

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

Datasheet - production data

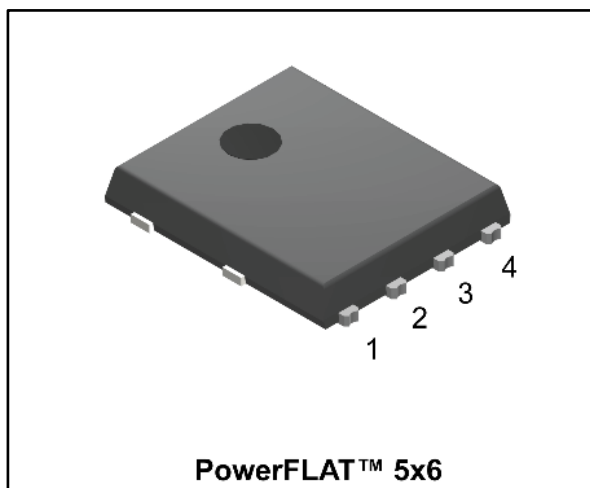
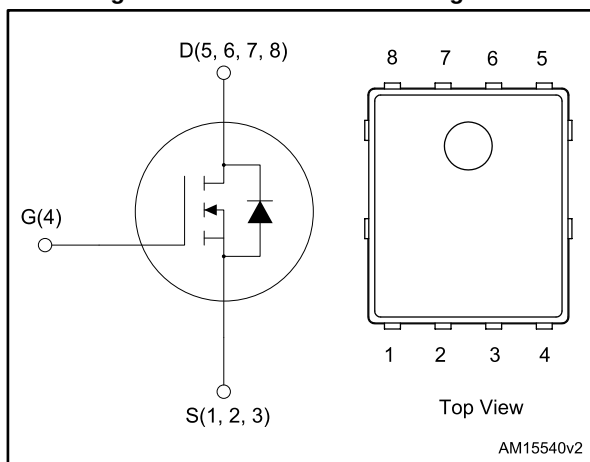


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL7N6LF3	60 V	43 mΩ	6.5 A

- AEC-Q101 qualified
- Logic level V_{GS(th)}
- 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	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	20	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	16	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	6.5	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	4.6	A
$I_{DM}^{(3),(2)}$	Drain current (pulsed)	26	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	52	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	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	$^\circ\text{C}$
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 $T_J = 25\text{ }^\circ\text{C}$, $I_D = 8\text{ A}$, $V_{DD} = 25\text{ V}$.

Table 3: Thermal resistance

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

Notes:

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

2 Electrical characteristics

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

Table 4: On/Off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	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	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 3\text{ A}$		35	43	$\text{m}\Omega$
		$V_{GS} = 5\text{ V}$, $I_D = 3\text{ A}$		48	60	$\text{m}\Omega$

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	432	-	pF
C_{oss}	Output capacitance		-	93	-	
C_{rss}	Reverse transfer capacitance		-	10.5	-	
Q_g	Total gate charge	$V_{DD} = 30\text{ V}$, $I_D = 6.5\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 13: "Test circuit for gate charge behavior")	-	8.7	-	nC
Q_{gs}	Gate-source charge		-	1.9	-	
Q_{gd}	Gate-drain charge		-	1.9	-	
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	6.3	-	Ω

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}$, $I_D = 3\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 12: "Test circuit for resistive load switching times" and Figure 17: "Switching time waveform")	-	6.7	-	ns
t_r	Rise time		-	10.4	-	
$t_{d(off)}$	Turn-off delay time		-	32.4	-	
t_f	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 Figure 14: "Test circuit for inductive load switching and diode recovery times")	-	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 μs , duty cycle 1.5 %

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

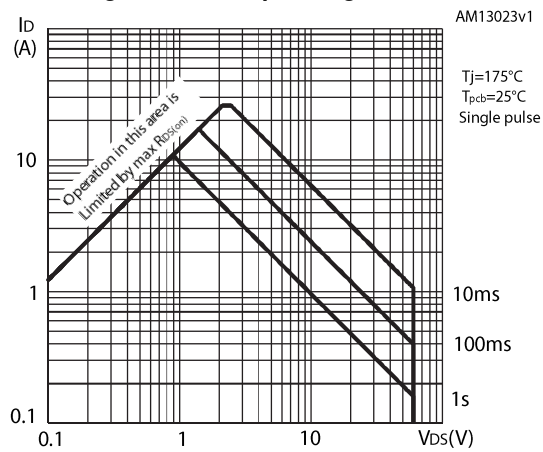


Figure 3: Thermal impedance

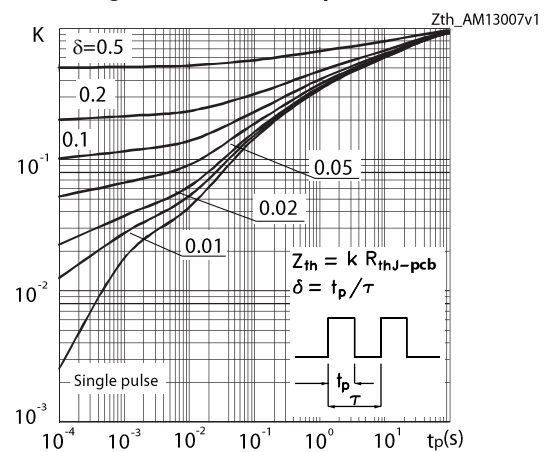


Figure 4: Output characteristics

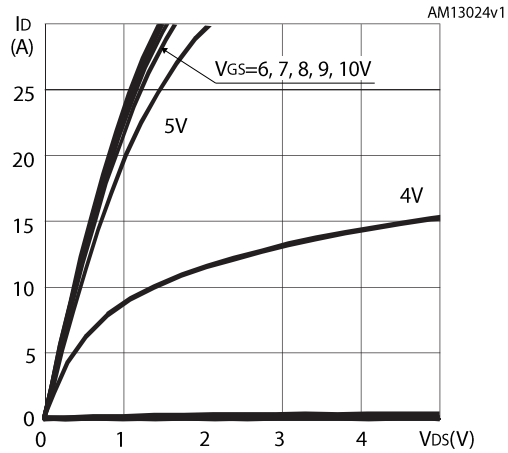


Figure 5: Transfer characteristics

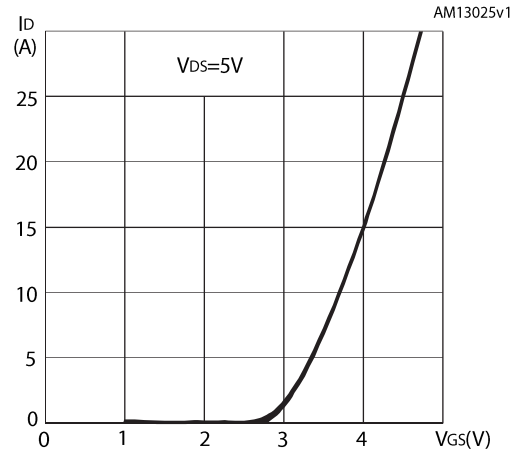
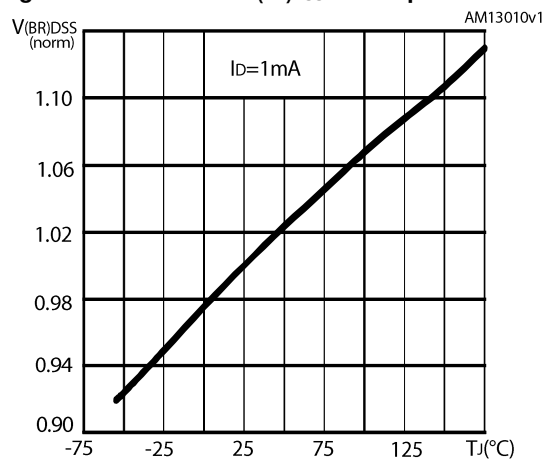
Figure 6: Normalized $V_{(BR)DSS}$ vs temperature

Figure 7: Static drain-source on-resistance

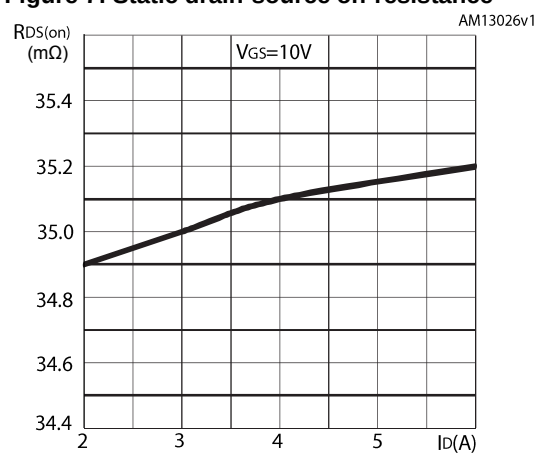


Figure 8: Gate charge vs gate-source voltage

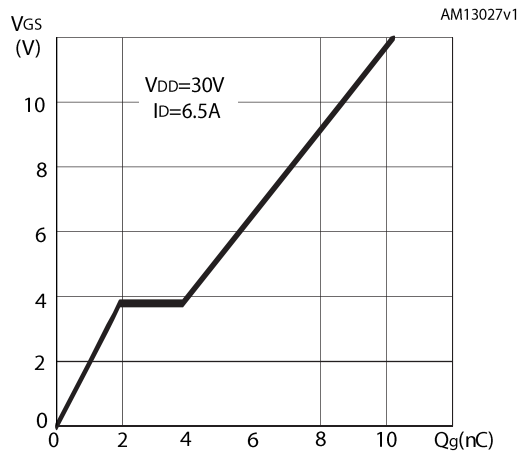


Figure 9: Capacitance variation

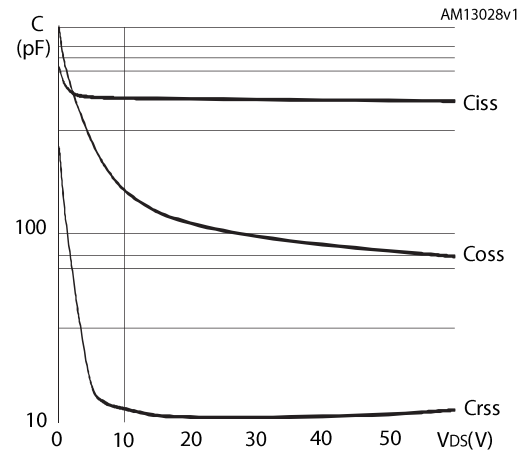


Figure 10: Normalized gate threshold voltage vs temperature

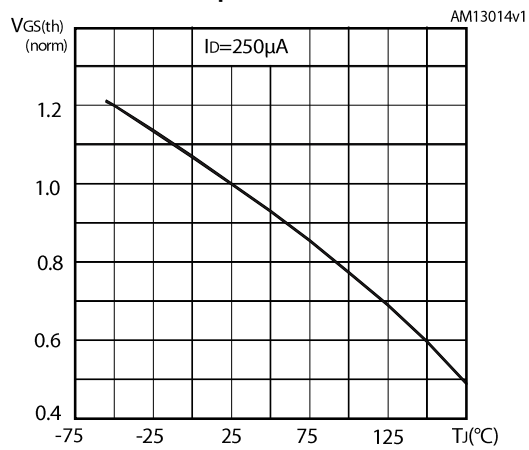
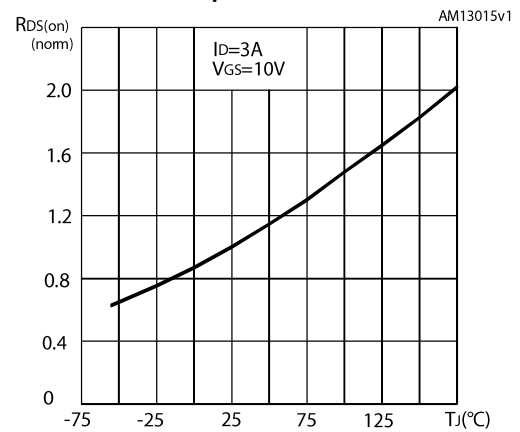
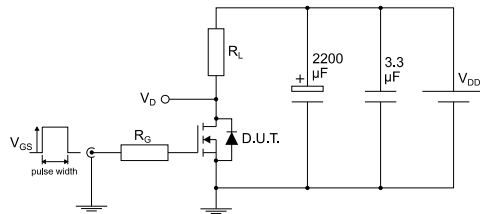


Figure 11: Normalized on-resistance vs temperature



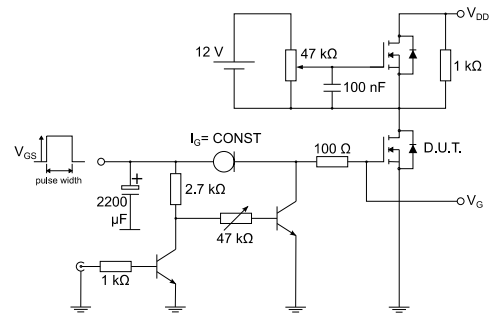
3 Test circuits

Figure 12: Test circuit for resistive load switching times



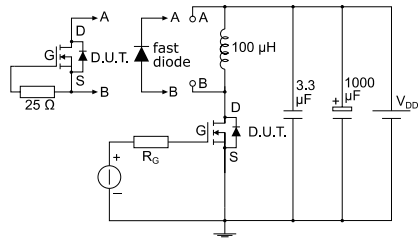
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Figure 13: Test circuit for gate charge behavior



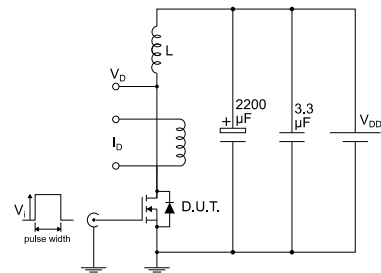
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Figure 14: Test circuit for inductive load switching and diode recovery times



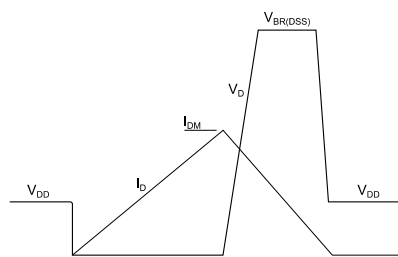
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Figure 15: Unclamped inductive load test circuit



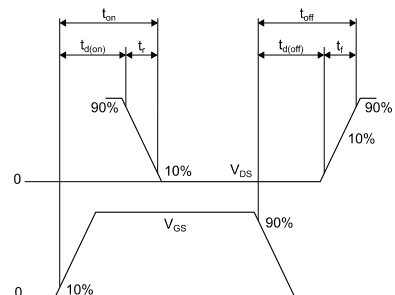
AM01471v1

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. ECOPACK® is an ST trademark.

4.1 PowerFLAT 5x6 WF type R package information

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

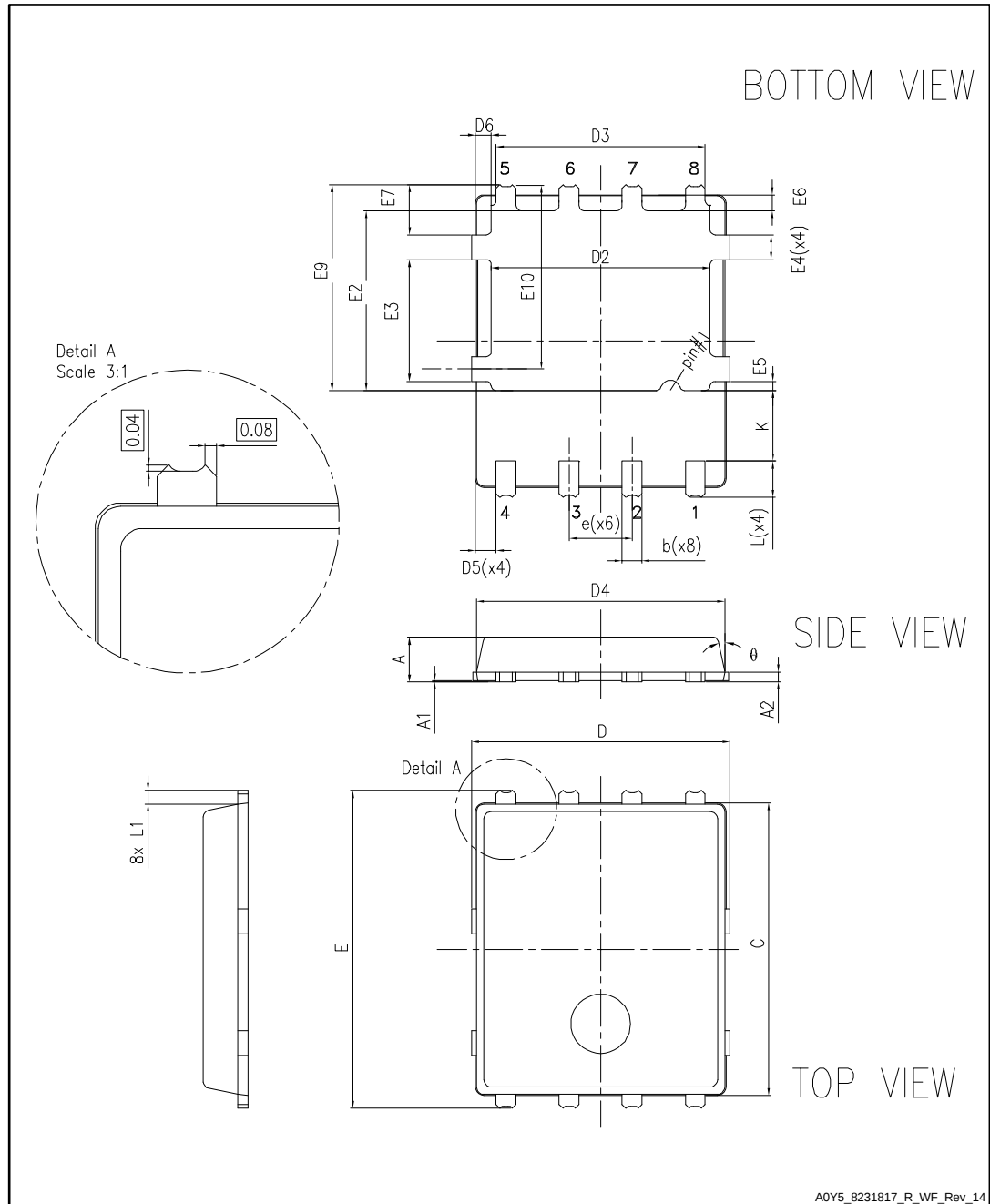
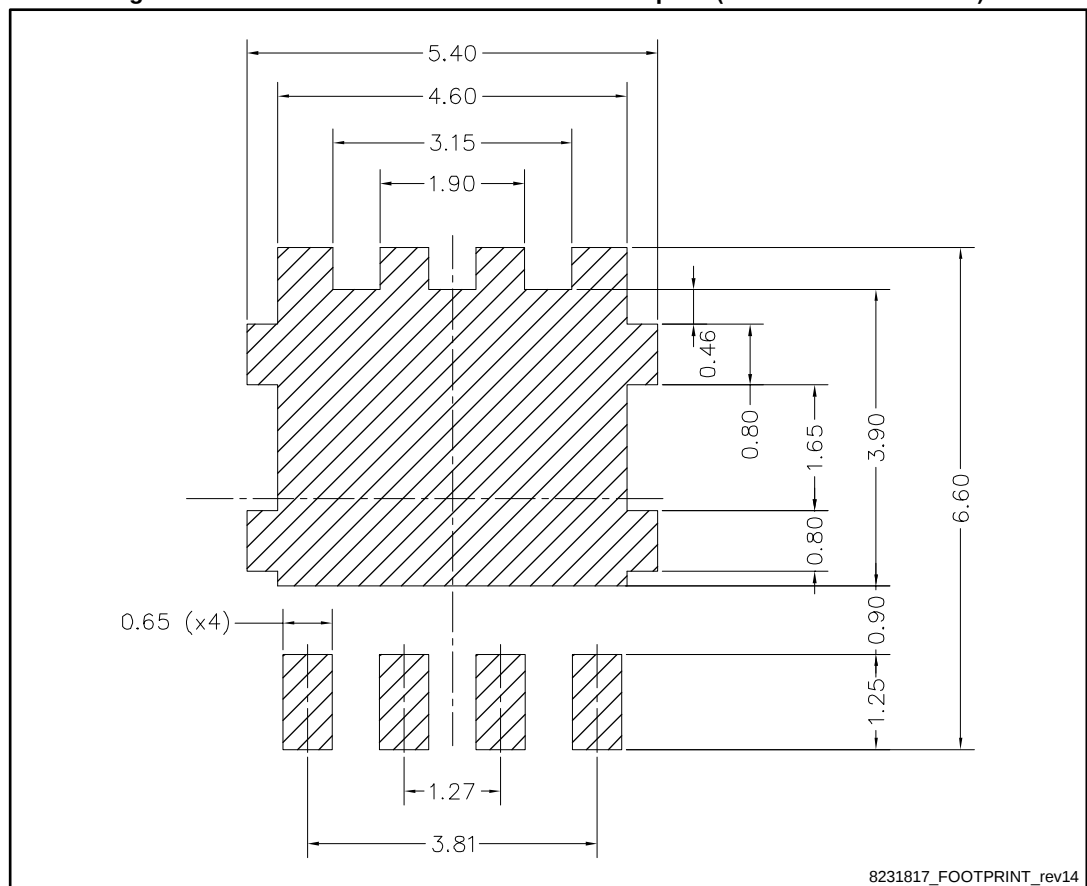


Table 8: PowerFLAT™ 5x6 WF type R mechanical data

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)

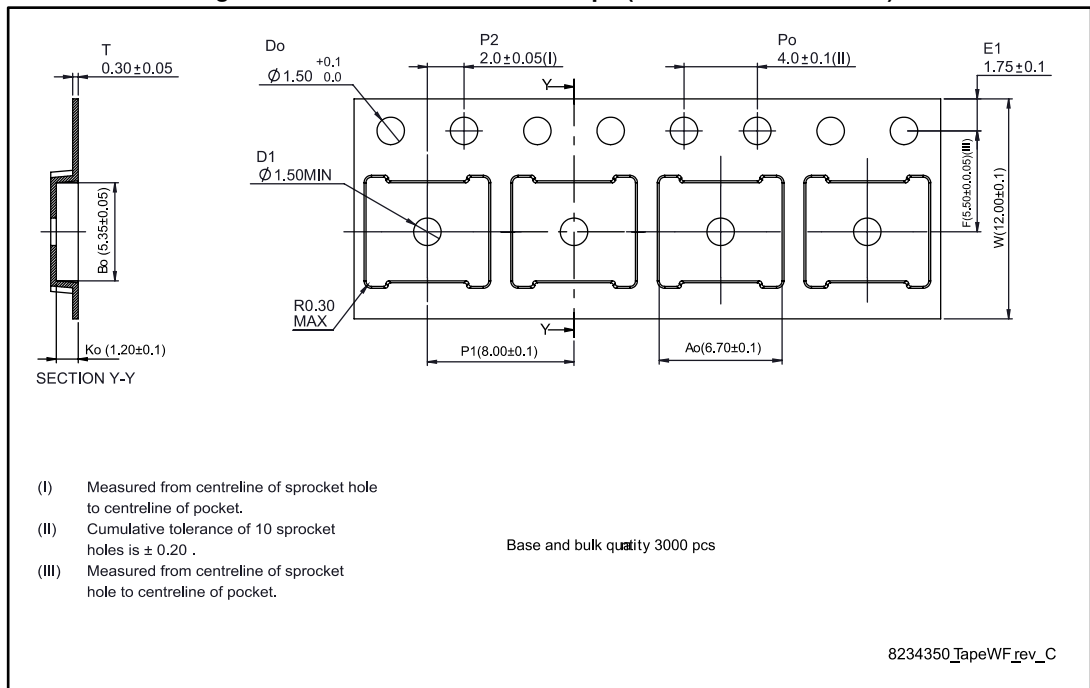


Figure 21: PowerFLAT™ 5x6 package orientation in carrier tape

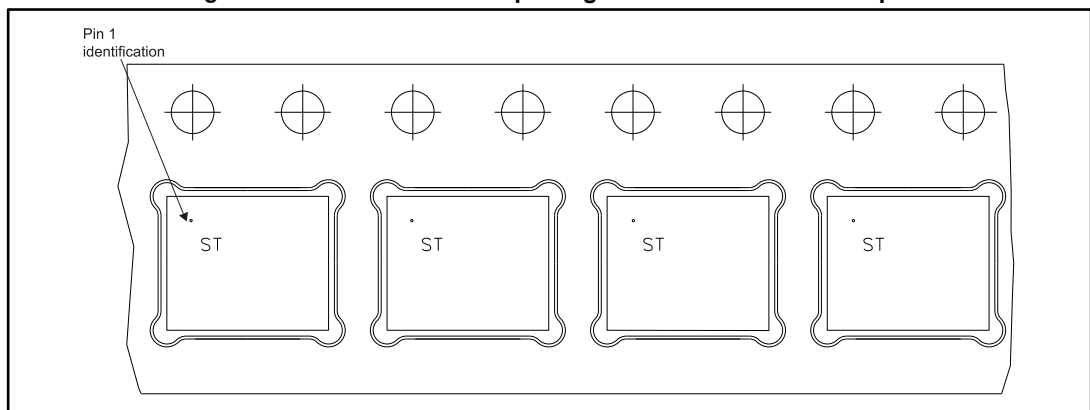
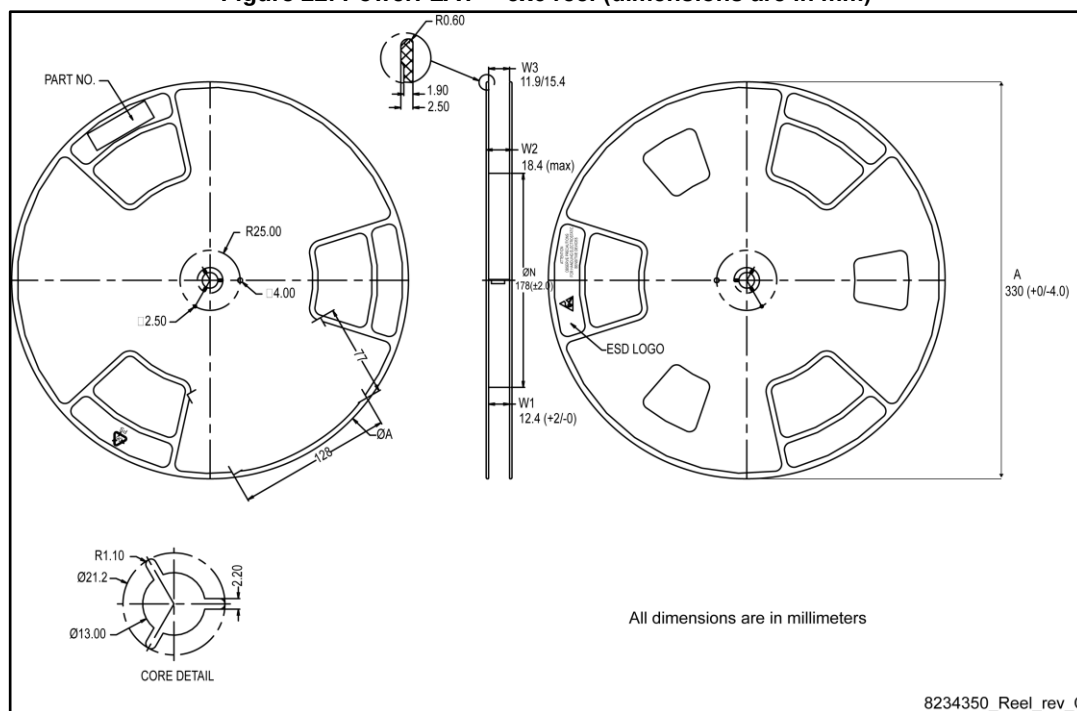


Figure 22: PowerFLAT™ 5x6 reel (dimensions are in mm)



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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