N-Channel Super Junction Power MOSFET Ⅳ

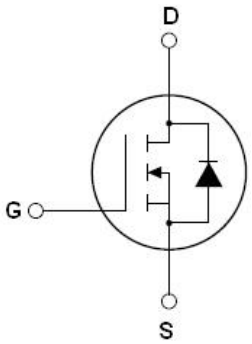
General Description

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.

$V_{DS\ min@Tjmax}$	710	V
$R_{DS(ON)TYP}$	160	mΩ
ID	20	A
Qg	28.5	nC

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



Schematic diagram

Application

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

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65N180F	TO-220F-3L	NCE65N180F

TO-220F

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	$I_{D\ (DC)}$	20	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	14	A
Pulsed drain current (Note 1)	$I_{DM\ (pluse)}$	60	A
Maximum Power Dissipation(Tc=25°C) Derate above 25°C	P_D	33.9 0.226	W W/°C
Avalanche current(Note 1)	I_{AS}	6	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	50	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}	4.42	°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			±100	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=10A		160	180	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		1550	1950	pF
Output Capacitance	C_{oss}			60		pF
Reverse Transfer Capacitance	C_{rss}			5		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=10.5A, V_{GS}=10V		28.5		nC
Gate-Source Charge	Q_{gs}			11.7		nC
Gate-Drain Charge	Q_{gd}			5		nC
Gate plateau voltage	Vgp			5.7		V
Intrinsic gate resistance	R_G	f = 1 MHz open drain		2		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=10A, R_G=1.7Ω,V_{GS}=10V		32		nS
Turn-on Rise Time	t_r			18		nS
Turn-Off Delay Time	$t_{d(off)}$			90		nS
Turn-Off Fall Time	t_f			8		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			20	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				60	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=20A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=10A, di/dt=100A/μs		300		nS
Reverse Recovery Charge	Q_{rr}			4.5		uC
Peak Reverse Recovery Current	I_{rrm}			30		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

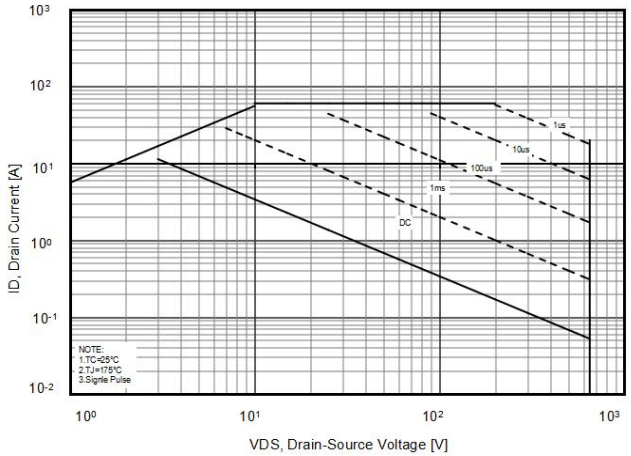


Figure2. Capacitance

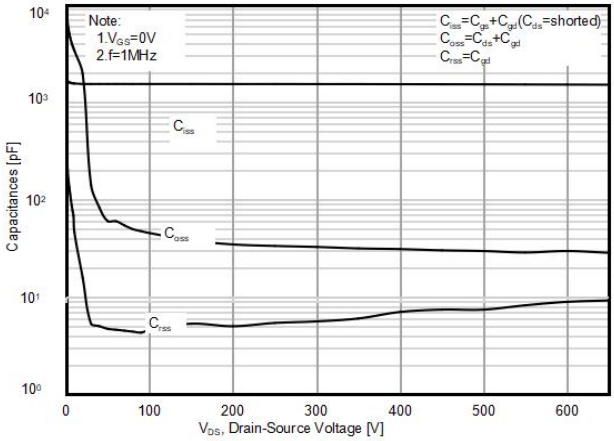


Figure3. Transfer characteristics

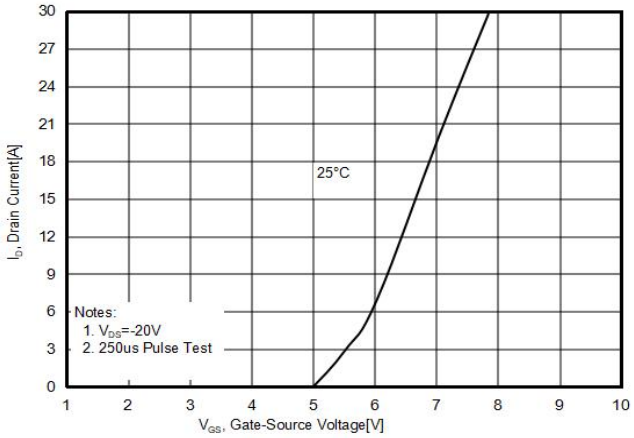


Figure4. Output characteristics

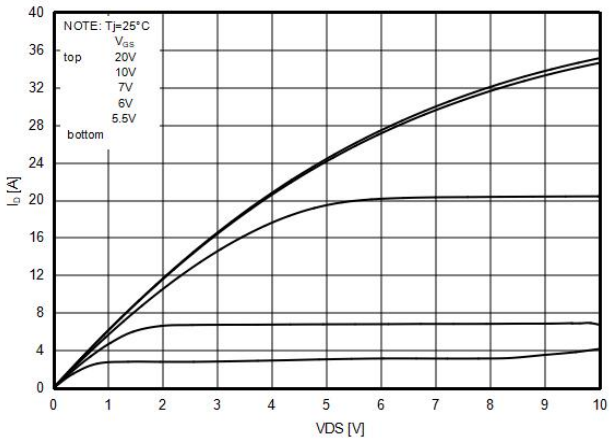


Figure5. $R_{DS(ON)}$ vs Junction Temperature

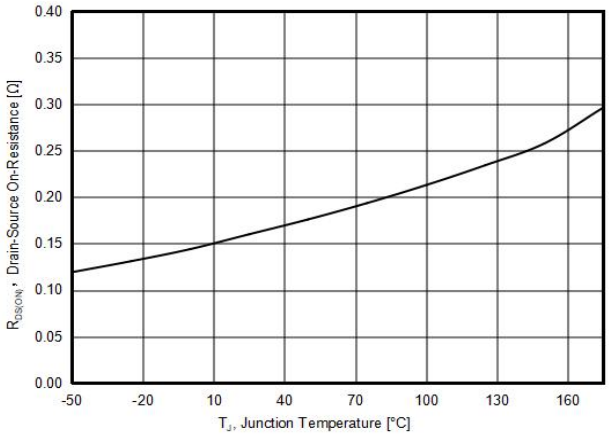


Figure6. BV_{DSS} vs Junction Temperature

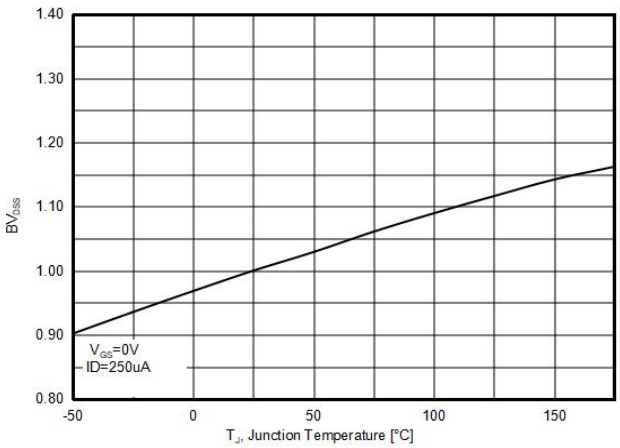


Figure7. Maximum I_D vs Junction Temperature

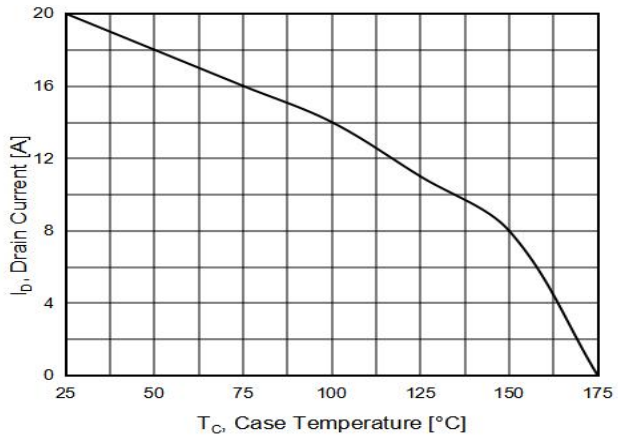


Figure8. Gate charge waveforms

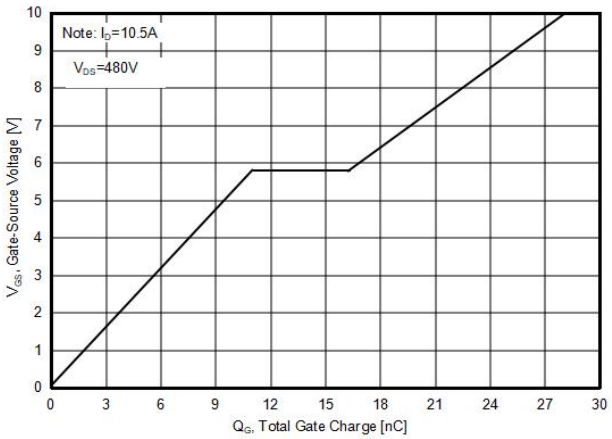


Figure9. Static drain-source on resistance

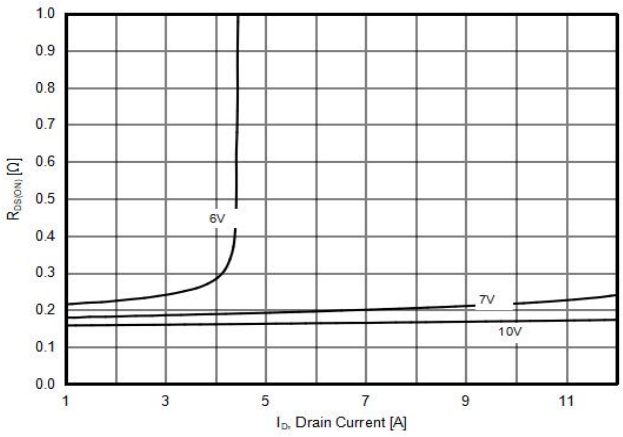
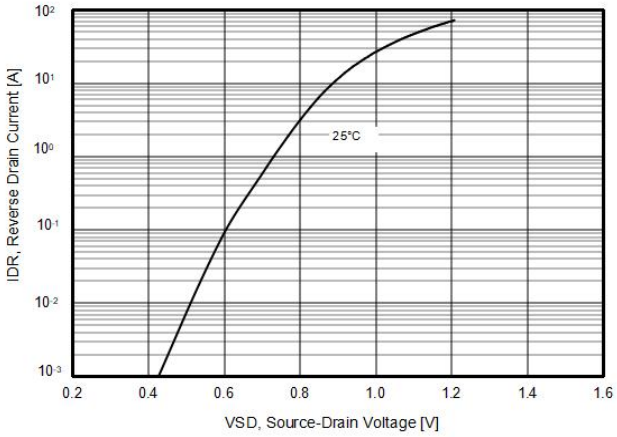
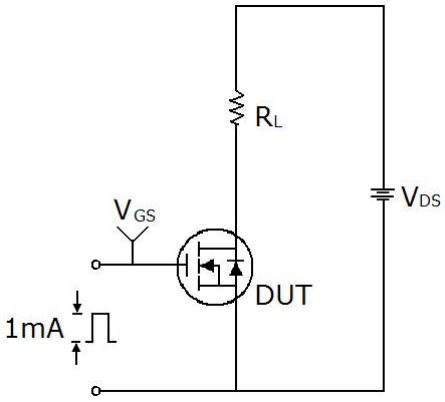


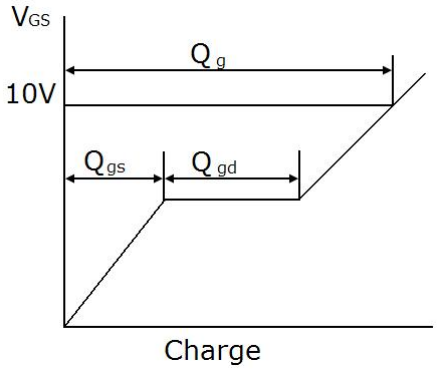
Figure10. Source-Drain Diode Forward Voltage



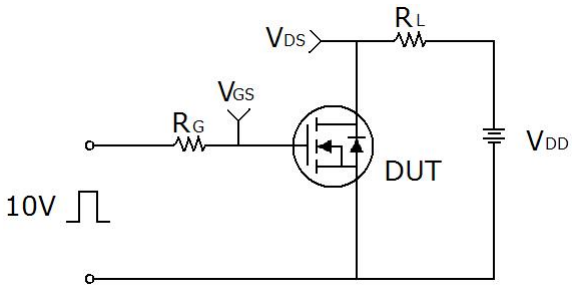
Test circuit

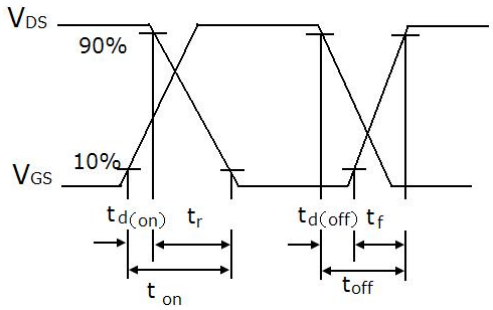
1）Gate charge test circuit & Waveform



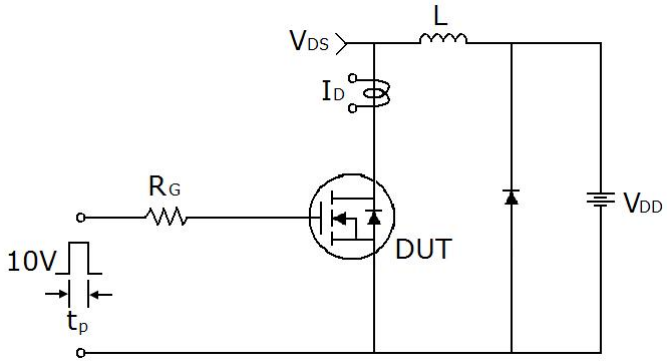


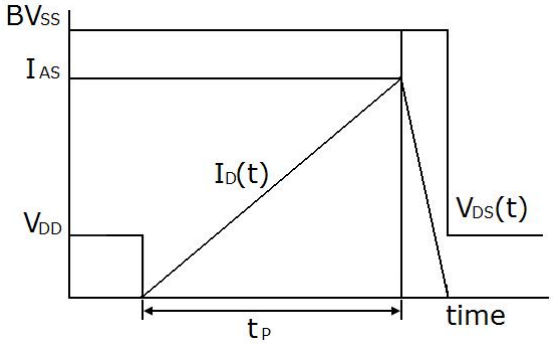
2）Switch Time Test Circuit：



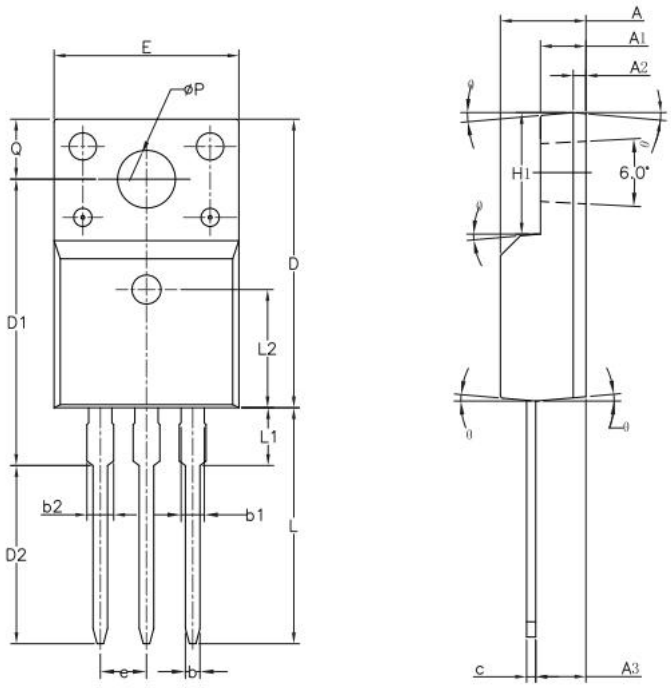


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-220F-3L-P Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.50	4.83	0.177	0.190
A1	2.34	2.74	0.092	0.108
A2	0.70 REF		0.70 REF	
A3	2.56	2.93	0.101	0.115
b1	1.18	1.38	0.046	0.054
b2		1.47		0.058
c	0.45	0.60	0.018	0.024
D	15.67	16.07	0.617	0.633
D1	15.55	15.95	0.612	0.628
D2	9.60	10.00	0.378	0.394
E	9.96	10.36	0.392	0.408
e	2.54 BSC		2.54 BSC	
H1	6.48	6.88	0.255	0.271
L	12.68	13.28	0.499	0.523
L1		3.50		0.138
L2	6.5 REF		6.5 REF	
ΦP	3.08	3.28	0.121	0.129
Q1	3.20	3.40	0.126	0.134

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