NCE Automotive N-Channel Super Trench Power MOSFET

Description

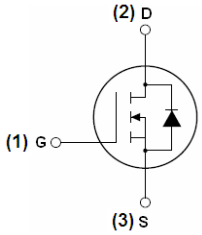
The NCEAP0178AK uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g. This device is ideal for high-frequency switching and synchronous rectification.

General Features

- V_{DS} =100V,I_D =78A
  $R_{DS(ON)}$ =7.2mΩ(typical) @ V_{GS}=10V
  $R_{DS(ON)}$ =9.5mΩ(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
- **AEC-Q101 qualified**

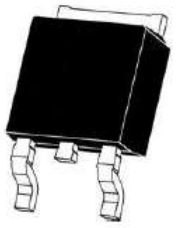
Application

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



Schematic diagram

Marking and pin assignment



TO-252-2L top view

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
AP0178AK	NCEAP0178AK	TO-252-2L	-	-	-

Absolute Maximum Ratings (T_C=25℃unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	100	V
Gate-Source Voltage	V_{GS}	±20	V
Drain Current-Continuous	I_D	78	A
Drain Current-Continuous(T_C=100℃)	I_D (100℃)	60	A
Pulsed Drain Current	I_{DM}	312	A
Maximum Power Dissipation	P_D	125	W
Derating factor		0.83	W/℃
Single pulse avalanche energy (Note 1)	E_{AS}	320	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 175	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case	$R_{\theta JC}$	1.2	℃/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	100	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=100V,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	1.2	1.7	2.2	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=20A	-	7.2	8.5	mΩ
		V_{GS}=4.5V, I_D=20A	-	9.5	12	mΩ
Forward Transconductance	g_{FS}	V_{DS}=10V,I_D=20A	40	-	-	S
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz	-	4200	5480	pF
Output Capacitance	C_{oss}		-	354	425	pF
Reverse Transfer Capacitance	C_{rss}		-	23	30	pF
Switching Characteristics (Note 2)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=50V,I_D=20A V_{GS}=10V,R_G=4.7Ω	-	15	-	nS
Turn-on Rise Time	t_r		-	10	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	41	-	nS
Turn-Off Fall Time	t_f		-	6	-	nS
Total Gate Charge	Q_g	V_{DS}=50V,I_D=20A, V_{GS}=10V	-	65	-	nC
Gate-Source Charge	Q_{gs}		-	15.3	-	nC
Gate-Drain Charge	Q_{gd}		-	9	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=20A	-	-	1.2	V
Diode Forward Current	I_S		-	-	78	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F = I_S di/dt = 100A/μs	-	101	-	nS
Reverse Recovery Charge	Qrr		-	193	-	nC

Notes:

1. EAS condition : Tj=25℃,V_{DD}=50V,V_G=10V,L=0.5mH,Rg=25Ω
2. Defined by design.Not Subject to production test
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

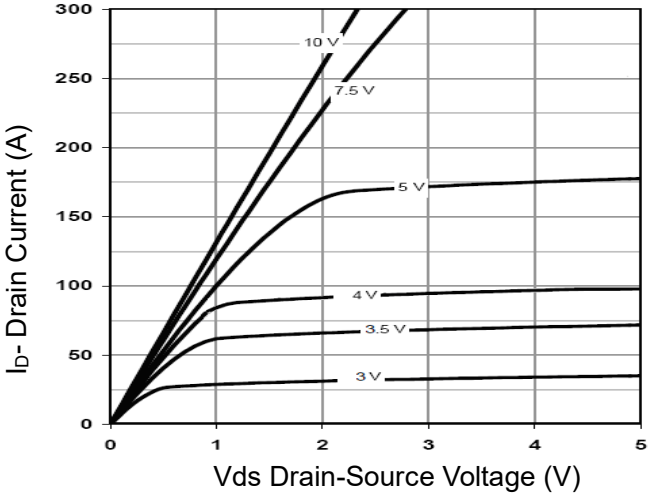


Figure 1 Output Characteristics

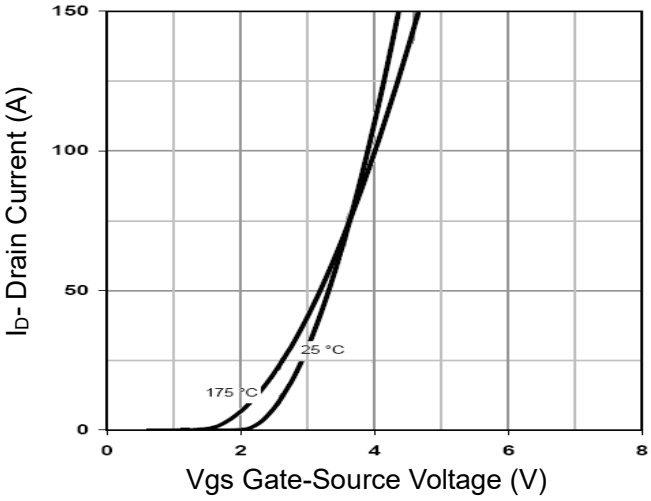


Figure 2 Transfer Characteristics

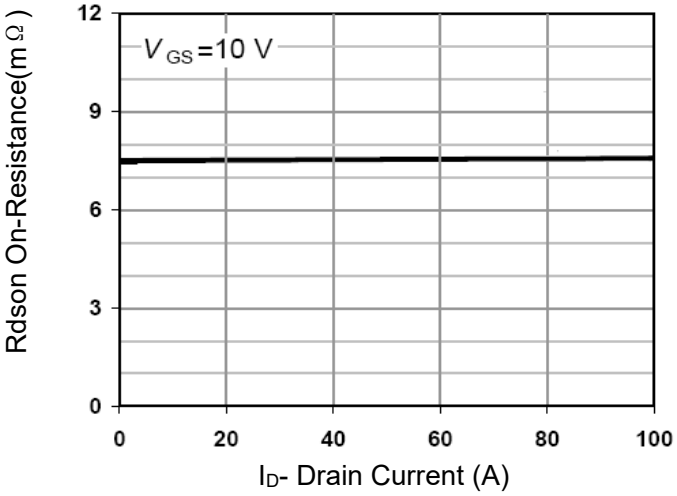


Figure 3 Rdson- Drain Current

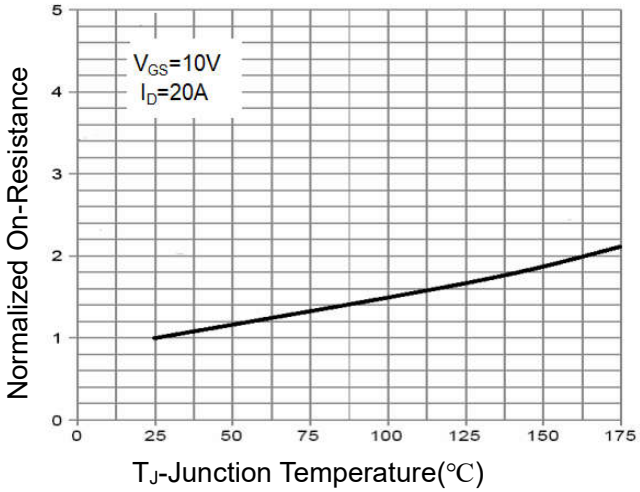


Figure 4 Rdson-JunctionTemperature

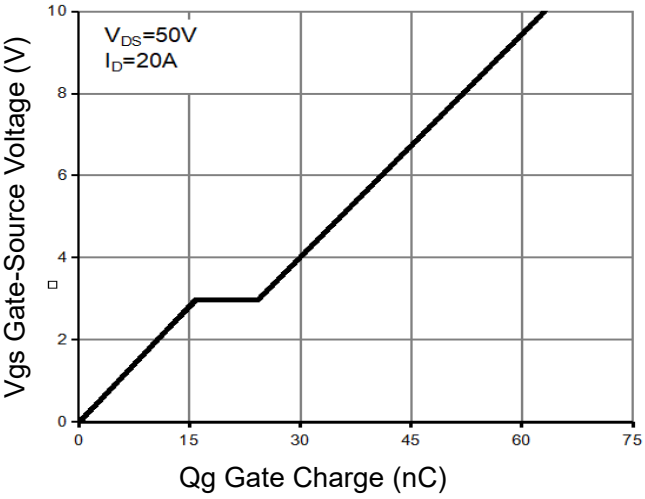


Figure 5 Gate Charge

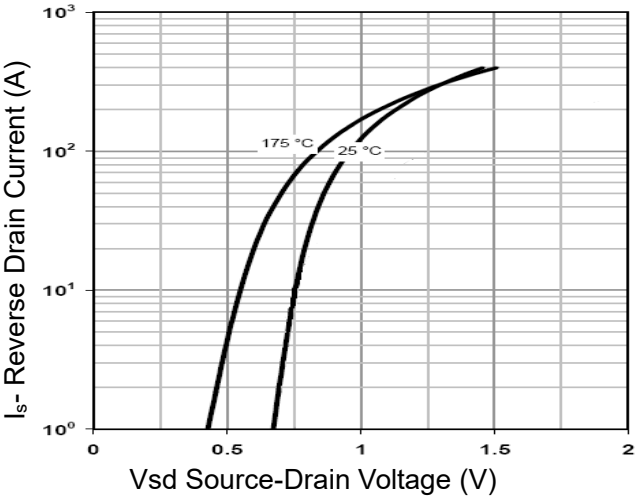


Figure 6 Source- Drain Diode Forward

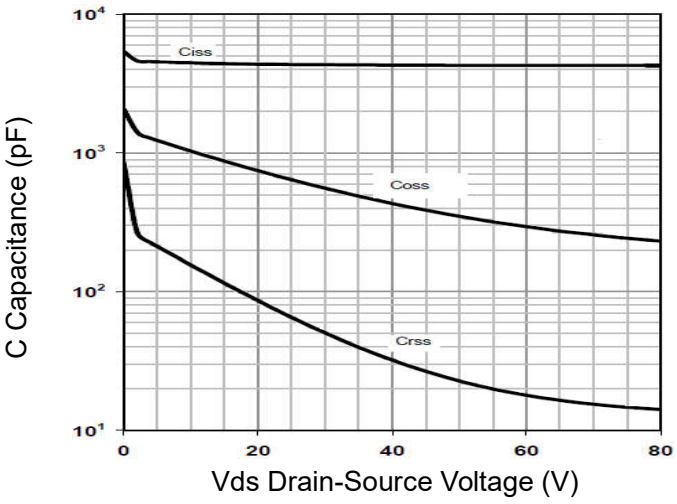


Figure 7 Capacitance vs Vds

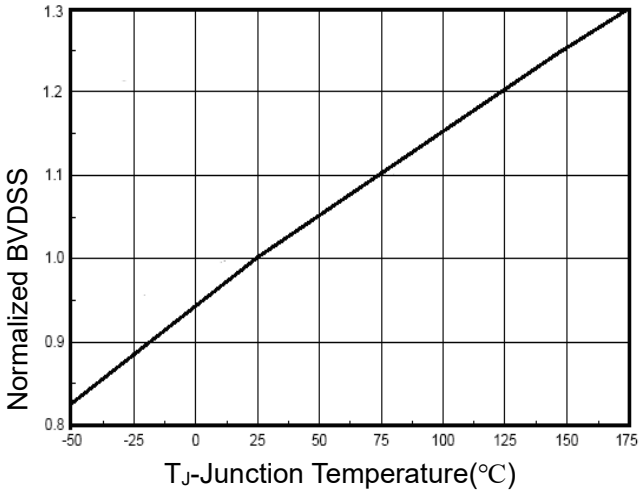


Figure 9 BV_{DSS} vs Junction Temperature

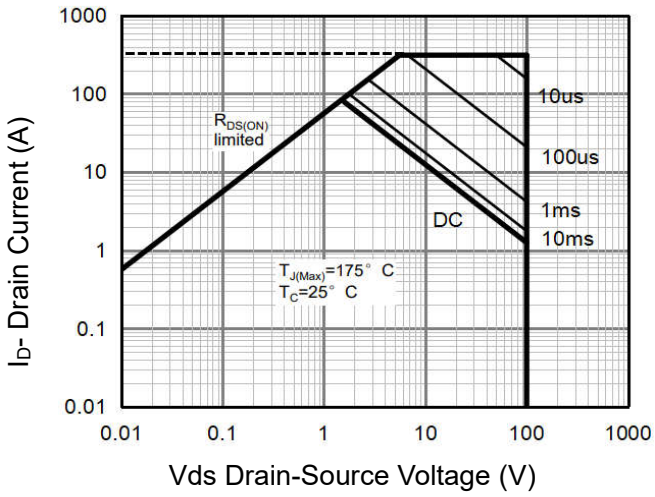


Figure 8 Safe Operation Area (Note3)

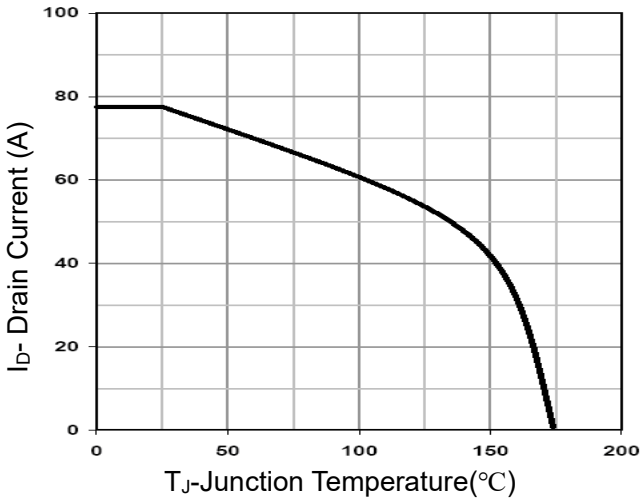


Figure 10 Current De-rating

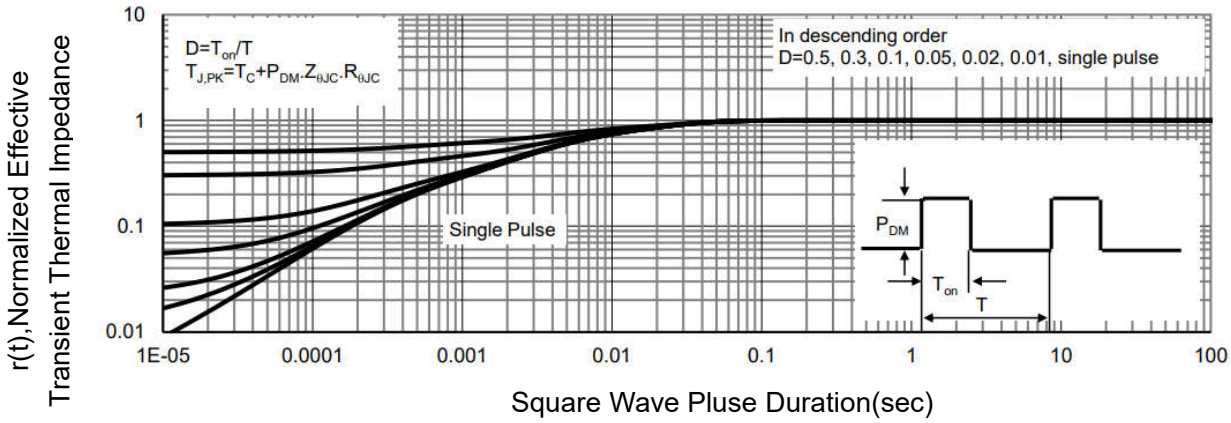
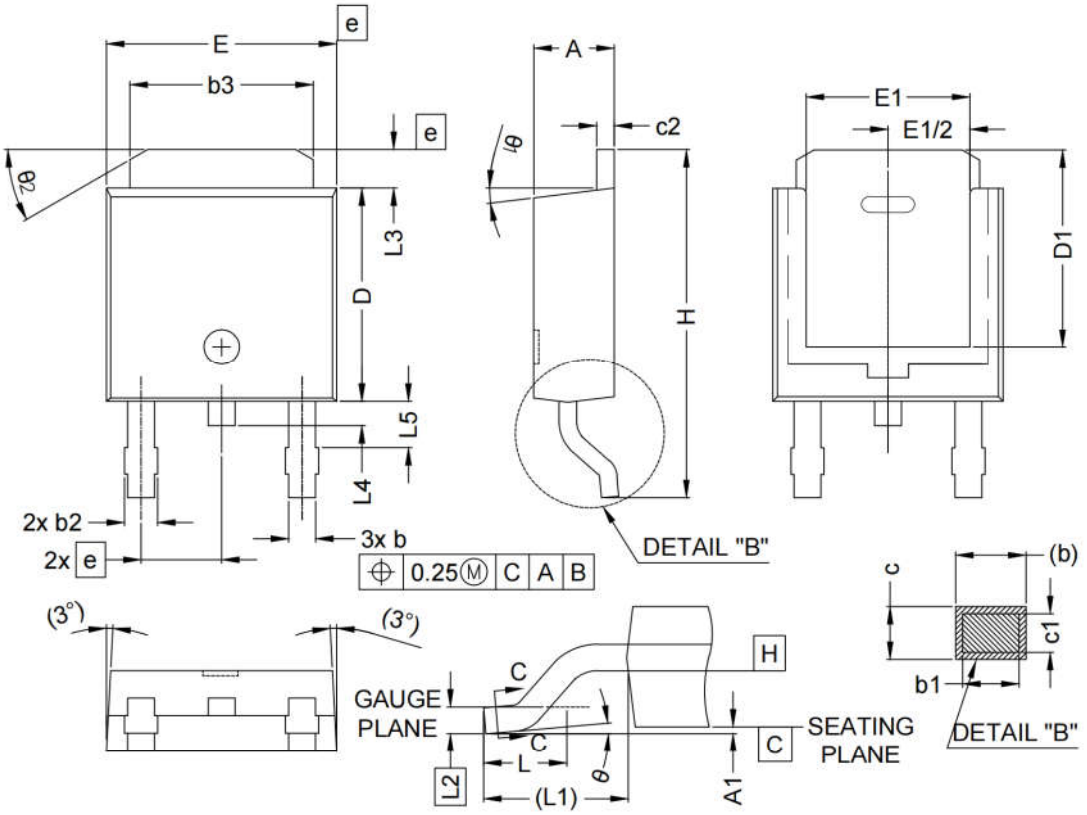


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252-2L Package Information



SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.
A	2.18	2.39	E	6.35	6.73	θ1	0°	15°
A1	-	0.13	E1	4.32	-	θ2	25°	35°
b	0.65	0.89	e	2.29 BSC				
b1	0.64	0.79	H	9.94	10.34			
b2	0.76	1.13	L	1.50	1.78			
b3	4.95	5.46	L1	2.74 REF				
c	0.46	0.61	L2	0.51 BSC				
c1	0.41	0.56	L3	0.89	1.27			
c2	0.46	0.60	L4	-	1.02			
D	5.97	6.22	L5	1.14	1.49			
D1	5.21	-	θ	0°	10°			

NOTE ; 1.0 DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
2.0 ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3.0 HEAT SINK SIDE FLASH IS MAX. 0.8mm.
4.0 RADIUS ON TERMINAL IS OPTIONAL.

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