

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

$V_{DS\ min@T_{jmax}}$	710	V
$R_{DS(ON)TYP}$	60	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
NCE65NF068D	TO-263	NCE65NF068D



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

TO-263

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
Gate-Source Voltage ($V_{DS}=0V$) DC	V_{GS}	± 20	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_D (DC)$	45	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_D (DC)$	31.5	A
Pulsed drain current (Note 1)	$I_{DM (pluse)}$	135	A
Maximum Power Dissipation ($T_c=25^\circ\text{C}$)	P_D	371	W
Derate above 25°C		2.47	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	E_{AS}	400	mJ
Avalanche current (Note 1)	I_{AS}	10	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}	$-55...+175$	$^\circ\text{C}$

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	0.40	°C /W
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	°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 =1mA	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			400	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 =500μA	3.5	4	5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =23A		60	68	mΩ
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =50V, V _{GS} =0V, F=1.0MHz		3900	4400	pF
Output Capacitance	C _{oss}			132		pF
Reverse Transfer Capacitance	C _{rss}			14		pF
Total Gate Charge	Q _g	V _{DS} =480V, I _D =23A, V _{GS} =10V		65	70	nC
Gate-Source Charge	Q _{gs}			21		nC
Gate-Drain Charge	Q _{gd}			17		nC
Gate plateau voltage	V _{gp}			6.5		V
Intrinsic gate resistance	R _G	f = 1 MHz open drain		3		Ω
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V, I _D =23A, R _G =1.7Ω, V _{GS} =10V		42		nS
Turn-on Rise Time	t _r			14		nS
Turn-Off Delay Time	t _{d(off)}			90		nS
Turn-Off Fall Time	t _f			12		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I _{SD}	T _C =25℃			45	A
Pulsed Source-drain current(Body Diode)	I _{SDM}				135	A
Forward On Voltage	V _{SD}	T _j =25℃, I _{SD} =45A, V _{GS} =0V		1.0	1.2	V
Reverse Recovery Time	t _{rr}	T _j =25℃, I _F =23A, di/dt=100A/μs		173		nS
Reverse Recovery Charge	Q _{rr}			1.13		uC
Peak Reverse Recovery Current	I _{rrm}			13		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

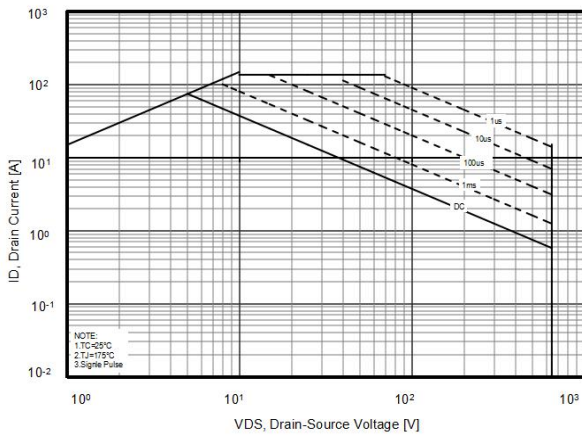


Figure2. Capacitance

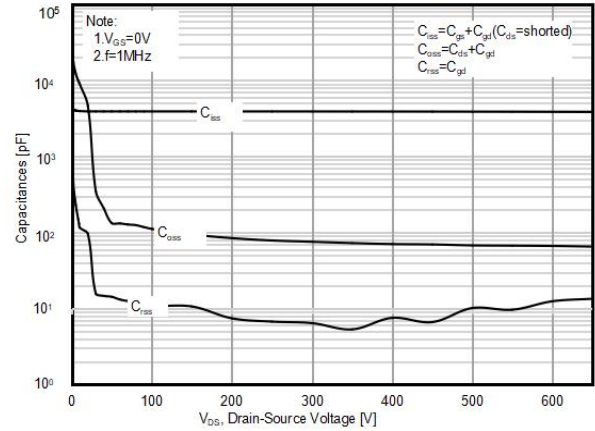


Figure3. Source-Drain Diode Forward Voltage

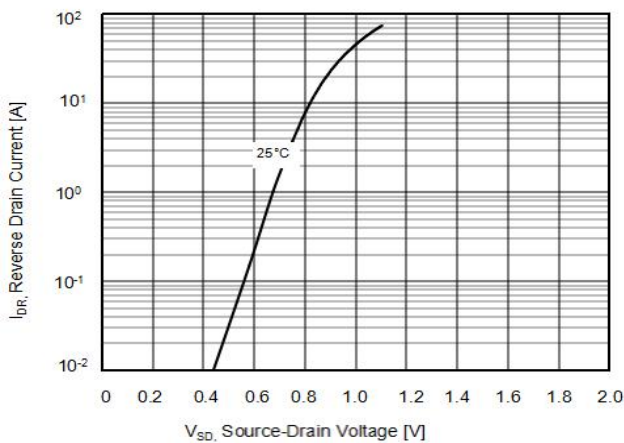


Figure4. Output characteristics

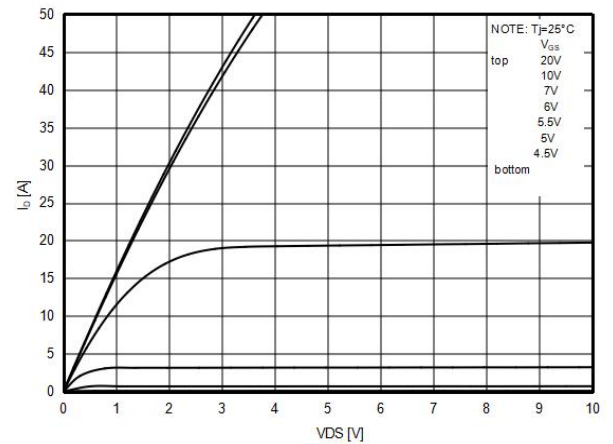


Figure5. $R_{DS(ON)}$ vs Junction Temperature

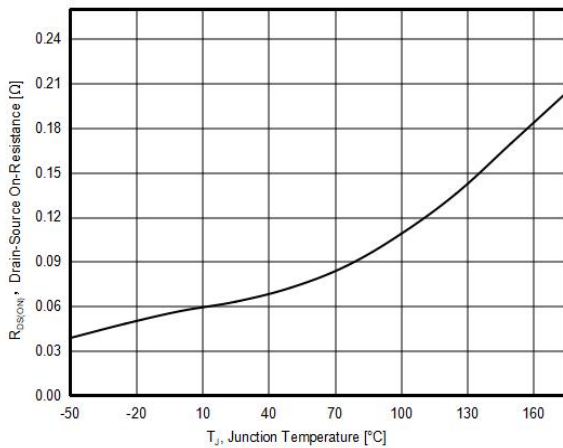


Figure6. BV_{DSS} vs Junction Temperature

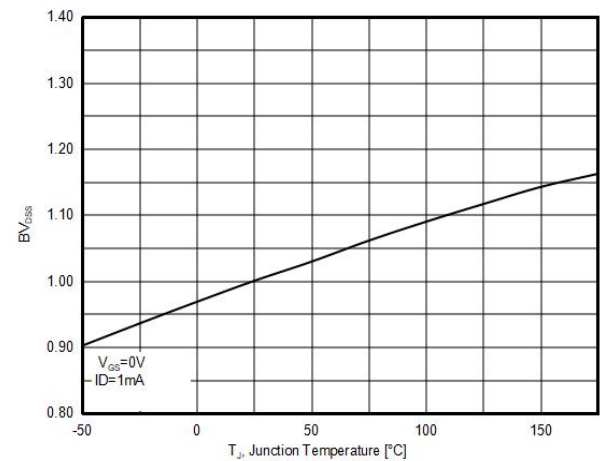


Figure7. Maximum I_D vs Junction Temperature

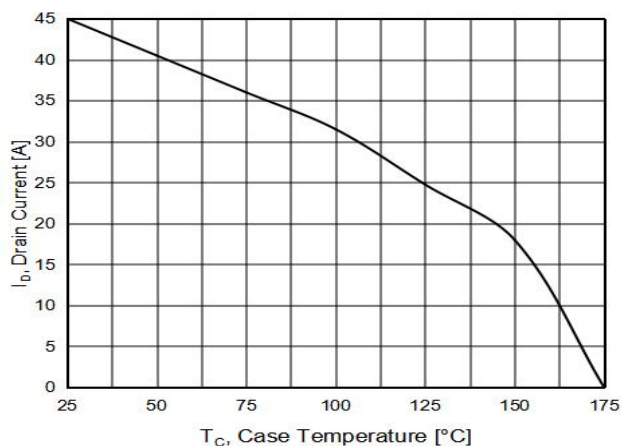


Figure8. Gate charge waveforms

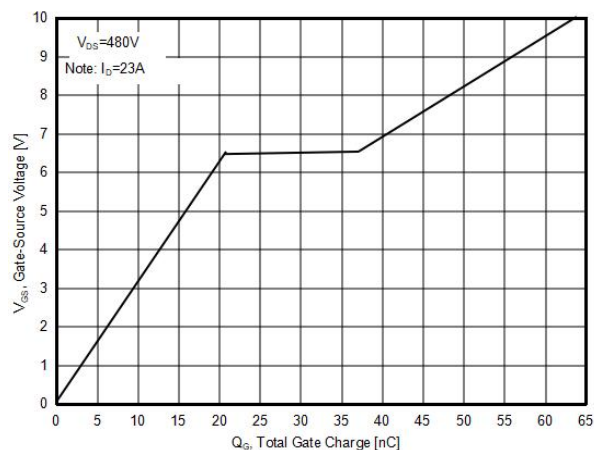


Figure9. Static drain-source on resistance

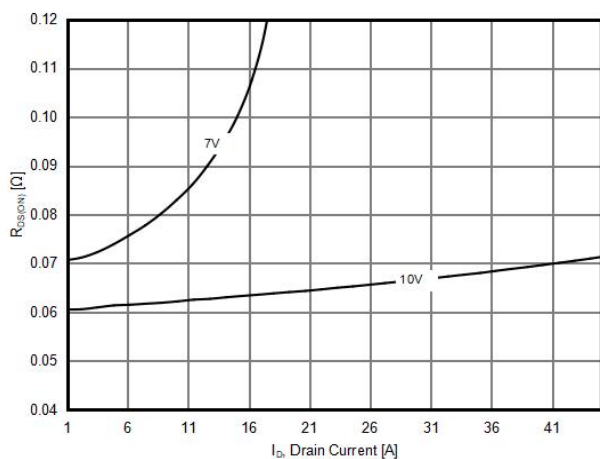
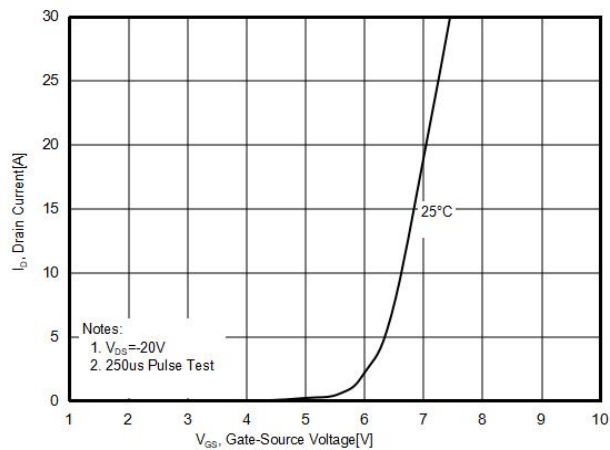


Figure10. Transfer characteristics



Test circuit

1) Gate charge test circuit & Waveform



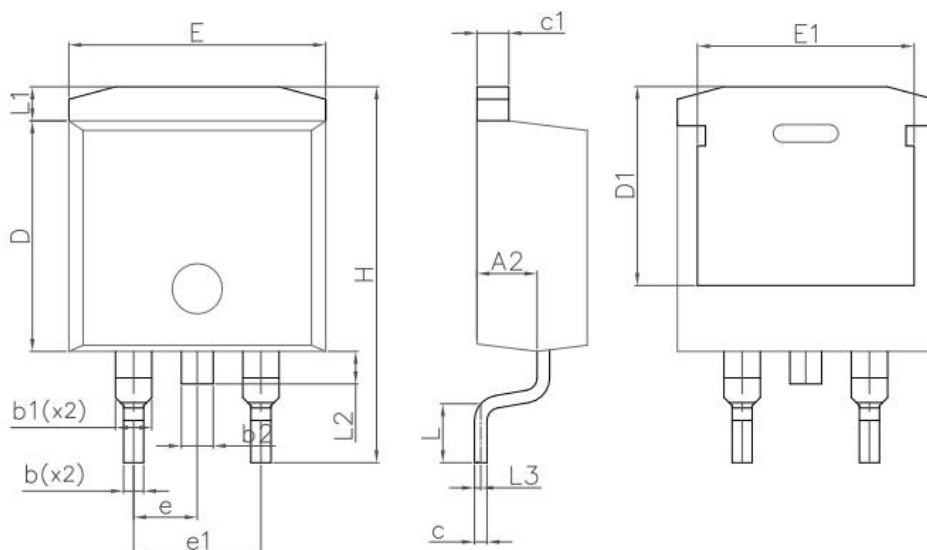
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

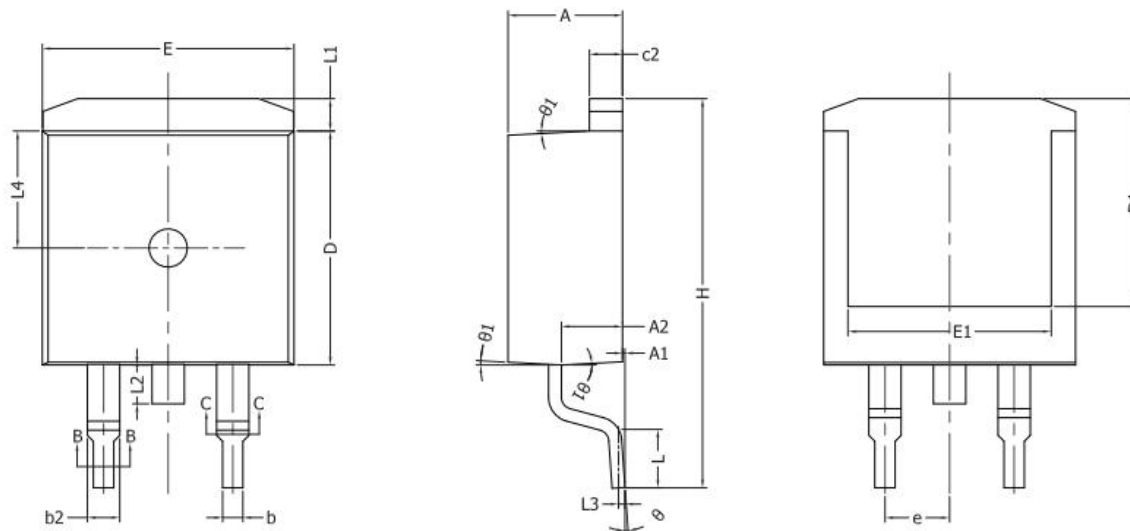


TO-263 (E) Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.20	4.60	0.165	0.181
A1	-	0.25	-	0.010
A2	2.20	2.60	0.087	0.102
b	0.70	0.90	0.028	0.035
b2	1.17	1.37	0.046	0.054
c	0.40	0.60	0.016	0.024
c1	1.15	1.40	0.045	0.055
D	9.10	9.30	0.358	0.366
D1	7.63	8.23	0.300	0.324
E	10.05	10.45	0.396	0.411
E1	8.35	8.95	0.329	0.352
e	2.54 BSC		0.100 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	1.36REF		0.053REF	
L2	1.3REF		0.051REF	
L3	0.25REF		0.009REF	

TO-263 (P) Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.17	0.18
A1	0.00	0.25	0.00	0.01
A2	2.20	2.60	0.09	0.10
b	0.76	0.89	0.03	0.04
b2	1.23	1.37	0.05	0.05
c	0.47	0.60	0.02	0.02
c2	1.25	1.35	0.05	0.05
D	9.10	9.30	0.36	0.37
E	9.80	10.00	0.39	0.39
H	14.90	15.70	0.59	0.62
L	2.00	2.60	0.08	0.10
L1	1.17	1.40	0.05	0.06
L2	----	1.75	----	0.07
L3	0.25BSC		0.01BSC	
L4	4.60REF		0.18REF	
θ	0°	8°	0°	8°
θ1	1°	5°	1°	5°

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