

Automotive-grade N-channel 30 V, 4 mΩ typ., 80 A STripFET™ H6 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

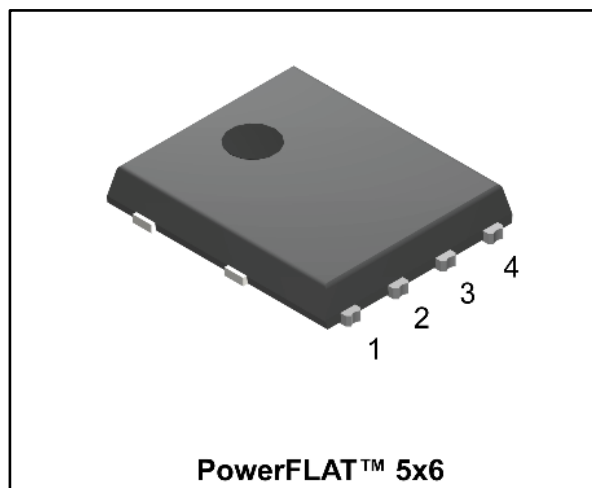


Figure 1: Internal schematic diagram

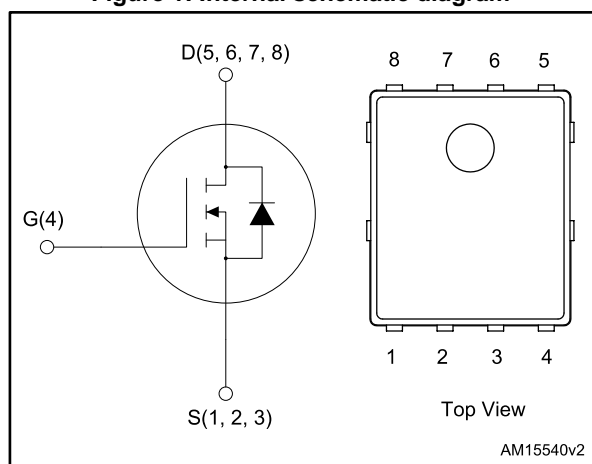


Table 1: Device summary

Order code	Marking	Package	Packing
STL86N3LLH6AG	86N3LLH6	PowerFLAT™ 5x6	Tape and reel

Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL86N3LLH6AG	30 V	5.2 mΩ	80 A



- AEC-Q101 qualified
- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss
- Logic level
- Wettable flank package

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the STripFET™ H6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R_{DS(on)} in all packages.

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	30	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 70\text{ }^\circ\text{C}$	60	
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	51	A
$I_{DM}^{(1), (2)}$	Drain current (pulsed)	320	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	21	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 70\text{ }^\circ\text{C}$	15.7	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	13.1	A
$I_{DM}^{(2), (3)}$	Drain current (pulsed)	84	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	60	W
$P_{TOT}^{(3)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4	
T_{stg}	Storage temperature range	- 55 to 150	$^\circ\text{C}$
T_j	Operating junction temperature range		

Notes:

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

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.08	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	

Notes:

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

2 Electrical characteristics

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

Table 4: On/off-states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 1\text{ mA}$	30			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 30\text{ V}$			1	μA
		$V_{GS} = 0, V_{DS} = 30\text{ V}, T_C = 125\text{ °C}$			10	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 10.5\text{ A}$		4	5.2	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 10.5\text{ A}$		6.7	7.6	$\text{m}\Omega$

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$	1350	1690	2030	pF
C_{oss}	Output capacitance		230	290	350	pF
C_{rss}	Reverse transfer capacitance		140	176	210	pF
Q_g	Total gate charge	$V_{DD} = 15\text{ V}, I_D = 21\text{ A}, V_{GS} = 4.5\text{ V}$ (see Figure 14: "Test circuit for gate charge behavior")	-	17	-	nC
Q_{gs}	Gate-source charge		-	8	-	nC
Q_{gd}	Gate-drain charge		-	6	-	nC
R_G	Gate input resistance	$f = 1\text{ MHz}, \text{Gate DC Bias} = 0,$ Test signal level = 20 mV open drain, $I_D = 0$	1.25	1.7	1.2	Ω

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}, I_D = 10.5\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$	-	9.5	-	ns
t_r	Rise time		-	30	-	ns
$t_{d(off)}$	Turn-off delay time	See Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform"	-	37	-	ns
t_f	Fall time		-	12	-	ns

Table 7: Source-drain diode

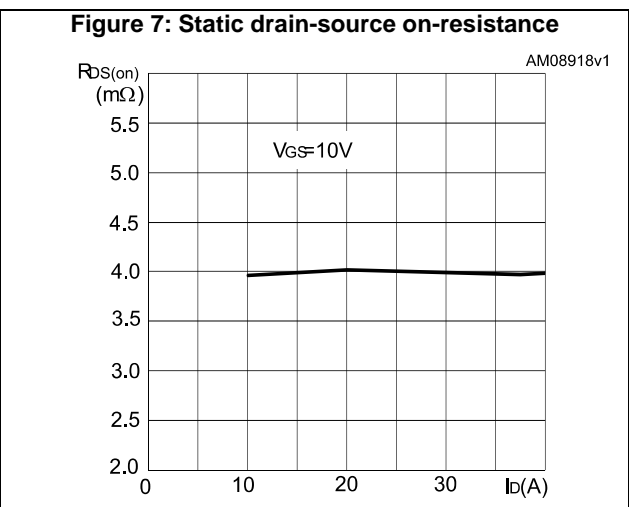
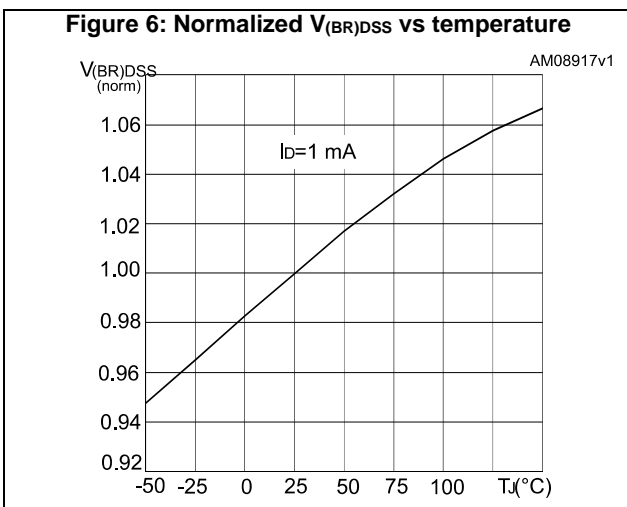
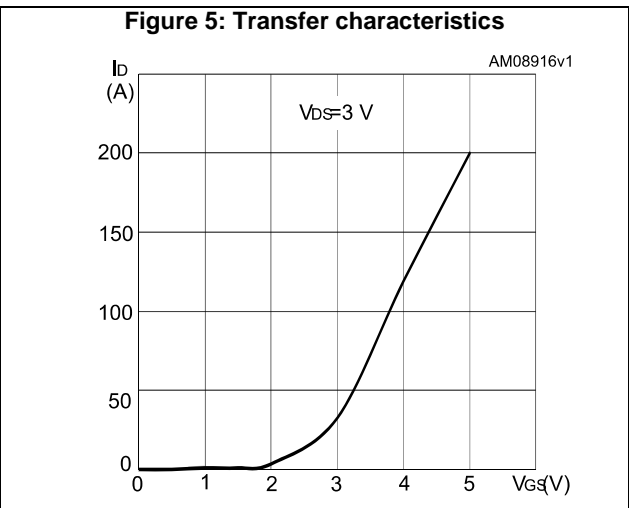
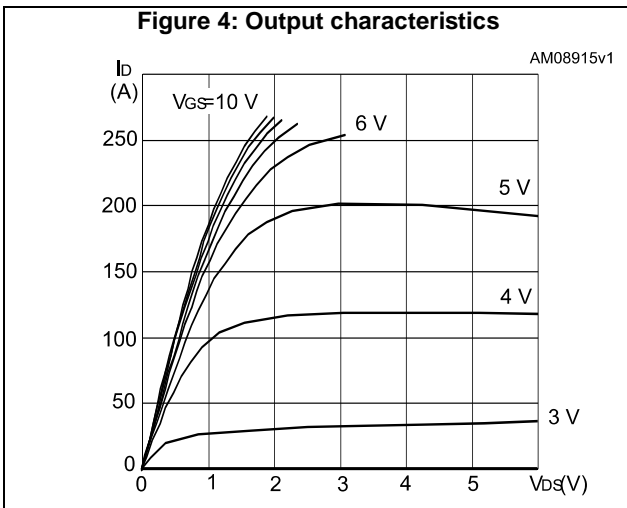
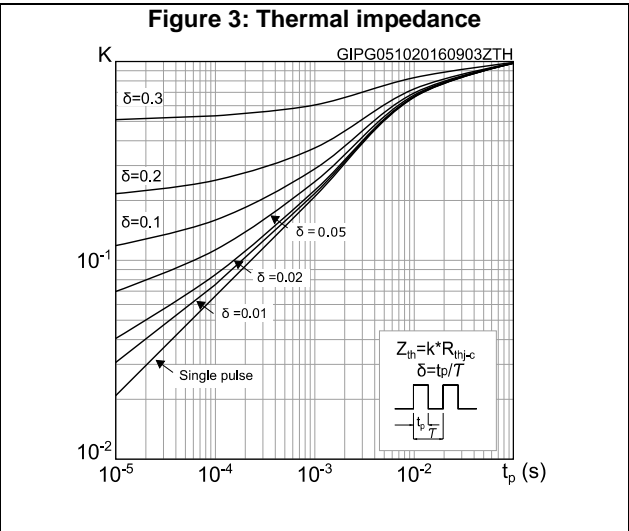
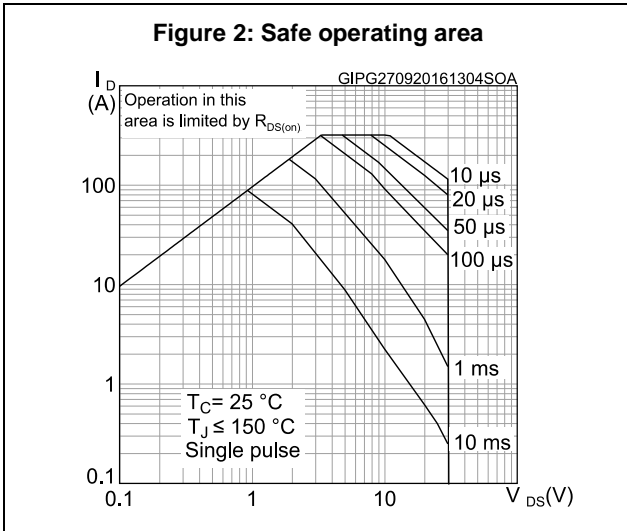
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		21	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		84	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 21 \text{ A}$, $V_{GS} = 0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 10.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 25 \text{ V}$ See Figure 15: "Test circuit for inductive load switching and diode recovery times"	-	24		ns
Q_{rr}	Reverse recovery charge		-	16.8		nC
I_{RRM}	Reverse recovery current		-	1.4		A

Notes:

(1)Pulse width limited by safe operating area.

(2)Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

2.2 Electrical characteristics (curves)



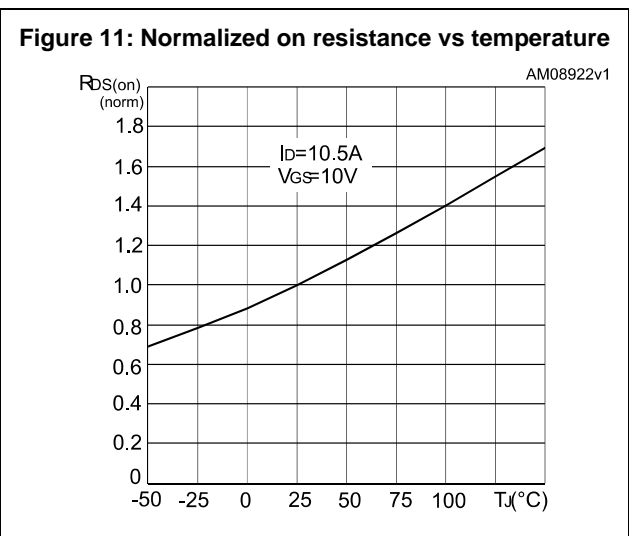
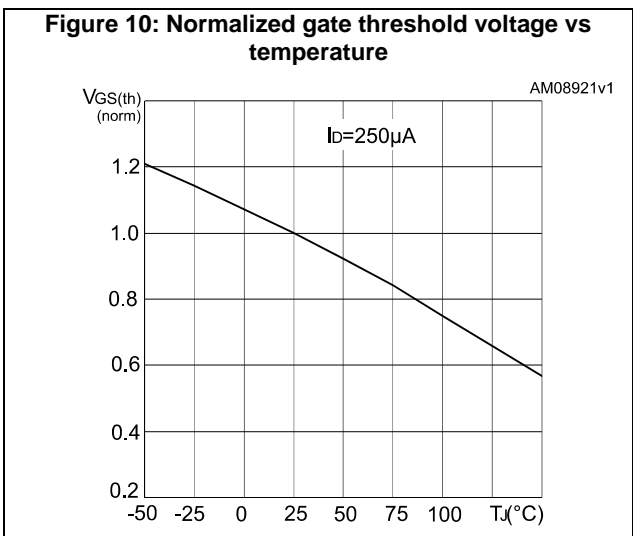
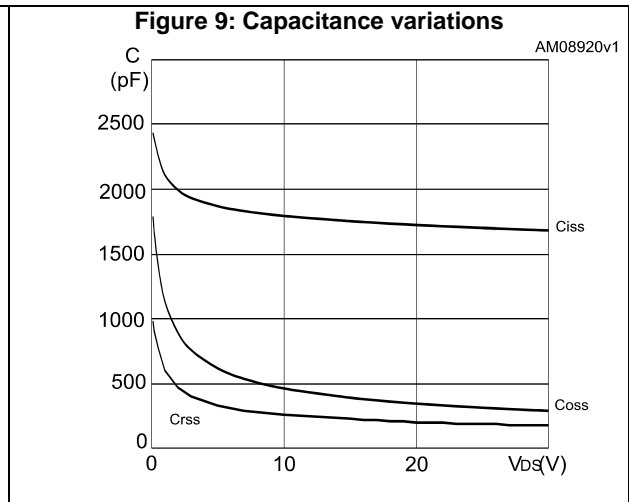
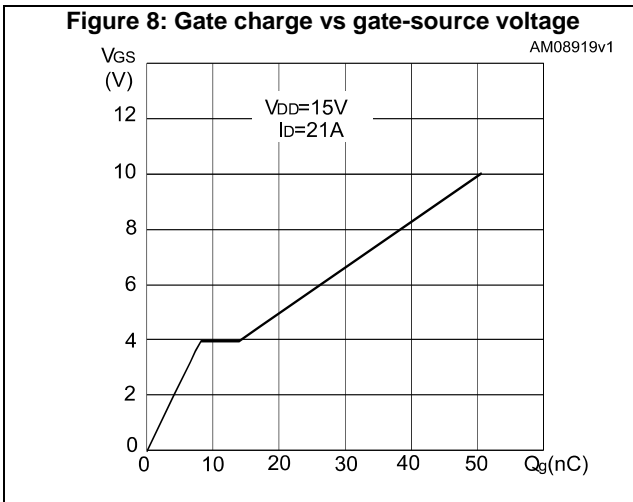
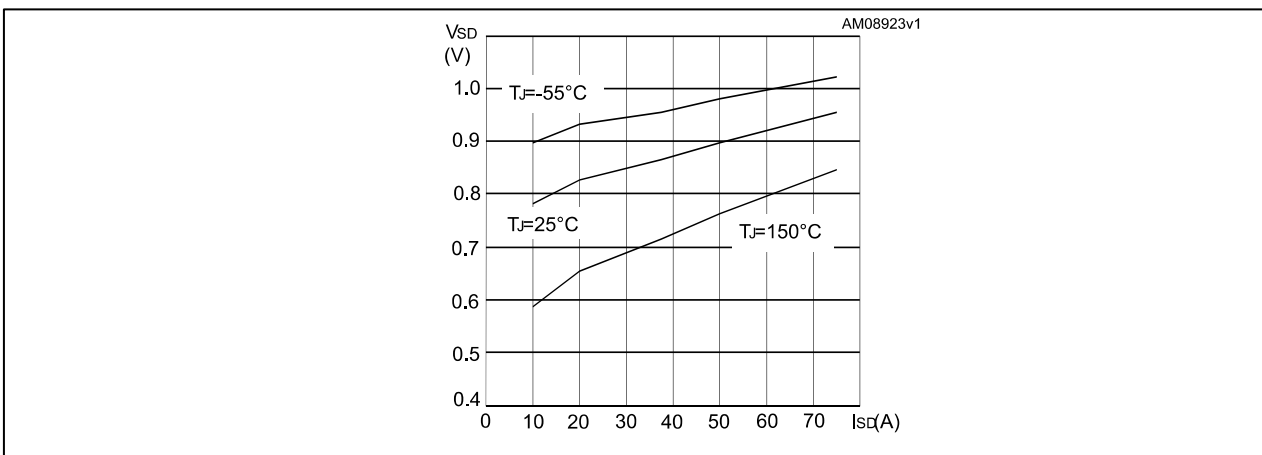
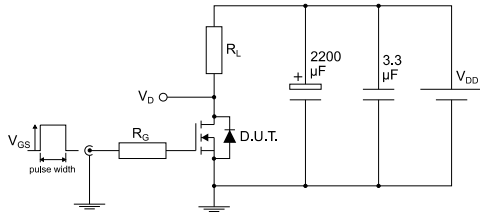


Figure 12: Source-drain diode forward characteristics



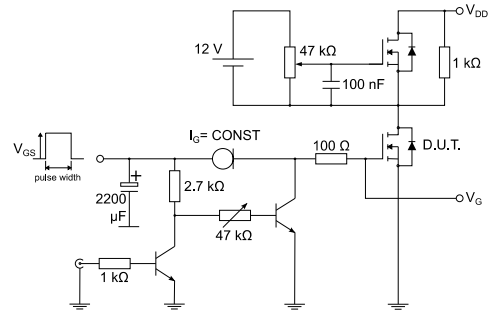
3 Test circuits

Figure 13: Test circuit for resistive load switching times



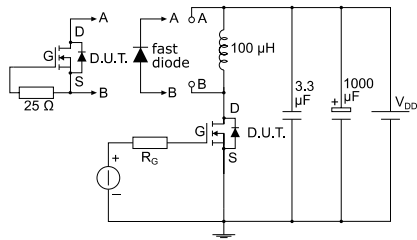
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Figure 14: Test circuit for gate charge behavior



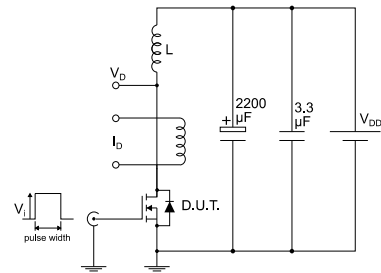
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Figure 15: Test circuit for inductive load switching and diode recovery times



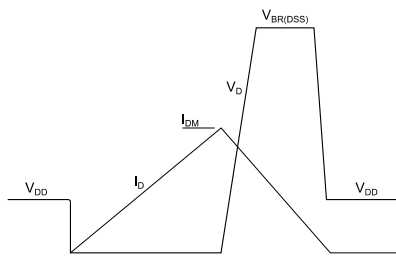
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Figure 16: Unclamped inductive load test circuit



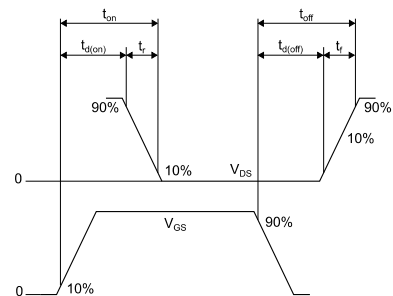
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Figure 17: Unclamped inductive waveform



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Figure 18: Switching time waveform



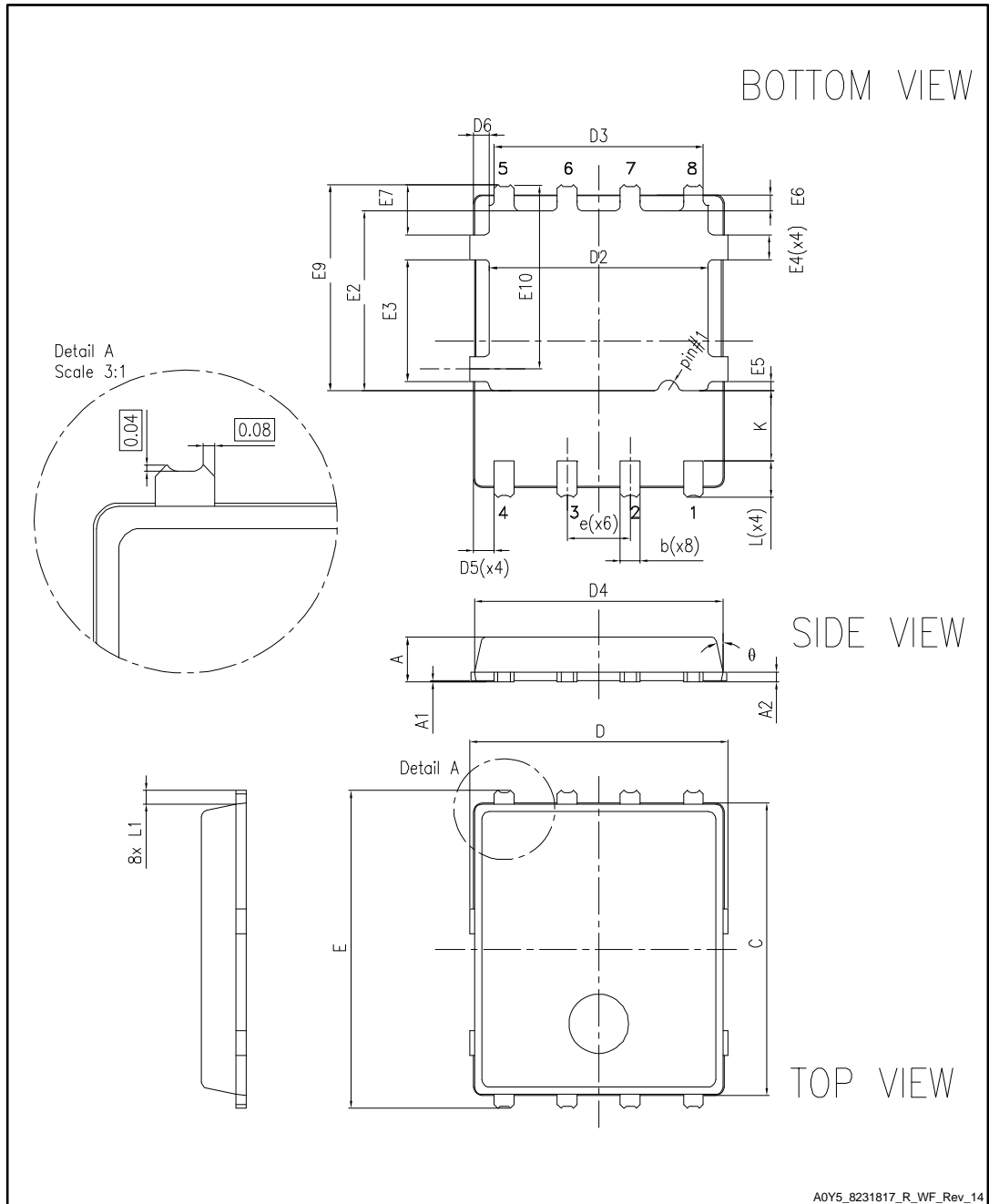
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4 Package information

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 19: PowerFLAT™ 5x6 WF type R package outline

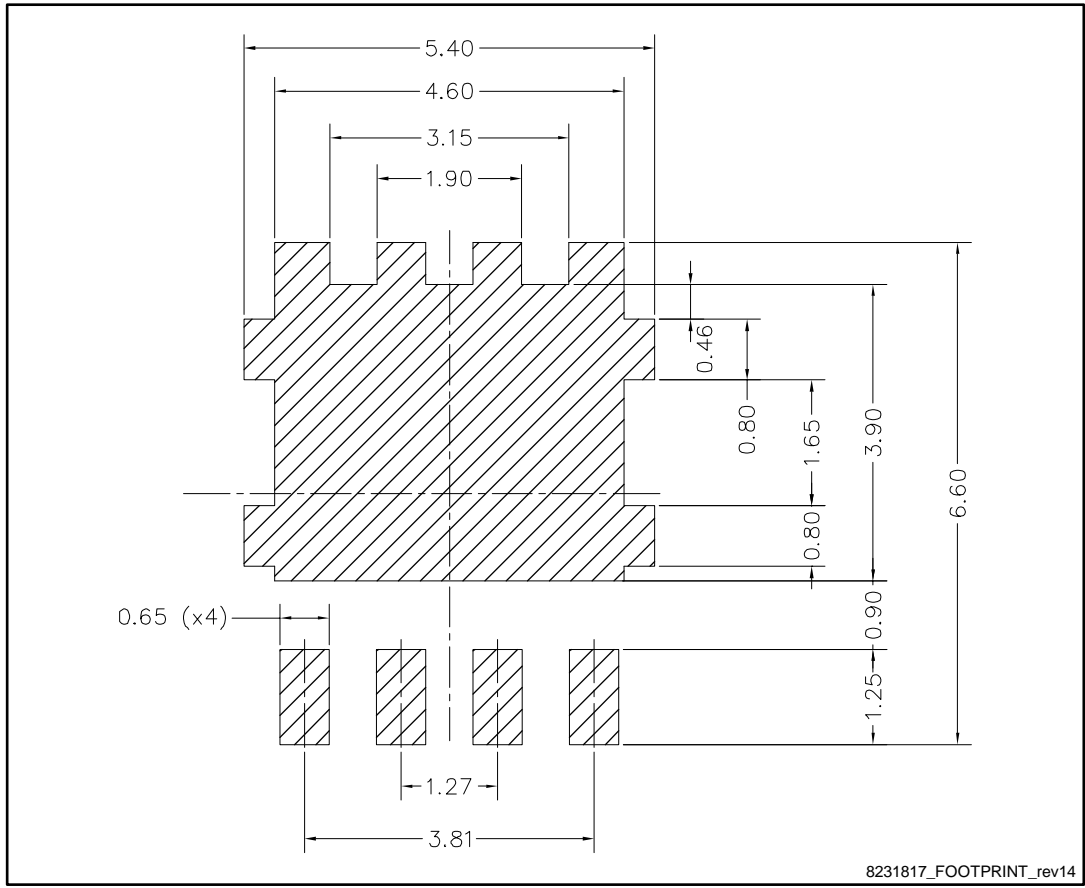


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Table 8: PowerFLAT™ 5x6 WF type R mechanical data

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



4.2 PowerFLAT™ 5x6 WF packing information

Figure 21: PowerFLAT™ 5x6 WF tape (dimensions are in mm)

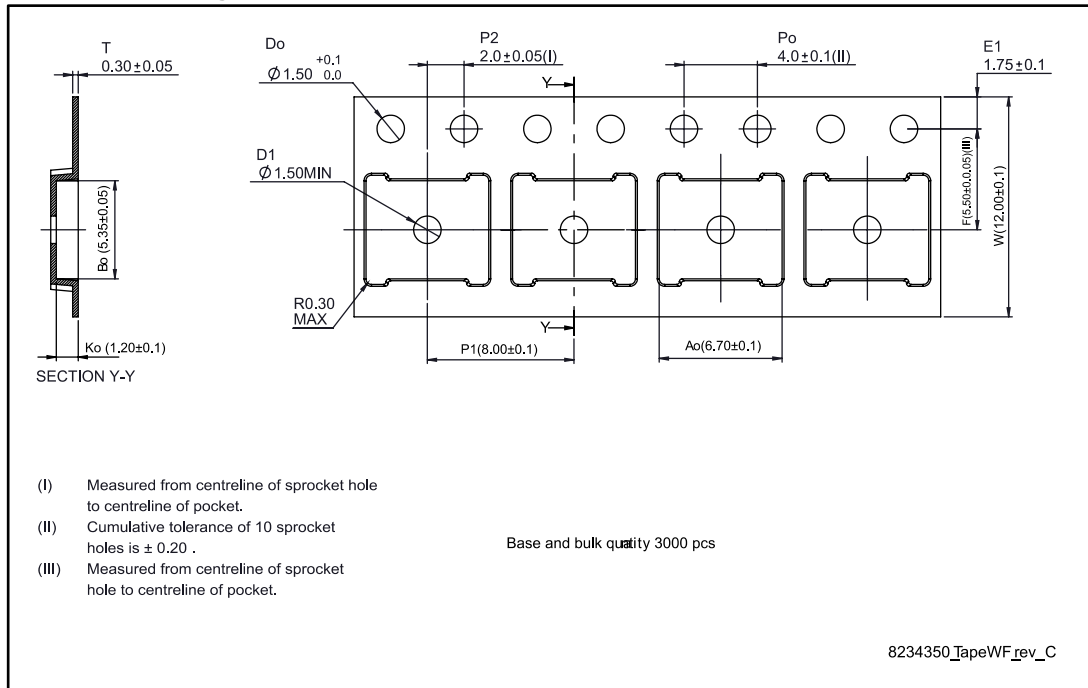


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

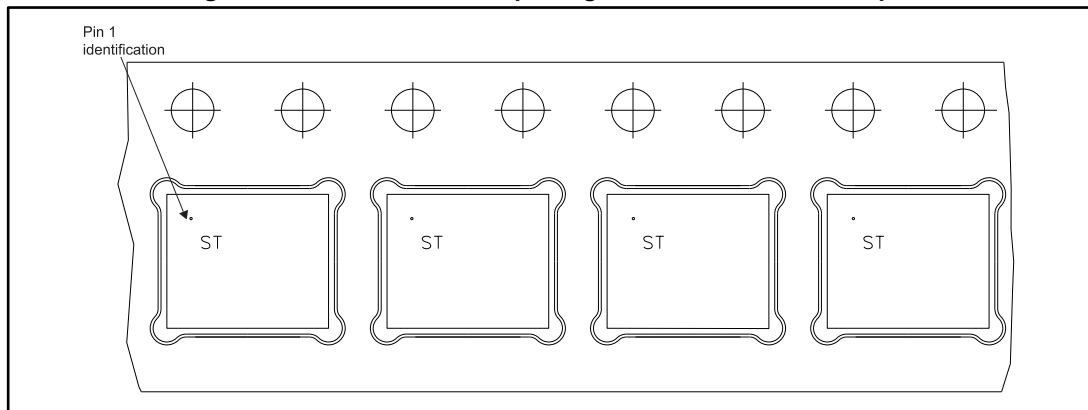
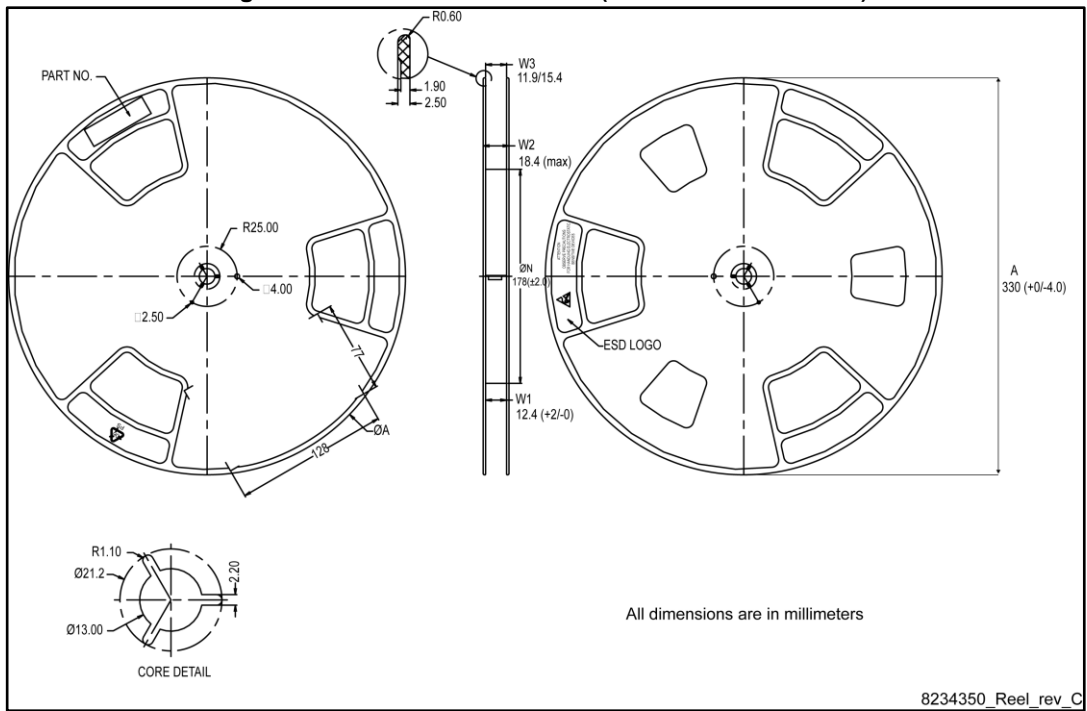


Figure 23: PowerFLAT™ 5x6 reel (dimensions are in mm)



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
26-Sep-2014	1	First release.
21-Jan-2015	2	Document status promoted from preliminary to production data. Updated <i>Section 4: Package mechanical data</i> .
03-Feb-2015	3	Updated title and features in cover page.
03-Oct-2016	4	Updated title and features in cover page. Updated <i>Table 2: "Absolute maximum ratings"</i> and <i>Table 4: "On/off-states"</i> . Changed <i>Figure 2: "Safe operating area"</i> and <i>Figure 3: "Thermal impedance"</i> .

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