

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.

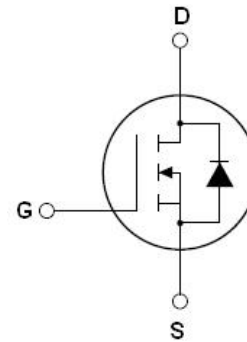
Features

- 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

$V_{DS\ min@T_{jmax}}$	650	V
$R_{DS(ON)TYP}$	70	mΩ
ID	41	A
Qg	53	nC



Schematic diagram

✧ Intrinsic fast-recovery body diode

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60NF080	TO-220	NCE60NF080



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

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	600	V
Gate-Source Voltage ($V_{DS}=0V$) AC ($f>1\text{ Hz}$)	V_{GS}	± 30	V
Gate-Source Voltage ($V_{DS}=0V$) DC	V_{GS}	± 20	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_D(DC)$	41	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_D(DC)$	28.7	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	123	A
Maximum Power Dissipation($T_c=25^\circ\text{C}$)	P_D	351	W
Derate above 25°C		2.34	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	E_{AS}	400	mJ
Avalanche current (Note 1)	I_{AS}	10	A
Repetitive Avalanche energy, t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	0.7	mJ
Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$,	dv/dt	50	V/ns
Reverse diode dv/dt , $V_{DS} \leq 480\text{ V}, I_{SD} < I_D$	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+175	$^\circ\text{C}$

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	0.427	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	$^{\circ}C/W$

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}	$V_{GS}=0V, I_D=500\mu A$	600			V
Zero Gate Voltage Drain Current(Tc=25°C)	I_{DSS}	$V_{DS}=600V, V_{GS}=0V$			10	μA
Zero Gate Voltage Drain Current(Tc=125°C)	I_{DSS}	$V_{DS}=600V, V_{GS}=0V$			300	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$			± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	3	4	5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=20A$		70	80	m Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$		2920		pF
Output Capacitance	C_{oss}			123		pF
Reverse Transfer Capacitance	C_{rss}			5.4		pF
Total Gate Charge	Q_g	$V_{DS}=480V, I_D=20A,$ $V_{GS}=10V$		53		nC
Gate-Source Charge	Q_{gs}			17		nC
Gate-Drain Charge	Q_{gd}			13		nC
Gate plateau voltage	V_{gp}			6.8		V
Intrinsic gate resistance	R_G	$f = 1 MHz$ open drain		1.0		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, I_D=20A,$ $R_G=1.7\Omega, V_{GS}=10V$		31		nS
Turn-on Rise Time	t_r			13		nS
Turn-Off Delay Time	$t_{d(off)}$			89		nS
Turn-Off Fall Time	t_f			8		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	$T_C=25^{\circ}C$			41	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				123	A
Forward On Voltage	V_{SD}	$T_j=25^{\circ}C, I_{SD}=41A, V_{GS}=0V$		1.0	1.2	V
Reverse Recovery Time	t_{rr}	$T_j=25^{\circ}C, I_F=20A,$ $di/dt=100A/\mu s$		120		nS
Reverse Recovery Charge	Q_{rr}			0.48		μC
Peak Reverse Recovery Current	I_{rrm}			8		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

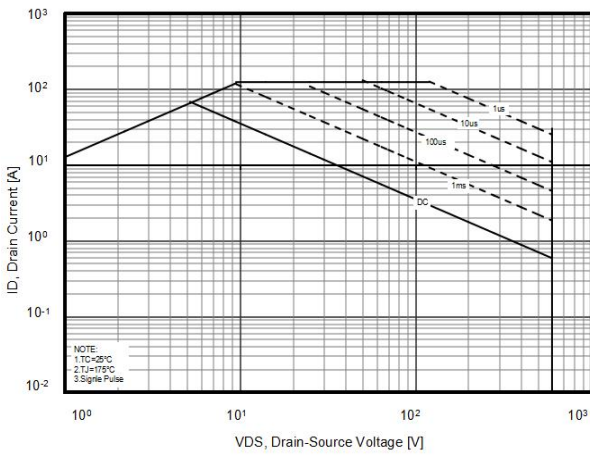


Figure2. Capacitance

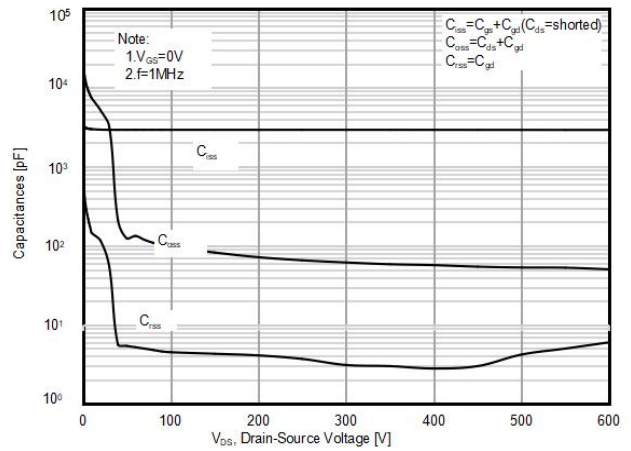


Figure3. Source-Drain Diode Forward Voltage

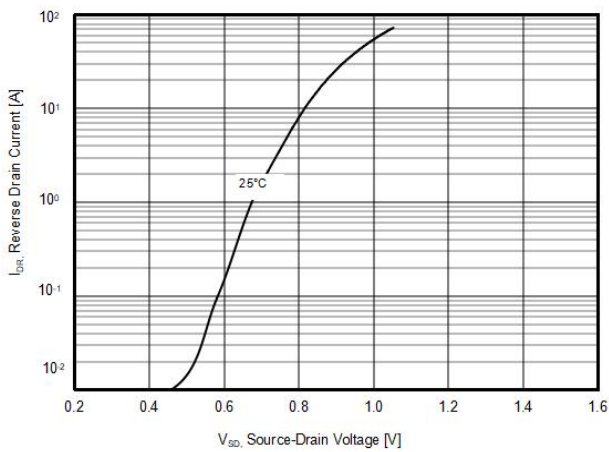


Figure4. Output characteristics

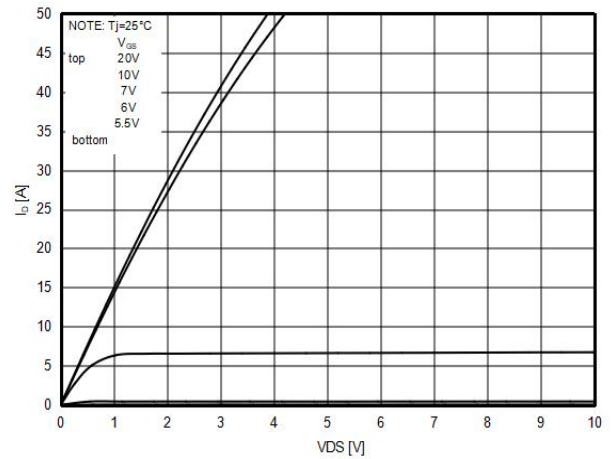


Figure5. $R_{DS(ON)}$ vs Junction Temperature

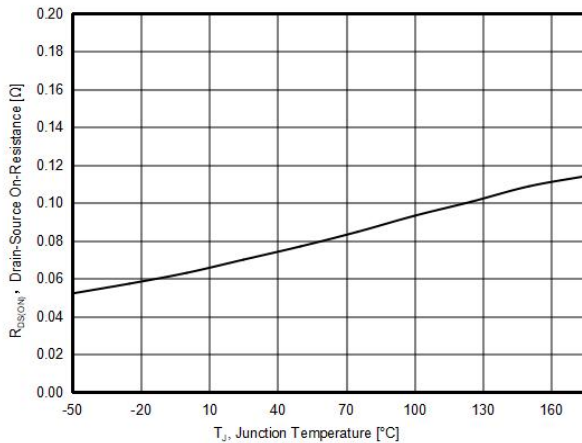


Figure6. BV_{DSS} vs Junction Temperature

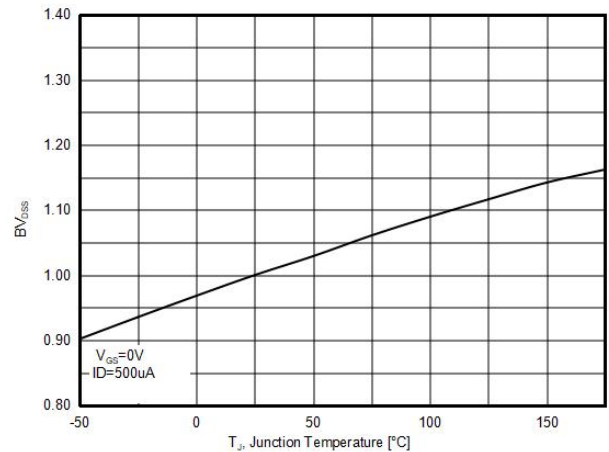


Figure7. Maximum I_D vs Junction Temperature

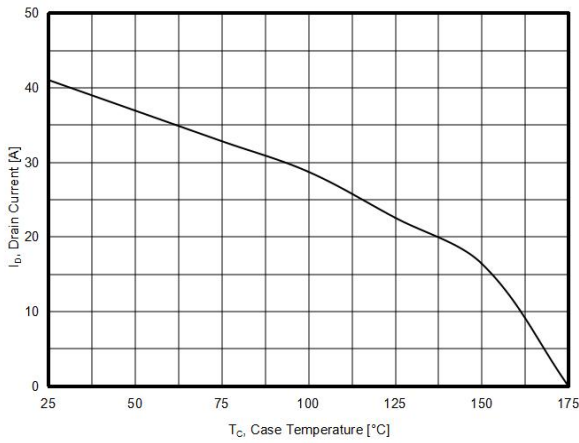


Figure8. Gate charge waveforms

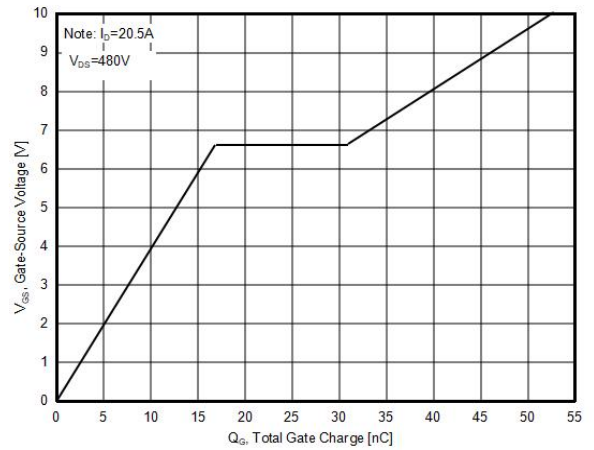


Figure9. Static drain-source on resistance

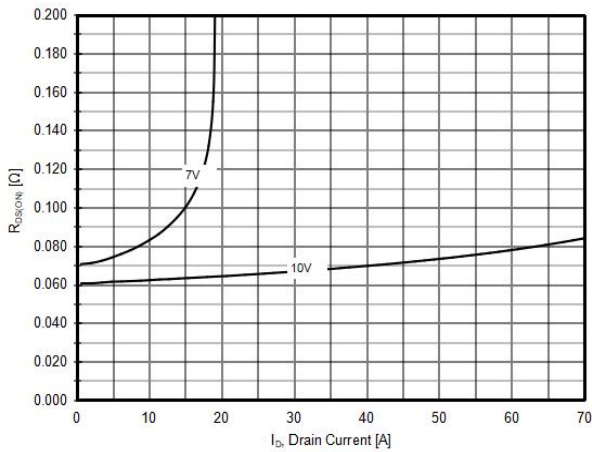
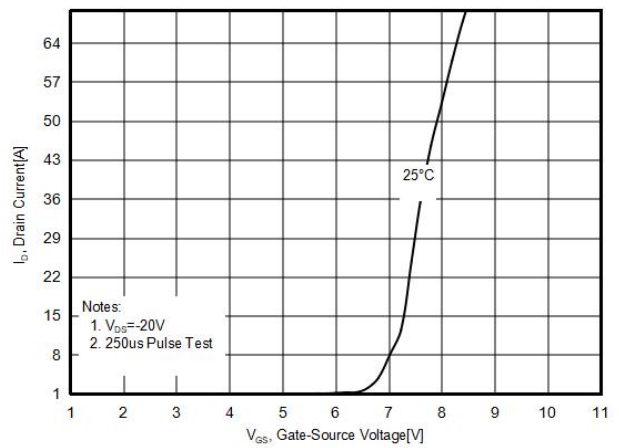


Figure10. Transfer characteristics

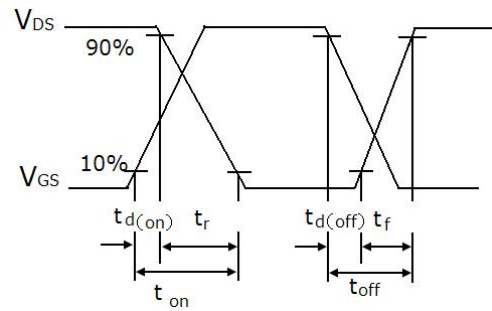


Test circuit

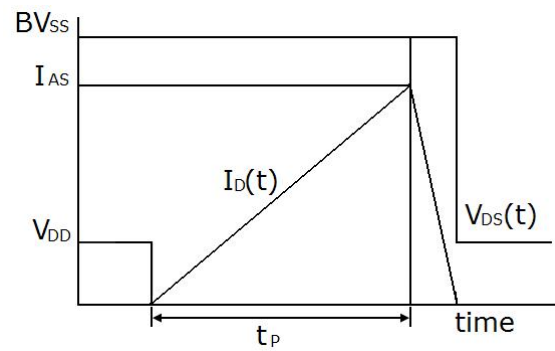
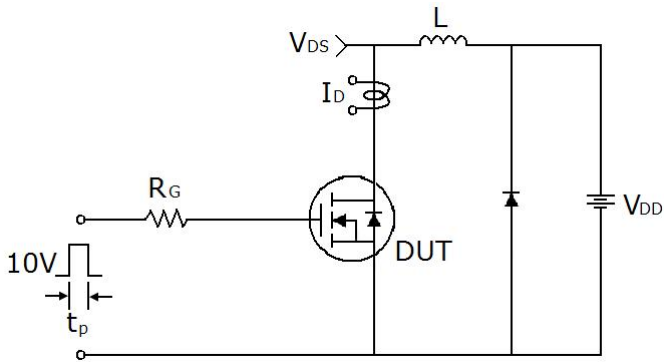
1) Gate charge test circuit & Waveform



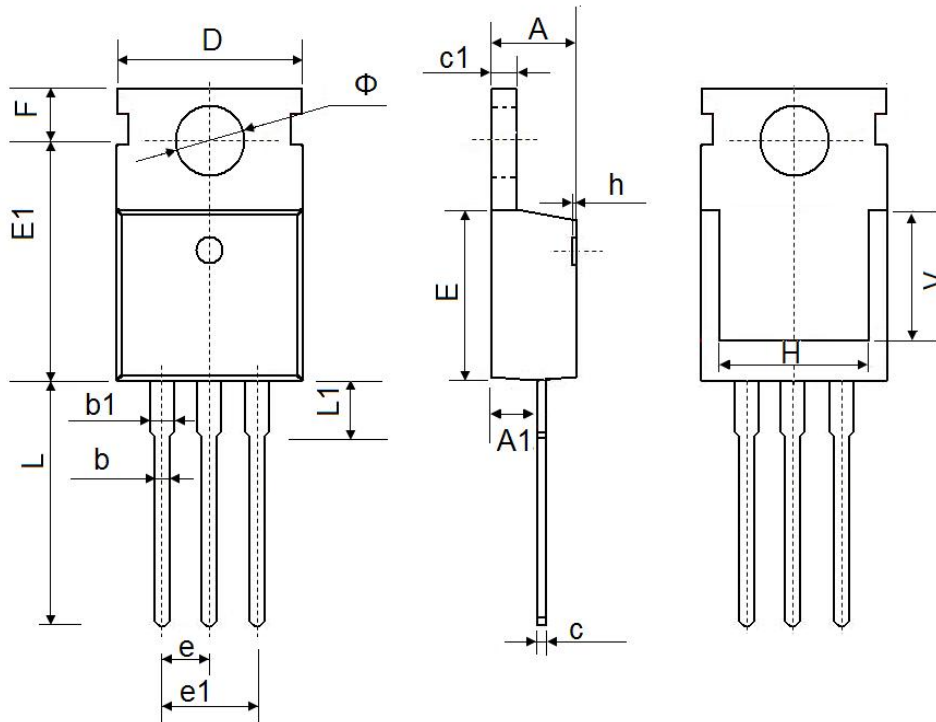
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-220-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.4	4.6	0.173	0.181
A1	2.25	2.55	0.089	0.1
b	0.71	0.91	0.028	0.036
b1	1.17	1.37	0.046	0.054
c	0.33	0.65	0.013	0.026
c1	1.2	1.4	0.047	0.055
D	9.91	10.25	0.39	0.404
E	8.95	9.75	0.352	0.384
E1	12.65	12.95	0.498	0.51
e	2.540 TYP.		0.100 TYP.	
e1	4.98	5.18	0.196	0.204
F	2.65	2.95	0.104	0.116
H	7.9	8.1	0.311	0.319
h	0	0.3	0	0.012
L	12.9	13.4	0.508	0.528
L1	2.85	3.25	0.112	0.128
V	7.500 REF.		0.295 REF.	
Φ	3.4	3.8	0.134	0.15

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