

N-channel 60 V, 10 mΩ typ., 11 A STripFET™ F7 Power MOSFET in a PowerFLAT™ 3.3x3.3 package

Datasheet - production data

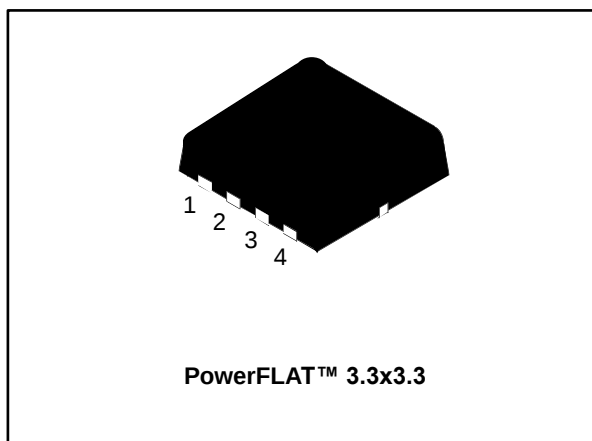
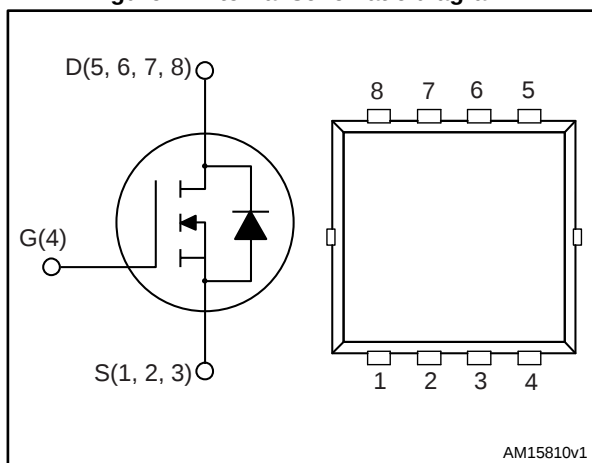


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL11N6F7	60 V	12 mΩ	11 A

Features

- Among the lowest R_{DS(on)} on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1: Device summary

Order code	Marking	Package	Packing
STL11N6F7	11N6F	PowerFLAT™ 3.3x3.3	Tape and reel

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{GS}	Gate source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	47	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	30	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	188	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	11	A
	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	7	
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	44	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	48	W
$P_{TOT}^{(3)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	2.9	W
T_J	Operating junction temperature	-55 to 150	$^\circ\text{C}$
T_{stg}	Storage temperature		

Notes:⁽¹⁾This value is rated according to R_{thj-c} ⁽²⁾Pulse width limited by safe operating area⁽³⁾This value is rated according to $R_{thj-pcb}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	42.8	$^\circ\text{C}/\text{W}$
$R_{thj-case}$	Thermal resistance junction-case max	2.6	$^\circ\text{C}/\text{W}$

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

2 Electrical characteristics

($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 4: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	60			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$			1	μA
I_{GSS}	Gate-body leakage current	$V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 5.5\text{ A}$		10	12	m Ω

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 30\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	1035	-	pF
C_{oss}	Output capacitance		-	450	-	pF
C_{rss}	Reverse transfer capacitance		-	53	-	pF
Q_g	Total gate charge	$V_{DD} = 30\text{ V}$, $I_D = 11\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Test circuit for gate charge behavior")	-	17	-	nC
Q_{gs}	Gate-source charge		-	5.7	-	nC
Q_{gd}	Gate-drain charge		-	5.7	-	nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}$, $I_D = 5.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13: "Test circuit for resistive load switching times")	-	14.5	-	ns
t_r	Rise time		-	15.3	-	ns
$t_{d(off)}$	Turn-off delay time		-	19.4	-	ns
t_f	Fall time		-	8	-	ns

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 11\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.2	V
t_{rr}	Reverse recovery time	$I_D = 11\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 48\text{ V}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	26.8		ns
Q_{rr}	Reverse recovery charge		-	14.2		nC
I_{RRM}	Reverse recovery current		-	1.06		A

Notes:

⁽¹⁾Pulsed: pulse duration = 300 μ s, duty cycle 1.5%

2.1 Electrical characteristics (curve)

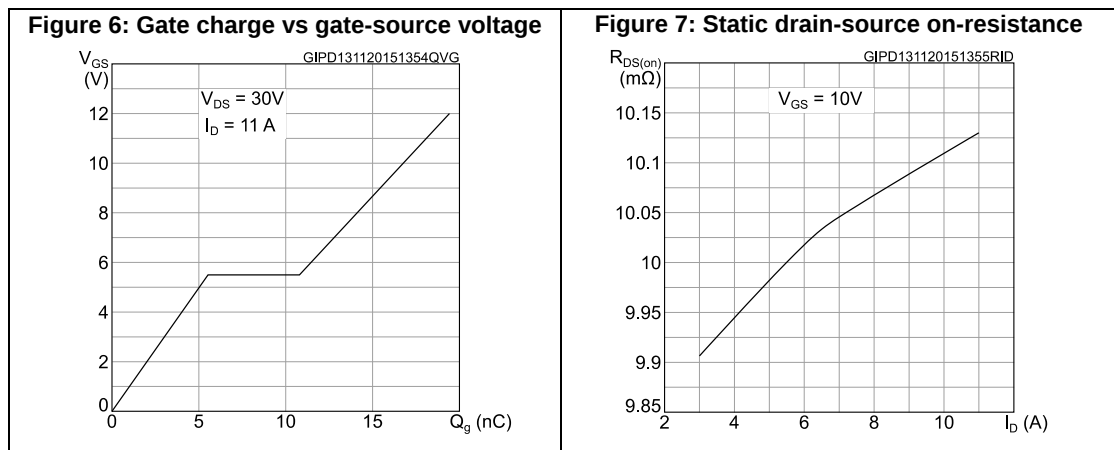
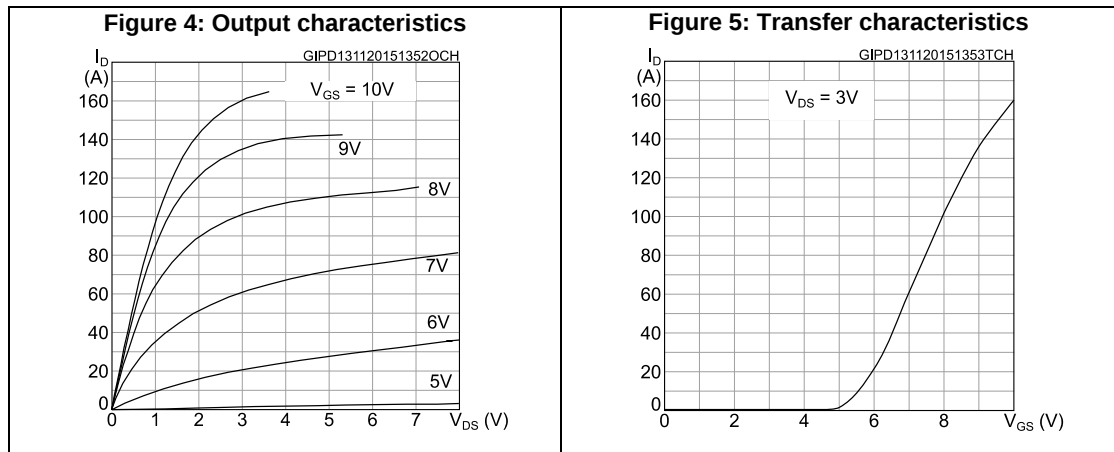
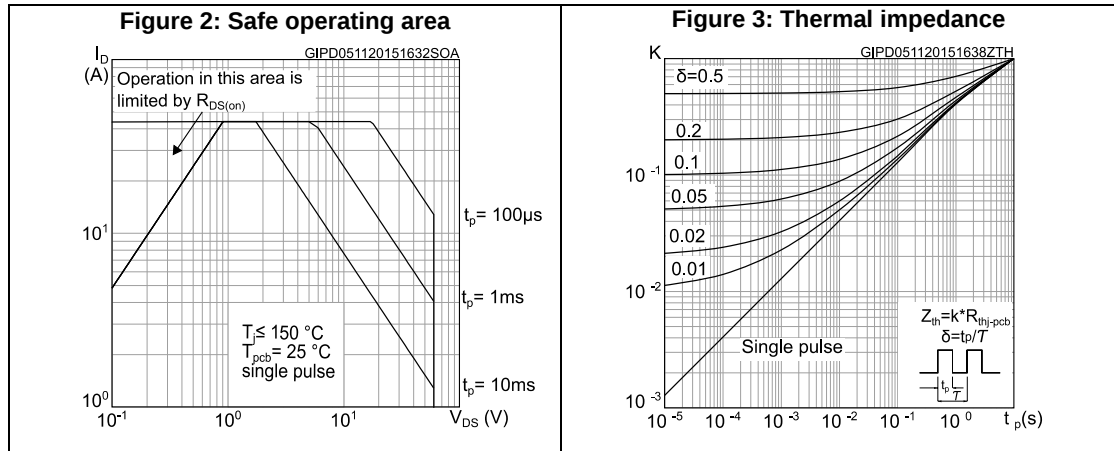


Figure 8: Capacitance variations

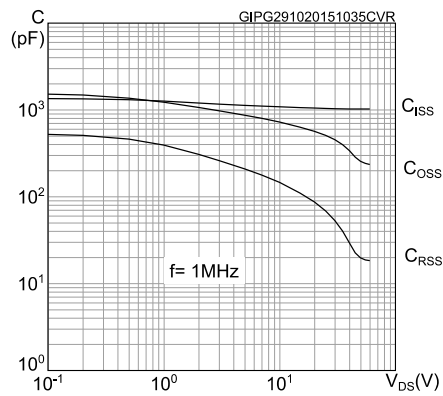


Figure 9: Normalized gate threshold voltage vs temperature

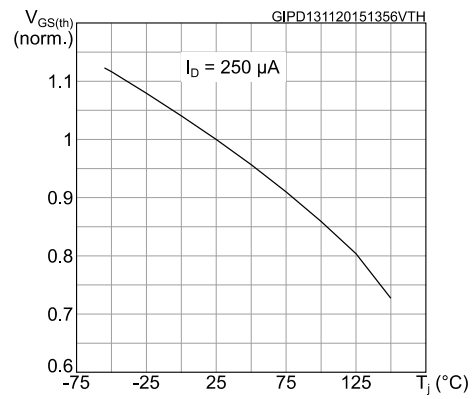


Figure 10: Normalized on-resistance vs temperature

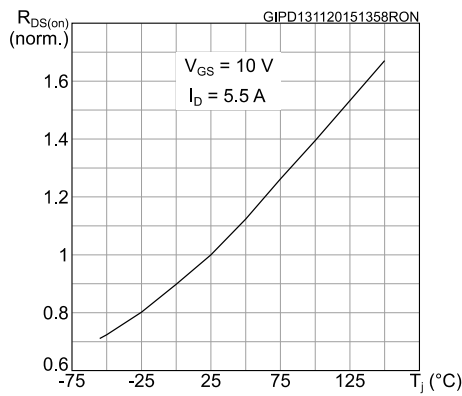
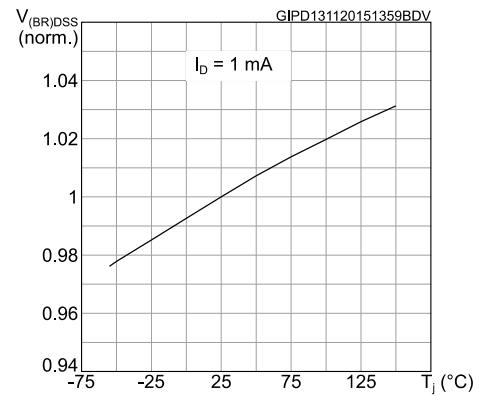
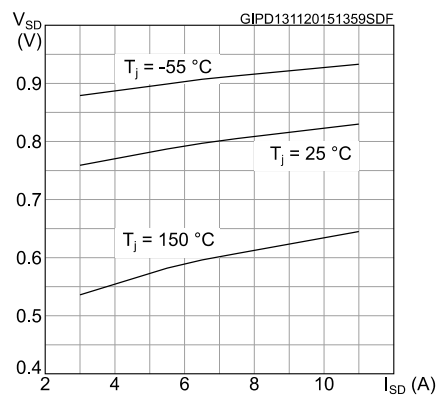
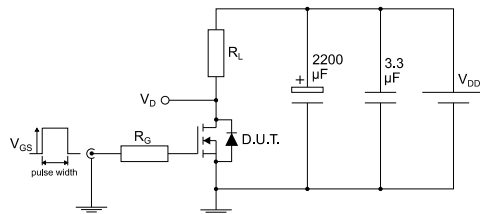
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Source-drain diode forward characteristics



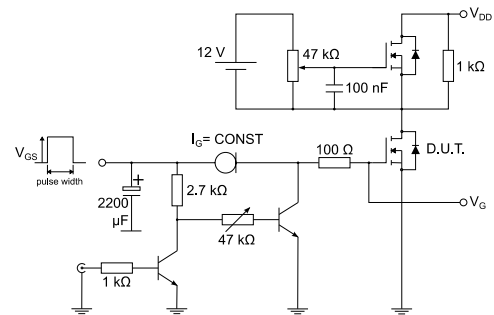
3 Test circuits

Figure 13: Test circuit for resistive load switching times



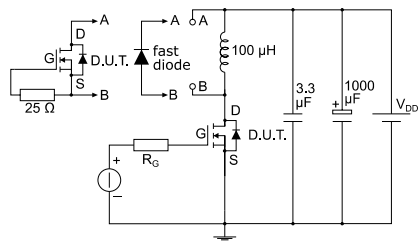
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Figure 14: Test circuit for gate charge behavior



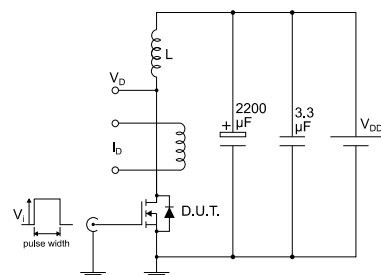
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Figure 15: Test circuit for inductive load switching and diode recovery times



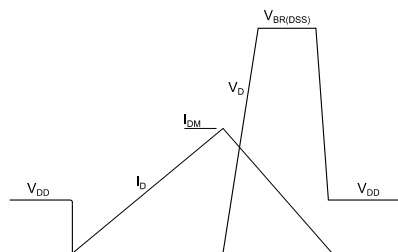
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Figure 16: Unclamped inductive load test circuit



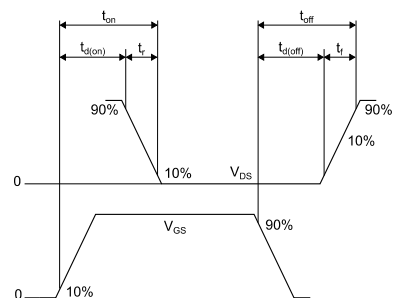
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Figure 17: Unclamped inductive waveform



AM01472v1

Figure 18: Switching time waveform



AM01473v1

4 Package information

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.

4.1 PowerFLAT 3.3x3.3 package information

Figure 19: PowerFLAT™ 3.3x3.3 package outline

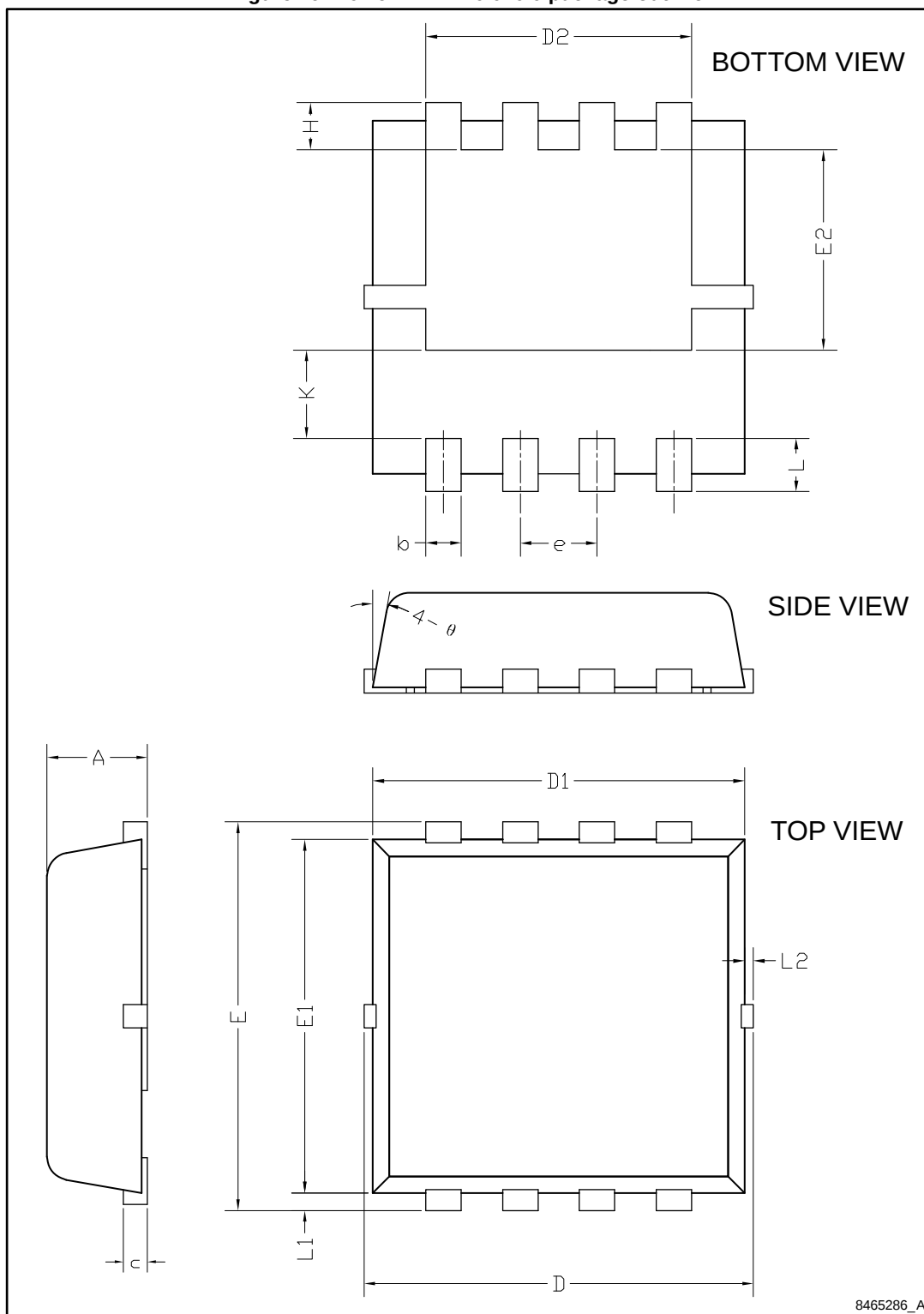
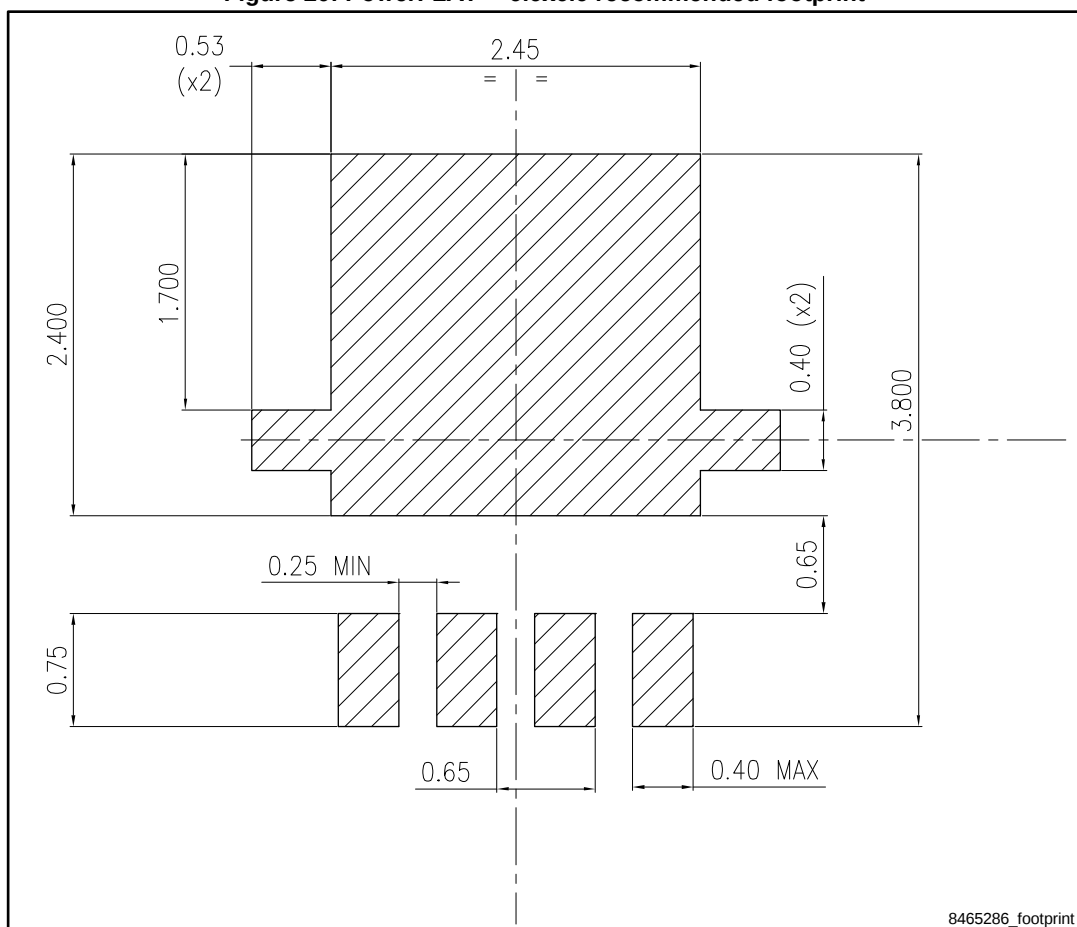


Table 8: PowerFLAT™ 3.3x3.3 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.70	0.80	0.90
b	0.25	0.30	0.39
c	0.14	0.15	0.20
D	3.10	3.30	3.50
D1	3.05	3.15	3.25
D2	2.15	2.25	2.35
e	0.55	0.65	0.75
E	3.10	3.30	3.50
E1	2.90	3.00	3.10
E2	1.60	1.70	1.80
H	0.25	0.40	0.55
K	0.65	0.75	0.85
L	0.30	0.45	0.60
L1	0.05	0.15	0.25
L2			0.15
θ	8°	10°	12°

Figure 20: PowerFLAT™ 3.3x3.3 recommended footprint



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
21-Jul-2015	1	First release.
17-Nov-2015	2	Document status changed from preliminary to production data. Updated title and features in cover page Updated Table 2: "Absolute maximum ratings" and Section 4: "Electrical characteristics" . Added Section 4.1: "Electrical characteristics (curve)" . Minor text changes

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