

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.

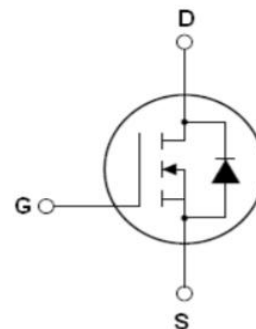
Features

- 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

$V_{DS\ min@T_{jmax}}$	750	V
$R_{DS(ON)TYP.}$	1000	m Ω
I_D	4.5	A
Q_g	9.5	nC



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE70N1K1I	TO-251	NCE70N1K1I



TO-251

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	700	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 $T_c=25^{\circ}\text{C}$	$I_{D(DC)}$	4.5	A
Continuous Drain Current at $T_c=100^{\circ}\text{C}$	$I_{D(DC)}$	3.15	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	13.5	A
Maximum Power Dissipation($T_c=25^{\circ}\text{C}$)	P_D	58	W
Derate above 25°C		0.38	W/ $^{\circ}\text{C}$
Single pulse avalanche current (Note 2)	I_{AS}	1.2	A
Reverse diode dv/dt, $V_{DS} \leq 480\text{ V}, I_{SD} < I_D$	dv/dt	15	V/ns
Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$	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}	2.58	$^{\circ}\text{C}/\text{W}$
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 =250uA	700			V
Zero Gate Voltage Drain Current(Tc=25℃)	I _{DSS}	V _{DS} =700V,V _{GS} =0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I _{DSS}	V _{DS} =700V,V _{GS} =0V			50	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 =250uA	3		4	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =2.3A		1000	1100	mΩ
Dynamic Characteristics						
Gate Resistance	R _g	F=1MHZ, D-S short		36		Ω
Input Capacitance	C _{iss}	V _{DS} =50V,V _{GS} =0V, F=1MHz		311		pF
Output Capacitance	C _{oss}			14		pF
Reverse Transfer Capacitance	C _{rss}			4		pF
Total Gate Charge	Q _g	V _{DS} =500V,I _D =2.3A, V _{GS} =10V		9.5		nC
Gate-Source Charge	Q _{gs}			3		nC
Gate-Drain Charge	Q _{gd}			2.7		nC
Gate plateau voltage	V _{gp}			5.5		V
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =500V,I _D =2.3A, R _G =4Ω,V _{GS} =10V		8		nS
Turn-on Rise Time	t _r			5		nS
Turn-Off Delay Time	t _{d(off)}			48		nS
Turn-Off Fall Time	t _f			8		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I _{SD}	T _C =25℃			4.5	A
Pulsed-Source-drain current(Body Diode)	I _{SDM}				13.5	A
Forward on voltage	V _{SD}	T _j =25℃,I _{SD} =4.5A,V _{GS} =0V		0.9	1.1	V
Reverse Recovery Time	t _{rr}	T _j =25℃,I _f 2.3A, di/dt=100A/μs		170		nS
Reverse Recovery Charge	Q _{rr}			0.46		uC
Peak reverse recovery current	I _{rrm}			5.5		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

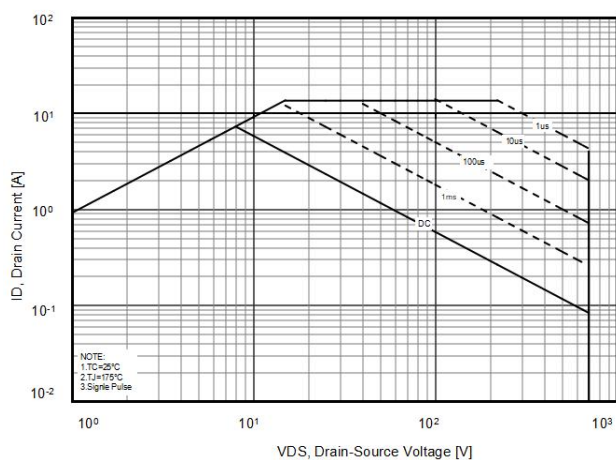


Figure2. Source-Drain Diode Forward Voltage

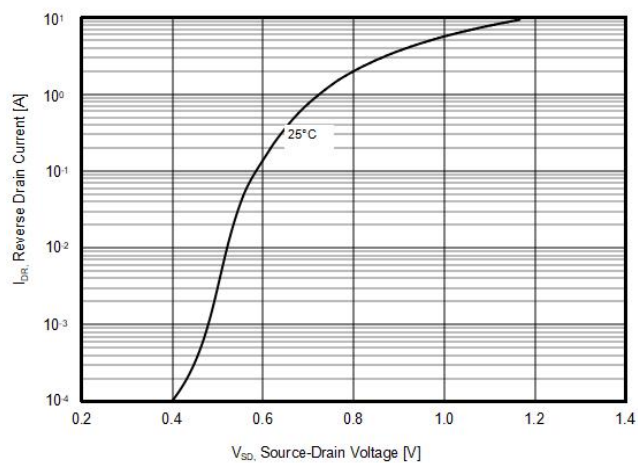


Figure3. Output characteristics

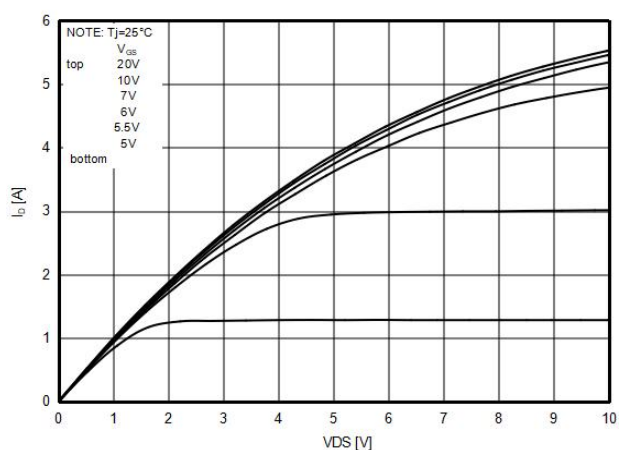


Figure4. Transfer characteristics

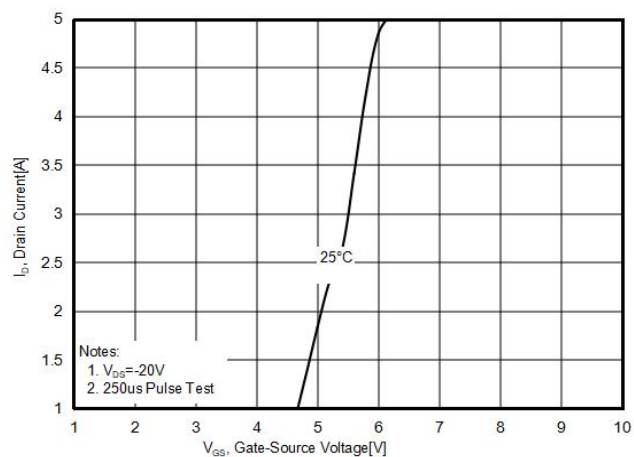


Figure5. Static drain-source on resistance

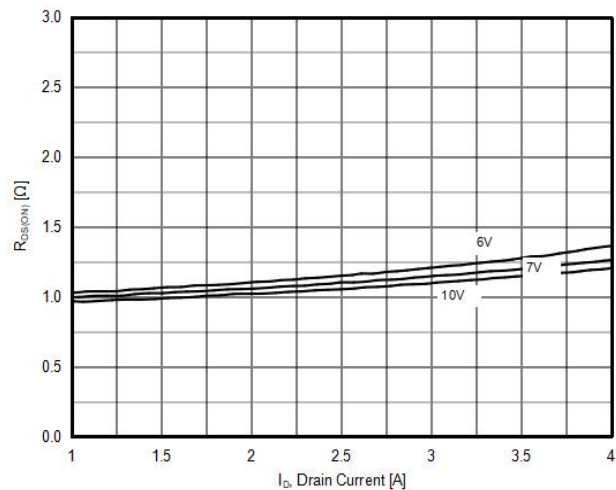


Figure6. $R_{DS(on)}$ vs Junction Temperature

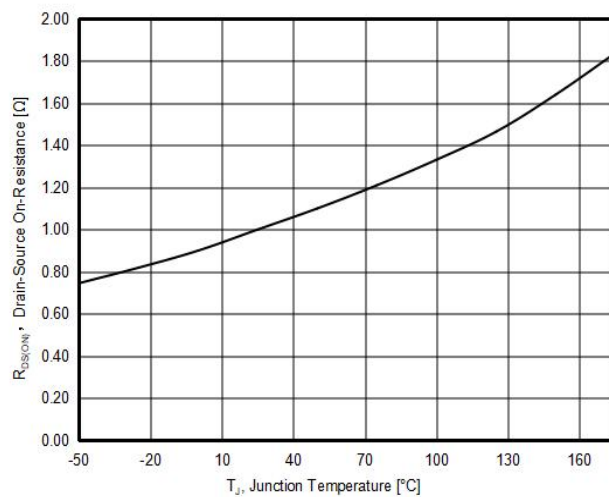


Figure7. BV_{DS} vs Junction Temperature

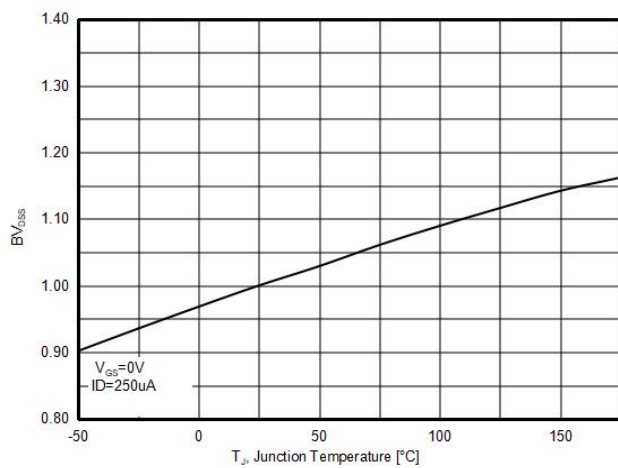


Figure8. Maximum I_D vs Junction Temperature

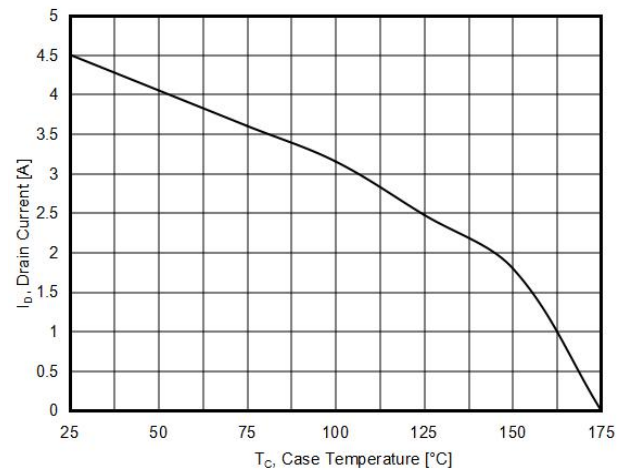


Figure9. Gate charge waveforms

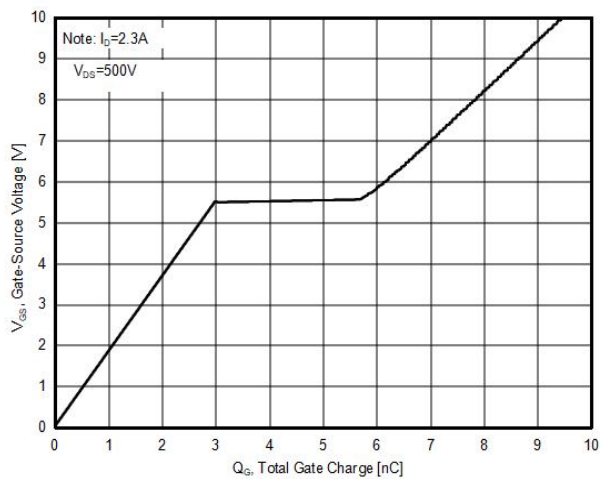
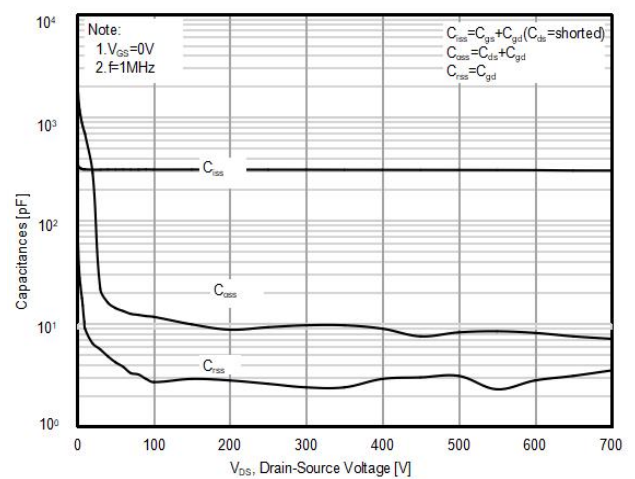
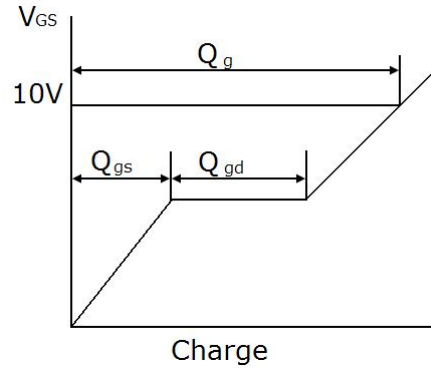


Figure10. Capacitance

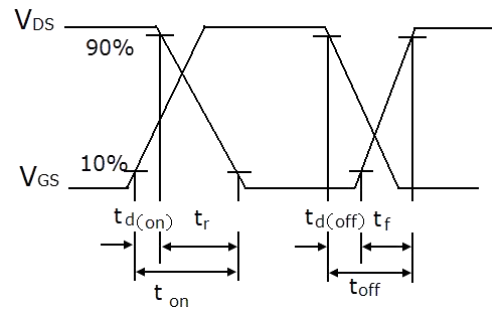


Test circuit

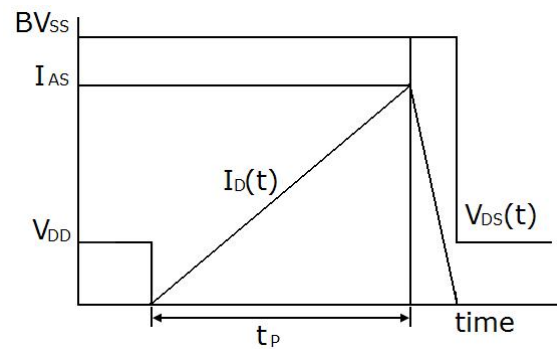
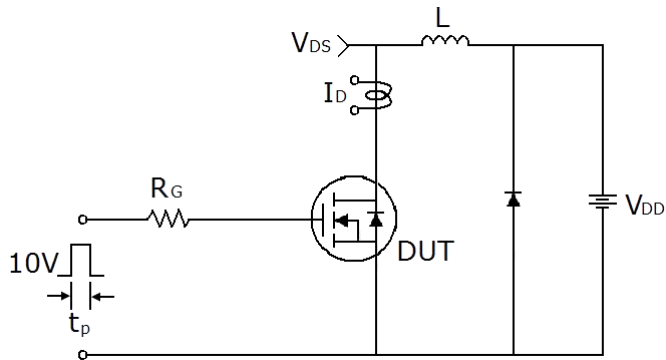
1) Gate charge test circuit & Waveform



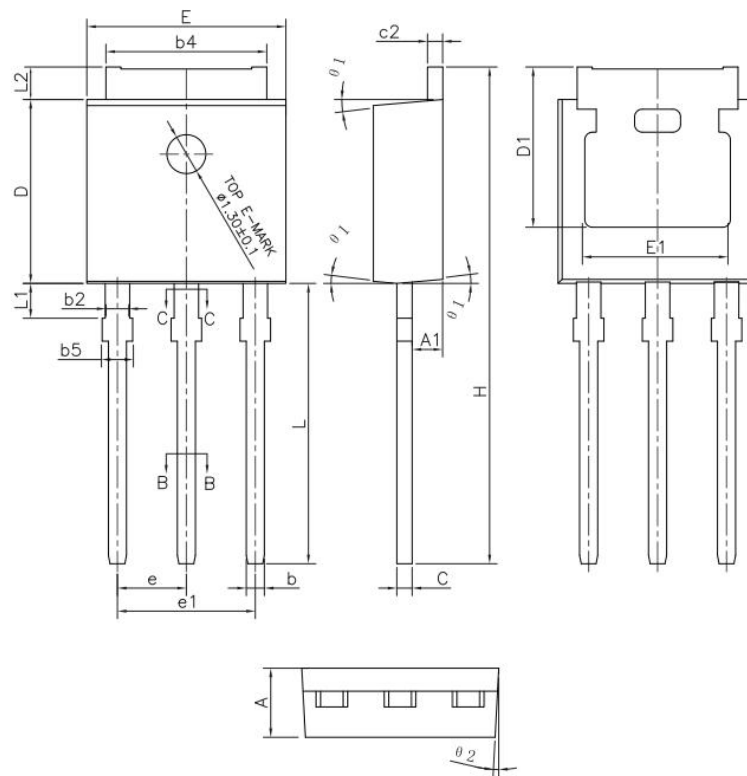
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

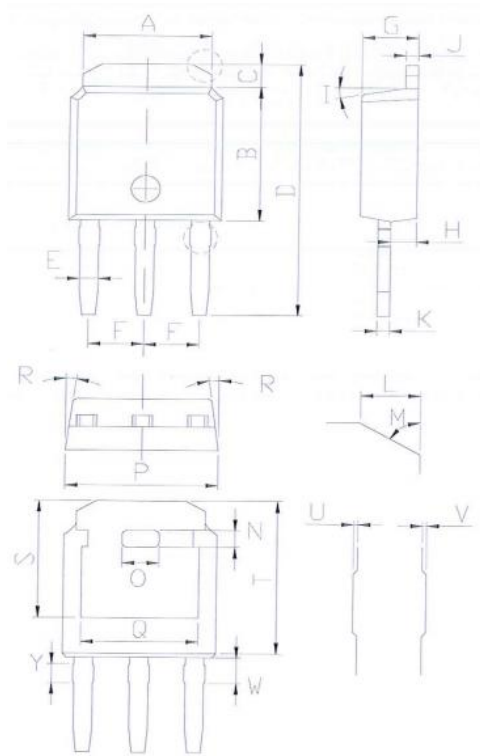


TO-251-P Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.35	0.087	0.093
A1	0.90	1.10	0.035	0.043
b	0.56	0.69	0.022	0.027
b1	0.55	0.65	0.022	0.026
b2	0.77	0.90	0.030	0.035
b3	0.76	0.86	0.030	0.034
b4	5.23	5.43	0.206	0.214
c	0.46	0.59	0.018	0.023
c1	0.45	0.55	0.018	0.022
c2	0.46	0.59	0.018	0.023
D	6.00	6.20	0.236	0.244
D1	5.20	-	0.205	-
E	6.50	6.70	0.256	0.264
E1	4.60	5.00	0.181	0.197
e	2.24	2.34	0.088	0.092
e1	4.47	4.67	0.176	0.184
H	16.18	16.78	0.637	0.661
L	9.00	9.60	0.354	0.378
L1	0.95	1.35	0.037	0.053
L2	0.90	1.25	0.035	0.049

TO-251-L 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	6.30	0.224	0.248
C	0.75	1.35	0.030	0.053
D	11.01	11.61	0.433	0.457
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
K	0.37	0.67	0.015	0.026
L	0.50	1.10	0.020	0.043
N	0.45	1.05	0.018	0.041
O	1.50	2.10	0.059	0.083
P	6.30	6.90	0.248	0.272
Q	4.55	5.15	0.179	0.203
S	5.00	5.60	0.197	0.220
T	6.60	7.20	0.260	0.283
W	0.90	1.40	0.035	0.055
Y	0.60	1.10	0.024	0.043

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