

## 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**

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

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

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

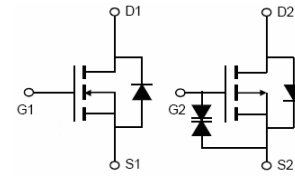
**P-channel**

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

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

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

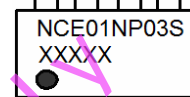
- High Power and current handing capability
- Lead free product is acquired



Schematic diagram

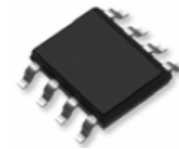
D1 D1 D2 D2

8 7 6 5

NCE01NP03S  
XXXXX

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**

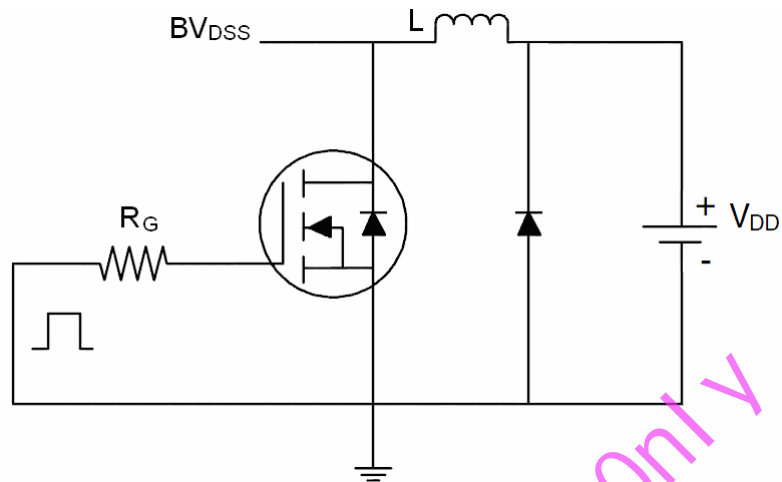
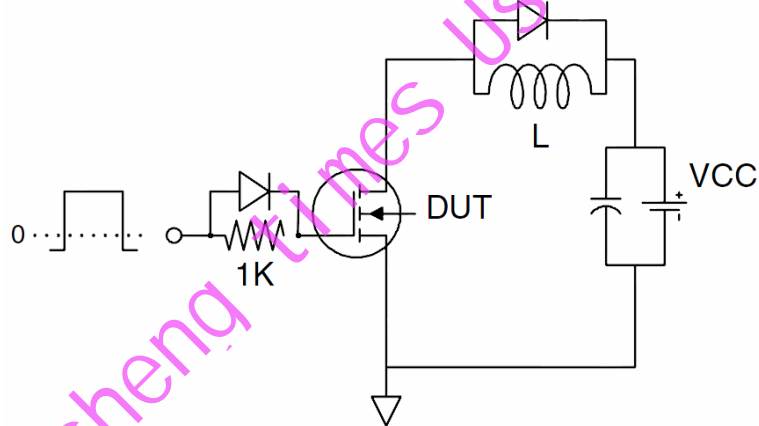
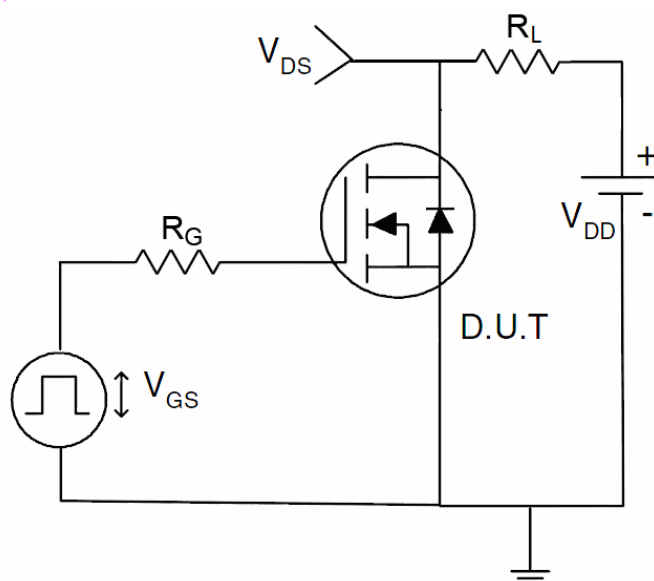
Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Ambient (Note 2) (N-channel)	$R_{\theta JA}$	-	62.5	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient (Note 2) (P-channel)	$R_{\theta JA}$	-	62.5	$^\circ\text{C/W}$

**N-channel Electrical Characteristics (T<sub>C</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	110	-	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	-	-	±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	1.0	1.5	2.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =3A	-	95	130	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A	-	100	140	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =3A	3.5	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHz	-	730	-	PF
Output Capacitance	C <sub>oss</sub>		-	37	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	27	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =50V, R <sub>L</sub> =15Ω V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω	-	11	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	7.4	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	35	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	9.1	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =3A, V <sub>GS</sub> =10V	-	21.5	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	3.2	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	6	-	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	-	26	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs (Note 3)	-	27	-	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. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. Surface Mounted on FR4 Board, t ≤ 10 sec. The current rating is based on the t ≤ 10s thermal resistance rating.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 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)

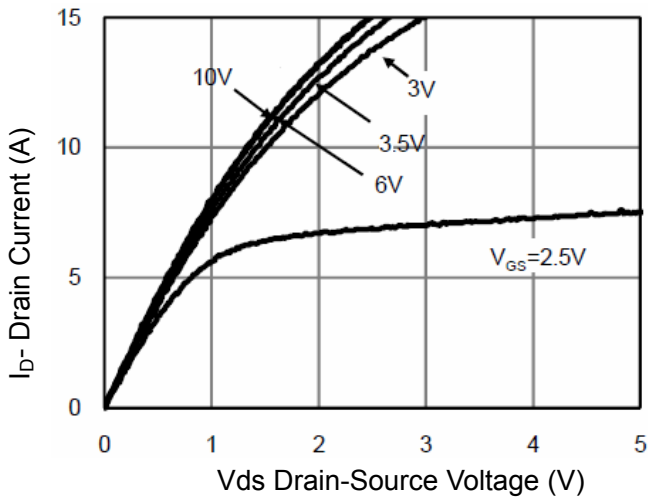


Figure 1 Output Characteristics

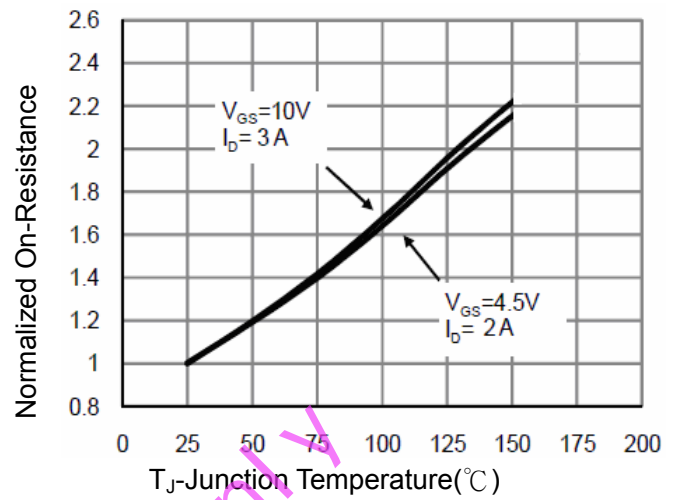


Figure 4  $R_{ds(on)}$ -Junction Temperature

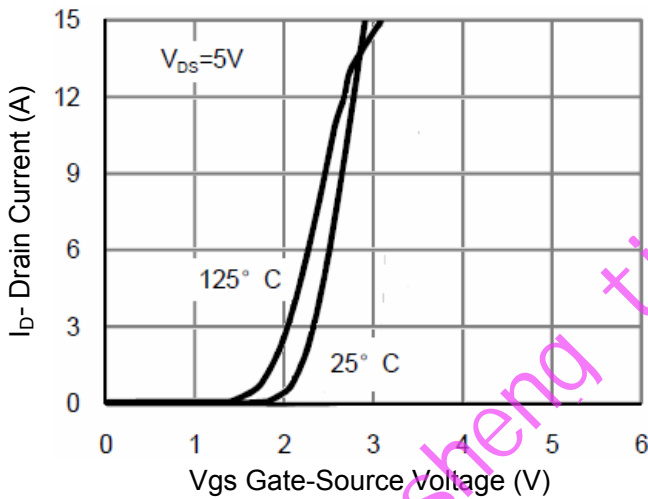


Figure 2 Transfer Characteristics

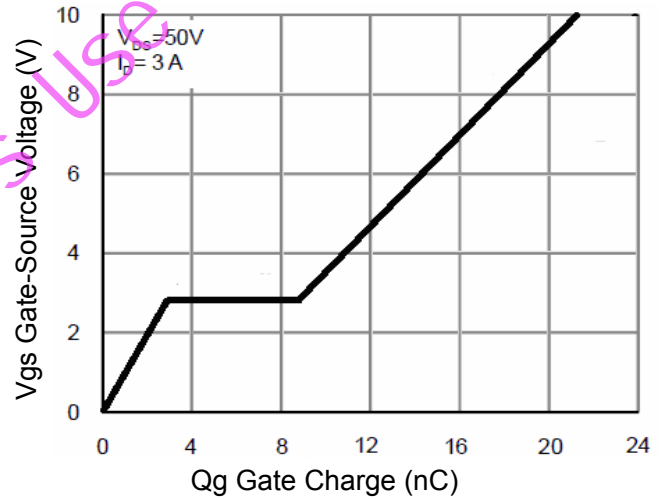


Figure 5 Gate Charge

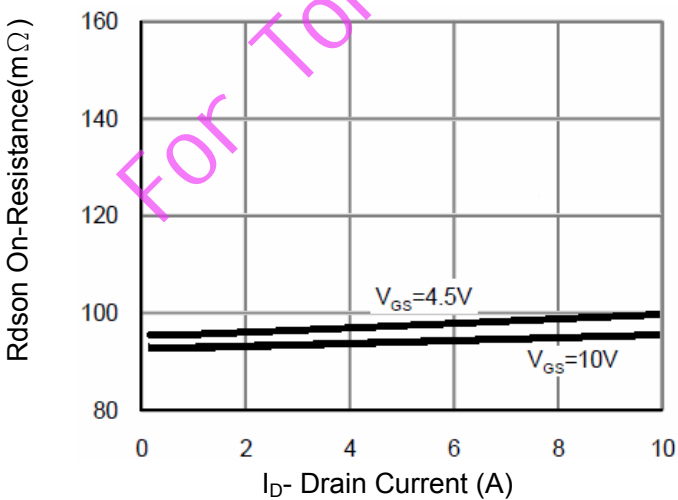


Figure 3  $R_{ds(on)}$ - Drain Current

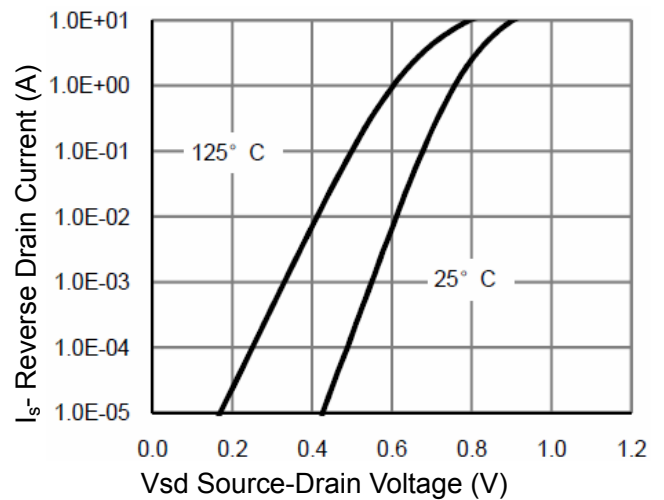


Figure 6 Source- Drain Diode Forward

<http://www.ncepower.com>

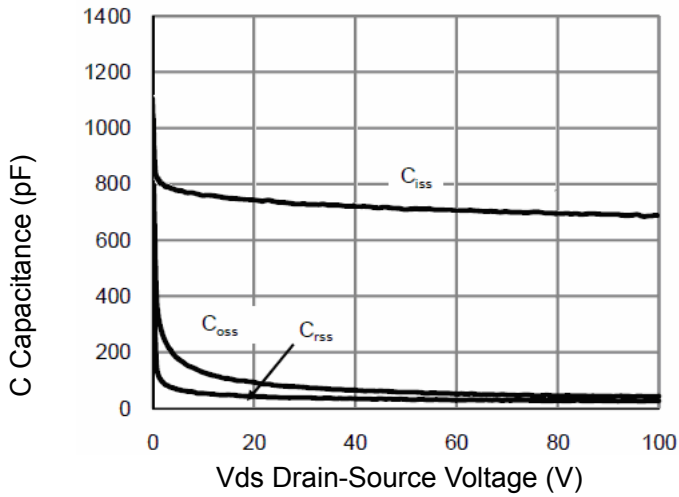


Figure 7 Capacitance vs Vds

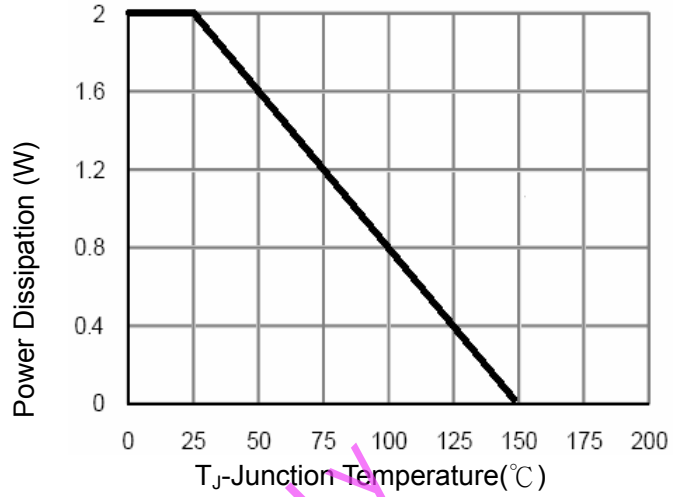


Figure 9 Power De-rating

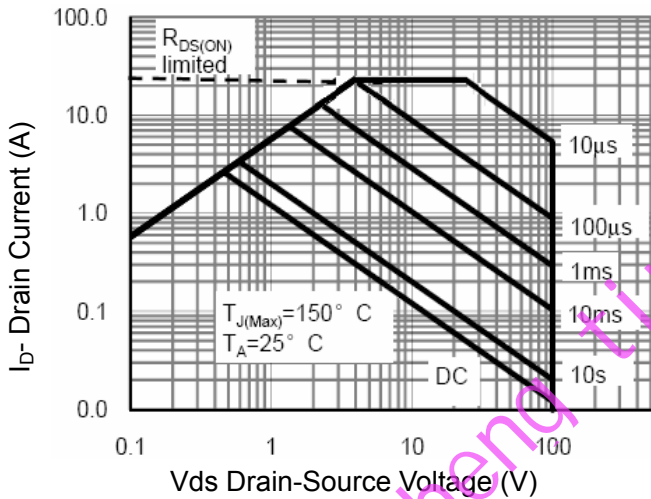


Figure 8 Safe Operation Area

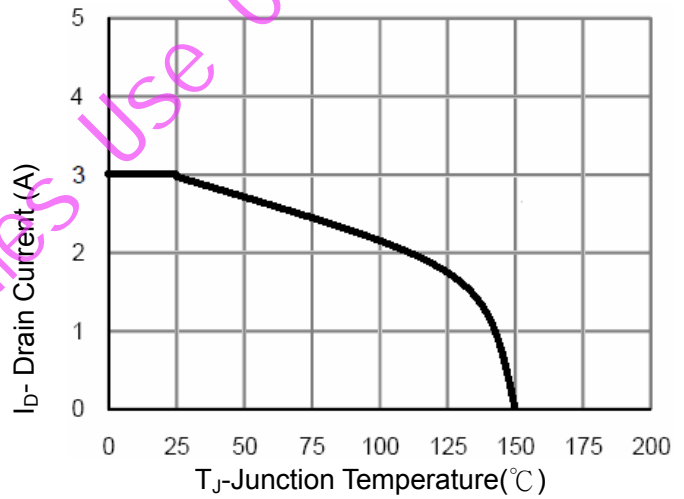


Figure 10 Current De-rating

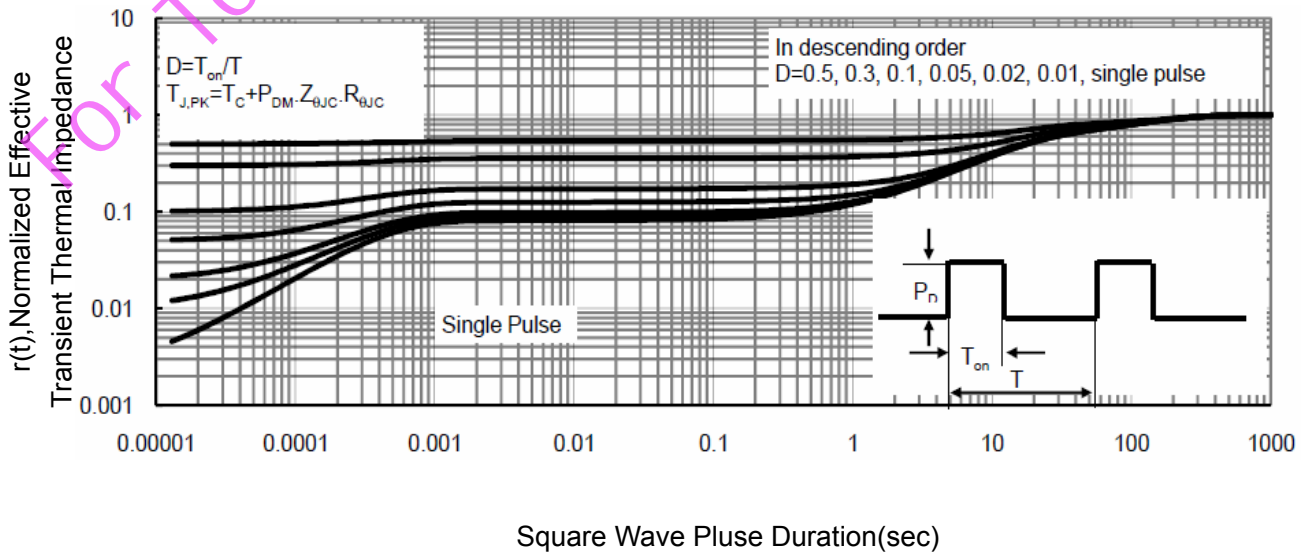


Figure 11 Normalized Maximum Transient Thermal Impedance

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

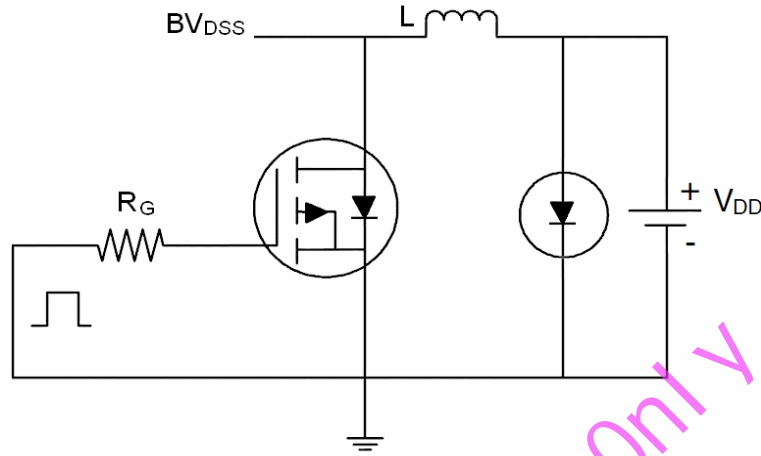
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-100	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-100V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage 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>	V <sub>DS</sub> =-50V, I <sub>D</sub> =-3A, V <sub>GS</sub> =-10V	-	18	-	nS
Total Gate Charge	Q <sub>g</sub>		-	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	-	35	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs (Note 3)	-	46	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### Notes:

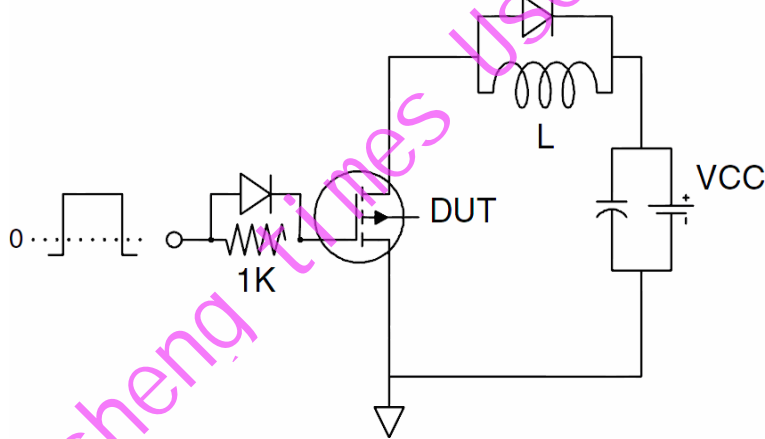
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. E<sub>AS</sub> condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=-50V, V<sub>G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

Test Circuit

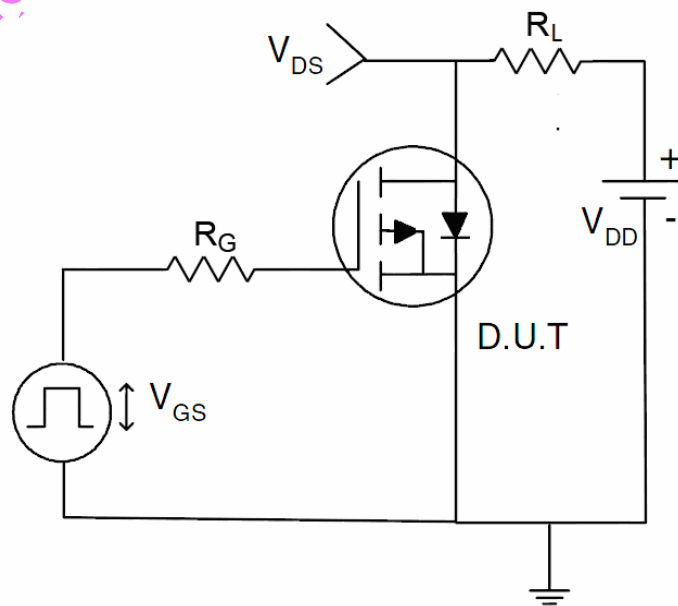
1) E<sub>AS</sub> Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



For Tongsheng Times Use Only

Typical Electrical and Thermal Characteristics (Curves)

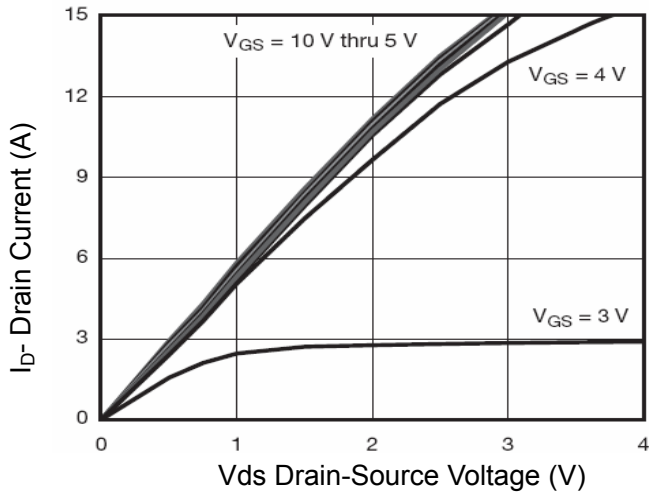


Figure 1 Output Characteristics

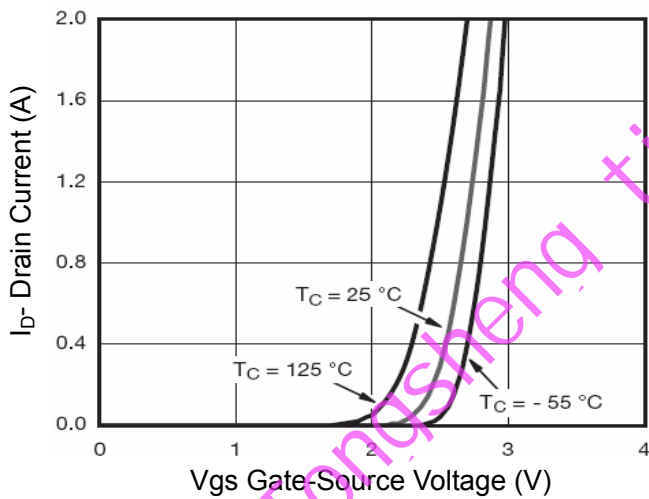


Figure 2 Transfer Characteristics

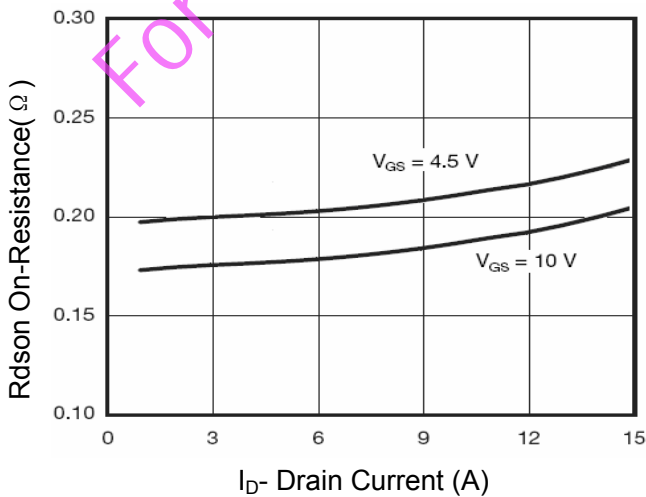


Figure 3 Rdson- Drain Current

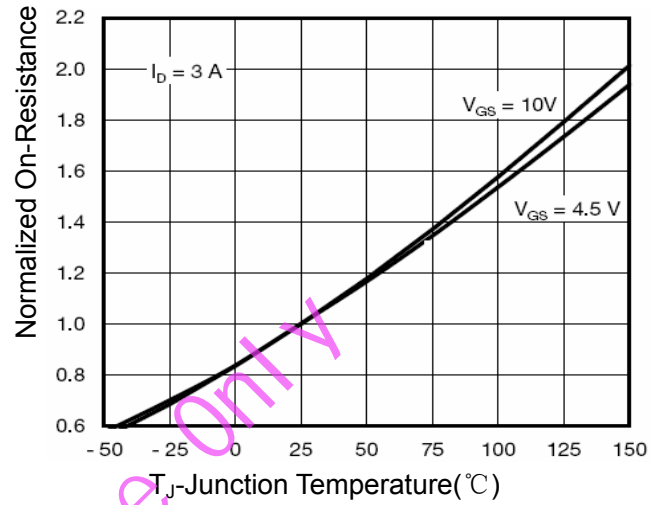


Figure 4 Rdson-Junction Temperature

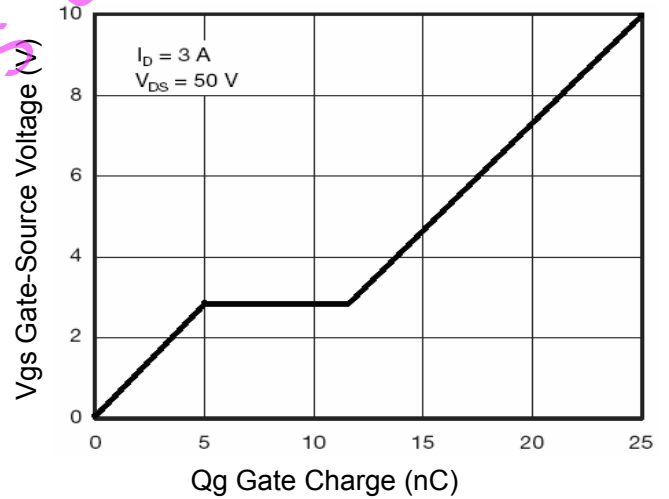


Figure 5 Gate Charge

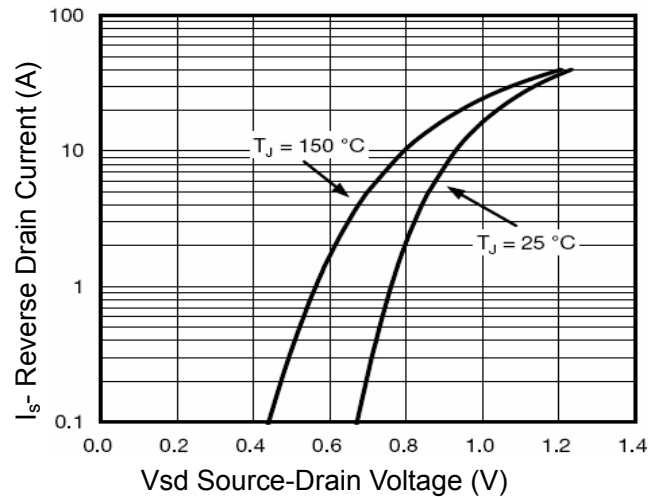


Figure 6 Source- Drain Diode Forward



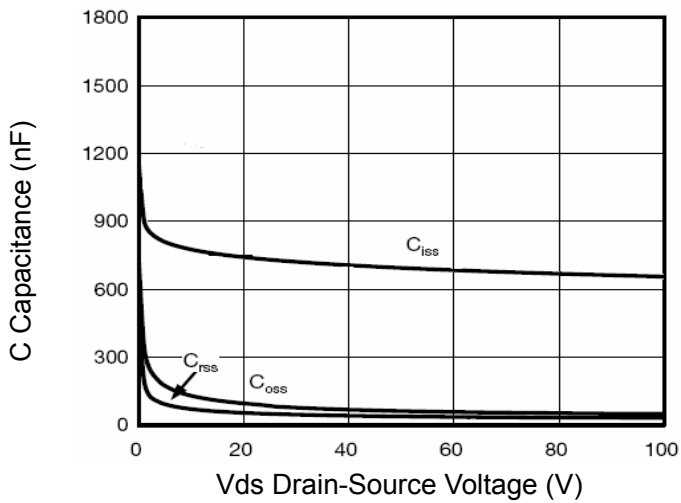


Figure 7 Capacitance vs Vds

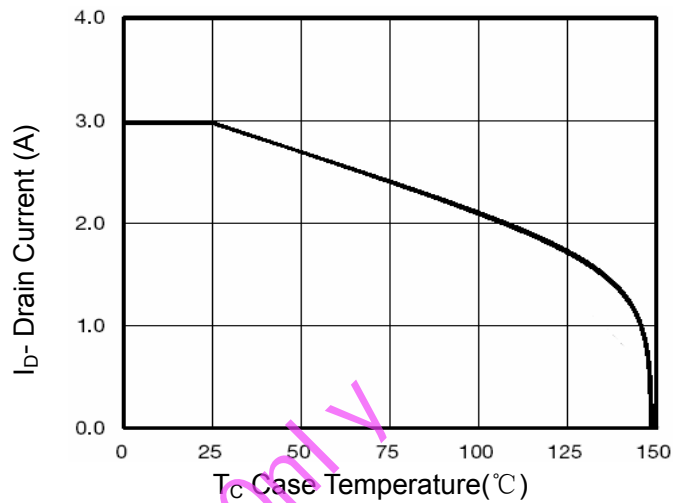


Figure 9 Drain Current vs Case Temperature

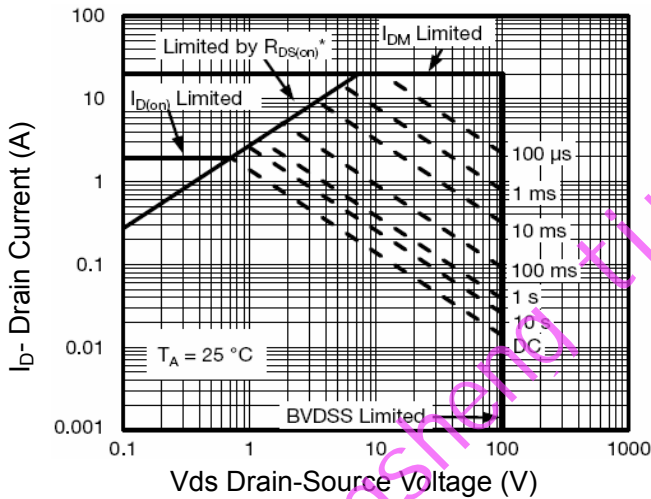


Figure 8 Safe Operation Area

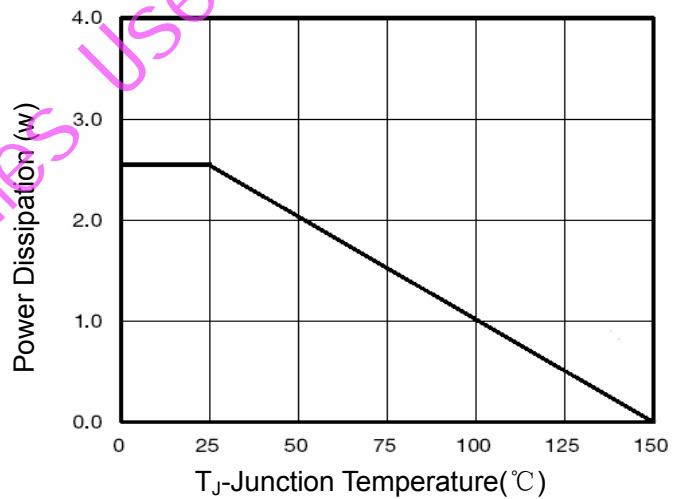


Figure 10 Power De-rating

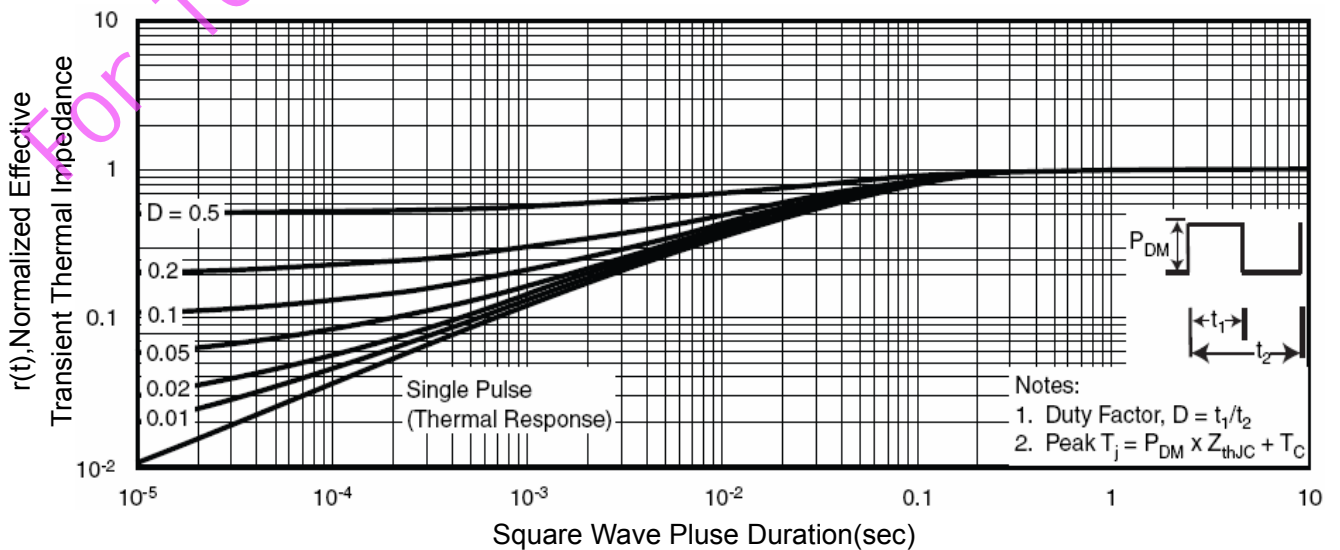
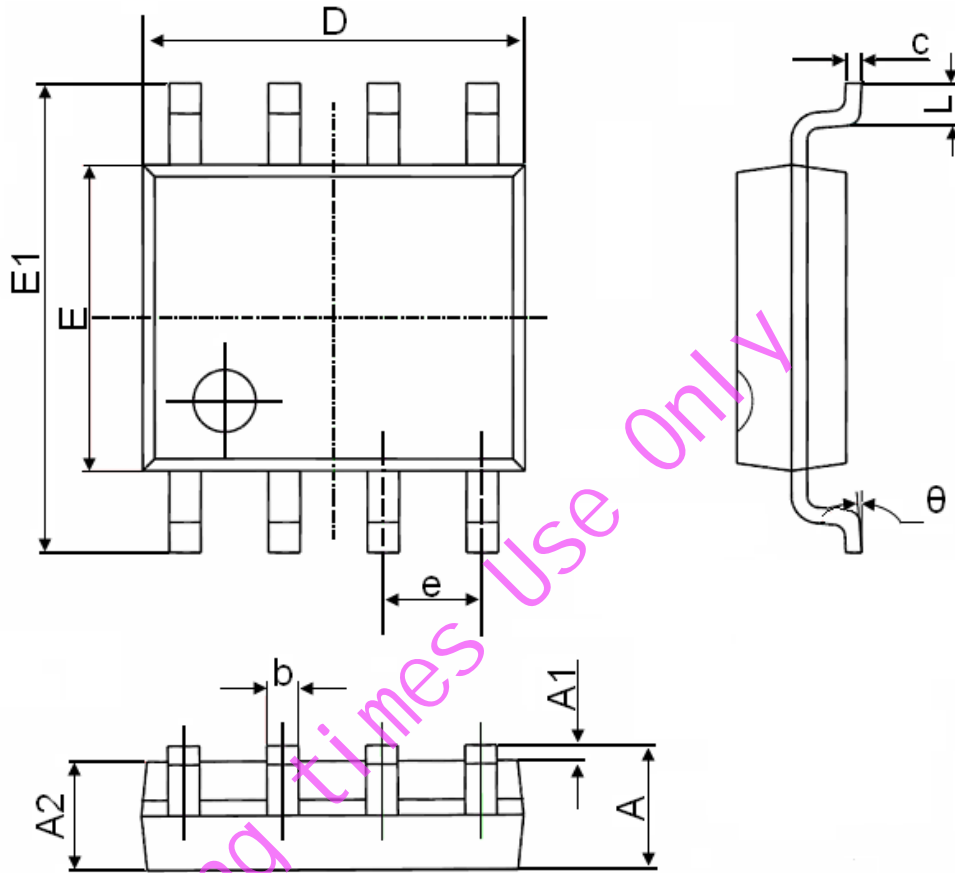


Figure 11 Normalized Maximum Transient Thermal Impedance

**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
θ	0°	8°	0°	8°

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