

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.

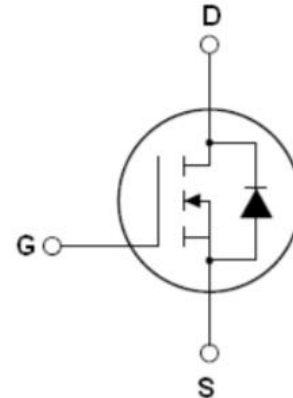
Features

- New technology for high voltage device
- 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)

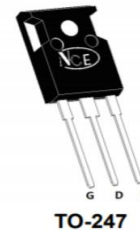
$V_{DS, min@T_{jmax}}$	650	V
$R_{DS(ON)TYP.}$	25	m Ω
I_D	73	A
Q_g	113	nC



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60NF031T	TO-247	NCE60NF031T



TO-247

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

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
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	73	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	51	A
Pulsed drain current (Note 1)	$I_{DM (pulse)}$	219	A
Maximum Power Dissipation($T_c=25^\circ\text{C}$)	P_D	490	W
Derate above 25°C		3.2	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	E_{AS}	2117	mJ
Single pulse avalanche current (Note 2)	I_{AS}	11	A
Repetitive Avalanche energy, t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	0.9	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}	0.31	$^{\circ}\text{C}/\text{W}$
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}	$V_{GS}=0V, I_D=10mA$	600			V
Zero Gate Voltage Drain Current($T_c=25^{\circ}\text{C}$)	I_{DSS}	$V_{DS}=600V, V_{GS}=0V$			5	μA
Zero Gate Voltage Drain Current($T_c=125^{\circ}\text{C}$)	I_{DSS}	$V_{DS}=600V, V_{GS}=0V$			400	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$			± 200	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=3mA$	2.5		4.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=37A$		25	31	m Ω
Dynamic Characteristics						
Gate Resistance	R_g	$F=1\text{MHz}, \text{D-S short}$		2.4		Ω
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V,$ $F=1\text{MHz}$		5310		pF
Output Capacitance	C_{oss}			358		pF
Reverse Transfer Capacitance	C_{riss}			6.3		pF
Total Gate Charge	Q_g	$V_{DS}=400V, I_D=40A, V_{GS}=10V$		113	120	nC
Gate-Source Charge	Q_{gs}			21		nC
Gate-Drain Charge	Q_{gd}			37		nC
Gate plateau voltage	V_{gp}			4.8		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, I_D=40A,$ $R_G=4\Omega, V_{GS}=10V$		55		nS
Turn-on Rise Time	t_r			50		nS
Turn-Off Delay Time	$t_{d(off)}$			177		nS
Turn-Off Fall Time	t_f			14		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	$T_c=25^{\circ}\text{C}$			73	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				219	A
Forward on voltage	V_{SD}	$T_j=25^{\circ}\text{C}, I_{SD}=80A, V_{GS}=0V$		1.0	1.2	V
Reverse Recovery Time	t_{rr}	$T_j=25^{\circ}\text{C}, I_F=40A,$ $di/dt=100A/\mu\text{s}$		248		nS
Reverse Recovery Charge	Q_{rr}			2.0		μC
Peak reverse recovery current	I_{rrm}			15.5		A

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

2. $T_j=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, R_G=25\Omega, L=35\text{mH}$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

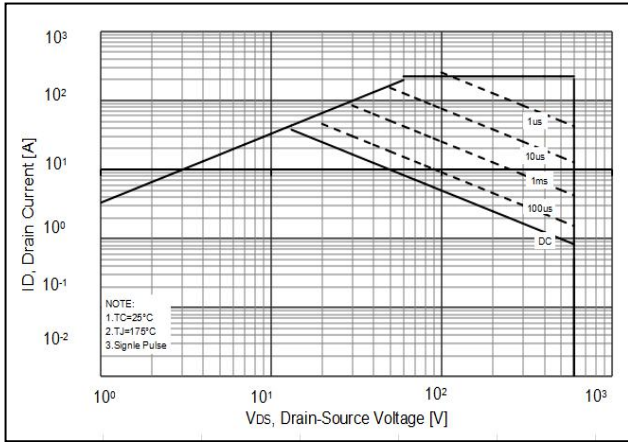


Figure2. Source-Drain Diode Forward Voltage

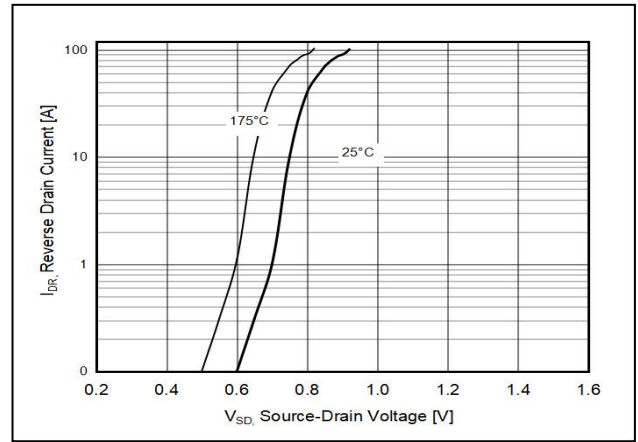


Figure3. Output characteristics

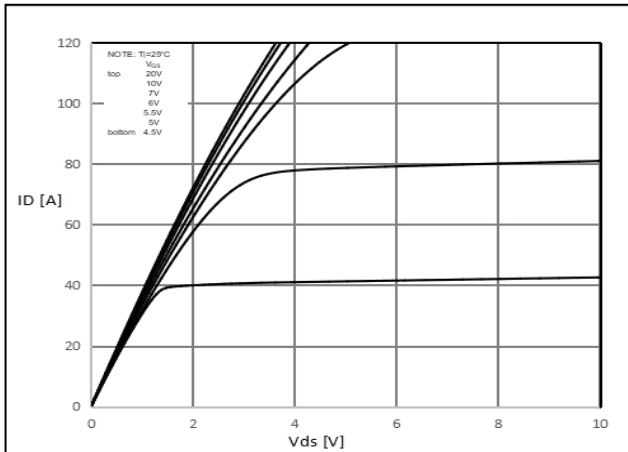


Figure4. Transfer characteristics

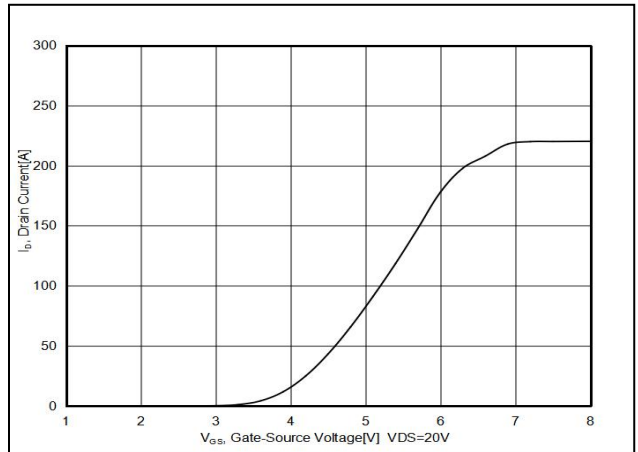


Figure5. Static drain-source on resistance

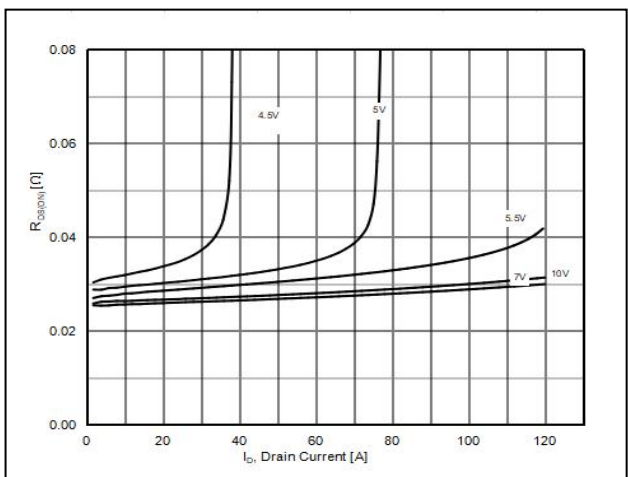


Figure6. $R_{DS(ON)}$ vs Junction Temperature

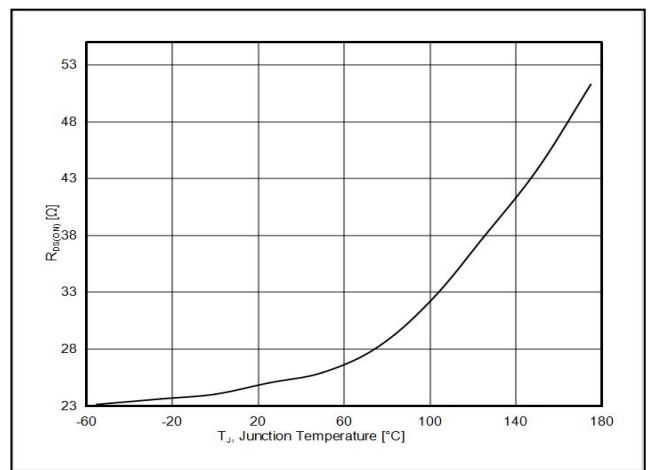


Figure7. BV_{DSS} vs Junction Temperature

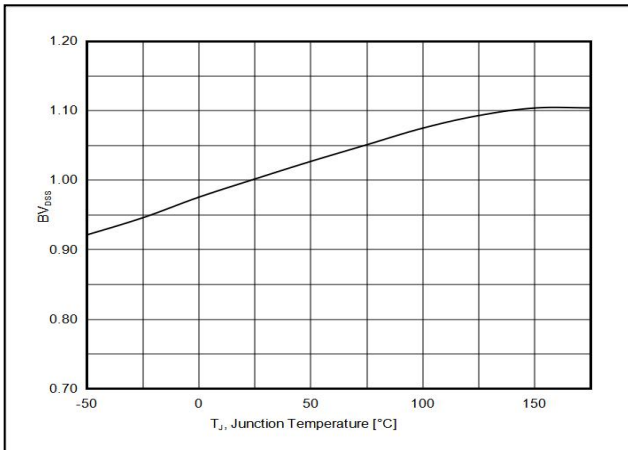


Figure8. Maximum I_D vs Junction Temperature

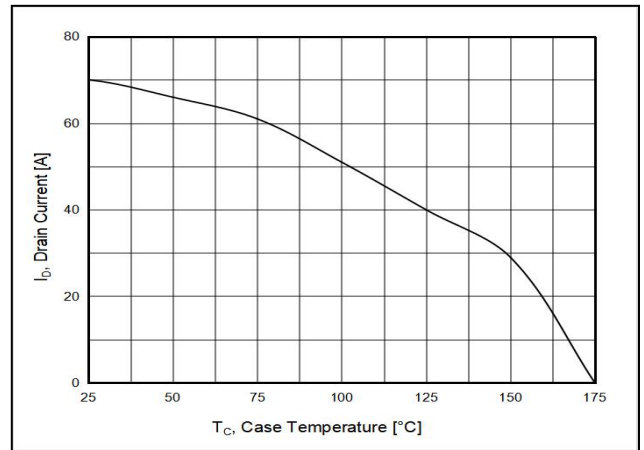


Figure9. Gate charge waveforms

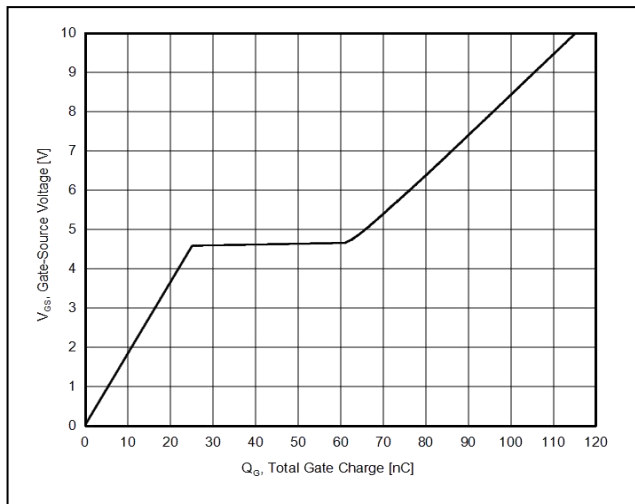
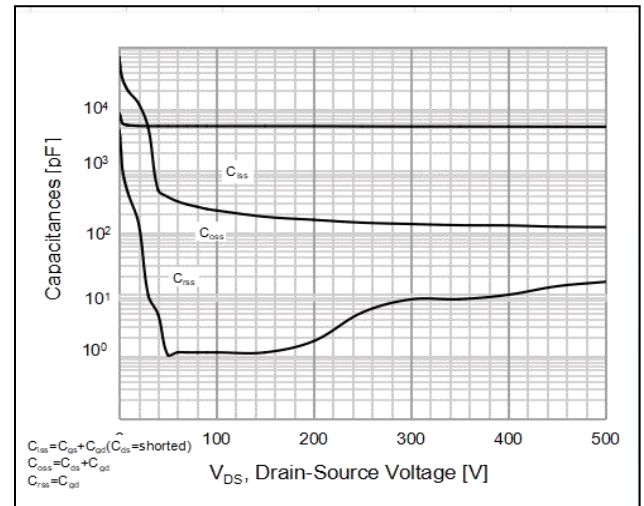
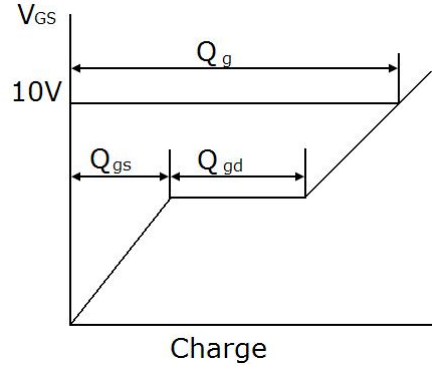
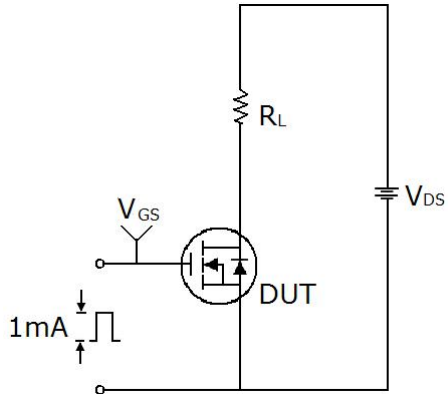


Figure10. Capacitance

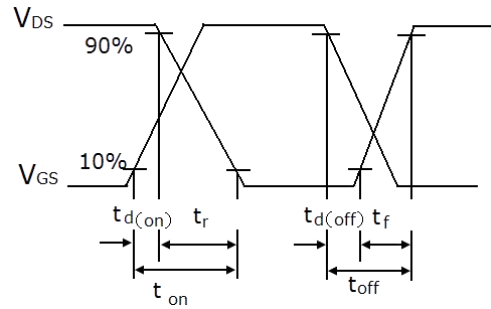
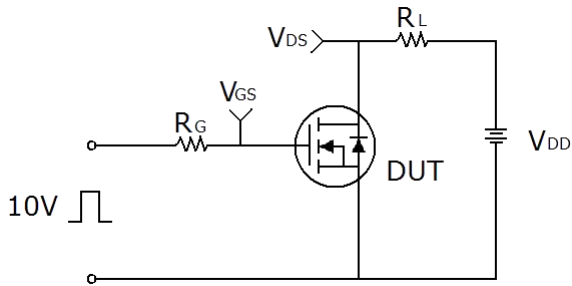


Test circuit

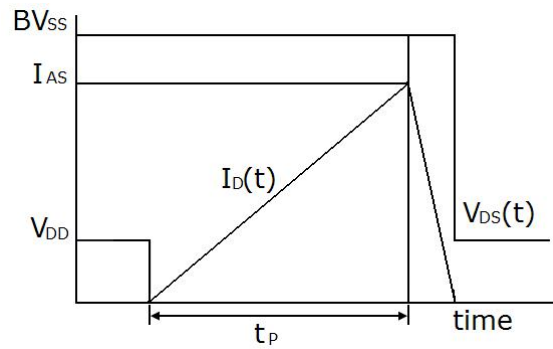
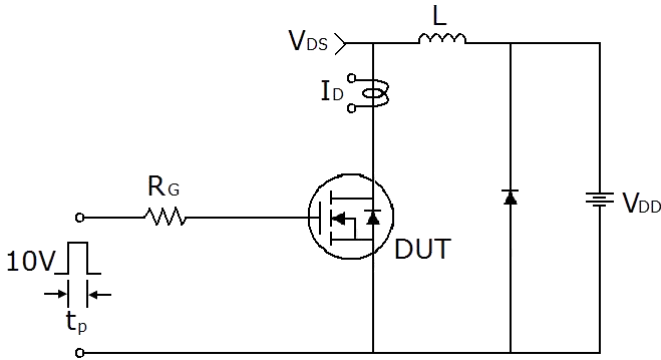
1) Gate charge test circuit & Waveform



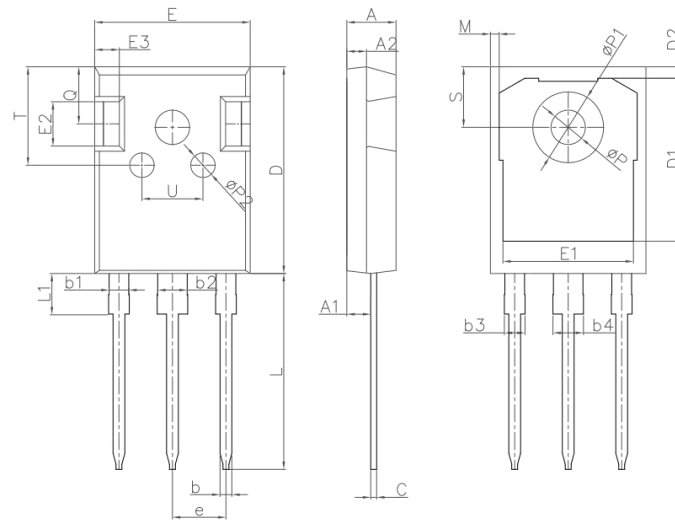
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-247 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	0.19	0.20
A1	2.31	2.51	0.09	0.10
A2	1.9	2.1	0.07	0.08
b	1.16	1.26	0.05	0.05
b1	1.96	2.06	0.08	0.08
b2	2.96	3.06	0.12	0.12
b3	/	2.25	/	0.09
b4	/	3.25	/	0.13
c	0.59	0.66	0.02	0.03
D	20.9	21.1	0.82	0.83
D1	16.25	16.85	0.64	0.66
D2	1.05	1.35	0.04	0.05
E	15.7	15.9	0.62	0.63
E2	4.4	4.6	0.17	0.18
E3	2.4	2.6	0.09	0.10
L	19.8	20.1	0.78	0.79
L1	/	4.3	/	0.17
Q	5.6	6	0.22	0.24
S	6.05	6.25	0.24	0.25
T	9.8	10.2	0.39	0.40
e	5.436BSC		0.214BSC	

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