



STB270N4F3 STI270N4F3 - STP270N4F3

N-channel 40V - 2.1mΩ - 160A - TO-220 - D²PAK - I²PAK
STripFET™ Power MOSFET

General features

Type	V _{DSS}	R _{DS(on)}	I _D	P _{TOT}
STB270N4F3	40V	<2.9mΩ	120A	330W
STI270N4F3	40V	<2.5mΩ	160A	330W
STP270N4F3	40V	<2.9mΩ	120A	330W

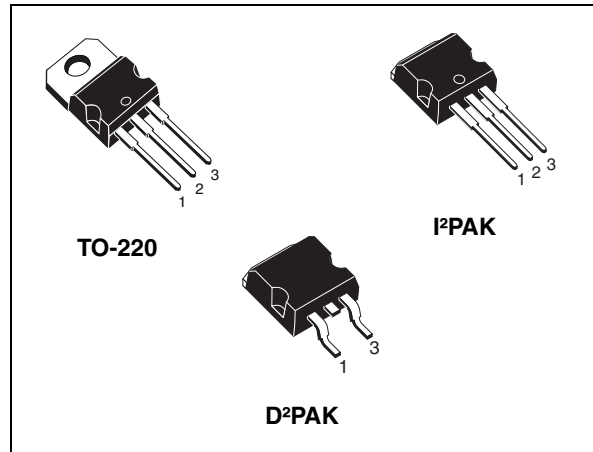
- 100% avalanche tested
- Standard threshold drive

Description

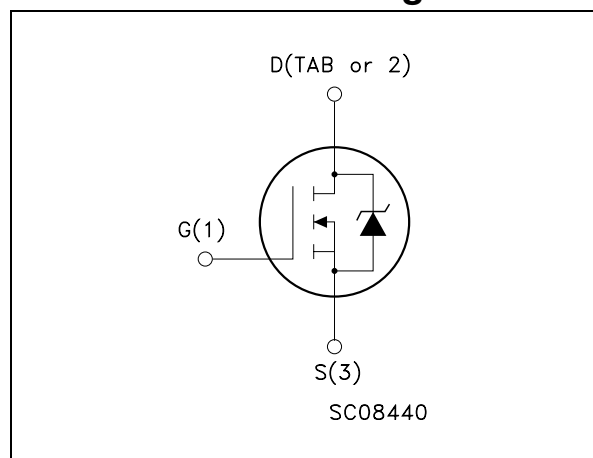
This N-Channel enhancement mode MOSFET is the latest refinement of STMicroelectronics unique "Single Feature Size™" strip-based process with less critical alignment steps and therefore a remarkable manufacturing reproducibility. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and low gate charge.

Applications

- High current, switching application
 - Automotive



Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STB270N4F3	270N4F3	D ² PAK	Tape & reel
STI270N4F3	270N4F3	I ² PAK	Tube
STP270N4F3	270N4F3	TO-220	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** 13

6 **Revision history** 14

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/I ² PAK	D ² PAK	
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	40		V
V_{GS}	Gate-source voltage	± 20		V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	120	160	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	120	160	A
$I_{DM}^{(2)}$	Drain current (pulsed)	480	640	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	330		W
	Derating factor	2.2		W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	3.5		V/n
$E_{AS}^{(4)}$	Single pulse avalanche energy	1		J
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175		$^\circ\text{C}$

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 20\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX}$
4. Starting $T_J = 25^\circ\text{C}$, $I_D = 80\text{A}$, $V_{DD} = 32\text{V}$

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		TO-220/I ² PAK	D ² PAK	
$R_{thj-case}$	Thermal resistance junction-case max	0.45		$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	--	35	$^\circ\text{C}/\text{W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5	--	$^\circ\text{C}/\text{W}$
T_I	Maximum lead temperature for soldering purpose (for 10 sec, 1.6mm from case)	300	--	$^\circ\text{C}$

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

2 Electrical characteristics

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

Table 3. On/off states

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 ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$, $V_{DS} = \text{Max rating}$ @ 125°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	$V_{GS} = 10\text{V}$, $I_D = 80\text{A}$	TO-220 I ² PAK		2.5	2.9	m Ω
			D ² PAK		2.1	2.5	m Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\text{V}$, $I_D = 80\text{A}$		200		S
C_{iss}	Input capacitance	$V_{DS} = 25\text{V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$		740		pF
C_{oss}	Output capacitance			0		pF
C_{rss}	Reverse transfer capacitance			180 0 47		pF pF pF
Q_g	Total gate charge	$V_{DD} = 20\text{V}$, $I_D = 160\text{A}$		110	150	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{V}$		27		nC
Q_{gd}	gate-drain charge	(see Figure 13)		25		nC

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

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	$V_{DD}=20\text{ V}$, $I_D=80\text{ A}$, $R_G=4.7\Omega$, $V_{GS}=10\text{ V}$ (see Figure 15)		22 180		ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	$V_{DD}=20\text{ V}$, $I_D=80\text{ A}$, $R_G=4.7\Omega$, $V_{GS}=10\text{ V}$ (see Figure 15)		110 45		ns ns

Table 6. Source drain diode

Symbol	Parameter		Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current	D ² PAK				160	A
		TO-220				120	A
		I ² PAK					
$I_{SDM}^{(1)}$	Source-drain current (pulsed)	D ² PAK				640	A
		TO-220 I ² PAK				480	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		$I_{SD}=160\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=32\text{ V}$, $T_j=150^\circ\text{C}$ (see Figure 14)		70 225 3.2		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 1. Safe operating area

Figure 2. Thermal impedance

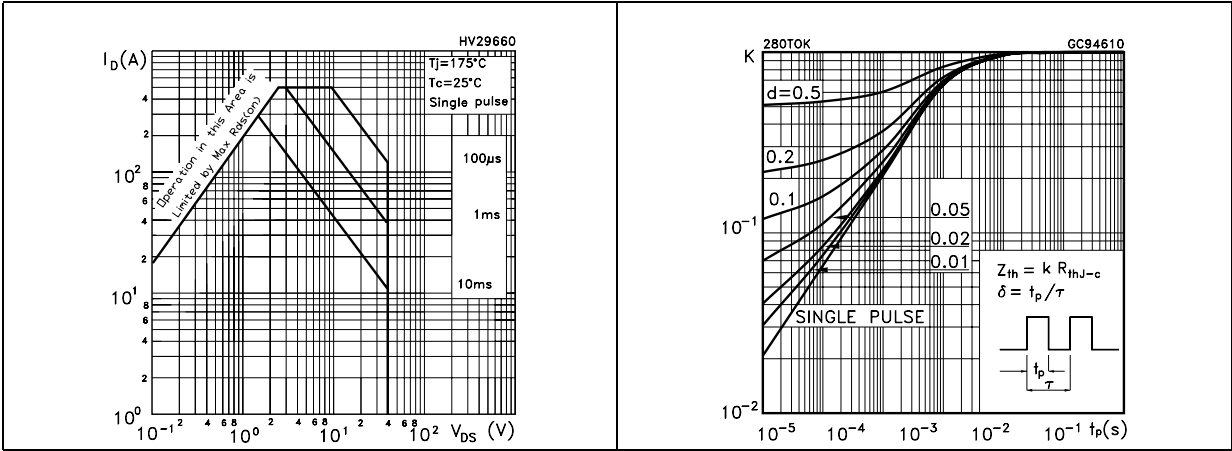


Figure 3. Output characteristics

Figure 4. Transfer characteristics

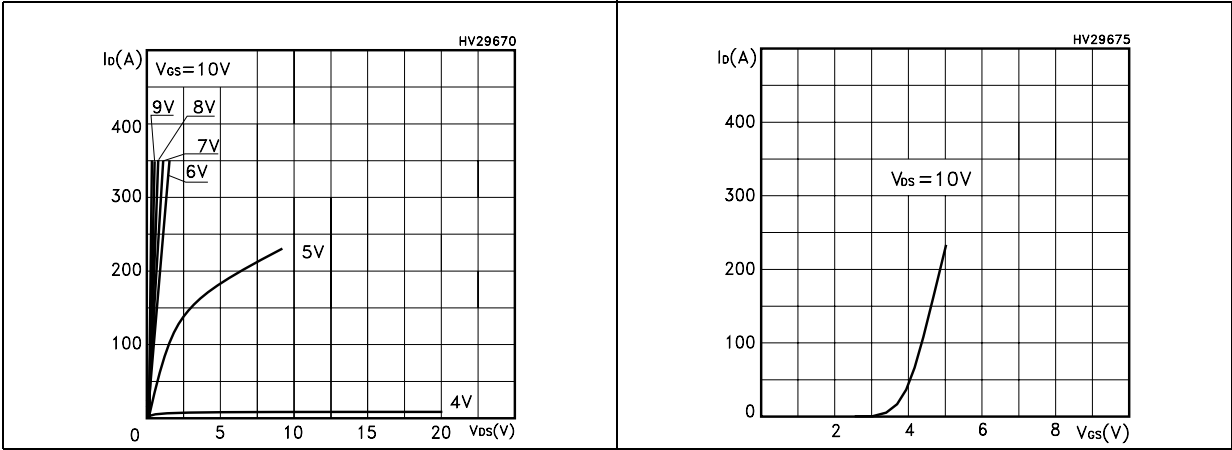


Figure 5. Static drain-source on resistance

Figure 6. Normalized $B_{V_{DS}}$ vs temperature

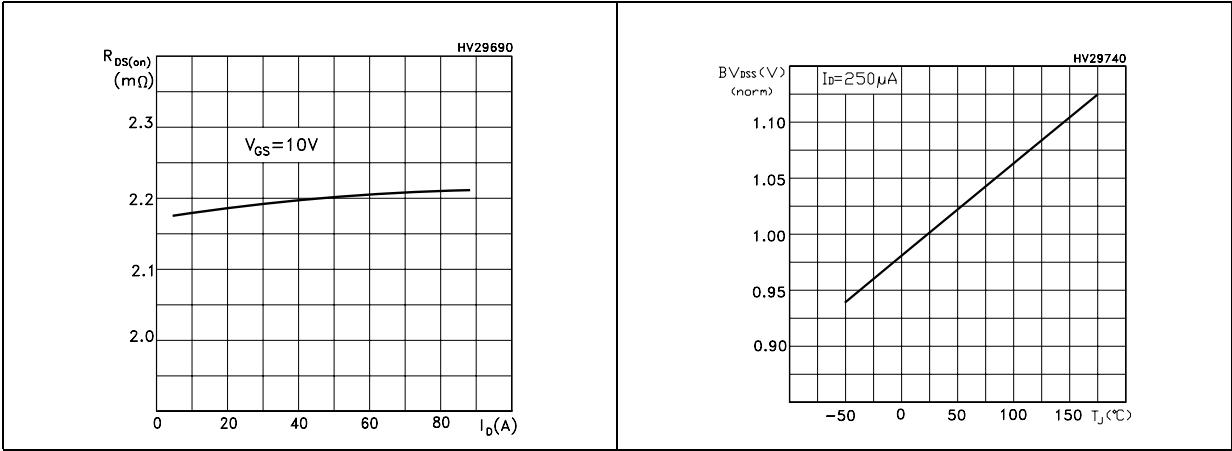


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

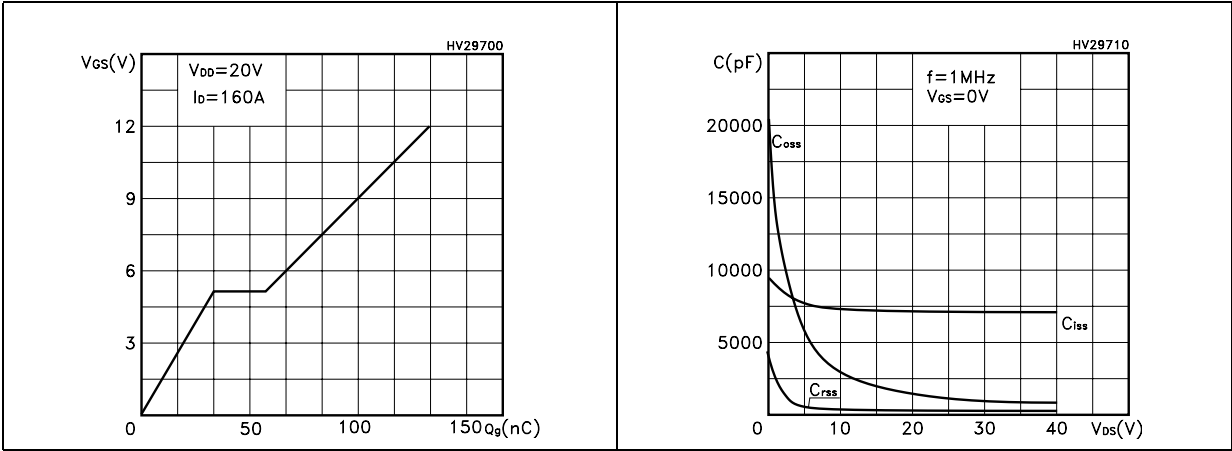


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

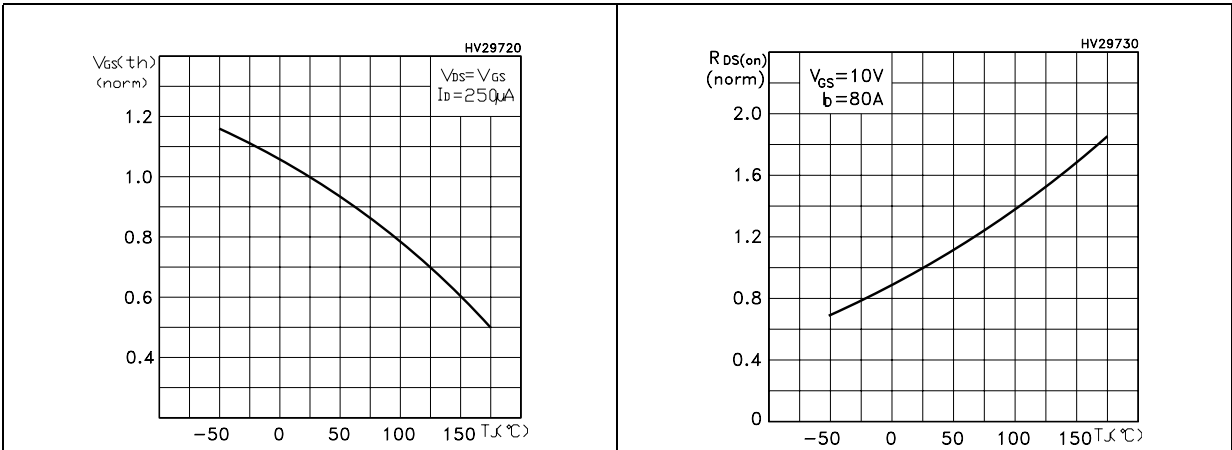
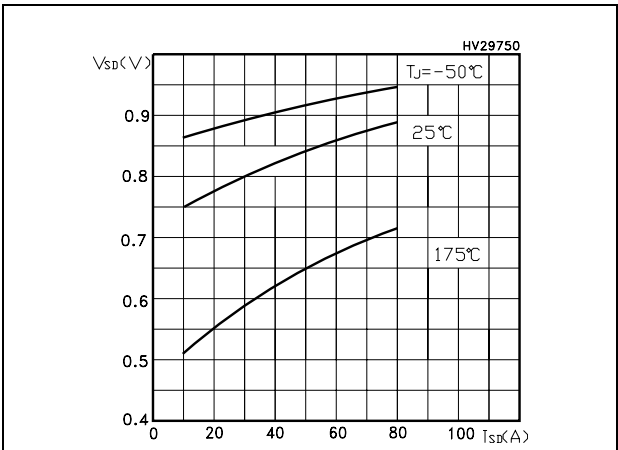


Figure 11. Source-drain diode forward characteristics



3 Test circuit

Figure 12. Switching times test circuit for resistive load

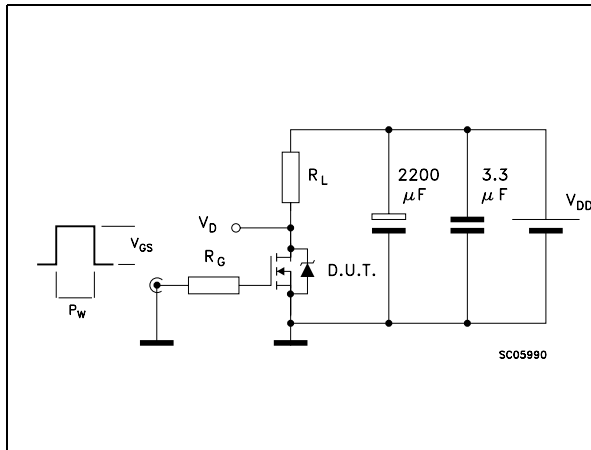


Figure 13. Gate charge test circuit

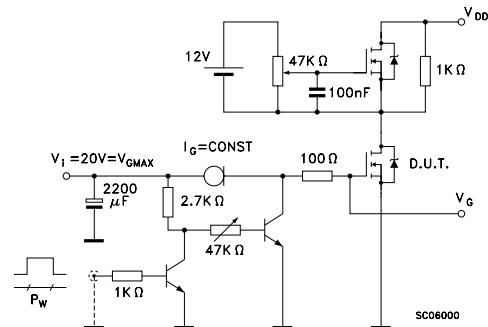


Figure 14. Test circuit for inductive load switching and diode recovery times

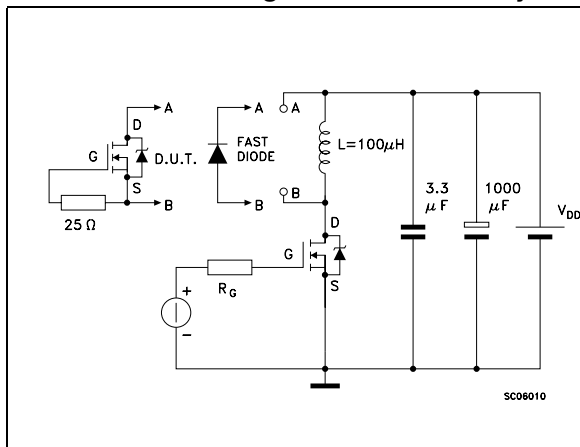


Figure 15. Unclamped Inductive load test circuit

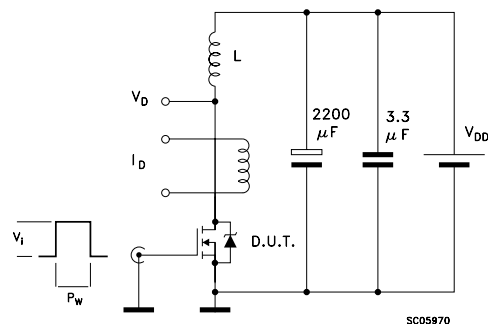


Figure 16. Unclamped inductive waveform

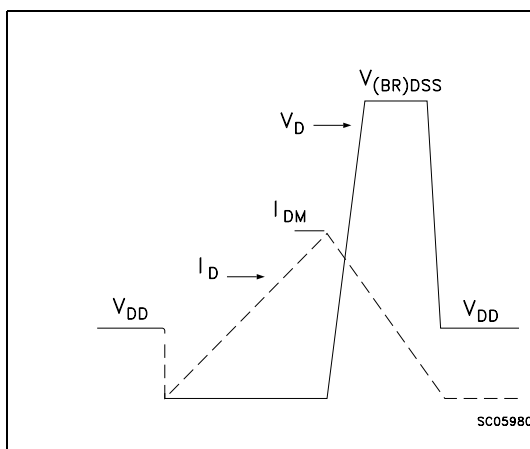
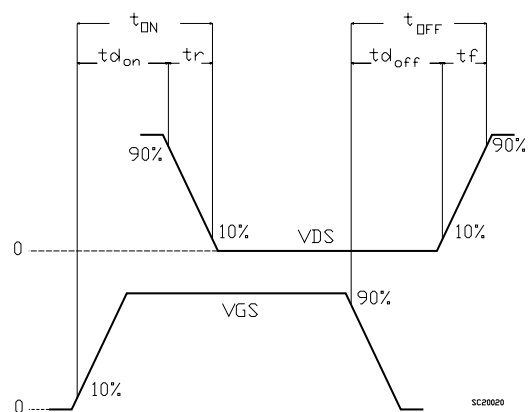


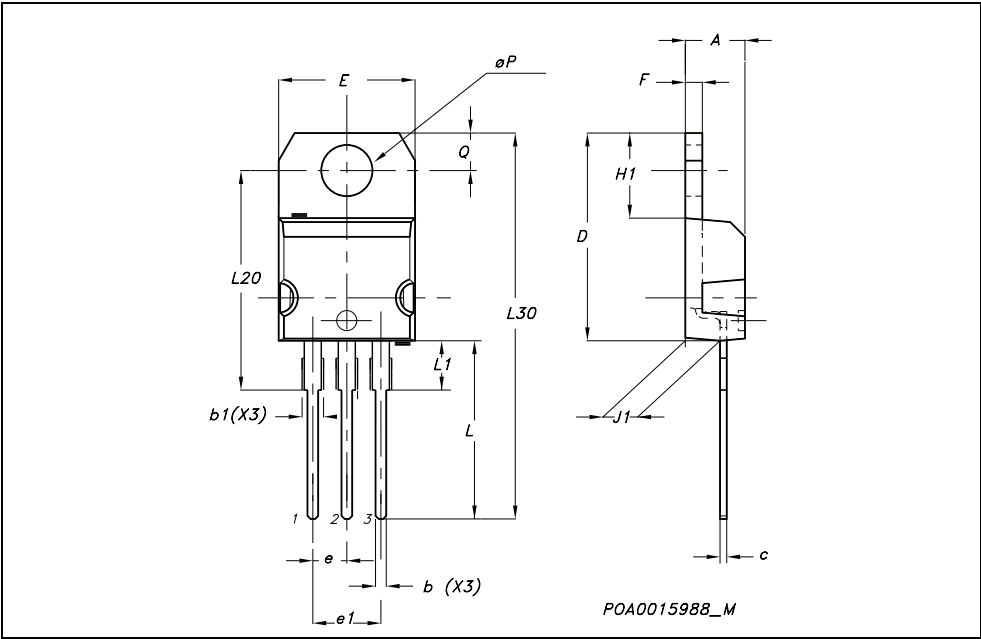
Figure 17. Switching time waveform



4 Package mechanical data

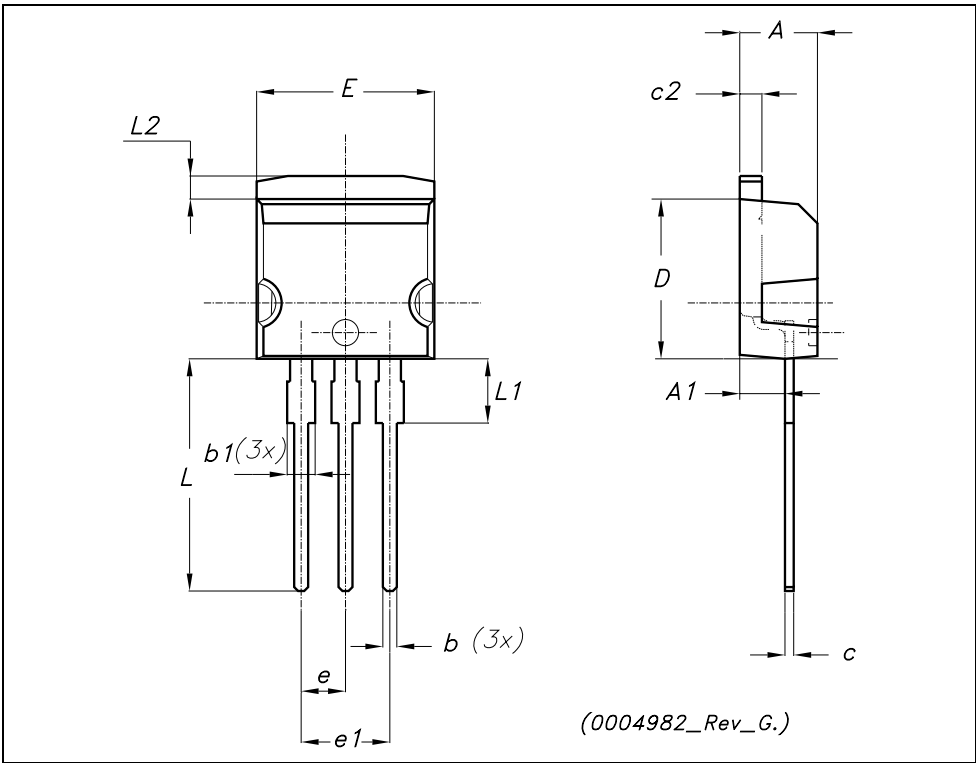
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings 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	1.15		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



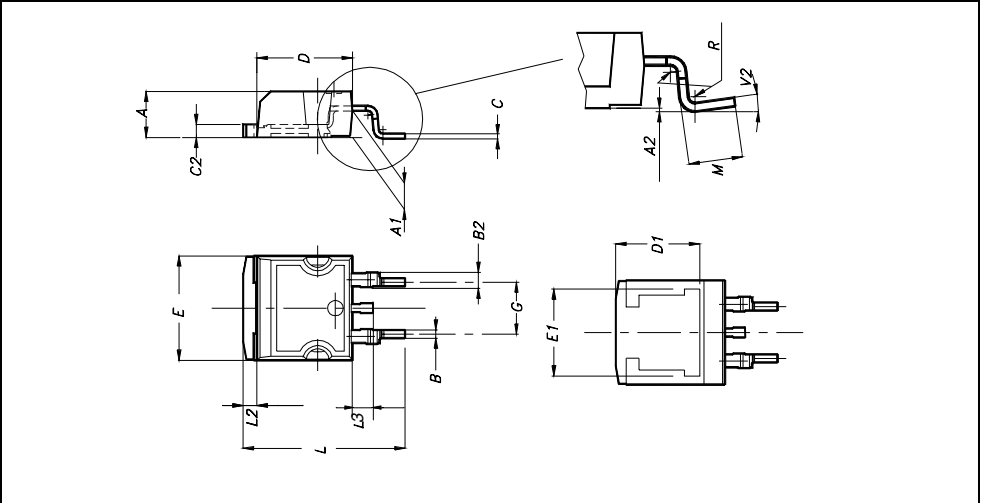
TO-262 (I²PAK) MECHANICAL DATA

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



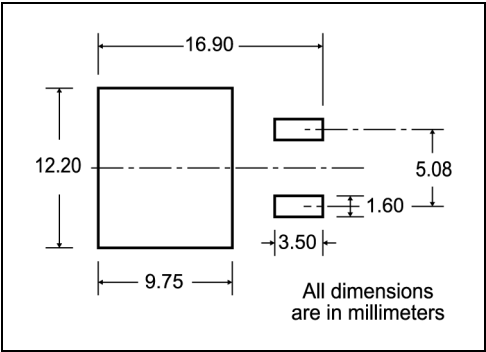
D²PAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			

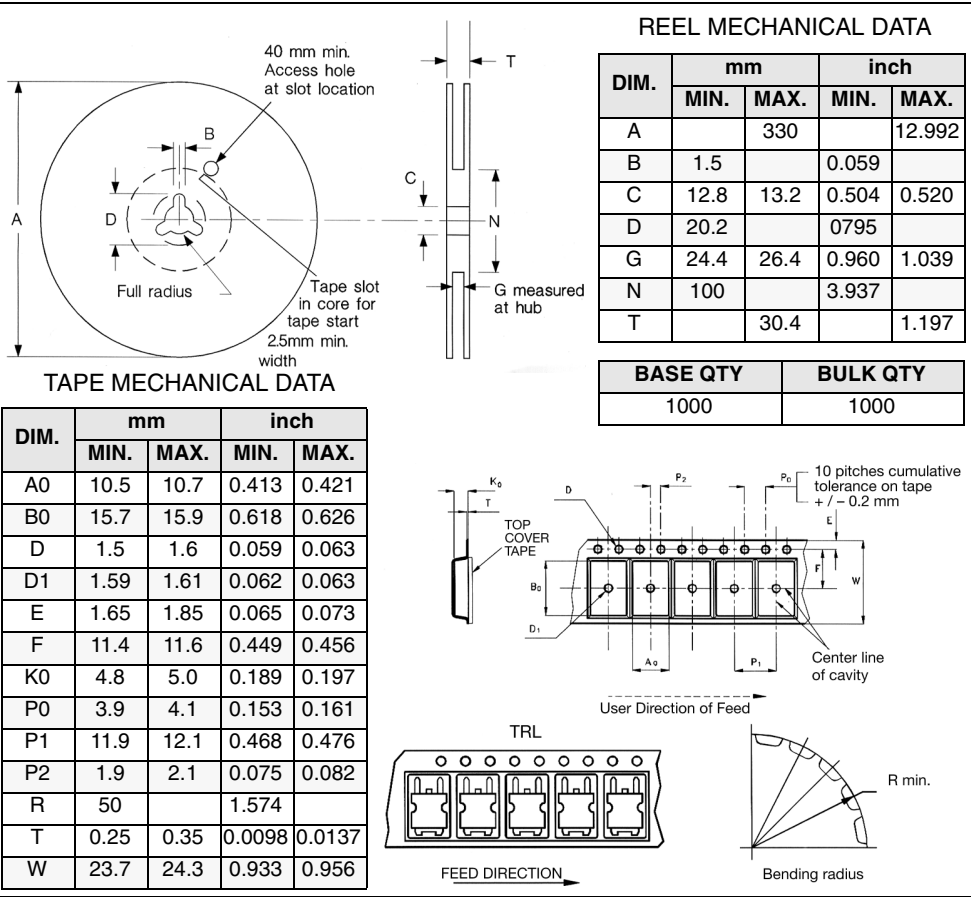


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



* on sales type

6 Revision history

Table 7. Revision history

Date	Revision	Changes
07-Feb-2007	1	Initial release.

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.

© 2007 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