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.

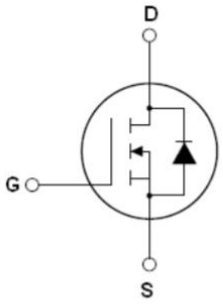
Features

- 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

$V_{DS\ min@Tjmax}$	550	V
$R_{DS(ON)TYP.}$	110	mΩ
I_D	23.5	A
Qg	24.5	nC



Schematic diagram

✧ **Intrinsic fast-recovery body diode**

Package Marking And Ordering Information

Device	Device Package	Marking
NCE50NF130D	TO-263	NCE50NF130D

TO-263-2L

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	500	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	$I_{D\ (DC)}$	23.5	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	16.45	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	70.5	A
Maximum Power Dissipation(Tc=25℃)	P_D	186	W
Derate above 25°C		1.24	W/°C
Single pulse avalanche current **(Note 2)**	I_{AS}	6	A
Reverse diode dv/dt， V_{DS} ≤400 V,I_{SD}<I_D	dv/dt	15	V/ns
Drain Source voltage slope， V_{DS} ≤400 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}	0.80	°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	500			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=500V,V_{GS}=0V			10	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=500V,V_{GS}=0V			300	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	3		5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=12A		110	130	mΩ
Dynamic Characteristics						
Gate Resistance	Rg	F=1MHZ, D-S short		2		Ω
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1MHz		1544		pF
Output Capacitance	C_{oss}			630		pF
Reverse Transfer Capacitance	C_{rss}			6.1		pF
Total Gate Charge	Q_g	V_{DS}=400V,I_D=12A, V_{GS}=10V		24.5		nC
Gate-Source Charge	Q_{gs}			11.5		nC
Gate-Drain Charge	Q_{gd}			6.5		nC
Gate plateau voltage	Vgp			7.7		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=400V,I_D=12A, R_G=4Ω,V_{GS}=10V		13		nS
Turn-on Rise Time	t_r			10		nS
Turn-Off Delay Time	$t_{d(off)}$			58		nS
Turn-Off Fall Time	t_f			9		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			23.5	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				70.5	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=23.5A,V_{GS}=0V		0.9	1.1	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F12A, di/dt=100A/μs		170		nS
Reverse Recovery Charge	Q_{rr}			1.02		uC
Peak reverse recovery current	I_{rrm}			12		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

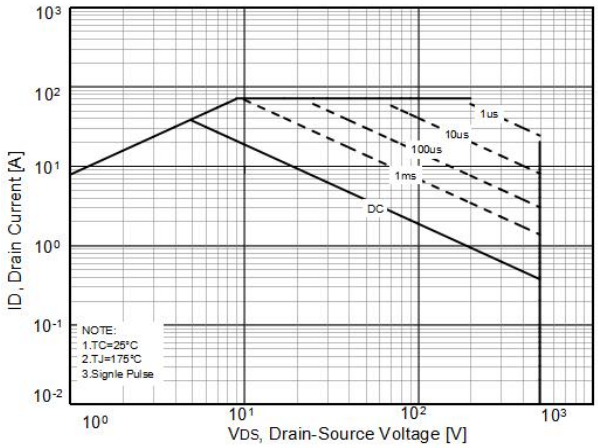


Figure2. Source-Drain Diode Forward Voltage

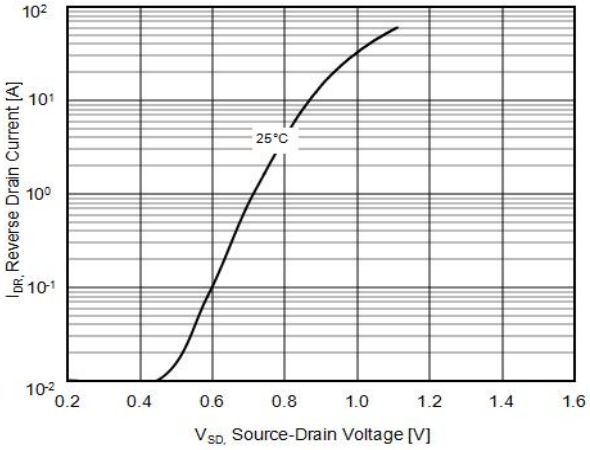


Figure3. Output characteristics

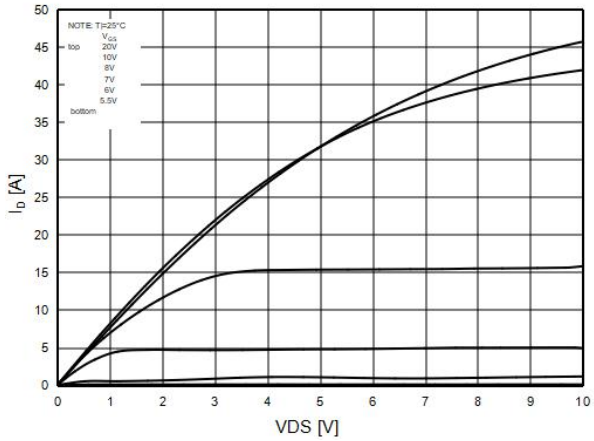


Figure4. Transfer characteristics

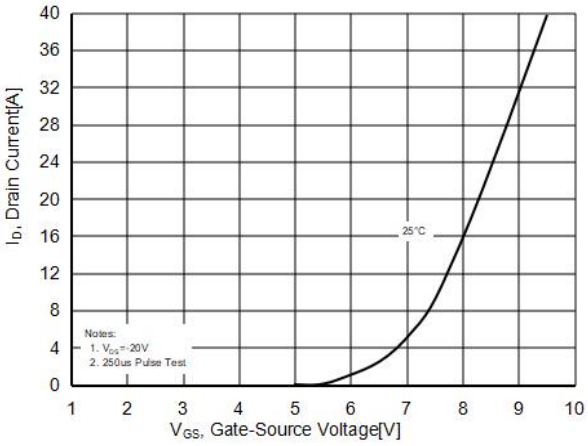


Figure5. Static drain-source on resistance

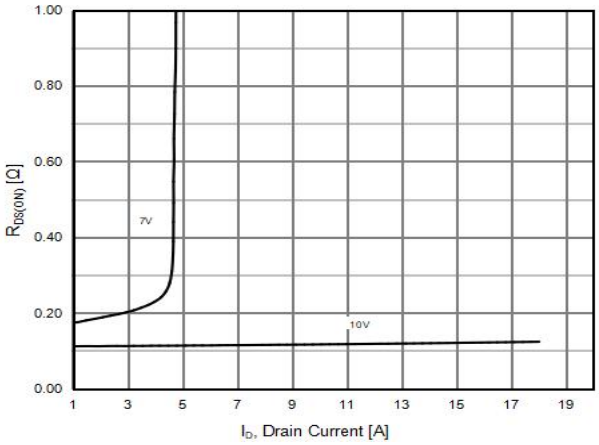


Figure6. $R_{DS(ON)}$ vs Junction Temperature

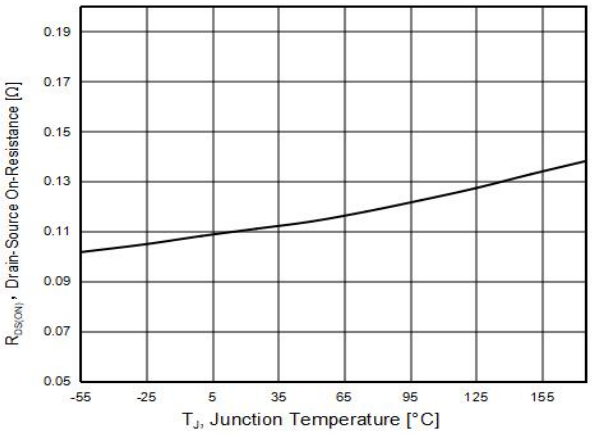


Figure7. BV_{DSS} vs Junction Temperature

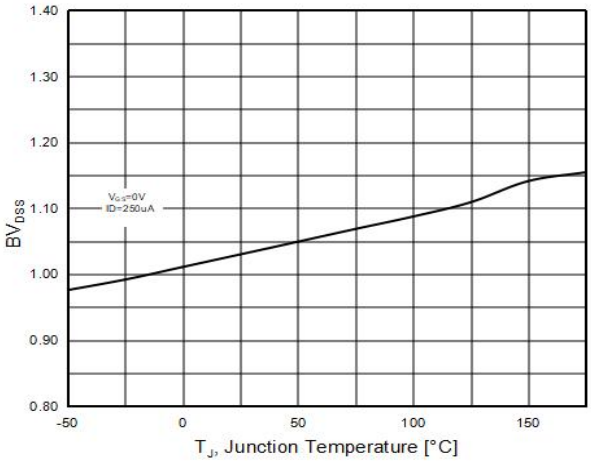


Figure8. Maximum I_D vs Junction Temperature

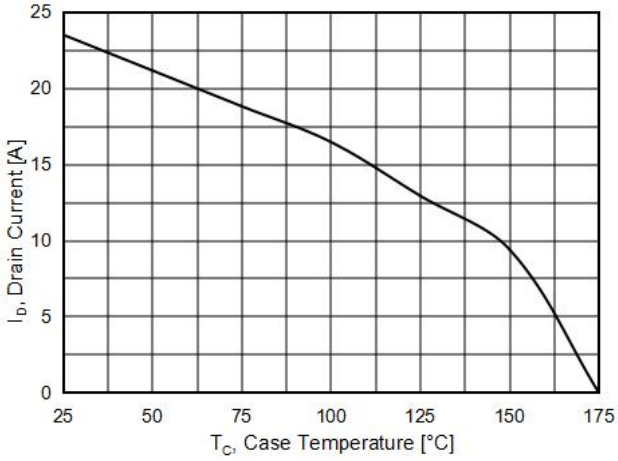


Figure9. Gate charge waveforms

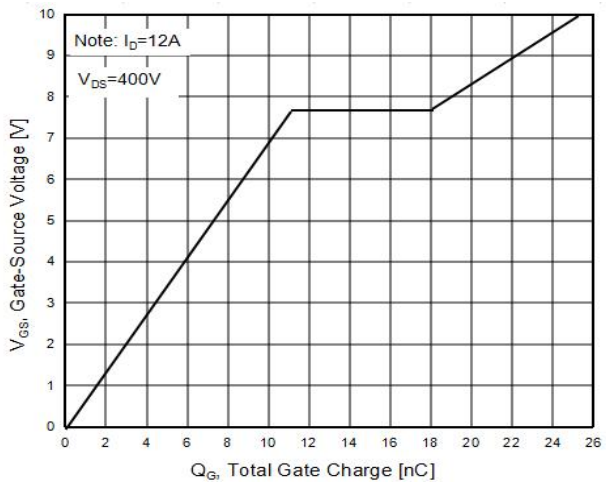
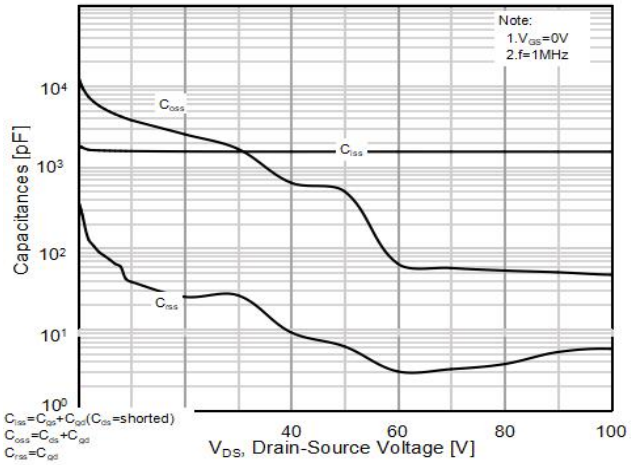
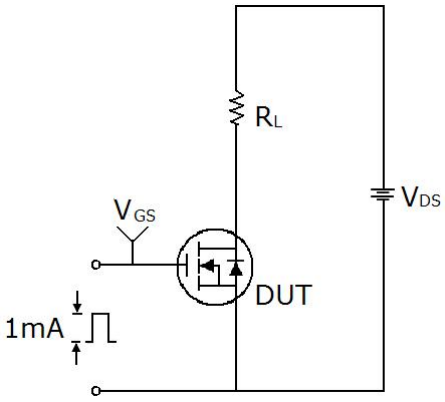


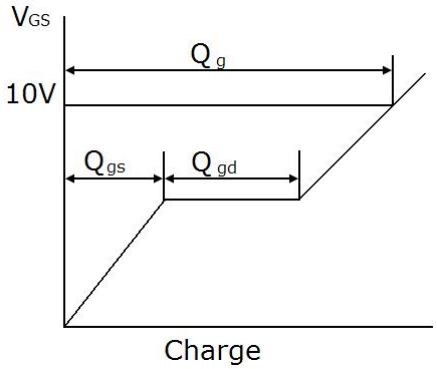
Figure10. Capacitance



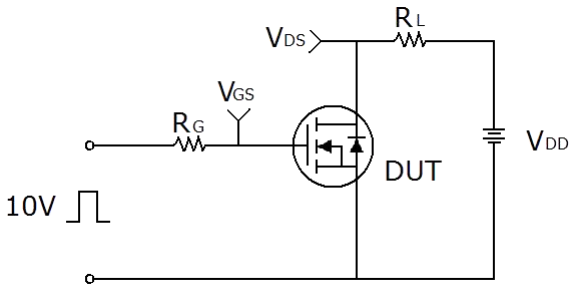
Test circuit

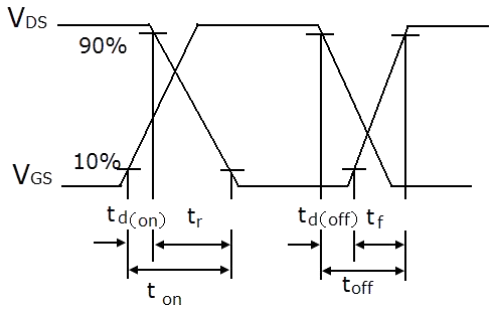
1）Gate charge test circuit & Waveform



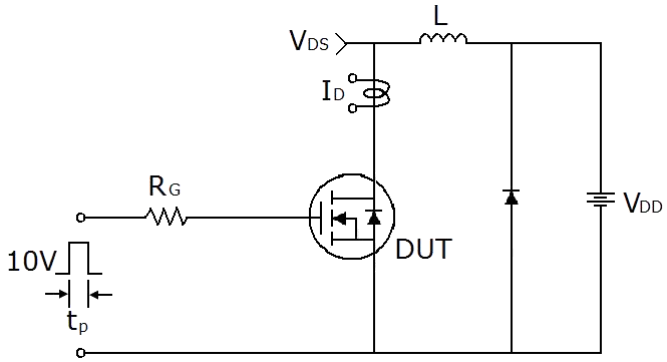


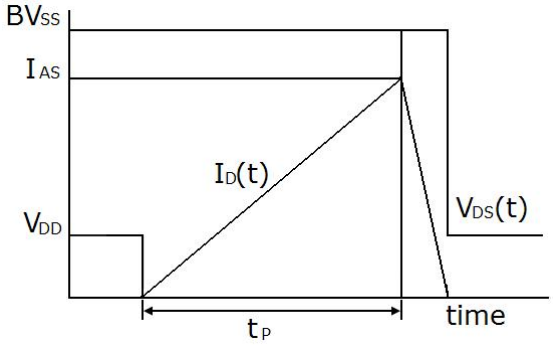
2）Switch Time Test Circuit：



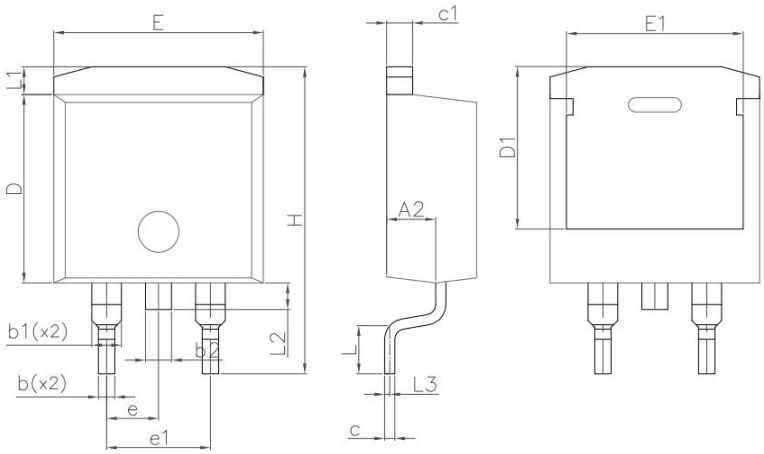


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-263-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.20	4.60	0.165	0.181
A1	0.00	0.25	0.00	0.010
A2	2.20	2.60	0.087	0.102
b	0.70	0.90	0.028	0.035
b1	1.20	1.75	0.047	0.069
b2	1.17	1.37	0.046	0.054
c	0.40	0.60	0.016	0.024
c1	1.15	1.40	0.045	0.055
D	9.10	9.30	0.358	0.366
D1	7.63	8.23	0.300	0.324
E	10.05	10.45	0.396	0.411
E1	8.35	8.95	0.329	0.352
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	1.36REF		0.054REF	
L2	1.30REF		0.051REF	

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