

N-channel 60 V, 9 mΩ typ., 60 A STripFET™ F7 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

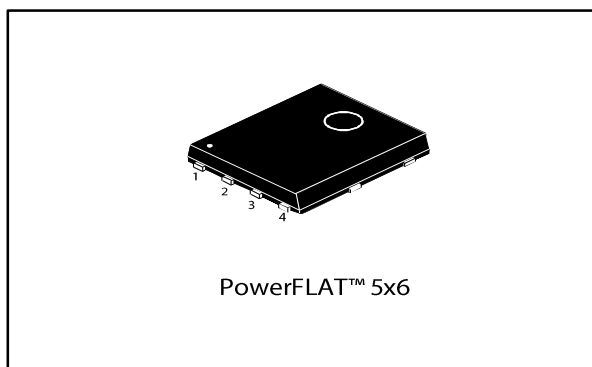
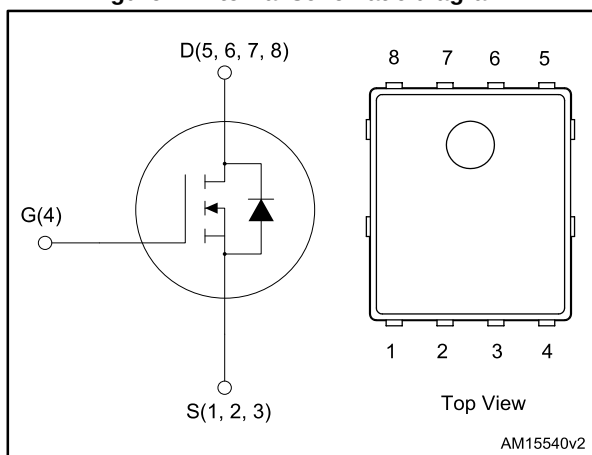


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL50N6F7	60 V	11 mΩ	60 A

- Among the lowest R_{DS(on)} on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} 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	Packaging
STL50N6F7	50N6F7	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 $T_C = 25\text{ }^\circ\text{C}$	60	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	43	A
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	240	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	15	A
$I_D^{(3)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	11	A
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	60	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	71	W
$P_{TOT}^{(3)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4.8	W
T_j	Operating junction temperature	-55 to 175	$^\circ\text{C}$
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.	31.3	$^\circ\text{C/W}$
$R_{thj-case}$	Thermal resistance junction-case max.	2.1	$^\circ\text{C/W}$

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

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 4: On/Off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	I _D = 1 mA, V _{GS} = 0 V	60			V
I _{DSS}	Zero gate voltage drain current	V _{GS} = 0 V V _{DS} = 60 V			1	μA
I _{GSS}	Gate-body leakage current	V _{GS} = 20 V, V _{DS} = 0 V			100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	2		4	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 7.5 A		9	11	mΩ

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 30 V, f = 1 MHz, V _{GS} = 0 V	-	1035	-	pF
C _{oss}	Output capacitance		-	450	-	pF
C _{rss}	Reverse transfer capacitance		-	53	-	pF
Q _g	Total gate charge	V _{DD} = 30 V, I _D = 15 A, V _{GS} = 10 V (see Figure 14: "Test circuit for gate charge behavior")	-	17	-	nC
Q _{gs}	Gate-source charge		-	5.7	-	nC
Q _{gd}	Gate-drain charge		-	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 V, I _D = 7.5 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13: "Test circuit for resistive load switching times")	-	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} = 15 A, V _{GS} = 0 V	-		1.2	V
t _{rr}	Reverse recovery time	I _D = 15 A, di/dt = 100 A/μs V _{DD} = 48 V (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	26.8		ns
Q _{rr}	Reverse recovery charge		-	14.2		nC
I _{RRM}	Reverse recovery current		-	1.06		A

Notes:

⁽¹⁾Pulsed: pulse duration = 300 μs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

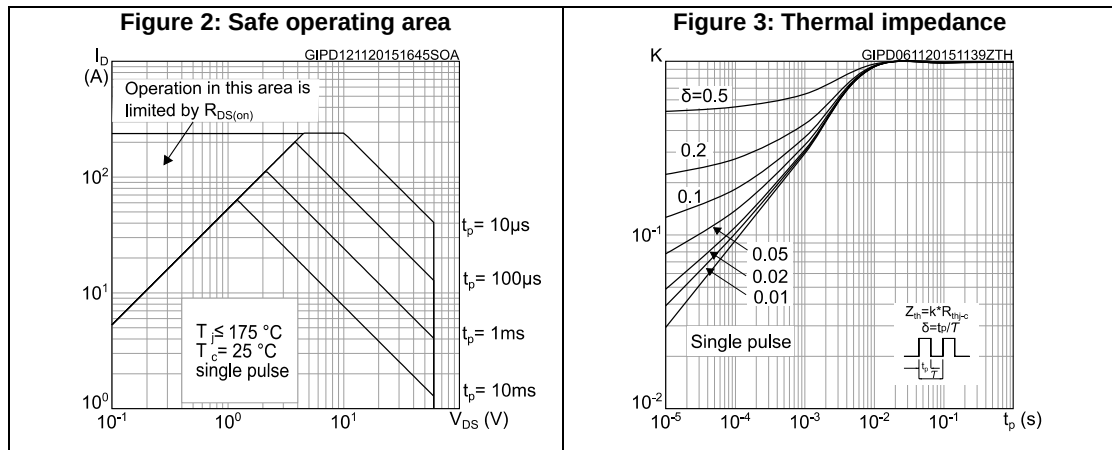
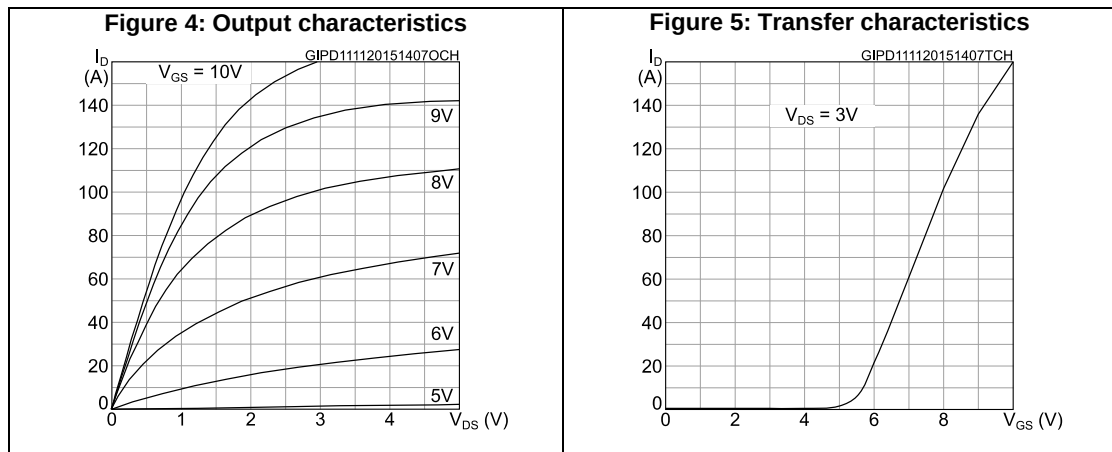
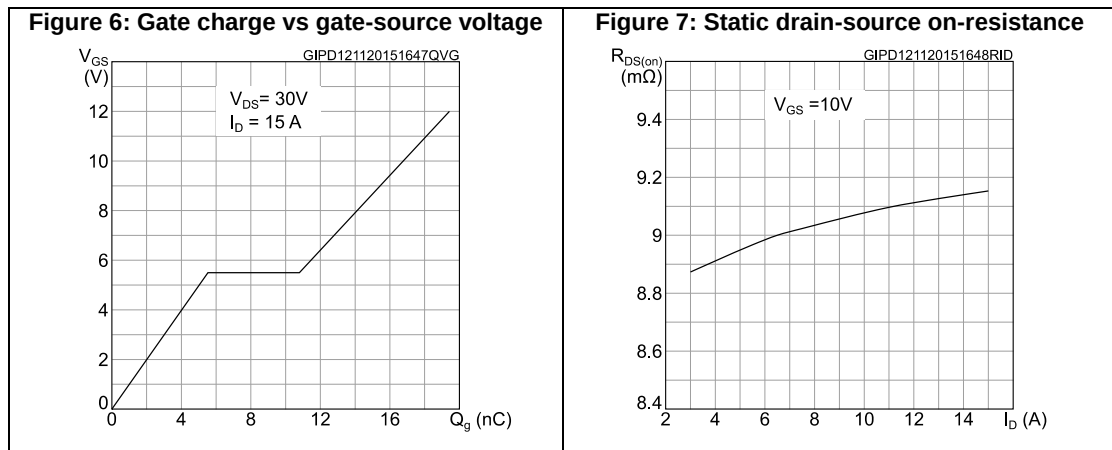


Figure 8: Capacitance variations

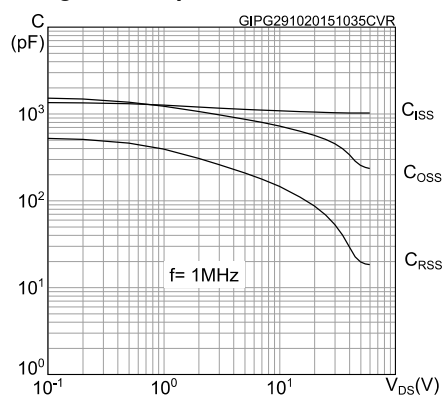


Figure 9: Normalized gate threshold voltage vs temperature

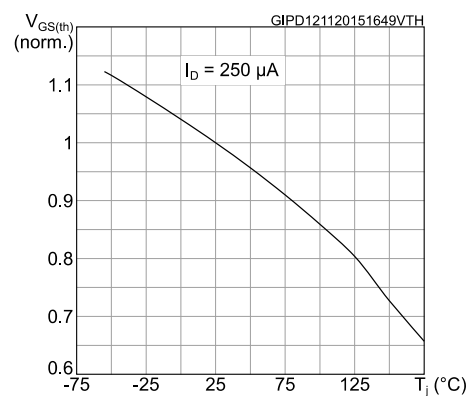


Figure 10: Normalized on-resistance vs temperature

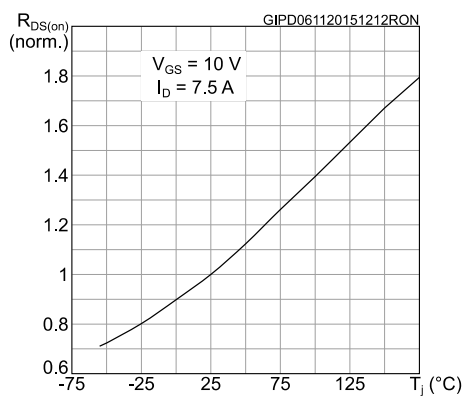
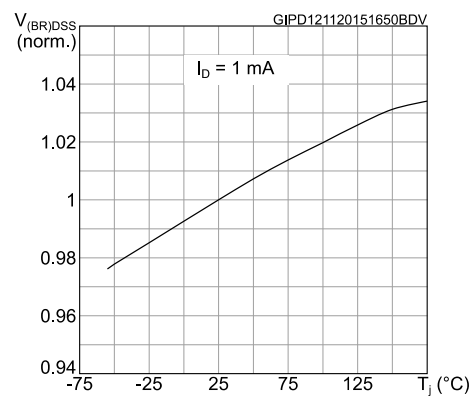
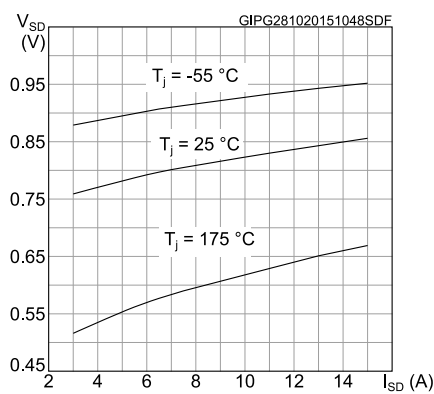
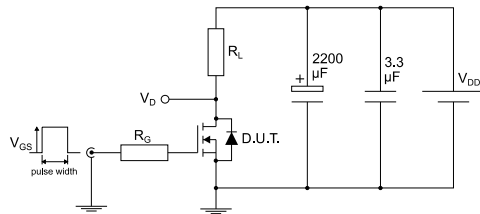
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Source-drain diode forward characteristics



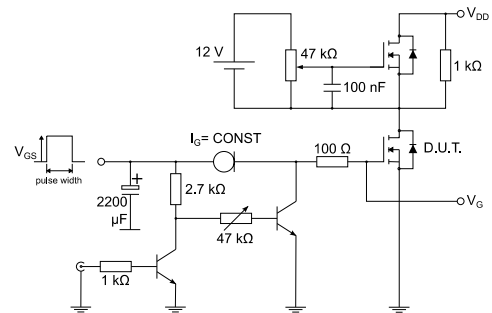
3 Test circuits

Figure 13: Test circuit for resistive load switching times



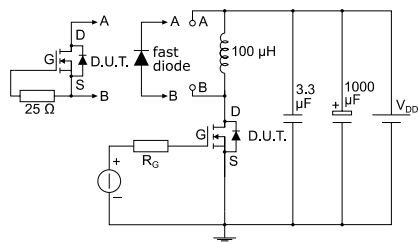
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Figure 14: Test circuit for gate charge behavior



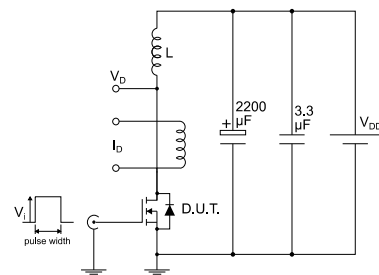
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Figure 15: Test circuit for inductive load switching and diode recovery times



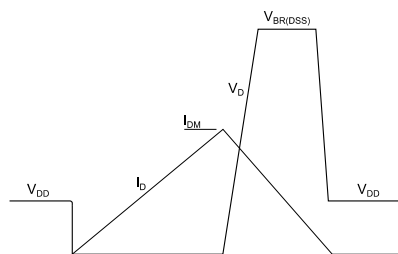
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Figure 16: Unclamped inductive load test circuit



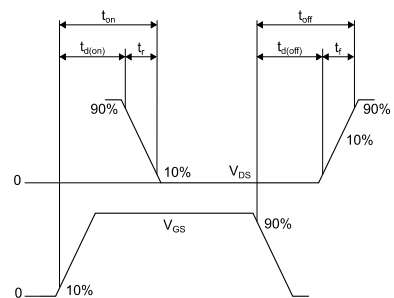
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Figure 17: Unclamped inductive waveform



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Figure 18: Switching time waveform



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4 Package mechanical data

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 type R package information

Figure 19: PowerFLAT™ 5x6 type R package outline

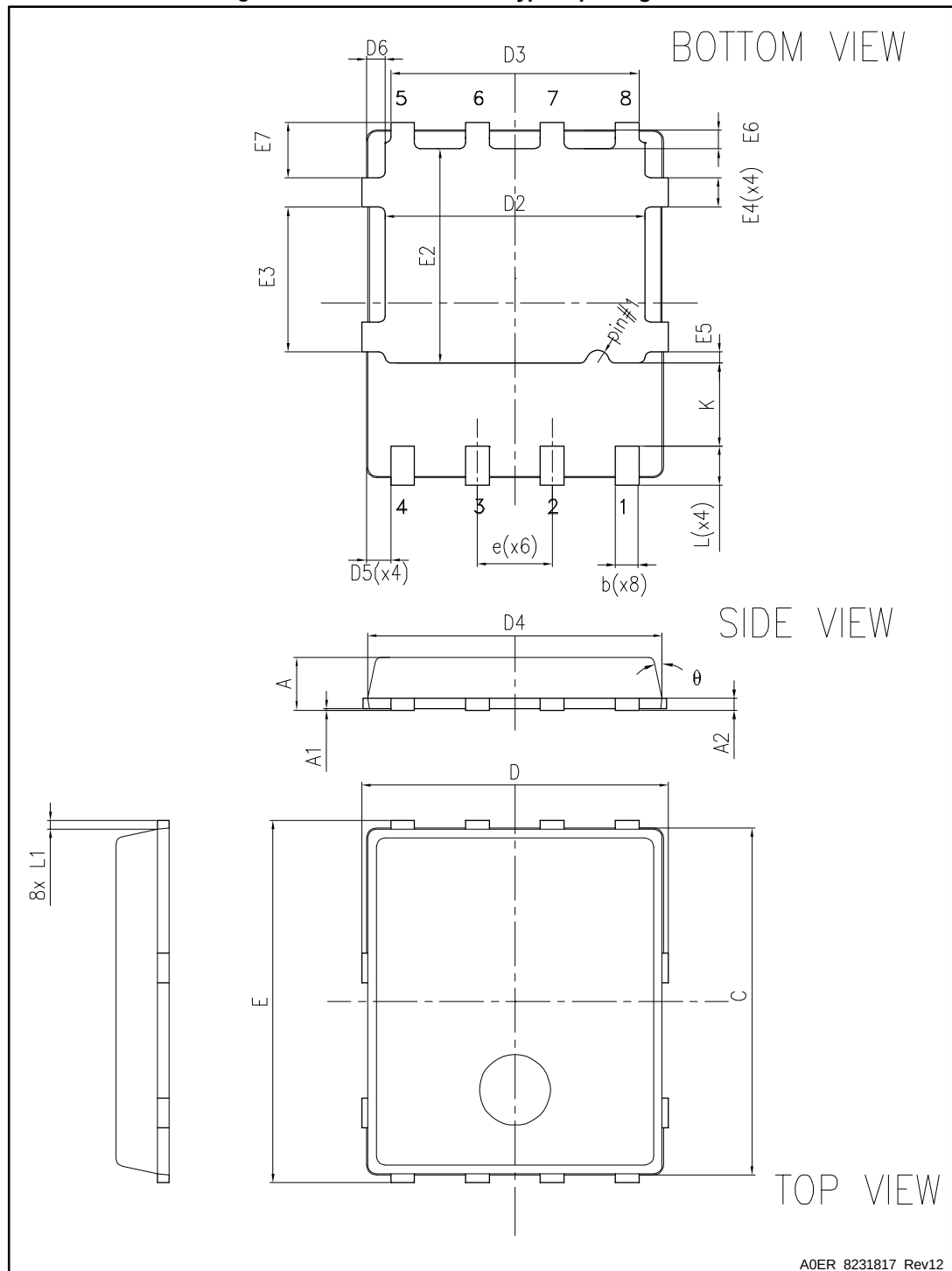
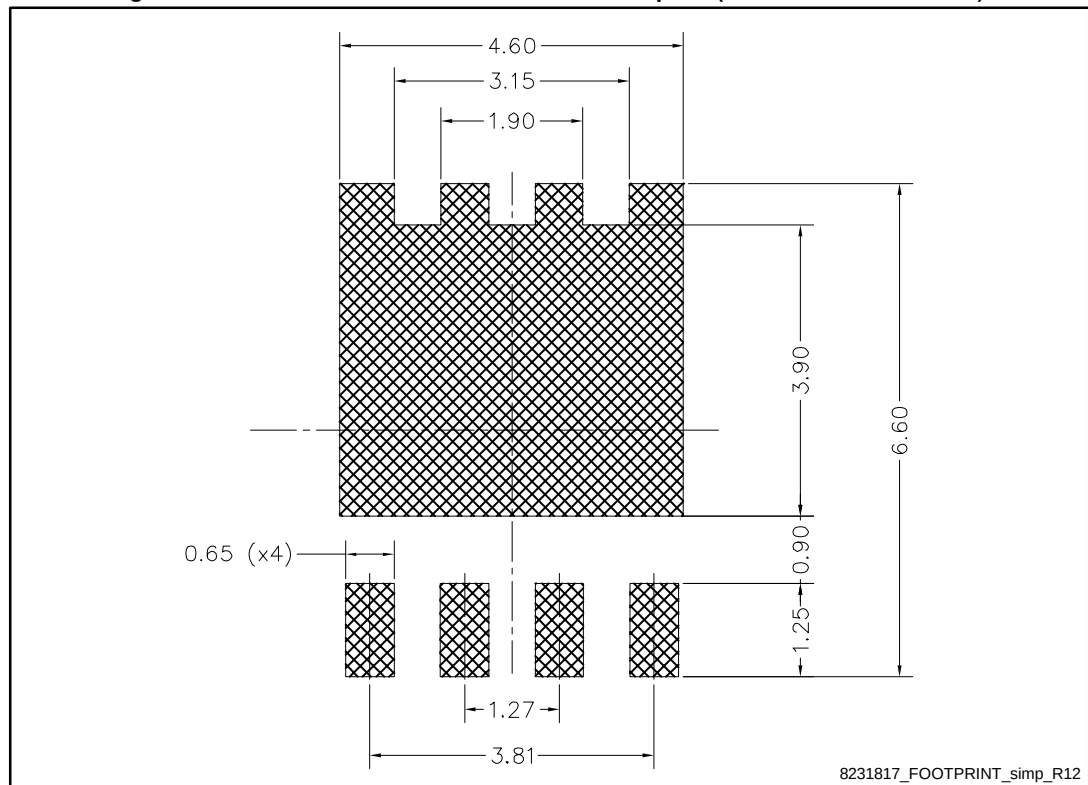


Table 8: PowerFLAT™ 5x6 type R mechanical data

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	6.20
D	5.00	5.20	5.40
D2	4.15		4.45
D3	4.05	4.20	4.35
D4	4.80	5.0	5.20
D5	0.25	0.4	0.55
D6	0.15	0.3	0.45
e		1.27	
E	5.95	6.15	6.35
E2	3.50		3.70
E3	2.35		2.55
E4	0.40		0.60
E5	0.08		0.28
E6	0.2	0.325	0.450
E7	0.75	0.90	1.25
K	1.275		1.575
L	0.60		0.80
L1	0.05	0.15	0.25
θ	0°		12°

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



4.2 Packing information

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

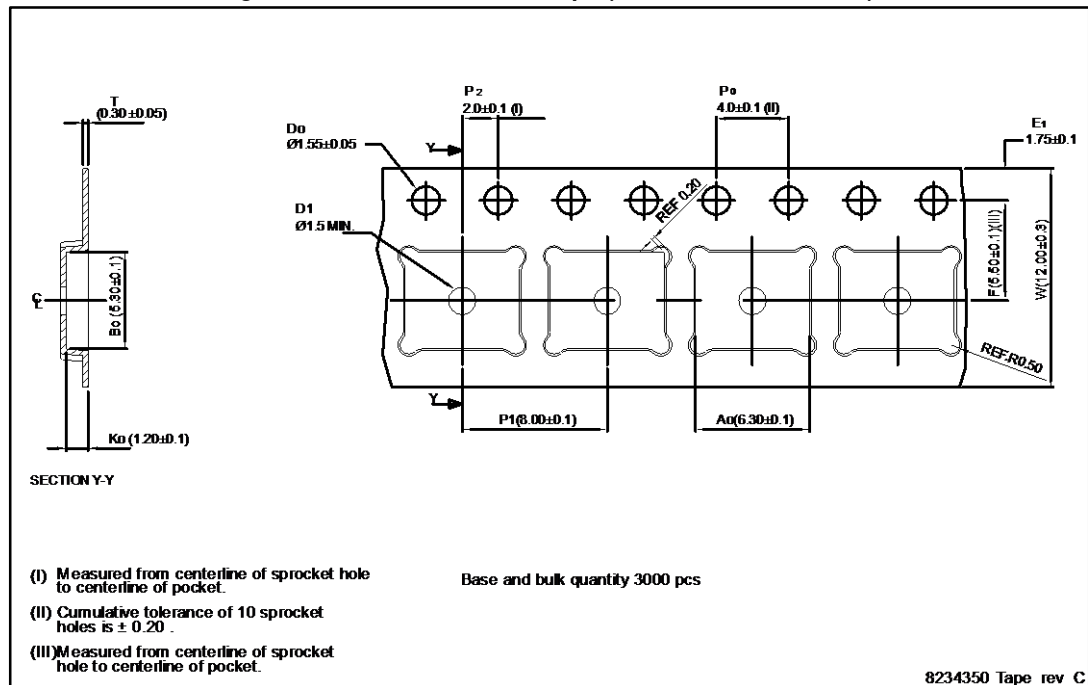


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

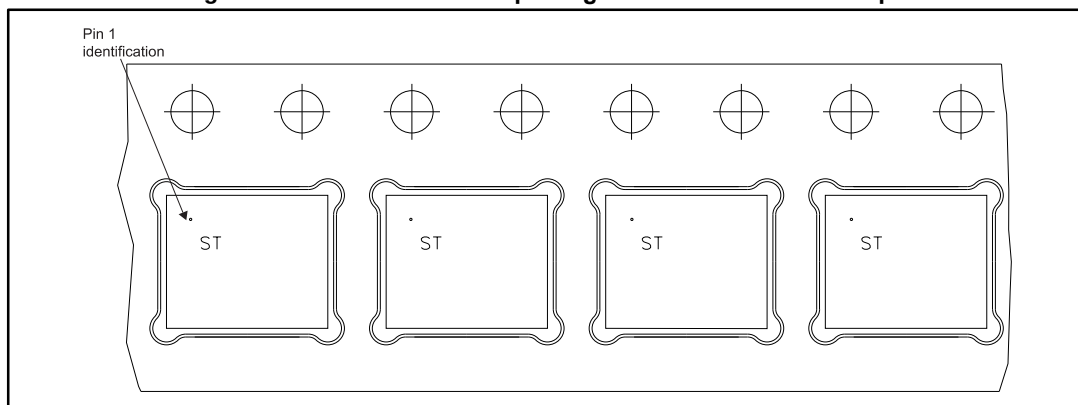
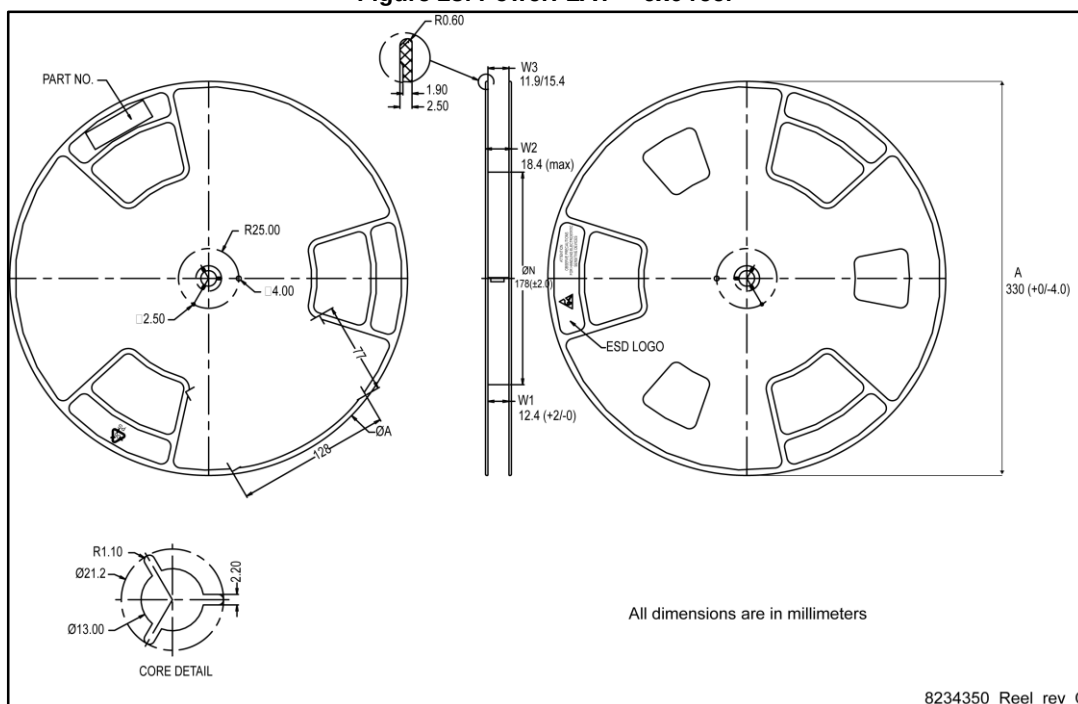


Figure 23: PowerFLAT™ 5x6 reel



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
22-Jul-2015	1	First release.
12-Nov-2015	2	Document status promoted from preliminary to production data. Updated title and features in cover page. Updated Table 2: "Absolute maximum ratings" and Section 3: "Electrical characteristics" . Added Section 3.1: "Electrical characteristics (curves)" Updated Section 5.1: "PowerFLAT 5x6 type R package information" . Minor text changes.

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