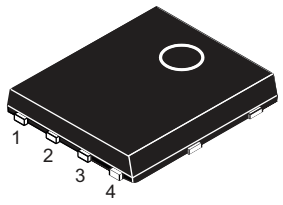
STL90N3LLH6

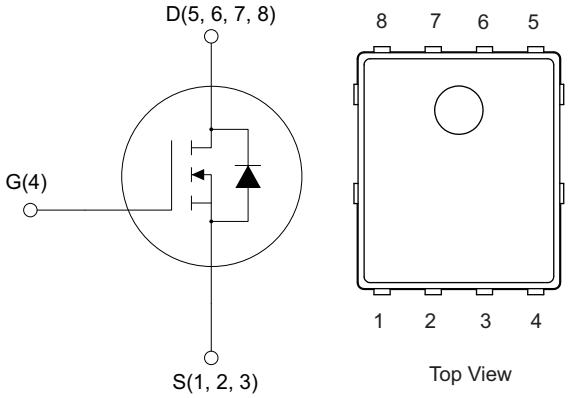
N-channel 30 V, 0.0038 Ω typ., 24 A STripFET™ VI DeepGATE™ Power MOSFET in PowerFLAT™ 5x6 package

Datasheet - production data



PowerFLAT™5x6

Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STL90N3LLH6	30 V	0.0045 Ω	24 A (1)

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

- $R_{DS(on)}$ * Q_g industry benchmark
- Extremely low on-resistance $R_{DS(on)}$
- High avalanche ruggedness
- Low gate drive power losses
- Very low switching gate charge

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the 6th generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest $R_{DS(on)}$ in all packages.

Table 1. Device summary

Order code	Marking	Packages	Packaging
STL90N3LLH6	90N3LLH6	PowerFLAT™ 5x6	Tape and reel

This is information on a product in full production. www.st.com

Contents

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 (1)	Drain current (continuous) at T_C = 25 °C	90	A
I_D (1)	Drain current (continuous) at T_C = 70 °C	67.5	A
I_D (1)	Drain current (continuous) at T_C = 100 °C	56.2	A
I_D (2)	Drain current (continuous) at T_{pcb} = 25 °C	24	A
I_D (2)	Drain current (continuous) at T_{pcb}= 70 °C	18	A
I_D (2)	Drain current (continuous) at T_{pcb}=100 °C	15	A
I_{DM} (2) (3)	Drain current (pulsed)	96	A
I_{DM} (1) (3)	Drain current (pulsed)	360	A
P_{TOT} (1)	Total dissipation at T_C = 25 °C	60	W
P_{TOT} (2)	Total dissipation at T_{pcb} = 25 °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 $R_{thj\text{-}c}$
2. The value is rated according to $R_{thj\text{-}pcb}$
3. Pulse width limited by safe operating area

Table 3. Thermal resistance

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

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

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D= 12 A; L= 1.25mH)	90	mJ

2 Electrical characteristics

(T_{CASE} = 25 °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 µA, V_{GS}= 0	30			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 30 V,			1	µA
		V_{DS} = 30 V T_C = 125 °C			10	µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS}= 10 V, I_D= 12 A		0.0038	0.0045	Ω
		V_{GS}= 4.5 V, I_D= 12 A		0.0057	0.0073	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f=1 MHz, V_{GS}=0	1350	1690	2030	pF
C_{oss}	Output capacitance		230	290	350	pF
C_{rss}	Reverse transfer capacitance		140	176	210	pF
Q_g	Total gate charge	V_{DD}=15 V, I_D = 24 A V_{GS} =4.5 V *(see Figure 14)*		17		nC
Q_{gs}	Gate-source charge			8		nC
Q_{gd}	Gate-drain charge			6		nC
R_G	Gate input resistance	f=1 MHz Gate DC Bias = 0 Test signal level = 20 mV open drain	1.25	1.7	2	Ω

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD}=15 V, I_D= 12 A, R_G=4.7 Ω, V_{GS}=10 V *(see Figure 13)*	-	9.5	-	ns
t_r	Rise time		-	30	-	ns
$t_{d(off)}$	Turn-off delay time		-	37	-	ns
t_f	Fall time		-	12	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		24	A
I_{SDM}(1)	Source-drain current (pulsed)		-		96	A
V_{SD}(2)	Forward on voltage	I_{SD} = 24 A, V_{GS}=0	-		1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 12 A, di/dt = 100 A/µs, V_{DD}=25 V	-	24		ns
Q_{rr}	Reverse recovery charge		-	16.8		nC
I_{RRM}	Reverse recovery current		-	1.4		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

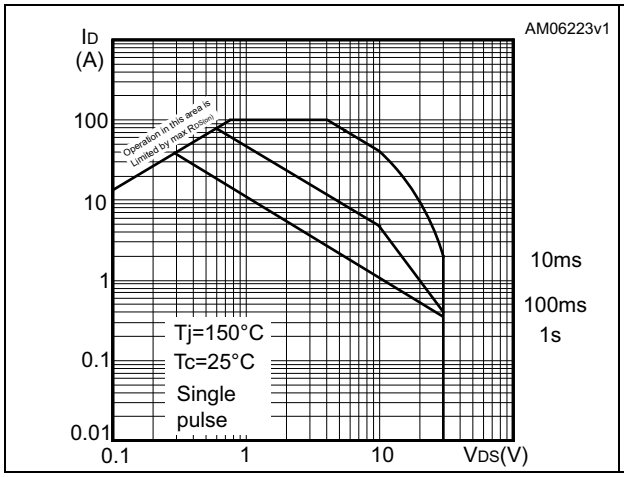


Figure 3. Thermal impedance

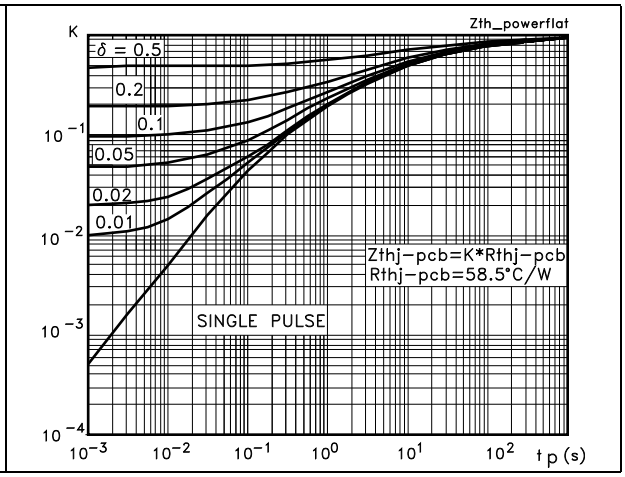


Figure 4. Output characteristics

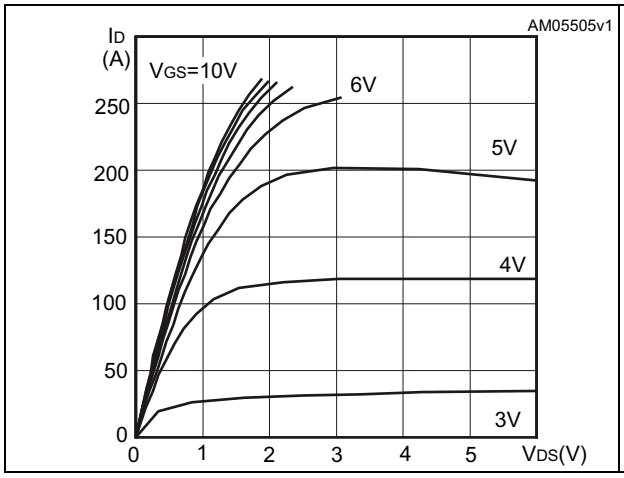


Figure 5. Transfer characteristics

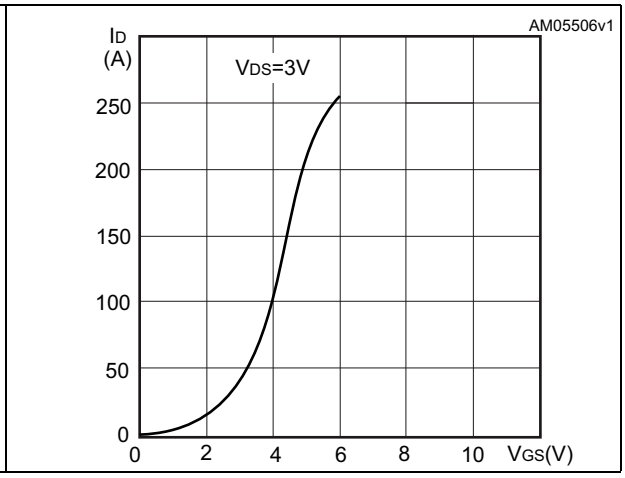


Figure 6. Normalized BV_{DSS} vs temperature

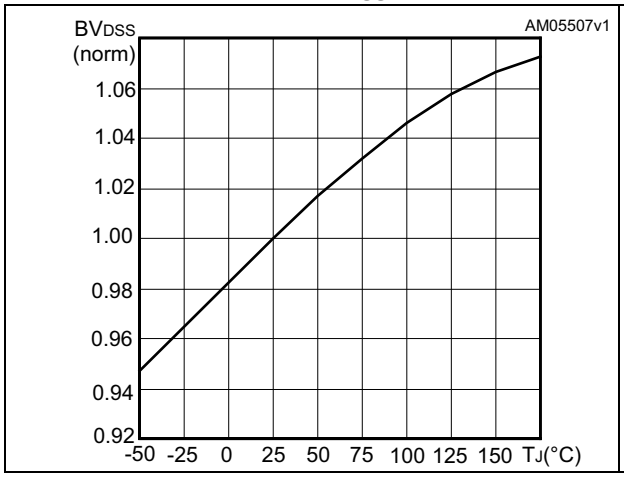


Figure 7. Static drain-source on-resistance

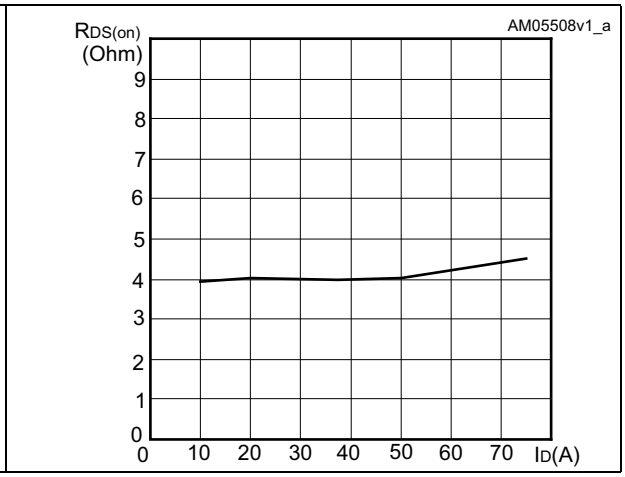


Figure 8. Gate charge vs gate-source voltage

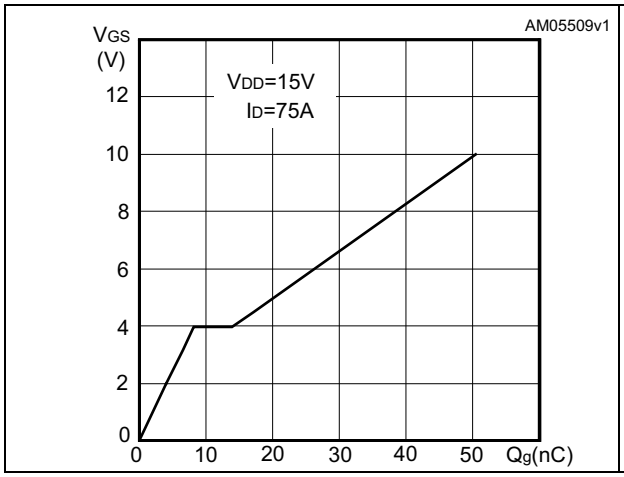


Figure 9. Capacitance variations

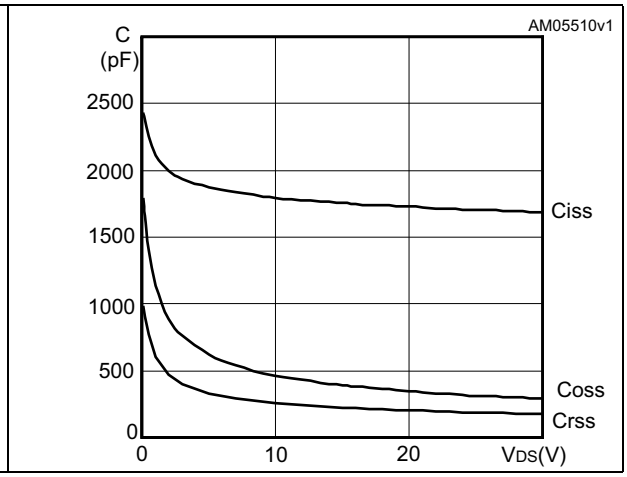


Figure 10. Normalized gate threshold voltage vs temperature

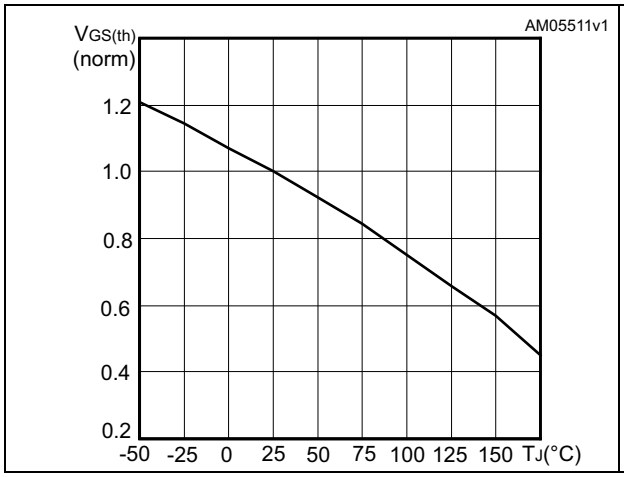


Figure 11. Normalized on-resistance vs temperature

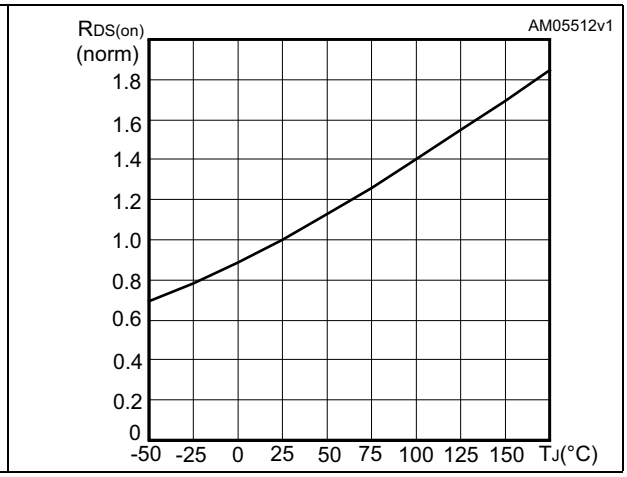
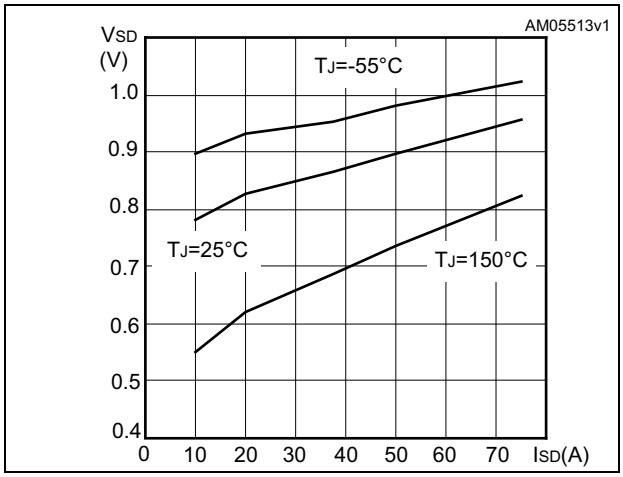


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

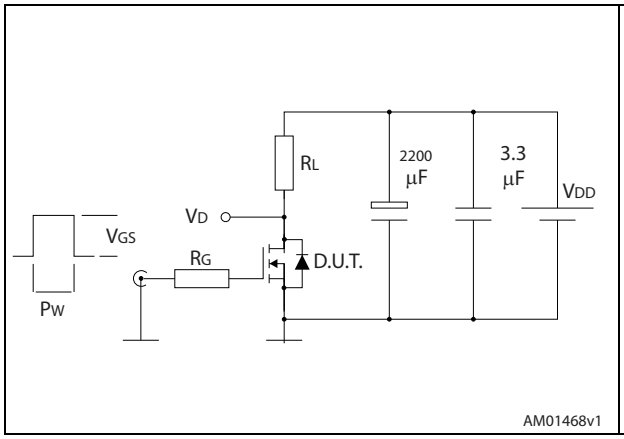


Figure 14. Gate charge test circuit

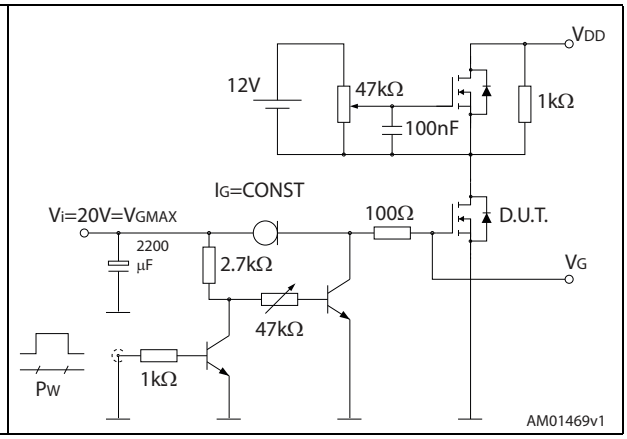


Figure 15. Test circuit for inductive load switching and diode recovery times

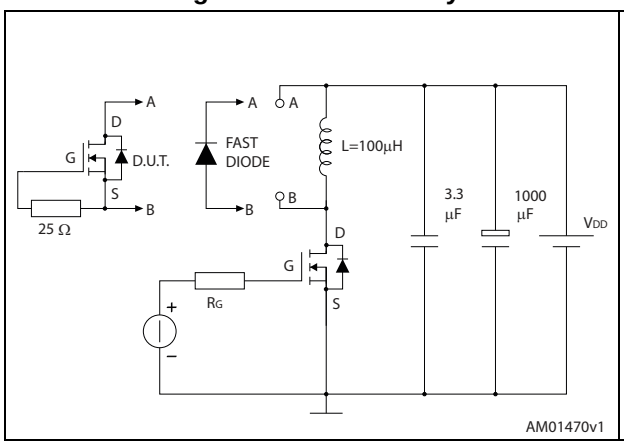


Figure 16. Unclamped inductive load test circuit

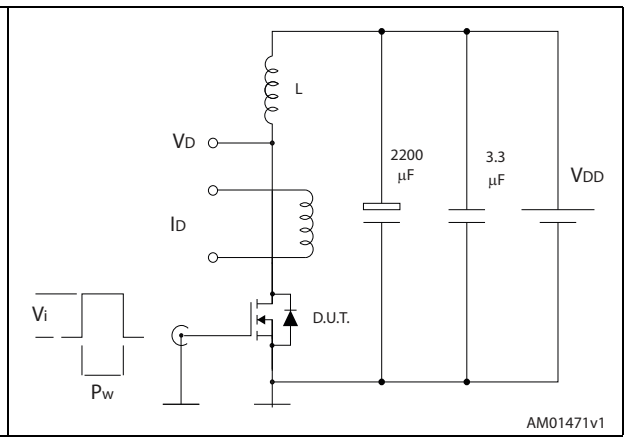


Figure 17. Unclamped inductive waveform

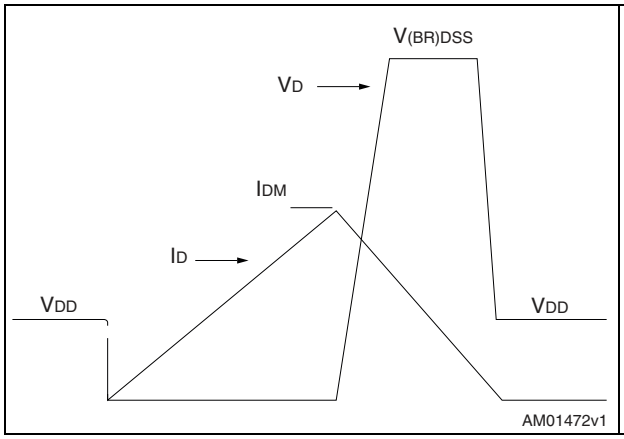
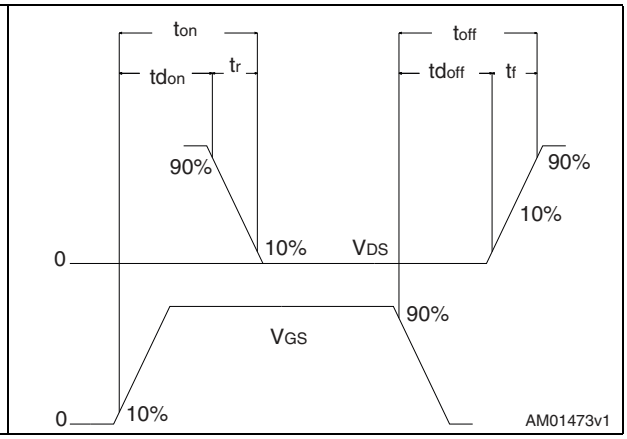


Figure 18. Switching time waveform



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

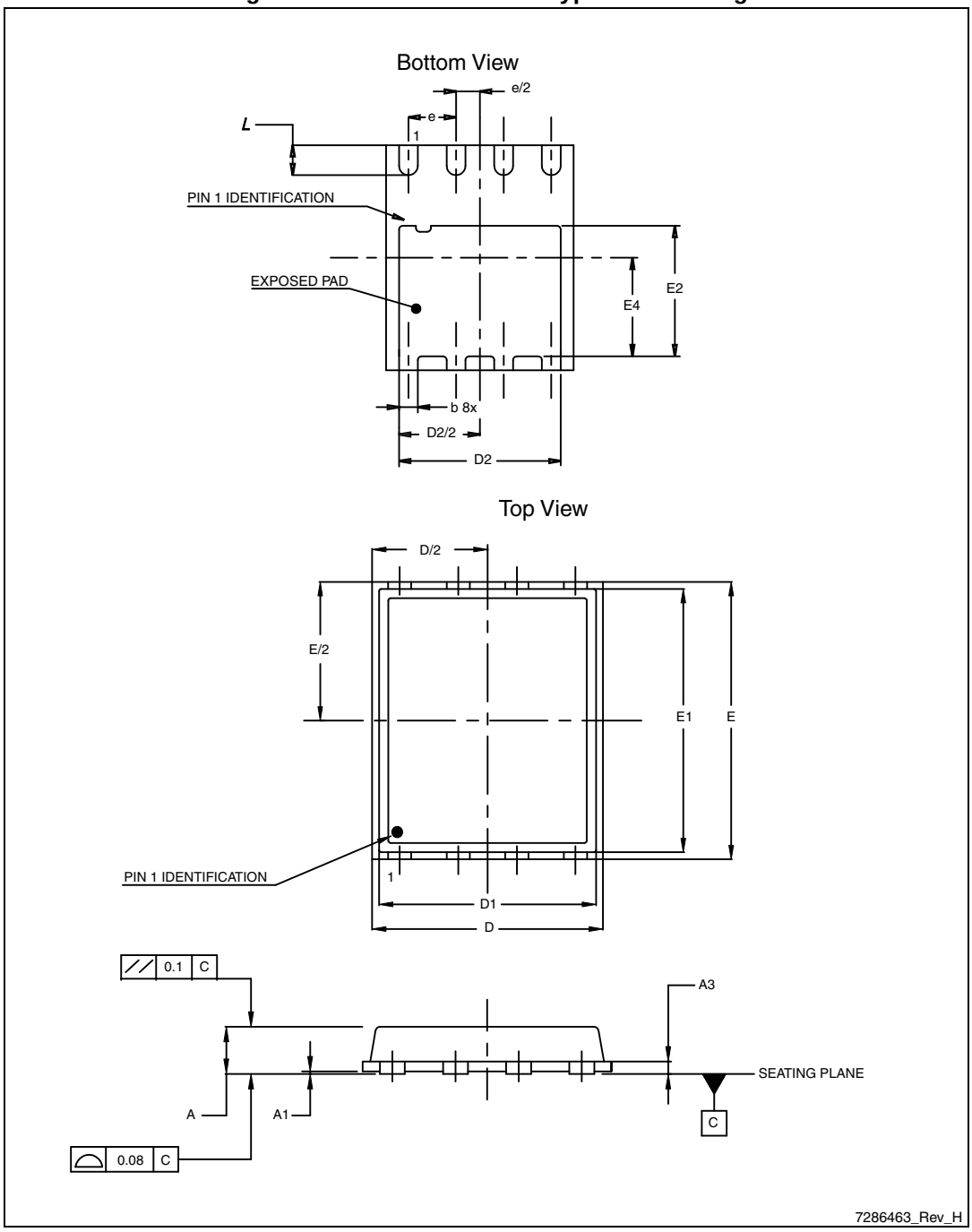


Table 10. PowerFLAT™ 5x6 type S-C mechanical data

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

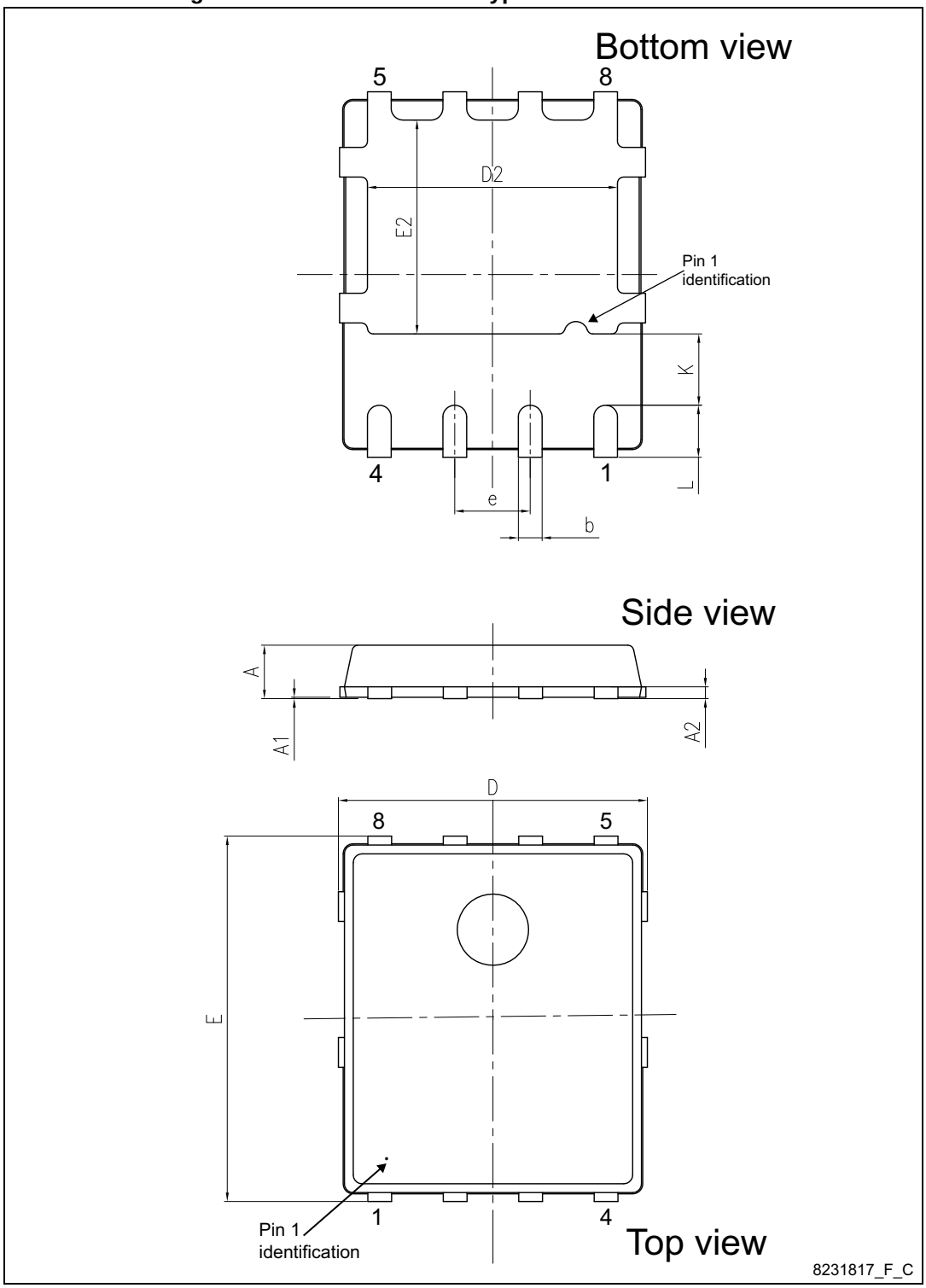
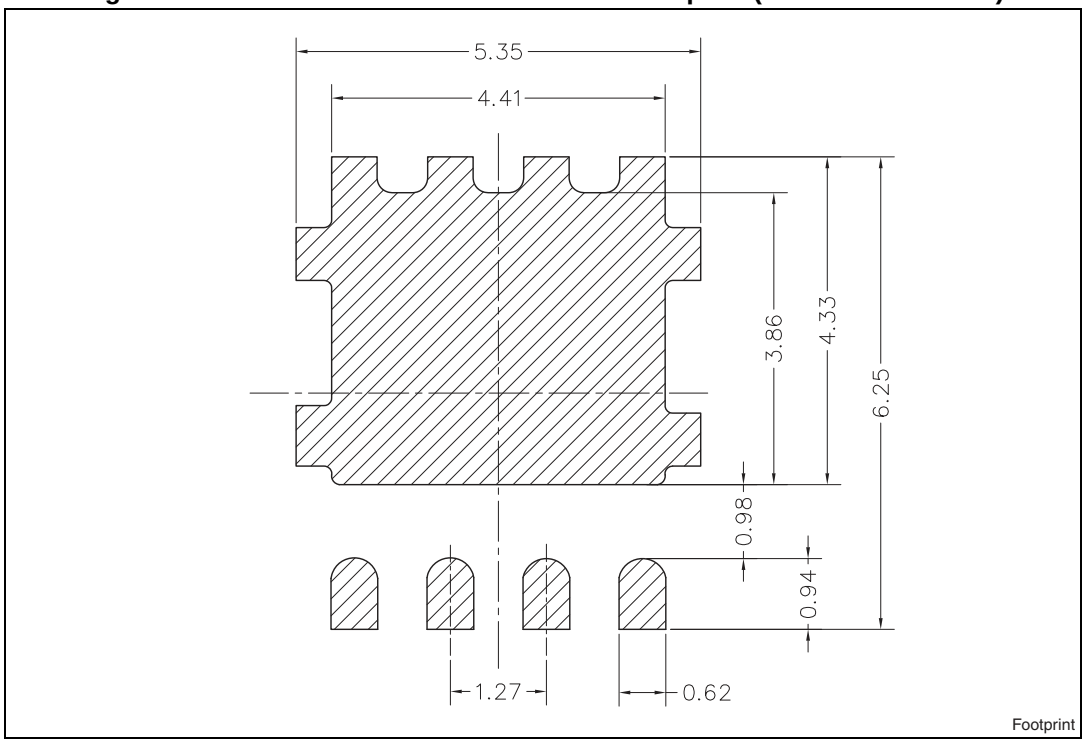


Figure 21. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



5 Revision history

Table 11. Document revision history

Date	Revision	Changes
10-Apr-2009	1	First release
17-Mar-2010	2	– Inserted new values on *Table 5*, *Table 6* and *Table 8* – Document status promoted from preliminary data to datasheet.
10-Nov-2011	3	Inserted I_D value @ 70 °C, in *Table 2: Absolute maximum ratings*. *Section 4: Package mechanical data* has been updated. Minor text changes.
03-Sep-2013	4	– Updated: title and *Figure 1* in the cover page. – Updated: *Section 4: Package mechanical data* – Updated: *Figure 13*, *14*, *15* and *16* – Added new *Table 4: Avalanche characteristics*. – Minor text changes – Document status promoted from preliminary to production data.

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