

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

Datasheet - production data

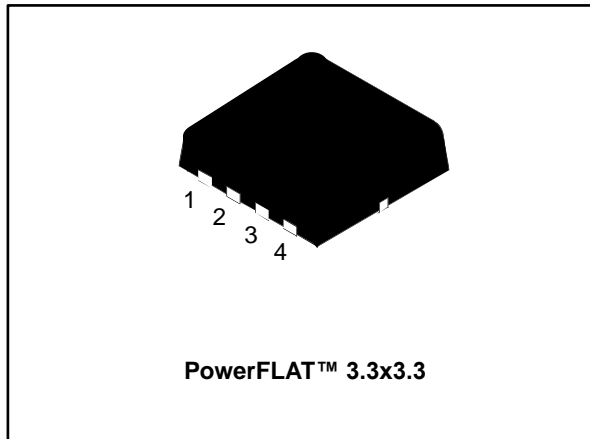
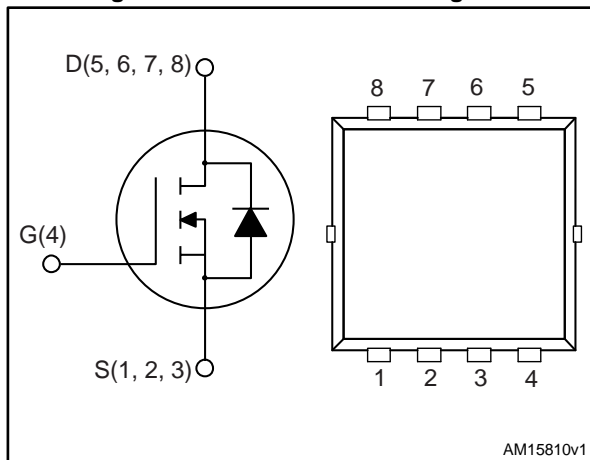


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STL11N6F7	60 V	12 mΩ	11 A

### Features

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent figure of merit (FoM)
- Low C<sub>rss</sub>/C<sub>iss</sub> 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	$\pm 20$	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 inch<sup>2</sup>, 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	$\mu\text{A}$
$I_{GSS}$	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 $\Omega$

**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	$V_{DD} = 30\text{ V}$ , $I_D = 11\text{ A}$ ,	-	17	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\text{ V}$	-	5.7	-	nC
$Q_{gd}$	Gate-drain charge	(see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> )	-	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 <a href="#">Figure 13: "Test circuit for resistive load switching times"</a> )	-	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

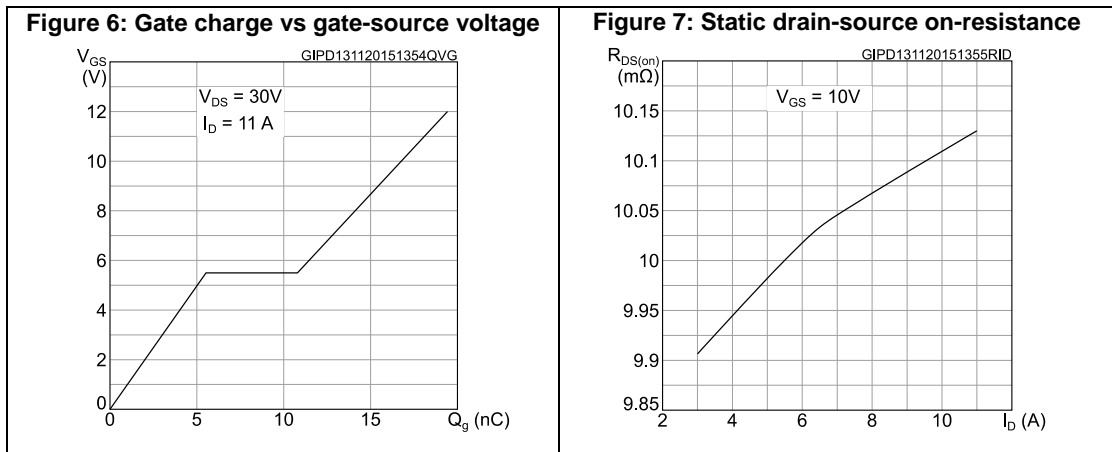
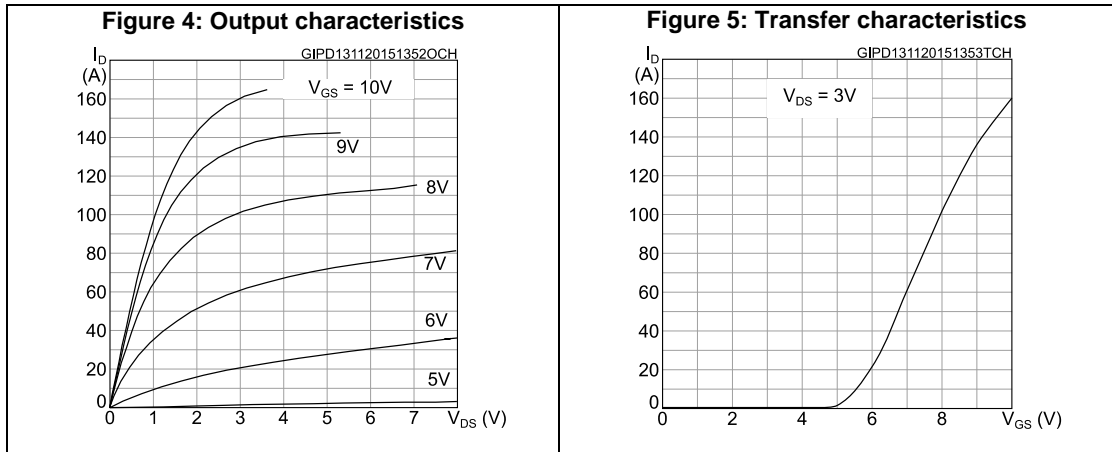
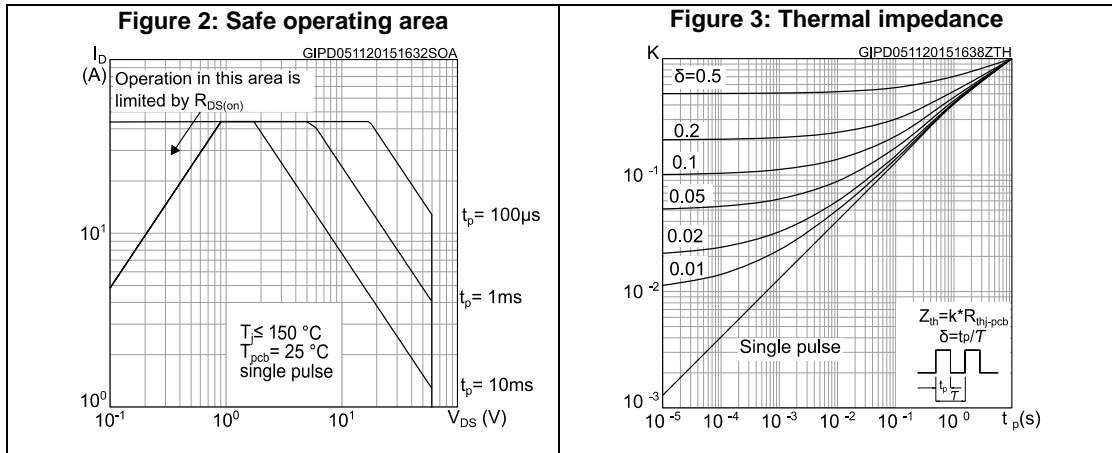
**Table 7: Source-drain diode**

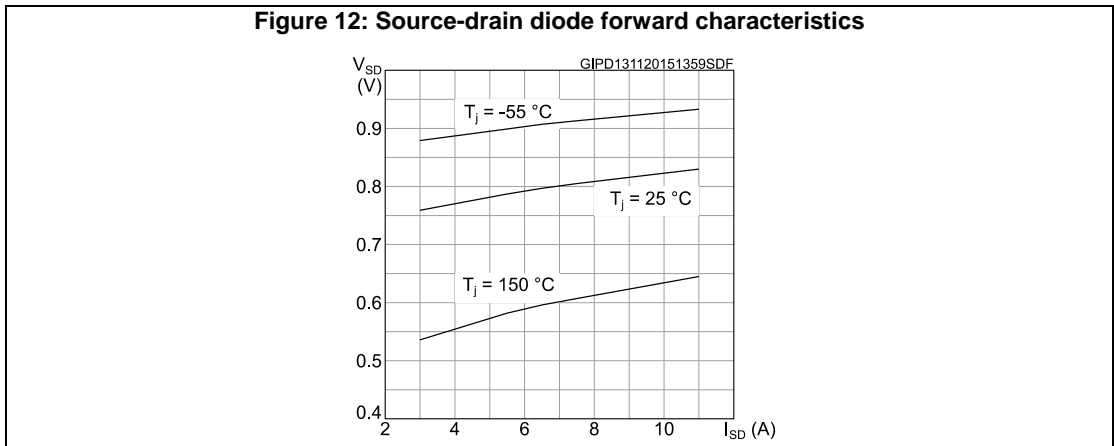
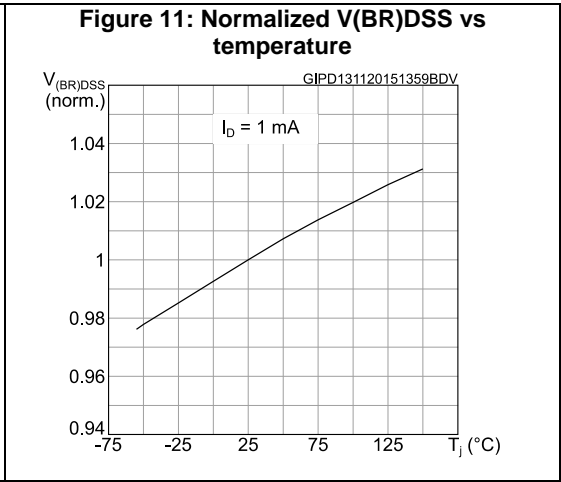
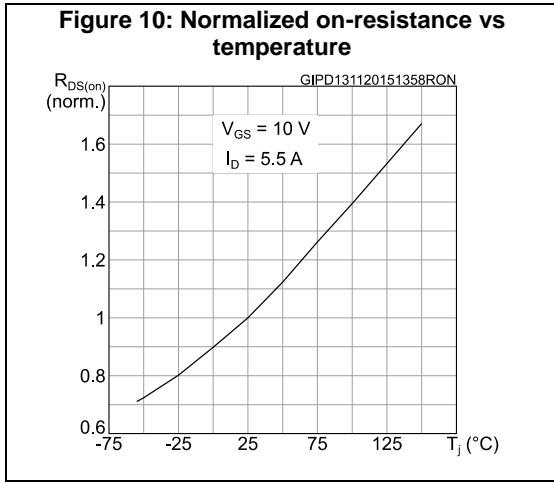
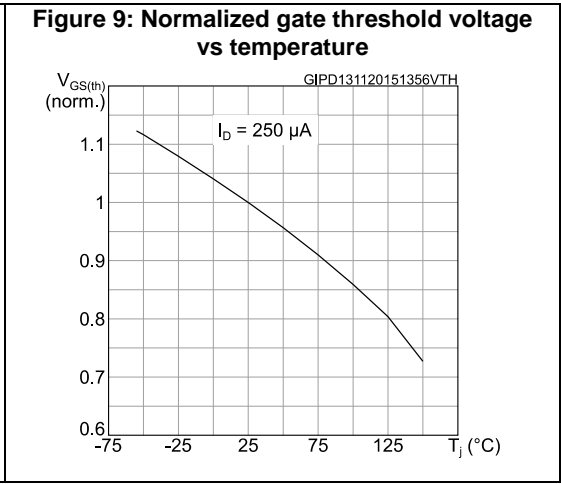
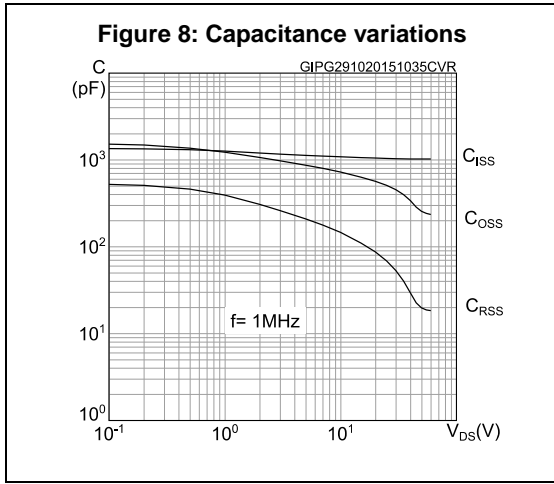
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 11\text{ A}$ , $V_{GS} = 0\text{ V}$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_D = 11\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 48\text{ V}$	-	26.8		ns
$Q_{rr}$	Reverse recovery charge	(see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

**Notes:**

(1) Pulsed: pulse duration = 300  $\mu$ s, duty cycle 1.5%

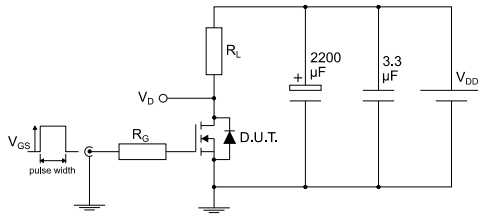
## 2.1 Electrical characteristics (curve)





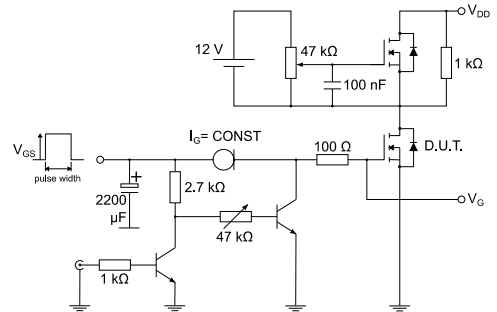
### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



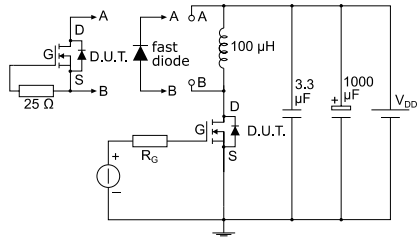
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**Figure 14: Test circuit for gate charge behavior**



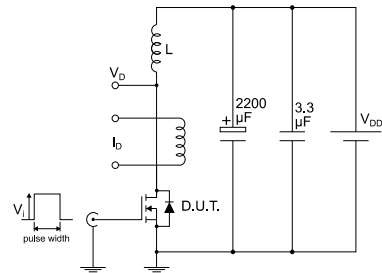
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



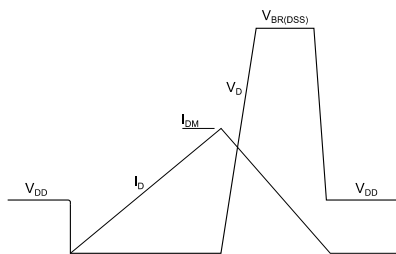
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**Figure 16: Unclamped inductive load test circuit**



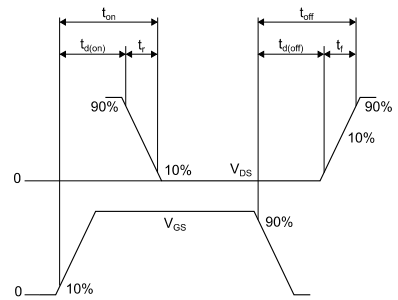
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**Figure 17: Unclamped inductive waveform**



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**Figure 18: Switching time waveform**



AM01473v1

## 4 Package information

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<sup>®</sup> is an ST trademark.



### 4.1 PowerFLAT 3.3x3.3 package information

Figure 19: PowerFLAT™ 3.3x3.3 package outline

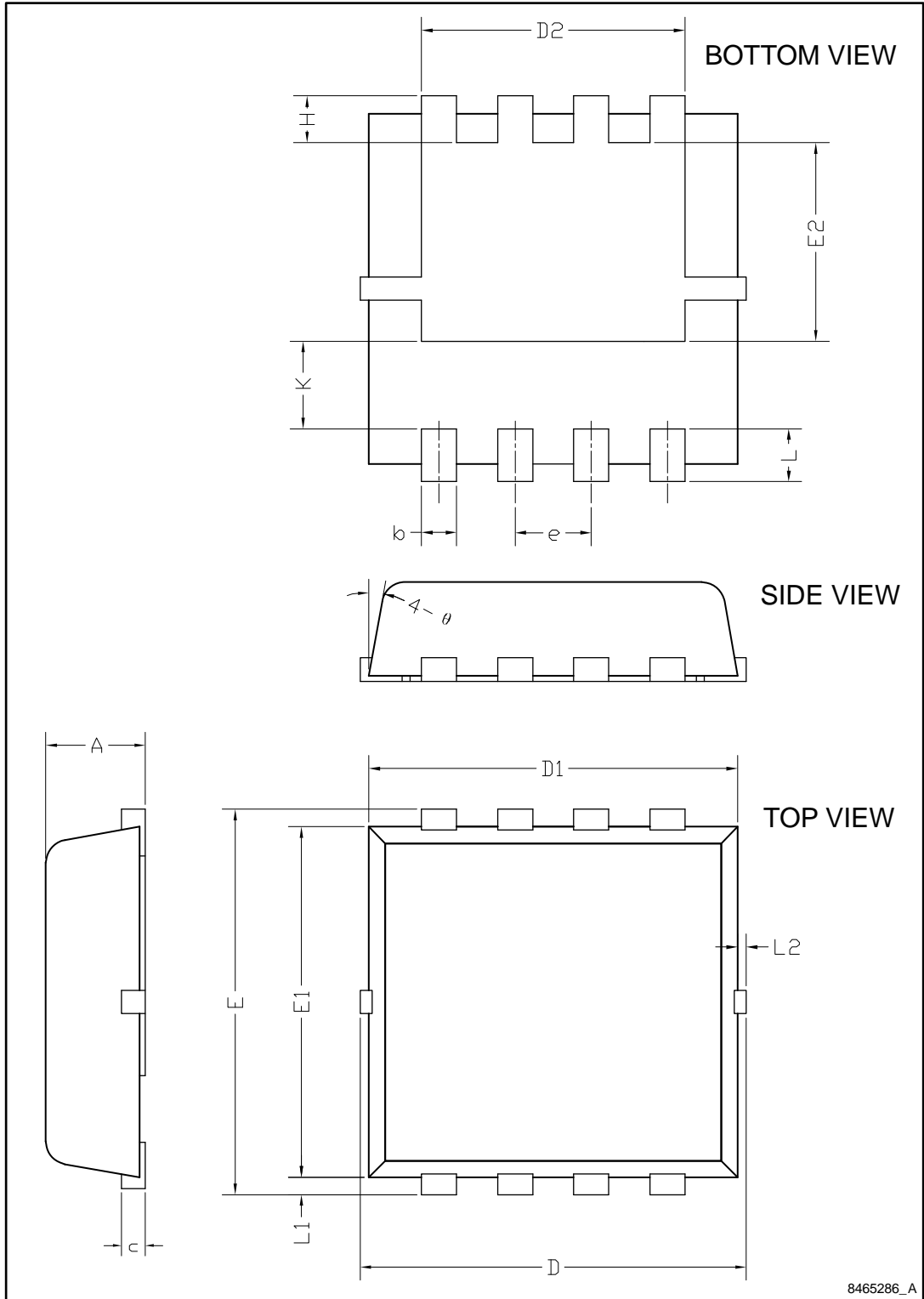
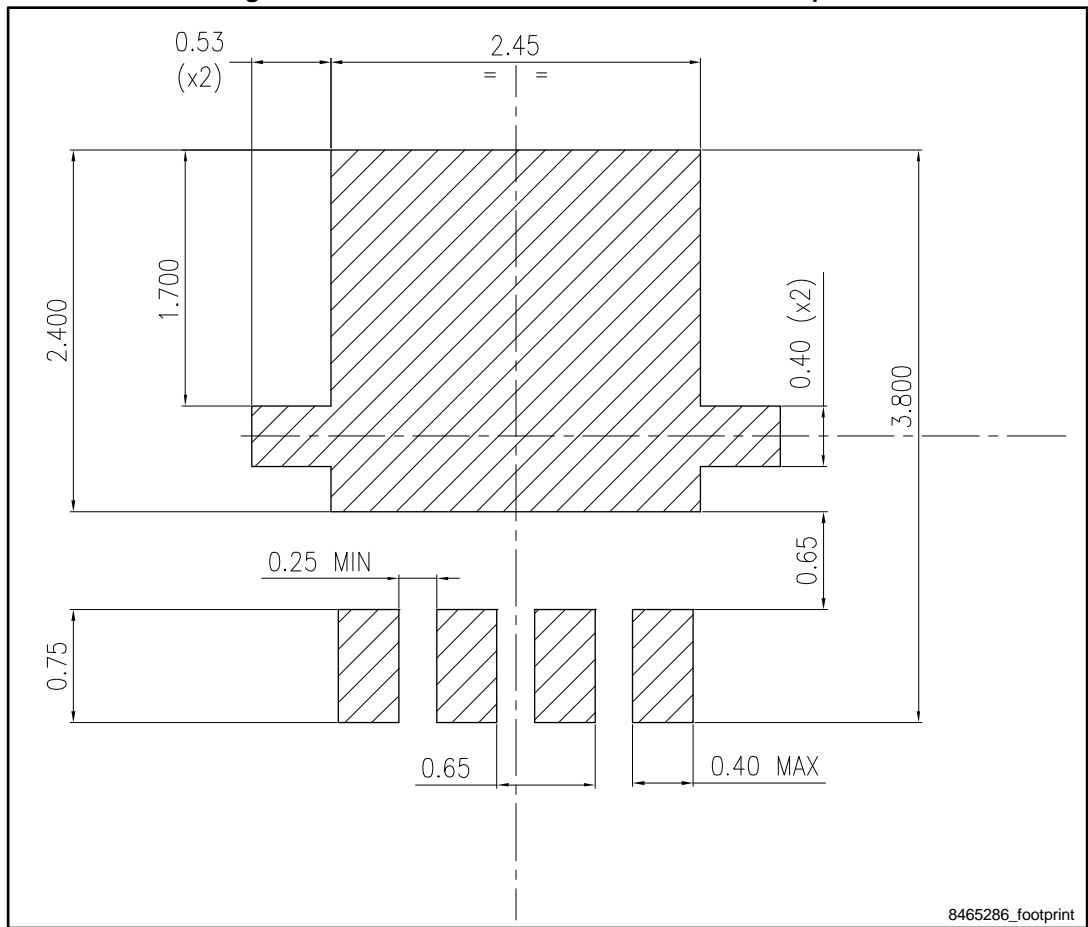


Table 8: PowerFLAT™ 3.3x3.3 package mechanical data

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 <i>Table 2: "Absolute maximum ratings"</i> and <i>Section 4: "Electrical characteristics"</i> . Added <i>Section 4.1: "Electrical characteristics (curve)"</i> . Minor text changes

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