

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.

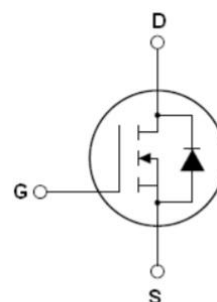
Features

- 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

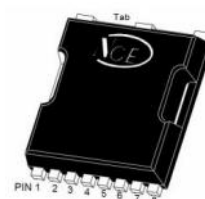


Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE50NF130LL	TOLL-8L	NCE50NF130LL



TOLL-8L

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)	$I_{DM}(\text{pluse})$	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 =250uA	500			V
Zero Gate Voltage Drain Current(Tc=25℃)	I _{DSS}	V _{DS} =500V,V _{GS} =0V			10	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I _{DSS}	V _{DS} =500V,V _{GS} =0V			300	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		5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =12A		110	130	mΩ
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 _{rss}			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 =4Ω,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℃			23.5	A
Pulsed-Source-drain current(Body Diode)	I _{SDM}				70.5	A
Forward on voltage	V _{SD}	T _J =25℃,I _{SD} =23.5A,V _{GS} =0V		0.9	1.1	V
Reverse Recovery Time	t _{rr}	T _J =25℃,I _F 12A, di/dt=100A/μs		170		nS
Reverse Recovery Charge	Q _{rr}			1.02		uC
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

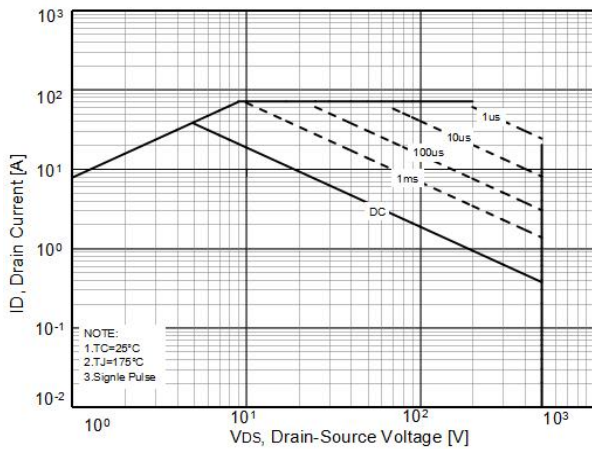


Figure2. Source-Drain Diode Forward Voltage

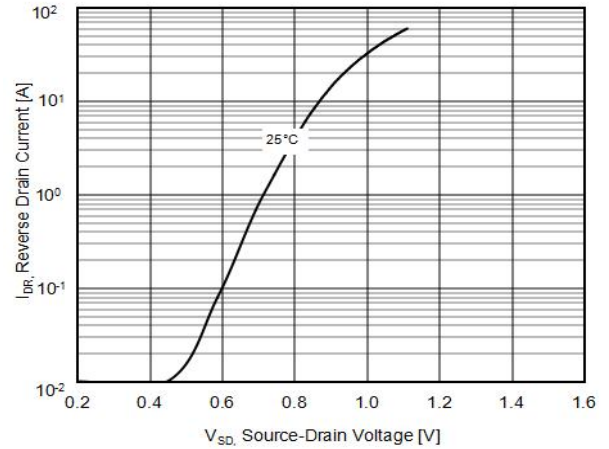


Figure3. Output characteristics

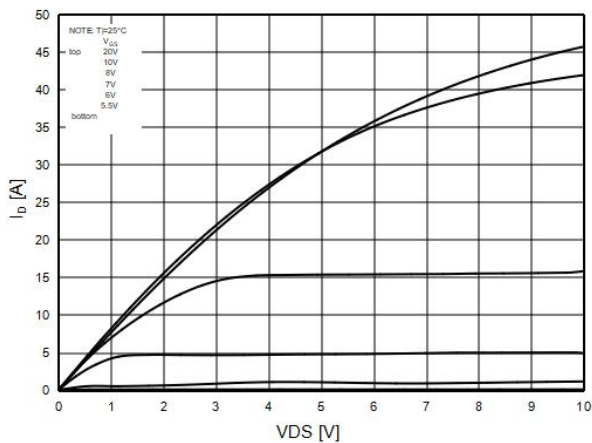


Figure4. Transfer characteristics

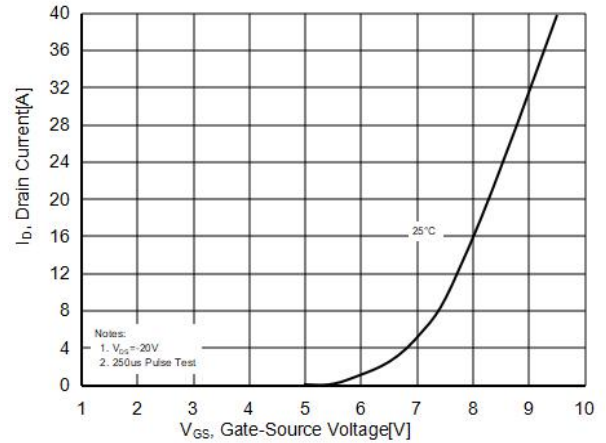


Figure5. Static drain-source on resistance

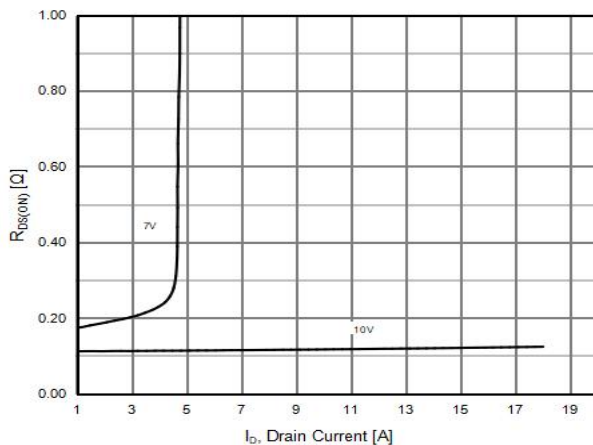


Figure6. $R_{DS(ON)}$ vs Junction Temperature

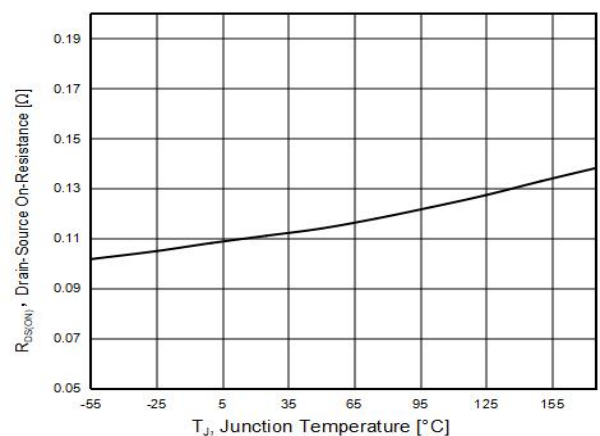


Figure7. BV_{DSS} vs Junction Temperature

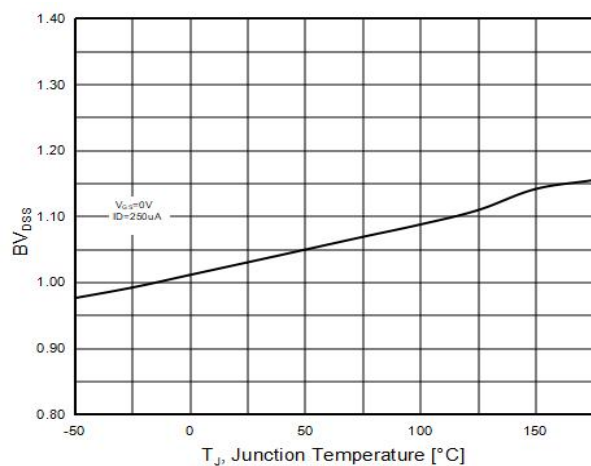


Figure8. Maximum I_D vs Junction Temperature

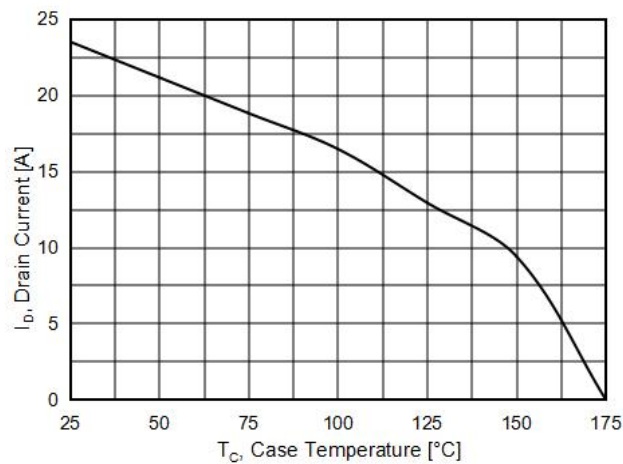


Figure9. Gate charge waveforms

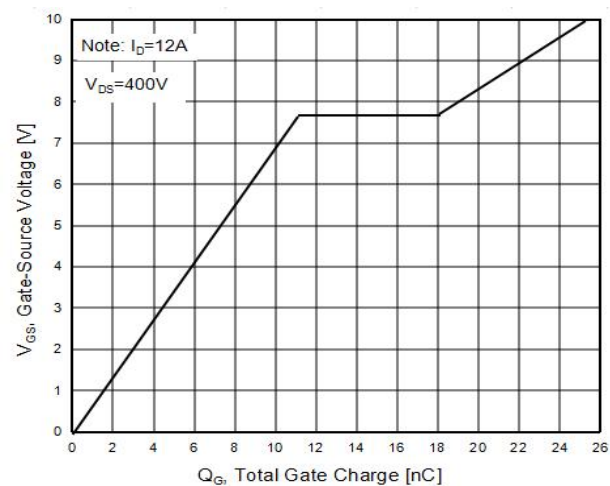
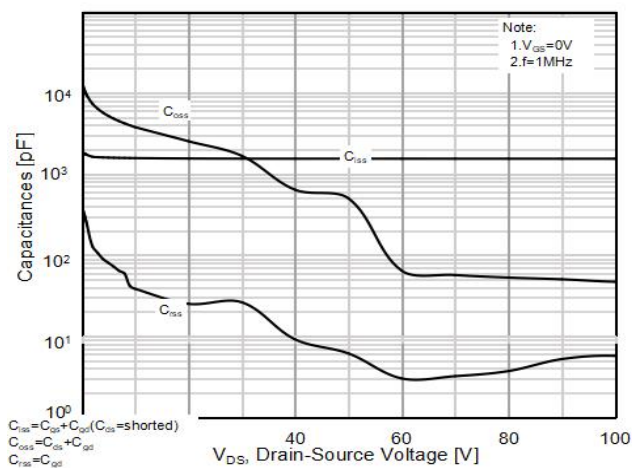
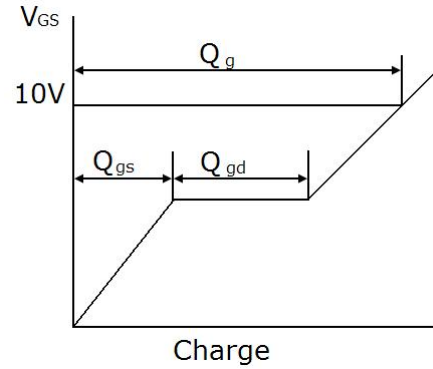
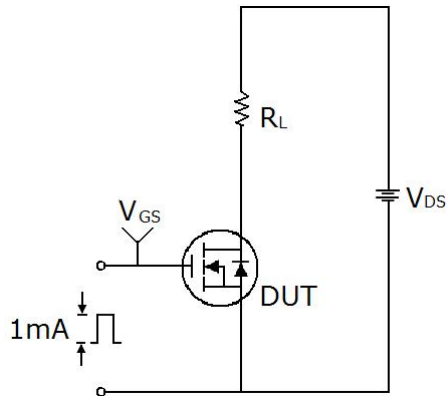


Figure10. Capacitance

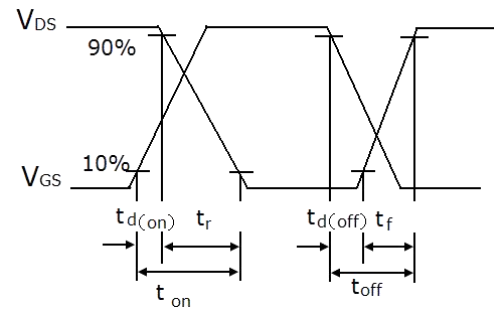
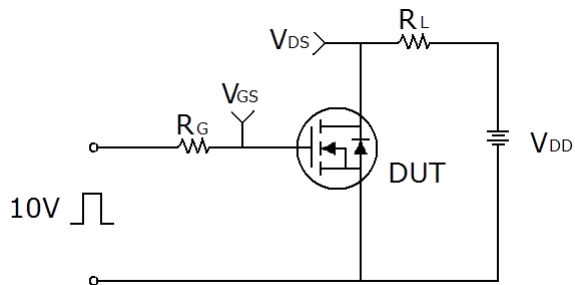


Test circuit

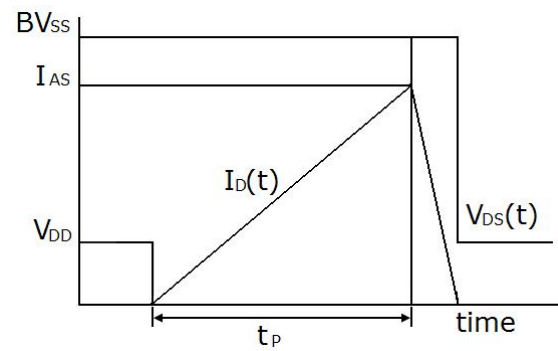
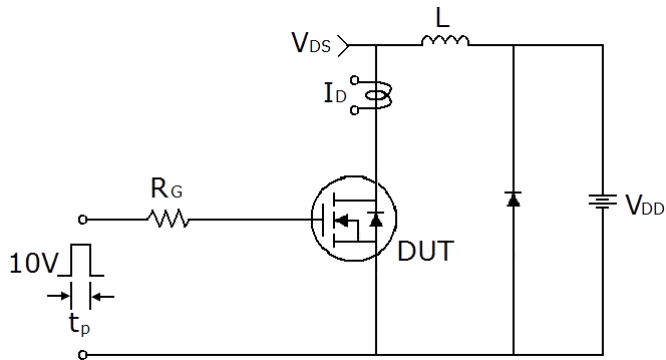
1) Gate charge test circuit & Waveform



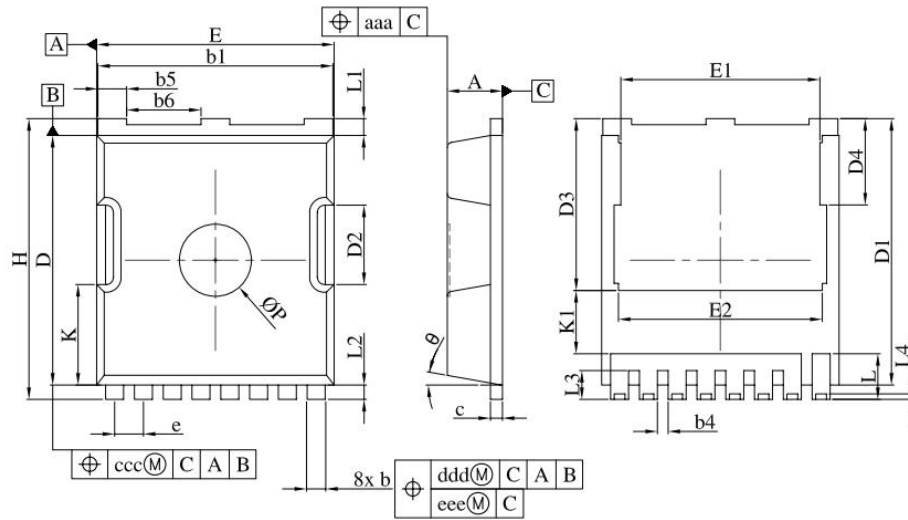
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TOLL-8L Package Information



SYMBOL	Dimensions In Millimeters			Dimensions In Inches		
	Min	Typ	Max	Min	Typ	Max
A	2.20	2.30	2.40	0.087	0.091	0.094
b	0.70	0.80	0.90	0.028	0.031	0.035
b1	9.70	9.80	9.90	0.382	0.386	0.390
b4	0.30	0.40	0.50	0.012	0.016	0.020
b5	1.10	1.20	1.30	0.043	0.047	0.051
b6	3.00	3.10	3.20	0.118	0.122	0.126
c	0.40	0.50	0.60	0.016	0.020	0.024
D	10.28	10.38	10.55	0.405	0.409	0.415
D1	10.98	11.08	11.18	0.432	0.436	0.440
D2	3.20	3.30	3.40	0.126	0.130	0.134
D3	7.00	7.15	7.30	0.276	0.281	0.287
D4	3.44	3.59	3.74	0.135	0.141	0.147
e	1.10	1.20	1.30	0.043	0.047	0.051
E	9.80	9.90	10.00	0.386	0.390	0.394
E1	8.20	8.30	8.40	0.323	0.327	0.331
E2	8.35	8.50	8.65	0.329	0.335	0.341
H	11.50	11.68	11.85	0.453	0.460	0.467
K	4.08	4.18	4.28	0.161	0.165	0.169
K1	2.45	--	--	0.096	--	--
L	1.60	1.90	2.10	0.063	0.075	0.083
L1	0.50	0.70	0.90	0.020	0.028	0.035
L2	0.50	0.60	0.70	0.020	0.024	0.028
L3	1.00	1.20	1.30	0.039	0.047	0.051
L4	0.13	0.23	0.33	0.005	0.009	0.013
P	2.85	3.00	3.15	0.112	0.118	0.124

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