

## 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

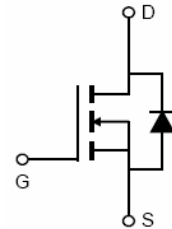
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

### General Features

- $V_{DS} = 100V, I_D = 52A$   
 $R_{DS(on)} = 6.7m\Omega$ , typical @  $V_{GS} = 10V$
- 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% ΔVs TESTED!**

TO-220F



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package
VCRRP060N10F		TO-220F

### 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	$I_D$	52	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	37	A
Pulsed Drain Current	$I_{DM}$	208	A
Maximum Power Dissipation	$P_D$	40	W
Derating factor		0.27	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	540	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	3.75	$^\circ C/W$
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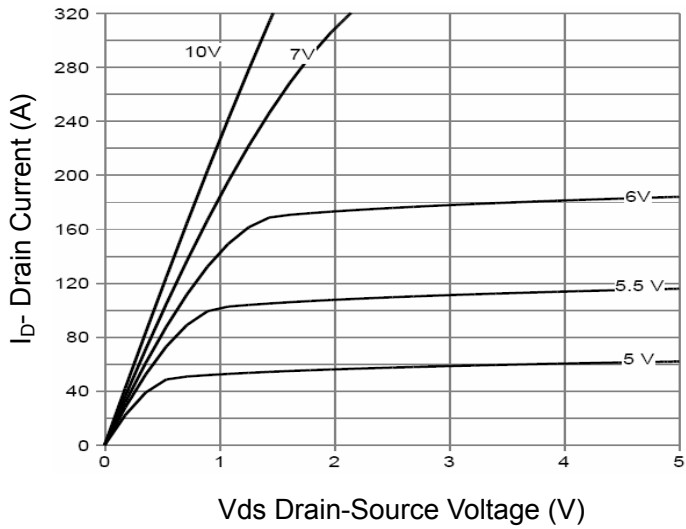
### Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	100		-	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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	3.0	4.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=26A$	-	6.7	7.3	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=26A$		60	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	3200	-	PF
Output Capacitance	$C_{oss}$		-	360	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	18	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=50V, I_D=26A$ $V_{GS}=10V, R_G=1.6\Omega$	-	20	-	nS
Turn-on Rise Time	$t_r$		-	59	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	39	-	nS
Turn-Off Fall Time	$t_f$		-	11	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=50V, I_D=26A,$ $V_{GS}=10V$	-	53	-	nC
Gate-Source Charge	$Q_{gs}$		-	20		nC
Gate-Drain Charge	$Q_{gd}$		-	12.5		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=26A$	-		1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	52	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = I_S$ $di/dt = 100\text{A}/\mu\text{s}$ (Note 3)	-	66	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	135	-	nC

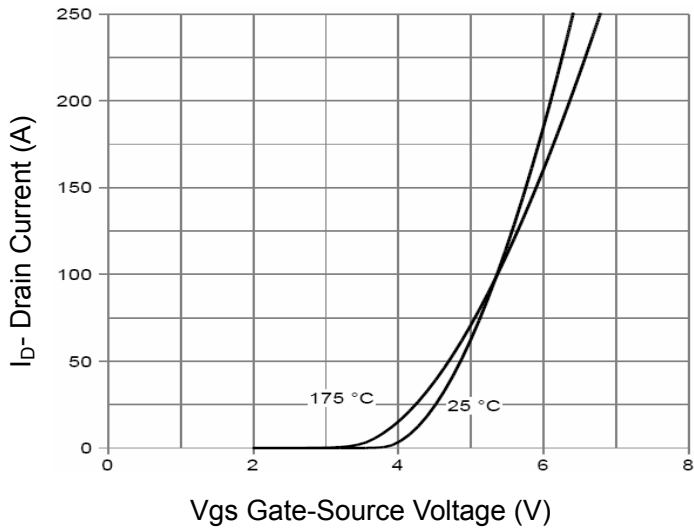
#### Notes:

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  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

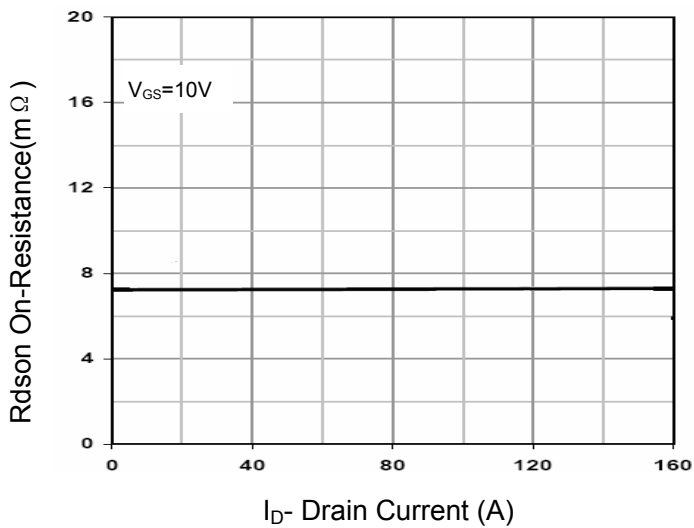
**Typical Electrical and Thermal Characteristics**



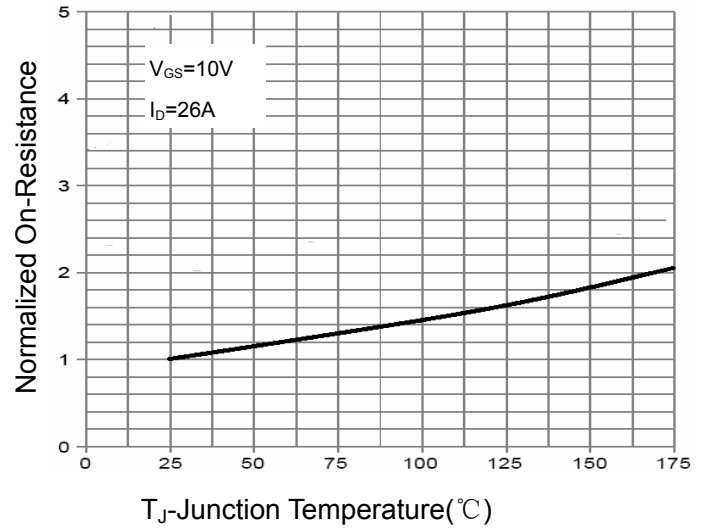
**Figure 1 Output Characteristics**



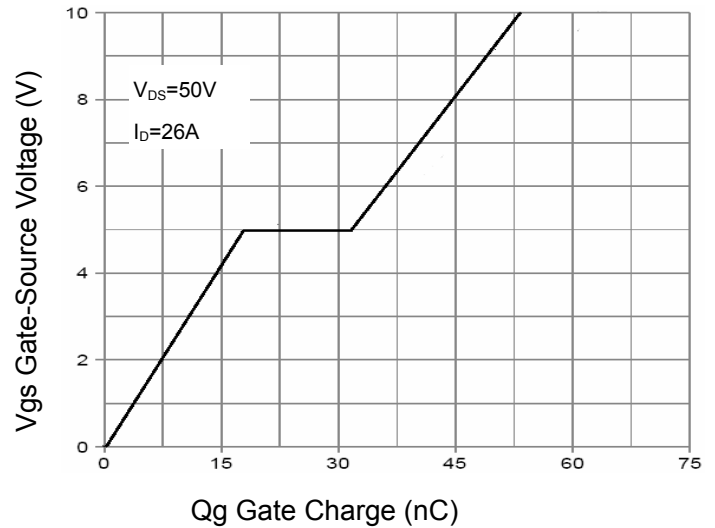
**Figure 2 Transfer Characteristics**



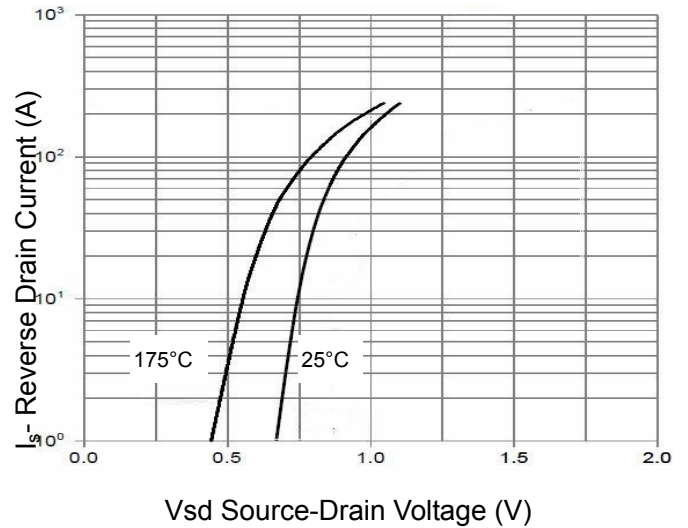
**Figure 3 Rdson- Drain Current**



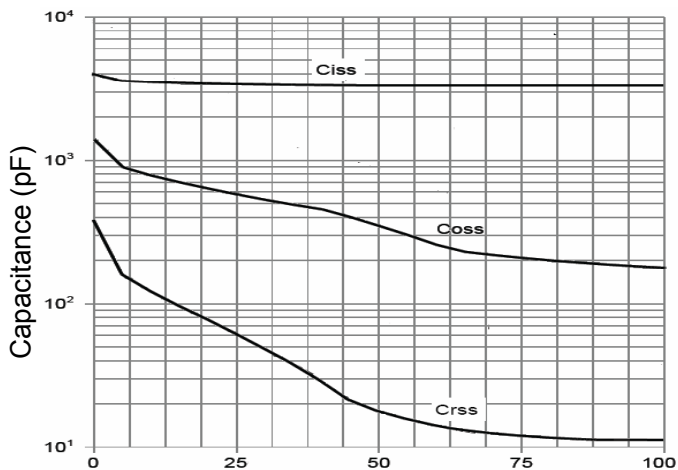
**Figure 4 Rdson-Junction Temperature**



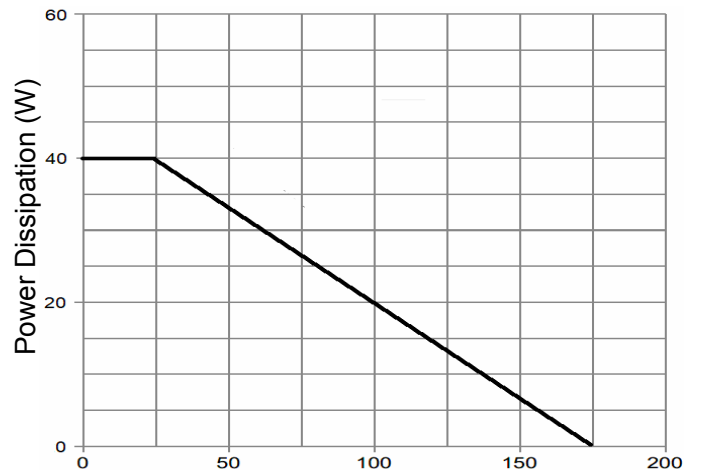
**Figure 5 Gate Charge**



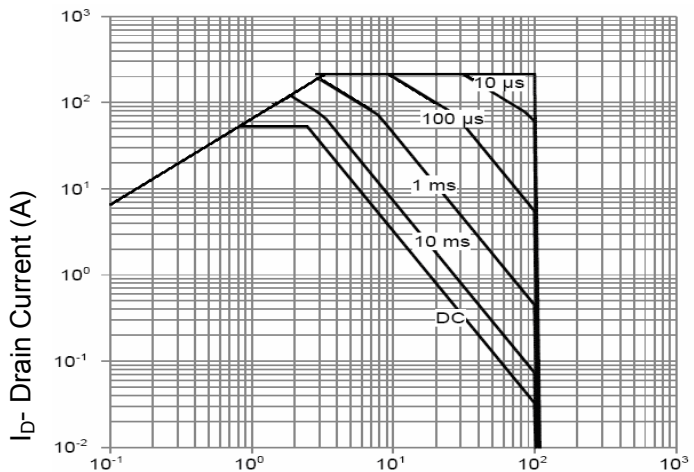
**Figure 6 Source- Drain Diode Forward**



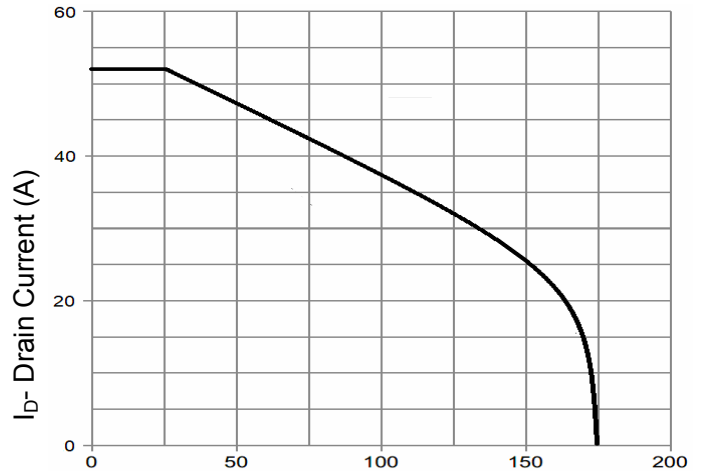
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



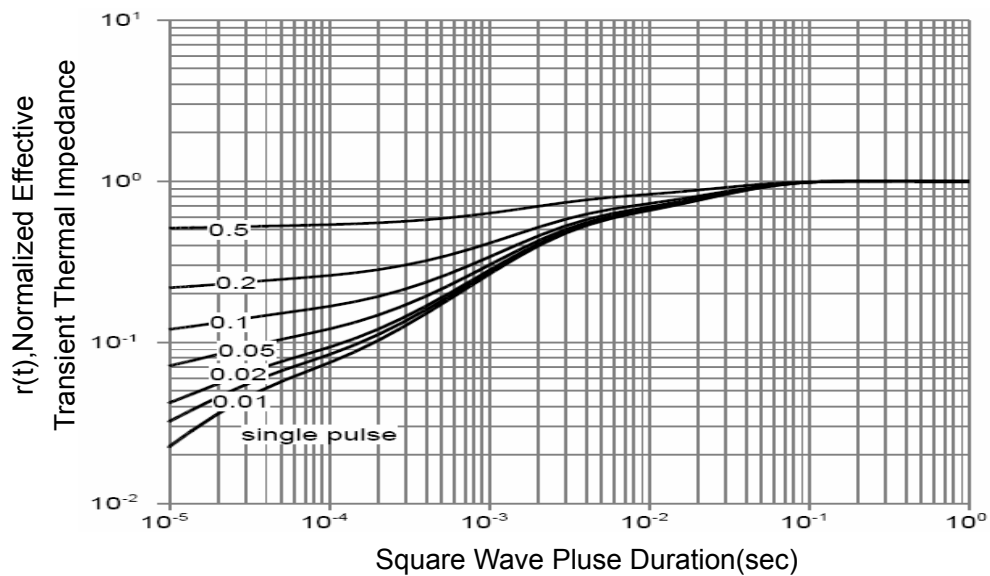
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 Power De-rating**



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

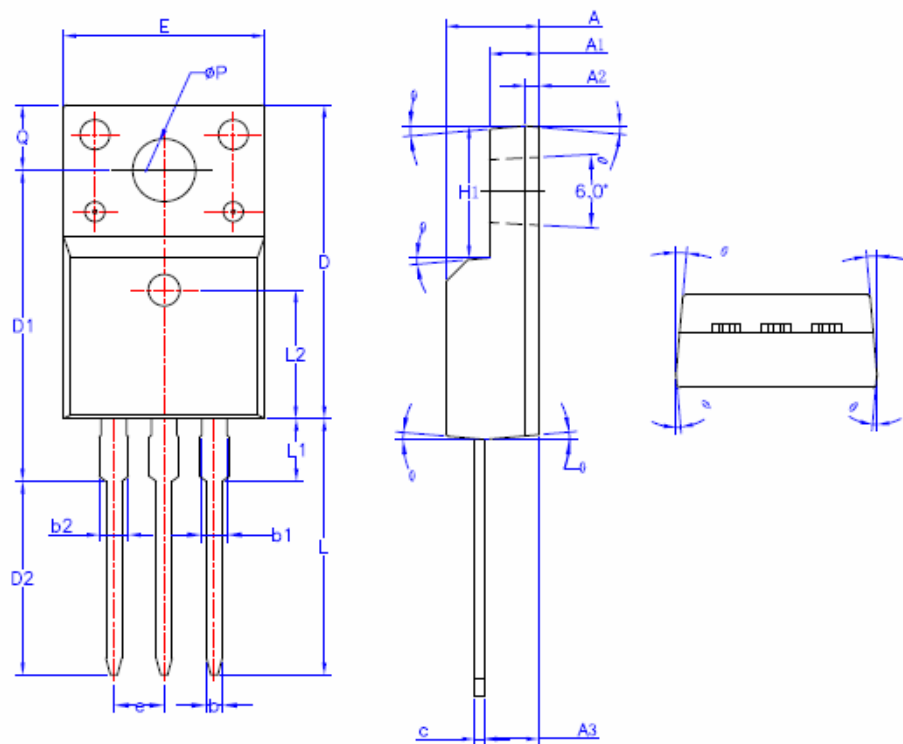


T<sub>J</sub>-Junction Temperature (°C)  
**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

**TO-220F Package Information**



SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.70	—	0.90
b1	1.18	—	1.38
b2	—	—	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	—	—	3.50
L2	6.50REF		
øP	3.08	3.18	3.28
Q	3.20	—	3.40
θ1	1°	3°	5°

## Attention

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