

## NCE Automotive N-Channel Super Trench Power MOSFET

### Description

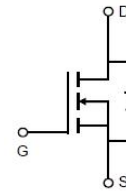
The NCEAP16N85AK uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

- $V_{DS}=85V, I_D=65A$   
 $R_{DS(ON)}=11.5m\Omega$  (typical) @  $V_{GS}=10V$   
 $R_{DS(ON)}=15m\Omega$  (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%  $\Delta V_{ds}$  tested
- **AEC-Q101 qualified**

### Application

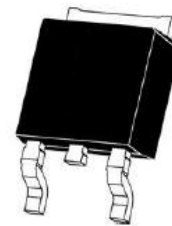
- Automotive application
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



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
AP16N85AK	NCEAP16N85AK	TO-252-2L	-	-	-

### Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	85	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	65	A
	$I_D(100^\circ\text{C})$	45	A
Pulsed Drain Current	$I_{DM}$	220	A
Maximum Power Dissipation	$P_D$	138	W
Derating factor		0.92	W/ $^\circ\text{C}$
Single pulse avalanche energy <sup>(Note 1)</sup>	$E_{AS}$	156	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ\text{C}$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.09	$^\circ\text{C/W}$
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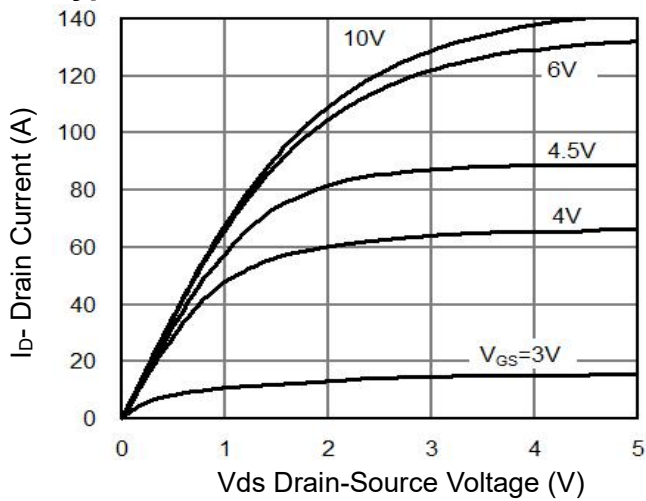
## Electrical Characteristics ( $T_c=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	85	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =85V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.2	1.7	2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =27.5A	-	11.5	16	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =27.5A	-	15	24	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =27.5A	-	35	-	S
Dynamic Characteristics						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, F=1.0MHz	-	1600	-	pF
Output Capacitance	C <sub>oss</sub>		-	250	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	20	-	pF
Switching Characteristics (Note 2)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =40V, I <sub>D</sub> =27.5A V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω	-	9	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	5	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	22	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	4	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =40V, I <sub>D</sub> =27.5A, V <sub>GS</sub> =10V	-	31	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	4.8	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	8.0	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =55A	-	-	1.2	V
Diode Forward Current	I <sub>S</sub>		-	-	65	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 55A	-	26	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 500A/μs <sup>(Note3)</sup>	-	98	-	nC

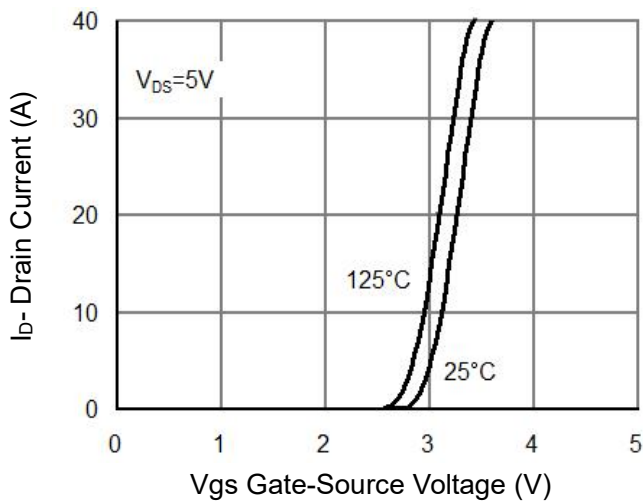
### Notes:

1. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=40V, V_G=10V, L=0.5mH, R_g=25\Omega$
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 heat sink, assuming a maximum junction temperature of  $T_J(MAX)=175^{\circ}\text{C}$ . The SOA curve provides a single pulse rating.

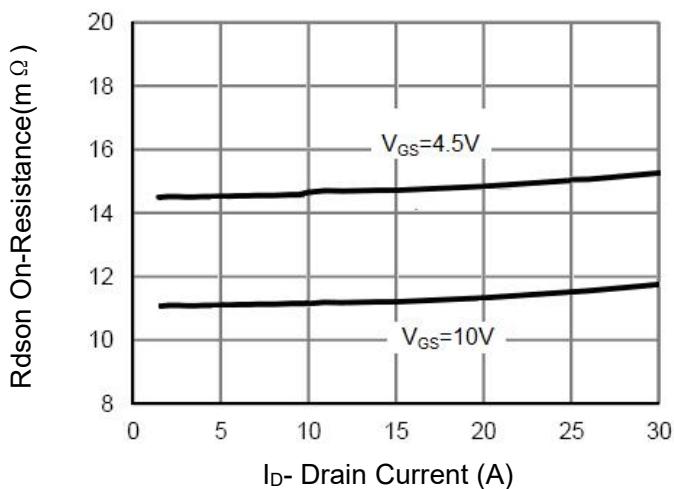
## Typical Electrical and Thermal Characteristics



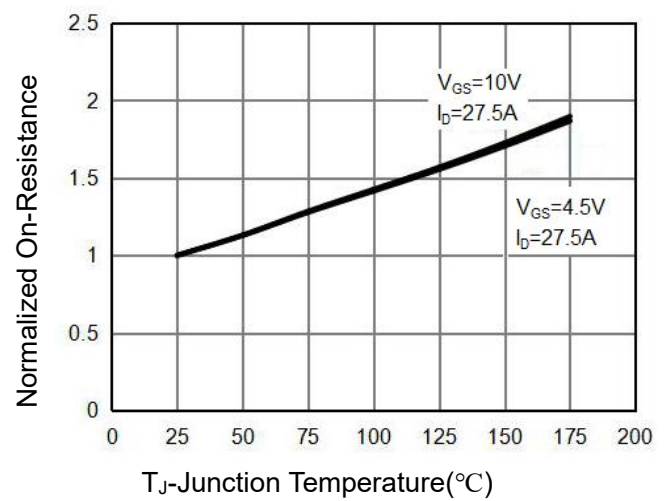
**Figure 1 Output Characteristics**



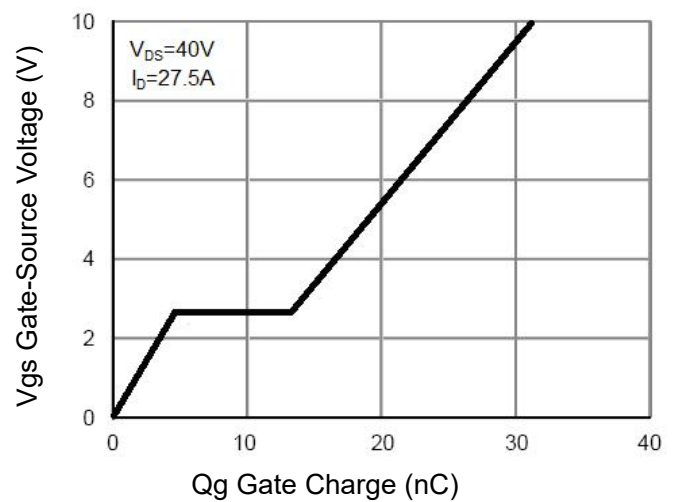
**Figure 2 Transfer Characteristics**



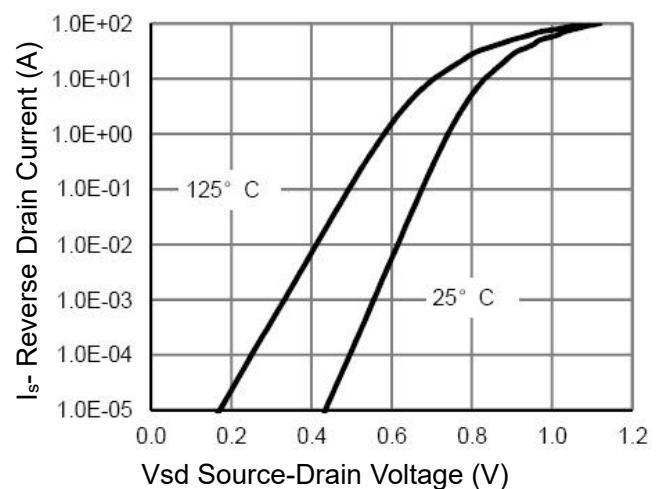
**Figure 3  $R_{DS(on)}$ - Drain Current**



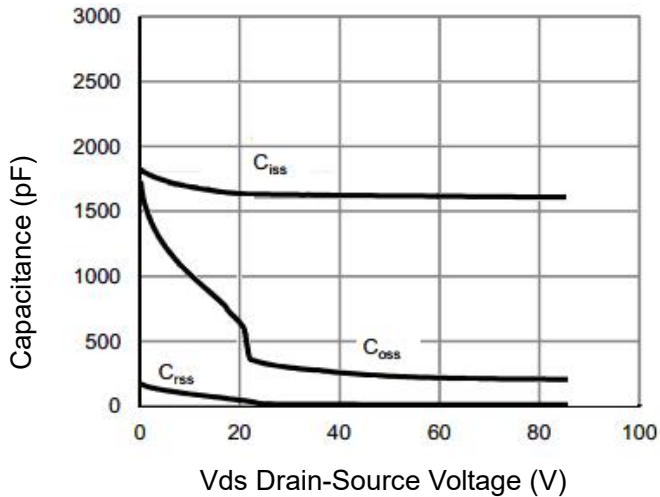
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



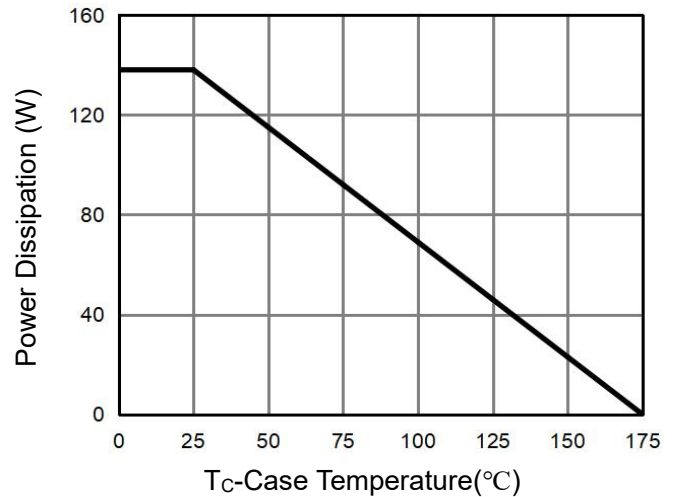
**Figure 5 Gate Charge**



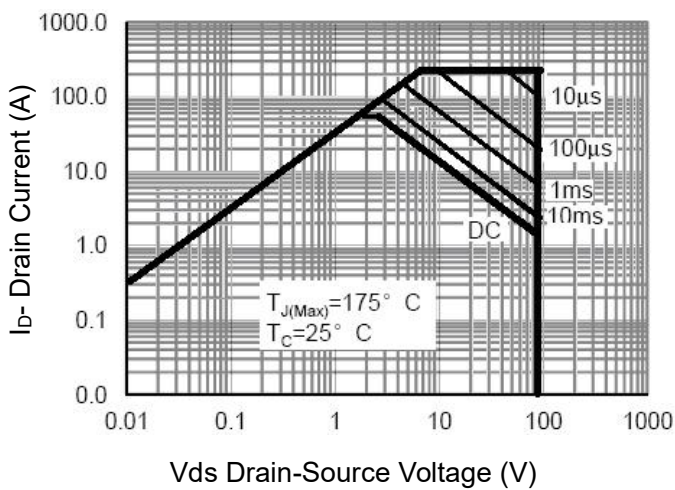
**Figure 6 Source- Drain Diode Forward**



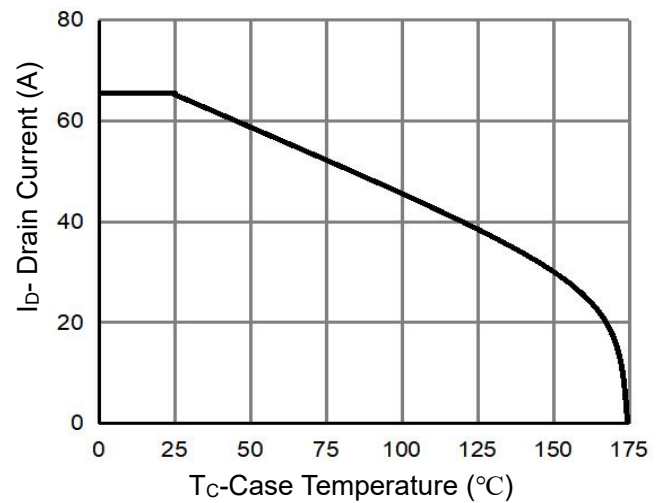
**Figure 7 Capacitance vs Vds**



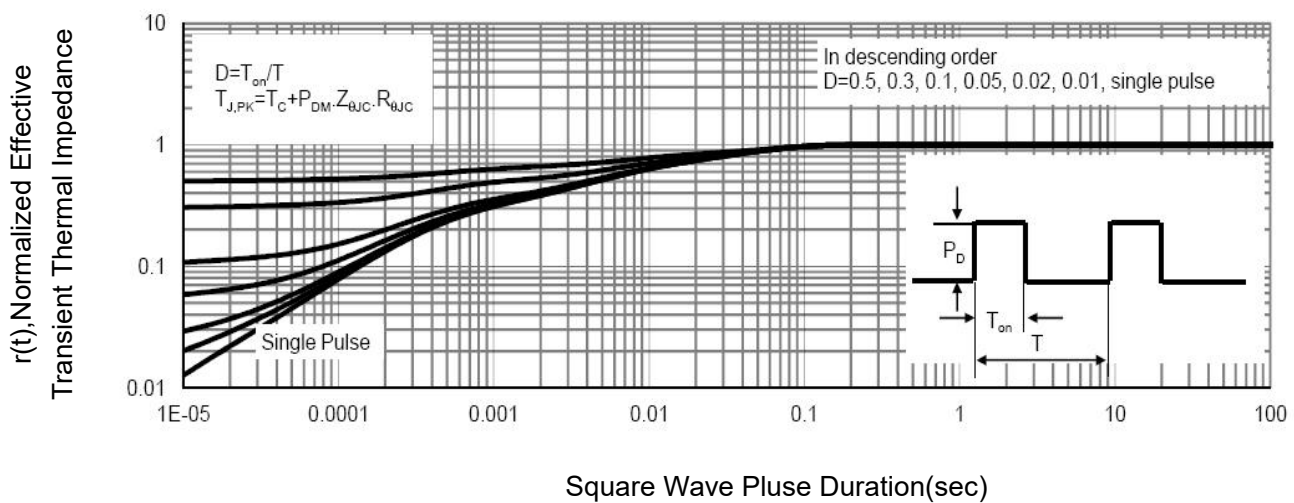
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area** (Note 3)

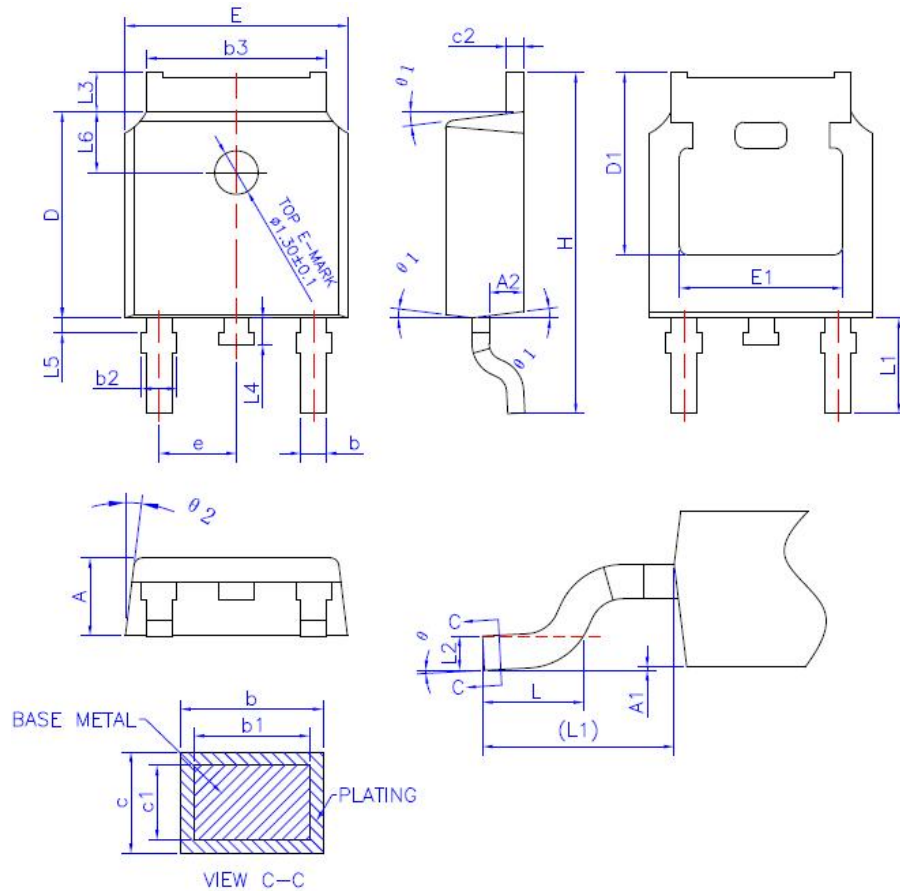


**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-252-2L Package Information



COMMON DIMENSIONS  
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	—	0.10
A2	0.90	1.01	1.10
b	0.72	—	0.85
b1	0.71	0.76	0.81
b2	0.72	—	0.90
b3	5.13	5.33	5.46
c	0.47	—	0.60
c1	0.46	0.51	0.56
c2	0.47	—	0.60
D	6.00	6.10	6.20
D1	5.25	—	—
E	6.50	6.60	6.70
E1	4.70	—	—
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.508 BSC		
L3	0.90	—	1.25
L4	0.60	0.80	1.00
L5	0.15	—	0.75
L6	1.80 REF		
θ	0°	—	8°
θ1	5°	7°	9°
θ2	5°	7°	9°

NOTES:  
ALL DIMENSIONS REFER TO JEDEC STANDARD  
TO-252 AA DO NOT INCLUDE MOLD FLASH OR  
PROTRUSIONS

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