



ROBERT STĘPIEŃ  
HURTOWNIA CZĘŚCI ELEKTRONICZNYCH  
podzespoly-elektroniczne.pl

# STP4NK80Z;ST;TO220;tranzystor; N- MOSFET;3A;800V;80W;3.5R



## **Dane techniczne:**

Nazwa: STP4NK80Z

Typ tranzystora: unipolarny

Kierunek przewodnictwa: N-MOSFET

Prąd kolektora: 3A

Napięcie kolektor-emiter: 800V

Moc: 80W

Montaż: przewlekany(THT)

Obudowa: TO220

Producent: ST

[www.podzespoly-elektroniczne.pl](http://www.podzespoly-elektroniczne.pl)

Robert Stępień Hurtownia Części Elektronicznych; Adres: ul. Wolumen 2, pawilon 71; 01-912 Warszawa; tel.: 601 296 402 /  
sklep@podzespoly-elektroniczne.pl



# STP4NK80Z - STP4NK80ZFP STD4NK80Z - STD4NK80Z-1

N-channel 800V - 3Ω - 3A - TO-220/TO-220FP/DPAK/IPAK  
Zener - Protected SuperMESH™ MOSFET

## General features

Type	V <sub>DSS</sub> (@T <sub>jmax</sub> )	R <sub>DS(on)</sub>	I <sub>D</sub>
STP4NK80Z	800 V	< 3.5 Ω	3 A
STP4NK80ZFP	800 V	< 3.5 Ω	3 A
STD4NK80Z	800 V	< 3.5 Ω	3 A
STD4NK80Z-1	800 V	< 3.5 Ω	3 A

- Extremely high dv/dt capability
- 100% avalanche tested
- Gate charge minimized
- Very low intrinsic capacitances
- Very good manufacturing repeatability

## Description

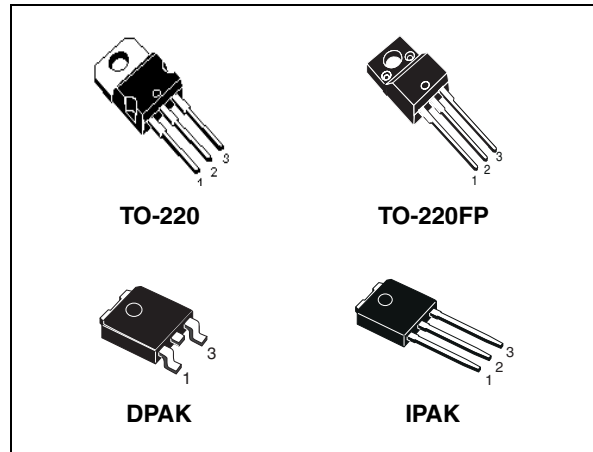
The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, special care is taken to ensure a very good dv/dt capability for the most demanding applications. Such series complements ST full range of high voltage MOSFETs including revolutionary MDmesh™ products.

## Applications

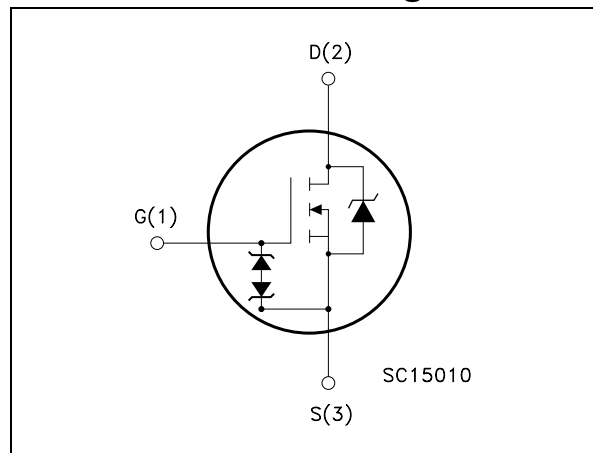
- Switching application

## Order codes

Part number	Marking	Package	Packaging
STP4NK80Z	P4NK80Z	TO-220	Tube
STP4NK80ZFP	P4NK80ZFP	TO-220FP	Tube
STD4NK80ZT4	D4NK80Z	DPAK	Tape & reel
STD4NK80Z-1	D4NK80Z	IPAK	Tube



## Internal schematic diagram



## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
1.1	Protection features of gate-to-source zener diodes .....	4
<b>2</b>	<b>Electrical characteristics</b> .....	<b>5</b>
2.1	Electrical characteristics (curves) .....	7
<b>3</b>	<b>Test circuit</b> .....	<b>10</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>11</b>
<b>5</b>	<b>Packaging mechanical data</b> .....	<b>16</b>
<b>6</b>	<b>Revision history</b> .....	<b>17</b>

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220/DPAK/ IPAK	TO-220FP	
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	800		V
$V_{GS}$	Gate-source voltage	$\pm 30$		V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	3	3 <sup>(1)</sup>	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	1.89	1.89 <sup>(1)</sup>	A
$I_{DM}^{(2)}$	Drain current (pulsed)	12	12 <sup>(1)</sup>	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	80	25	W
	Derating factor	0.64	0.21	W/°C
$V_{ESD(G-S)}$	Gate source ESD (HBM-C=100pF, R=1.5K $\Omega$ )	3000		V
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	4.5		V/ns
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1s; $T_C = 25^\circ\text{C}$ )	-	2500	V
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150		°C

- Limited only by maximum temperature allowed
- Pulse width limited by safe operating area
- $I_{SD} \leq 4\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$ .

**Table 2. Thermal data**

Symbol	Parameter	Value			Unit
		TO-220	TO-220FP	DPAK IPAK	
$R_{thj-case}$	Thermal resistance junction- case max	1.56	5	1.56	°C/W
$R_{thj-a}$	Thermal resistance junction- ambient max	62.5		100	°C/W
$T_I$	Maximum lead temperature for soldering purpose	300			°C

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj Max)	3	A
$E_{AS}$	Single pulse avalanche energy (starting Tj=25°C, Id=Iar, Vdd=50V)	190	mJ

**Table 4. Gate-source zener diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$BV_{GSO}$	Gate-source breakdown voltage	Igs=± 1mA (Open Drain)	30			V

## 1.1 Protection features of gate-to-source zener diodes

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1mA, V_{GS} = 0$	800			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating},$ $T_c = 125^{\circ}C$			1 50	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{GS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 10$	$\mu A$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 50\mu A$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 1.5 A$		3	3.5	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 1.5A$		2.9		S
$C_{iss}$	Input capacitance	$V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$		575		pF
$C_{oss}$	Output capacitance			67		pF
$C_{rss}$	Reverse transfer capacitance			13		pF
$C_{osseq}^{(2)}$	Equivalent output capacitance	$V_{GS} = 0, V_{DS} = 0V \text{ to } 400V$		60		pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400V, I_D = 1.5A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see <a href="#">Figure 18</a> )		13		ns
$t_r$	Rise time			12		ns
$t_{d(off)}$	Off-voltage rise time			35		ns
$t_f$	Fall time			32		ns
$t_{r(Voff)}$	Off-voltage rise time	$V_{DD} = 640V, I_D = 3A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see <a href="#">Figure 16</a> )		18		ns
$t_f$	Fall time			7.5		ns
$t_c$	Cross-over time			25		ns
$Q_g$	Total gate charge	$V_{DD} = 640V, I_D = 3A$		22.5		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10V$		4.2		nC
$Q_{gd}$	Gate-drain charge	(see <a href="#">Figure 19</a> )		11.3		nC

1. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

2.  $C_{osseq}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				3	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				12	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=3\text{ A}$ , $V_{GS}=0$			1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD}=3\text{ A}$ , $di/dt = 100\text{A}/\mu\text{s}$ , $V_{DD}=80\text{ V}$ , $T_j=150^\circ\text{C}$ (see <a href="#">Figure 20</a> )		400		ns
$Q_{rr}$	Reverse recovery charge			1520		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			7.6		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220/DPAK/IPAK

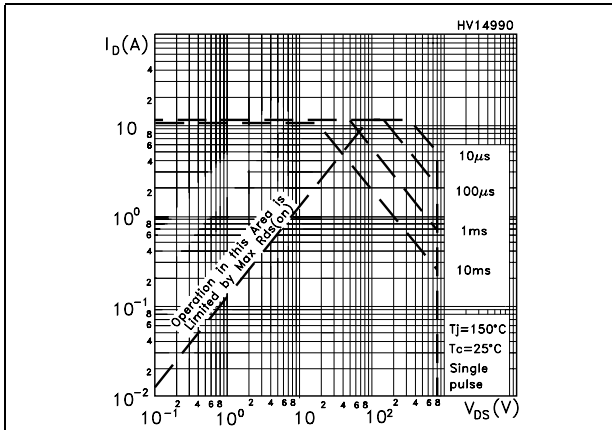


Figure 2. Thermal impedance for TO-220/DPAK/IPAK

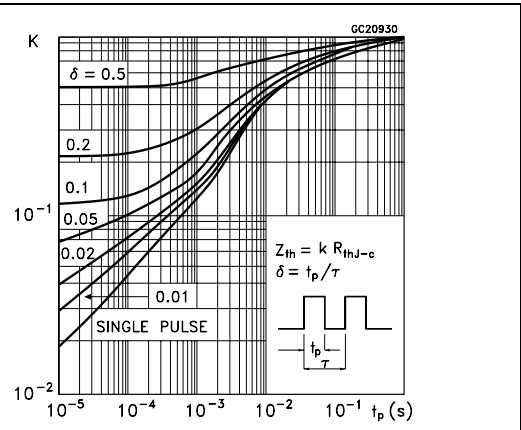


Figure 3. Safe operating area for TO-220FP

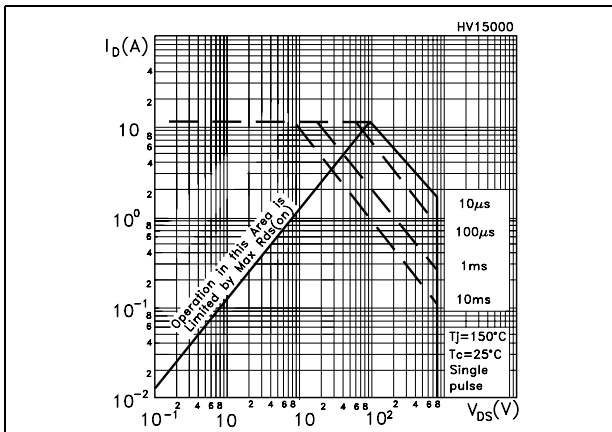


Figure 4. Thermal impedance for TO-220FP

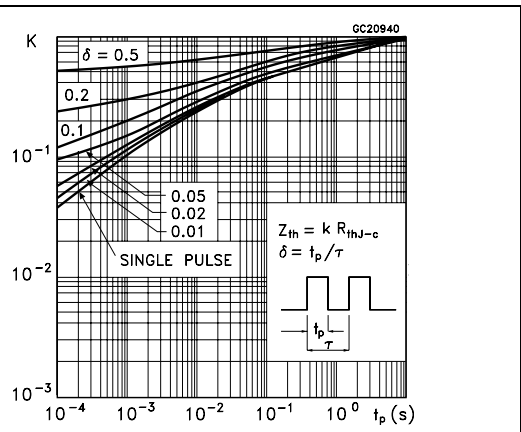


Figure 5. Output characteristics

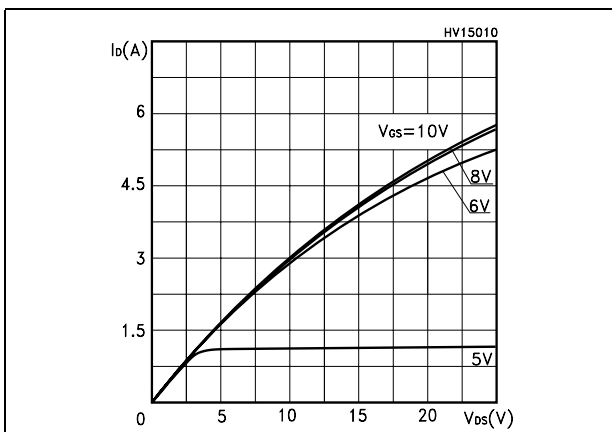


Figure 6. Transfer characteristics

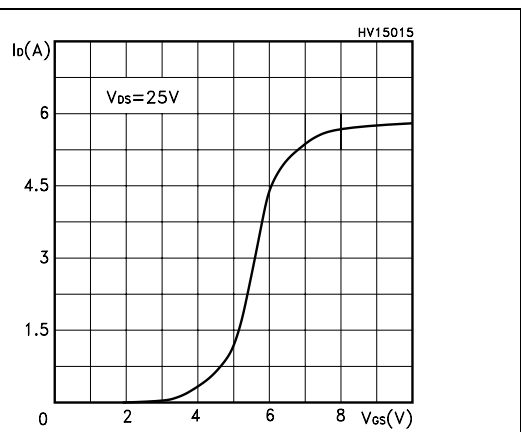




Figure 7. Transconductance

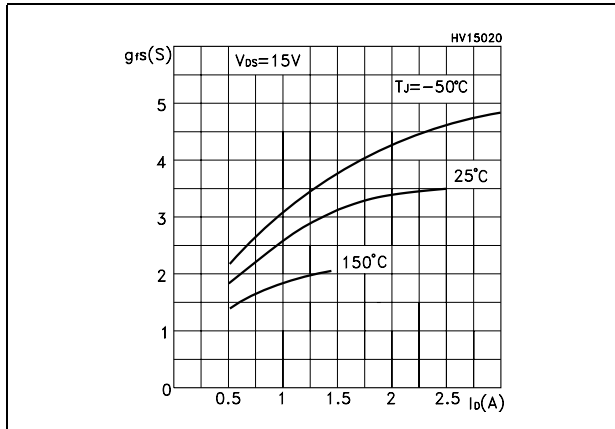


Figure 8. Static drain-source on resistance

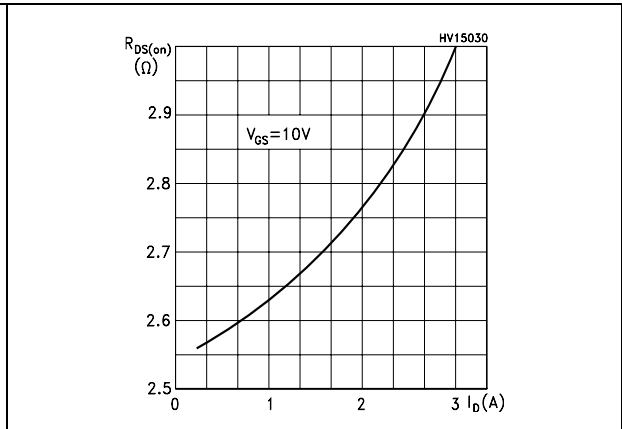


Figure 9. Gate charge vs gate-source voltage

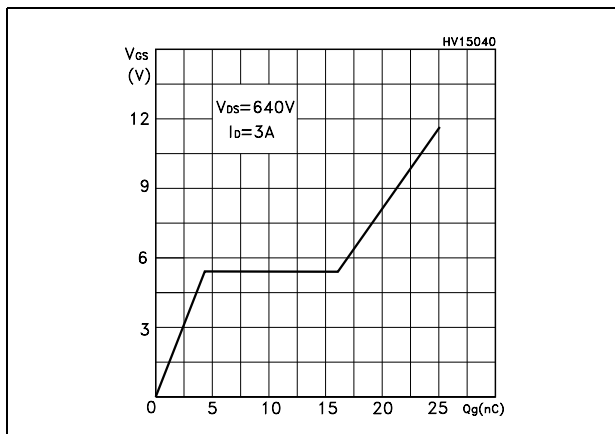


Figure 10. Capacitance variations

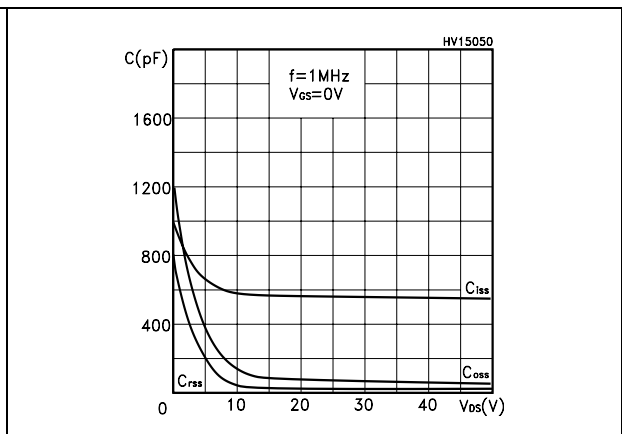


Figure 11. Source-drain diode forward characteristics

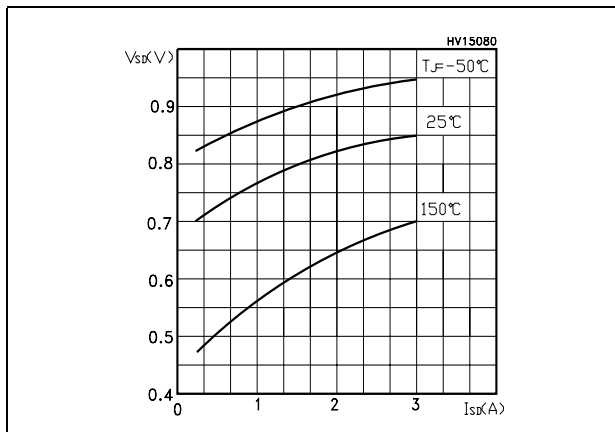


Figure 12. Normalized BVdss vs temperature

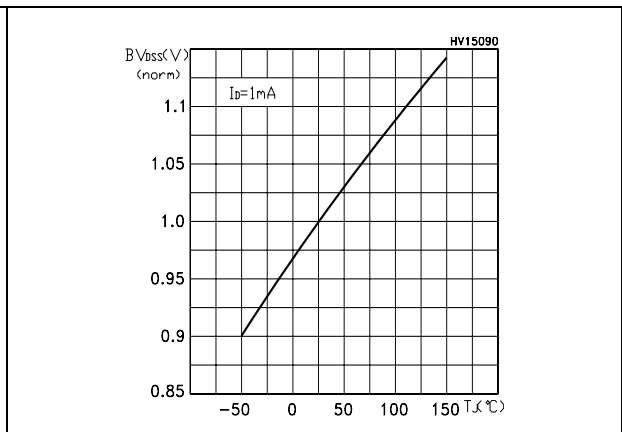


Figure 13. Normalized gate threshold voltage vs temperature

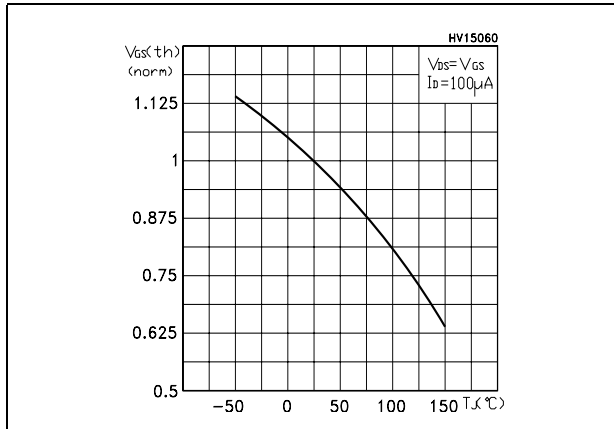


Figure 14. Avalanche energy vs temperature

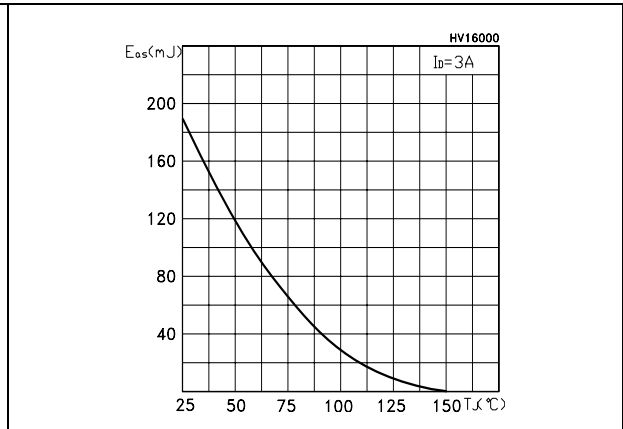
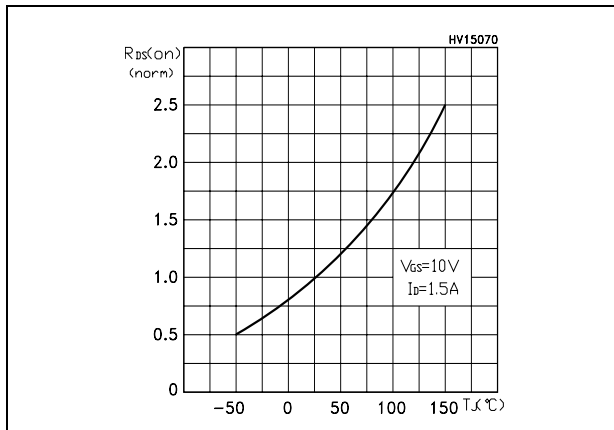


Figure 15. Normalized on resistance vs temperature



### 3 Test circuit

Figure 16. Unclamped Inductive load test circuit

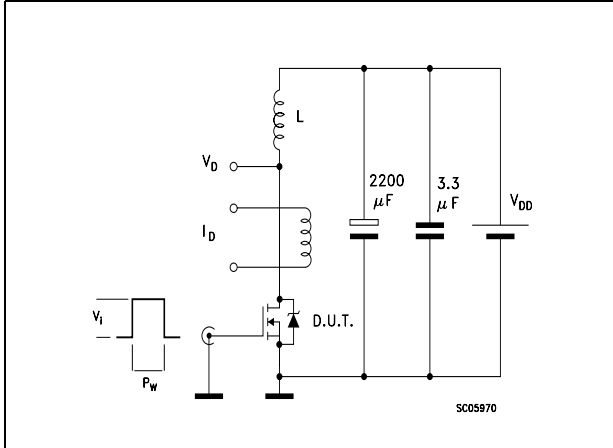


Figure 17. Unclamped Inductive waveform

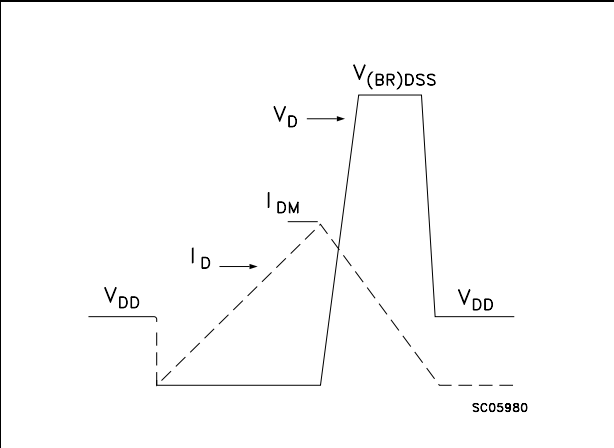


Figure 18. Switching times test circuit for resistive load

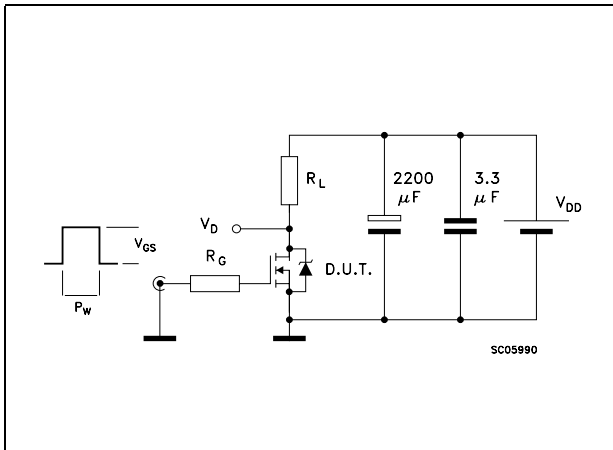


Figure 19. Gate charge test circuit

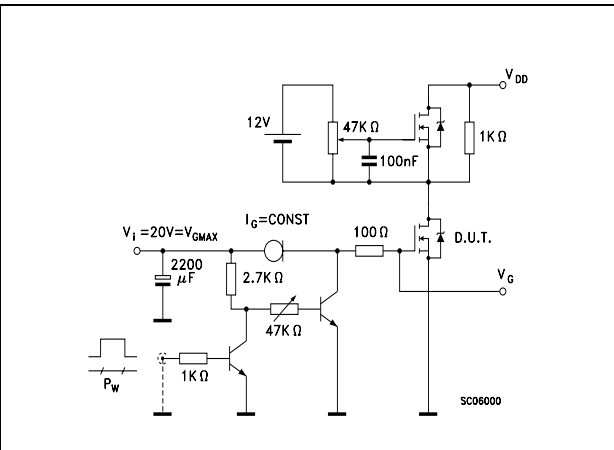
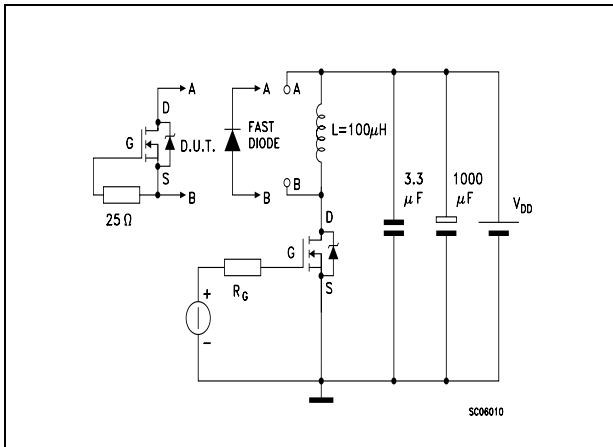


Figure 20. Test circuit for inductive load switching and diode recovery times

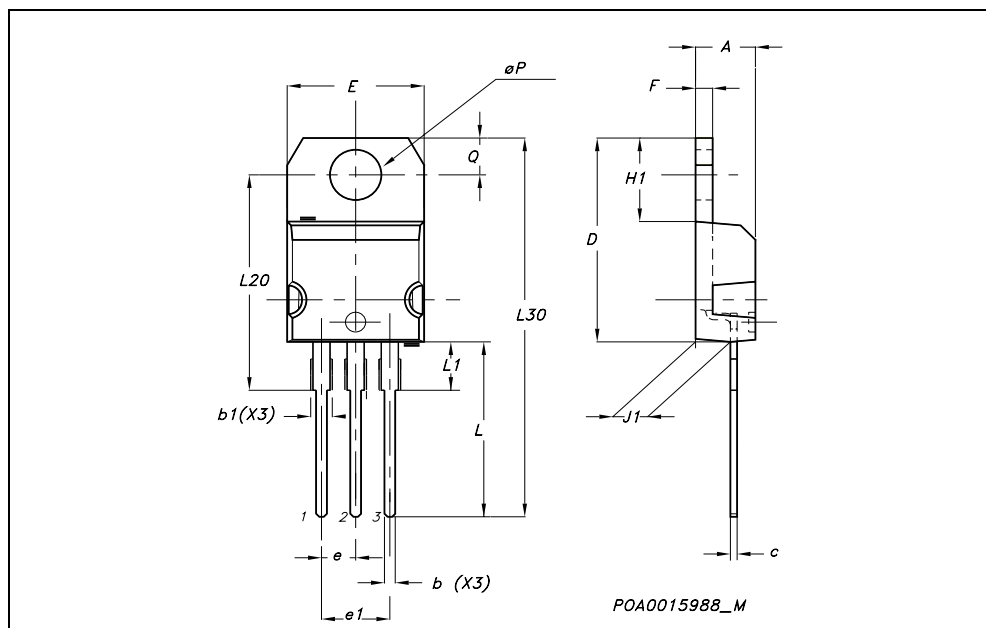


## 4 Package mechanical data

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](http://www.st.com)

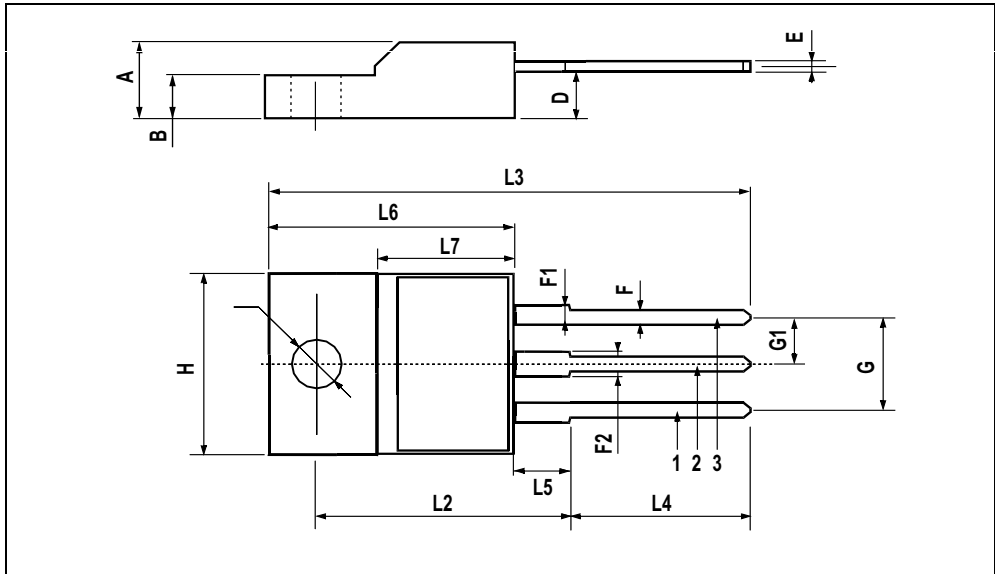
**TO-220 MECHANICAL DATA**

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	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
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		0.052
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



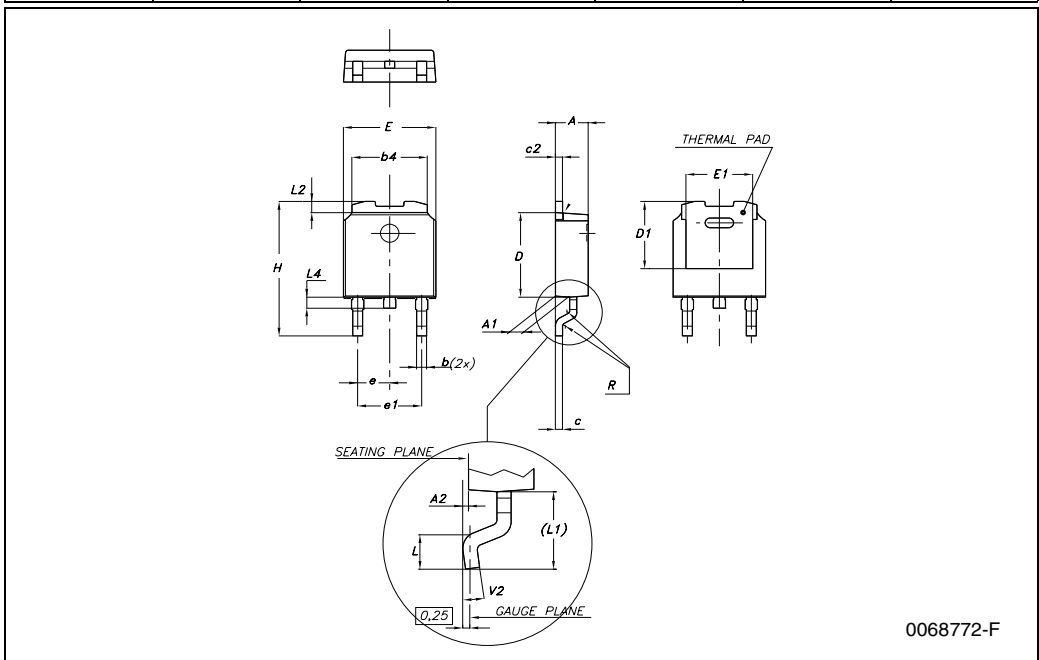
**TO-220FP MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



**DPAK MECHANICAL DATA**

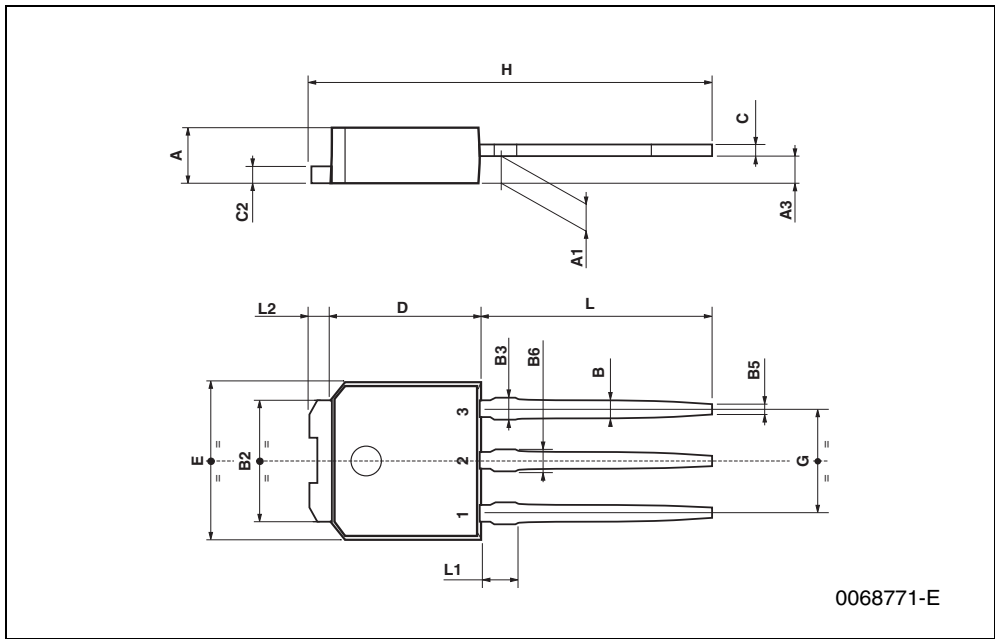
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



0068772-F

**TO-251 (IPAK) MECHANICAL DATA**

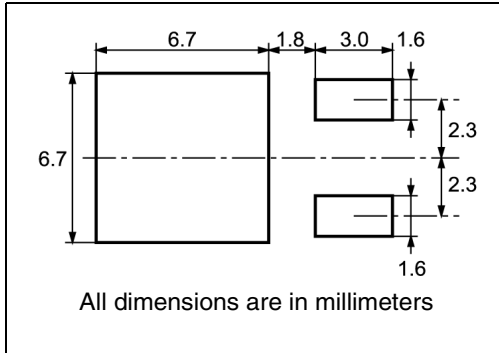
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039





# 5 Packaging mechanical data

## DPAK FOOTPRINT



## TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

T

C

N

G measured at hub

REEL MECHANICAL DATA				
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA				
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

10 pitches cumulative tolerance on tape +/- 0.2 mm

TOP COVER TAPE

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius

R min.

For machine ref. only including draft and radii concentric around B0

## 6 Revision history

**Table 8. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
30-Mar-2005	5	Preliminary version
06-Sep-2005	6	Final version
21-Jan-2006	7	Inserted ecopack indication
16-Aug-2006	8	New template, no content change

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2006 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)