

Automotive-grade N-channel 40 V, 6.1 mΩ typ., 18 A STripFET™ F5 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

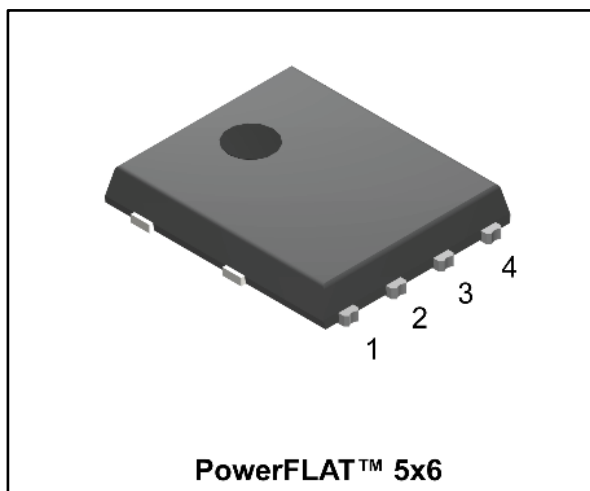
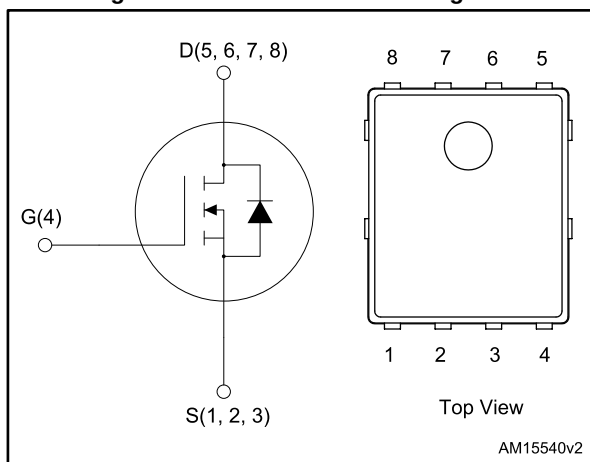


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL70N4LLF5	40 V	6.7 mΩ	18 A

- AEC-Q101 qualified
- Low on-resistance R_{DS(on)}
- High avalanche ruggedness
- Low gate drive power loss
- Wetable flank package



Applications

- Switching applications

Description

This N-channel Power MOSFET is developed using the STripFET™ F5 technology and has been optimized to achieve very low on-state resistance, contributing to a FoM that is among the best in its class.

Table 1: Device summary

Order code	Marking	Package	Packing
STL70N4LLF5	70N4LLF5	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	40	V
V_{GS}	Gate-source voltage	± 22	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	70	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	44	
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	18	
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	11.5	
$I_{DM}^{(1)(3)}$	Drain current (pulsed)	72	
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	72	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4.8	
T_{stg}	Storage temperature range	-55 to 175	$^\circ\text{C}$
T_J	Operation junction temperature range		

Notes:(1)The value is rated according to R_{thj-c} .(2)The value is rated according to $R_{thj-pcb}$.

(3)Pulse width limited by safe operating area

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, $t < 10\text{ s}$

Table 4: Avalanche data

Symbol	Parameter	Value	Unit
I_{AV}	Not-repetitive avalanche current (pulse width limited by $T_{jmax.}$)	9	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AV}$, $V_{DD} = 24\text{ V}$)	470	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 5: On/off-states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	I _D = 250 µA, V _{GS} = 0 V	40			V
I _{DSS}	Zero gate voltage drain current	V _{GS} = 0 V V _{DS} = 40 V			1	µA
I _{DSS}	Zero gate voltage drain current	V _{GS} = 0 V V _{DS} = 40 V, T _J = 125 °C ⁽¹⁾			10	
I _{GSS}	Gate-body leakage current	V _{GS} = ± 22 V, V _{DS} = 0 V			±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250 µA	1		2.5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 9 A		6.1	6.7	mΩ
		V _{GS} = 4.5 V, I _D = 9 A		7.6	9.0	

Notes:

⁽¹⁾Defined by design, not subject to production test

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 25 V, f = 1 MHz, V _{GS} = 0 V	-	1570	-	pF
C _{oss}	Output capacitance		-	257	-	pF
C _{rss}	Reverse transfer capacitance		-	32	-	pF
Q _g	Total gate charge	V _{DD} = 15 V, I _D = 18 A, V _{GS} = 4.5 V (see Figure 14: "Test circuit for gate charge behavior")	-	12.9	-	nC
Q _{gs}	Gate-source charge		-	3.9	-	nC
Q _{gd}	Gate-drain charge		-	5.3	-	nC
R _G	Gate input resistance	f = 1 MHz, gate DC bias = 0 V, test signal level = 20 mV, I _D = 0 A	-	1.5	-	Ω

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 15 V, I _D = 9 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13: "Test circuit for resistive load switching times")	-	14	-	ns
t _r	Rise time		-	42	-	ns
t _{d(off)}	Turn-off delay time		-	37	-	ns
t _f	Fall time		-	5.2	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		18	A
$I_{SDM}^{(1)}$	Source-drain current pulsed		-		72	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 18\text{ A}$, $V_{GS} = 0\text{ V}$			1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 18\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 25\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	27.2		ns
Q_{rr}	Reverse recovery charge		-	24.5		nC
I_{RRM}	Reverse recovery current		-	1.8		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 2: Safe operating area

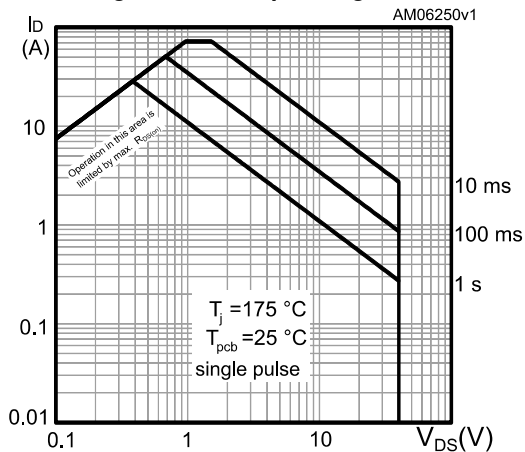


Figure 3: Thermal impedance

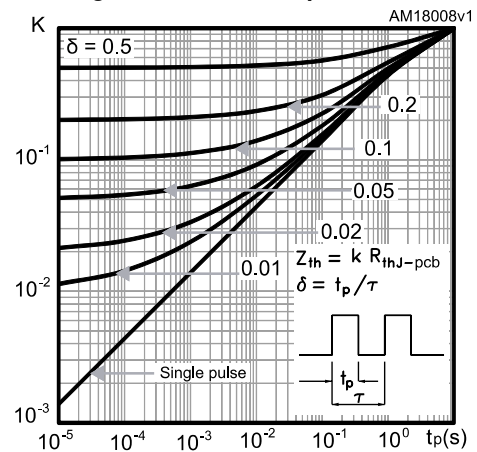


Figure 4: Output characteristics

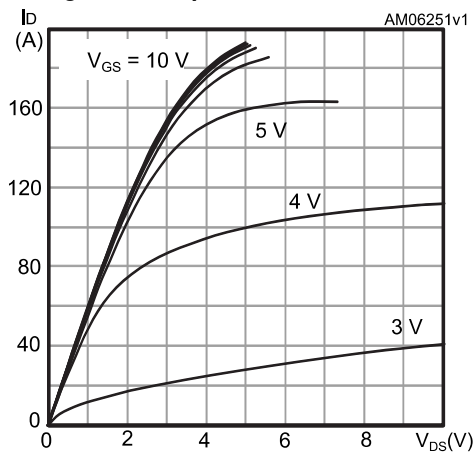


Figure 5: Transfer characteristics

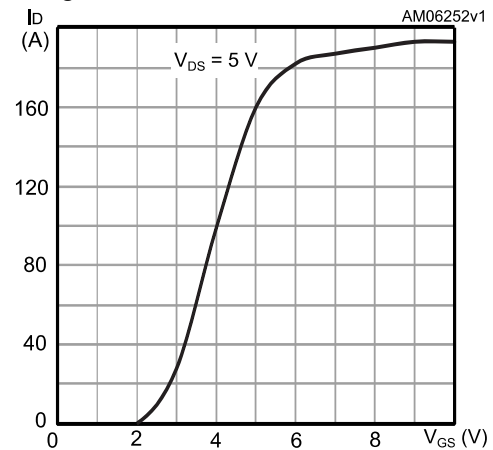
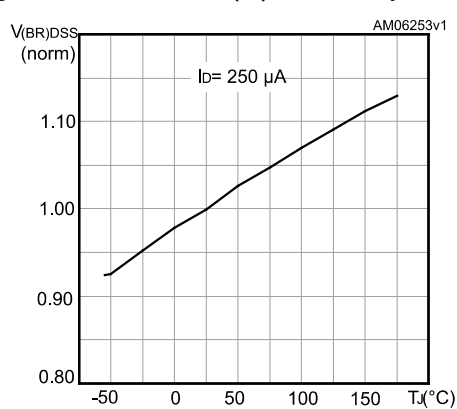
Figure 6: Normalized $V_{(BR)DSS}$ vs. temperature

Figure 7: Static drain-source on-resistance

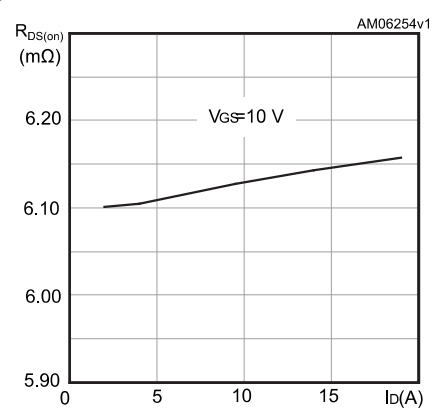


Figure 8: Gate charge vs. gate-source voltage

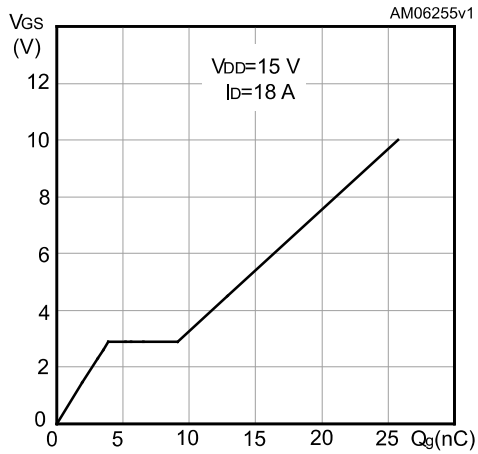


Figure 9: Capacitance variations

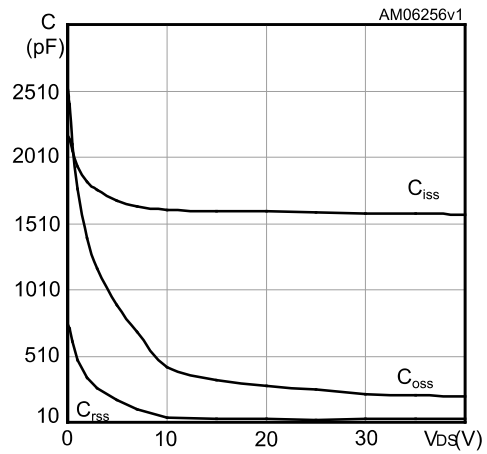


Figure 10: Normalized gate threshold voltage vs. temperature

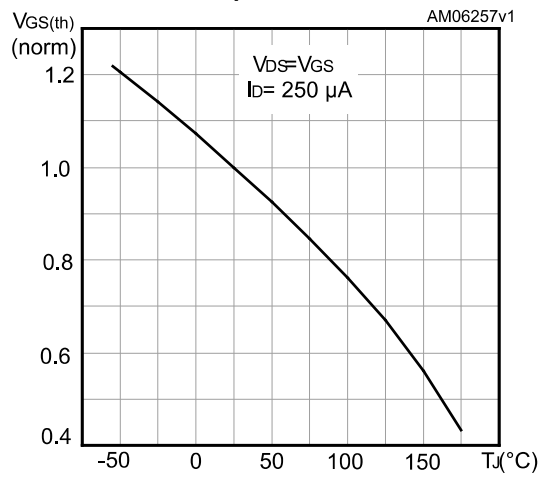


Figure 11: Normalized on-resistance vs. temperature

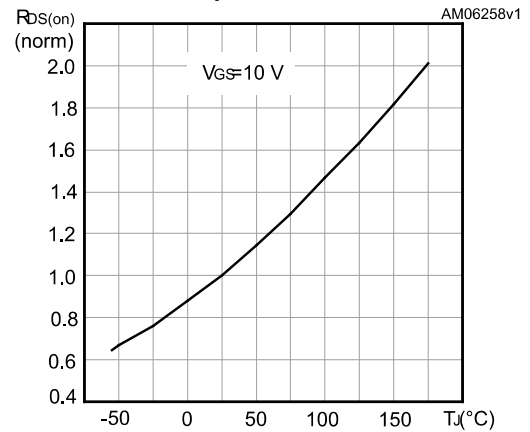
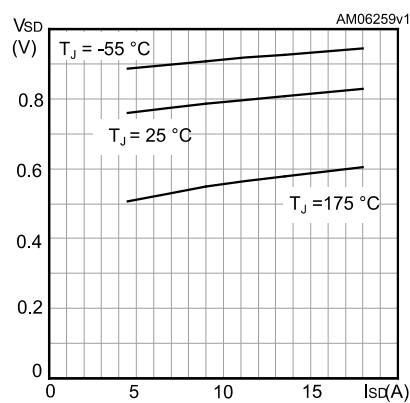
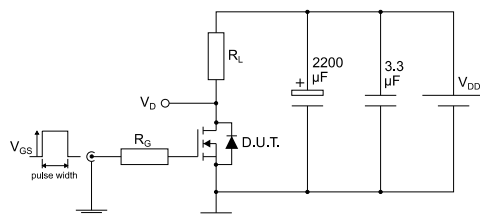


Figure 12: Source-drain diode forward characteristics



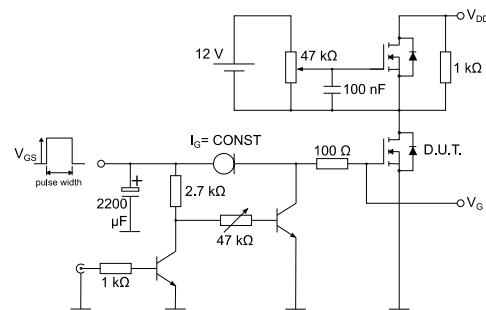
3 Test circuits

Figure 13: Test circuit for resistive load switching times



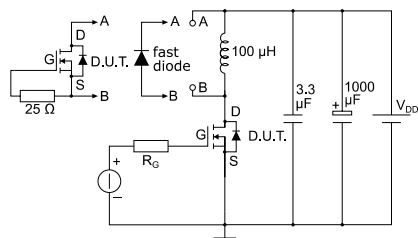
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Figure 14: Test circuit for gate charge behavior



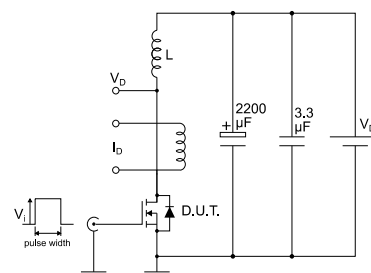
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Figure 15: Test circuit for inductive load switching and diode recovery times



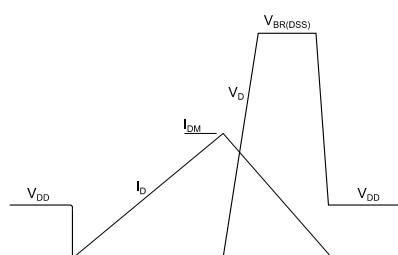
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Figure 16: Unclamped inductive load test circuit



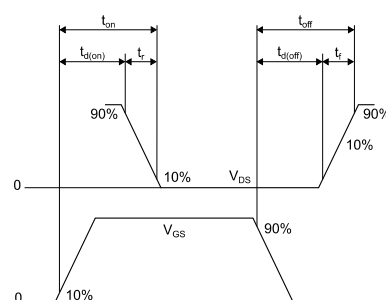
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Figure 17: Unclamped inductive waveform



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™ 5x6 single island WF type C package information

Figure 19: PowerFLAT™ 5x6 WF type C package outline

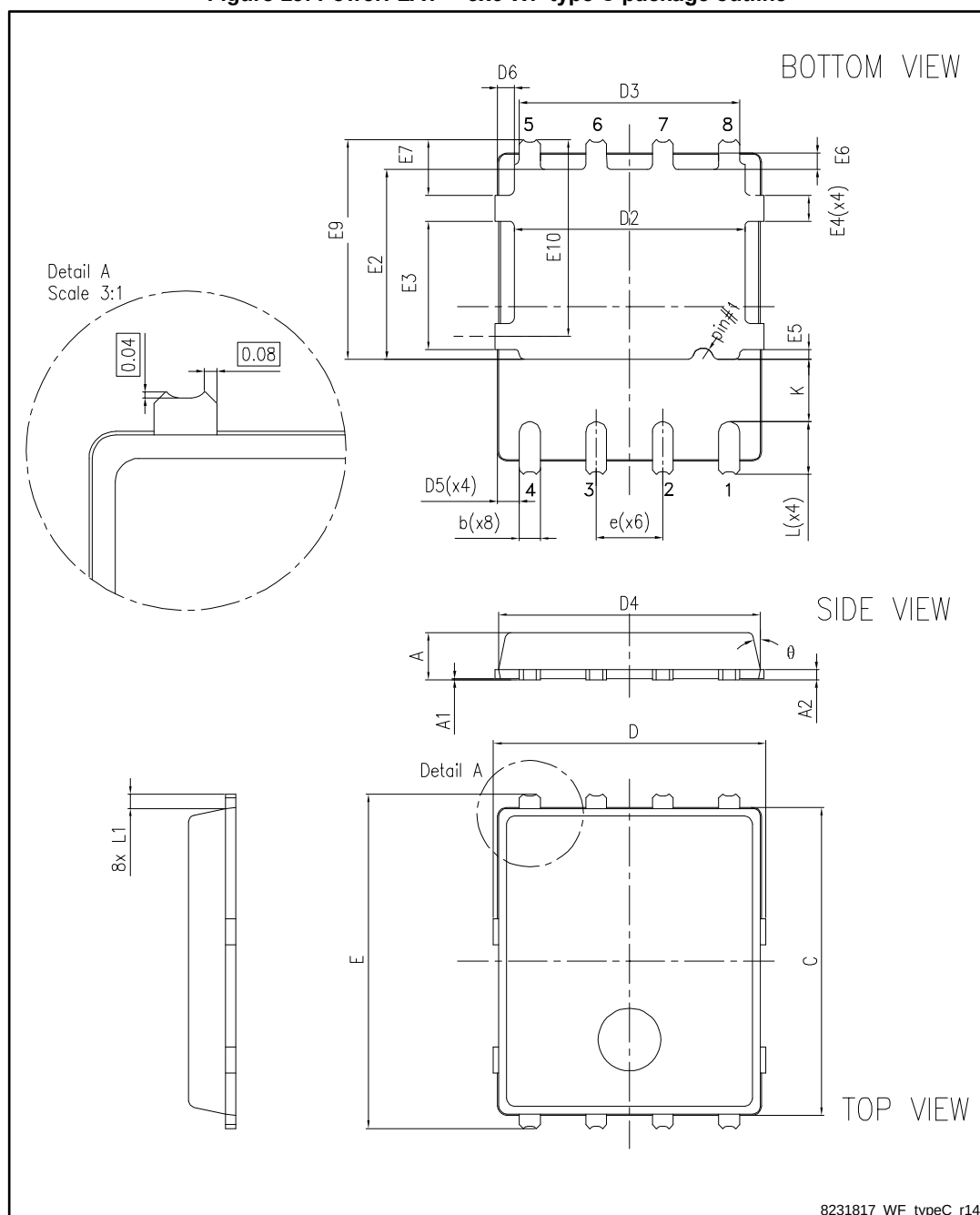
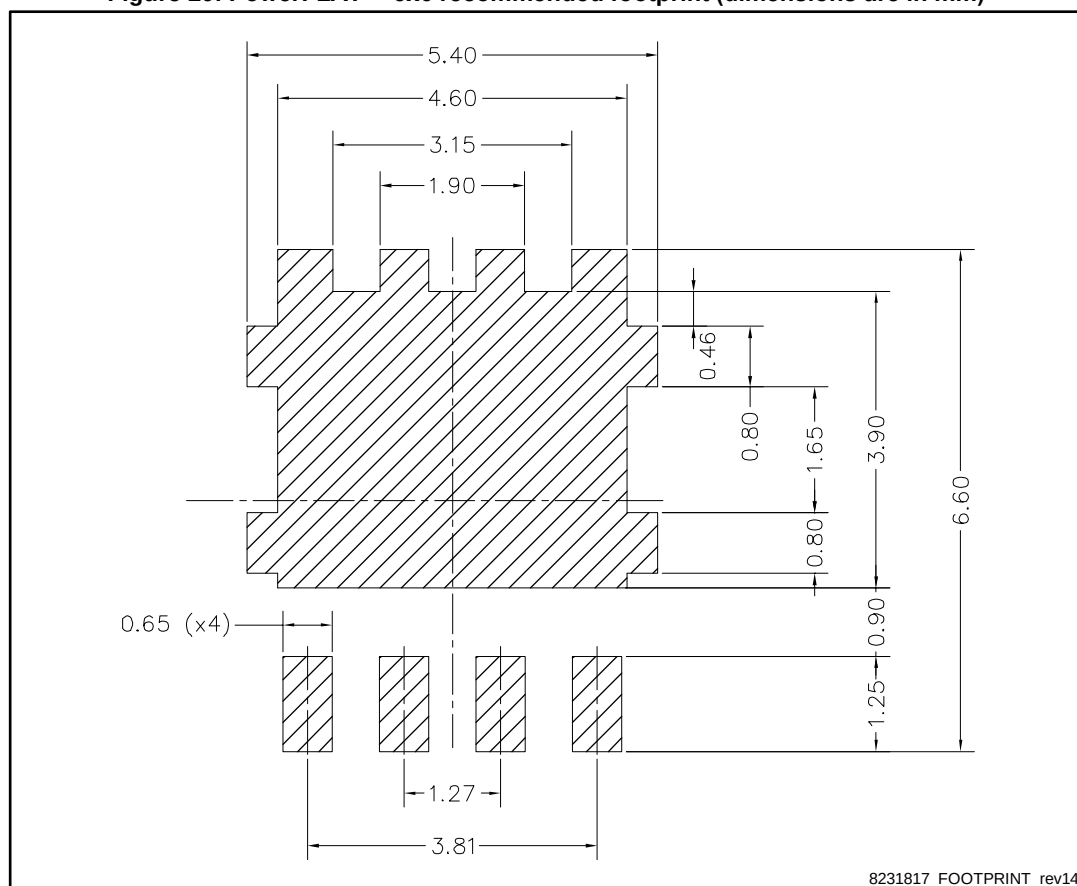


Table 9: PowerFLAT™ 5x6 WF type C mechanical data

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	0.40	0.55
D6	0.15	0.30	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	1.05		1.35
L	0.90	1.00	1.10
L1	0.175	0.275	0.375
θ	0°		12°

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



4.2 Packing information

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

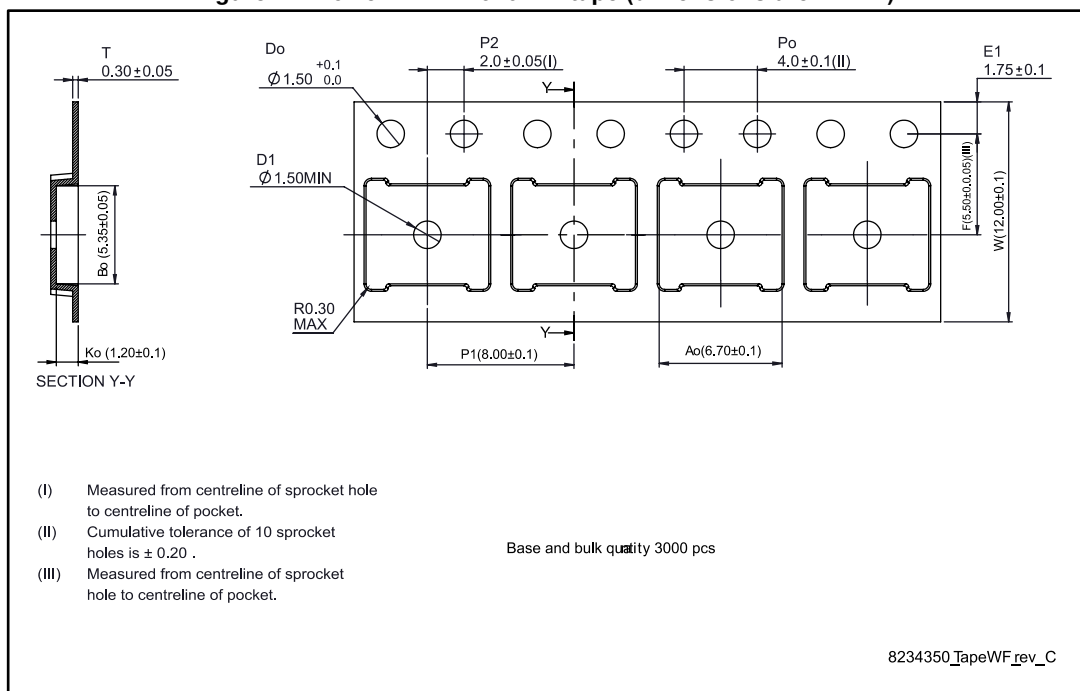


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

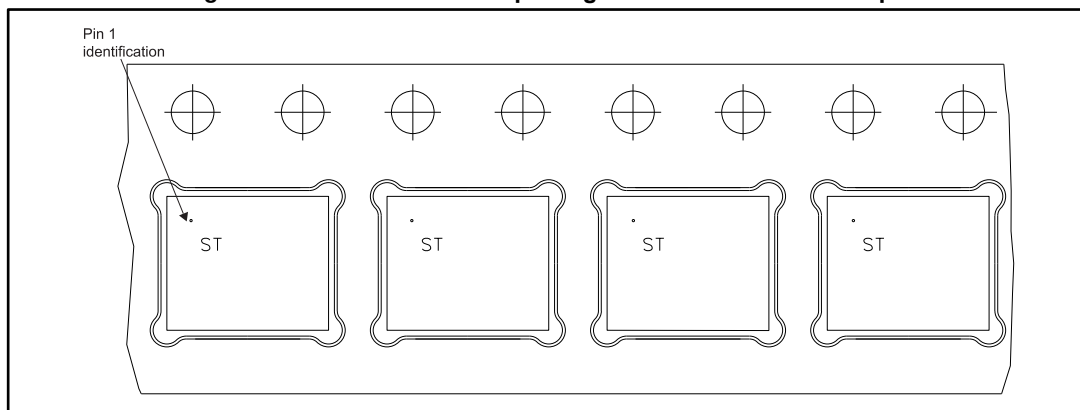
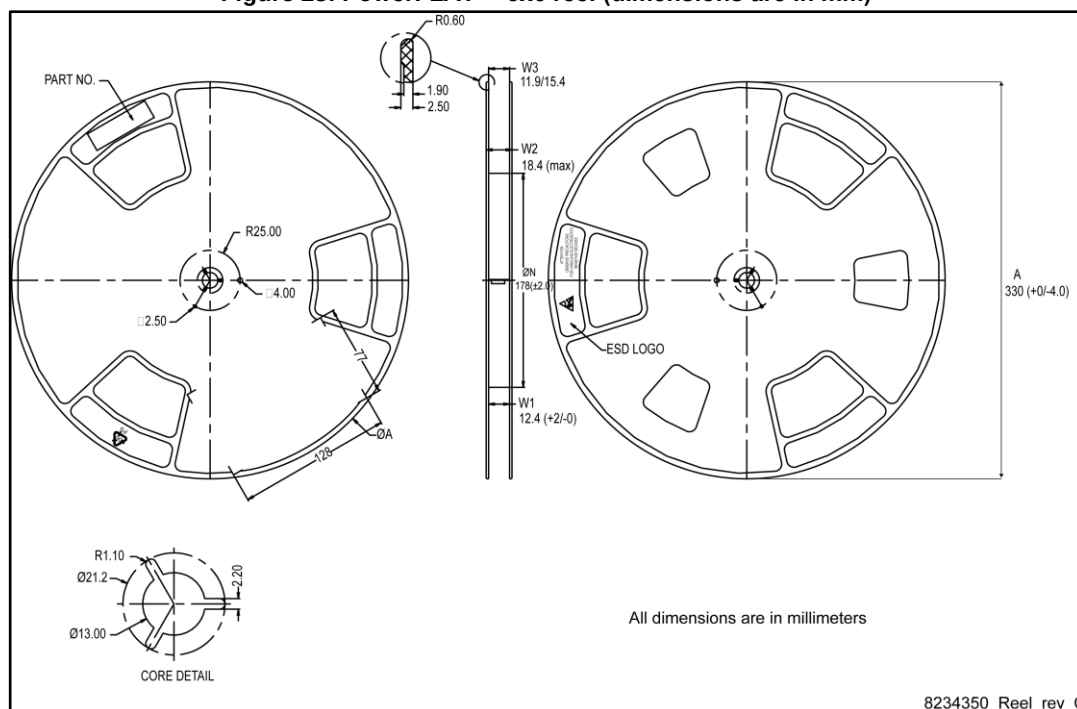


Figure 23: PowerFLAT™ 5x6 reel (dimensions are in mm)



5 Revision history

Table 10: Document revision history

Date	Revision	Changes
01-Dec-2008	1	First release.
18-Jul-2011	2	Section 4: Package mechanical data has been modified: – Added <i>Table 9: PowerFLAT™ 5x6 type S-C mechanical data</i> – Added <i>Figure 19: PowerFLAT™ 5x6 type S-C mechanical data</i> – Added <i>PowerFLAT™ 5x6 type C-B mechanical data</i> – Added <i>PowerFLAT™ 5x6 type C-B drawing</i> Minor text changes.
21-Dec-2011	3	Section 4: Package mechanical data has been modified.
25-Jan-2013	4	– Table 1: Device summary has been updated. -Minor text changes. –Changed: <i>Figure 1</i> -Added <i>Section 5: Packaging mechanical data</i> .
12-Feb-2013	5	-Updated T_J and T_{stg} in Table 2: Absolute maximum ratings. – Updated <i>Section 4: Package mechanical data</i> and <i>Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape</i> .
24-May-2013	6	– Modified: title and <i>Section 4: Package mechanical data</i> - Minor text changes.
17-Dec-2014	7	– Modified: Figure 2 and 3 – Updated: Figure 13, 14, 15 and 16 – Updated: Section 4: Package mechanical data and Section 5: Packaging mechanical data – Minor text changes.
08-Apr-2016	8	– Updated <i>Section 4: Package information</i> and <i>Section 4.1: Packing information</i> -Minor text changes.
22-Sep-2016	9	Updated $V_{GS(th)}$ in <i>Table 5: "On/off-states"</i> .

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