

NCE Automotive P-Channel Super Trench Power MOSFET

Description

The NCEAP40PT15D 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.

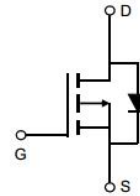
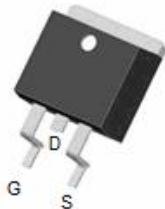
Application

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

General Features

- $V_{DS} = -40V, I_D = -195A$
 $R_{DS(ON)} = 2.8m\Omega$ (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
- 100% ΔV_{ds} tested
- **AEC-Q101 qualified**

TO-263



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
AP40PT150D	NCEAP40PT15D	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}	± 20	V
Drain Current-Continuous	I_D	-195	A
Drain Current-Continuous($T_C = 100^\circ C$)	$I_D(100^\circ C)$	-137	A
Pulsed Drain Current	I_{DM}	-780	A
Maximum Power Dissipation	P_D	250	W
Derating factor		1.67	W/ $^\circ C$
Single pulse avalanche energy ^(Note 5)	E_{AS}	1345	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case ^(Note 2)	$R_{\theta JC}$	0.6	$^\circ C/W$
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Electrical Characteristics (T_c=25°C 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 (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =-250μA	-1.0	-1.6	-2.2	V
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =-10V, I _D =-20A	-	2.8	3.4	mΩ
		V _{GS} =-4.5V, I _D =-20A	-	3.8	4.6	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-20A	-	30	-	S
Dynamic Characteristics (Note4)						
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
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-20V, I _D =-20A V _{GS} =-10V, R _G =1.6Ω	-	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 =-20A, V _{GS} =-10V	-	104.4	-	nC
Gate-Source Charge	Q _{gs}		-	20.8	-	nC
Gate-Drain Charge	Q _{gd}		-	13.5	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-20A	-	-	-1.2	V
Diode Forward Current (Note 2)	I _S		-	-	-195	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = -20A	-	75	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs (Note3)	-	125	-	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition : T_J=25°C, V_{DD}=-20V, V_G=-10V, L=0.5mH, R_G=25Ω

Typical Electrical and Thermal Characteristics

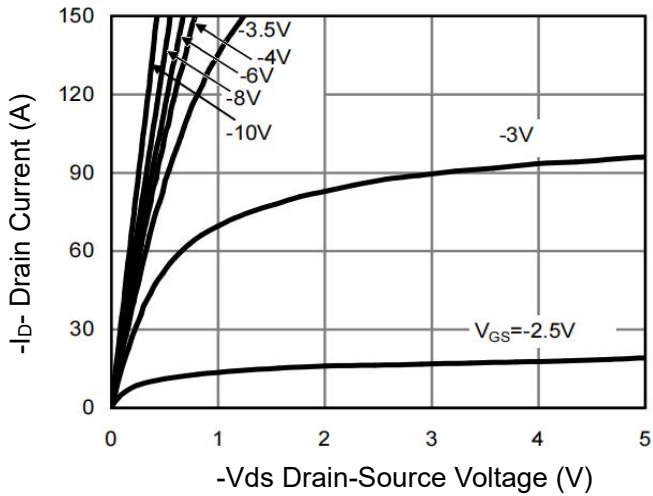


Figure 1 Output Characteristics

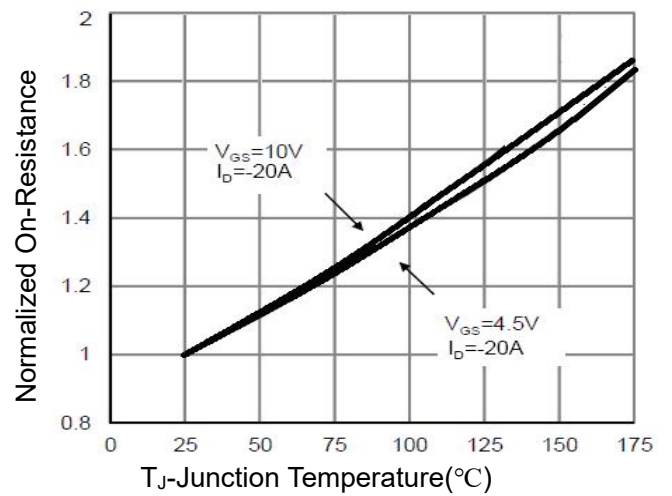


Figure 4 R_{DS(on)}-Junction Temperature

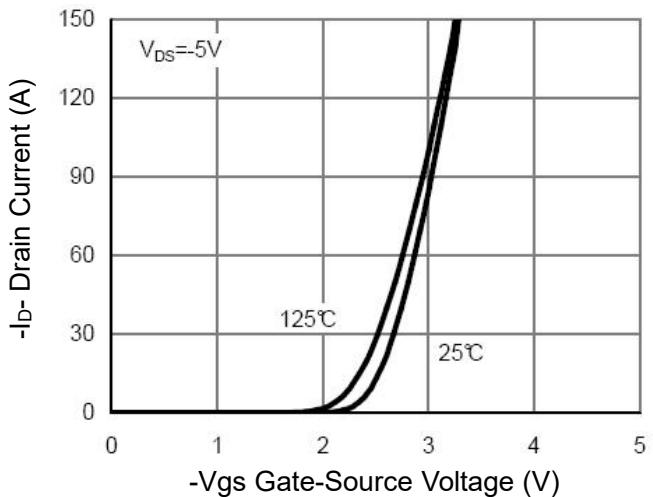


Figure 2 Transfer Characteristics

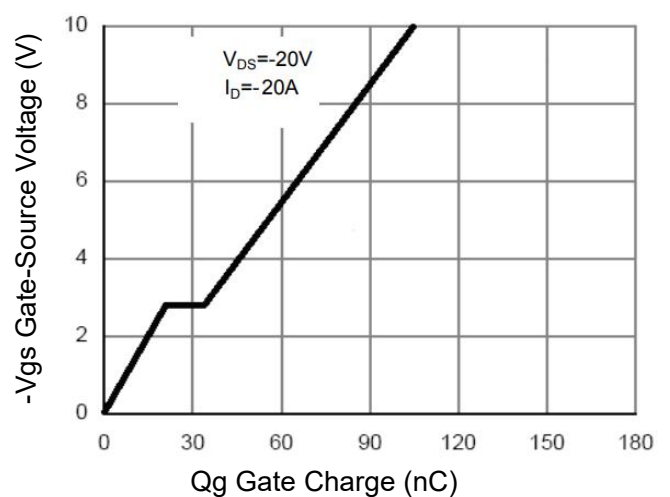


Figure 5 Gate Charge

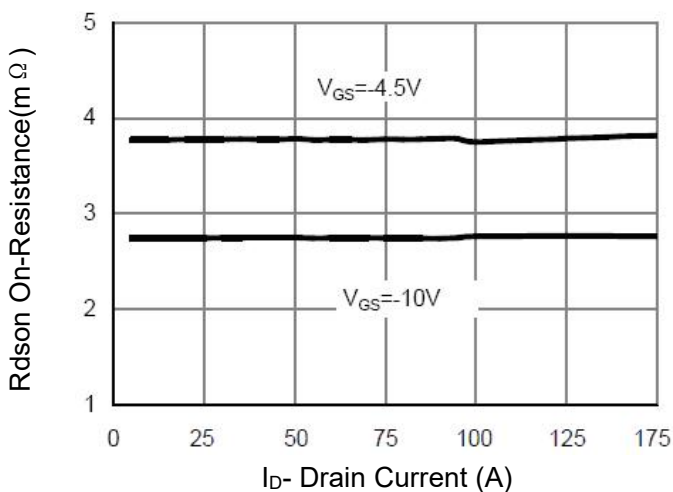


Figure 3 R_{DS(on)}- Drain Current

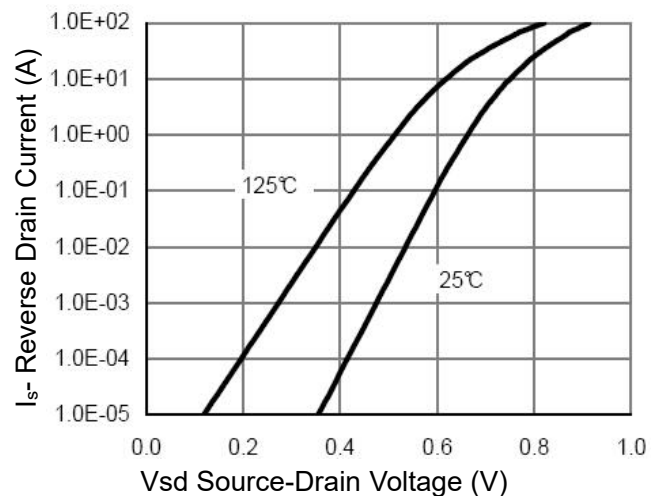


Figure 6 Source- Drain Diode Forward

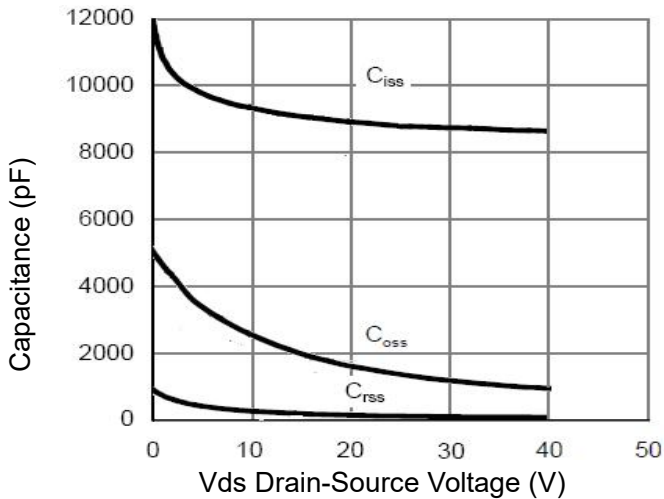


Figure 7 Capacitance vs Vds

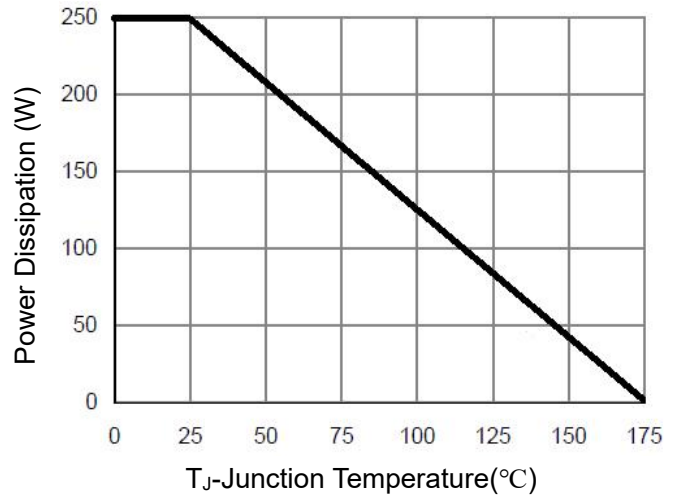


Figure 9 Power De-rating

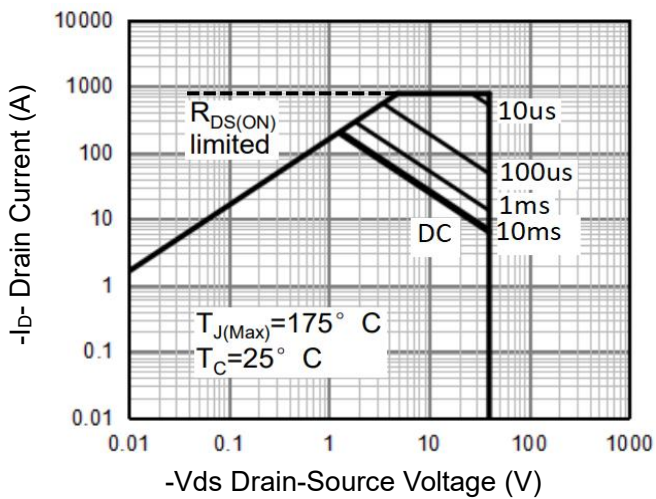


Figure 8 Safe Operation Area

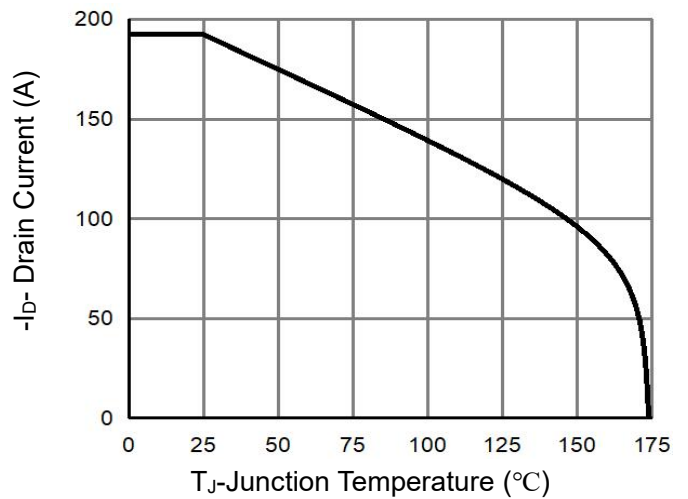


Figure 10 Current De-rating

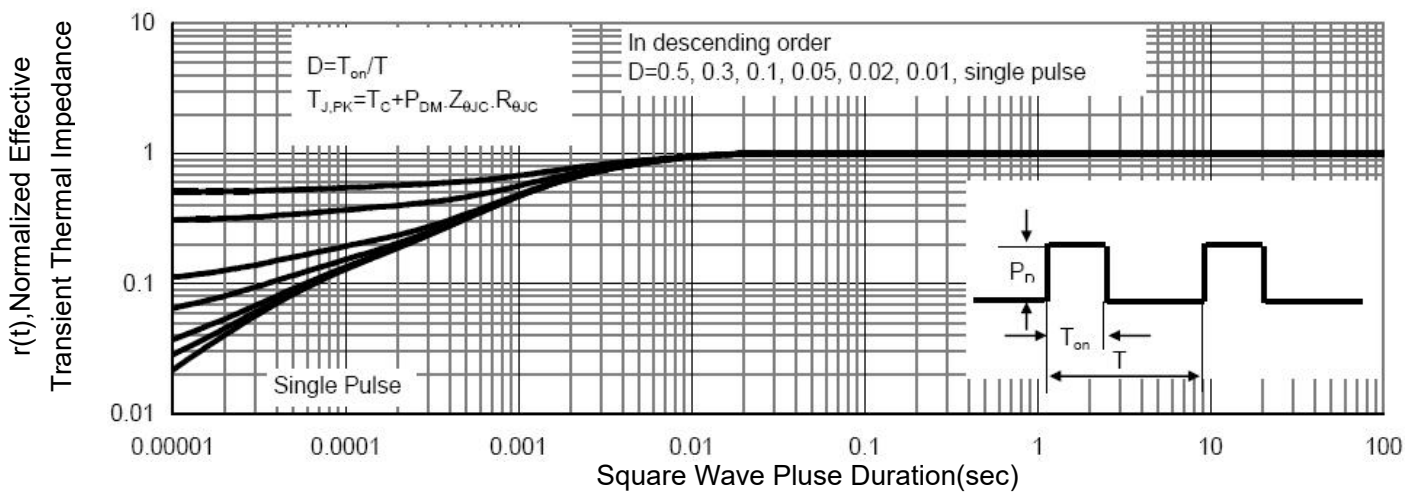
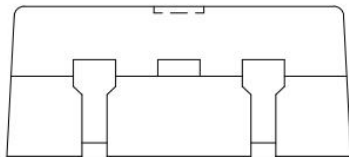
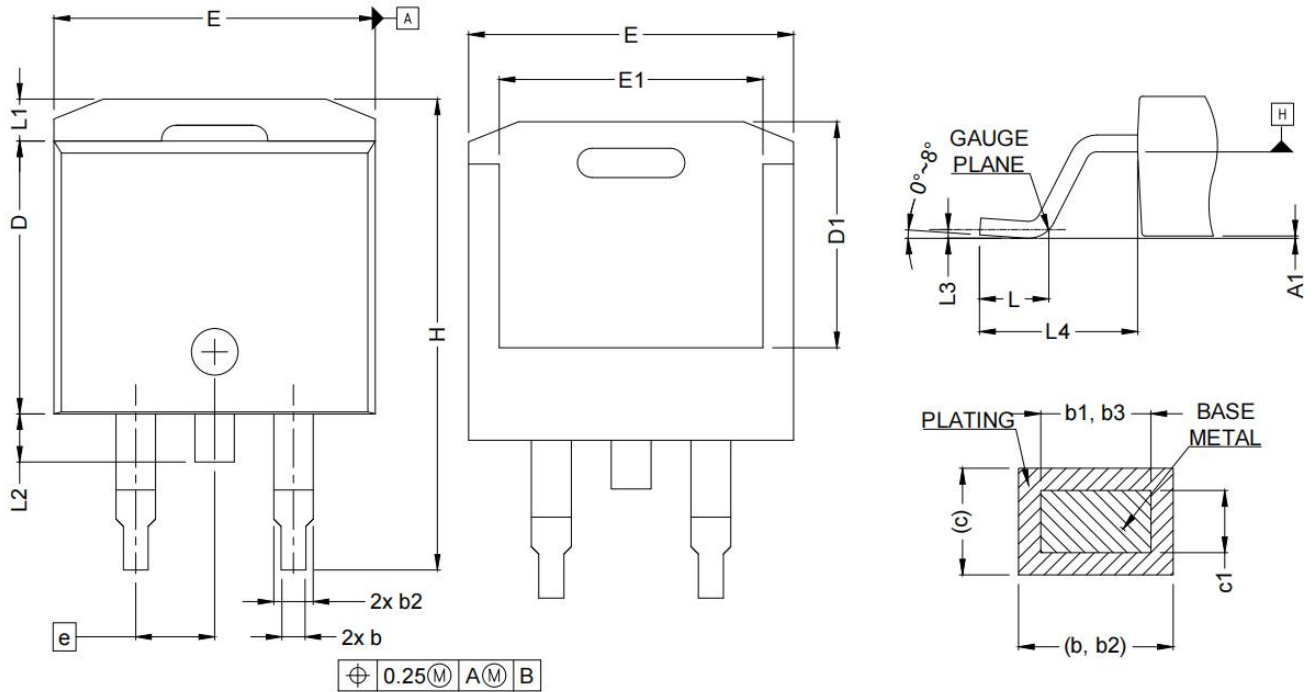


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-263-2L Package Information



OPTION 1

2 LEADs

SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.
A	4.36	4.56	E	10.15	10.55
A1	0	0.25	E1	8.10	8.70
b	0.70	0.90	e	2.54 BSC	
b1	0.51	0.89	H	15.00	15.60
b2	1.17	1.37	L	1.90	2.50
b3	1.17	1.37	L1	-	1.65
c	0.38	0.69	L2	-	1.78
c1	0.38	0.53	L3	0.25 TYP	
c2	1.19	1.34	L4	4.78	5.28
D	8.60	9.00	J1	2.56	2.96
D1	6.90	7.50			

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