



STD90N4F3 - STI90N4F3 STP90N4F3 - STU90N4F3

N-channel 40 V, 5.4 mΩ, 80 A, DPAK, TO-220, IPAK, I²PAK
STripFET™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on) max}	I _D	P _w
STD90N4F3	40 V	< 6.5 mΩ	80 A	110 W
STI90N4F3	40 V	< 6.5 mΩ	80 A	110 W
STP90N4F3	40 V	< 6.5 mΩ	80 A	110 W
STU90N4F3	40 V	< 6.5 mΩ	80 A	110 W

- Standard threshold drive
- 100% avalanche tested

Application

- Switching applications

Description

This n-channel enhancement mode Power MOSFET is the latest refinement of STMicroelectronics unique “single feature size” strip-based process with less critical alignment steps and therefore a remarkable manufacturing reproducibility. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and low gate charge.

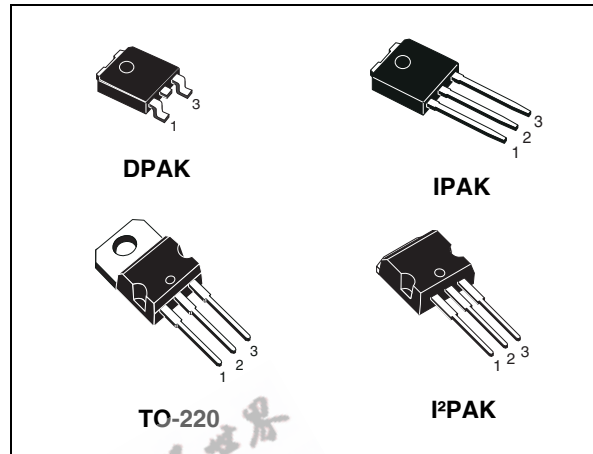


Figure 1. Internal schematic diagram

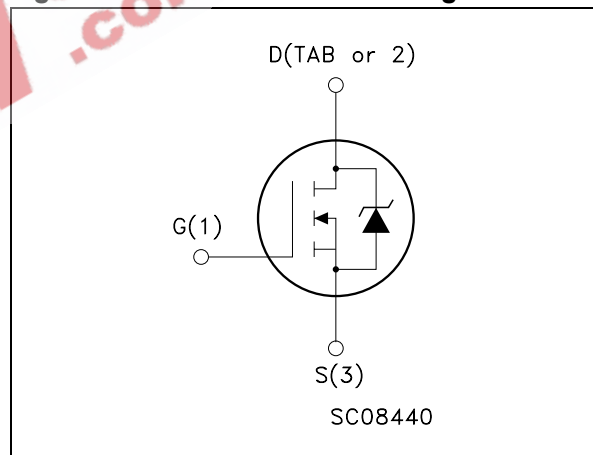


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD90N4F3	90N4F3	DPAK	Tape & reel
STI90N4F3	90N4F3	I ² PAK	Tube
STP90N4F3	90N4F3	TO-220	Tube
STU90N4F3	90N4F3	IPAK	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
2.1	Electrical characteristics (curves)	6
3	Test circuit	8
4	Package mechanical data	9
5	Packaging mechanical data	12
6	Revision history	13



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS}=0$)	40	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	65	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	110	W
	Derating factor	0.73	W/°C
$dv/dt^{(3)}$	Peak diode recovery voltage slope	8	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	400	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 175	°C

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 80\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS} \leq V_{(BR)DSS}$, $T_j \leq T_{jmax}$
4. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 40\text{ A}$, $V_{DD} = 30\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value			Unit
		TO-220 I ² PAK	IPAK	DPAK	
Rthj-case	Thermal resistance junction-case max	1.36			°C/W
Rthj-a	Thermal resistance junction-ambient max	62.5	100	--	°C/W
Rthj-pcb ⁽¹⁾	Thermal resistance junction-ambient max	--	--	50	°C/W
T_l	Maximum lead temperature for soldering purpose	300	275	--	°C

1. When mounted on 1inch² FR-4 2Oz Cu board

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	40			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$, $V_{DS} = \text{Max rating}$, $T_c = 125\text{ °C}$			10 100	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\ \text{V}$			± 200	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\ \text{V}$, $I_D = 40\ \text{A}$		5.4	6.5	m Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 25\ \text{V}$, $I_D = 40\ \text{A}$		100		S
C_{iss}	Input capacitance	$V_{DS} = 25\ \text{V}$, $f = 1\ \text{MHz}$, $V_{GS} = 0$		2200		pF
C_{oss}	Output capacitance			580		pF
C_{rss}	Reverse transfer capacitance			40		pF
Q_g	Total gate charge	$V_{DD} = 20\ \text{V}$, $I_D = 80\ \text{A}$		40	54	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\ \text{V}$		11		nC
Q_{gd}	Gate-drain charge	(see Figure 14)		8		nC

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

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	$V_{DD}=20\text{ V}$, $I_D=40\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ <i>(see Figure 16)</i>		15 50		ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	$V_{DD}=20\text{ V}$, $I_D=40\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ <i>(see Figure 16)</i>		40 15		ns ns

Table 7. 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	$I_{SD}=80\text{ A}$, $V_{GS}=0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=80\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=30\text{ V}$, $T_J=150^\circ\text{C}$ <i>(see Figure 15)</i>		45 60 2.8		ns nC A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

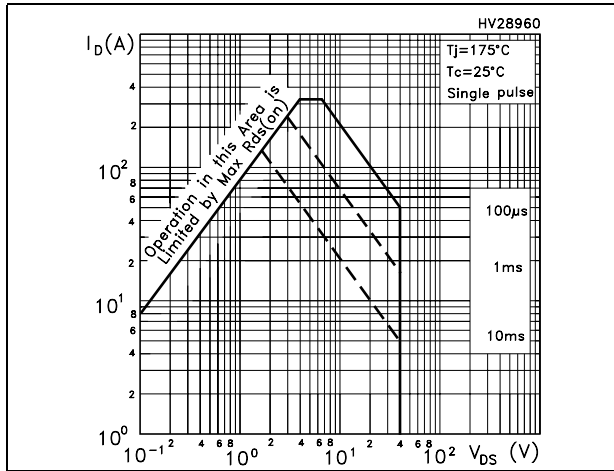


Figure 3. Thermal impedance

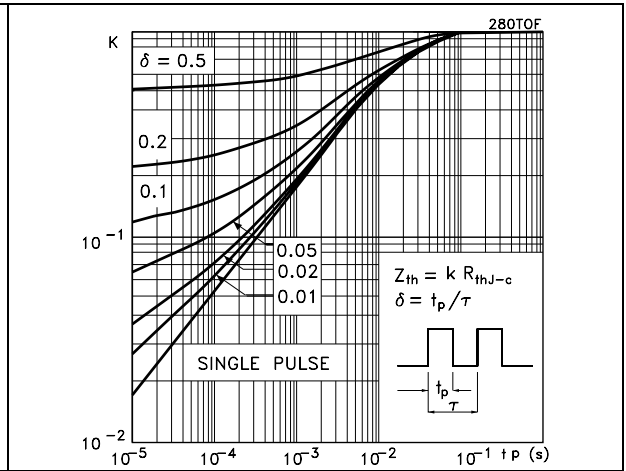


Figure 4. Output characteristics

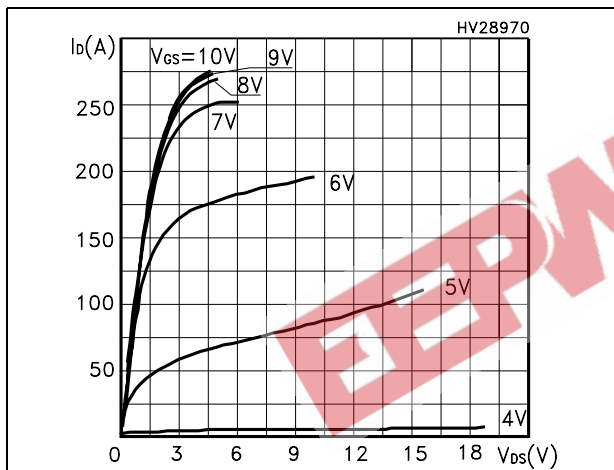


Figure 5. Transfer characteristics

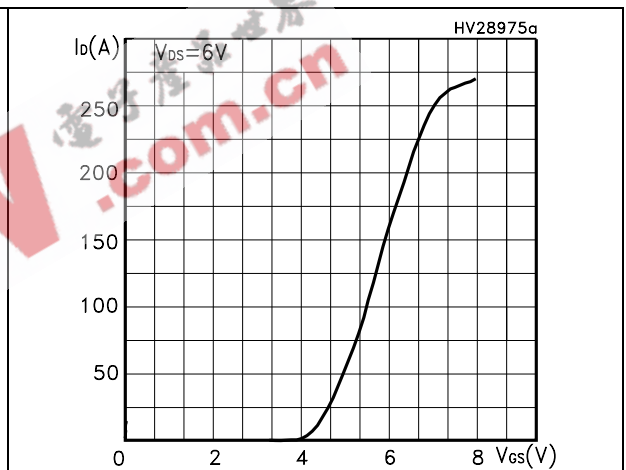


Figure 6. Static drain-source on resistance

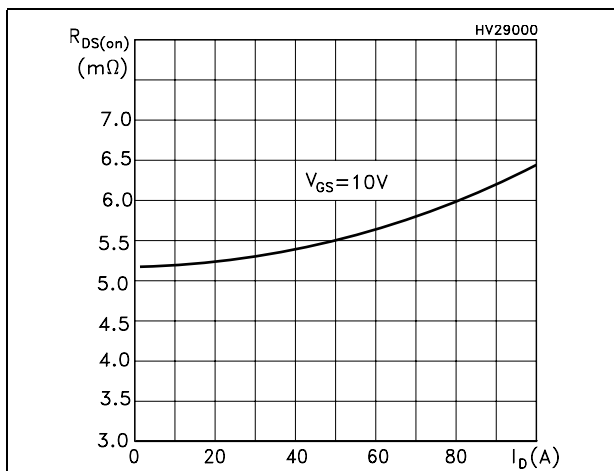


Figure 7. Normalized BV_{DSS} vs temperature

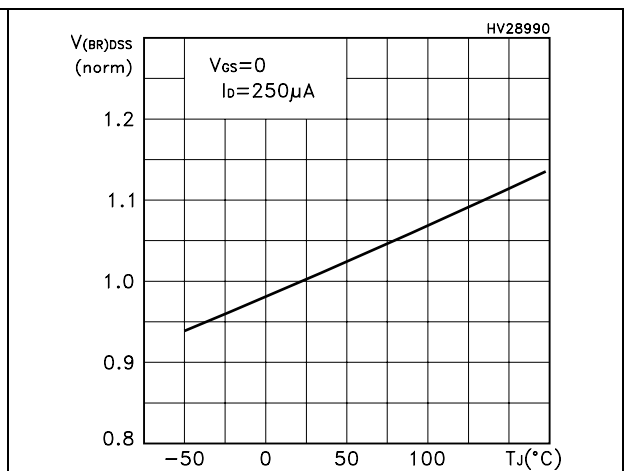


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

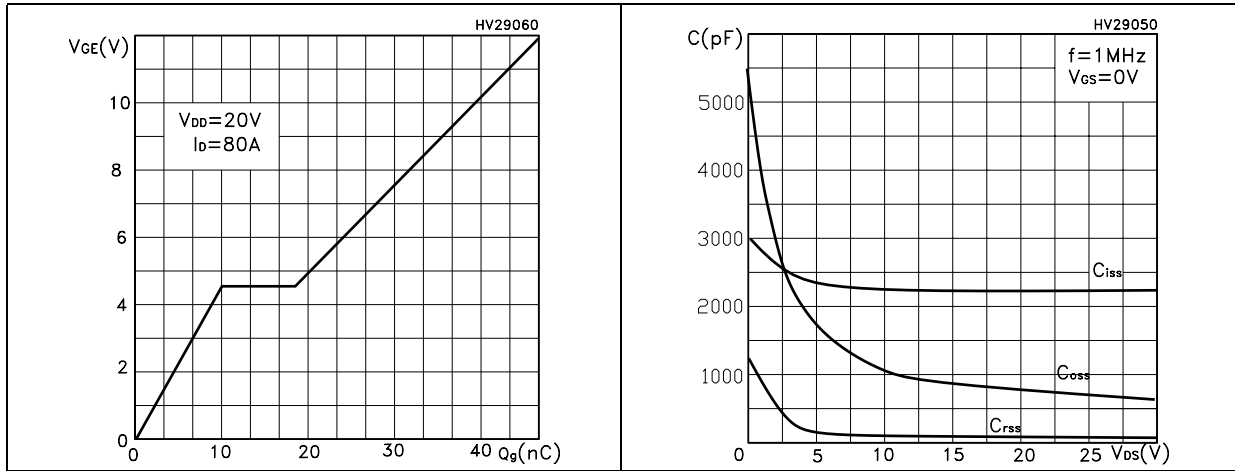


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

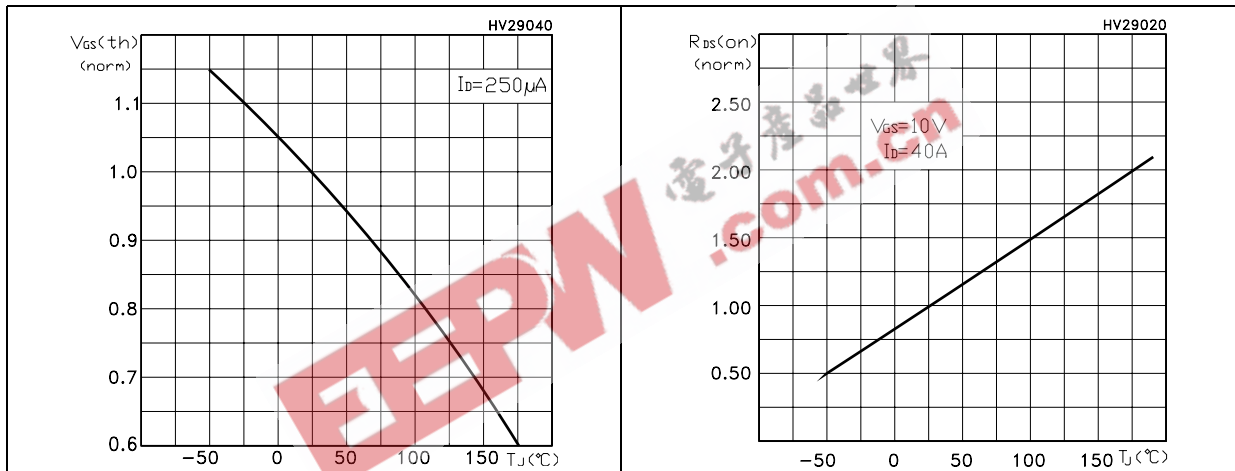
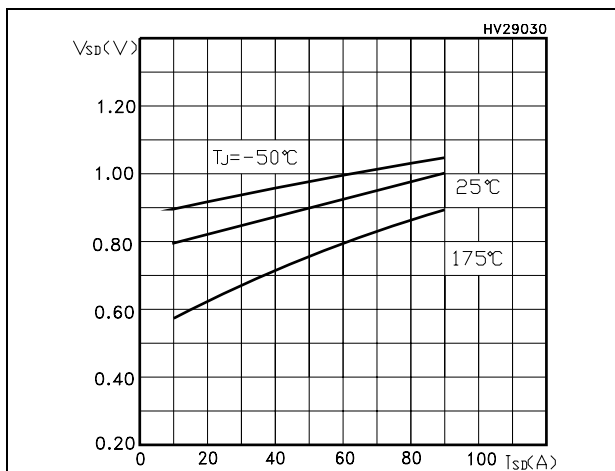


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

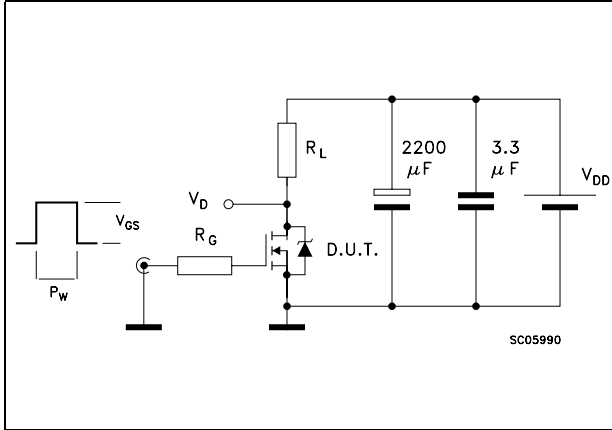


Figure 14. Gate charge test circuit

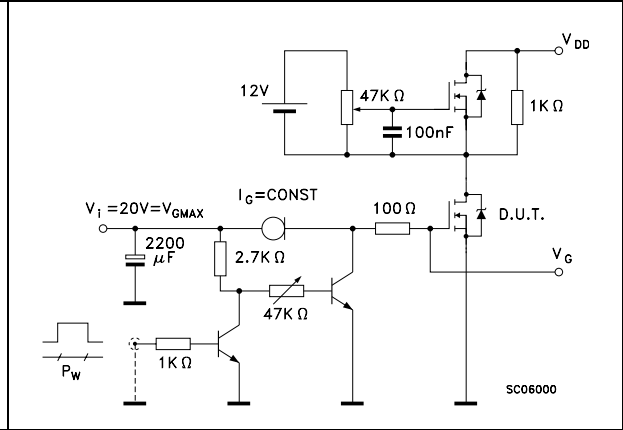


Figure 15. Test circuit for inductive load switching and diode recovery times

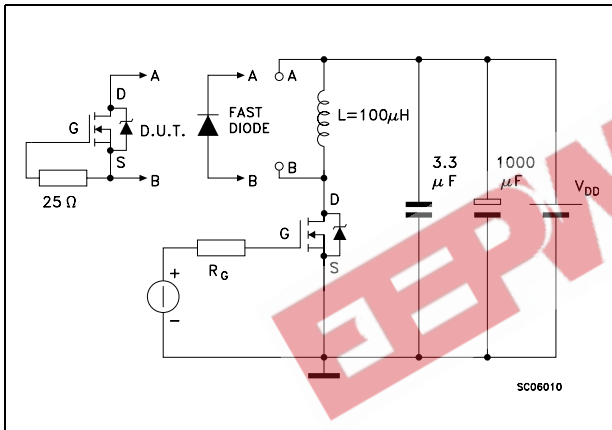


Figure 16. Unclamped Inductive load test circuit

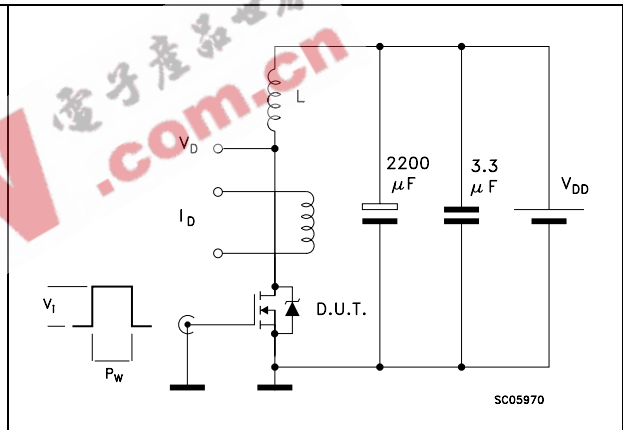


Figure 17. Unclamped inductive waveform

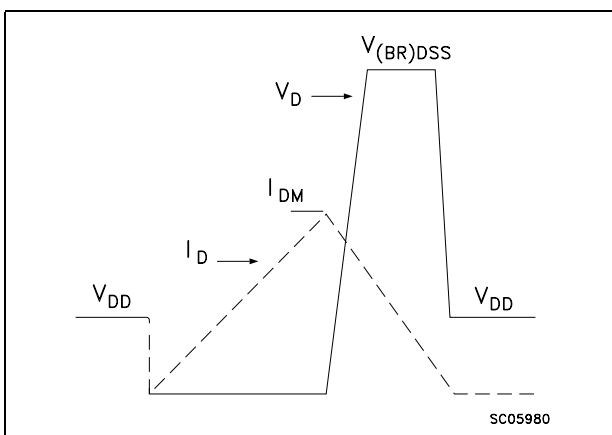
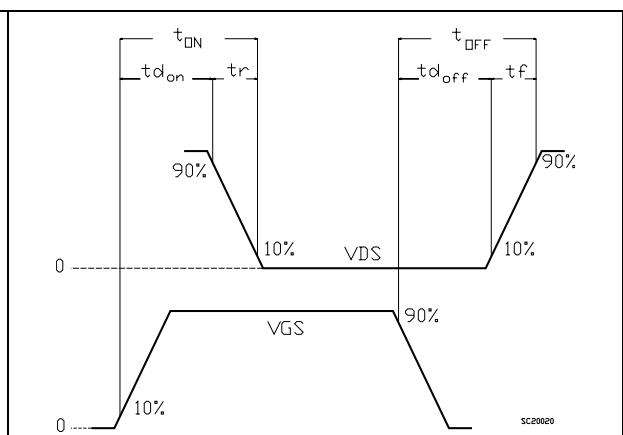


Figure 18. Switching time waveform



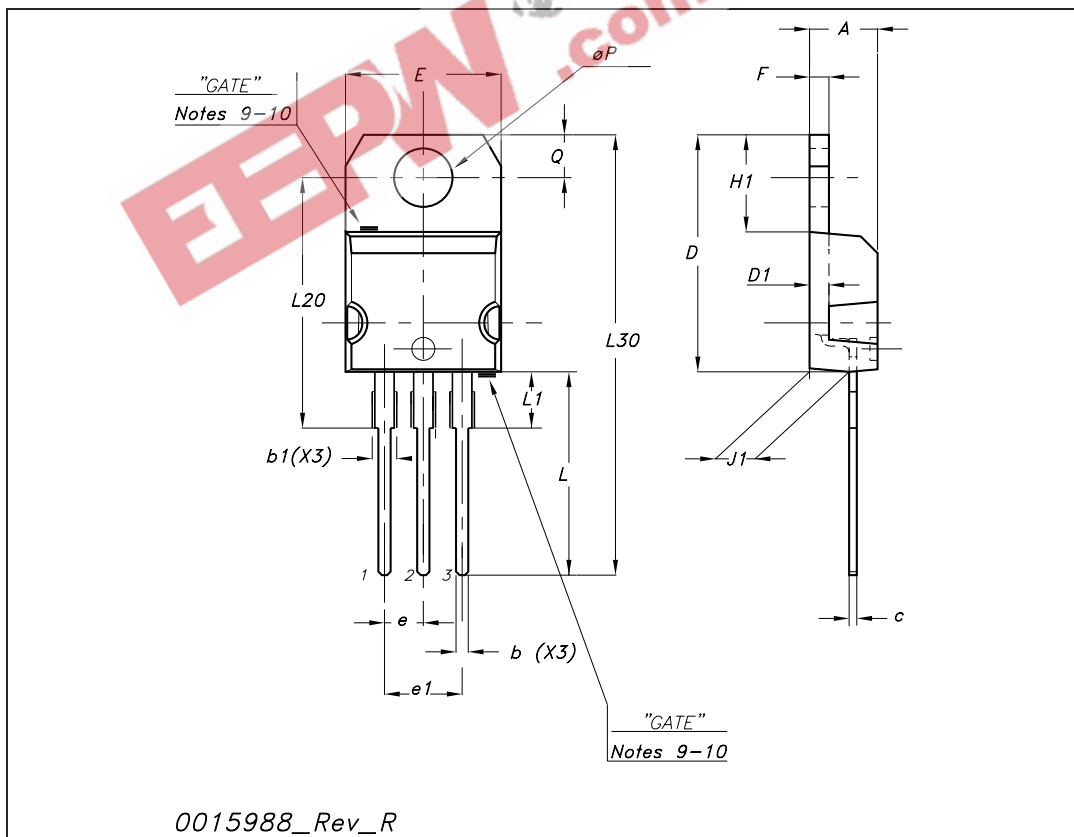
4 Package mechanical data

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

EEPW 电子產品世界
.com.cn

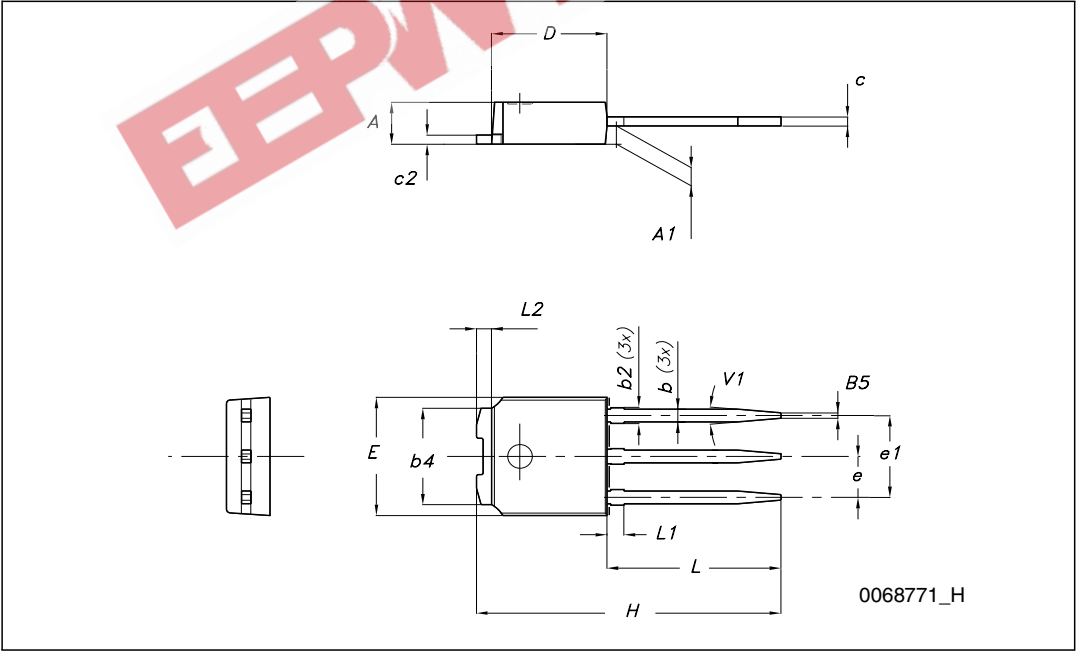
TO-220 mechanical data

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	0.48		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



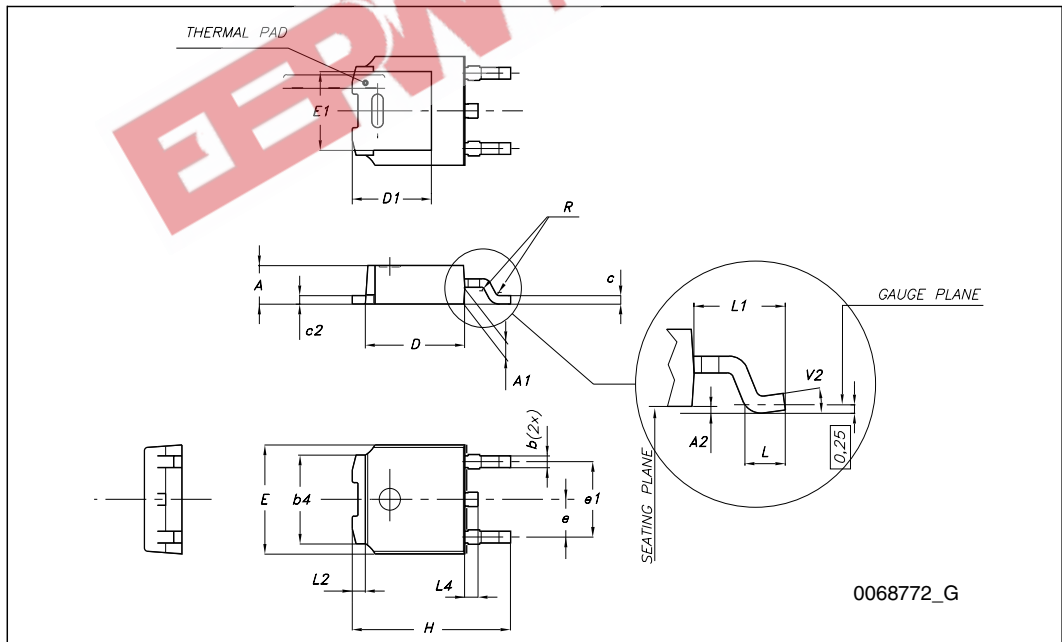
TO-251 (IPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10°	



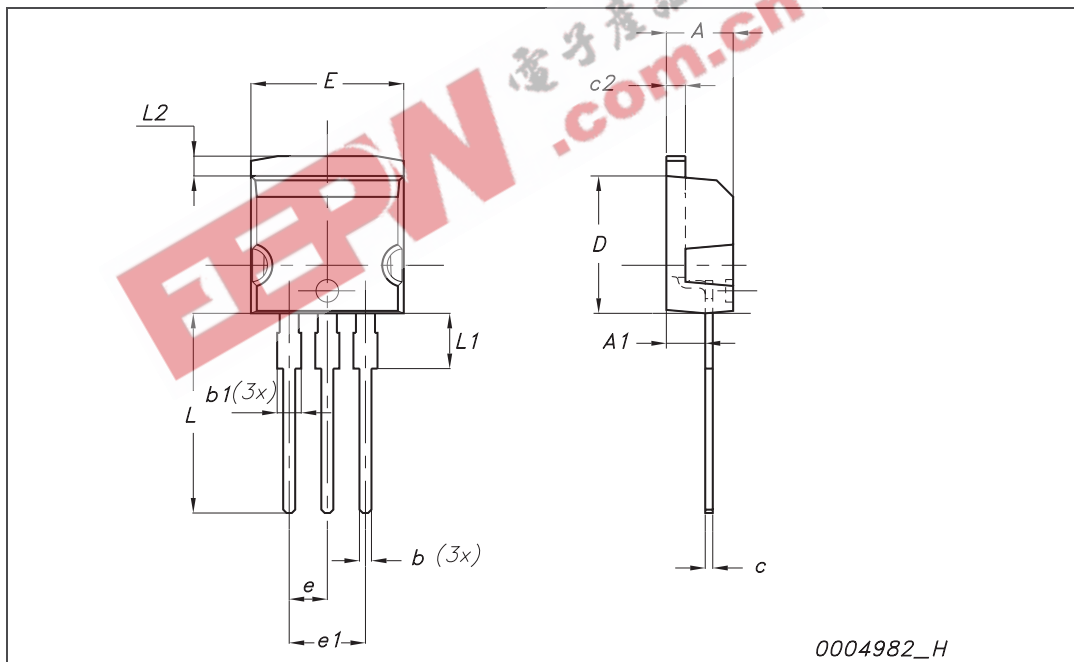
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°



I²PAK (TO-262) mechanical data

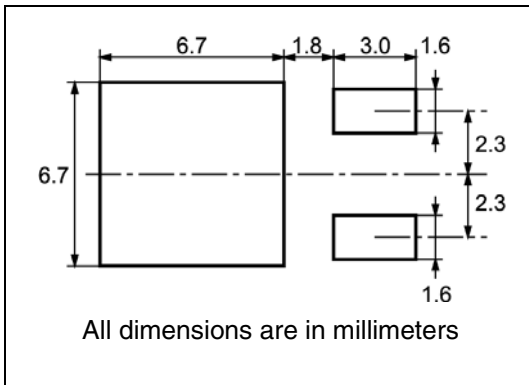
Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



0004982_H

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

G measured at hub

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

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

TOP COVER TAPE

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

6 Revision history

Table 8. Document revision history

Date	Revision	Changes
29-Nov-2007	1	First release
15-Jul-2008	2	Added new package, mechanical data: I ² PAK

EEPW 电子產品世界
.com.cn

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.

© 2008 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