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.

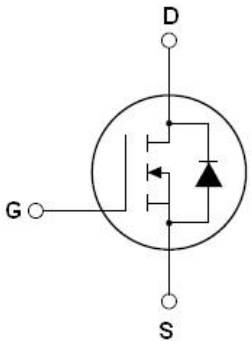
Features

- 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

$V_{DS\ min@Tjmax}$	650	V
$R_{DS(ON)TYP}$	145	mΩ
ID	21	A
Qg	23	nC



Schematic diagram

✧ **Intrinsic fast-recovery body diode**

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60NF160K	TO-252	NCE60NF160K

G D S

TO-252

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (VGS=0V）	V_{DS}	600	V
Gate-Source Voltage (VDS=0V) AC (f>1 Hz)	V_{GS}	±30	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	21	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	14.7	A
Pulsed drain current (Note 1)	$I_{DM\ (pluse)}$	63	A
Maximum Power Dissipation(Tc=25°C) Derate above 25°C	P_D	194 1.29	W W/°C
Single pulse avalanche energy (Note 2)	E_{AS}	64	mJ
Avalanche current(Note 1)	I_{AR}	4	A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	0.35	mJ
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}	0.77	°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	600			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			10	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			200	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	4	5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=10.5A		145	160	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		1200	1400	pF
Output Capacitance	C_{oss}			50		pF
Reverse Transfer Capacitance	C_{rss}			1.5		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=10.5A, V_{GS}=10V		23		nC
Gate-Source Charge	Q_{gs}			9		nC
Gate-Drain Charge	Q_{gd}			6.5		nC
Gate plateau voltage	Vgp			6.1		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=10.5A, R_G=1.7Ω,V_{GS}=10V		42		nS
Turn-on Rise Time	t_r			18		nS
Turn-Off Delay Time	$t_{d(off)}$			90		nS
Turn-Off Fall Time	t_f			24		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			18	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				54	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=21A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=10.5A, di/dt=100A/μs		113		nS
Reverse Recovery Charge	Q_{rr}			0.5		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

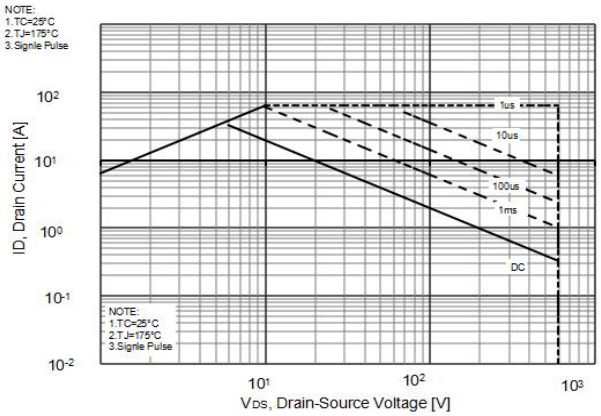


Figure2. Capacitance

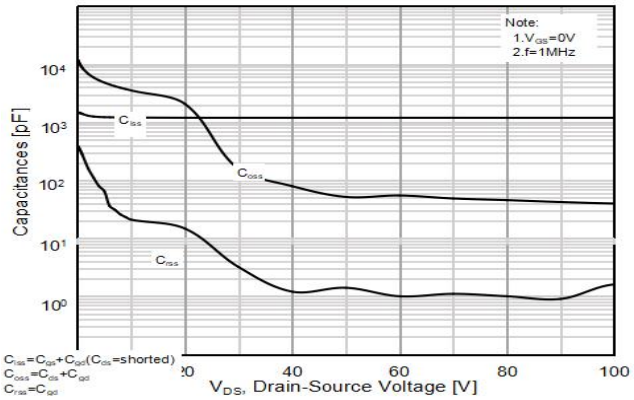


Figure3. Source-Drain Diode Forward Voltage

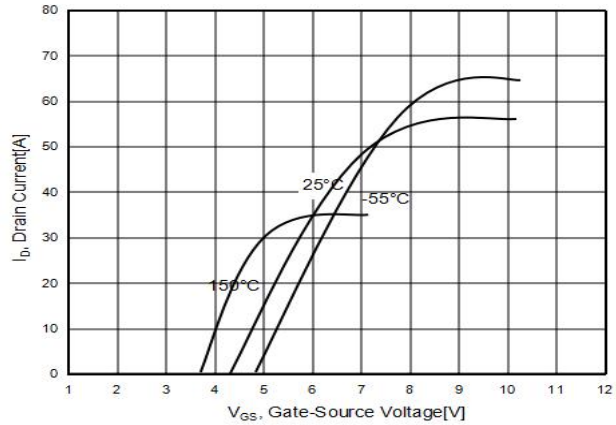


Figure4. Output characteristics

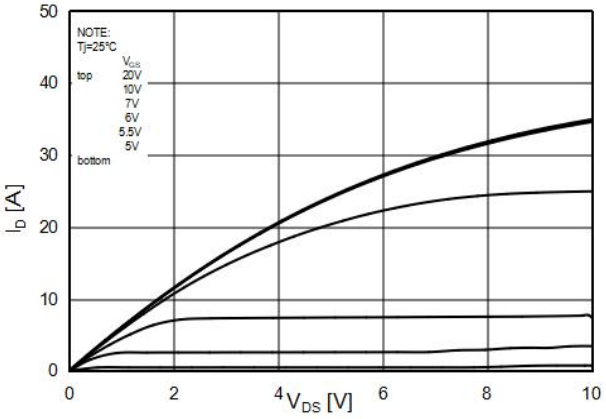


Figure5. $R_{DS(ON)}$ vs Junction Temperature

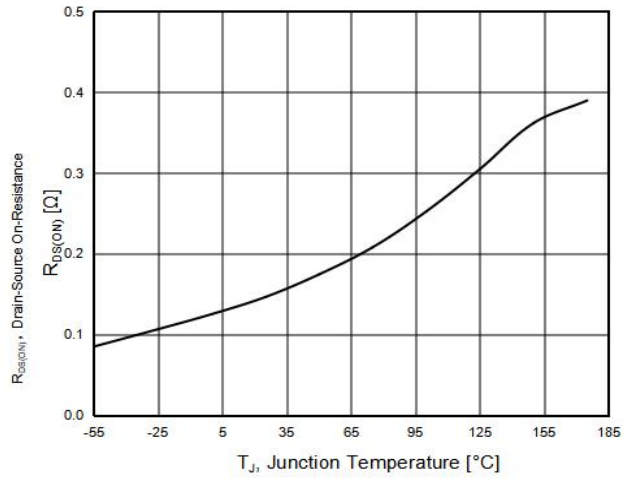


Figure6. BV_{DSS} vs Junction Temperature

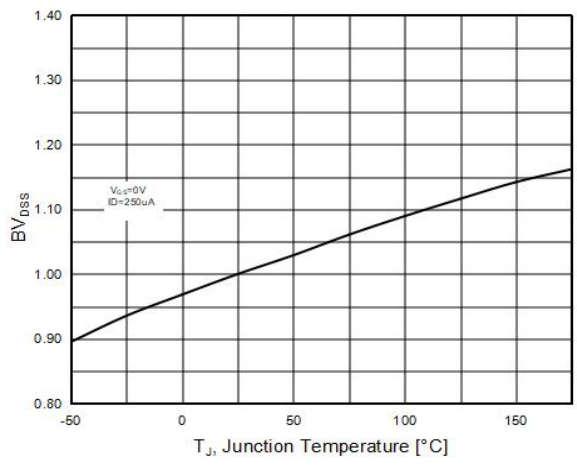


Figure7. Maximum I_D vs Junction Temperature

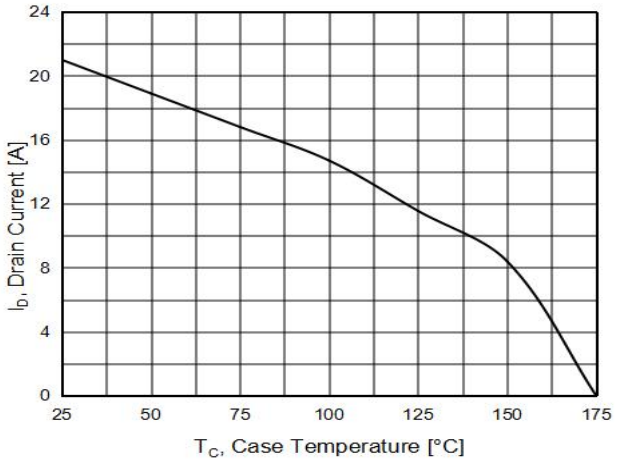


Figure8. Gate charge waveforms

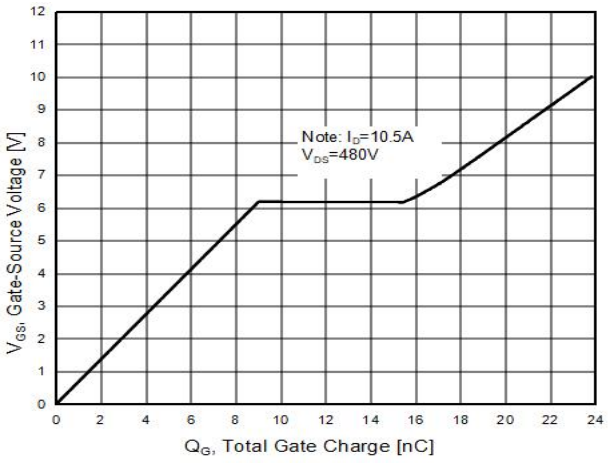


Figure9. Static drain-source on resistance

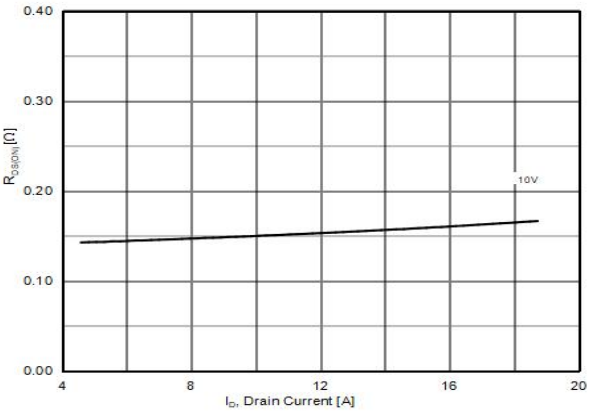
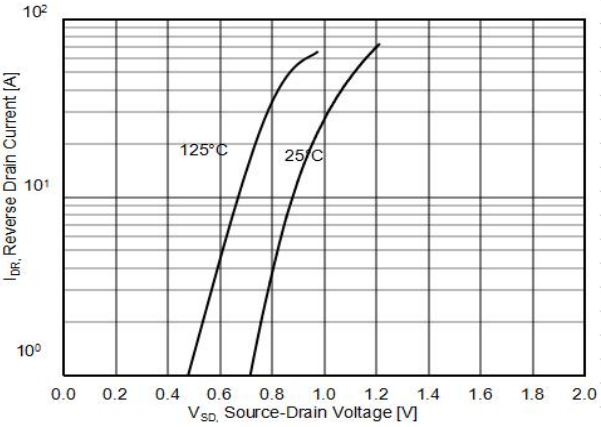
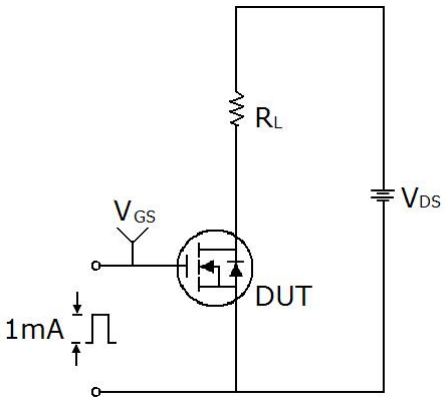


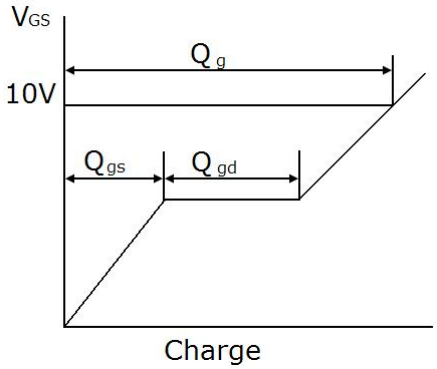
Figure10. Source-Drain Diode Forward Voltage



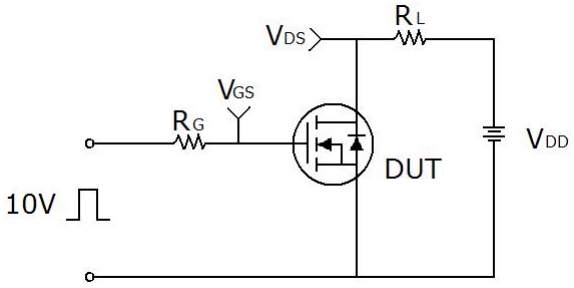
Test circuit

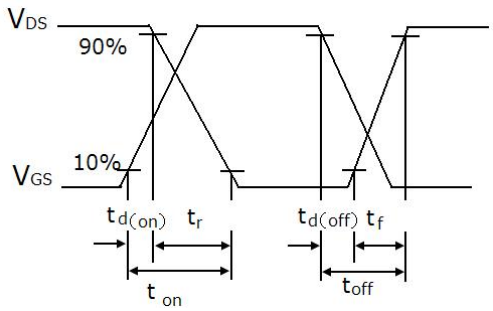
1）Gate charge test circuit & Waveform



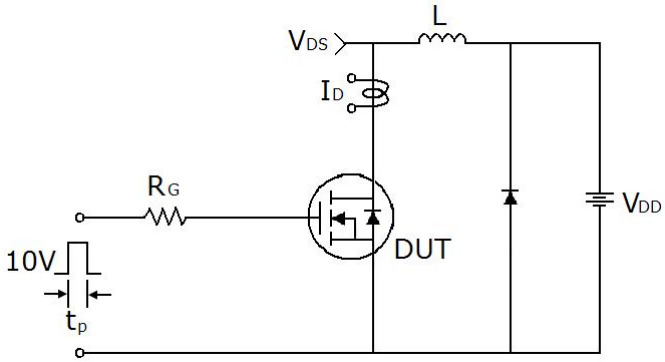


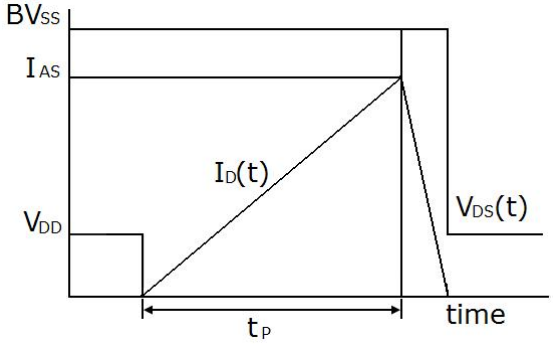
2）Switch Time Test Circuit：



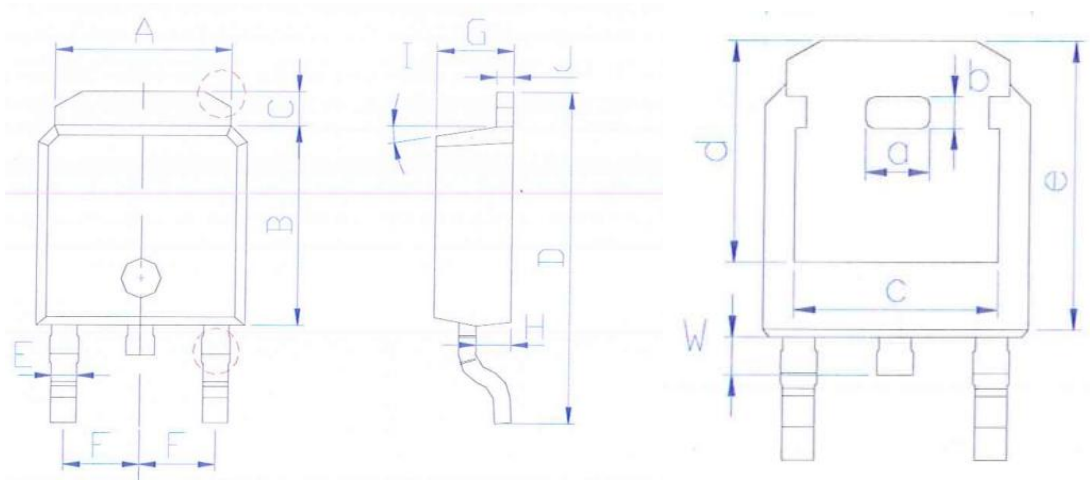


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-252 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	5.04	5.64	0.198	0.222
B	5.70	6.03	0.224	0.237
C	0.75	1.35	0.030	0.053
D	9.65	10.25	0.380	0.404
E	0.61	0.91	0.024	0.036
F	2.13	2.43	0.084	0.096
G	2.00	2.60	0.079	0.102
H	0.76	1.36	0.030	0.054
J	0.36	0.66	0.014	0.026
W	0.60	1.20	0.024	0.047
a	1.50	2.10	0.059	0.083
b	0.45	1.05	0.018	0.041
c	4.55	5.15	0.179	0.203
d	5.00	5.60	0.197	0.220
e	6.60	7.20	0.260	0.283

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