NCE N&P-Channel complementary Power MOSFET

Description

The NCE60NP2016G uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

N channel

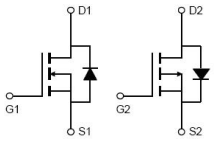
- V_{DS} =60V,I_D =20A
  $R_{DS(ON)}$ <28mΩ @ V_{GS}=10V
  $R_{DS(ON)}$ <32mΩ @ V_{GS}=4.5V

p channel

- V_{DS} =-60V,I_D =-16A
  $R_{DS(ON)}$ <60mΩ @ V_{GS}=-10V
  $R_{DS(ON)}$ <72mΩ @ V_{GS}=-4.5V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

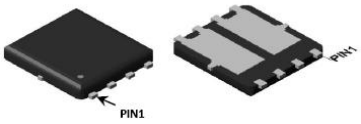
Application

- H-bridge
- Inverters



Schematic diagram

Marking and pin assignment



Top View Bottom View

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
60NP2016G	NCE60NP2016G	DFN5X6-8L	-	-	-

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

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	60	-60	V
Gate-Source Voltage		V_{GS}	±20	±20	V
Continuous Drain Current	T_C=25℃	I_D	20	-16	A
	T_C=100℃		14	-11.2	
Pulsed Drain Current (Note 1)		I_{DM}	60	-48	A
Maximum Power Dissipation	T_C=25℃	P_D	42		W
Single pulse avalanche energy (Note 5)		E_{AS}	72		mJ
Operating Junction and Storage Temperature Range		T_J,T_{STG}	-55 To 150		℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case(Note 2)	$R_{\theta JC}$	3	℃/W

Thermal Resistance,Junction-to-Ambient (Note 2)	$R_{\theta JA}$	60	℃/W

N-Channel Electrical Characteristics (T_C=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250μA	60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=60V,V_{GS}=0V	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	1.2	1.6	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=10A	-	23	28	mΩ
		V_{GS}=4.5V, I_D=10A	-	27	32	mΩ
Forward Transconductance	g_{FS}	V_{DS}=5V,I_D=10A	11	-	-	S
Gate resistance	Rg	V_{DS}=0V,V_{GS}=0V,F=1.0MHz		2.2		Ω
Dynamic Characteristics (Note4)						
Input Capacitance	C_{lss}	V_{DS}=30V,V_{GS}=0V, F=1.0MHz	-	973.2	-	PF
Output Capacitance	C_{oss}		-	61.2	-	PF
Reverse Transfer Capacitance	C_{rss}		-	58.8	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=30V ,R_L=3Ω V_{GS}=10V,R_G=3Ω	-	7	-	nS
Turn-on Rise Time	t_r		-	20	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	16	-	nS
Turn-Off Fall Time	t_f		-	23	-	nS
Total Gate Charge	Q_g	V_{DS}=30V,I_D=10A, V_{GS}=10V	-	25		nC
Gate-Source Charge	Q_{gs}		-	4.5		nC
Gate-Drain Charge	Q_{gd}		-	6.5		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	V_{GS}=0V,I_S=10A	-		1.2	V
Diode Forward Current (Note 2)	I_S		-	-	20	A
Reverse Recovery Time	t_{rr}	TJ = 25°C, IF =10A di/dt = 100A/μs (Note3)	-	29	-	nS
Reverse Recovery Charge	Qrr		-	49	-	nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition:Tj=25℃,VDD=30V,VG=10V,L=0.5mH,Rg=25Ω

N- Channel Typical Electrical and Thermal Characteristics (Curves)

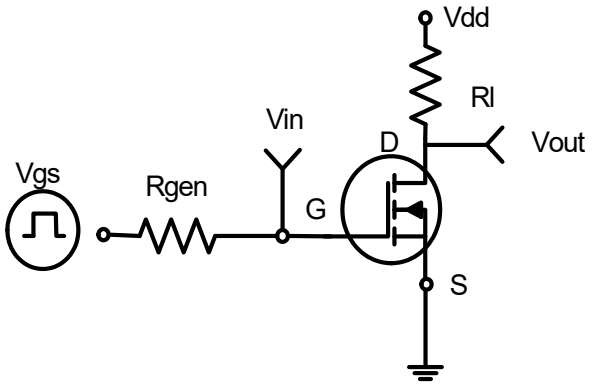


Figure 1:Switching Test Circuit

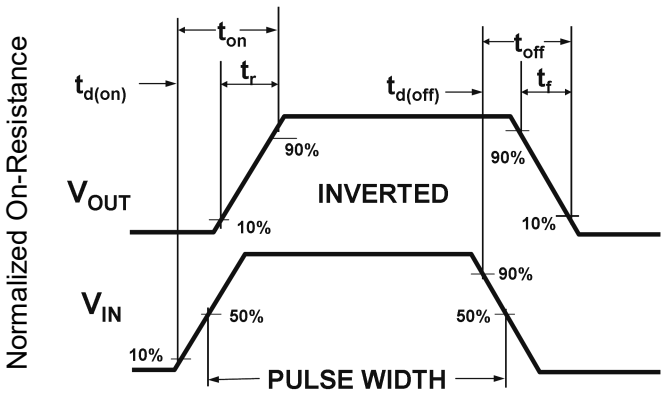


Figure 2:Switching Waveforms

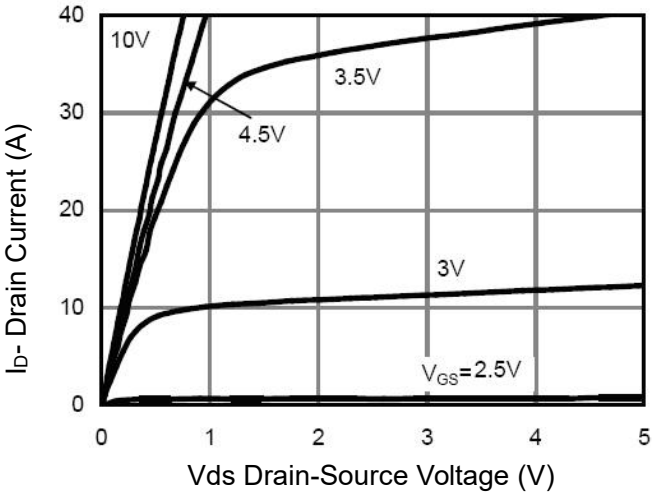


Figure 3 Output Characteristics

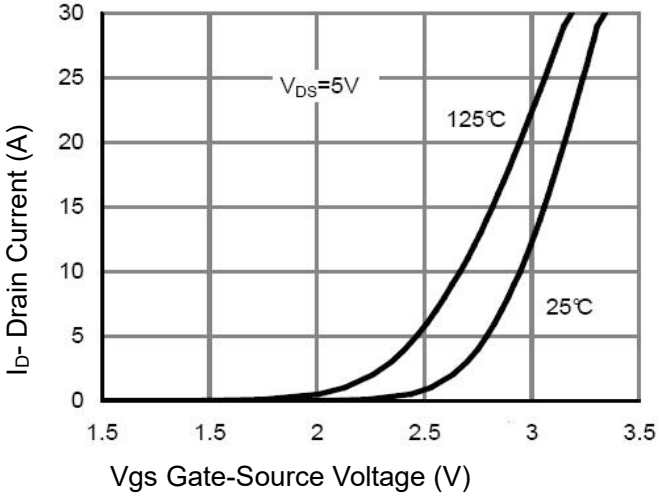


Figure 4 Transfer Characteristics

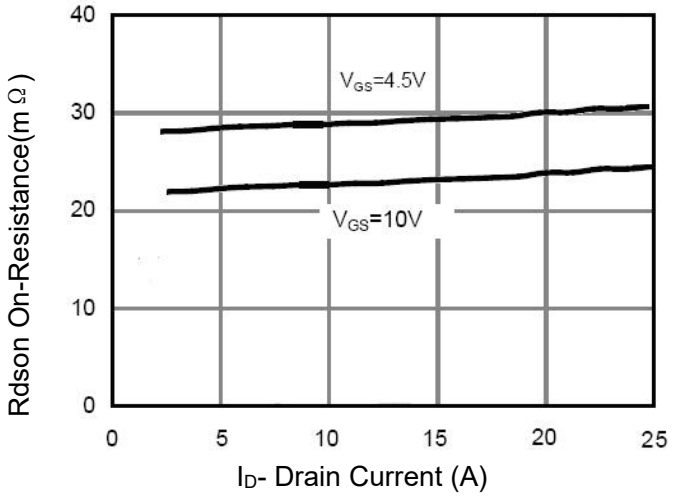


Figure 5 Rdson- Drain Current

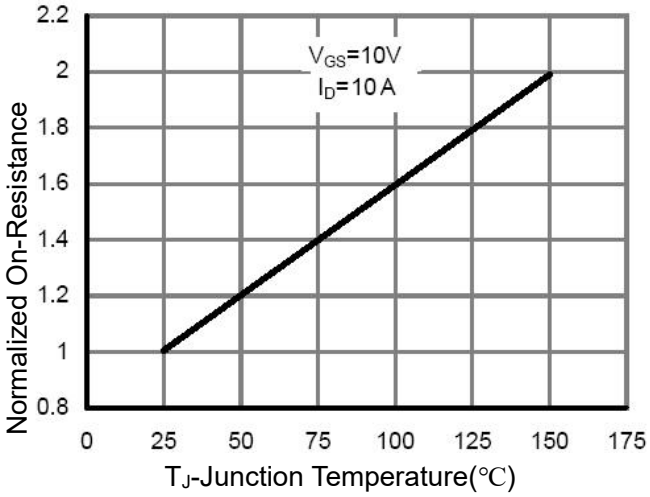


Figure 6 Drain-Source On-Resistance

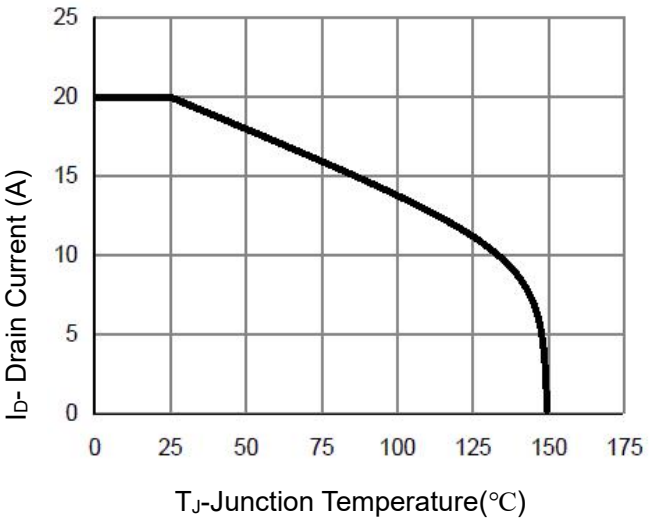


Figure7 Rdson vs Vgs

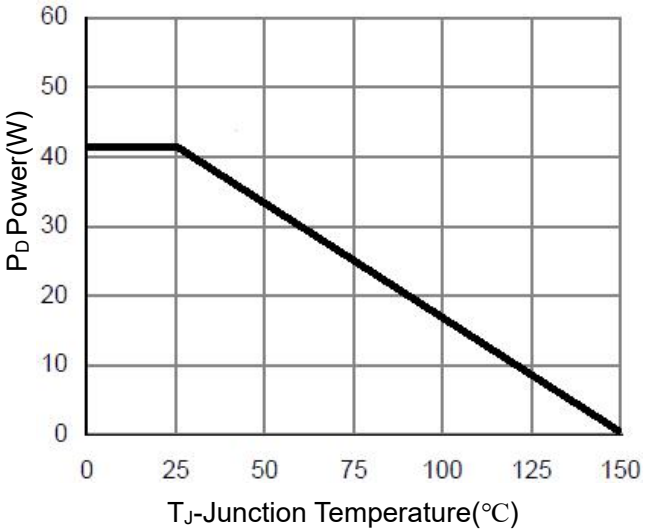


Figure 8 Power Dissipation

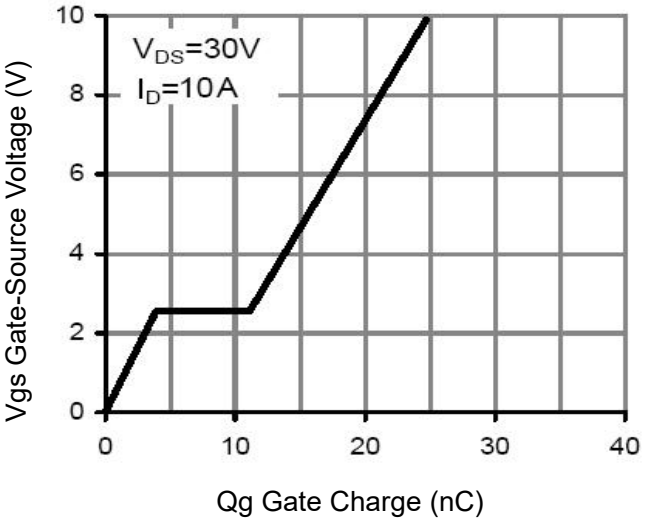


Figure 9 Gate Charge

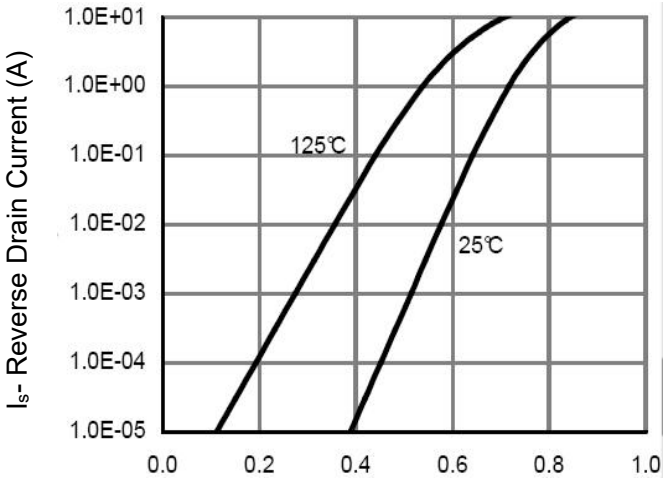


Figure 10 Source- Drain Diode Forward

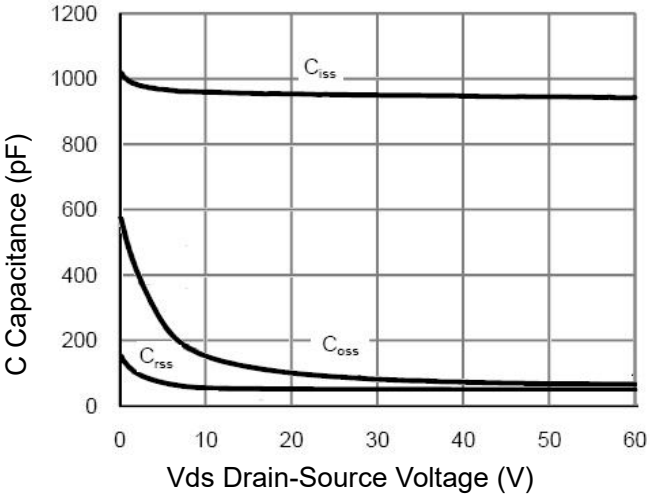


Figure 11 Capacitance vs Vds

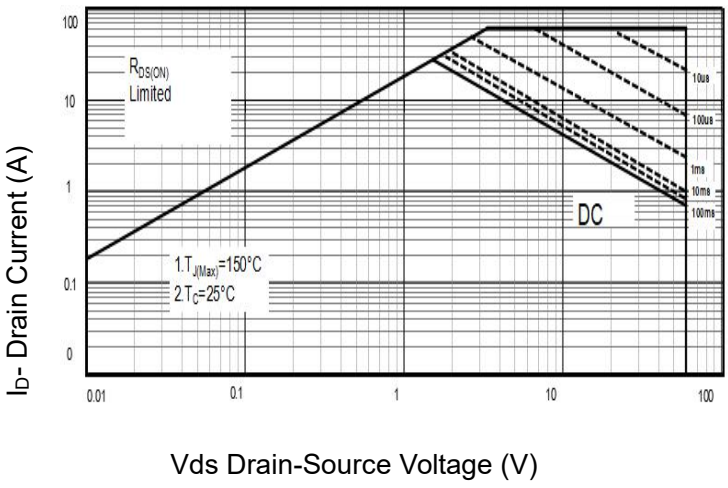


Figure 12 Safe Operation Area

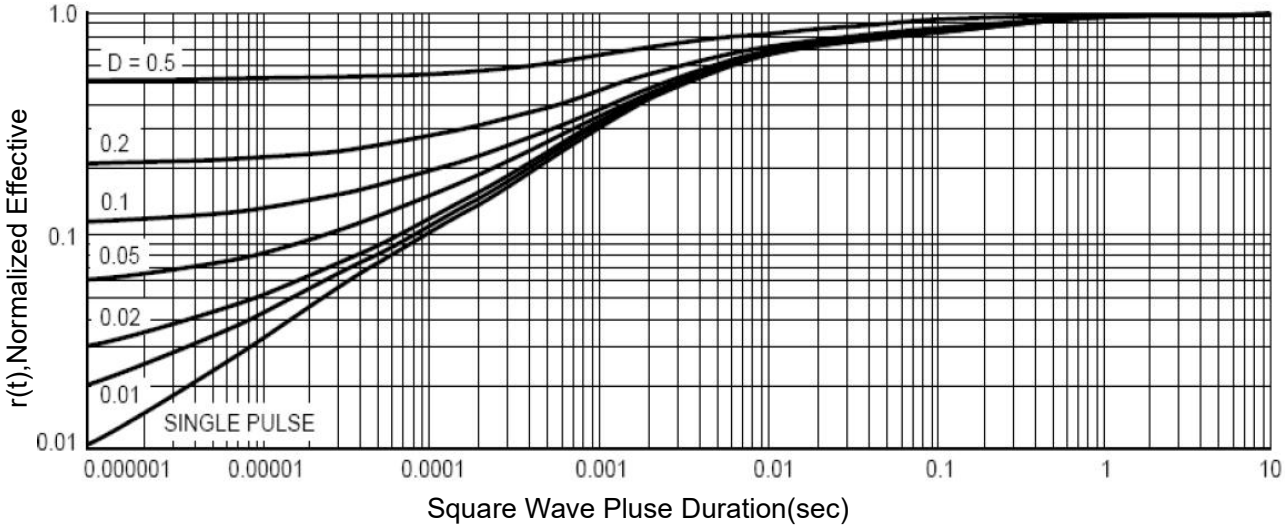


Figure 13 Normalized Maximum Transient Thermal Impedance

P-Channel Electrical Characteristics (T_C=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=-250μA	-60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-60V,V_{GS}=0V	-	-	-1	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=-250μA	-1.0	-1.5	-2.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D=-8A	-	52	60	mΩ
		V_{GS}=-4.5V, I_D=-8A	-	60	72	mΩ
Forward Transconductance	g_{FS}	V_{DS}=-5V,I_D=-8A	-	15	-	S
Gate resistance	Rg	V_{DS}=0V,V_{GS}=0V,F=1.0MHz		8.5		Ω
Dynamic Characteristics (Note4)						
Input Capacitance	C_{lss}	V_{DS}=-30V,V_{GS}=0V, F=1.0MHz	-	1108	-	PF
Output Capacitance	C_{oss}		-	73.7	-	PF
Reverse Transfer Capacitance	C_{rss}		-	58.2	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=-30V, R_L=3.75Ω V_{GS}=-10V,R_{GEN}=3Ω	-	8	-	nS
Turn-on Rise Time	t_r		-	4	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	32	-	nS
Turn-Off Fall Time	t_f		-	7	-	nS
Total Gate Charge	Q_g	V_{DS}=-30V,I_D=-8A V_{GS}=-10V	-	23.4	-	nC
Gate-Source Charge	Q_{gs}		-	4.1	-	nC
Gate-Drain Charge	Q_{gd}		-	4.8	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	V_{GS}=0V,I_S=-16A	-	-	-1.2	V
Diode Forward Current (Note 2)	I_S		-	-	-16	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F =- 8A di/dt = -100A/μs(Note3)	-	25		nS
Reverse Recovery Charge	Qrr		-	31		nC

P- Channel Typical Electrical and Thermal Characteristics (Curves)

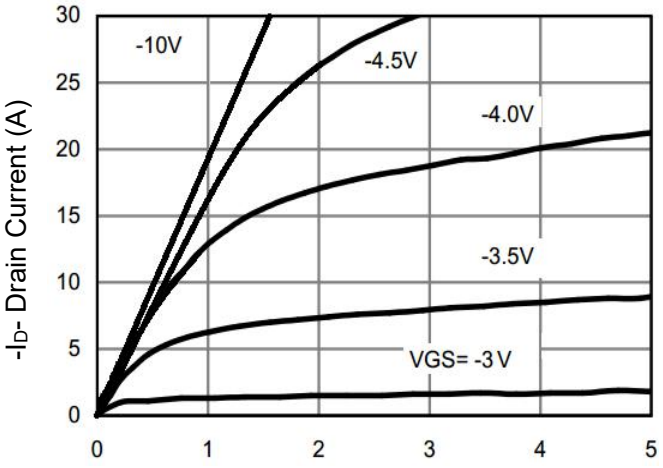


Figure 1 Output Characteristics

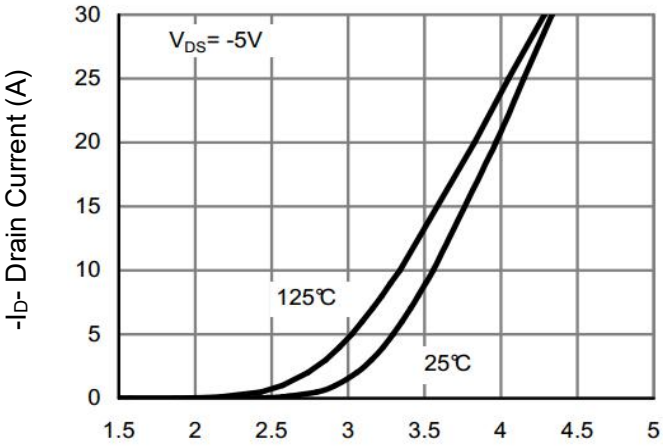


Figure 2 Transfer Characteristics

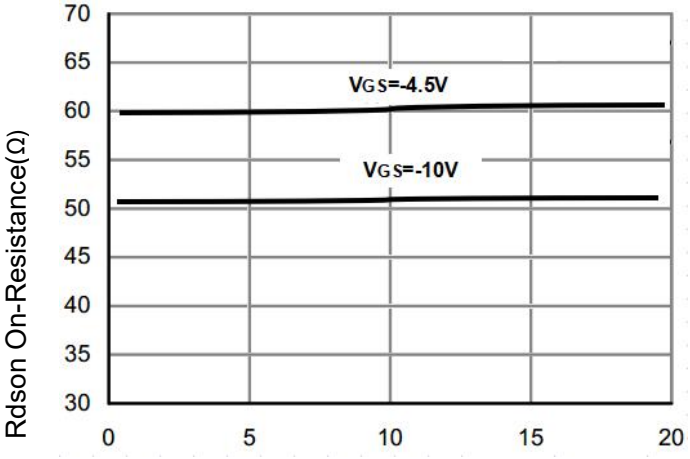


Figure 3 Rdson- Drain Current

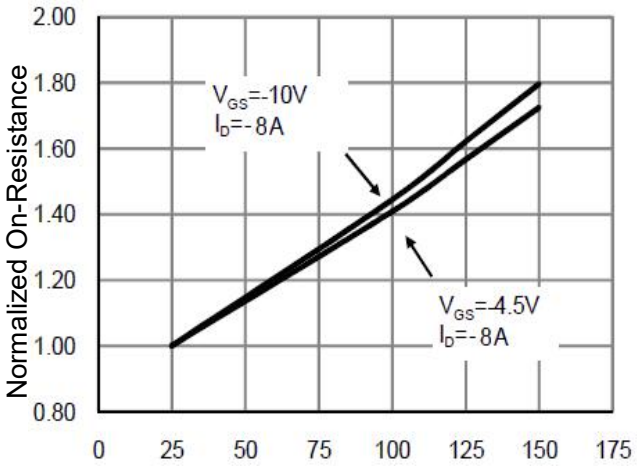


Figure 4 Rdson-Junction Temperature

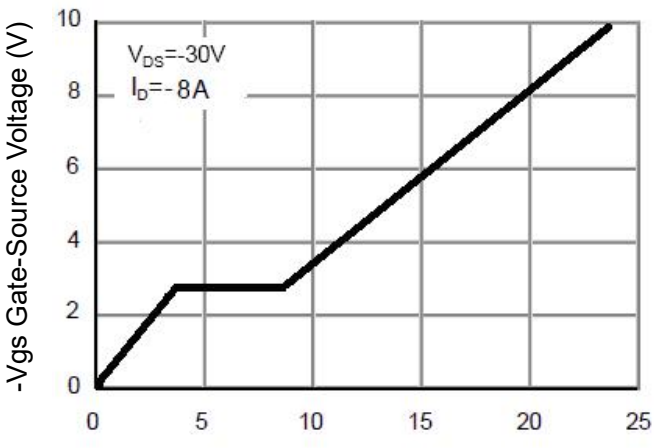


Figure 5 Gate Charge

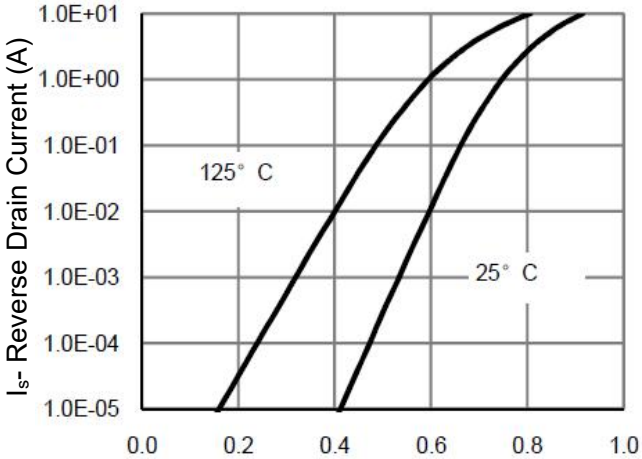


Figure 6 Source- Drain Diode Forward

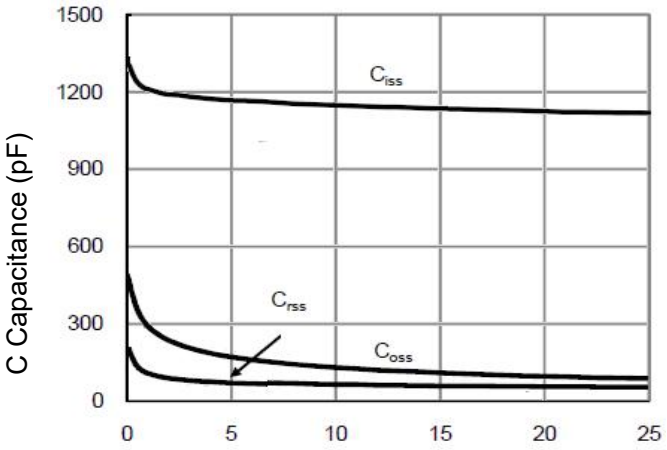


Figure 7 Capacitance vs Vds

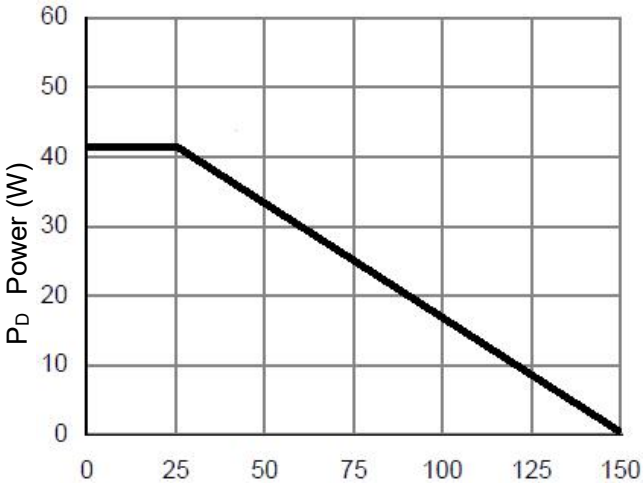


Figure 9 Power Dissipation

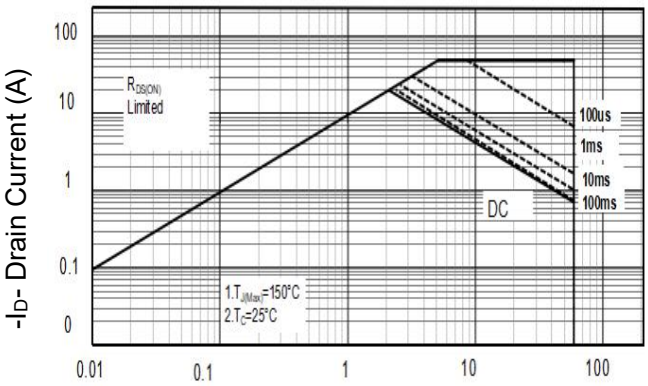


Figure 8 Safe Operation Area

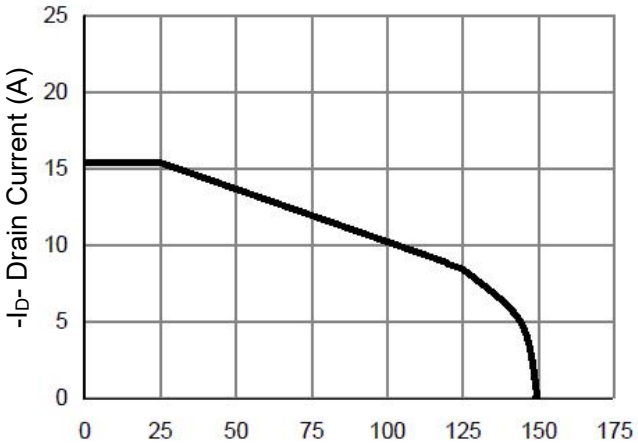


Figure 10 ID Current De-rating

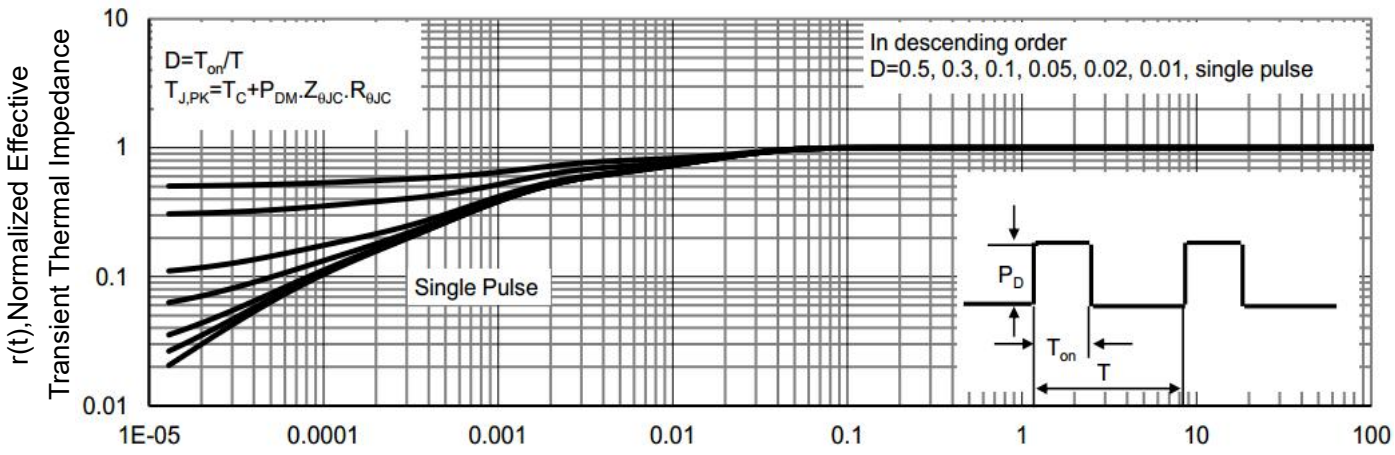
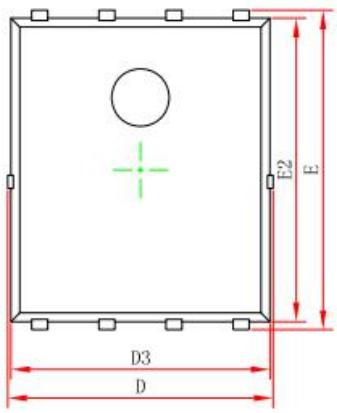
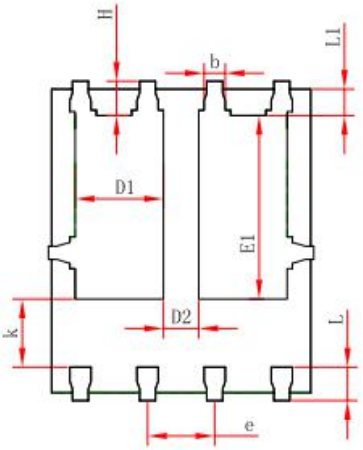


Figure 11 Normalized Maximum Transient Thermal Impedance

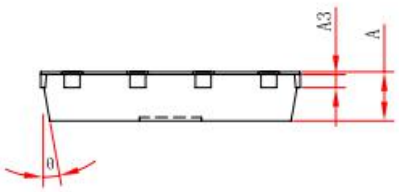
DFN5X6-8L Package Information



Top View
[顶视图]



Bottom View
[背视图]



Side View
[侧视图]

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A3	0.254 REF.		0.010REF.	
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°

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