

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.

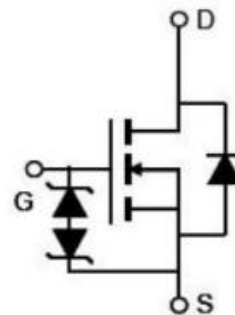
Features

- 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&Halogen compliant

Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)
- LLC Half-bridge

$V_{DS\ min@T_{jmax}}$	650	V
$R_{DS(ON)TYP.}$	380	mΩ
I_D	10	A
Q_g	13.7	nC



Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60NF420	TO-220	NCE60NF420

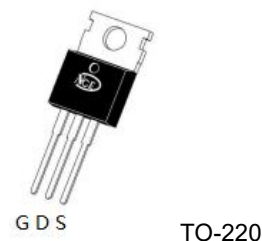


Table 1. Absolute Maximum Ratings ($T_c=25^{\circ}C$)

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	600	V
Gate-Source Voltage ($V_{DS}=0V$), AC ($f>1\ Hz$)	V_{GS}	± 30	V
Gate-Source Voltage ($V_{DS}=0V$), DC	V_{GS}	± 20	V
Continuous Drain Current at $T_c=25^{\circ}C$	$I_{D(DC)}$	10	A
Continuous Drain Current at $T_c=100^{\circ}C$	$I_{D(DC)}$	7	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	30	A
Maximum Power Dissipation($T_c=25^{\circ}C$)	P_D	96	W
Derate above $25^{\circ}C$		0.64	W/ $^{\circ}C$
Single pulse avalanche current (Note 2)	I_{AS}	2	A
Reverse diode dv/dt, $V_{DS} \leq 480\ V, I_{SD} < I_D$	dv/dt	50	V/ns
Drain Source voltage slope, $V_{DS} \leq 480\ V$	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+175	$^{\circ}C$

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	1.56	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	$^{\circ}C/W$

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	600			V
Zero Gate Voltage Drain Current(Tc=25℃)	I _{DSS}	V _{DS} =600V,V _{GS} =0V			10	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I _{DSS}	V _{DS} =600V,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	4.2	5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =5A		380	420	mΩ
Dynamic Characteristics						
Gate Resistance	R _g	F=1MHZ, D-S short		41		Ω
Input Capacitance	C _{iss}	V _{DS} =50V,V _{GS} =0V, F=1MHz		591		pF
Output Capacitance	C _{oss}			17		pF
Reverse Transfer Capacitance	C _{rss}			1.9		pF
Total Gate Charge	Q _g	V _{DS} =400V,I _D =5A, V _{GS} =10V		13.7	15	nC
Gate-Source Charge	Q _{gs}			3.3		nC
Gate-Drain Charge	Q _{gd}			6.9		nC
Gate plateau voltage	V _{gp}			7.2		V
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =5A, R _G =4Ω,V _{GS} =10V		16		nS
Turn-on Rise Time	t _r			12		nS
Turn-Off Delay Time	t _{d(off)}			50		nS
Turn-Off Fall Time	t _f			9		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I _{SD}	T _C =25℃			10	A
Pulsed-Source-drain current(Body Diode)	I _{SDM}				30	A
Forward on voltage	V _{SD}	T _j =25℃,I _{SD} =10A,V _{GS} =0V		1.0	1.2	V
Reverse Recovery Time	t _{rr}	T _j =25℃,I _F =5A, di/dt=100A/μs		80		nS
Reverse Recovery Charge	Q _{rr}			0.24		uC
Peak reverse recovery current	I _{rrm}			6		A

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. $T_j=25^{\circ}C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

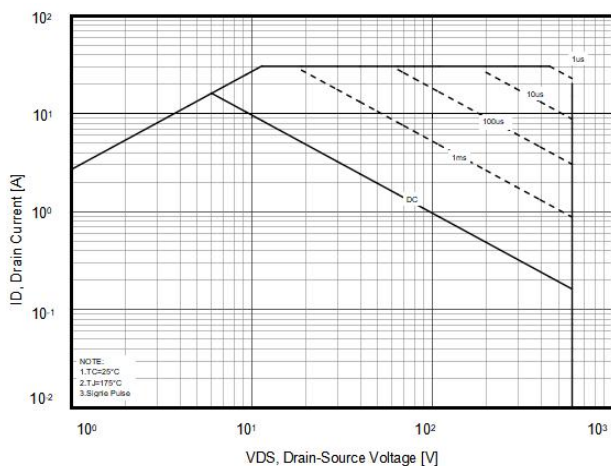


Figure2. Source-Drain Diode Forward Voltage

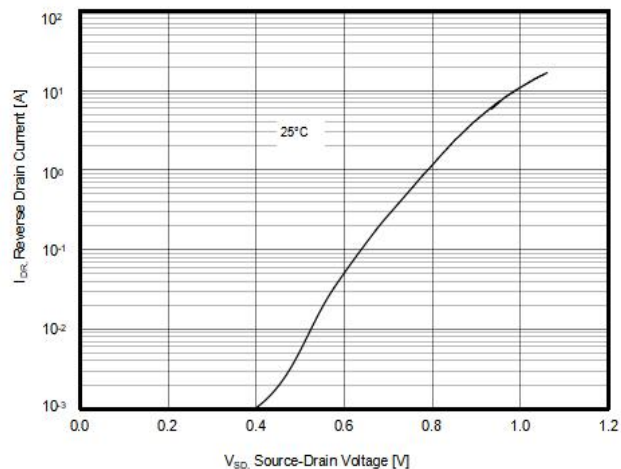


Figure3. Transfer characteristics

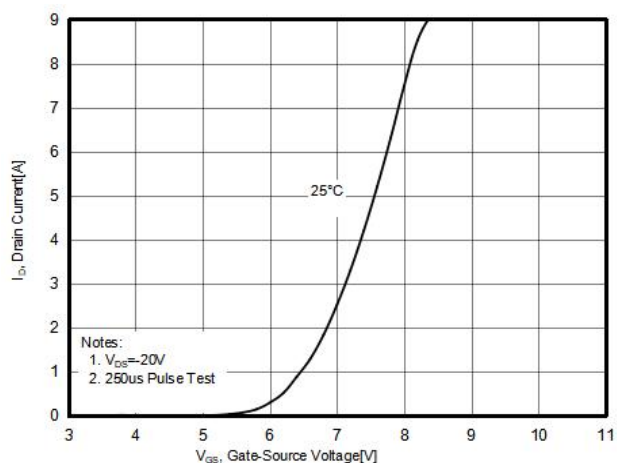


Figure4. Output characteristics

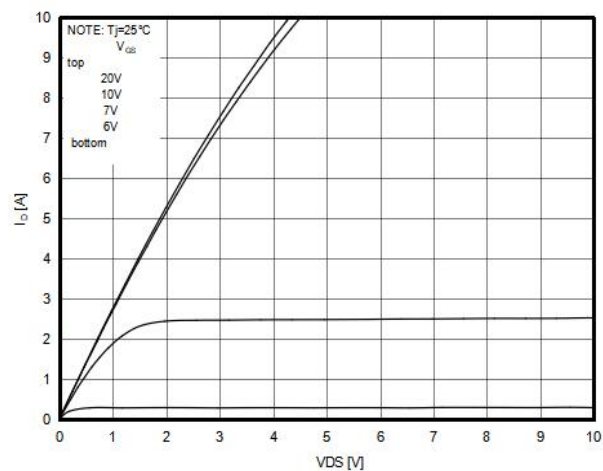


Figure5. Static drain-source on resistance

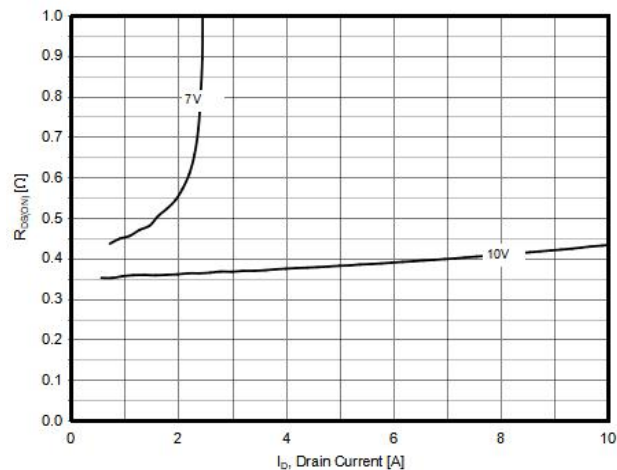


Figure6. RDS(ON) vs Junction Temperature

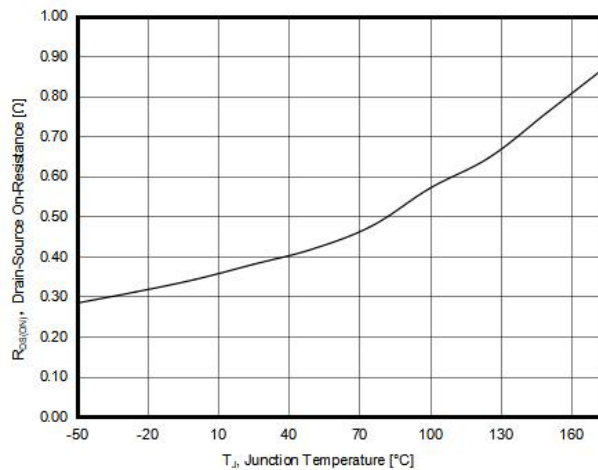


Figure7. BV_{DS} vs Junction Temperature

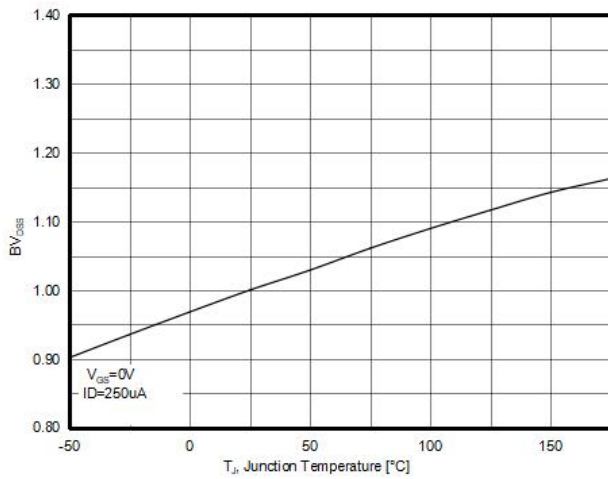


Figure8. Maximum I_D vs Junction Temperature

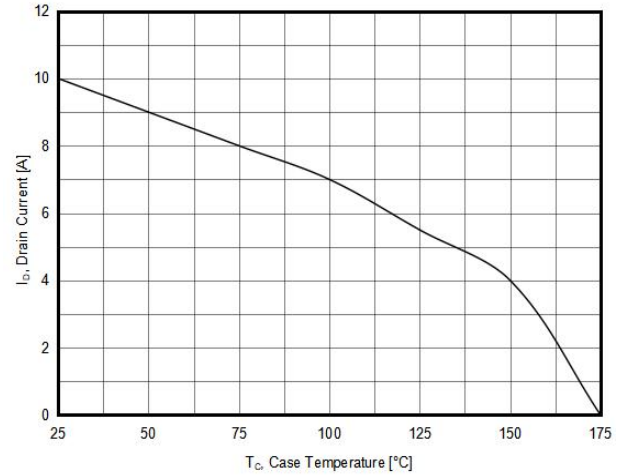


Figure9. Gate charge waveforms

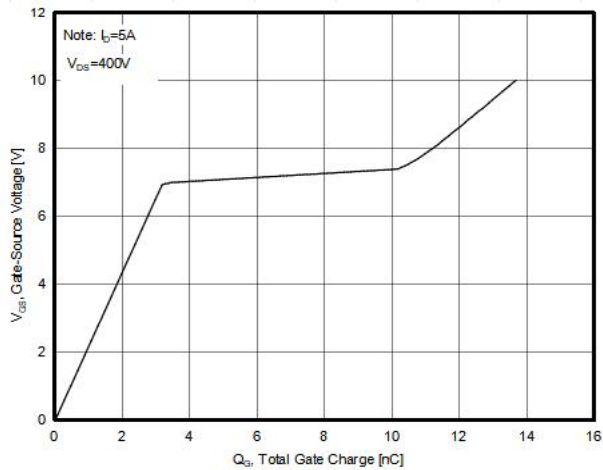
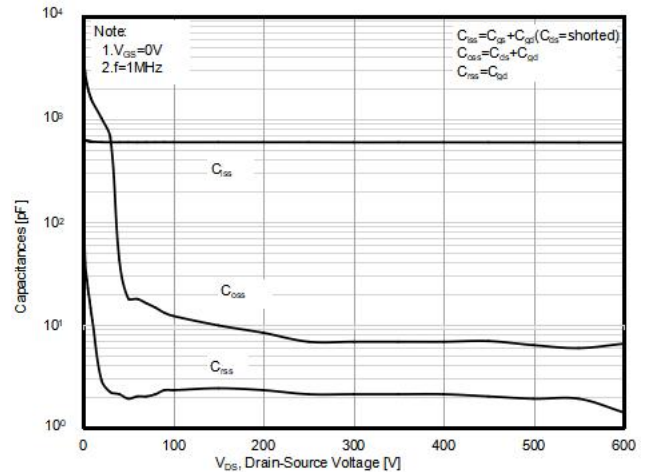
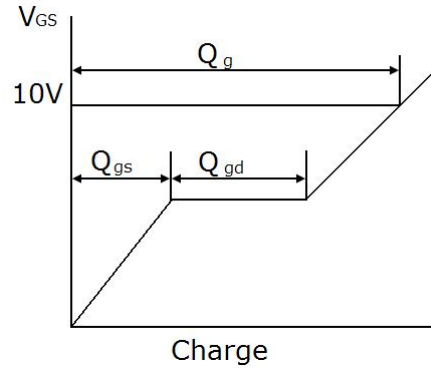


Figure10. Capacitance

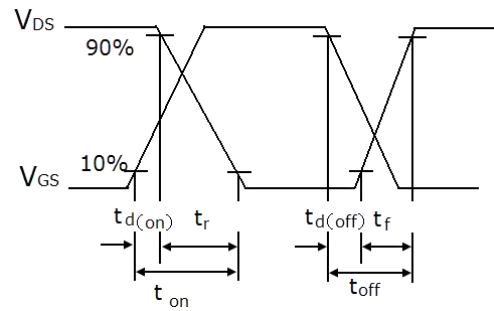


Test circuit

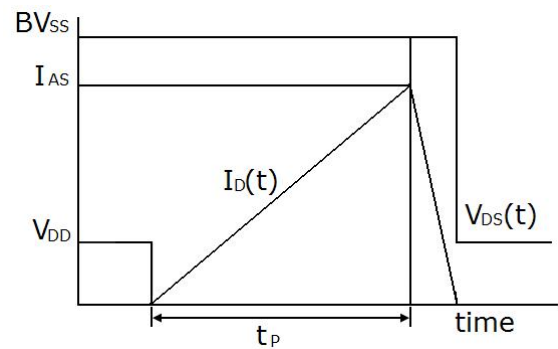
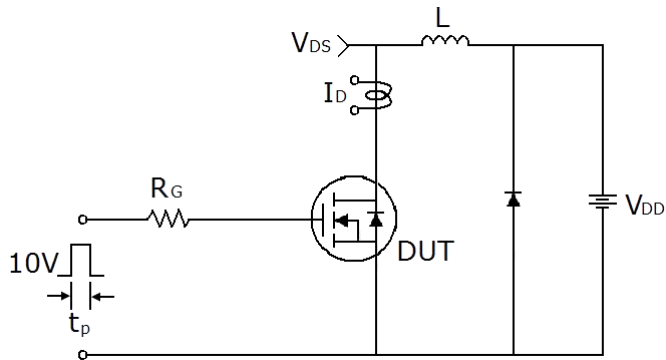
1) Gate charge test circuit & Waveform



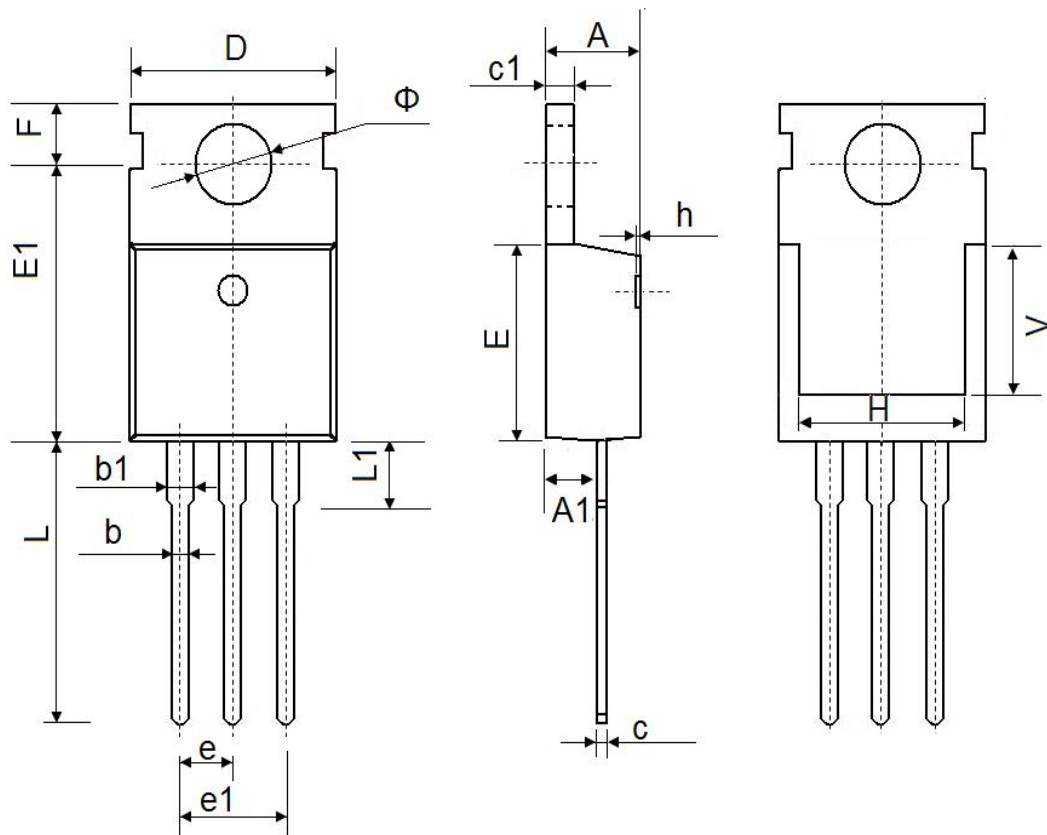
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-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

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