

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP3040Q uses **Super Trench** 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.

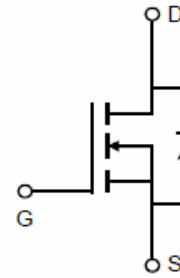
### General Features

- $V_{DS} = 30V, I_D = 40A$   
 $R_{DS(ON)} = 6.8m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 9.5m\Omega$  (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

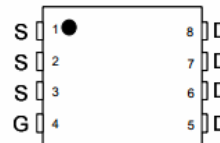
### Application

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

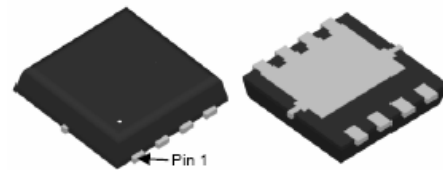
**100% UIS TESTED!**  
**100%  $\Delta V_{ds}$  TESTED!**



Schematic Diagram



Pin Assignment



Top View

Bottom View

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP3040Q	NCEP3040Q	DFN3.3X3.3-8L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	40	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	28.3	A
Pulsed Drain Current	$I_{DM}$	125	A
Maximum Power Dissipation	$P_D$	25	W
Derating factor		0.2	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	150	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	5	$^{\circ}C/W$
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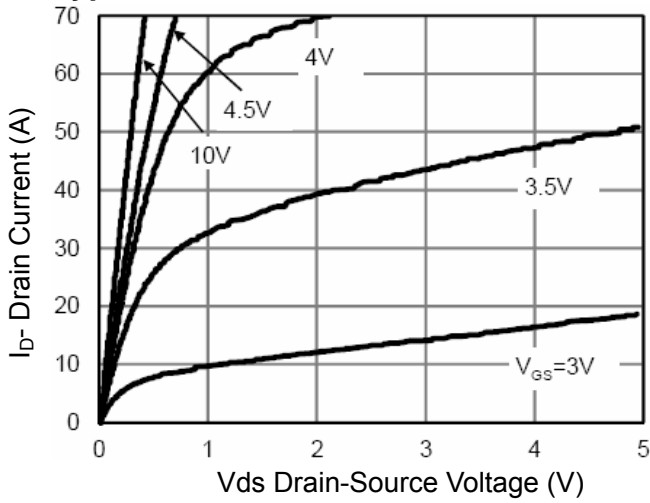
## Electrical Characteristics ( $T_C=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	30		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=30V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> <sup>(Note 3)</sup>						
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	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	6.8	7.1	m $\Omega$
		$V_{GS}=4.5V, I_D=20A$	-	9.5	11	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$		30	-	S
<b>Dynamic Characteristics</b> <sup>(Note 4)</sup>						
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V,$ $F=1.0MHz$	-	822	-	PF
Output Capacitance	$C_{oss}$		-	344	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	15.3	-	PF
<b>Switching Characteristics</b> <sup>(Note 4)</sup>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=15V, I_D=20A$ $V_{GS}=10V, R_G=1.6\Omega$	-	6.5	-	nS
Turn-on Rise Time	$t_r$		-	2.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	17	-	nS
Turn-Off Fall Time	$t_f$		-	2.5	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=15V, I_D=20A,$ $V_{GS}=10V$	-	15	-	nC
Gate-Source Charge	$Q_{gs}$		-	2.9	-	nC
Gate-Drain Charge	$Q_{gd}$		-	2.1	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{SD}$	$V_{GS}=0V, I_S=20A$	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_S$		-	-	40	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}C, I_F = I_S$ $di/dt = 100A/\mu s$ <sup>(Note 3)</sup>	-	11	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	19	-	nC

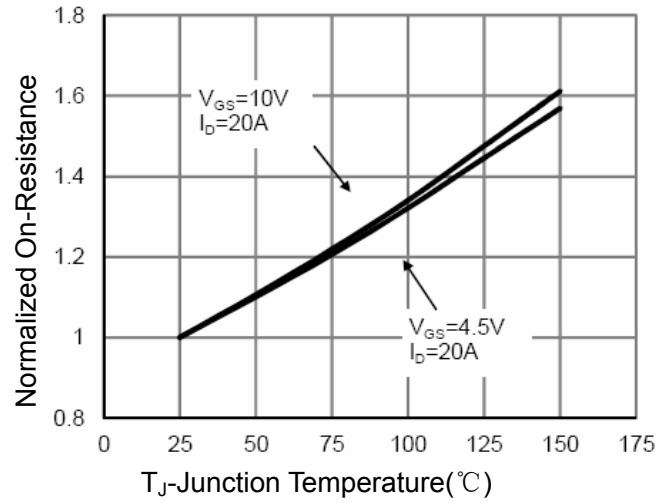
### Notes:

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 :  $T_J=25^{\circ}C, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$

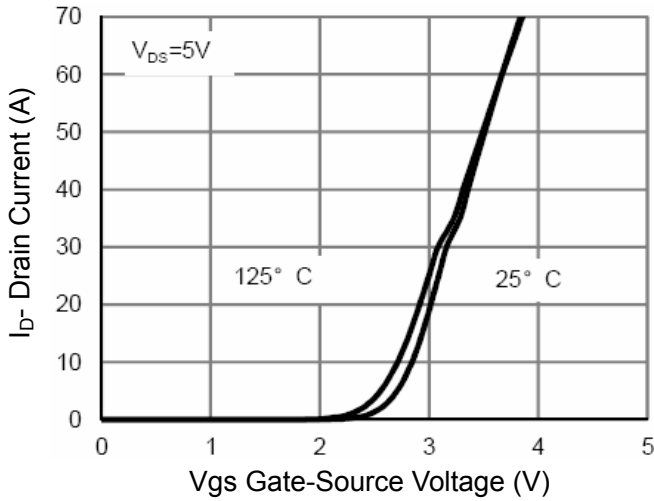
**Typical Electrical and Thermal Characteristics**



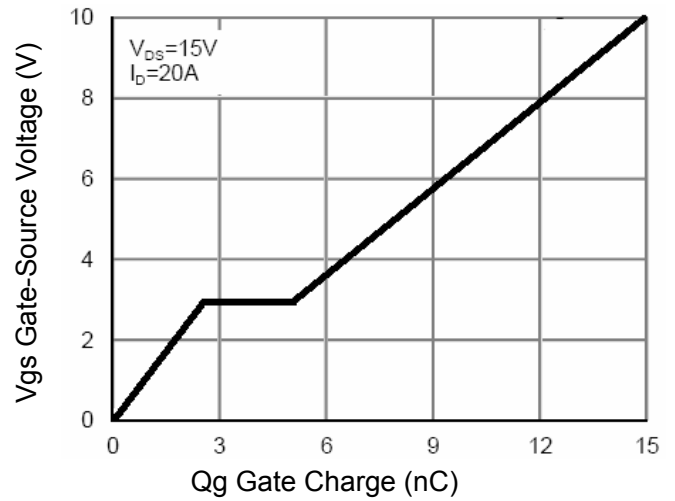
**Figure 1 Output Characteristics**



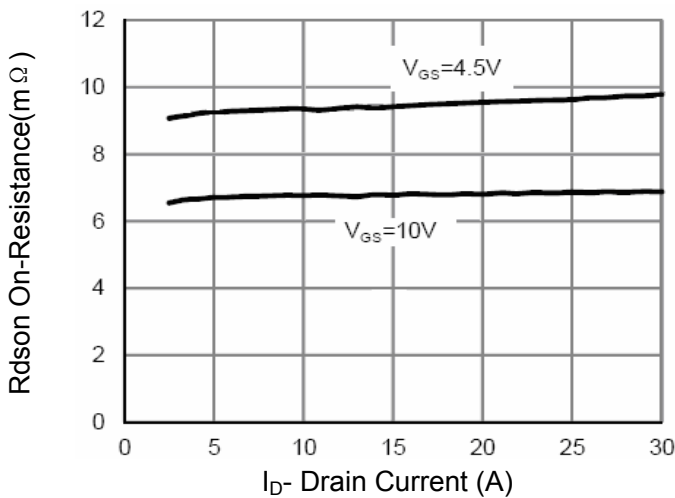
**Figure 4 Rds(on)-Junction Temperature**



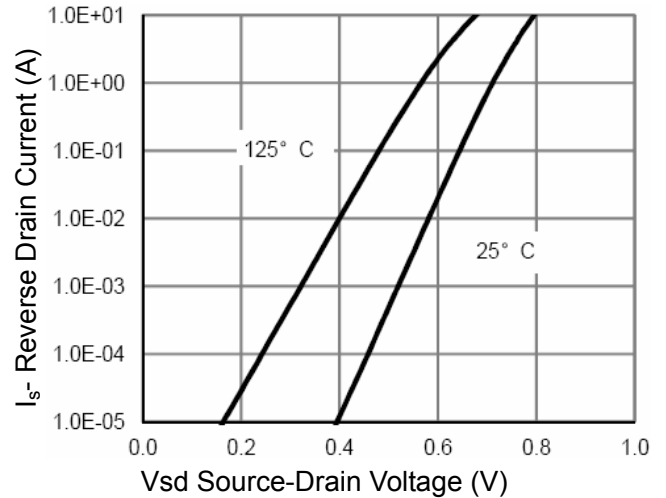
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



**Figure 3 Rds(on)- Drain Current**



**Figure 6 Source- Drain Diode Forward**

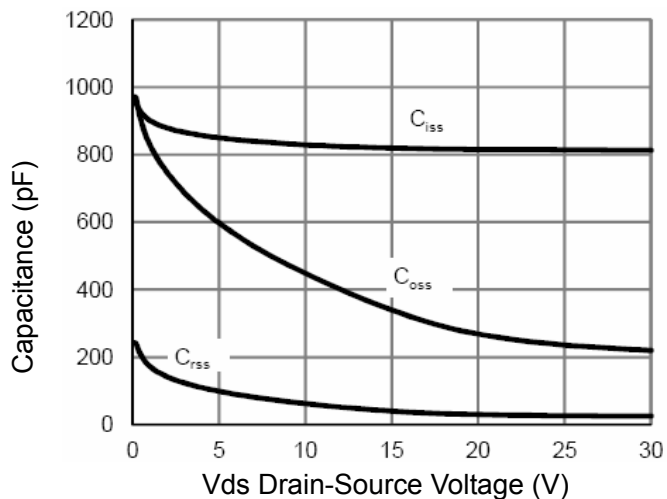


Figure 7 Capacitance vs Vds

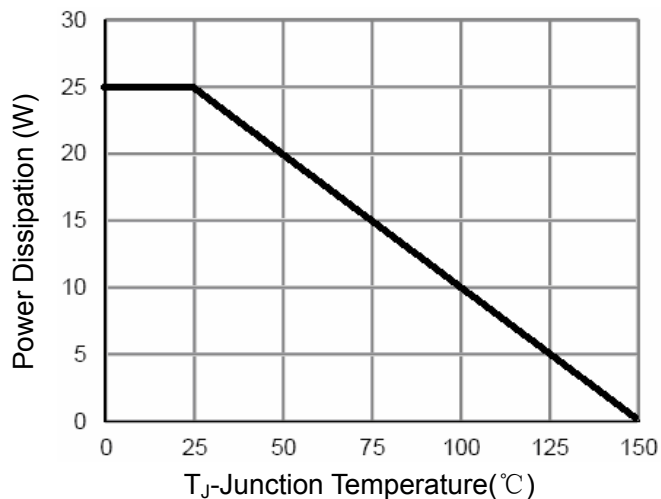


Figure 9 Power De-rating

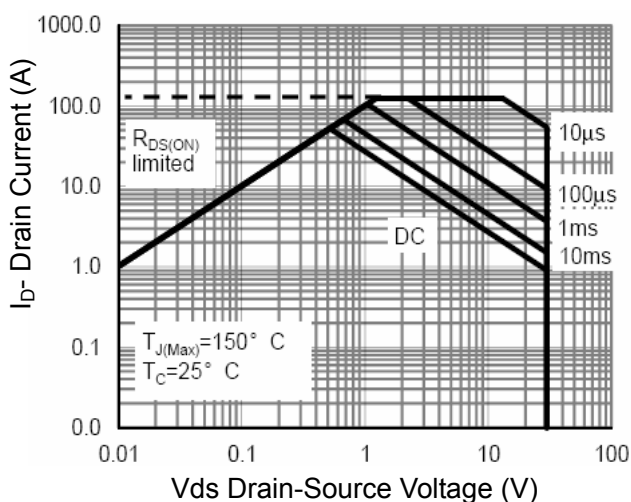


Figure 8 Safe Operation Area

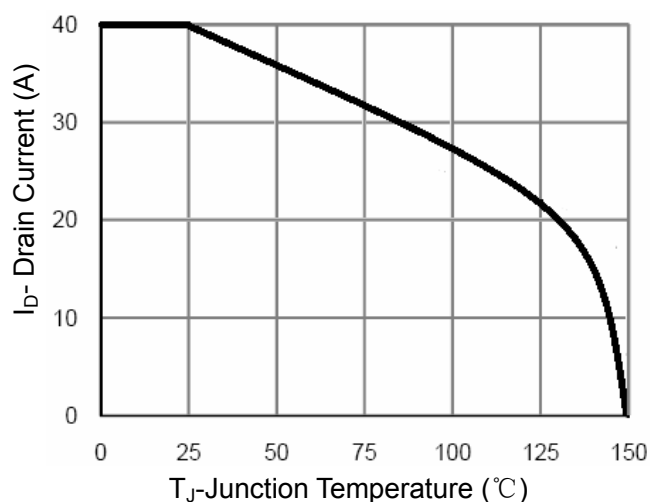


Figure 10 Current De-rating

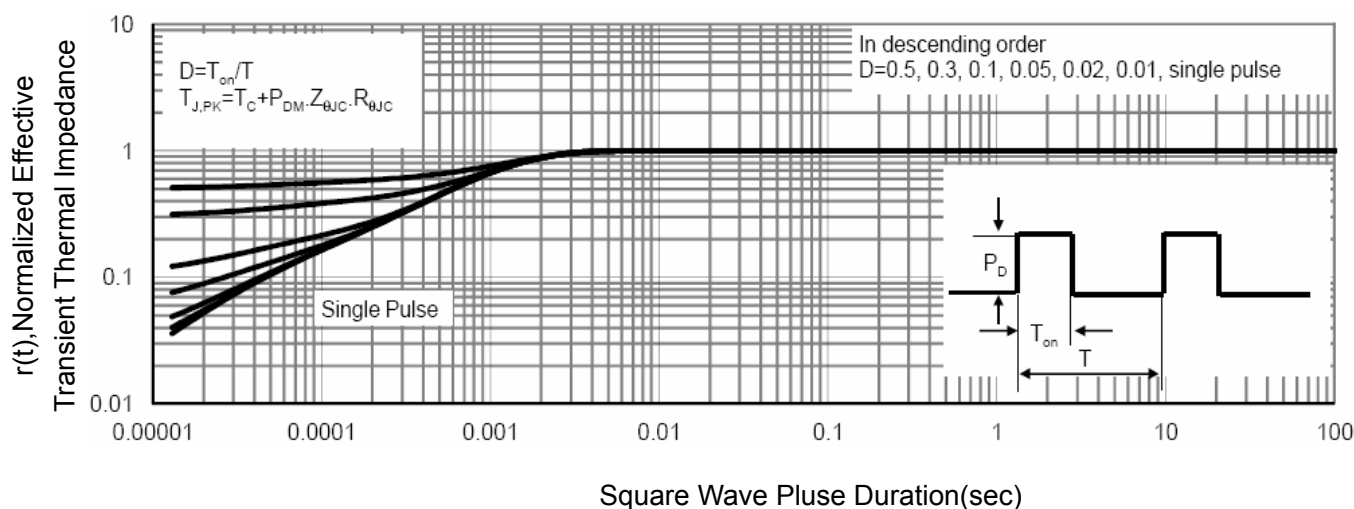
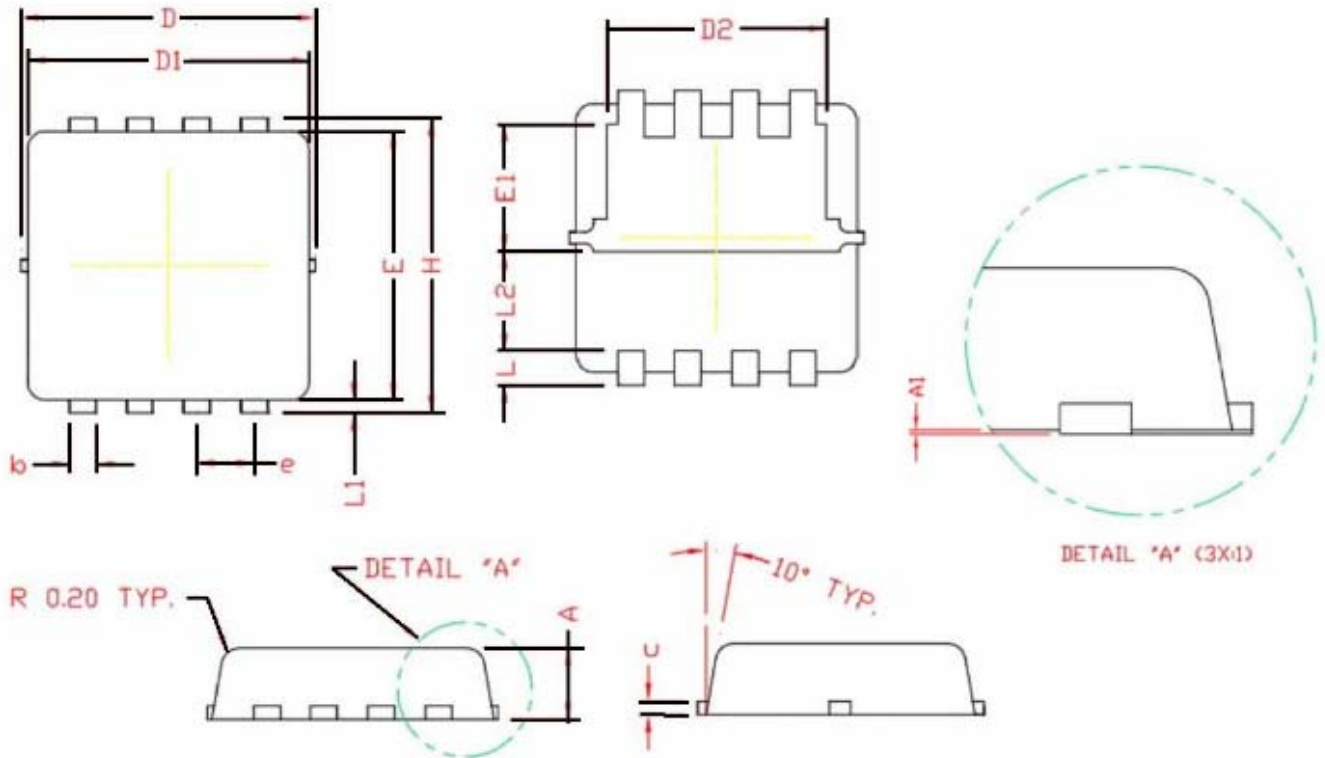


Figure 11 Normalized Maximum Transient Thermal Impedance

DFN3.3X3.3-8L Package Information



COMMON DIMENSIONS

(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.80	0.90
A1	0.00	0.03	0.05
b	0.24	0.30	0.35
c	0.10	0.15	0.20
D	3.25	3.32	3.40
D1	3.05	3.15	3.25
D2	2.40	2.50	2.60
E	3.00	3.10	3.20
E1	1.35	1.45	1.55
e	0.65 BSC.		
H	3.20	3.30	3.40
L	0.30	0.40	0.50
L1	0.10	0.15	0.20
L2	1.13 REF.		

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