

P-channel 30 V, 0.048 Ω typ., 4 A STripFET™ H6 DeepGATE™ Power MOSFET in PowerFLAT™ 2x2 package

Datasheet - preliminary data

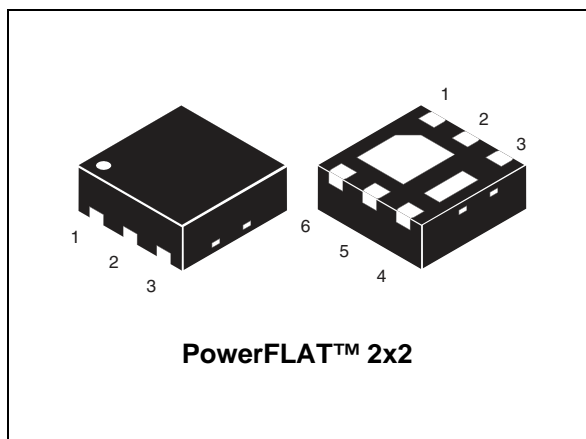
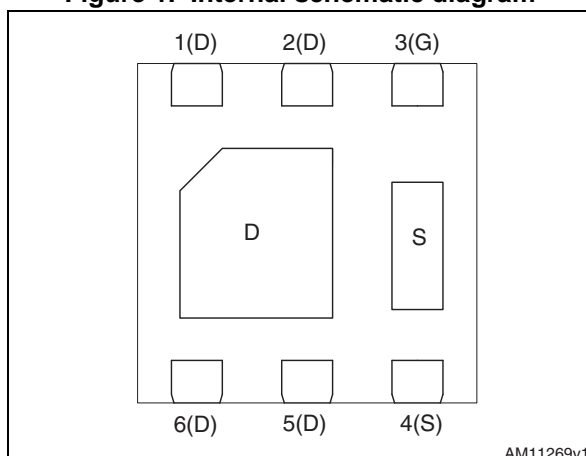


Figure 1. Internal schematic diagram



Features

Order code	V _{DSS}	R _{DS(on)} max.	I _D
STL4P3LLH6	30 V	0.056 Ω at 10 V	4 A

- Very low on-resistance R_{DS(on)}
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

Applications

- Switching application

Description

This device is a P-channel Power MOSFET developed using the STripFET™ H6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R_{DS(on)} in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STL4P3LLH6	4K3L	PowerFLAT™ 2x2	Tape and reel

Note: For the P-channel MOSFET the actual polarity of the voltages and the current must be reversed.

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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	± 20	V
I_D	Drain current (continuous) at $T_{amb} = 25\text{ }^\circ\text{C}$	4	A
I_D	Drain current (continuous) at $T_{amb} = 100\text{ }^\circ\text{C}$	2.75	A
$I_{DM}^{(1)}$	Drain current (pulsed)	16	A
P_{TOT}	Total dissipation at $T_{amb} = 25\text{ }^\circ\text{C}$	2.4	W
T_J	Operating junction temperature	150	$^\circ\text{C}$
T_{stg}	Storage temperature	-55 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area

Table 3. Thermal resistance

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

1. When mounted on FR-4 board of 1inch², 2oz Cu, $t < 10$ sec

Note: For the P-channel MOSFET the actual polarity of the voltages and the current must be reversed.

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	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V}, T_J = 125\text{ °C}$			10	
I_{GSS}	Gate body leakage current	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 2\text{ A}$		0.048	0.056	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 2\text{ A}$		0.075	0.09	

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	639	-	μF
C_{oss}	Output capacitance		-	79	-	
C_{rss}	Reverse transfer capacitance		-	52	-	
Q_g	Total gate charge	$V_{DD} = 15\text{ V}, I_D = 4\text{ A}, V_{GS} = 4.5\text{ V}$	-	6	-	nC
Q_{gs}	Gate-source charge		-	1.9	-	
Q_{gd}	Gate-drain charge		-	2.1	-	

Table 6. Switching times

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}, I_D = 4\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$	-	5.4	-	ns
t_r	Rise time		-	5	-	
$t_{d(off)}$	Turn-off delay time		-	19.2	-	
t_f	Fall time		-	3.4	-	

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 4 \text{ A}$, $V_{GS} = 0$	-	-	1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 4 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 16 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$	-	11.2	-	ns
Q_{rr}	Reverse recovery charge		-	3.5	-	nC
I_{RRM}	Reverse recovery current		-	0.6	-	A

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

Note: For the P-channel MOSFET the actual polarity of the voltages and the current must be reversed.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

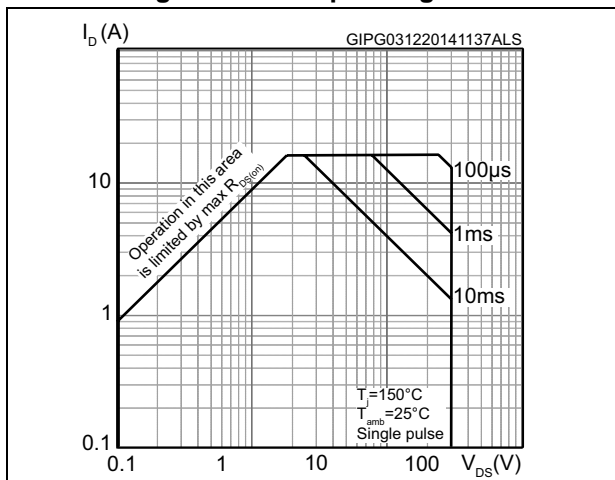


Figure 3. Thermal impedance

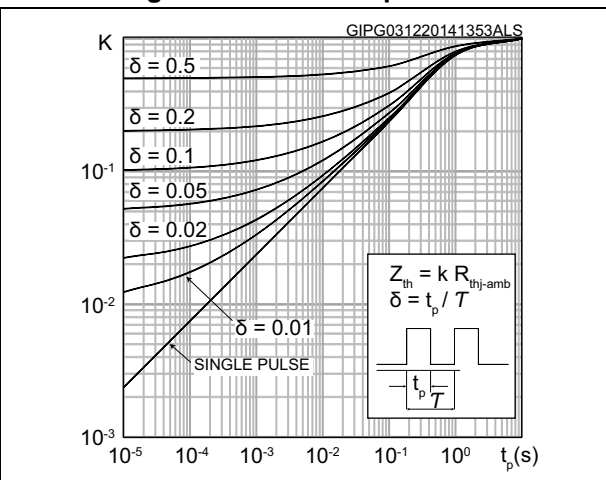


Figure 4. Output characteristics

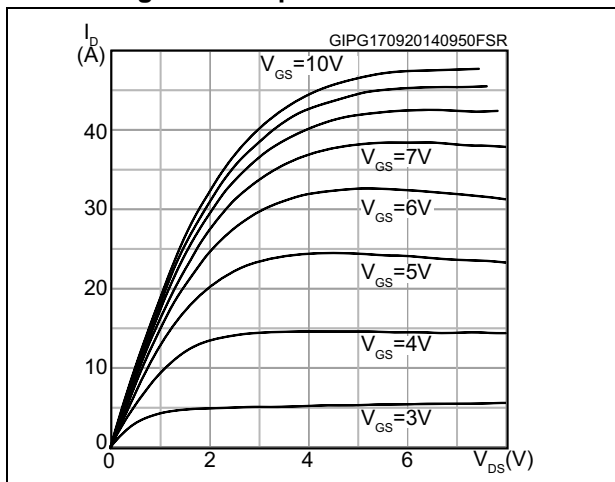


Figure 5. Transfer characteristics

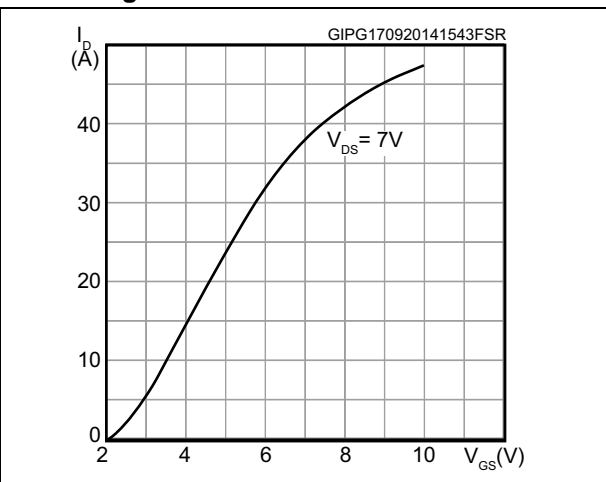


Figure 6. Gate charge vs gate-source voltage

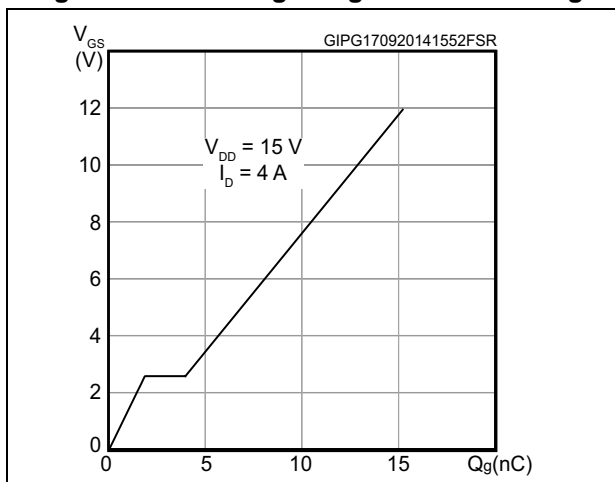


Figure 7. Static drain-source on-resistance

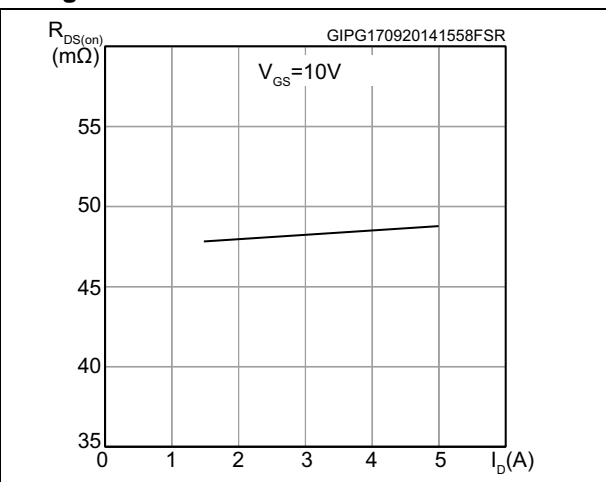


Figure 8. Normalized $V_{(BR)DSS}$ vs temperature

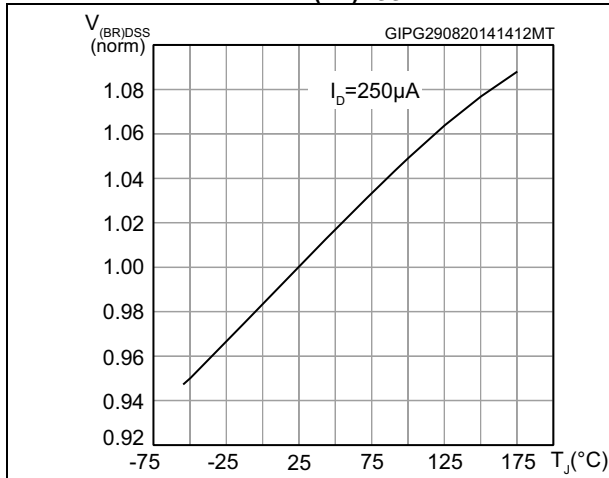


Figure 9. Capacitance variations

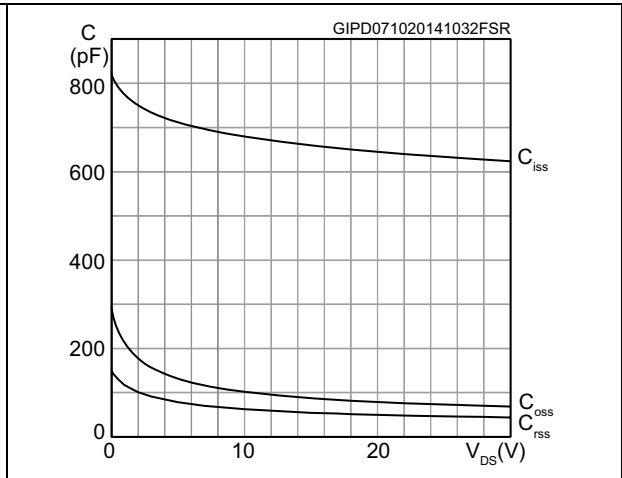


Figure 10. Normalized gate threshold voltage vs. temperature

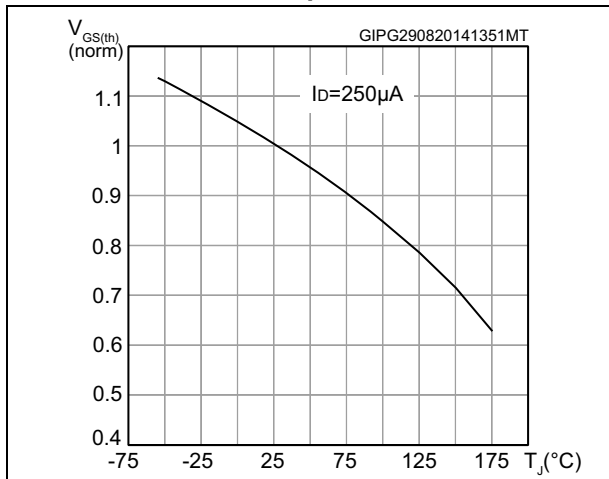


Figure 11. Normalized on-resistance vs. temperature

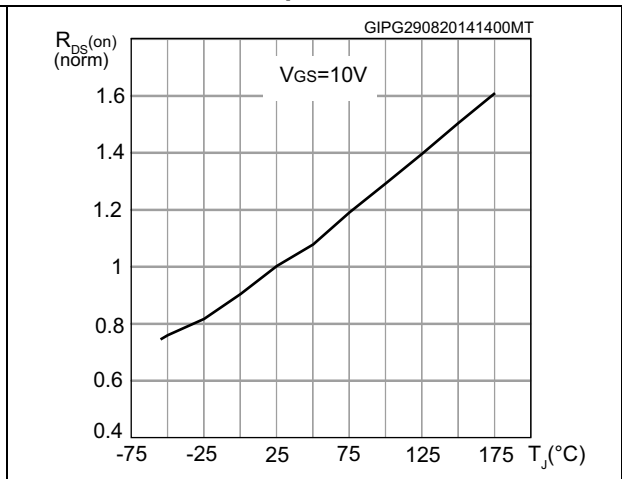
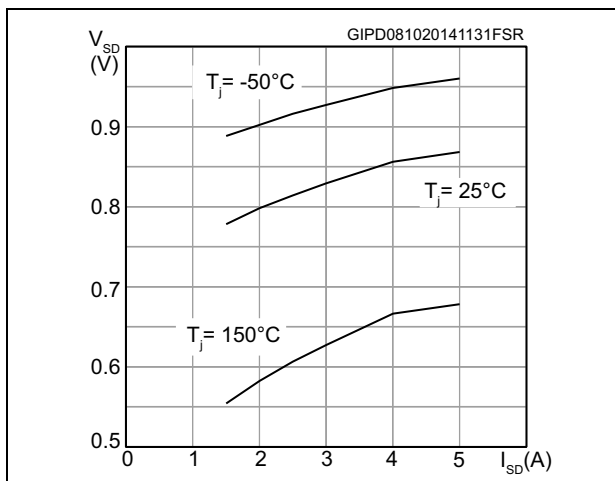


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

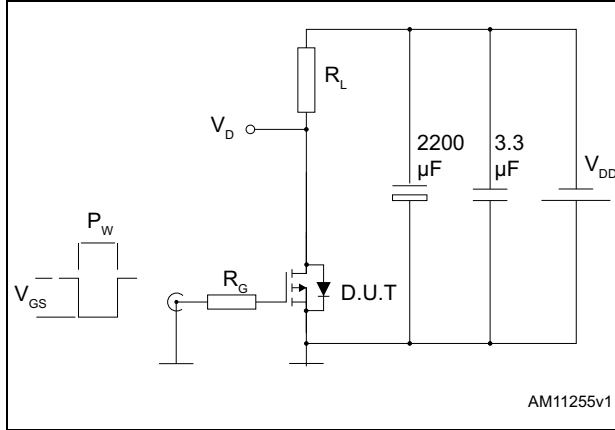


Figure 14. Gate charge test circuit

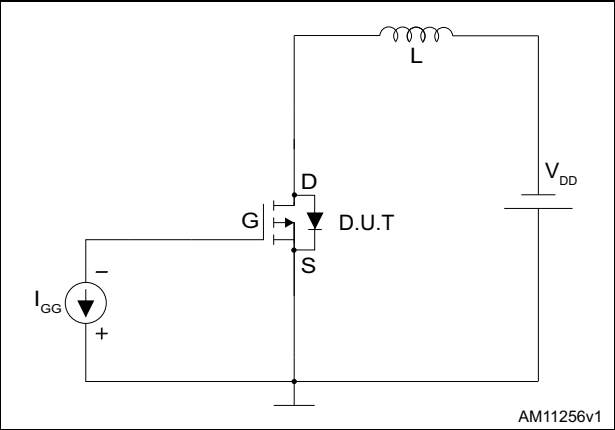
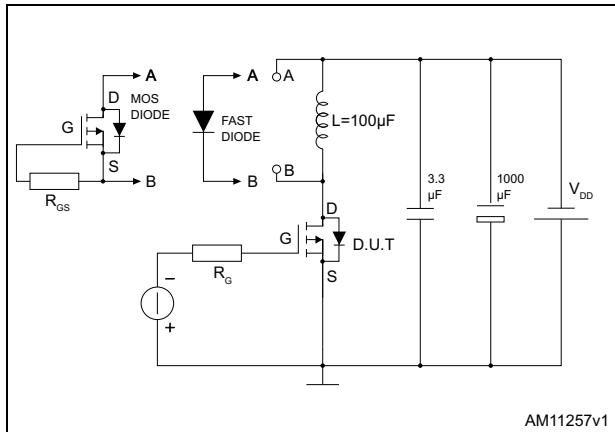


Figure 15. Test circuit for inductive load switching and diode recovery times



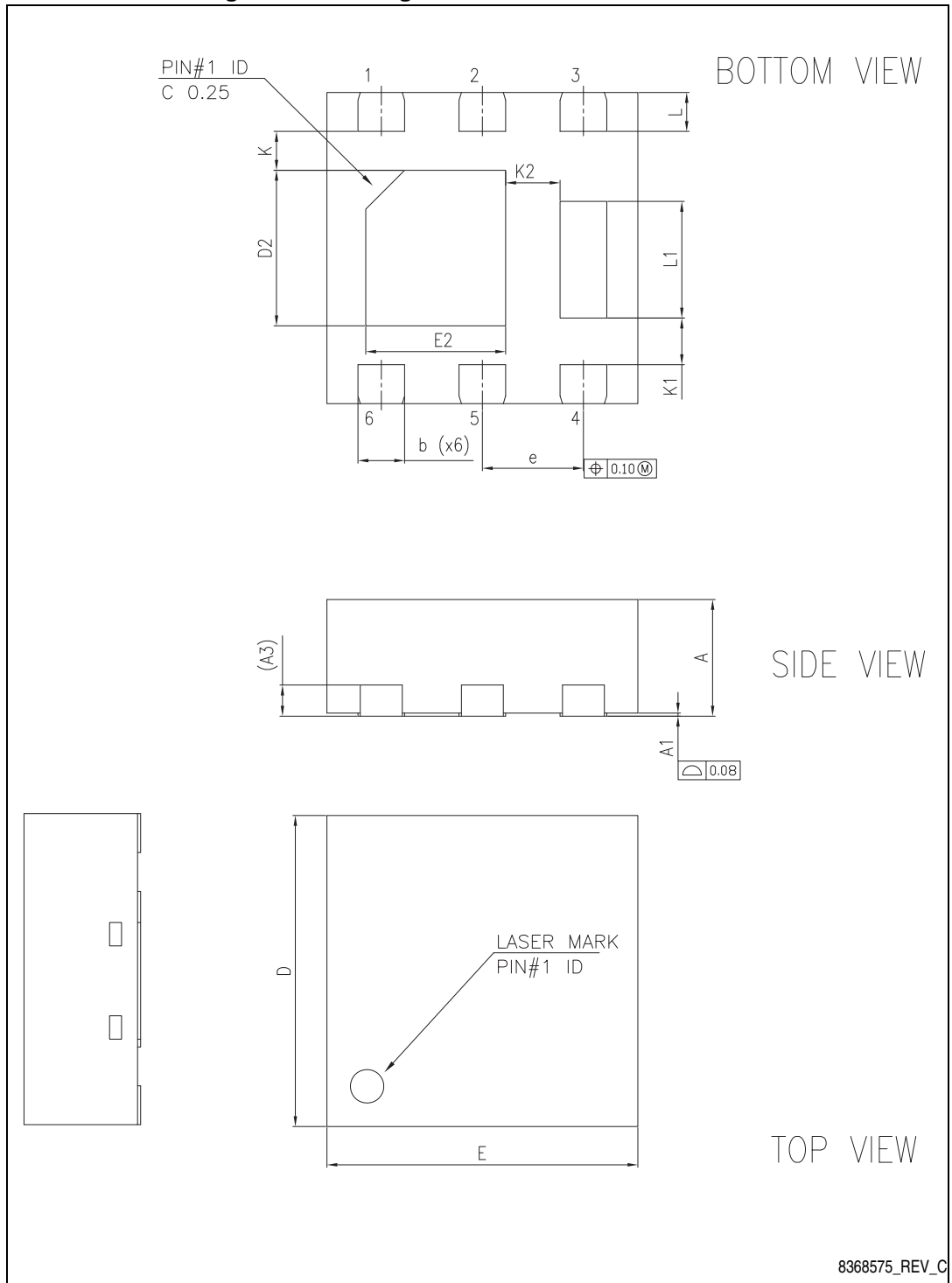
4 Package mechanical data

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.

Table 8. PowerFLAT™ 2 x 2 mechanical data

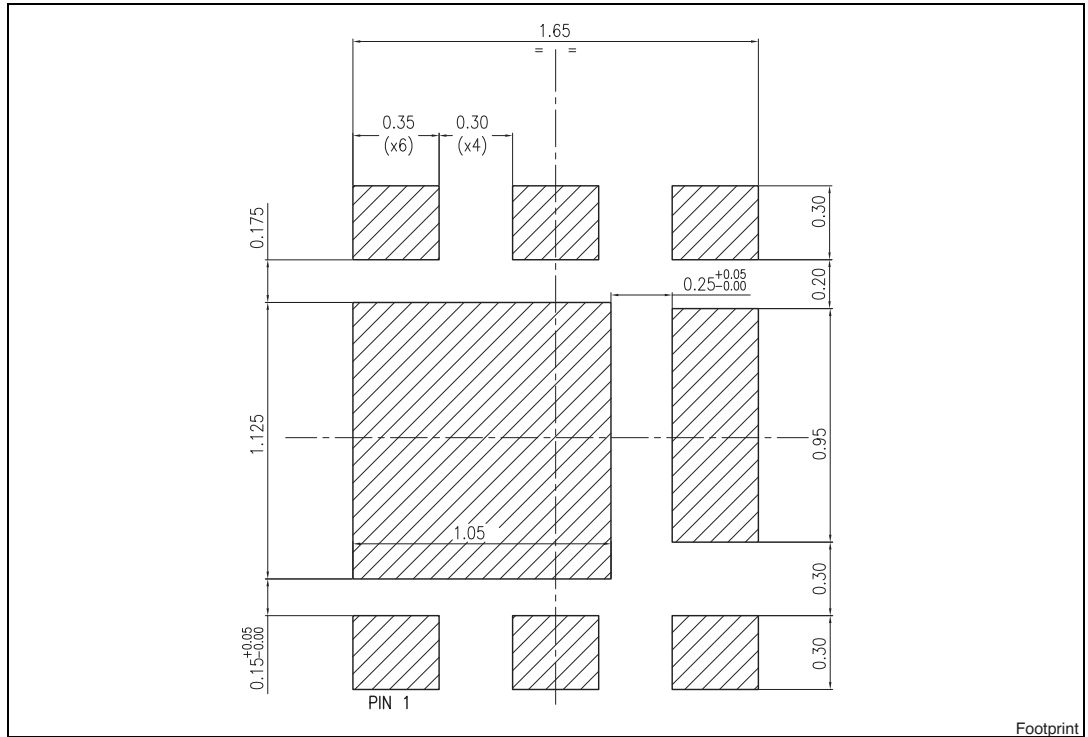
Dim.	mm.		
	Min.	Typ.	Max.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.20	
b	0.25	0.30	0.35
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.90	1.00	1.10
E2	0.80	0.90	1.00
e	0.55	0.65	0.75
K	0.15	0.25	0.35
K1	0.20	0.30	0.40
K2	0.25	0.35	0.45
L	0.20	0.25	0.30
L1	0.65	0.75	0.85

Figure 16. Drawing dimension PowerFLAT™ 2 x 2



5 Packaging mechanical data

Figure 17. PowerFLAT™ 2 x 2 footprint (dimensions in mm)



6 Revision history

Table 9. Document revision history

Date	Revision	Changes
09-May-2013	1	Initial release.
09-Dec-2014	2	Text edits throughout document On cover page: – changed title description – updated features and description In Table 4 , changed $R_{DS(on)}$ values In Table 5 , changed values and test conditions In Table 6 , changed values and test conditions In Table 7 , changed values and test conditions Added Section 2.1: Electrical characteristics (curves) Updated Section 3: Test circuits Updated Section 4: Package mechanical data

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