

Super Junction MOSFET

NCE N-Channel Enhancement Mode 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.

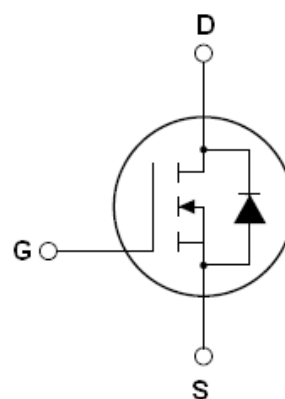
Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested

Application

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

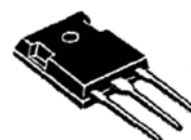
V_{DS}	650	V
$R_{DS(ON)}$	190	mΩ
I_D	20	A



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE20N65T	TO-247	20N65C3



TO-247

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

Parameter	Symbol	NCE20N65T	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	650	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

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	NCE20N65T	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 =250μA	650			V
Zero Gate Voltage Drain Current(Tc=25℃)	I _{DSS}	V _{DS} =650V,V _{GS} =0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I _{DSS}	V _{DS} =650V,V _{GS} =0V			100	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 =10A			190	mΩ
Dynamic Characteristics						
Forward Transconductance	g _{FS}	V _{DS} = 20V, I _D = 10A		17.5		S
Input Capacitance	C _{iss}	V _{DS} =100V,V _{GS} =0V, F=1.0MHz		2300		PF
Output Capacitance	C _{oss}			95		PF
Reverse Transfer Capacitance	C _{rss}			7		PF
Total Gate Charge	Q _g	V _{DS} =480V,I _D =20A, V _{GS} =10V		85	114	nC
Gate-Source Charge	Q _{gs}			11		nC
Gate-Drain Charge	Q _{gd}			33		nC
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =20A, R _G =3.6Ω,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℃			20	A
Pulsed Source-drain current(Body Diode)	I _{SDM}				60	A
Forward on voltage	V _{SD}	T _j =25℃,I _{SD} =20A,V _{GS} =0V		0.9	1.3	V
Reverse Recovery Time	t _{rr}	T _j =25℃,I _f =20A,di/dt=100A/μs		500		nS
Reverse Recovery Charge	Q _{rr}			11		nC

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 NCE20N65T

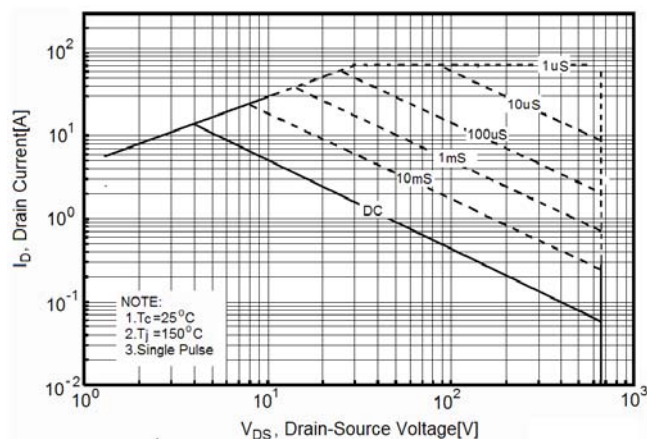


Figure3. Source-Drain Diode Forward Voltage

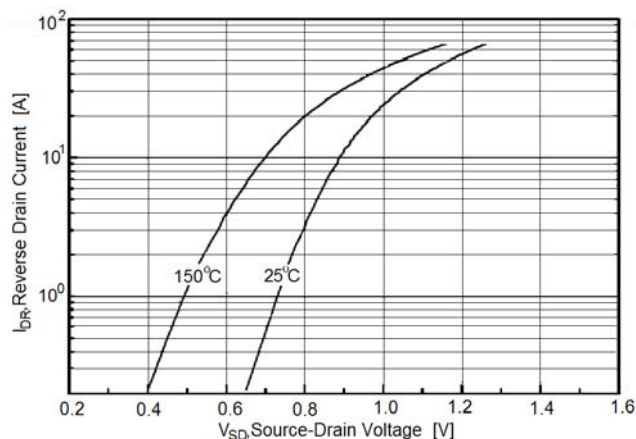


Figure4. Output characteristics

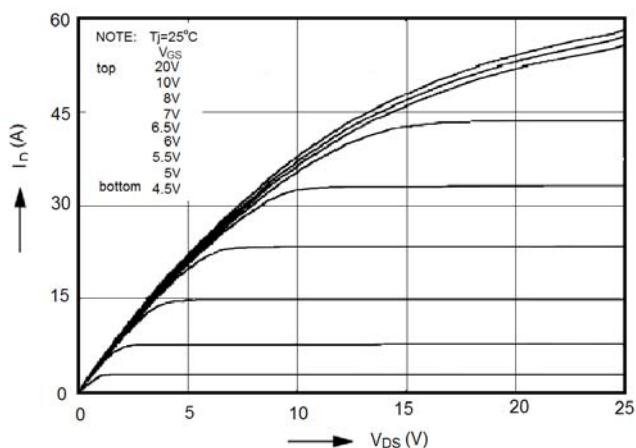


Figure5. Transfer characteristics

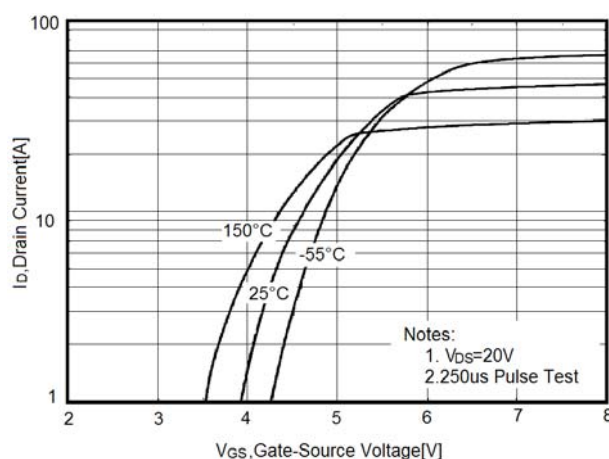


Figure6. Static drain-source on resistance

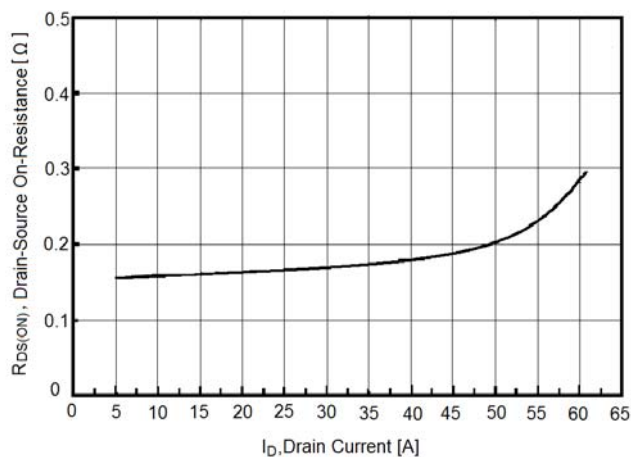


Figure7. R_DS(on) vs Junction Temperature

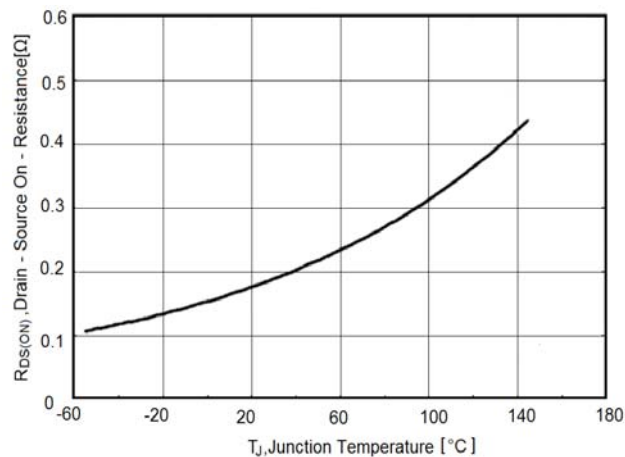


Figure8. BV_{DSS} vs Junction Temperature

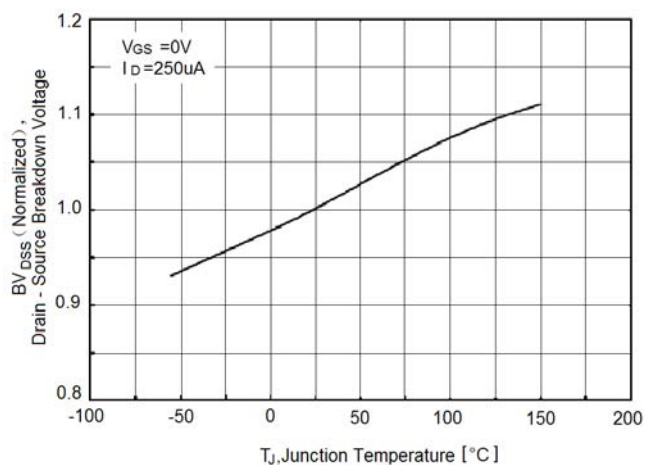


Figure9. Maximum I_D vs Junction Temperature

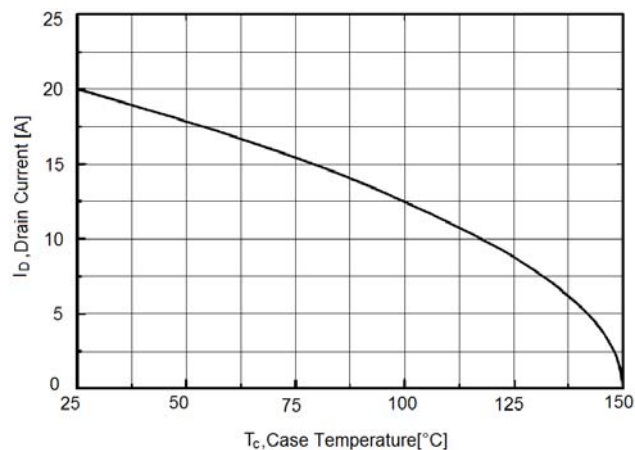


Figure10. Gate charge waveforms

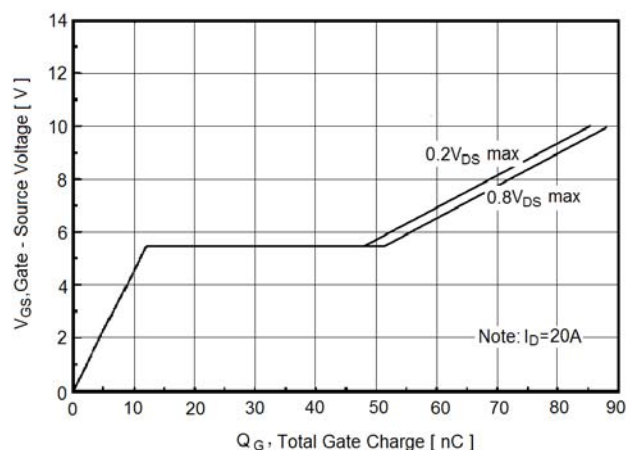


Figure10. Capacitance

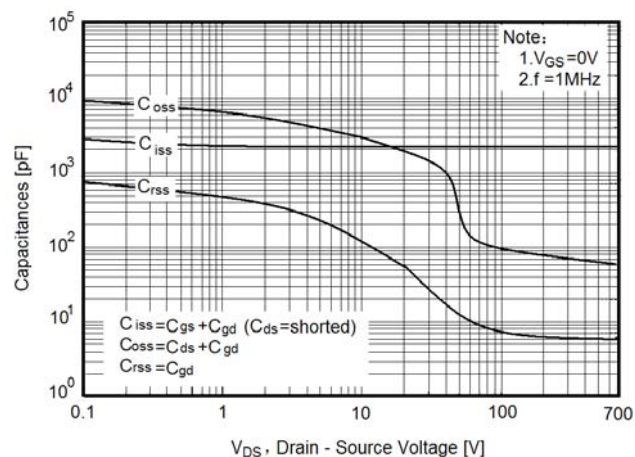
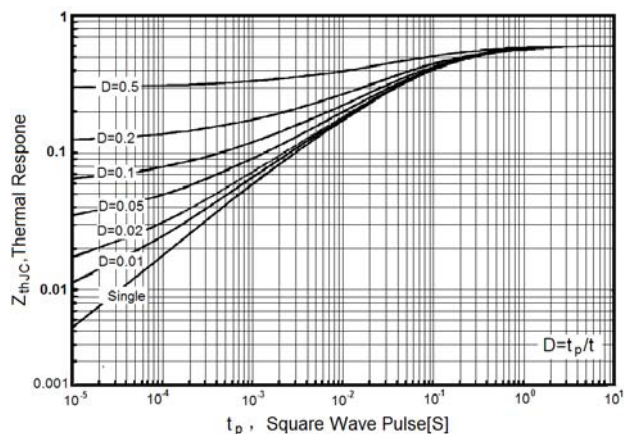
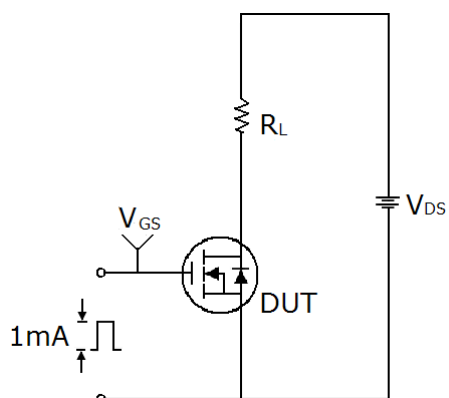
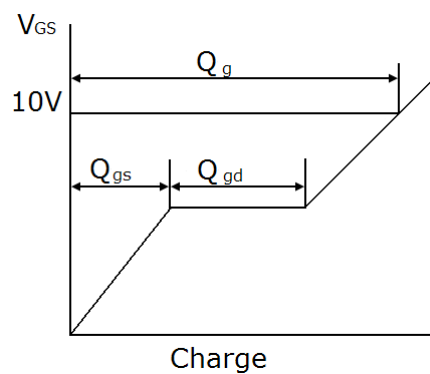


Figure11. Transient Thermal Impedance for NCE20N65T

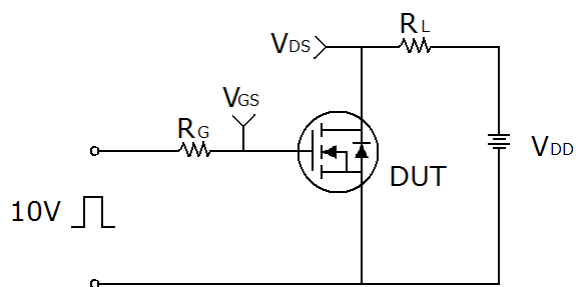
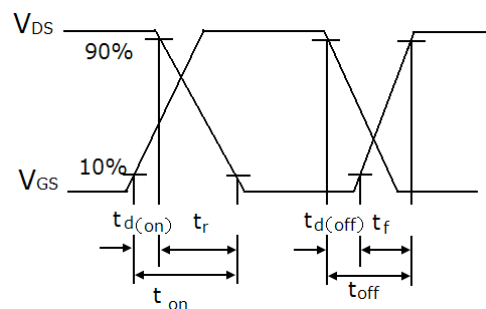


Test circuit

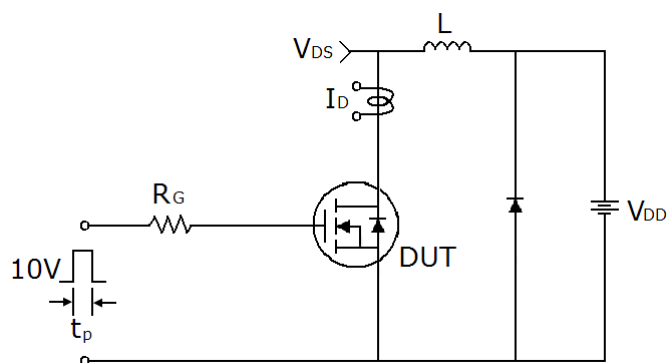
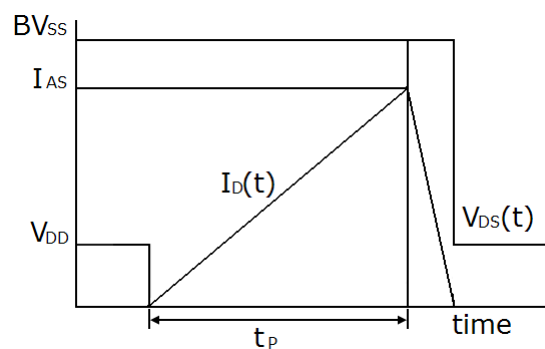
1) Gate charge test circuit & Waveform



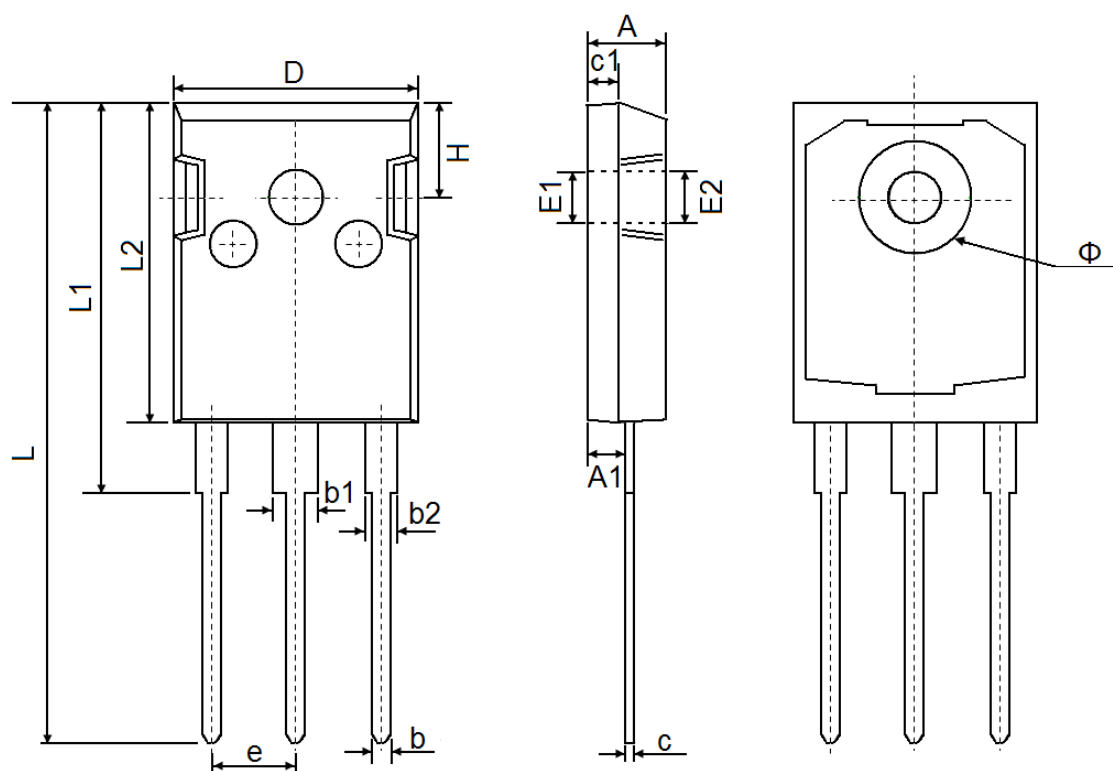
2) Switch Time Test Circuit:



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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