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STL140N4LLF5

N-channel 40 V, 0.00275 Ω , 32 A, PowerFLAT™ 5x6
STripFET™ V Power MOSFET

Features

Type	V _{DSS}	R _{DS(on) max}	I _D
STL140N4LLF5	40 V	0.00275 Ω	32 A ⁽¹⁾

1. The value is rated according R_{thj-pcb}.

- R_{DS(on)} * Q_g industry benchmark
- Extremely low on-resistance R_{DS(on)}
- 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

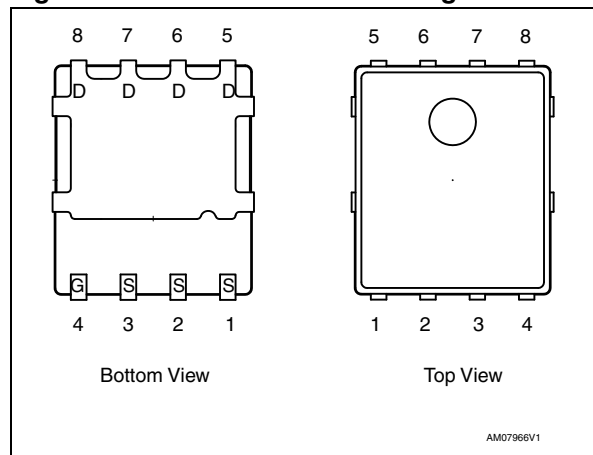


Table 1. Device summary

Order code	Marking	Package	Packaging
STL140N4LLF5	140N4LLF5	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	40	V
V_{GS}	Gate-source voltage	± 22	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	140	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	88	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	32	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	20	A
$I_{DM}^{(3)}$	Drain current (pulsed)	128	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	80	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4	W
	Derating factor	0.03	W/ $^\circ\text{C}$
T_J	Operating junction temperature	-55 to 150	$^\circ\text{C}$
T_{stg}	Storage temperature		

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)	1.56	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-ambient	31.3	$^\circ\text{C}/\text{W}$

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

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
I_{AV}	Not-repetitive avalanche current, (pulse width limited by $T_J\text{ max}$)	16	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AV}$, $V_{DD} = 24\text{ V}$)	300	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	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$	40			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 40\text{ V}$, $V_{DS} = 40\text{ V}$ at $T_C = 125\text{ °C}$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 22\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 16\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 16\text{ A}$		0.0021 0.0024	0.00275 0.0031	Ω Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	5900	-	pF
C_{oss}	Output capacitance			870		
C_{rss}	Reverse transfer capacitance			130		
Q_g	Total gate charge	$V_{DD} = 15\text{ V}$, $I_D = 32\text{ A}$ $V_{GS} = 4.5\text{ V}$ <i>(see Figure 14)</i>	-	45	-	nC
Q_{gs}	Gate-source charge			14		
Q_{gd}	Gate-drain charge			17		
R_G	Gate input resistance	$f = 1\text{ MHz}$ Gate DC Bias = 0 Test signal level = 20 mV open drain	-	1.2	-	Ω

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=15\text{ V}$, $I_D=16\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ <i>(see Figure 13)</i>		19		ns
t_r	Rise time			29		ns
$t_{d(off)}$	Turn-off delay time		-	90	-	ns
t_f	Fall time			21		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		18	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		72	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 32\text{ A}$, $V_{GS}=0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 32\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 25\text{ V}$		44		ns
Q_{rr}	Reverse recovery charge		-	57		nC
I_{RRM}	Reverse recovery current			2.6		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

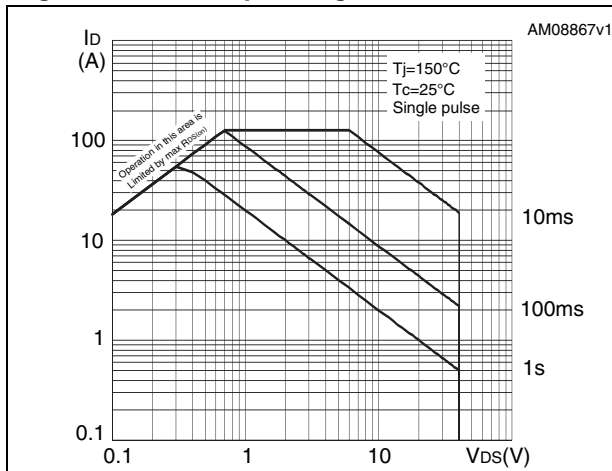


Figure 3. Thermal impedance

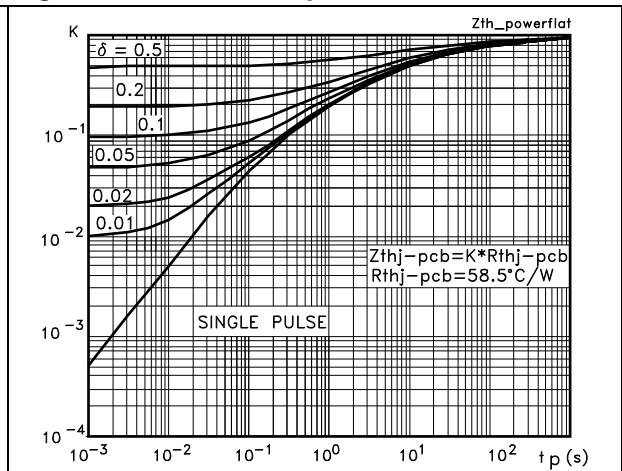


Figure 4. Output characteristics

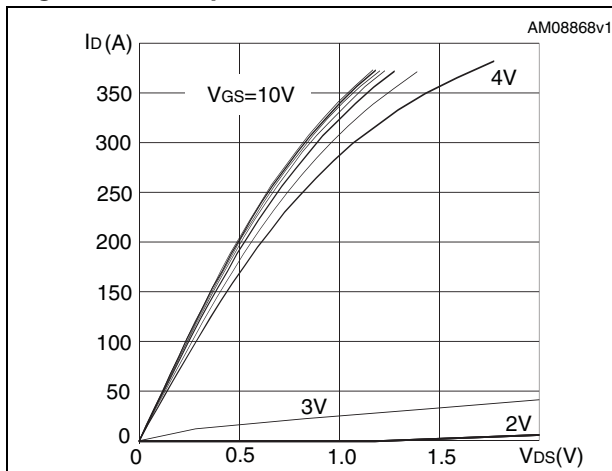


Figure 5. Transfer characteristics

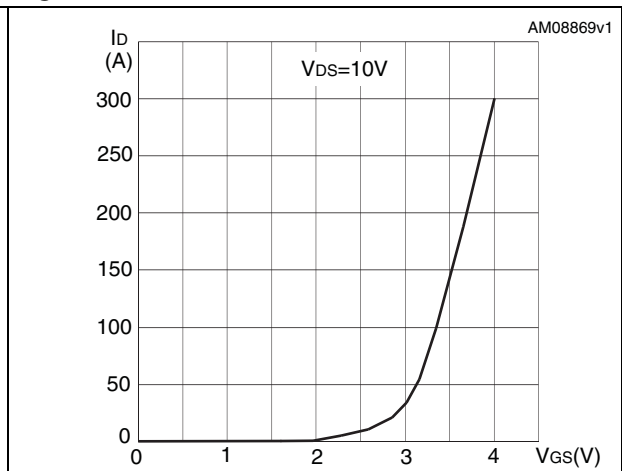


Figure 6. Normalized BV_{DSS} vs temperature

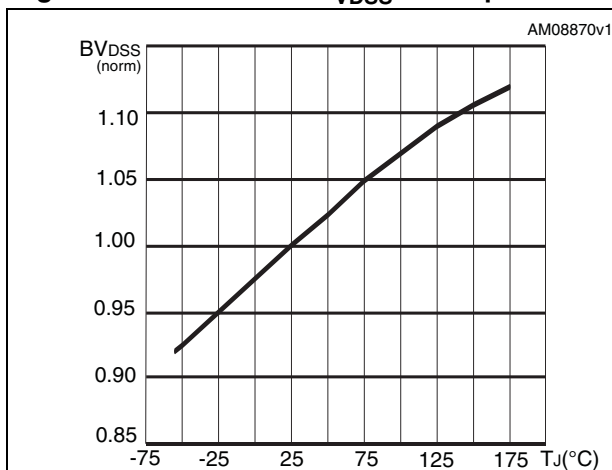


Figure 7. Static drain-source on resistance

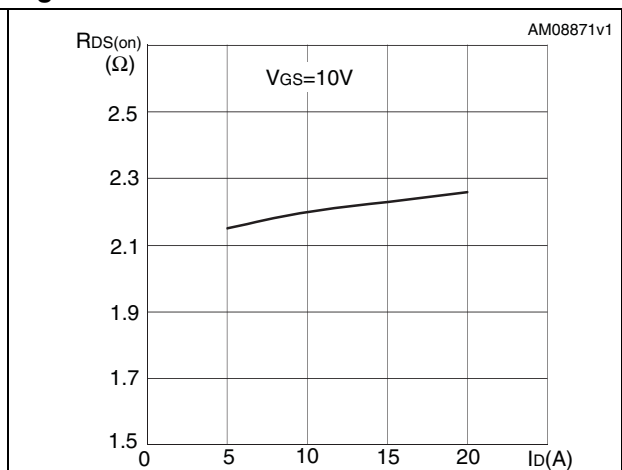


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

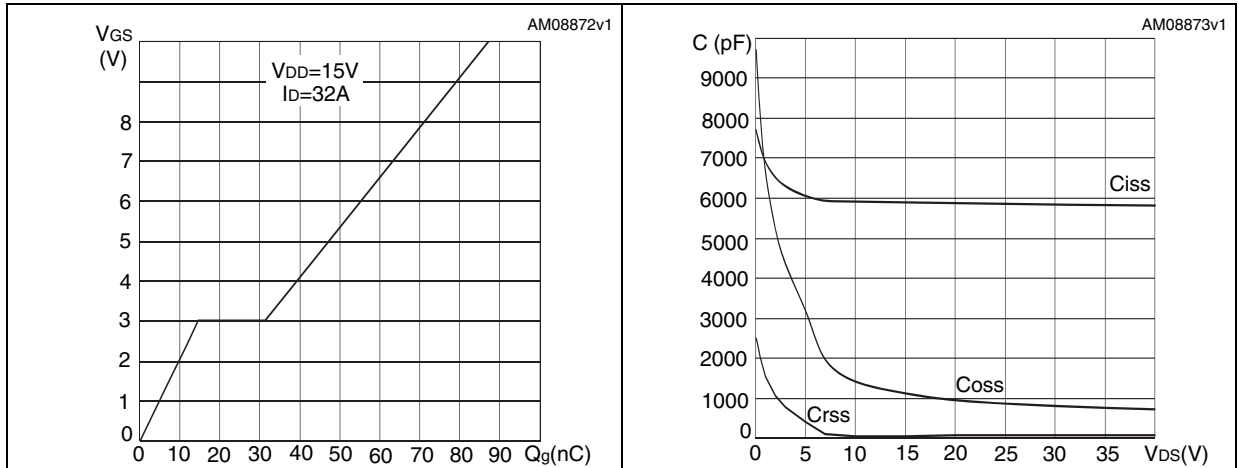


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

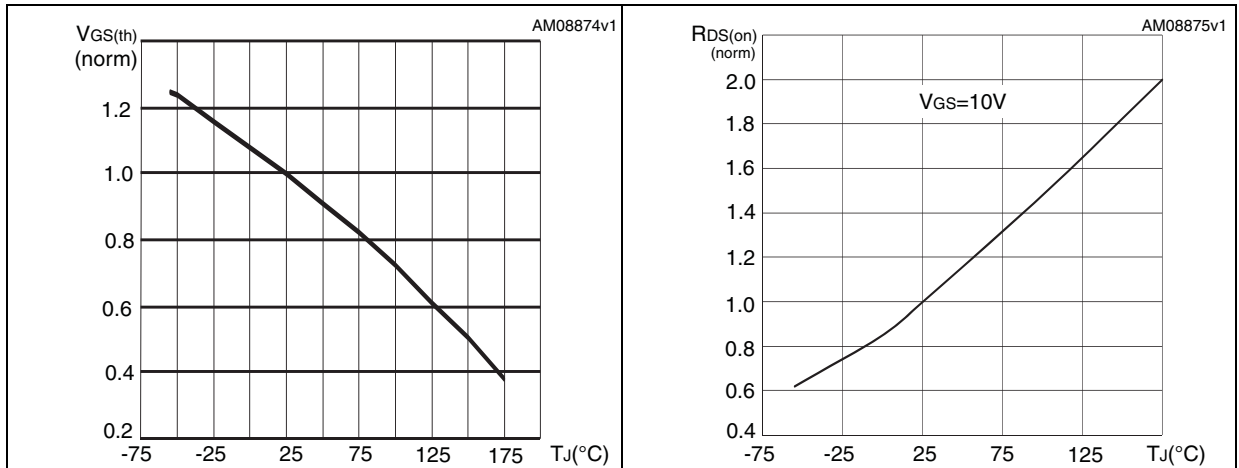
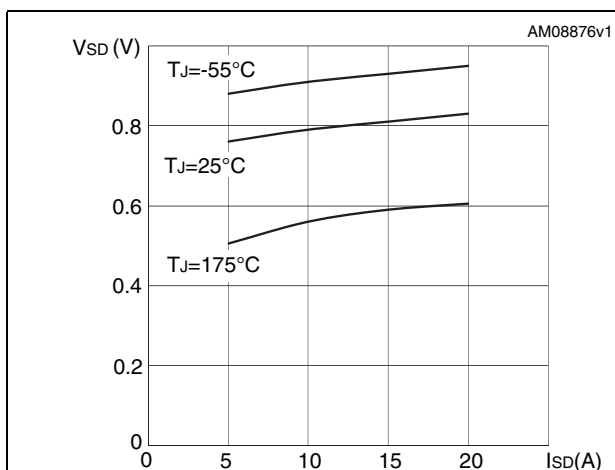


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

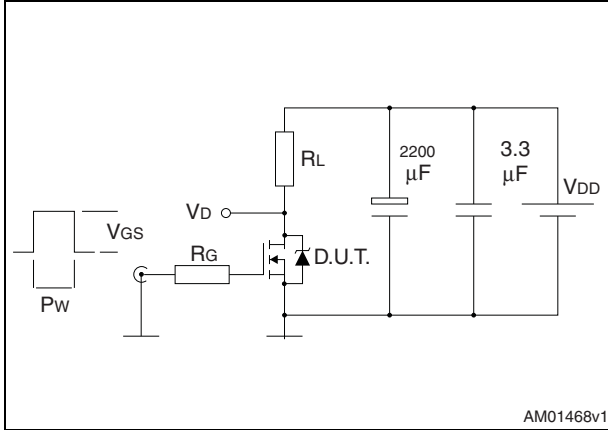


Figure 14. Gate charge test circuit

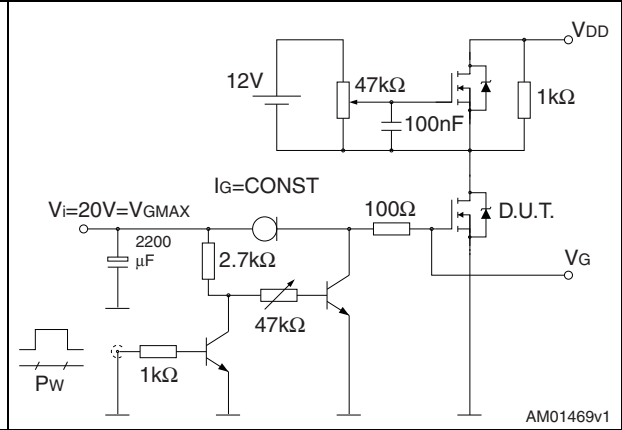


Figure 15. Test circuit for inductive load switching and diode recovery times

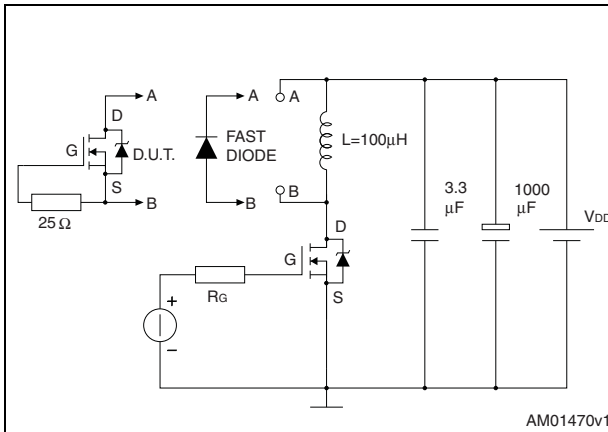


Figure 16. Unclamped inductive load test circuit

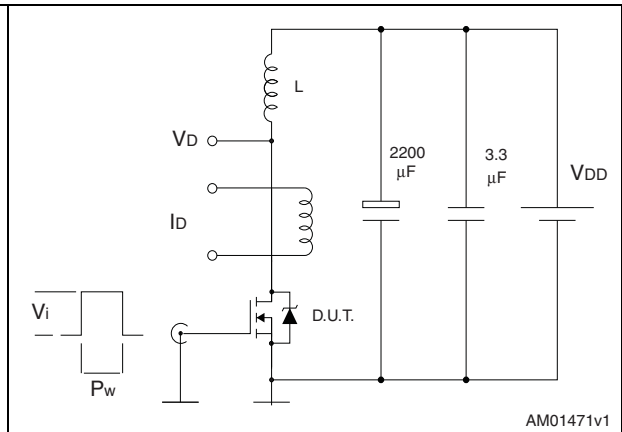


Figure 17. Unclamped inductive waveform

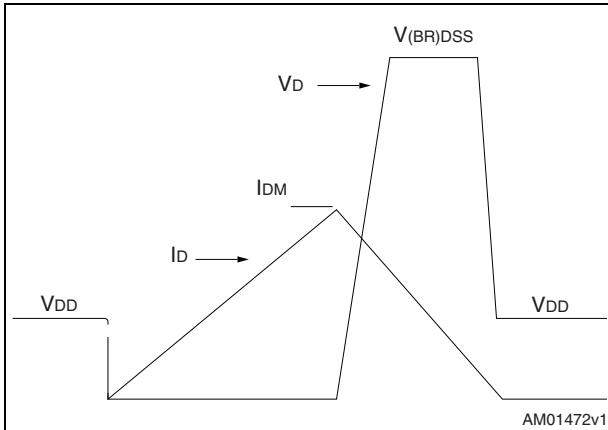
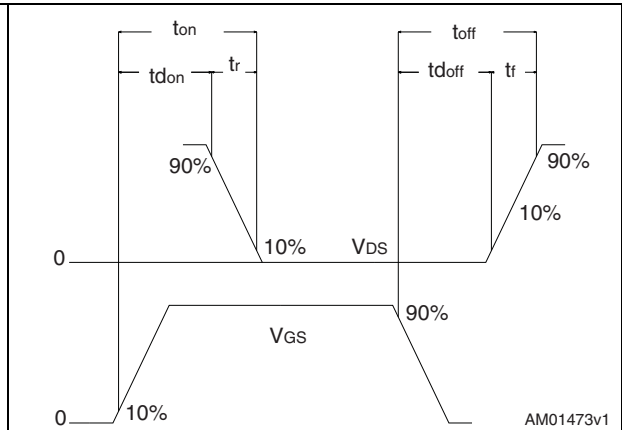


Figure 18. Switching time waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® 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 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

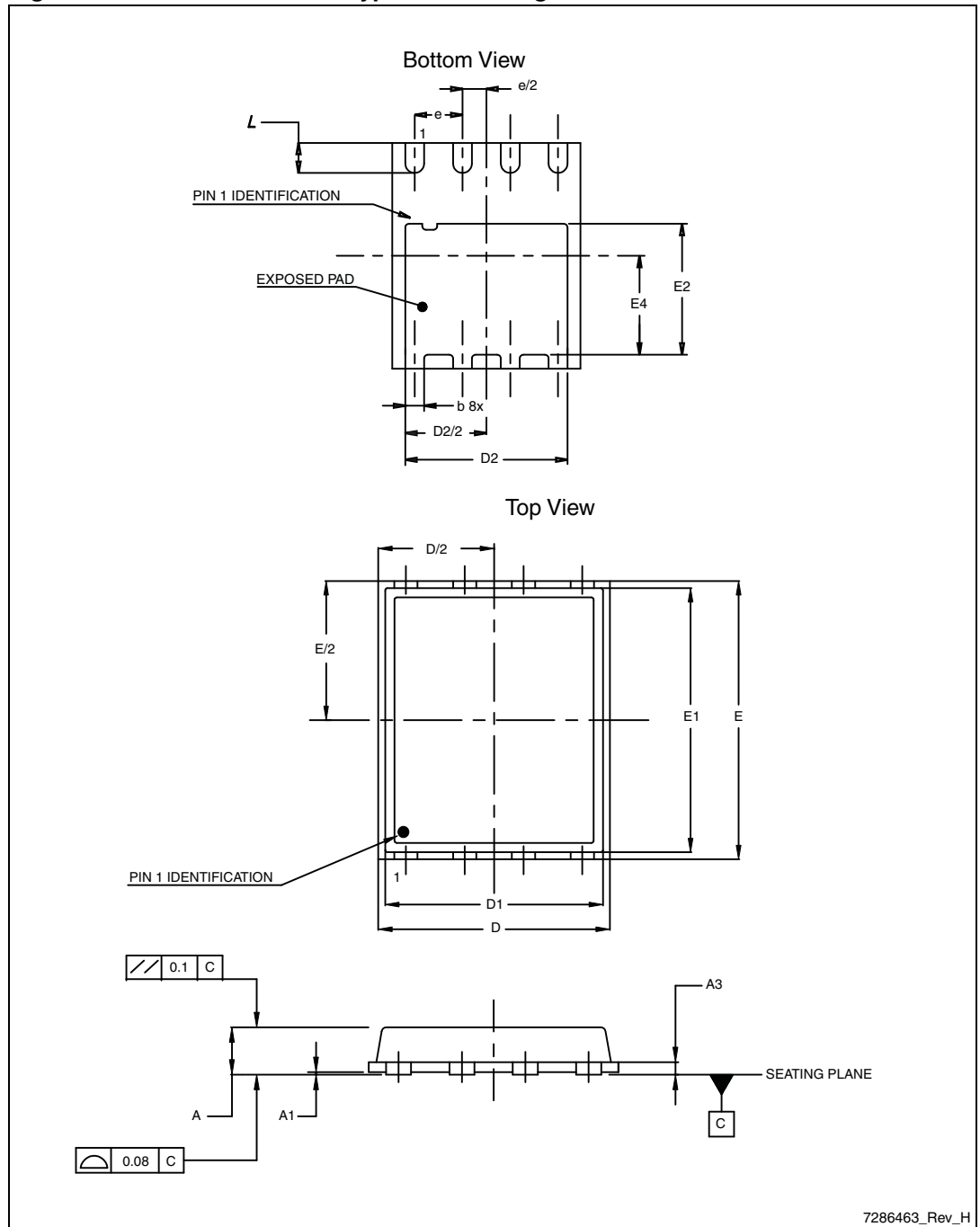


Table 10. PowerFLAT™ 5x6 type S-C mechanical data

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	
e1		0.65	
L	0.715		1.015
K	1.05		1.35

Figure 20. PowerFLAT™ 5x6 type S-C mechanical data

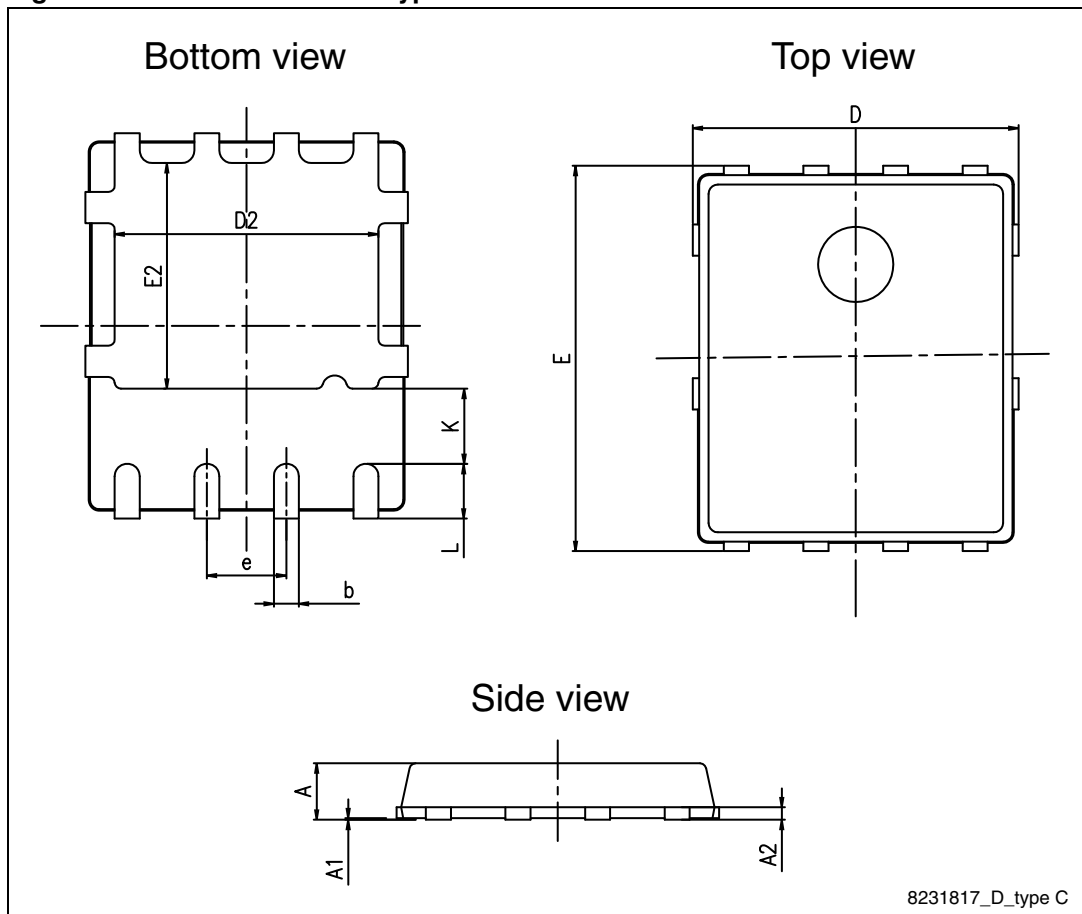
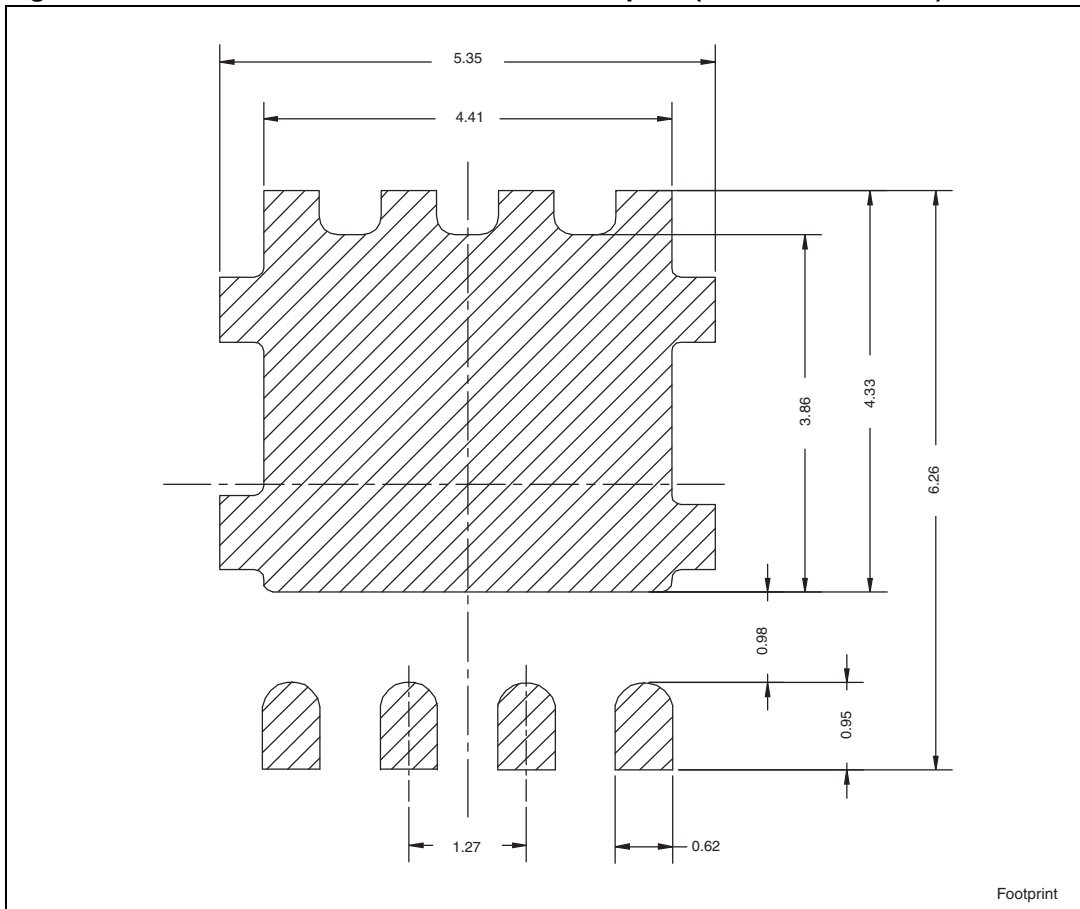


Figure 21. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



5 Revision history

Table 11. Document revision history

Date	Revision	Changes
03-Jun-2010	1	First release.
29-Apr-2011	2	Document status promoted from preliminary data to datasheet.
10-Nov-2011	3	<i>Section 4: Package mechanical data</i> has been updated. Minor text changes.

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