NCE Automotive N-Channel Super Trench Power MOSFET

Description

The NCEAP40T15AGU 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

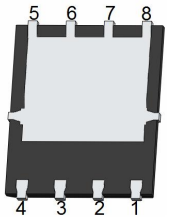
- Automotive application
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

General Features

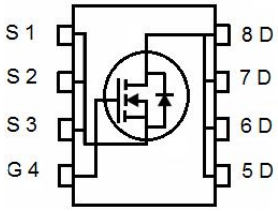
- V_{DS} =40V,I_D =240A (Silicon Limited)
  $R_{DS(ON)}$=1.35mΩ , typical@ V_{GS}=10V
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175°C operating temperature
- Pb-free lead plating
- 100% UIS tested
- 100% ΔVds tested
- **AEC-Q101 qualified**

DFN5X6

Top View



Bottom View



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
AP40T15AGU	NCEAP40T15AGU	DFN5X6-8L	-	-	-

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	240	A
Drain Current-Continuous (Silicon Limited)(Note1)	I_D (100℃)	170	A
Drain Current-Continuous (Package Limited)	I_D	150	A
Pulsed Drain Current	I_{DM}	600	A
Maximum Power Dissipation	P_D	160	W
Derating factor		1.1	W/℃
Single pulse avalanche energy (Note 2)	E_{AS}	1479	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 175	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case	$R_{\theta JC}$	0.93	℃/W
Thermal Resistance,Junction-to-Ambient (Note 4)	$R_{\theta JA}$	50	℃/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	-	1.35	1.45	mΩ
Forward Transconductance	g_{FS}	V_{DS}=5V,I_D=20A	-	80	-	S
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=20V,V_{GS}=0V, F=1.0MHz	-	4135	5375	pF
Output Capacitance	C_{oss}		-	2110	2743	pF
Reverse Transfer Capacitance	C_{rss}		-	120	180	pF
Switching Characteristics (Note 1)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=20V,I_D=20A V_{GS}=10V,R_G=1.6Ω	-	9	-	nS
Turn-on Rise Time	t_r		-	6	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	42	-	nS
Turn-Off Fall Time	t_f		-	8	-	nS
Total Gate Charge	Q_g	V_{DS}=20V,I_D=20A, V_{GS}=10V	-	62	81	nC
Gate-Source Charge	Q_{gs}		-	19.7	26.0	nC
Gate-Drain Charge	Q_{gd}		-	14.4	21.6	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=20A	-	-	1.2	V
Diode Forward Current	I_S		-	-	150	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F = I_S di/dt = 100A/μs	-	30	-	nS
Reverse Recovery Charge	Qrr		-	110	-	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 heatsin k, assuming a maximum junction temperature of TJ(MAX)=175° C. The SOA curve provides a single pulse rating.
4. The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25° C. The maximum allowed junction temperature of 175° C. The value in any given application depends on the user's specific board design.

Typical Electrical and Thermal Characteristics

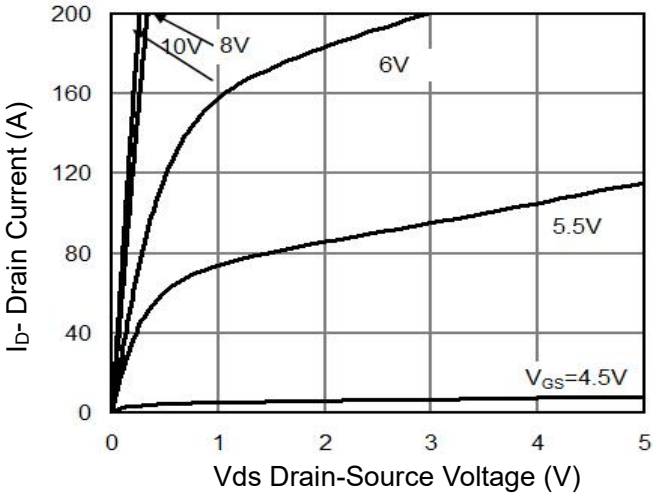


Figure 1 Output Characteristics

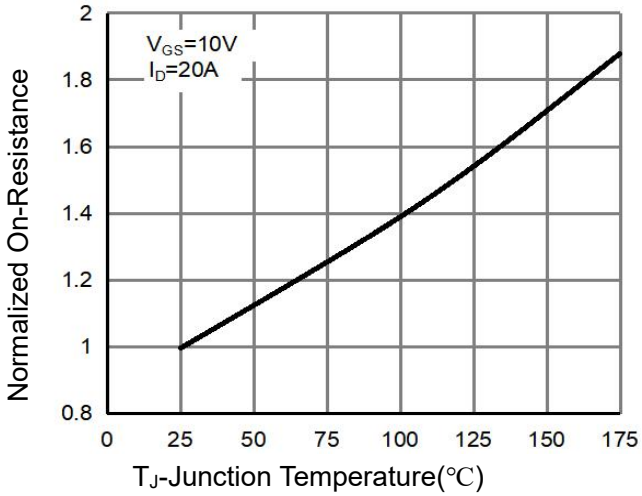


Figure 4 Rdson-JunctionTemperature

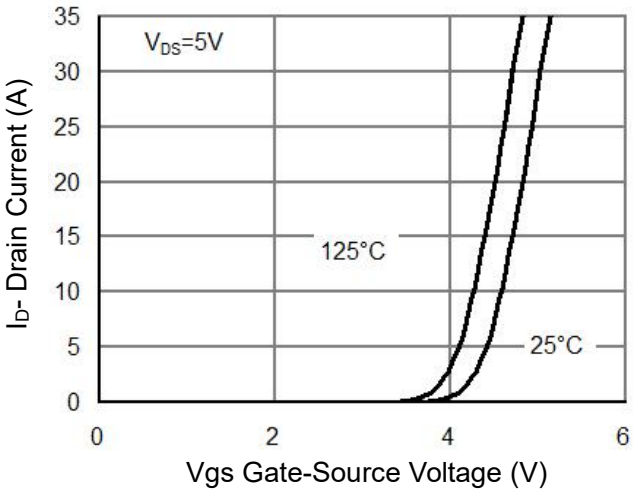


Figure 2 Transfer Characteristics

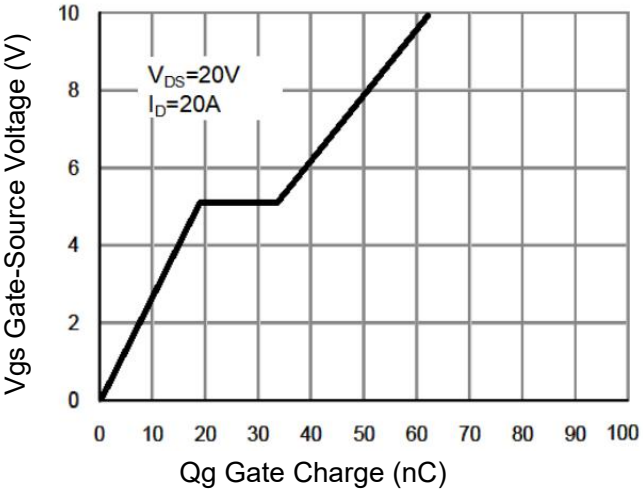


Figure 5 Gate Charge

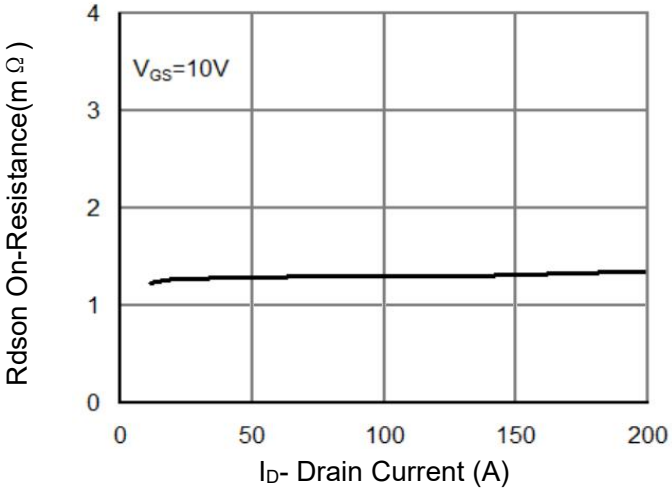


Figure 3 Rdson- Drain Current

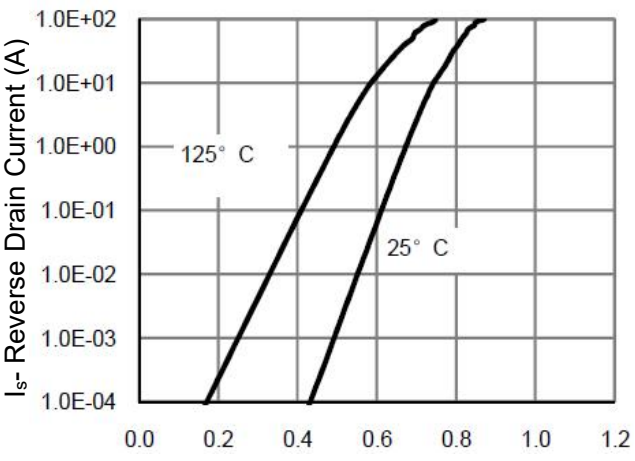


Figure 6 Source- Drain Diode Forward

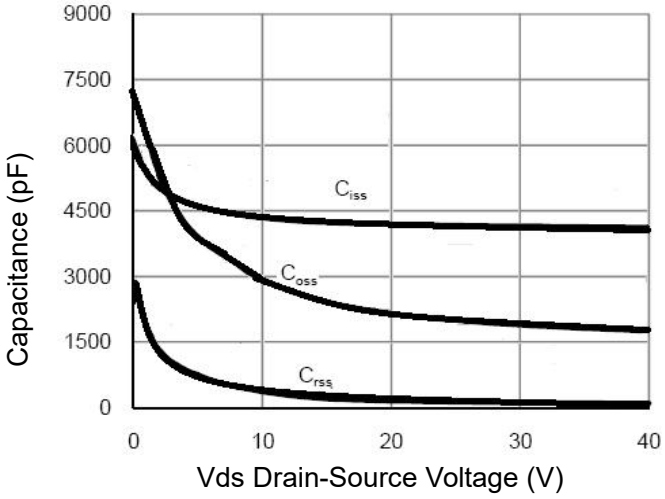


Figure 7 Capacitance vs Vds

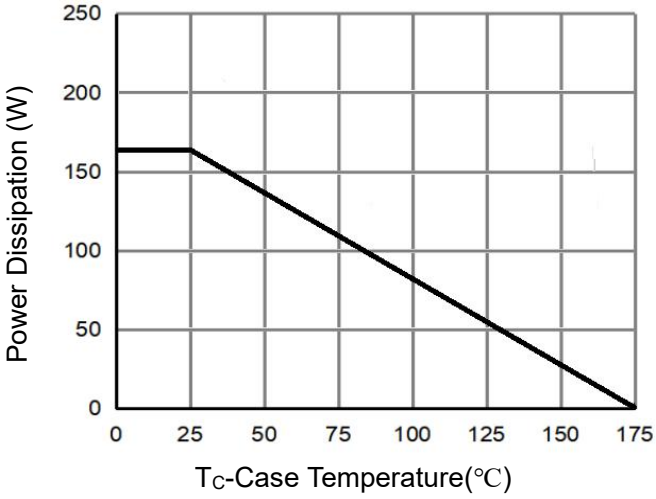


Figure 9 Power De-rating

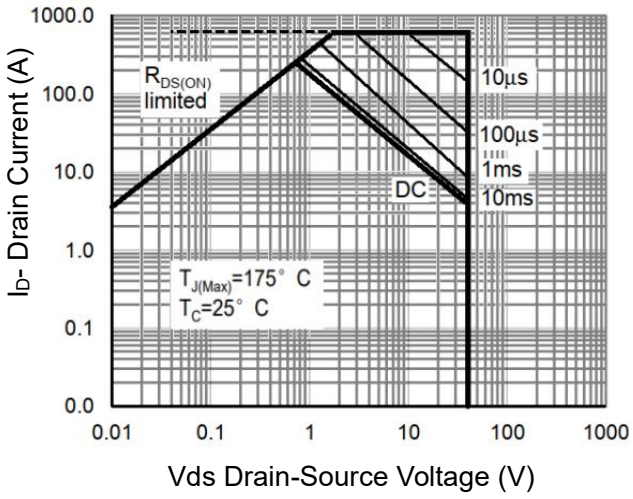


Figure 8 Safe Operation Area(Note4)

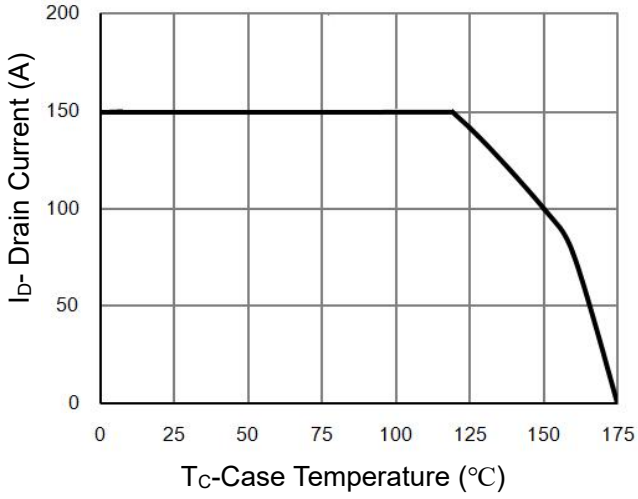


Figure 10 Current De-rating

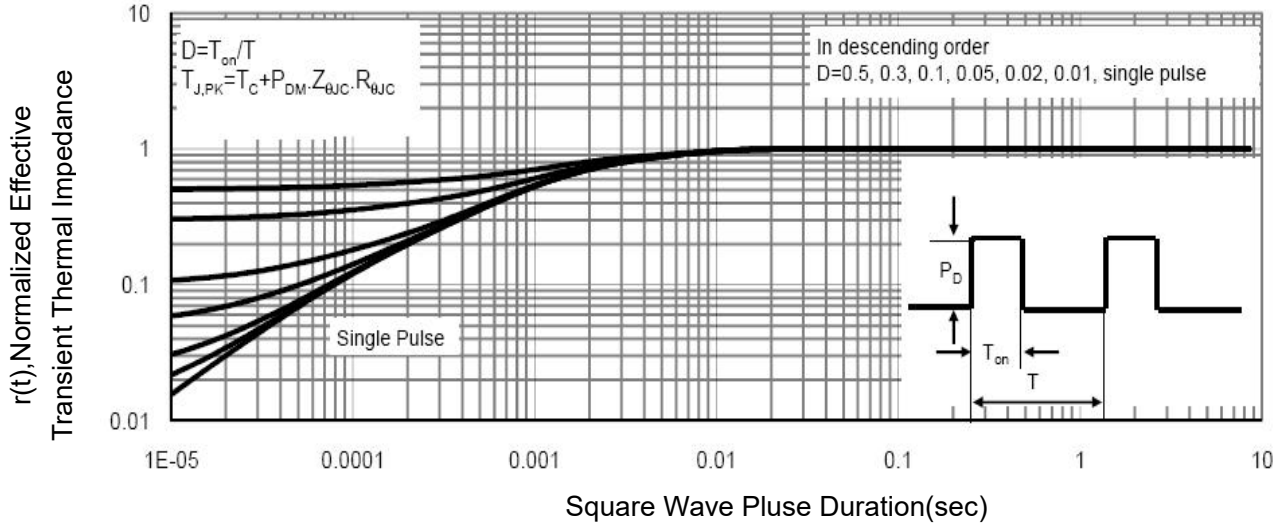


Figure 11 Normalized Maximum Transient Thermal Impedance

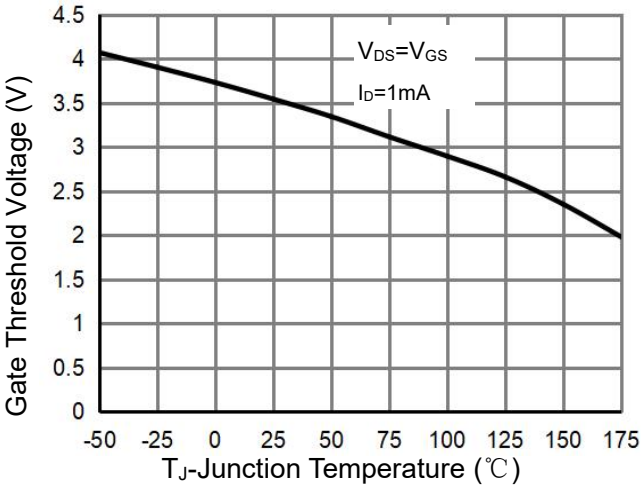


Figure 12 $V_{GS(th)}$-Junction Temperature

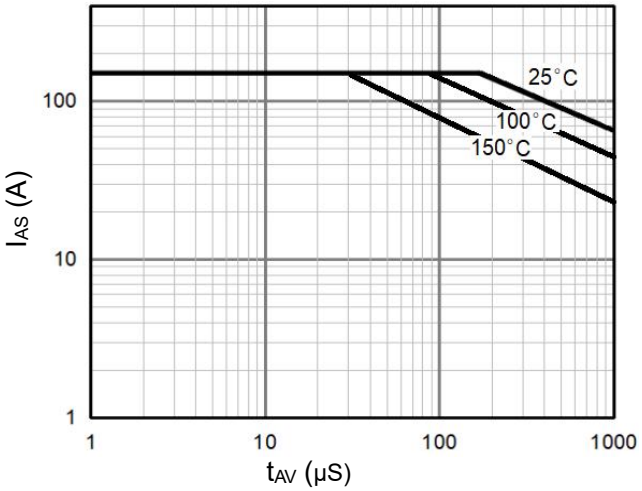
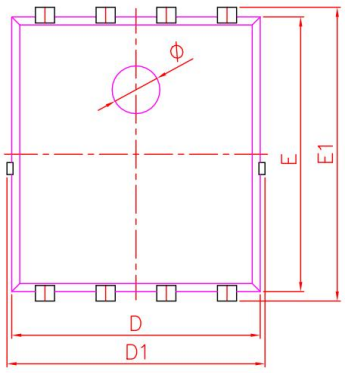
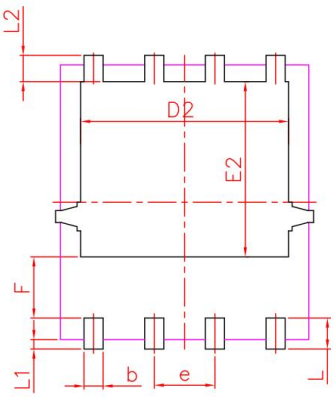


Figure 13 Single Pulse Avalanche capability

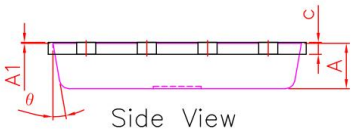
DFN5X6-8L Package Information



Top View



Bottom View



Side View

PDFN5X6-8L			
DIM.	MIN.	NOM.	MAX.
A	0.90	0.95	1.00
A1	0.00	0.02	0.05
b	0.35	0.40	0.50
c	0.20	0.25	0.30
D	5.10	5.20	5.30
D1	5.10	5.40	5.50
D2	4.25	4.35	4.45
e	1.27 BSC		
E	5.70	5.75	5.80
E1	6.00	6.15	6.30
E2	3.57	3.67	3.77
F	1.18	1.28	1.38
L	0.55	0.65	0.75
L1	0.15	0.20	0.25
L2	0.45	0.55	0.65
ø	0.90	1.00	1.10
Θ	8°	10°	12°
All dimensions in millimeters			

Revision History

Revision	Date	Subjects
V1.0	2022.08.16	Product data sheet
V2.0	2023.06.14	$R_{\theta JA}$
V3.0	2023.11.16	Ciss C_{oss} C_{rss} Q_g Q_{gs} Q_{gd} Max value
V4.0	2023.12.19	VGS(th)-Junction Temperature
V5.0	2024.04.23	Single Pulse Avalanche capability
V5.1	2024.05.09	Update $R_{DS(ON)}$ Typ value

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