



# STL50N3LLH5

N-channel 30 V, 0.015  $\Omega$ , 50 A, PowerFLAT™ 5x6  
STripFET™ V Power MOSFET

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on) max</sub>	I <sub>D</sub>
STL50N3LLH5	30 V	< 0.019 $\Omega$	50 A <sup>(1)</sup>

1. The value is rated according R<sub>thj-pcb</sub>

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

## Applications

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using STMicroelectronics' STripFET™V technology. The device has been optimized to achieve very low on-state resistance, contributing to an FOM that is among the best in its class.



Figure 1. Internal schematic diagram

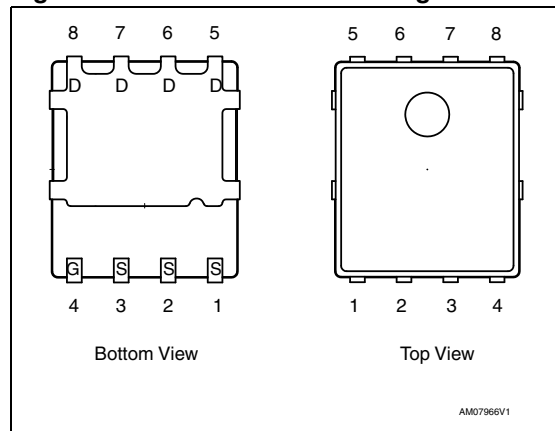


Table 1. Device summary

Order code	Marking	Package	Packaging
STL50N3LLH5	50N3LLH5	PowerFLAT™ 5x6	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	$\pm 22$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	50	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	31.5	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	12.6	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb}=100\text{ }^\circ\text{C}$	7.9	A
$I_{DM}^{(3)}$	Drain current (pulsed)	50.4	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	60	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4	W
	Derating factor	0.03	W/°C
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150	°C

1. The value is rated according to  $R_{thj-c}$
2. The value is rated according to  $R_{thj-pcb}$
3. Pulse width limited by safe operating area

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case (drain, steady state)	2.08	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-ambient	31.3	°C/W

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

**Table 4. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AV}$	Not-repetitive avalanche current, (pulse width limited by $T_J$ max)	5.5	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 24\text{ V}$ )	180	mJ

## 2 Electrical characteristics

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

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 30\text{ V}$ , $V_{DS} = 30\text{ V}$ at $T_C = 125\text{ °C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 22\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 6.3\text{ A}$ $V_{GS} = 4.5\text{ V}$ , $I_D = 6.3\text{ A}$		0.015 0.019	0.019 0.022	$\Omega$ $\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		724		pF
$C_{oss}$	Output capacitance		-	132	-	pF
$C_{rss}$	Reverse transfer capacitance				20	pF
$Q_g$	Total gate charge	$V_{DD} = 15\text{ V}$ , $I_D = 12.6\text{ A}$		5		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 4.5\text{ V}$	-	2	-	nC
$Q_{gd}$	Gate-drain charge	<a href="#">Figure 14</a>		2		nC

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=15\text{ V}$ , $I_D=6.3\text{ A}$ , $R_G=4.7\ \Omega$ , $V_{GS}=4.5\text{ V}$ <i>Figure 13</i>	-	4	-	ns
$t_r$	Rise time			4.2		ns
$t_{d(off)}$	Turn-off delay time			2.1		ns
$t_f$	Fall time			3.5		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		12.6	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		50.4	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12.6\text{ A}$ , $V_{GS}=0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12.6\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD}=20\text{ V}$ , $T_j=150\text{ }^\circ\text{C}$	-	21		ns
$Q_{rr}$	Reverse recovery charge			10		nC
$I_{RRM}$	Reverse recovery current			1		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

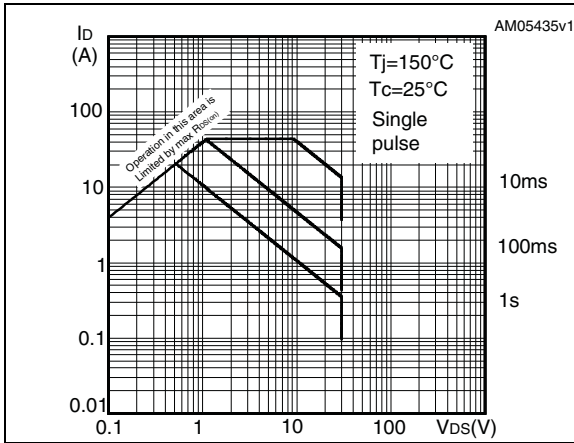


Figure 3. Thermal impedance

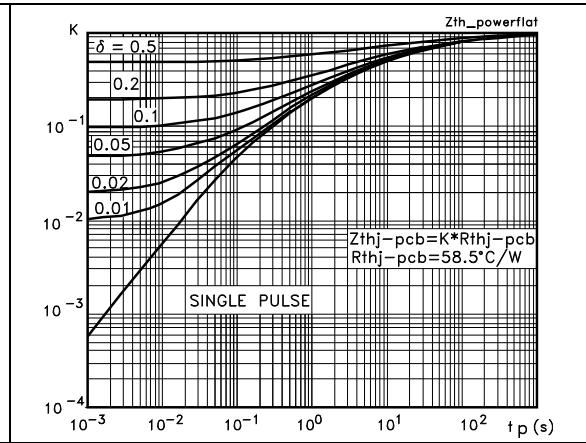


Figure 4. Output characteristics

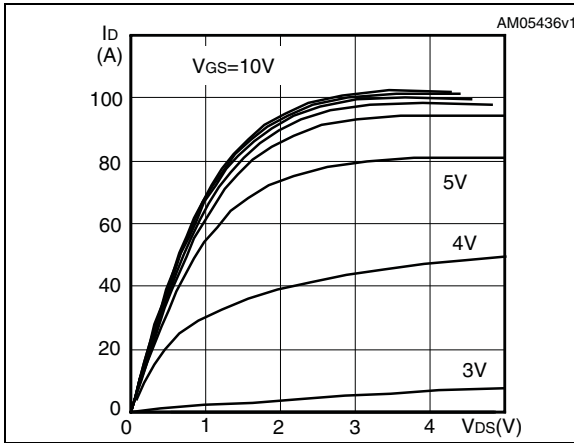


Figure 5. Transfer characteristics

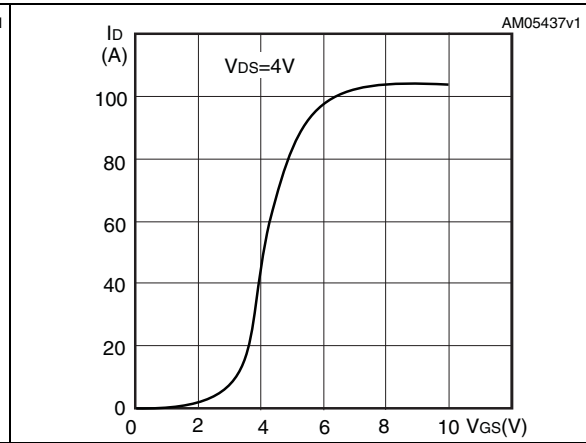


Figure 6. Normalized BV<sub>DSS</sub> vs temperature

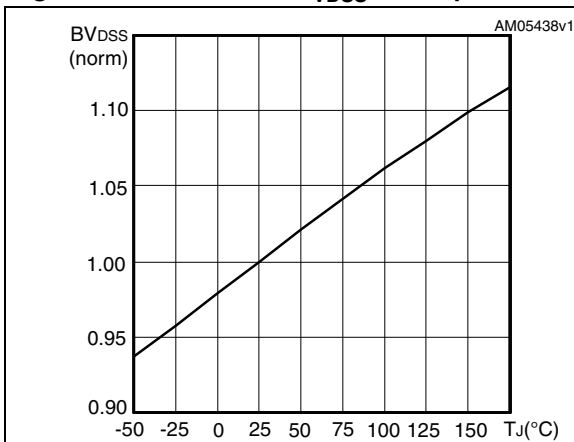


Figure 7. Static drain-source on resistance

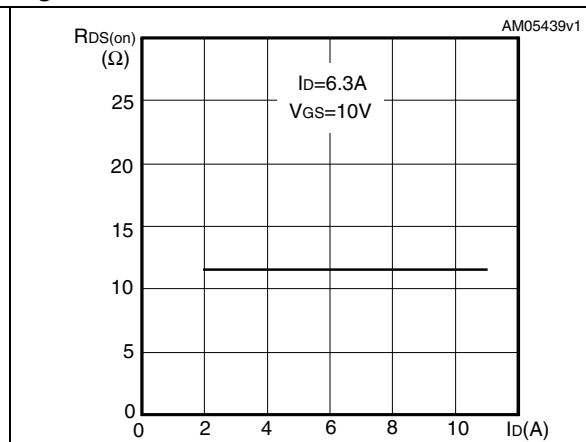


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

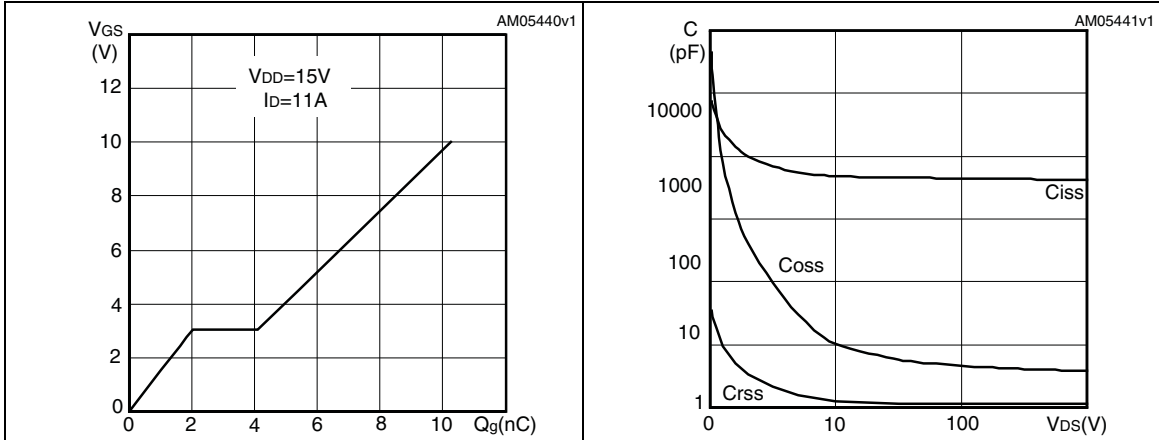


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

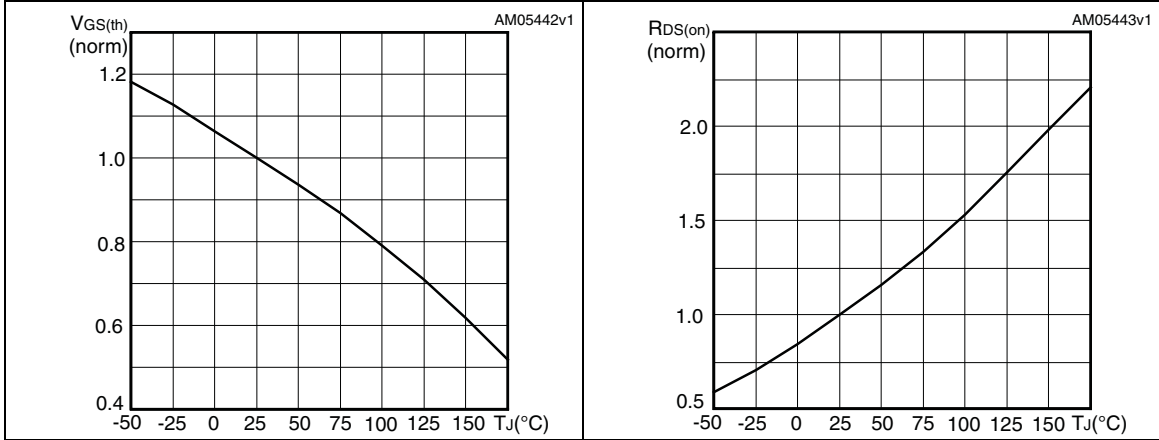
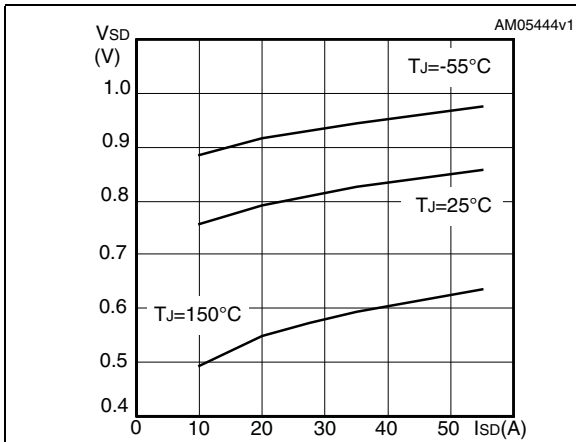


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load

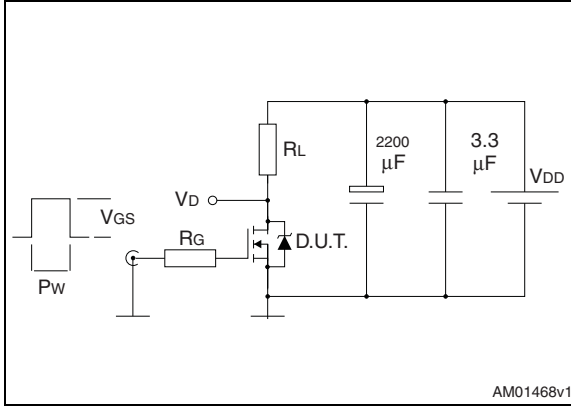


Figure 14. Gate charge test circuit

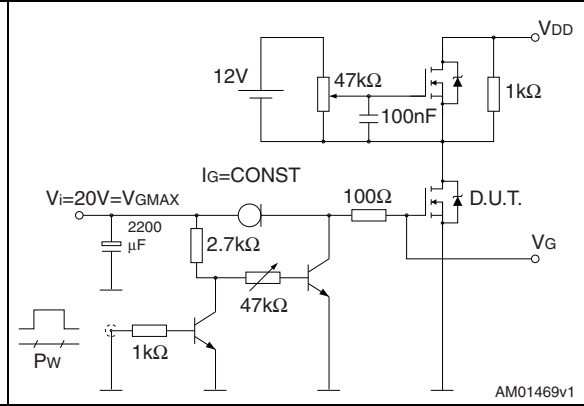


Figure 15. Test circuit for inductive load switching and diode recovery times

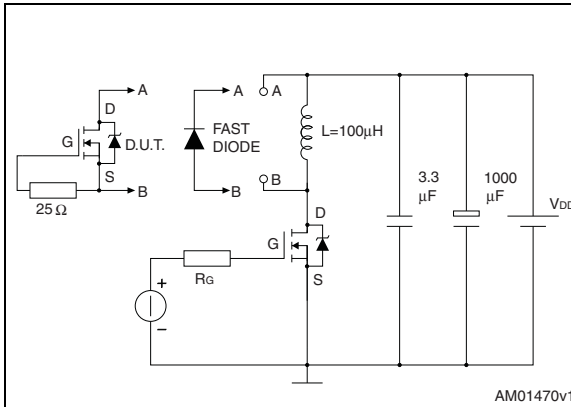


Figure 16. Unclamped inductive load test circuit

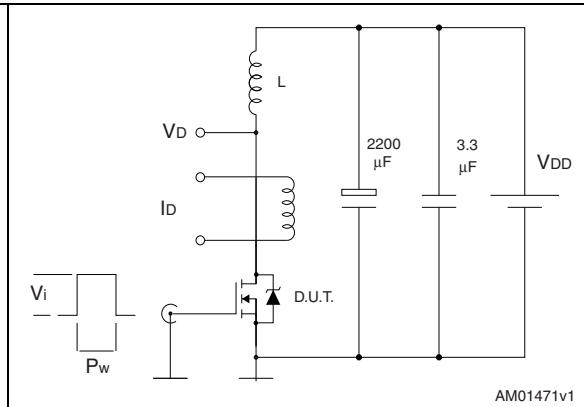


Figure 17. Unclamped inductive waveform

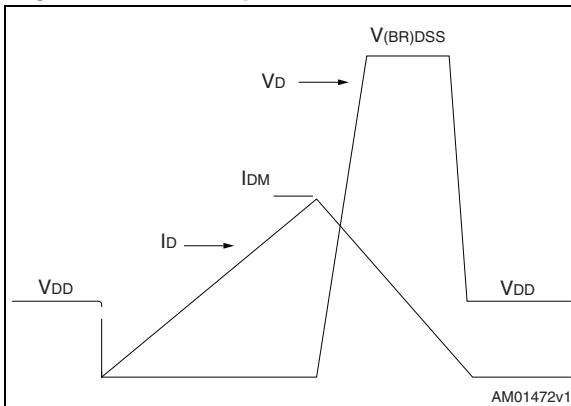
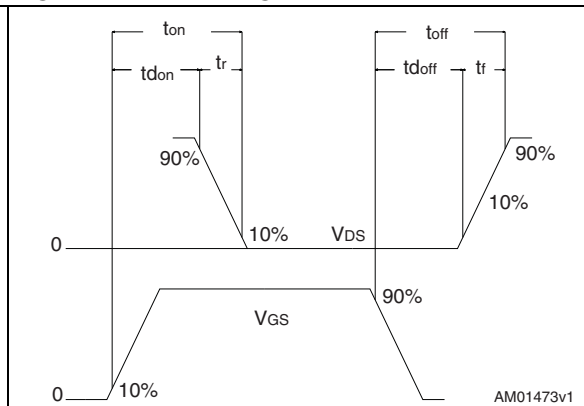


Figure 18. Switching time waveform





## 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 is an ST trademark.

Table 9. PowerFLAT™ 5x6 type C-B mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80	0.83	0.93
A1	0	0.02	0.05
A3		0.20	
b	0.35	0.40	0.47
D		5.00	
D1		4.75	
D2	4.15	4.20	4.25
E		6.00	
E1		5.75	
E2	3.43	3.48	3.53
E4	2.58	2.63	2.68
e		1.27	
L	0.70	0.80	0.90

Figure 19. PowerFLAT™ 5x6 type C-B drawing

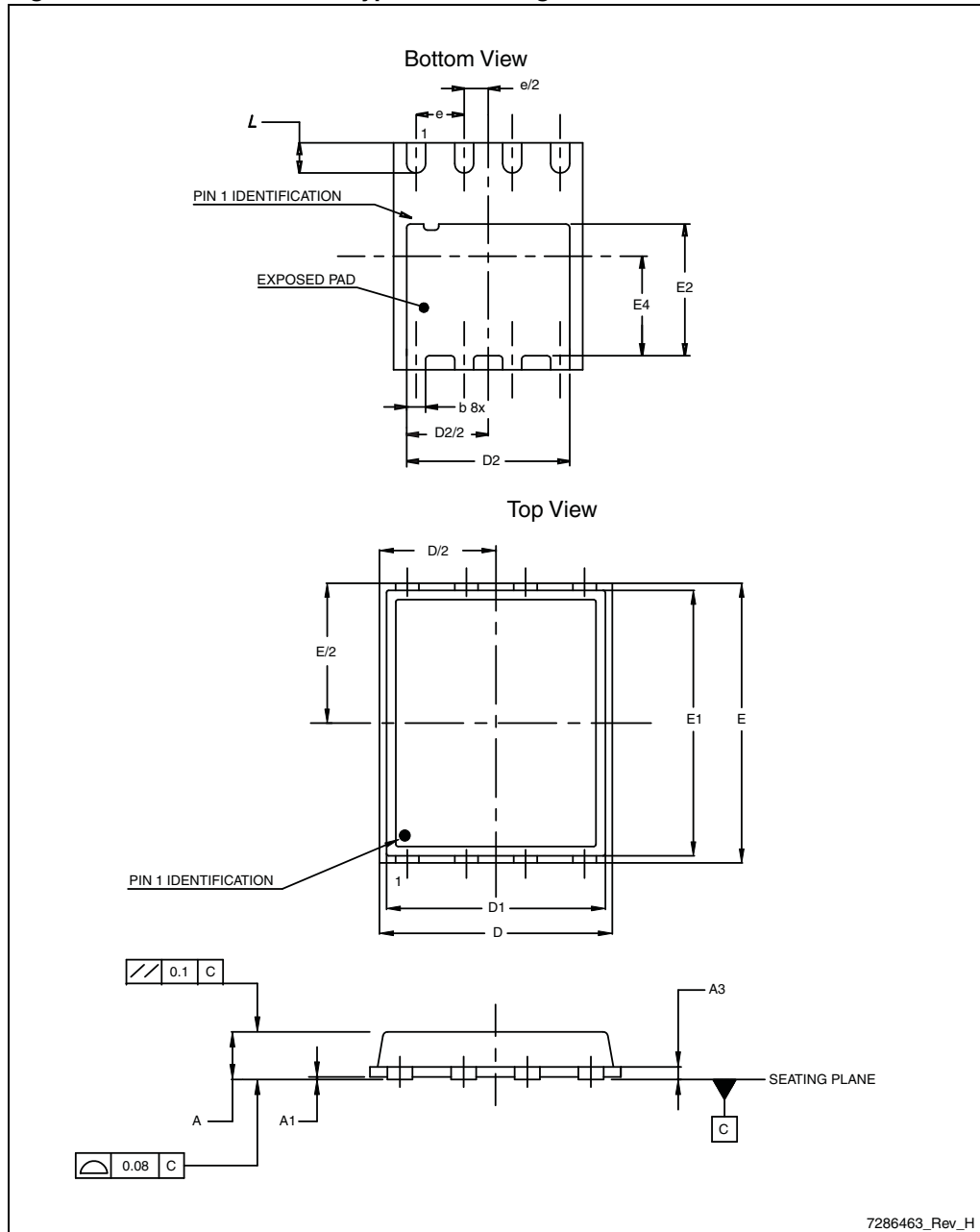


Table 10. PowerFLAT 5x6 mechanical data type S-R

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D		5.20	
E		6.15	
D2	4.11		4.31
E2	3.50		3.70
e		1.27	
L	0.50		0.80
K	1.275		1.575

Figure 20. PowerFLAT 5x6 type S-R drawing

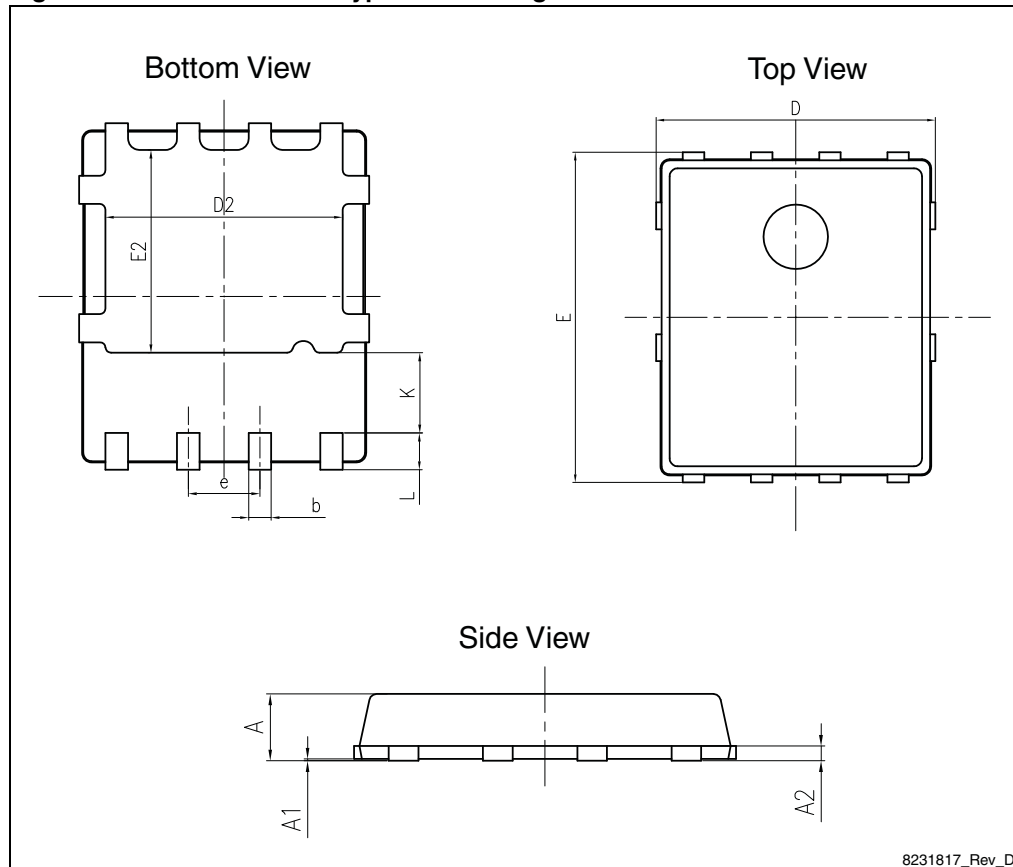
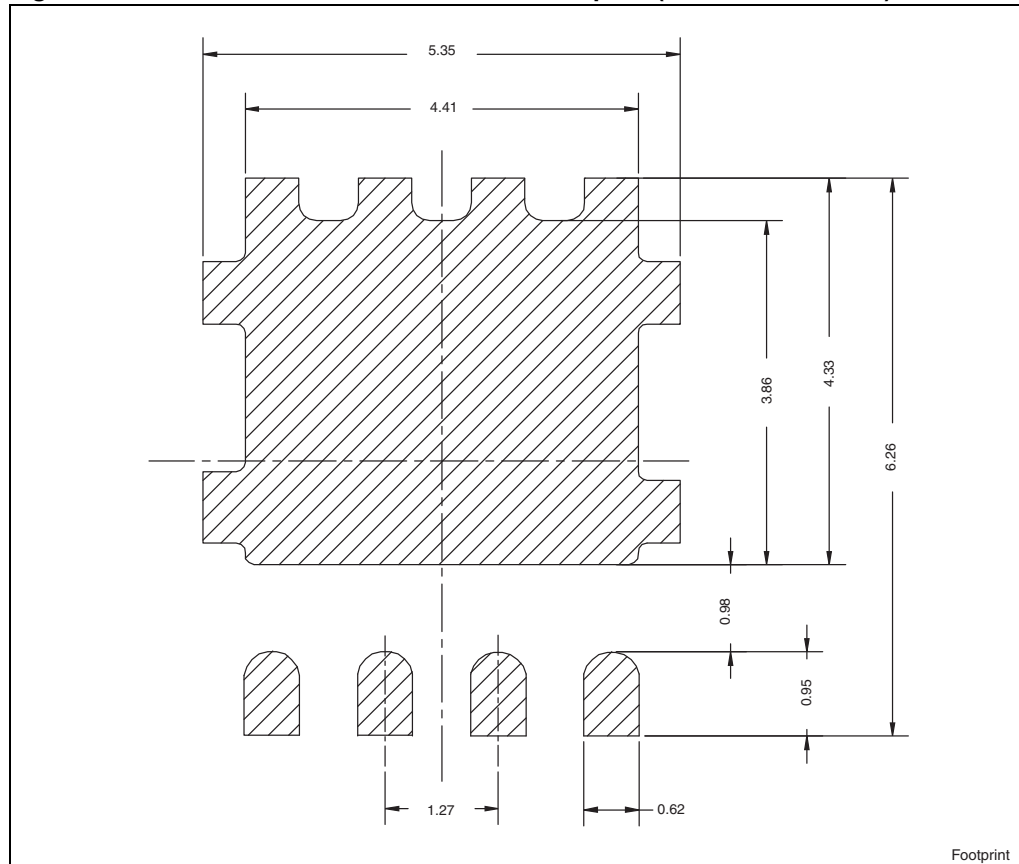


Figure 21. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



## 5 Revision history

Table 11. Document revision history

Date	Revision	Changes
10-Sep-2009	1	First release
02-Dec-2011	2	<i>Section 4: Package mechanical data</i> has been updated. Minor text changes.

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