N-Channel Super Junction Power MOSFET

General Description

The series of devices use advanced 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.

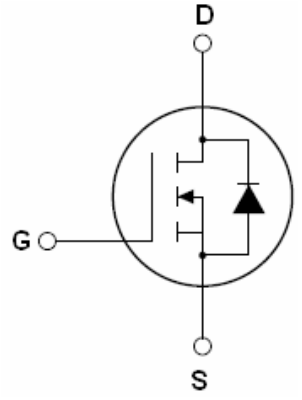
V_{DS} @T_{jmax}	650	V
$R_{DS(ON)}$	900	mΩ
I_D	5	A

Features

- New technology for high voltage device
- 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）



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE05N60L	TO-251S	NCE05N60L

TO-251S

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

Parameter	Symbol	NCE05N60L	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	600	V
Gate-Source Voltage (V_{DS}=0V)	V_{GS}	±30	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	5	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	3	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	15	A
Drain Source voltage slope, VDS = 480 V, ID = 5 A, Tj = 125 °C	dv/dt	50	V/ns
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	50 0.4	W W/°C
Single pulse avalanche energy **(Note2)**	E_{AS}	130	mJ
Avalanche current **(Note 1)**	I_{AR}	5	A

Parameter	Symbol	Value	Unit
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} **(Note 1)**	E_{AR}	0.4	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+150	°C

Table 2. Thermal Characteristic

Parameter	Symbol	NCE05N60L	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	2.5	°C /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	75	°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=250μA	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}=±30V,V_{DS}=0V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	2.5	3	3.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=3A		850	900	mΩ
Dynamic Characteristics						
Forward Transconductance	g_{FS}	V_{DS} = 20V, I_D = 3A		5		S
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		520		pF
Output Capacitance	C_{oss}			52		pF
Reverse Transfer Capacitance	C_{rss}			4.5		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=5A, V_{GS}=10V		12	25	nC
Gate-Source Charge	Q_{gs}			2.2		nC
Gate-Drain Charge	Q_{gd}			4.5		nC
Intrinsic gate resistance	R_G	f = 1 MHz open drain		2.6		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=5A, R_G=18Ω,V_{GS}=10V		6		nS
Turn-on Rise Time	t_r			2.5		nS
Turn-Off Delay Time	$t_{d(off)}$			55	80	nS
Turn-Off Fall Time	t_f			9	14	nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			5	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				15	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=5A,V_{GS}=0V		1	1.3	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=5A,di/dt=100A/μs		200		nS
Reverse Recovery Charge	Q_{rr}			1.6		uC
Peak reverse recovery current	I_{rrm}			15		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 for NCE05N60L

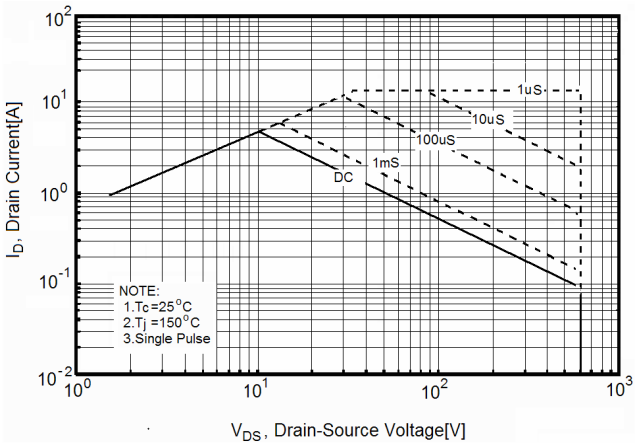


Figure2. Source-Drain Diode Forward Voltage

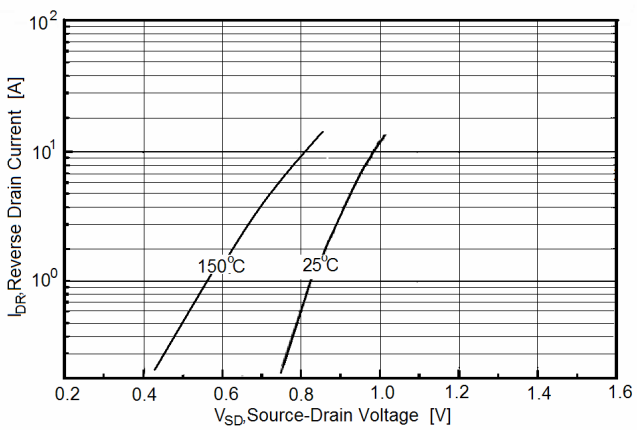


Figure3. Output characteristics

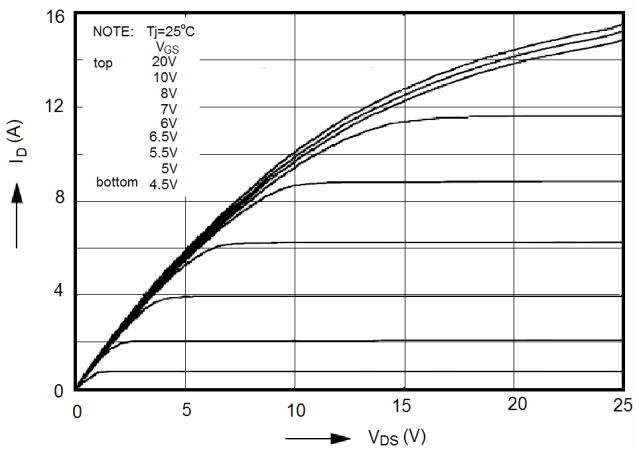


Figure4. Transfer characteristics

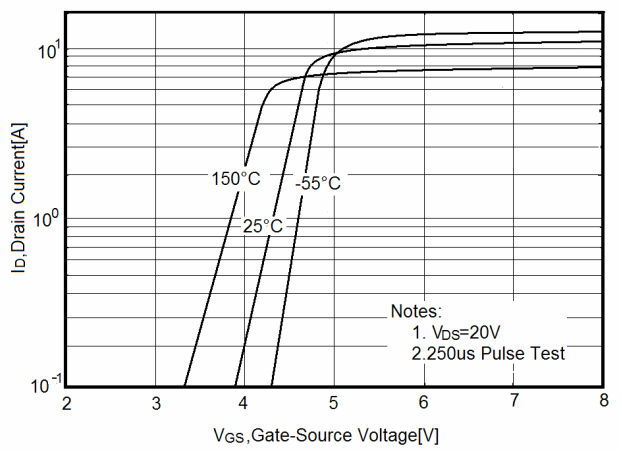


Figure5. Static drain-source on resistance

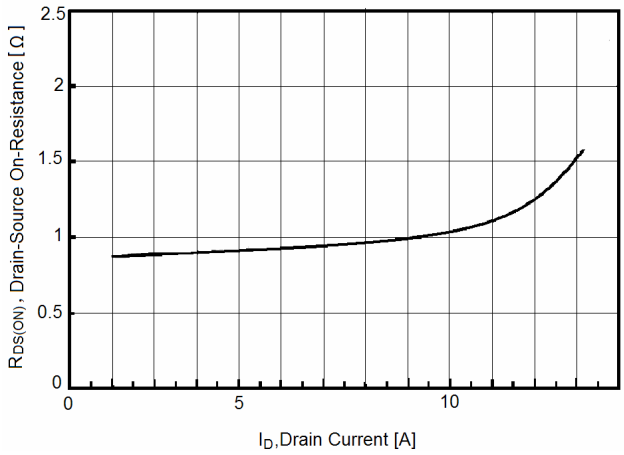


Figure6. $R_{DS(ON)}$ vs Junction Temperature

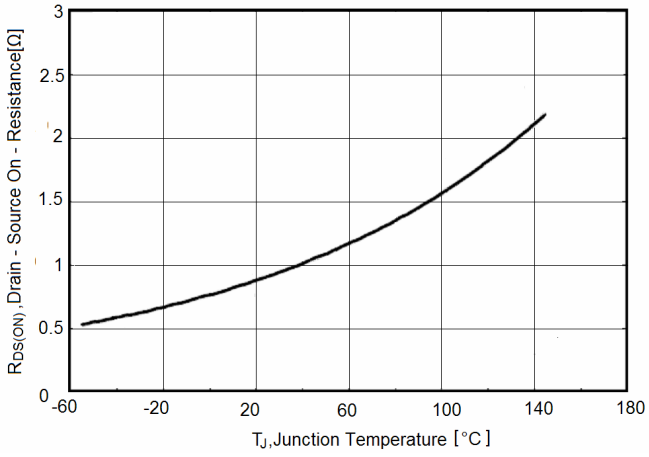


Figure7. BV_{DSS} vs Junction Temperature

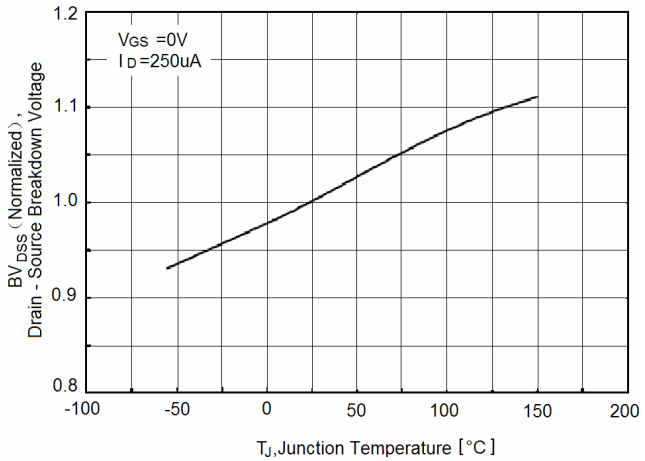


Figure8. Maximum I_D vs Junction Temperature

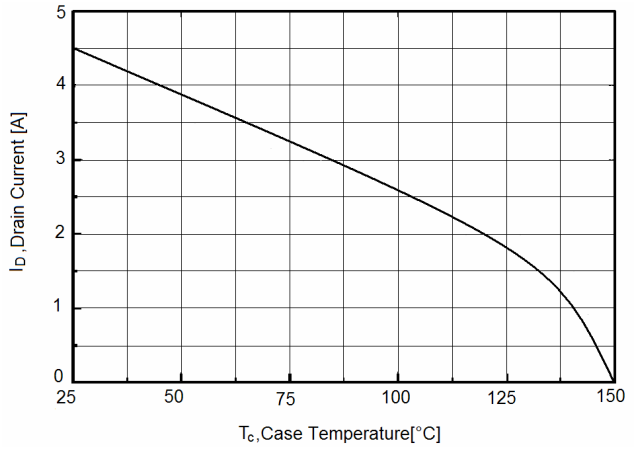


Figure9. Gate charge waveforms

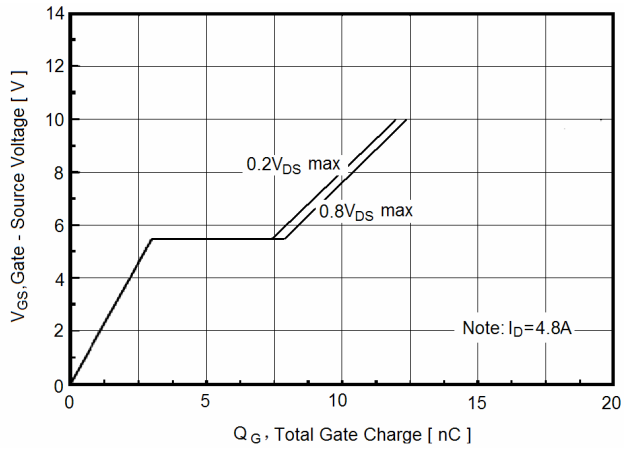


Figure10. Capacitance

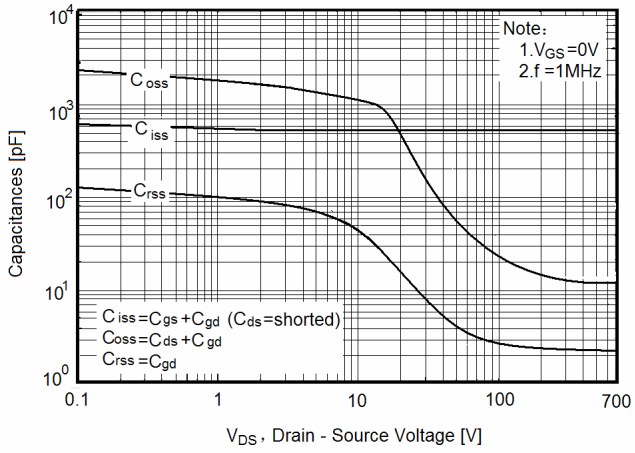
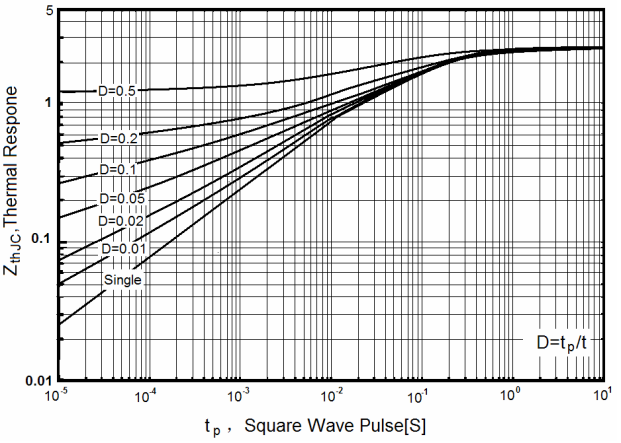
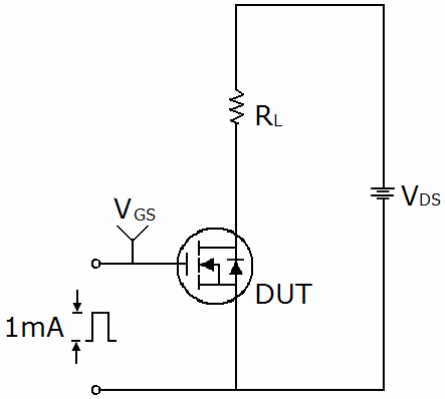


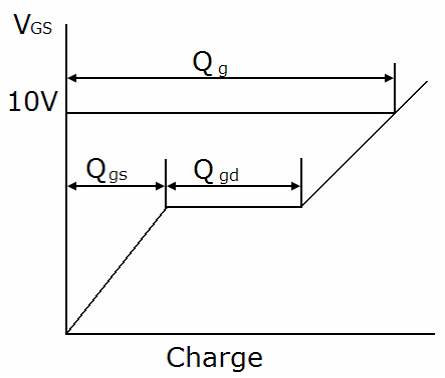
Figure11. Transient Thermal Impedance for NCE05N60L



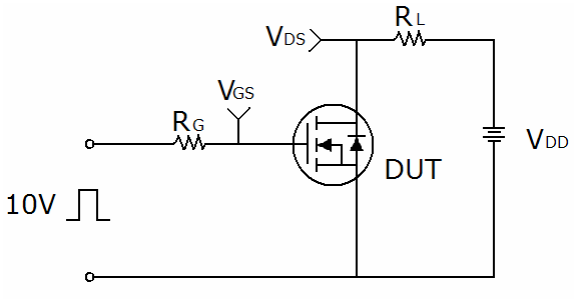
Test circuit

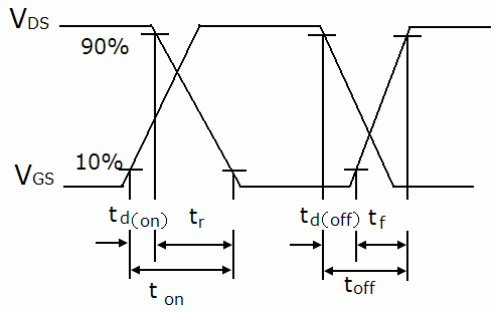
1）Gate charge test circuit & Waveform



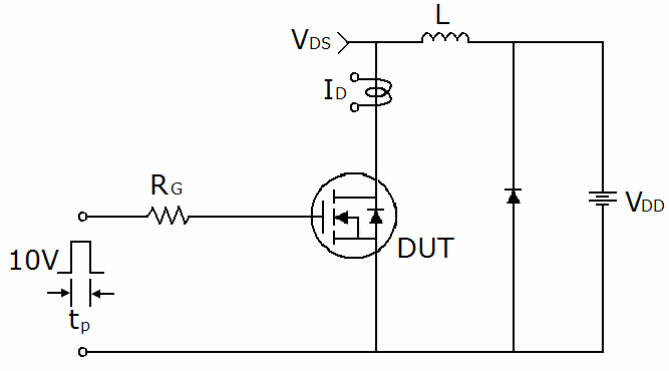


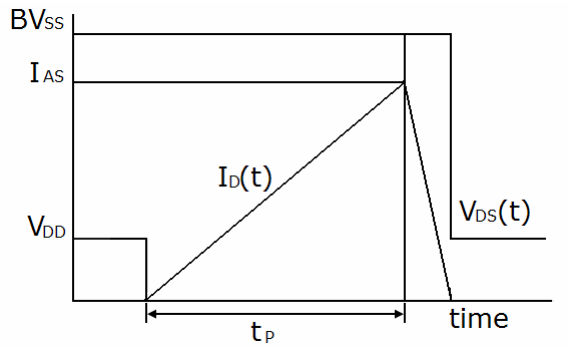
2）Switch Time Test Circuit:



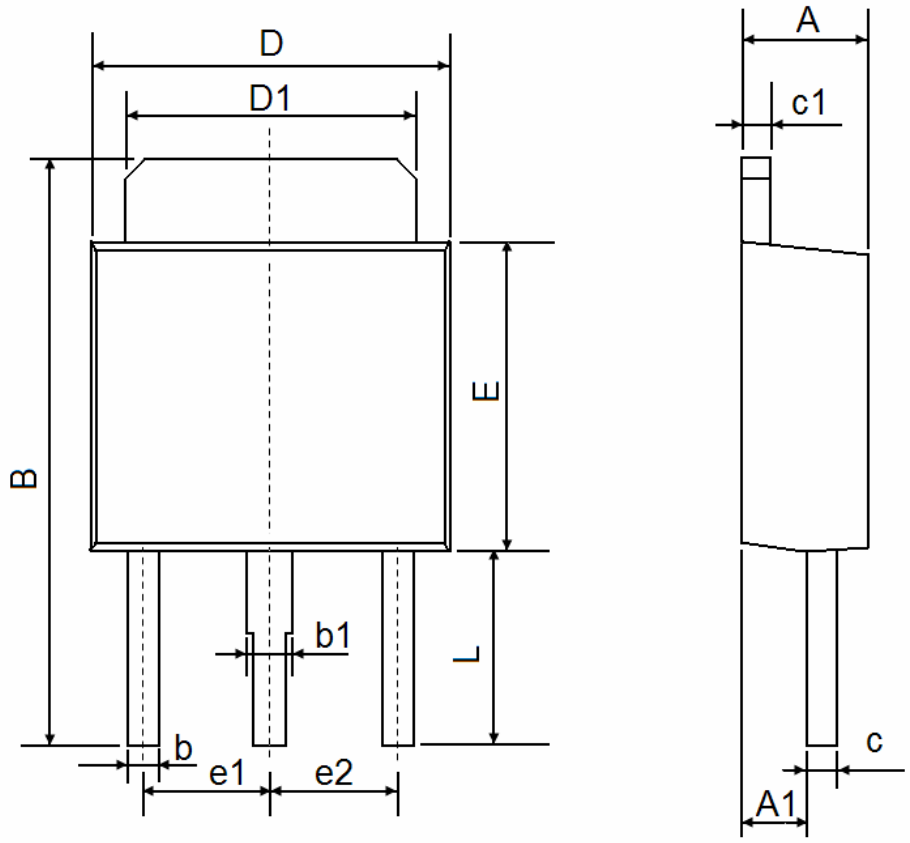


3）Unclamped Inductive Switching Test Circuit & Waveforms





TO-251S Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.250	2.350	0.089	0.093
A1	1.150	1.250	0.045	0.049
B	10.200	10.800	0.402	0.425
b	0.550	0.650	0.022	0.026
b1	0.750	0.850	0.030	0.033
c	0.480	0.540	0.019	0.021
c1	0.480	0.540	0.019	0.021
D	6.400	6.600	0.252	0.260
D1	5.250	5.350	0.207	0.211
E	5.400	5.600	0.213	0.220
e1	2.300 TYP		0.091 TYP	
e2	2.300 TYP		0.091 TYP	
L	3.300	3.700	0.130	0.146

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