



# STE250NS10

N-channel 100 V, 0.0045  $\Omega$ , 220 A, ISOTOP  
STripFET™ Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STE250NS10	100 V	<0.0055 $\Omega$	220 A

- Standard threshold drive
- 100% avalanche tested

## Description

This Power MOSFET is the latest development of STMicroelectronics unique "single feature size" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

## Applications

- Switching application

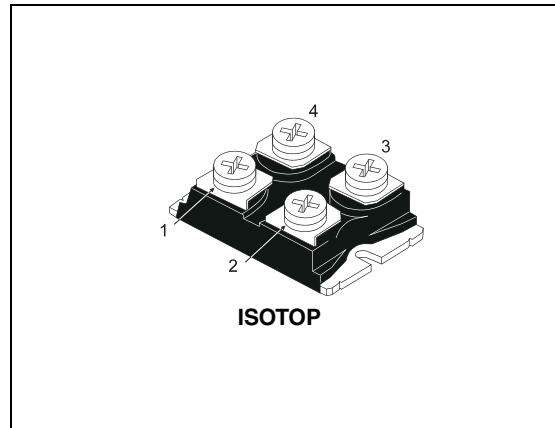


Figure 1. Internal schematic diagram

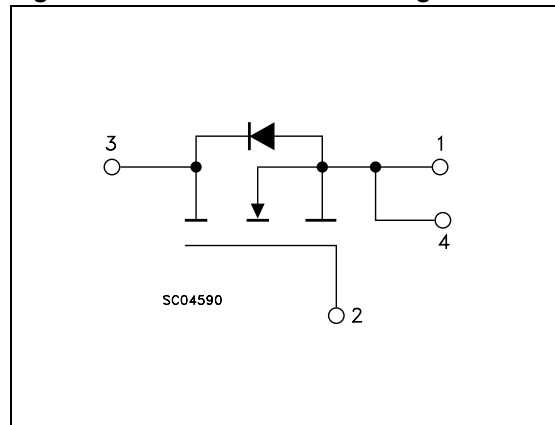


Table 1. Device summary

Order code	Marking	Package	Packaging
STE250NS10	E250NS10	ISOTOP	Tube

---

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>9</b>
<b>5</b>	<b>Mounting information</b> .....	<b>11</b>
	5.1 Mounting on heatsink .....	11
<b>6</b>	<b>Revision history</b> .....	<b>13</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $v_{GS} = 0$ )	100	V
$V_{GS}$	Gate- source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	220	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	156	A
$I_{DM}^{(1)}$	Drain current (pulsed)	880	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	500	W
	Derating factor	4	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	3.5	V/ns
$V_{ISO}$	Insulation withstand voltage (DC)	2500	V
$T_J$	Operating junction temperature	150	$^\circ\text{C}$
$T_{stg}$	Storage temperature	-55 to 150	

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 220$  A,  $di/dt \leq 200$  A/ $\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case Max	0.25	$^\circ\text{C/W}$
$R_{thj-a}$	Thermal resistance junction-ambient Max	50	$^\circ\text{C/W}$

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AS}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ max)	220	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_d = I_{AS}$ , $V_{DD} = 64$ V)	800	mJ

## 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	$I_D = 1 \text{ mA}, V_{GS} = 0$	100			V
$I_{DSS}$	Zero gate voltage Drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating},$ $T_C = 125^{\circ}C$			50	$\mu A$
					500	$\mu A$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 \text{ V}$			$\pm 400$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 125 \text{ A}$		0.0045	0.0055	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward transconductance	$V_{DS} = 20 \text{ V}, I_D = 70 \text{ A}$	-	60	-	S
$C_{iss}$	Input capacitance	$V_{DS} = 25 \text{ V}, f = 1 \text{ MHz},$ $V_{GS} = 0$		31		nF
$C_{oss}$	Output capacitance			4.3	-	nF
$C_{rss}$	Reverse transfer capacitance			1.2		nF
$Q_g$	Total gate charge	$V_{DD} = 50 \text{ V}, I_D = 22 \text{ A},$ $V_{GS} = 10 \text{ V}$		900		nC
$Q_{gs}$	Gate-source charge			160	-	nC
$Q_{gd}$	Gate-drain charge			330		nC

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time	$V_{DD} = 50 \text{ V}, I_D = 125 \text{ A},$ $R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (see <a href="#">Figure 14</a> )		110		ns
	Rise time			380		ns
$t_{d(off)}$ $t_f$	Turn-off-delay time	$V_{DD} = 50 \text{ V}, I_D = 125 \text{ A},$ $R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (see <a href="#">Figure 13</a> )		1100		ns
	Fall time			300		ns
$t_{r(Voff)}$ $t_f$ $t_c$	Off-voltage rise time	$V_{DD} = 80 \text{ V}, I_D = 220 \text{ A},$ $R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (see <a href="#">Figure 15</a> )		950		ns
	fall time			330		ns
	cross-over time			600		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		220	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		880	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 220 \text{ A}, V_{GS} = 0$	-		1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 220 \text{ A}, V_{DD} = 30 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$ , $T_j = 150^\circ\text{C}$ (see Figure 16)	-	200 1.35 13.5		ns $\mu\text{C}$ 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 2. Safe operating area

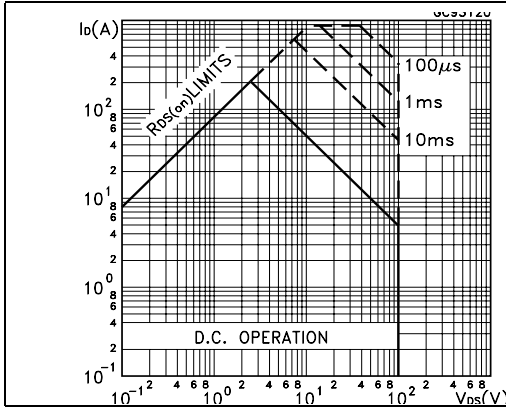


Figure 3. Thermal impedance

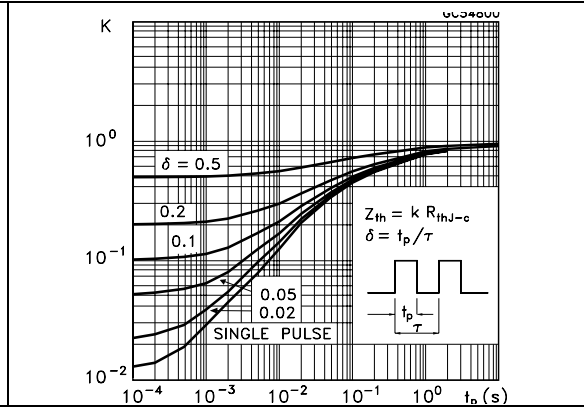


Figure 4. Output characteristics

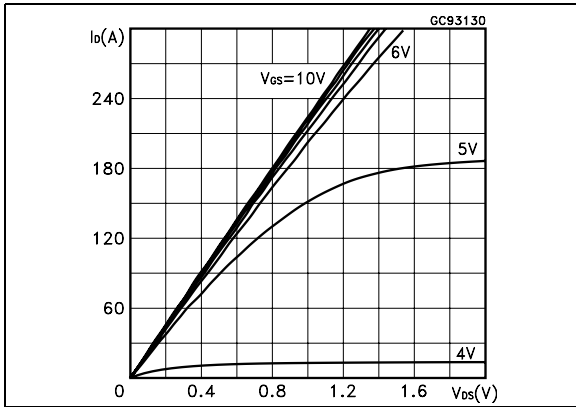


Figure 5. Transfer characteristics

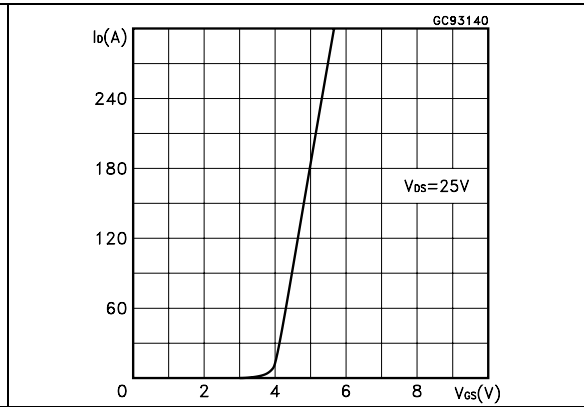


Figure 6. Transconductance

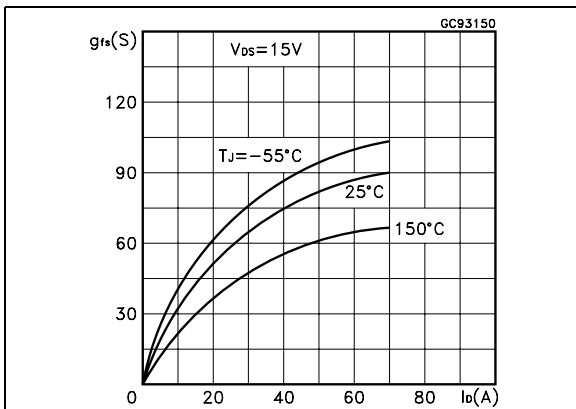


Figure 7. Static drain-source on resistance

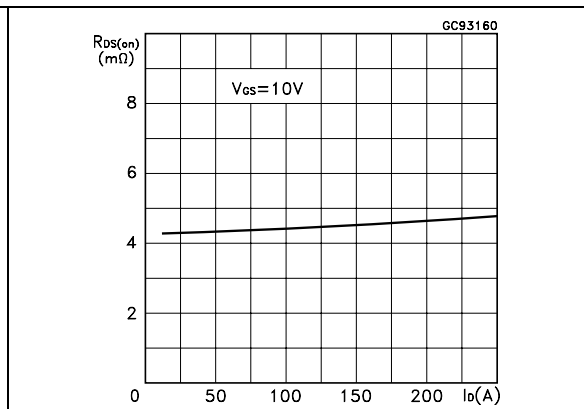


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

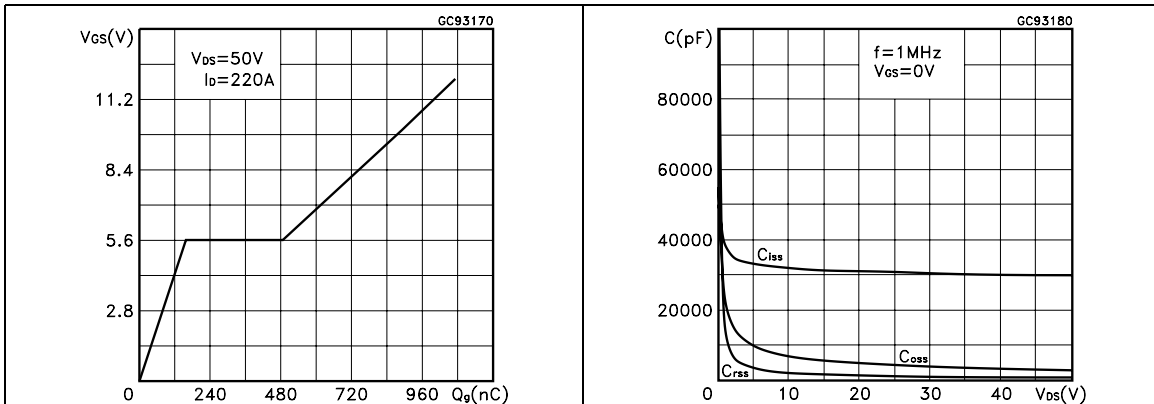


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

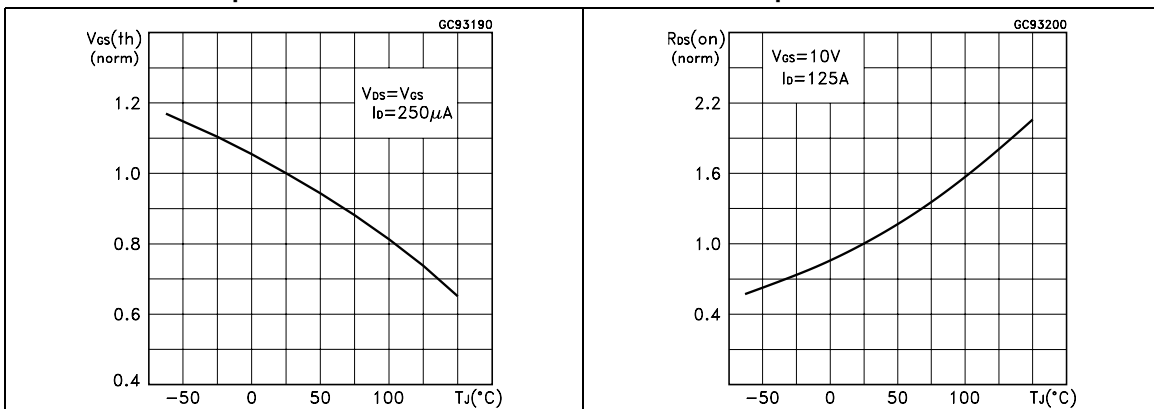
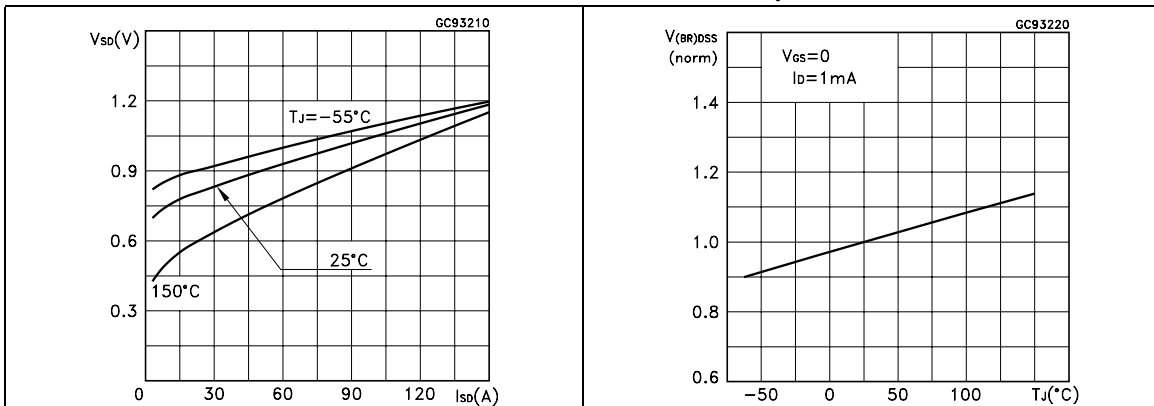


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized breakdown voltage vs temperature



### 3 Test circuits

Figure 14. Switching times test circuit for resistive load

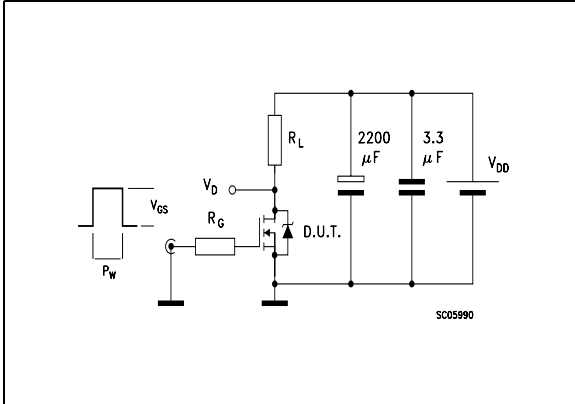


Figure 15. Gate charge test circuit

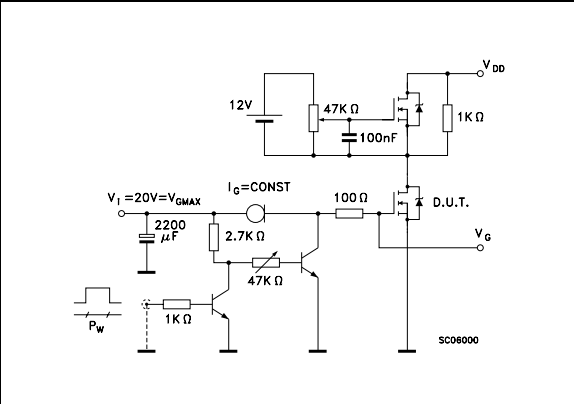


Figure 16. Test circuit for inductive load switching and diode recovery times

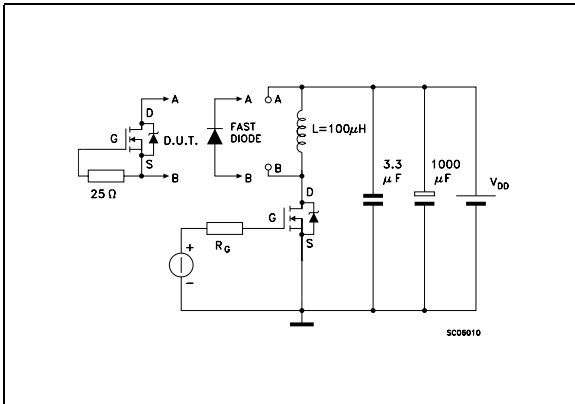


Figure 17. Unclamped inductive load test circuit

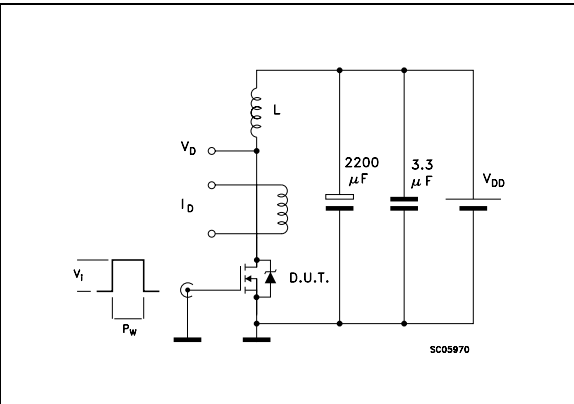


Figure 18. Unclamped inductive waveform

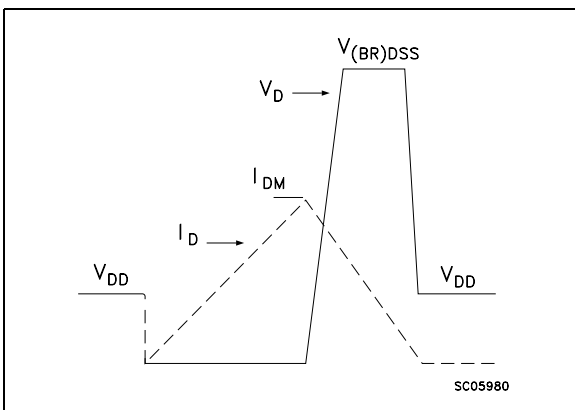
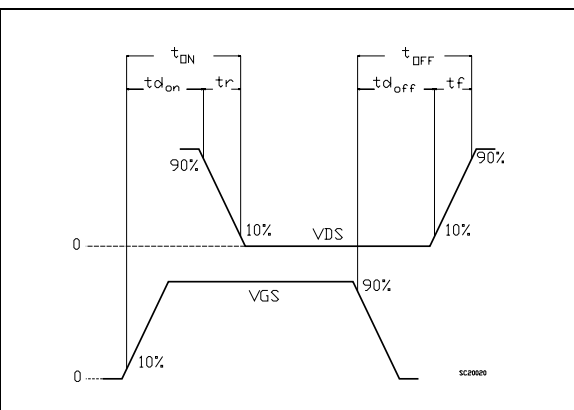


Figure 19. Switching time waveform



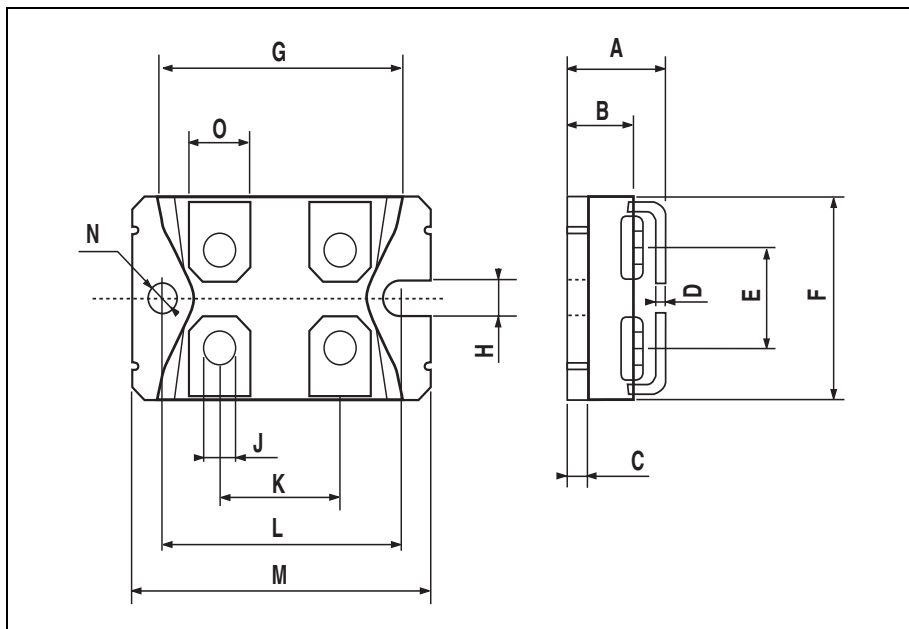


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

**ISOTOP MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	11.8		12.2	0.466		0.480
B	8.9		9.1	0.350		0.358
C	1.95		2.05	0.076		0.080
D	0.75		0.85	0.029		0.033
E	12.6		12.8	0.496		0.503
F	25.15		25.5	0.990		1.003
G	31.5		31.7	1.240		1.248
H	4			0.157		
J	4.1		4.3	0.161		0.169
K	14.9		15.1	0.586		0.594
L	30.1		30.3	1.185		1.193
M	37.8		38.2	1.488		1.503
N	4			0.157		
O	7.8		8.2	0.307		0.322



## 5 Mounting information

### 5.1 Mounting on heatsink

Figure 20. Screws distance

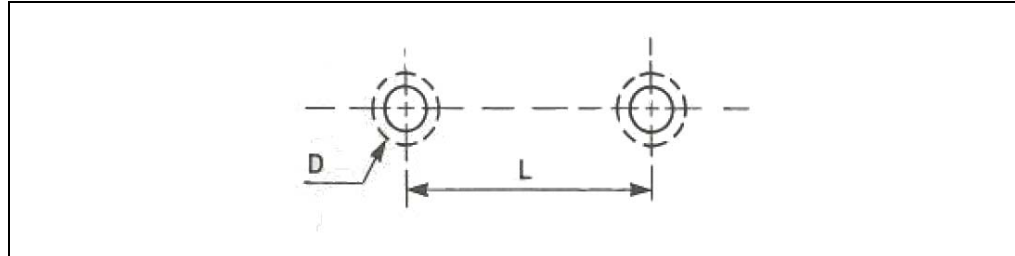


Table 9. Heatsink specification

Parameter	Value
Flatness (max concavity or convexity between fixing holes)	$\leq 20 \mu\text{m}$ (0.78 mils)
Surface finish	$\pm 1.2 \mu\text{m}$ ( $\pm 0.05$ mils)
Fixing holes	D= M4 L= $30 + 3 \text{ mm}$ ( $1.181 + 0.012$ inch)

Table 10. Mounting specification

Parameter	Value
Fixing screw	M4 + lock washer
Torque	$1.3 \pm 0.2 \text{ N}\cdot\text{m}$ ( $7.6 \pm 1.2 \text{ LBS}\cdot\text{inch}$ )
$R_{\text{thj-case/ heatsink}}$	$\leq 0.05 \text{ }^\circ\text{CW}$

Table 11. Connectors

Parameter	Value
Screws	See <a href="#">Figure 21</a>
Torque	$1.3 \pm 0.2 \text{ N}\cdot\text{m}$ ( $7.6 \pm 1.2 \text{ LBS}\cdot\text{inch}$ )
Pull test (fast on pins)	$\leq 80 \text{ N}$
Twist test	N/A

Table 11. Connectors (continued)

Parameter	Value
Contact area (screw version)	45 mm <sup>2</sup>
Lead inductance	≤ 5 nH

Figure 21. Mounting section

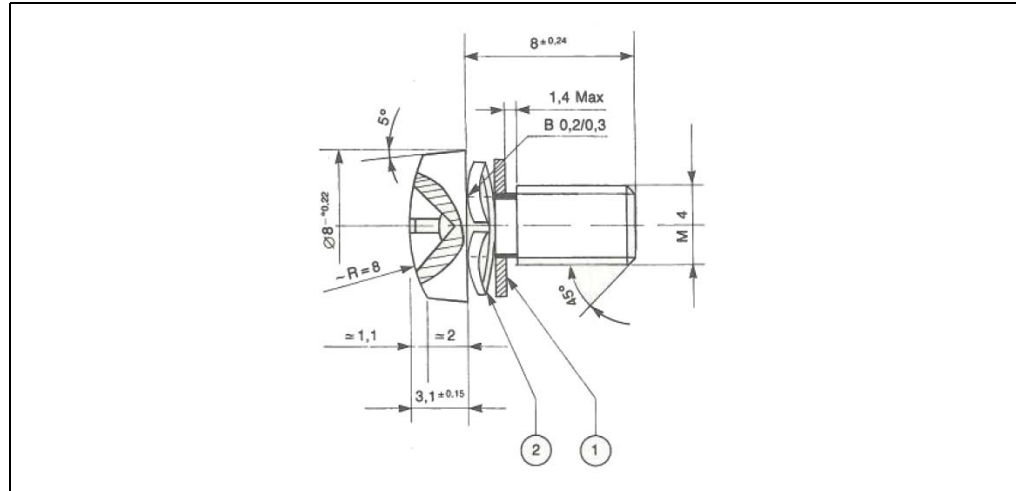


Figure 22. Cross form

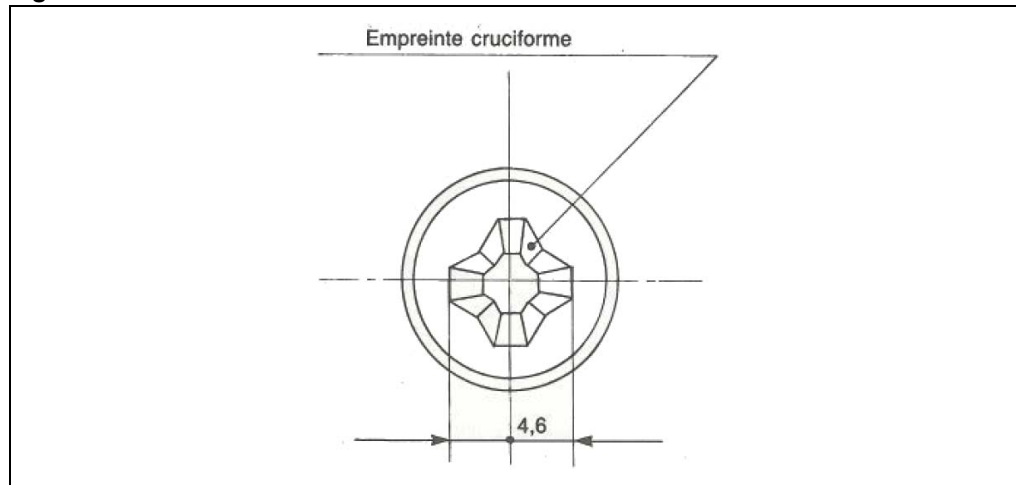


Table 12. Package for shipment

Shipment	Details
Tube	10 pcs + contact set (screw +washer)
Elementary box (bulk quantity)	100 pieces (10 tubes)
Ordered quantity	Multiples of 10 pcs

## 6 Revision history

Table 13. Revision history

Date	Revision	Changes
21-Jun-2004	1	Complete version.
04-Oct-2006	2	New template, no content change.
22-Mar-2010	3	Added <a href="#">Section 5: Mounting information</a> .

**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.

© 2010 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 - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

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