

## NCE P-Channel Super Trench Power MOSFET

### Description

The NCEP40PT15D 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.

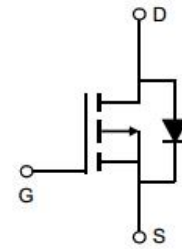
### General Features

- $V_{DS} = -40V, I_D = -150A$
- $R_{DS(ON)} = 2.8m\Omega$  (typical) @  $V_{GS} = -10V$
- $R_{DS(ON)} = 3.8m\Omega$  (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

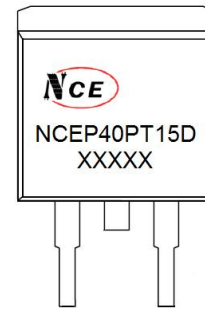
### Application

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

**100% UIS TESTED!**  
**100% ΔVds TESTED!**



Schematic Diagram



Marking and pin assignment



TO-263-2L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP40PT15D	NCEP40PT15D	TO-263-2L	-	-	-

### 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	$I_D$	-150	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	-120	A
Pulsed Drain Current	$I_{DM}$	-600	A
Maximum Power Dissipation	$P_D$	250	W
Derating factor		1.67	W/°C
Single pulse avalanche energy (Note 1)	$E_{AS}$	1345	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

## Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.6	$^{\circ}C/W$
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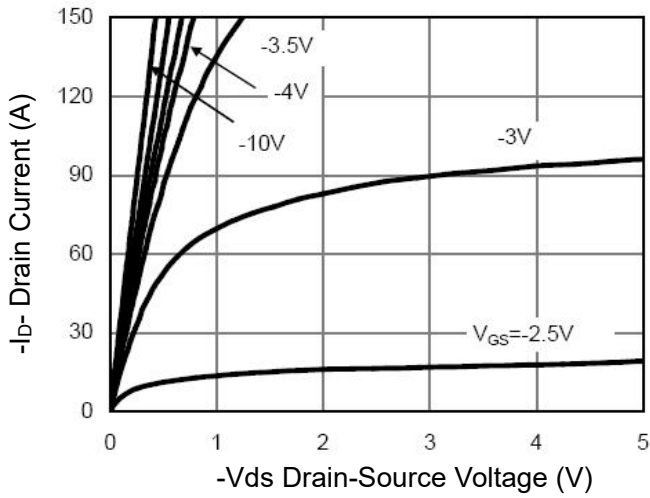
## Electrical Characteristics ( $T_c=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-40		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-40V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.0	-1.6	-2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-75A$	-	2.8	3.4	m $\Omega$
		$V_{GS}=-4.5V, I_D=-75A$	-	3.8	4.6	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-75A$	-	30	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=-20V, V_{GS}=0V,$ $F=1.0MHz$	-	8940	-	PF
Output Capacitance	$C_{oss}$		-	1900	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	45	-	PF
<b>Switching Characteristics</b> (Note 2)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-20V, I_D=-75A$ $V_{GS}=-10V, R_G=1.6\Omega$	-	18	-	nS
Turn-on Rise Time	$t_r$		-	13	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	90	-	nS
Turn-Off Fall Time	$t_f$		-	15	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-20V, I_D=-75A,$ $V_{GS}=-10V$	-	104.4	-	nC
Gate-Source Charge	$Q_{gs}$		-	20.8	-	nC
Gate-Drain Charge	$Q_{gd}$		-	13.5	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=-75A$	-		-1.2	V
Diode Forward Current	$I_S$		-	-	-150	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}C, I_F = -75A$ $di/dt = 100A/\mu s$	-		35	nS
Reverse Recovery Charge	$Q_{rr}$		-		85	nC

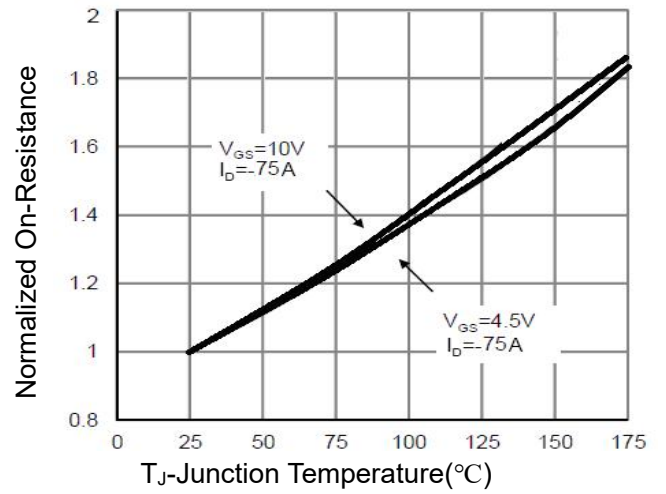
### Notes:

- EAS condition :  $T_J=25^{\circ}C, V_{DD}=-20V, V_G=-10V, L=0.5mH, R_G=25\Omega$
- Guaranteed by design, not subject to production
- 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  $T_J(MAX)=175^{\circ}C$ . The SOA curve provides a single pulse rating.

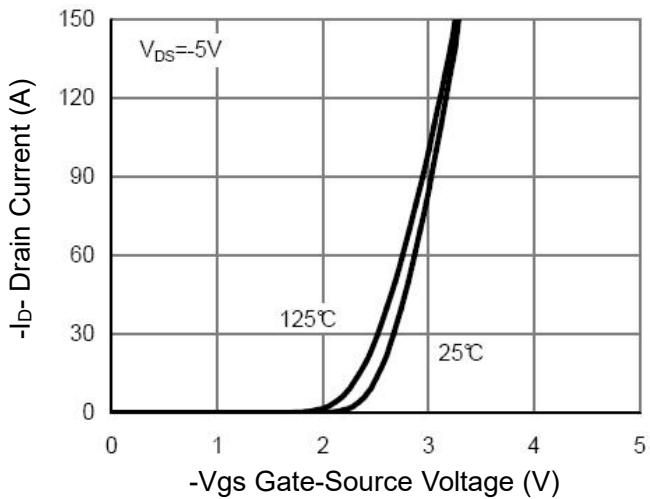
## Typical Electrical and Thermal Characteristics



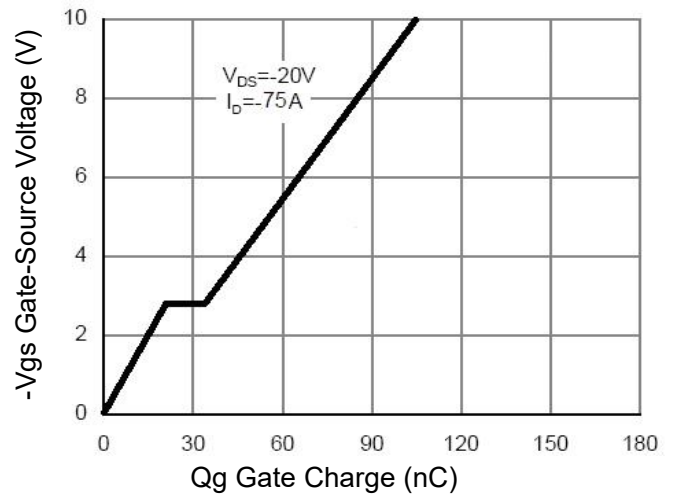
**Figure 1 Output Characteristics**



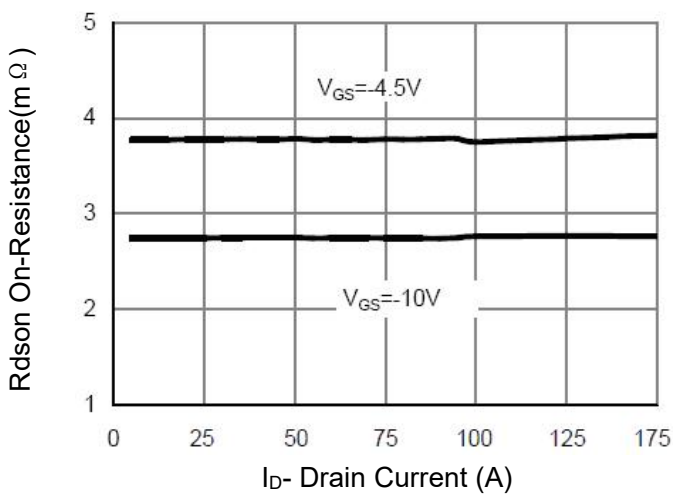
**Figure 4  $R_{dson}$ -Junction Temperature**



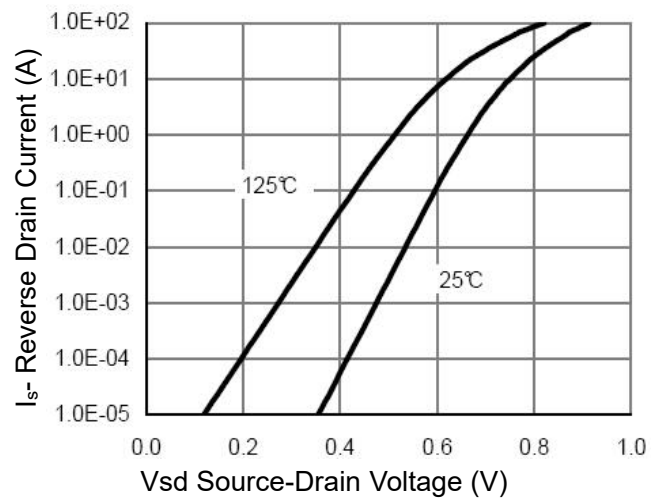
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



**Figure 3  $R_{dson}$ - Drain Current**



**Figure 6 Source- Drain Diode Forward**

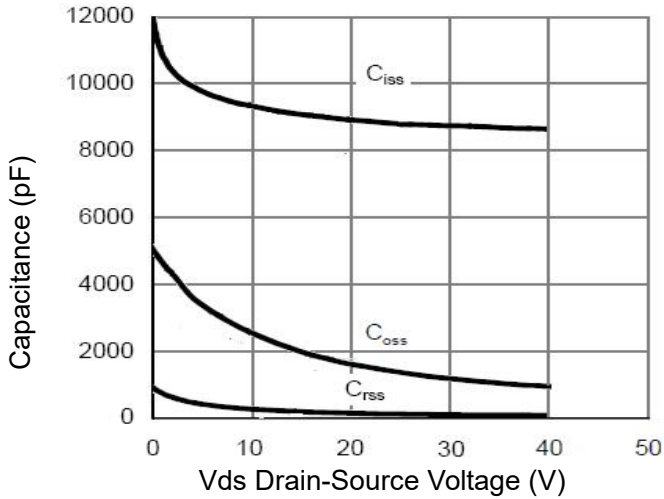


Figure 7 Capacitance vs Vds

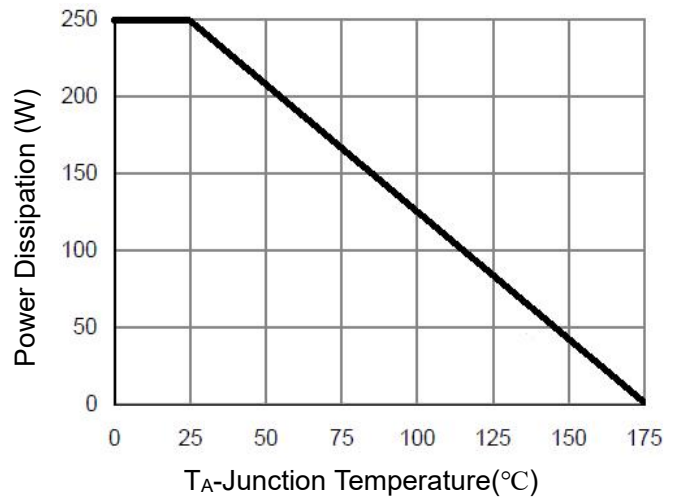


Figure 9 Power De-rating

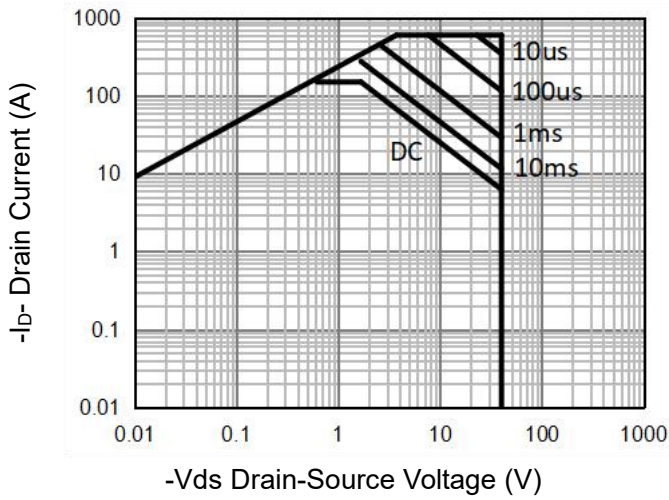


Figure 8 Safe Operation Area (Note 3)

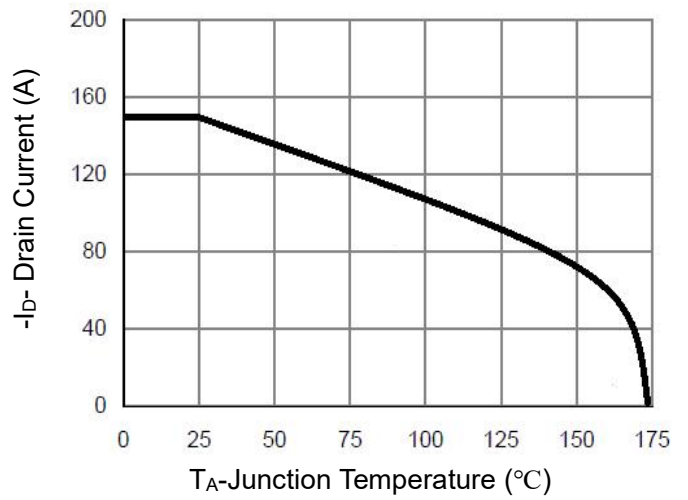


Figure 10 Current De-rating

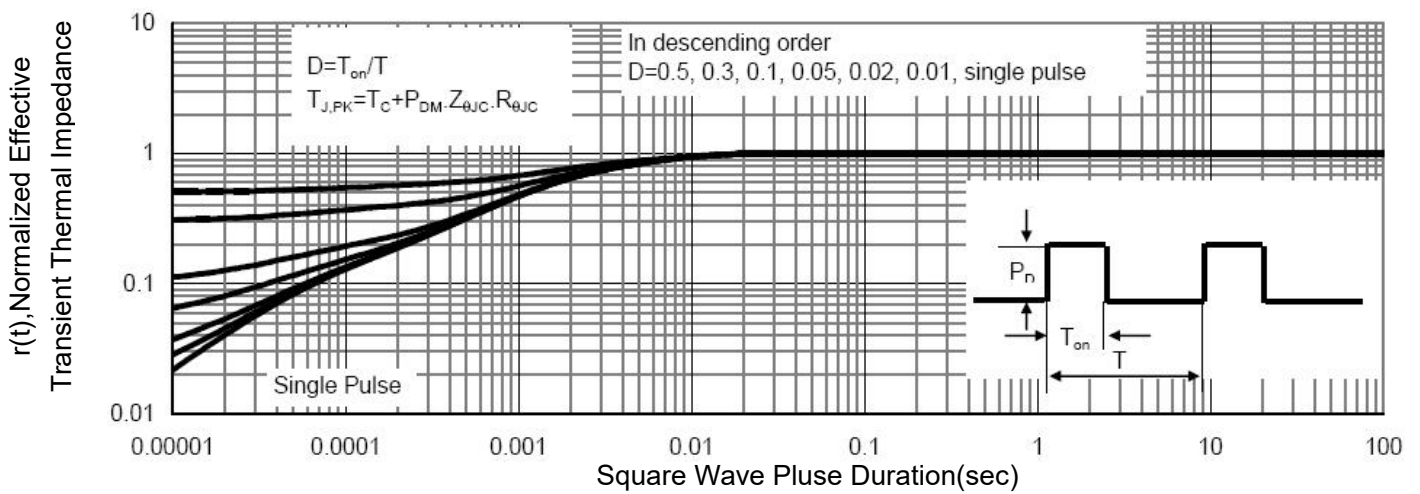
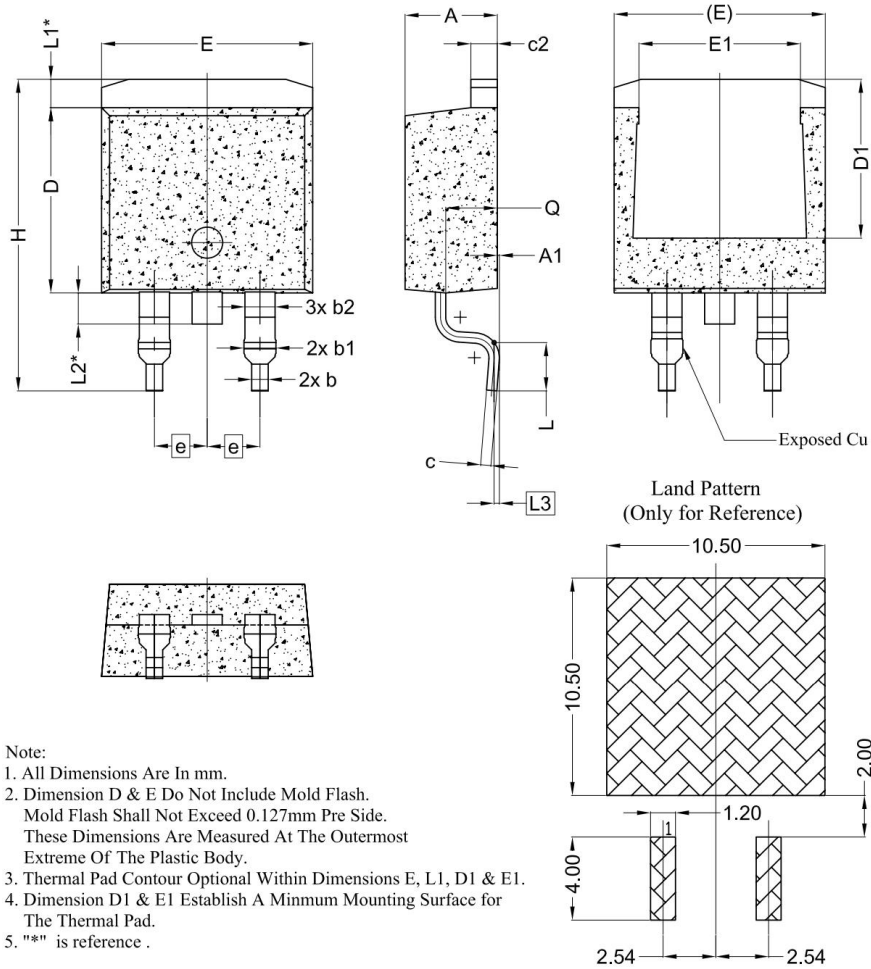


Figure 11 Normalized Maximum Transient Thermal Impedance

## TO-263-2L Package Information



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.24	4.44	4.64
A1	0.00	0.10	0.25
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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