N-Channel Super Junction Power MOSFET Ⅳ

General Description

The series of devices use advanced trench gate super junction technology and design to provide ultra-low $R_{DS(ON)}$ and low gate charge and With a rapid recovery body diode.This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, industrial power applications,Fast charger, new energy vehicle charging pile, on-board OBC etc.

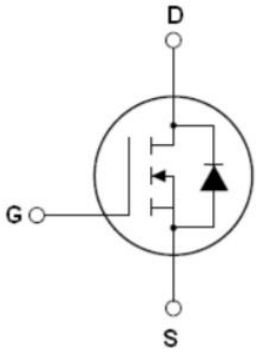
$V_{DS\ min@Tjmax}$	650	V
$R_{DS(ON)TYP.}$	1950	mΩ
I_D	1.8	A
Qg	3.9	nC

Features

- ●New technology for high voltage device
- ●Ultra low on-resistance and ultra low conduction losses
- ●Ultra Low Gate Charge cause lower driving requirements
- ●Diode reverse recovery speed is super fast
- ●100% Avalanche Tested and 100% T_{rr} Tested
- ●High reliability
- ●ROHS compliant

Application

- Power factor correction（PFC）
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）
- On-board charger(OBC)



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60N2K1R	SOT-223-2L	NCE60N2K1R

SOT-223-2L

Table 1. Absolute Maximum Ratings (T_C=25℃)

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	600	V
Gate-Source Voltage (V_{DS}=0V) ,AC (f>1 Hz)	V_{GS}	±30	V
Gate-Source Voltage (V_{DS}=0V) ,DC	V_{GS}	±20	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	1.8	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	1.26	A
Pulsed drain current (Note 1)	$I_{DM\ (pluse)}$	5.4	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	4.7 0.03	W W/°C
Single pulse avalanche energy (Note 2)	E_{AS}	1.25	mJ
Single pulse avalanche current (Note 2)	I_{AS}	0.5	A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	0.02	mJ

Reverse diode dv/dt， V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	15	V/ns
Drain Source voltage slope， V_{DS} ≤480 V	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+175	°C

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	31.9	°C /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	62	°C /W

Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250uA	600			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			100	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V			±200	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250uA	2.5	3.2	4.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=0.9A		1950	2100	mΩ
Dynamic Characteristics						
Gate Resistance	Rg	F=1MHZ, D-S short		17		Ω
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1MHz		119		pF
Output Capacitance	C_{oss}			17.3		pF
Reverse Transfer Capacitance	C_{rss}			6.8		pF
Total Gate Charge	Q_g	V_{DS}=450V,I_D=0.8A, V_{GS}=10V		3.9		nC
Gate-Source Charge	Q_{gs}			0.4		nC
Gate-Drain Charge	Q_{gd}			1		nC
Gate plateau voltage	Vgp			4.9		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=0.9A, R_G=3Ω,V_{GS}=10V		6		nS
Turn-on Rise Time	t_r			6		nS
Turn-Off Delay Time	$t_{d(off)}$			29		nS
Turn-Off Fall Time	t_f			48		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			1.8	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				5.4	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=1.8A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=0.9 A, di/dt=100A/μs		130		nS
Reverse Recovery Charge	Q_{rr}			0.52		uC
Peak reverse recovery current	I_{rrm}			8		A

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. Tj=25℃,VDD=50V,VG=10V, R_G=25Ω

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

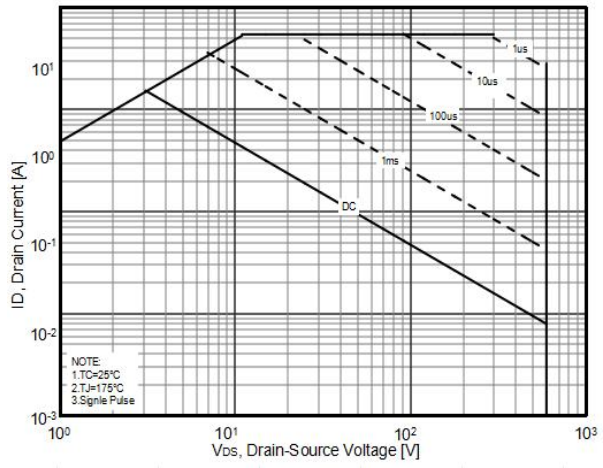


Figure2. Capacitance

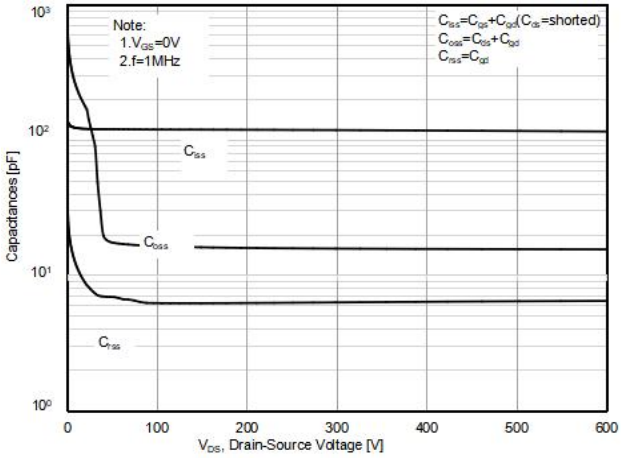


Figure3. Source-Drain Diode Forward Voltage

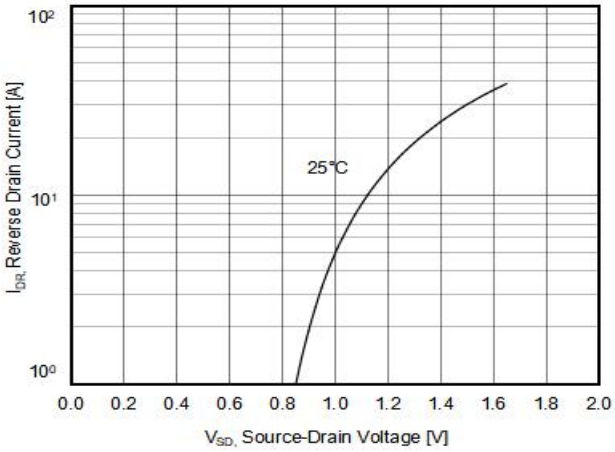


Figure4. Output characteristics

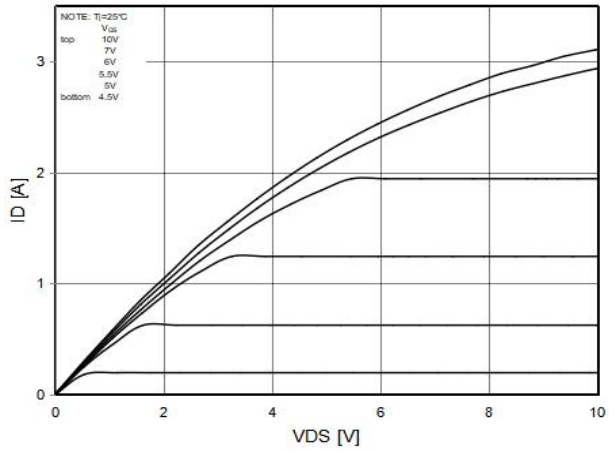


Figure5. Transfer characteristics

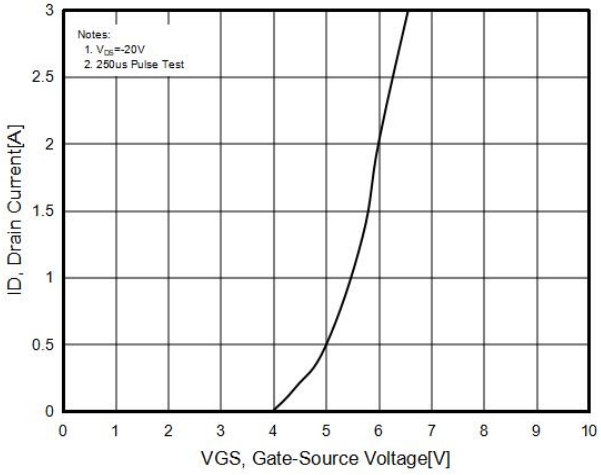


Figure6. Static drain-source on resistance

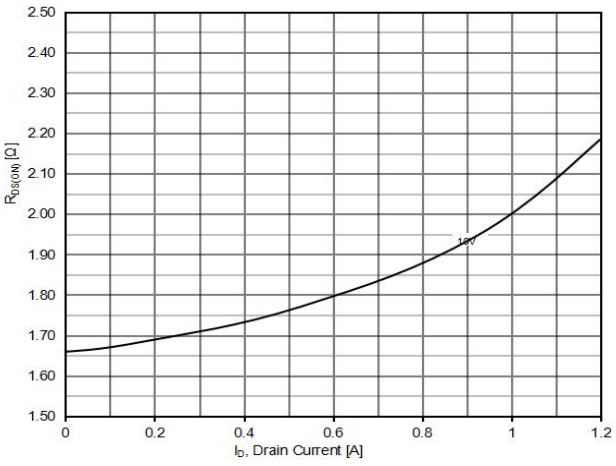


Figure7. $R_{DS(ON)}$ vs Junction Temperature

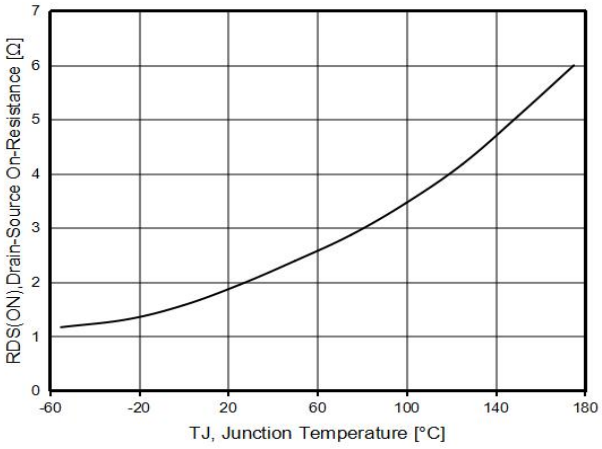


Figure8. BV_{DSS} vs Junction Temperature

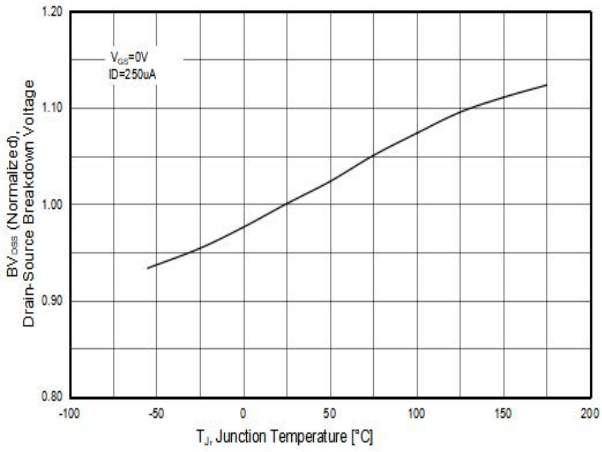


Figure9. Maximum I_D vs Junction Temperature

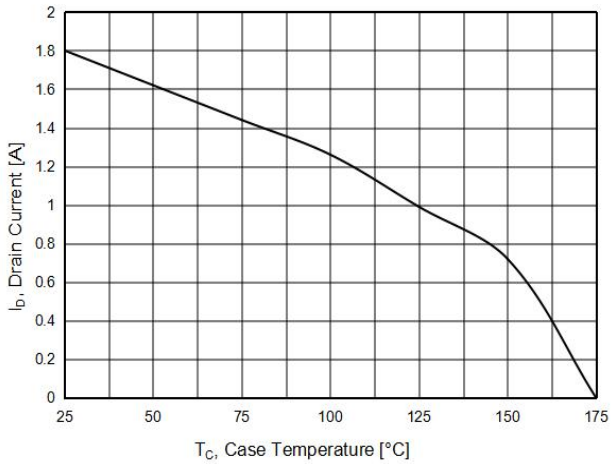
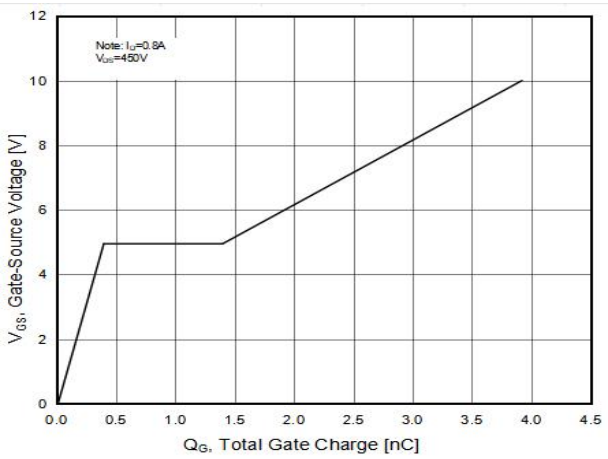
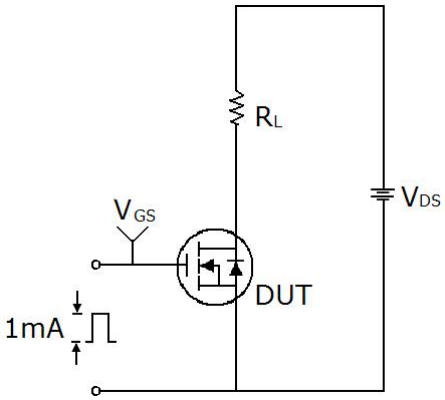


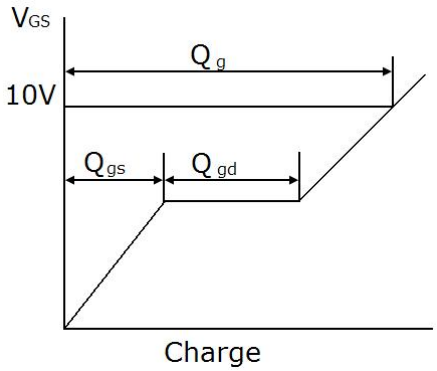
Figure10. Gate charge waveforms



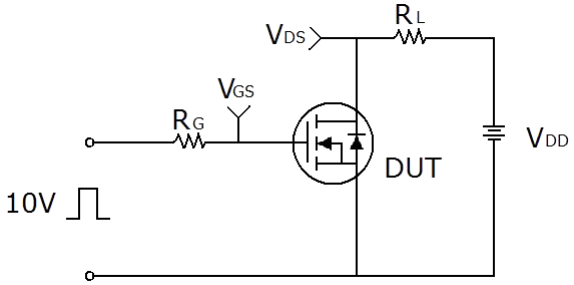
Test circuit

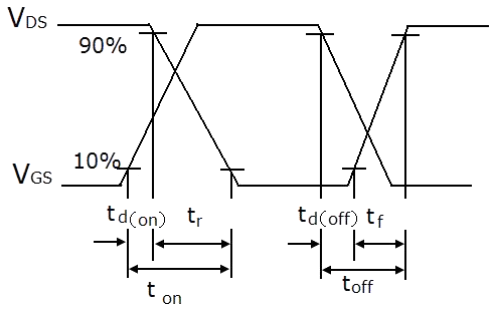
1）Gate charge test circuit & Waveform



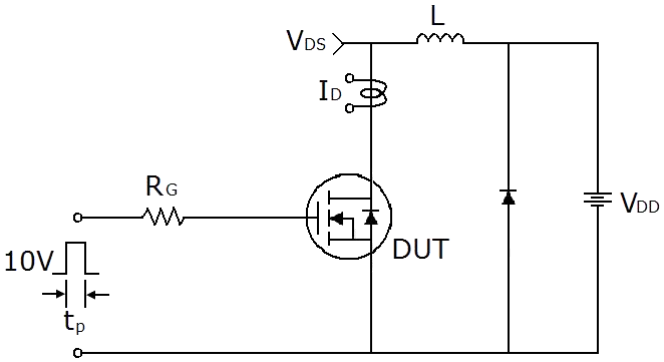


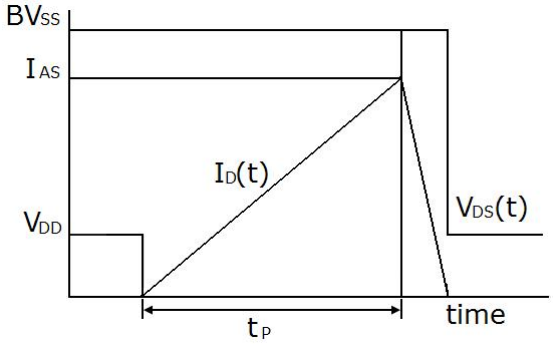
2）Switch Time Test Circuit：



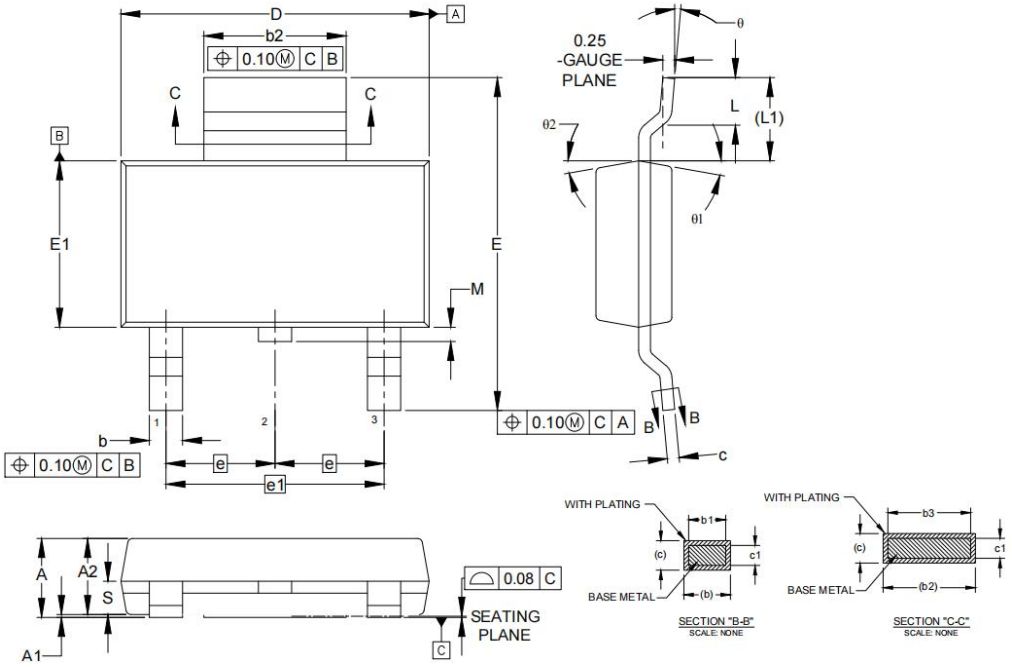


3）Unclamped Inductive Switching Test Circuit & Waveforms





SOT-223-2L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.52	1.80	0.060	0.071
A1	0.02	0.10	0.001	0.004
A2	1.50	1.70	0.059	0.067
b	0.60	0.80	0.024	0.031
b1	0.60	0.78	0.024	0.031
b2	2.95	3.10	0.116	0.122
b3	2.95	3.05	0.116	0.120
c	0.24	0.32	0.009	0.013
c1	0.24	0.30	0.009	0.012
D	6.30	6.70	0.248	0.264
E	6.70	7.30	0.264	0.287
E1	3.30	3.70	0.130	0.146
e	2.30 BSC.		0.091 BSC.	
e1	4.60 BSC.		0.182 BSC.	
L	0.90	1.10	0.035	0.043
L1	1.75 REF		0.069 REF	
M	——	0.50	——	0.020
S	0.70 REF		0.028 REF	
θ	0°	10°	0°	10°
θ1	10° REF		10° REF	
θ2	10° REF		10° REF	

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