output Characteristics

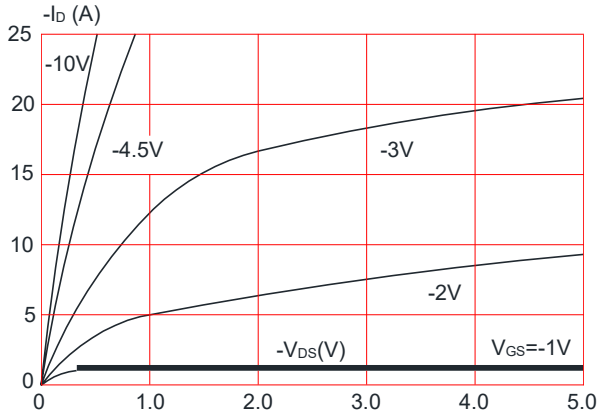


Figure 2: Typical Transfer Characteristics

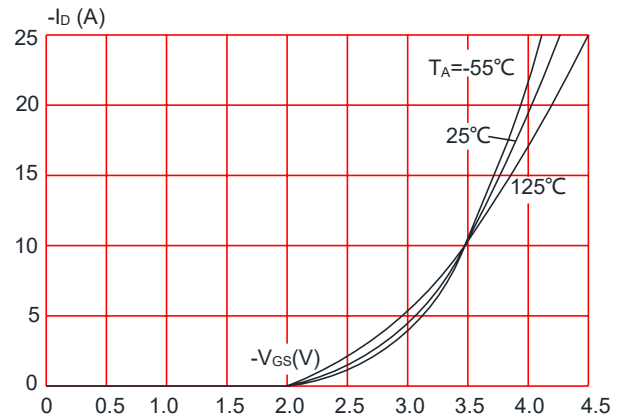


Figure 3: On-resistance vs. Drain Current

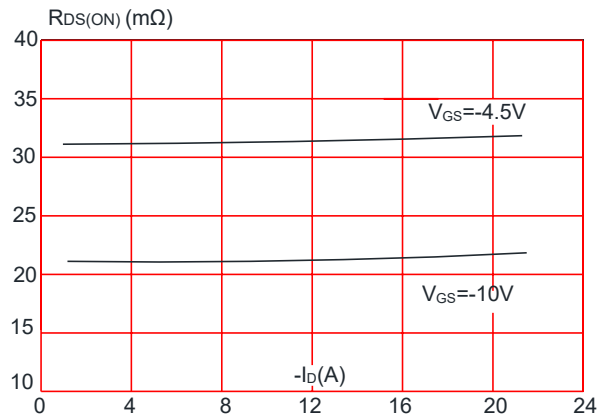


Figure 4: Body Diode Characteristics

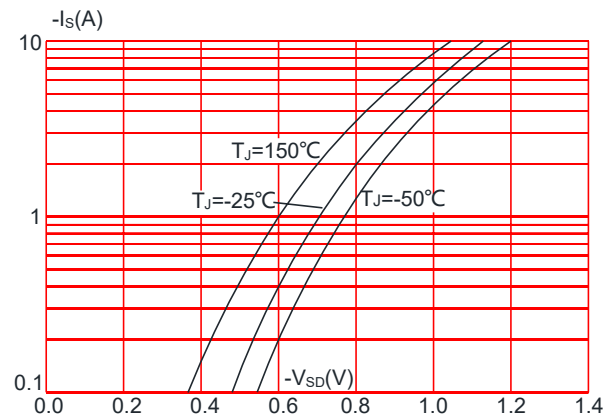


Figure 5: Gate Charge Characteristics

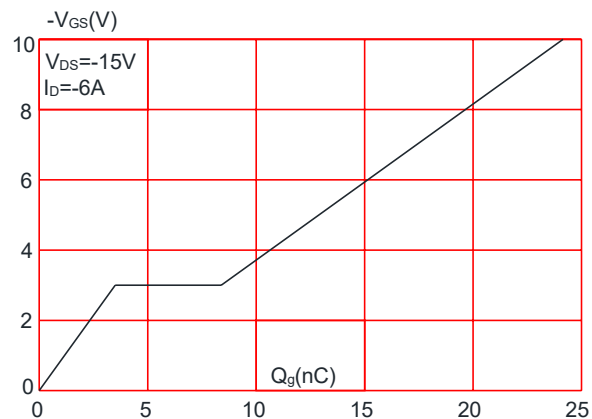
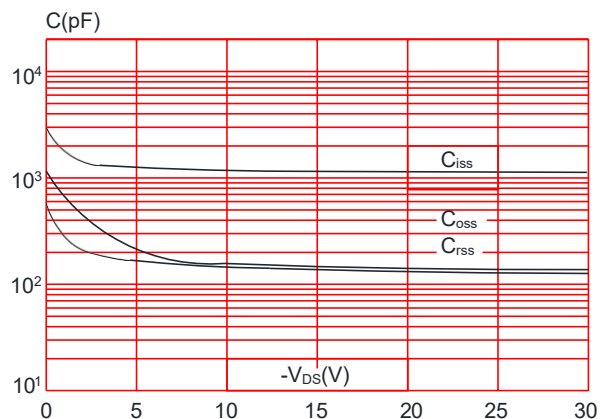
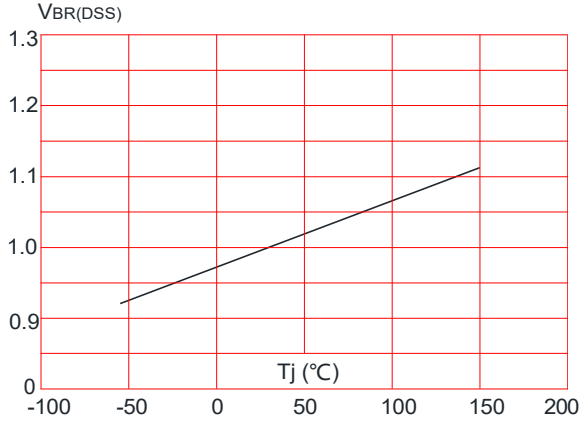


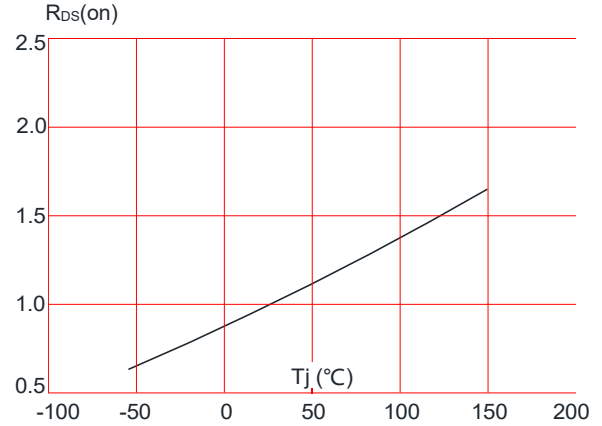
Figure 6: Capacitance Characteristics



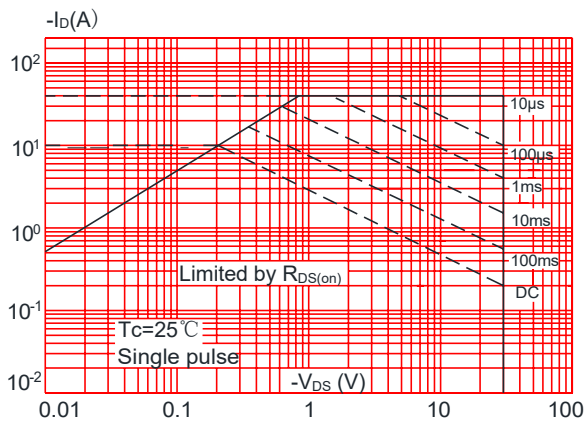
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



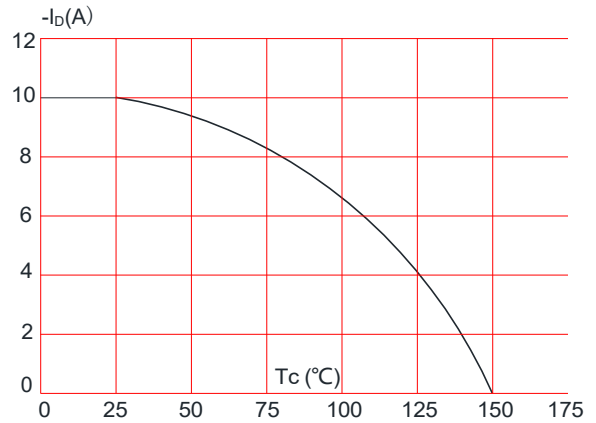
**Figure 8:** Normalized on Resistance vs. Junction Temperature



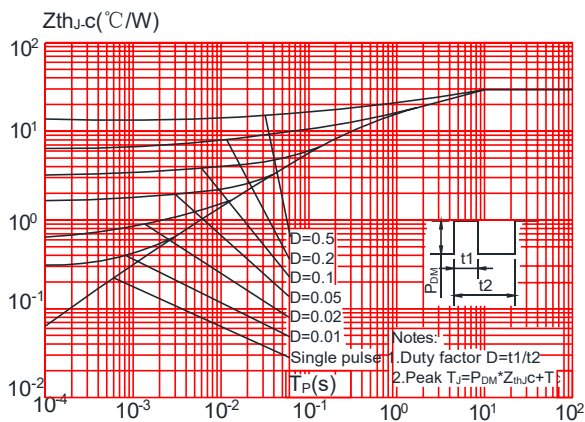
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



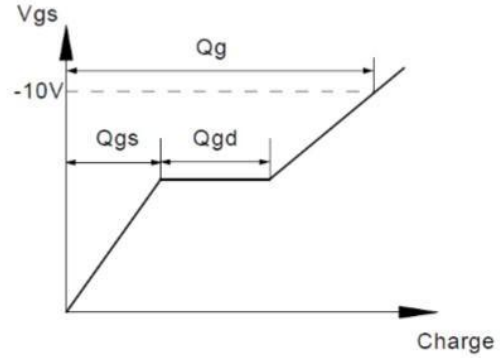
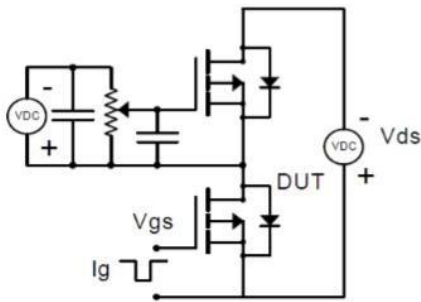
**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case



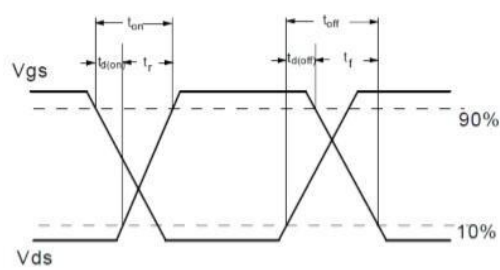
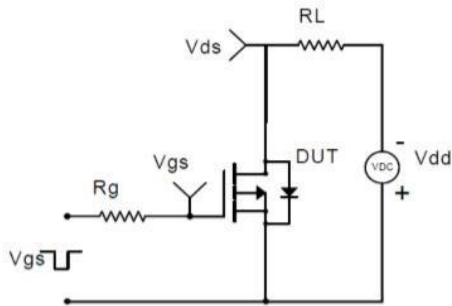


Test Circuit-P

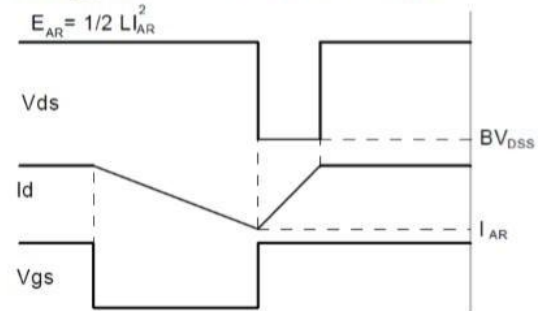
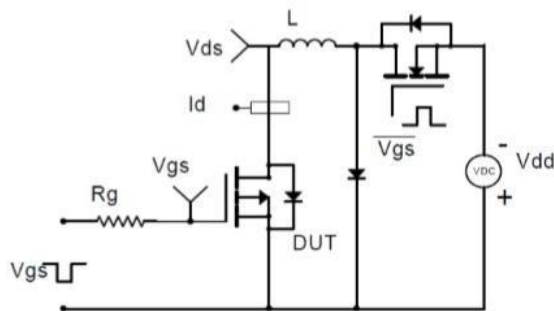
Gate Charge Test Circuit & Waveform



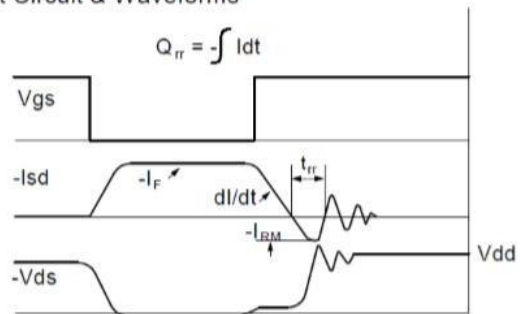
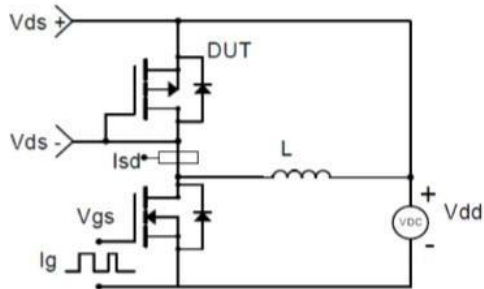
Resistive Switching Test Circuit & Waveforms



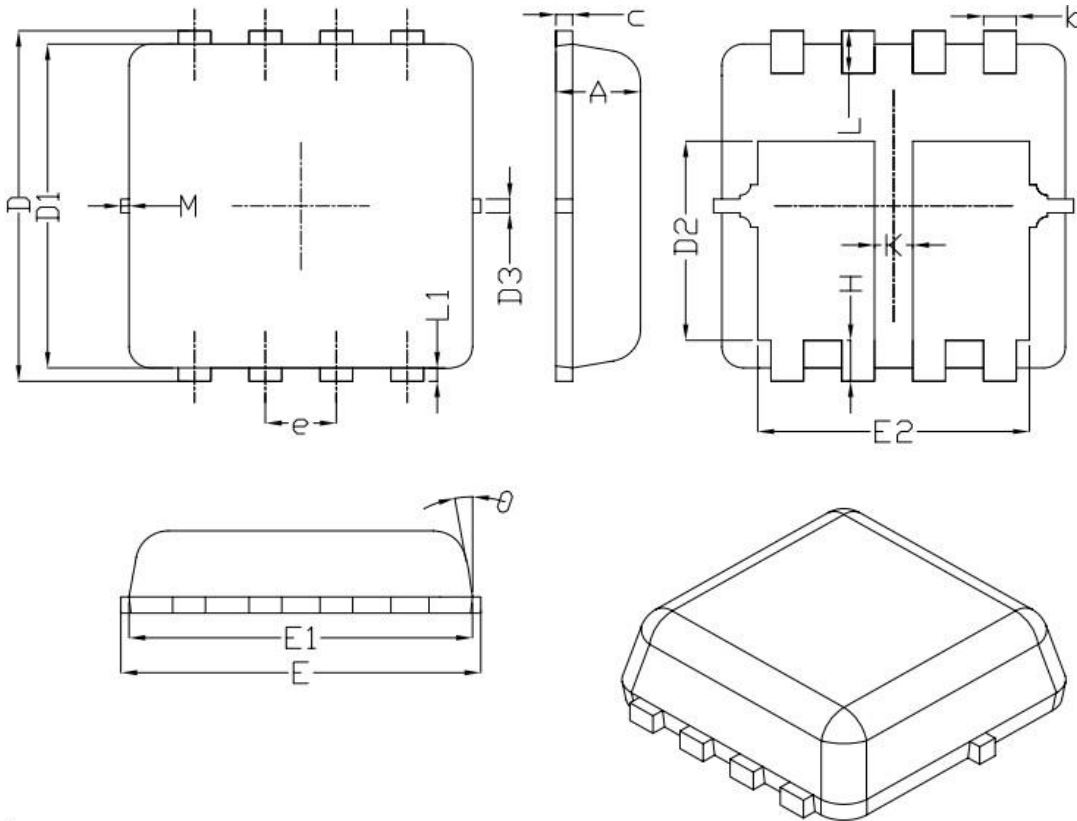
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



PDFN3333-8L Package Outline Data



Symbol	Dimensions (unit: mm)		
	Min	Typ	Max
A	0.70	0.75	0.80
b	0.25	0.30	0.35
c	0.10	0.15	0.25
D	3.25	3.35	3.45
D1	3.00	3.10	3.20
D2	1.78	1.88	1.98
D3	--	0.13	--
E	3.20	3.30	3.40
E1	3.00	3.15	3.20
E2	2.39	2.49	2.59
e	0.65 BSC		
H	0.30	0.39	0.50
L	0.30	0.40	0.50
L1	--	0.13	--
K	0.30	--	--
θ	--	10°	12°
M	*	*	0.15
* Not Specified			

- Notes:
1. Refer to JEDEC MO-240 variation CA.
  2. Dimensions "D1" and "E1" do NOT include mold flash protrusions or gate burrs.
  3. Dimensions "D1" and "E1" include interterminal flash or protrusion.