

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.

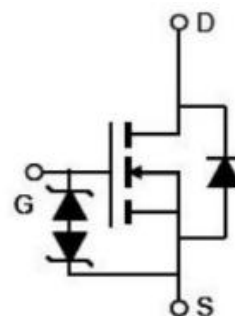
Features

- 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

$V_{DS\ min@T_{jmax}}$	650	V
$R_{DS(ON)TYP.}$	230	m Ω
I_D	14	A
Q_g	19	nC

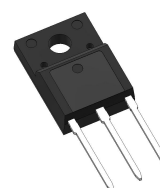


Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60NF260FW	TO-220FW	NCE60NF260FW



TO-220FW

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	600	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 $T_C=25^{\circ}\text{C}$	$I_{D(DC)}$	14	A
Continuous Drain Current at $T_C=100^{\circ}\text{C}$	$I_{D(DC)}$	9.8	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	42	A
Maximum Power Dissipation($T_C=25^{\circ}\text{C}$)	P_D	33.2	W
Derate above 25°C		0.22	W/ $^{\circ}\text{C}$
Single pulse avalanche current (Note 2)	I_{AS}	2.5	A
Single pulse avalanche energy (Note 2)	E_{AS}	25	mJ
Reverse diode dv/dt, $V_{DS} \leq 480\text{ V}, I_{SD} < I_D$	dv/dt	50	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}	4.52	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	$^{\circ}\text{C}/\text{W}$

Table 3. Electrical Characteristics ($T_J=25^{\circ}\text{C}$ 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(Tj=25℃)	I _{DSS}	V _{DS} =600V,V _{GS} =0V			10	μA
Zero Gate Voltage Drain Current(Tj=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	5.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =7A		230	260	mΩ
Dynamic Characteristics						
Gate Resistance	R _g	F=1MHZ, D-S short		17.3		Ω
Input Capacitance	C _{iss}	V _{DS} =50V,V _{GS} =0V, F=1MHz		946		pF
Output Capacitance	C _{oss}			50		pF
Reverse Transfer Capacitance	C _{rss}			1.6		pF
Total Gate Charge	Q _g	V _{DS} =400V,I _D =7A, V _{GS} =10V		19		nC
Gate-Source Charge	Q _{gs}			9.8		nC
Gate-Drain Charge	Q _{gd}			3.1		nC
Gate plateau voltage	V _{gp}			6.8		V
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =7A, R _G =4Ω,V _{GS} =10V		18		nS
Turn-on Rise Time	t _r			13		nS
Turn-Off Delay Time	t _{d(off)}			52		nS
Turn-Off Fall Time	t _f			10		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I _{SD}	T _C =25℃			14	A
Pulsed-Source-drain current(Body Diode)	I _{SDM}				42	A
Forward on voltage	V _{SD}	Tj=25℃,I _{SD} =14A,V _{GS} =0V		1.0	1.2	V
Reverse Recovery Time	t _{rr}	Tj=25℃,I _F =7A, di/dt=100A/μs		85		nS
Reverse Recovery Charge	Q _{rr}			0.29		uC
Peak reverse recovery current	I _{rrm}			7		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

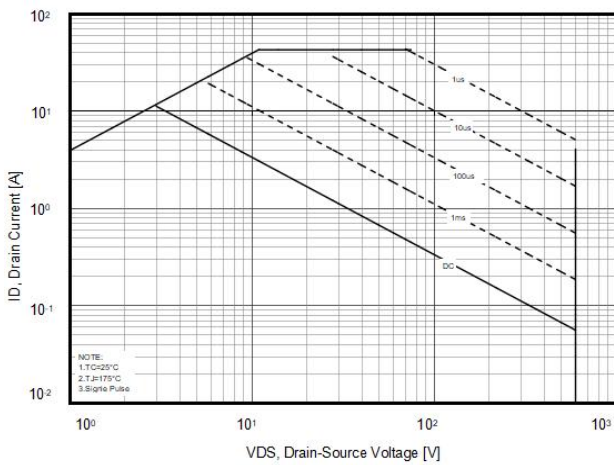


Figure2. Source-Drain Diode Forward Voltage

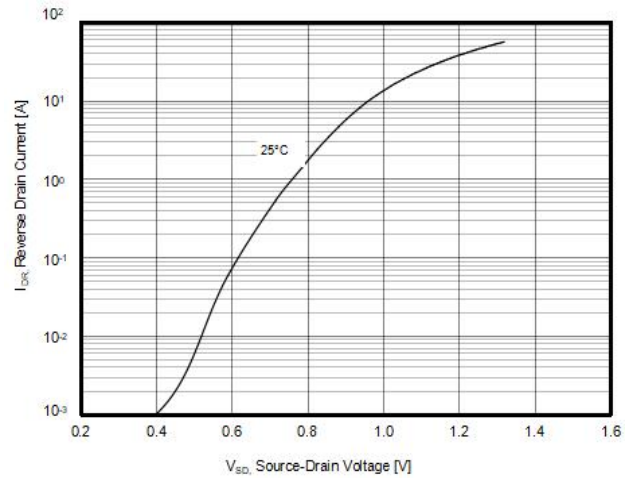


Figure4. Transfer characteristics

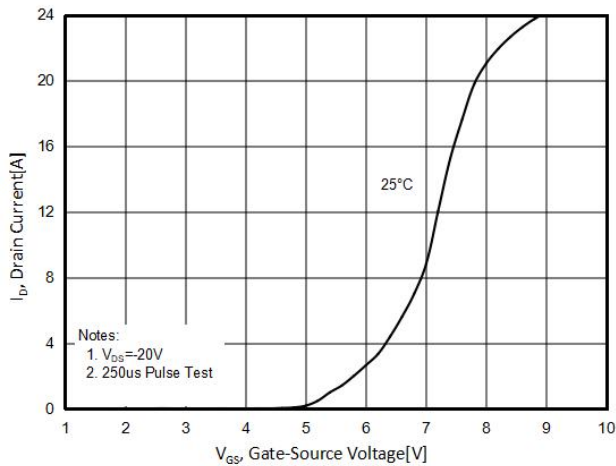


Figure3. Output characteristics

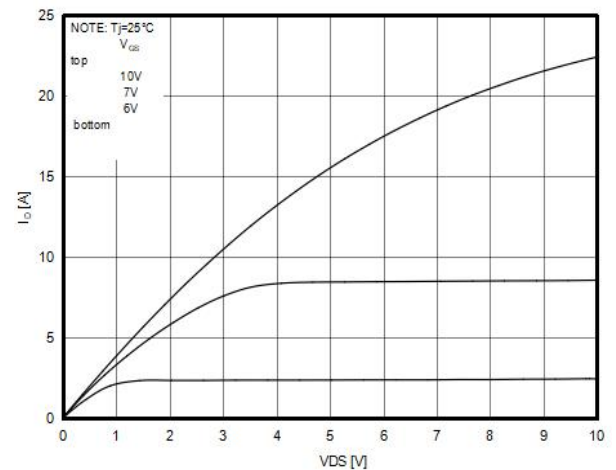


Figure5. Static drain-source on resistance

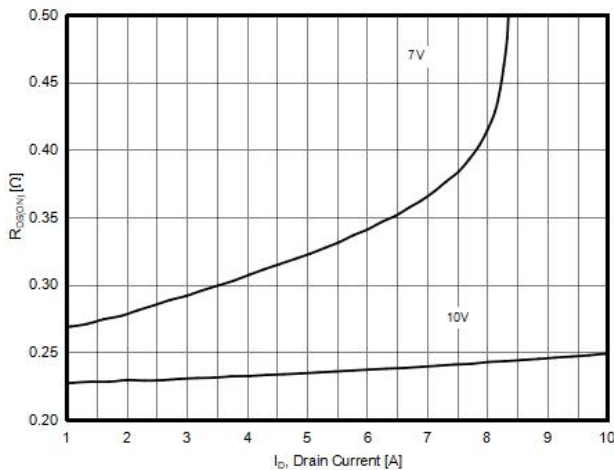


Figure6. $R_{DS(ON)}$ vs Junction Temperature

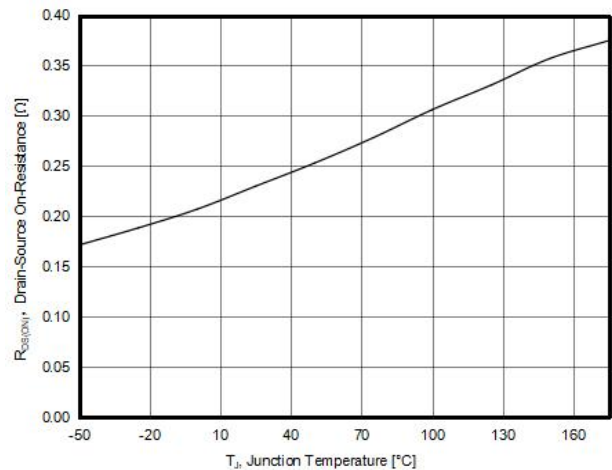


Figure7. BV_{DS} vs Junction Temperature

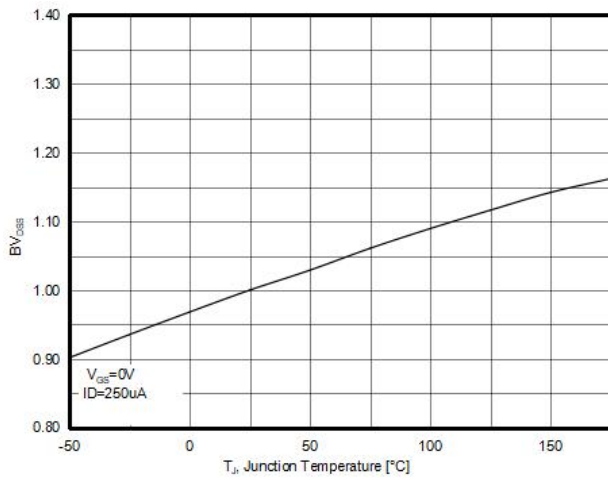


Figure8. Maximum I_D vs Junction Temperature

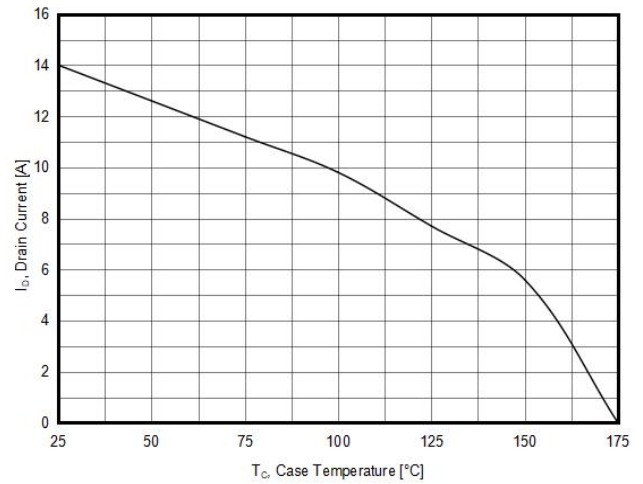


Figure9. Gate charge waveforms

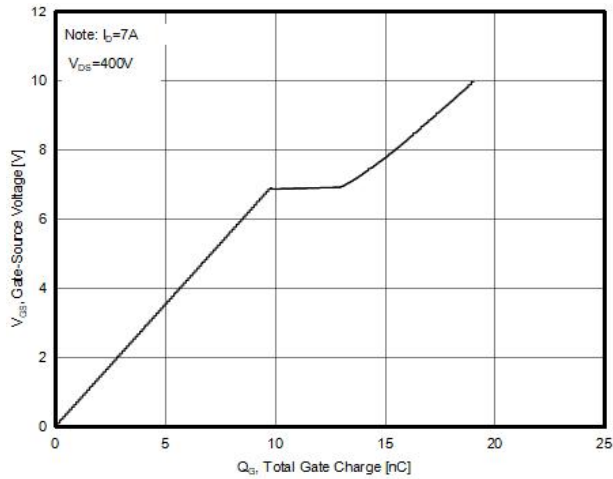
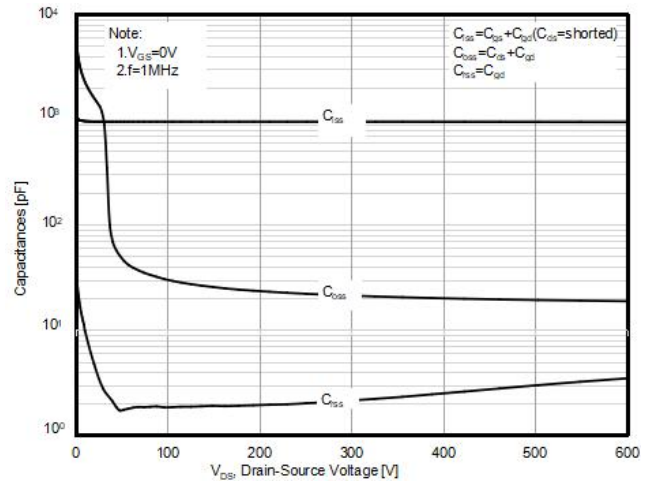
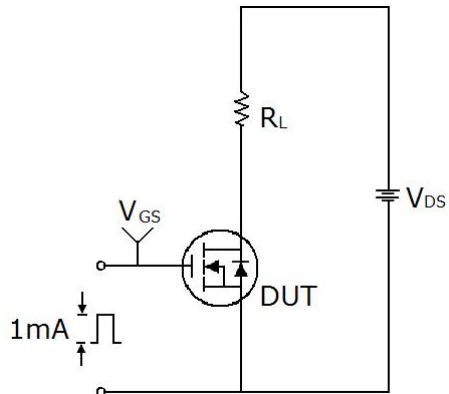
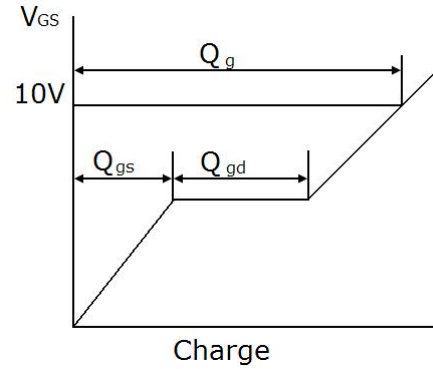


Figure10. Capacitance

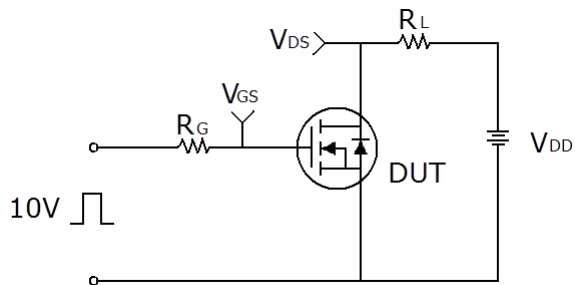
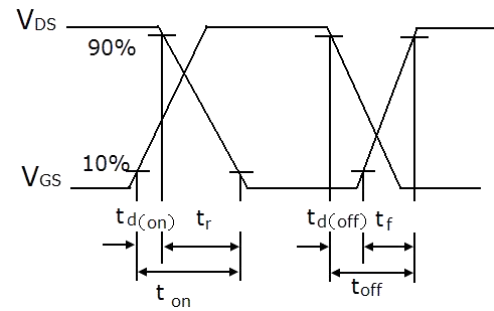


Test circuit

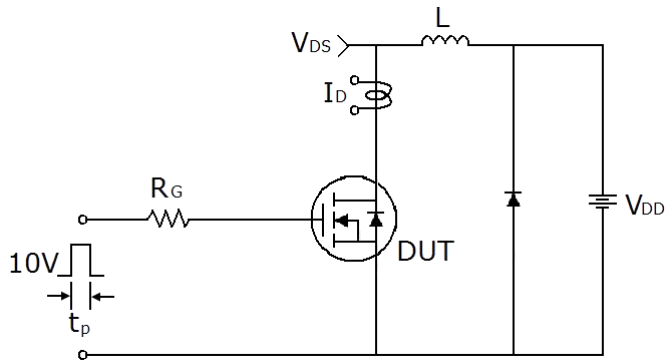
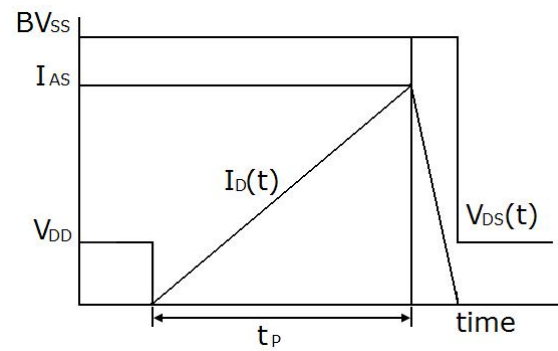
1) Gate charge test circuit & Waveform



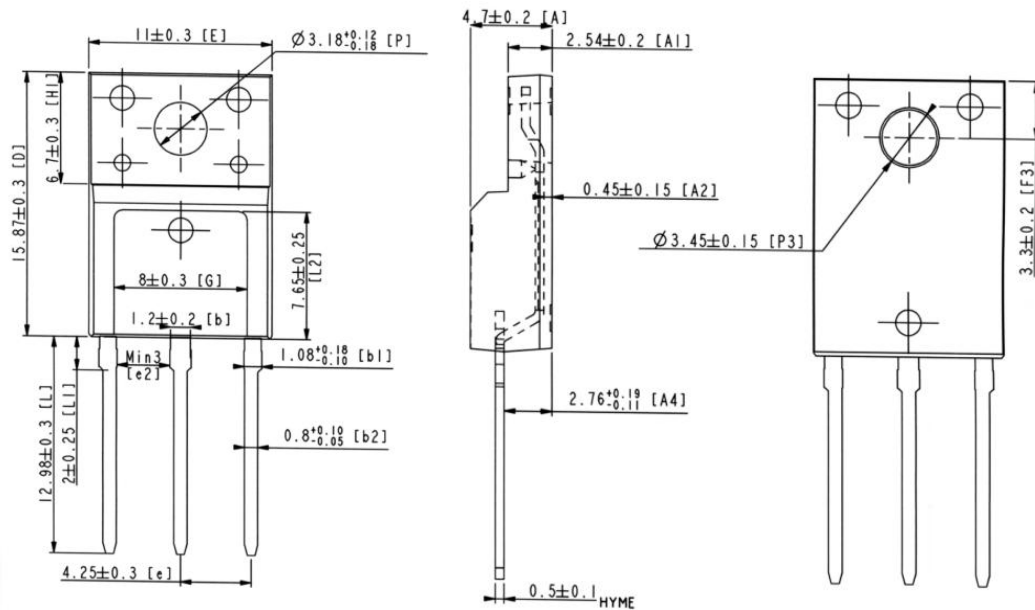
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-220FM-3L-c Package Information



Items	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.50	4.90	0.177	0.193
A1	2.34	2.74	0.092	0.108
A2	0.30	0.60	0.012	0.024
A4	2.65	2.95	0.104	0.116
Hyme	0.40	0.60	0.016	0.024
E	10.70	11.30	0.422	0.445
D	15.57	16.17	0.613	0.637
H1	6.40	7.00	0.252	0.276
L	12.68	13.28	0.500	0.523
L1	1.75	2.25	0.069	0.089
G	7.70	8.30	0.303	0.327
b	1.00	1.40	0.039	0.055
L2	7.40	7.90	0.292	0.311
b1	0.98	1.26	0.039	0.050
b2	0.75	0.90	0.030	0.035
e	4.25±0.3			
e2	3.00	-	0.118	-
Ø P	3.00	3.30	0.118	0.130
Ø P3	3.30	3.60	0.130	0.142
F3	3.10	3.50	0.122	0.138

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