NCE Automotive N-Channel Super Trench Power MOSFET

Description

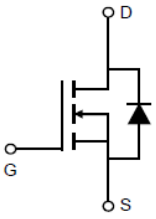
The NCEAP40T14AK uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g. This device is ideal for high-frequency switching and synchronous rectification.

General Features

- V_{DS} =40V,I_D =190A (Silicon Limited)
  $R_{DS(ON)}$=1.95mΩ (typical) @ V_{GS}=10V
- 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**

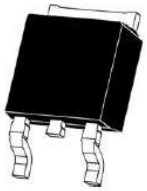
Application

- 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
AP40T14AK	NCEAP40T14AK	TO-252-2L	-	-	-

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 (Silicon Limited)(Note1)	I_D	190	A
Drain Current-Continuous (Silicon Limited)(Note1)	I_D (100℃)	136	A
Drain Current-Continuous (Package Limited)	I_D	140	A
Pulsed Drain Current	I_{DM}	560	A
Maximum Power Dissipation	P_D	165	W
Derating factor		1.1	W/℃
Single pulse avalanche energy (Note 2)	E_{AS}	1036	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 175	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case	$R_{\theta JC}$	0.91	℃/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	2.0	3.0	4.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=20A	-	1.95	2.4	mΩ
Forward Transconductance	g_{FS}	V_{DS}=5V,I_D=40A	-	80	-	S
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=20V,V_{GS}=0V, F=1.0MHz	-	4180	-	pF
Output Capacitance	C_{oss}		-	1920	-	pF
Reverse Transfer Capacitance	C_{rss}		-	85	-	pF
Switching Characteristics (Note 1)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=20V,I_D=40A V_{GS}=10V,R_G=1.6Ω	-	90	-	nS
Turn-on Rise Time	t_r		-	35	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	70	-	nS
Turn-Off Fall Time	t_f		-	22	-	nS
Total Gate Charge	Q_g	V_{DS}=20V,I_D=20A, V_{GS}=10V	-	59.5	-	nC
Gate-Source Charge	Q_{gs}		-	20.5	-	nC
Gate-Drain Charge	Q_{gd}		-	10	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=20A	-	-	1.2	V
Diode Forward Current	I_S		-	-	140	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F =70A di/dt = 100A/μs	-	50	-	nS
Reverse Recovery Charge	Qrr		-	62	-	nC

Notes:

1. Defined by design.Not Subject to production test
2. EAS condition : Tj=25℃,V_{DD}=20V,V_G=10V,L=0.5mH,Rg=25Ω
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 TJ(MAX)=175°C. The SOA curve provides a single pulse rating.

Typical Electrical and Thermal Characteristics

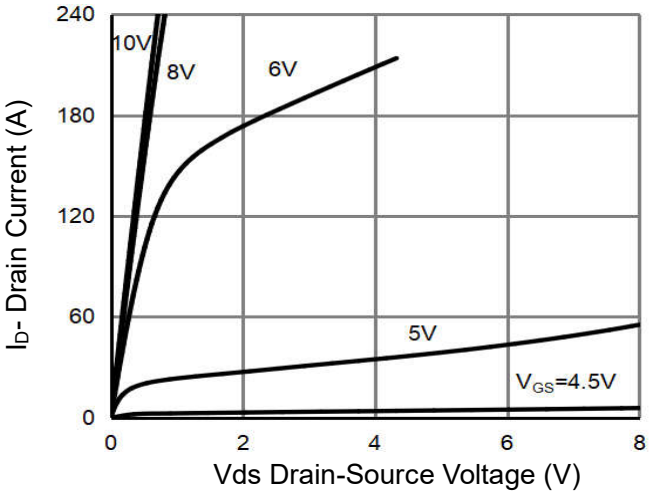


Figure 1 Output Characteristics

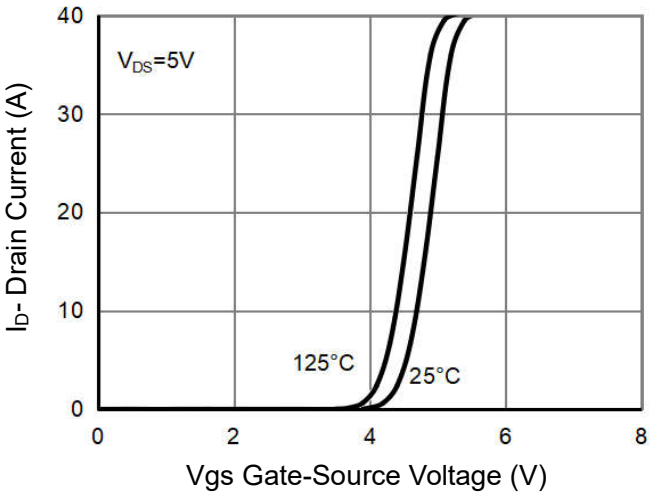


Figure 2 Transfer Characteristics

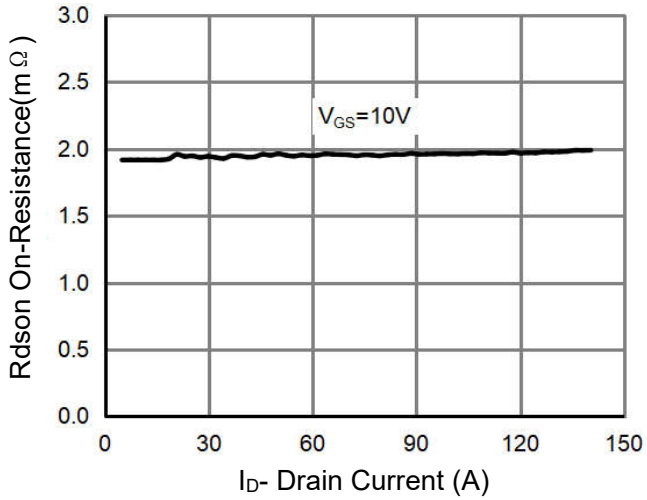


Figure 3 Rdson- Drain Current

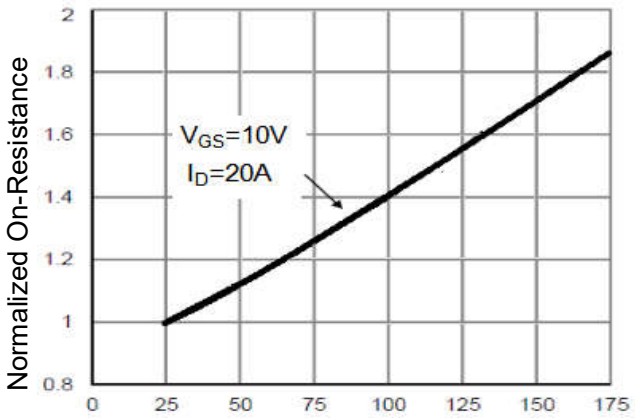


Figure 4 Rdson-JunctionTemperature

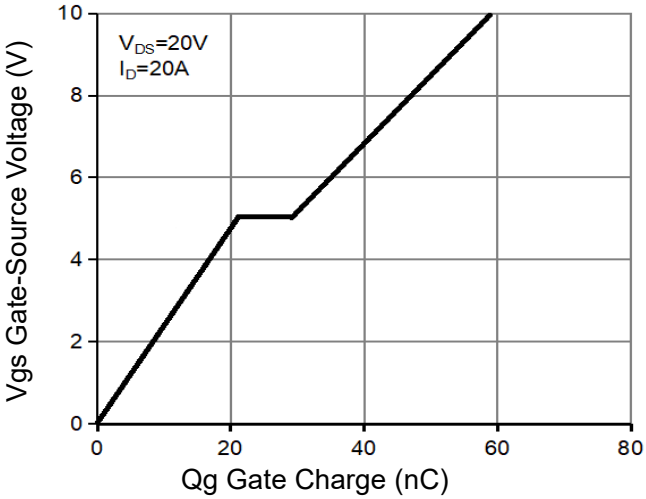


Figure 5 Gate Charge

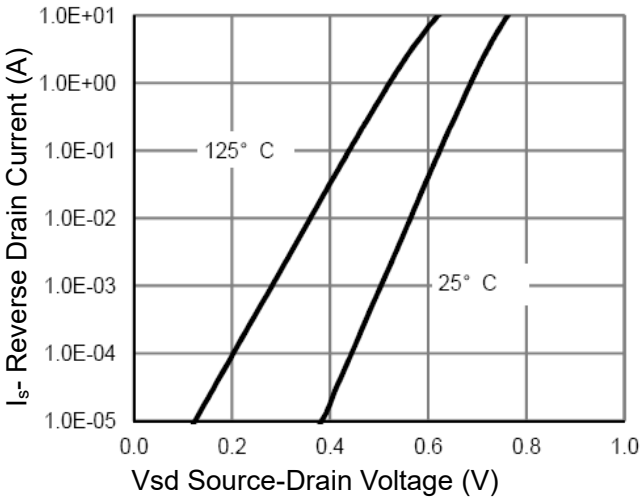


Figure 6 Source- Drain Diode Forward

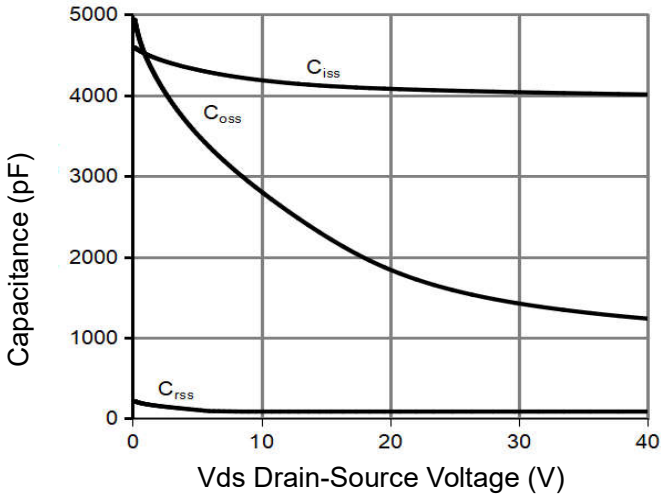


Figure 7 Capacitance vs Vds

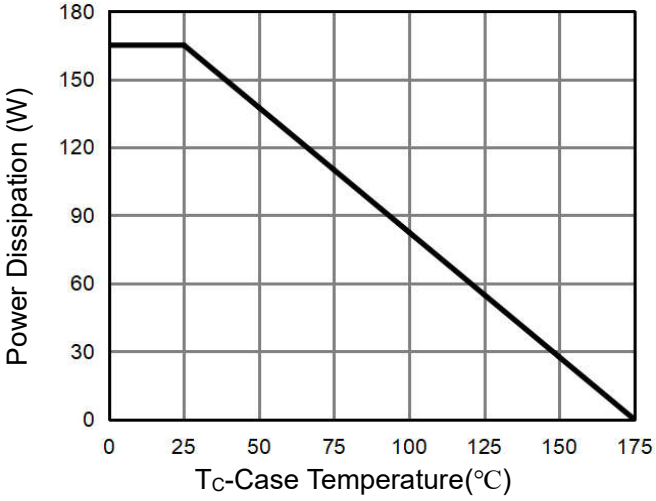


Figure 9 Power De-rating

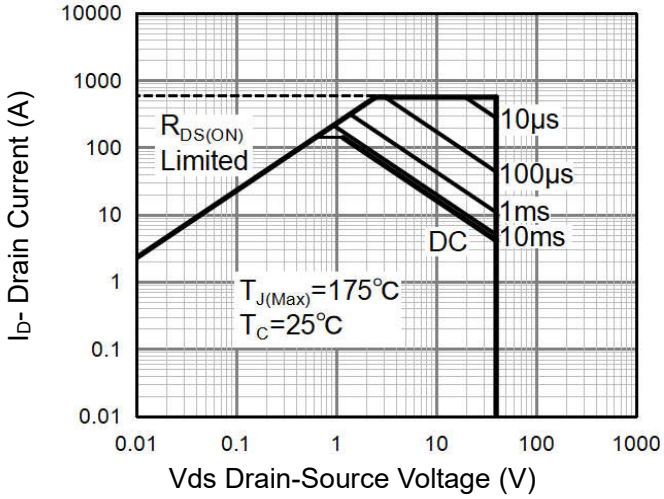


Figure 8 Safe Operation Area(Note 3)

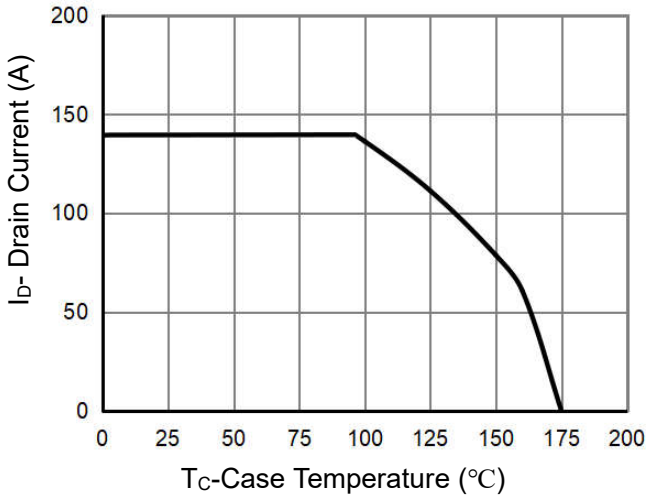


Figure 10 Current De-rating

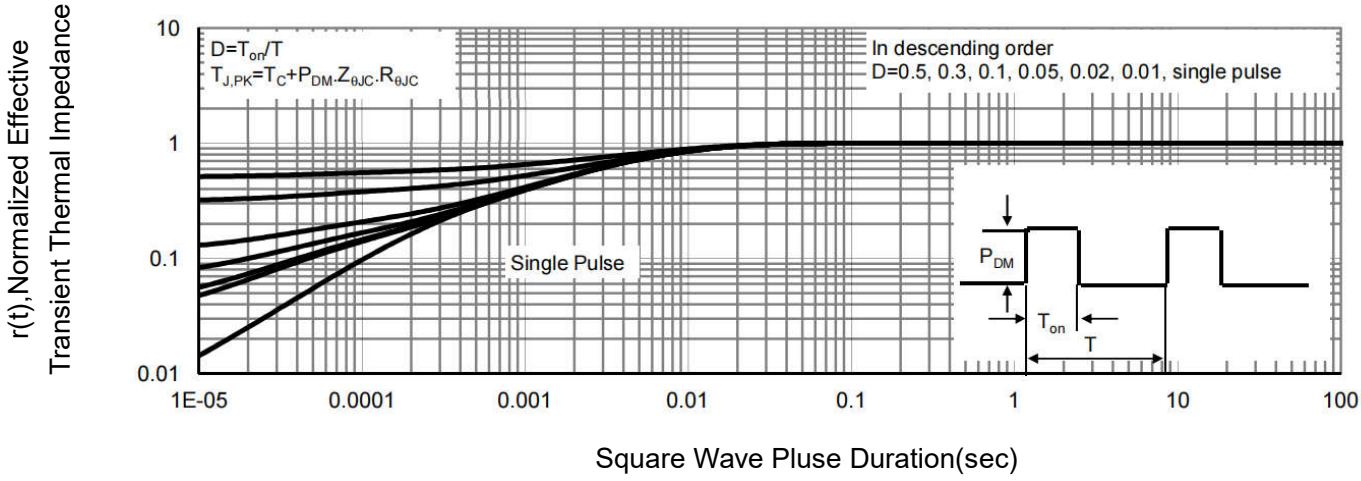
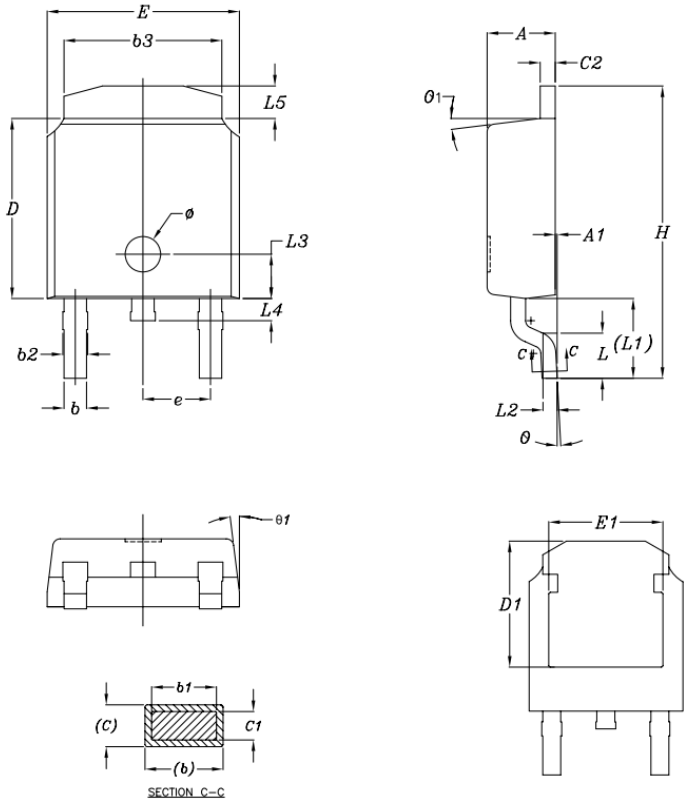


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252-2L Package Information



ITEM	DIMENSIONS			
	MILLMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.18	2.39	0.086	0.094
A1	——	0.13	——	0.005
b	0.70	0.89	0.028	0.035
b1	0.70	0.86	0.028	0.034
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c1	0.41	0.56	0.016	0.022
c2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.21	——	0.205	——
E	6.35	6.73	0.250	0.265
E1	4.32	——	0.170	——
e	2.29 BSC		0.090 BSC	
H	9.40	10.41	0.370	0.410
L	1.40	1.78	0.055	0.070
L1	2.60	2.90	0.102	0.114
L2	0.51 BSC		0.020 BSC	
③ L3	1.65	1.95	0.065	0.077
L4	0.60	0.90	0.024	0.035
③ L5	0.89	1.27	0.035	0.050
θ	1°	5°	1°	5°
θ1	7° REF		7° REF	
ø	1.20 REF		1.20 REF	

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