N-Channel Super Junction Power MOSFET Ⅳ

General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

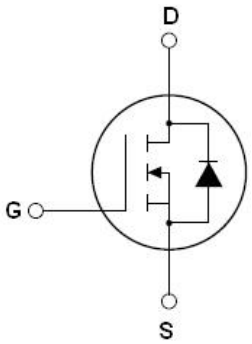
Features

- Optimized body diode reverse recovery performance
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

- Power factor correction（PFC）
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）
- LLC Half-bridge

$V_{DS\ min@Tjmax}$	710	V
$R_{DS(ON)TYP}$	460	mΩ
ID	8	A
Qg	12.8	nC



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65N520	TO-220-3L	NCE65N520

TO-220

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (VGS=0V）	V_{DS}	650	V
Gate-Source Voltage (VDS=0V) AC (f>1 Hz)	V_{GS}	±30	V
Gate-Source Voltage (VDS=0V) DC	V_{GS}	±20	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	8	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	5.6	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	24	A
Maximum Power Dissipation(Tc=25°C) Derate above 25°C	P_D	93 0.62	W W/°C
Avalanche current**(Note 2)**	I_{AS}	2.5	A
Drain Source voltage slope, V_{DS} ≤480 V,	dv/dt	50	V/ns
Reverse diode dv/dt，V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+175	°C

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	1.61	°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=250μA	650			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=650V,V_{GS}=0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=650V,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=250μA	3	3.5	4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=4A		460	530	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		532		pF
Output Capacitance	C_{oss}			21		pF
Reverse Transfer Capacitance	C_{rss}			3.5		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=4A, V_{GS}=10V		12.8		nC
Gate-Source Charge	Q_{gs}			1.9		nC
Gate-Drain Charge	Q_{gd}			6		nC
Gate plateau voltage	Vgp			4.9		V
Intrinsic gate resistance	R_G	f = 1 MHz open drain		35		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=480V,I_D=4A, R_G=1.7Ω,V_{GS}=10V		9		nS
Turn-on Rise Time	t_r			6		nS
Turn-Off Delay Time	$t_{d(off)}$			52		nS
Turn-Off Fall Time	t_f			7		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			8	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				24	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=8A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=4A, di/dt=100A/μs		190		nS
Reverse Recovery Charge	Q_{rr}			1.34		uC
Peak Reverse Recovery Current	I_{rrm}			14		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

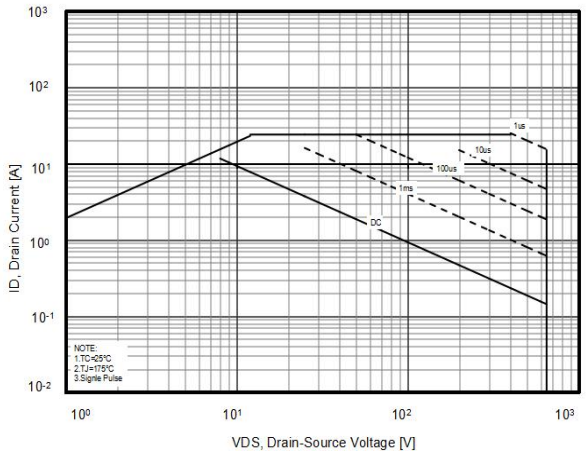


Figure2. Capacitance

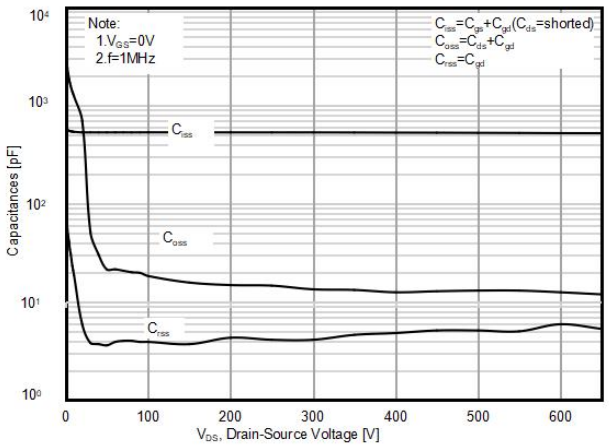


Figure3. Transfer characteristics

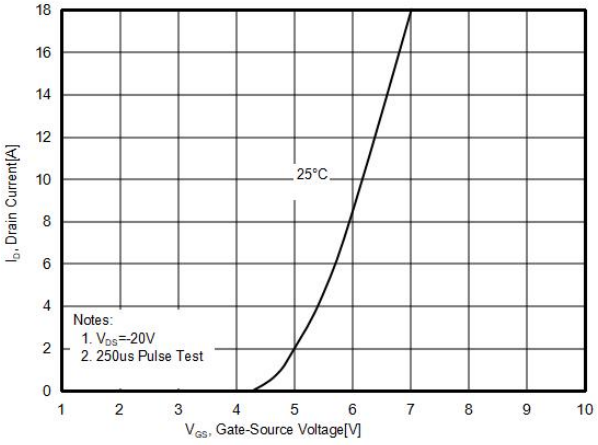


Figure4. Output characteristics

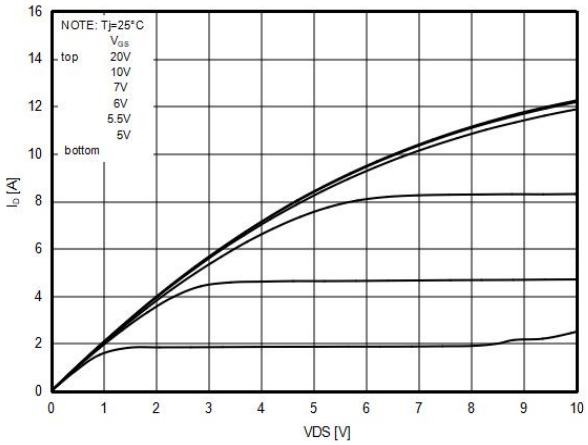


Figure5. $R_{DS(ON)}$ vs Junction Temperature

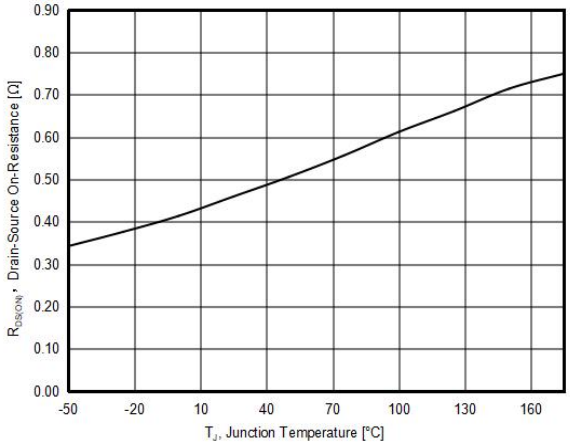


Figure6. BV_{DSS} vs Junction Temperature

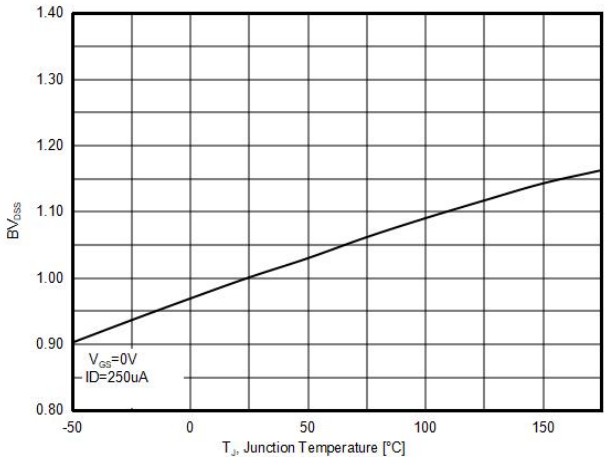


Figure7. Maximum I_D vs Junction Temperature

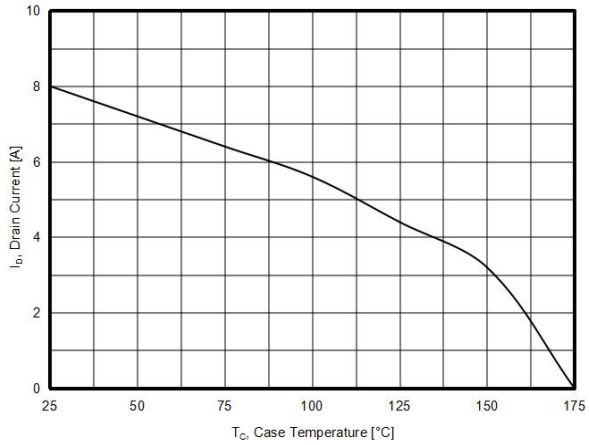


Figure8. Gate charge waveforms

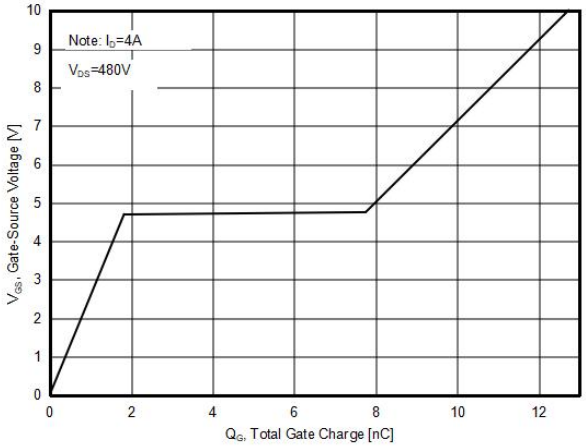


Figure9. Static drain-source on resistance

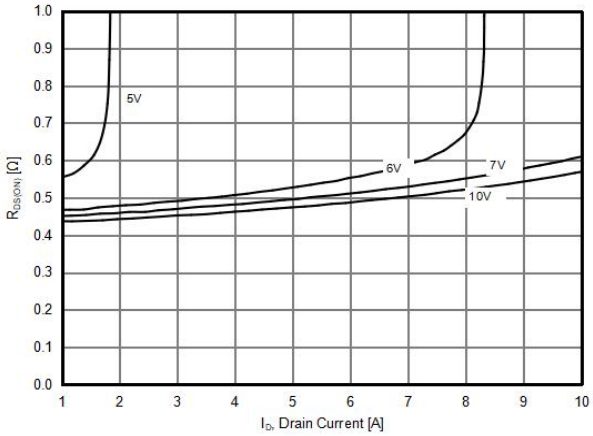
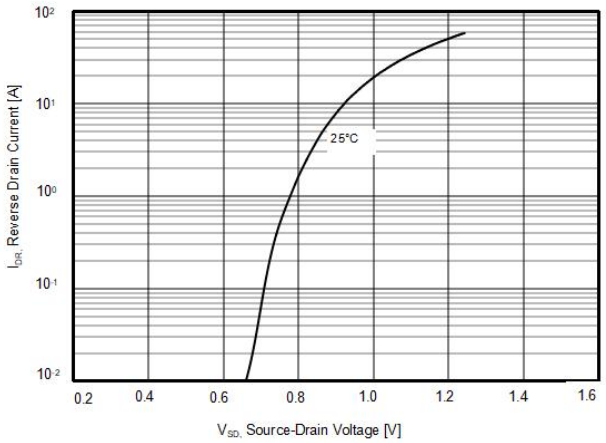
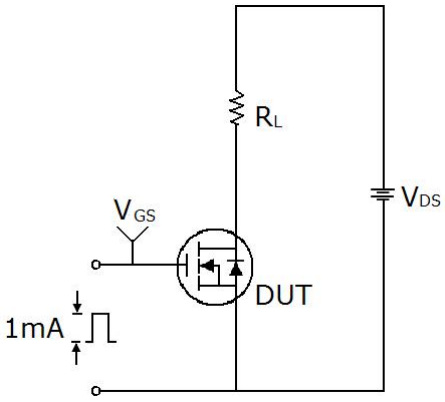


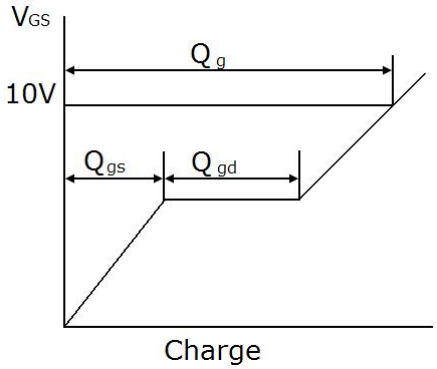
Figure10. Source-Drain Diode Forward Voltag



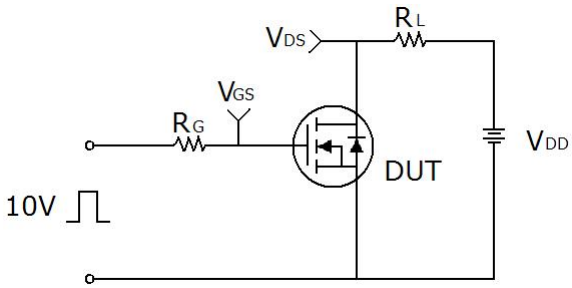
Test circuit

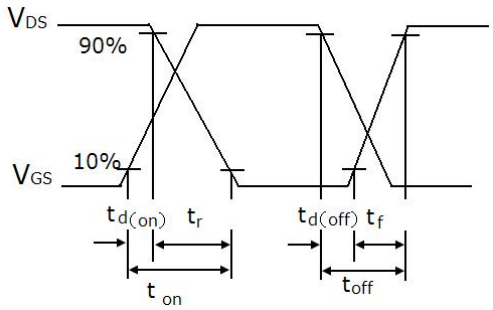
1）Gate charge test circuit & Waveform



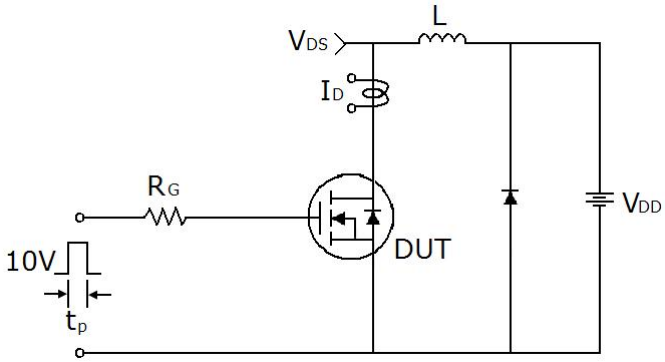


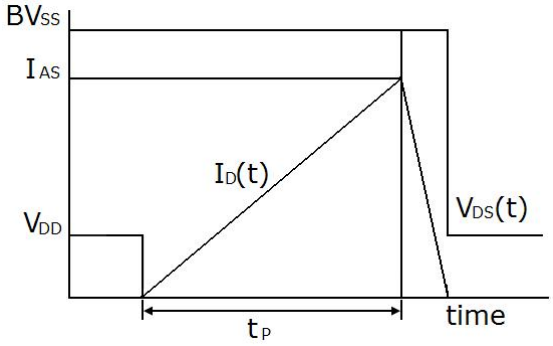
2）Switch Time Test Circuit：



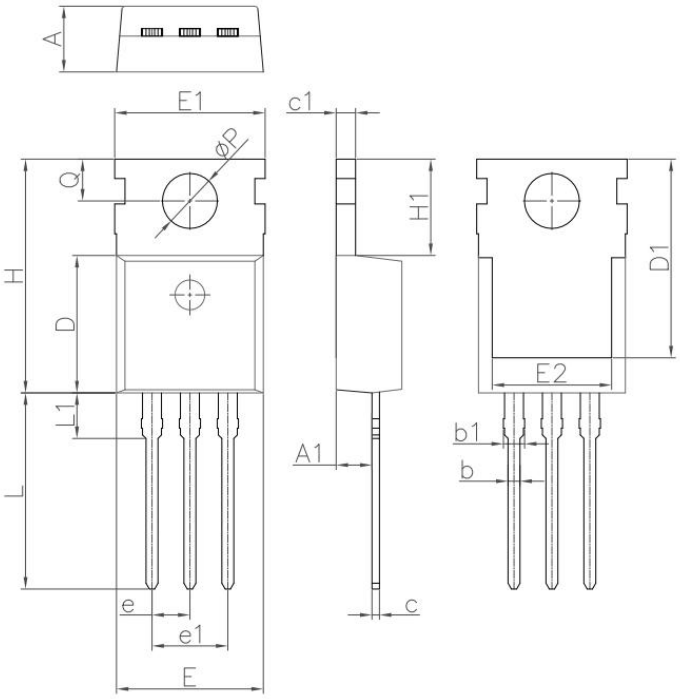


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-220-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.20	4.60	0.165	0.181
A1	2.25	2.55	0.089	0.100
b	0.70	0.90	0.028	0.035
b1	1.17	1.37	0.046	0.054
c	0.33	0.65	0.013	0.026
c1	1.20	1.40	0.047	0.055
D	8.95	9.75	3.524	3.839
D1	13.10	13.50	5.157	5.315
E	9.74	10.04	3.835	3.953
E1	9.91	10.25	3.902	4.035
E2	7.90	8.10	3.110	3.189
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	15.45	15.85	6.083	6.240
H1	6.30	6.60	2.480	2.598
L	12.90	13.40	5.079	5.276
L1	2.85	3.25	1.122	1.280
Q	2.65	2.95	1.043	1.161
ΦP	3.40	3.80	1.339	1.496

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