

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.

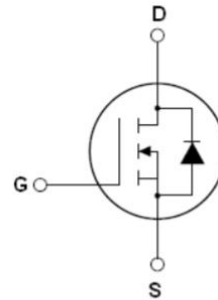
Features

- 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

$V_{DS\ min@T_{jmax}}$	550	V
$R_{DS(ON)TYP.}$	110	m Ω
I_D	23.5	A
Q_g	24.5	nC

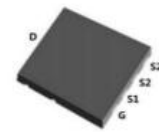


Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE50NF130V	DFN8*8	NCE50NF130V



DFN8×8

Table 1. Absolute Maximum Ratings ($T_c=25^\circ\text{C}$)

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	500	V
Gate-Source Voltage ($V_{DS}=0V$), AC ($f>1\text{ Hz}$)	V_{GS}	± 30	V
Gate-Source Voltage ($V_{DS}=0V$), DC	V_{GS}	± 20	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	23.5	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	16.45	A
Pulsed drain current (Note 1)	$I_{DM(pulse)}$	70.5	A
Maximum Power Dissipation($T_c=25^\circ\text{C}$)	P_D	186	W
Derate above 25°C		1.24	W/ $^\circ\text{C}$
Single pulse avalanche current (Note 2)	I_{AS}	6	A
Reverse diode dv/dt , $V_{DS} \leq 400\text{ V}$, $I_{SD} < I_D$	dv/dt	15	V/ns
Drain Source voltage slope, $V_{DS} \leq 400\text{ V}$	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+175	$^\circ\text{C}$

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	0.80	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	$^{\circ}\text{C}/\text{W}$

Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	500			V
Zero Gate Voltage Drain Current(Tc=25°C)	I_{DSS}	$V_{DS}=500V, V_{GS}=0V$			10	μA
Zero Gate Voltage Drain Current(Tc=125°C)	I_{DSS}	$V_{DS}=500V, V_{GS}=0V$			300	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$			± 200	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	3		5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=12A$		110	130	m Ω
Dynamic Characteristics						
Gate Resistance	R_g	F=1MHZ, D-S short		2		Ω
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V,$ F=1MHZ		1544		pF
Output Capacitance	C_{oss}			630		pF
Reverse Transfer Capacitance	C_{riss}			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	V_{gp}			7.7		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=400V, I_D=12A,$ $R_G=4\Omega, V_{GS}=10V$		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}	$T_c=25^{\circ}\text{C}$			23.5	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				70.5	A
Forward on voltage	V_{SD}	$T_j=25^{\circ}\text{C}, I_{SD}=23.5A, V_{GS}=0V$		0.9	1.1	V
Reverse Recovery Time	t_{rr}	$T_j=25^{\circ}\text{C}, I_F=12A,$ $di/dt=100A/\mu s$		170		nS
Reverse Recovery Charge	Q_{rr}			1.02		μC
Peak reverse recovery current	I_{rrm}			12		A

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature
 2. $T_j=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

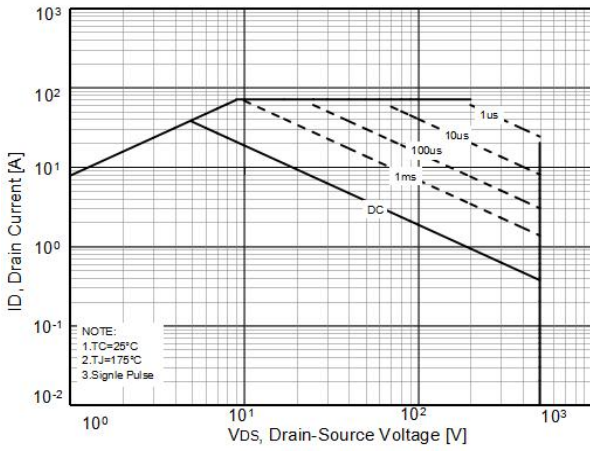


Figure2. Source-Drain Diode Forward Voltage

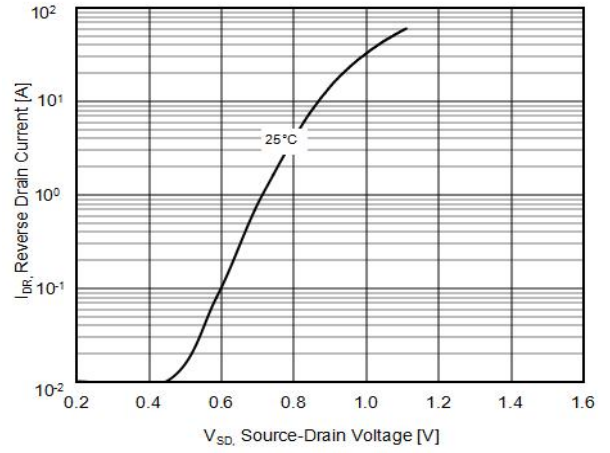


Figure3. Output characteristics

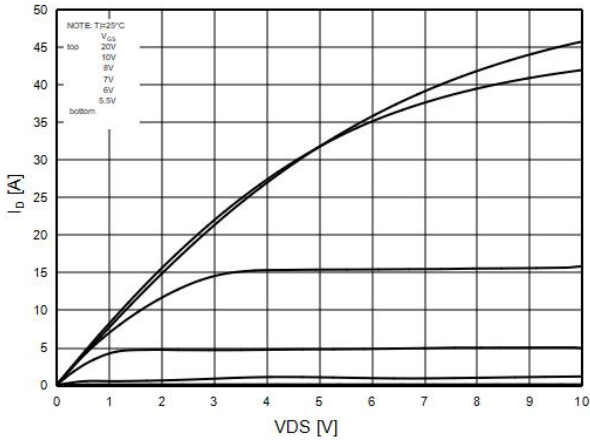


Figure4. Transfer characteristics

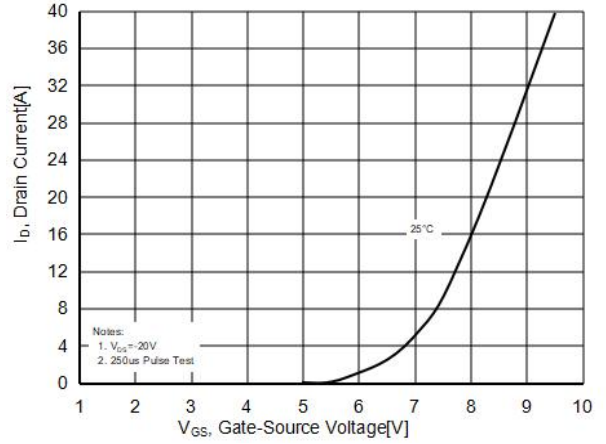


Figure5. Static drain-source on resistance

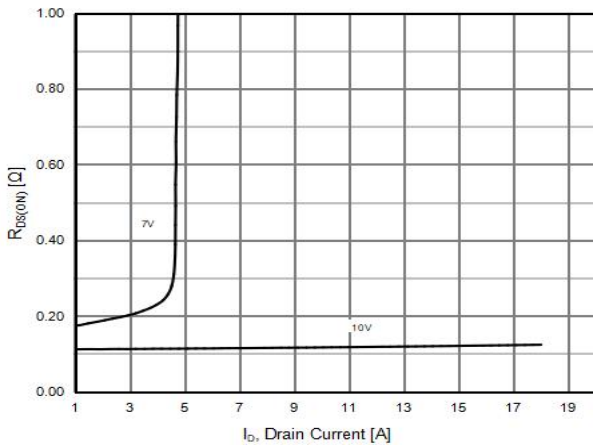


Figure6. RDS(ON) vs Junction Temperature

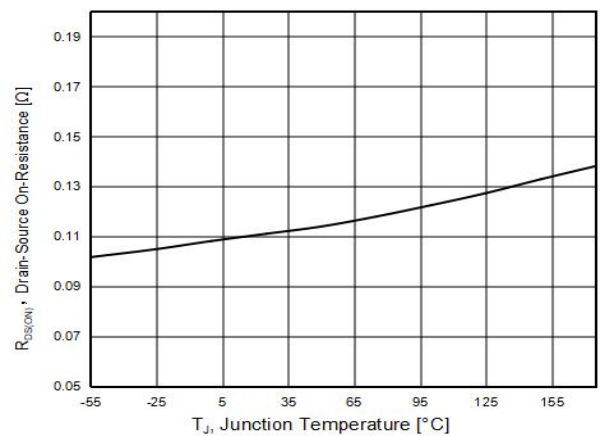


Figure7. BV_{DSS} vs Junction Temperature

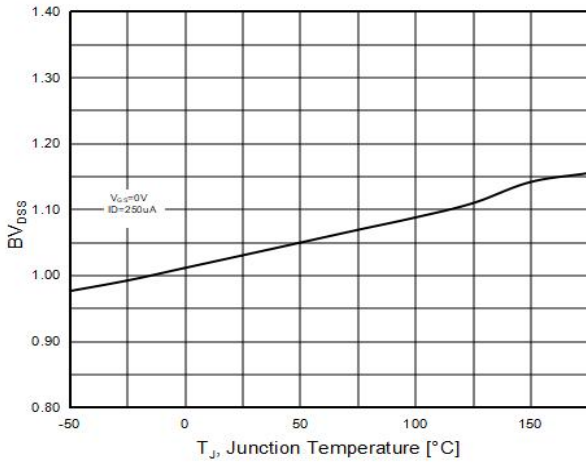


Figure8. Maximum I_D vs Junction Temperature

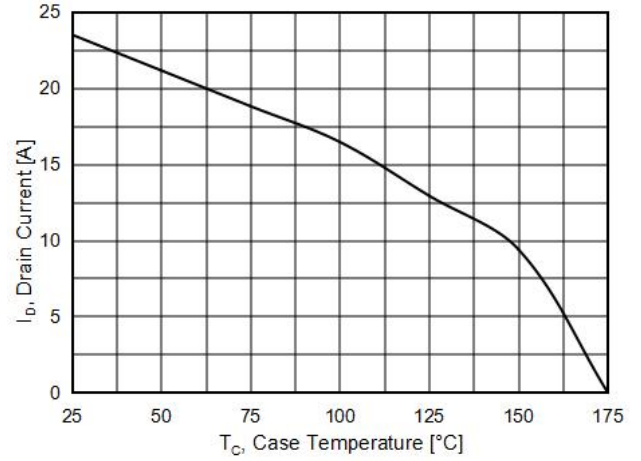


Figure9. Gate charge waveforms

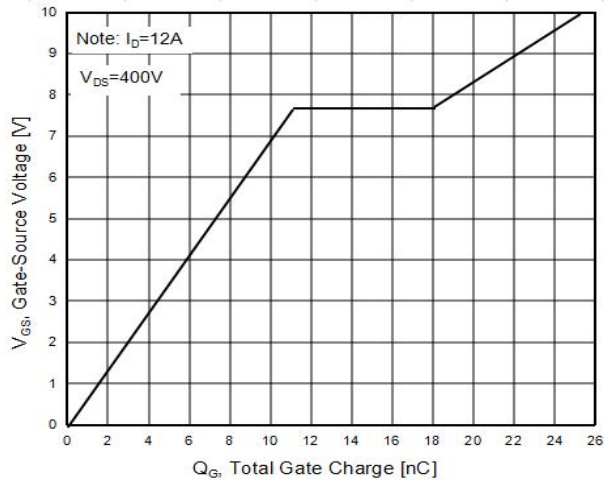
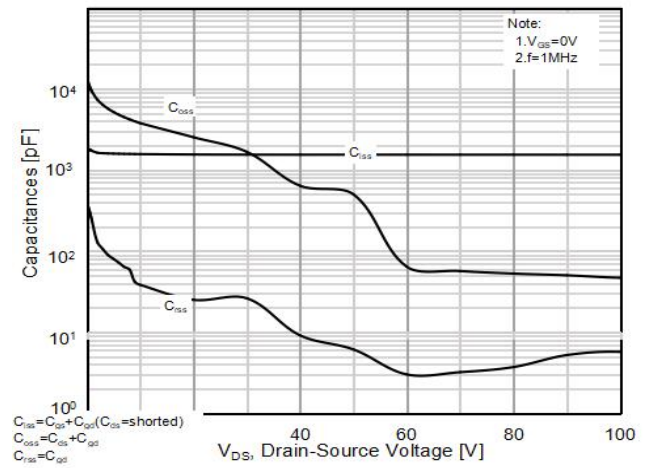


Figure10. Capacitance

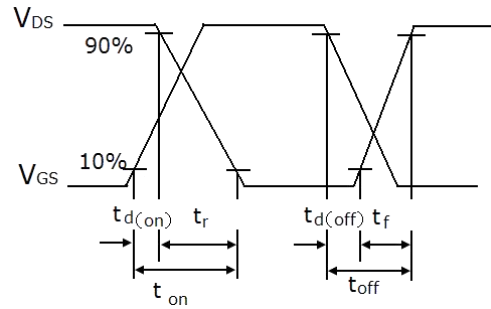


Test circuit

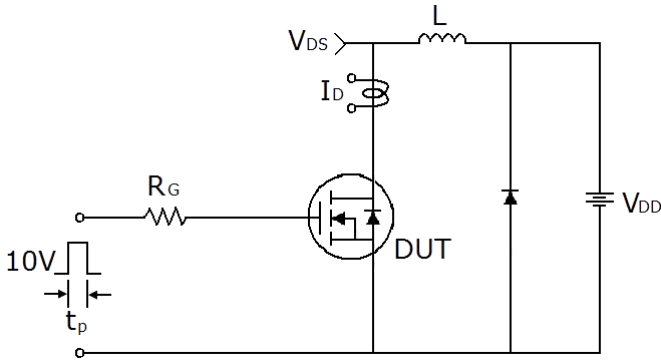
1) Gate charge test circuit & Waveform



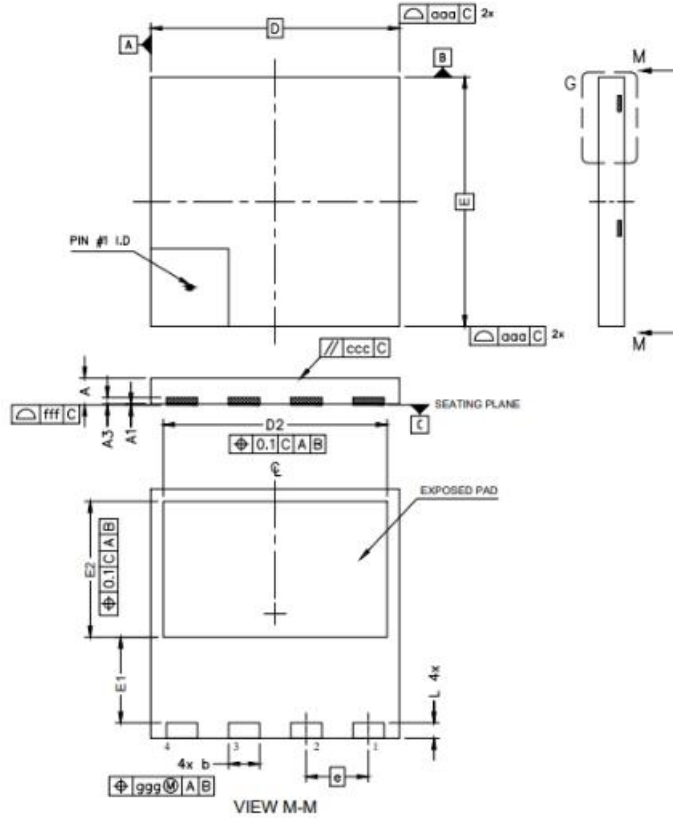
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



DFN8*8-B Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.75	0.95	0.030	0.037
A1	0.00	0.05	0.000	0.002
b	0.90	1.10	0.035	0.043
A3	0.10	0.30	0.004	0.012
D	7.90	8.10	0.311	0.319
E	7.90	8.10	0.311	0.319
D2	7.10	7.30	0.280	0.287
E1	2.65	2.85	0.104	0.112
E2	4.25	4.45	0.167	0.175
e	2.00 BSC		0.079 BSC	
L	0.40	0.60	0.016	0.024

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