

## NCE N-Channel and P-Channel Enhancement Mode Power MOSFET

**Description**

The NCE01NP03S 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**

- $V_{DS} = 100V, I_D = 3A$

$$R_{DS(ON)} < 130m\Omega @ V_{GS}=10V$$

$$R_{DS(ON)} < 140m\Omega @ V_{GS}=4.5V$$

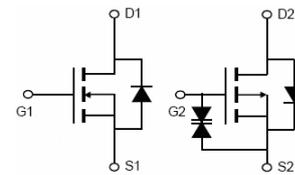
- High Power and current handling capability
- Lead free product is acquired

**P-channel**

- $V_{DS} = -100V, I_D = -3A$

$$R_{DS(ON)} < 200m\Omega @ V_{GS}=-10V$$

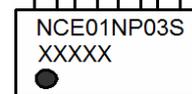
$$R_{DS(ON)} < 230m\Omega @ V_{GS}=-4.5V$$



Schematic diagram

D1 D1 D2 D2

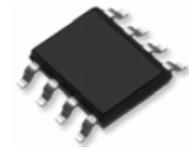
8 7 6 5

NCE01NP03S  
XXXXX

1 2 3 4

S1 G1 S2 G2

Pin assignment



SOP-8 top view

**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE01NP03S	NCE01NP03S	SOP-8	Ø330mm	12mm	4000 units

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

Parameter	Symbol	N-channel	P-channel	Unit	
Drain-Source Voltage	$V_{DS}$	100	-100	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V	
Drain Current-Continuous (Note 2)	$I_D$	$T_A=25^\circ\text{C}$	3	-3	A
		$T_A=70^\circ\text{C}$	2.45	-2.45	A
Drain Current -Pulsed (Note 1)	$I_{DM}$	12	-12	A	
Power Dissipation	$P_D$	2	2	W	
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	-55 To 150	$^\circ\text{C}$	

**Thermal Characteristic**

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Ambient (Note 2) (N-channel)	$R_{\theta JA}$	-	62.5	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Note 2) (P-channel)	$R_{\theta JA}$	-	62.5	$^\circ\text{C}/\text{W}$

N-channel Electrical Characteristics ( $T_C=25^\circ\text{C}$  unless otherwise noted)

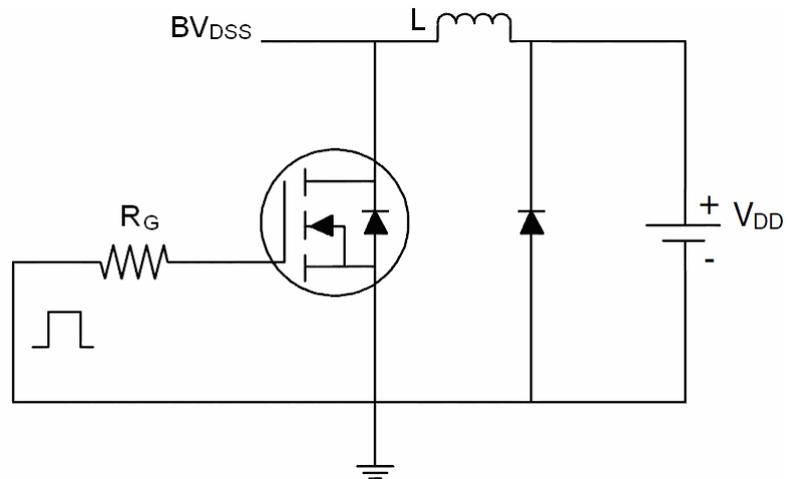
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	100	110	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=100V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.5	2.0	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=3A$	-	95	130	m $\Omega$
		$V_{GS}=4.5V, I_D=3A$		100	140	
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=3A$	3.5	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	730	-	PF
Output Capacitance	$C_{oss}$		-	37	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	27	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=50V, R_L=15\Omega$ $V_{GS}=10V, R_G=2.5\Omega$	-	11	-	nS
Turn-on Rise Time	$t_r$		-	7.4	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	35	-	nS
Turn-Off Fall Time	$t_f$		-	9.1	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=50V, I_D=3A,$ $V_{GS}=10V$	-	21.5	-	nC
Gate-Source Charge	$Q_{gs}$		-	3.2	-	nC
Gate-Drain Charge	$Q_{gd}$		-	6	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=3A$	-	-	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	3	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = 3A$ $di/dt = 100A/\mu\text{s}$ (Note 3)	-	26	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	27	-	nC
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

## Notes:

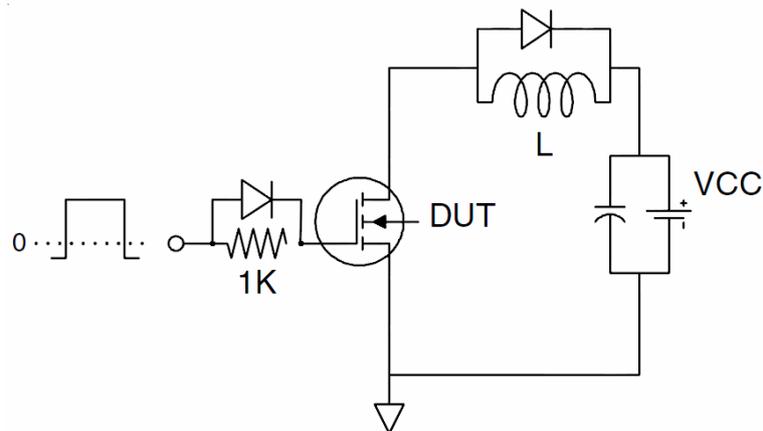
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design. Surface Mounted on FR4 Board,  $t \leq 10$  sec. The current rating is based on the  $t \leq 10$ s thermal resistance rating.
3. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production .

## Test Circuit

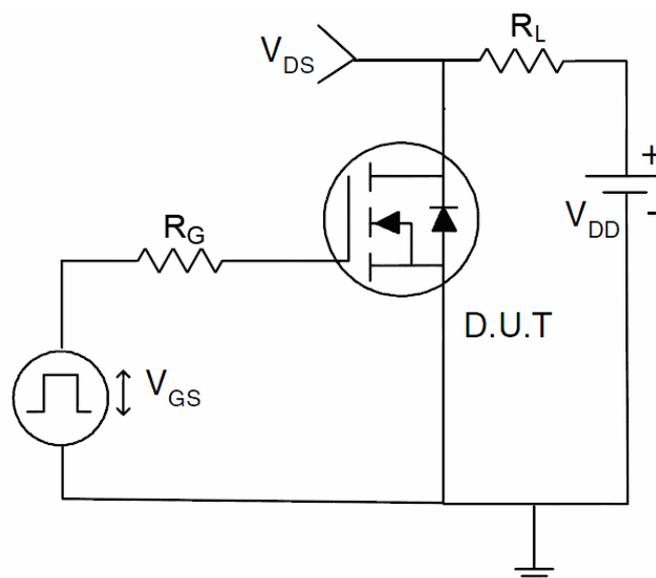
### 1) $E_{AS}$ test Circuit



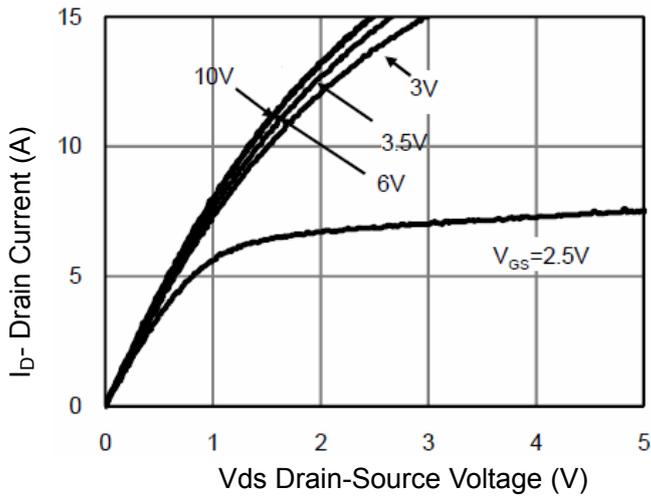
### 2) Gate charge test Circuit



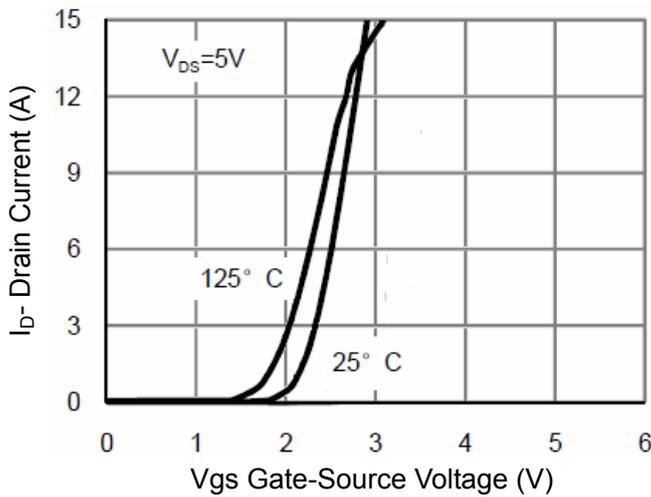
### 3) Switch Time Test Circuit



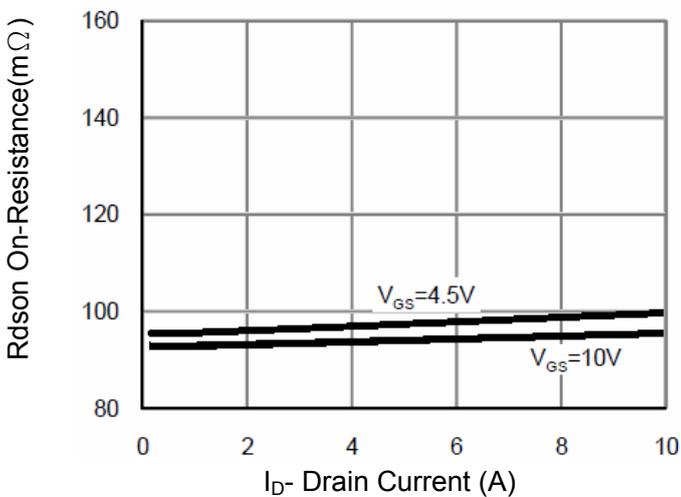
## N-channel Typical Electrical and Thermal Characteristics (Curves)



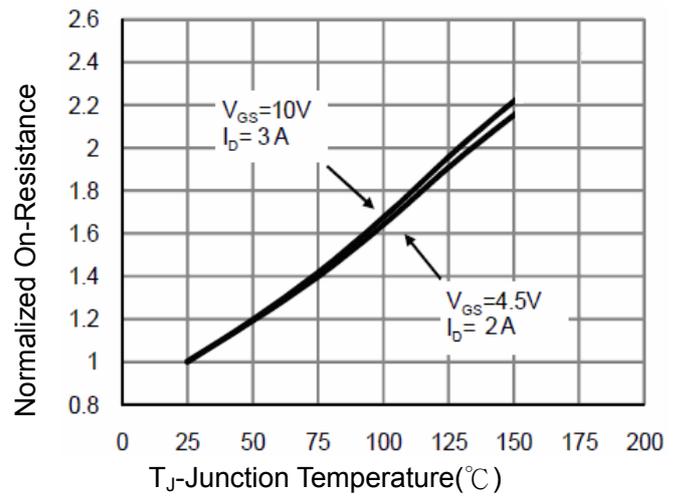
**Figure 1 Output Characteristics**



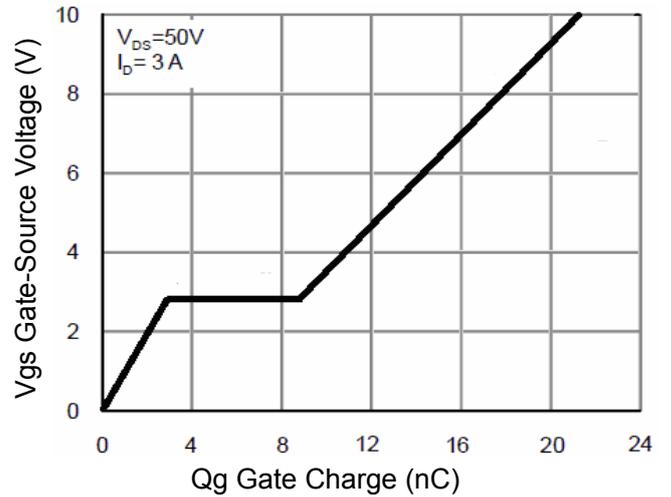
**Figure 2 Transfer Characteristics**



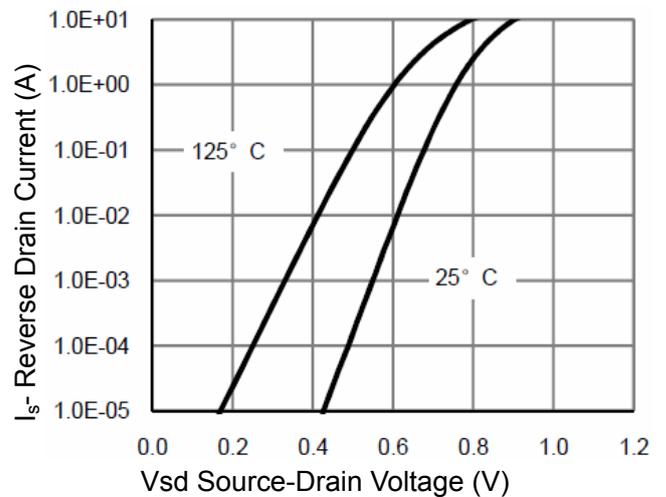
**Figure 3 Rdson- Drain Current**



**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

# NCE01NP03S

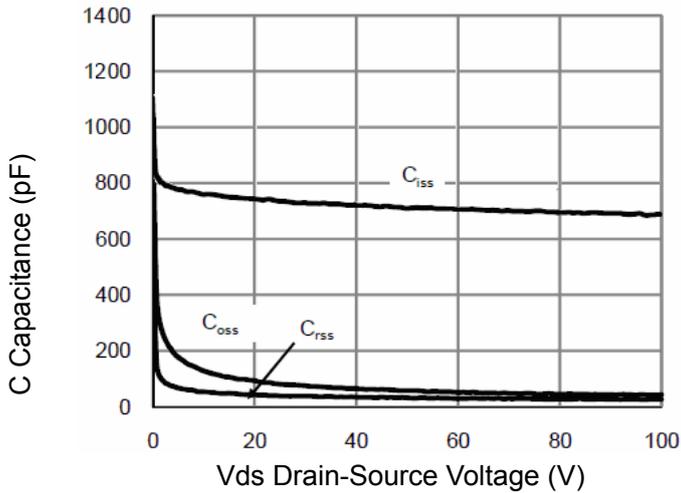


Figure 7 Capacitance vs Vds

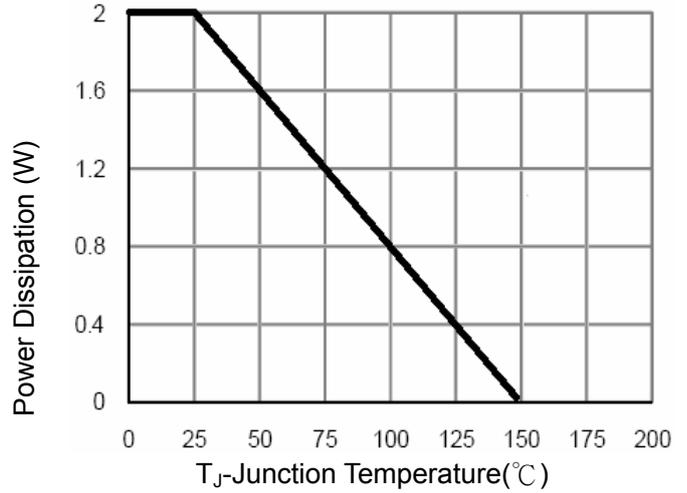


Figure 9 Power De-rating

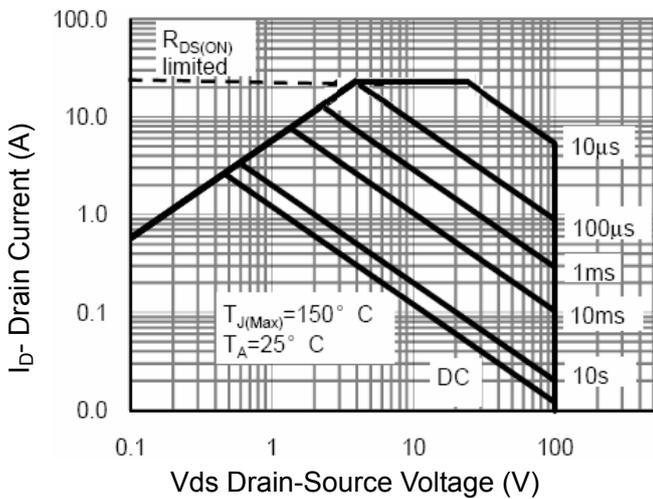


Figure 8 Safe Operation Area

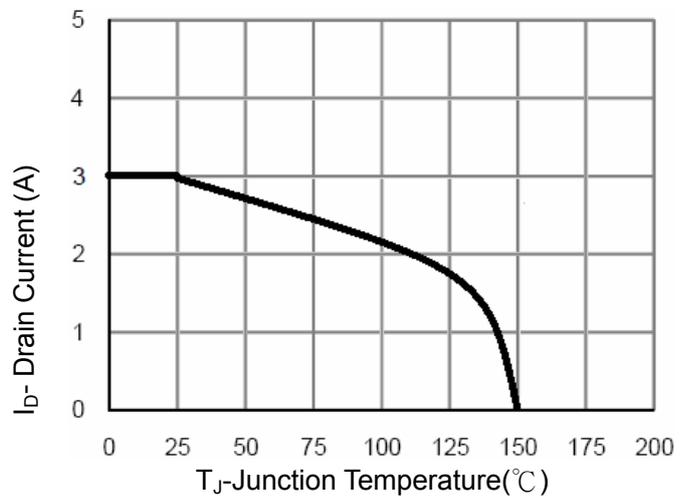


Figure 10 Current De-rating

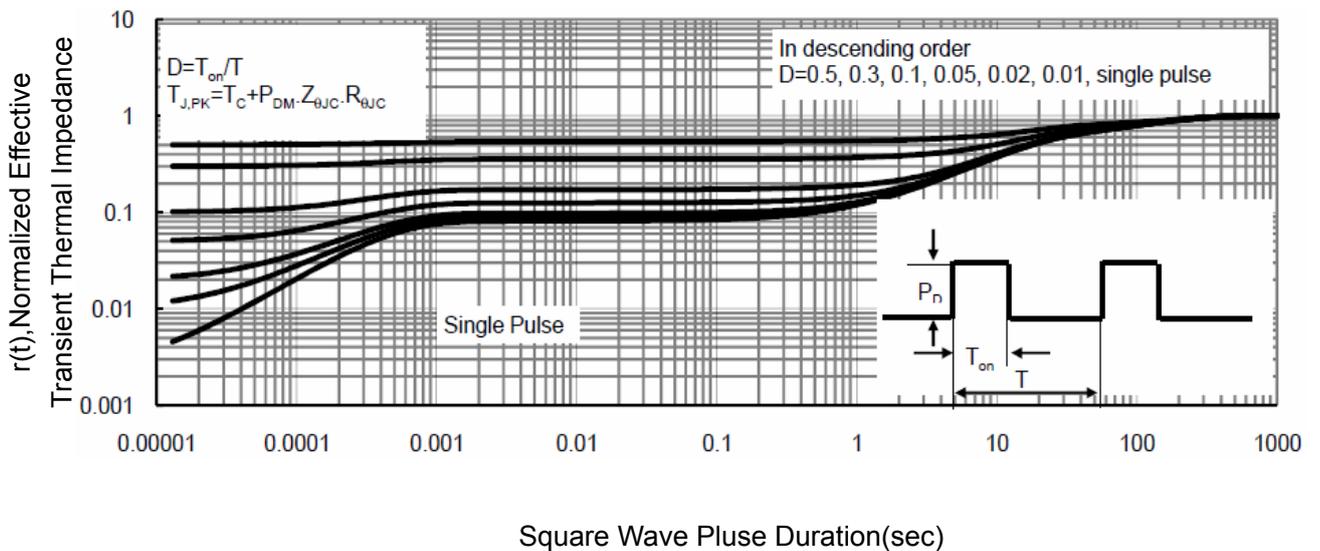


Figure 11 Normalized Maximum Transient Thermal Impedance

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

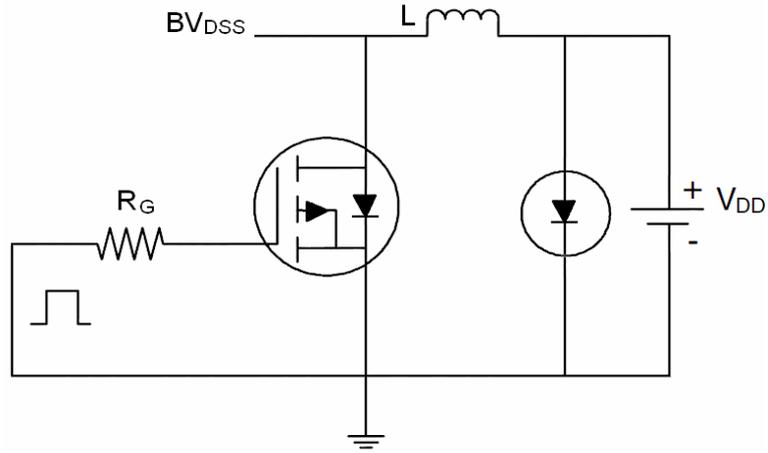
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-100	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-100V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±10	μA
<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	-1.9	-3	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-3A	-	170	200	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-2A	-	200	230	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-3A	2	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-25V, V <sub>GS</sub> =0V, F=1.0MHz	-	760	-	PF
Output Capacitance	C <sub>oss</sub>		-	260	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	170	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-50V, I <sub>D</sub> =-3A V <sub>GS</sub> =-10V, R <sub>GEN</sub> =9Ω	-	14	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	18	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	50	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	18	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-50V, I <sub>D</sub> =-3A, V <sub>GS</sub> =-10V	-	25	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	5	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	7	-	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> =-3A	-	-	-1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>	-	-	-	-3	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = -3A di/dt = 100A/μs (Note 3)	-	35	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	46	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### Notes:

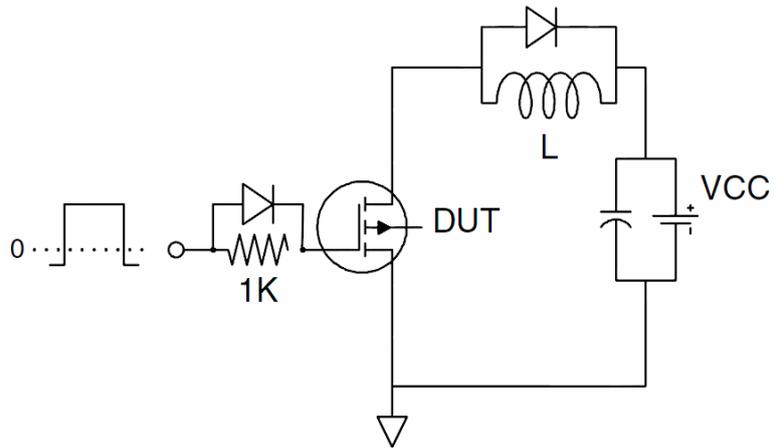
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. E<sub>AS</sub> condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=-50V, V<sub>G</sub>=-10V, L=0.5mH, R<sub>g</sub>=25Ω

## Test Circuit

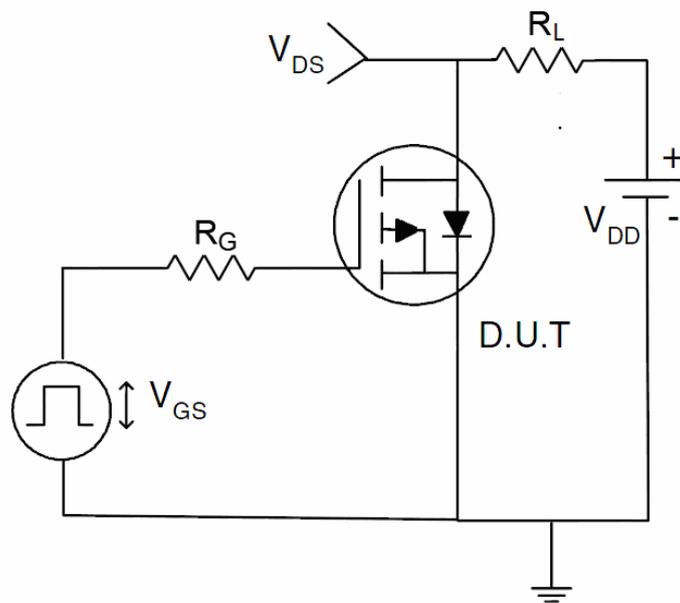
### 1) E<sub>AS</sub> Test Circuit



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

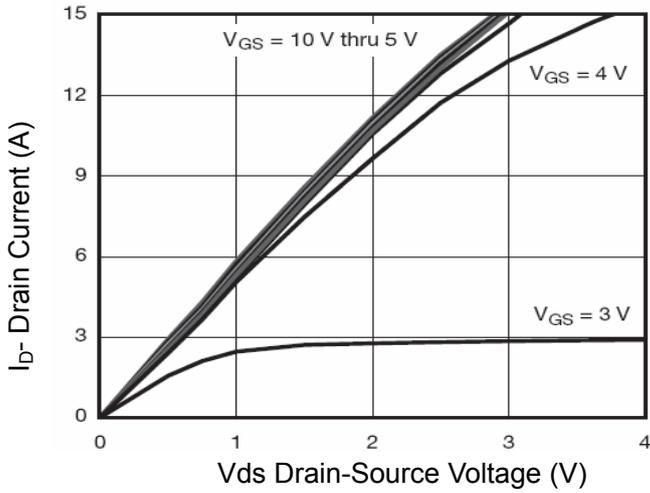


Figure 1 Output Characteristics

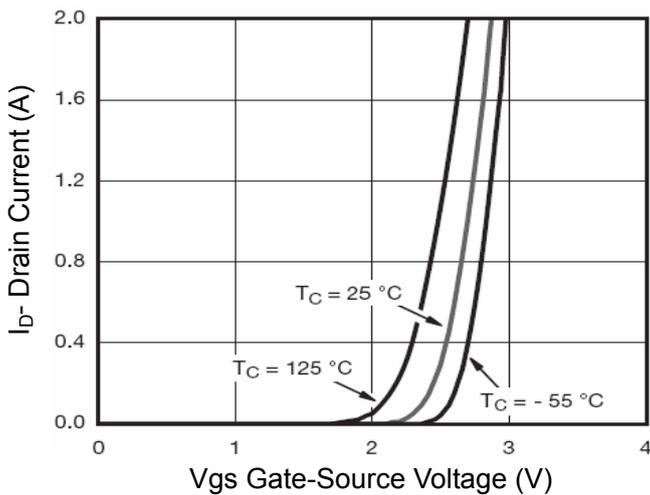


Figure 2 Transfer Characteristics

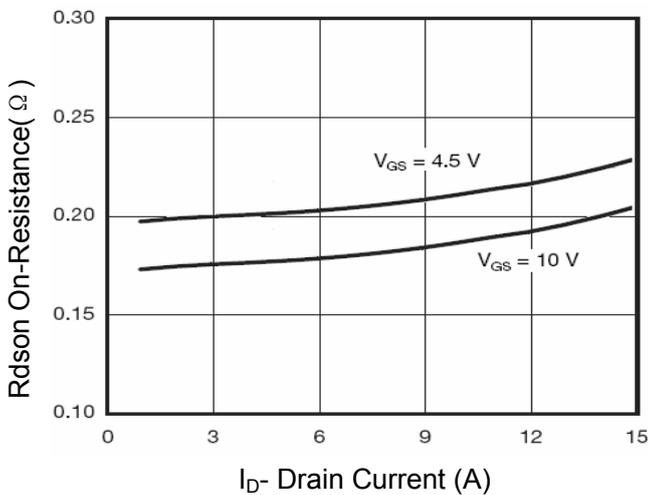


Figure 3 Rdson- Drain Current

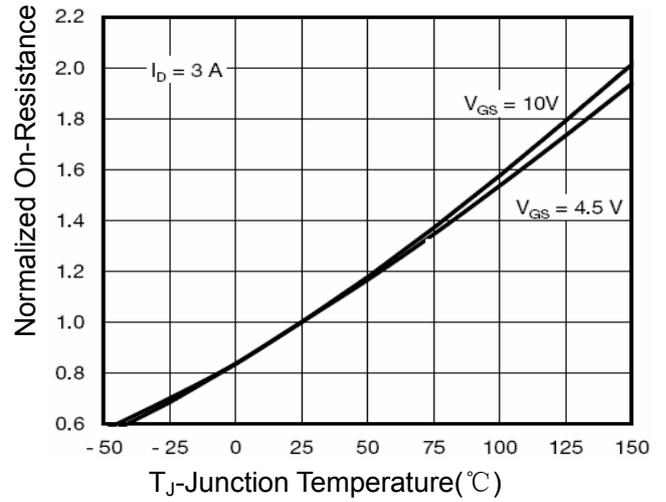


Figure 4 Rdson-Junction Temperature

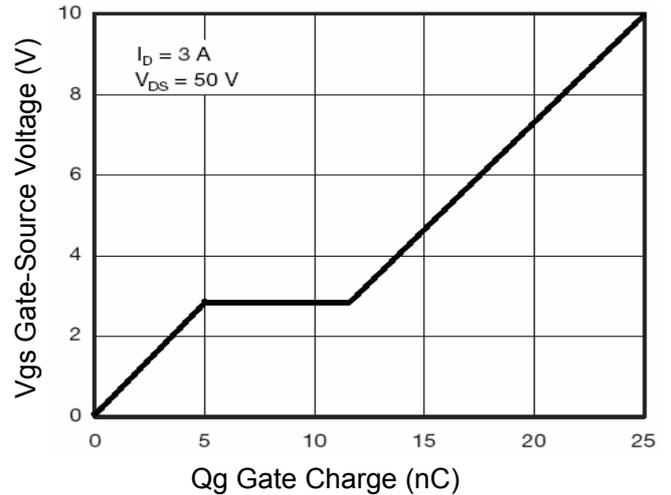


Figure 5 Gate Charge

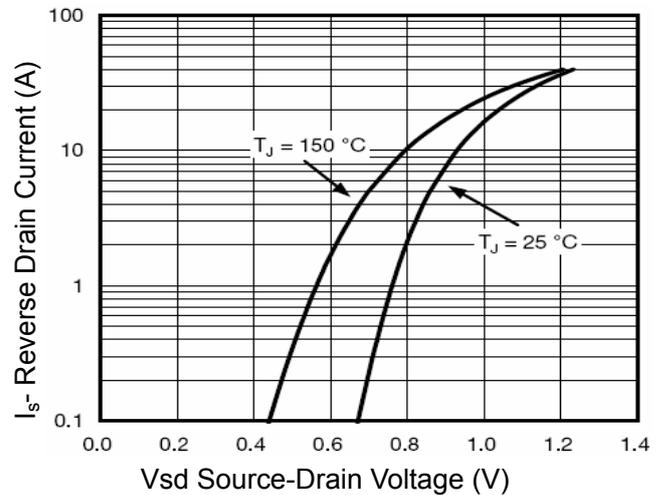
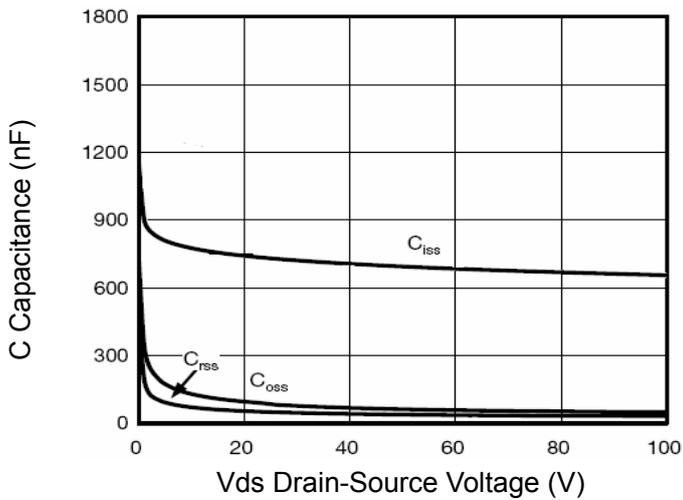
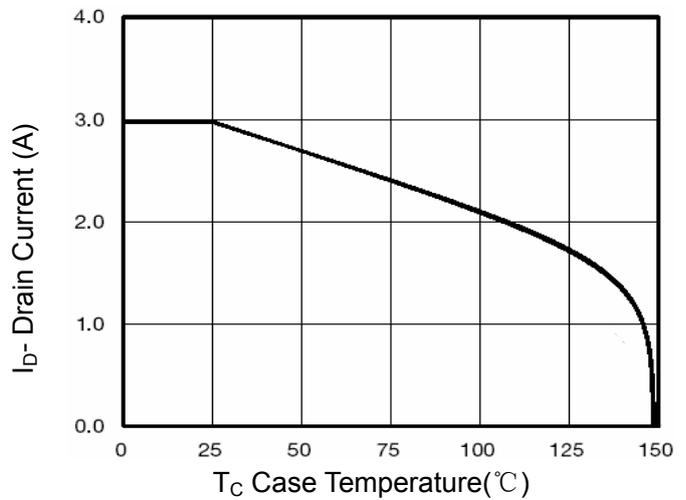


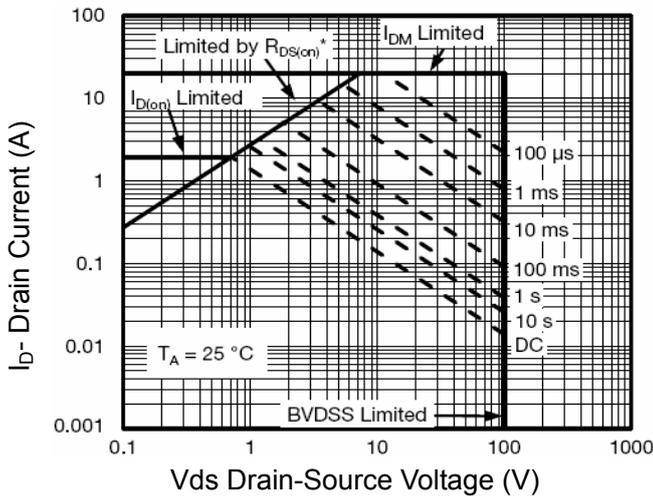
Figure 6 Source- Drain Diode Forward



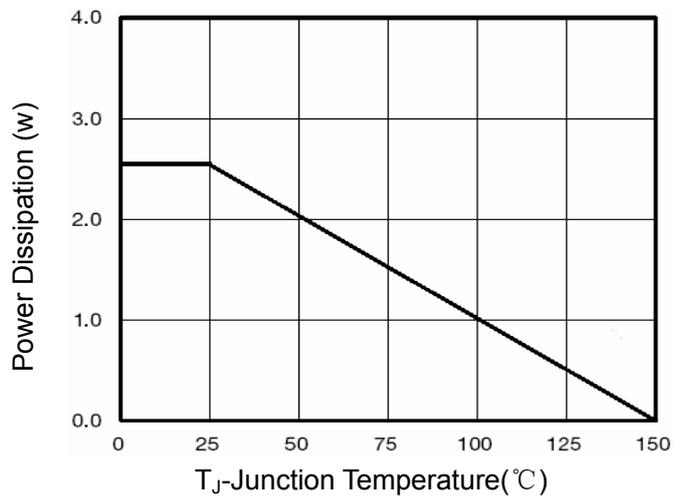
**Figure 7 Capacitance vs Vds**



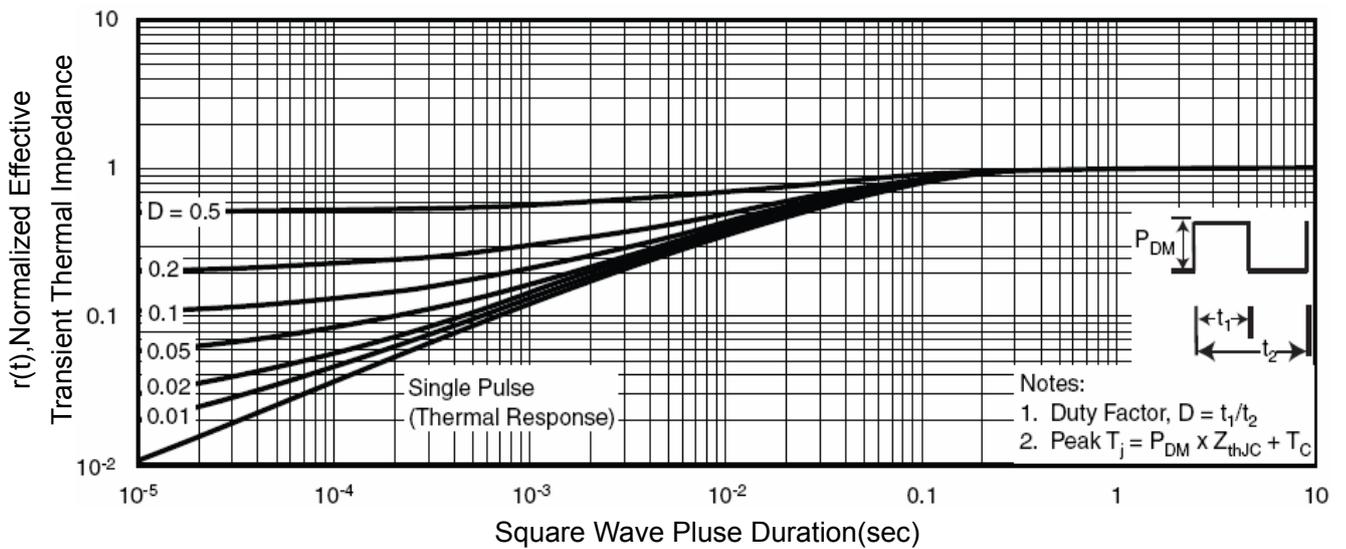
**Figure 9 Drain Current vs Case Temperature**



**Figure 8 Safe Operation Area**

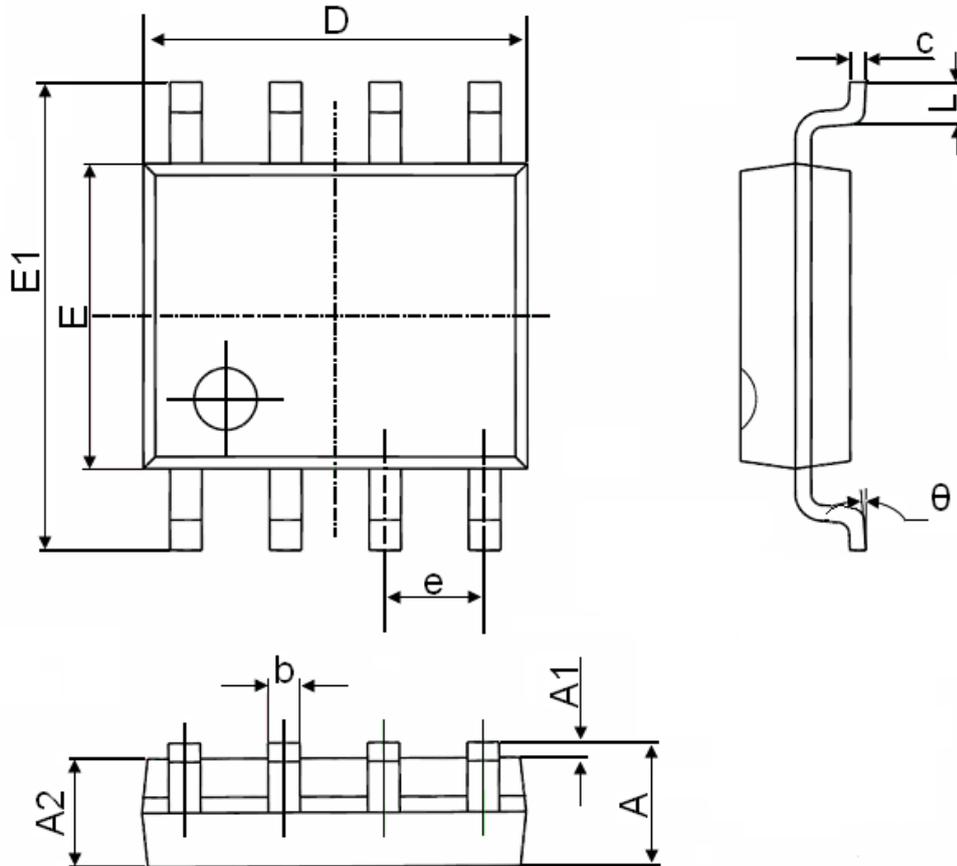


**Figure 10 Power De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## SOP-8 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
theta	0°	8°	0°	8°

**Attention:**

- Any and all NCE power products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your NCE power representative nearest you before using any NCE power products described or contained herein in such applications.
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