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.

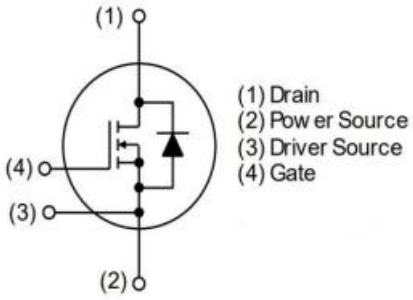
Features

- 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)

$V_{DS\ min@Tjmax}$	710	V
$R_{DS(ON)TYP.}$	21	mΩ
I_D	96	A
Qg	183	nC



✧ **Intrinsic fast-recovery body diode**

Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65NF023T4	TO-247-4L	NCE65NF023T4

TO-247-4L

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	650	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	$I_{D\ (DC)}$	96	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	67.2	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	288	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	530 3.53	W W/°C
Single pulse avalanche energy **(Note 2)**	E_{AS}	576	mJ
Single pulse avalanche current **(Note 2)**	I_{AS}	12	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	°C

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	0.28	°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=1mA	650			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=650V,V_{GS}=0V			15	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=650V,V_{GS}=0V			400	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=3mA	3	4	5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=48A		21	23	mΩ
Dynamic Characteristics						
Gate Resistance	Rg	F=1MHZ, D-S short		2.7		Ω
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1MHz		11300		pF
Output Capacitance	C_{oss}			386		pF
Reverse Transfer Capacitance	C_{rss}			57		pF
Total Gate Charge	Q_g	V_{DS}=400V,I_D=48A,V_{GS}=10V		183	193	nC
Gate-Source Charge	Q_{gs}			75.8		nC
Gate-Drain Charge	Q_{gd}			55.2		nC
Gate plateau voltage	Vgp			7.2		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=50A, R_G=3Ω,V_{GS}=10V		57		nS
Turn-on Rise Time	t_r			22		nS
Turn-Off Delay Time	$t_{d(off)}$			186		nS
Turn-Off Fall Time	t_f			13		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			96	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				288	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=96A,V_{GS}=0V		1.0	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F50A, di/dt=100A/μs		270		nS
Reverse Recovery Charge	Q_{rr}			2.1		uC
Peak reverse recovery current	I_{rrm}			15.5		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

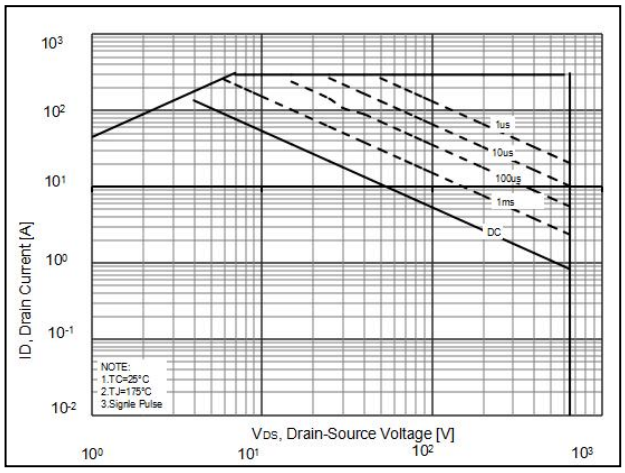


Figure2. Source-Drain Diode Forward Voltage

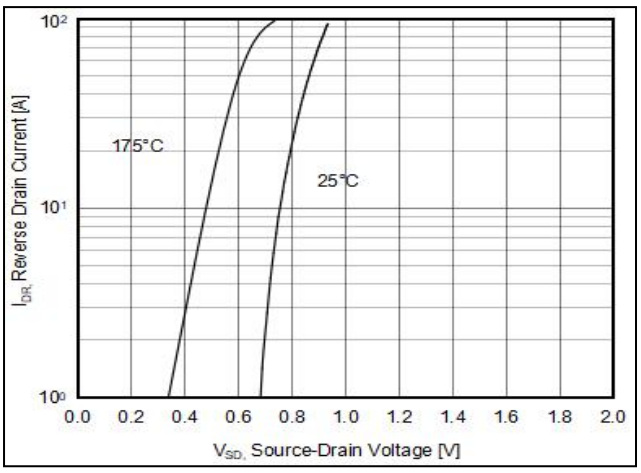


Figure3. Output characteristics

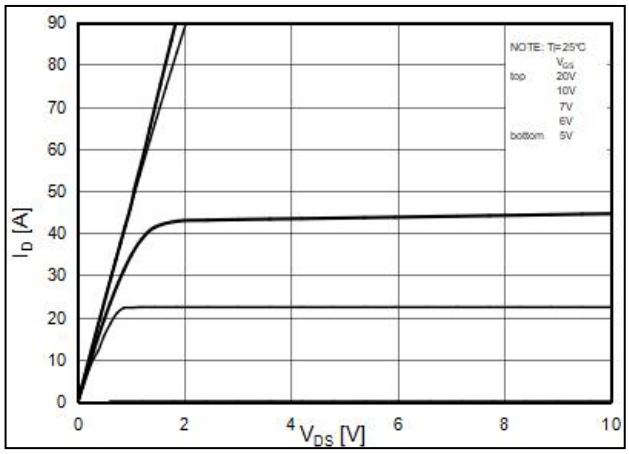


Figure4. Transfer characteristics

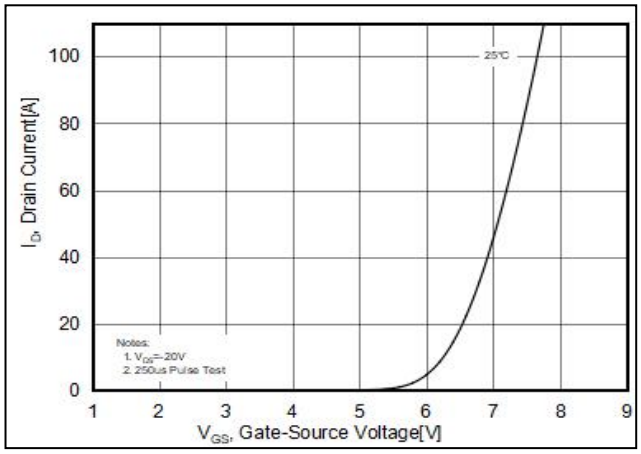


Figure5. Static drain-source on resistance

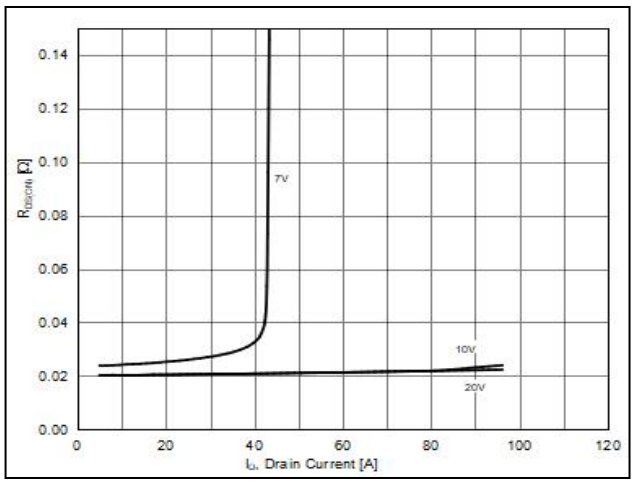


Figure6. $R_{DS(ON)}$ vs Junction Temperature

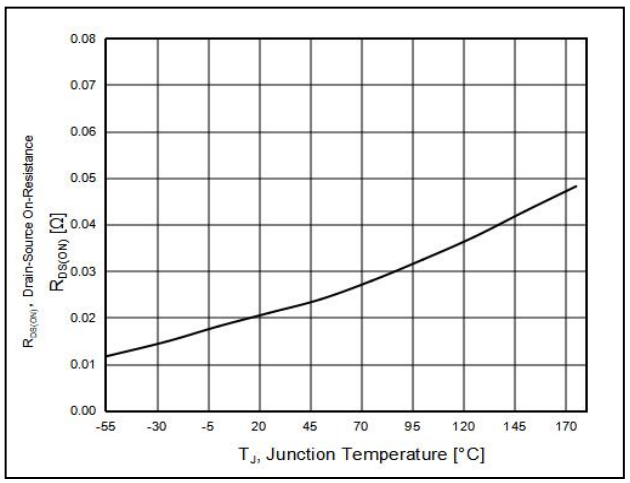


Figure7. BV_{DSS} vs Junction Temperature

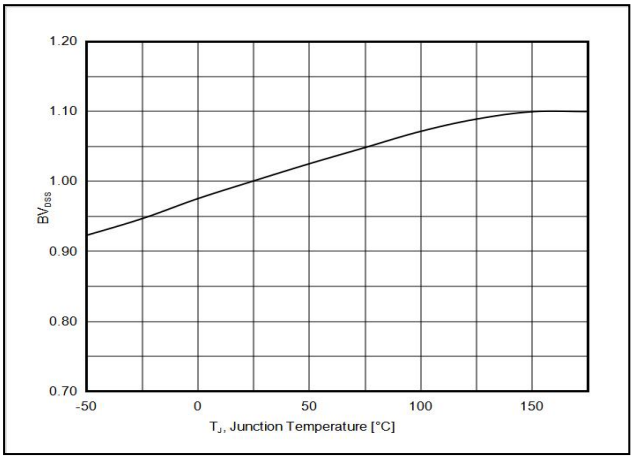


Figure8. Maximum I_D vs Junction Temperature

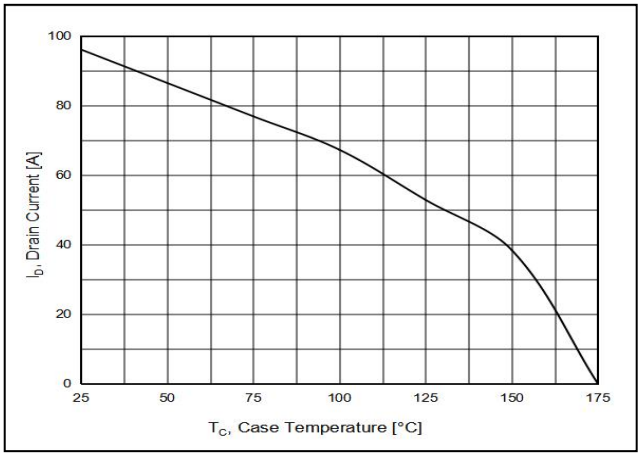


Figure9. Gate charge waveforms

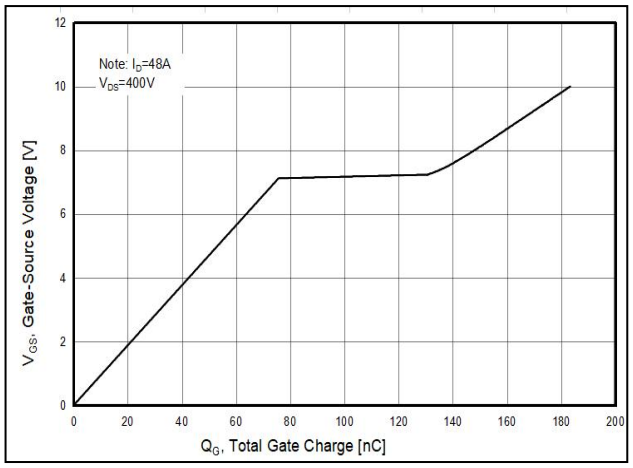


Figure10. Capacitance

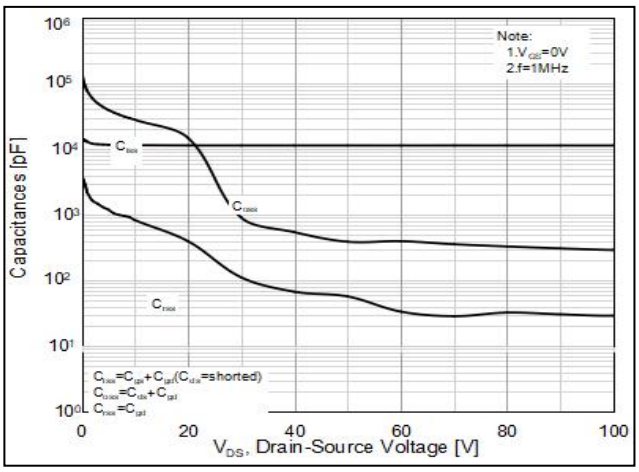
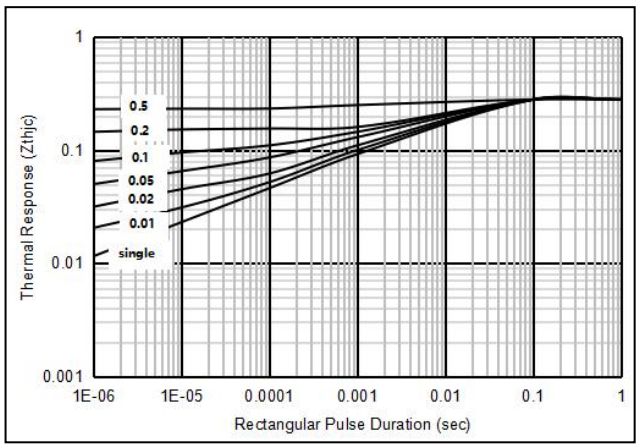
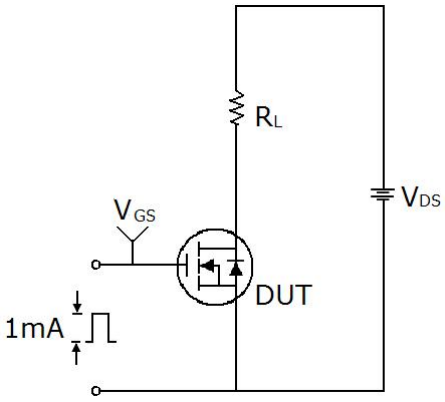


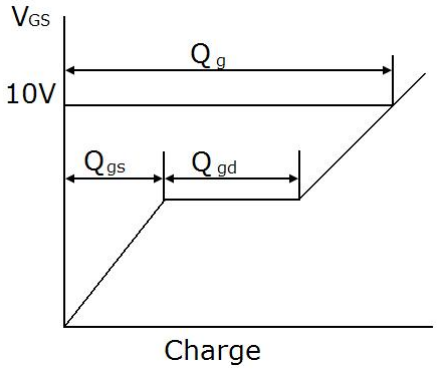
Figure11. Transient Thermal Impedance



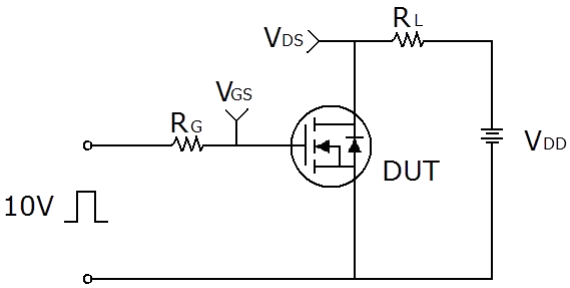
Test circuit

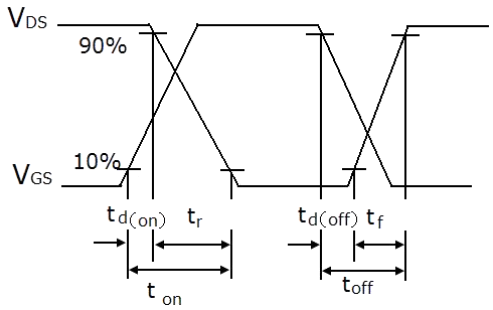
1）Gate charge test circuit & Waveform



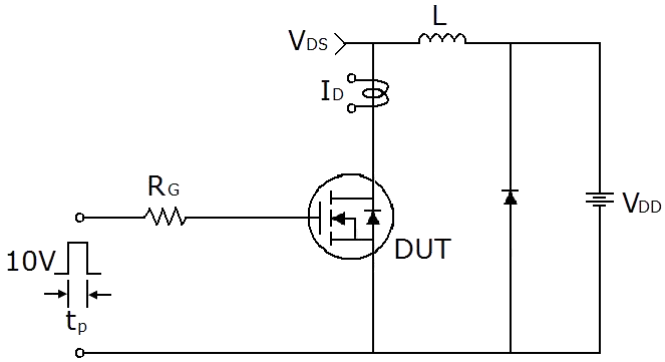


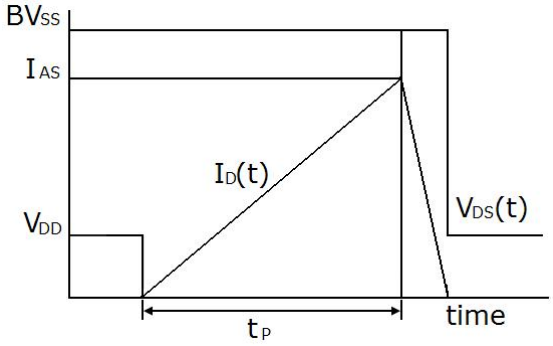
2）Switch Time Test Circuit：



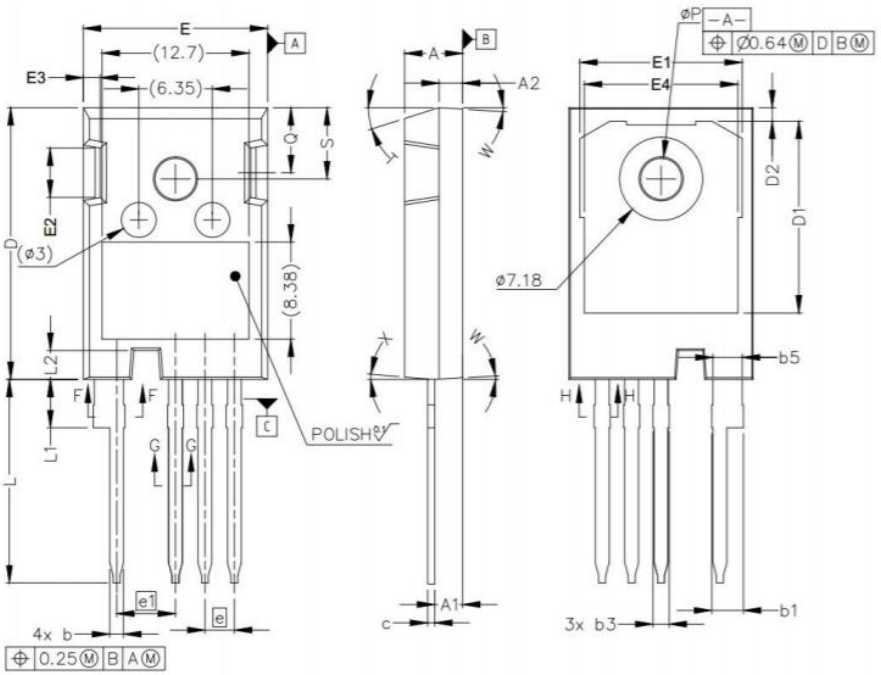


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-247-4L-B Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	0.190	0.205
A1	2.29	2.54	0.090	0.100
A2	1.91	2.16	0.075	0.085
b’	1.07	1.28	0.042	0.050
b	1.07	1.33	0.042	0.052
b1	2.39	2.94	0.094	0.116
b2	2.39	2.84	0.094	0.112
b3	1.07	1.60	0.042	0.063
b4	1.07	1.50	0.042	0.059
c	0.55	0.68	0.022	0.027
c‘	0.55	0.65	0.022	0.026
D	23.30	23.60	0.917	0.929
D1	16.25	17.65	0.640	0.695
D2	0.95	1.25	0.037	0.049
E	15.75	16.13	0.620	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	1.90	0.039	0.075
E4	12.38	13.43	0.487	0.529
L	17.31	17.82	0.681	0.702
L1	3.97	4.37	0.156	0.172
Q	5.49	6.00	0.216	0.236

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