



STL9N3LLH5

N-channel 30 V, 0.015 Ω typ., 9 A STripFET™ V Power MOSFET
in a PowerFLAT™ (3.3x3.3) package

Datasheet — production data

Features

Order code	V _{DSS}	R _{DS(on)} max	I _D
STL9N3LLH5	30 V	< 0.019 Ω	9 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)}
- 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 a FOM that is among the best in its class.

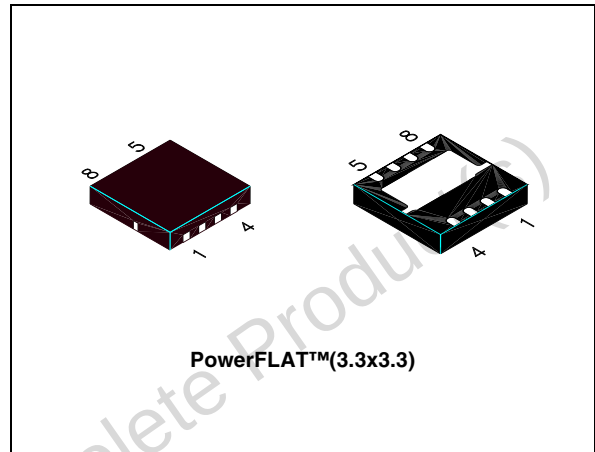


Figure 1. Internal schematic diagram

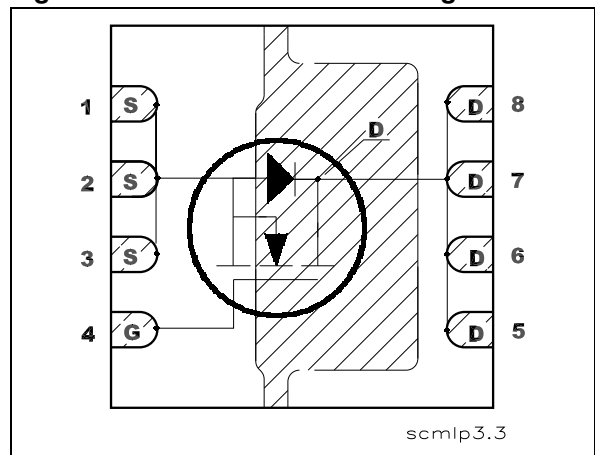


Table 1. Device summary

Order code	Marking	Package	Packaging
STL9N3LLH5	9N3L	PowerFLAT™ (3.3x3.3)	Tape and reel

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Obsolete Product(s) - Obsolete Product(s)



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	30	V
V_{GS}	Gate-source voltage	± 22	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	9	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	6	A
$I_{DM}^{(2)}$	Drain current (pulsed)	36	A
$P_{TOT}^{(3)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	50	W
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	2	W
	Derating factor	0.4	W/ $^\circ\text{C}$
T_J T_{stg}	Operating junction temperature storage temperature	-55 to 150	$^\circ\text{C}$

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

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case (drain)	2.5	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	42.8	$^\circ\text{C/W}$
$R_{thj-pcb}^{(2)}$	Thermal resistance junction-pcb	63.5	$^\circ\text{C/W}$

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

Table 4. Avalanche data

Symbol	Parameter	Value	Unit
$I_{AV}^{(1)}$	Not-repetitive avalanche current	7.5	A
$E_{AS}^{(2)}$	Thermal resistance junction-pcb	150	mJ

1. Pulse width limited by T_{Jmax} .
2. Starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AV}$, $V_{DD} = 21\text{ V}$

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} = Max rating, V _{DS} = Max rating @ 125 °C			1 10	µA µA
I _{GSS}	Gate body leakage current (V _{DS} = 0)	V _{GS} = ± 22 V			±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250 µA	1		2.5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 4.5 A V _{GS} = 4.5 V, I _D = 4.5 A		15 19	19 22	mΩ mΩ

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	-	724	900 ⁽¹⁾	pF
C _{oss}	Output capacitance			132	165 ⁽¹⁾	pF
C _{rss}	Reverse transfer capacitance			20	25 ⁽¹⁾	pF
Q _g	Total gate charge	V _{DD} = 15 V, I _D = 9 A	-	5	6 ⁽¹⁾	nC
Q _{gs}	Gate-source charge	V _{GS} = 4.5 V		2	2.5 ⁽¹⁾	nC
Q _{gd}	Gate-drain charge	(see Figure 14)		2	2.5 ⁽¹⁾	nC
R _G	Gate input resistance	f = 1 MHz Gate DC Bias = 0 Test signal level = 20 mV Open drain	-		3.3	Ω

1. Max values not tested

Table 7. Switching times ⁽¹⁾

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 15 V, I _D = 4.5 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13)	-	4	5	ns
t _r	Rise time			4.2	5.2	ns
t _{d(off)}	Turn-off delay time			21	26	ns
t _f	Fall time			3.5	4.25	ns

1. Max values not tested

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		9	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		36	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 9\text{ A}$, $V_{GS} = 0$	-		1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 9\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 20\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 18)	-	21 10 1		ns nC 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

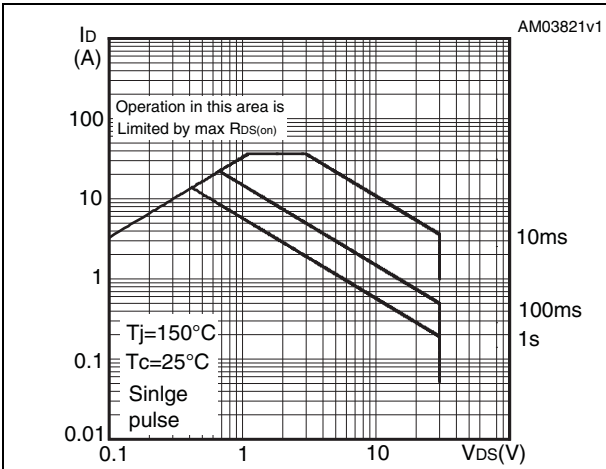


Figure 3. Thermal impedance

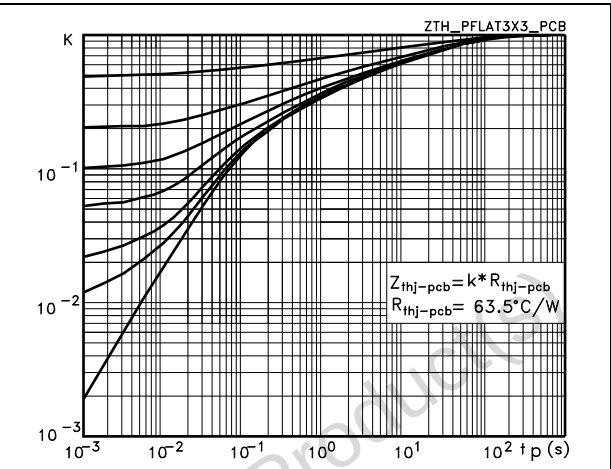


Figure 4. Output characteristics

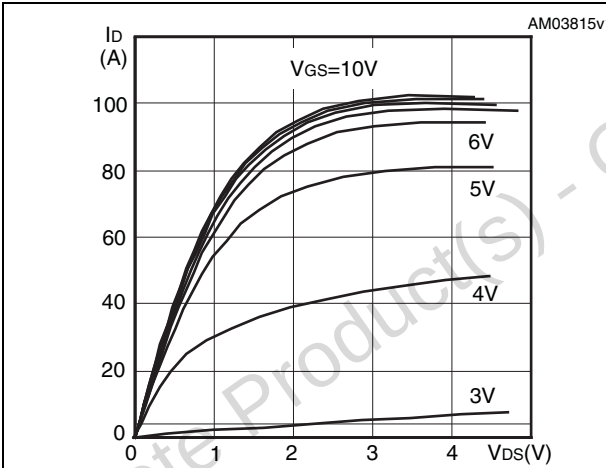


Figure 5. Transfer characteristics

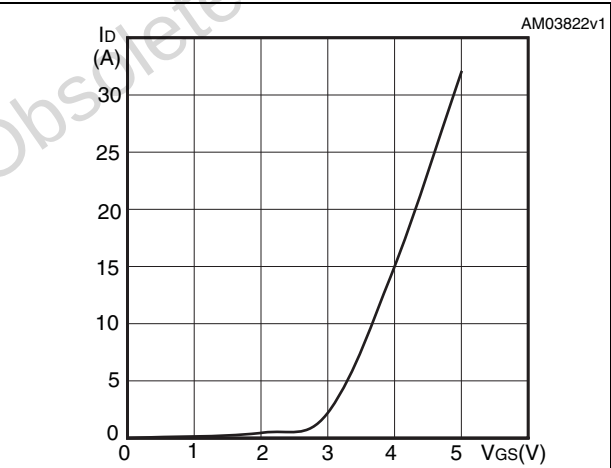


Figure 6. Normalized BVDS vs temperature

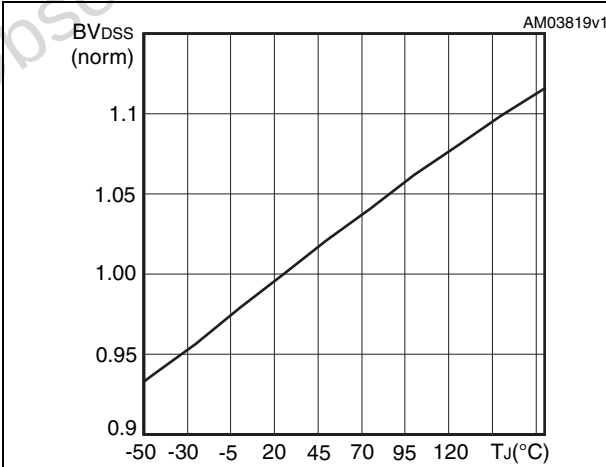


Figure 7. Static drain-source on-resistance

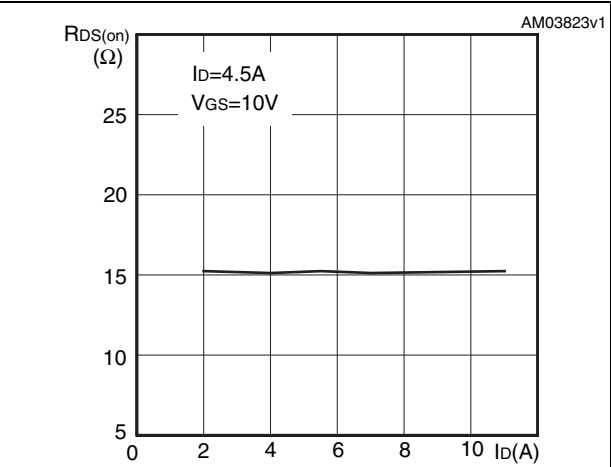


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

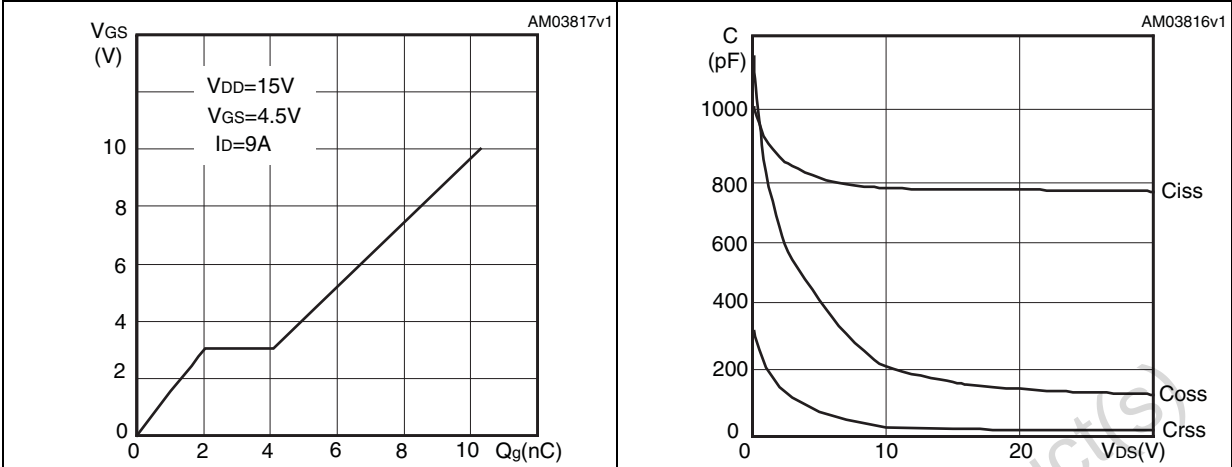


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on-resistance vs temperature

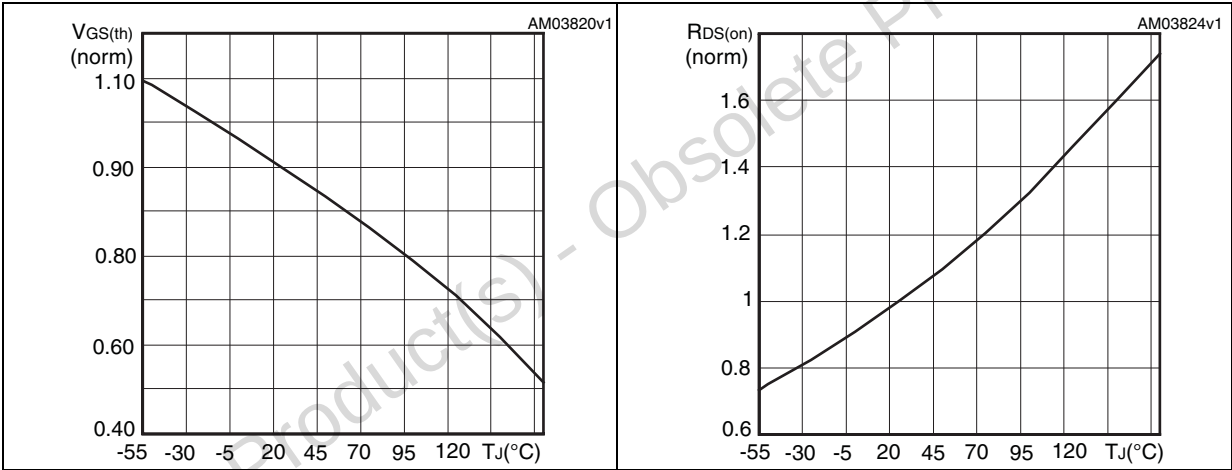
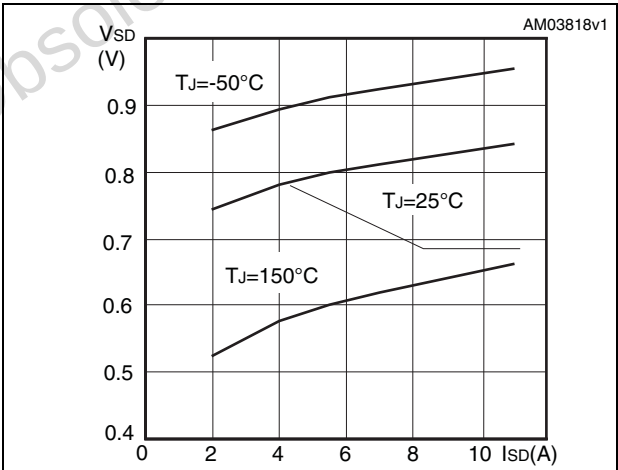


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

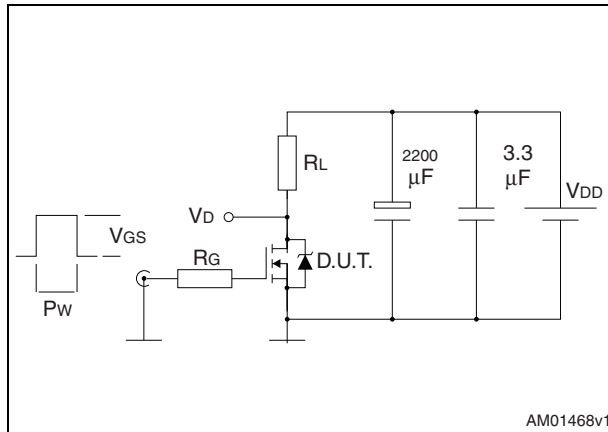


Figure 14. Gate charge test circuit

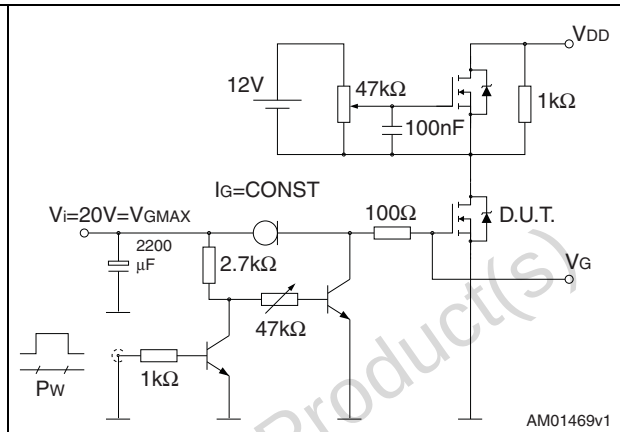


Figure 15. Test circuit for inductive load switching and diode recovery times

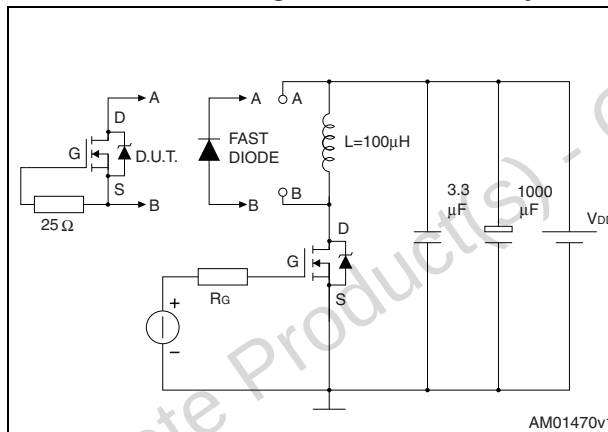


Figure 16. Unclamped inductive load test circuit

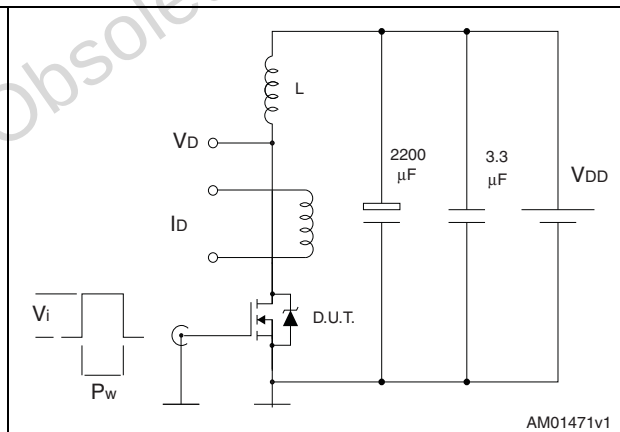


Figure 17. Unclamped inductive waveform

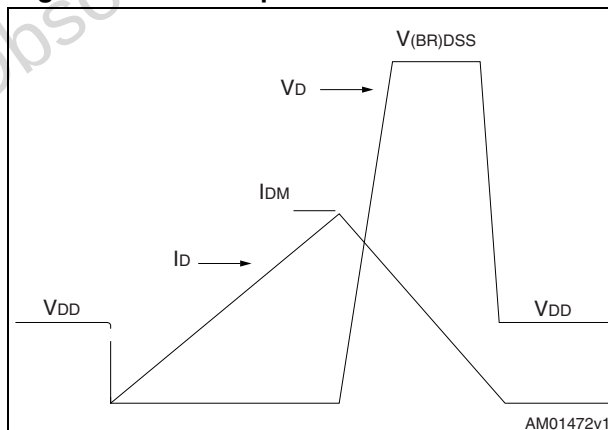
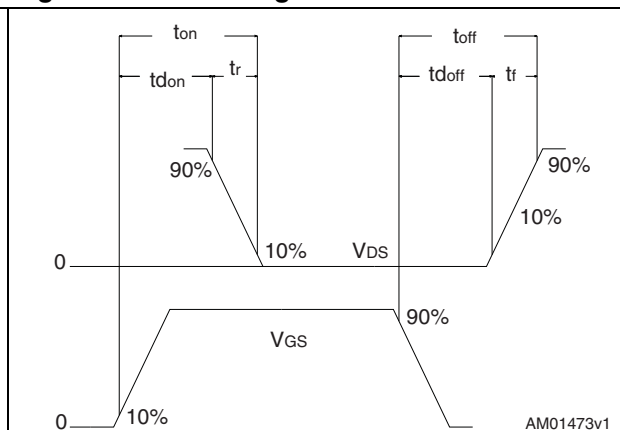


Figure 18. Switching time waveform



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™ 3.3 x 3.3 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80	0.90	1.00
A1	0		0.05
A3		0.20	
b	0.23		0.38
D	3.20	3.30	3.40
D2	2.50		2.75
E	3.20	3.30	3.40
E2	1.25		1.50
e		0.65	
L	0.30		0.50

Figure 19. PowerFLAT™ 3.3 x 3.3 drawing

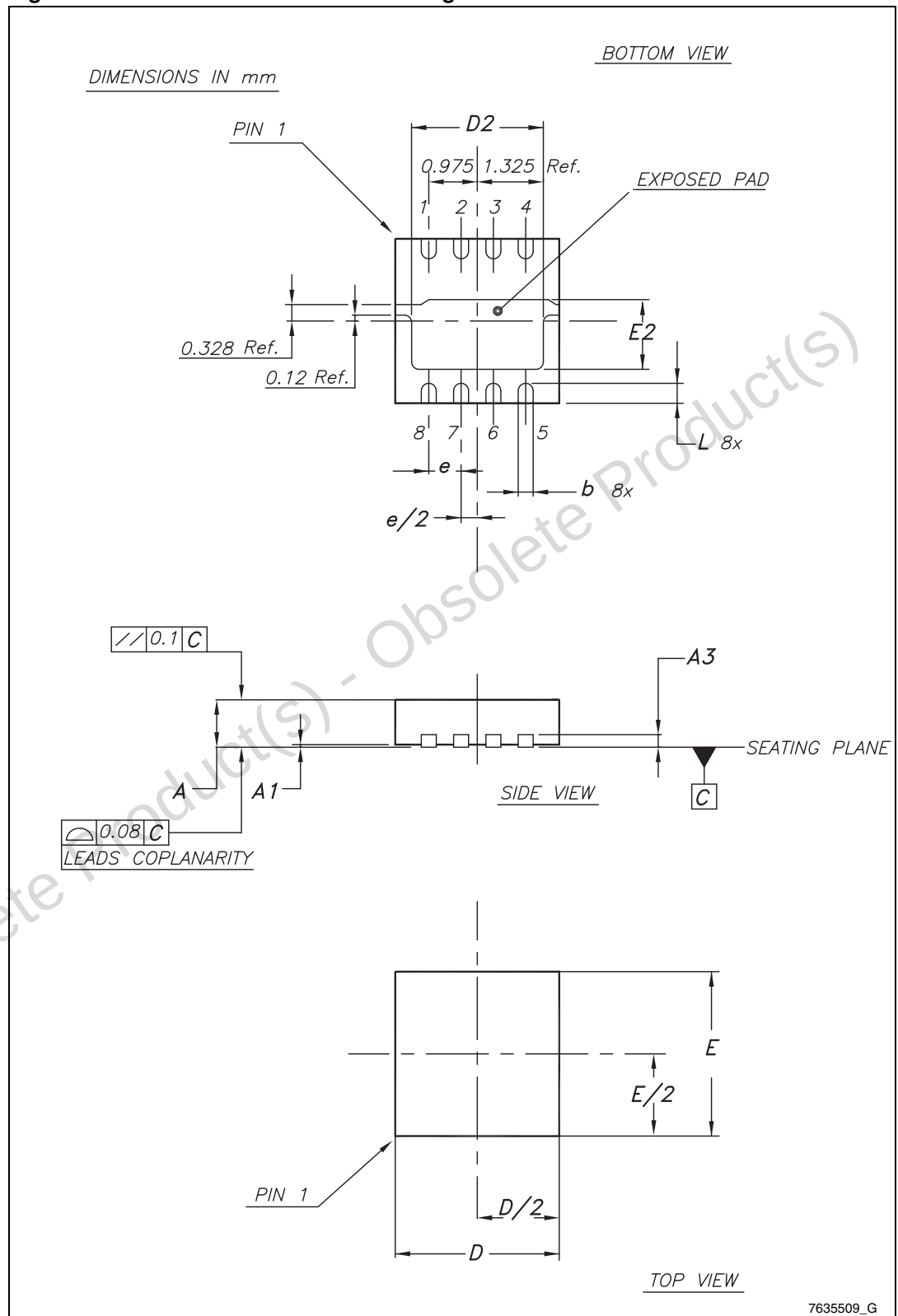
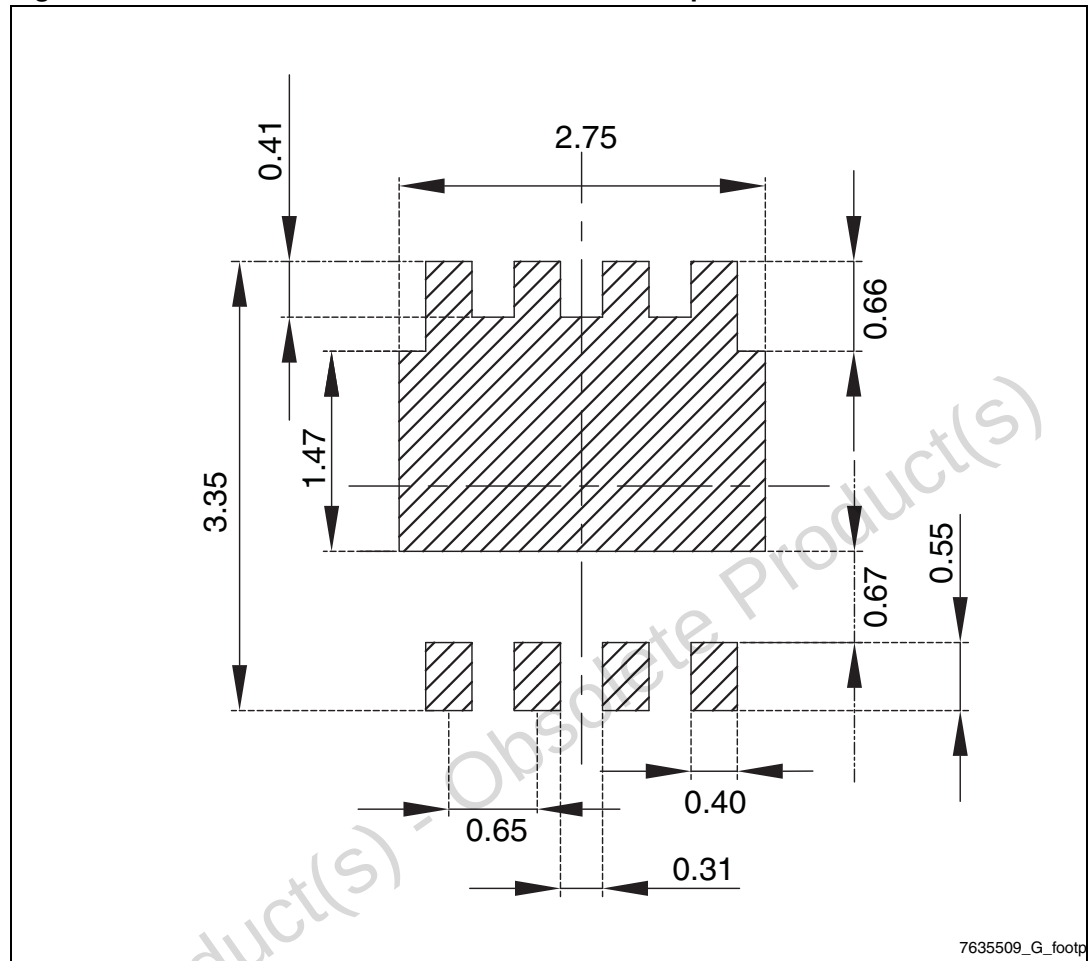


Figure 20. PowerFLAT™ 3.3 x 3.3 recommended footprint



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
09-Jul-2009	1	First release
01-Oct-2012	2	Updated Section 4: Package mechanical data . Updated Figure 1 , title and description on the cover page.

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