

## N and P-Channel Enhancement Mode Power MOSFET

### Description

The NCE1205 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

### General Features

#### ● N-Channel

$$V_{DS} = 12V, I_D = 5A$$

$$R_{DS(ON)} < 32m\Omega @ V_{GS} = 4.5V$$

$$R_{DS(ON)} < 42m\Omega @ V_{GS} = 2.5V$$

$$R_{DS(ON)} < 80m\Omega @ V_{GS} = 1.8V$$

#### ● P-Channel

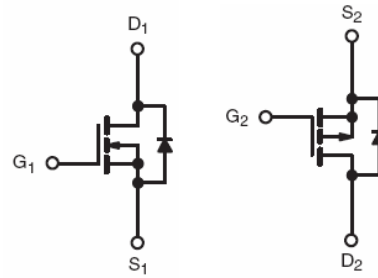
$$V_{DS} = -12V, I_D = -5A$$

$$R_{DS(ON)} < 74m\Omega @ V_{GS} = -4.5V$$

$$R_{DS(ON)} < 110m\Omega @ V_{GS} = -2.5V$$

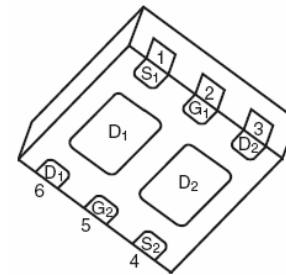
$$R_{DS(ON)} < 220m\Omega @ V_{GS} = -1.8V$$

#### ● Load Switch for Portable Devices



N-channel

P-channel



Pin assignment

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
1205	NCE1205	DFN2X2-6L	-	-	-

### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	N-Channel	P-Channel	Unit	
Drain-Source Voltage	$V_{DS}$	12	-12	V	
Gate-Source Voltage	$V_{GS}$	$\pm 12$	$\pm 12$	V	
Continuous Drain Current	$I_D$	$T_A = 25^\circ\text{C}$	5	-5	A
		$T_A = 70^\circ\text{C}$	4.5	-3.8	
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	20	-15	A	
Maximum Power Dissipation	$P_D$	1.9	1.9	W	
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	-55 To 150	$^\circ\text{C}$	

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient <sup>(Note2)</sup>	$R_{\theta JA}$	N-Ch	65	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient <sup>(Note2)</sup>	$R_{\theta JA}$	P-Ch	65	$^\circ\text{C/W}$

**N-CH Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	12	20	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=12V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.4	0.6	1	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=5A$	-	28	32	$m\Omega$
		$V_{GS}=2.5V, I_D=4.6A$	-	36	42	$m\Omega$
		$V_{GS}=1.8V, I_D=4.1A$	-	55	80	$m\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=5A$	-	20	-	S
<b>Dynamic Characteristics (Note4)</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=6V, V_{GS}=0V,$ $F=1.0MHz$	-	495	-	PF
Output Capacitance	$C_{oss}$		-	155	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	95	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=6V, R_L=1.2\Omega$ $V_{GS}=10V, R_{GEN}=4.5\Omega$	-	7.0	-	nS
Turn-on Rise Time	$t_r$		-	5.0	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	18	-	nS
Turn-Off Fall Time	$t_f$		-	6	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=6V, I_D=5A,$ $V_{GS}=4.5V$	-	6.6	-	nC
Gate-Source Charge	$Q_{gs}$		-	1	-	nC
Gate-Drain Charge	$Q_{gd}$		-	1.2	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=5A$	-	-	1.2	V

**P-CH Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-12	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-12V, V_{GS}=0V$	-	-	-1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.4	-0.7	-1	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-4.5V, I_D=-4.5A$	-	60	74	m $\Omega$
		$V_{GS}=-2.5V, I_D=-3.2A$	-	84	110	m $\Omega$
		$V_{GS}=-1.8V, I_D=-1A$	-	130	220	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-10V, I_D=-5A$	-	10	-	S
<b>Dynamic Characteristics (Note 4)</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=-6V, V_{GS}=0V,$ $F=1.0MHz$	-	520	-	PF
Output Capacitance	$C_{OSS}$		-	100	-	PF
Reverse Transfer Capacitance	$C_{RSS}$		-	65	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-6V, R_L=2.3\Omega$ $V_{GS}=-10V, R_{GEN}=6\Omega$	-	7.5	-	nS
Turn-on Rise Time	$t_r$		-	5.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	19	-	nS
Turn-Off Fall Time	$t_f$		-	7	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-6V, I_D=-4.5A$ $V_{GS}=-4.5V$	-	9.2	-	nC
Gate-Source Charge	$Q_{gs}$		-	1.6	-	nC
Gate-Drain Charge	$Q_{gd}$		-	2.2	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=-5A$	-	-	-1.2	V

**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

N- Channel Typical Electrical and Thermal Characteristics (Curves)

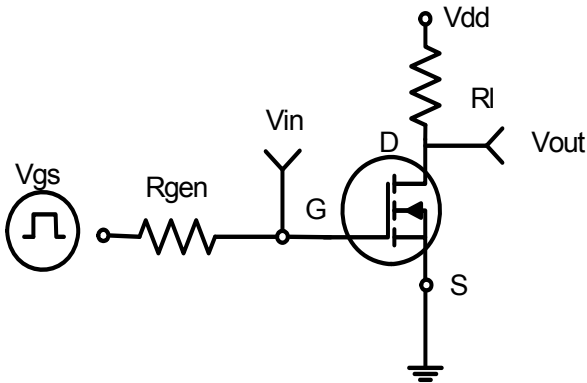


Figure 1: Switching Test Circuit

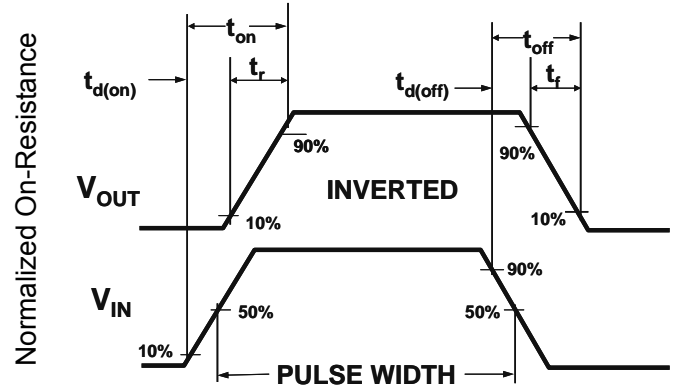


Figure 2: Switching Waveforms

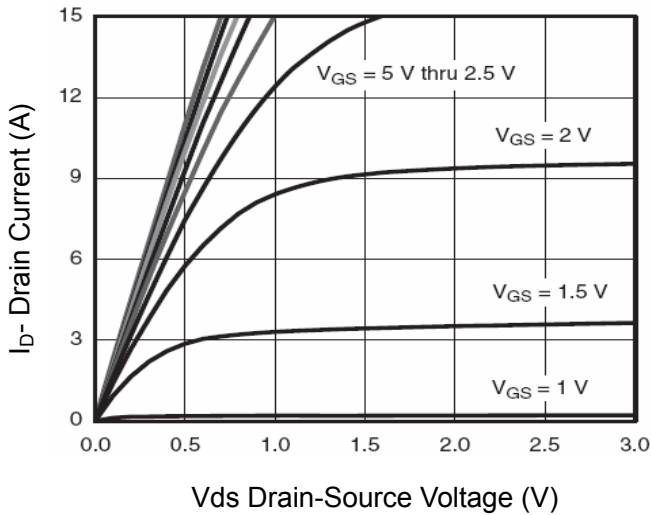


Figure 3 Output Characteristics

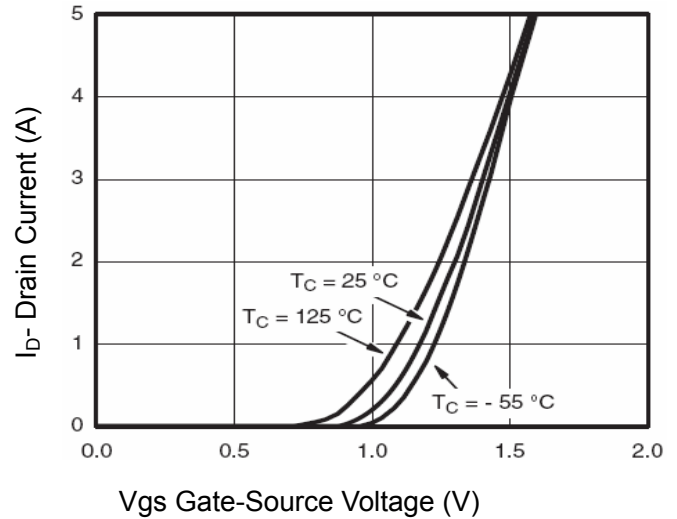


Figure 4 Transfer Characteristics

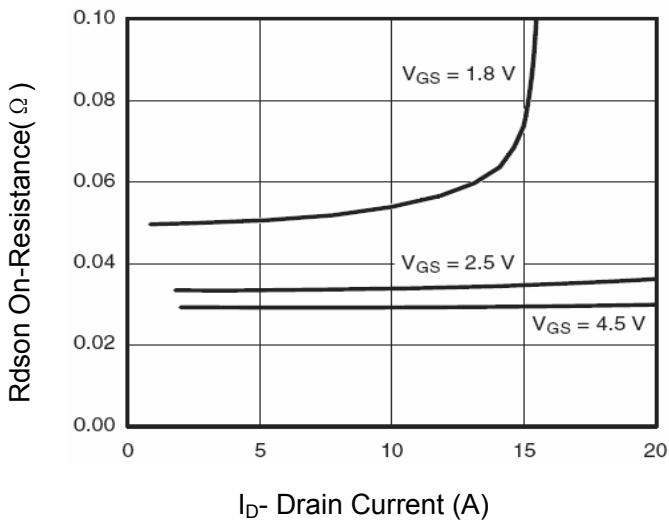


Figure 5 Drain-Source On-Resistance

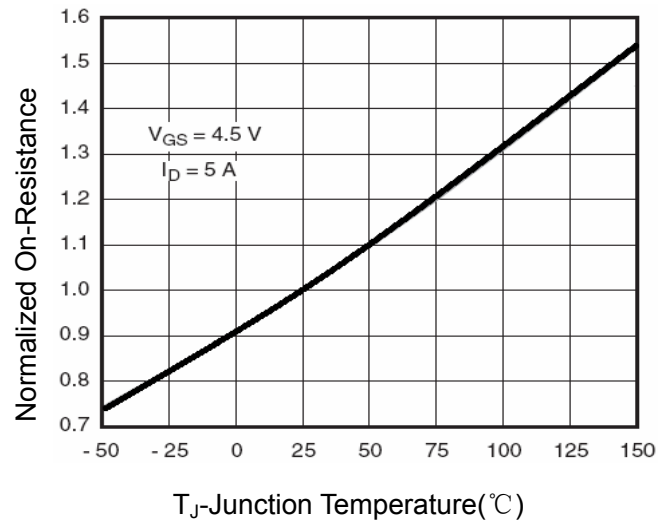
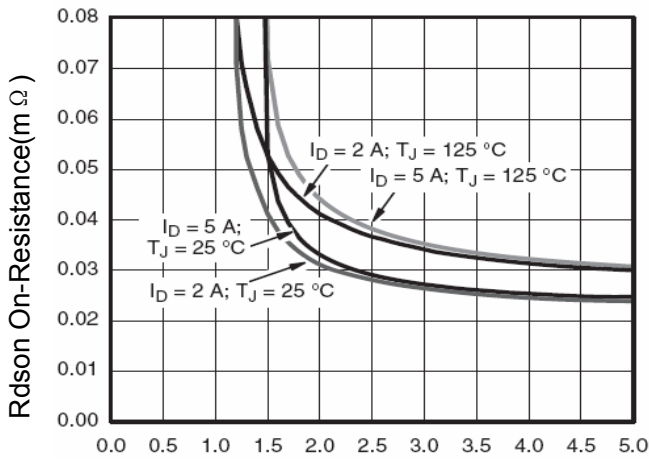
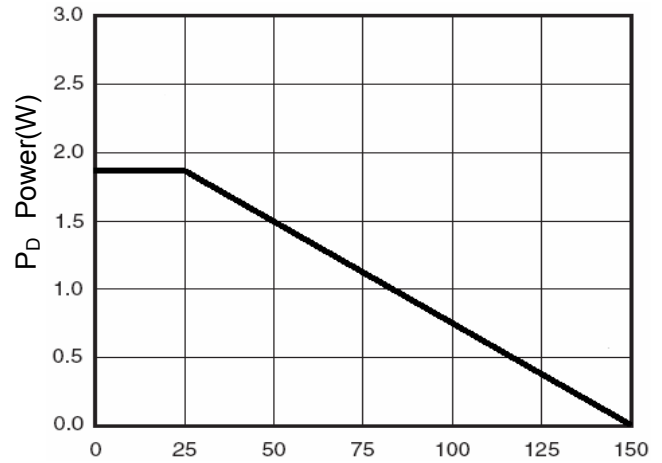


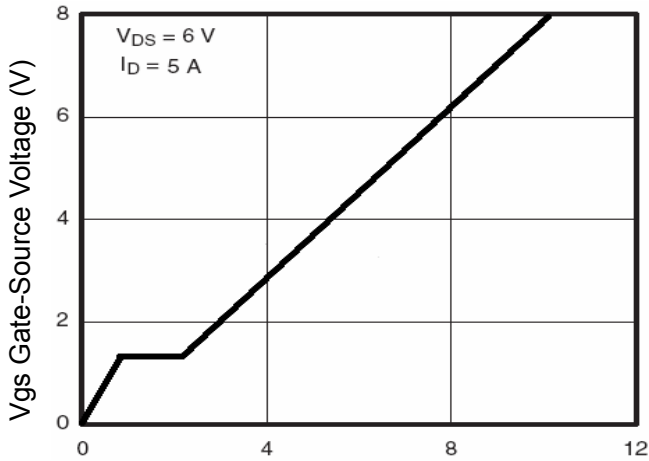
Figure 6 Drain-Source On-Resistance



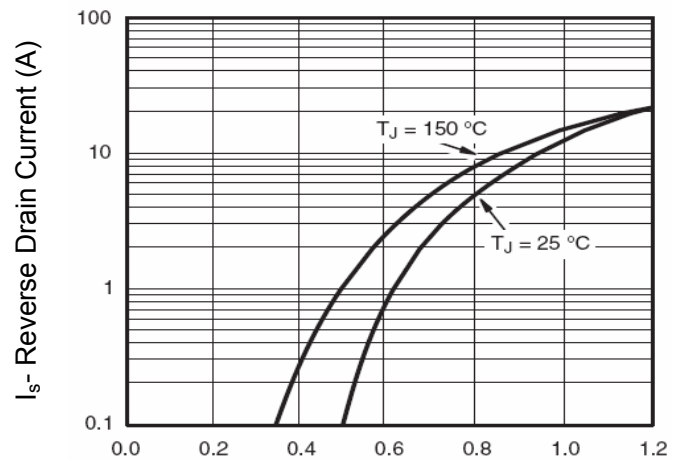
Vgs Gate-Source Voltage (V)  
**Figure 7 Rdson vs Vgs**



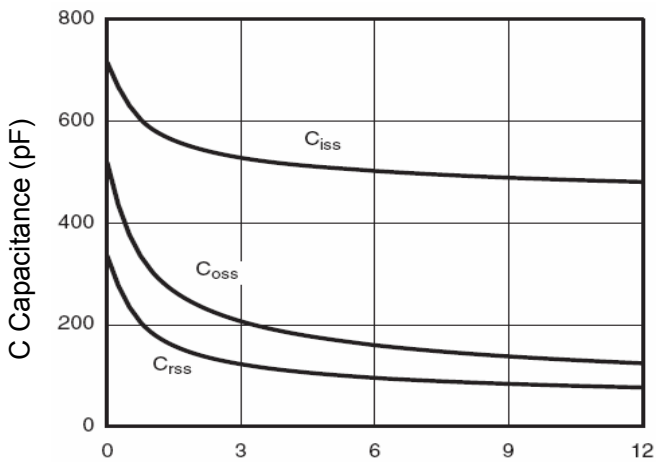
Tj Junction Temperature (°C)  
**Figure 8 Power Dissipation**



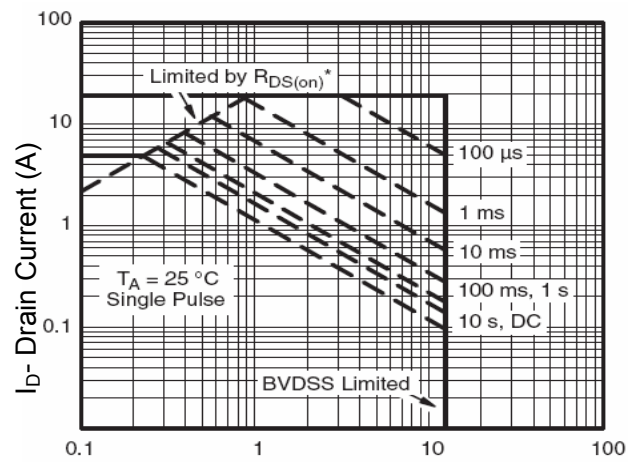
Qg Gate Charge (nC)  
**Figure 9 Gate Charge**



Vds Drain-Source Voltage (V)  
**Figure 10 Source- Drain Diode Forward**



Vds Drain-Source Voltage (V)  
**Figure 11 Capacitance vs Vds**



Vds Drain-Source Voltage (V)  
**Figure 12 Safe Operation Area**

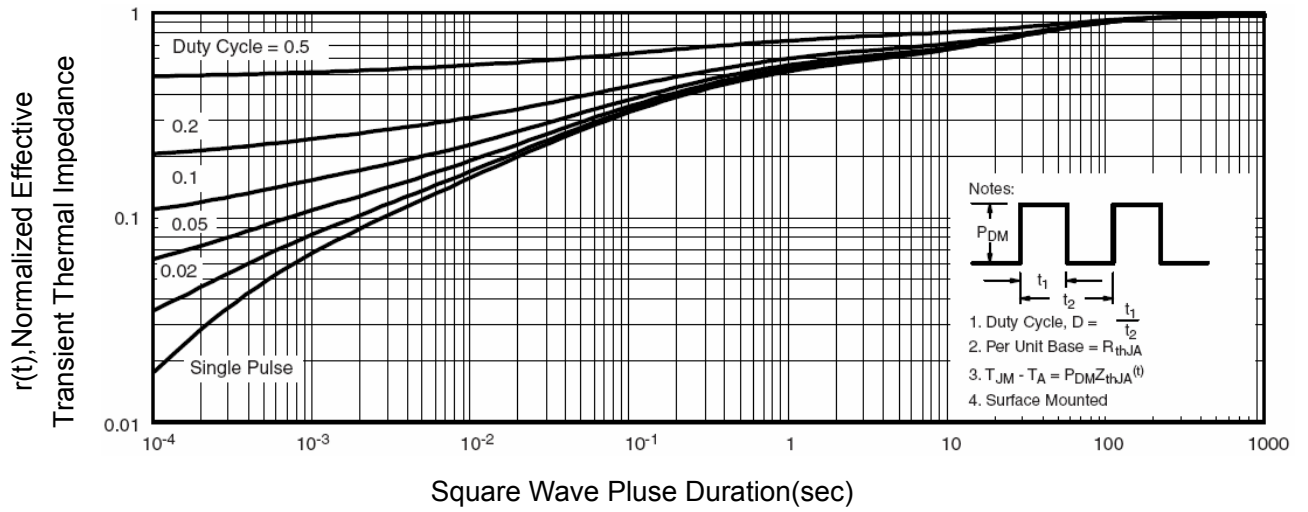
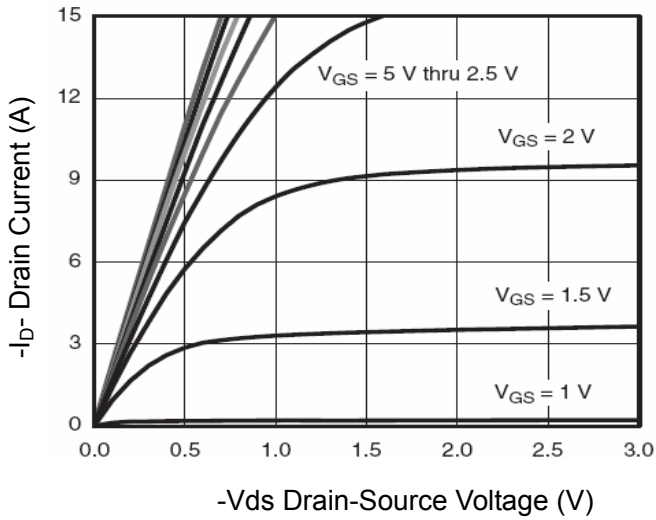
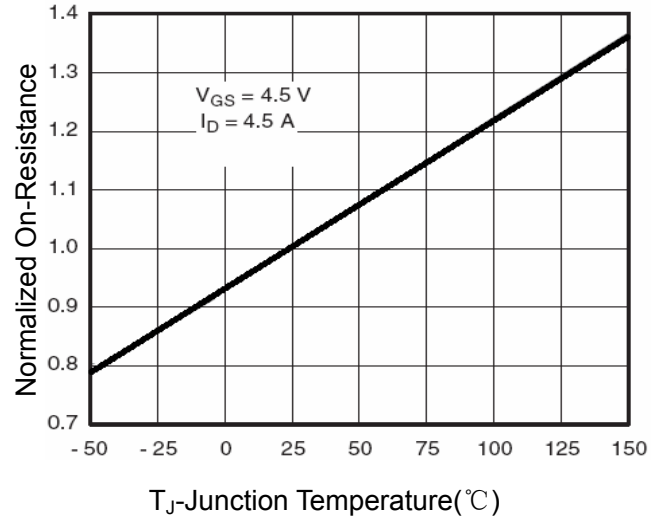


Figure 13 Normalized Maximum Transient Thermal Impedance

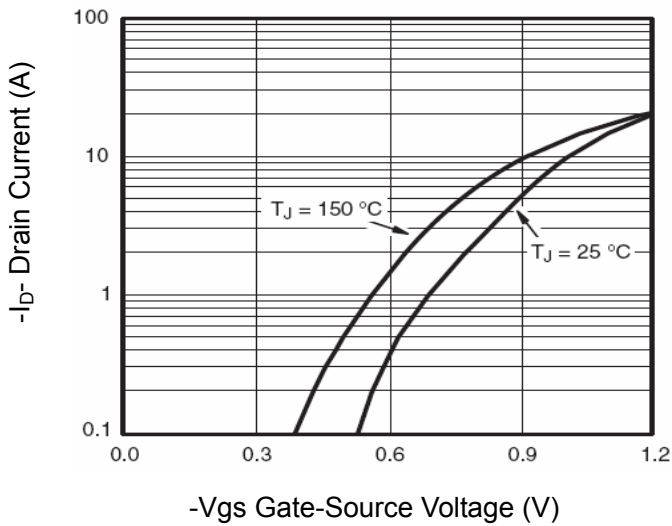
**P- Channel Typical Electrical and Thermal Characteristics (Curves)**



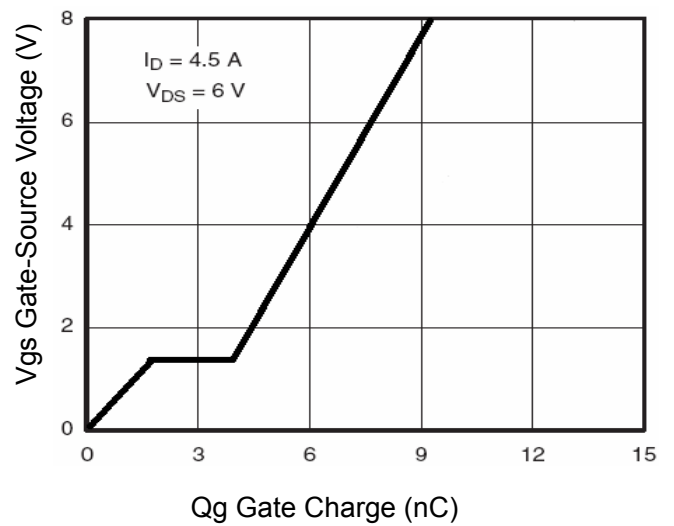
**Figure 1 Output Characteristics**



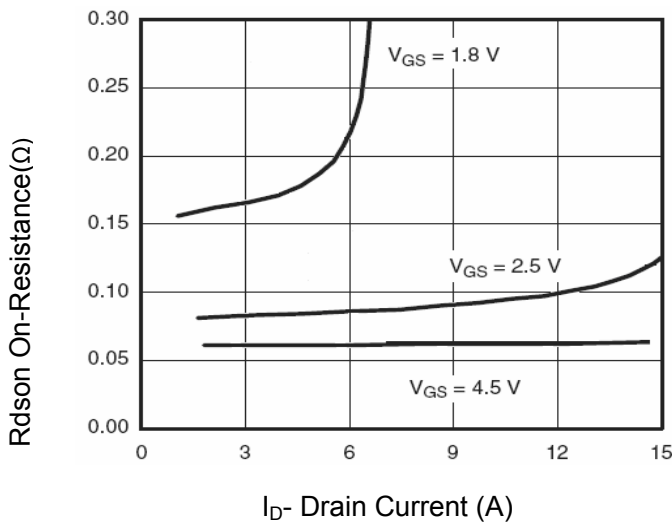
**Figure 4 Rdson-Junction Temperature**



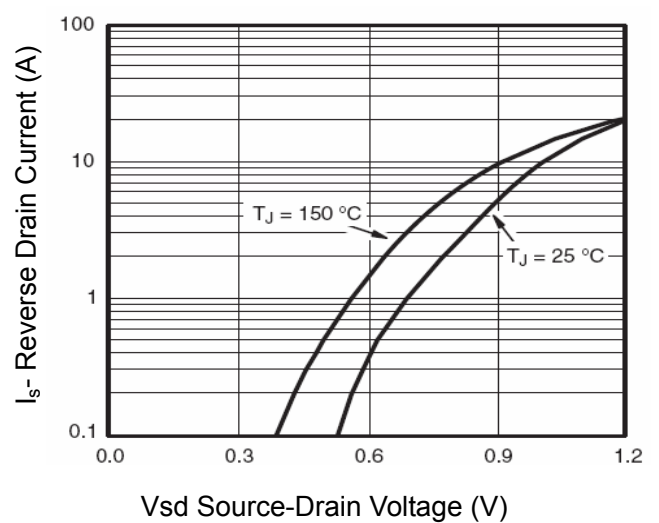
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



**Figure 3 Rdson- Drain Current**



**Figure 6 Source- Drain Diode Forward**

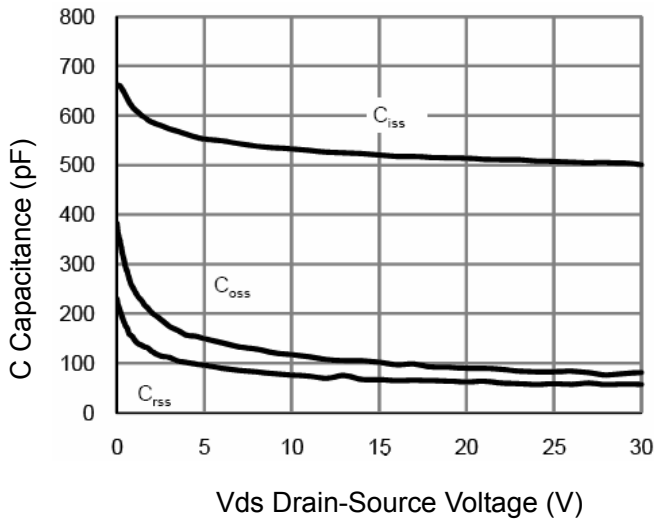


Figure 7 Capacitance vs Vds

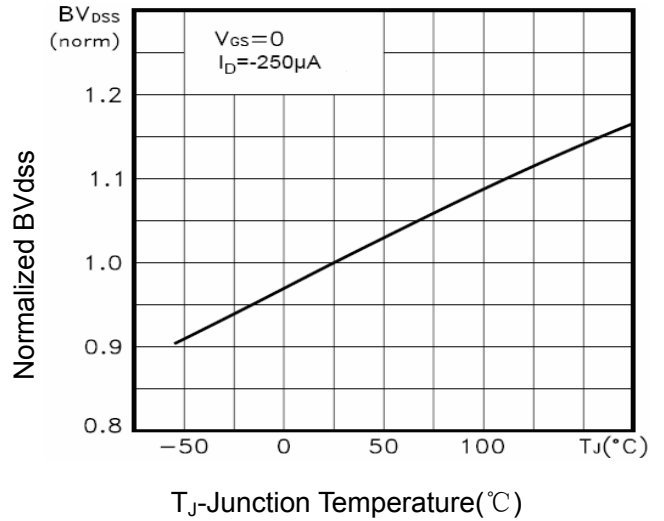


Figure 9  $BV_{DSS}$  vs Junction Temperature

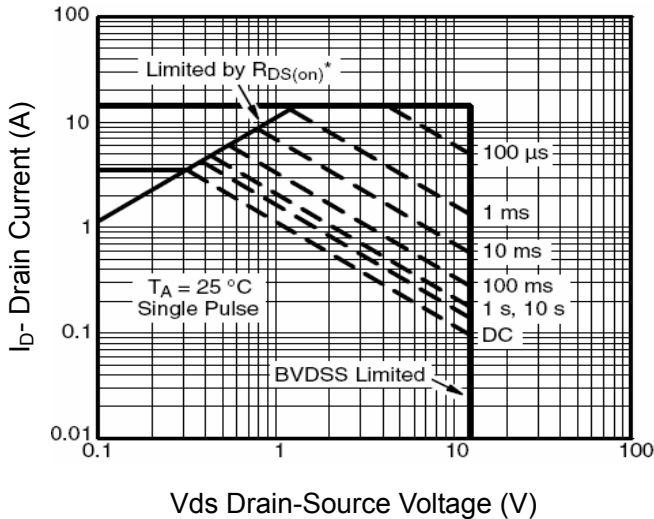


Figure 8 Safe Operation Area

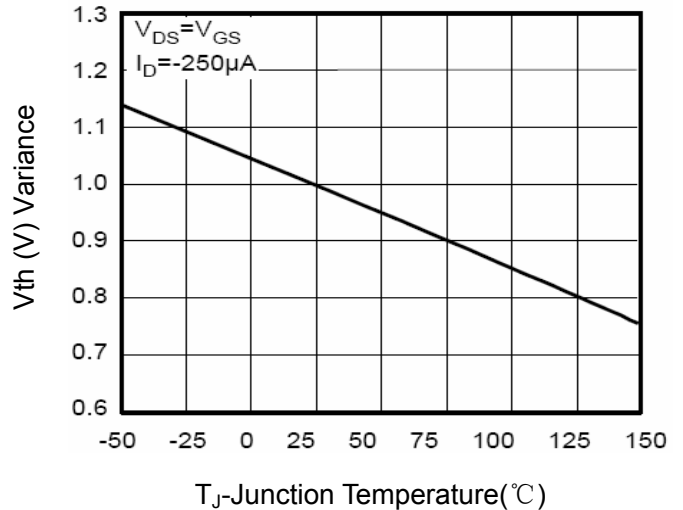


Figure 10  $V_{GS(th)}$  vs Junction Temperature

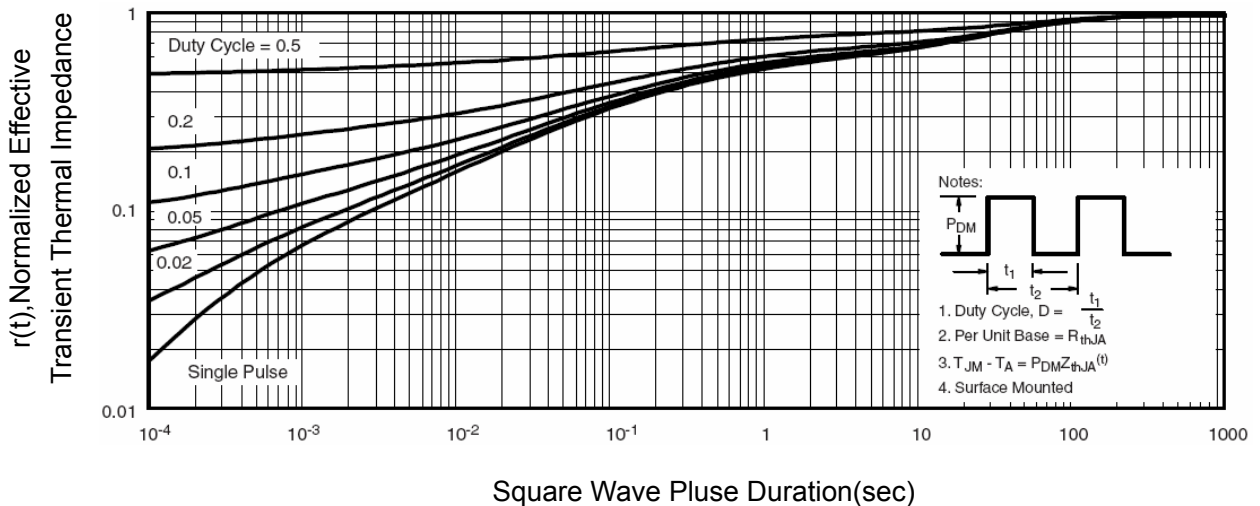
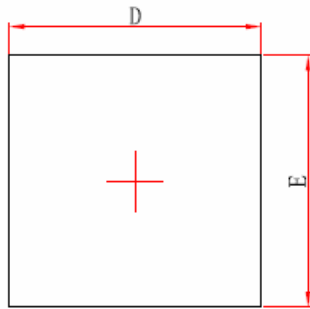


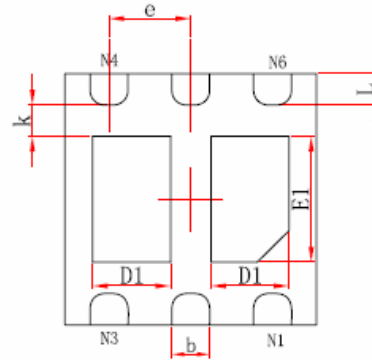
Figure 11 Normalized Maximum Transient Thermal Impedance



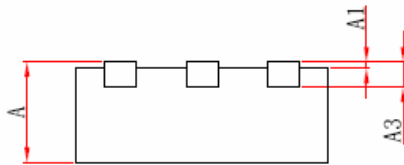
DFN2X2-6L Package Information



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.924	2.076	0.076	0.082
E	1.924	2.076	0.076	0.082
D1	0.520	0.720	0.020	0.028
E1	0.900	1.100	0.035	0.043
k	0.200MIN.		0.008MIN.	
b	0.250	0.350	0.010	0.014
e	0.650TYP.		0.026TYP.	
L	0.174	0.326	0.007	0.013

## Attention

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