

## NCE Automotive N-Channel Super Trench Power MOSFET

### Description

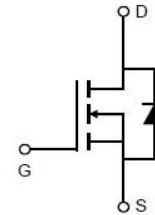
The NCEAP0135AK uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(on)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

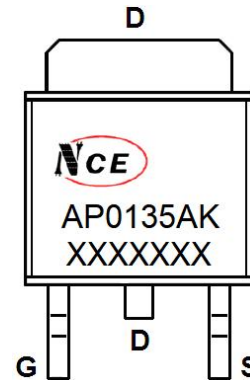
- $V_{DS} = 100V, I_D = 35A$   
 $R_{DS(on)} = 18m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(on)} = 22m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested
- 100%  $\Delta V_d$ s tested
- **AEC-Q101 qualified**

### Application

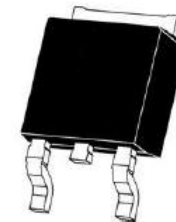
- Automotive application
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



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
AP0135AK	NCEAP0135AK	TO-252-2L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	100	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	35	A
Drain Current-Continuous( $T_c = 100^\circ C$ )	$I_D(100^\circ C)$	24.7	A
Pulsed Drain Current	$I_{DM}$	140	A
Maximum Power Dissipation	$P_D$	70	W
Derating factor		0.47	W/ $^\circ C$
Single pulse avalanche energy (Note 5)	$E_{AS}$	200	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	2.14	$^{\circ}\text{C/W}$
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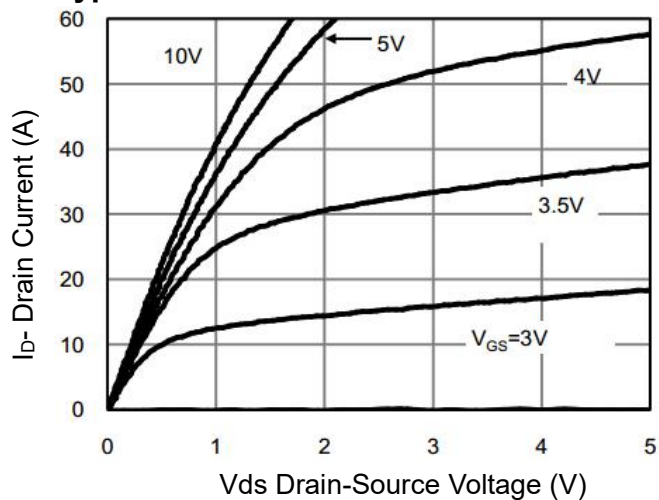
## Electrical Characteristics ( $T_c=25^{\circ}\text{C}$ unless otherwise noted)

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	100		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =100V,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 (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	1.2	2.0	2.8	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	-	18	23	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A	-	22	27	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V,I <sub>D</sub> =20A	-	35	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V,V <sub>GS</sub> =0V, F=1.0MHz	-	1600	-	PF
Output Capacitance	C <sub>oss</sub>		-	139	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	11	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =50V,I <sub>D</sub> =20A V <sub>GS</sub> =10V,R <sub>G</sub> =1.6Ω	-	6	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	2	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	18	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	2	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =50V,I <sub>D</sub> =20A, V <sub>GS</sub> =10V	-	26	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	7.4		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	3.8		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =35A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	35	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A di/dt = 500A/μs (Note3)	-	26	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	98	-	nC

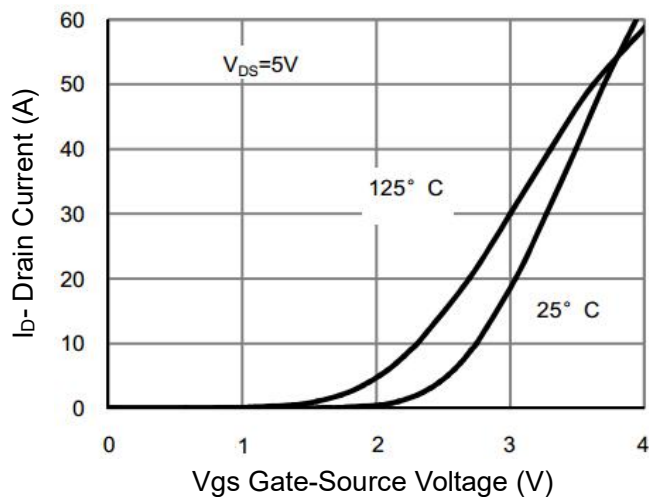
### Notes:

1. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^{\circ}\text{C}$ .
2. Guaranteed by design, not subject to production
3. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

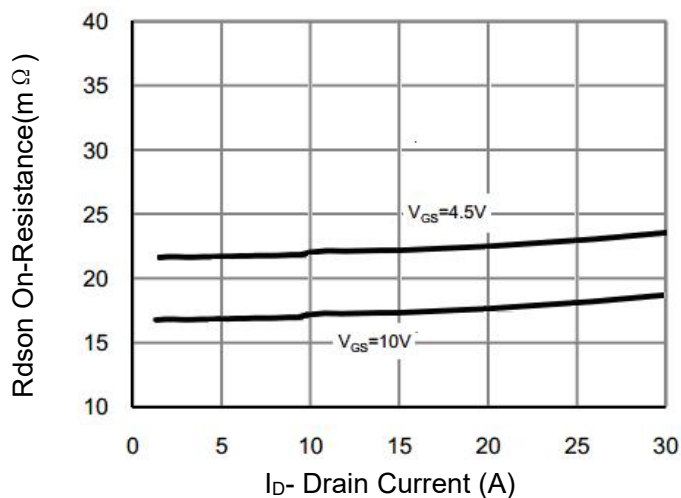
## Typical Electrical and Thermal Characteristics



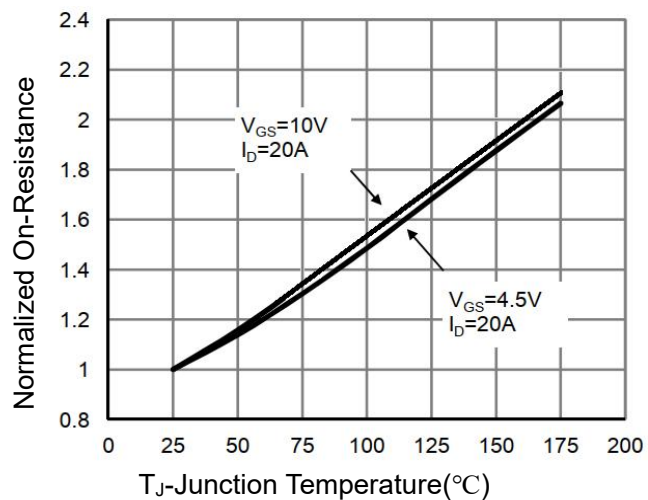
**Figure 1 Output Characteristics**



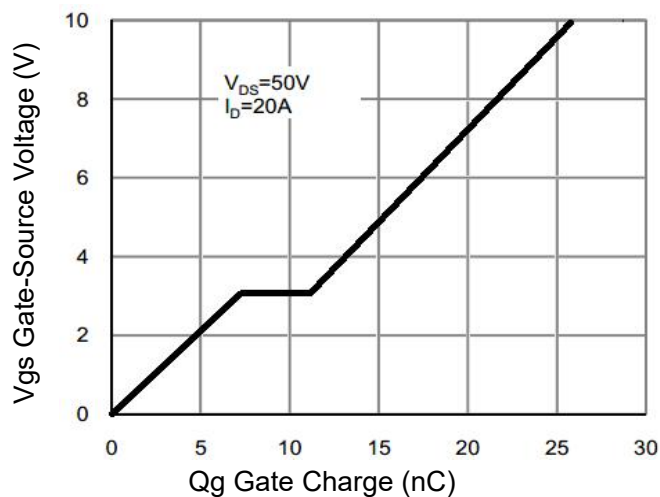
**Figure 2 Transfer Characteristics**



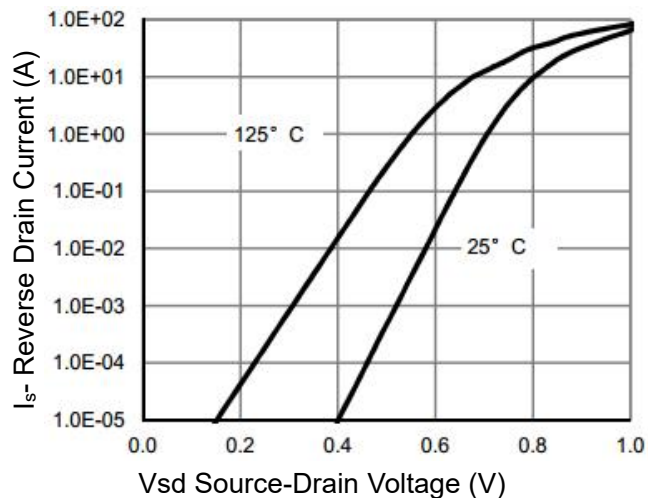
**Figure 3  $R_{DS(on)}$ - Drain Current**



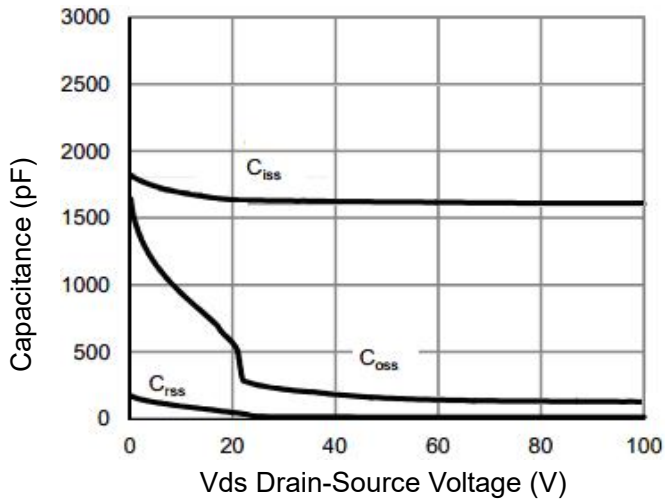
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



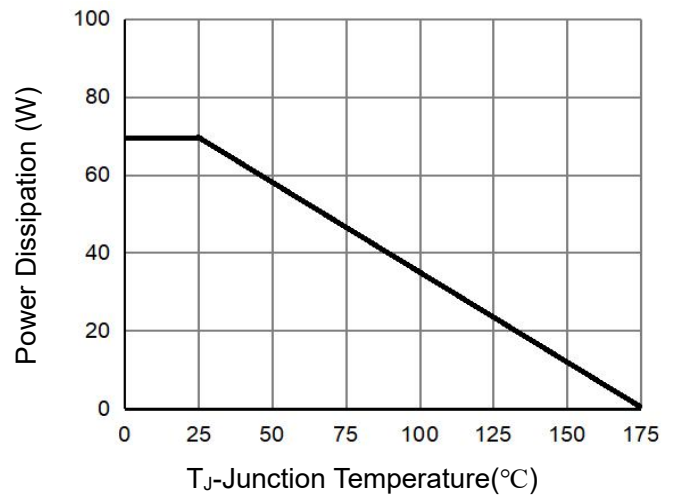
**Figure 5 Gate Charge**



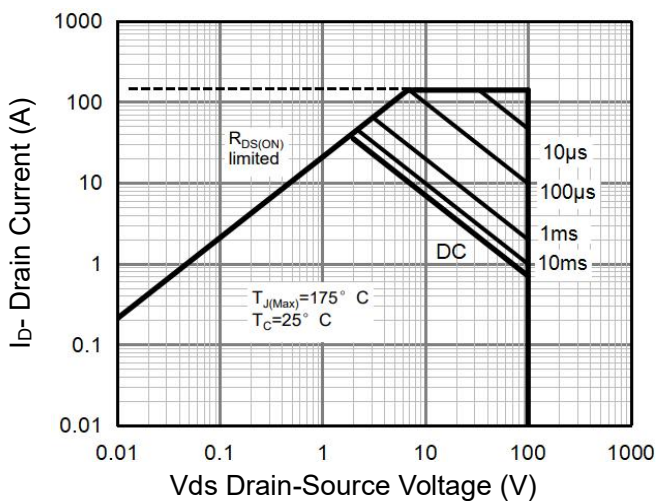
**Figure 6 Source- Drain Diode Forward**



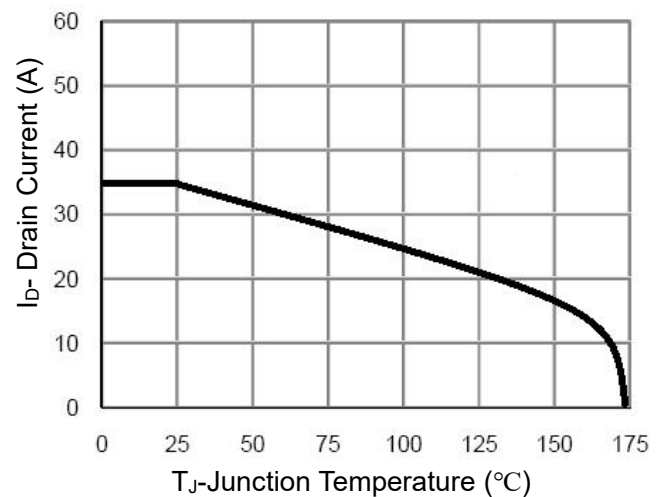
**Figure 7 Capacitance vs Vds**



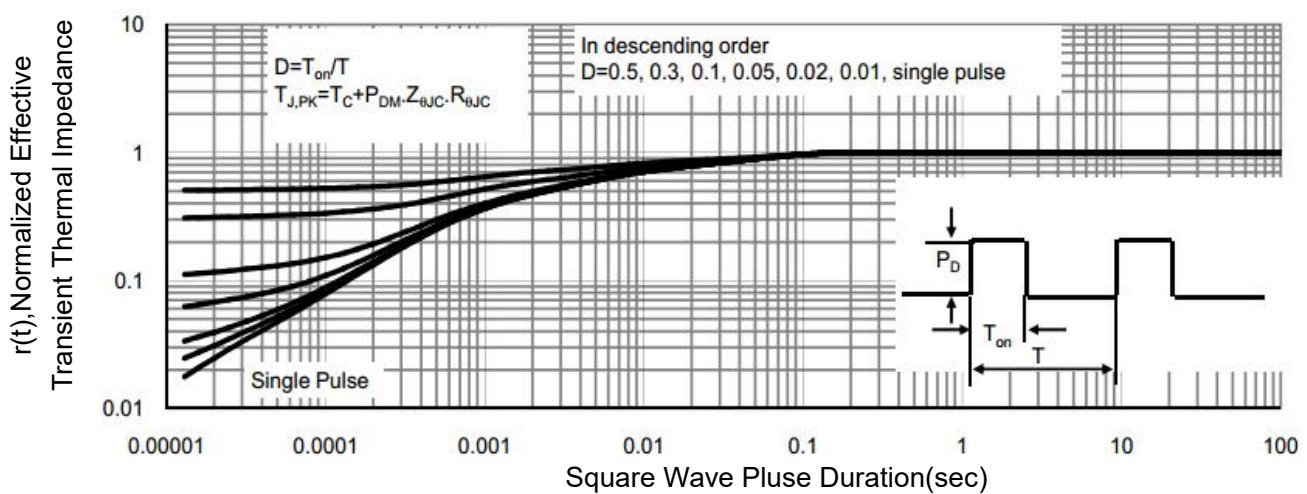
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**

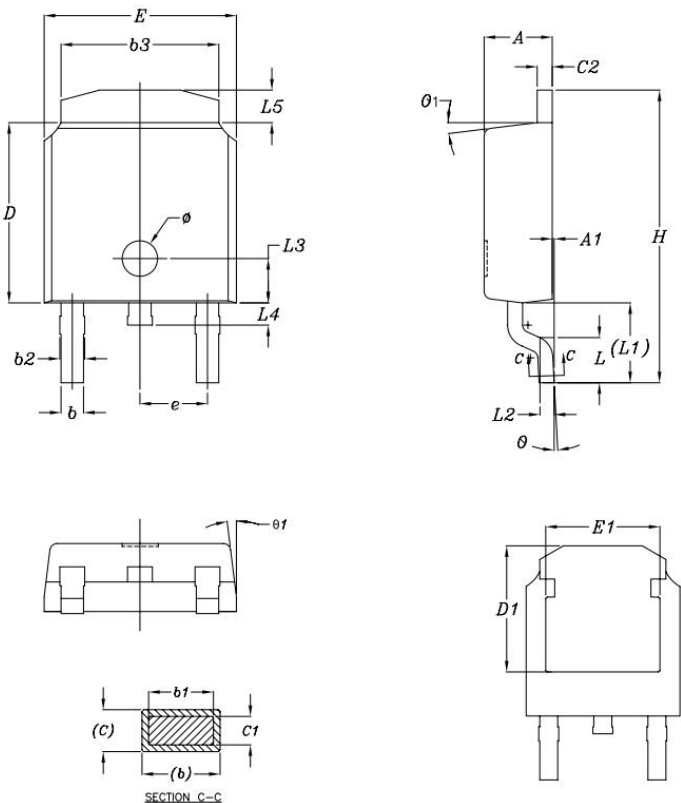


**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

TO-252-2L Package Information



I T E M	DIMENSIONS			
	MILLIMETERS		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	
L3	1.65	1.95	0.065	0.077
L4	0.60	0.90	0.024	0.035
L5	0.89	1.27	0.035	0.050
$\phi$	1"	5"	1"	5"
$\theta1$	7° REF		7° REF	
$\theta$	1.20 REF		1.20 REF	

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