



# STE250NS10

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

## General features

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

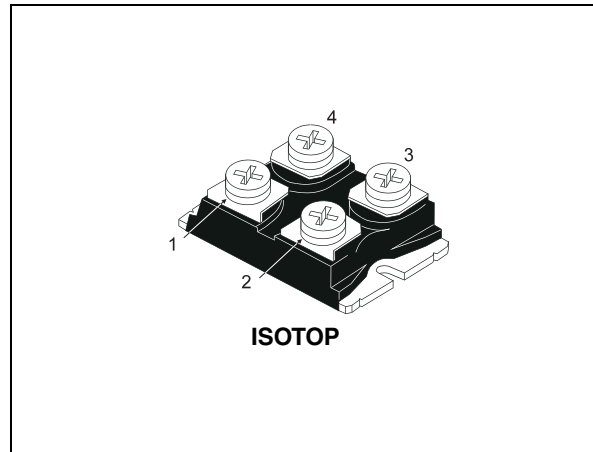
- Standard threshold drive
- 100% avalanche tested

## Description

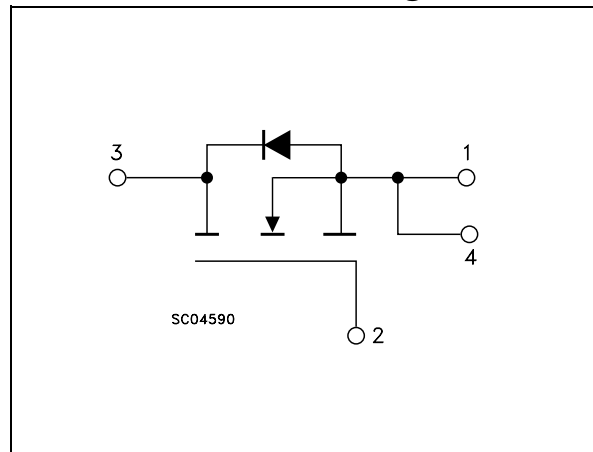
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STE250NS10	E250NS10	ISOTOP	Tube

# Contents

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# 1 Electrical ratings

**Table 1. 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/°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	°C
$T_{stg}$	Storage temperature	-55 to 150	

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

**Table 2. Thermal data**

$R_{thj-case}$	Thermal resistance junction-case Max	0.25	°CW
$R_{thj-a}$	Thermal resistance junction-ambient Max	50	°CW

**Table 3. 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 $T_J=25^\circ\text{C}$ , $I_d=I_{ar}$ , $V_{dd}=64\text{V}$ )	800	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	$I_D = 1 \text{ mA}, V_{GS} = 0$	100			V
$I_{DSS}$	Zero gate voltage	$V_{DS} = \text{Max rating}$			50	$\mu\text{A}$
	Drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $T_C = 125^{\circ}C$			500	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 400$	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	$V_{GS} = 10V, I_D = 125A$		0.0045	0.0055	$\Omega$

**Table 5. Dynamic**

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

**Table 6. Switching times**

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

**Table 7. 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	$I_{SD} = 220A, V_{GS} = 0$			1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 220A, V_{DD} = 30V$ $di/dt = 100A/\mu s,$ $T_j = 150^\circ C$ (see Figure 15)		200		ns
$Q_{rr}$	Reverse recovery charge			1.35		$\mu C$
$I_{RRM}$	Reverse recovery current			13.5		A

1. Pulse width limited by safe operating area.

2. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

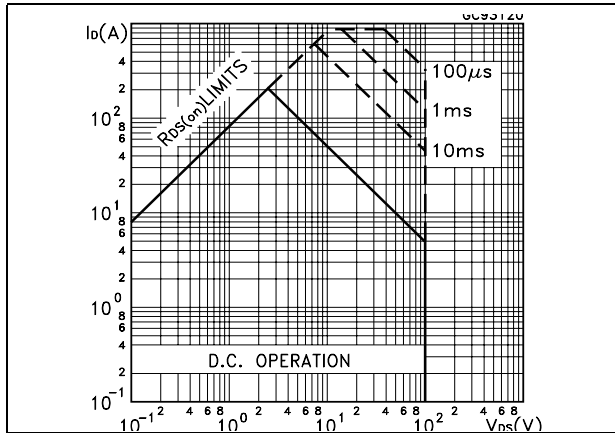


Figure 2. Thermal impedance

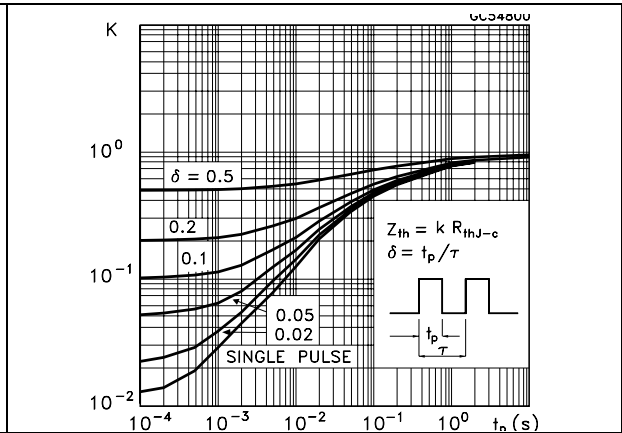


Figure 3. Output characteristics

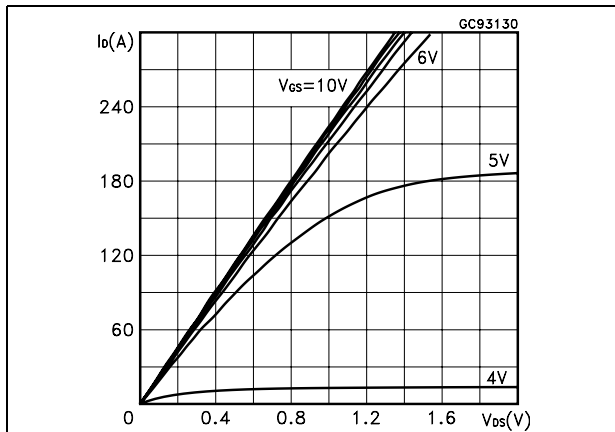


Figure 4. Transfer characteristics

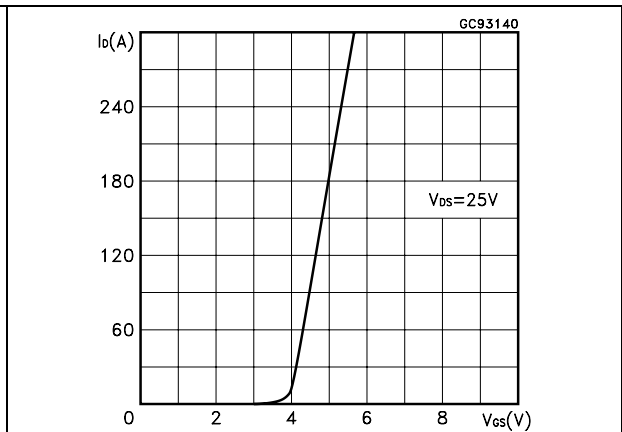


Figure 5. Transconductance

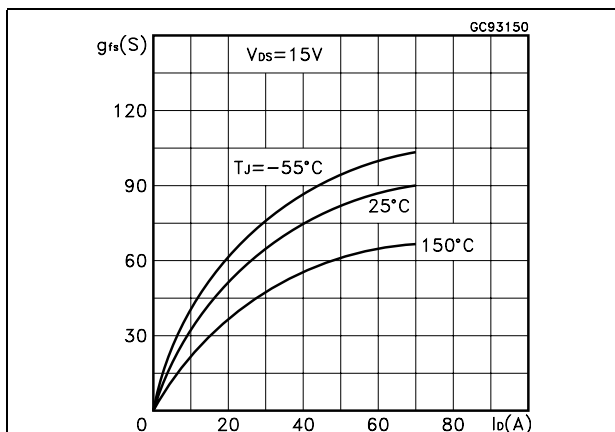


Figure 6. Static drain-source on resistance

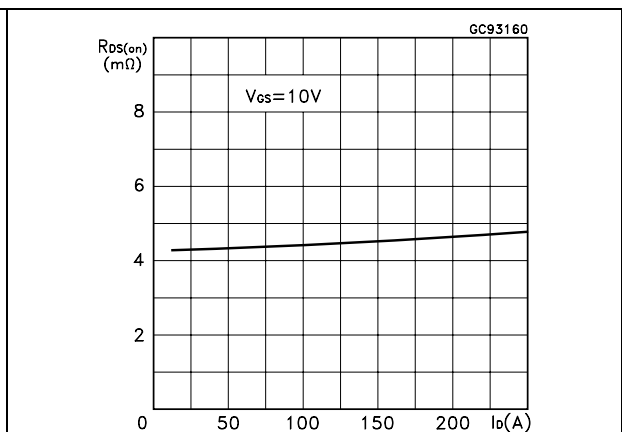


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

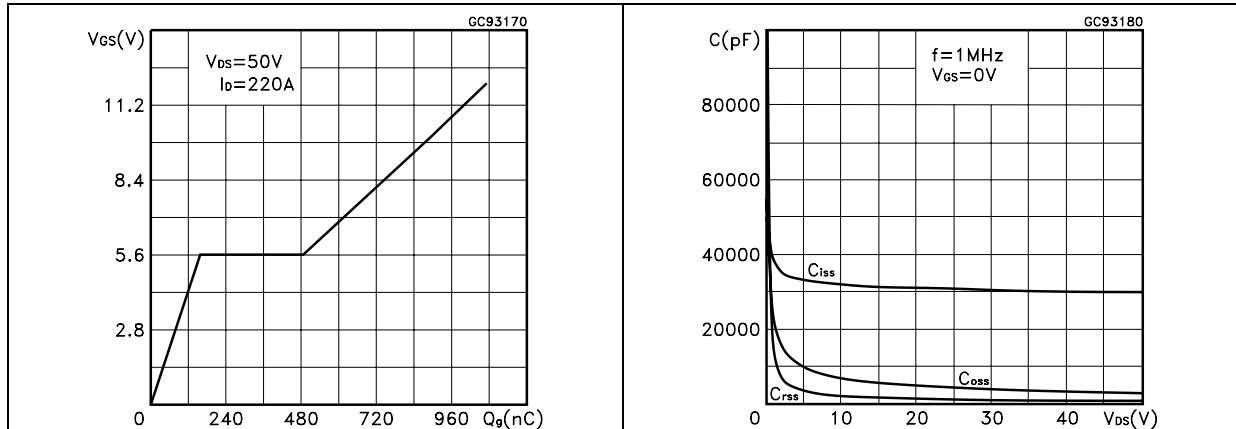


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

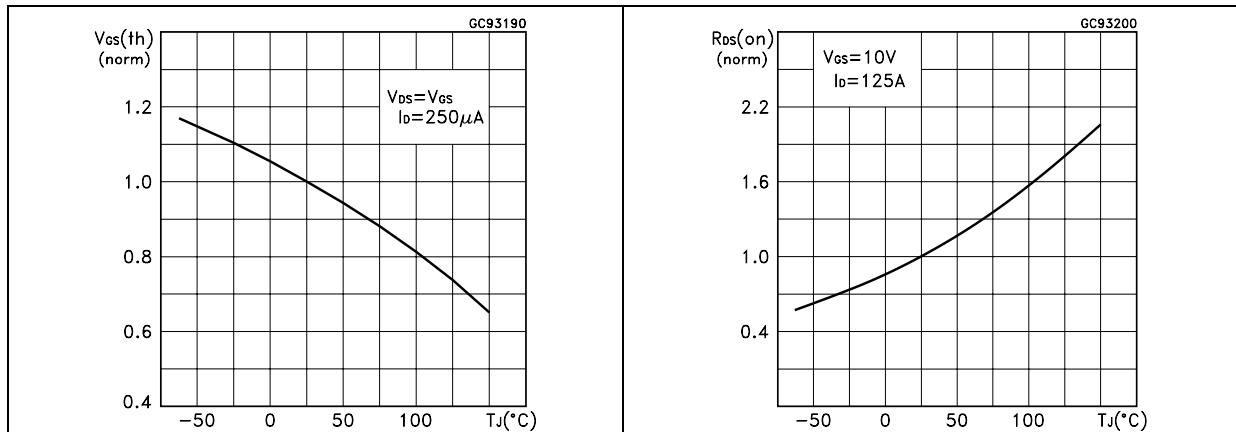
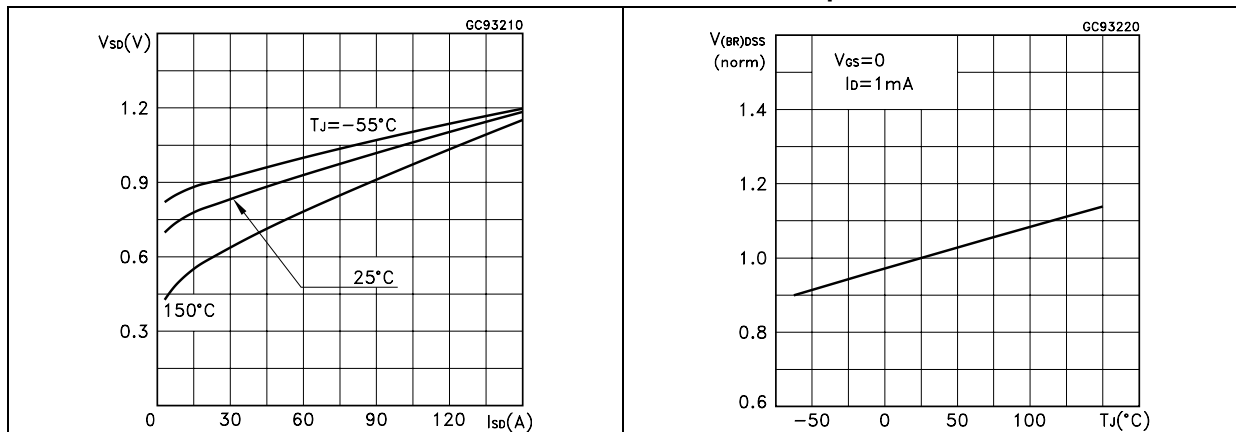


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized breakdown voltage vs temperature



### 3 Test circuit

Figure 13. Switching times test circuit for resistive load

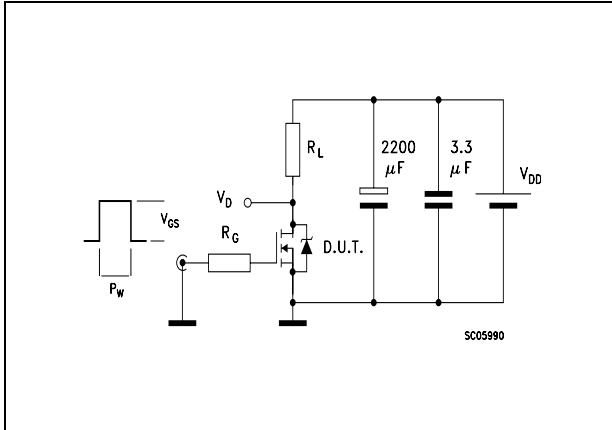


Figure 14. Gate charge test circuit

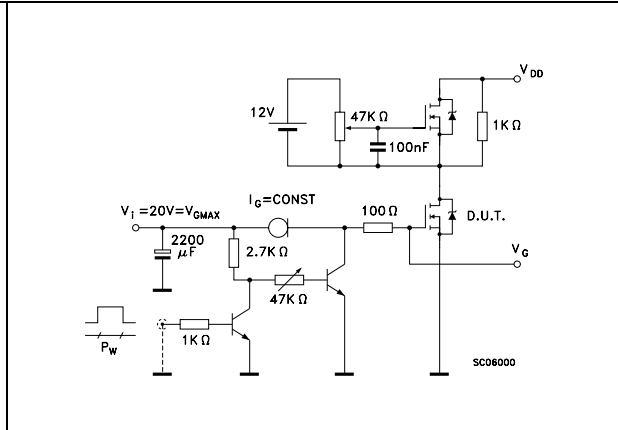


Figure 15. Test circuit for inductive load switching and diode recovery times

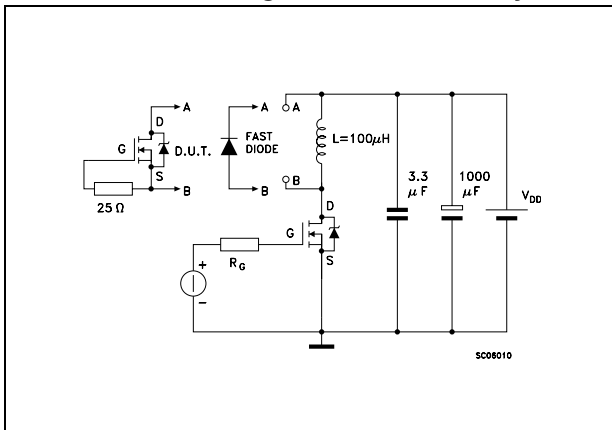


Figure 16. Unclamped Inductive load test circuit

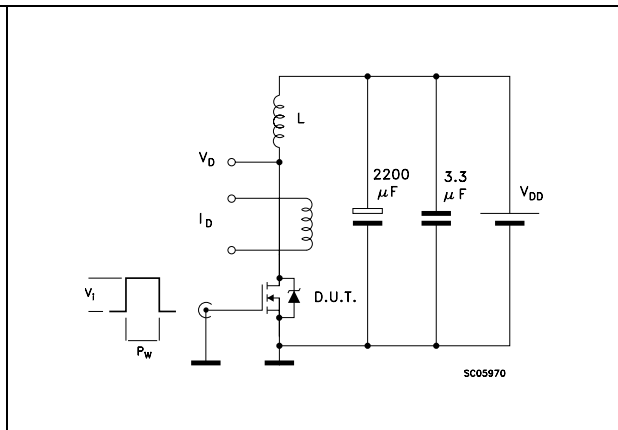


Figure 17. Unclamped inductive waveform

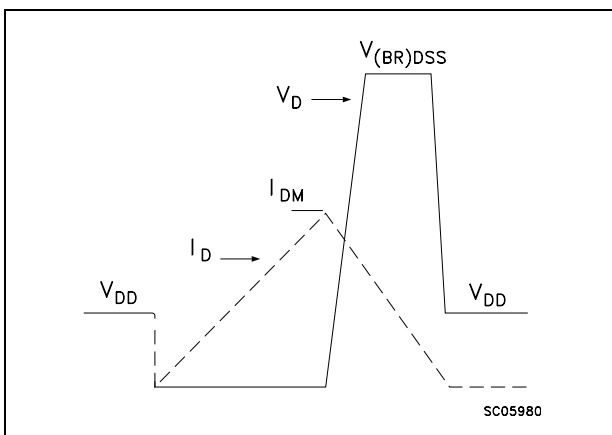
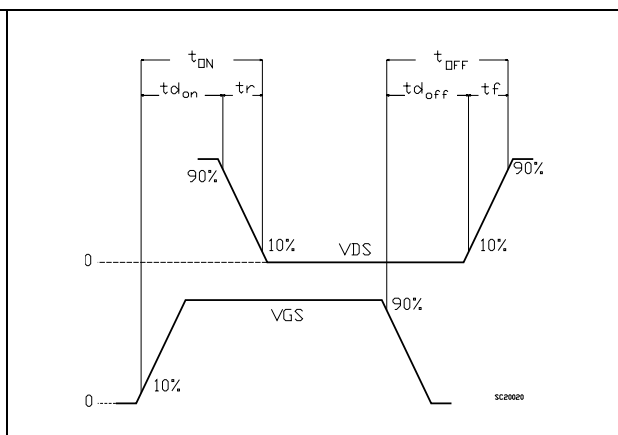


Figure 18. Switching time waveform



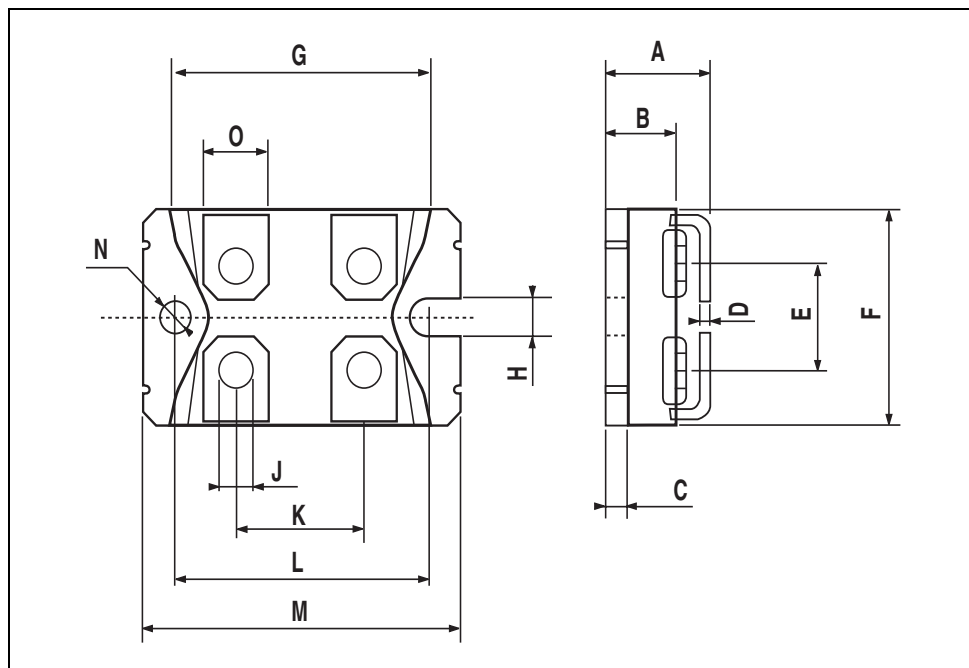


## 4 Package mechanical data

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

**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 Revision history

**Table 8. Revision history**

Date	Revision	Changes
21-Jun-2004	1	Complete version
04-Oct-2006	2	New template, no content change

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