

## Automotive-grade N-channel 60 V, 35 mΩ typ., 6.5 A STripFET™ F3 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

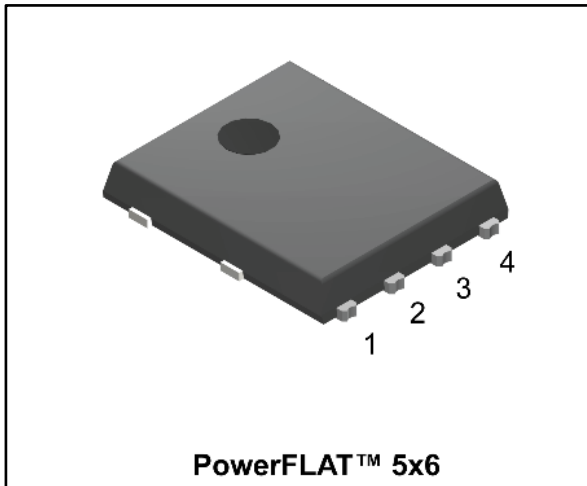
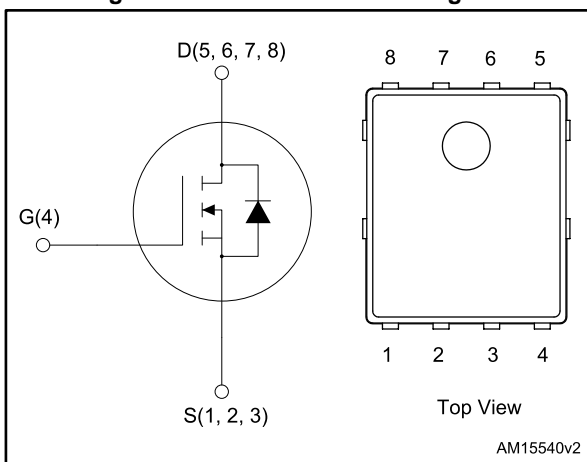


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STL7N6LF3	60 V	43 mΩ	6.5 A

- AEC-Q101 qualified
- Logic level V<sub>GS(th)</sub>
- 175 °C maximum junction temperature
- 100% avalanche rated
- Wettable flank package



### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using STripFET™ F3 technology. It is designed to minimize on-resistance and gate charge to provide superior switching performance.

Table 1: Device summary

Order code	Marking	Package	Packing
STL7N6LF3	7N6LF3	PowerFLAT™ 5x6	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 $T_C = 25\text{ °C}$	20	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	16	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ °C}$	6.5	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ °C}$	4.6	A
$I_{DM}^{(3),(2)}$	Drain current (pulsed)	26	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ °C}$	52	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ °C}$	4.3	W
$I_{AV}$	Not-repetitive avalanche current	6.5	A
$E_{AS}^{(4)}$	Single pulse avalanche energy	190	mJ
$T_j$	Operating junction temperature range	-55 to 175	°C
$T_{stg}$	Storage temperature range		

**Notes:**

- (1) This value is rated according to  $R_{thj-case}$
- (2) This value is rated according to  $R_{thj-pcb}$
- (3) Pulse width limited by safe operating area.
- (4) Starting  $T_J = 25\text{ °C}$ ,  $I_D = 8\text{ A}$ ,  $V_{DD} = 25\text{ V}$ .

**Table 3: Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.9	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	°C/W

**Notes:**

- (1) When mounted on FR-4 board of 1 inch<sup>2</sup>, 2oz Cu,  $t < 10\text{ s}$

## 2 Electrical characteristics

(T<sub>C</sub> = 25 °C unless otherwise specified)

**Table 4: On/Off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60			V
I <sub>DSS</sub>	Zero gate voltage drain current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 60 V			1	μA
I <sub>GSS</sub>	Gate-body leakage current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1		2.5	V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3 A		35	43	mΩ
		V <sub>GS</sub> = 5 V, I <sub>D</sub> = 3 A		48	60	mΩ

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0 V	-	432	-	pF
C <sub>oss</sub>	Output capacitance		-	93	-	
C <sub>rss</sub>	Reverse transfer capacitance		-	10.5	-	
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 6.5 A, V <sub>GS</sub> = 0 to 10 V (see <a href="#">Figure 13: "Test circuit for gate charge behavior"</a> )	-	8.7	-	nC
Q <sub>gs</sub>	Gate-source charge		-	1.9	-	
Q <sub>gd</sub>	Gate-drain charge		-	1.9	-	
R <sub>G</sub>	Intrinsic gate resistance	f = 1 MHz, I <sub>D</sub> = 0 A	-	6.3	-	Ω

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 3 A, R <sub>G</sub> = 4.7 Ω, V <sub>GS</sub> = 10 V (see <a href="#">Figure 12: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 17: "Switching time waveform"</a> )	-	6.7	-	ns
t <sub>r</sub>	Rise time		-	10.4	-	
t <sub>d(off)</sub>	Turn-off delay time		-	32.4	-	
t <sub>f</sub>	Fall time		-	5.4	-	

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		6.5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		26	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{DS} = 6.5 \text{ A}$ , $V_{GS} = 0 \text{ V}$	-		1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 6.5 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$	-	24		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 48 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 14: "Test circuit for inductive load switching and diode recovery times"</a> )	-	23.3		nC
$I_{RRM}$	Reverse recovery current		-	1.9		A

**Notes:**

(1)Pulse width limited by safe operating area

(2)Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

## 2.1 Electrical characteristics (curves)

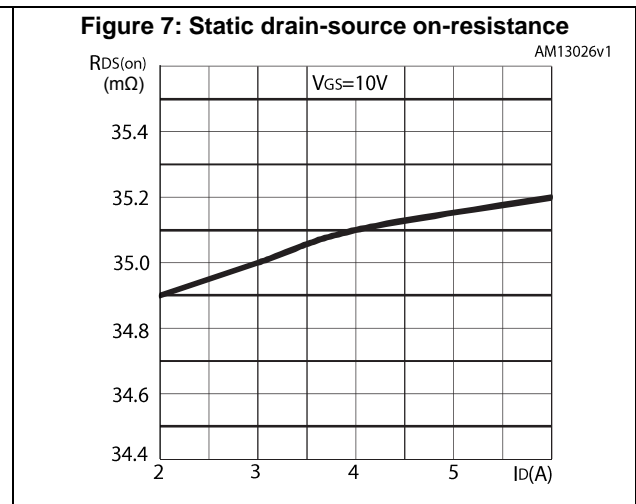
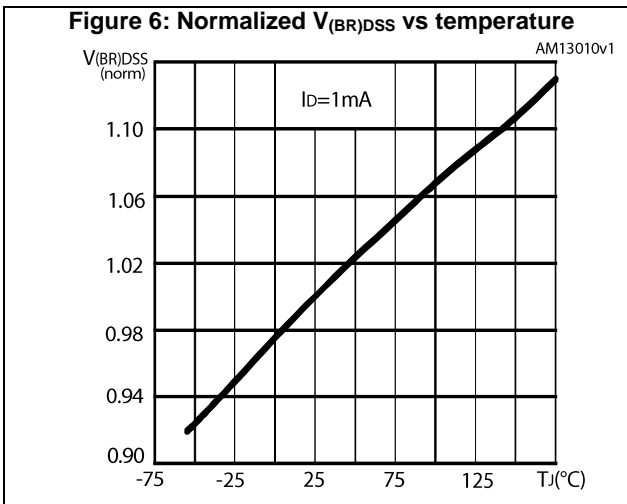
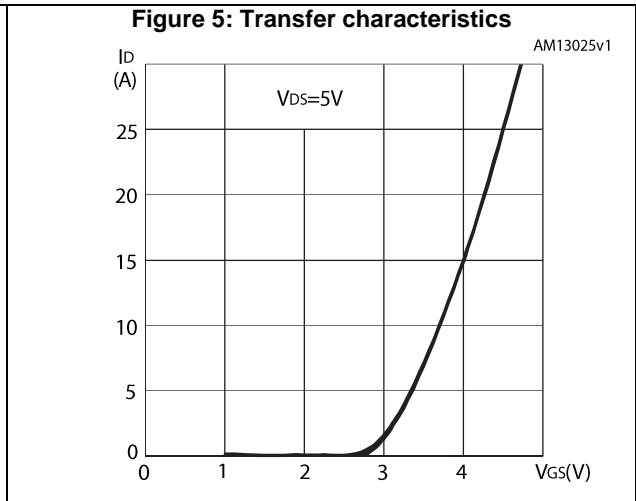
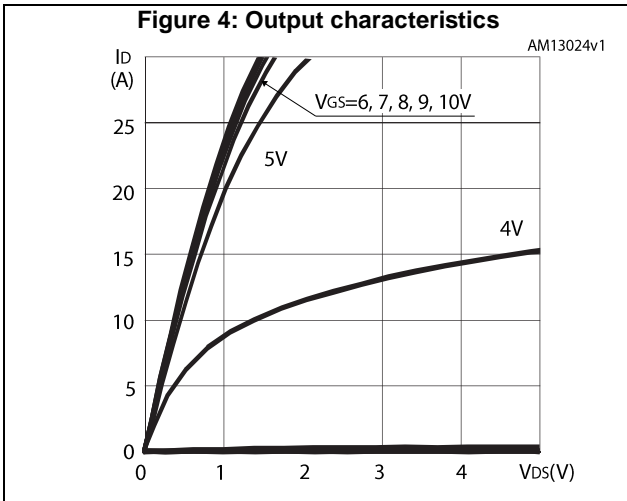
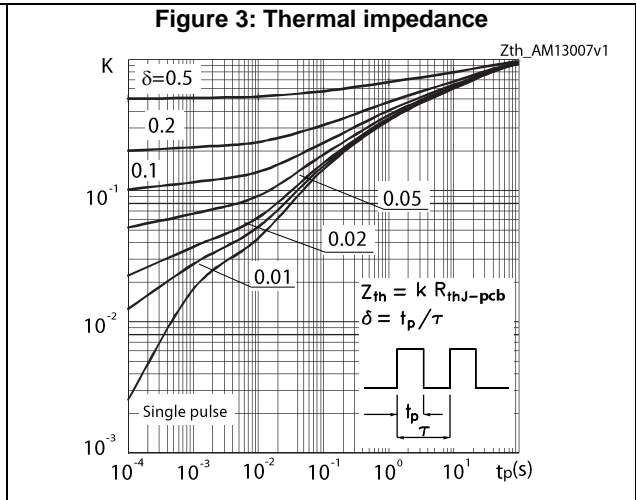
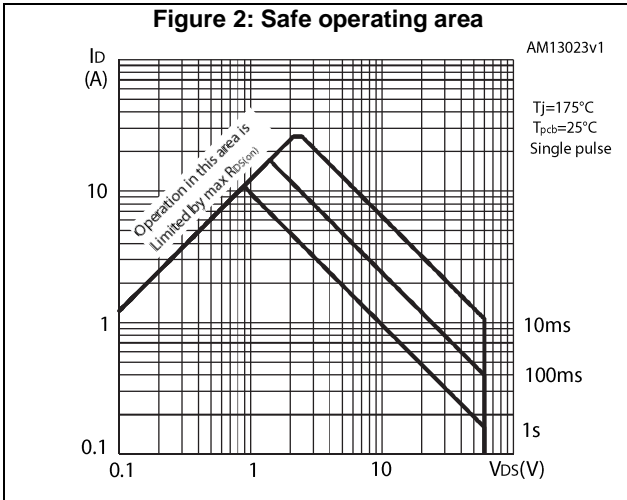


Figure 8: Gate charge vs gate-source voltage

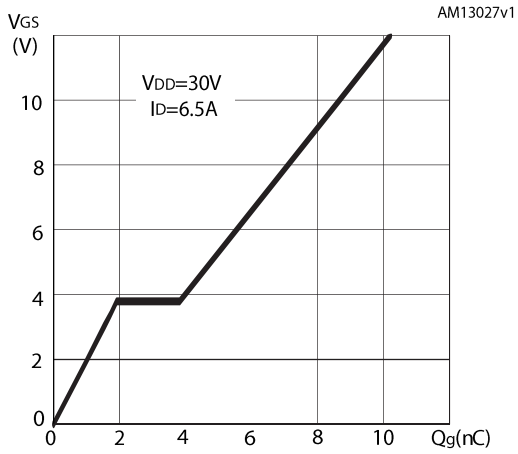


Figure 9: Capacitance variation

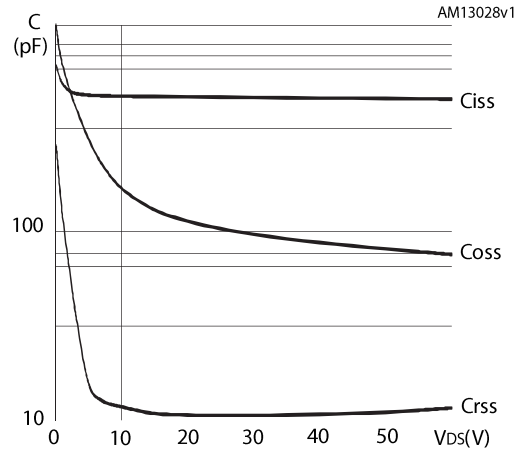


Figure 10: Normalized gate threshold voltage vs temperature

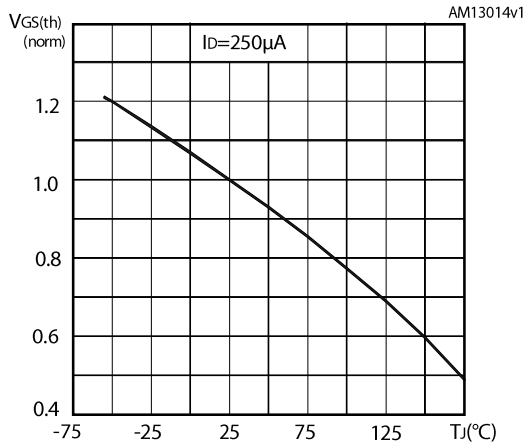
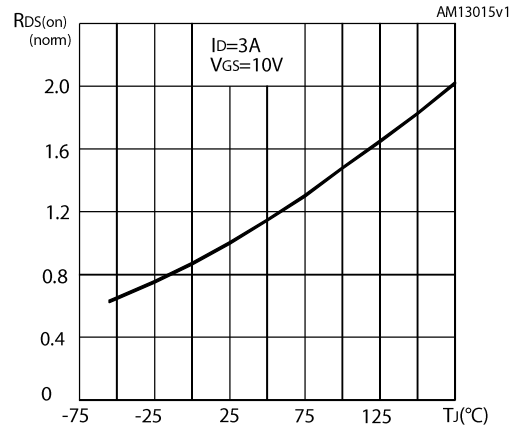


Figure 11: Normalized on-resistance vs temperature



### 3 Test circuits

**Figure 12: Test circuit for resistive load switching times**



AM01468v1

**Figure 13: Test circuit for gate charge behavior**



AM01469v1

**Figure 14: Test circuit for inductive load switching and diode recovery times**



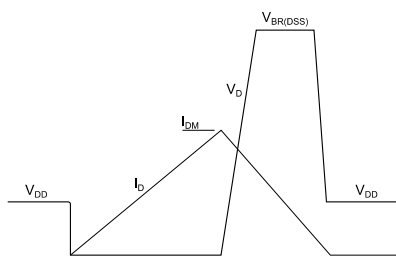
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**Figure 15: Unclamped inductive load test circuit**



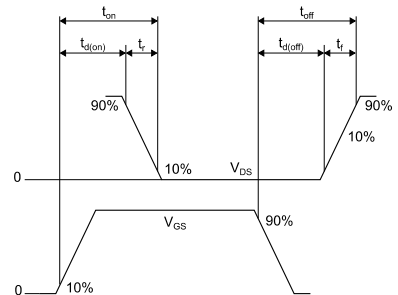
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**Figure 16: Unclamped inductive waveform**



AM01472v1

**Figure 17: 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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 PowerFLAT 5x6 WF type R package information

Figure 18: PowerFLAT™ 5x6 WF type R package outline

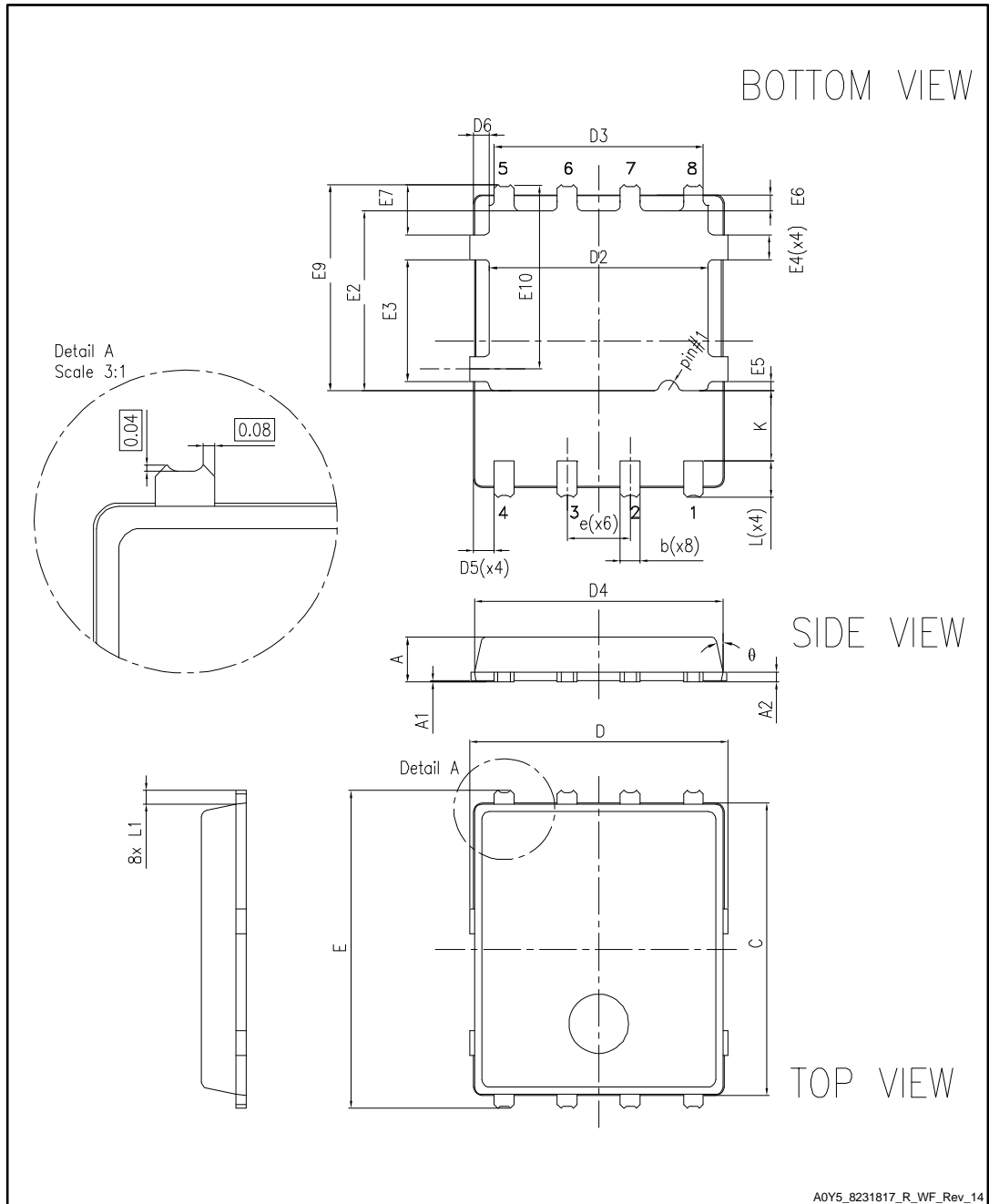
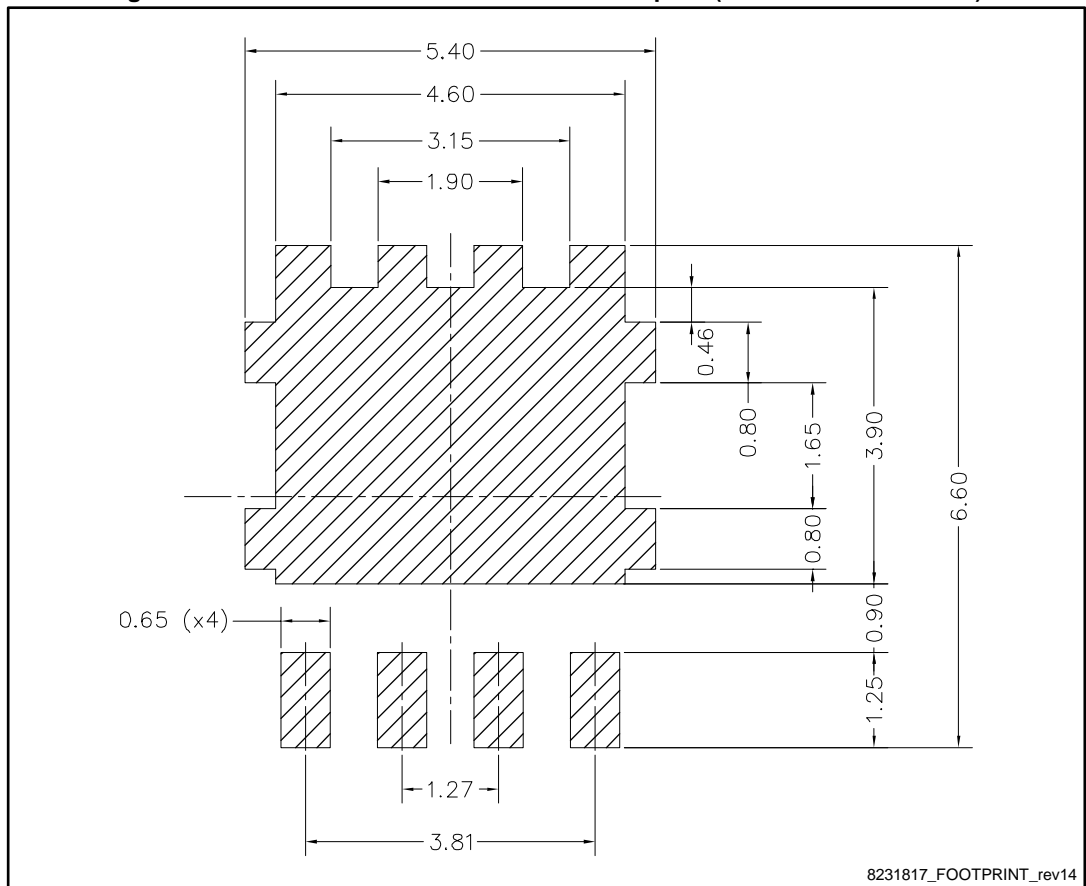


Table 8: PowerFLAT™ 5x6 WF type R mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
C	5.80	6.00	6.10
D	5.00	5.20	5.40
D2	4.15		4.45
D3	4.05	4.20	4.35
D4	4.80	5.00	5.10
D5	0.25	0.4	0.55
D6	0.15	0.3	0.45
e		1.27	
E	6.20	6.40	6.60
E2	3.50		3.70
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28
E6	0.20	0.325	0.45
E7	0.85	1.00	1.15
E9	4.00	4.20	4.40
E10	3.55	3.70	3.85
K	1.275		1.575
L	0.725	0.825	0.925
L1	0.175	0.275	0.375
θ	0°		12°

Figure 19: PowerFLAT™ 5x6 recommended footprint (dimensions are in mm)



## 4.2 Packing information

Figure 20: PowerFLAT™ 5x6 WF tape (dimensions are in mm)

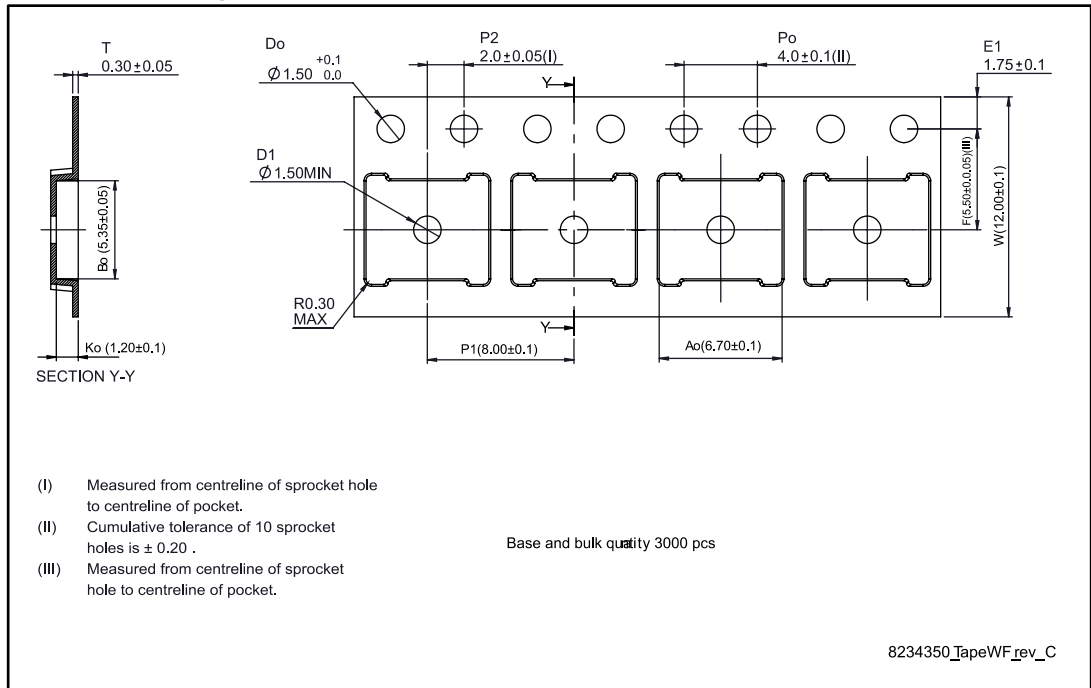


Figure 21: PowerFLAT™ 5x6 package orientation in carrier tape

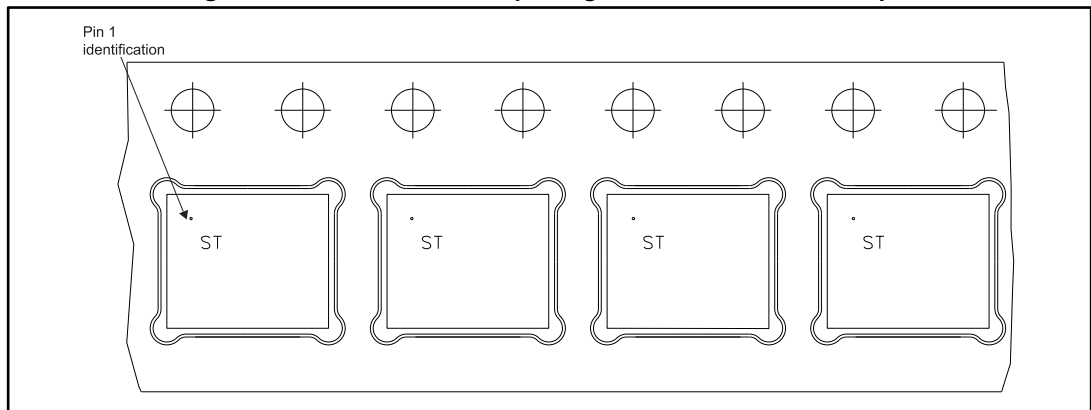
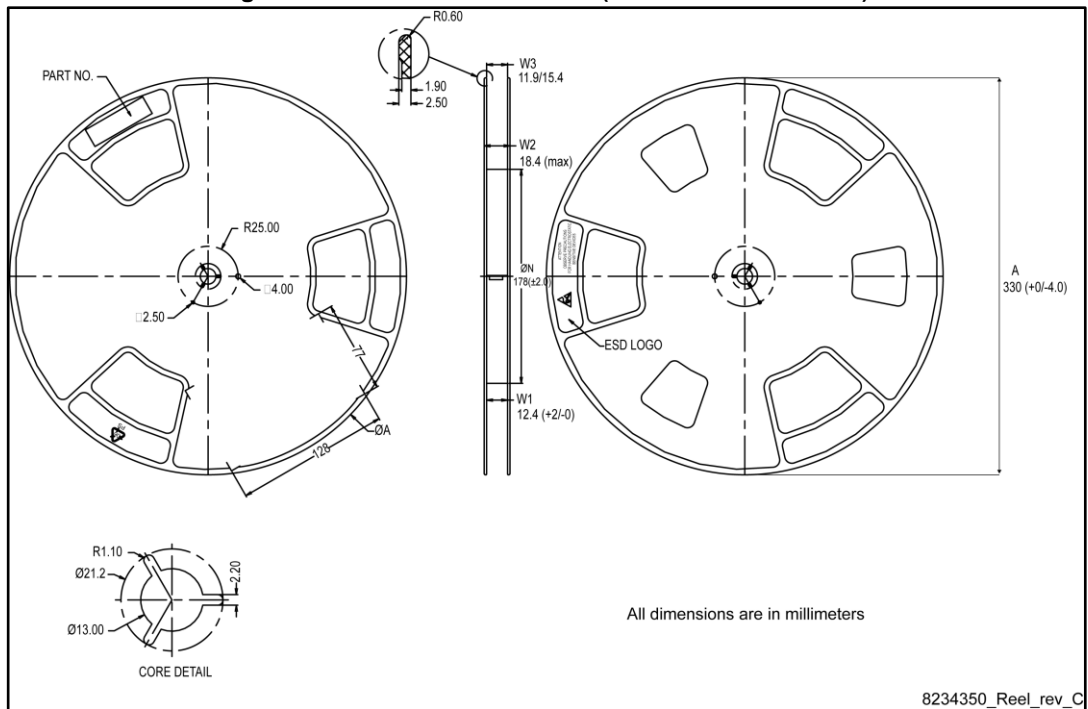


Figure 22: PowerFLAT™ 5x6 reel (dimensions are in mm)



## 5 Revision history

**Table 9: Document revision history**

Date	Revision	Changes
14-Oct-2014	1	First release.
10-Feb-2015	2	Updated <i>Table 4: On/off states</i> , <i>Table 5: Dynamic</i> , <i>Table 6: Switching times</i> , <i>Table 7: Source drain diode</i> and <i>Section 4: Package mechanical data</i> .
26-May-2015	3	Updated title and features. Document status from preliminary to production data.
13-Feb-2017	4	Modified features on cover page. Modified <i>Table 2: "Absolute maximum ratings"</i> and <i>Table 5: "Dynamic"</i> . Minor text changes.

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#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.