



# STL6N3LLH6

N-channel 30 V, 0.021  $\Omega$  typ., 6 A STripFET™ VI DeepGATE™ Power MOSFET in a PowerFLAT™ 2x2 package

Datasheet — preliminary data

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STL6N3LLH6	30 V	0.025 $\Omega$ (V <sub>GS</sub> =10 V) 0.04 $\Omega$ (V <sub>GS</sub> =4.5 V)	6 A	2.4 W

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- High avalanche ruggedness
- Low gate drive power losses
- Very low switching gate charge

## Applications

- Switching application

## Description

This device is an N-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

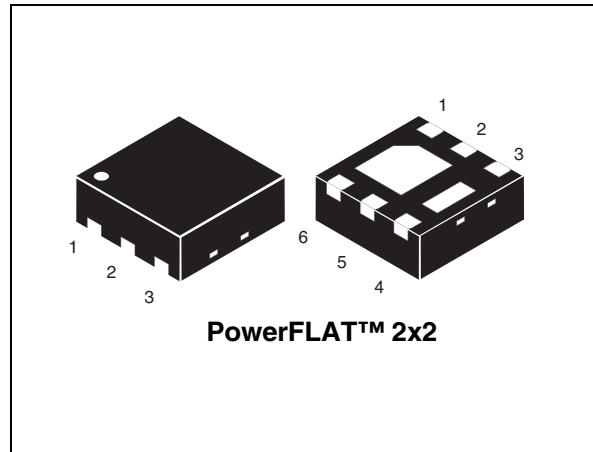


Figure 1. Internal schematic diagram

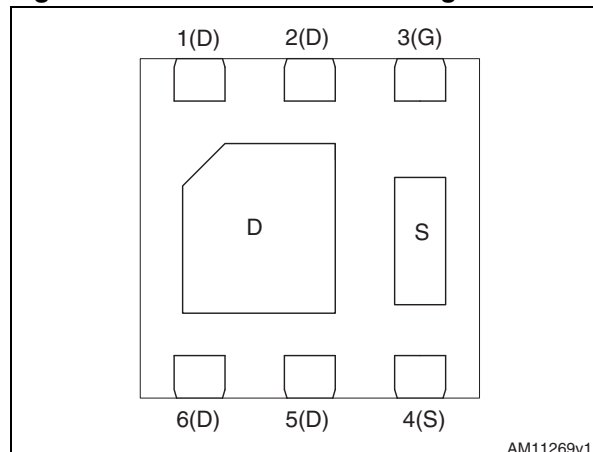


Table 1. Device summary

Order code	Marking	Package	Packaging
STL6N3LLH6	STG1	PowerFLAT™ 2x2	Tape and reel

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	30	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	6	A
$I_D$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	3.75	A
$I_{DM}^{(1)}$	Drain current (pulsed)	24	A
$P_{TOT}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	2.4	W
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	52	$^\circ\text{C/W}$

1. When mounted on FR-4 board of 1inch<sup>2</sup>, 2oz Cu,  $t < 10\text{ sec}$

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  unless otherwise specified).

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 30\text{ V}$ , $V_{DS} = 30\text{ V}$ , $T_J = 125\text{ °C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	1			V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 3\text{ A}$ $V_{GS} = 4.5\text{ V}$ , $I_D = 3\text{ A}$		0.021 0.032	0.025 0.04	$\Omega$ $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 24\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	283	-	pF
$C_{oss}$	Output capacitance			61		
$C_{rss}$	Reverse transfer capacitance			31		
$Q_g$	Total gate charge	$V_{DD} = 10\text{ V}$ , $I_D = 6\text{ A}$ $V_{GS} = 4.5\text{ V}$ (see Figure 14)	-	3.6	-	nC
$Q_{gs}$	Gate-source charge			1.5		
$Q_{gd}$	Gate-drain charge			1.1		

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 10\text{ V}$ , $I_D = 3\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$ (see Figure 13)	-	4.8	-	ns
$t_r$	Rise time			11.2		
$t_{d(off)}$	Turn-off delay time			9.4		
$t_f$	Fall time			5.4		

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		6	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		24	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 6 \text{ A}, V_{GS} = 0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 6 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 16 \text{ V}, T_J = 150 \text{ }^\circ\text{C}$	-	10.6		ns
$Q_{rr}$	Reverse recovery charge			2.8		nC
$I_{RRM}$	Reverse recovery current			0.5		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

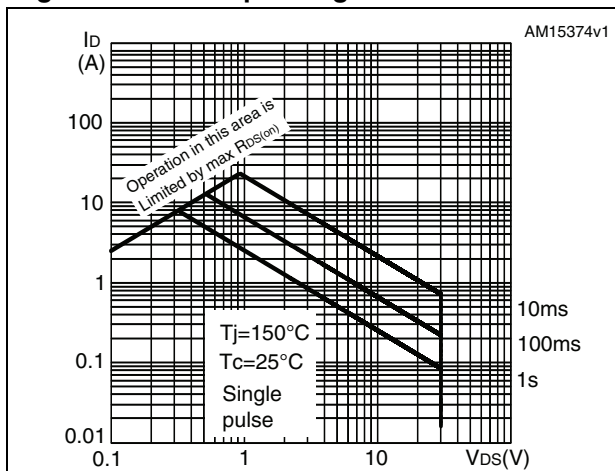


Figure 3. Thermal impedance

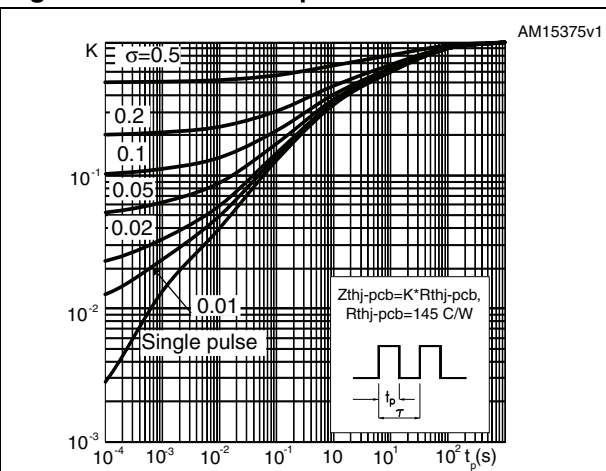


Figure 4. Output characteristics

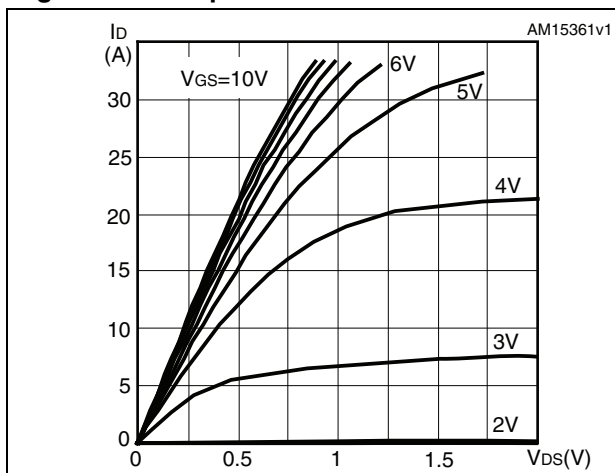


Figure 5. Transfer characteristics

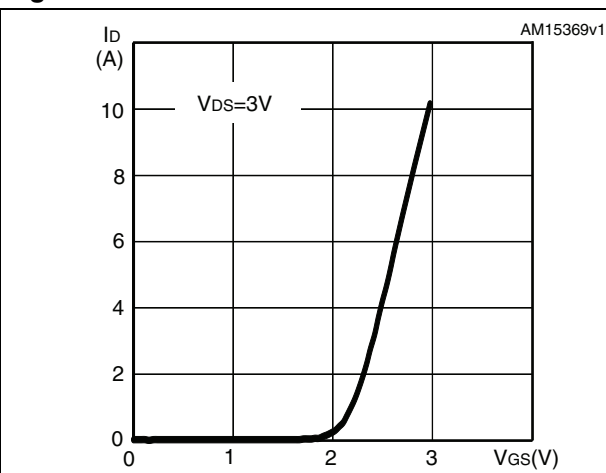


Figure 6. Gate charge vs gate-source voltage

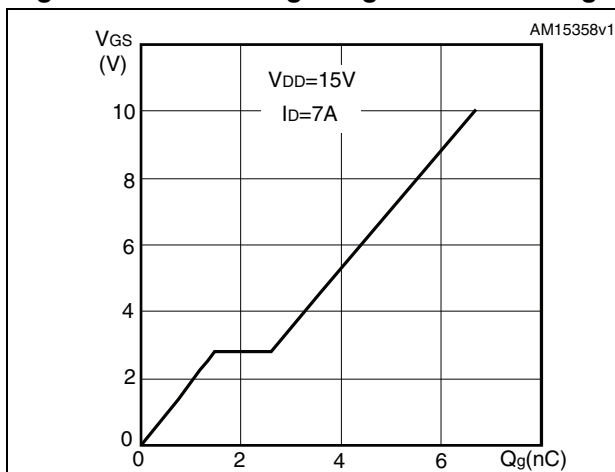


Figure 7. Static drain-source on-resistance

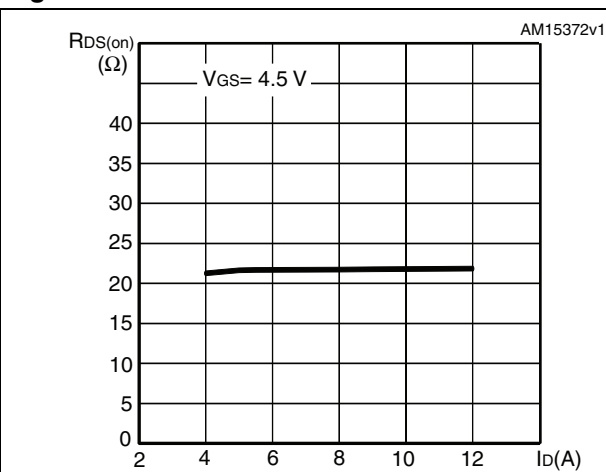


Figure 8. Capacitance variations

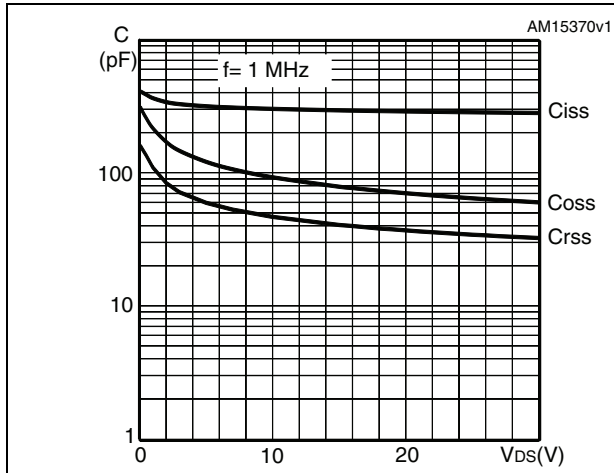


Figure 9. Normalized on-resistance vs temperature

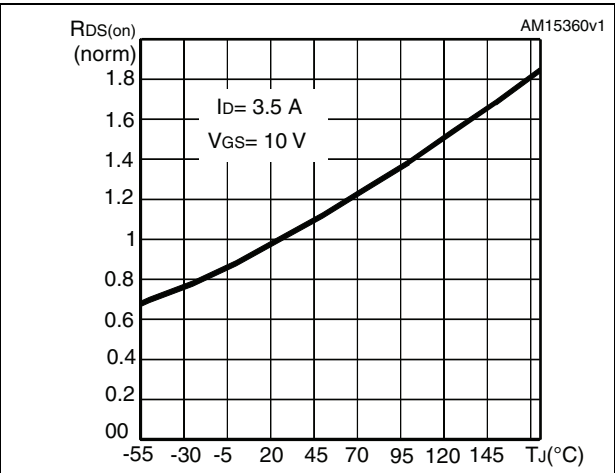


Figure 10. Normalized gate threshold voltage vs temperature

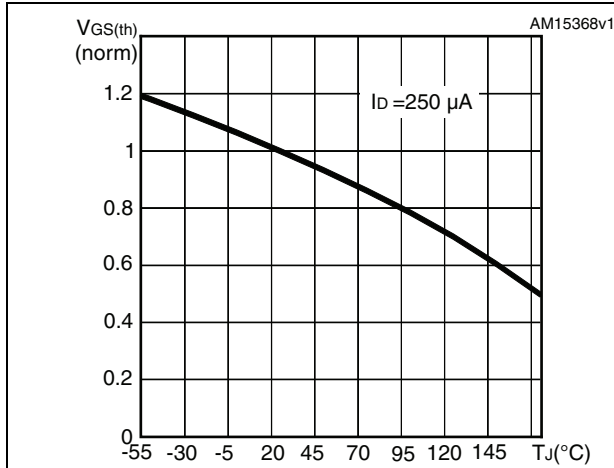


Figure 11. Normalized B<sub>VDSS</sub> vs temperature

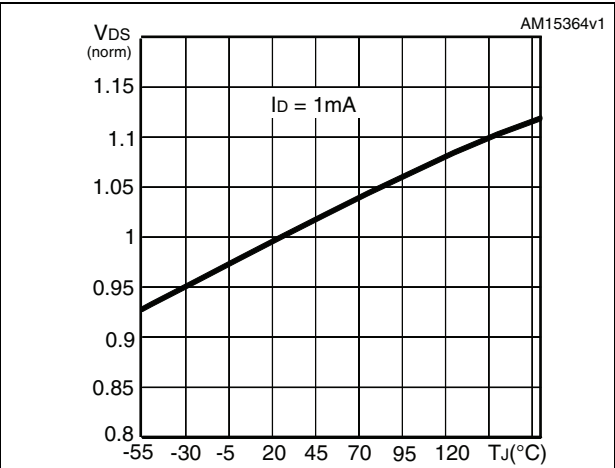
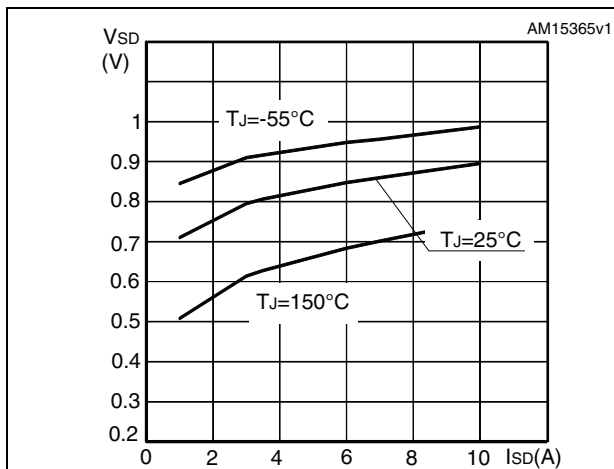


Figure 12. Source-drain diode forward characteristics

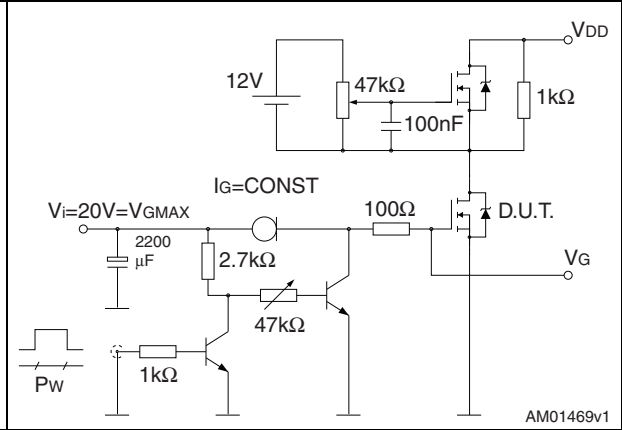


### 3 Test circuits

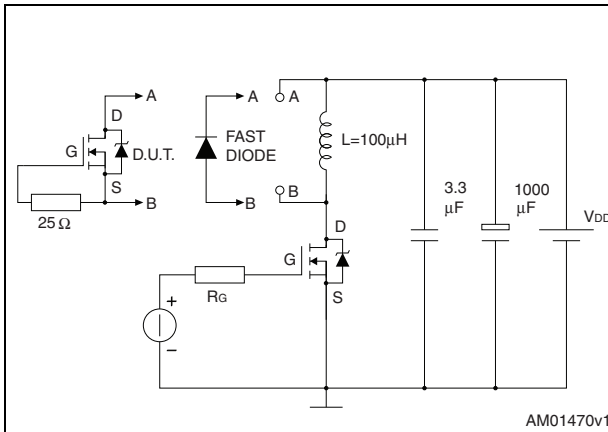
**Figure 13. Switching times test circuit for resistive load**



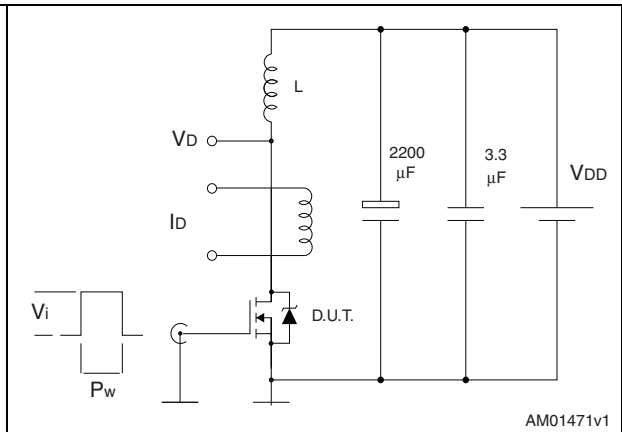
**Figure 14. Gate charge test circuit**



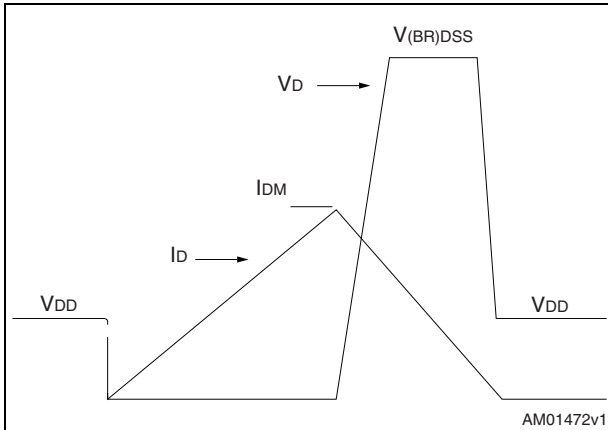
**Figure 15. Test circuit for inductive load switching and diode recovery times**



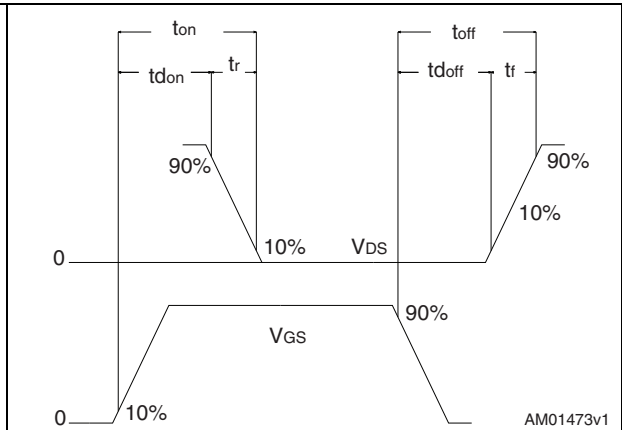
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**





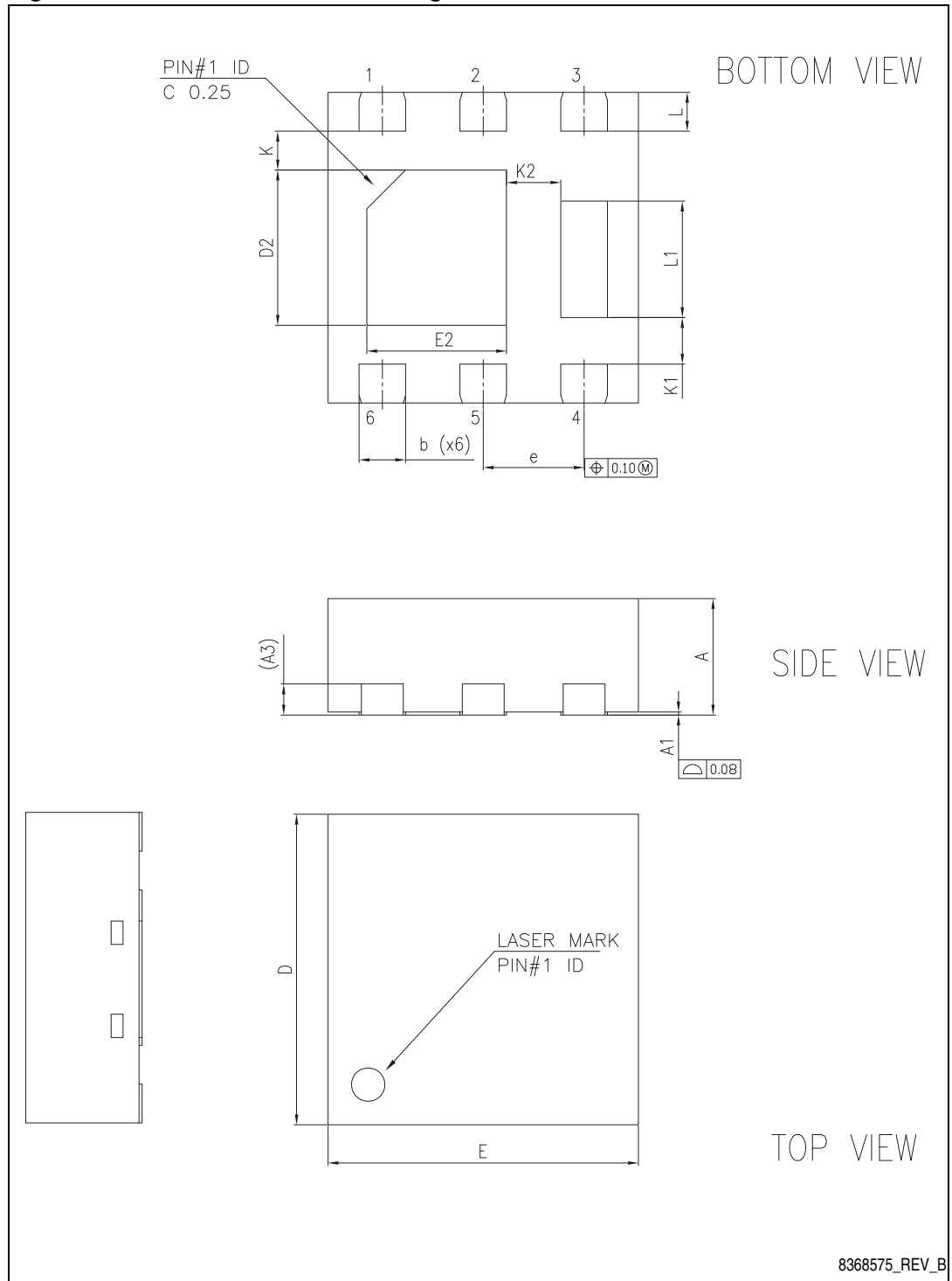
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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<sup>®</sup> is an ST trademark.

Table 8. PowerFLAT™ 2x2 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.20	
b	0.25	0.30	0.35
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.90	1.00	1.10
E2	0.80	0.90	1.00
e	0.55	0.65	0.75
K	0.15	0.25	0.35
K1	0.20	0.30	0.40
K2	0.25	0.35	0.45
L	0.20	0.25	0.30
L1	0.65	0.75	0.85

Figure 19. PowerFLAT™ 2 x 2 drawing





## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
25-May-2012	1	First release
11-Oct-2012	2	<ul style="list-style-type: none"><li>– Added <a href="#">Section 2.1: Electrical characteristics (curves)</a>.</li><li>– <math>R_{DS(on)}</math> values (typ. and max.) updated</li><li>– Typical values updated in <a href="#">Table 5</a>, <a href="#">6</a> and <a href="#">7</a></li><li>– Minor text changes.</li></ul>

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