



STE250NS10

N-channel 100 V, 0.0045 Ω , 220 A, ISOTOP
STripFET™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)}	I _D
STE250NS10	100 V	<0.0055 Ω	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

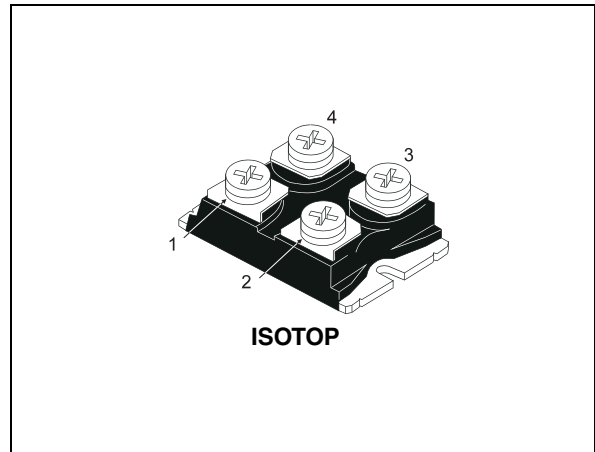


Figure 1. Internal schematic diagram

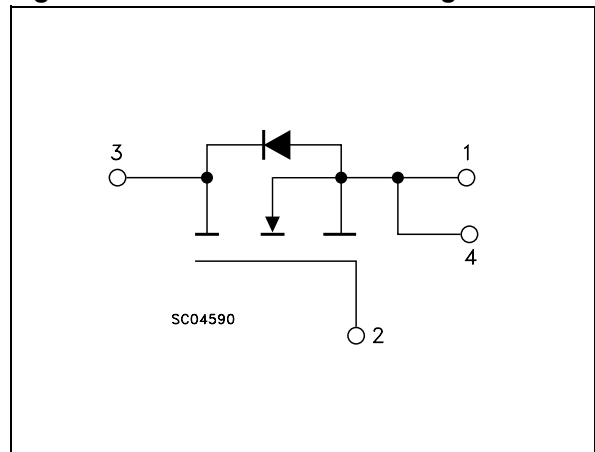


Table 1. Device summary

Order code	Marking	Package	Packaging
STE250NS10	E250NS10	ISOTOP	Tube

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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	± 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 T_{stg}	Operating junction temperature Storage temperature	150 -55 to 150	$^\circ\text{C}$

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

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

($T_{CASE}=25^{\circ}\text{C}$ 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 ($V_{GS} = 0$)	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$, $T_C = 125^{\circ}\text{C}$			50 500	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20 \text{ V}$			± 400	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$	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	Ω

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
$t_{d(on)}$	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 Figure 14)	-	110	-	ns
t_r	Rise time			380		ns
$t_{d(off)}$	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 Figure 13)	-	1100	-	ns
t_f	Fall time			300		ns
$t_{r(Voff)}$	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 Figure 15)	-	950	-	ns
t_f	fall time			330		ns
t_c	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}	Reverse recovery time	$I_{SD} = 220\text{ A}$, $V_{DD} = 30\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$, $T_j = 150^\circ\text{C}$ (see Figure 16)	-	200		ns
Q_{rr}	Reverse recovery charge			1.35		μC
I_{RRM}	Reverse recovery current			13.5		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 2. Safe operating area

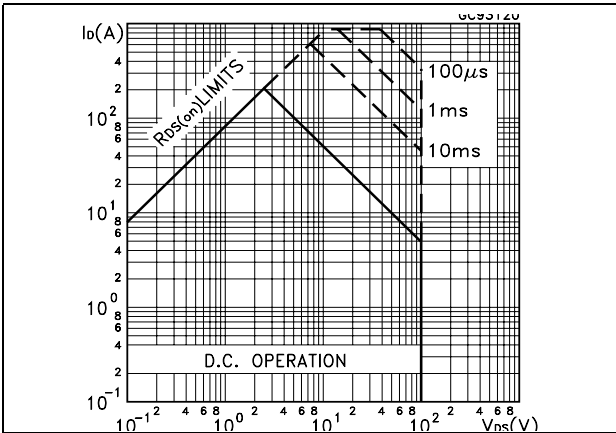


Figure 3. Thermal impedance

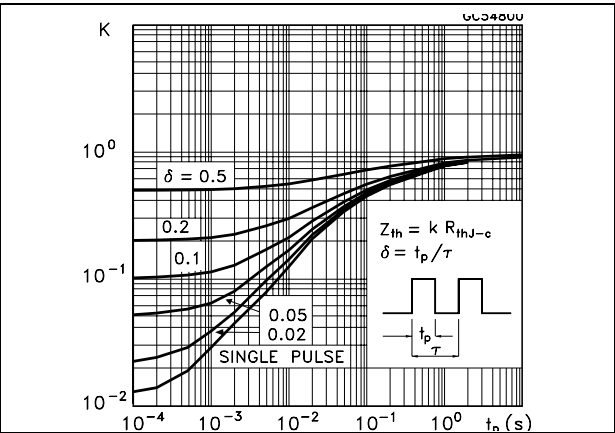


Figure 4. Output characteristics

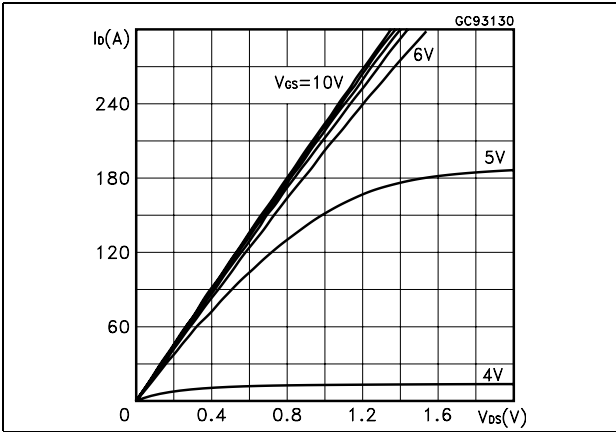


Figure 5. Transfer characteristics

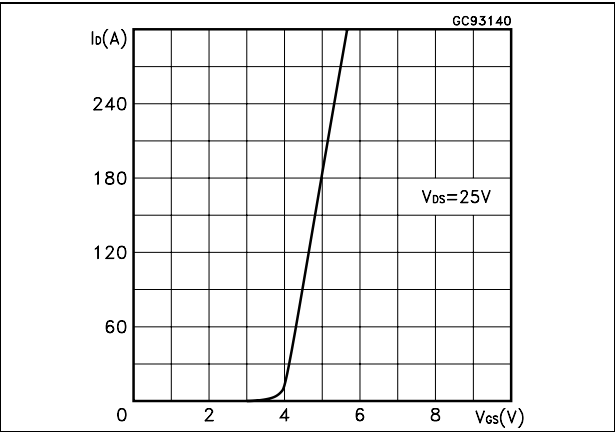


Figure 6. Transconductance

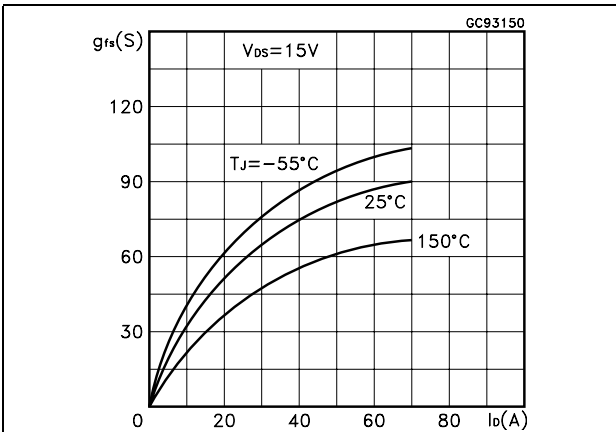


Figure 7. Static drain-source on resistance

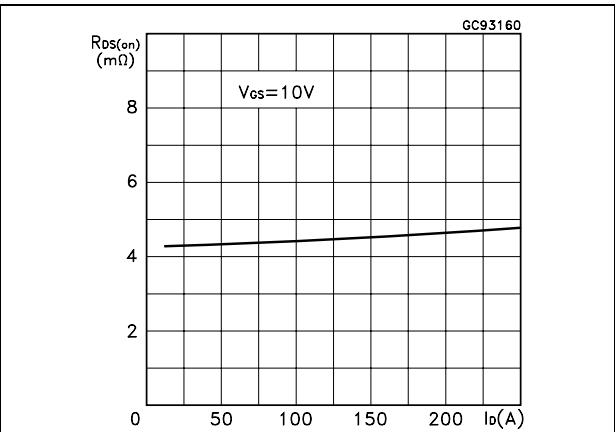


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

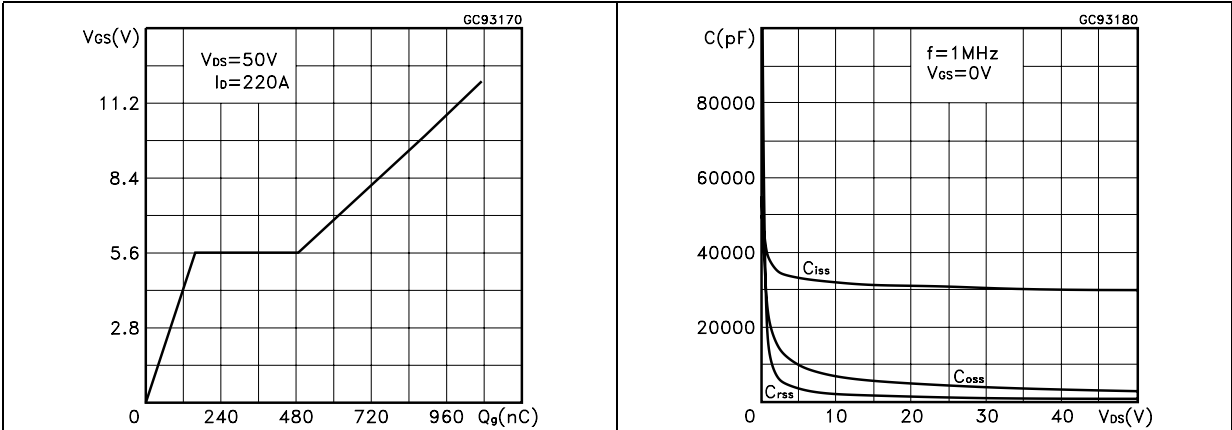


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

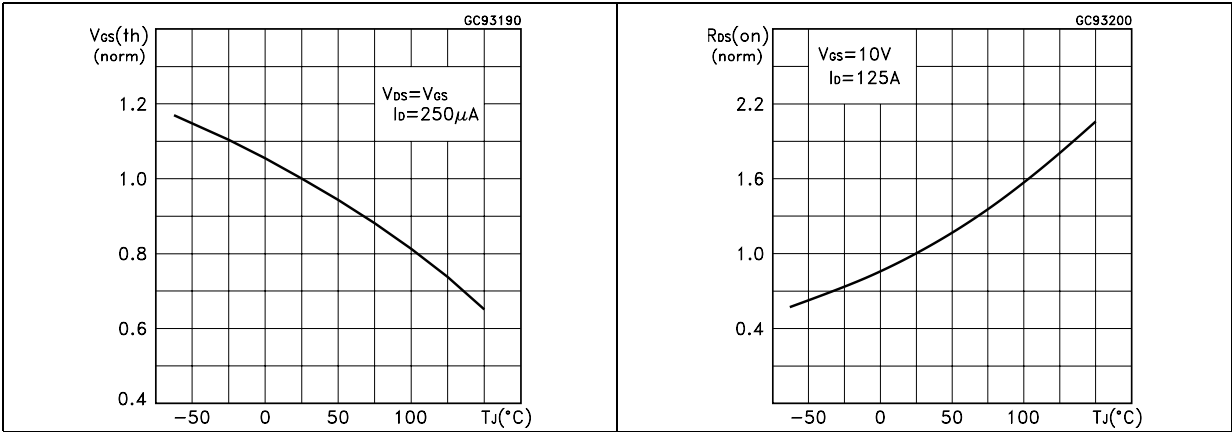
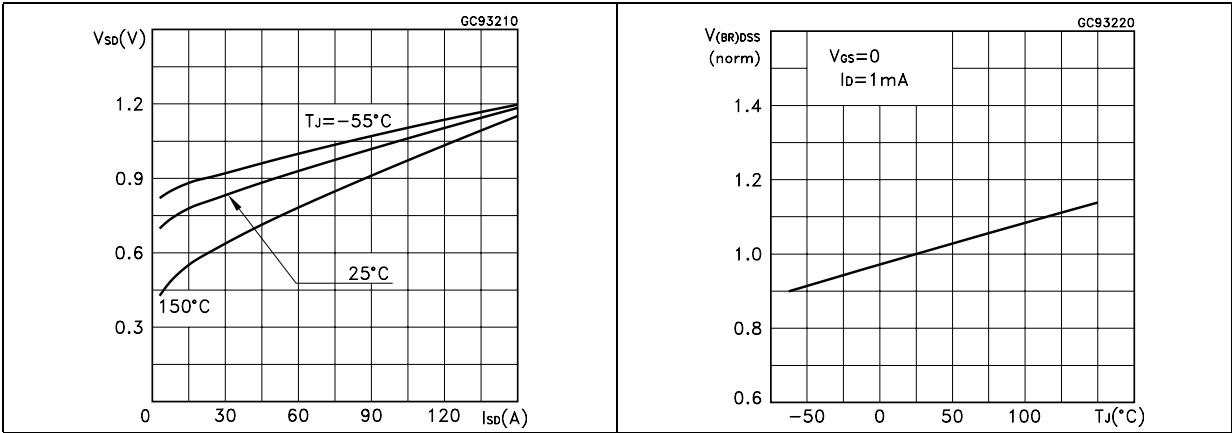


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized breakdown voltage vs temperature



3 Test circuits

Figure 14. Switching times test circuit for resistive load

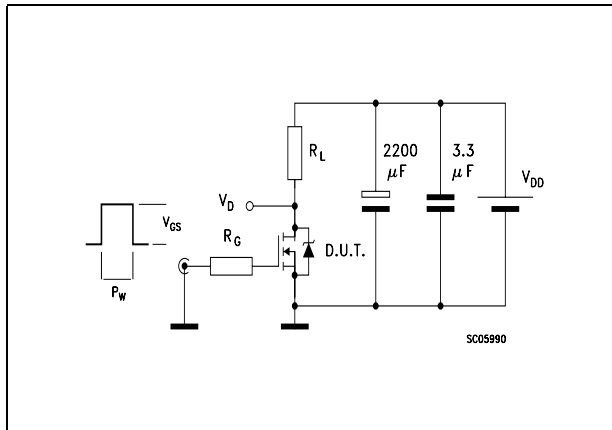


Figure 15. Gate charge test circuit

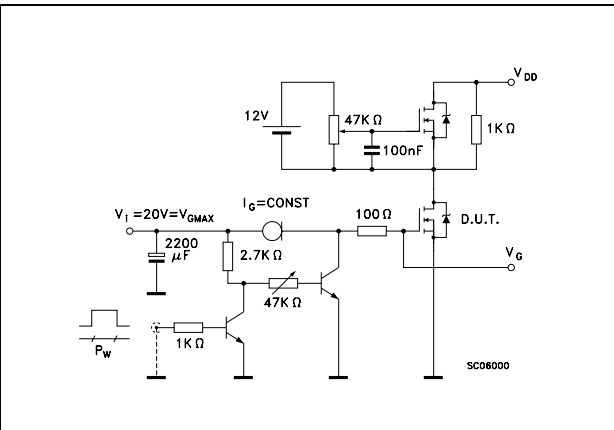


Figure 16. Test circuit for inductive load switching and diode recovery times

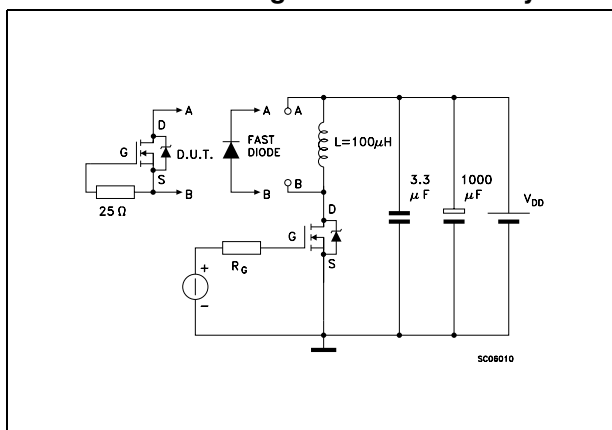


Figure 17. Unclamped inductive load test circuit

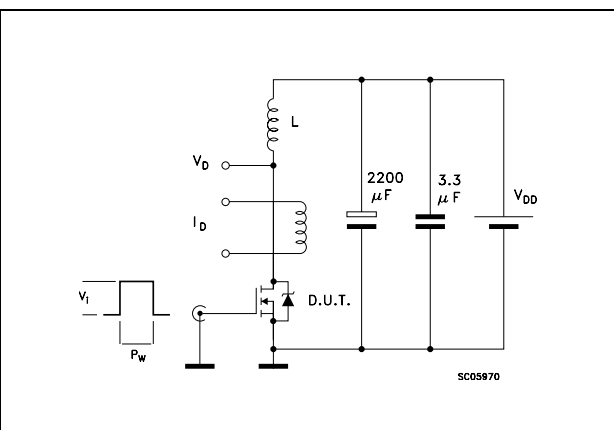


Figure 18. Unclamped inductive waveform

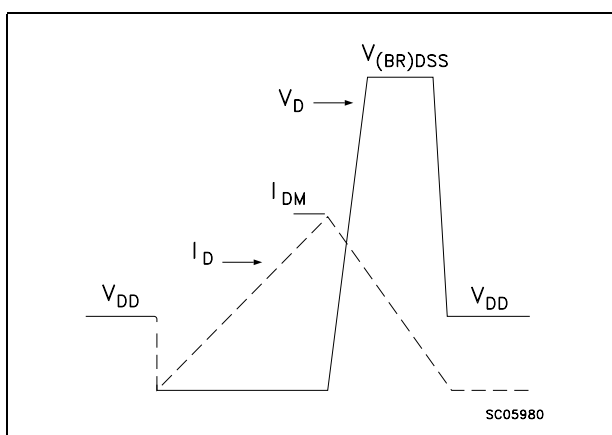
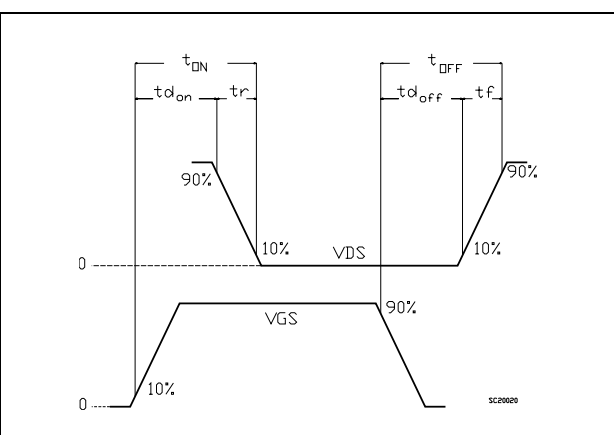


Figure 19. Switching time waveform

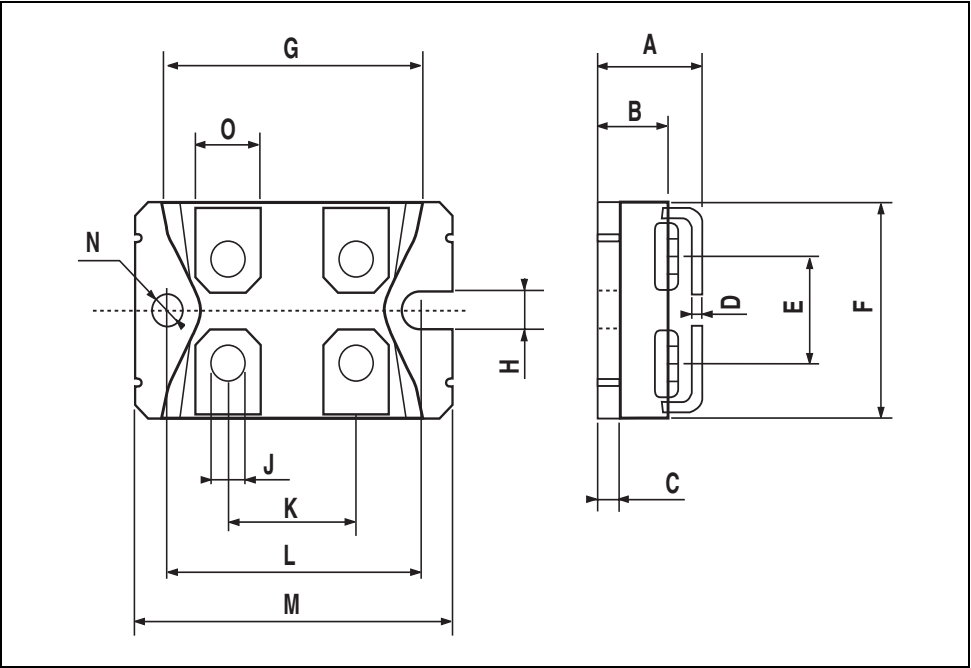


4 **Package mechanical data**

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: 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

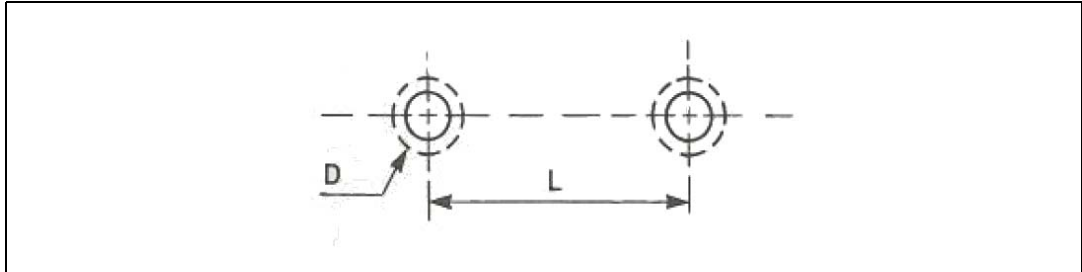


Table 9. Heatsink specification

Parameter	Value
Flatness (max concavity or convexity between fixing holes)	$\leq 20 \mu\text{m}$ (0.78 mils)
Surface finish	$\pm 1.2 \mu\text{m}$ (± 0.05 mils)
Fixing holes	D= M4 L= $30 \pm 3 \text{ mm}$ (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 Figure 21
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 ²
Lead inductance	≤ 5 nH

Figure 21. Mounting section

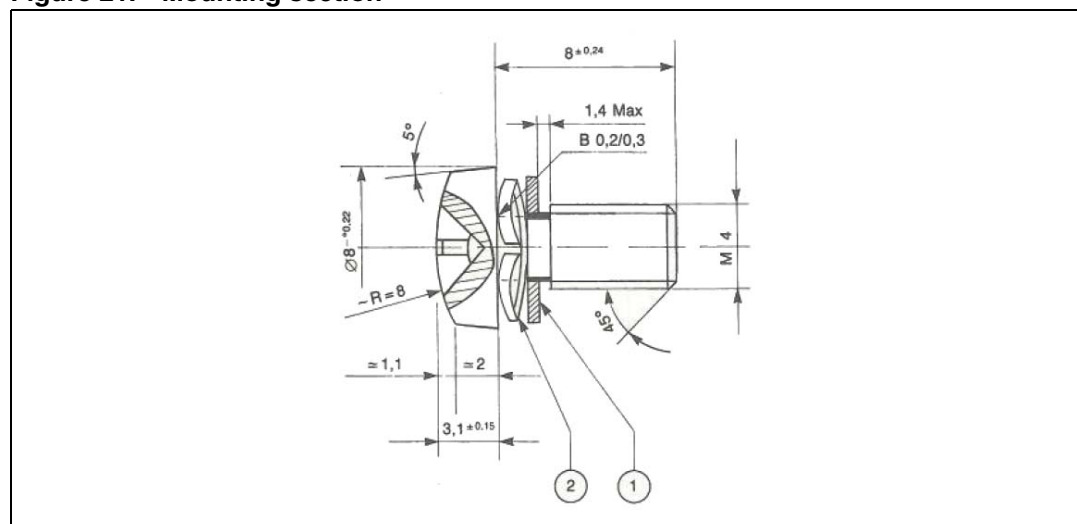


Figure 22. Cross form

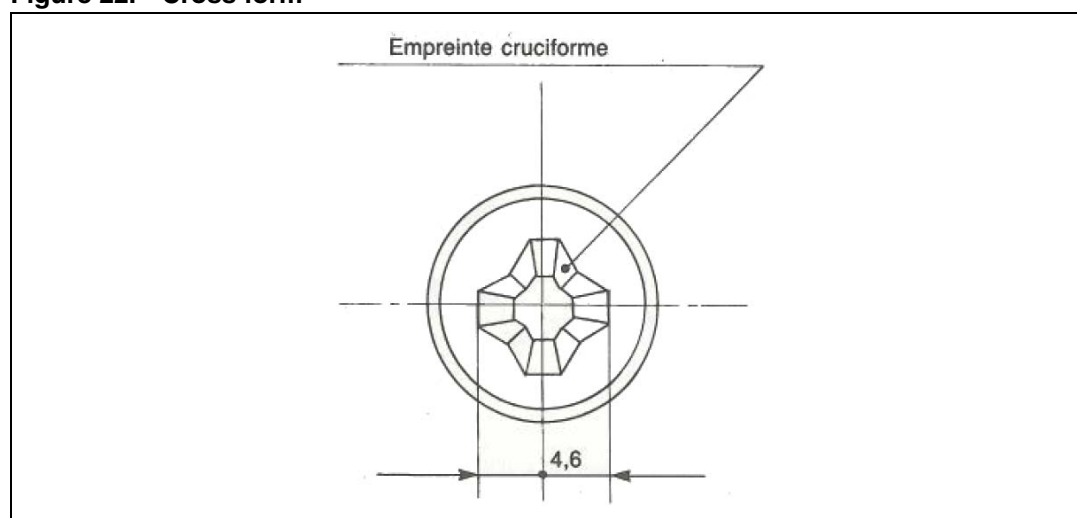


Table 12. Package for shipment

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 Section 5: Mounting information .

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