

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

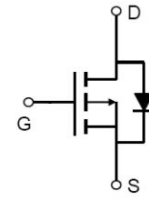
The NCEA02P20K uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

- $V_{DS} = -200V, I_D = -20A$   
 $R_{DS(ON)} < 200m\Omega @ V_{GS} = -10V$  (Typ: 183m $\Omega$ )  
 $R_{DS(ON)} < 240m\Omega @ V_{GS} = -4.5V$  (Typ: 188m $\Omega$ )
- Super high dense cell design
- Advanced trench process technology
- Reliable and rugged
- High density cell design for ultra low On-Resistance
- Pb-free lead plating
- 100% UIS tested
- 100%  $\Delta V_{ds}$  tested
- **AEC-Q101 qualified**

### Application

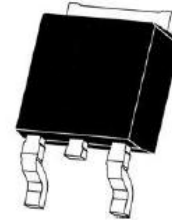
- Automotive application
- Portable equipment and battery powered systems



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
A02P20K	NCEA02P20K	TO-252-2L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-200	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-20	A
Drain Current-Continuous( $T_c = 100^\circ C$ )	$I_D(100^\circ C)$	-14.1	A
Pulsed Drain Current	$I_{DM}$	-80	A
Maximum Power Dissipation	$P_D$	180	W
Single pulse avalanche energy (Note 1)	$E_{AS}$	282	mJ
Derating factor		1.2	W/ $^\circ C$
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.83	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient (Note 4)	$R_{\theta JA}$	50	$^\circ C/W$

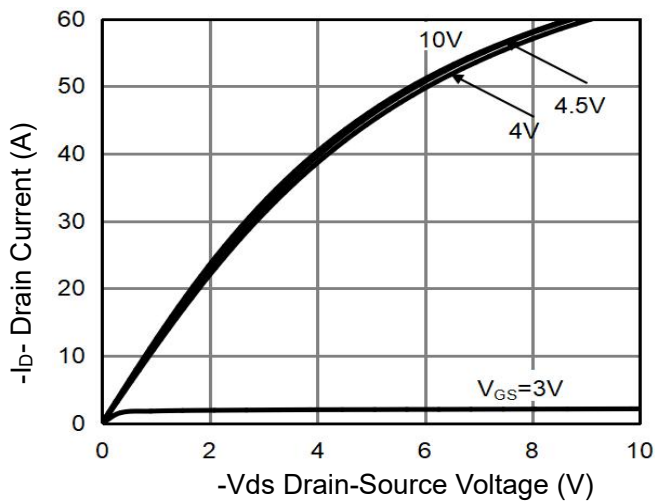
## Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

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	-200	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-200V, 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	-1.8	-2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-15A	-	183	200	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-15A	-	188	220	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-10V, I <sub>D</sub> =-20A	-	50	-	S
Dynamic Characteristics						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-100V, V <sub>GS</sub> =0V, F=1.0MHz	-	6596	-	pF
Output Capacitance	C <sub>oss</sub>		-	82	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	59	-	pF
Switching Characteristics (Note 2)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-100V, I <sub>D</sub> =-20A V <sub>GS</sub> =-10V, R <sub>GEN</sub> =5Ω	-	17	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	80	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	45	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	65	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-100V, I <sub>D</sub> =-20A, V <sub>GS</sub> =-10V	-	122	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	19	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	22	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-20A	-	-	-1.2	V
Diode Forward Current	I <sub>S</sub>	-	-	-	-20	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> =-20A di/dt = 100A/μs	-	90	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	145	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

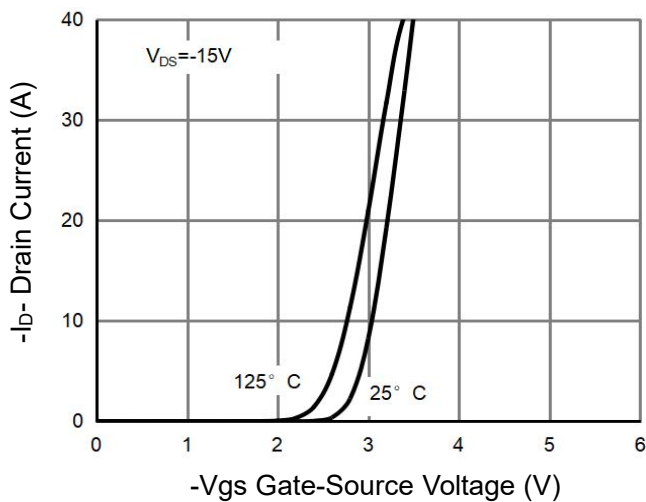
### Notes:

1. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=20V, V<sub>G</sub>=10V, L=0.5mH, R<sub>g</sub>=25Ω
2. Guaranteed by design, not subject to production
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<sub>J(MAX)</sub>=175°C. The SOA curve provides a single pulse rating.
4. The value of R<sub>θJA</sub> is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub> =25° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.

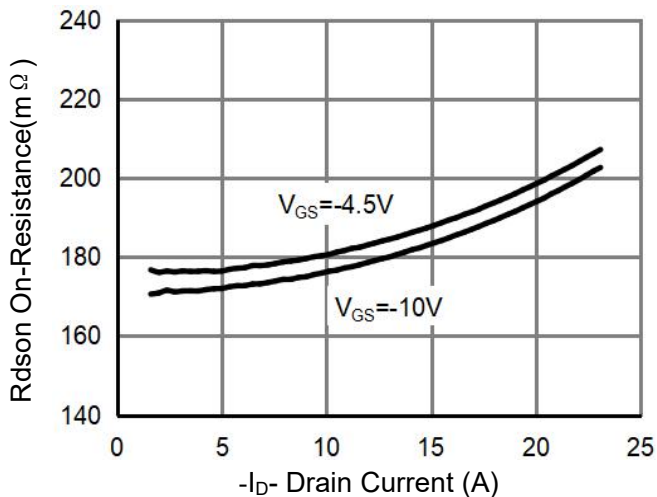
## Typical Electrical and Thermal Characteristics (Curves)



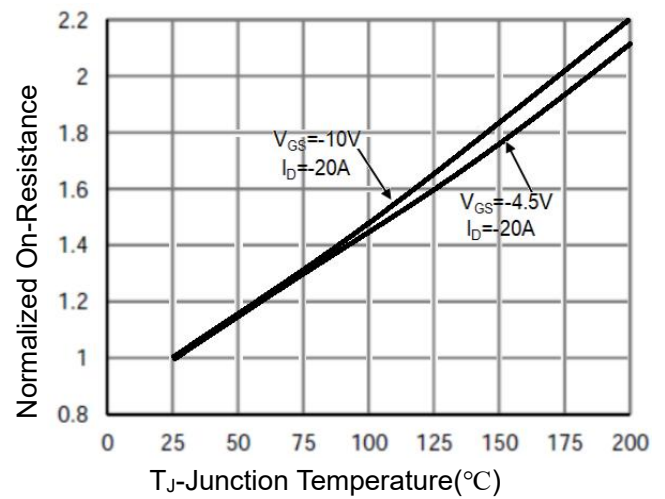
**Figure 1 Output Characteristics**



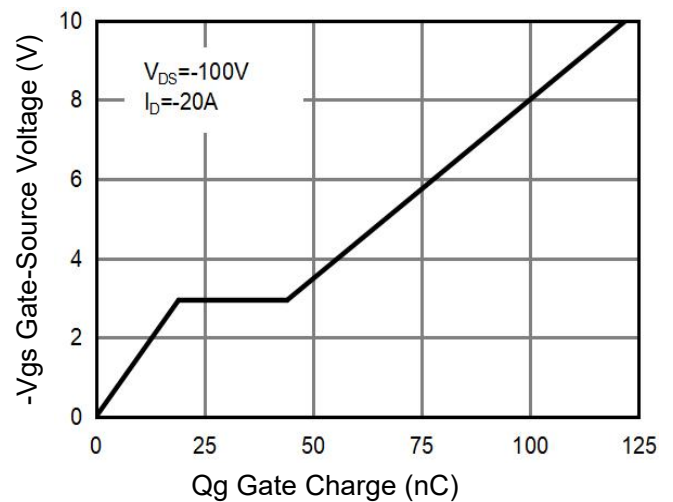
**Figure 2 Transfer Characteristics**



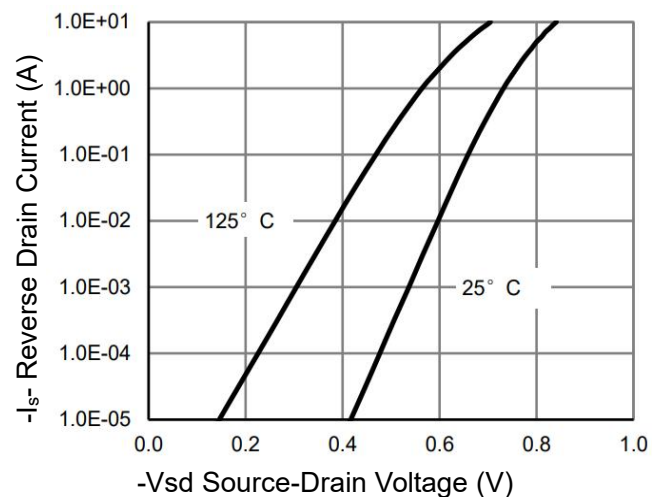
**Figure 3 Rdson- Drain Current**



**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

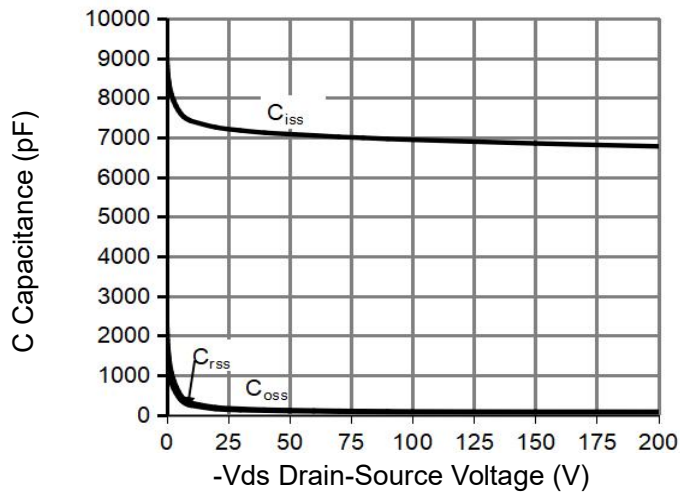


Figure 7 Capacitance vs Vds

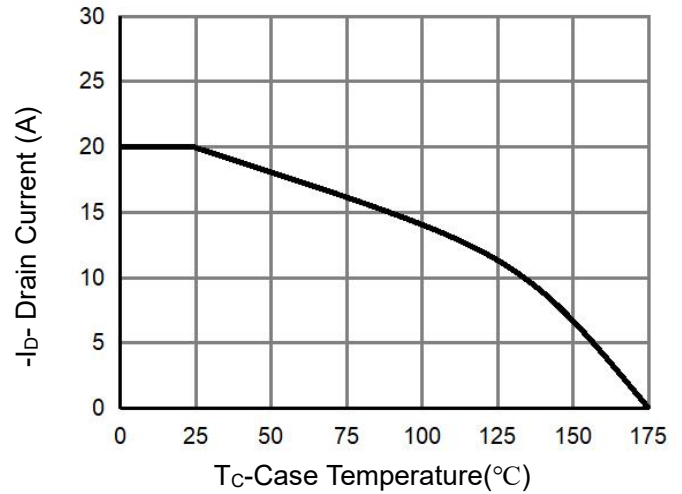


Figure 9 Drain Current vs Case Temperature

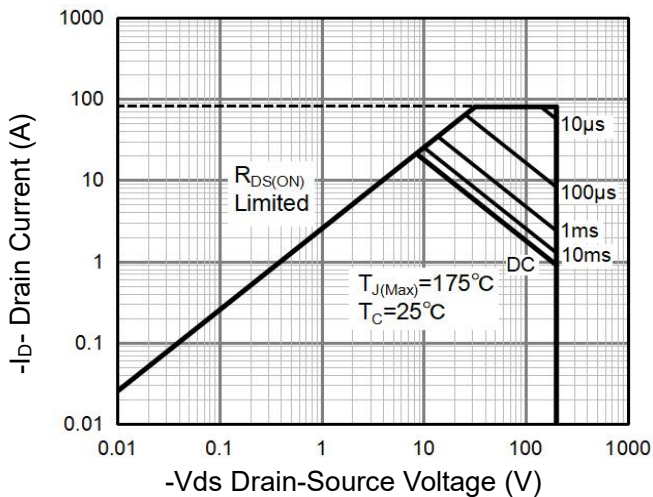


Figure 8 Safe Operation Area (Note3)

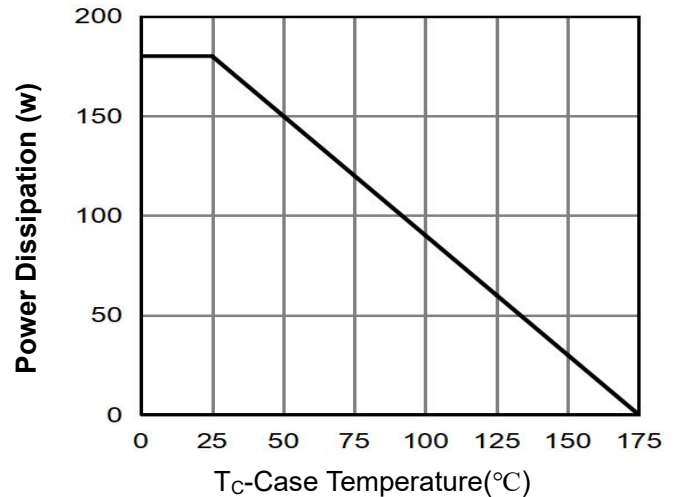


Figure 10 Power De-rating

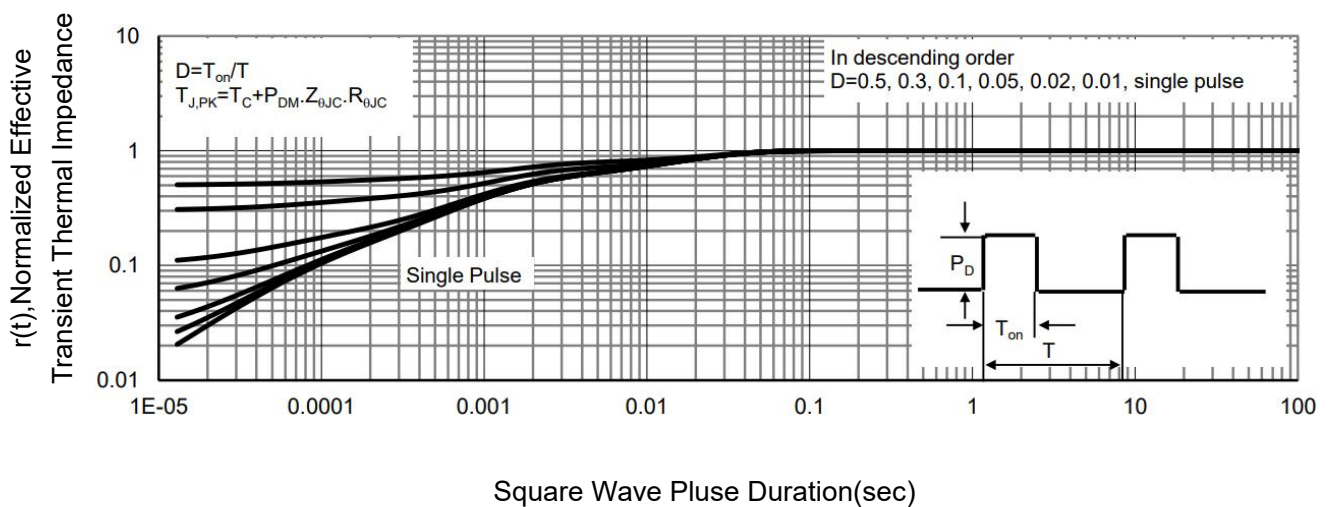
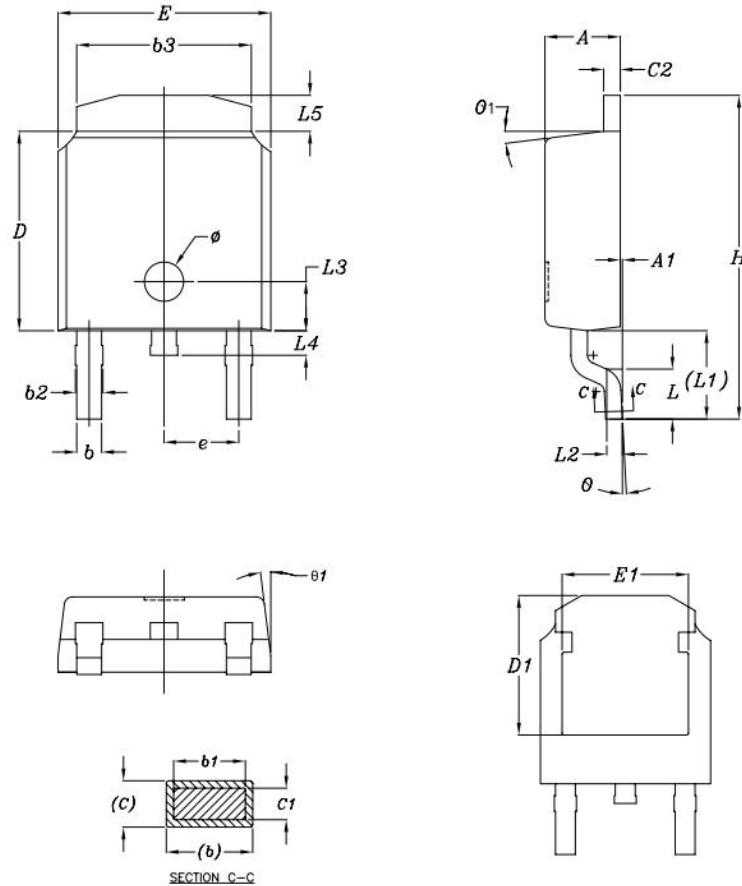


Figure 11 Normalized Maximum Transient Thermal Impedance

## 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
$\theta$	1°	5°	1°	5°
$\theta_1$	7° REF		7° REF	
$\phi$	1.20 REF		1.20 REF	

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