

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP0140AL 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.

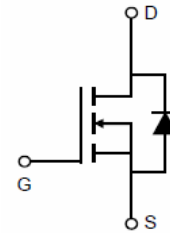
### General Features

- $V_{DS} = 100V, I_D = 45A$   
 $R_{DS(ON)} = 18m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 22m\Omega$  (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

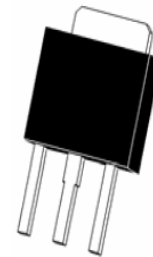
**100% UIS TESTED!**  
**100%  $\Delta V_{ds}$  TESTED!**



Schematic Diagram



Marking and pin assignment



TO-251S top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP0140AL	NCEP0140AL	TO-251S	-	-	-

### 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 (Silicon Limited)	$I_D$	45	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	31.8	A
Pulsed Drain Current (Package Limited)	$I_{DM}$	180	A
Maximum Power Dissipation	$P_D$	110	W
Derating factor		0.73	W/ $^\circ C$
Single pulse avalanche energy (Note 5)	$E_{AS}$	200	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>	$R_{\theta JC}$	1.36	$^{\circ}C/W$
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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	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	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> <sup>(Note 3)</sup>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	2.0	2.8	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	18	23	m $\Omega$
		$V_{GS}=4.5V, I_D=20A$	-	22	27	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$	-	35	-	S
<b>Dynamic Characteristics</b> <sup>(Note 4)</sup>						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$	-	1600	-	PF
Output Capacitance	$C_{oss}$		-	139	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	11	-	PF
<b>Switching Characteristics</b> <sup>(Note 4)</sup>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=50V, I_D=20A$ $V_{GS}=10V, R_G=1.6\Omega$	-	6	-	nS
Turn-on Rise Time	$t_r$		-	2	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	18	-	nS
Turn-Off Fall Time	$t_f$		-	2	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=50V, I_D=20A,$ $V_{GS}=10V$	-	26	-	nC
Gate-Source Charge	$Q_{gs}$		-	7.4	-	nC
Gate-Drain Charge	$Q_{gd}$		-	3.8	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{SD}$	$V_{GS}=0V, I_S=45A$	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_S$		-	-	45	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}C, I_F = 20A$ $di/dt = 500A/\mu s$ <sup>(Note 3)</sup>	-		26	nS
Reverse Recovery Charge	$Q_{rr}$		-		98	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

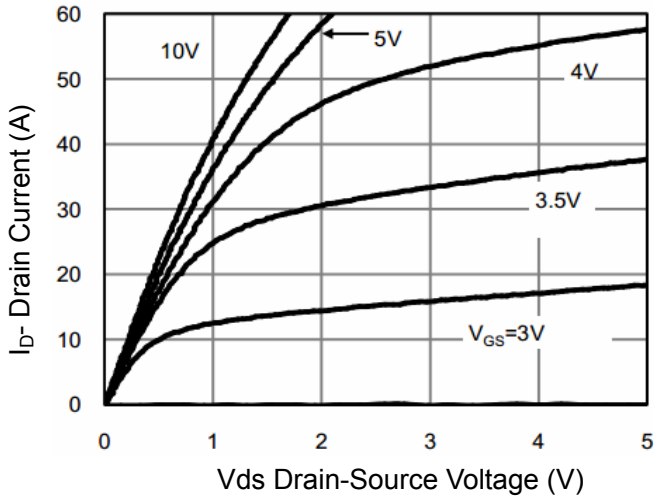


Figure 1 Output Characteristics

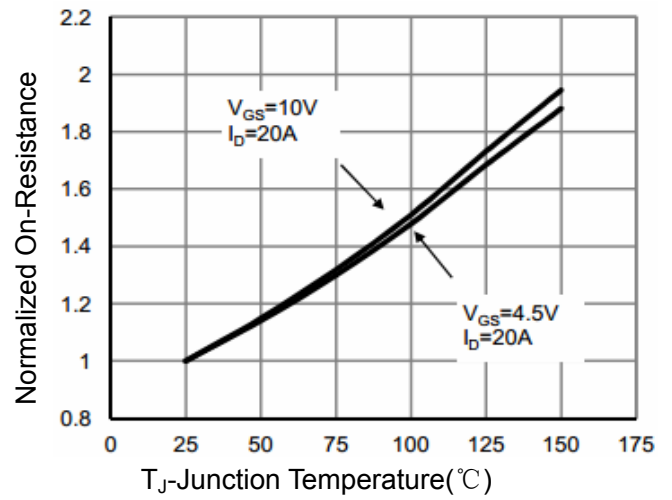


Figure 4  $R_{dson}$ -Junction Temperature

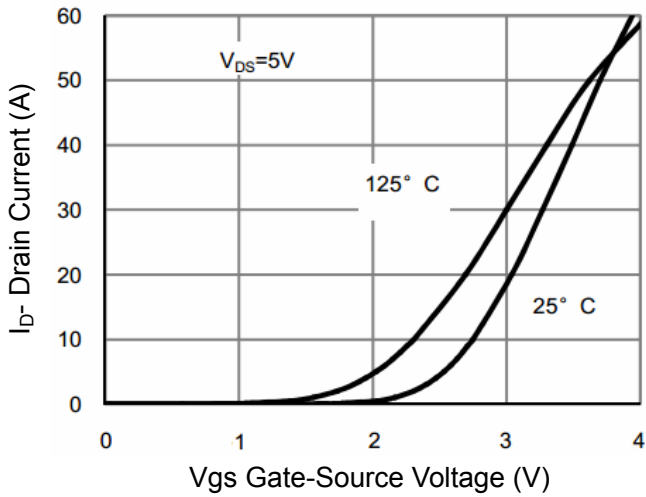


Figure 2 Transfer Characteristics

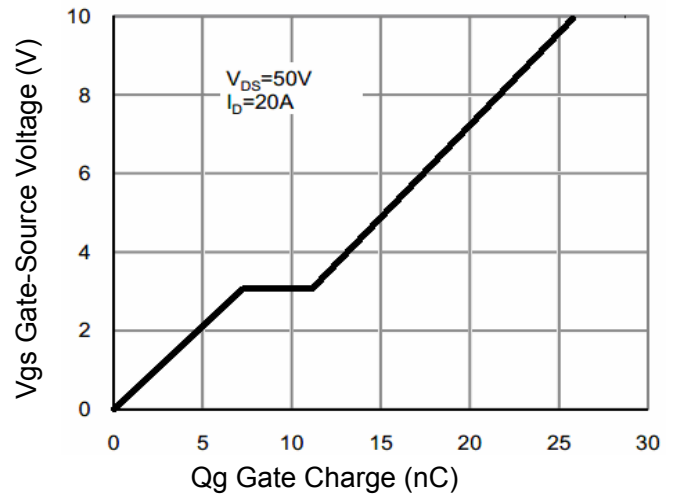


Figure 5 Gate Charge

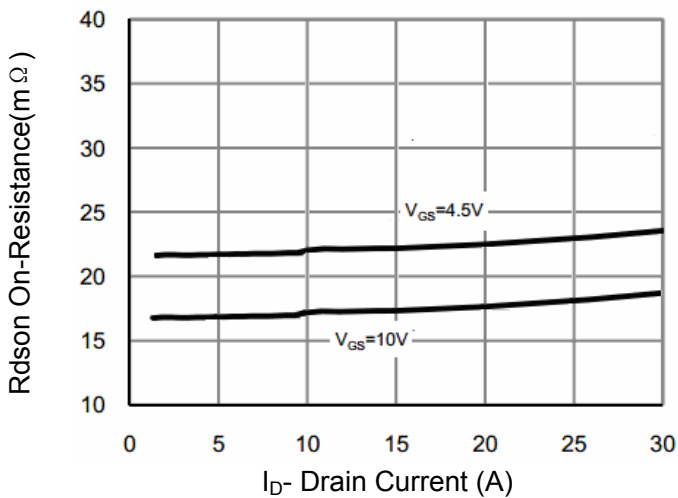


Figure 3  $R_{dson}$ - Drain Current

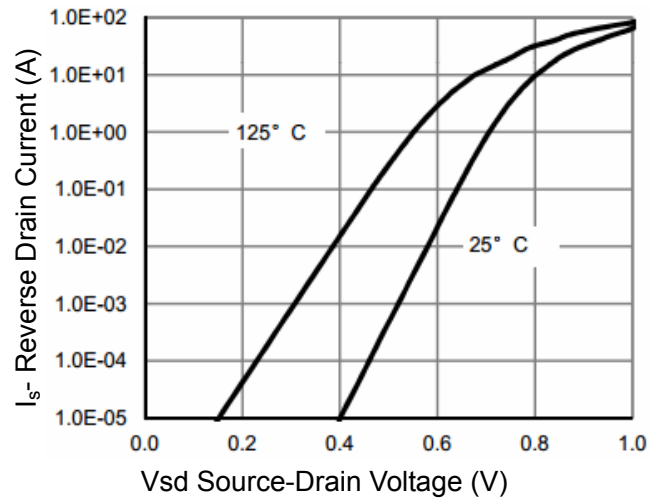


Figure 6 Source- Drain Diode Forward

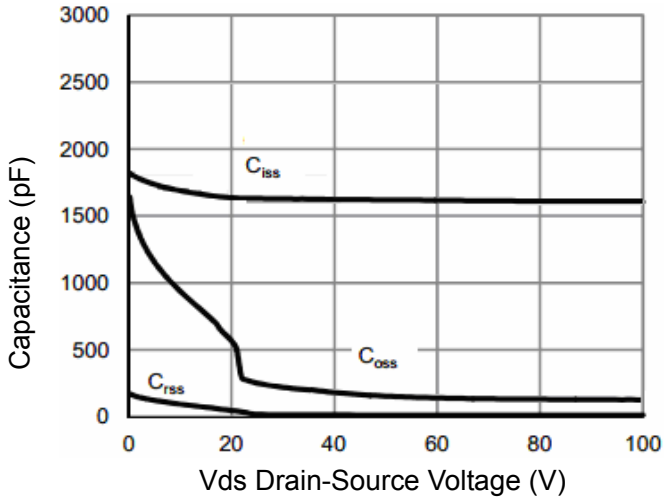


Figure 7 Capacitance vs Vds

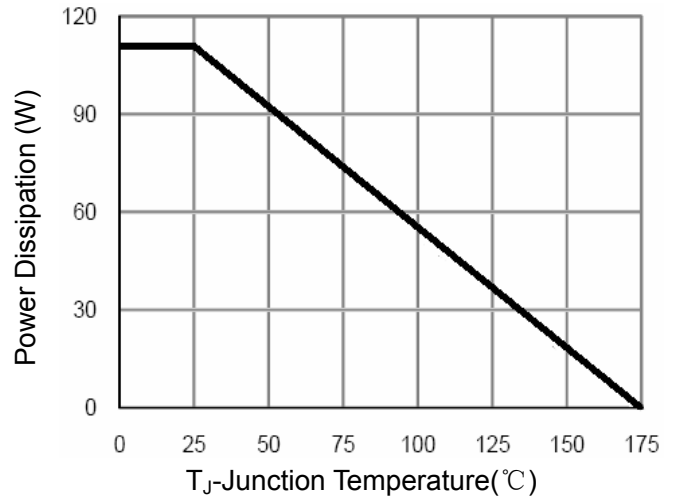


Figure 9 Power De-rating

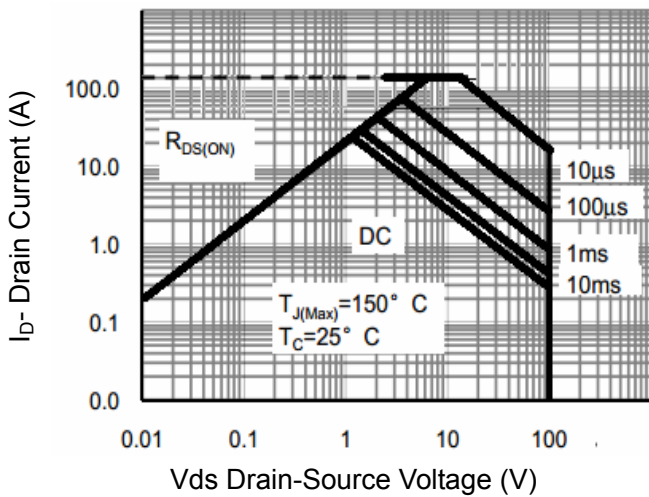


Figure 8 Safe Operation Area

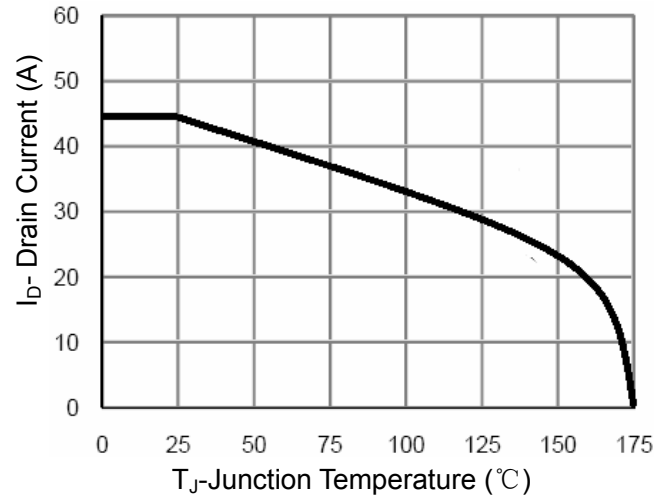


Figure 10 Current De-rating

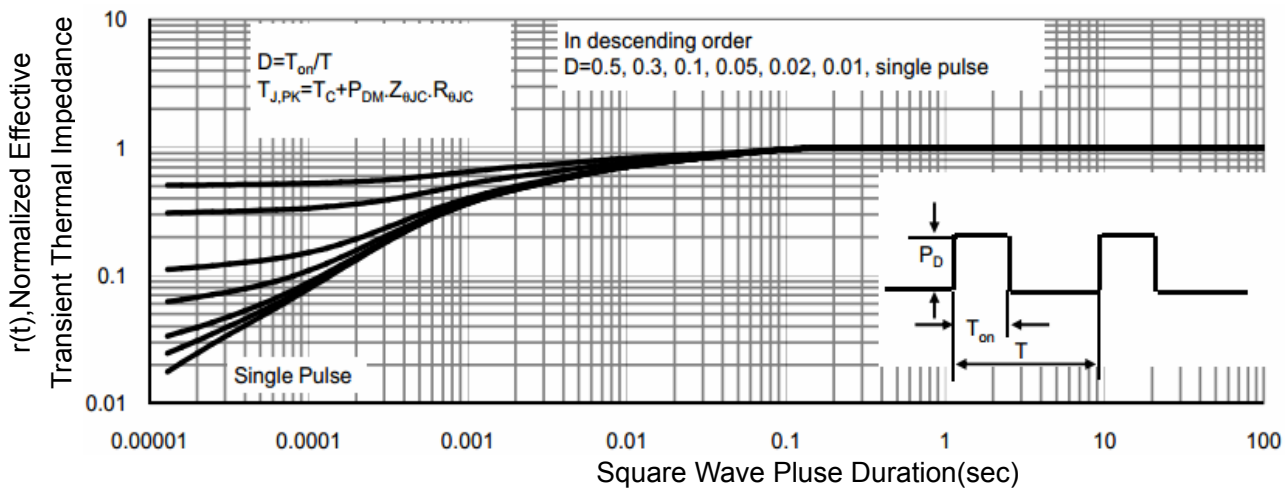
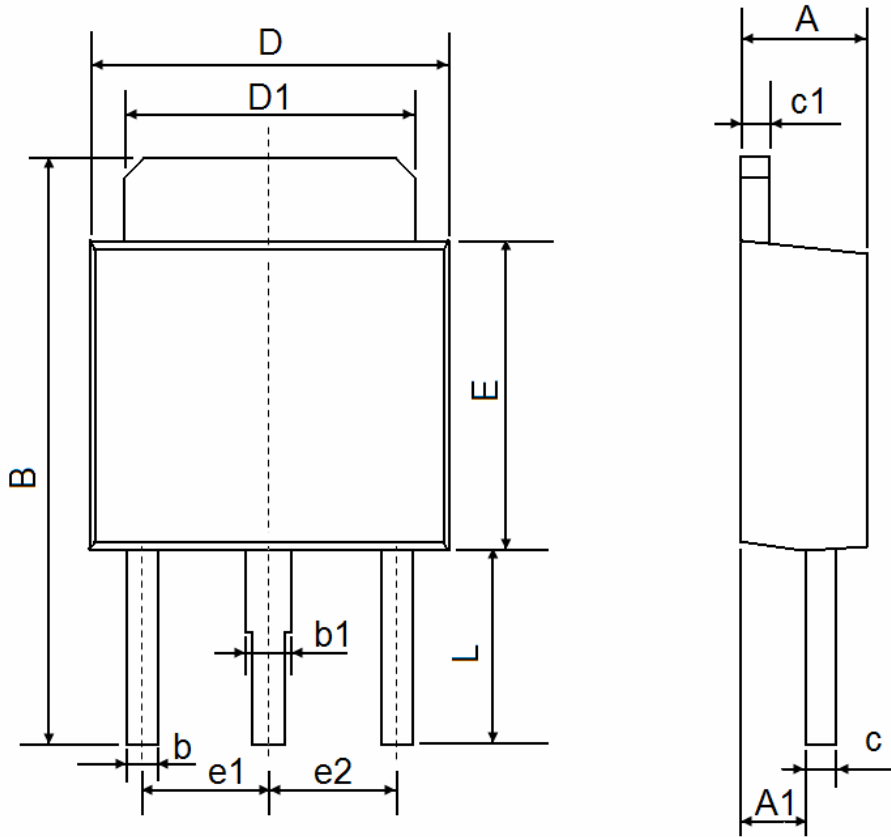


Figure 11 Normalized Maximum Transient Thermal Impedance

**TO-251S Package Information**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.250	2.350	0.089	0.093
A1	1.150	1.250	0.045	0.049
B	10.200	10.800	0.402	0.425
b	0.550	0.650	0.022	0.026
b1	0.750	0.850	0.030	0.033
c	0.480	0.540	0.019	0.021
c1	0.480	0.540	0.019	0.021
D	6.400	6.600	0.252	0.260
D1	5.250	5.350	0.207	0.211
E	5.400	5.600	0.213	0.220
e1	2.300 TYP		0.091 TYP	
e2	2.300 TYP		0.091 TYP	
L	3.300	3.700	0.130	0.146

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