

N-Ch and P-Ch Fast Switching MOSFETs

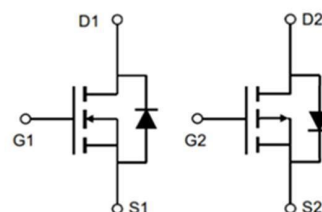
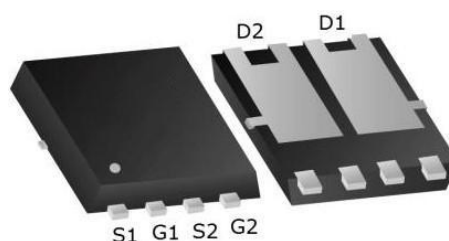
- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology


Product Summary

BVDSS	RDS(on)	ID
30V	4.5mΩ	60A
-30V	7.5mΩ	-60A

Description

The XR60G30F is the high performance complementary N-ch and P-ch MOSFETs with high cell density, which provide excellent RDS(on) and gate charge for most of the synchronous buck converter applications. The XR60G30F meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

PDFN5060-8L Pin Configuration

Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Ch	P-Ch	
V _{DS}	Drain-Source Voltage	30	-30	V
V _{GS}	Gate-Source Voltage	±20	±20	V
I _D @Ta=25°C	Continuous Drain Current, V _{GS} @ 10V ¹	60	-60	A
I _D @Ta=100°C	Continuous Drain Current, V _{GS} @ 10V ¹	35	-32	A
I _{DM}	Pulsed Drain Current ²	220	-200	A
EAS	Single Pulse Avalanche Energy ³	56	80	mJ
P _D @Tc=25°C	Total Power Dissipation ⁴	42	43.1	W
T _{STG}	Storage Temperature Range	-55 to 150	-55 to 150	°C
T _J	Operating Junction Temperature Range	-55 to 150	-55 to 150	°C

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
R _{θJA}	Thermal Resistance Junction-Ambient ¹	---	50	°C/W
R _{θJC}	Thermal Resistance Junction-Case ¹	---	4	°C/W

N-Ch and P-Ch Fast Switching MOSFETs
Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=250\mu A$	30	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1\text{mA}$	---	---	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V$, $I_D=1$	---	4.5	6.0	$\text{m}\Omega$
		$V_{GS}=4.5V$, $I_D=1A$	---	5.6	7.2	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=250\mu A$	1.0	1.5	2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	---	---	$\text{mV}/^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=30V$, $V_{GS}=0V$, $T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=30V$, $V_{GS}=0V$, $T_J=55^\circ\text{C}$	---	---	---	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V$, $V_{DS}=0V$	---	---	± 100	nA
R_g	Gate Resistance	$V_{DS}=0V$, $V_{GS}=0V$, $f=1\text{MHz}$	---	---	---	Ω
Q_g	Total Gate Charge (4.5V)	$V_{DS}=15V$, $V_{GS}=10V$, $I_D=30A$	---	33.7	---	nC
Q_{gs}	Gate-Source Charge		---	8.5	---	
Q_{gd}	Gate-Drain Charge		---	7.5	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=15V$, $V_{GS}=10V$, $R_G=3\Omega$ $I_D=30A$	---	7.5	---	ns
T_r	Rise Time		---	14.5	---	
$T_{d(off)}$	Turn-Off Delay Time		---	35.2	---	
T_f	Fall Time		---	9.6	---	
C_{iss}	Input Capacitance	$V_{DS}=15V$, $V_{GS}=0V$, $f=1\text{MHz}$	---	1614	---	pF
C_{oss}	Output Capacitance		---	245	---	
C_{rss}	Reverse Transfer Capacitance		---	215	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V$, Force Current	---	---	60	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V$, $I_S=22A$, $T_J=25^\circ\text{C}$	---	---	1.2	V

Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition: $T_J=25^\circ\text{C}$, $V_{DD}=15V$, $V_G=10V$, $R_G=25\Omega$, $L=0.5\text{mH}$, $I_{AS}=9A$

3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 0.5\%$

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Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =-250uA	-30	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV _{DSS} Temperature Coefficient	Reference to 25°C, I _D =-1mA	---	---	---	V/°C
R _{DS(ON)}	Static Drain-Source On-Resistance ²	V _{GS} =-10V, I _D =-1A	---	7.5	9.7	mΩ
		V _{GS} =-4.5V, I _D =-1A	---	10.5	13.6	
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =-250uA	-1	-1.5	-2.5	V
$\Delta V_{GS(th)}$	V _{GS(th)} Temperature Coefficient		---	---	---	mV/°C
I _{DSS}	Drain-Source Leakage Current	V _{DS} =-30V, V _{GS} =0V, T _J =25°C	---	---	-1	uA
		V _{DS} =-30V, V _{GS} =0V, T _J =100°C	---	---	---	
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±20V, V _{DS} =0V	---	---	±100	nA
g _{fs}	Forward Transconductance	V _{DS} =-10V, I _D =-15A	---	44	---	S
R _g	Gate Resistance	V _{DS} =0V, V _{GS} =0V, f=1MHz	---	10.5	---	Ω
Q _g	Total Gate Charge	V _{DS} =-15V, V _{GS} =-10V, I _D =-15A	---	30	---	nC
Q _{gs}	Gate-Source Charge		---	5	---	
Q _{gd}	Gate-Drain Charge		---	7.5	---	
T _{d(on)}	Turn-On Delay Time	V _{GS} =-10V, V _{DS} =-15V, R _L =1.5Ω, R _{GEN} =3Ω	---	14.1	---	ns
T _r	Rise Time		---	20	---	
T _{d(off)}	Turn-Off Delay Time		---	94	---	
T _f	Fall Time		---	65	---	
C _{iss}	Input Capacitance	V _{DS} =-15V, V _{GS} =0V, f=1MHz	---	2503	---	pF
C _{oss}	Output Capacitance		---	315	---	
C _{rss}	Reverse Transfer Capacitance		---	279	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I _S	Continuous Source Current ^{1,5}	V _G =V _D =0V, Force Current	---	---	-60	A
V _{SD}	Diode Forward Voltage ²	V _{GS} =0V, I _S =1A, T _J =25°C	---	---	-1.2	V

Note :

1. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
3. The EAS data shows Max. rating. The test condition is T_J = 25°C, V_{DD}=-24V, V_{GS}=-10V, L=0.1mH.
4. The power dissipation is limited by 150°C junction temperature
5. The data is theoretically the same as I_D and I_{DM}, in real applications, should be limited by total power dissipation.

Typical Performance Characteristics-N

Figure1: Output Characteristics

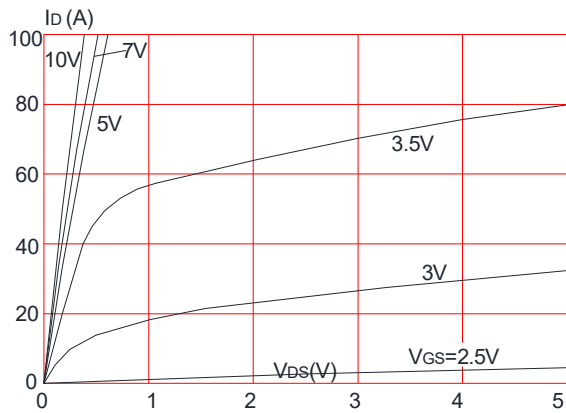


Figure 2: Typical Transfer Characteristics

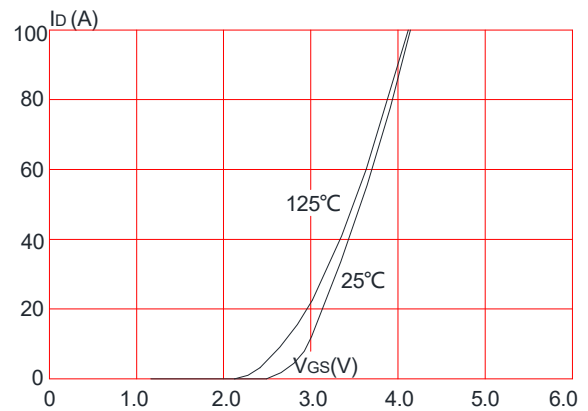


Figure 3: On-resistance vs. Drain Current

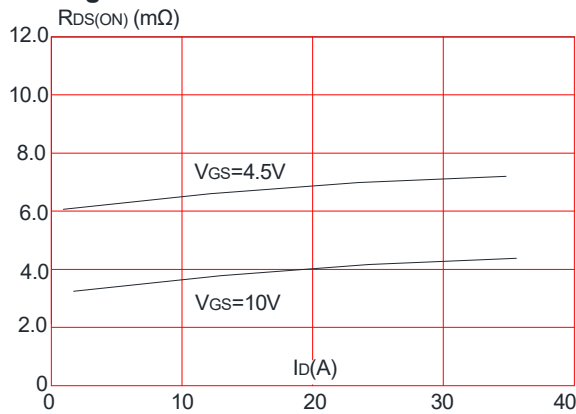


Figure 4: Body Diode Characteristics

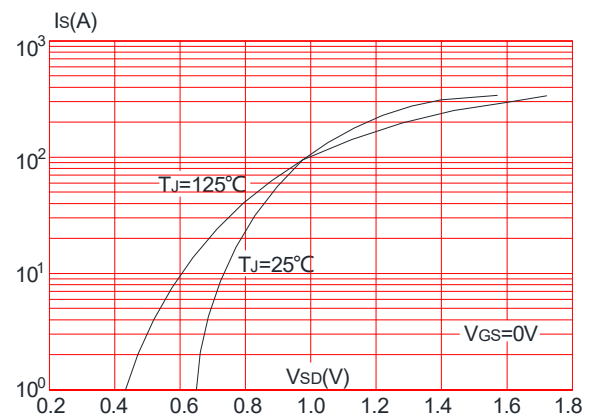


Figure 5: Gate Charge Characteristics

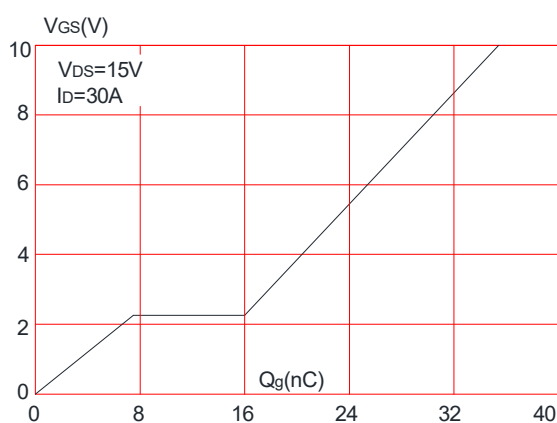
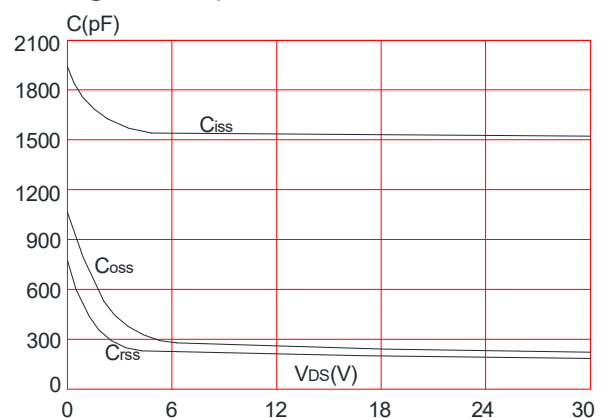


Figure 6: Capacitance Characteristics



N-Ch and P-Ch Fast Switching MOSFETs

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

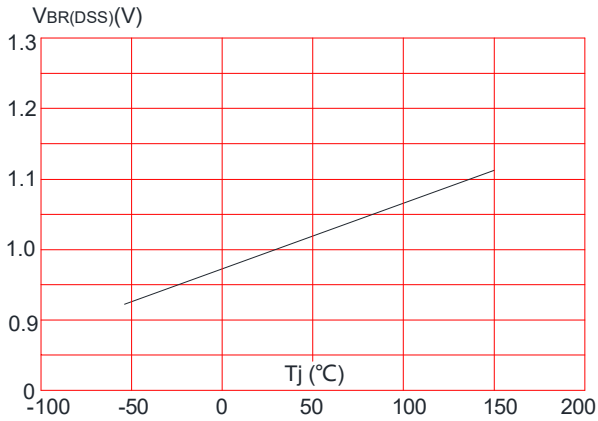


Figure 8: Normalized on Resistance vs. Junction Temperature

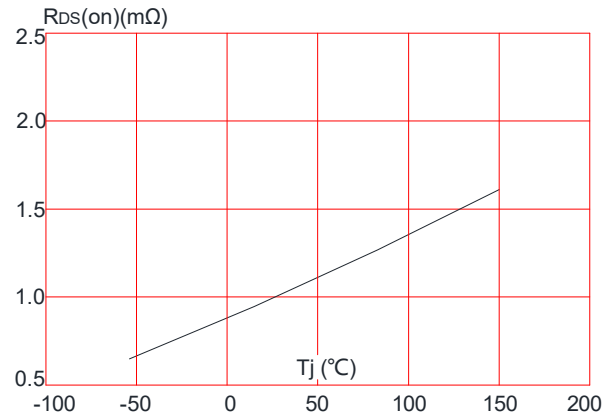


Figure 9: Maximum Safe Operating Area

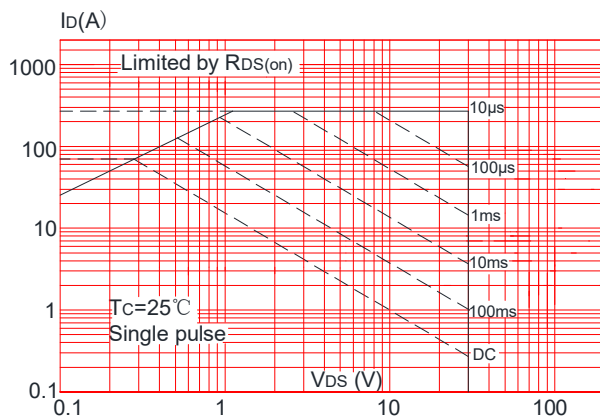


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

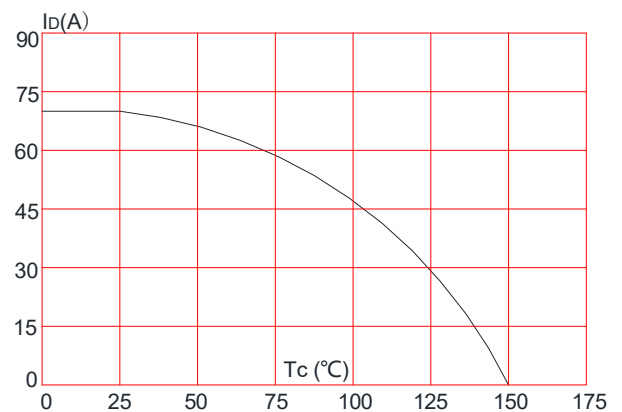
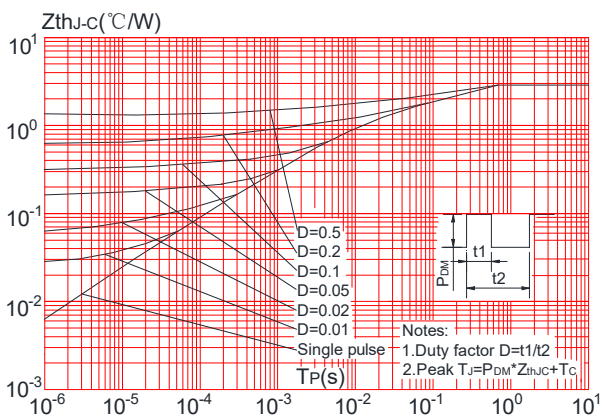


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



Test Circuit-N

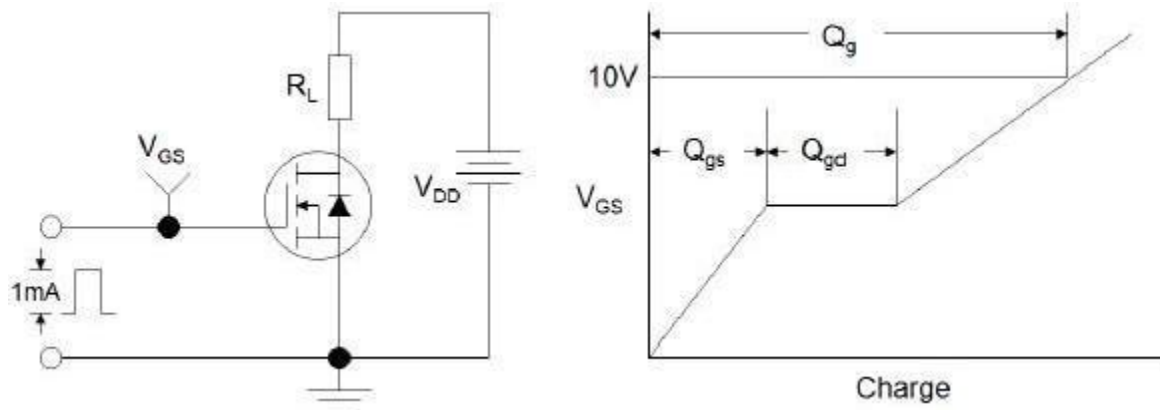


Figure1:Gate Charge Test Circuit & Waveform

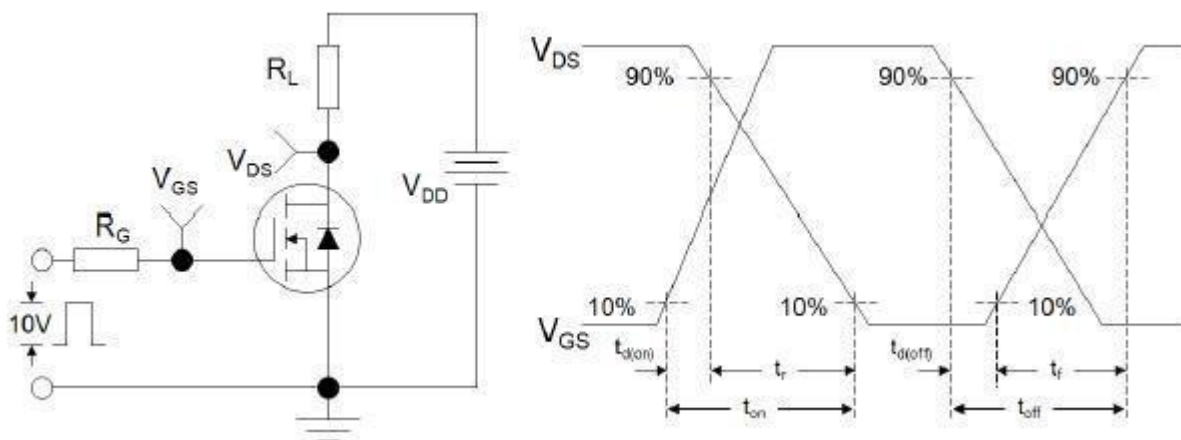


Figure 2: Resistive Switching Test Circuit & Waveforms

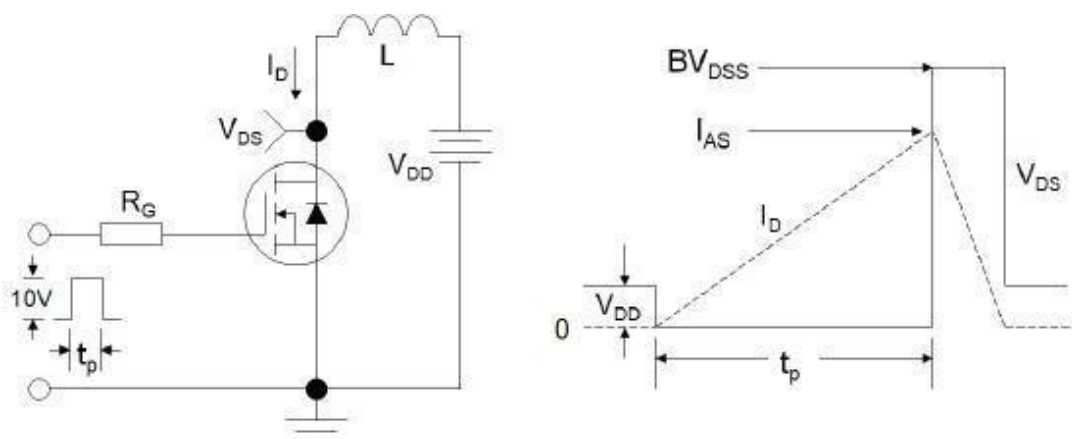


Figure 3:Unclamped Inductive Switching Test Circuit & Wavefor

Typical Characteristics-P

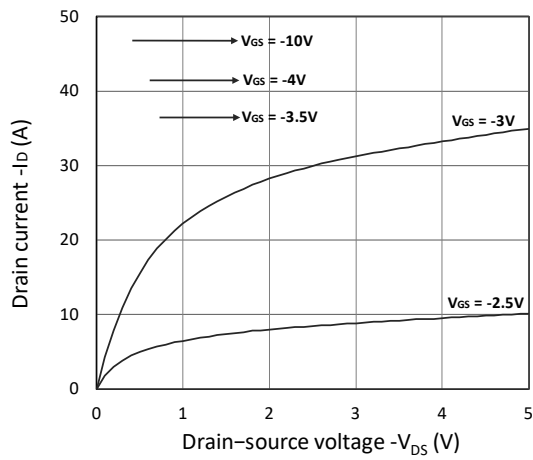


Figure 1. Output Characteristics

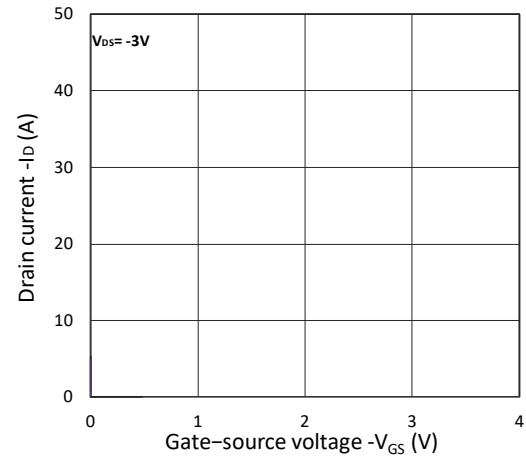


Figure 2. Transfer Characteristics

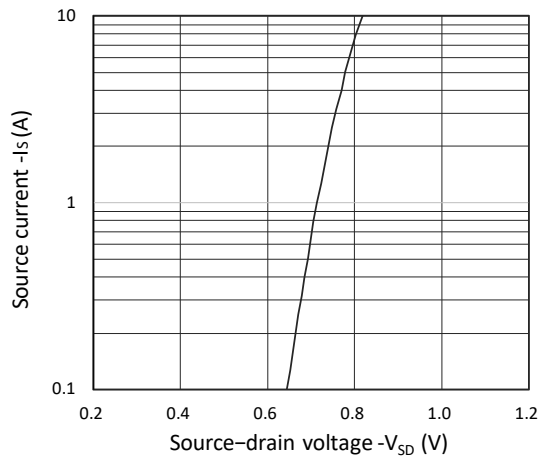


Figure 3. Forward Characteristics of Reverse

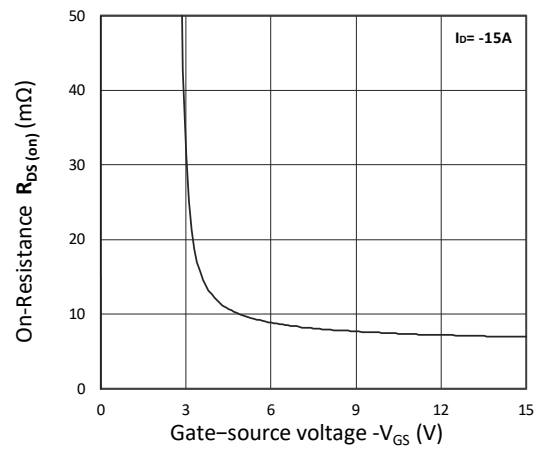


Figure 4. $R_{DS(on)}$ vs. V_{GS}

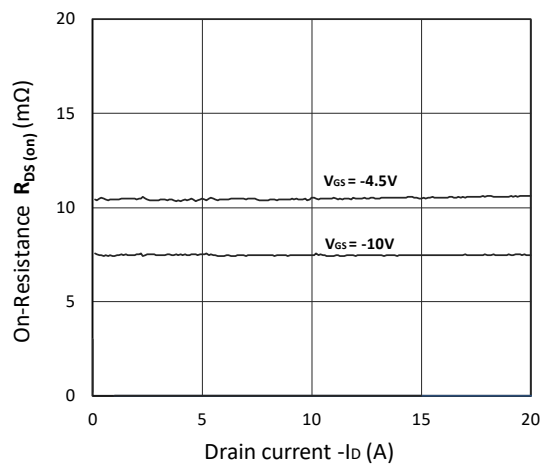


Figure 5. $R_{DS(on)}$ vs. I_D

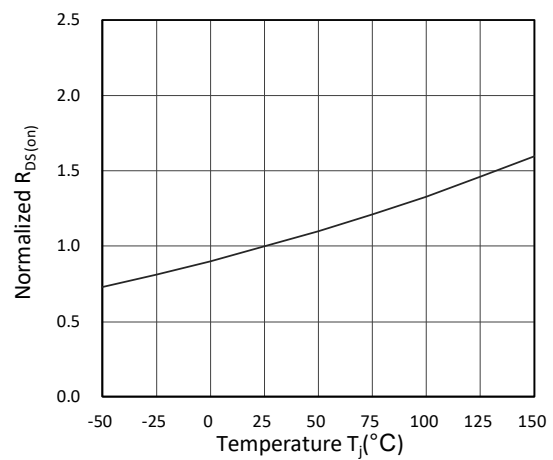


Figure 6. Normalized $R_{DS(on)}$ vs. Temperature

N-Ch and P-Ch Fast Switching MOSFETs

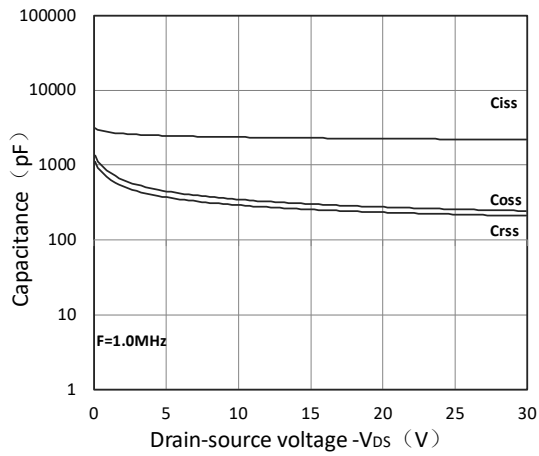


Figure 7. Capacitance Characteristics

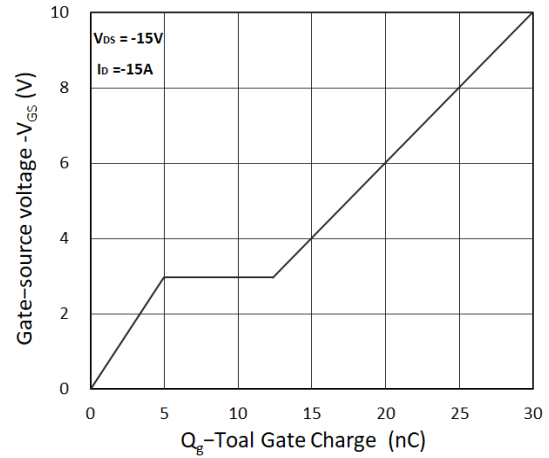


Figure 8. Gate Charge Characteristics

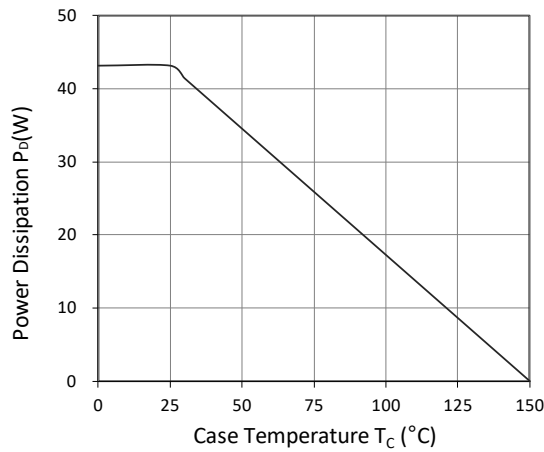


Figure 9. Power Dissipation

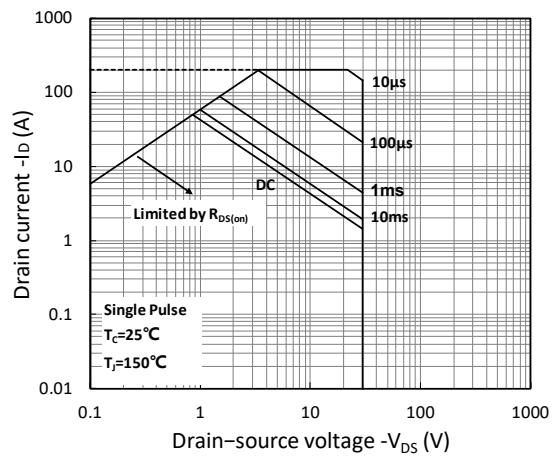


Figure 10. Safe Operating Area

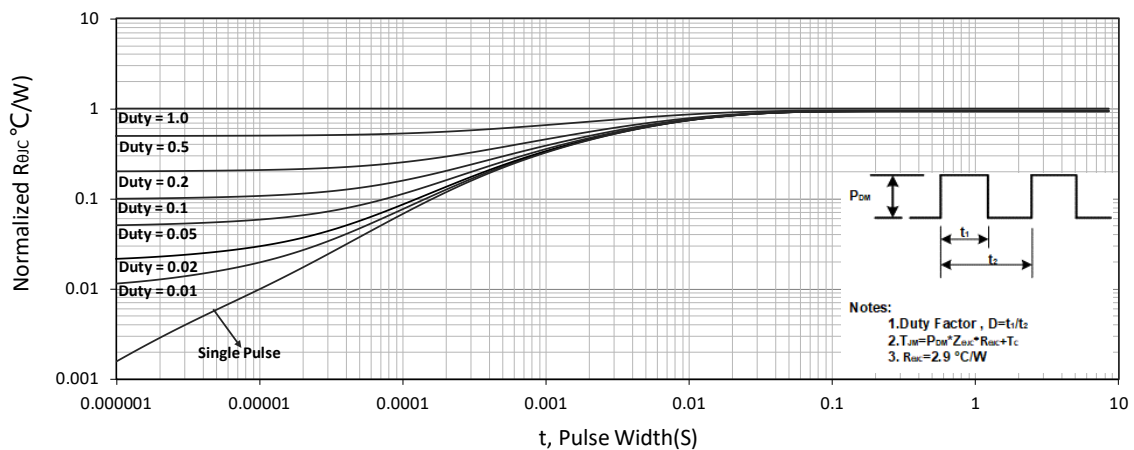
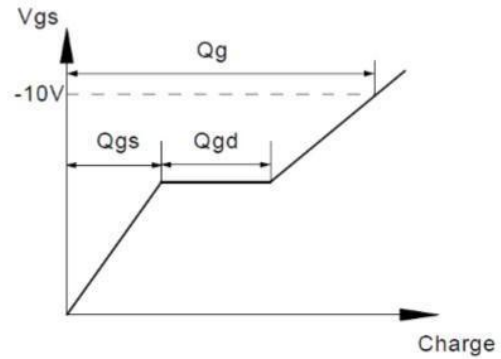
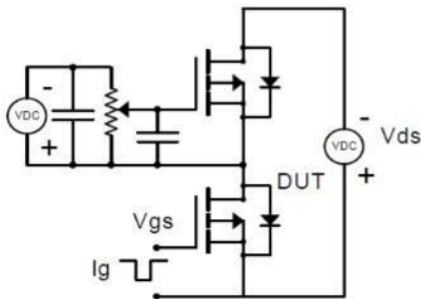


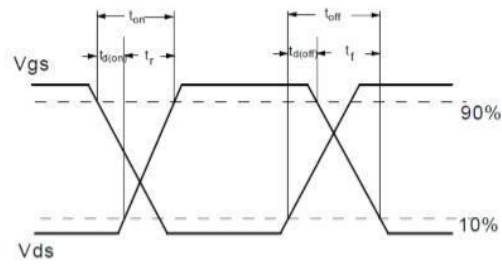
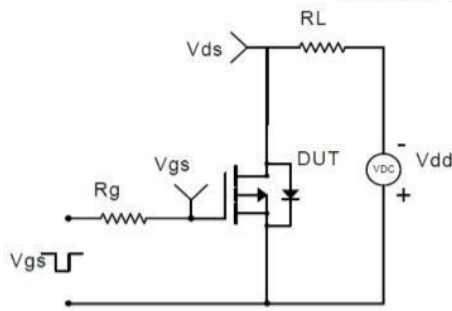
Figure 11. Normalized Maximum Transient Thermal Impedance

Test Circuit-P

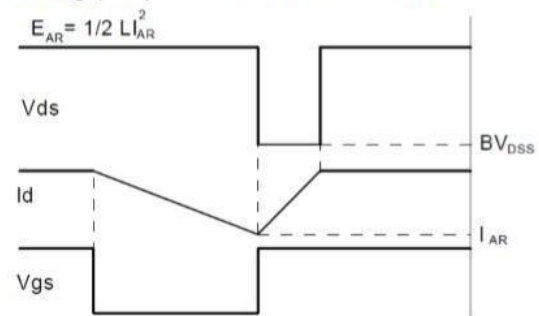
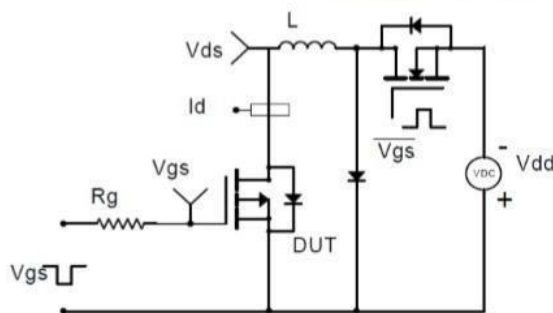
Gate Charge Test Circuit & Waveform



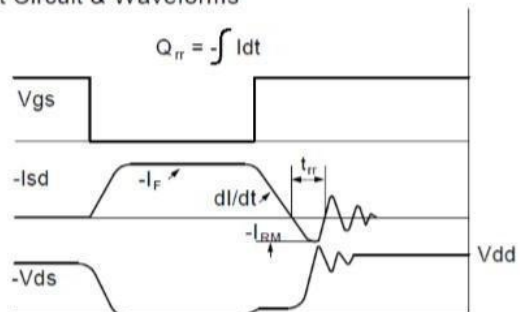
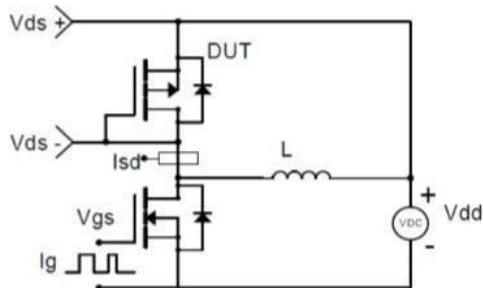
Resistive Switching Test Circuit & Waveforms

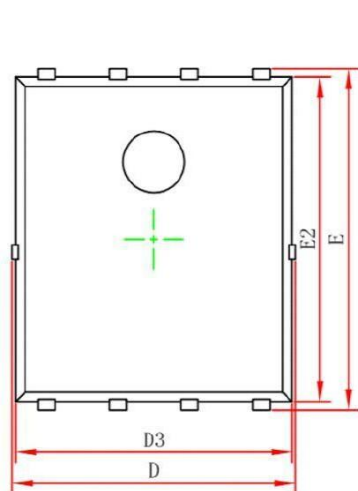
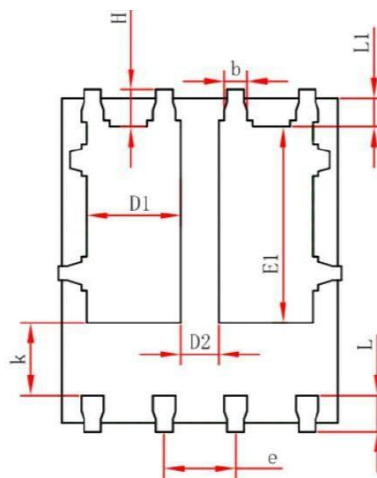
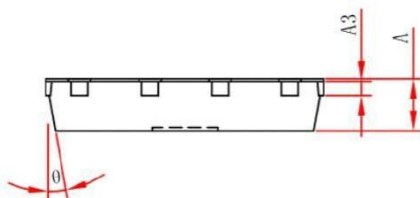


Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Mechanical Data- PDFN5060-8L

Top View

Bottom View

Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A3	0.154REF.		0.006REF.	
D	4.944	5.096	0.195	0.201
E	5.974	6.126	0.235	0.241
D1	1.470	1.870	0.058	0.074
D2	0.470	0.870	0.019	0.034
E1	3.375	3.575	0.133	0.141
D3	4.824	4.976	0.190	0.196
E2	5.674	5.826	0.223	0.229
k	1.190	1.390	0.047	0.055
b	0.350	0.450	0.014	0.018
e	1.270TYP.		0.050TYP.	
L	0.559	0.711	0.022	0.028
L1	0.424	0.576	0.017	0.023
H	0.574	0.726	0.023	0.029
θ	10°	12°	10°	12°