

## NCE P-Channel Super Trench Power MOSFET

### Description

The NCEP40P60Q 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

### Application

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

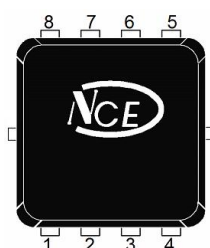
### General Features

- $V_{DS} = -40V, I_D = -60A$   
 $R_{DS(ON)} = 8.8m\Omega$  (typical) @  $V_{GS} = -10V$   
 $R_{DS(ON)} = 12.5m\Omega$  (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

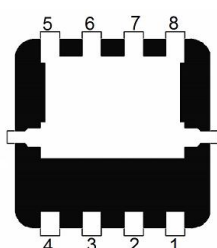
**100% UIS TESTED!**

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

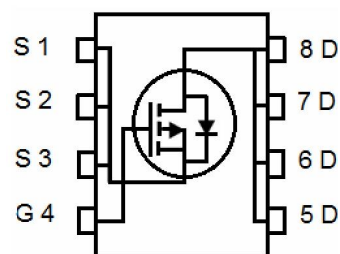
**DFN 3.3X3.3-8L**



**Top View**



**Bottom View**



**Schematic Diagram**

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP40P60Q	NCEP40P60Q	DFN3.3X3.3-8L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D(T_c = 25^\circ C)$	-60	A
Drain Current-Continuous( $T_c = 100^\circ C$ )	$I_D(T_c = 100^\circ C)$	-42	A
Pulsed Drain Current	$I_{DM}$	-240	A
Maximum Power Dissipation( $T_c = 25^\circ C$ )	$P_D(T_c = 25^\circ C)$	75	W
Pulsed Drain Current	$I_{DM}$	-240	A
Derating factor		0.6	W/ $^\circ C$
Single pulse avalanche energy (Note 1)	$E_{AS}$	352	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.67	$^\circ C/W$
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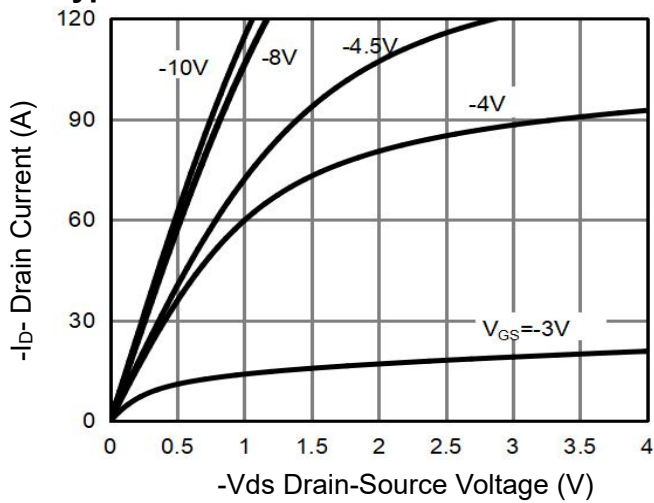
## Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

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	-40		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-40V, 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	-1.1	-1.7	-2.2	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A	-	8.8	11	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-20A	-	12.5	17.0	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-20A	-	30	-	S
Dynamic Characteristics						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, F=1.0MHz	-	2450	-	PF
Output Capacitance	C <sub>oss</sub>		-	660	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	18	-	PF
Switching Characteristics <small>(Note 2)</small>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-20V, I <sub>D</sub> =-20A V <sub>GS</sub> =-10V, R <sub>G</sub> =1.6Ω	-	9	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	4	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	30	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	5	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-20V, I <sub>D</sub> =-20A, V <sub>GS</sub> =-10V	-	39	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	7.8		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	5.3		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-20A	-		-1.2	V
Diode Forward Current	I <sub>S</sub>		-	-	-60	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> =-20A	-	22		nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs	-	58		nC

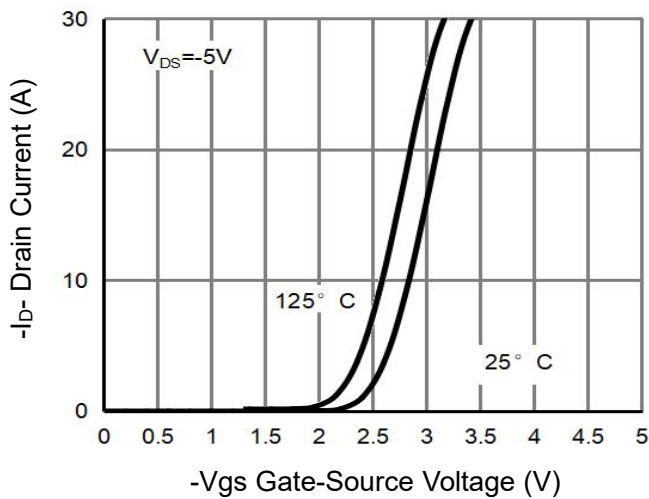
### Notes:

1. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=-20V, 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)=150°C. The SOA curve provides a single pulse rating.

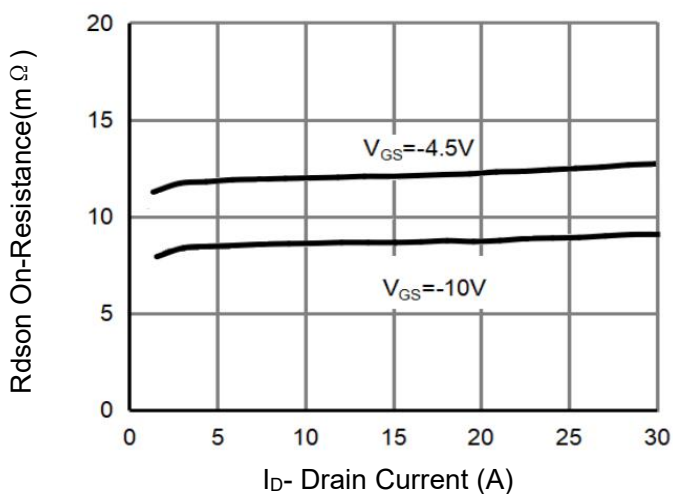
## Typical Electrical and Thermal Characteristics



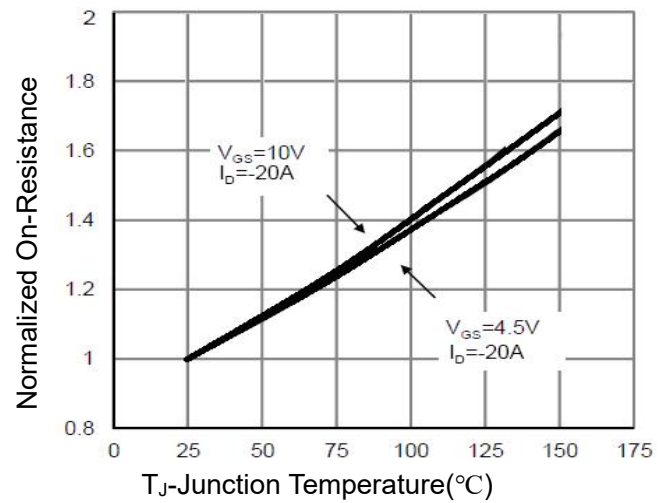
**Figure 1 Output Characteristics**



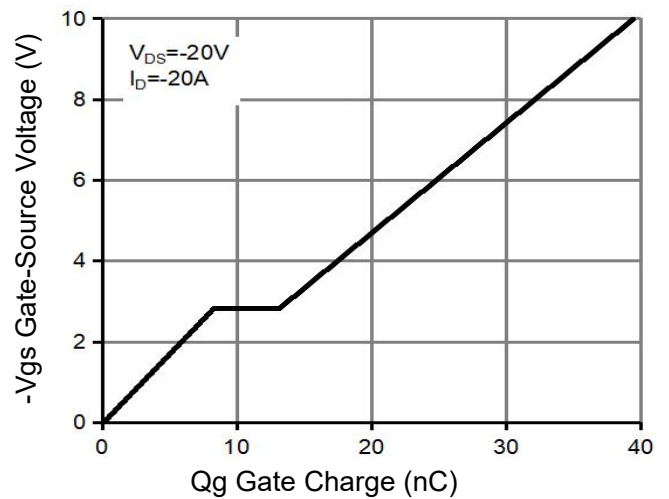
**Figure 2 Transfer Characteristics**



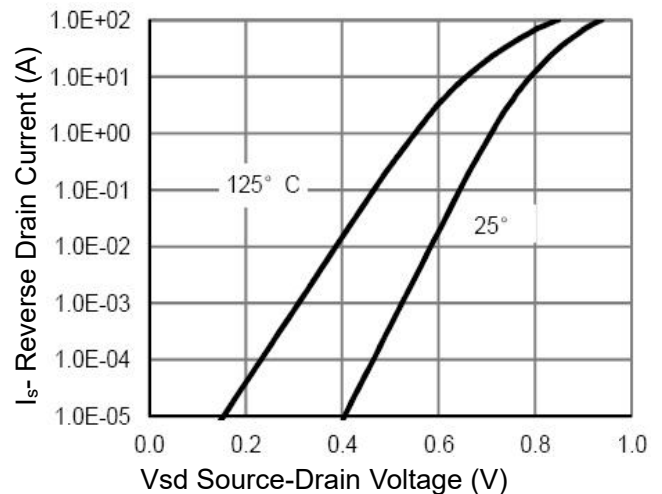
**Figure 3 Rdson- Drain Current**



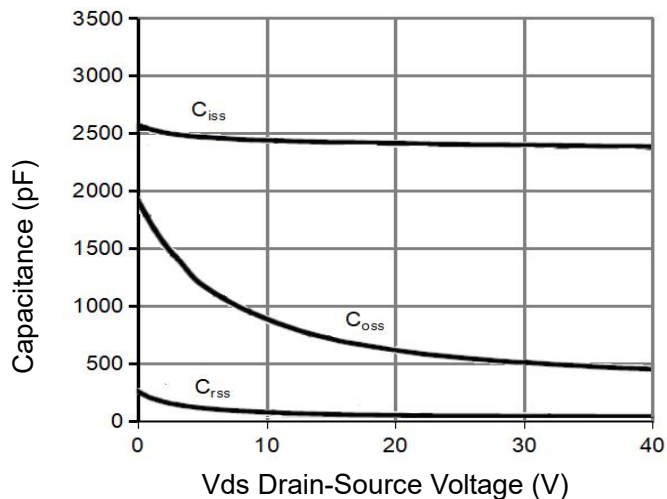
**Figure 4 Rdson-Junction Temperature**



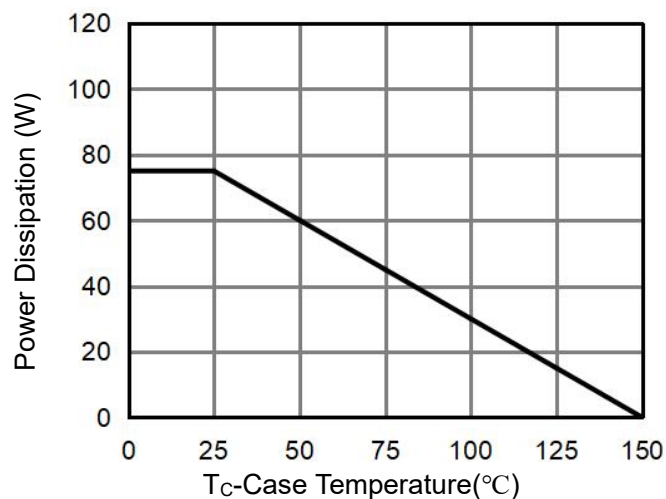
**Figure 5 Gate Charge**



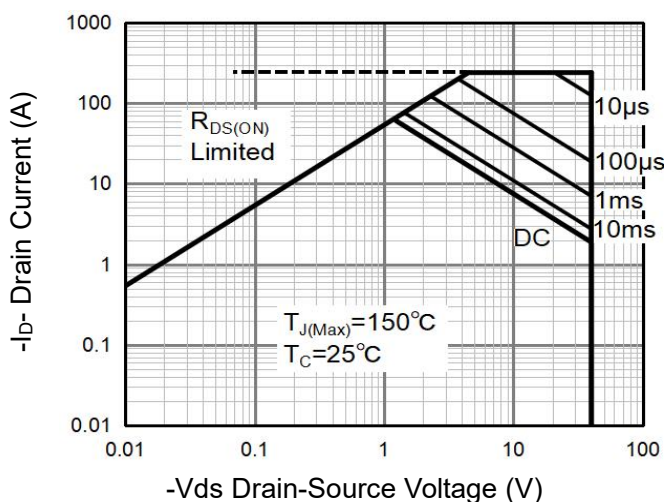
**Figure 6 Source- Drain Diode Forward**



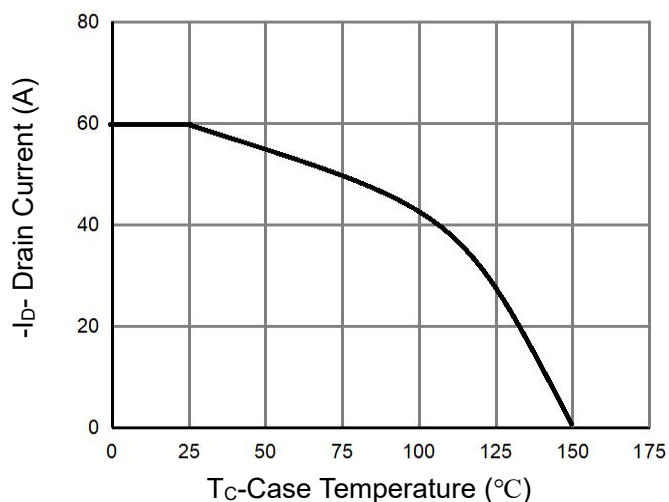
**Figure 7 Capacitance vs Vds**



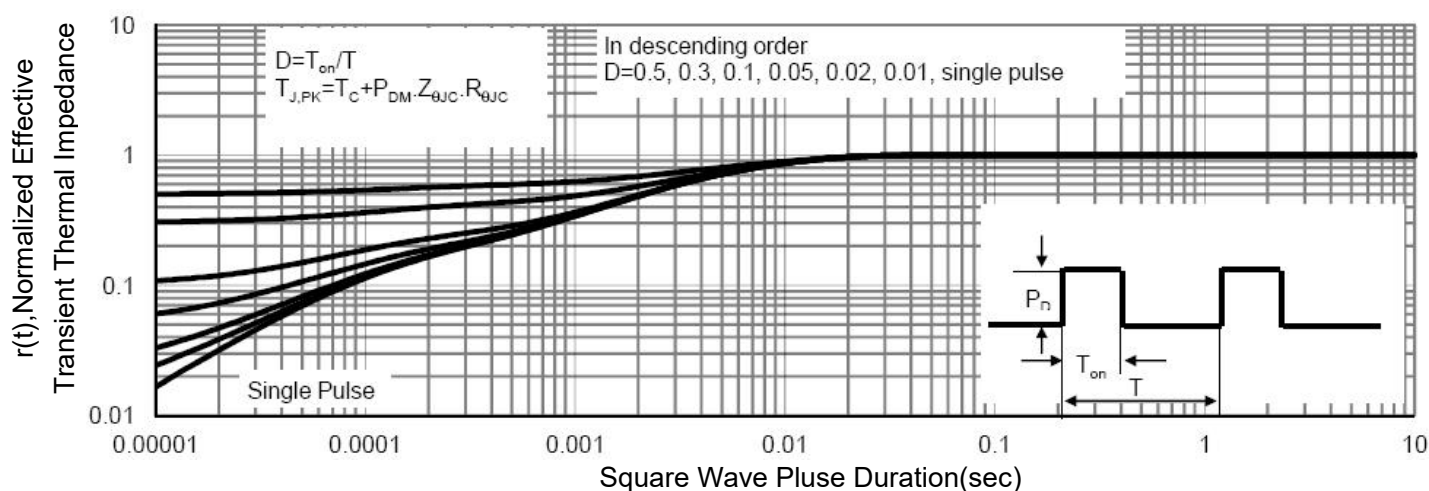
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area** (Note 3)

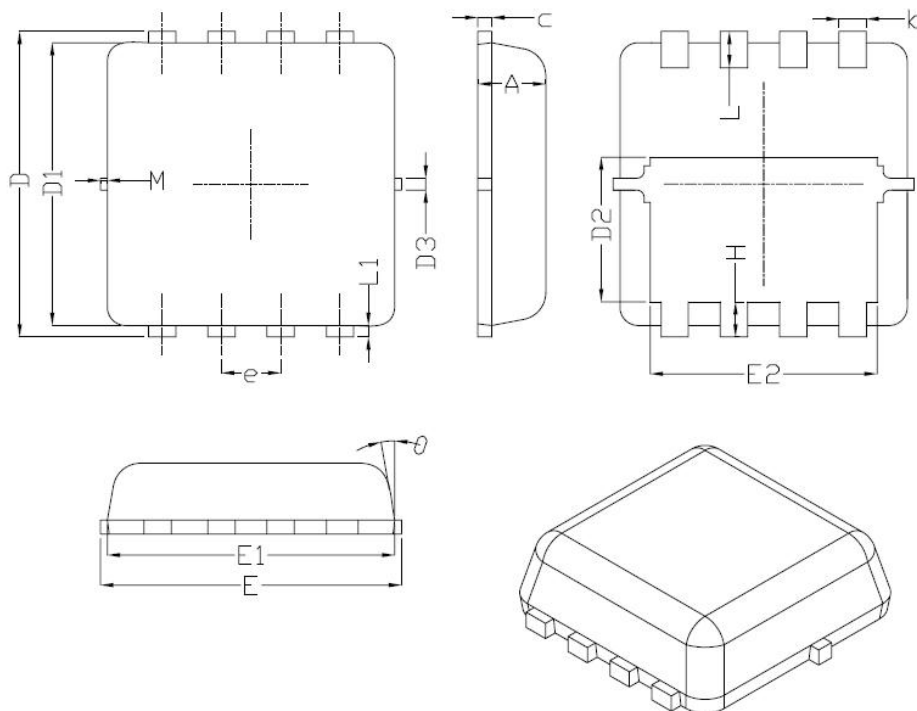


**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## DFN3.3X3.3-8L Package Information



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	0.70	0.75	0.80
b	0.25	0.30	0.35
c	0.10	0.15	0.25
D	3.25	3.35	3.45
D1	3.00	3.10	3.20
D2	1.48	1.58	1.68
D3	-	0.13	-
E	3.20	3.30	3.40
E1	3.00	3.15	3.20
E2	2.39	2.49	2.59
e	0.65BSC		
H	0.30	0.39	0.50
L	0.30	0.40	0.50
L1	-	0.13	-
M	*	*	0.15
$\theta$		10°	12°

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