N-Channel Super Junction Power MOSFET Ⅳ

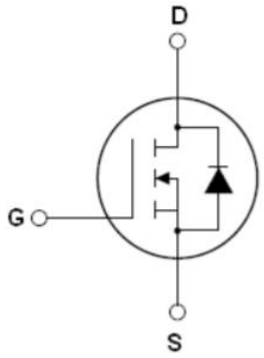
General Description

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.

$V_{DS\ min@Tjmax}$	650	V
$R_{DS(ON)TYP.}$	880	mΩ
I_D	4.3	A
Qg	8.5	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



Schematic diagram

Application

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

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60N1K0D	TO-263-2L	NCE60N1K0D

TO-263

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	600	V
Gate-Source Voltage (V_{DS}=0V) ,AC (f>1 Hz)	V_{GS}	±30	V
Gate-Source Voltage (V_{DS}=0V) ,DC	V_{GS}	±20	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	4.3	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	3.0	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	12.9	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	47 0.31	W W/°C
Single pulse avalanche current **(Note 2)**	I_{AS}	1	A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} **(Note 1)**	E_{AR}	0.9	mJ
Reverse diode dv/dt， V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	15	V/ns
Drain Source voltage slope， V_{DS} ≤480 V	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+175	°C

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	3.19	°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=250uA	600			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=600V,V_{GS}=0V			50	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V			±200	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250uA	3		4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=2A		880	1000	mΩ
Dynamic Characteristics						
Gate Resistance	Rg	F=1MHZ, D-S short		40		Ω
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1MHz		252		pF
Output Capacitance	C_{oss}			1.82		pF
Reverse Transfer Capacitance	C_{rss}			0.78		pF
Total Gate Charge	Q_g	V_{DS}=400V,I_D=2A, V_{GS}=10V		8.5	10.5	nC
Gate-Source Charge	Q_{gs}			1.6		nC
Gate-Drain Charge	Q_{gd}			3		nC
Gate plateau voltage	Vgp			4.8		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=2A, R_G=4Ω,V_{GS}=10V		8		nS
Turn-on Rise Time	t_r			10		nS
Turn-Off Delay Time	$t_{d(off)}$			18		nS
Turn-Off Fall Time	t_f			15		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			4.3	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				12.9	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=4.3A,V_{GS}=0V		0.9	1.1	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=2A, di/dt=100A/μs		150		nS
Reverse Recovery Charge	Q_{rr}			0.87		uC
Peak reverse recovery current	I_{rrm}			11.6		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

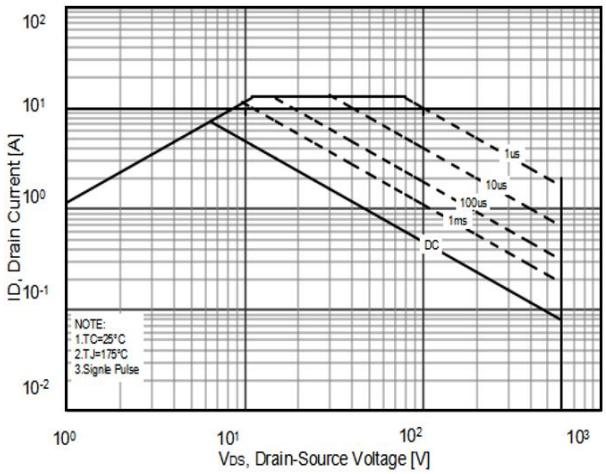


Figure2. Source-Drain Diode Forward Voltage

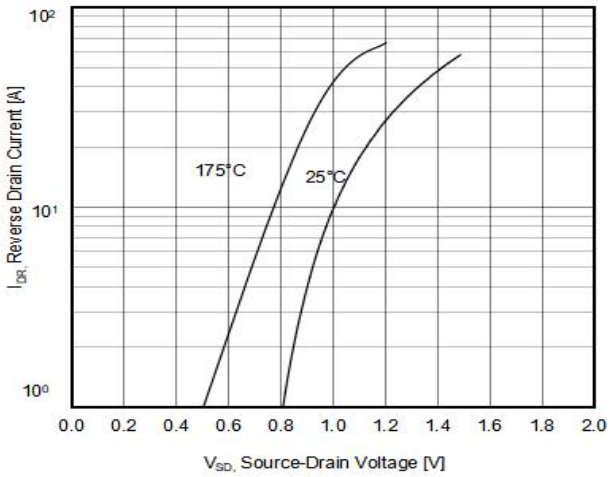


Figure3. Transfer characteristics

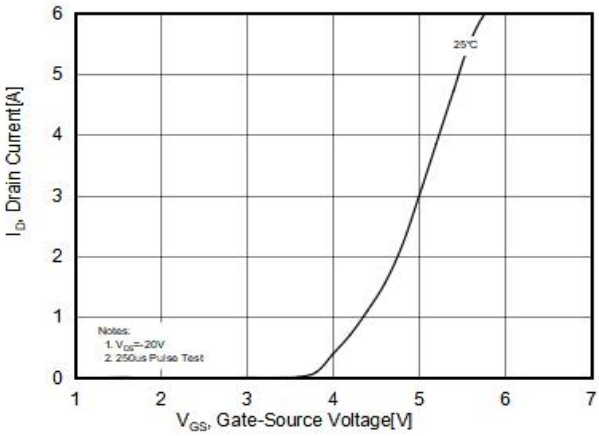


Figure4. Output characteristics

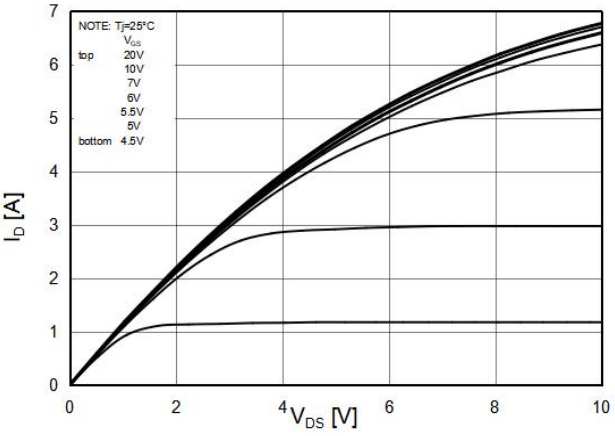


Figure5. Static drain-source on resistance

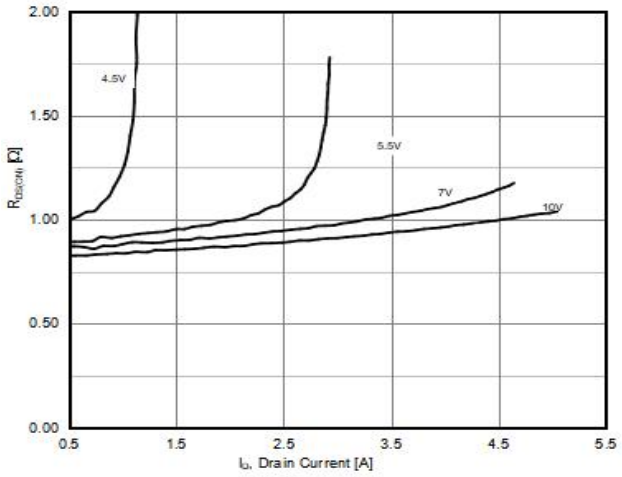


Figure6. $R_{DS(ON)}$ vs Junction Temperature

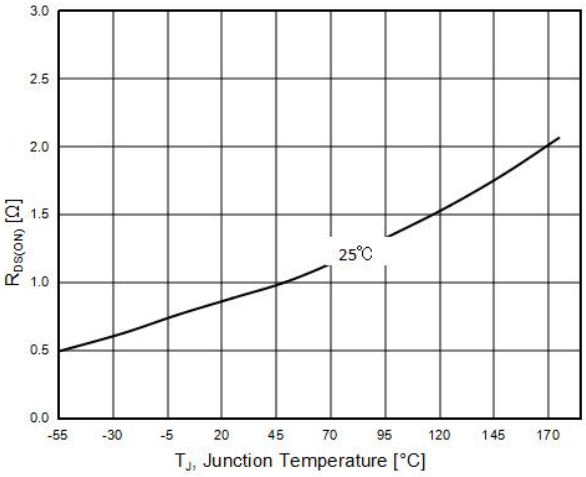


Figure7. BV_{DSS} vs Junction Temperature

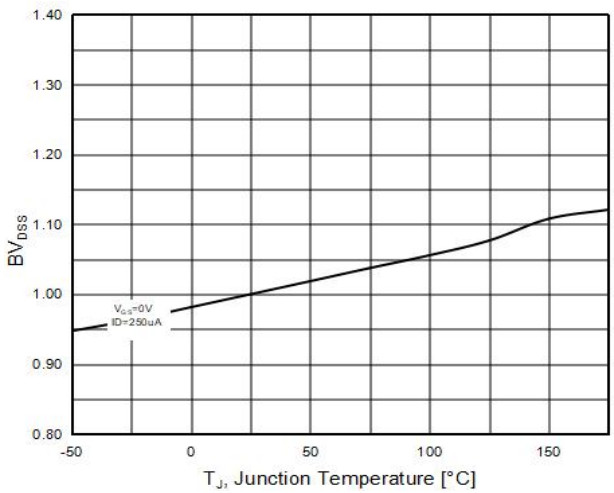


Figure8. Maximum I_D vs Junction Temperature

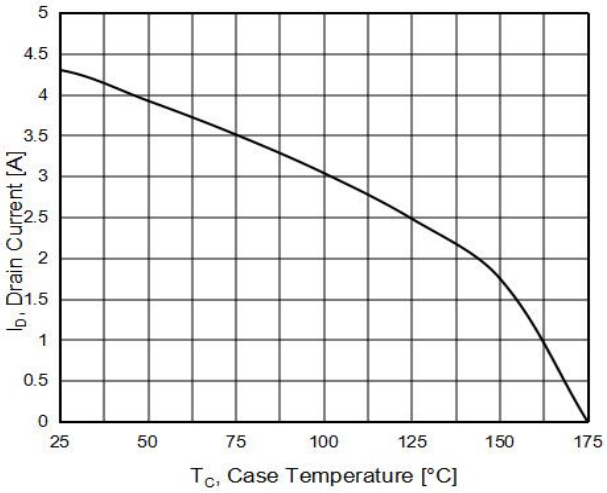


Figure9. Gate charge waveforms

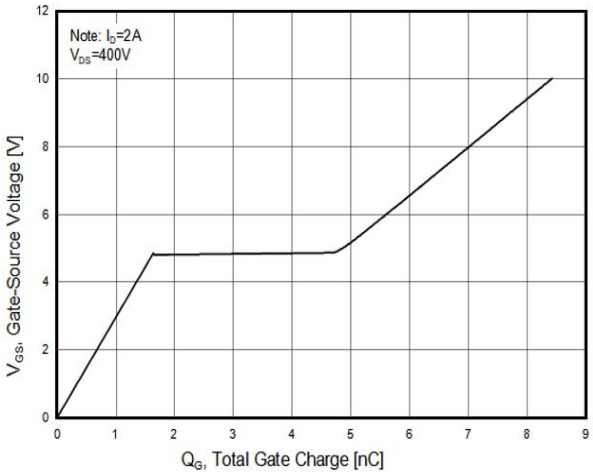
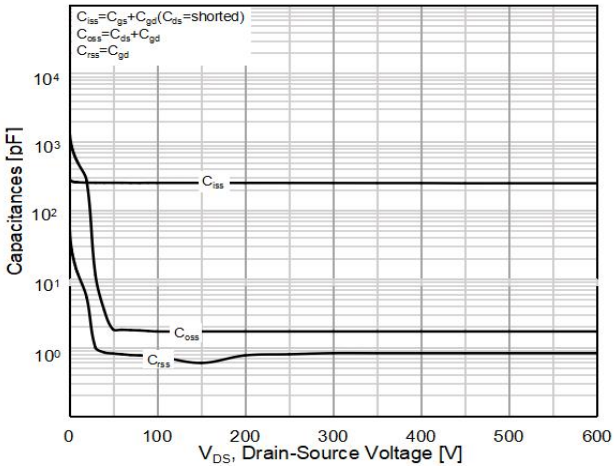
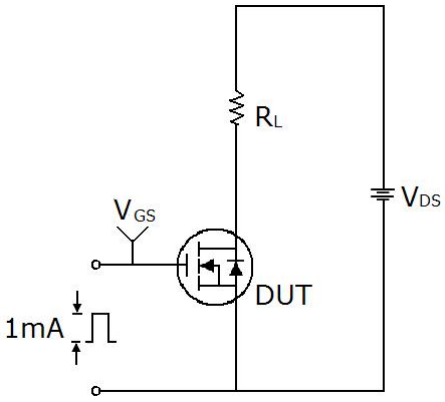


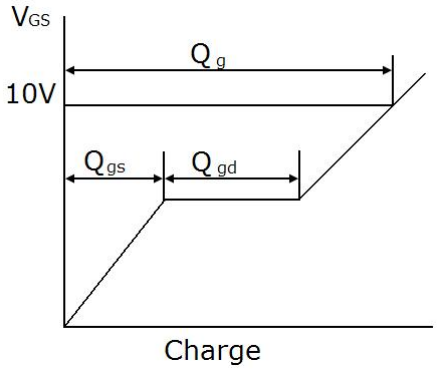
Figure10. Capacitance



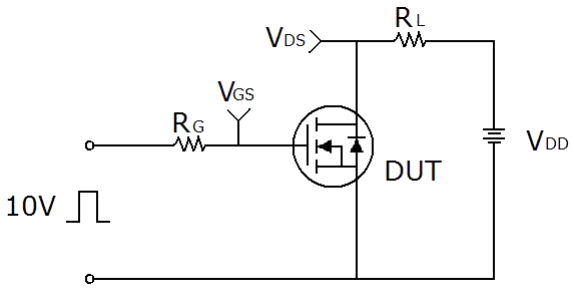
Test circuit

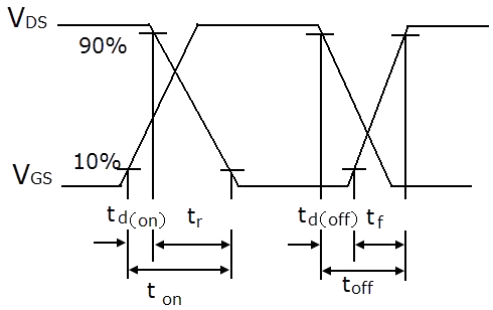
1）Gate charge test circuit & Waveform



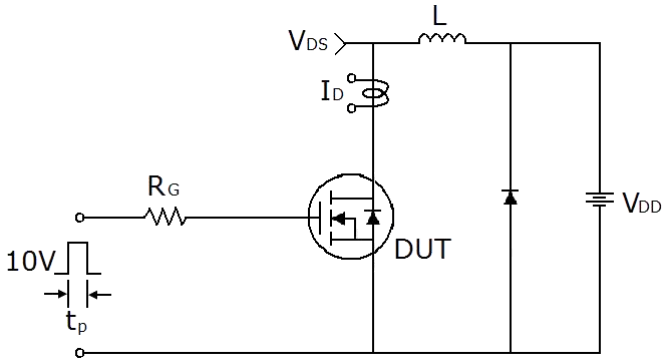


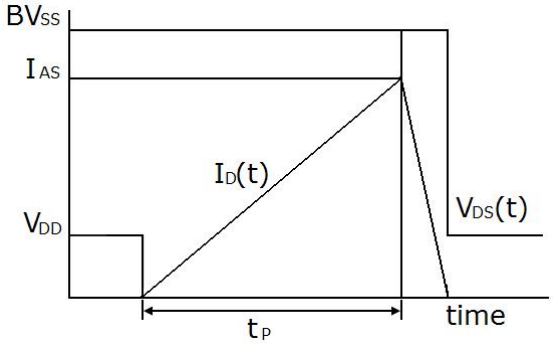
2）Switch Time Test Circuit：



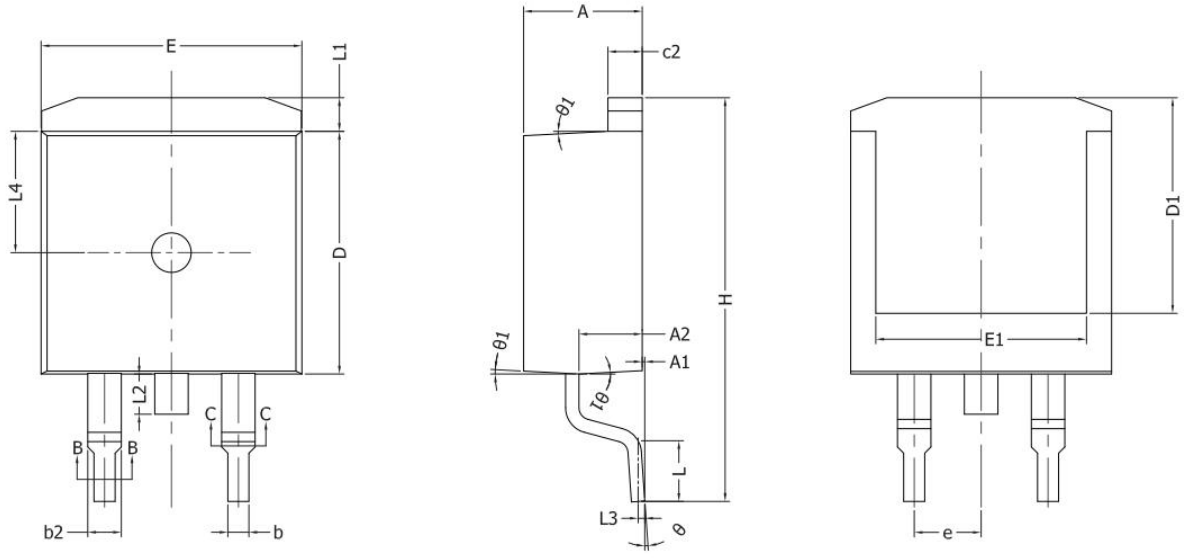


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-263-P Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	0.00	0.25	0.000	0.010
A2	2.20	2.60	0.087	0.102
b	0.76	0.89	0.030	0.035
b1	0.75	0.85	0.030	0.033
b2	1.23	1.37	0.048	0.054
b3	1.22	1.32	0.048	0.052
c	0.47	0.60	0.019	0.024
c1	0.46	0.56	0.018	0.022
c2	1.25	1.35	0.049	0.053
D	9.10	9.30	0.358	0.366
D1	8.00		0.315	
E	9.80	10.00	0.386	0.394
E1	7.80		0.307	
e	2.54BSC		0.100BSC	
H	14.90	15.70	0.587	0.618
L	2.00	2.60	0.079	0.102
L1	1.17	1.40	0.046	0.055
L2		1.75		0.069
L3	0.25BSC		0.101BSC	
L4	4.60REF		0.181REF	

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