

STP90NS04ZC

N-channel clamped 5mΩ - 80A TO-220 Fully protected SAFeFET™ Power MOSFET

Features

Туре	V _{DSS}	R _{DS(on)}	I _D
STP90NS04ZC	Clamped	< 6mΩ	80A

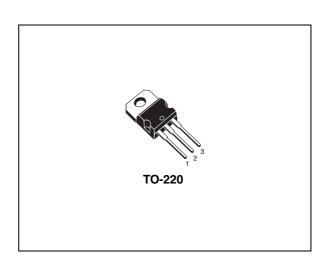
- Low capacitance and gate charge
- 100% avalanche tested
- 175°C maximum junction temperature

Description

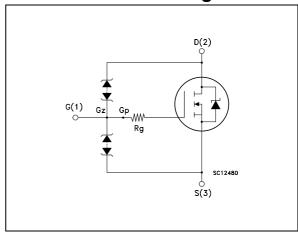
This fully clamped Power MOSFET is produced by using the latest advanced company's Mesh OVERLAY process which is based on a novel strip layout. The inherent benefits of the new technology coupled with the extra clamping capabilities make this product particularly suitable for the harshest operation conditions such as those encountered in the automotive environment. Any other application requiring extra ruggedness is also recommended.

Applications

- Switching applications
 - ABS, solenoid drivers
 - Motor control
 - Dc-dc converters



Internal schematic diagram



Order code

Part number	Part number Marking Package		Packaging
STP90NS04ZC	P90NS04ZC	TO-220	Tube

Contents STP90NS04ZC

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STP90NS04ZC Electrical ratings

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{DS}	Drain-source voltage (V _{GS} = 0)	33 ⁽¹⁾	V
V_{DG}	drain-gate voltage	33 ⁽¹⁾	V
V _{GS}	Gate-source voltage	±20 ⁽¹⁾	٧
I _D ⁽²⁾	Drain current (continuous) at T _C = 25°C	80	Α
I _D ⁽²⁾	Drain current (continuous) at T _C =100°C	80	Α
I _{DG}	Drain gate current (continuous)	±50	Α
I _{GS}	Gate-source current (continuous)	±50	Α
I _{DM} ⁽³⁾	Drain current (pulsed)	320	Α
P _{TOT}	Total dissipation at T _C = 25°C	280	W
	Derating factor	1.87	W/°C
V _{ESD(G-S)}	Gate-source ESD (HBM-C=100pF, R=1.5KΩ)	± 8	kV
V _{ESD(G-D)} Gate-drain ESD (HBM-C=100pF, R=1.5KΩ)		± 8	kV
V _{ESD(D-S)}	Drain-source ESD (HBM-C=100pF, R=1.5KΩ)	± 8	kV
T _J T _{stg}	Operating junction temperature Storage temperature	-55 to 175	°C

- 1. Voltage is limited by zener diodes
- 2. Current limited by wire bonding
- 3. Pulse width limited by safe operating area

Table 2. Thermal data

Symbol	Parameter Value		Unit
R _{thj-case}	Thermal resistance junction-case max	0.53	°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	62.5	°C/W
T _I	Maximum lead temperature for soldering purpose	300	°C

Table 3. Avalanche data

Symbol	Parameter	Value	Unit
I _{AS}	Avalanche current, repetitive or not repetitive (pulse width limited by Tjmax)	80	Α
E _{AS}	Single pulse avalanche energy (starting Tj=25°C, I _D =I _{AS} , V _{DD} =50V)	750	mJ

Electrical characteristics STP90NS04ZC

2 Electrical characteristics

(T_{CASE}=25°C unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{(BR)DG}	Clamped voltage	$I_D = 1 \text{mA}, V_{GS} = 0$	33			V
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = 16V			1	μΑ
I _{GSS}	Gate body leakage current (V _{DS} = 0)	V _{GS} = ±10V			2	μΑ
V _{GSS}	Gate-source breakdown voltage	I _{GS} =±100μA	18		25	V
V _{GS(th)}	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 1 \text{mA}$	2	3	4	٧
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10V, I _D = 40A		5	6	mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
g _{fs} ⁽¹⁾	Forward transconductance	$V_{DS} = 15V, I_{D} = 40A$		100		S
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} =25V, f=1 MHz, V _{GS} =0		3400 1250 450		pF pF pF
t _{r(Voff)} t _f t _c	Off voltage rise time Fall time Cross-over time	V_{CLAMP} =32V, I_{D} =80A, V_{GS} =10V, R_{G} =4.7 Ω (see Figure 18)		230 140 295		ns ns ns
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} =20V, I_{D} = 80A V_{GS} =10V (see Figure 19)		100 25 36	135	nC nC nC
R _G	Internal gate resistor			14		Ω

^{1.} Pulsed: pulse duration=300µs, duty cycle 1.5%

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I _{SD}	Source-drain current Source-drain current (pulsed)				80 320	A A
V _{SD} ⁽²⁾	Forward on voltage	I _{SD} =80A, V _{GS} =0			1.5	٧
t _{rr} Q _{rr} I _{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I _{SD} =80A, di/dt = 100A/μs, V _{DD} = 30 V, Tj=150°C (see Figure 23)		55 85 3		ns nC A

^{1.} Pulse width limited by safe operating area

^{2.} Pulsed: pulse duration=300 μ s, duty cycle 1.5%

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2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

Figure 2. Thermal impedance

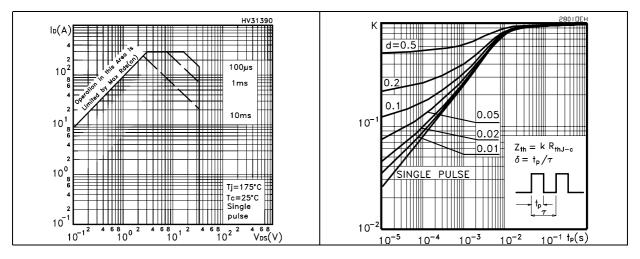


Figure 3. Output characteristics

Figure 4. Transfer characteristics

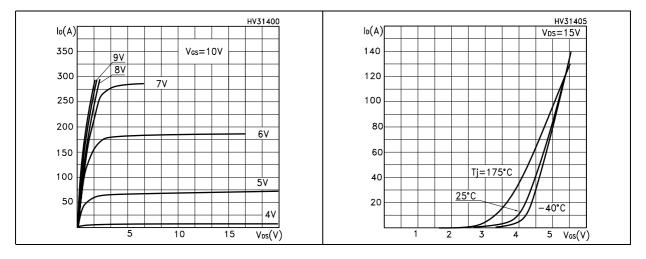
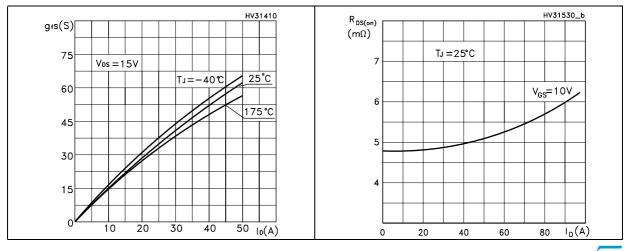


Figure 5. Transconductance

Figure 6. Static drain-source on resistance



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Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

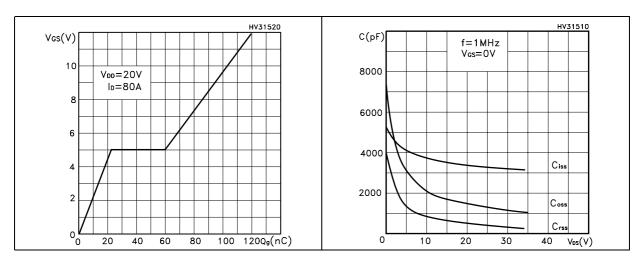


Figure 9. Normalized gate threshold voltage vs temperature

Figure 10. Normalized on resistance vs temperature

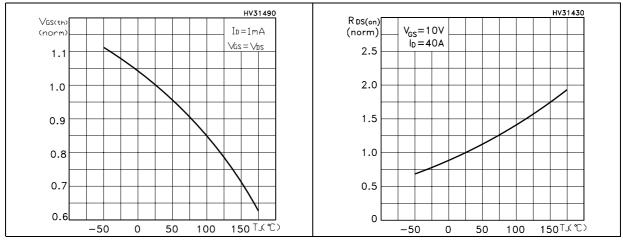
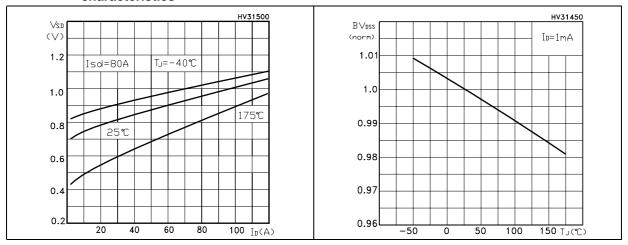


Figure 11. Source-drain diode forward characteristics

Figure 12. Maximum avalanche energy



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Figure 13. Zero gate voltage drain current vs temperature

Figure 14. Typical drain source clamped voltage vs drain current

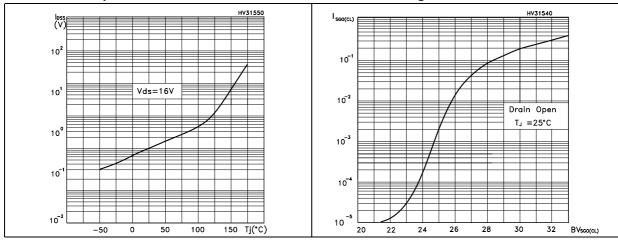


Figure 15. Typ. drain source clamped voltage vs gate source clamping current

Figure 16. Typ. drain source clamped voltage vs drain current

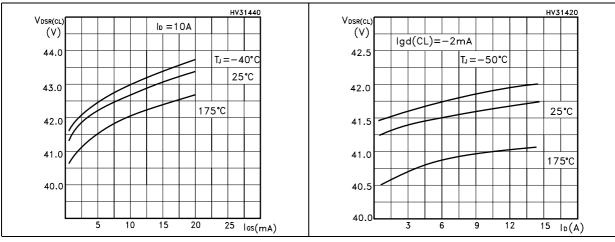
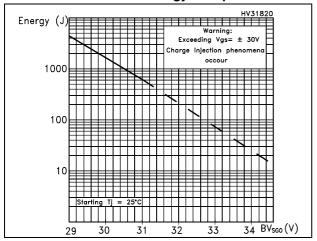


Figure 17. Gate-source zener diodes: maximum energy dissipation



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STP90NS04ZC Test circuit

3 Test circuit

Figure 18. Switching times test circuit for resistive load

Figure 19. Gate charge test circuit

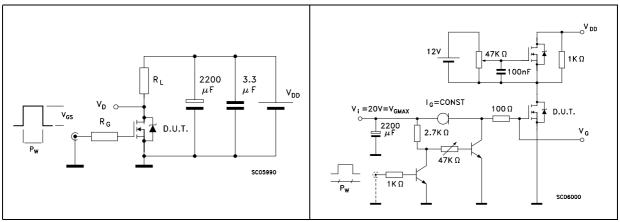


Figure 20. Test circuit for inductive load switching and diode recovery times

Figure 21. Unclamped Inductive load test circuit

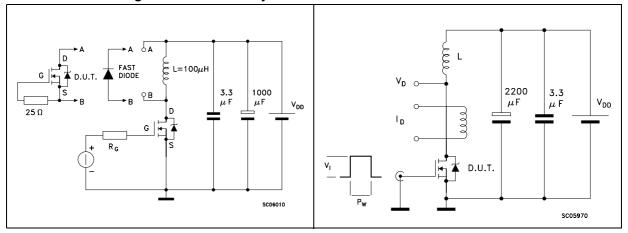
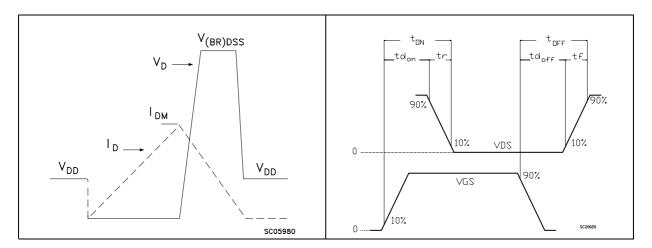


Figure 22. Unclamped inductive waveform

Figure 23. Switching time waveform



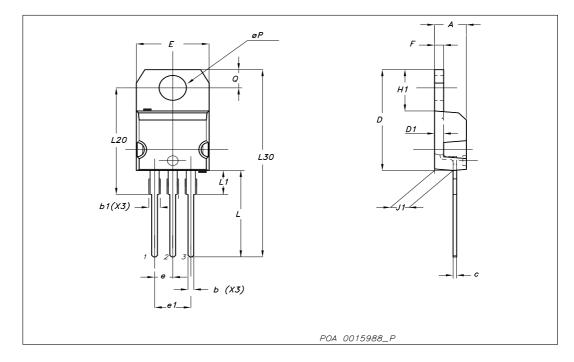
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4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

TO-220 mechanical data

Dim		mm			inch	
Dim	Min	Тур	Max	Min	Тур	Max
Α	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
С	0.49		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
е	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
ØP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



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Revision history STP90NS04ZC

5 Revision history

Table 7. Revision history

Date	Revision	Changes
04-May-2007	1	First release

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