

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.

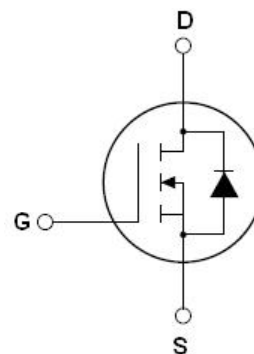
Features

- 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
- High reliability
- ROHS compliant & Halogen Free

Application

- Power factor correction (PFC)
- Switched mode power supplies (SMPS)
- Uninterruptible Power Supply (UPS)
- On-board charger (OBC)

$V_{DS \min @ T_{jmax}}$	710	V
$R_{DS(ON)TYP}$	110	mΩ
I_D	26	A
Q_g	41	nC



Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65NF130	TO-220-3L	NCE65NF130



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

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	650	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 $T_c=25^\circ\text{C}$	$I_D (DC)$	26	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_D (DC)$	18.2	A
Pulsed drain current (Note 1)	$I_{DM (pluse)}$	78	A
Maximum Power Dissipation ($T_c=25^\circ\text{C}$)	P_D	237	W
Derate above 25°C		1.58	W/ $^\circ\text{C}$
Avalanche current (Note 1)	I_{AS}	7	A
Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$,	dv/dt	50	V/ns
Reverse diode dv/dt , $V_{DS} \leq 480\text{ V}$, $I_{SD} < I_D$	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+175	$^\circ\text{C}$

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	0.63	$^{\circ}\text{C}/\text{W}$
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	650			V
Zero Gate Voltage Drain Current(Tc=25℃)	I _{DSS}	V _{DS} =650V,V _{GS} =0V			10	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			±100	nA
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =500uA	3.5	4.2	5.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =13A		110	130	mΩ
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =50V,V _{GS} =0V, F=1.0MHz		2161		pF
Output Capacitance	C _{oss}			95		pF
Reverse Transfer Capacitance	C _{rss}			50		pF
Total Gate Charge	Q _g	V _{DS} =480V,I _D =13A, V _{GS} =10V		41.2		nC
Gate-Source Charge	Q _{gs}			16.3		nC
Gate-Drain Charge	Q _{gd}			12.8		nC
Gate plateau voltage	V _{gp}			7.0		V
Intrinsic gate resistance	R _G	f = 1 MHz open drain		1.5		Ω
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =13A, R _G =1.7Ω,V _{GS} =10V		43		nS
Turn-on Rise Time	t _r			16		nS
Turn-Off Delay Time	t _{d(off)}			93		nS
Turn-Off Fall Time	t _f			20		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I _{SD}	T _C =25℃			26	A
Pulsed Source-drain current(Body Diode)	I _{SDM}				78	A
Forward On Voltage	V _{SD}	T _j =25℃,I _{SD} =26A,V _{GS} =0V		1.0	1.2	V
Reverse Recovery Time	t _{rr}	T _j =25℃,I _F =13A,di/dt=100A/μs		145		nS
Reverse Recovery Charge	Q _{rr}			0.725		uC
Peak Reverse Recovery Current	I _{rrm}			10		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

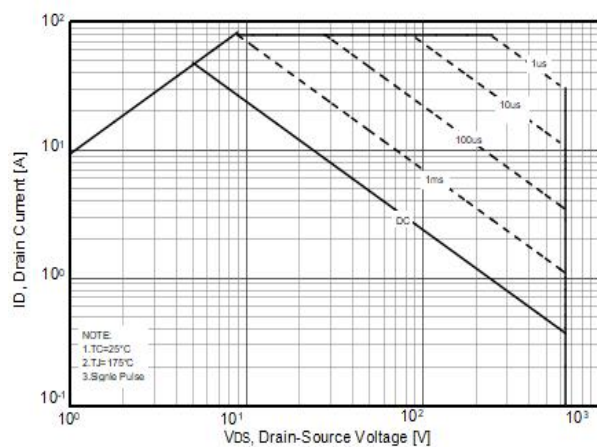


Figure2. Capacitance

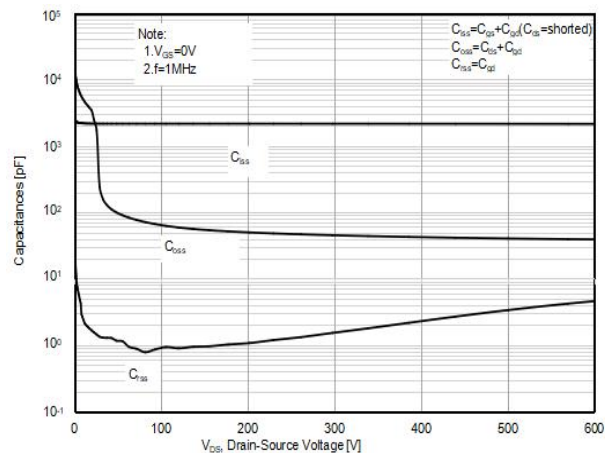


Figure3. Output characteristics

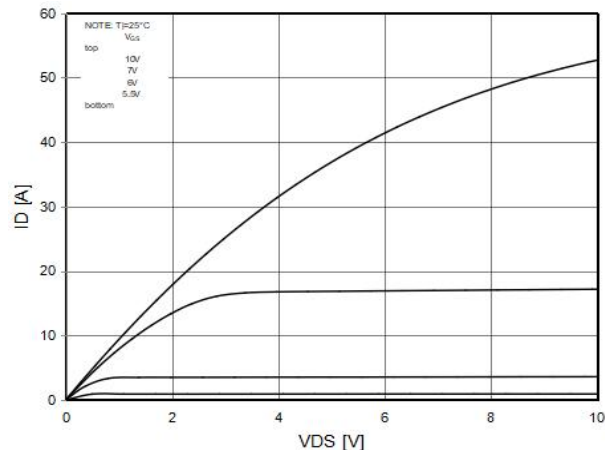


Figure4. Source-Drain Diode Forward Voltage

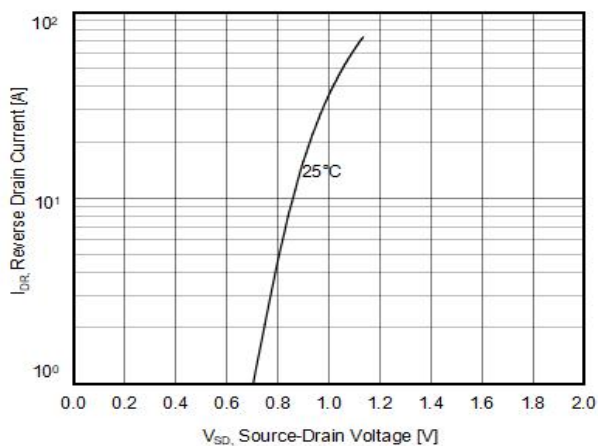


Figure5. Static drain-source on resistance

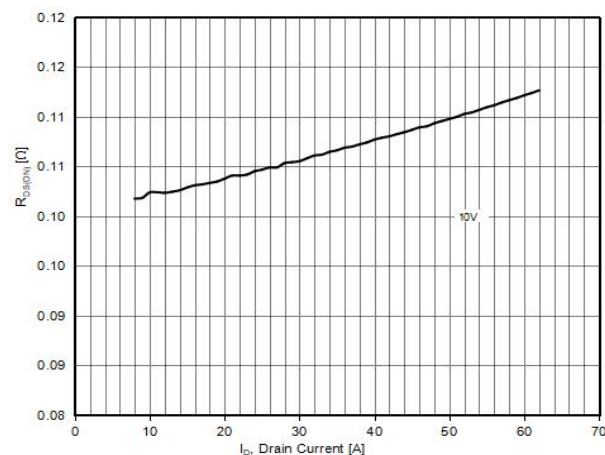


Figure6. Transfer characteristics

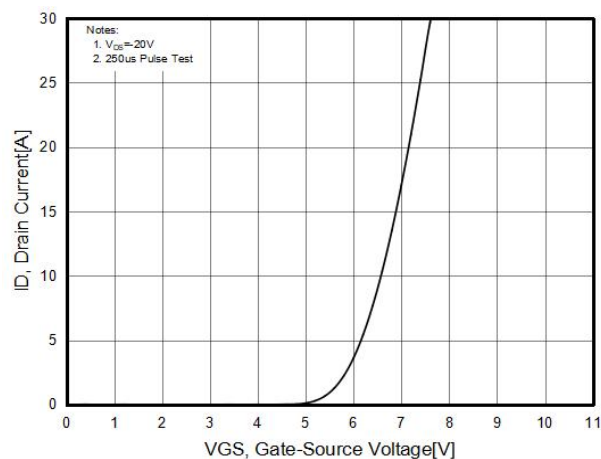


Figure7. $R_{DS(ON)}$ vs Junction Temperature

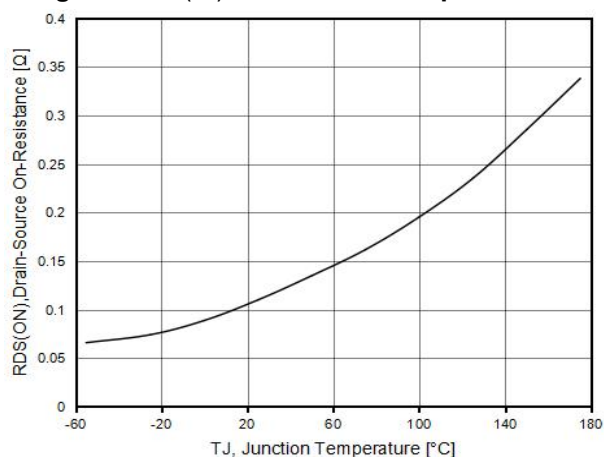


Figure8. BV_{DSS} vs Junction Temperature

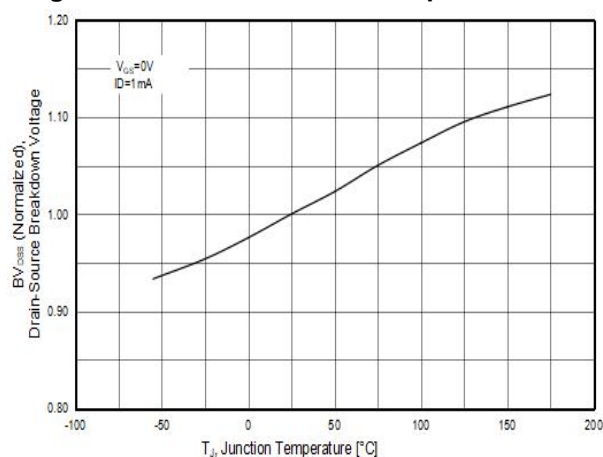


Figure9. Gate charge waveforms

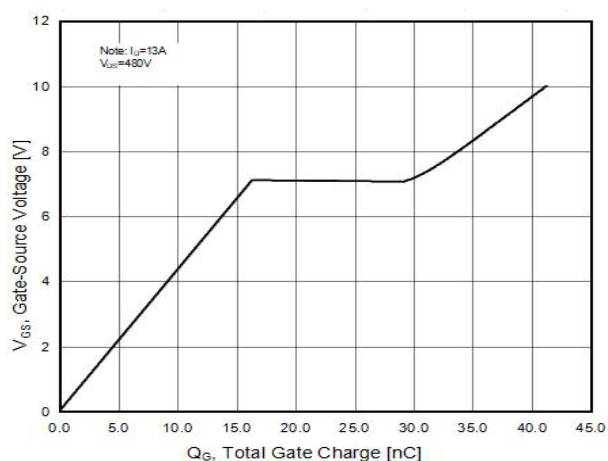
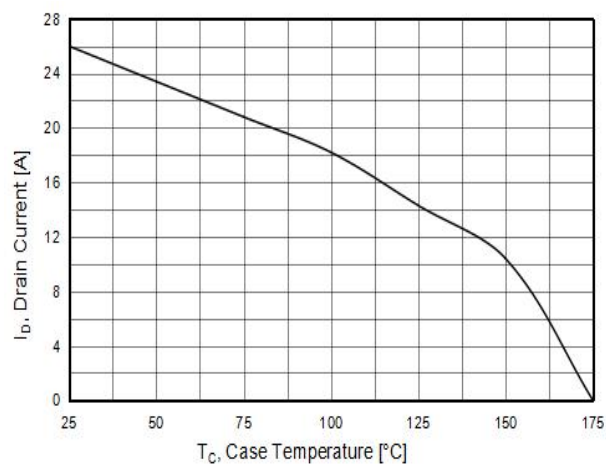
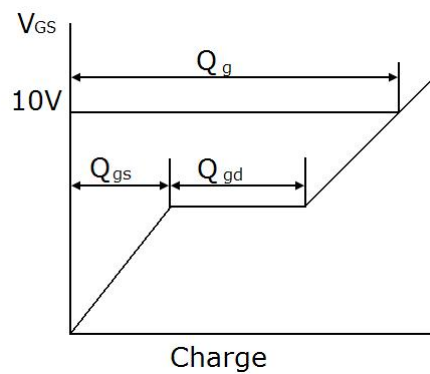
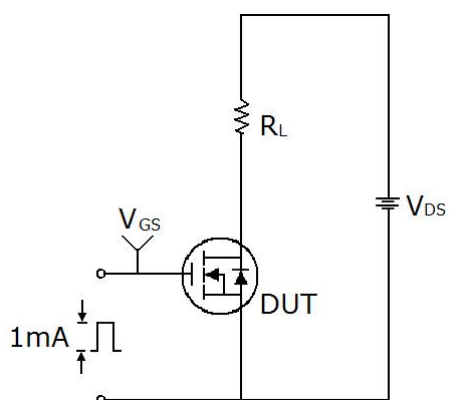


Figure10. Maximum I_D vs Junction Temperature

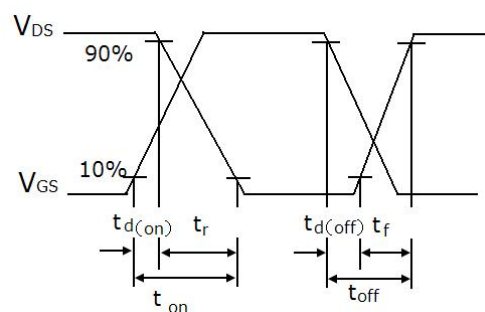


Test circuit

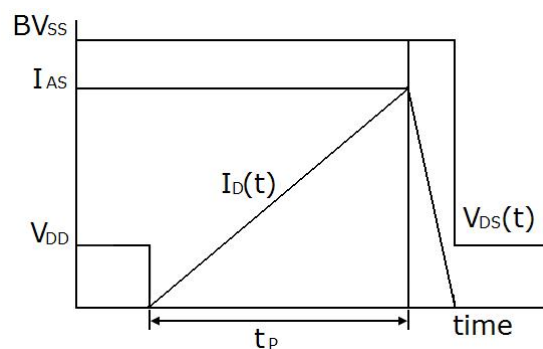
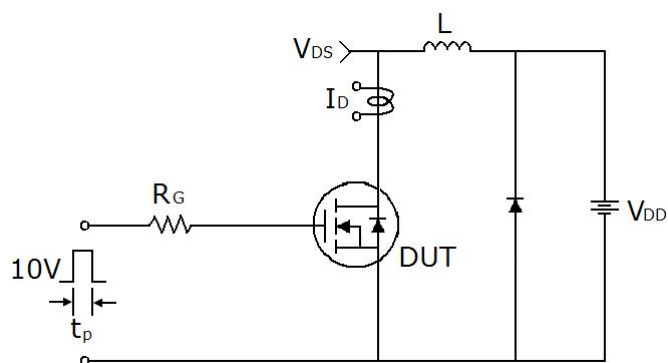
1) Gate charge test circuit & Waveform



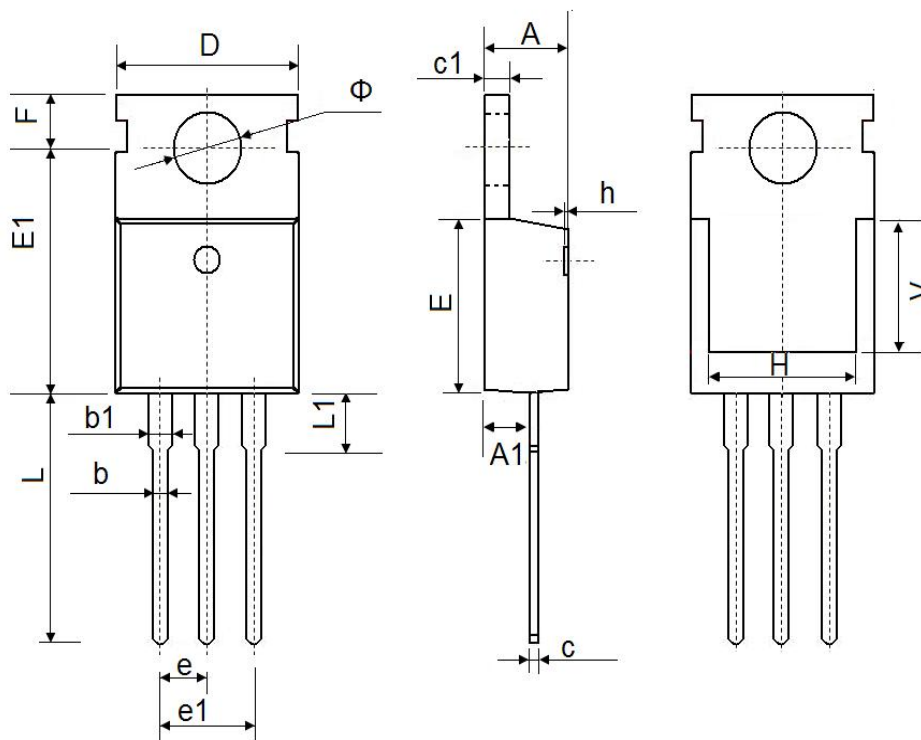
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

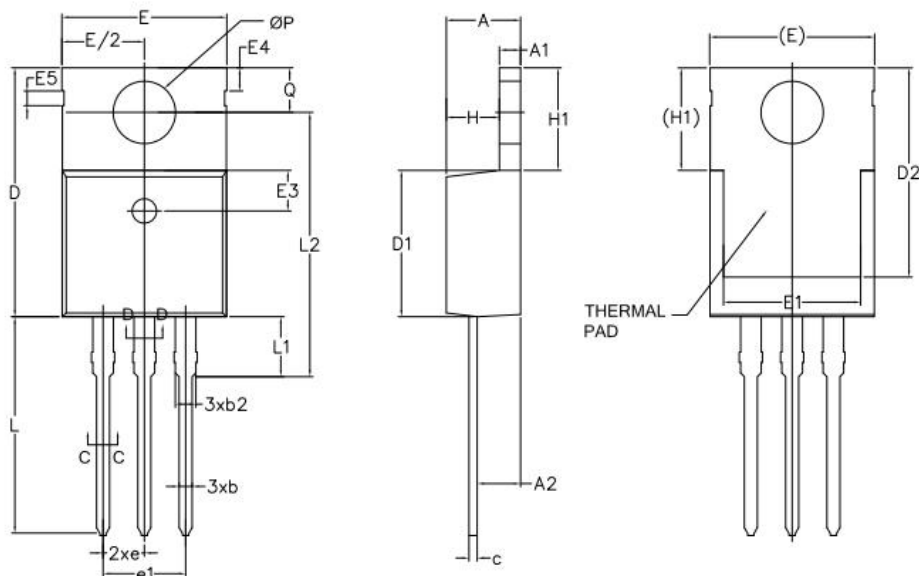


TO-220-3L-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.20	4.60	0.165	0.181
A1	2.25	2.55	0.089	0.100
b	0.70	0.90	0.028	0.035
b1	1.17	1.37	0.046	0.054
c	0.33	0.65	0.013	0.026
c1	1.20	1.40	0.047	0.055
D	8.95	9.75	0.352	0.384
E	9.74	10.04	0.352	0.384
E1	9.91	10.25	0.390	0.404
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	15.45	15.85	0.608	0.624
L	12.90	13.40	0.508	0.528
L1	2.85	3.25	0.112	0.128
Φ	3.40	3.80	0.134	0.150

TO-220-3L-J Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.47	4.67	0.176	0.184
A1	1.20	1.40	0.047	0.055
A2	2.35	2.90	0.093	0.114
b	0.71	0.91	0.028	0.036
b1	0.71	0.86	0.028	0.034
b2	1.22	1.36	0.048	0.054
c	0.47	0.60	0.019	0.024
c1	0.47	0.55	0.019	0.022
D	14.70	15.80	0.579	0.622
D1	8.90	9.47	0.350	0.373
D2	11.75	13.60	0.463	0.535
E	9.70	10.37	0.382	0.408
E1	7.00	8.89	0.276	0.350
E2	9.80	10.20	0.386	0.402
E3	2.40	2.60	0.094	0.102
E4	1.27	1.57	0.050	0.062
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	3.00	3.40	0.118	0.134
L	12.90	14.80	0.508	0.583
L1	2.54	3.84	0.100	0.151
L2	12.13	16.50	0.478	0.650
ØP	3.60	3.90	0.142	0.154
Q	4.60	4.90	0.181	0.193

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