NCE P-Channel Super Trench Power MOSFET

Description

The NCEP40PT13D 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
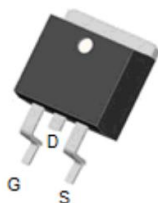- Ideal for high-frequency switching and synchronous rectification

General Features

- V_{DS} =-40V,I_D =-130A

  $R_{DS(ON)}$=3.85mΩ (typical) @ V_{GS}=-10V

  $R_{DS(ON)}$=5.0mΩ (typical) @ V_{GS}=-4.5V
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
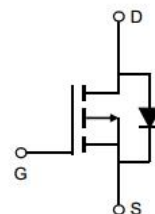- 175 °C operating temperature
- Pb-free lead plating

  100% UIS TESTED!

  100% ΔVds TESTED!

TO-263-2L

Top View

Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP40PT13D	NCEP40PT13D	TO-263-2L	Ø330mm	24mm	800units

Absolute Maximum Ratings (T$_C$=25℃unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	-40	V
Gate-Source Voltage	V_{GS}	±20	V
Drain Current-Continuous	I_D	-130	A
Drain Current-Continuous(T$_C$=100℃)	I_D (100℃)	-91	A
Pulsed Drain Current	I_{DM}	-520	A
Maximum Power Dissipation	P_D	220	W
Derating factor		1.47	W/℃
Single pulse avalanche energy [Note 1]	E_{AS}	1155	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 175	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case	$R_{\theta JC}$	0.68	℃/W

Electrical Characteristics (T$_C$=25℃ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV$_{DSS}$	V$_{GS}$=0V I$_D$=-250µA	-40		-	V
Zero Gate Voltage Drain Current	I$_{DSS}$	V$_{DS}$=-40V,V$_{GS}$=0V	-	-	1	µA
Gate-Body Leakage Current	I$_{GSS}$	V$_{GS}$=±20V,V$_{DS}$=0V	-	-	±100	nA
On Characteristics						
Gate Threshold Voltage	V$_{GS(th)}$	V$_{DS}$=V$_{GS}$,I$_D$=-250µA	-1.0	-1.6	-2.5	V
Drain-Source On-State Resistance	R$_{DS(ON)}$	V$_{GS}$=-10V, I$_D$=-20A	-	3.85	4.65	mΩ
		V$_{GS}$=-4.5V, I$_D$=-20A	-	5.0	7.5	mΩ
Forward Transconductance	g$_{FS}$	V$_{DS}$=-5V,I$_D$=-40A	-	50	-	S
Dynamic Characteristics						
Input Capacitance	C$_{Iss}$	V$_{DS}$=-20V,V$_{GS}$=0V, F=1.0MHz	-	6100	-	PF
Output Capacitance	C$_{oss}$		-	1500	-	PF
Reverse Transfer Capacitance	C$_{rss}$		-	95	-	PF
Switching Characteristics [Note 2]						
Turn-on Delay Time	t$_{d(on)}$	V$_{DD}$=-20V,I$_D$=-20A V$_{GS}$=-10V,R$_G$=1.6Ω	-	13	-	nS
Turn-on Rise Time	t$_r$		-	30	-	nS
Turn-Off Delay Time	t$_{d(off)}$		-	75	-	nS
Turn-Off Fall Time	t$_f$		-	14	-	nS
Total Gate Charge	Q$_g$	V$_{DS}$=-20V,I$_D$=-20A, V$_{GS}$=-10V	-	86	-	nC
Gate-Source Charge	Q$_{gs}$		-	17.5		nC
Gate-Drain Charge	Q$_{gd}$		-	10.5		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V$_{SD}$	V$_{GS}$=0V,I$_S$=-20A	-		-1.2	V
Diode Forward Current	I$_S$		-	-	-130	A
Reverse Recovery Time	t$_{rr}$	T$_J$ = 25°C, I$_F$ =-65A di/dt = 100A/µs	-	55	-	nS
Reverse Recovery Charge	Qrr		-	75	-	nC

Notes:

1. EAS condition : Tj=25℃,V$_{DD}$=-20V,V$_G$=-10V,L=0.5mH,Rg=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$_{J(MAX)}$=175°C. The SOA curve provides a single pulse rating.
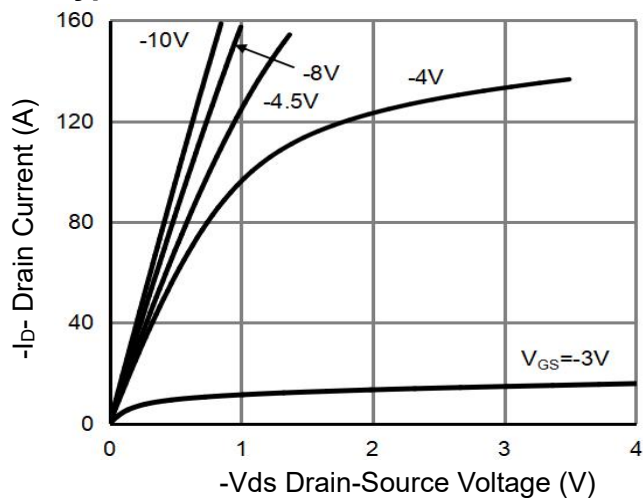
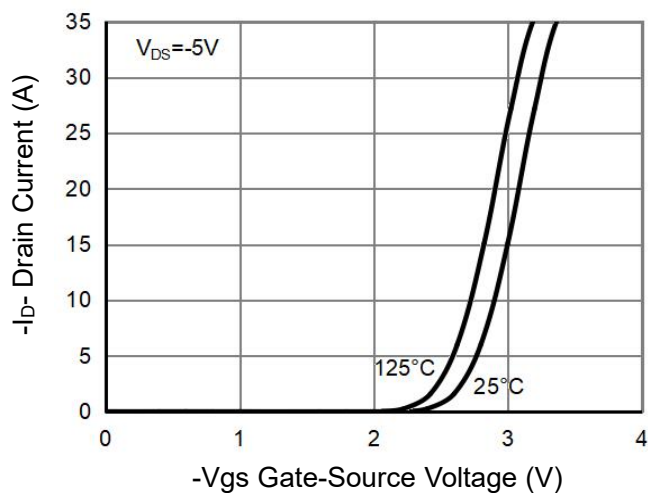## Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics
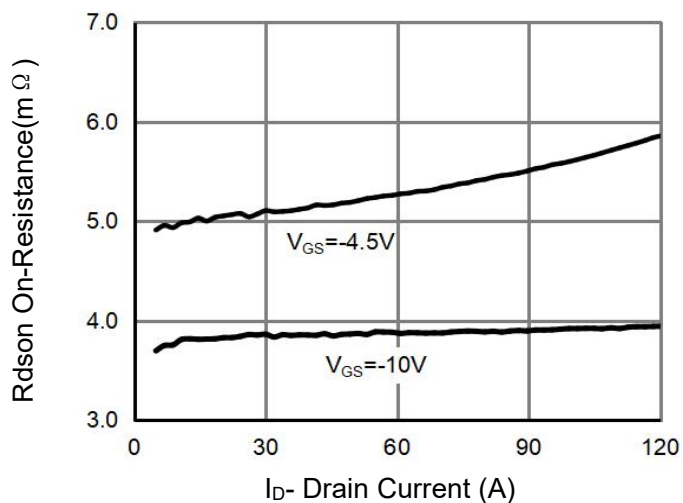

Figure 2 Transfer Characteristics
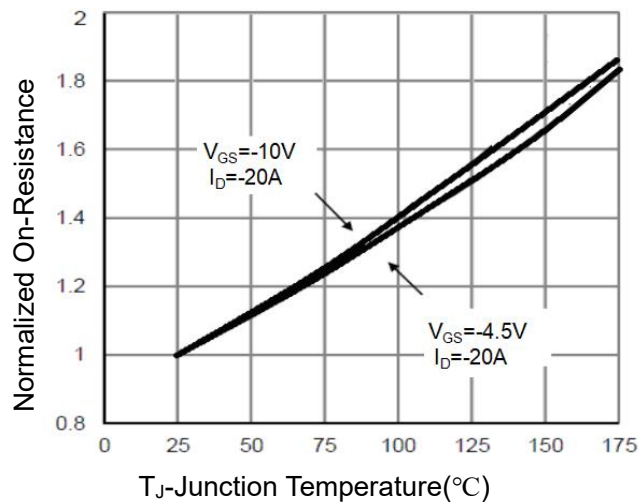

Figure 3 Rdson- Drain Current

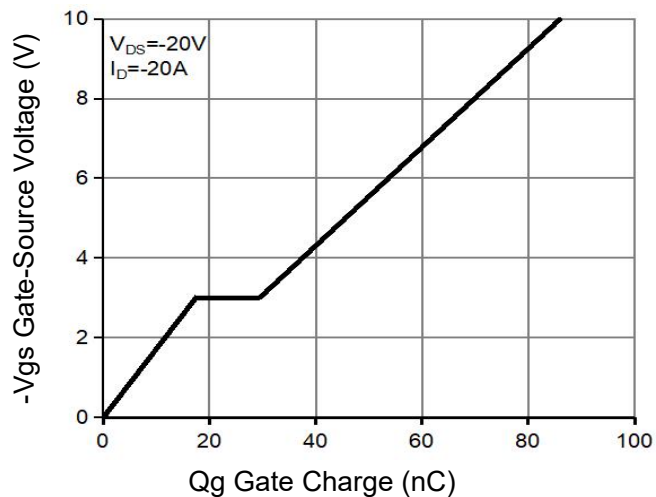**Figure 4 Rdson-JunctionTemperature**
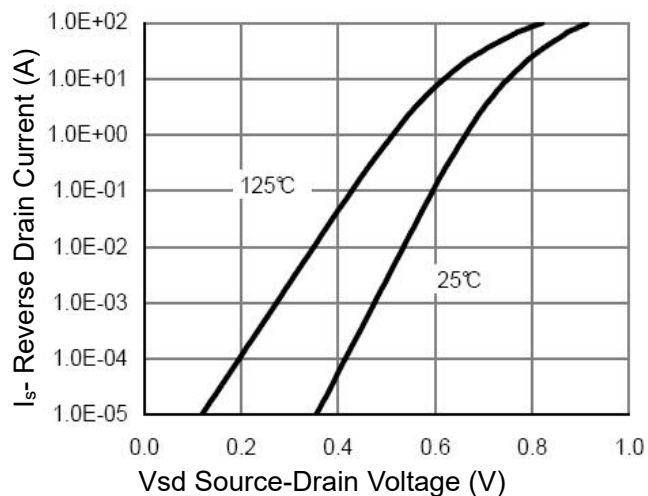

Figure 5 Gate Charge
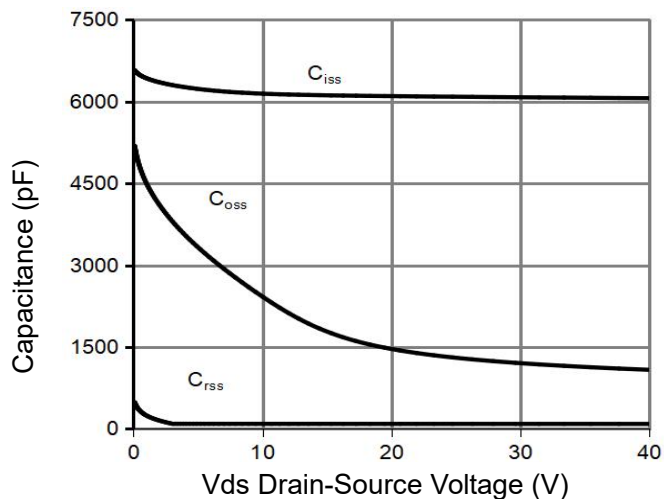

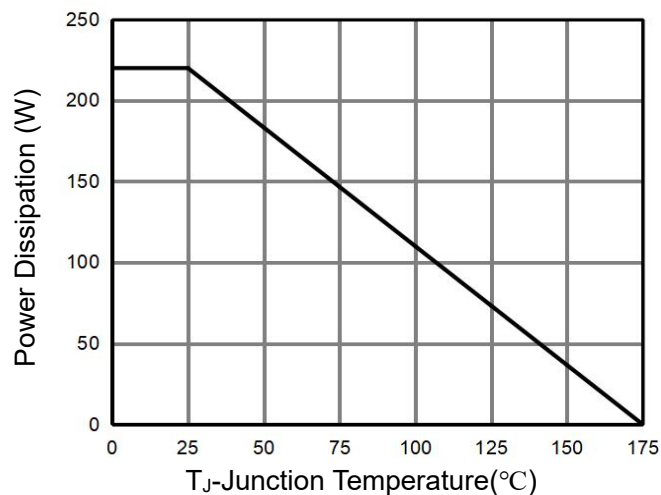**Figure 6 Source- Drain Diode Forward**

Figure 7 Capacitance vs Vds
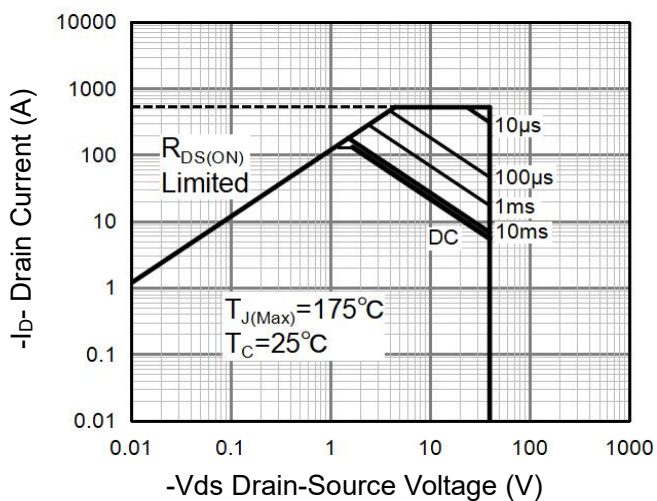

Figure 9 Power De-rating

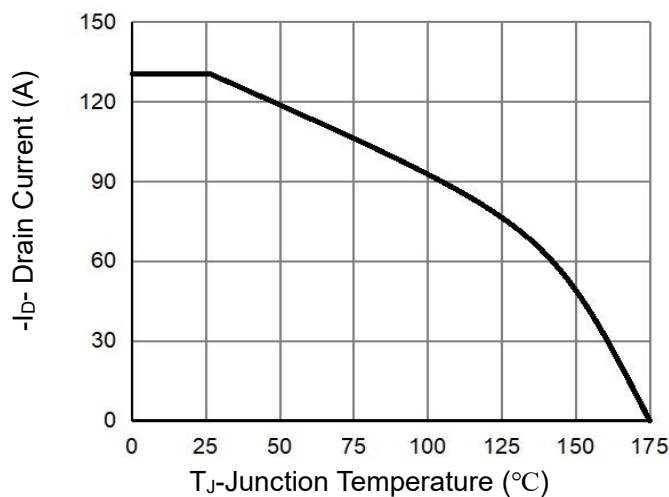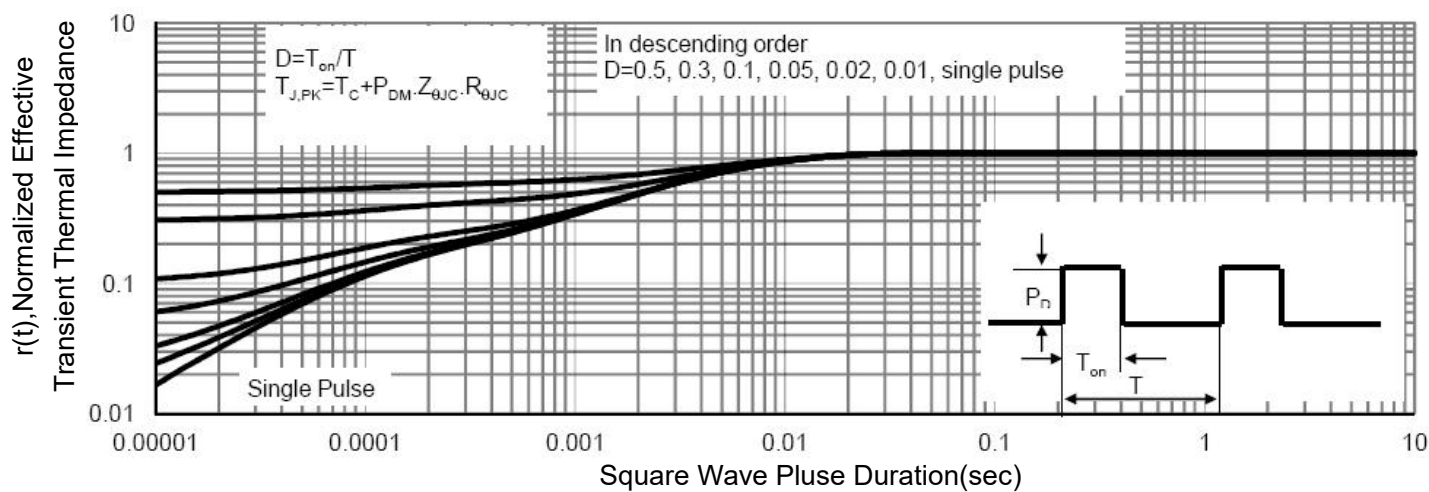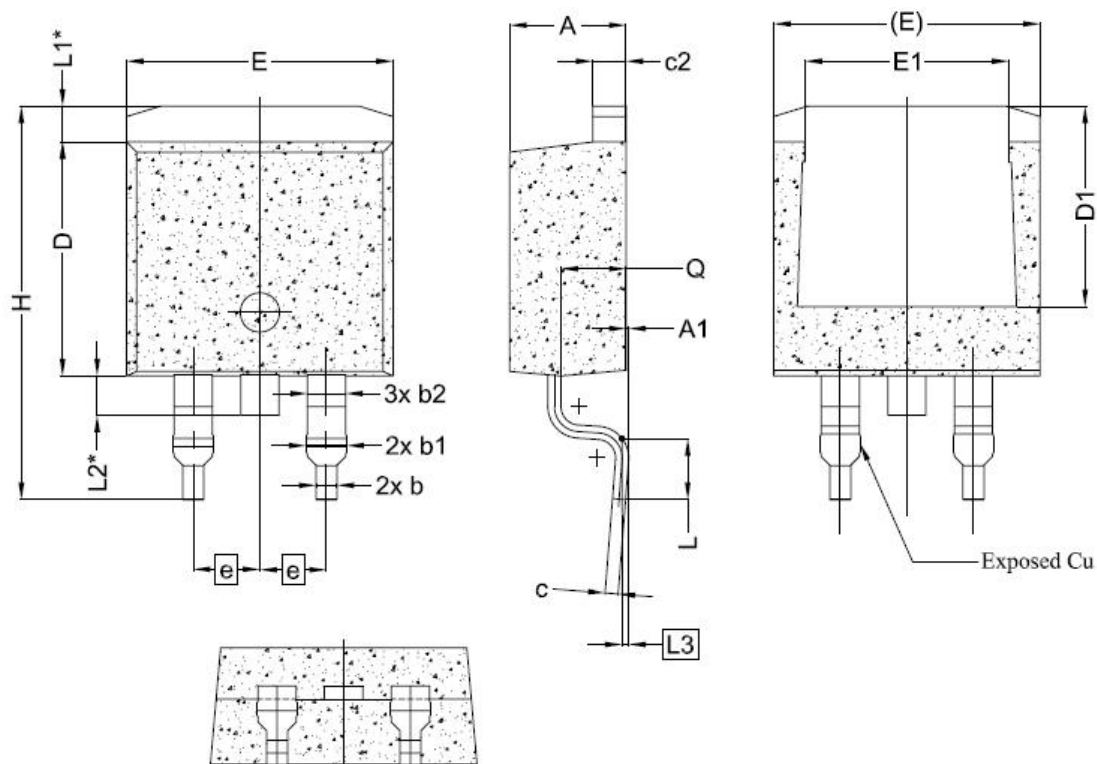**Figure 8 Safe Operation Area**[Note3]

Figure 10 Current De-rating

Figure 11 Normalized Maximum Transient Thermal Impedance

TO-263-2L Package Information

SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.24	4.44	4.64
A1	0.00	0.10	0.15
b	0.70	0.80	0.90
b1	1.20	1.55	1.75
b2	1.20	1.45	1.70
c	0.40	0.50	0.60
c2	1.15	1.27	1.40
D	8.82	8.92	9.02
D1	6.86	7.65	—
E	9.96	10.16	10.36
E1	6.89	7.77	7.89
e	2.54 BSC		
H	14.61	15.00	15.88
L	1.78	2.32	2.79
L1	1.36 REF.		
L2	1.50 REF.		
L3	0.25 BSC		
Q	2.30	2.48	2.70

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