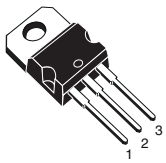
STP90NS04ZC

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

Features

Type	V_{DSS}	$R_{DS(on)}$	I_D
STP90NS04ZC	Clamped	< 6mΩ	80A

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

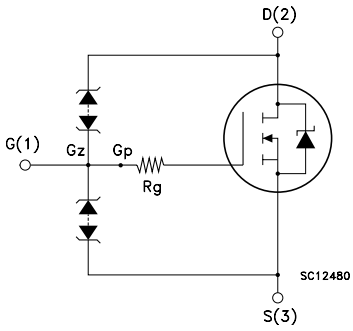


TO-220

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.

Internal schematic diagram



Applications

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

Order code

Part number	Marking	Package	Packaging
STP90NS04ZC	P90NS04ZC	TO-220	Tube

Contents

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)	V
I_D (2)	Drain current (continuous) at T_C = 25°C	80	A
I_D (2)	Drain current (continuous) at T_C=100°C	80	A
I_{DG}	Drain gate current (continuous)	±50	A
I_{GS}	Gate-source current (continuous)	±50	A
I_{DM} (3)	Drain current (pulsed)	320	A
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
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.53	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	62.5	°C/W
T_l	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	A
E_{AS}	Single pulse avalanche energy (starting Tj=25°C, I_D=I_{AS}, V_{DD}=50V)	750	mJ

2 Electrical characteristics

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

Table 4. On/off states

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	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=4.7Ω *(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.	Typ.	Max.	Unit
I_{SD} I_{SDM}(1)	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	V
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=300µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

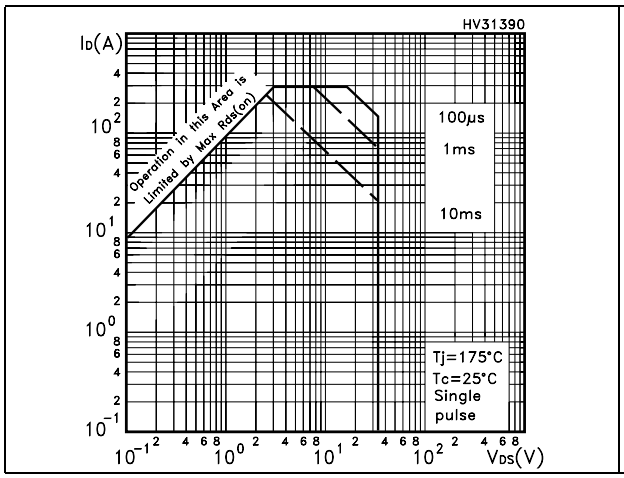


Figure 2. Thermal impedance

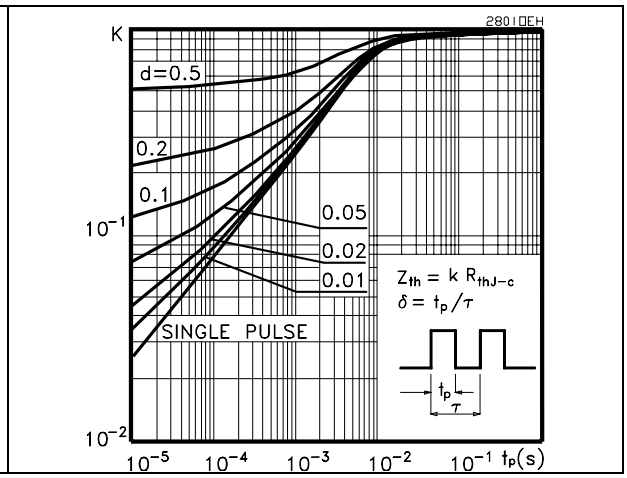


Figure 3. Output characteristics

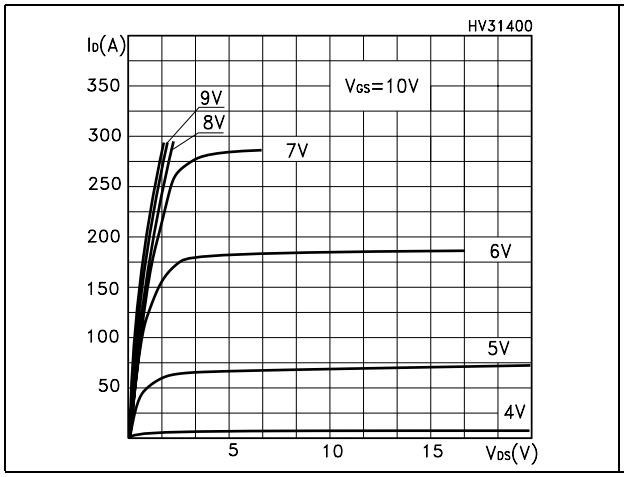


Figure 4. Transfer characteristics

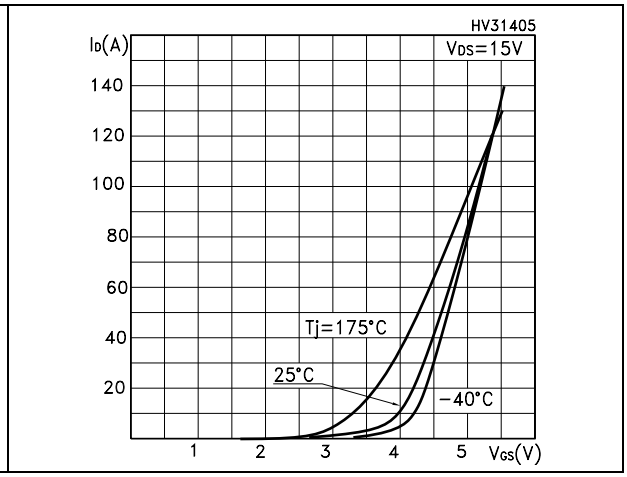


Figure 5. Transconductance

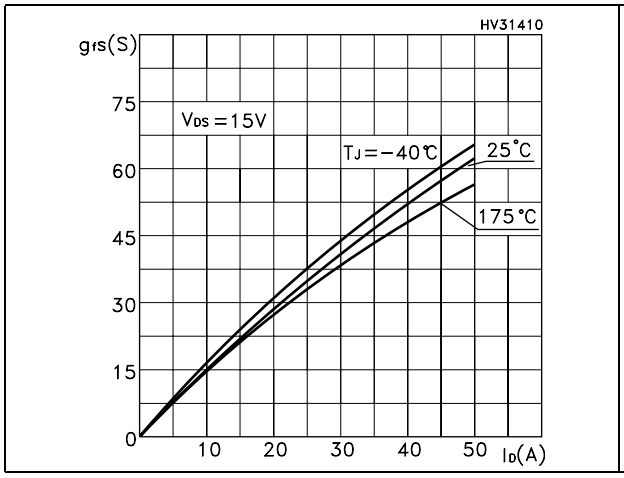


Figure 6. Static drain-source on resistance

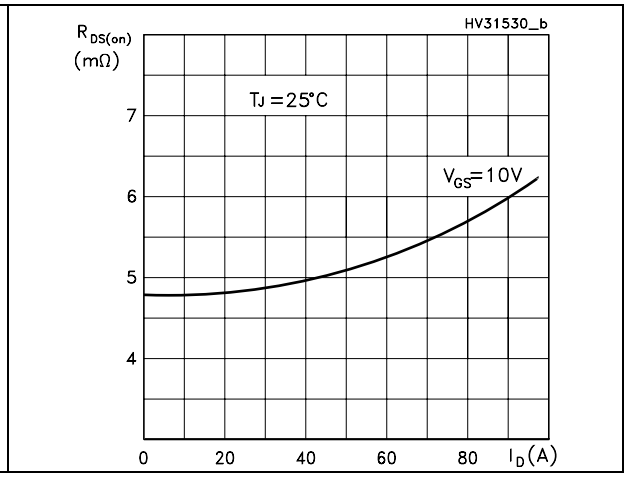


Figure 7. Gate charge vs gate-source voltage

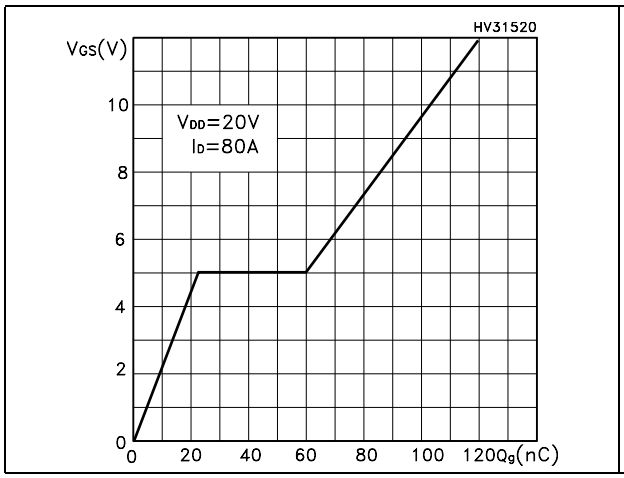


Figure 8. Capacitance variations

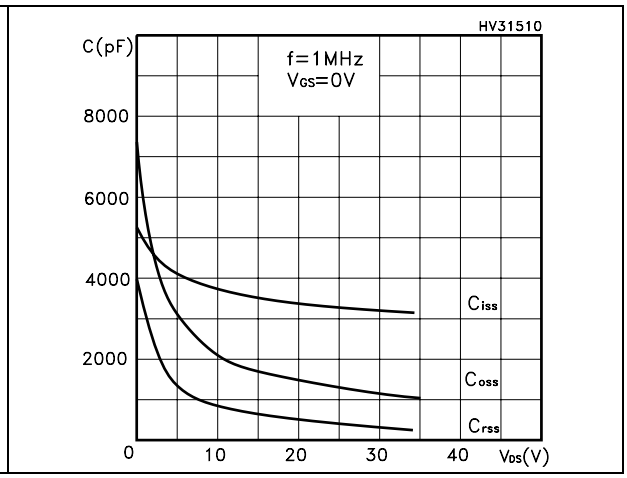


Figure 9. Normalized gate threshold voltage vs temperature

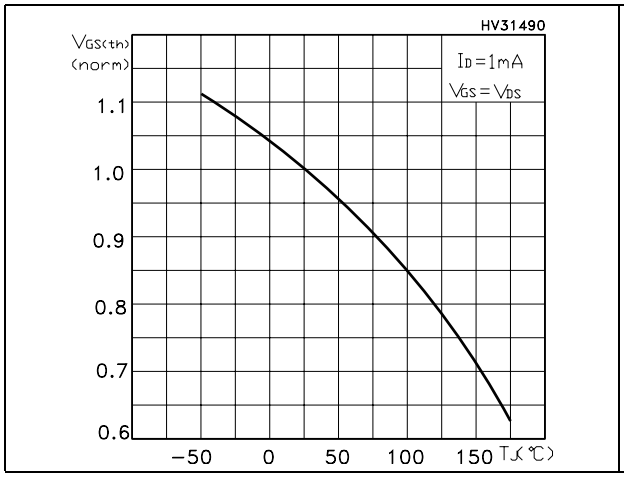


Figure 10. Normalized on resistance vs temperature

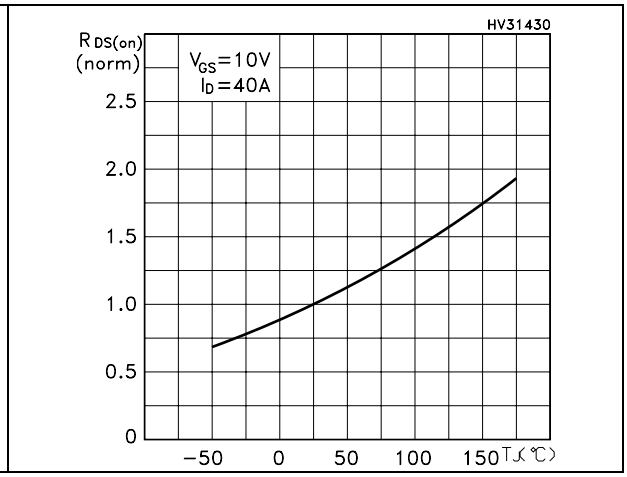


Figure 11. Source-drain diode forward characteristics

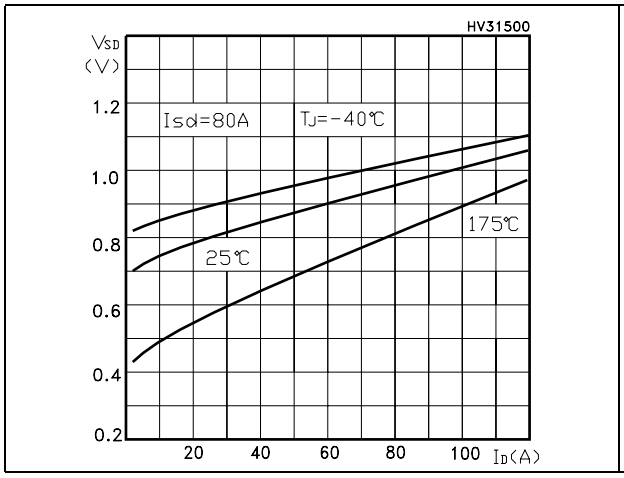


Figure 12. Maximum avalanche energy

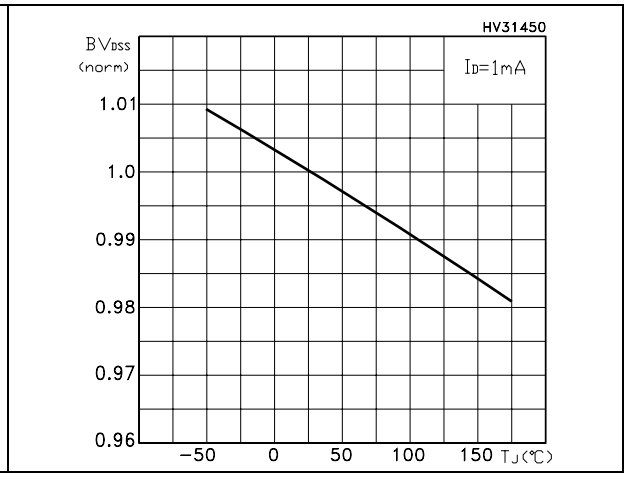


Figure 13. Zero gate voltage drain current vs temperature

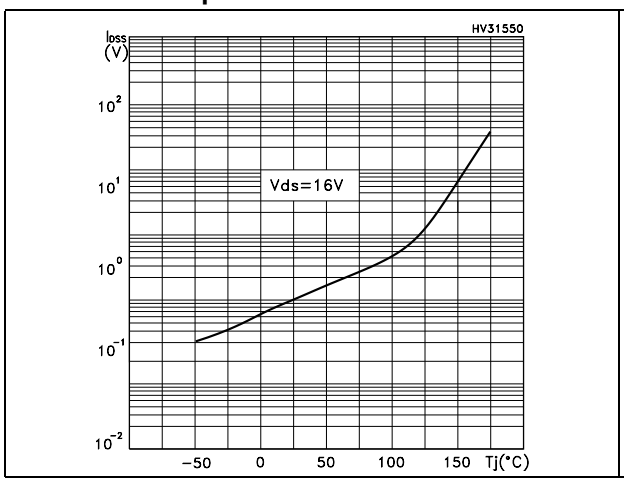


Figure 14. Typical drain source clamped voltage vs drain current

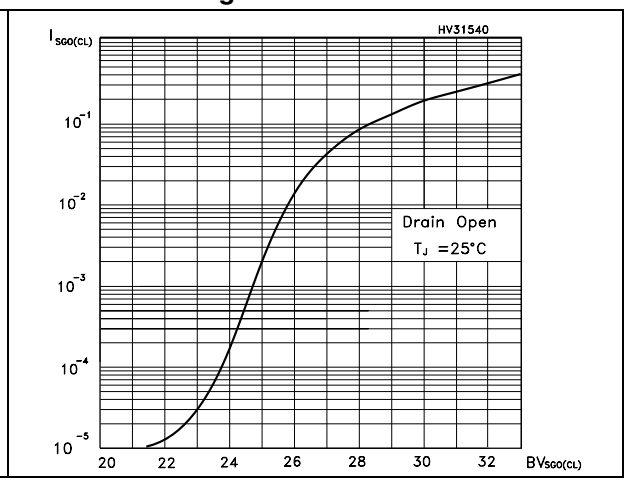


Figure 15. Typ. drain source clamped voltage vs gate source clamping current

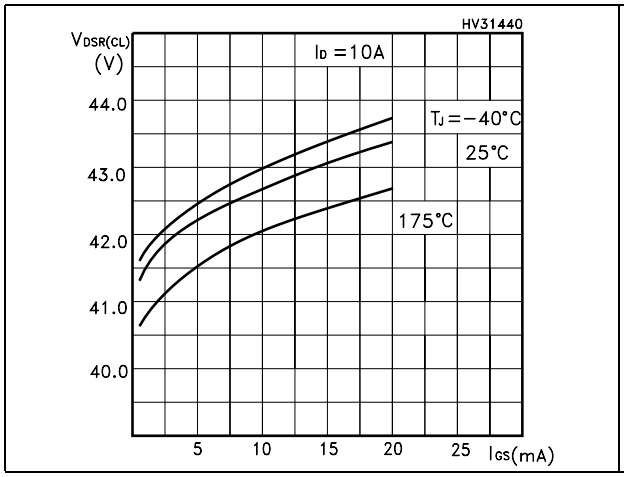


Figure 16. Typ. drain source clamped voltage vs drain current

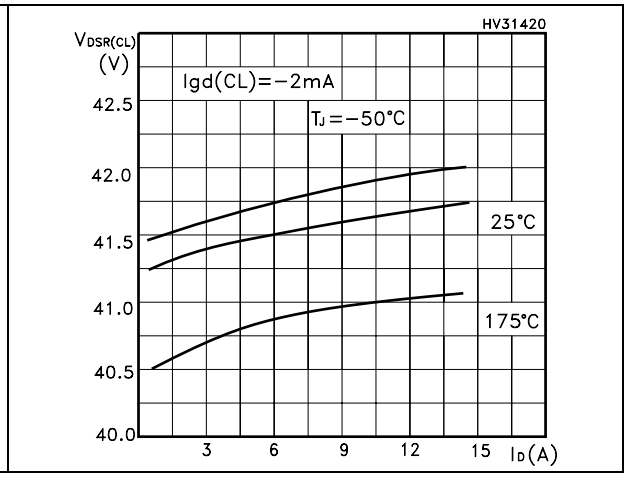
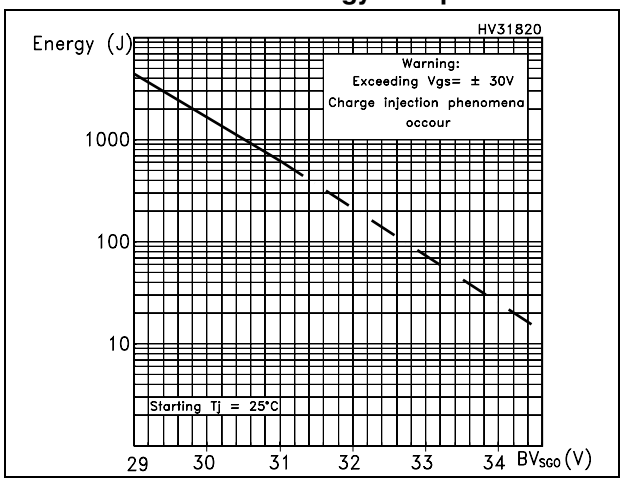


Figure 17. Gate-source zener diodes: maximum energy dissipation



3 Test circuit

Figure 18. Switching times test circuit for resistive load

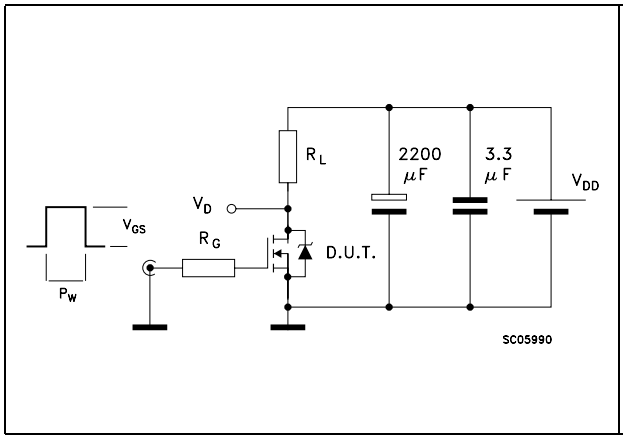


Figure 19. Gate charge test circuit

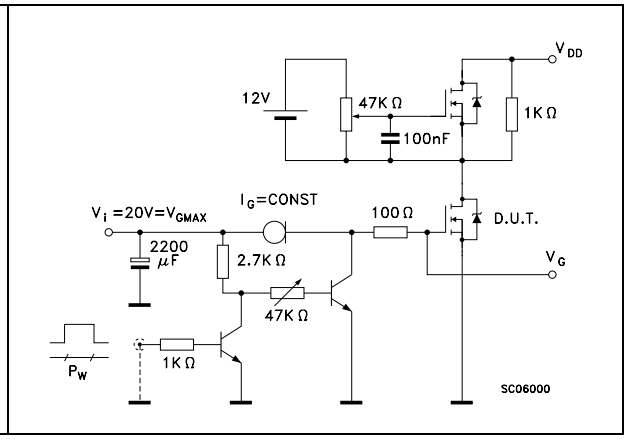


Figure 20. Test circuit for inductive load switching and diode recovery times

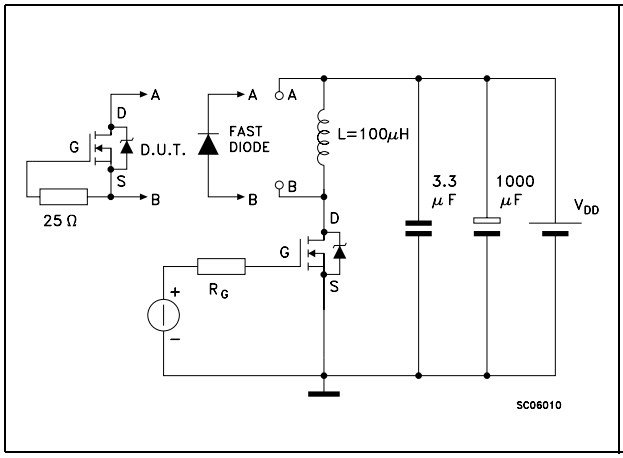


Figure 21. Unclamped Inductive load test circuit

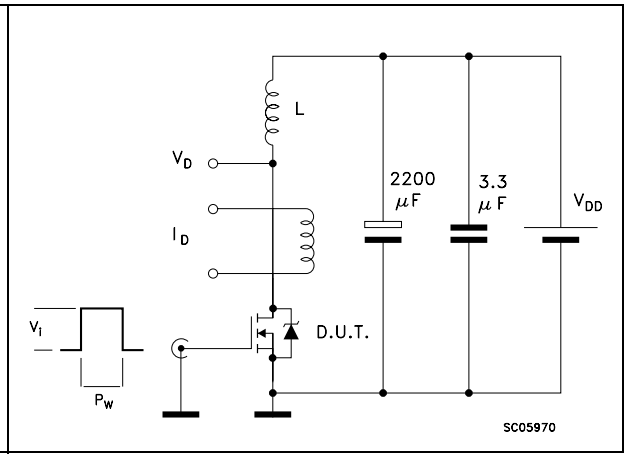


Figure 22. Unclamped inductive waveform

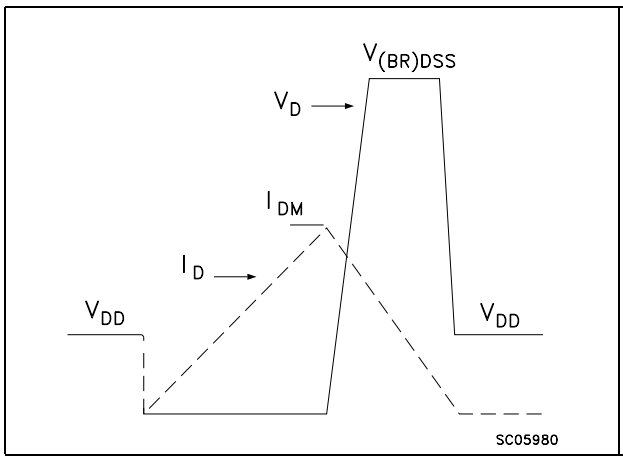
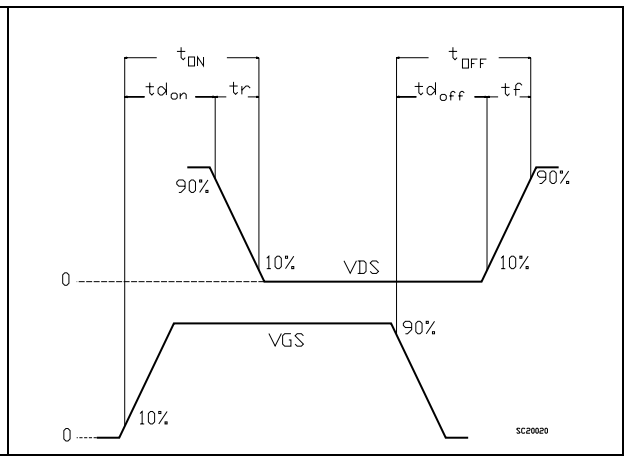


Figure 23. Switching time waveform

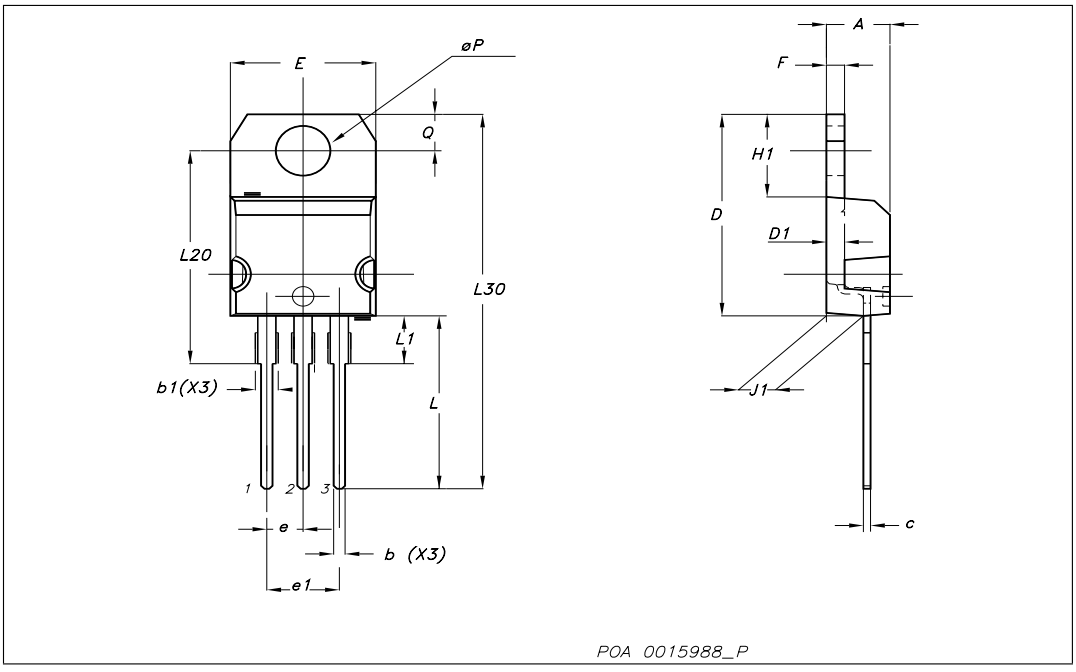


4 Package mechanical data

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		
	Min	Typ	Max	Min	Typ	Max
A	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
c	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
e	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	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



5 Revision history

Table 7. Revision history

Date	Revision	Changes
04-May-2007	1	First release

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