

## NCE N-Channel Super Trench II Power MOSFET

### Description

The NCEP13N10AS uses **Super Trench II** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### Application

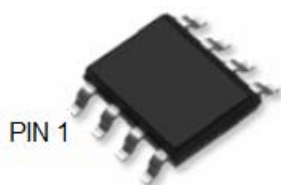
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

### General Features

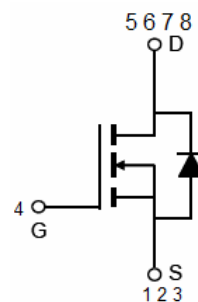
- $V_{DS} = 100V, I_D = 10A$   
 $R_{DS(ON)} = 12m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 15m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150°C operating temperature
- Pb-free lead plating

**100% UIS TESTED!**  
**100%  $\Delta V_{ds}$  TESTED!**

SOP-8



Top View



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP13N10AS	NCEP13N10AS	SOP-8	Ø330mm	12mm	4000 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	100	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	10	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D (100^\circ C)$	7	A
Pulsed Drain Current	$I_{DM}$	40	A
Maximum Power Dissipation	$P_D$	3.3	W
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	156	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	38	$^\circ C/W$
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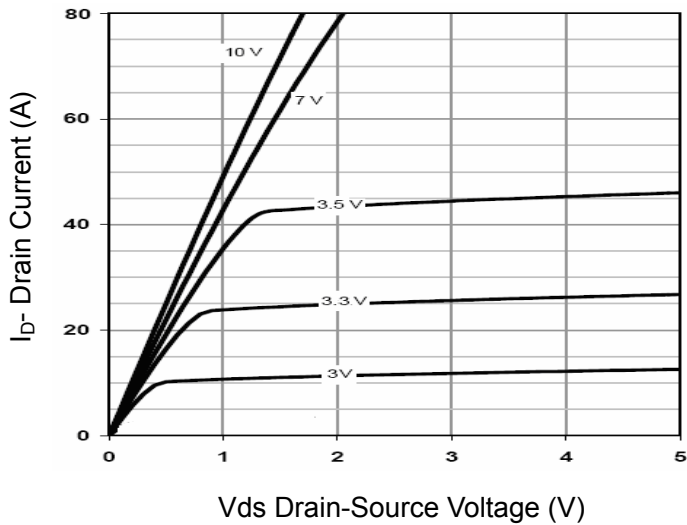
## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
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	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.1	1.8	2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =10A	-	12	13.5	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	-	15	17	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =10A	25	-	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHz	-	2050	-	PF
Output Capacitance	C <sub>oss</sub>		-	180	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	21	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =50V, I <sub>D</sub> =10A V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω	-	16	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	18	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	32	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	10	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V	-	42	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	7.8		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	11		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =10A	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	10	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 10A di/dt = 100A/μs <sup>(Note3)</sup>	-	45	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	95	-	nC

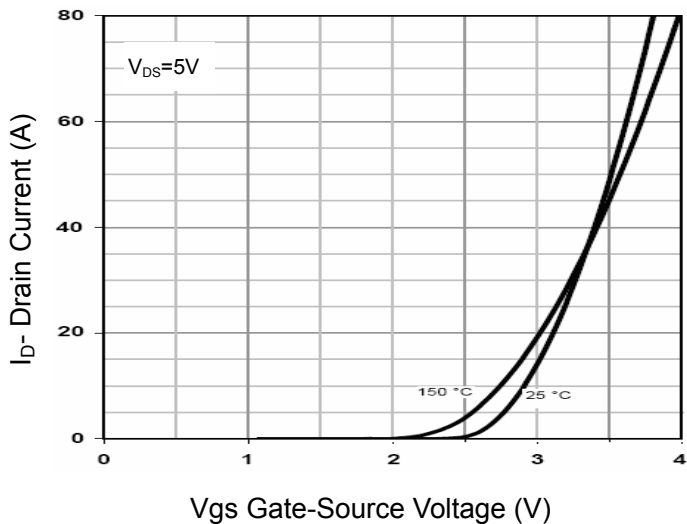
### Notes:

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 :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega$

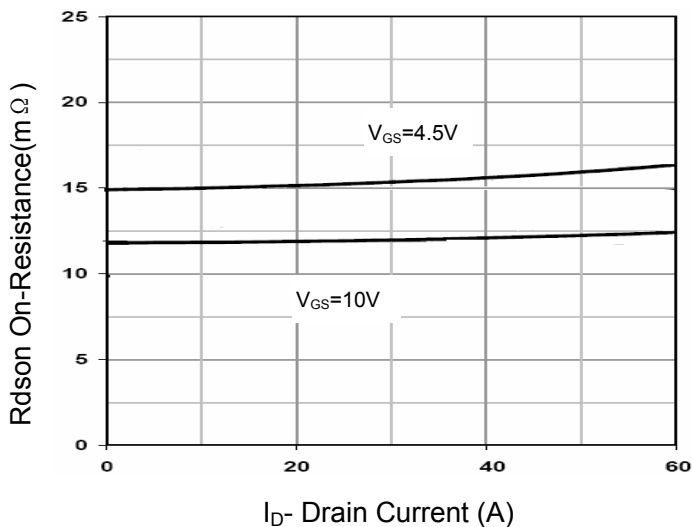
## Typical Electrical and Thermal Characteristics



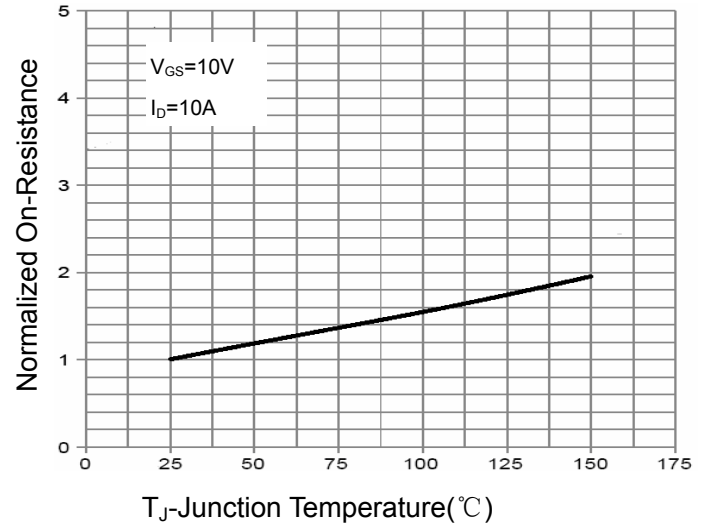
**Figure 1 Output Characteristics**



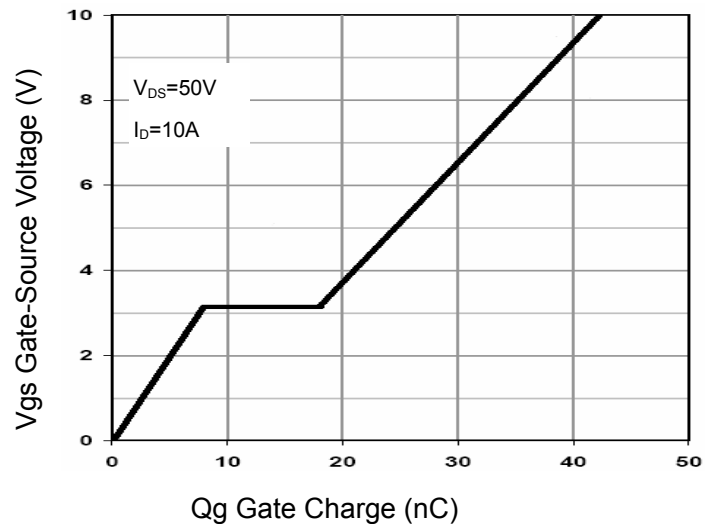
**Figure 2 Transfer Characteristics**



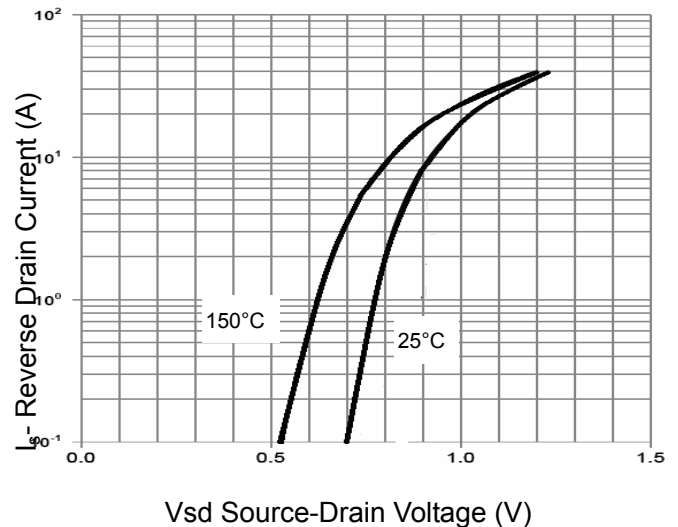
**Figure 3 Rdson- Drain Current**



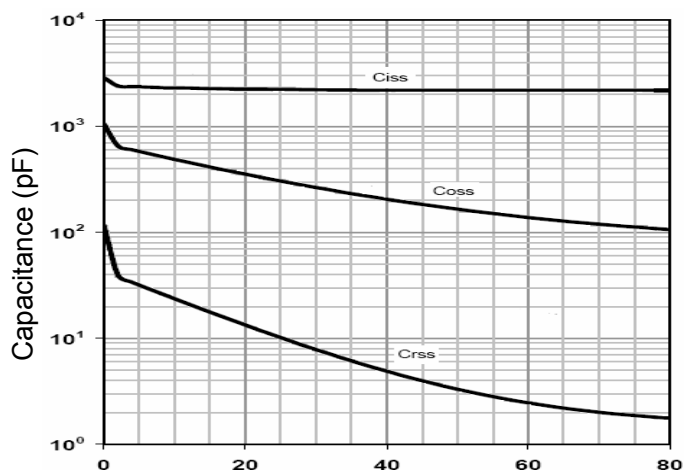
**Figure 4 Rdson-Junction Temperature**



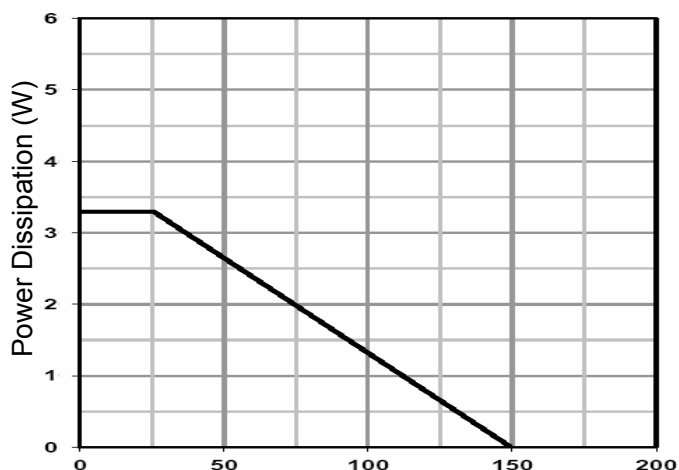
**Figure 5 Gate Charge**



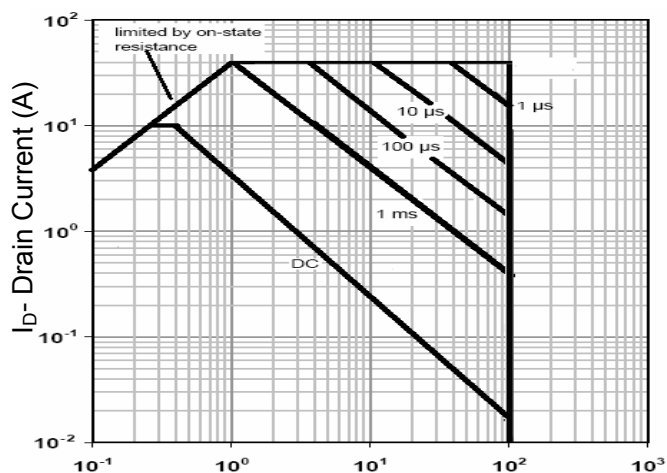
**Figure 6 Source- Drain Diode Forward**



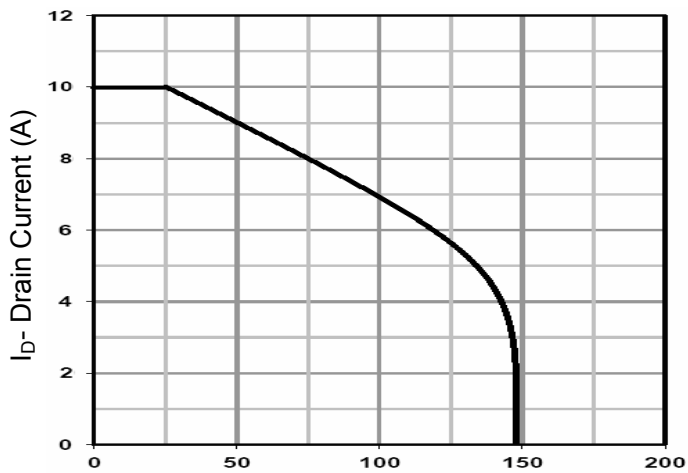
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



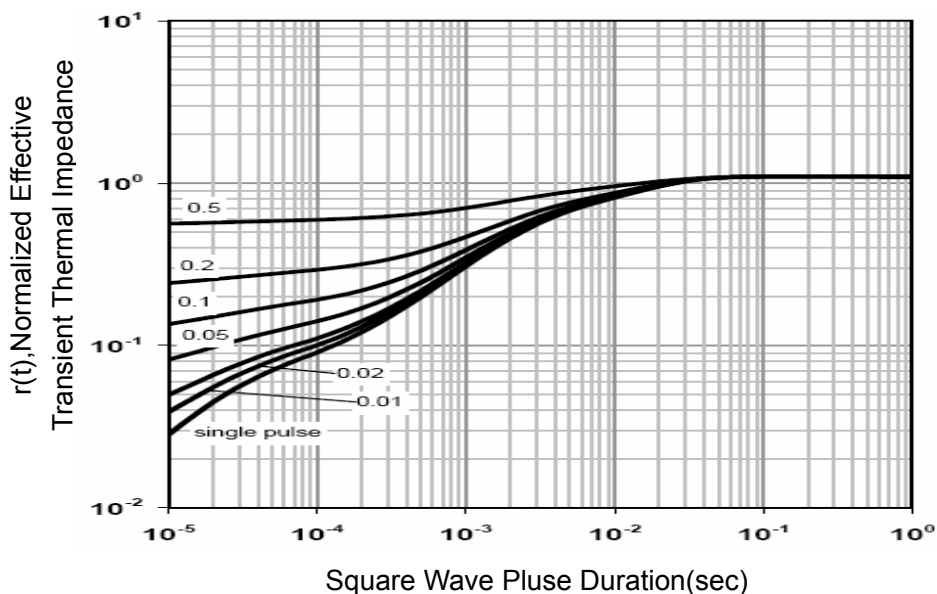
T<sub>C</sub>-Case Temperature(°C)  
**Figure 9 Power De-rating**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

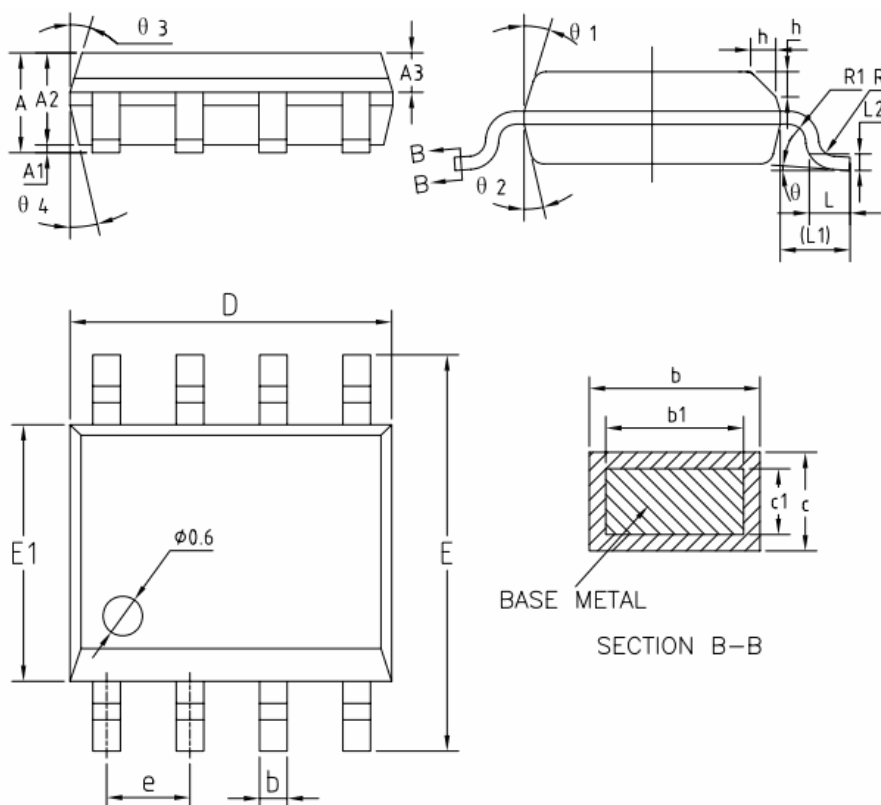


T<sub>C</sub>-Case Temperature (°C)  
**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## Sop-8 Package Information



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	—	0.51
b1	0.37	0.42	0.47
c	0.18	—	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.17	1.27	1.37
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	—	—
R1	0.07	—	—
h	0.30	0.40	0.50
$\theta$	0°	—	8°
$\theta 1$	15°	17°	19°
$\theta 2$	11°	13°	15°
$\theta 3$	15°	17°	19°
$\theta 4$	11°	13°	15°

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