



N-Channel Super Junction Power MOSFET II

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.

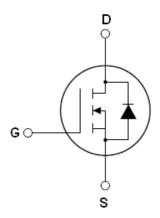
Features

- 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
- ■ROHS compliant

Application

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

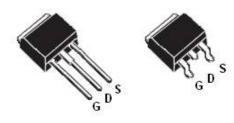
V _{DS} @T _{jmax}	650	V
R _{DS(ON) MAX}	540	mΩ
I_D	8	A



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE60R540I	TO-251	NCE60R540I
NCE60R540K	TO-252	NCE60R540K



TO-251 TO-252

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (Vgs=0V)	V _{DS}	600	V
Gate-Source Voltage (VDS=0V)	V _G S	±30	V
Continuous Drain Current at Tc=25°C	I _{D (DC)}	8	Α
Continuous Drain Current at Tc=100°C	I _{D (DC)}	5.2	Α
Pulsed drain current (Note 1)	I _{DM (pluse)}	24	Α
Maximum Power Dissipation(Tc=25℃)	P _D	80	W
Derate above 25°C		0.64	w/°C
Single pulse avalanche energy (Note 2)	Eas	185	mJ
Avalanche current ^(Note 1)	I _{AR}	4	Α
Repetitive Avalanche energy , t_{AR} limited by T_{jmax} (Note 1)	E _{AR}	0.4	mJ



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Parameter	Symbol	Value	Unit
Drain Source voltage slope, V _{DS} ≤480 V,	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480 \text{ V,I}_{SD} < I_{D}$	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	T_{J} , T_{STG}	-55+150	°C

^{*} limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	1.56	°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	Тур	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	μΑ
Zero Gate Voltage Drain Current(Tc=125℃)	I _{DSS}	V _{DS} =600V,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 =4A		480	540	mΩ
Dynamic Characteristics			•			
Forward Transconductance	g FS	$V_{DS} = 20V, I_{D} = 4A$		5.5		S
Input Capacitance	C _{Iss}	\/ -50\/\/ -0\/		680		pF
Output Capacitance	Coss	V_{DS} =50V, V_{GS} =0V, F=1.0MHz		58		pF
Reverse Transfer Capacitance	C _{rss}	F=1.UIVITZ		4		pF
Total Gate Charge	Qg	V -400V L -0A		14.5	22	nC
Gate-Source Charge	Q _{gs}	V _{DS} =480V,I _D =8A,		2.8		nC
Gate-Drain Charge	Q_{gd}	V _{GS} =10V		5.5		nC
Intrinsic gate resistance	R_G	f = 1 MHz open drain		2		Ω
Switching times						
Turn-on Delay Time	t _{d(on)}			5.5		nS
Turn-on Rise Time	t _r	V_{DD} =380 V , I_{D} =4 A ,		3.5		nS
Turn-Off Delay Time	t _{d(off)}	$R_G=12\Omega, V_{GS}=10V$		55	75	nS
Turn-Off Fall Time	t _f			6.5	10	nS
Source- Drain Diode Characteristics			•			
Source-drain current(Body Diode)	I _{SD}	T -05°0			8	Α
Pulsed Source-drain current(Body Diode)	I _{SDM}	T _C =25°C			23.4	Α
Forward On Voltage	V _{SD}	Tj=25°C,I _{SD} =8A,V _{GS} =0V		0.9	1.2	V
Reverse Recovery Time	t _{rr}	Tj=25°C,I _F =8A,di/dt=100A/μs		220		nS
Reverse Recovery Charge	Q _{rr}			2.2		uC
Peak Reverse Recovery Current	I _{rrm}			20		Α

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

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^{2.} Tj=25°C,VDD=50V,VG=10V, R_G=25 Ω





TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure 1. Safe operating area

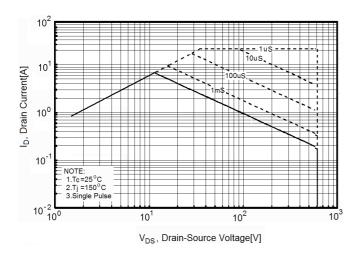


Figure 3. Output characteristics

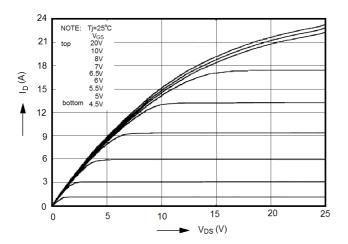


Figure 5. Static drain-source on resistance

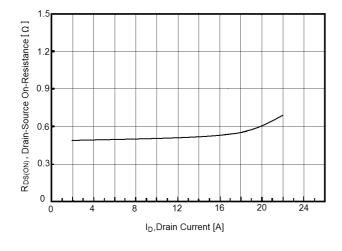


Figure 2. Source-Drain Diode Forward Voltage

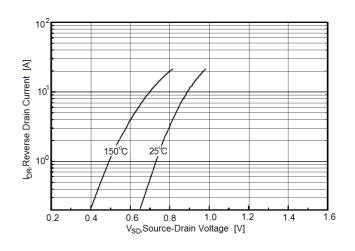


Figure 4. Transfer characteristics

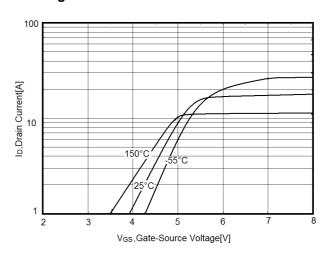
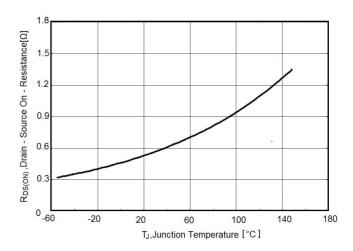


Figure 6. R_{DS(ON)} vs Junction Temperature





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Figure 7. BV_{DSS} vs Junction Temperature

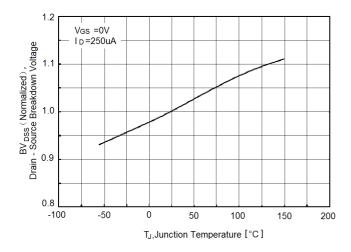


Figure 9. Gate charge waveforms

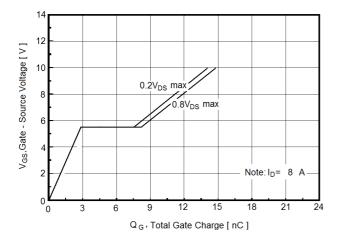


Figure 11. Transient Thermal Impedance

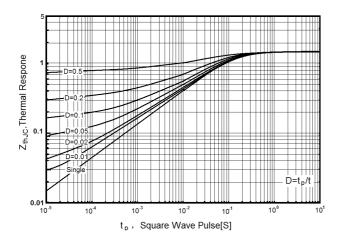


Figure 8. Maximum I_D vs Junction Temperature

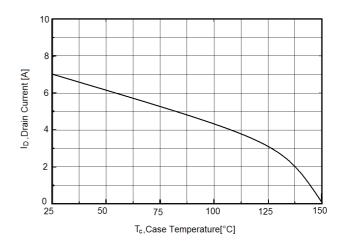
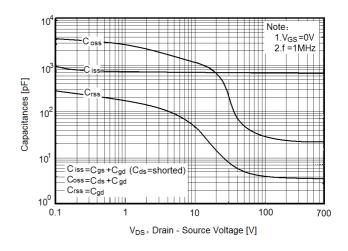


Figure 10. Capacitance

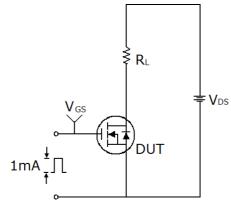


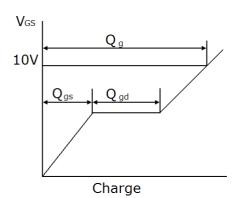




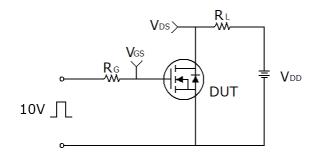
Test circuit

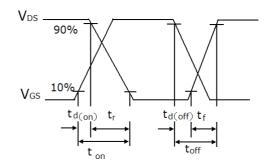
1) Gate charge test circuit & Waveform



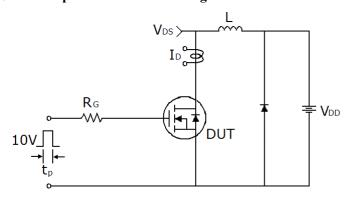


2) Switch Time Test Circuit:

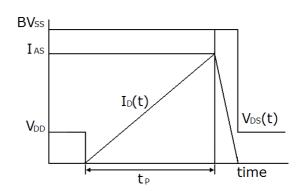




3) Unclamped Inductive Switching Test Circuit & Waveforms



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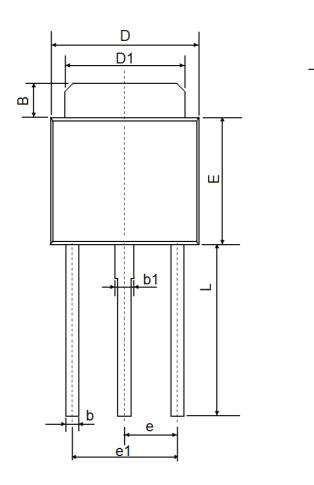




c1



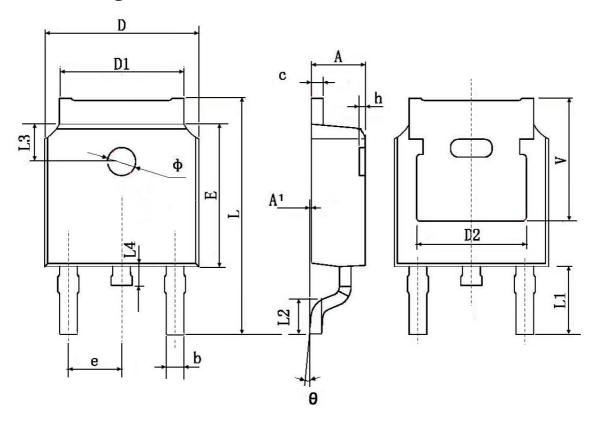
TO-251 Package Information



Comphal	Dimensions	In Millimeters	Dimensions In Inches		
Symbol	Min.	Max.	Min.	Max.	
A	2.200	2.400	0.087	0.094	
A1	1.050	1.350	0.042	0.054	
В	1.350	1.650	0.053	0.065	
b	0.500	0.700	0.020	0.028	
b1	0.700	0.900	0.028	0.035	
С	0.430	0.580	0.017	0.023	
c1	0.430	0.580	0.017	0.023	
D	6.350	6.650	0.250	0.262	
D1	5.200	5.400	0.205	0.213	
E	5.400	5.700	0.213	0.224	
е	2.300 TYP.		0.091 TYP.		
e1	4.500	4.700	0.177	0.185	
L	7.500	7.900	0.295	0.311	



TO-252 Package Information



Cumbal	Dimensions	In Millimeters	Dimensions In Inches		
Symbol	Min.	Max.	Min.	Max.	
A	2.200	2.400	0.087	0.094	
A1	0.000	0.127	0.000	0.005	
b	0.660	0.860	0.026	0.034	
С	0.460	0.580	0.018	0.023	
D	6.500	6.700	0.256	0.264	
D1	5.100	5.460	0.201	0.215	
D2	4.83	0 TYP.	0.190 TYP.		
E	6.000	6.200	0.236	0.244	
е	2.186	2.386	0.086	0.094	
L	9.800	10.400	0.386	0.409	
L1	2.90	0 TYP.	0.114 TYP.		
L2	1.400	1.700	0.055	0.067	
L3	1.60	0 TYP.	0.063 TYP.		
L4	0.600	1.000	0.024	0.039	
Ф	1.100	1.300	0.043	0.051	
θ	0°	8°	0°	8°	
h	0.000	0.300	0.000	0.012	
V	5.350 TYP.		0.211 TYP.		

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