NCE Automotive N-Channel Super Trench Power MOSFET

Description

The NCEAP6050AQU 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.

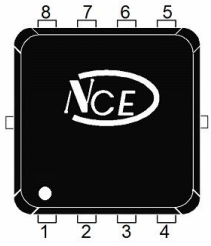
Application

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

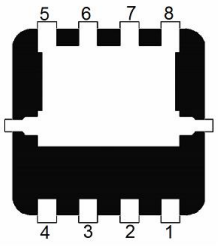
General Features

- V_{DS} =60V,I_D =68A
  $R_{DS(ON)}$=6.5mΩ (typical) @ V_{GS}=10V
  $R_{DS(ON)}$=7.7mΩ (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
- 100% UIS tested
- 100% ΔVds tested
- Pb-free lead plating
- **AEC-Q101 qualified**

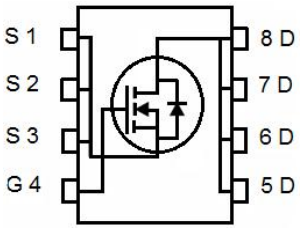
PDFN 3X3-8L



Top View



Bottom View



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
AP6050AQU	NCEAP6050AQU	PDFN3X3-8L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	±20	V
Drain Current-Continuous	I_D	68	A
Drain Current-Continuous(T_C=100℃)	I_D (100℃)	48	A
Pulsed Drain Current	I_{DM}	200	A
Maximum Power Dissipation	P_D	71	W
Derating factor		0.48	W/℃
Single pulse avalanche energy (Note 1)	E_{AS}	288	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 175	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case	$R_{\theta JC}$	2.1	℃/W
Thermal Resistance,Junction-to-Ambient (Note 4)	$R_{\theta JA}$	60	℃/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	60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=60V,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	1.8	2.4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=40A	-	6.5	7.5	mΩ
		V_{GS}=4.5V, I_D=20A	-	7.7	9.0	
Forward Transconductance	g_{FS}	V_{DS}=10V,I_D=20A	-	40	-	S
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=30V,V_{GS}=0V, F=1.0MHz	-	1892	-	pF
Output Capacitance	C_{oss}		-	356	-	pF
Reverse Transfer Capacitance	C_{rss}		-	37	-	pF
Switching Characteristics (Note2)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=30V,I_D=20A V_{GS}=10V,R_G=3Ω	-	10	-	nS
Turn-on Rise Time	t_r		-	30	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	36	-	nS
Turn-Off Fall Time	t_f		-	8	-	nS
Total Gate Charge	Q_g	V_{DS}=30V,I_D=20A, V_{GS}=10V	-	34.8	-	nC
Gate-Source Charge	Q_{gs}		-	7	-	nC
Gate-Drain Charge	Q_{gd}		-	5.3	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=40A	-	-	1.2	V
Diode Forward Current	I_S		-	-	68	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F =40A di/dt = 100A/μs	-	42	-	nS
Reverse Recovery Charge	Qrr		-	48	-	nC

Notes:

1. Defined by design.Not Subject to production test
2. EAS condition : Tj=25℃,V_{DD}=30V,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 $T_{J(MAX)}$=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

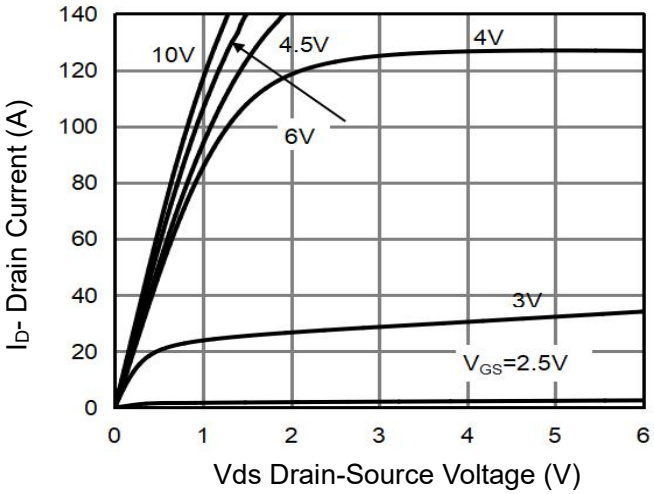


Figure 1 Output Characteristics

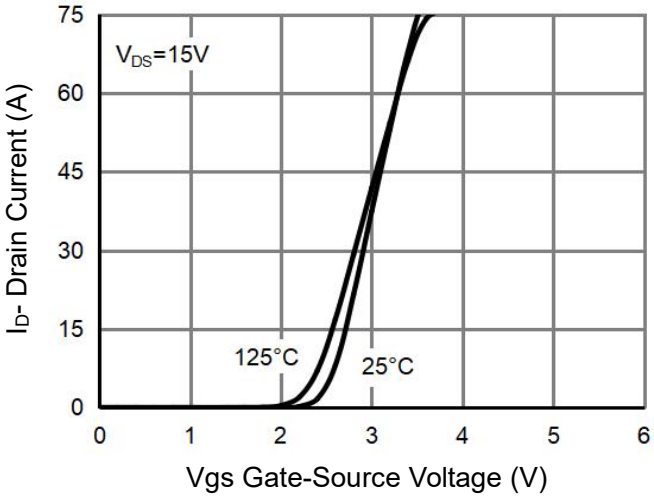


Figure 2 Transfer Characteristics

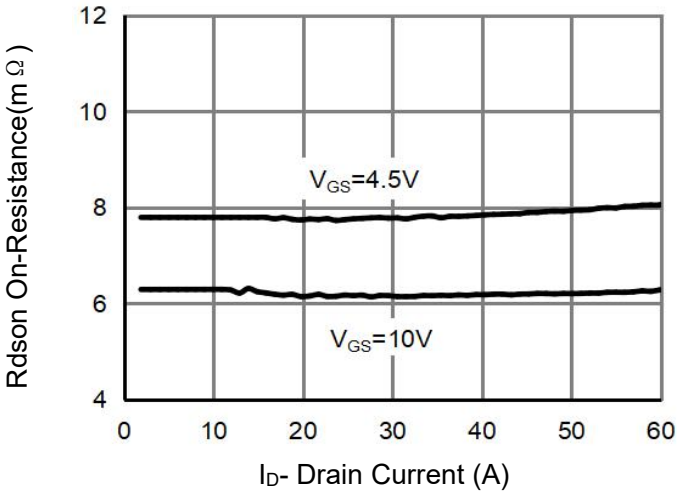


Figure 3 Rdson- Drain Current

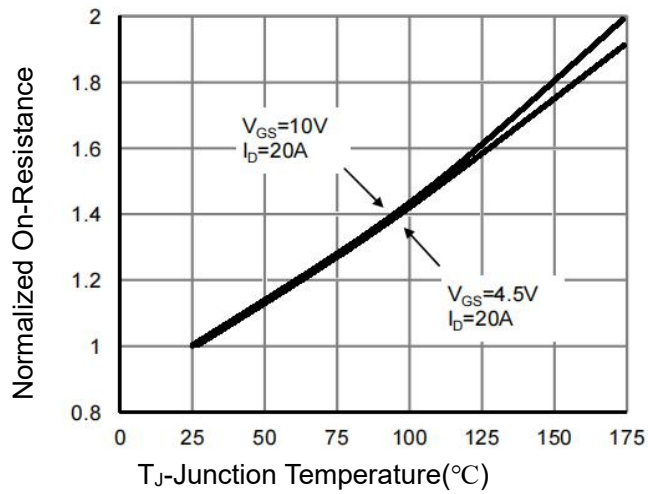


Figure 4 Rdson-Junction Temperature

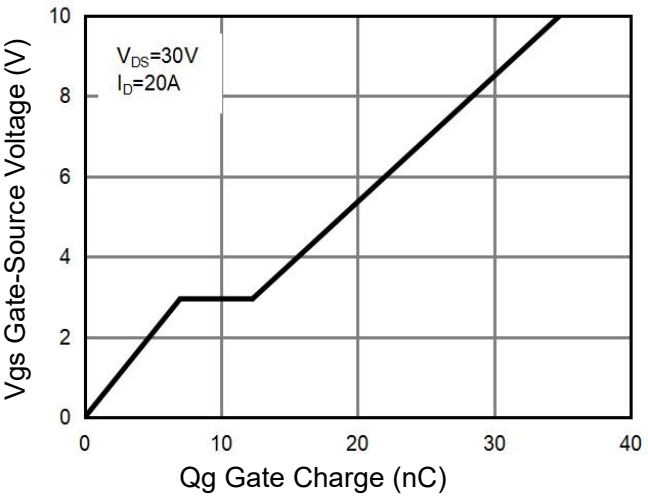


Figure 5 Gate Charge

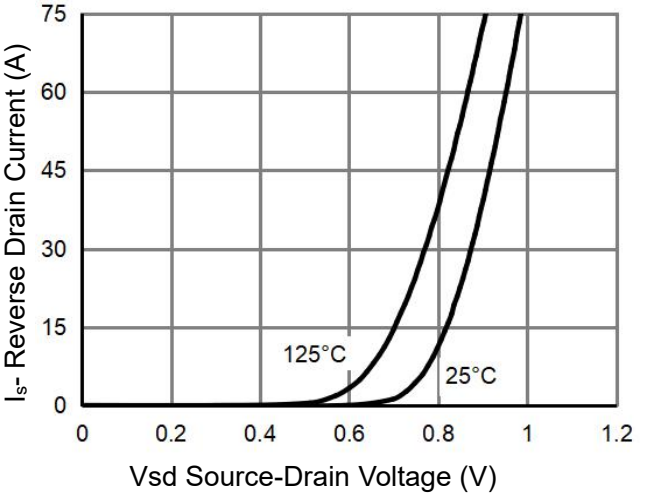


Figure 6 Source- Drain Diode Forward

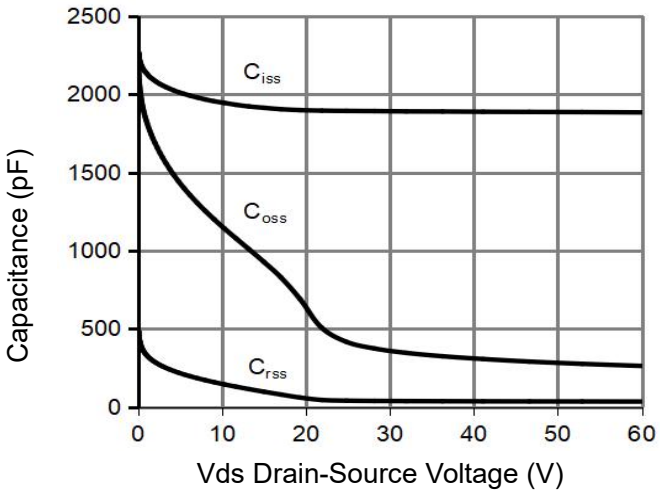


Figure 7 Capacitance vs Vds

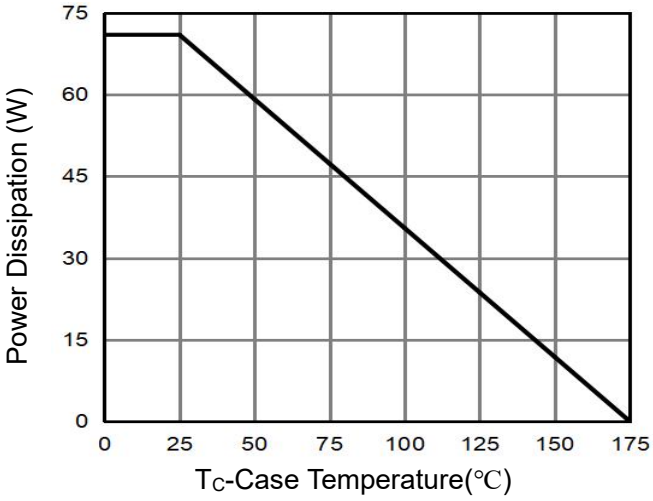


Figure 9 Power De-rating

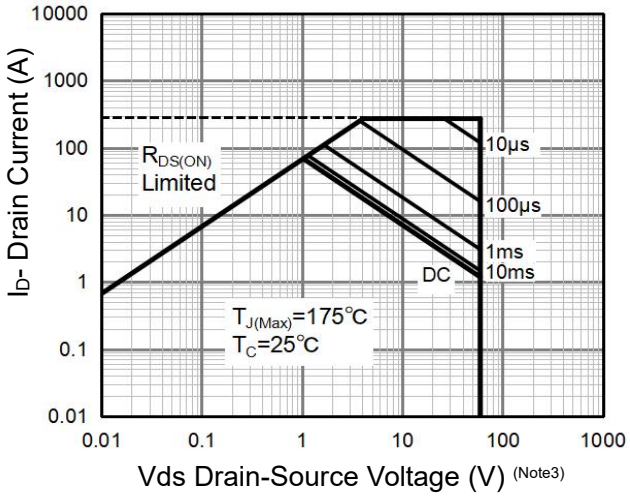


Figure 8 Safe Operation Area

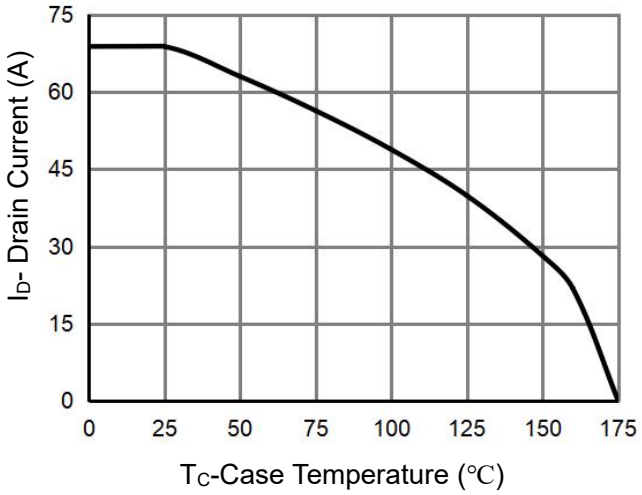


Figure 10 Current De-rating

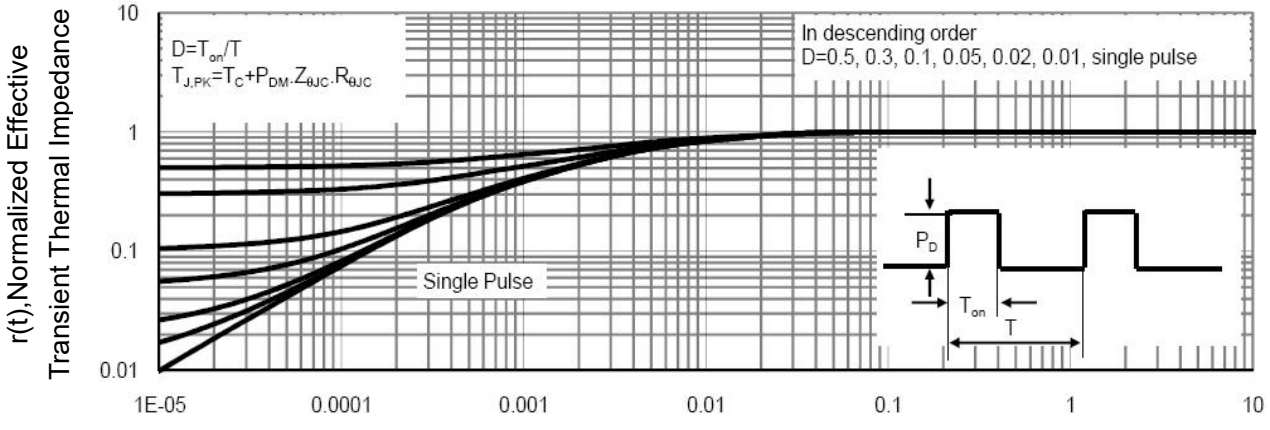
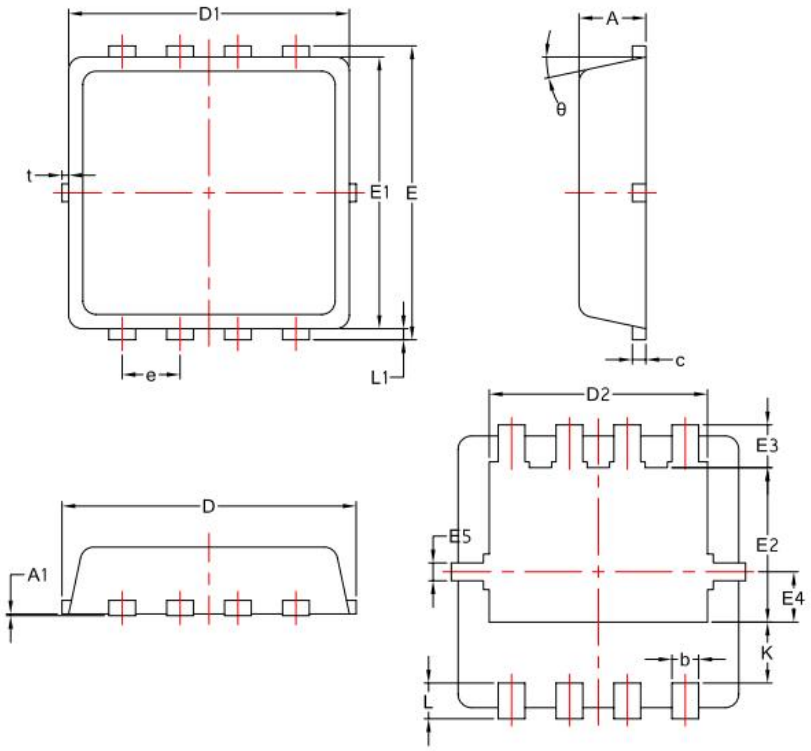


Figure 11 Normalized Maximum Transient Thermal Impedance

PDFN3X3-8L Package Information



	SYMBOL	COMMON		
		MM		
		MIN	NOM	MAX
	A	0.70	0.75	0.85
	A1	/	/	0.05
	b	0.20	0.30	0.40
	c	0.10	0.152	0.25
	D	3.15	3.30	3.45
2	D1	3.00	3.15	3.25
2	D2	2.29	2.45	2.65
	E	3.15	3.30	3.45
	E1	2.90	3.05	3.20
	E2	1.54	1.74	1.94
3	E3	0.28	0.48	0.65
	E4	0.37	0.57	0.77
	E5	0.10	0.20	0.30
	e	0.60	0.65	0.70
2	K	0.59	0.69	0.89
	L	0.30	0.40	0.50
	L1	0.06	0.125	0.20
2	t	0	0.075	0.13
2	θ	10°	12°	14°

Revision History

Revision	Date	Subjects
V1.0	2023.12.15	Product data sheet
V2.0	2024.11.19	Update 4.5V Max $R_{DS(ON)}$

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