

Automotive-grade N-channel 60 V, 21 mΩ typ., 32 A STripFET™ F6 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

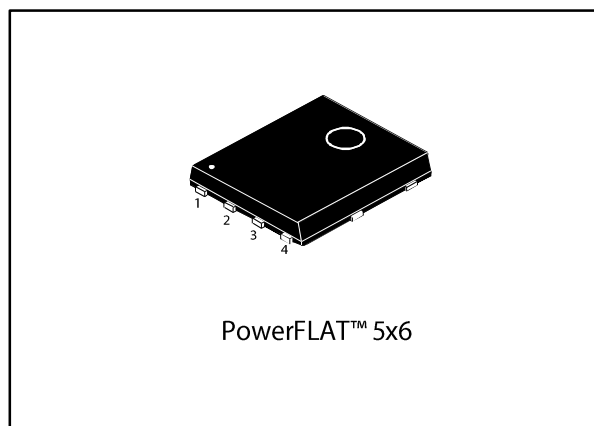
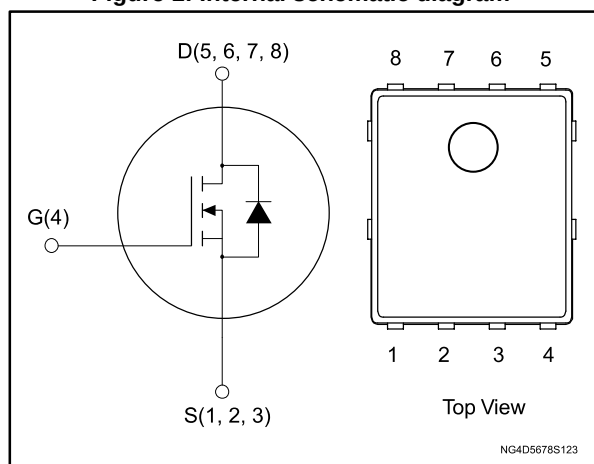


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STL8N6LF6AG	60 V	27 mΩ	32 A	55 W

- Designed for automotive applications and AEC-Q101 qualified
- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss
- Wetable flank package

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R_{DS(on)} in all packages.

Table 1: Device summary

Order code	Marking	Package	Packing
STL8N6LF6AG	8N6LF6	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	Drain current (continuous) at $T_{case} = 25\text{ }^{\circ}\text{C}$	32	A
	Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$	23	
$I_D^{(1)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^{\circ}\text{C}$	9.6	A
	Drain current (continuous) at $T_{pcb} = 100\text{ }^{\circ}\text{C}$	6.8	
$I_{DM}^{(1)(2)}$	Drain current (pulsed)	38	A
$I_{DM}^{(2)}$	Drain current (pulsed)	128	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$	55	W
P_{TOT}	Total dissipation at $T_{pcb} = 25\text{ }^{\circ}\text{C}$	4.8	
T_{stg}	Storage temperature	-55 to 175	$^{\circ}\text{C}$
T_j	Operating junction temperature		

Notes:

⁽¹⁾ When mounted on a 1-inch² FR-4, 2 Oz copper board, $t < 10\text{ s}$.

⁽²⁾ Pulse width is limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	2.7	$^{\circ}\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	31.3	

Notes:

⁽¹⁾ When mounted on a 1-inch² FR-4, 2 Oz copper board, $t < 10\text{ s}$.

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AV}	Avalanche current, not repetitive	32	A
$E_{AS}^{(1)}$	Single pulse avalanche energy	120	mJ

Notes:

⁽¹⁾ starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AV}$, $V_{DD} = 43.5\text{ V}$.

2 Electrical characteristics

(T_{case} = 25 °C unless otherwise specified)

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	V _{GS} = 0 V, I _D = 250 μA	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 _{DS} = 0 V, V _{GS} = ±20 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 = 9.6 A		21	27	mΩ
		V _{GS} = 4.5 V, I _D = 9.6 A		25	31	

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	-	1340	-	pF
C _{oss}	Output capacitance		-	90	-	
C _{rss}	Reverse transfer capacitance		-	60	-	
Q _g	Total gate charge	V _{DD} = 30 V, I _D = 9.6 A, V _{GS} = 10 V (see Figure 14: "Test circuit for gate charge behavior")	-	27	-	nC
Q _{gs}	Gate-source charge		-	4.6	-	
Q _{gd}	Gate-drain charge		-	4.3	-	

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-on delay time	V _{DD} = 30 V, I _D = 12.5 A R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	9.6	-	ns
t _r	Rise time		-	20	-	
t _{d(off)}	Turn-off delay time		-	56	-	
t _f	Fall time		-	7	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I _{SD}	Source-drain current		-		9.6	A
I _{SDM} ⁽¹⁾	Source-drain current (pulsed)		-		38	A
V _{SD} ⁽²⁾	Forward on voltage	V _{GS} = 0 V, I _{SD} = 9.6 A	-		1.3	V
t _{rr}	Reverse recovery time	I _{SD} = 25 A, di/dt = 100 A/μs, V _{DD} = 48 V (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	22.5		ns
Q _{rr}	Reverse recovery charge		-	22.2		nC
I _{RRM}	Reverse recovery current		-	2.0		A

Notes:

⁽¹⁾ Pulse width is limited by safe operating area.

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

2.1 Electrical characteristics (curves)

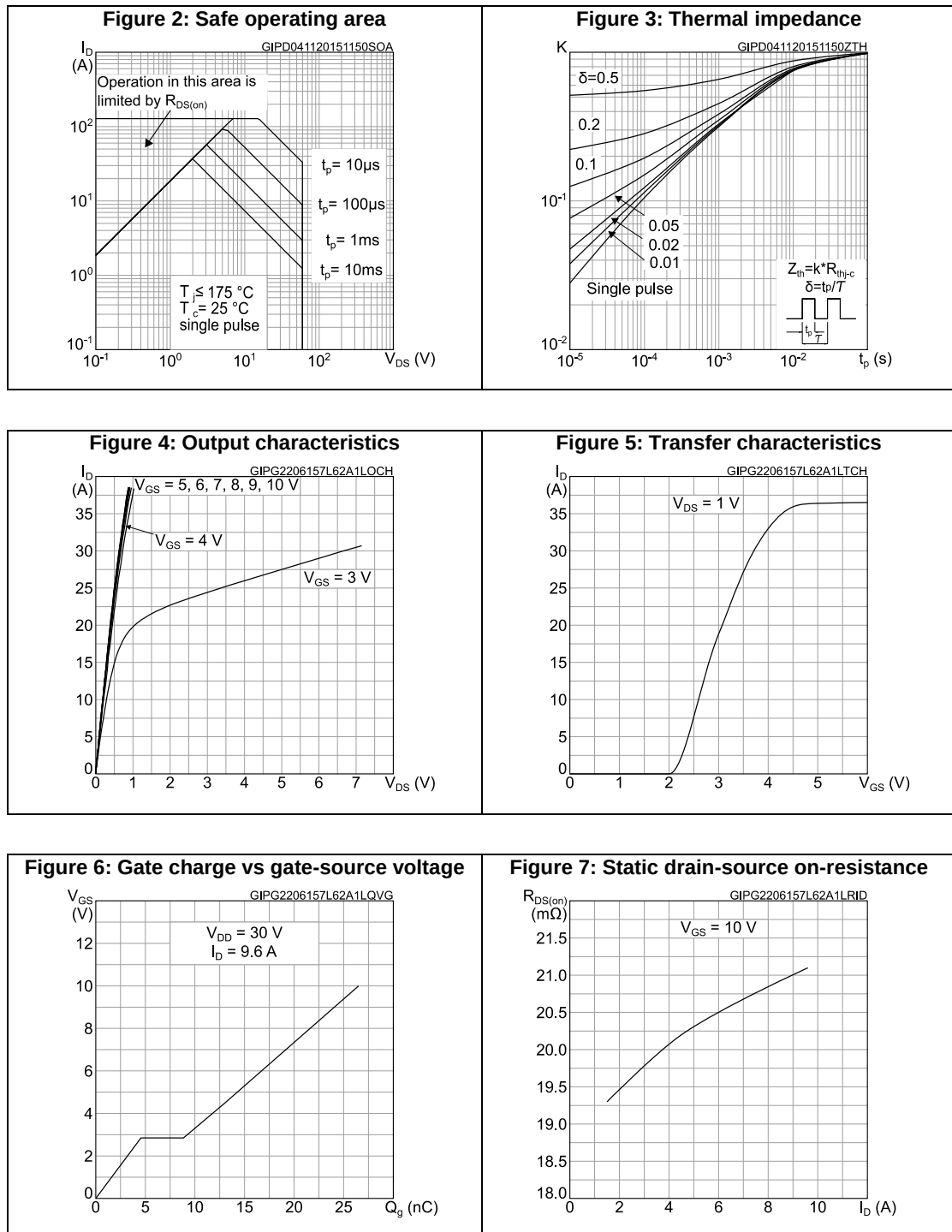


Figure 8: Capacitance variations

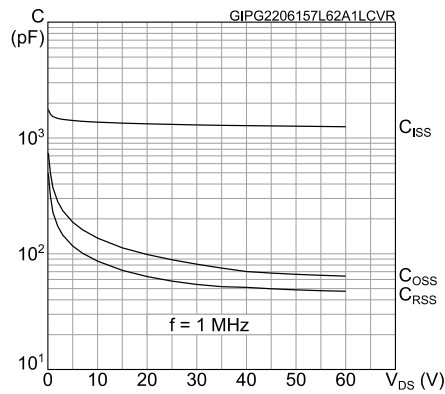


Figure 9: Normalized gate threshold voltage vs temperature

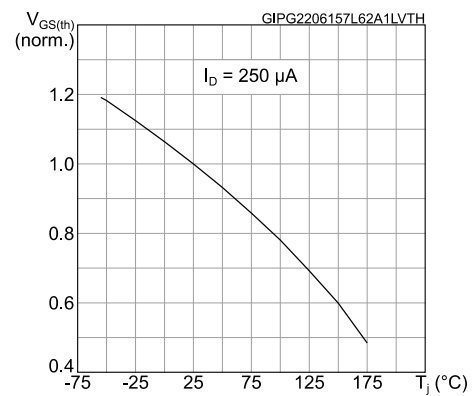


Figure 10: Normalized on-resistance vs temperature

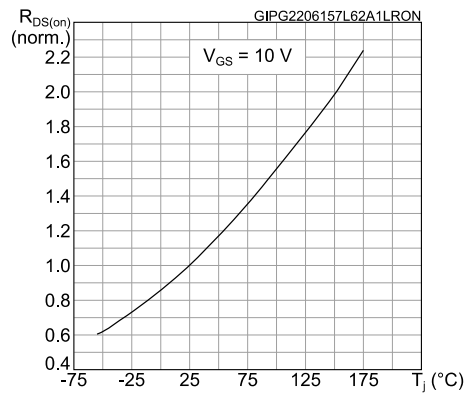


Figure 11: Normalized V(BR)DSS vs temperature

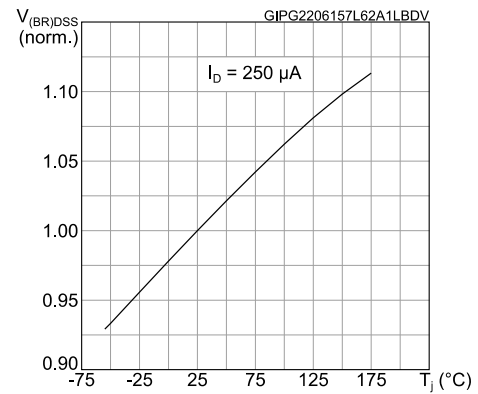
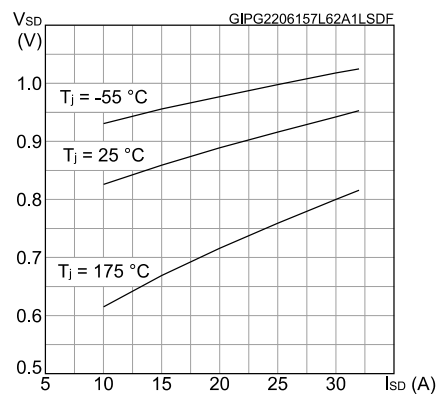
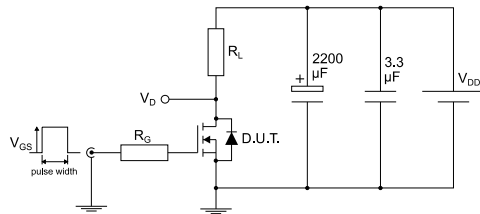


Figure 12: Source-drain diode forward characteristics



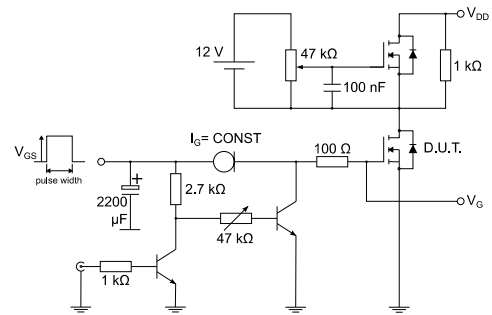
3 Test circuits

Figure 13: Test circuit for resistive load switching times



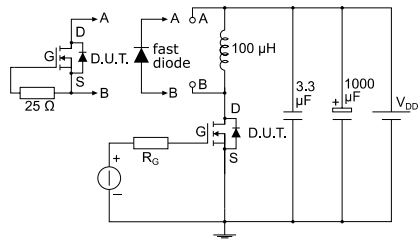
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Figure 14: Test circuit for gate charge behavior



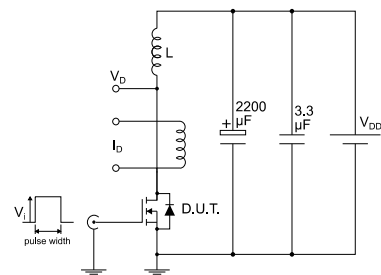
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Figure 15: Test circuit for inductive load switching and diode recovery times



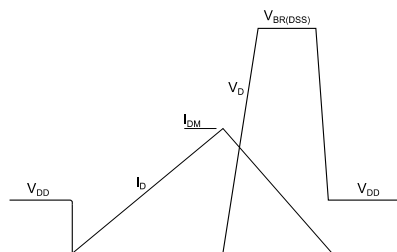
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Figure 16: Unclamped inductive load test circuit



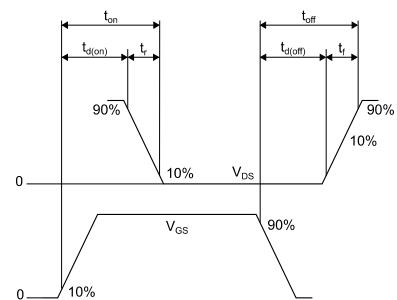
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Figure 17: Unclamped inductive waveform



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Figure 18: Switching time waveform



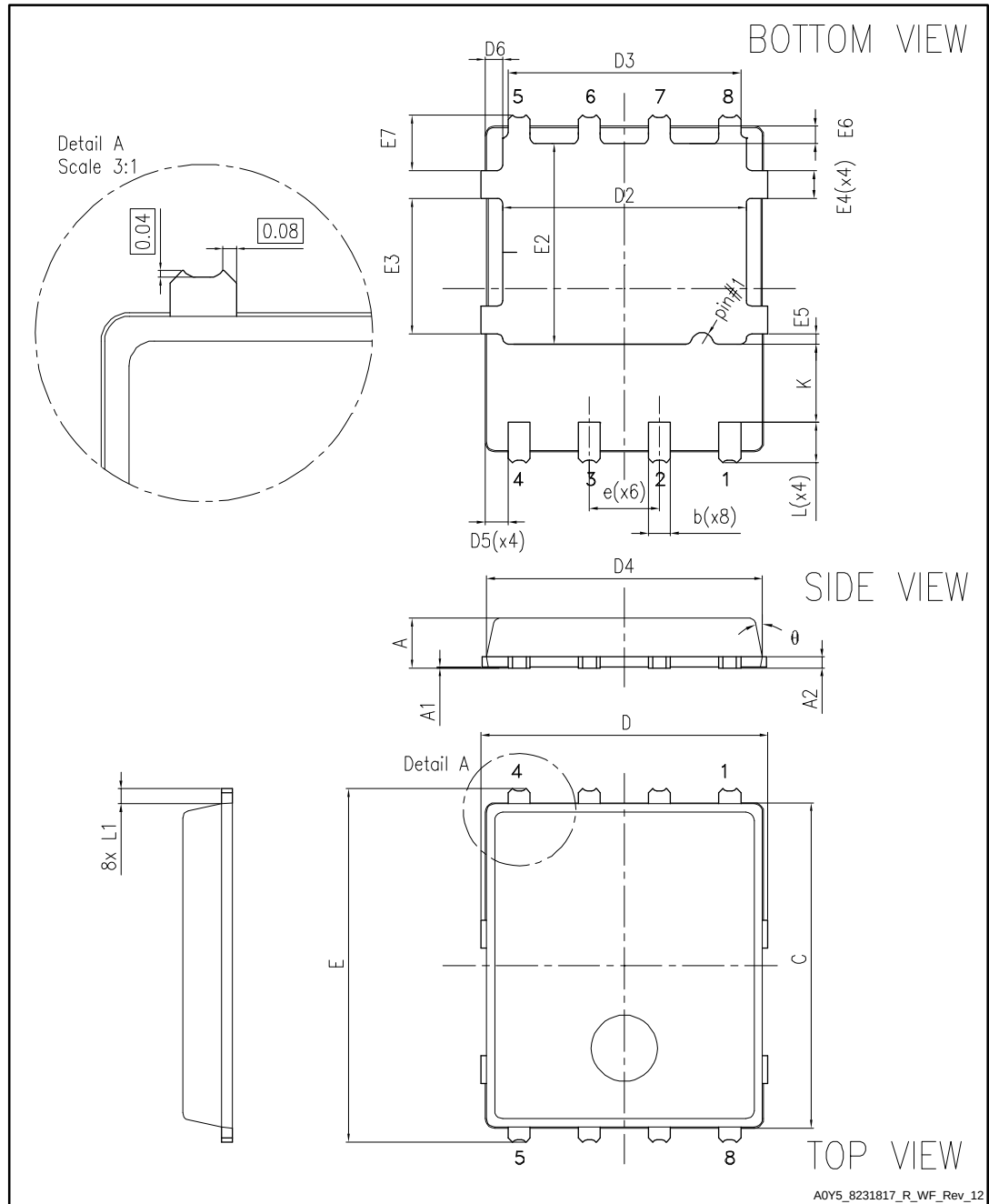
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4 Package information

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

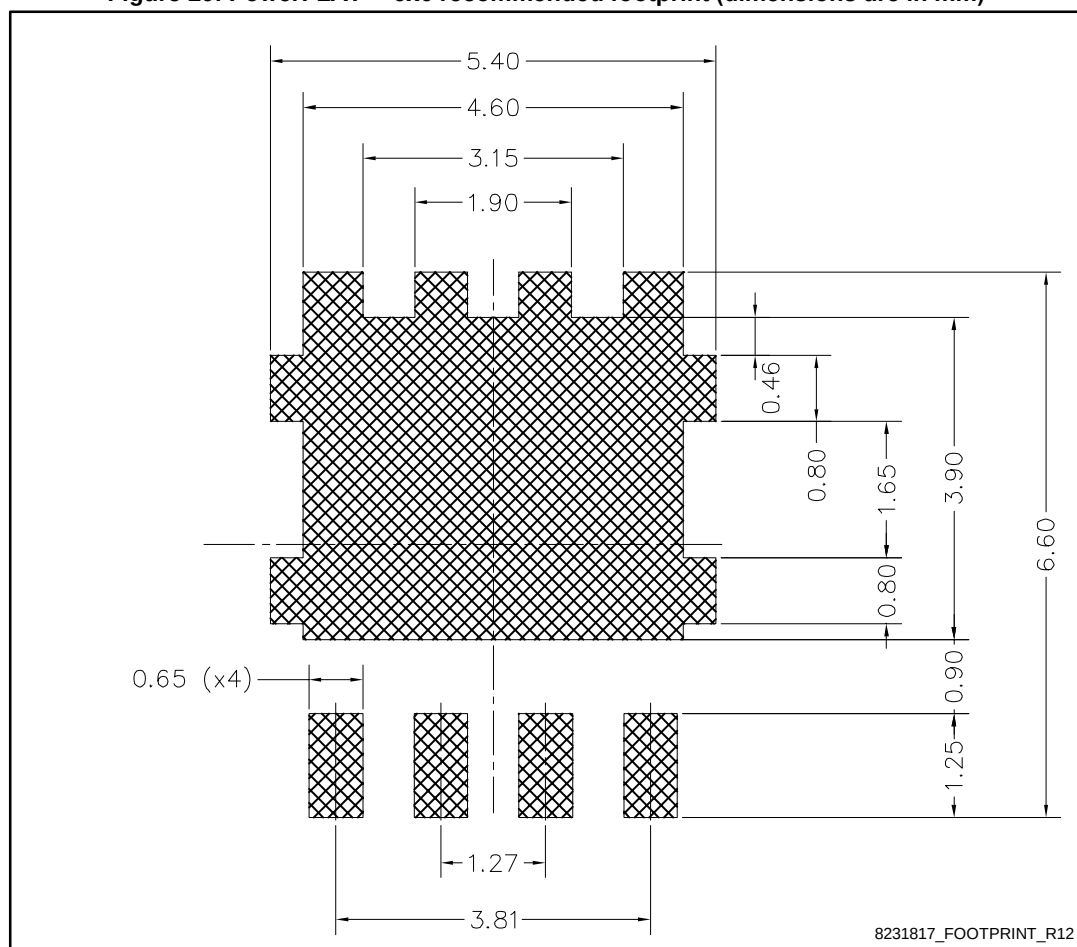


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Table 9: PowerFLAT™ 5x6 WF type R mechanical data

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	6.20
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	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	0.175	0.325	0.450
E7	0.85	1.00	1.15
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

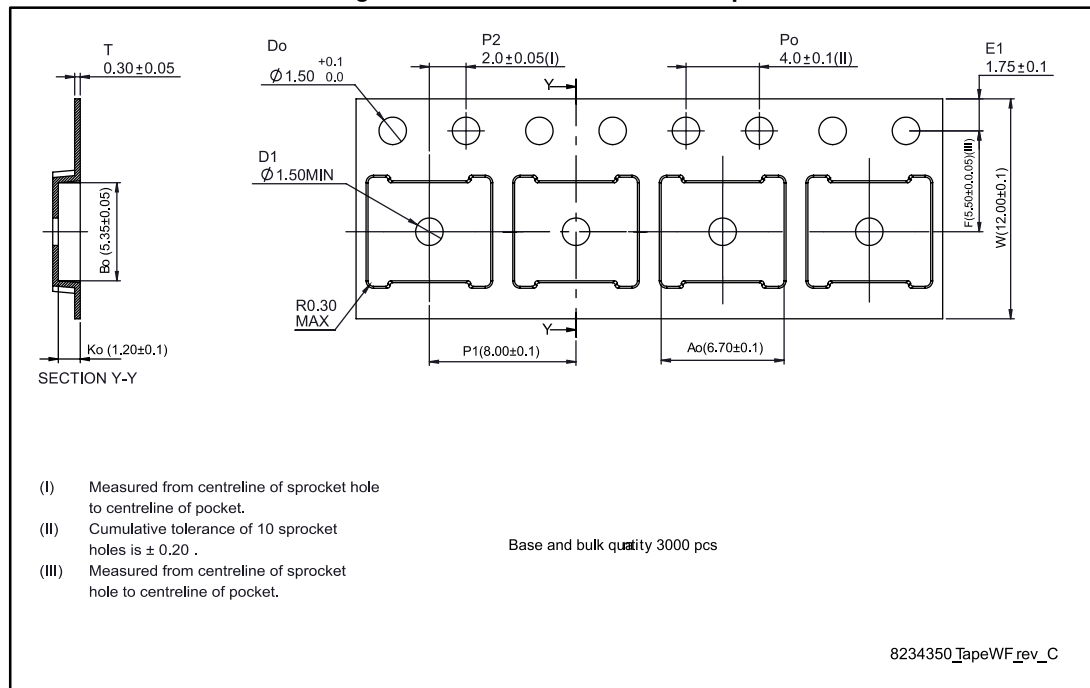
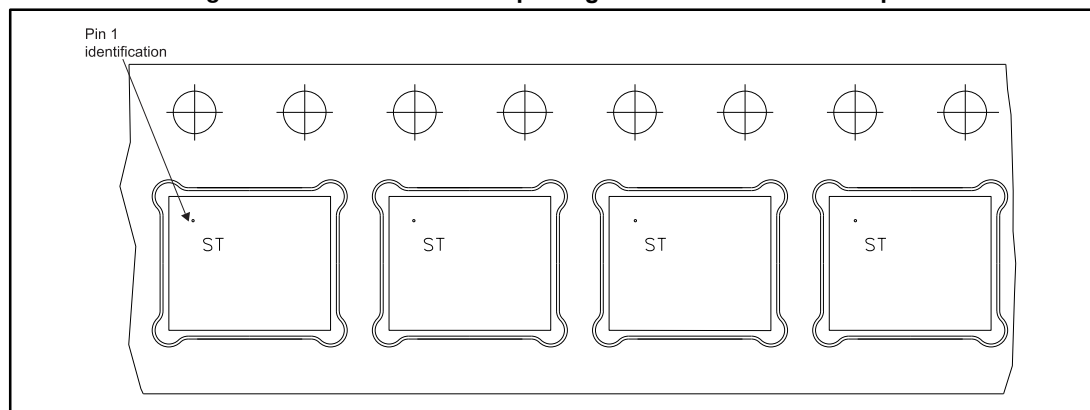


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape



Technical drawing of a reel showing top, side, and core detail views with dimensions.

Top View (Left): Shows a circular reel with a central hub and six segments. Dimensions include: PART NO. (pointing to a segment), R25.00 (radius of the outer edge), $\phi 4.00$ (inner hole diameter), $\phi 2.50$ (segment width), and $\sqrt{2} \phi A$ (segment length).

Side View (Right): Shows the reel's profile with dimensions: W3 11.9/15.4 (total width), W2 18.4 (max) (segment width), 2N 178 $\pm$ 2.0 (segment thickness), W1 12.4 (+2/-0) (segment width), and A 330 (+0/-4.0) (total height).

Core Detail (Bottom Left): Shows a cross-section of the reel core with dimensions: R1.10 (radius), $\phi 21.2$ (outer diameter), $\phi 13.00$ (inner diameter), and 2.20 (thickness).

ESD LOGO: A logo is present on one of the segments, indicating Electrostatic Discharge protection.

Notes:

- ESD LOGO
- All dimensions are in millimeters

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
06-Jul-2015	1	First release.
07-Jan-2016	2	Updated title and features in cover page. Updated Section 1: "Electrical ratings" , Section 2: "Electrical characteristics" and Section 4.1: "PowerFLAT™ 5x6 WF type R package information" .

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