

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.

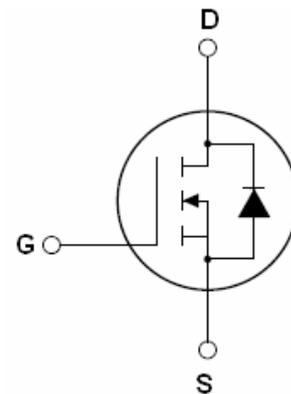
Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- 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)

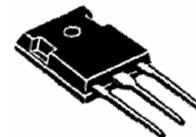
$V_{DS@T_{jmax}}$	650	V
$R_{DS(ON)}$	190	mΩ
I_D	20	A



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE20N60T	TO-247	NCE20N60T



TO-247

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

Parameter	Symbol	NCE20N60T	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 $T_c=25^\circ\text{C}$	$I_{D(DC)}$	20	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	12.5	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	60	A
Drain Source voltage slope, $V_{DS} = 480\text{ V}$, $I_D = 20\text{ A}$, $T_j = 125^\circ\text{C}$	dv/dt	50	V/ns
Maximum Power Dissipation($T_c=25^\circ\text{C}$)	P_D	208	W
Derate above 25°C		1.67	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	E_{AS}	690	mJ
Avalanche current (Note 1)	I_{AR}	20	A

Parameter	Symbol	NCE20N60T	Unit
Repetitive Avalanche energy , t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	1	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+150	°C

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	NCE20N60T	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	0.6	°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}	$V_{GS}=0V, I_D=250\mu A$	600			V	
Zero Gate Voltage Drain Current($T_C=25^\circ C$)	I_{DSS}	$V_{DS}=600V, V_{GS}=0V$		0.05	1	μA	
Zero Gate Voltage Drain Current($T_C=125^\circ C$)	I_{DSS}	$V_{DS}=600V, V_{GS}=0V$			100	μA	
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 30V, V_{DS}=0V$			± 100	nA	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5	3	3.5	V	
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=10A$		155	190	m Ω	
Dynamic Characteristics							
Forward Transconductance	g_{FS}	$V_{DS} = 20V, I_D = 10A$		17.5		S	
Input Capacitance	C_{ISS}	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$		2400		pF	
Output Capacitance	C_{OSS}			180		pF	
Reverse Transfer Capacitance	C_{RSS}			5.7		pF	
Total Gate Charge	Q_g	$V_{DS}=480V, I_D=20A,$ $V_{GS}=10V$		55	114	nC	
Gate-Source Charge	Q_{gs}			11		nC	
Gate-Drain Charge	Q_{gd}			22		nC	
Intrinsic gate resistance	R_G	$f = 1 MHz$ open drain		0.9		Ω	
Switching times							
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, I_D=20A,$ $R_G=3.6\Omega, V_{GS}=10V$		10		nS	
Turn-on Rise Time	t_r			5		nS	
Turn-Off Delay Time	$t_{d(off)}$			67	100	nS	
Turn-Off Fall Time	t_f			4	12	nS	
Source- Drain Diode Characteristics							
Source-drain current(Body Diode)	I_{SD}	$T_C=25^\circ C$			20	A	
Pulsed Source-drain current(Body Diode)	I_{SDM}				60	A	
Forward on voltage	V_{SD}	$T_J=25^\circ C, I_{SD}=20A, V_{GS}=0V$		0.9	1.3	V	
Reverse Recovery Time	t_{rr}	$T_J=25^\circ C, I_F=20A, di/dt=100A/\mu s$		360		nS	
Reverse Recovery Charge	Q_{rr}				5.5		μC
Peak Reverse Recovery Current	I_{rrm}				30		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 for NCE20N60T

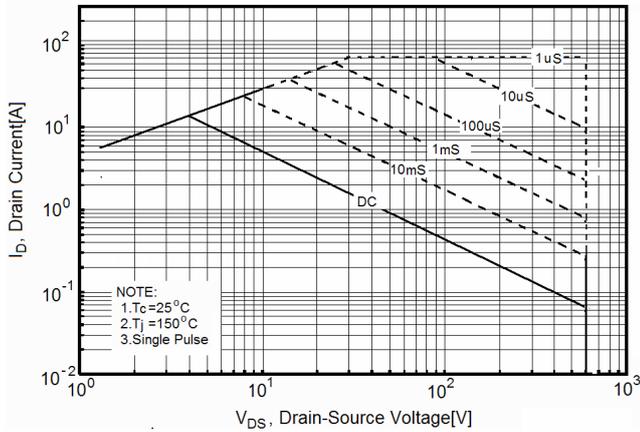


Figure2. Source-Drain Diode Forward Voltage

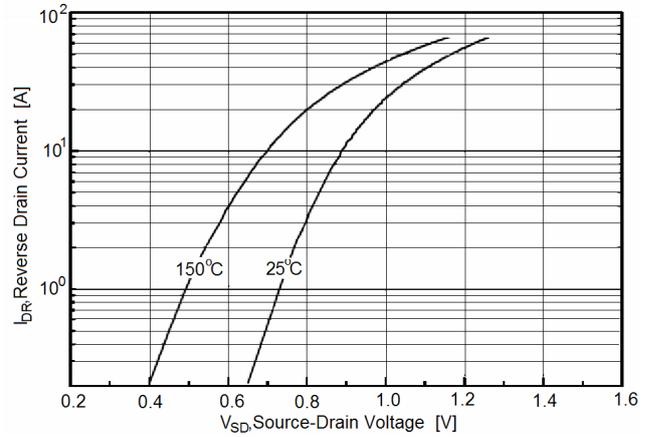


Figure3. Output characteristics

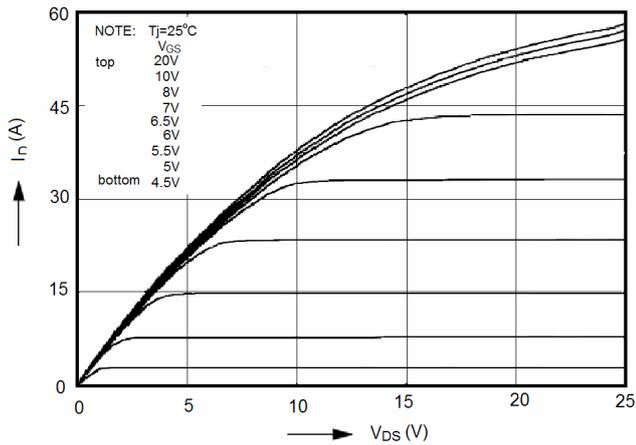


Figure4. Transfer characteristics

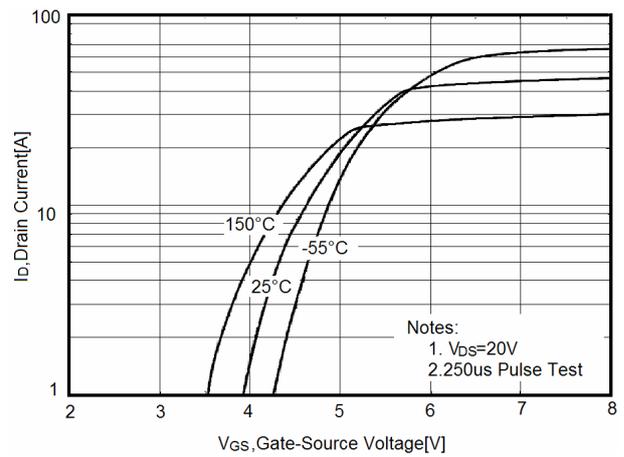


Figure5. Static drain-source on resistance

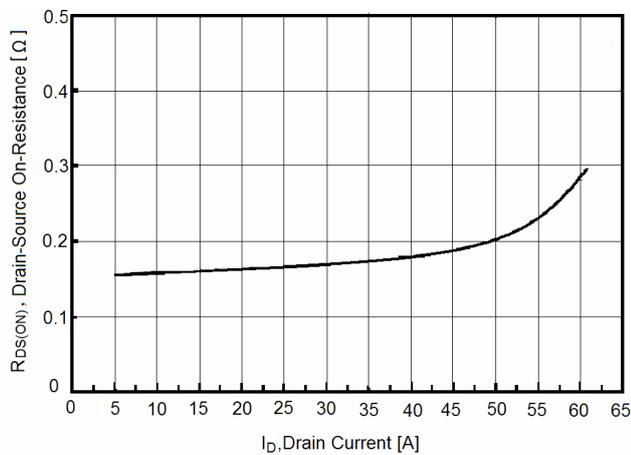


Figure6. RDS(ON) vs Junction Temperature

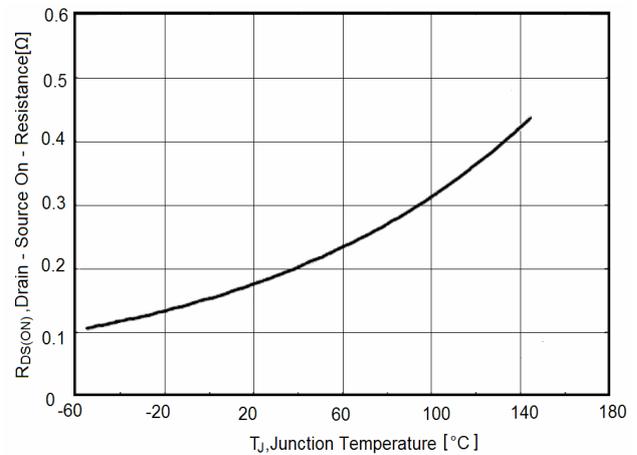


Figure7. BV_{DSS} vs Junction Temperature

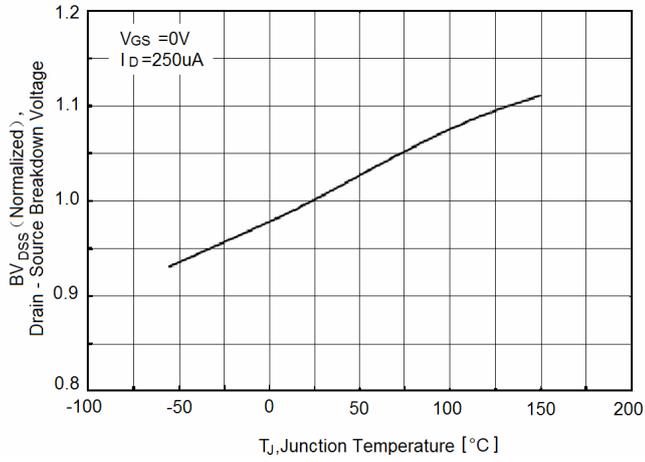


Figure8. Maximum I_D vs Junction Temperature

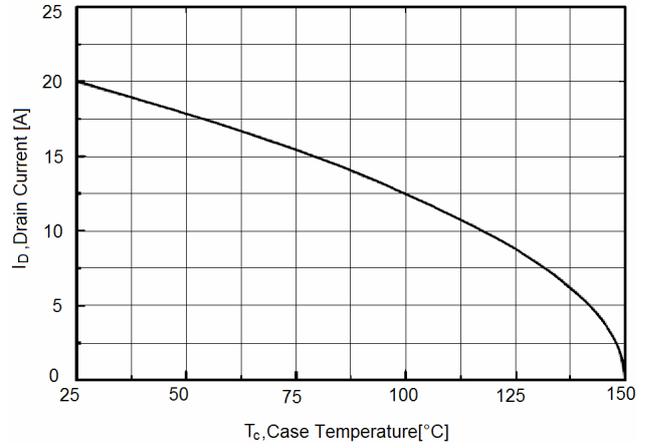


Figure9. Gate charge waveforms

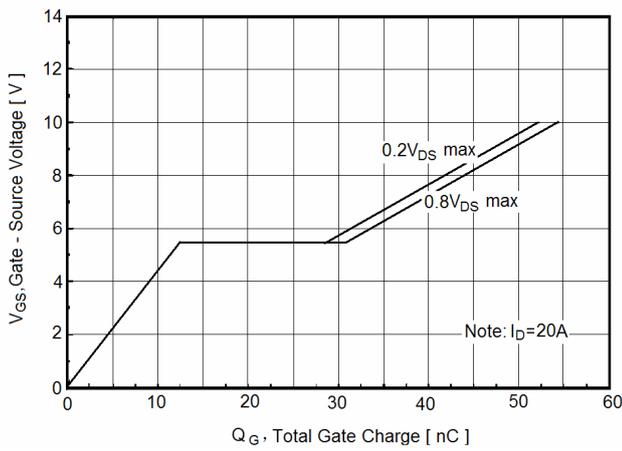


Figure10. Capacitance

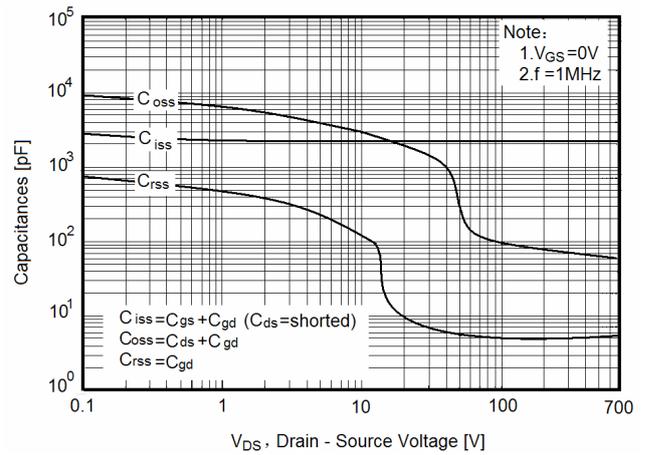
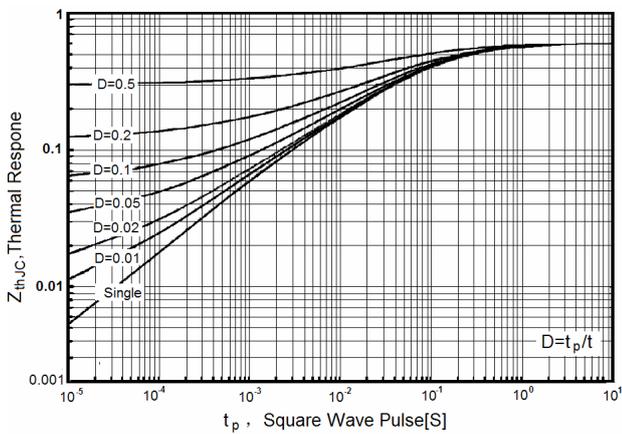
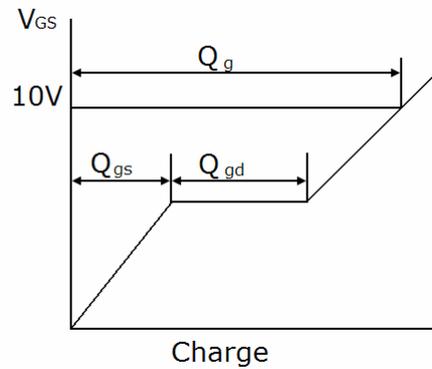
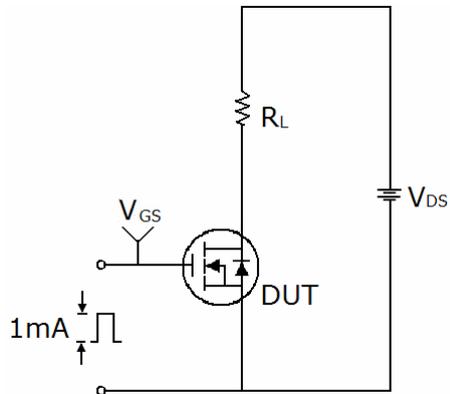


Figure11. Transient Thermal Impedance

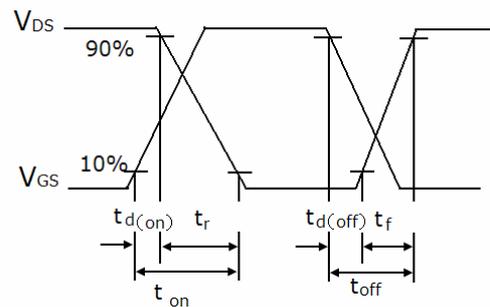
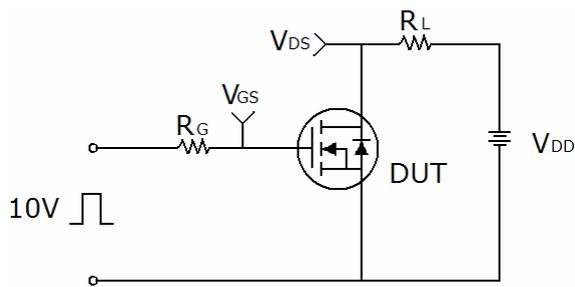


Test circuit

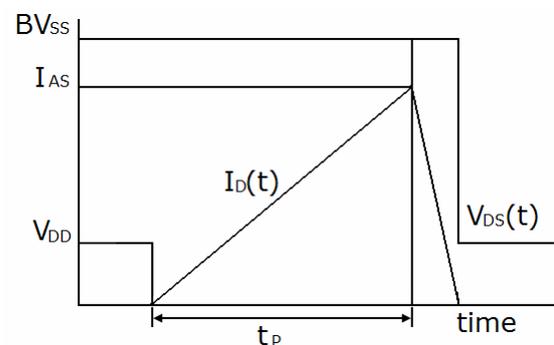
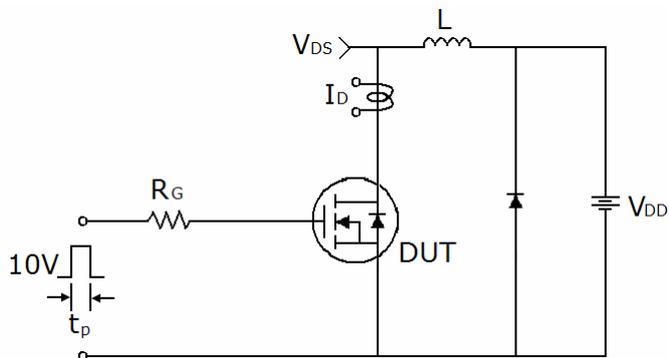
1) Gate charge test circuit & Waveform



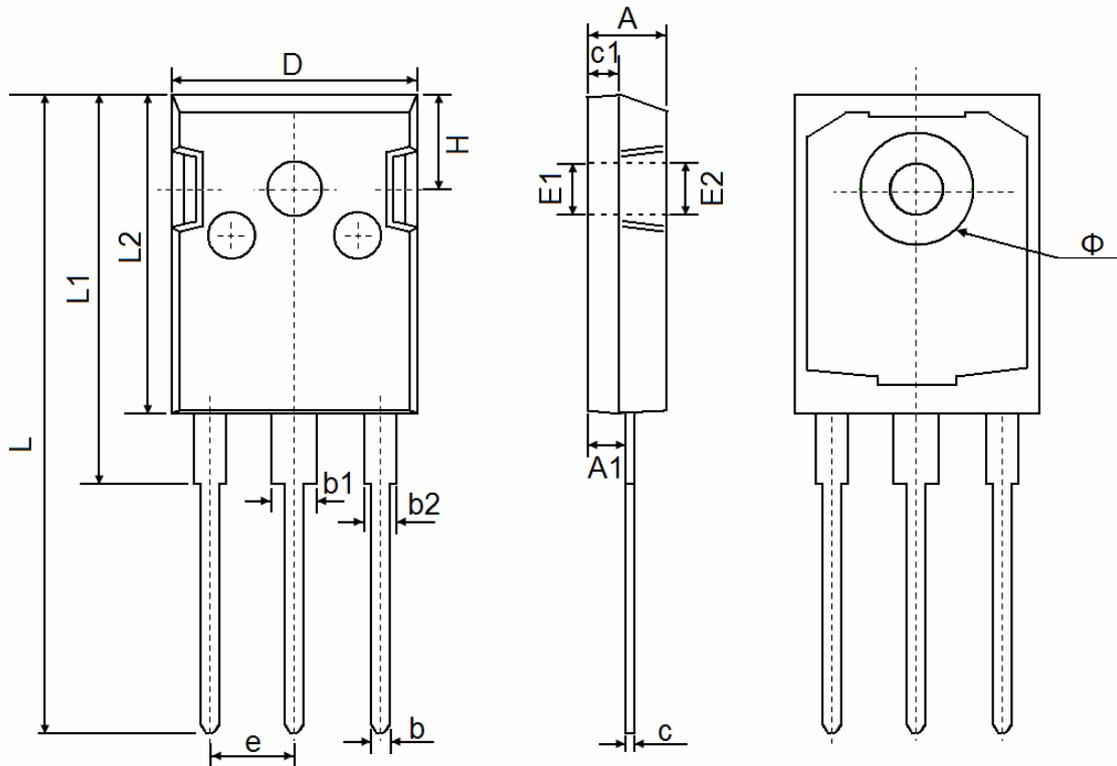
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-247 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		0.138 REF	
E2	3.600 REF		0.142 REF	
L	40.900	41.300	1.610	1.626
L1	24.800	25.100	0.976	0.988
L2	20.300	20.600	0.799	0.811
Φ	7.100	7.300	0.280	0.287
e	5.450 TYP		0.215 TYP	
H	5.980 REF		0.235 REF	

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