

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.

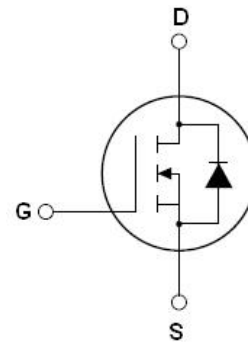
Features

- 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

$V_{DS\ min@T_{jmax}}$	710	V
$R_{DS(ON)TYP}$	62	mΩ
I_D	45	A
Q_g	65	nC

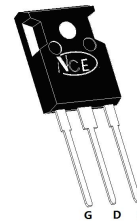


Schematic diagram

✦ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65TF078T	TO-247	NCE65TF078T



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}	650	V
Gate-Source Voltage ($V_{DS}=0V$) AC ($f>1\text{ Hz}$)	V_{GS}	± 30	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_D (DC)$	45	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_D (DC)$	28.3	A
Pulsed drain current (Note 1)	$I_{DM (pluse)}$	135	A
Maximum Power Dissipation($T_c=25^\circ\text{C}$)	P_D	400	W
Derate above 25°C		3.2	W/ $^\circ\text{C}$
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, $V_{DS} \leq 480\text{ V}$,	dv/dt	50	V/ns
Reverse diode dv/dt , $V_{DS} \leq 480\text{ V}, I_{SD} < I_D$	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+150	$^\circ\text{C}$

* limited by maximum junction temperature

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}	$V_{GS}=0V, I_D=500\mu A$	650			V
Zero Gate Voltage Drain Current(Tc=25°C)	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			10	μA
Zero Gate Voltage Drain Current(Tc=125°C)	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			100	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$			± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5	3.5	4.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=23A$		62	78	m Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0\text{MHz}$		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	V_{gp}			6		V
Intrinsic gate resistance	R_G	$f = 1 \text{ MHz open drain}$		10.5		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, I_D=23A,$ $R_G=1.7\Omega, V_{GS}=10V$		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}	$T_C=25^{\circ}\text{C}$			45	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				135	A
Forward On Voltage	V_{SD}	$T_j=25^{\circ}\text{C}, I_{SD}=45A, V_{GS}=0V$		0.9	1.2	V
Reverse Recovery Time	t_{rr}	$T_j=25^{\circ}\text{C}, I_F=23A, di/dt=100$ $A/\mu s$		180		nS
Reverse Recovery Charge	Q_{rr}			1.6		μC
Peak Reverse Recovery Current	I_{rrm}			18		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

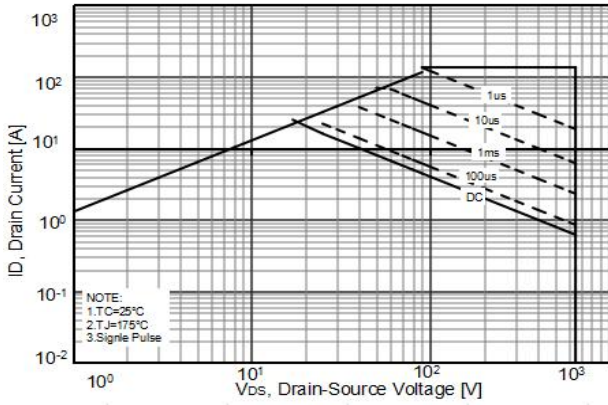


Figure2. Capacitance

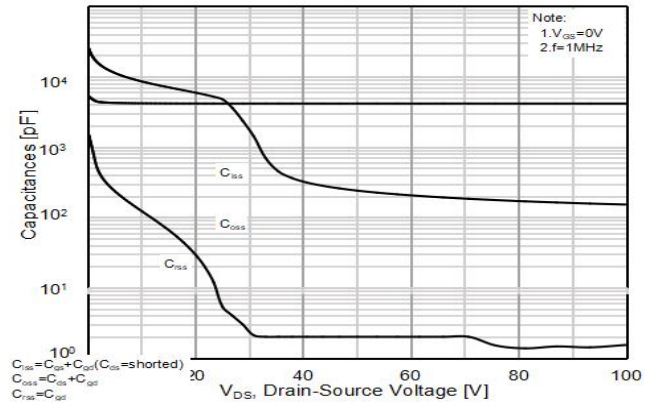


Figure3. Source-Drain Diode Forward Voltage

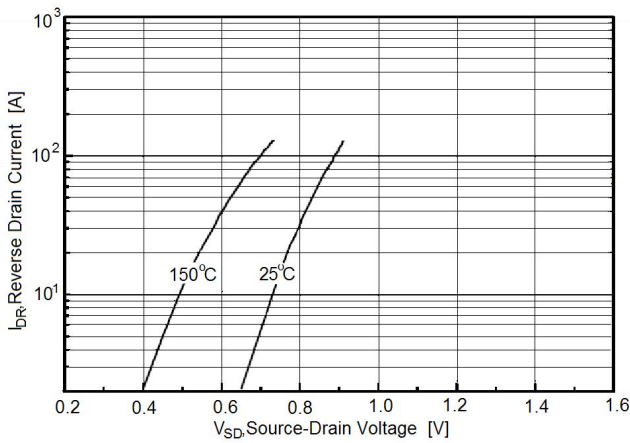


Figure4. Output characteristics

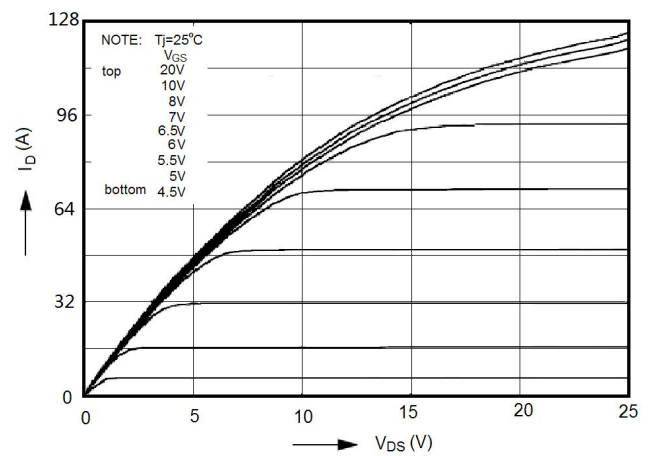


Figure5. Transfer characteristics

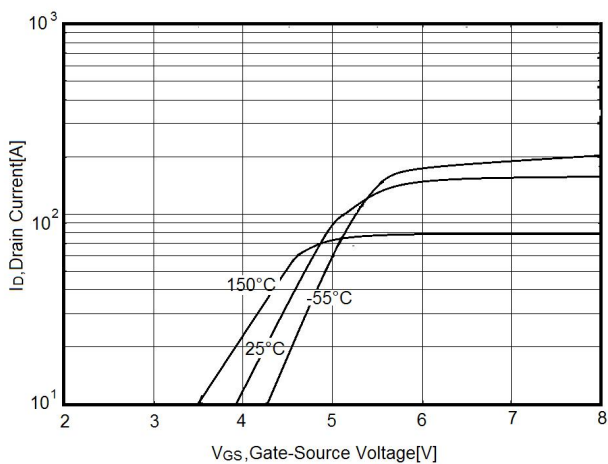


Figure6. Static drain-source on resistance

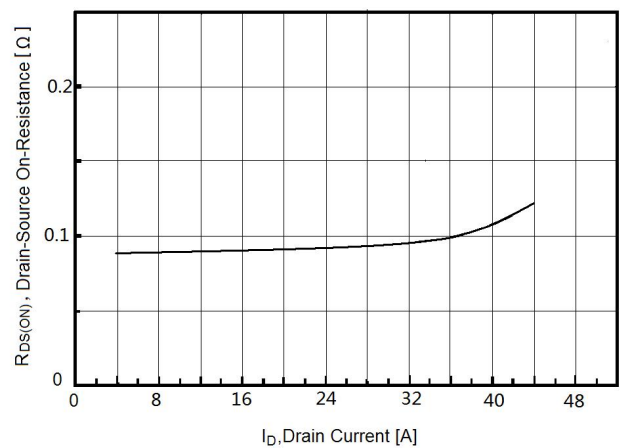


Figure7. $R_{DS(ON)}$ vs Junction Temperature

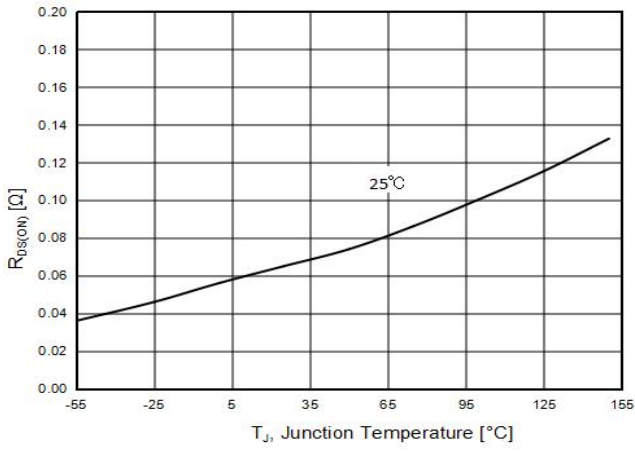


Figure8. BV_{DSS} vs Junction Temperature

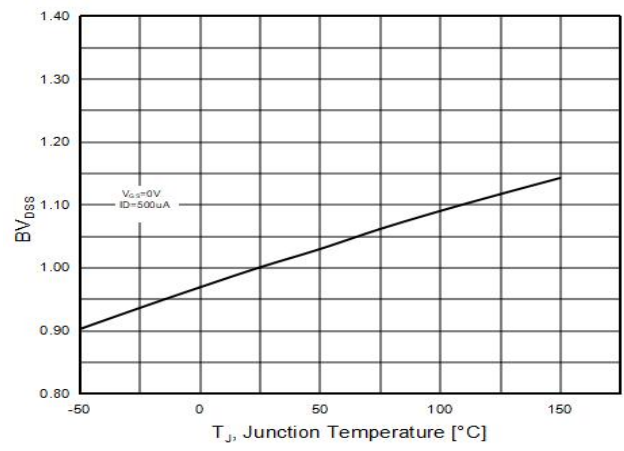


Figure9. Maximum I_D vs Junction Temperature

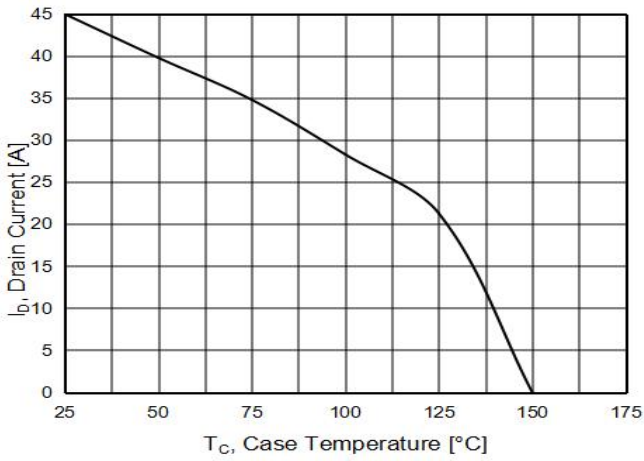
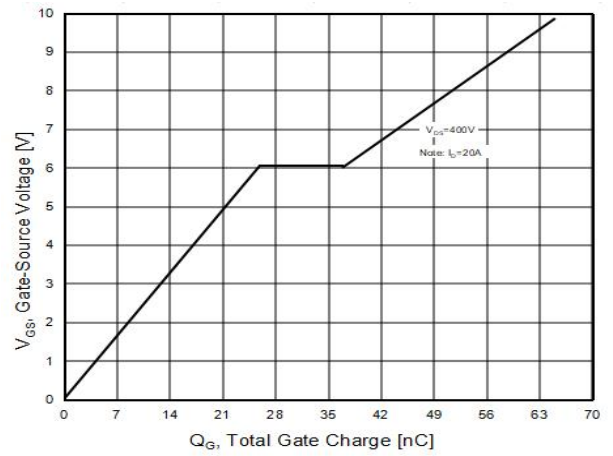
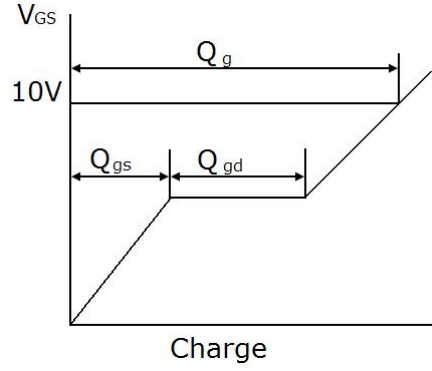
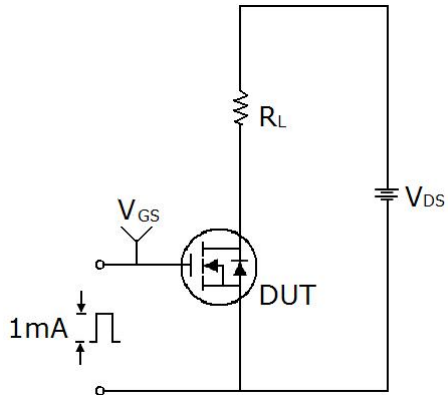


Figure10. Gate charge waveforms

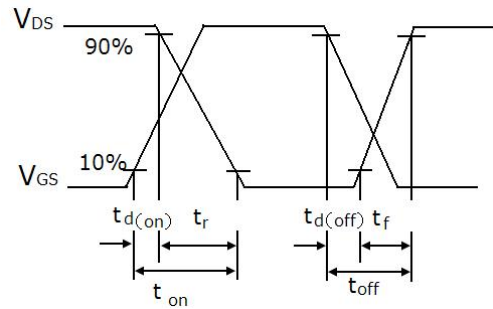
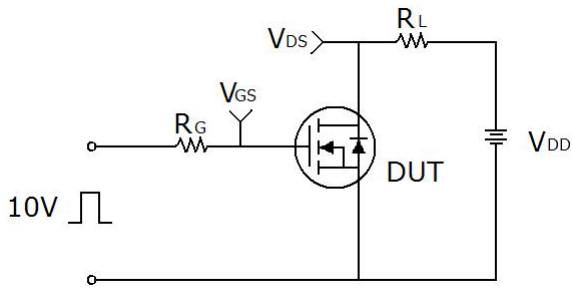


Test circuit

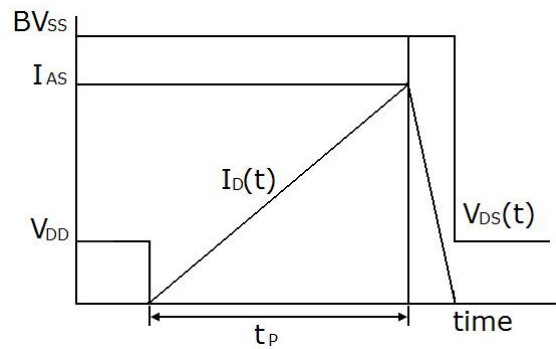
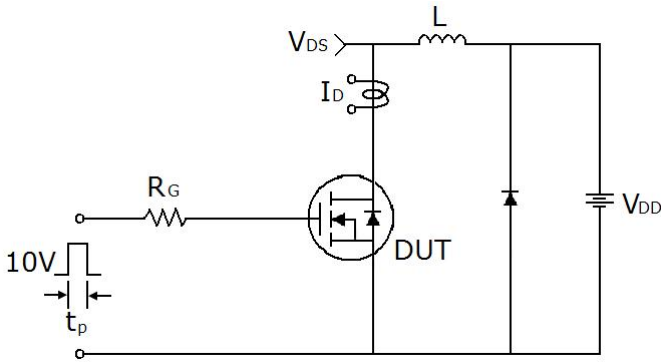
1) Gate charge test circuit & Waveform



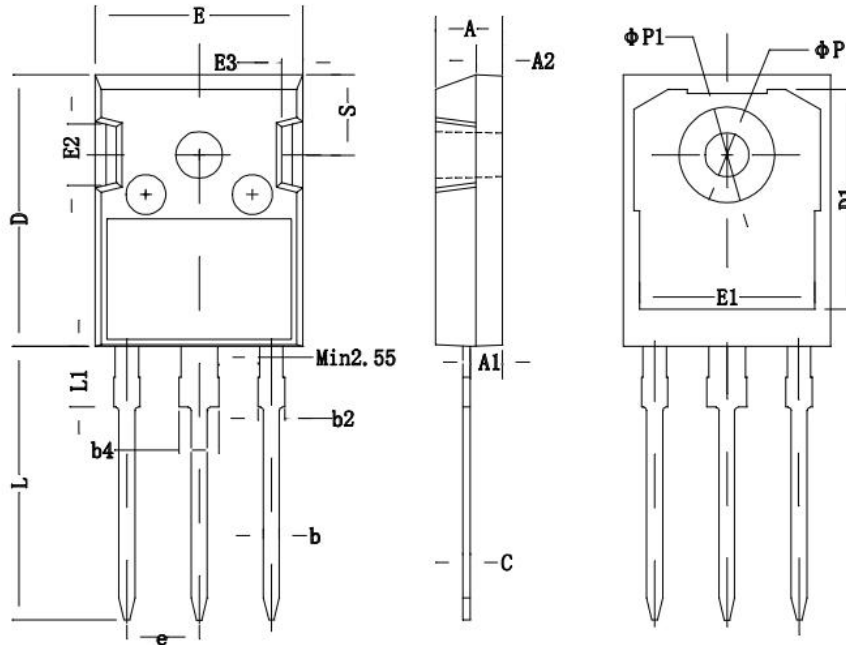
2) Switch Time Test Circuit:



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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