

N-Ch and P-Ch Fast Switching MOSFETs



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

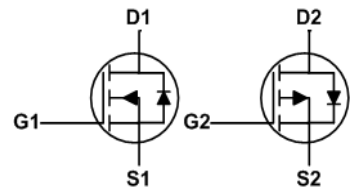
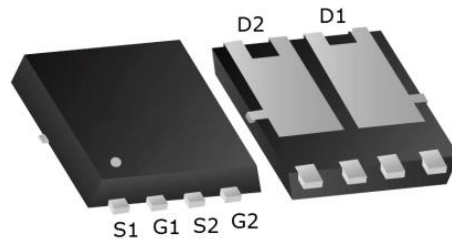
Description

The XR60G20F 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 XR60G20F meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

Product Summary

BVDSS	RDSON	ID
60V	25mΩ	20A
-60V	42mΩ	-20A

PDFN5060-8L Pin Configuration



Absolute Maximum Ratings ($T_C=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter		Max. N-Channel	Max. P-Channel	Units
V_{DSS}	Drain-Source Voltage		60	60	V
V_{GSS}	Gate-Source Voltage		± 30	± 20	V
I_D	Continuous Drain Current	$T_C = 25^{\circ}\text{C}$	20	-20	A
		$T_C = 100^{\circ}\text{C}$	13	-13	A
I_{DM}	Pulsed Drain Current ^{note1}		100	-100	A
E_{AS}	Single Pulsed Avalanche Energy ^{note2}		39	90	mJ
P_D	Power Dissipation	$T_C = 25^{\circ}\text{C}$	41.7	89	W
$R_{\theta JA}$	Thermal Resistance, Junction to Case		50	47	$^{\circ}\text{C}/\text{W}$
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		$^{\circ}\text{C}$

N-Channel Electrical Characteristics (T_J=25 °C, unless otherwise noted)

Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static Characteristics							
Drain-Source Breakdown Voltage		V _{(BR)DSS}	V _{GS} = 0V, I _D = 250μA	60	-	-	V
Gate-Body Leakage Current		I _{GSS}	V _{DS} = 0V, V _{GS} = ±20V	-	-	±100	nA
Zero Gate Voltage Drain Current	T _J =25℃	I _{DSS}	V _{DS} = 60V, V _{GS} = 0V	-	-	1	μA
	T _J =100℃			-	-	100	
Gate-Threshold Voltage		V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250μA	1.2	1.7	2.5	V
Drain-Source on-Resistance ⁴		R _{DS(on)}	V _{GS} = 10V, I _D = 10A	-	25	31	mΩ
			V _{GS} = 4.5V, I _D = 5A	-	31	40	
Forward Transconductance ⁴		g _{fs}	V _{DS} = 5V, I _D = 10A	-	15.5	-	S
Dynamic Characteristics ⁵							
Input Capacitance		C _{iss}	V _{DS} = 30V, V _{GS} =0V, f =1MHz	-	1355	-	pF
Output Capacitance		C _{oss}		-	60	-	
Reverse Transfer Capacitance		C _{rss}		-	49	-	
Gate Resistance		R _G	f =1MHz	-	1.2	-	Ω
Switching Characteristics ⁵							
Total Gate Charge		Q _g	V _{GS} = 10V, V _{DD} = 30V, I _D = 10A	-	22	-	nC
Gate-Source Charge		Q _{gs}		-	4.2	-	
Gate-Drain Charge		Q _{gd}		-	6.9	-	
Turn-on Delay Time		t _{d(on)}	V _{GS} =10V, V _{DD} = 30V, R _G = 3Ω, I _D = 10A	-	6.4	-	ns
Rise Time		t _r		-	15.3	-	
Turn-off Delay Time		t _{d(off)}		-	25	-	
Fall Time		t _f		-	7.6	-	
Body Diode Reverse Recovery Time		t _{rr}	I _F =10A, dI _F /dt=100A/μs	-	26	-	ns
Body Diode Reverse Recovery Charge		Q _{rr}		-	45	-	nC
Drain-Source Body Diode Characteristics							
Diode Forward Voltage ⁴		V _{SD}	I _S = 10A, V _{GS} = 0V	-	-	1.2	V
Continuous Source Current	T _C =25℃	I _S	-	-	-	20	A

Notes:

1. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150°C
2. The EAS data shows Max. rating . The test condition is V_{DD}=25V, V_{GS}=10V, L=0.4mH, I_{AS}=14A
3. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper, The value in any given application depends on the user's specific board design.
4. The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%.
5. This value is guaranteed by design hence it is not included in the production test.

P-Channel Electrical Characteristics (T_J=25 °C, unless otherwise noted)

Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static Characteristics							
Drain-Source Breakdown Voltage		V _{(BR)DSS}	V _{GS} = 0V, I _D = -250μA	-60	-	-	V
Gate-Body Leakage Current		I _{GSS}	V _{DS} = 0V, V _{GS} = ±20V	-	-	±100	nA
Zero Gate Voltage Drain Current	T _J =25℃	I _{DSS}	V _{DS} = -60V, V _{GS} = 0V	-	-	1	μA
	T _J =100℃			-	-	100	
Gate-Threshold Voltage		V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250μA	-1.2	-1.7	-2.5	V
Drain-Source on-Resistance ⁴		R _{DS(on)}	V _{GS} = -10V, I _D = -20A	-	42	52	mΩ
			V _{GS} = -4.5V, I _D = -10A	-	55	68	
Forward Transconductance ⁴		g _{fs}	V _{DS} = 5V, I _D = 10A	-	-	-	S
Dynamic Characteristics ⁵							
Input Capacitance		C _{iss}	V _{DS} = -30V, V _{GS} = 0V, f = 1MHz	-	862	-	pF
Output Capacitance		C _{oss}		-	163	-	
Reverse Transfer Capacitance		C _{rss}		-	8	-	
Gate Resistance		R _G	f = 1MHz	-	13	-	Ω
Switching Characteristics ⁵							
Total Gate Charge		Q _g	V _{GS} = -10V, V _{DD} = -30V, I _D = -10A	-	13.4	-	nC
Gate-Source Charge		Q _{gs}		-	3.35	-	
Gate-Drain Charge		Q _{gd}		-	1.82	-	
Turn-on Delay Time		t _{d(on)}	V _{GS} = -10V, V _{DD} = -30V, R _G = 5Ω, I _D = -10A	-	10	-	ns
Rise Time		t _r		-	6	-	
Turn-off Delay Time		t _{d(off)}		-	23	-	
Fall Time		t _f		-	11	-	
Body Diode Reverse Recovery Time		t _{rr}	I _F = -10A, dI _F /dt = 100A/μs	-	18	-	ns
Body Diode Reverse Recovery Charge		Q _{rr}		-	27	-	nC
Drain-Source Body Diode Characteristics							
Diode Forward Voltage ⁴		V _{SD}	I _S = 10A, V _{GS} = 0V	-	-	-1.2	V
Continuous Source Current	T _C = 25℃	I _S	-	-	-	-20	A

Notes:

1. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150°C
2. The EAS data shows Max. rating . The test condition is V_{DD}=-25V, V_{GS}=-10V, L=0.4mH, I_{AS}=-14A
3. The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper, The value in any given application depends on the user's specific board design.
4. The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%.
5. This value is guaranteed by design hence it is not included in the production test.

N-Channel Typical Characteristics

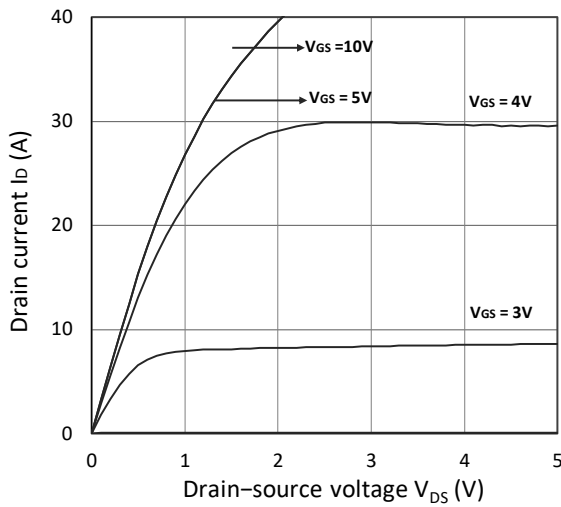


Figure 1. Output Characteristics

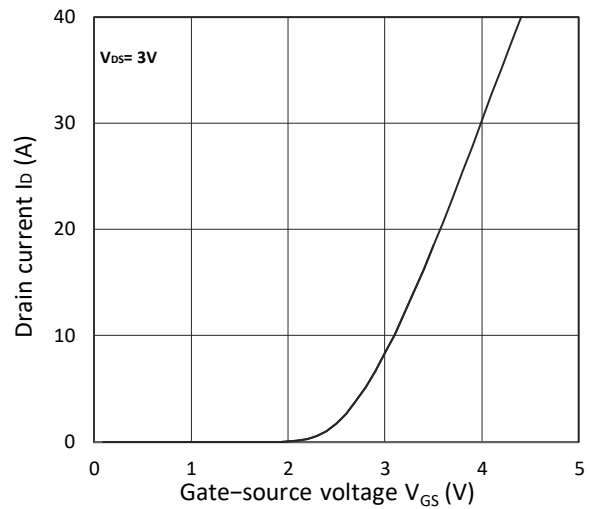


Figure 2. Transfer Characteristics

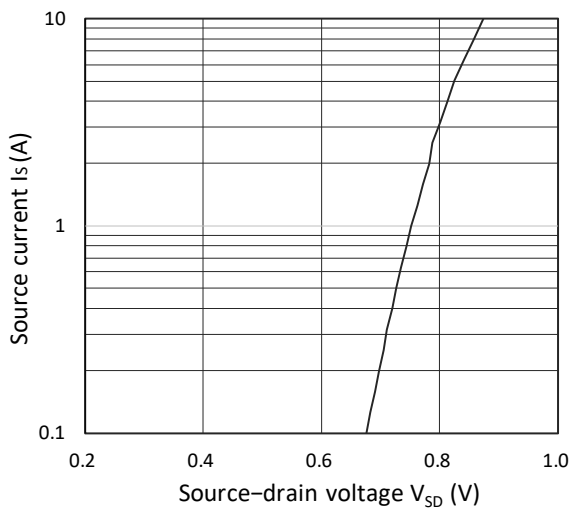


Figure 3. Forward Characteristics of Reverse

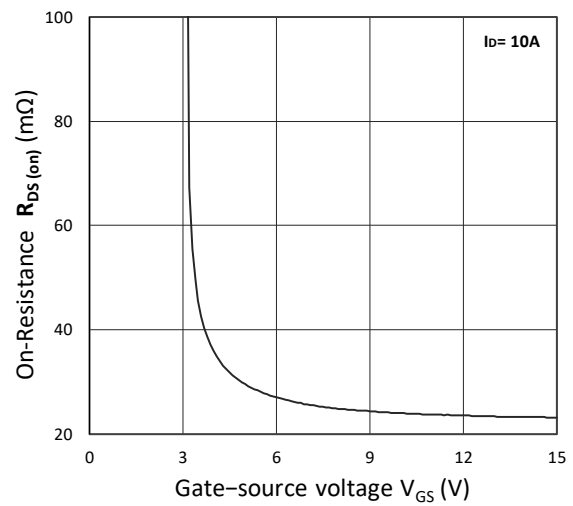


Figure 4. $R_{DS(on)}$ vs. V_{GS}

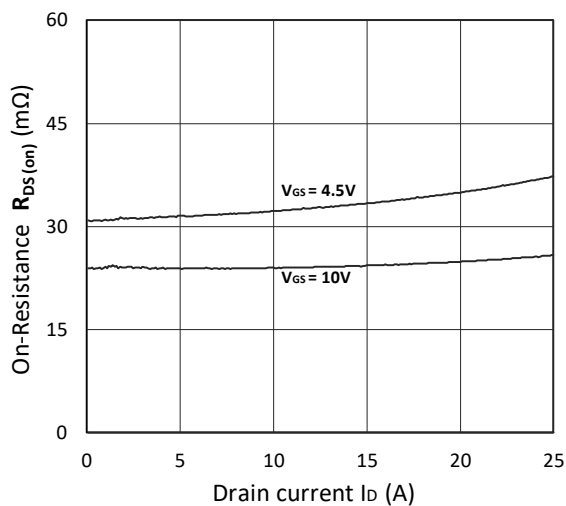


Figure 5. $R_{DS(on)}$ vs. I_D

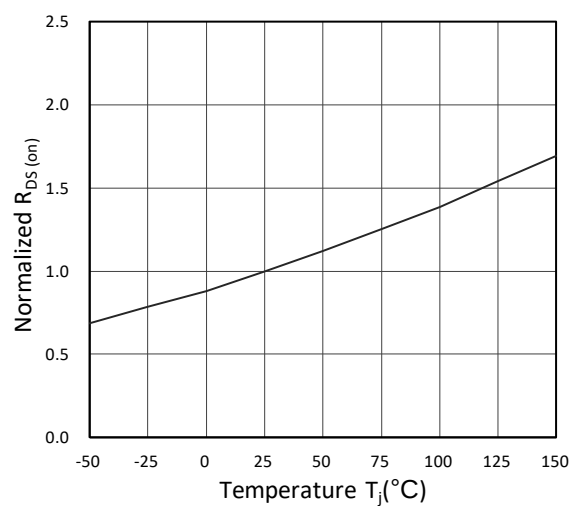


Figure 6. Normalized $R_{DS(on)}$ vs. Temperature

N-Channel Typical Characteristics

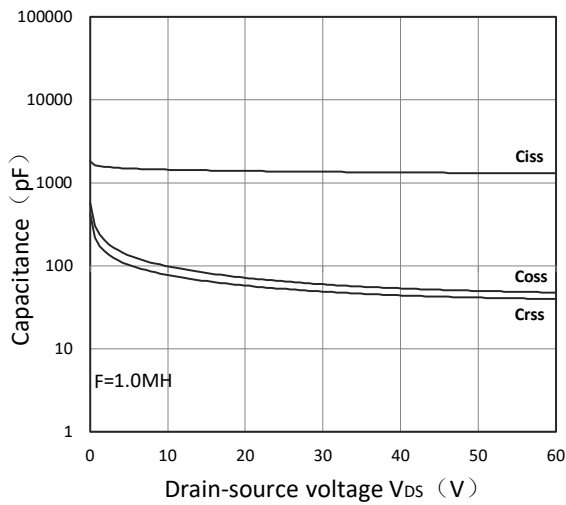


Figure 7. Capacitance Characteristics

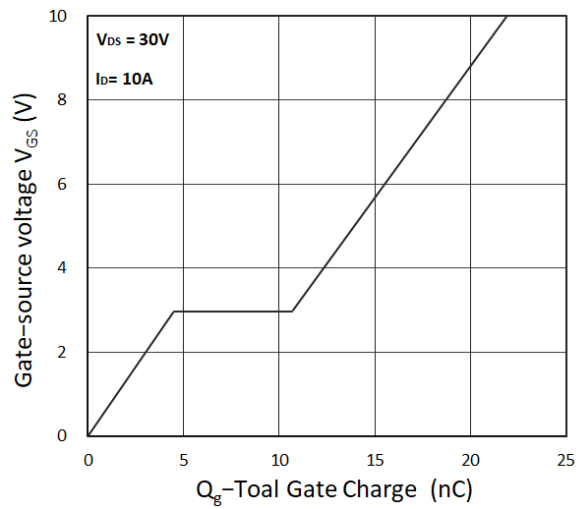


Figure 8. Gate Charge Characteristics

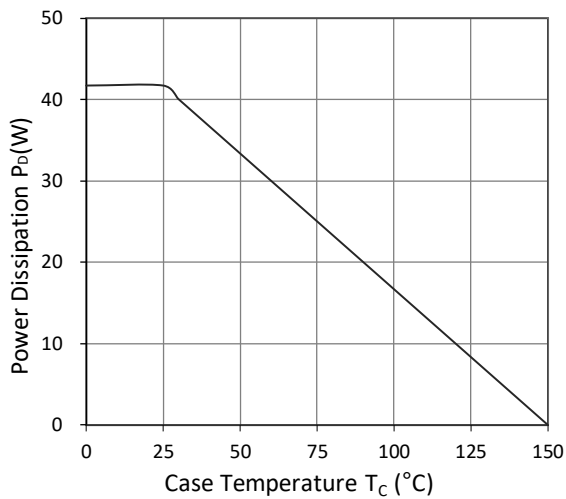


Figure 9. Power Dissipation

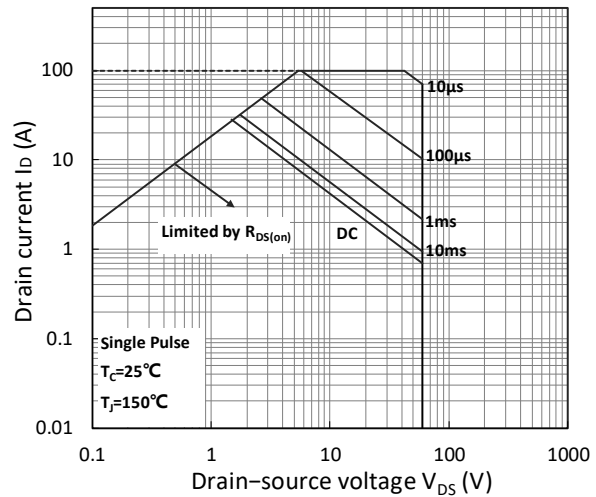


Figure 10. Safe Operating Area

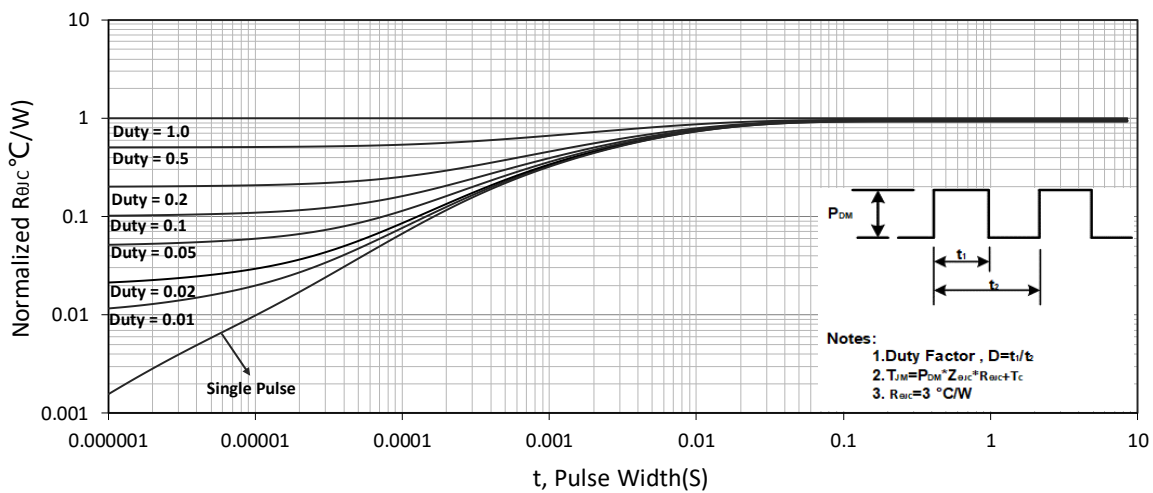
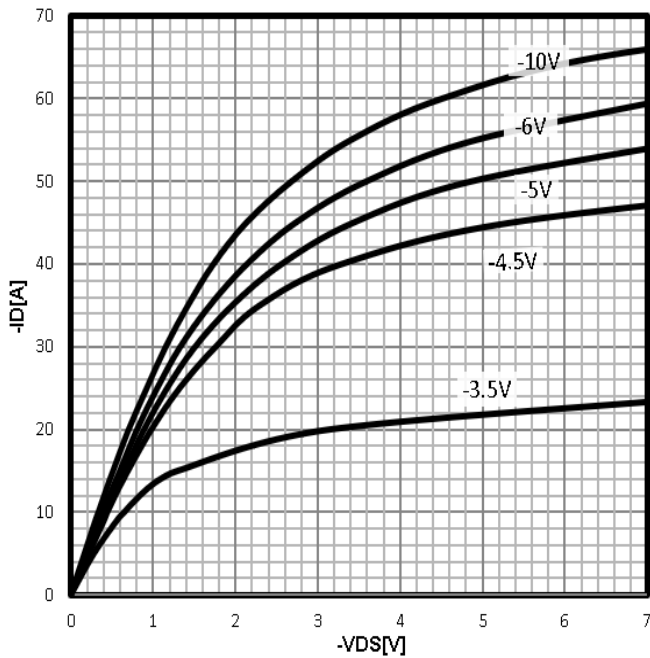


Figure 11. Normalized Maximum Transient Thermal Impedance

P-Channel Typical Characteristics

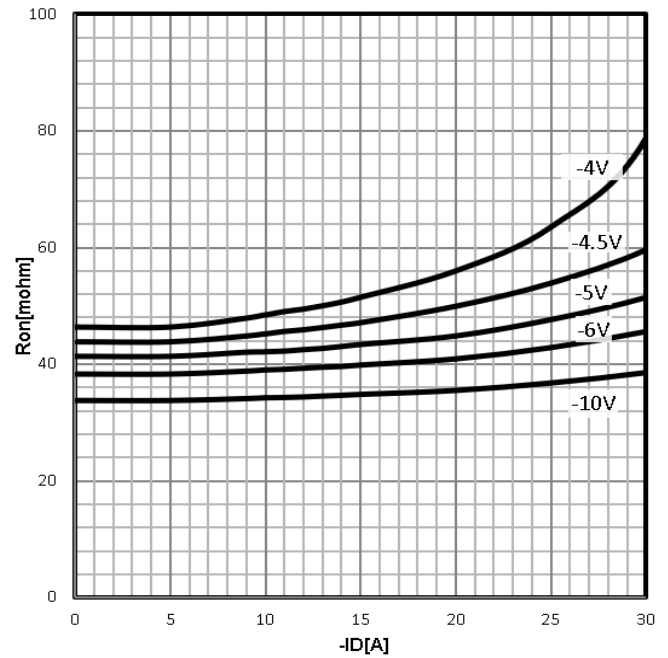
Typ. output characteristics

$$-I_D = f(-V_{DS})$$



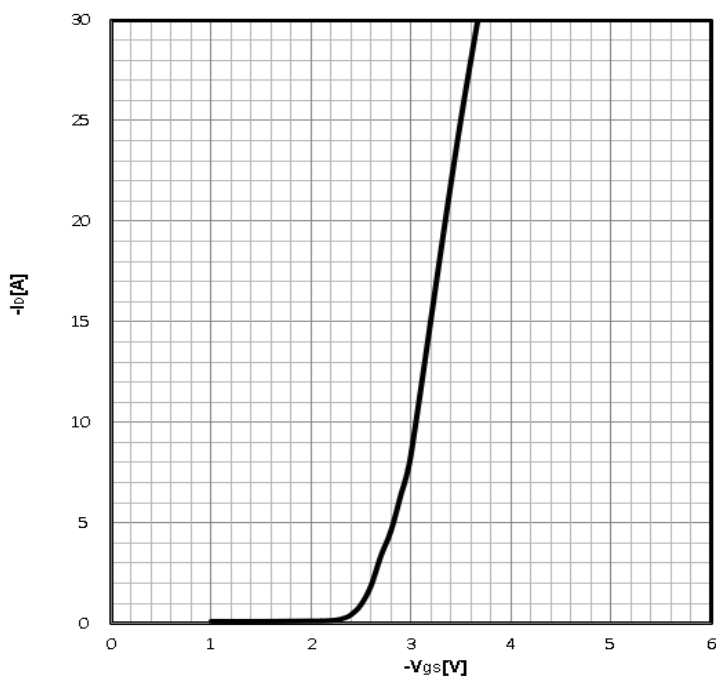
Typ. drain-source on resistance

$$R_{DS(on)} = f(-I_D)$$



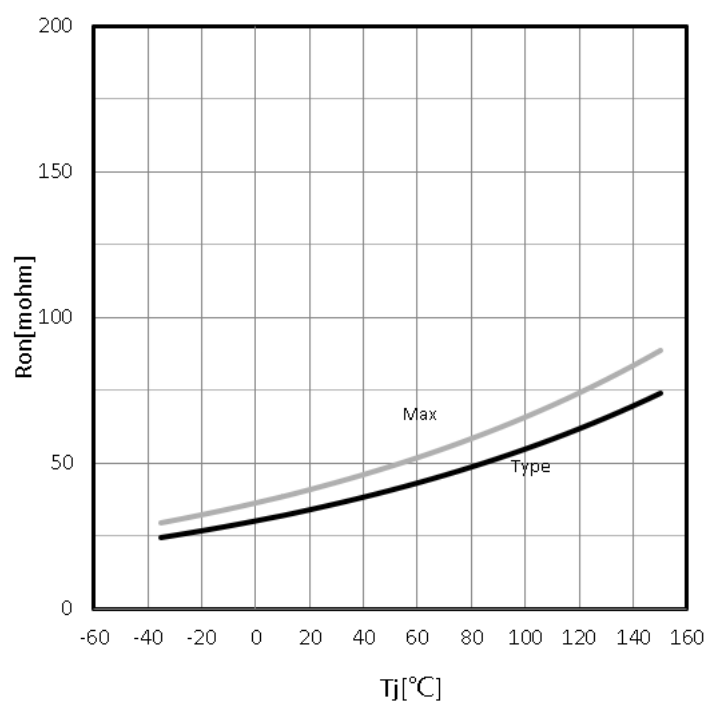
Typ. transfer characteristics

$$-I_D = f(-V_{GS})$$



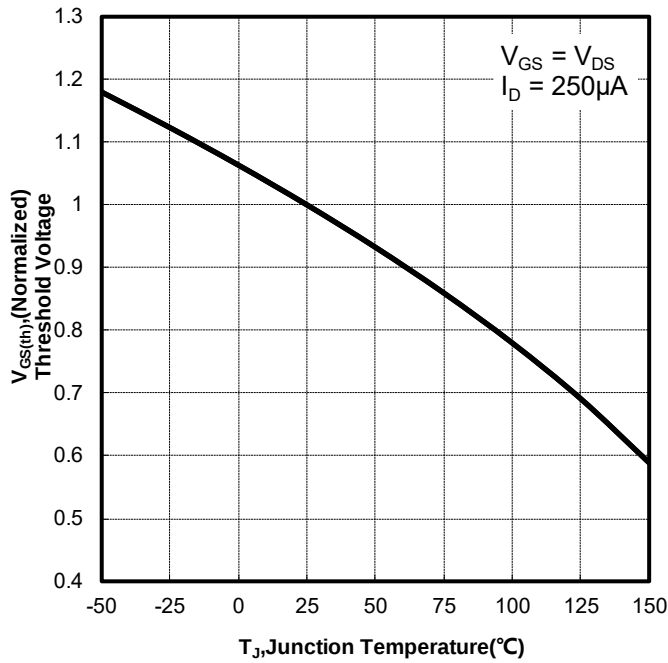
Drain-source on-state resistance

$$R_{DS(on)} = f(T_j); I_D = -20A; V_{GS} = -10V$$



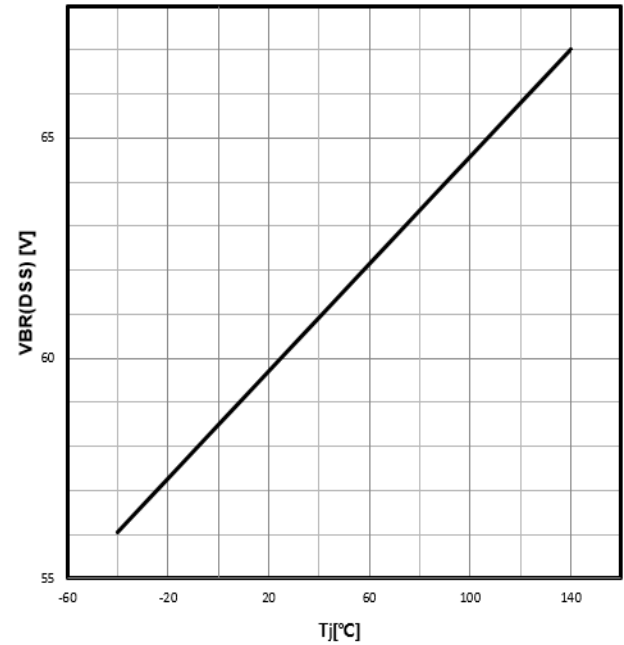
Gate Threshold Voltage

$$-V_{TH}=f(T_j); I_D=-250\mu A$$



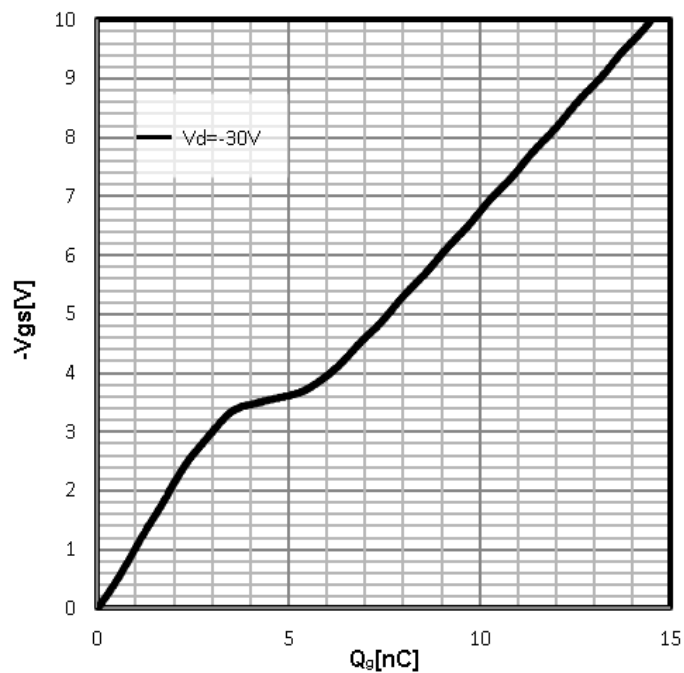
Drain-source breakdown voltage

$$-V_{BR(DSS)}=f(T_j); I_D=-250\mu A$$



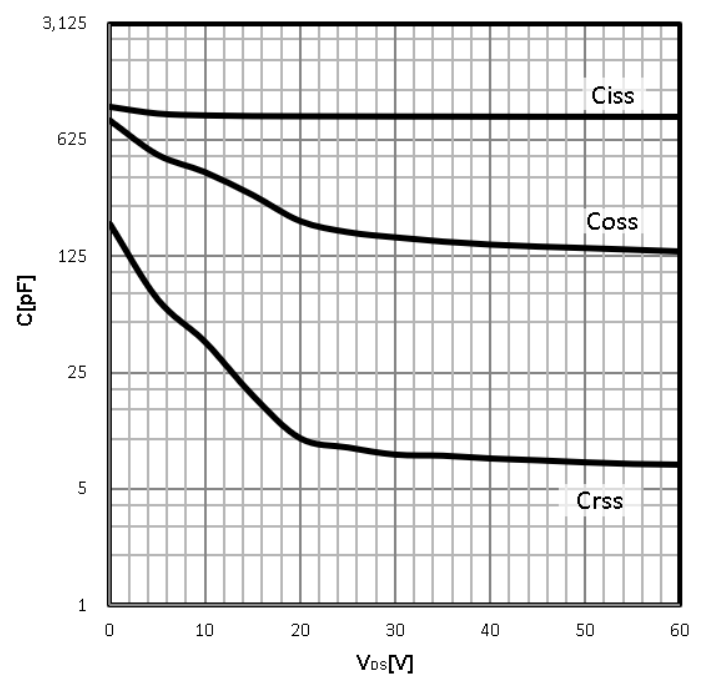
Typ. gate charge

$$-V_{GS}=f(Q_g); I_D=-20A$$



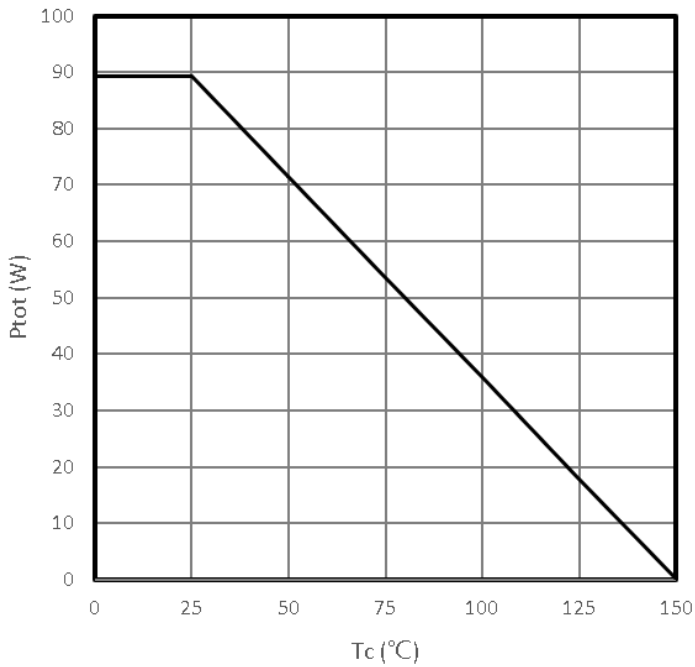
Typ. capacitances

$$C=f(-V_{DS}); V_{GS}=0V; f=1MHz$$



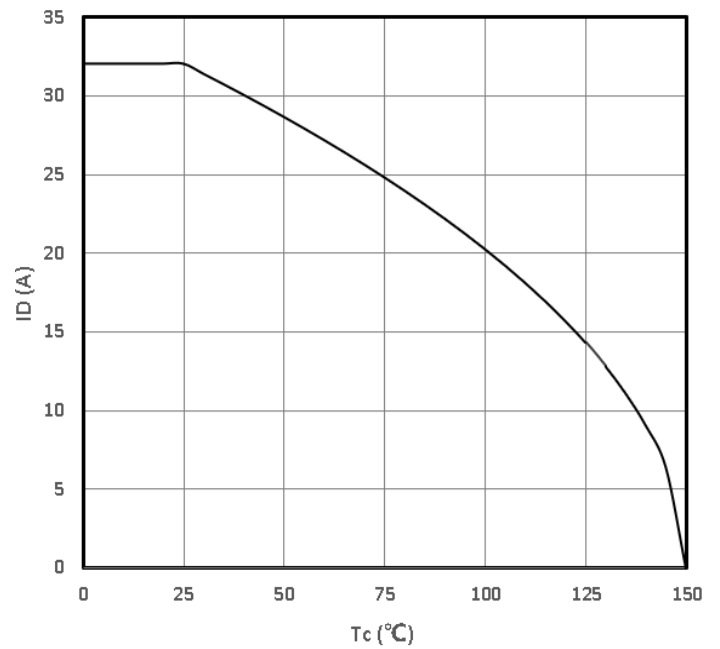
Power Dissipation

$$P_{\text{tot}} = f(T_C)$$



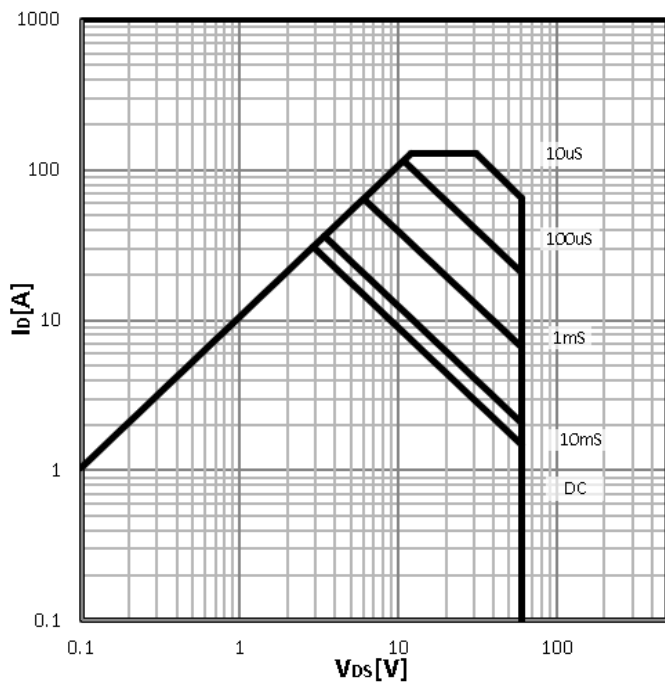
Maximum Drain Current

$$-I_D = f(T_C)$$



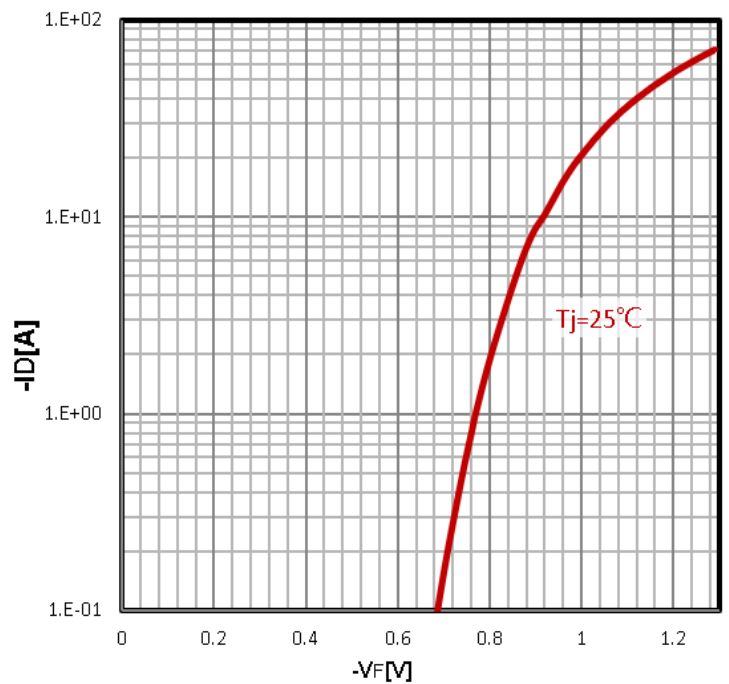
Safe operating area

$$-I_D = f(-V_{DS})$$



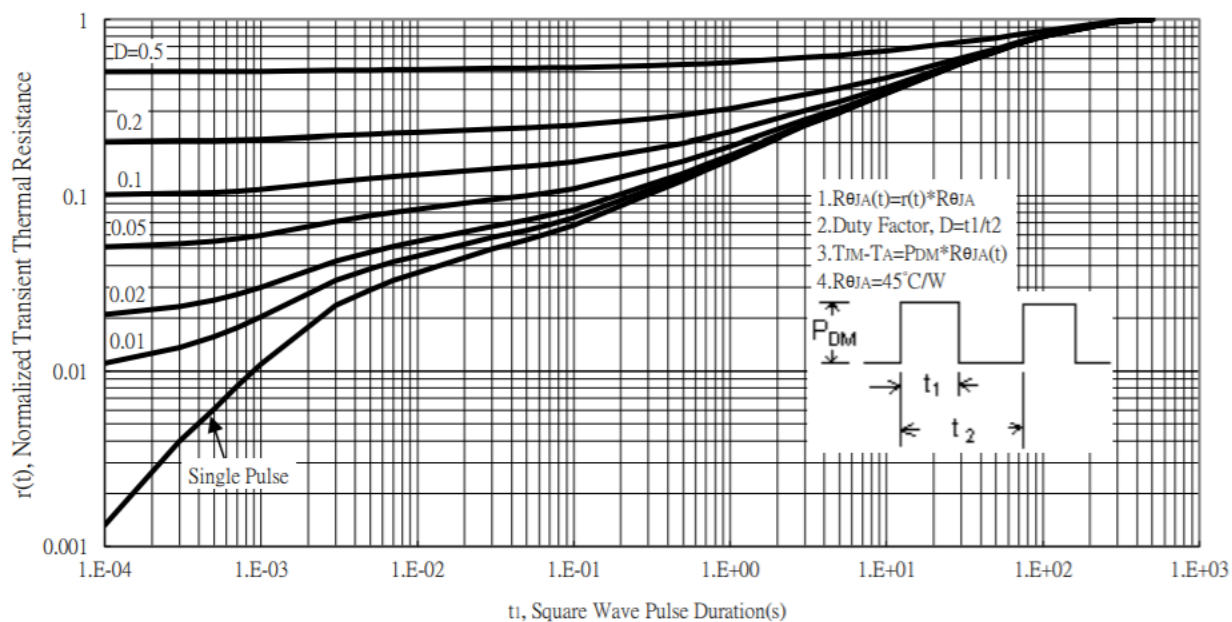
Body Diode Forward Voltage Variation

$$-I_F = f(-V_{DS})$$

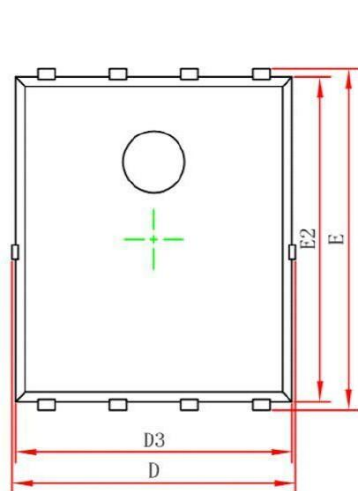


Max. transient thermal impedance

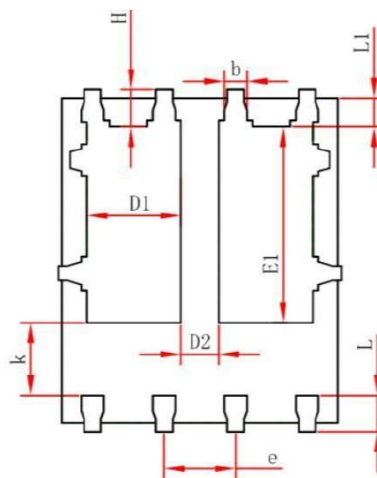
$$Z_{thJC}=f(t_p)$$



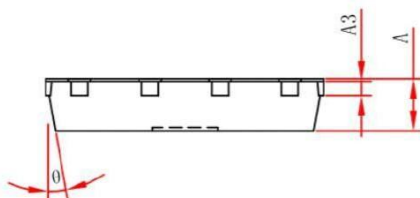
Package Mechanical Data- PDFN5060-8L



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°