



STB60NF06 STB60NF06-1

N-channel 60V - 0.014Ω - 60A - D²PAK/I²PAK
STripFET™ II Power MOSFET

General features

Type	V _{DSS}	R _{DS(on)}	I _D
STB60NF06-1	60V	<0.016Ω	60A
STB60NF06	60V	<0.016Ω	60

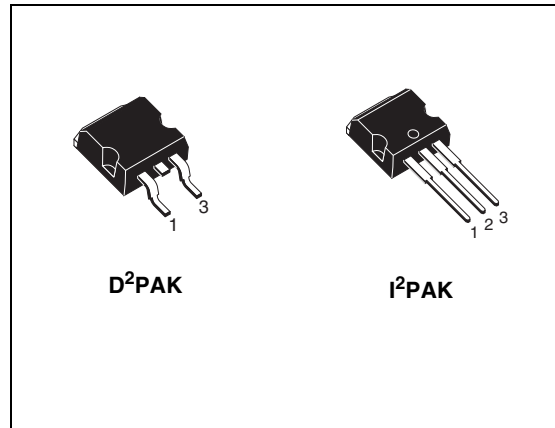
- Exceptional dv/dt capability
- 100% avalanche tested
- Application oriented characterization

Description

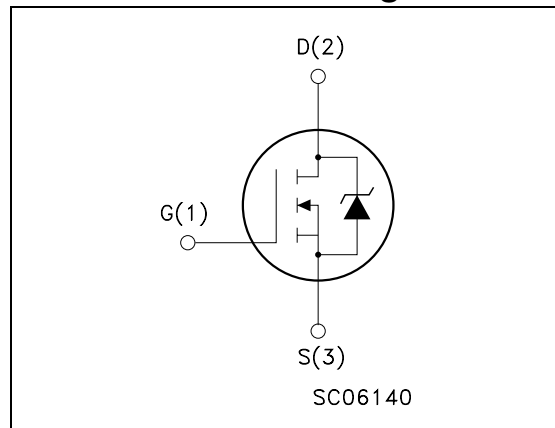
This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer application. It is also intended for any application with low gate charge drive requirements.

Applications

- Switching application



Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STB60NF06T4	B60NF06	D ² PAK	Tape & reel
STB60NF06-1	B60NF06	I ² PAK	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	Packing mechanical data	12
6	Revision history	13

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	60	V
V_{DGR}	Drain-gate voltage ($R_{GS} = 20\text{ k}\Omega$)	60	V
V_{GS}	Gate- source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	60	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	42	A
$I_{DM}^{(1)}$	Drain current (pulsed)	240	A
P_{tot}	Total dissipation at $T_C = 25^\circ\text{C}$	110	W
	Derating Factor	0.73	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4	V/ns
T_{stg}	Storage temperature	-65 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area.

2. $I_{SD} \leq 60\text{A}$, $di/dt \leq 400\text{A}/\mu\text{s}$, $V_{DD} \leq 24\text{V}$, $T_j \leq T_{JMAX}$

Table 2. Thermal data

$R_{thj-case}$	Thermal resistance junction-case max	1.36	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
T_J	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

Table 3. Avalanche characteristics

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	30	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 30\text{ V}$)	360	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0$	60			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 10	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 30A$		0.015	0.016	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 30A$		20		S
C_{iss}	Input capacitance	$V_{DS} = 25V, f = 1MHz,$ $V_{GS} = 0$		1810		pF
C_{oss}	Output capacitance			360		pF
C_{rss}	Reverse transfer capacitance			125		pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30V, I_D = 30A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 12)		16		ns
t_r	Rise time			108		ns
$t_{d(off)}$	Turn-off delay time			43		ns
t_f	Fall time			20		ns
Q_g	Total gate charge	$V_{DD} = 48V, I_D = 60A,$ $V_{GS} = 10V, R_G = 4.7\Omega$ (see Figure 13)		49	66	nC
Q_{gs}	Gate-source charge			18		nC
Q_{gd}	Gate-drain charge			14		nC

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

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				60	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				240	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 60A, V_{GS} = 0$			1.3	V
t_{rr}	Reverse recovery time	$I_{SD} = 60A, di/dt = 100A/\mu s,$ $V_{DD} = 25V, T_j = 150^\circ C$ (see Figure 14)		73		ns
Q_{rr}	Reverse recovery charge			182		nC
I_{RRM}	Reverse recovery current			5		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

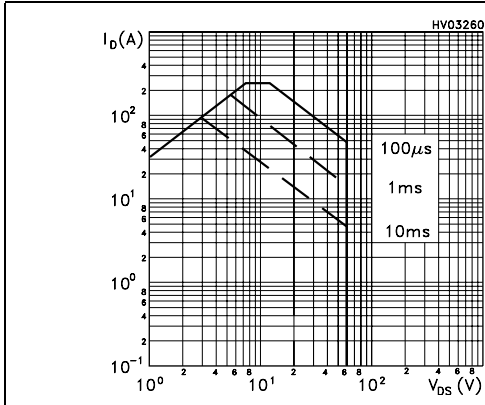


Figure 2. Thermal impedance

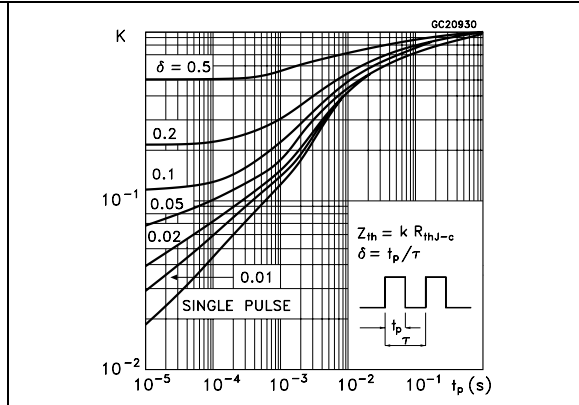


Figure 3. Output characteristics

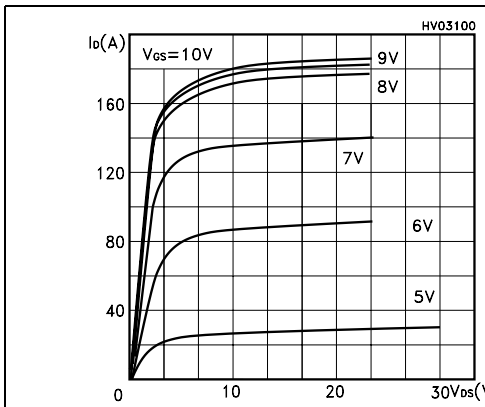


Figure 4. Transfer characteristics

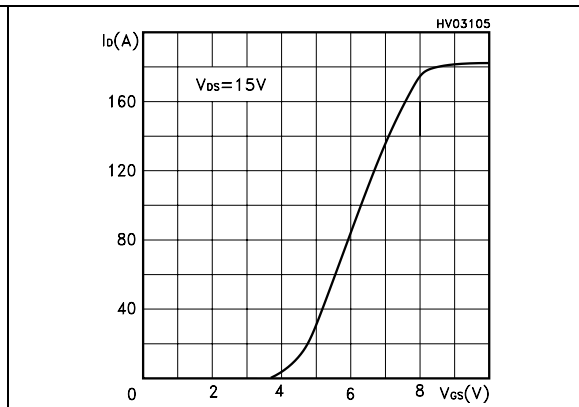


Figure 5. Transconductance

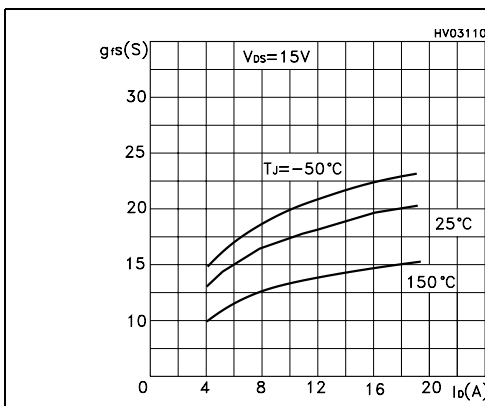


Figure 6. Static drain-source on resistance

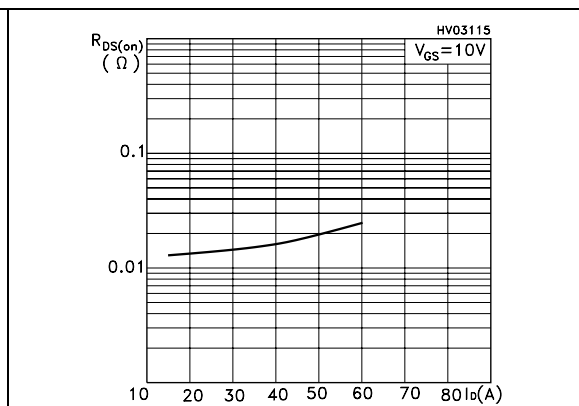


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

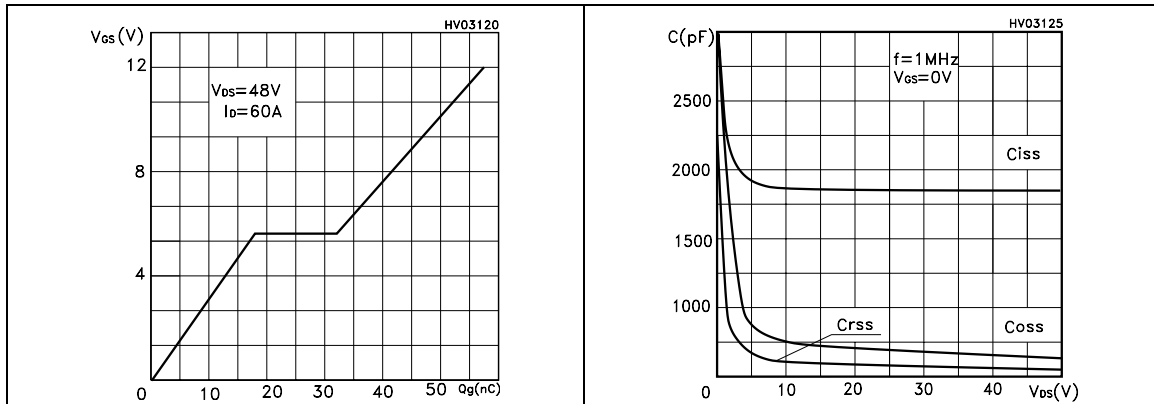


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

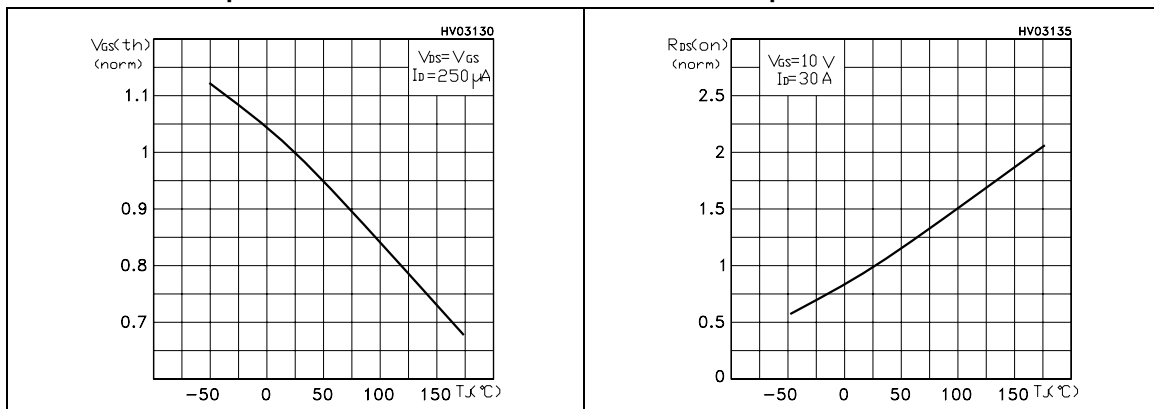
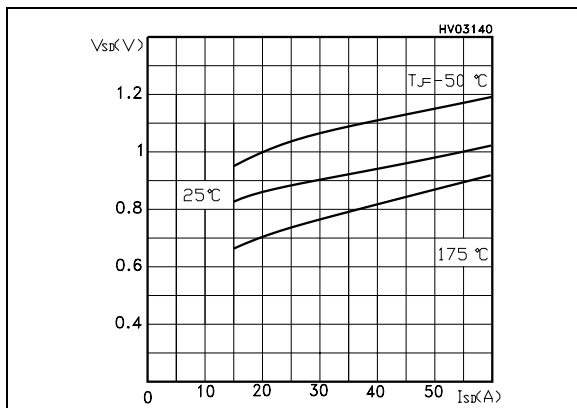


Figure 11. Source-drain diode forward characteristics



3 Test circuit

Figure 12. Switching times test circuit for resistive load

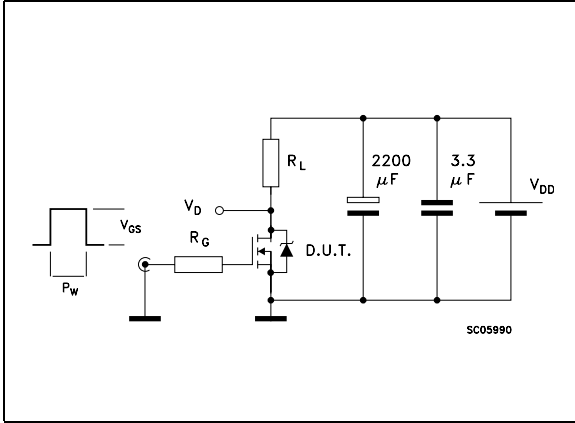


Figure 13. Gate charge test circuit

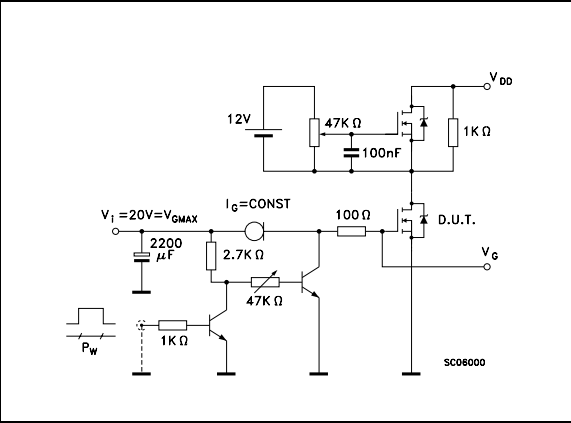


Figure 14. Test circuit for inductive load switching and diode recovery times

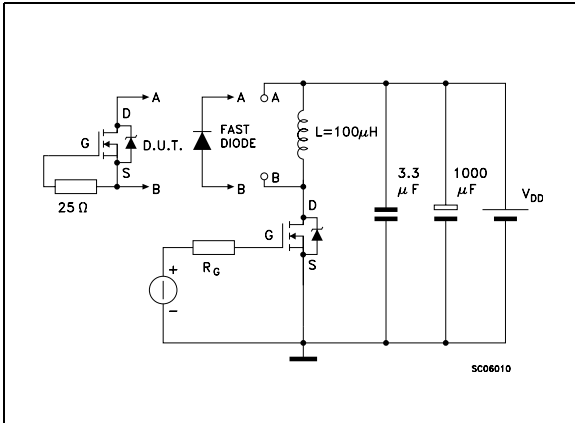


Figure 15. Unclamped Inductive load test circuit

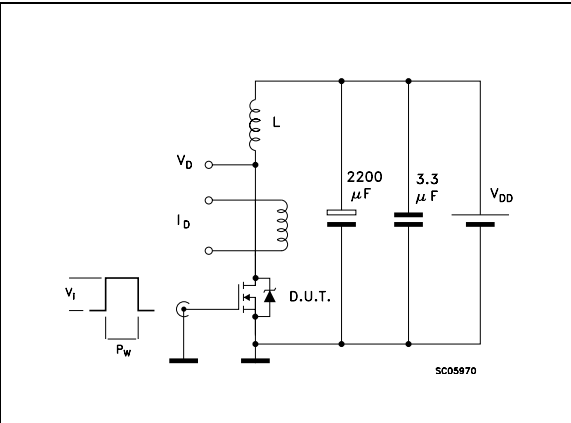


Figure 16. Unclamped inductive waveform

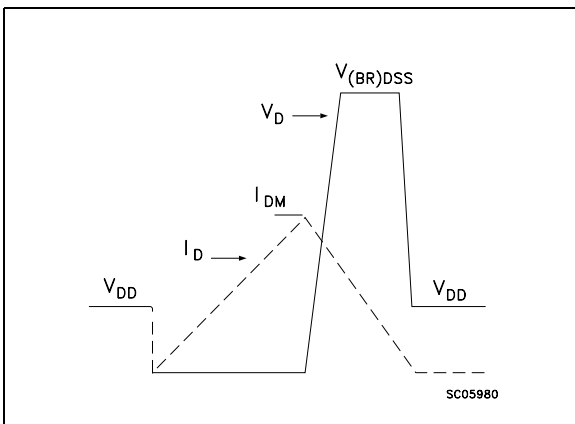
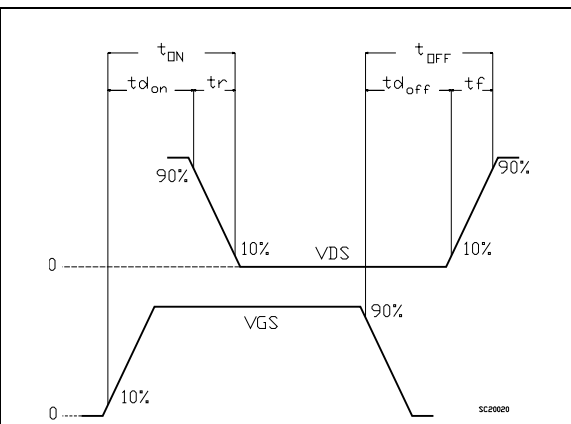


Figure 17. Switching time waveform

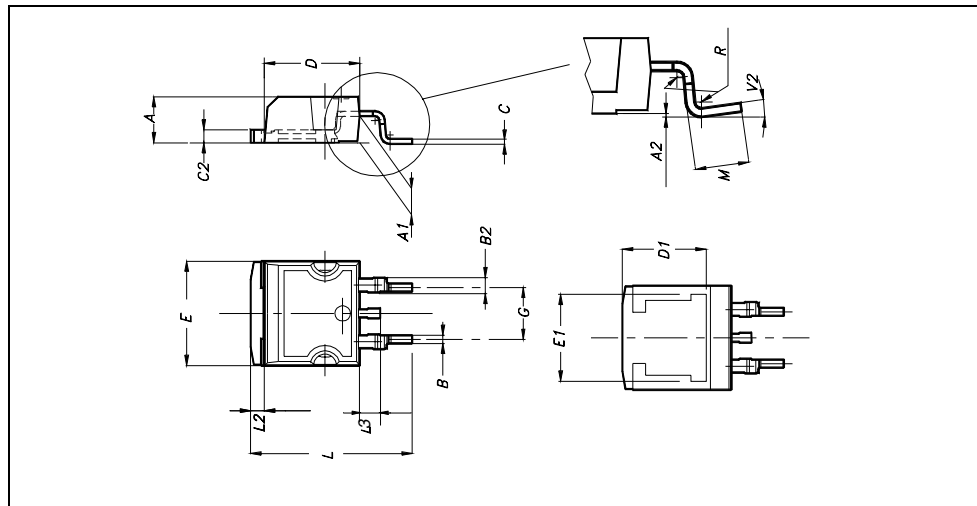


4 Package mechanical data

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

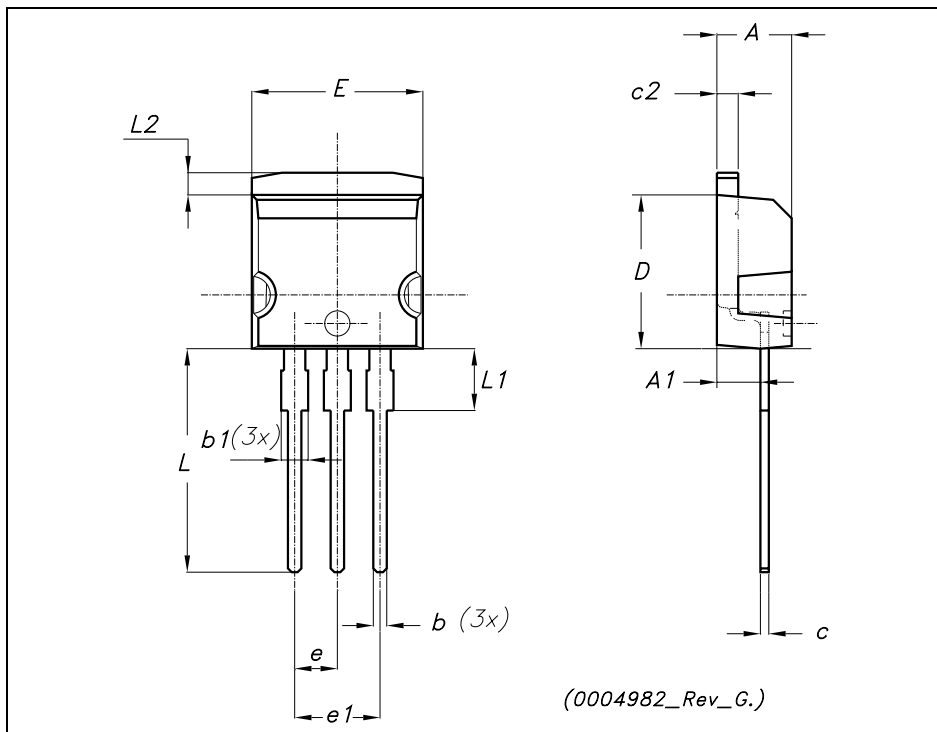
D²PAK MECHANICAL DATA

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°			



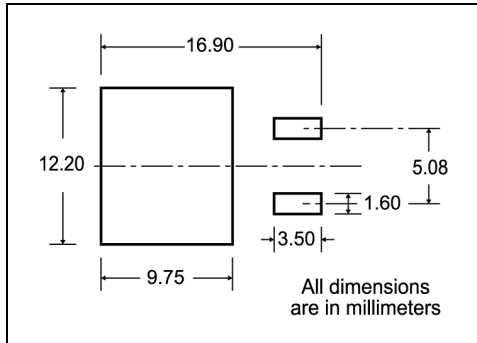
TO-262 (I²PAK) MECHANICAL DATA

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



5 Packing mechanical data

D²PAK 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

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

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	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

TRL

FEED DIRECTION

Bending radius

R min.

* on sales type

6 Revision history

Table 7. Revision history

Date	Revision	Changes
21-Jun-2004	2	Preliminary version
16-Jun-2006	3	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 REPRESENTATIVE OF ST, ST PRODUCTS ARE NOT DESIGNED, 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.

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