

## NCE N&P-Channel complementary Power MOSFET

### Description

The NCE30NP4030G uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. This device is suitable for use in inverter and other applications.

### General Features

#### N-channel

●  $V_{DS} = 30V, I_D = 40A$

$R_{DS(ON)} < 9.5m\Omega @ V_{GS}=10V$

$R_{DS(ON)} < 23m\Omega @ V_{GS}=4.5V$

● High Power and current handling capability

● Lead free product is acquired

● Surface mount package

### Application

● H-bridge

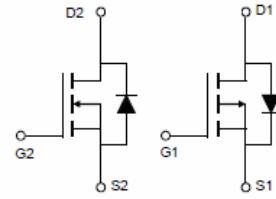
● Inverters

#### P-channel

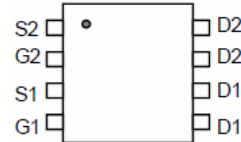
●  $V_{DS} = -30V, I_D = -30A$

$R_{DS(ON)} < 11m\Omega @ V_{GS}=-10V$

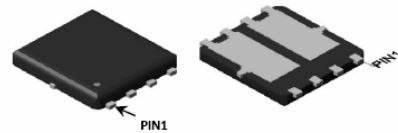
$R_{DS(ON)} < 20m\Omega @ V_{GS}=-4.5V$



Schematic diagram



Pin assignment



DFN5X6-8L Bottom View

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
30NP4030G	NCE30NP4030G	DFN5X6-8L	-	-	-

### Absolute Maximum Ratings ( $T_C=25^\circ C$ unless otherwise noted)

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	$V_{DS}$	30	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C=25^\circ C$	-30	A
		$T_C=100^\circ C$	-21.2	
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	160	-120	A
Maximum Power Dissipation	$P_D$	35		W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150		$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	3.6	$^\circ C/W$
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### N-channel Electrical Characteristics ( $T_C=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=30V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA

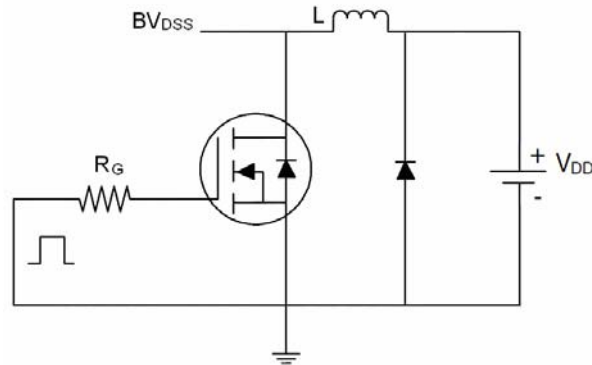
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.9	1.5	2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	7	9.5	mΩ
		$V_{GS}=4.5V, I_D=20A$	-	11	23	mΩ
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$	26	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V,$ $F=1.0MHz$	-	1000	-	PF
Output Capacitance	$C_{oss}$		-	180.8	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	164.4	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=15V, R_L=0.75\Omega$ $V_{GS}=10V, R_G=3\Omega$	-	5	-	nS
Turn-on Rise Time	$t_r$		-	12	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	19	-	nS
Turn-Off Fall Time	$t_f$		-	6	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=15V, I_D=20A,$ $V_{GS}=10V$	-	17		nC
Gate-Source Charge	$Q_{gs}$		-	2.8		nC
Gate-Drain Charge	$Q_{gd}$		-	3.9		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=20A$	-		1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	40	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ C, I_F = 20A$ $di/dt = 100A/\mu s$ (Note3)	-	19	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	10	-	nC
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### Notes:

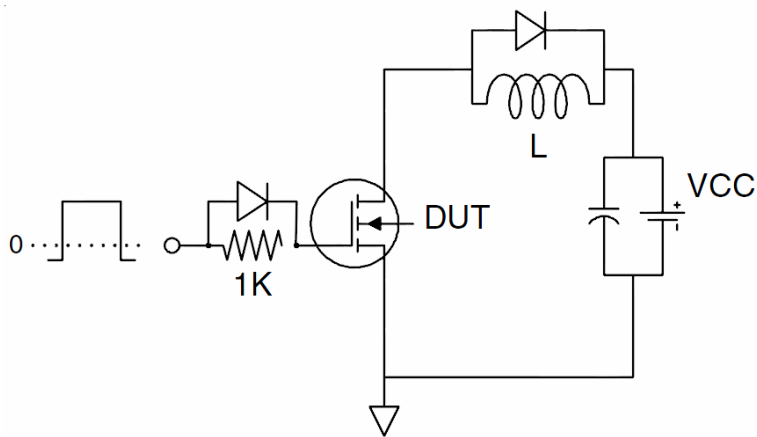
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^\circ C, V_{DD}=15V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test circuit

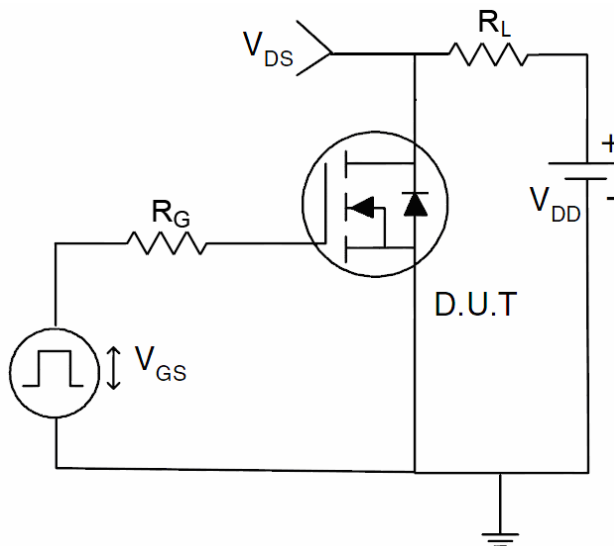
### 1) $E_{AS}$ test Circuits



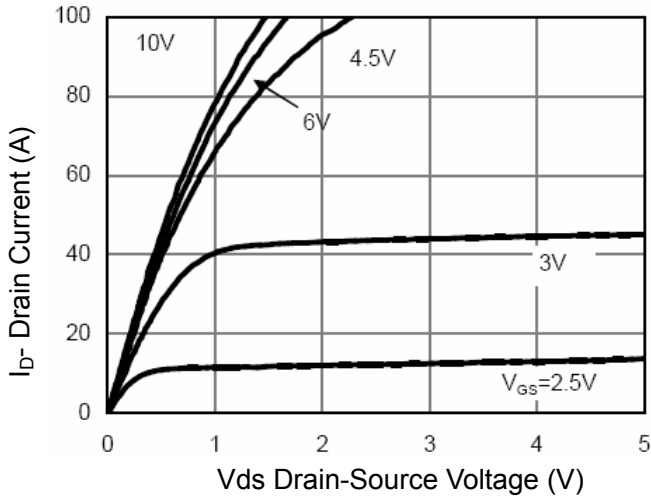
### 2) Gate charge test Circuit:



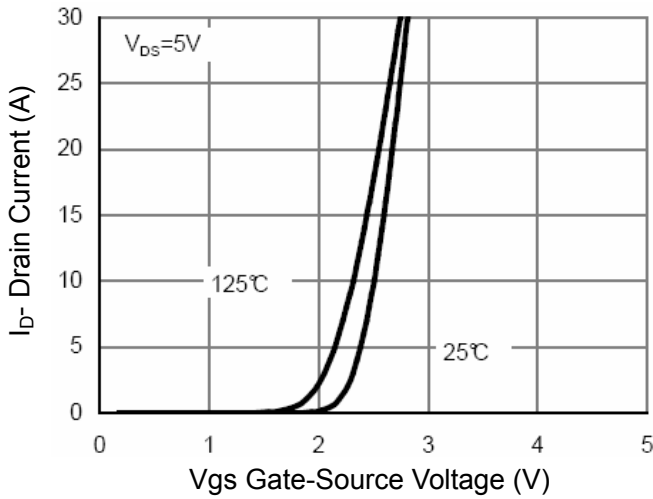
### 3) Switch Time Test Circuit:



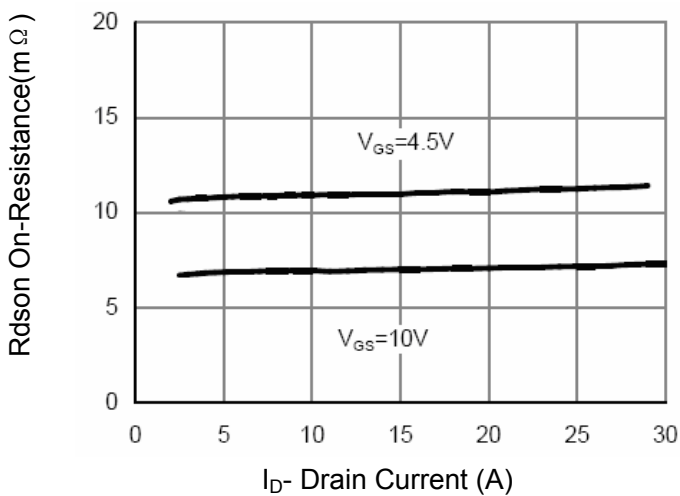
## N-channel Typical Electrical and Thermal Characteristics (Curves)



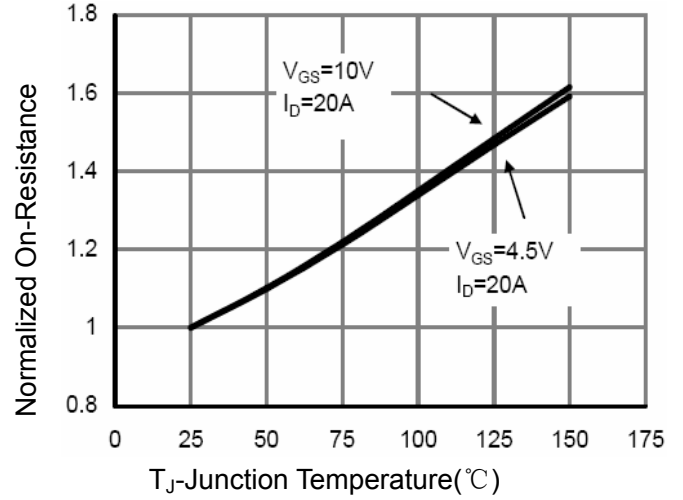
**Figure 1 Output Characteristics**



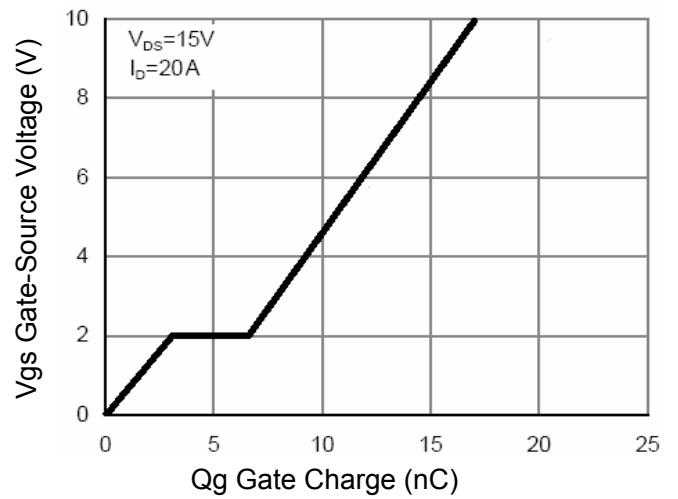
**Figure 2 Transfer Characteristics**



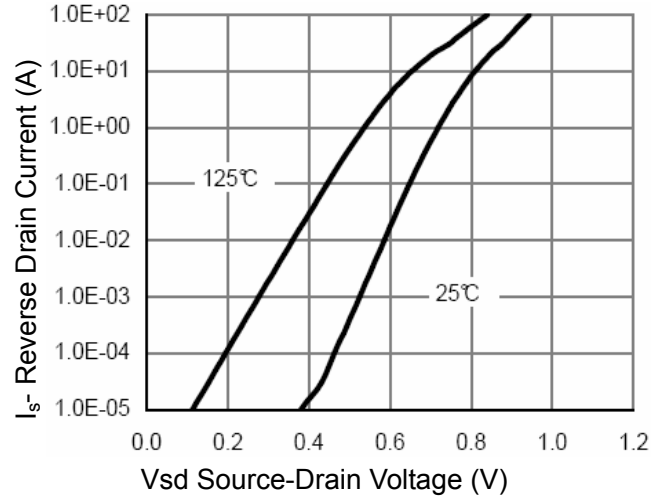
**Figure 3 Rdson- Drain Current**



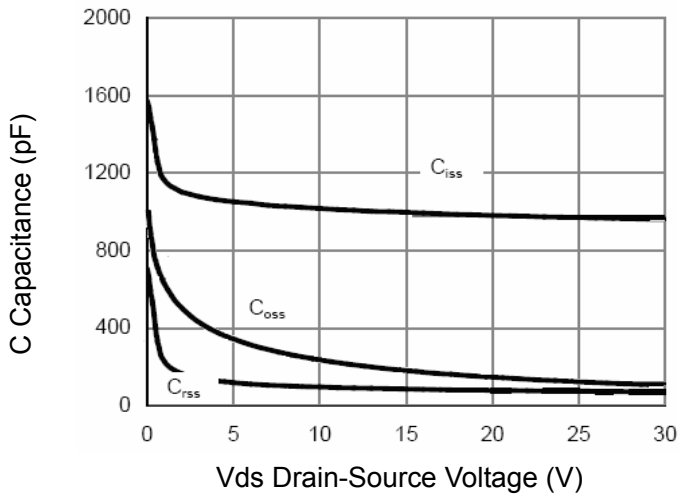
**Figure 4 Rdson-Junction Temperature**



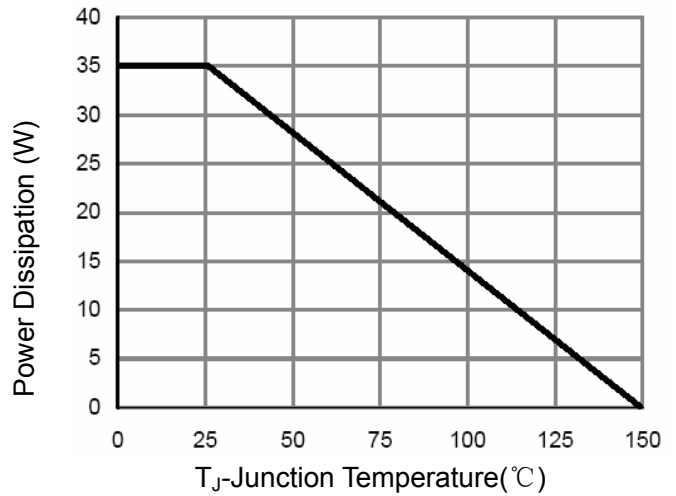
**Figure 5 Gate Charge**



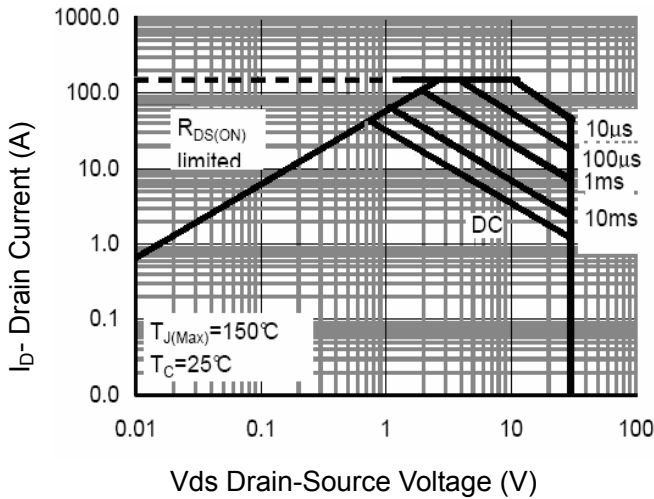
**Figure 6 Source- Drain Diode Forward**



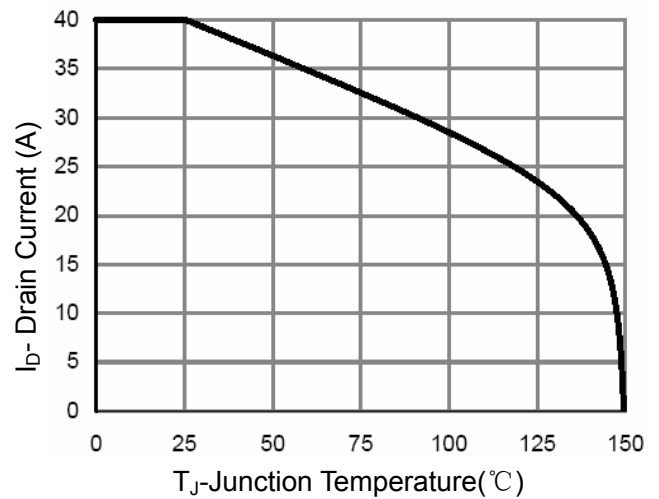
**Figure 7 Capacitance vs Vds**



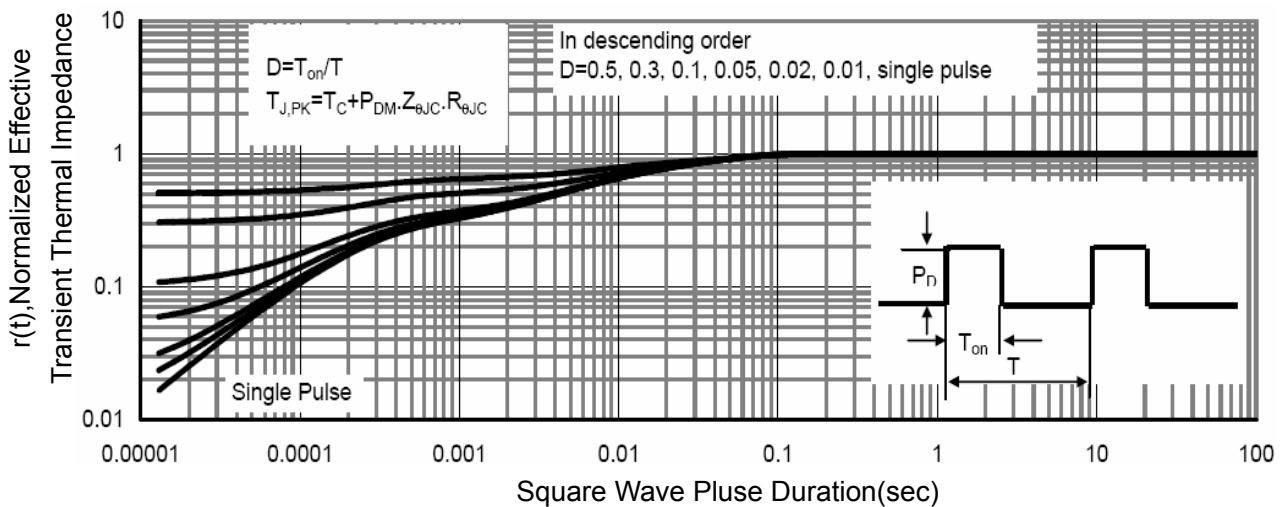
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**



**Figure 10 ID Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## P-channel Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-30	-33	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V	-	-	-1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1	-1.6	-2.2	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-15A	-	9	11	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-15A	-	15	20	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-15A	15	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, F=1.0MHz	-	1632	-	PF
Output Capacitance	C <sub>OSS</sub>		-	227	-	PF
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	178	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-15V, I <sub>D</sub> =-15A, V <sub>GS</sub> =-10V, R <sub>GEN</sub> =1Ω	-	12	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	10	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	25	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	13	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-15V, I <sub>D</sub> =-15A, V <sub>GS</sub> =-10V	-	45.6	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	4.6	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	11.1	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-15A	-	-	-1.2	V

### 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

## Typical Electrical and Thermal Characteristics

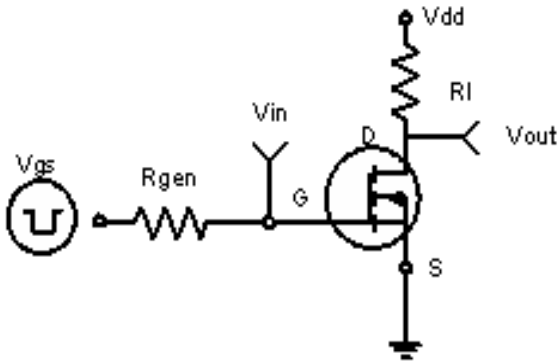


Figure 1: Switching Test Circuit

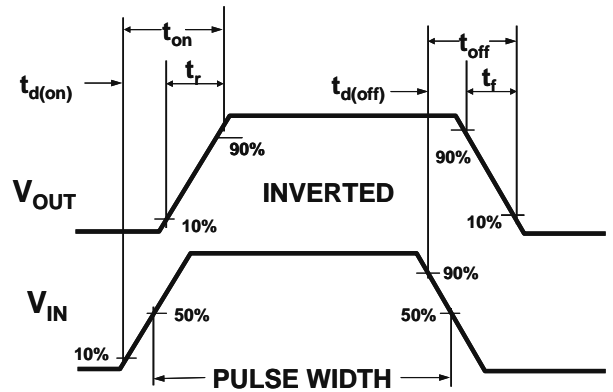


Figure 2: Switching Waveforms

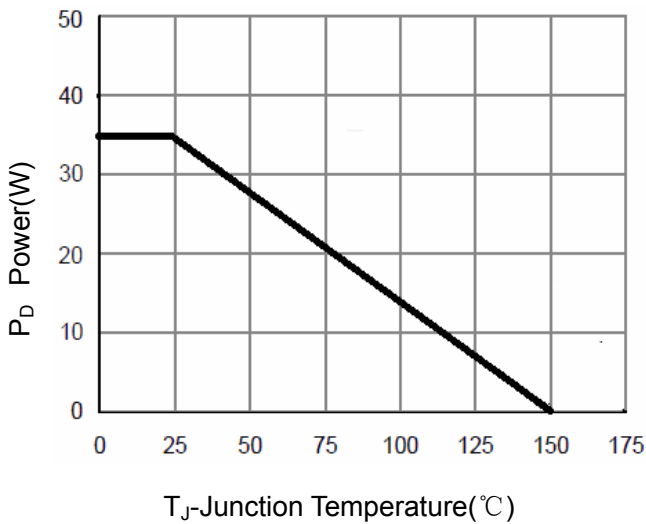


Figure 3 Power Dissipation

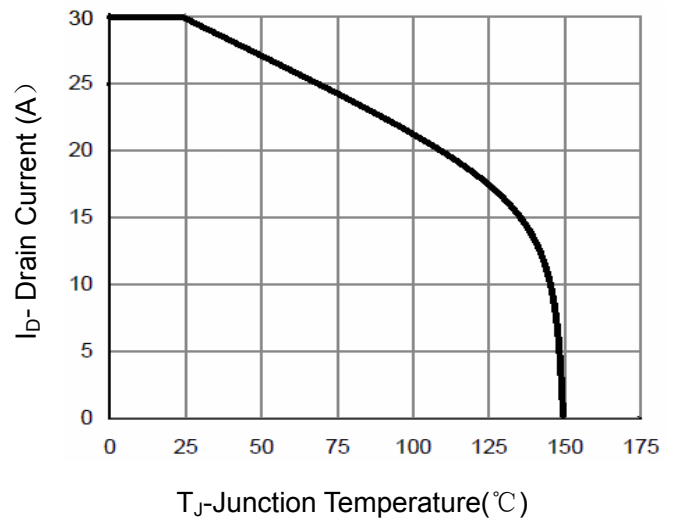


Figure 4 Drain Current

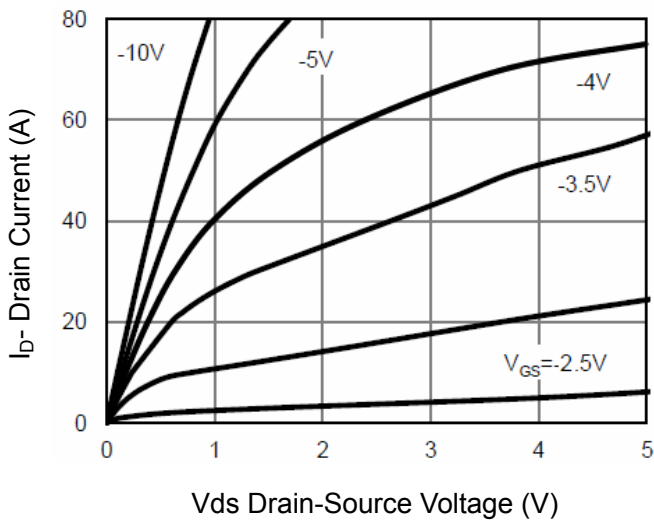


Figure 5 Output Characteristics

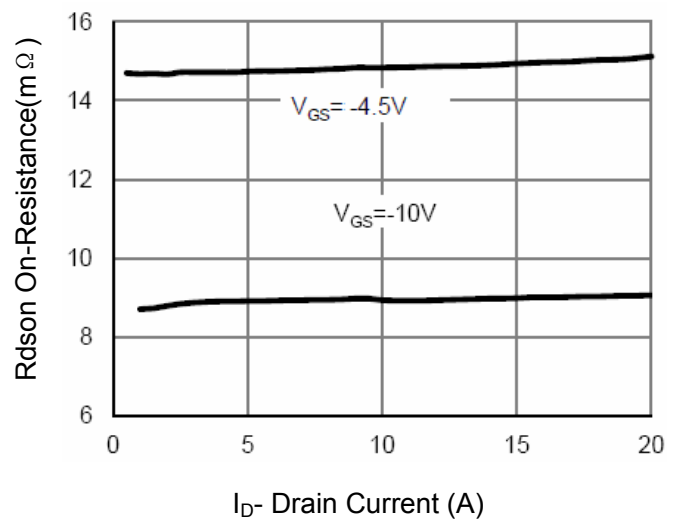
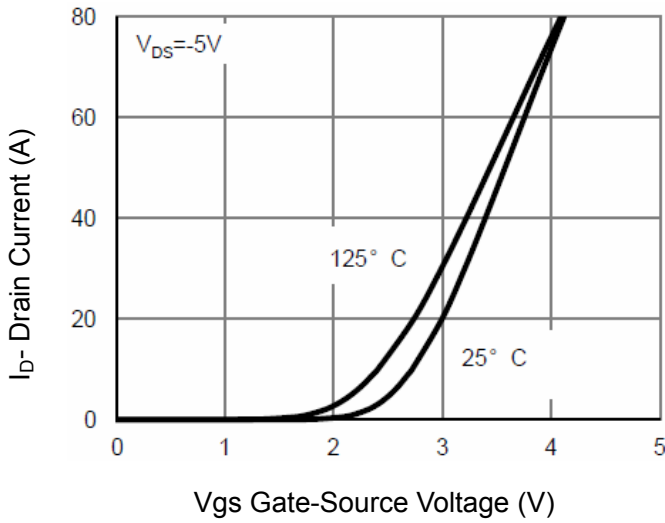
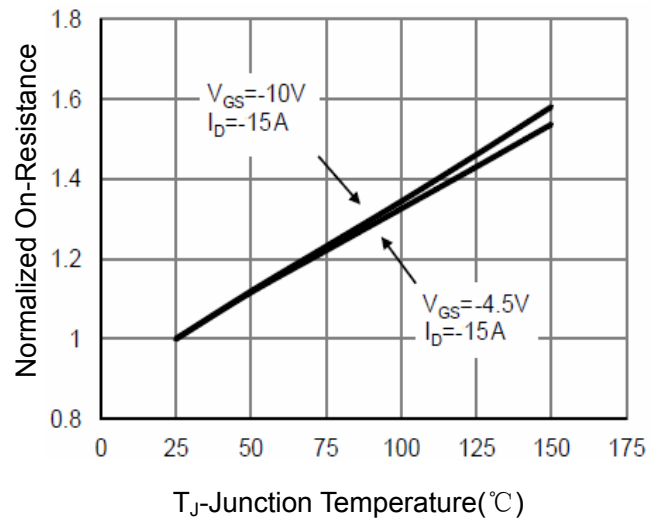


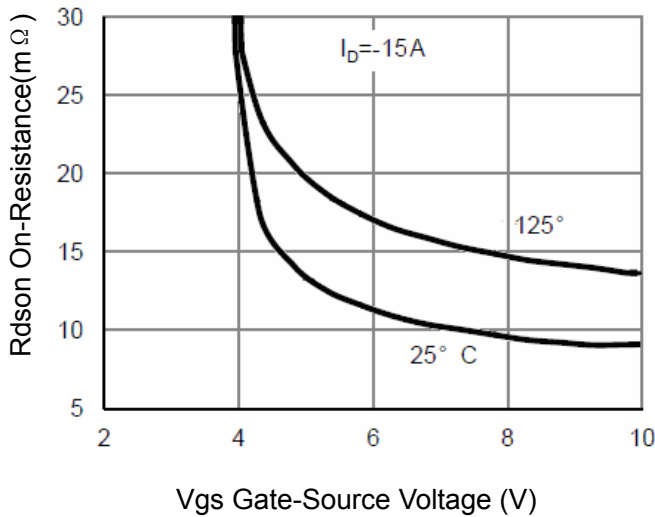
Figure 6 Drain-Source On-Resistance



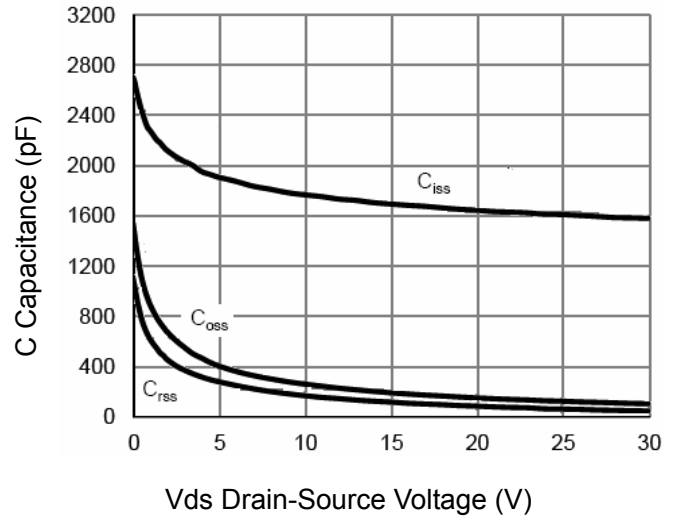
**Figure 7 Transfer Characteristics**



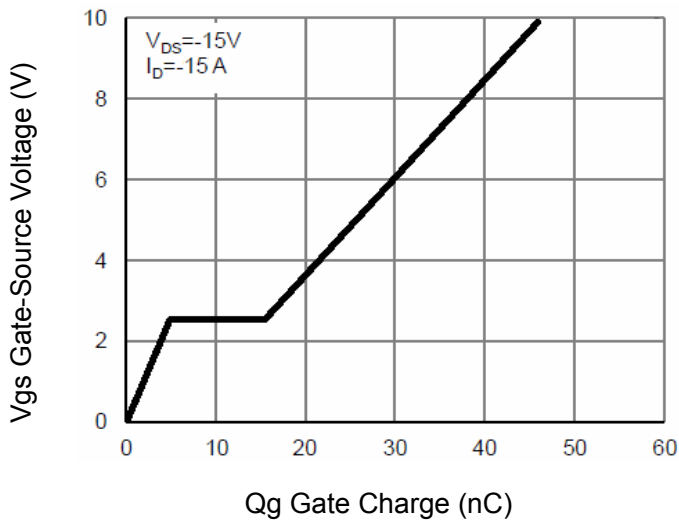
**Figure 8 Drain-Source On-Resistance**



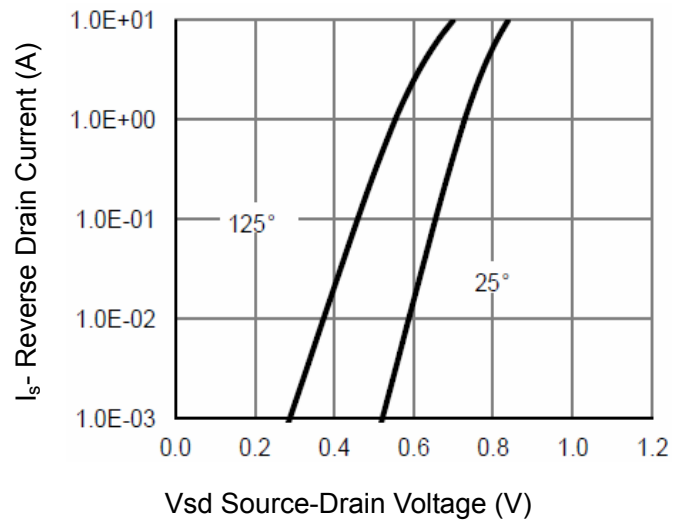
**Figure 9 Rdson vs Vgs**



**Figure 10 Capacitance vs Vds**

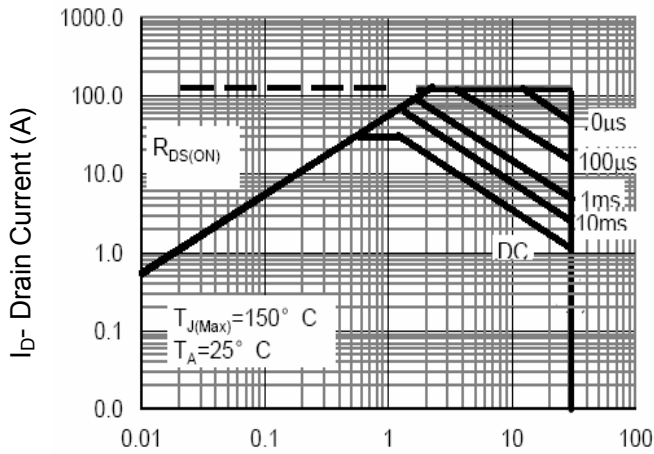


**Figure 11 Gate Charge**

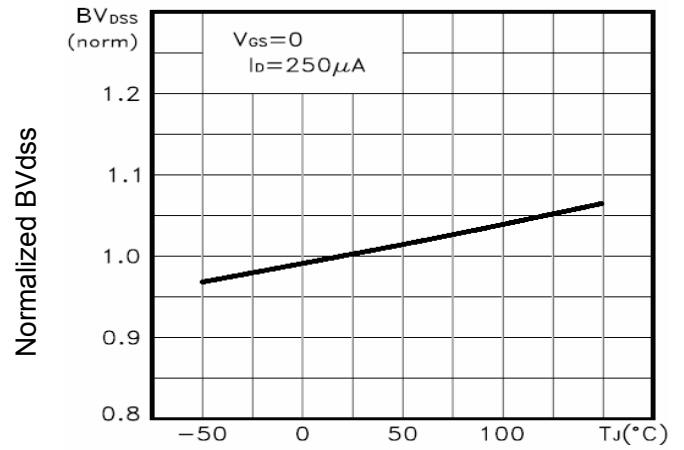


**Figure 12 Source- Drain Diode Forward**

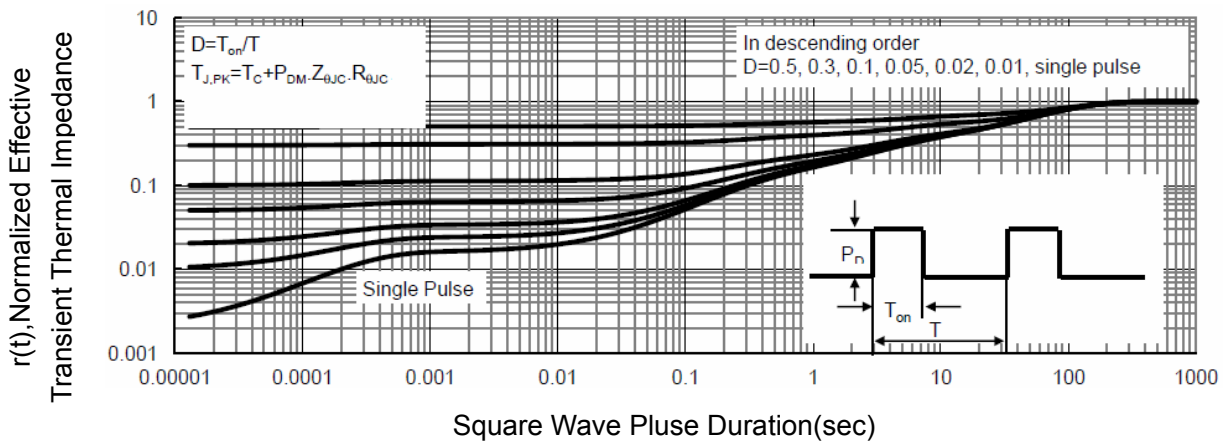




Vds Drain-Source Voltage (V)  
**Figure 13 Safe Operation Area**

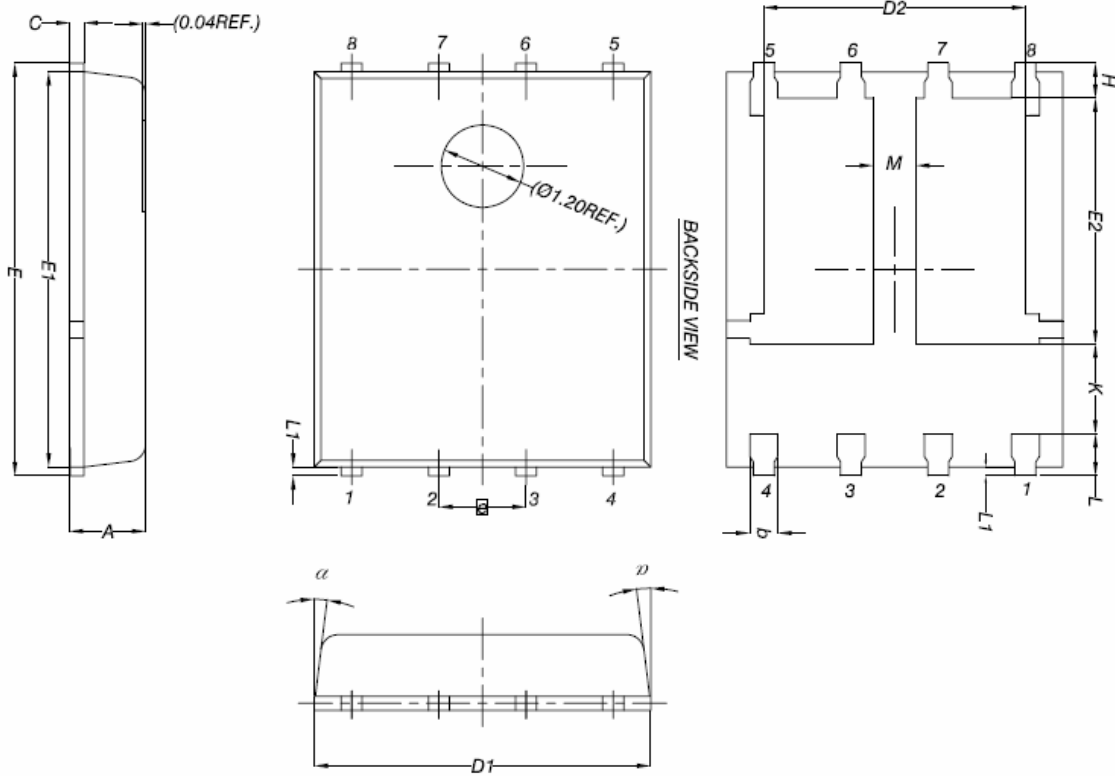


T<sub>J</sub>-Junction Temperature(°C)  
**Figure 14 BV<sub>DSS</sub> vs Junction Temperature**



**Figure 15 Normalized Maximum Transient Thermal Impedance**

DFN5X6-8L Package Information



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.27 BSC		
H	0.41	0.51	0.61
K	1.10	-	-
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
M	0.50	-	-
α	0°	-	12°

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