

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.

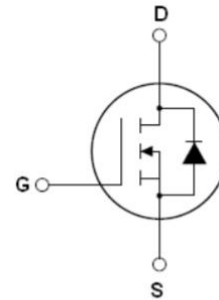
Features

- 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

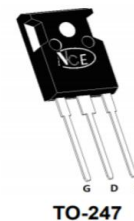


Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE50NF130T	TO-247	NCE50NF130T



TO-247

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

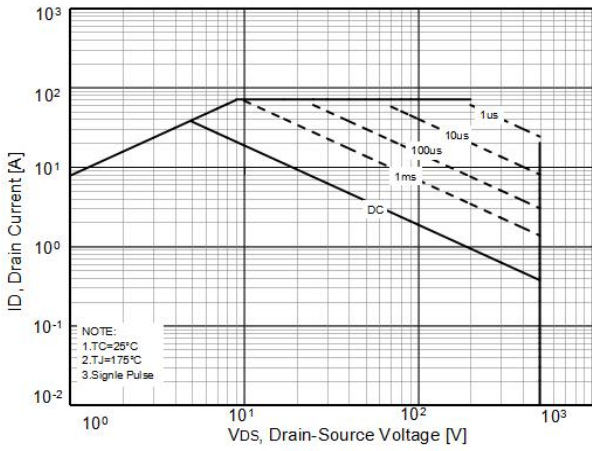


Figure2. Source-Drain Diode Forward Voltage

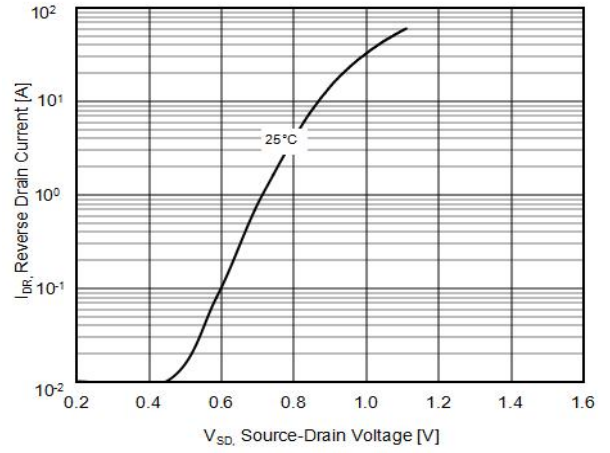


Figure3. Output characteristics

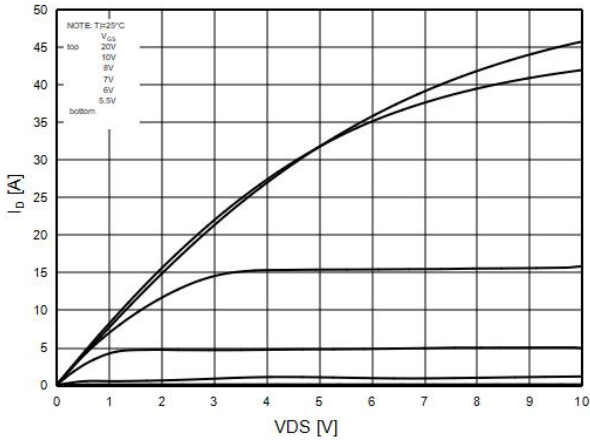


Figure4. Transfer characteristics

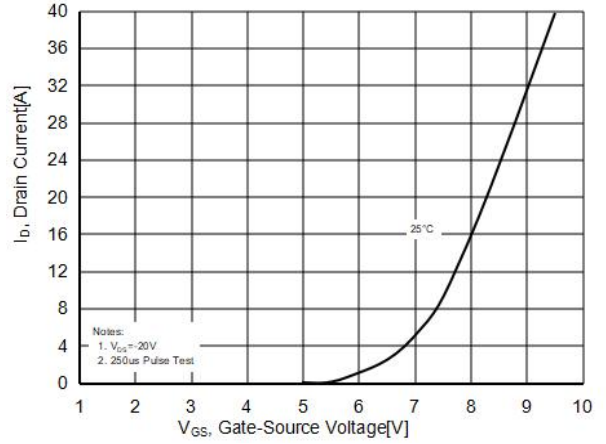


Figure5. Static drain-source on resistance

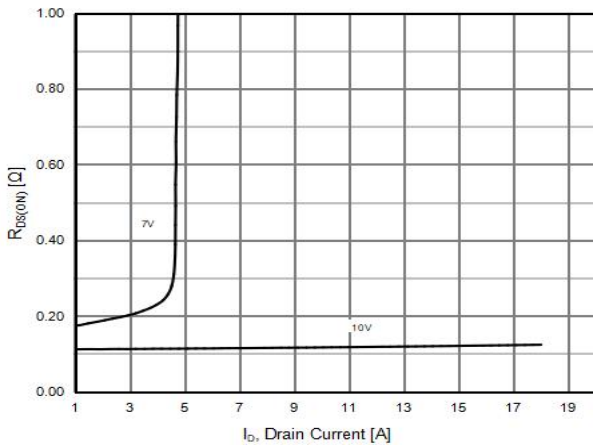


Figure6. $R_{DS(ON)}$ vs Junction Temperature

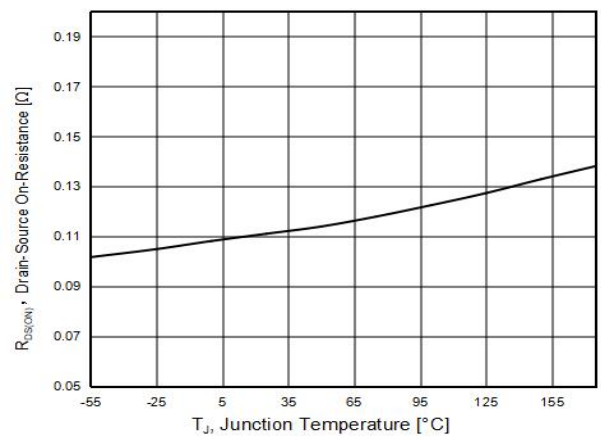


Figure7. BV_{DSS} vs Junction Temperature

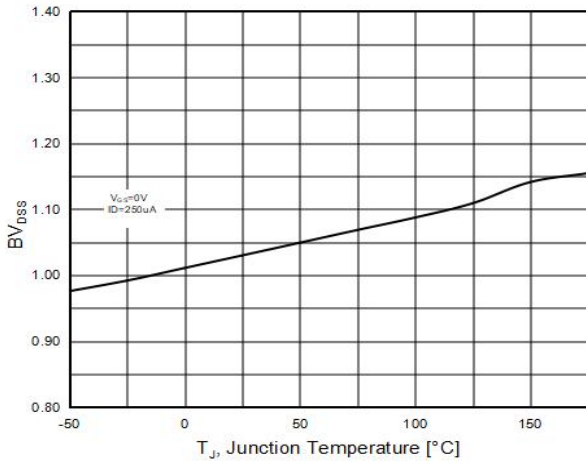


Figure8. Maximum I_D vs Junction Temperature

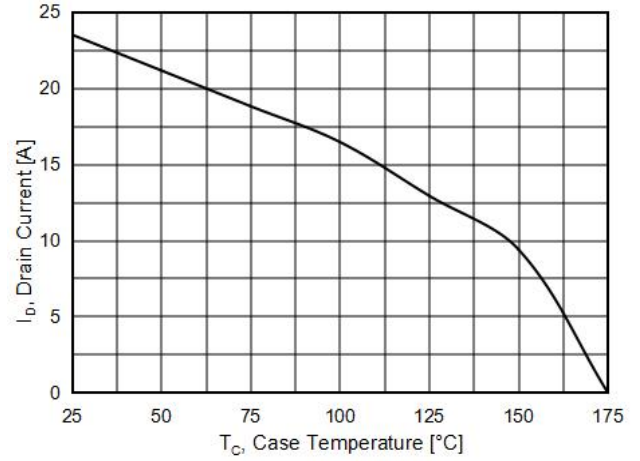


Figure9. Gate charge waveforms

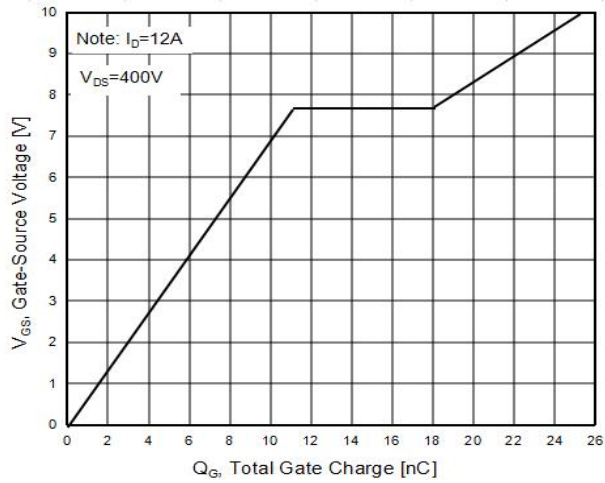
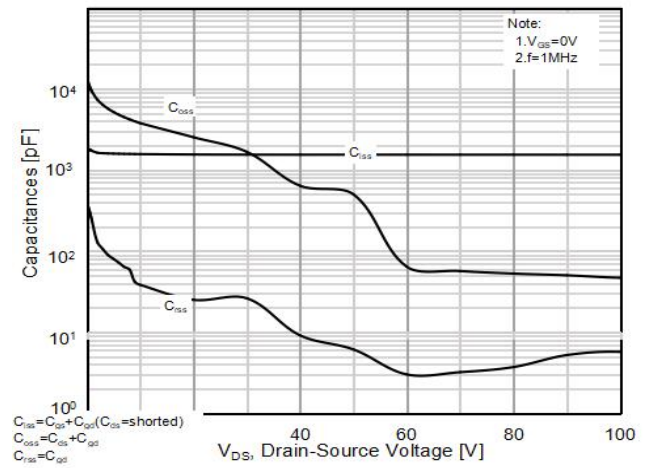


Figure10. Capacitance

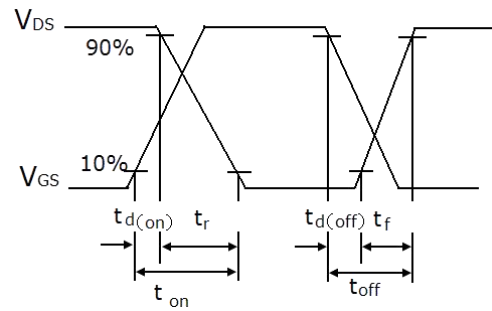


Test circuit

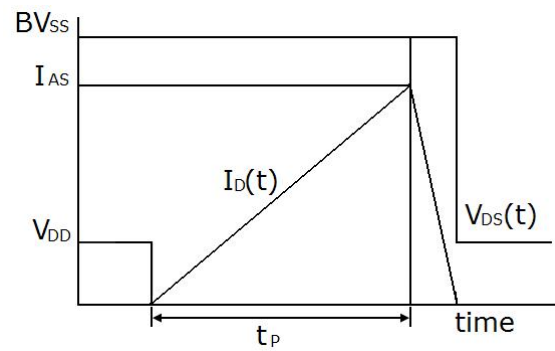
1) Gate charge test circuit & Waveform



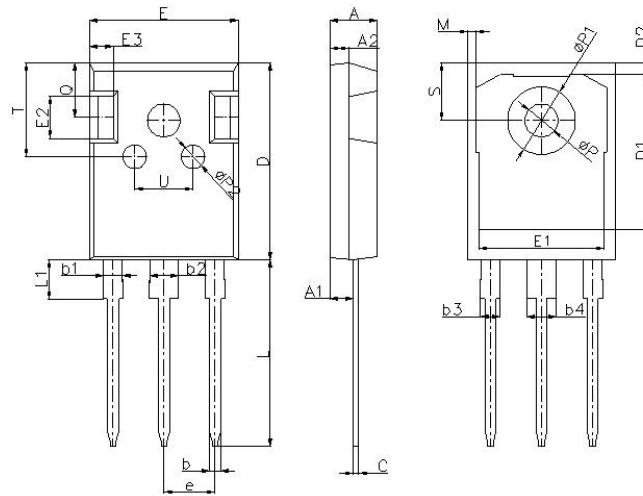
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-247-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.06	0.077	0.081
b2	2.96	3.06	0.117	0.120
b3	-	2.25	-	0.089
b4	-	3.25	-	0.128
C	0.59	0.66	0.023	0.026
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
E2	4.40	4.60	0.173	0.181
E3	2.40	2.60	0.094	0.102
e	5.436BSC		0.214BSC	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
M	0.35	0.95	0.014	0.037
P	3.40	3.60	0.134	0.142
P1	7.00	7.40	0.276	0.291
P2	2.40	2.60	0.094	0.102
Q	5.60	6.00	0.220	0.236
S	6.05	6.25	0.238	0.246
T	9.80	10.20	0.386	0.402
U	6.00	6.40	0.236	0.252

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