

## NCE N-Channel Super Trench II Power MOSFET

### Description

The series of devices 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

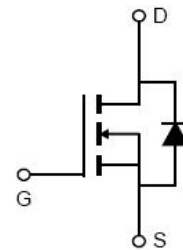
### General Features

- $V_{DS} = 85V, I_D = 180A$   
 $R_{DS(ON)} = 2.9m\Omega$ , typical (TO-220) @  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

**100% UIS TESTED!**

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

TO-220



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP031N85M	NCEP031N85M	TO-220	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	85	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	180	A
Drain Current-Continuous( $T_c = 100^\circ\text{C}$ )	$I_D(100^\circ\text{C})$	135	A
Pulsed Drain Current	$I_{DM}$	720	A
Maximum Power Dissipation	$P_D$	230	W
Derating factor		1.53	W/ $^\circ\text{C}$
Single pulse avalanche energy <sup>(Note1)</sup>	$E_{AS}$	1344	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ\text{C}$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.65	$^\circ\text{C/W}$
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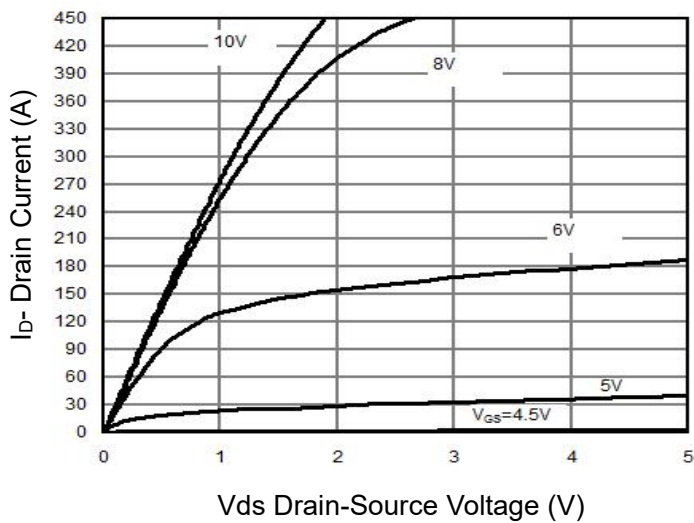
## Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

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	85		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =85V, 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						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0	3.0	4.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =90A	-	2.9	3.1	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =90A		100	-	S
Dynamic Characteristics						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, F=1.0MHz	-	7650	-	PF
Output Capacitance	C <sub>oss</sub>		-	1350	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	62	-	PF
Switching Characteristics <small>(Note 2)</small>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =40V, I <sub>D</sub> =90A V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω	-	25	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	15	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	52	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	16	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =40V, I <sub>D</sub> =90A, V <sub>GS</sub> =10V	-	117	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	36		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	31		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =90A	-		1.2	V
Diode Forward Current	I <sub>S</sub>		-	-	180	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 90A di/dt = 100A/μs	-	85	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	156	-	nC

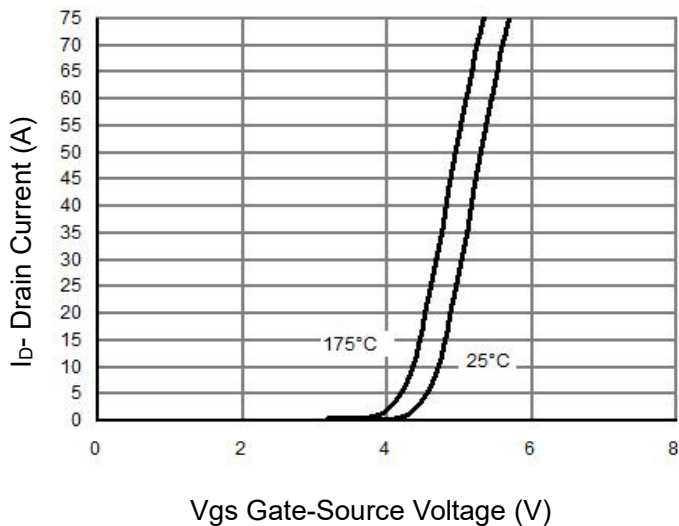
### Notes:

1. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=40V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω
2. Guaranteed by design, not subject to production
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J</sub>(MAX)=175° C. The SOA curve provides a single pulse rating.

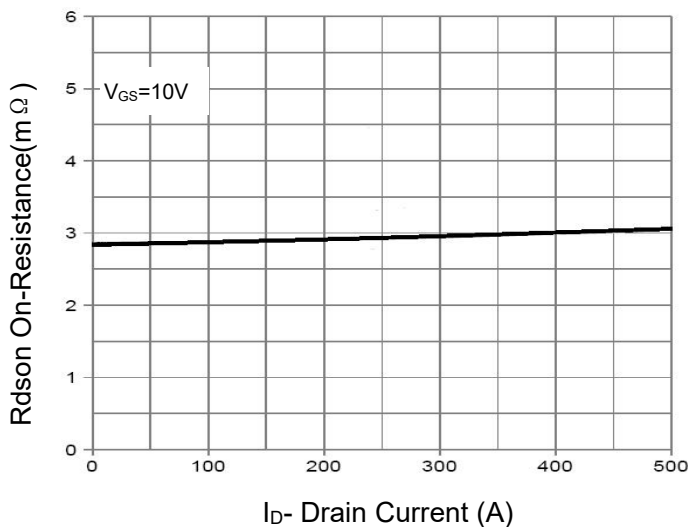
## Typical Electrical and Thermal Characteristics



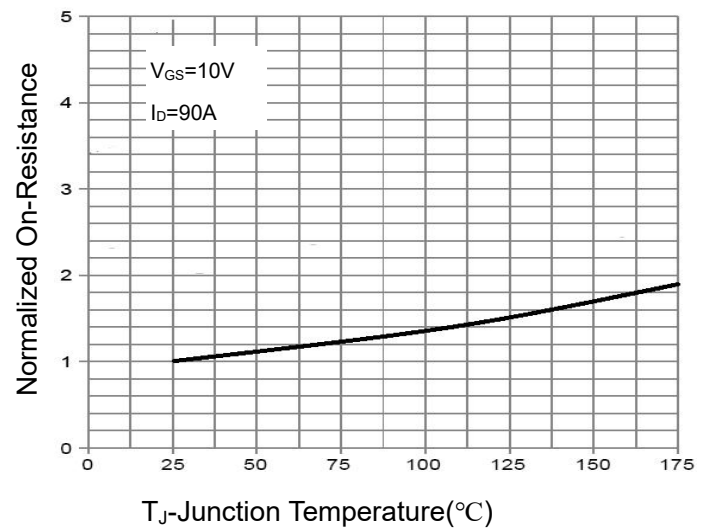
**Figure 1 Output Characteristics**



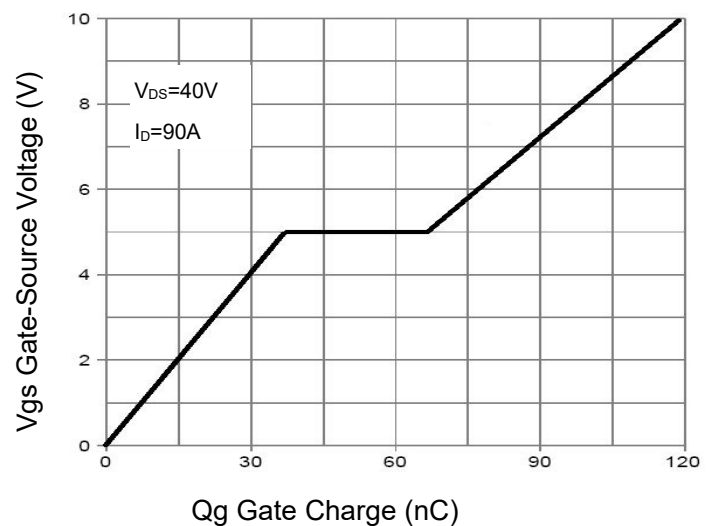
**Figure 2 Transfer Characteristics**



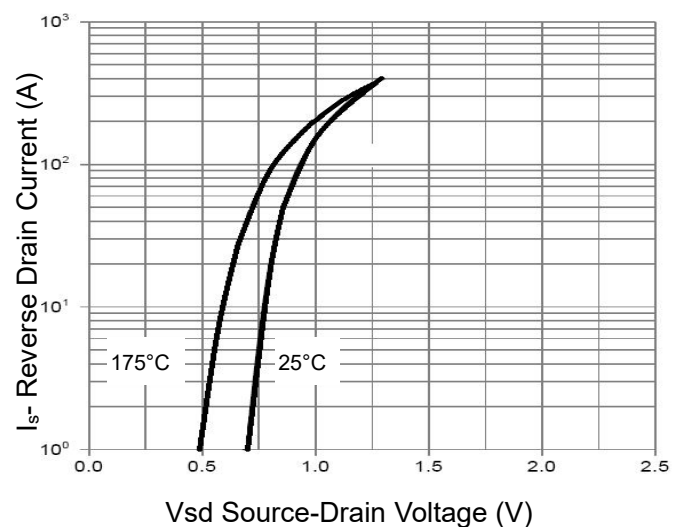
**Figure 3  $R_{DS(on)}$ - Drain Current**



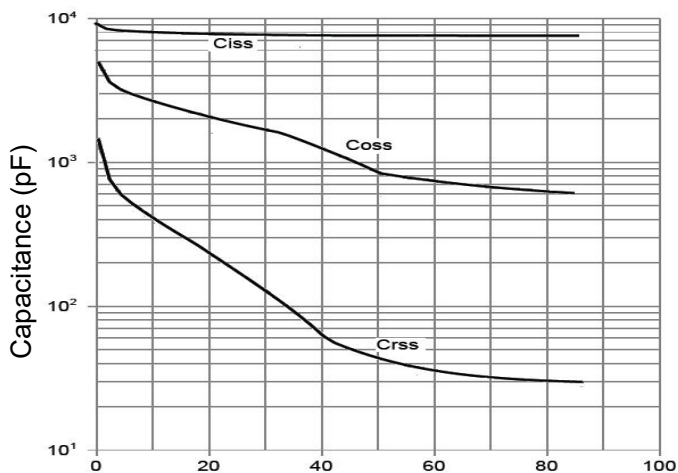
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



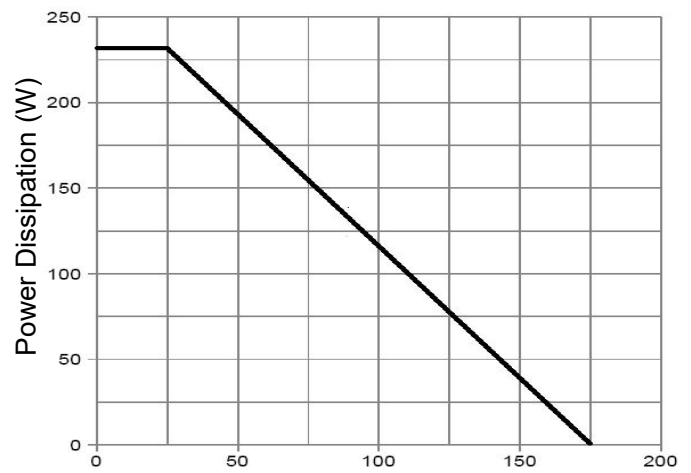
**Figure 5 Gate Charge**



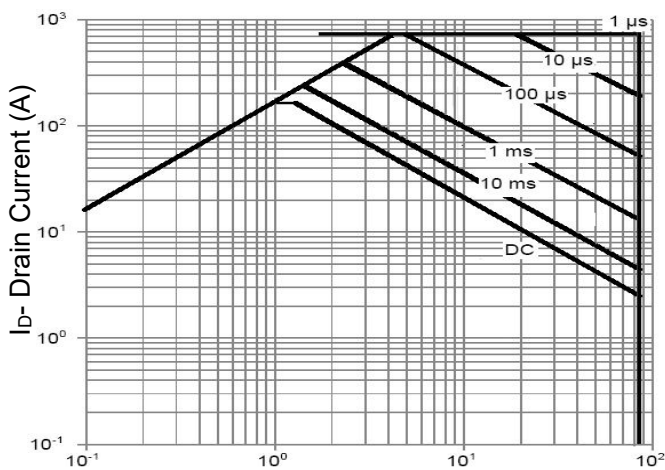
**Figure 6 Source- Drain Diode Forward**



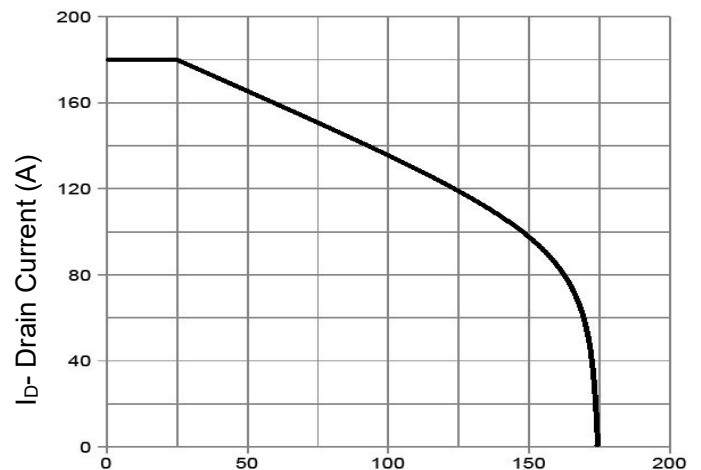
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



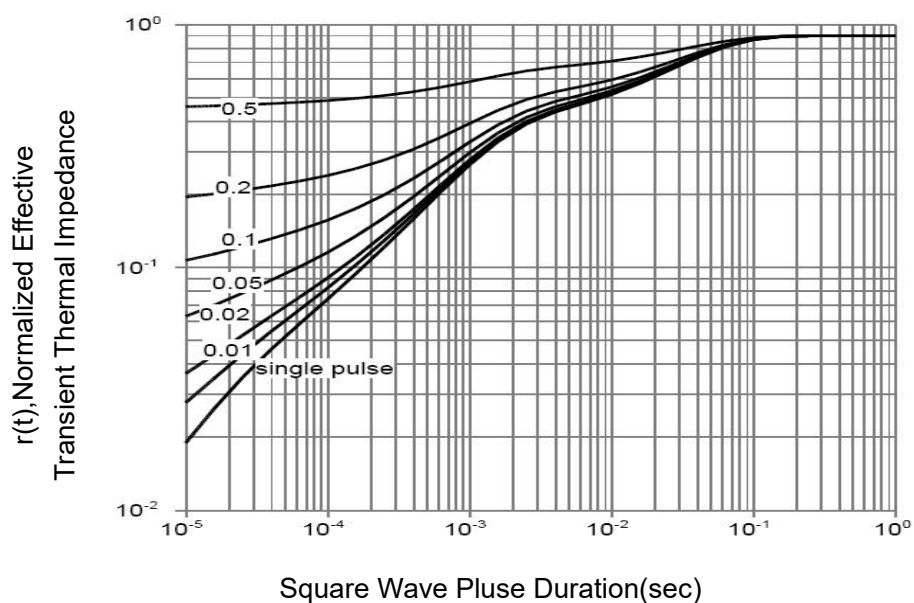
TA-Case Temperature(°C)  
**Figure 9 Power De-rating**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**(Note3)

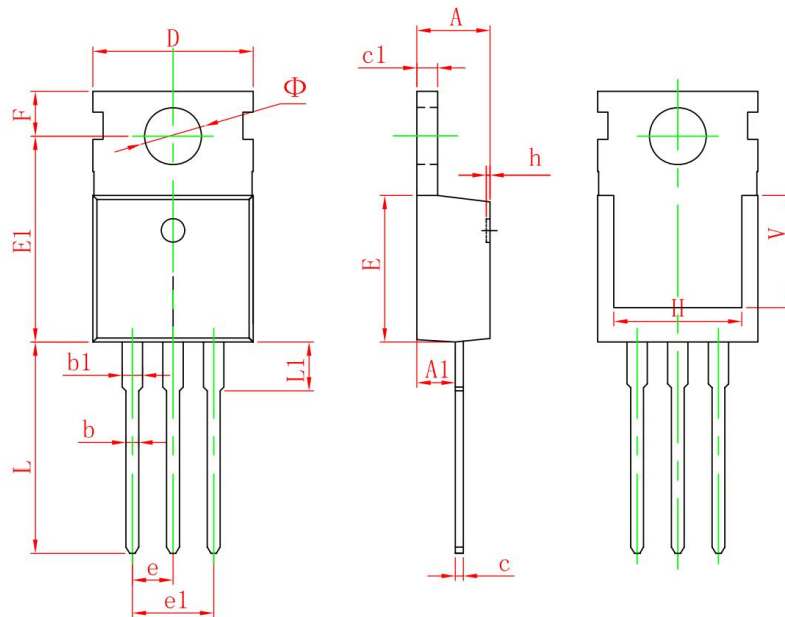


TA-Case Temperature (°C)  
**Figure 10 Current De-rating**



Square Wave Pluse Duration(sec)  
**Figure 11 Normalized Maximum Transient Thermal Impedance**

# TO-220-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.950	9.750	0.352	0.384
E1	12.650	13.050	0.498	0.514
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	6.900 REF.		0.276 REF.	
Φ	3.400	3.800	0.134	0.150

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