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.

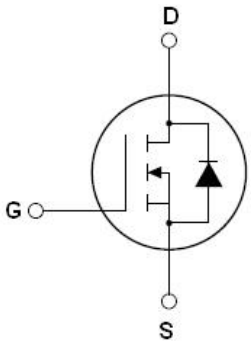
Features

- 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

$V_{DS\ min@Tjmax}$	650	V
$R_{DS(ON)TYP}$	50	mΩ
ID	51	A
Qg	58	nC



Schematic diagram

✧ **Intrinsic fast-recovery body diode**

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60NF055D	T0-263	NCE60NF055D

TO-263

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (VGS=0V）	V_{DS}	600	V
Gate-Source Voltage (VDS=0V) AC (f>1 Hz)	V_{GS}	±30	V
Gate-Source Voltage (VDS=0V) DC	V_{GS}	±20	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	51	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	35.7	A
Pulsed drain current (Note 1)	$I_{DM\ (pluse)}$	153	A
Maximum Power Dissipation(Tc=25°C) Derate above 25°C	P_D	378 2.52	W W/°C
Single pulse avalanche energy (Note 2)	E_{AS}	576	mJ
Avalanche current(Note 1)	I_{AR}	12	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...+175	°C

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	0.39	°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=1mA	600			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			10	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			300	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	4	5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=25A		50	55	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		3836		pF
Output Capacitance	C_{oss}			155		pF
Reverse Transfer Capacitance	C_{rss}			5.1		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=25A, V_{GS}=10V		58		nC
Gate-Source Charge	Q_{gs}			22		nC
Gate-Drain Charge	Q_{gd}			15		nC
Gate plateau voltage	Vgp			6.6		V
Intrinsic gate resistance	R_G	f = 1 MHz open drain		2		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=25A, R_G=1.7Ω,V_{GS}=10V		32		nS
Turn-on Rise Time	t_r			14		nS
Turn-Off Delay Time	$t_{d(off)}$			90		nS
Turn-Off Fall Time	t_f			9		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			51	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				153	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=51A,V_{GS}=0V		1.0	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=25A, di/dt=100A/μs		140		nS
Reverse Recovery Charge	Q_{rr}			0.63		uC
Peak Reverse Recovery Current	I_{rrm}			9		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

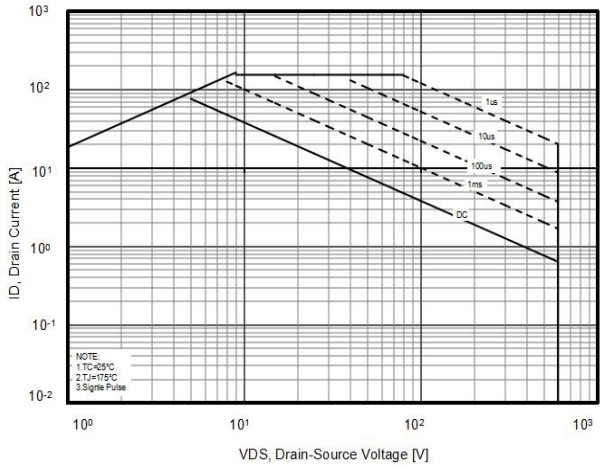


Figure2. Capacitance

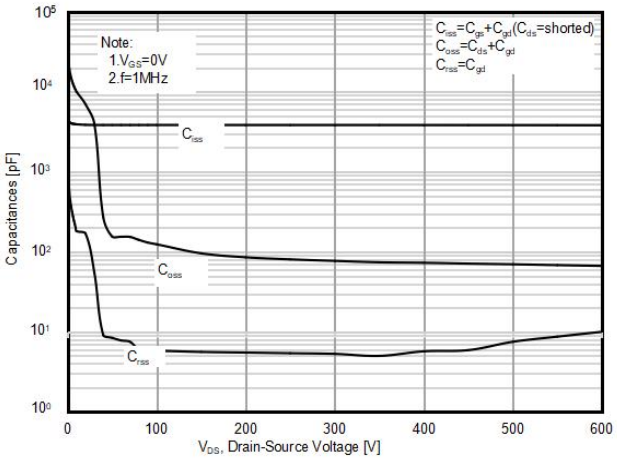


Figure3. Source-Drain Diode Forward Voltage

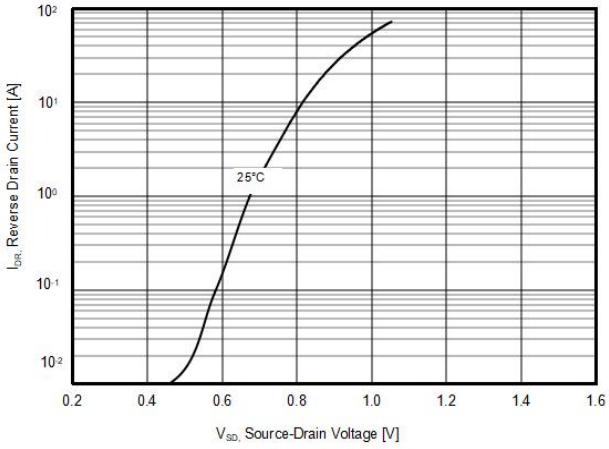


Figure4. Output characteristics

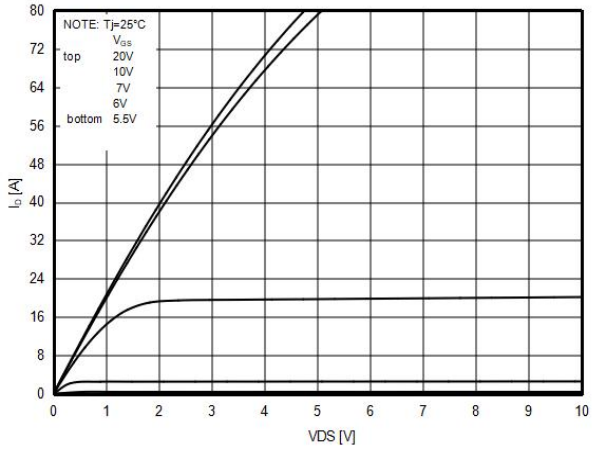


Figure5. $R_{DS(ON)}$ vs Junction Temperature

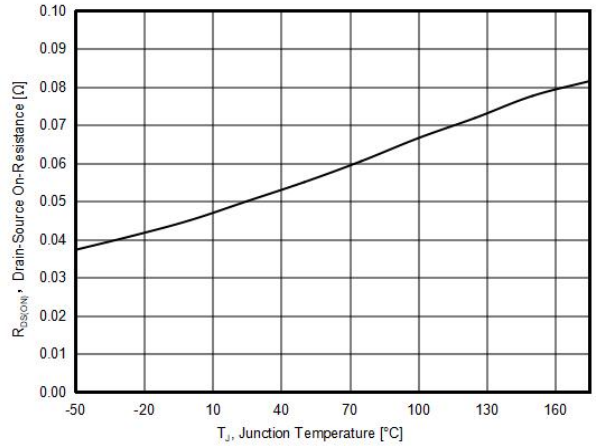


Figure6. BV_{DSS} vs Junction Temperature

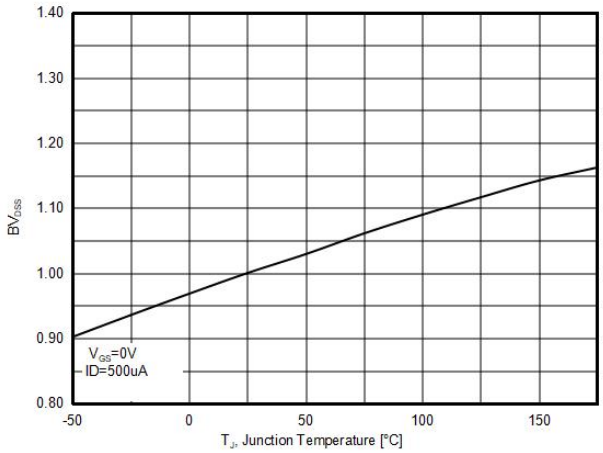


Figure7. Maximum I_D vs Junction Temperature

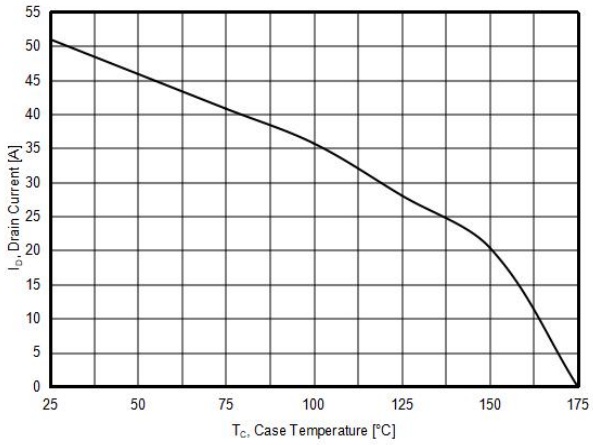


Figure8. Gate charge waveforms

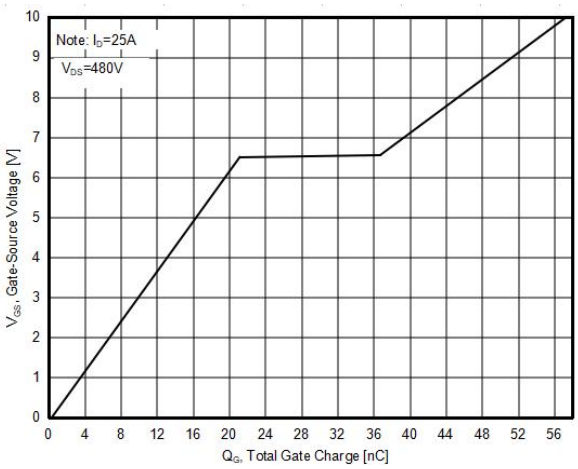


Figure9. Static drain-source on resistance

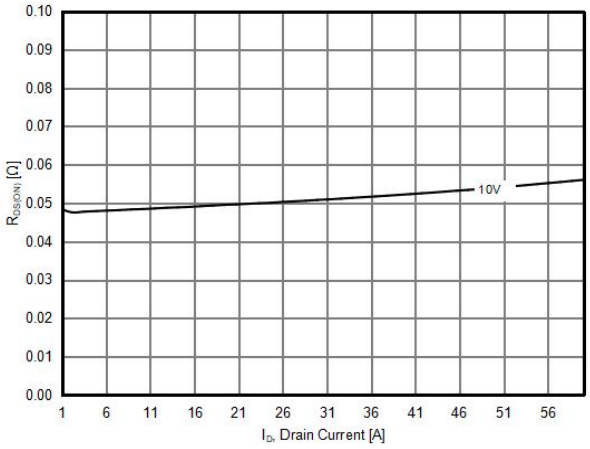
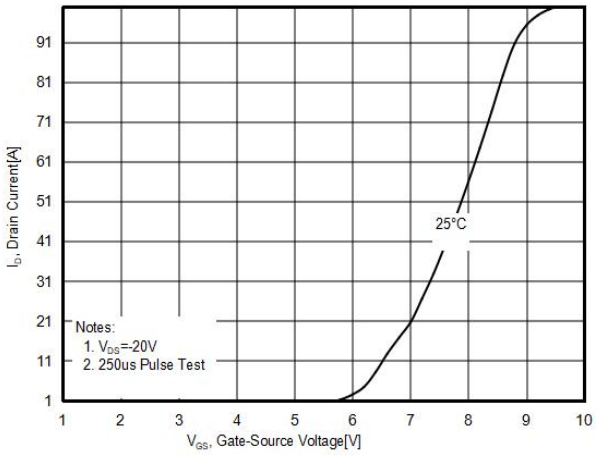
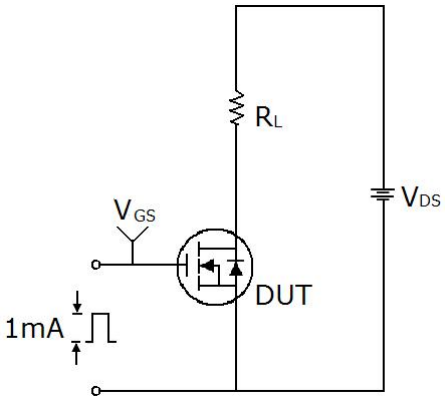


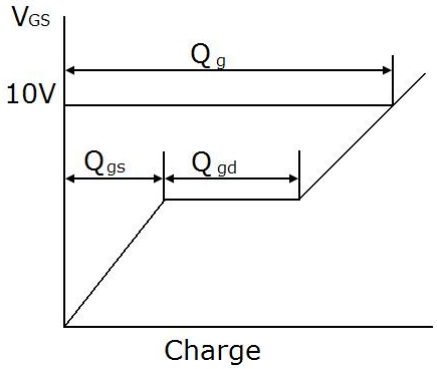
Figure10. Transfer characteristics



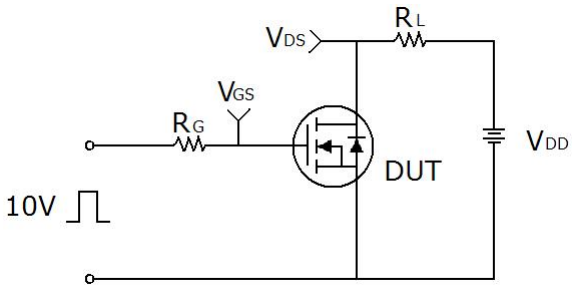
Test circuit

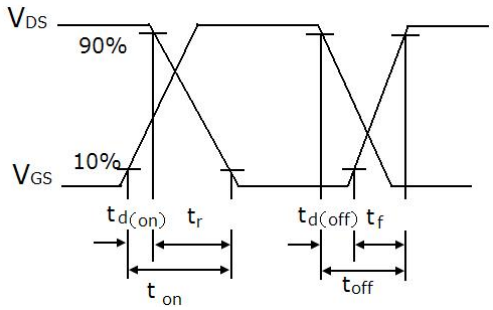
1）Gate charge test circuit & Waveform



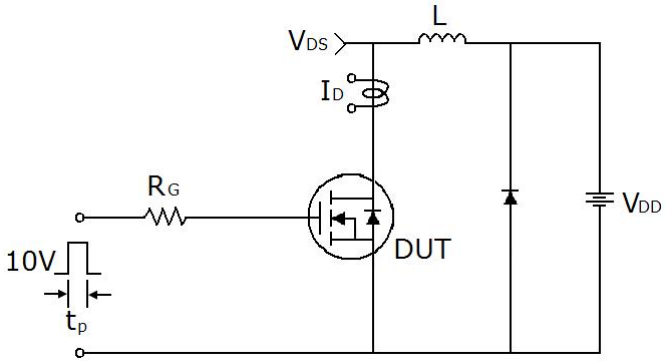


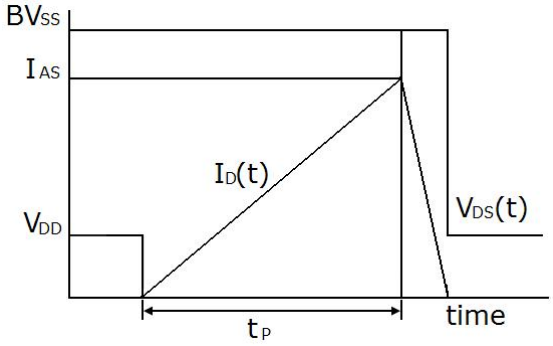
2）Switch Time Test Circuit：



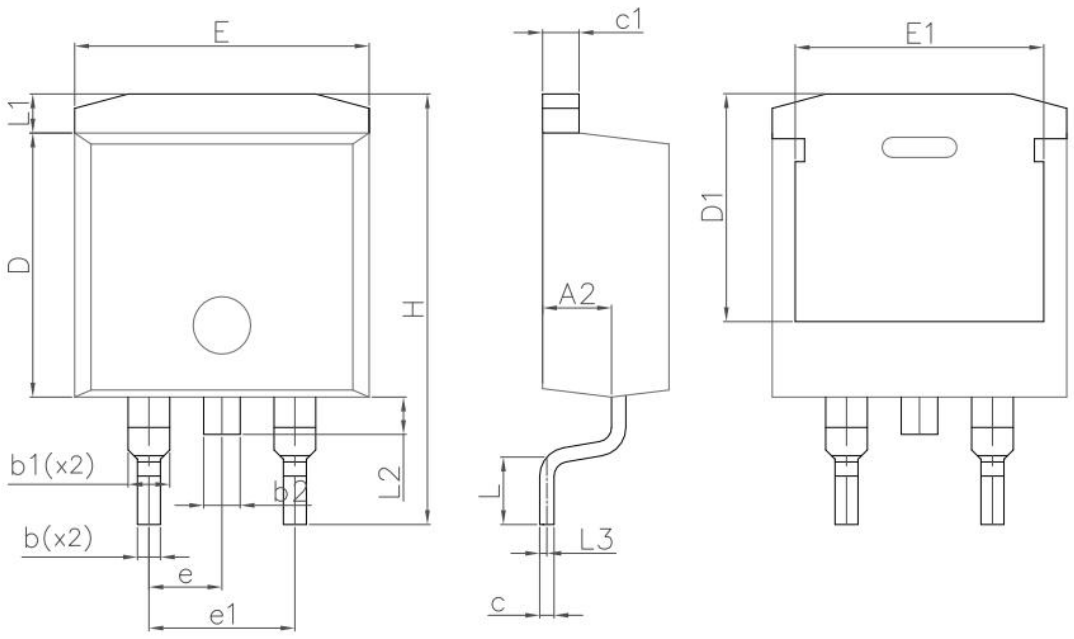


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-263-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A2	4.20	4.60	0.165	0.181
b	0.70	0.90	0.028	0.035
b1	1.20	1.75	0.047	0.069
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	8.65	0.329	0.341
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	1.36REF		0.054REF	
L2	1.30REF		0.051REF	

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