N-Channel Super Junction Power MOSFET Ⅲ

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.

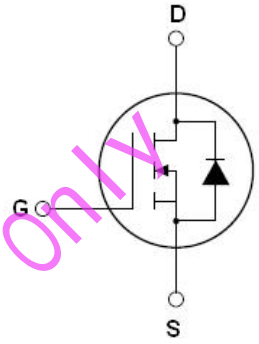
$V_{DS\ min@Tjmax}$	710	V
$R_{DS(ON)TYP}$	62	mΩ
ID	45	A
Qg	65	nC

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

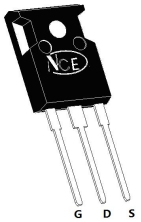
Application

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



Schematic diagram

✧ Intrinsic fast-recovery body diode



TO-247

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65TF078T	TO-247	NCE65TF078T

Table 1. Absolute Maximum Ratings (T_C=25℃)

Parameter	Symbol	Value	Unit
Drain-Source Voltage (VGS=0V)	V_{DS}	650	V
Gate-Source Voltage (VDS=0V) AC (f>1 Hz)	V_{GS}	±30	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	45	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	28.3	A
Pulsed drain current (Note 1)	$I_{DM\ (pluse)}$	135	A
Maximum Power Dissipation(Tc=25°C)	P_D	400	W
Derate above 25°C		3.2	W/°C
Single pulse avalanche energy (Note 2)	E_{AS}	907	mJ
Avalanche current(Note 1)	I_{AR}	11	A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	0.9	mJ
Drain Source voltage slope, V_{DS} ≤480 V,	dv/dt	50	V/ns
Reverse diode dv/dt， V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+150	°C

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	0.31	°C /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	62	°C /W

Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=500μA	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			100	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=250μA	2.5	3.5	4.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=23A		62	78	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		4000	4400	pF
Output Capacitance	C_{oss}			240		pF
Reverse Transfer Capacitance	C_{rss}			1.1		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=23A, V_{GS}=10V		65	75	nC
Gate-Source Charge	Q_{gs}			24		nC
Gate-Drain Charge	Q_{gd}			15		nC
Gate plateau voltage	Vgp			6		V
Intrinsic gate resistance	R_G	f = 1 MHz open drain		10.5		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=23A, R_G=1.7Ω,V_{GS}=10V		16		nS
Turn-on Rise Time	t_r			13		nS
Turn-Off Delay Time	$t_{d(off)}$			71		nS
Turn-Off Fall Time	t_f			13		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			45	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				135	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=45A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=23A,di/dt=100 A/μs		180		nS
Reverse Recovery Charge	Q_{rr}			1.6		uC
Peak Reverse Recovery Current	I_{rrm}			18		A

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

2. Tj=25℃,VDD=50V,VG=10V, R_G=25Ω

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

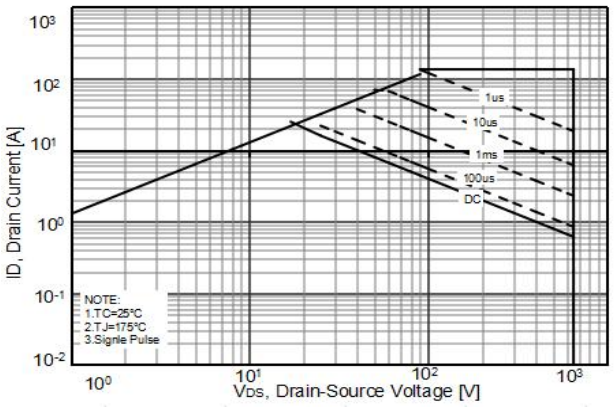


Figure2. Capacitance

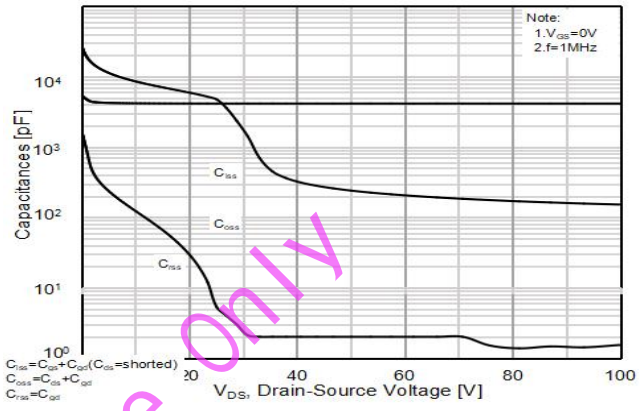


Figure3. Source-Drain Diode Forward Voltage

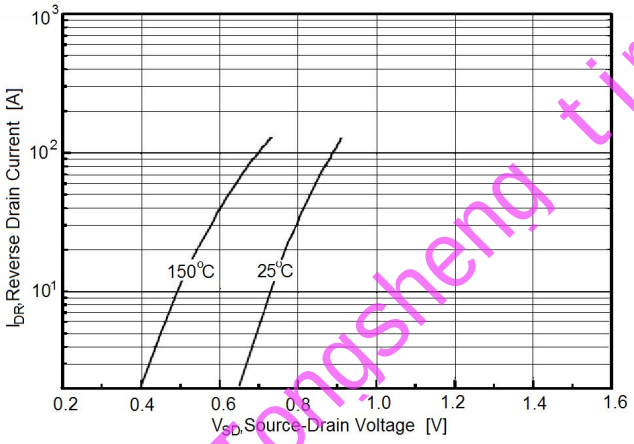


Figure4. Output characteristics

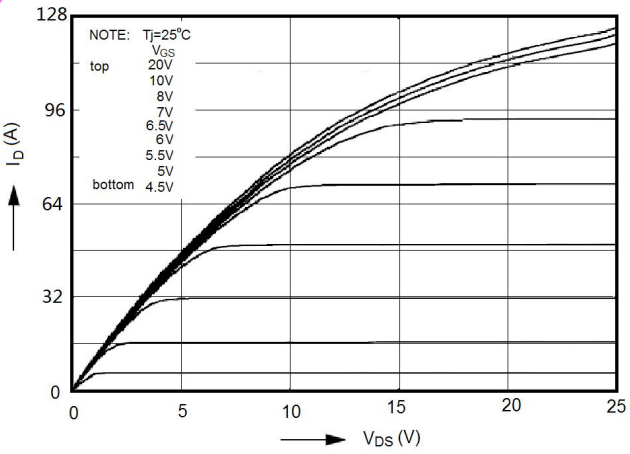


Figure5. Transfer characteristics

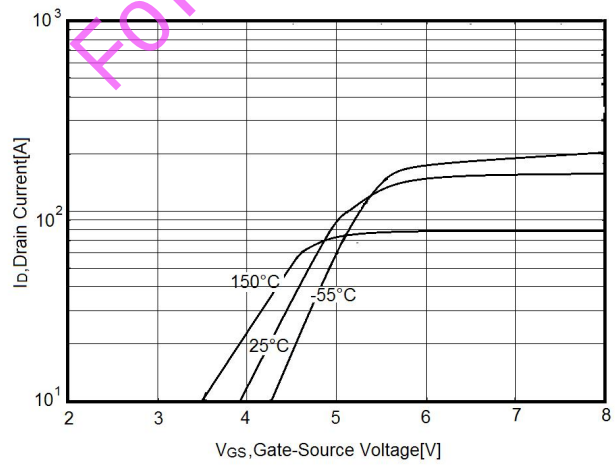


Figure6. Static drain-source on resistance

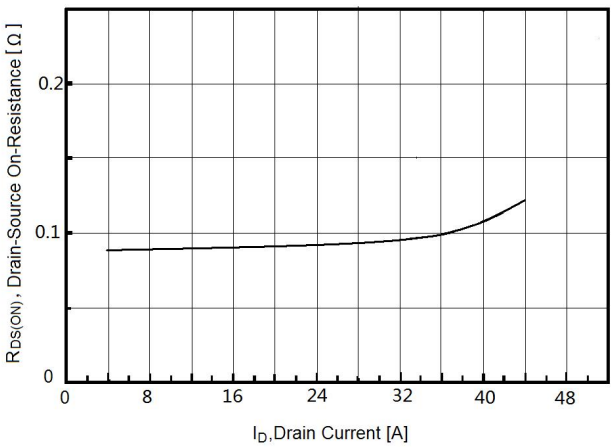


Figure7. $R_{DS(ON)}$ vs Junction Temperature

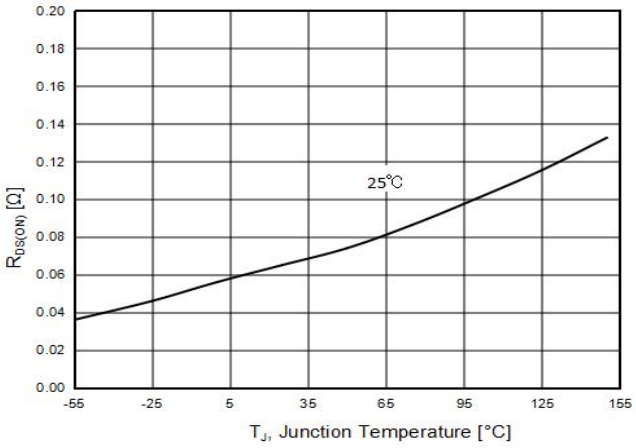


Figure8. BV_{DSS} vs Junction Temperature

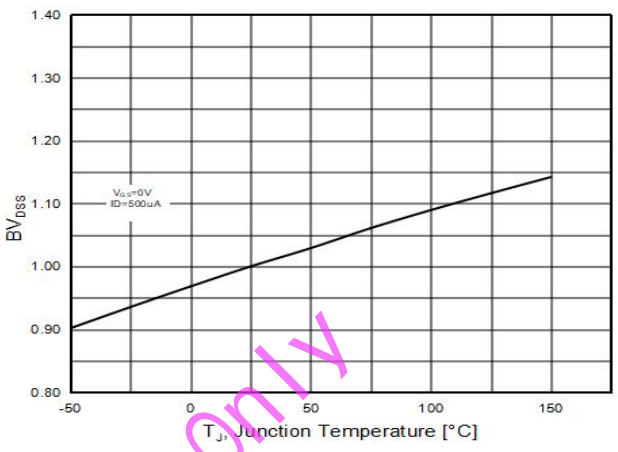


Figure9. Maximum I_D vs Junction Temperature

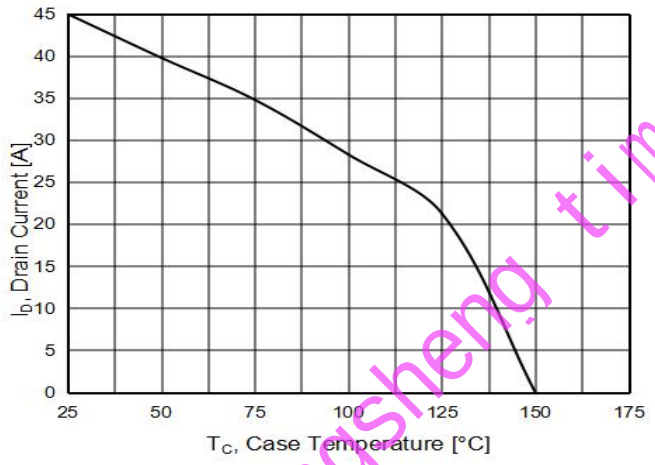
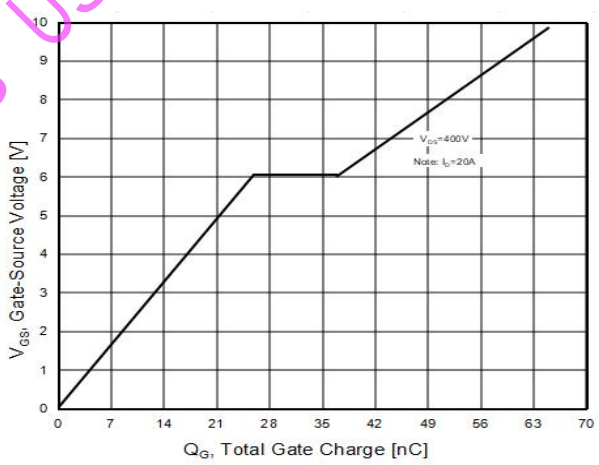
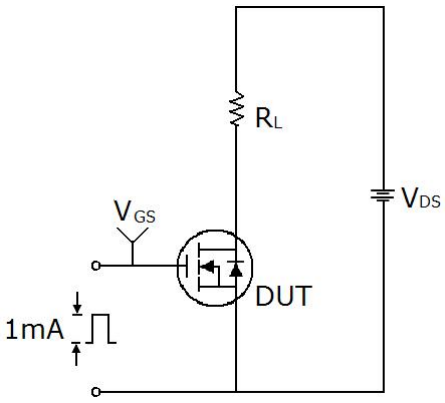


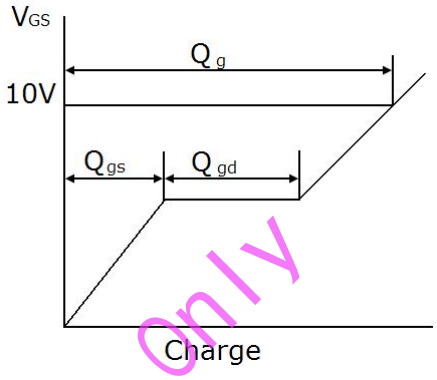
Figure10. Gate charge waveforms



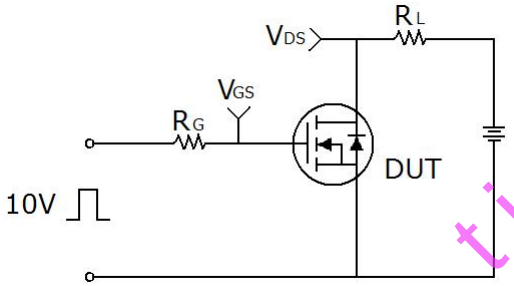
Test circuit

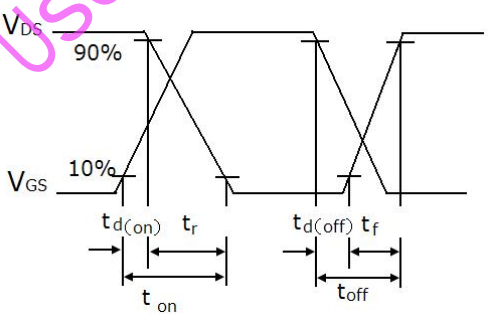
1）Gate charge test circuit & Waveform



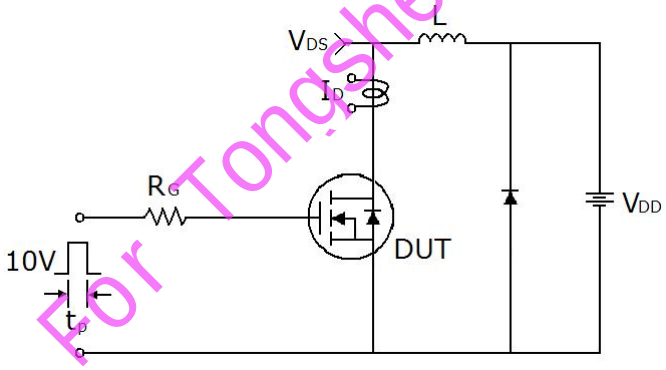


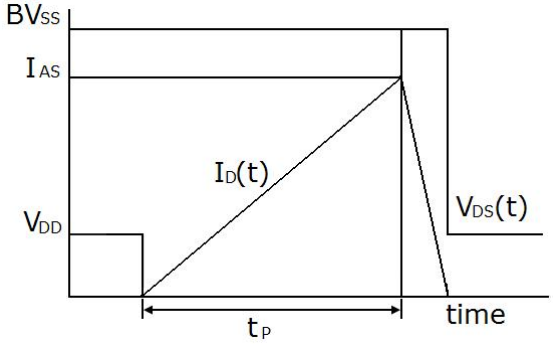
2）Switch Time Test Circuit：



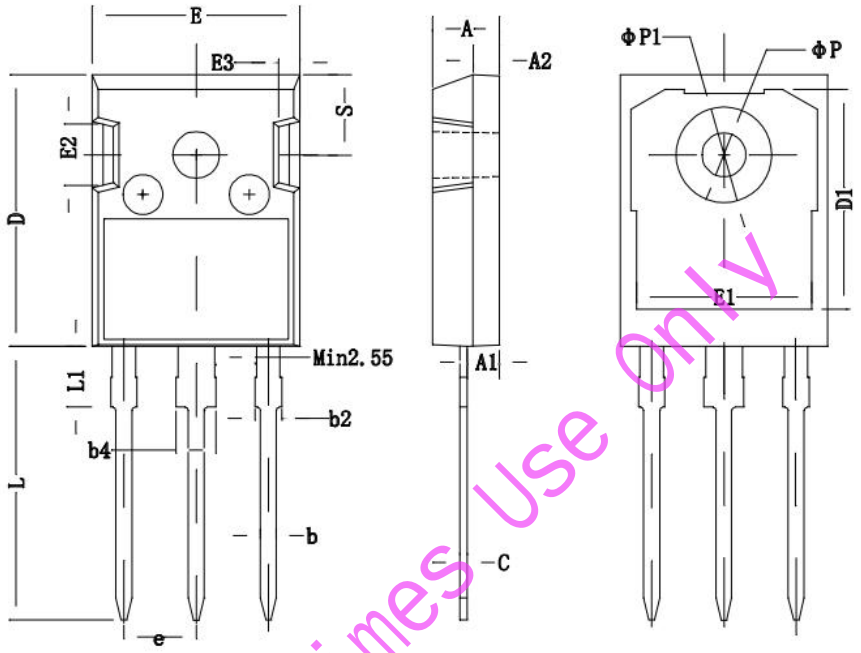


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-247 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.80	5.20	0.19	0.20
A1	2.21	2.59	0.09	0.10
A2	1.85	2.15	0.07	0.08
b	1.11	1.36	0.04	0.05
b2	1.91	2.21	0.08	0.09
b4	2.91	3.21	0.11	0.13
C	0.51	0.75	0.02	0.03
D	20.80	21.30	0.82	0.84
D1	16.25	16.85	0.64	0.66
E	15.50	16.10	0.61	0.63
E1	13.00	13.60	0.51	0.54
E2	4.80	5.20	0.19	0.20
E3	2.30	2.70	0.09	0.11
e	5.44 BSC		0.21 BSC	
L	19.82	20.22	0.78	0.80
L1	-	4.30	-	0.17
ΦP	3.40	3.80	0.13	0.15
ΦP1	-	7.30	-	0.29
S	6.15BSC		0.24 BSC	

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