

## NCE P-Channel Super Trench Power MOSFET

### Description

The NCEP60P90AK 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

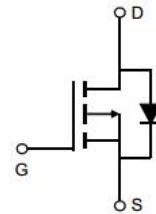
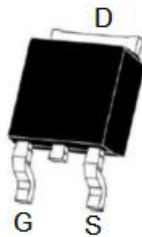
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

### General Features

- $V_{DS} = -60V, I_D = -90A$
- $R_{DS(ON)} = 7.6m\Omega$  (typical) @  $V_{GS} = -10V$
- $R_{DS(ON)} = 9.2m\Omega$  (typical) @  $V_{GS} = -4.5V$
- 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% ΔVds TESTED!**

TO-252-2L



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP60P90AK	NCEP60P90AK	TO-252-2L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-90	A
Drain Current-Continuous( $T_c = 100^\circ C$ )	$I_D(100^\circ C)$	-63	A
Pulsed Drain Current	$I_{DM}$	-360	A
Maximum Power Dissipation	$P_D$	140	W
Derating factor		1.53	W/ $^\circ C$
Single pulse avalanche energy (Note 1)	$E_{AS}$	519	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.07	$^\circ C/W$
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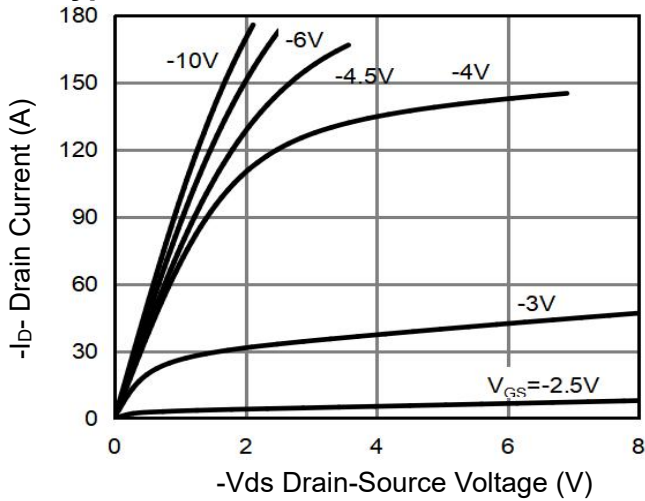
## Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-60		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-60V, 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
<b>On Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1.2	-1.7	-2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A	-	7.6	10.0	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-20A	-	9.2	12.0	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-10V, I <sub>D</sub> =-20A	-	60	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, F=1.0MHz	-	4291	-	pF
Output Capacitance	C <sub>oss</sub>		-	643	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	23	-	PF
<b>Switching Characteristics</b> (Note 2)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-30V, I <sub>D</sub> =-20A V <sub>GS</sub> =-10V, R <sub>G</sub> =1.6Ω	-	15	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	18	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	50	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	18	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-30V, I <sub>D</sub> =-20A, V <sub>GS</sub> =-10V	-	64	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	12	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	8	-	nC
<b>Drain-Source Diode Characteristics</b>						
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>		-	-	-90	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = -20A	-	55	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs	-	101	-	nC

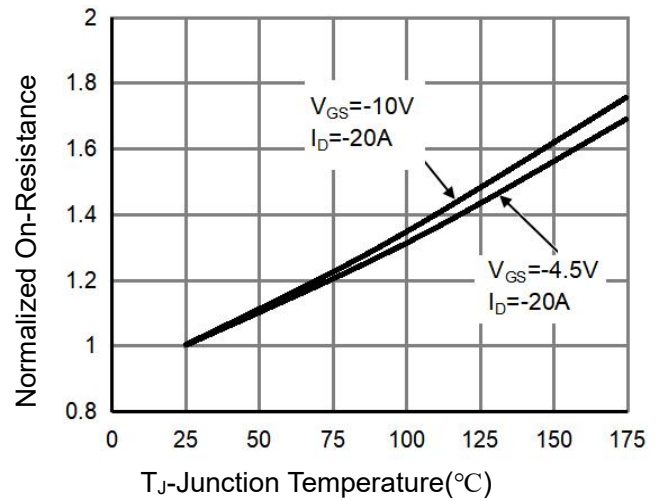
### Notes:

1. EAS condition : T<sub>j</sub>=25°C, V<sub>DD</sub>=-30V, 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.

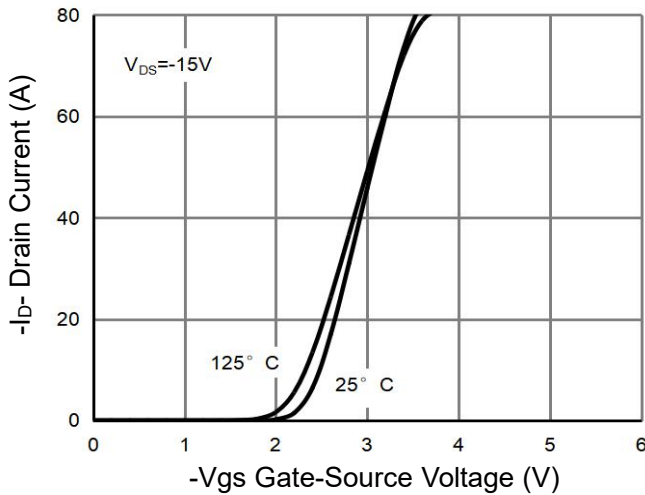
## Typical Electrical and Thermal Characteristics



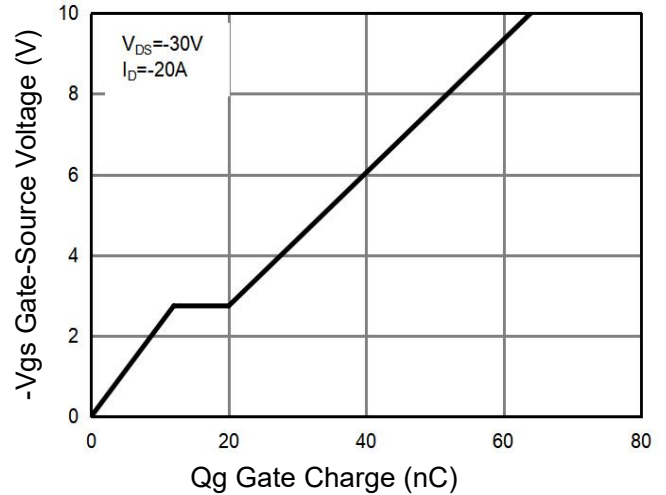
**Figure 1 Output Characteristics**



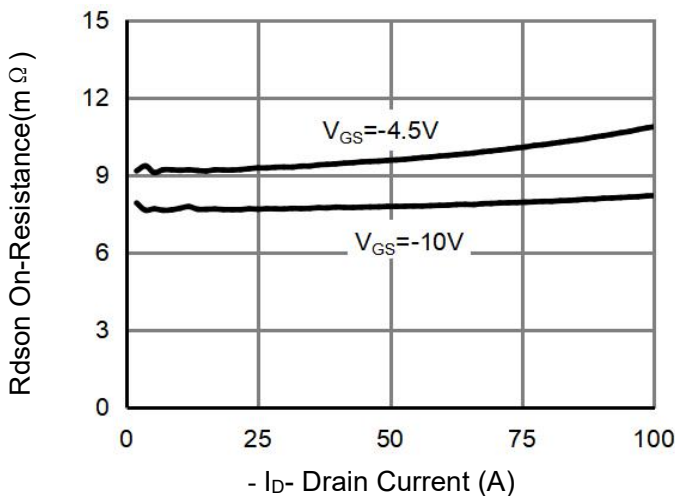
**Figure 4 Rdson-Junction Temperature**



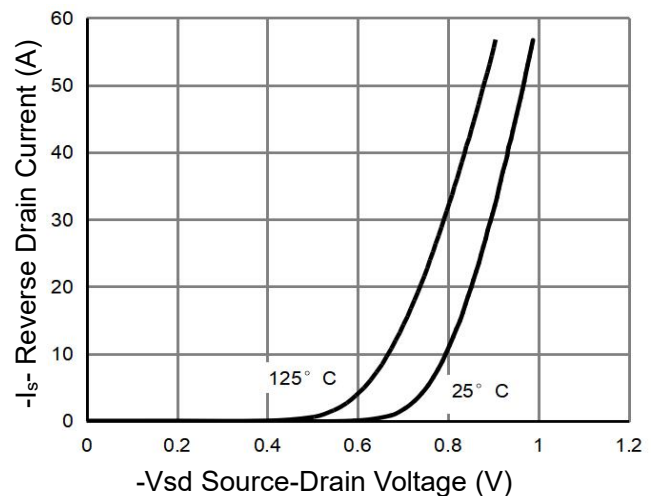
**Figure 2 Transfer Characteristics**



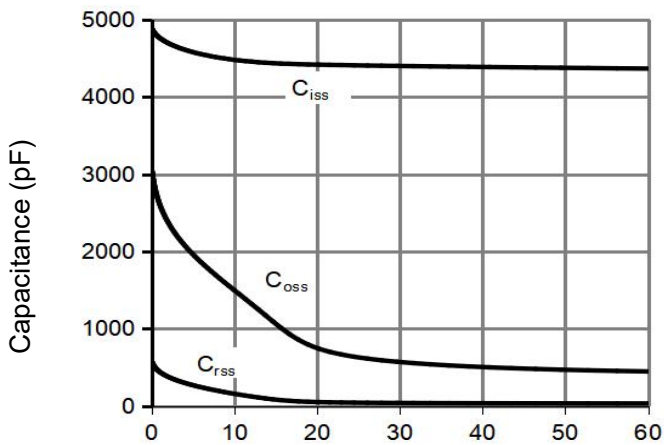
**Figure 5 Gate Charge**



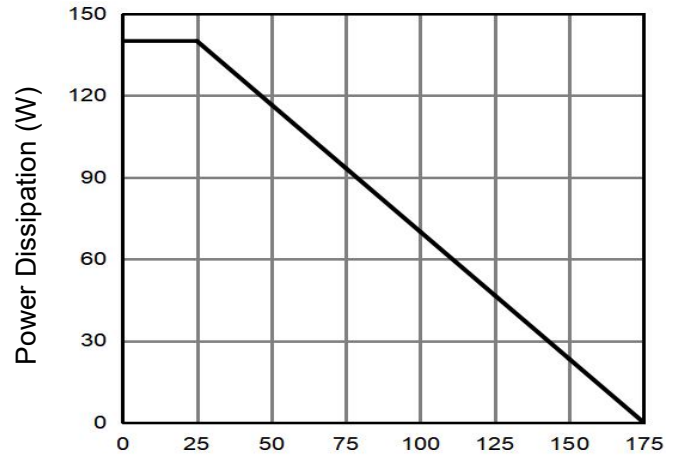
**Figure 3 Rdson- Drain Current**



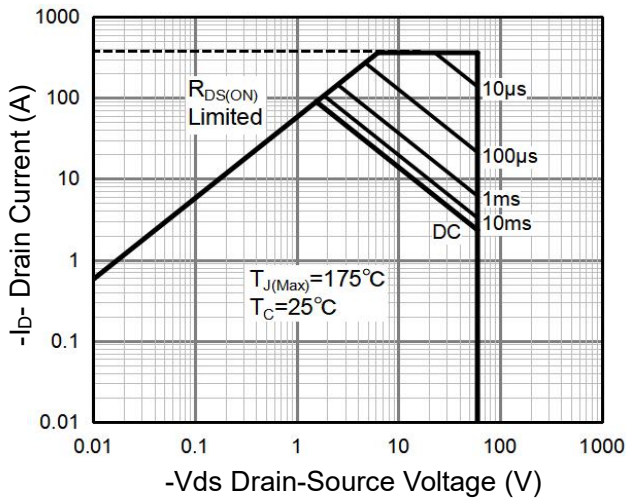
**Figure 6 Source- Drain Diode Forward**



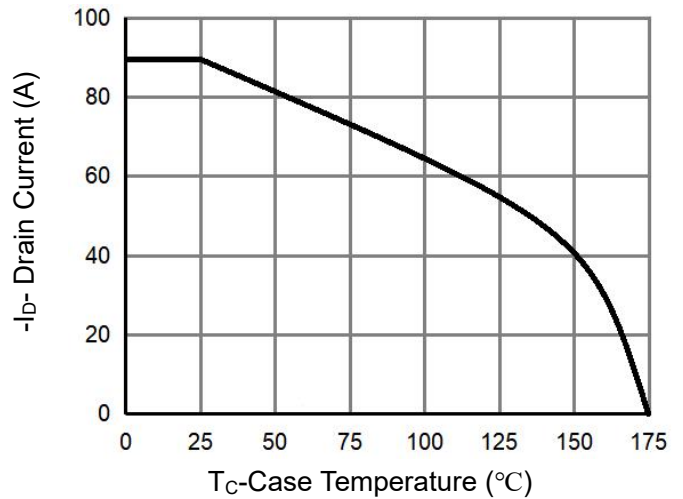
-Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



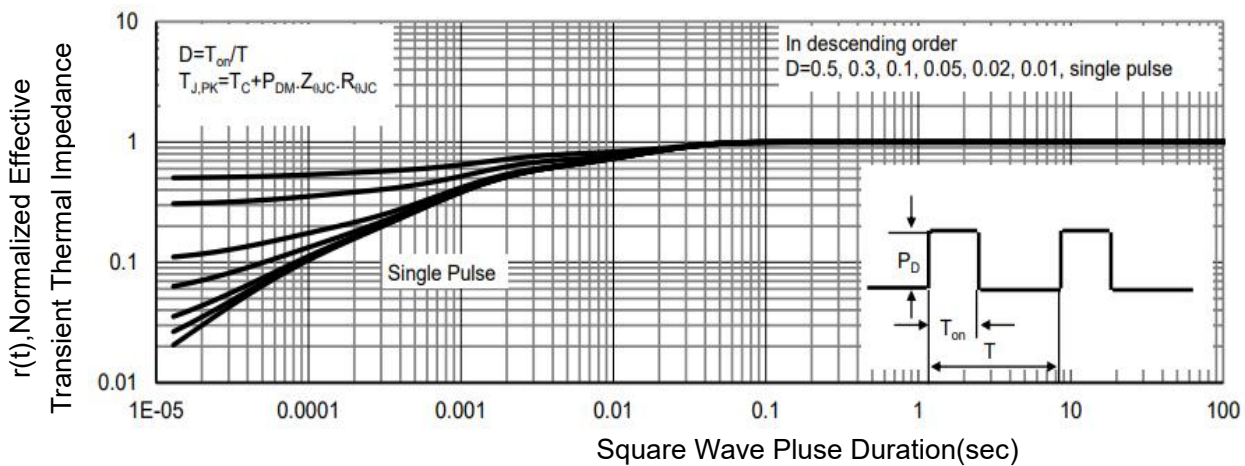
T<sub>C</sub>-Case Temperature(°C)  
**Figure 9 Power De-rating**



-I<sub>D</sub>- Drain Current (A)  
**Figure 8 Safe Operation Area** (Note 3)

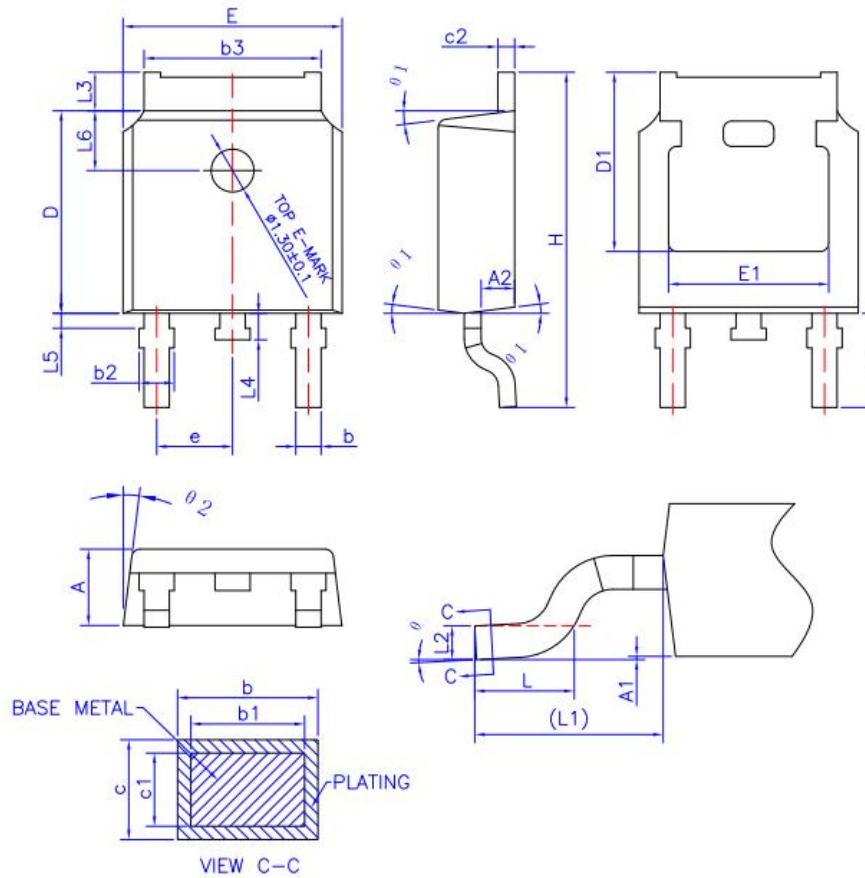


-I<sub>D</sub>- Drain Current (A)  
**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-252-2L Package Information



COMMON DIMENSIONS  
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	---	0.10
A2	0.90	1.01	1.10
b	0.72	---	0.85
b1	0.71	0.76	0.81
b2	0.72	---	0.90
b3	5.13	5.33	5.46
c	0.47	---	0.60
c1	0.46	0.51	0.56
c2	0.47	---	0.60
D	6.00	6.10	6.20
D1	5.25	---	---
E	6.50	6.60	6.70
E1	4.70	---	---
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.508 BSC		
L3	0.90	---	1.25
L4	0.60	0.80	1.00
L5	0.15	---	0.75
L6	1.80 REF		
$\theta$	0°	---	8°
$\theta_1$	5°	7°	9°
$\theta_2$	5°	7°	9°

NOTES:  
ALL DIMENSIONS REFER TO JEDEC STANDARD TO-252 AA DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS

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