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.

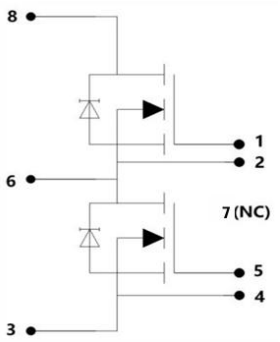
Features

- 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)
- LLC Half-bridge

$V_{DS\ min@Tjmax}$	650	V
$R_{DS(ON)TYP.}$	35	mΩ
I_D	61	A
Qg	87	nC

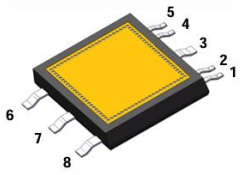


✧ **Intrinsic fast-recovery body diode**

Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60NF040S	HSOP8	NCE60NF040S



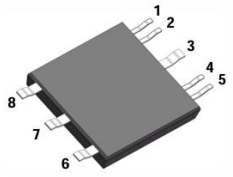


Table 1. Absolute Maximum Ratings (T_C=25℃)

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	$I_{D\ (DC)}$	61	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	42.7	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	183	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	411 2.74	W W/°C
Single pulse avalanche energy **(Note 2)**	E_{AS}	484	mJ
Single pulse avalanche current **(Note 2)**	I_{AS}	11	A

Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	0.9	mJ
Reverse diode dv/dt， V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	50	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	℃

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	0.36	℃ /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	62	℃ /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=1mA	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			600	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=2mA	3.5	4.2	5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=30.5A		35	40	mΩ
Dynamic Characteristics						
Gate Resistance	Rg	F=1MHZ, D-S short		2.6		Ω
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1MHz		5480		pF
Output Capacitance	C_{oss}			242		pF
Reverse Transfer Capacitance	C_{rss}			5.5		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=30.5A,V_{GS}=10 V		87		nC
Gate-Source Charge	Q_{gs}			35		nC
Gate-Drain Charge	Q_{gd}			29		nC
Gate plateau voltage	Vgp			7.3		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=30.5A, R_G=3Ω,V_{GS}=10V		48		nS
Turn-on Rise Time	t_r			18		nS
Turn-Off Delay Time	$t_{d(off)}$			126		nS
Turn-Off Fall Time	t_f			15		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			61	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				183	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=61A,V_{GS}=0V		1.0	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=30.5 A, di/dt=100A/μs		175		nS
Reverse Recovery Charge	Q_{rr}			1.14		uC
Peak reverse recovery current	I_{rrm}			13		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

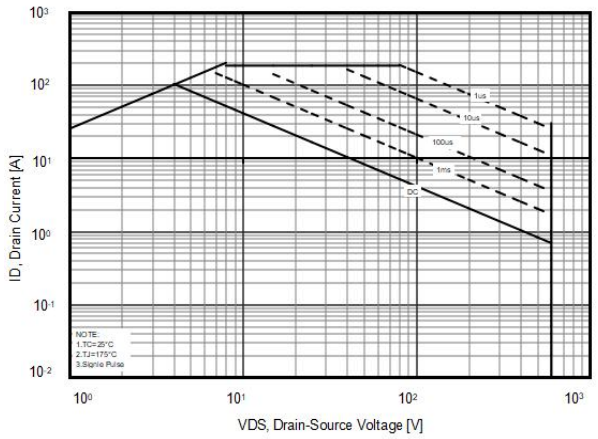


Figure2. Capacitance

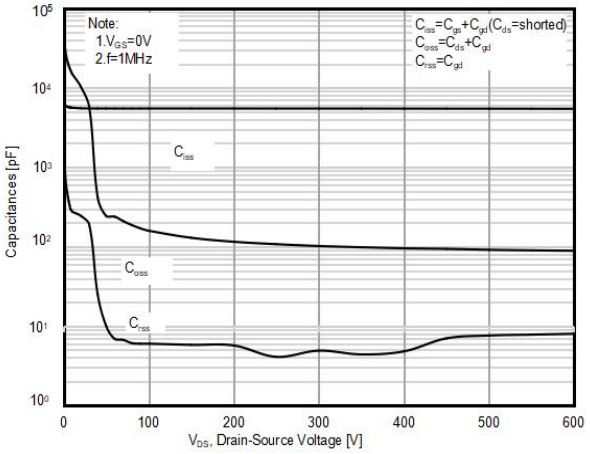


Figure3. Source-Drain Diode Forward Voltage

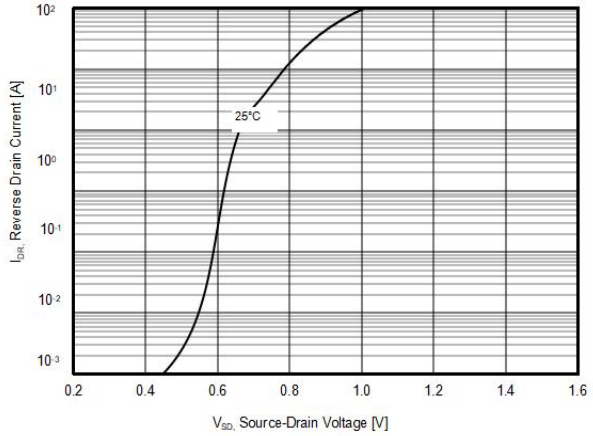


Figure4. Output characteristics

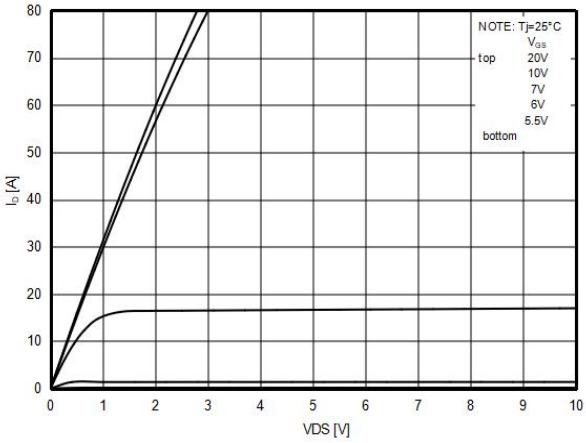


Figure5. Transfer characteristics

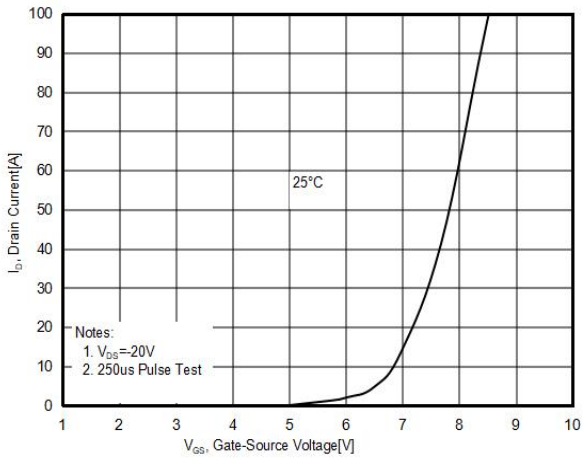


Figure6. Static drain-source on resistance

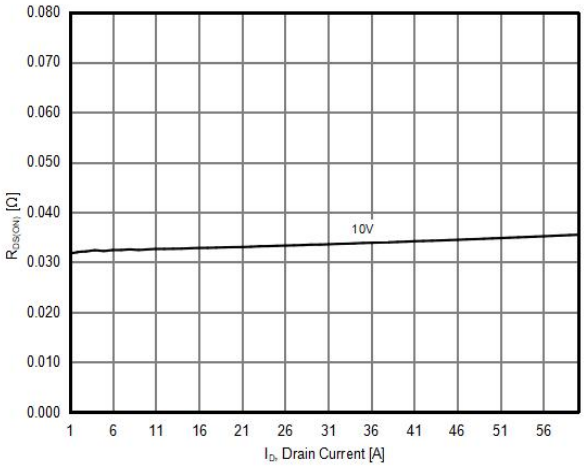


Figure7. $R_{DS(ON)}$ vs Junction Temperature

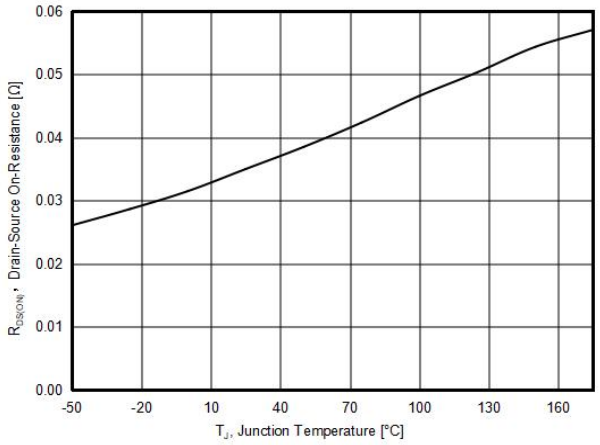


Figure8. BV_{DSS} vs Junction Temperature

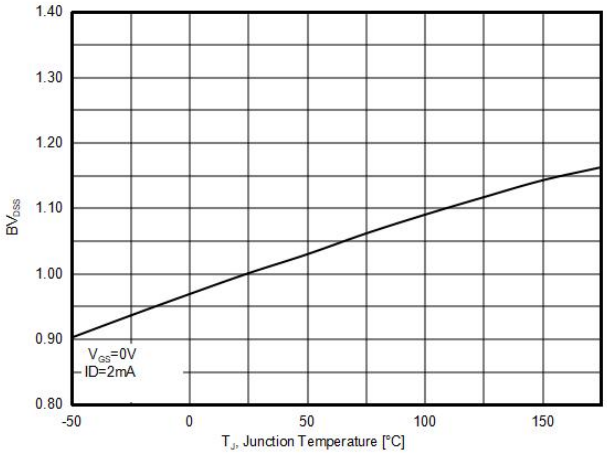


Figure9. Maximum I_D vs Junction Temperature

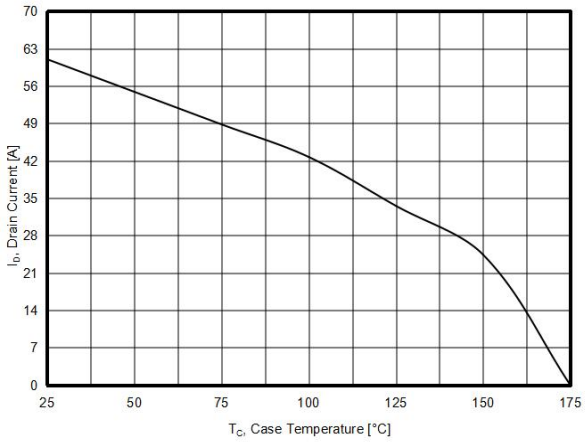
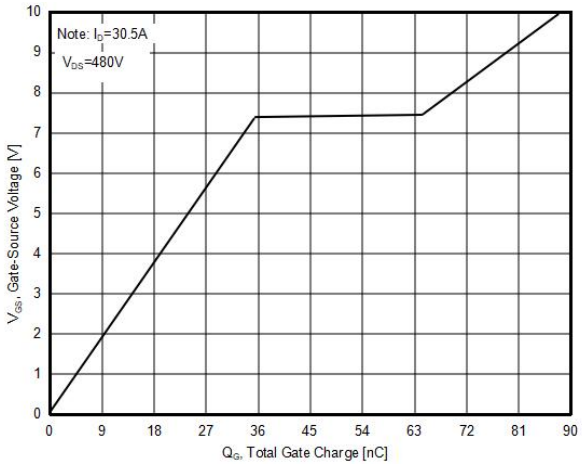
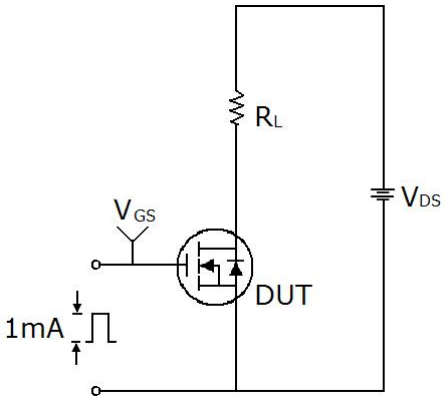


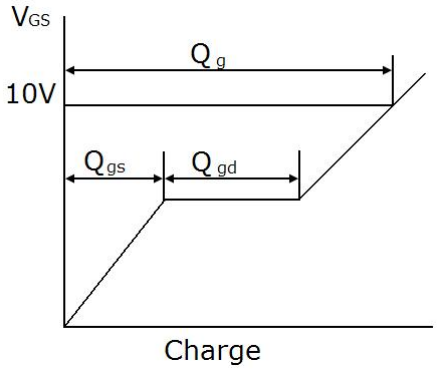
Figure10. Gate charge waveforms



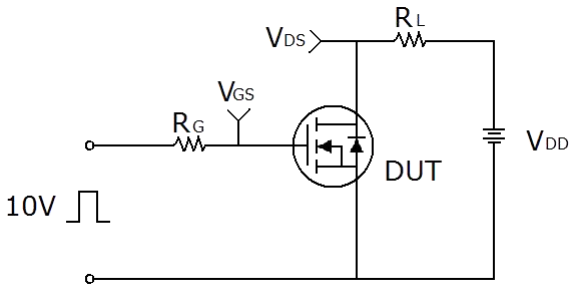
Test circuit

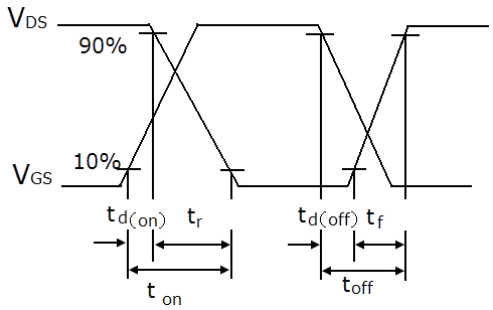
1）Gate charge test circuit & Waveform



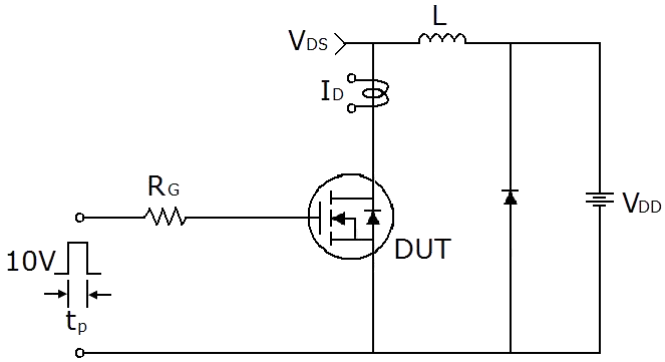


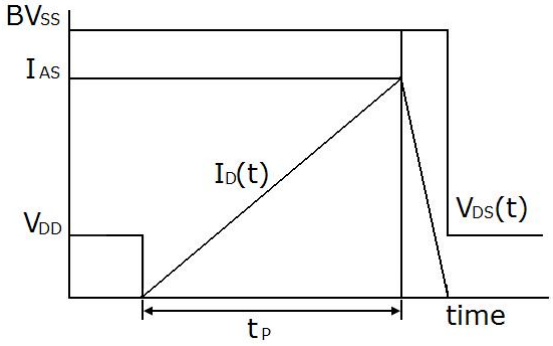
2）Switch Time Test Circuit：



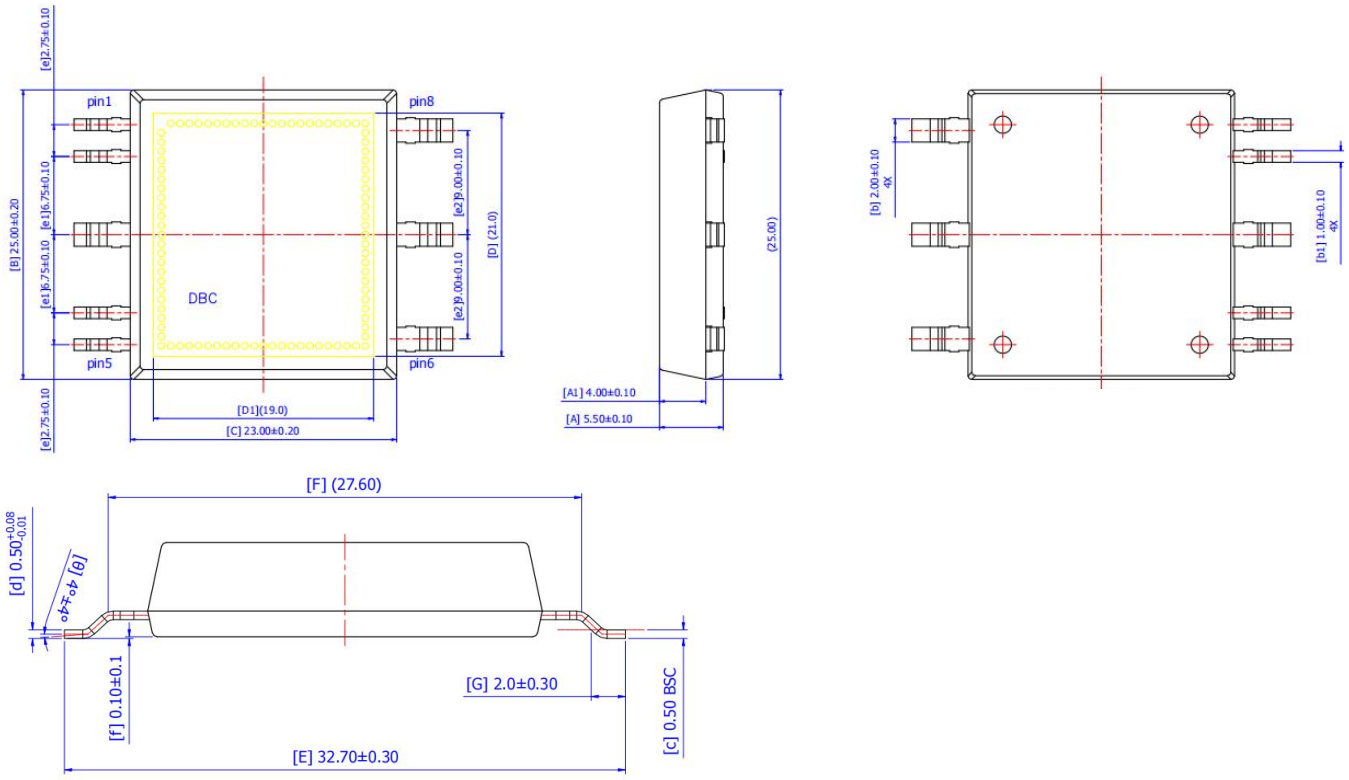


3）Unclamped Inductive Switching Test Circuit & Waveforms





HSOP8-P Package Information



SYMBOL	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	5.40	5.60	0.213	0.220
A1	3.90	4.10	0.154	0.161
B	24.80	25.20	0.976	0.992
b	1.90	2.10	0.075	0.083
b1	0.90	1.10	0.035	0.043
C	22.80	23.20	0.898	0.913
c	0.50		0.020	
D	21.00		0.827	
D1	19.00		0.748	
d	0.49	0.51	0.019	0.020
E	32.40	33.00	1.276	1.299
e	2.65	2.85	0.104	0.112
e1	6.65	6.85	0.262	0.270
e2	8.90	9.10	0.350	0.358
F	27.60		1.087	
f	0.00	0.20	0.000	0.008
G	1.70	2.30	0.067	0.091
θ	0°	8°		

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