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P-channel -60 V, 23 mΩ typ., -42 A STripFET™ F6 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

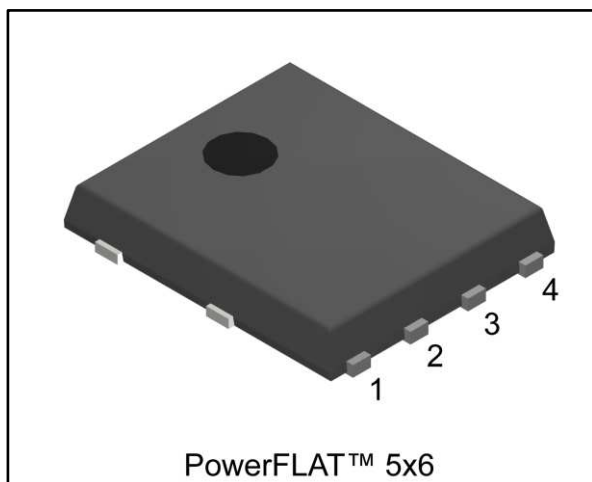
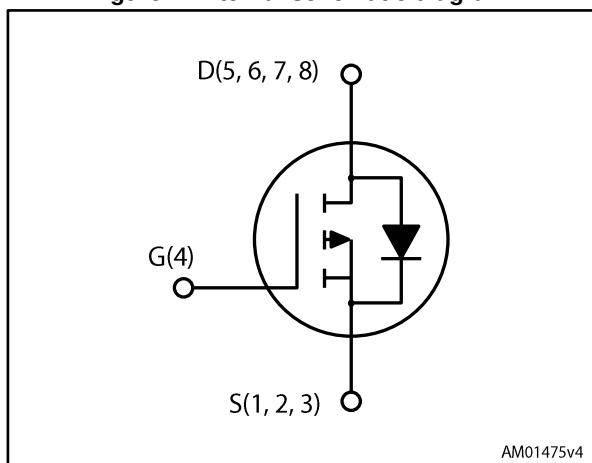


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL42P6LLF6	-60 V	26 mΩ	-42 A

- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

Applications

- Switching applications

Description

This device is a P-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	Packaging
STL42P6LLF6	42P6LLF6	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 $T_C = 25\text{ }^\circ\text{C}$	-42	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	-30	A
$I_D^{(1)(3)}$	Drain current (pulsed)	-168	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$	-9	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$	-6.6	A
$I_{DM}^{(2)(3)}$	Drain current (pulsed)	-36	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	100	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	4.8	W
T_{stg}	Storage temperature range	-55 to 175	$^\circ\text{C}$
T_j	Operating junction temperature range		

Notes:

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

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.5	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	31.3	$^\circ\text{C/W}$

Notes:

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

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 4: 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
		V _{GS} = 0 V, V _{DS} = -60 V, T _C = 125 °C ⁽¹⁾			-10	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 = -4.5 A		23	26	mΩ
		V _{GS} = -4.5 V, I _D = -4.5 A		28	34	

Notes:

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

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = -25 V, f = 1 MHz, V _{GS} = 0 V	-	3780	-	pF
C _{oss}	Output capacitance		-	262	-	pF
C _{rss}	Reverse transfer capacitance		-	170	-	pF
Q _g	Total gate charge	V _{DD} = -30 V, I _D = -9 A, V _{GS} = -4.5 V (see Figure 14: "Gate charge test circuit")	-	30	-	nC
Q _{gs}	Gate-source charge		-	10.8	-	nC
Q _{gd}	Gate-drain charge		-	10.5	-	nC
R _G	Gate input resistance	I _D = 0 A, f = 1 MHz	-	1.7	-	Ω

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 = -4.5 A, R _G = 4.7 Ω, V _{GS} = -10 V (see Figure 13: "Switching times test circuit for resistive load")	-	51.4	-	ns
t _r	Rise time		-	39	-	ns
t _{d(off)}	Turn-off-delay time		-	171	-	ns
t _f	Fall time		-	21	-	ns

Table 7: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-42		A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-168		A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = -9\text{ A}$	-		-1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = -9\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = -4.8\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	34		ns
Q_{rr}	Reverse recovery charge		-	48		nC
I_{RRM}	Reverse recovery current		-	-2.8		A

Notes:

(1)Pulse width limited by safe operating area

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

2.1 Electrical characteristics (curves)



For the P-channel Power MOSFET, current polarity of voltages and current have to be reversed.

Figure 2: Safe operating area

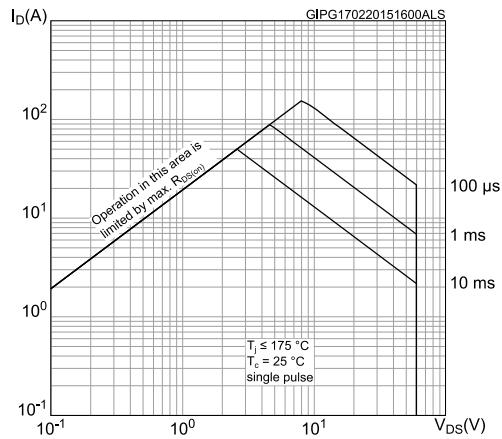


Figure 3: Thermal impedance

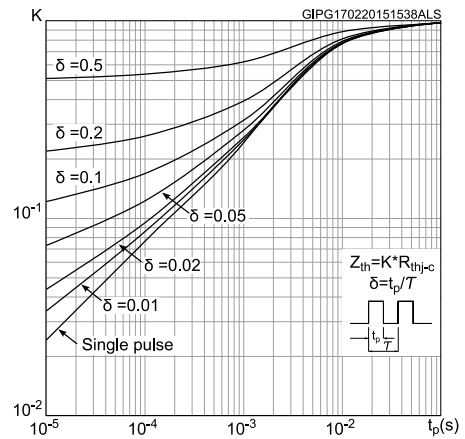


Figure 4: Output characteristics

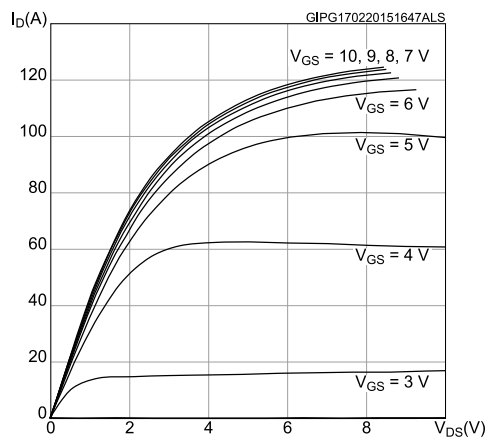


Figure 5: Transfer characteristics

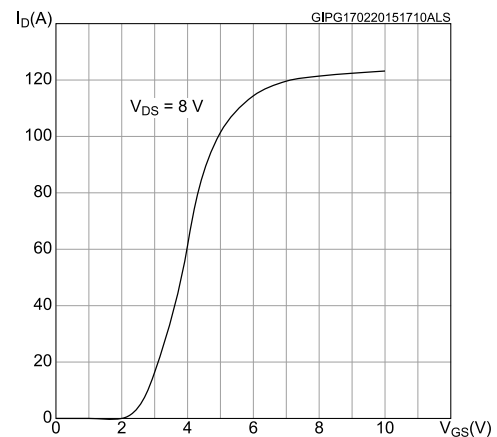


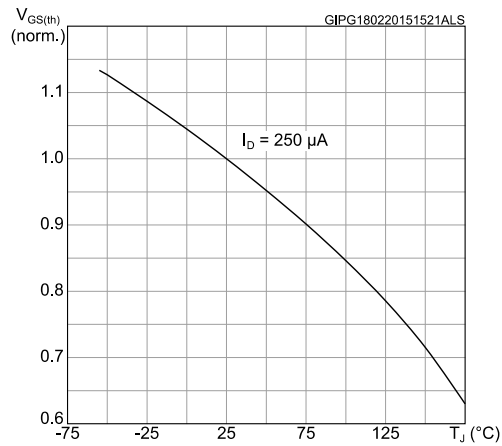
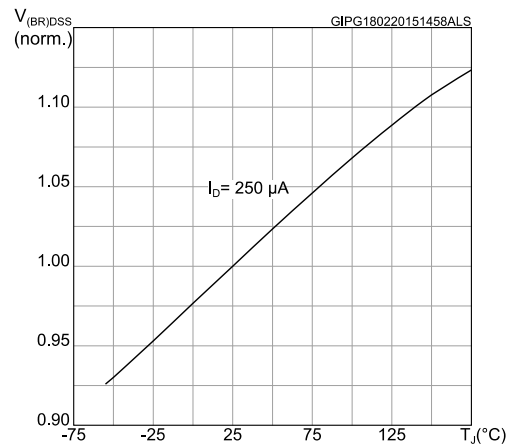
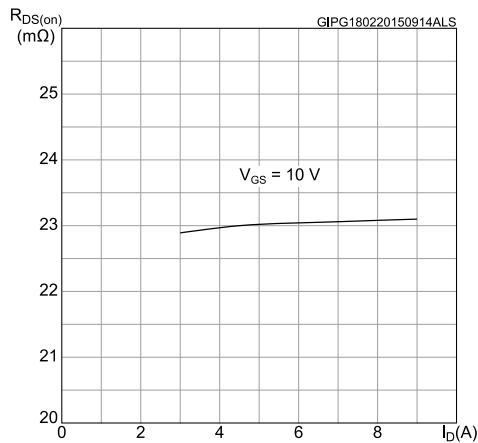
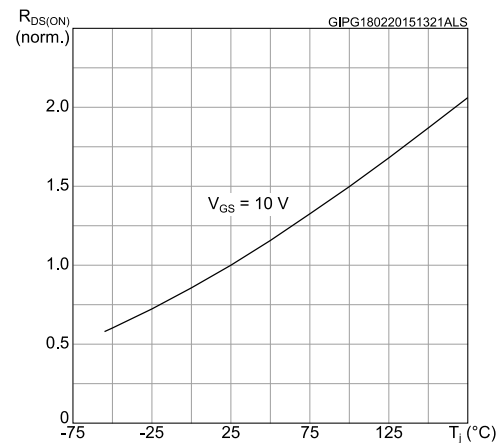
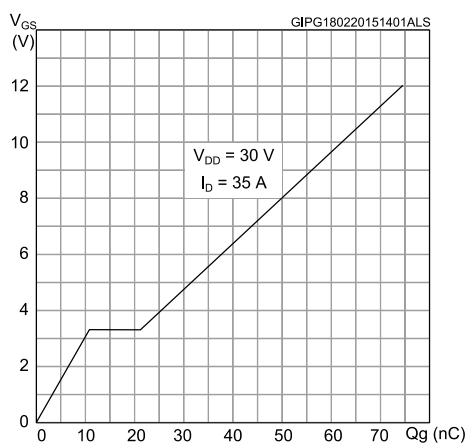
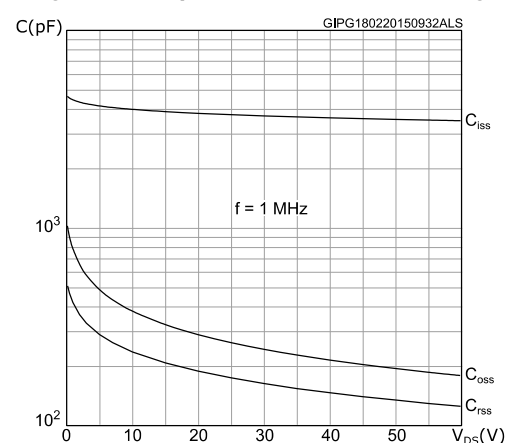
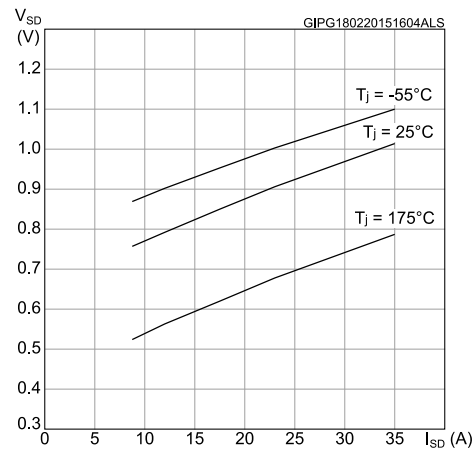
Figure 6: Normalized gate threshold voltage vs temperature**Figure 7: Normalized $V_{(BR)DSS}$ vs temperature****Figure 8: Static drain-source on-resistance****Figure 9: Normalized on-resistance vs. temperature****Figure 10: Gate charge vs gate-source voltage****Figure 11: Capacitance variations voltage**

Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Switching times test circuit for resistive load

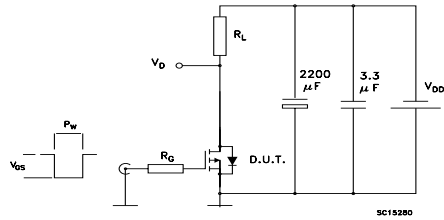


Figure 14: Gate charge test circuit

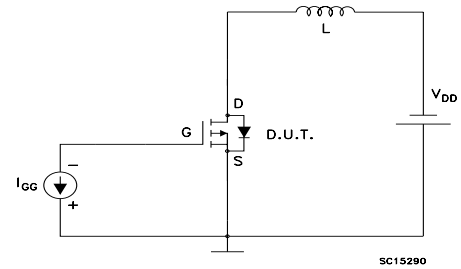
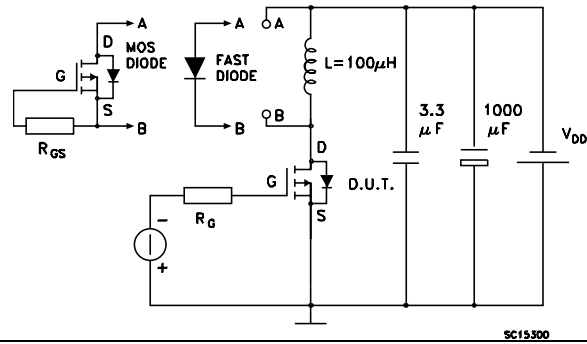


Figure 15: Test circuit for inductive load switching and diode recovery times



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 16: PowerFLAT™ 5x6 type R package outline

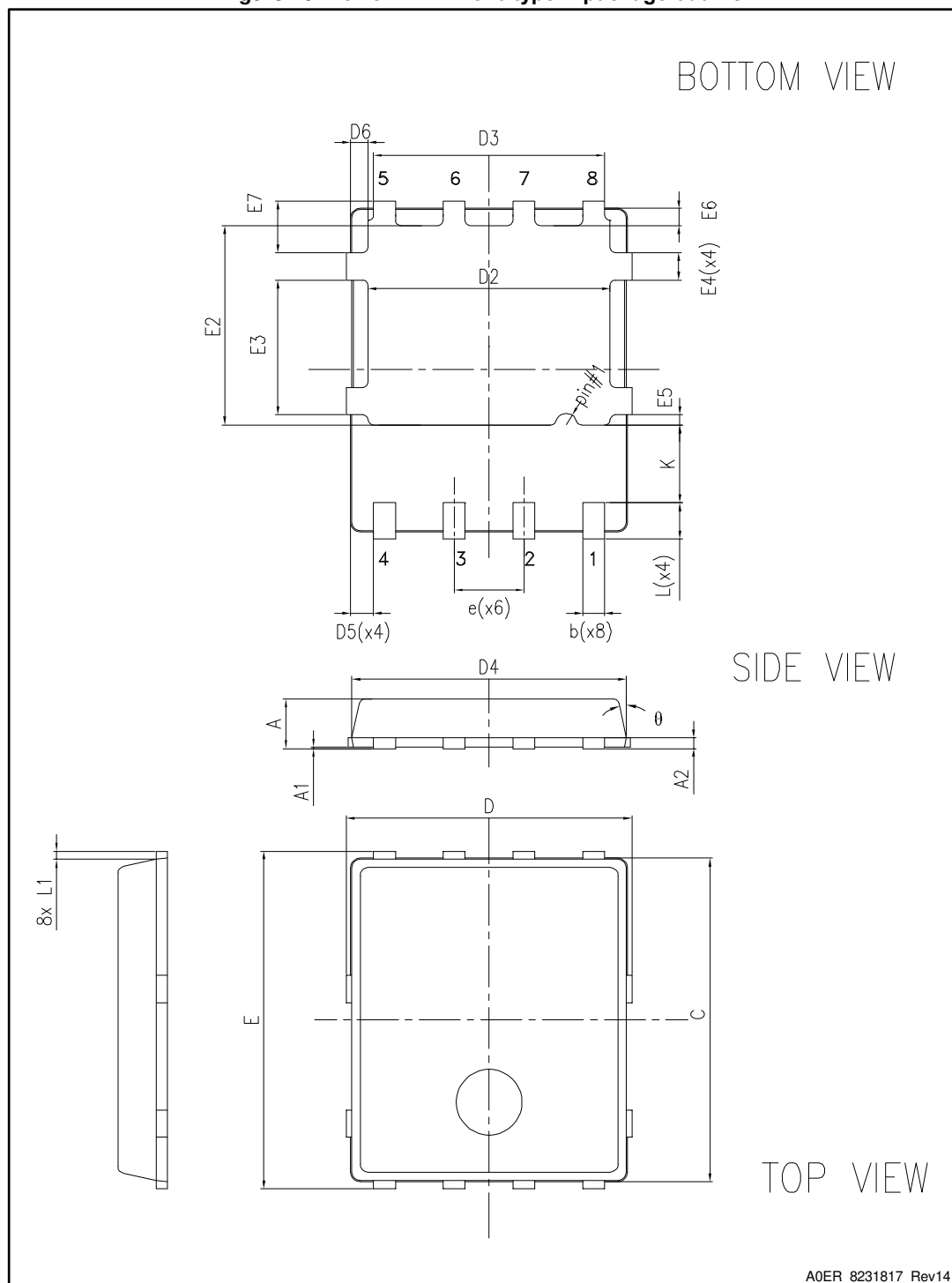
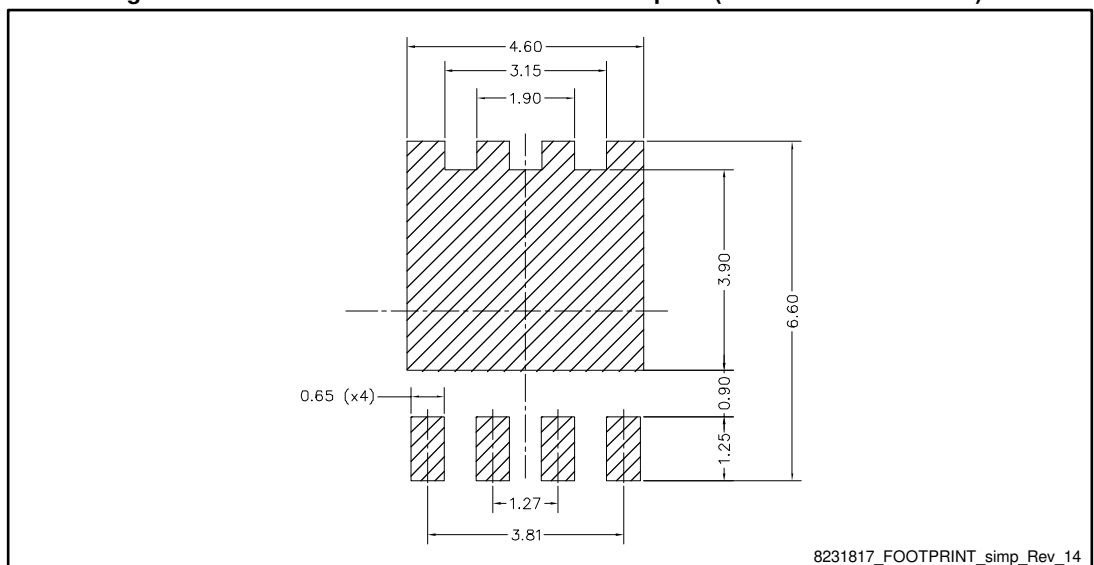


Table 8: PowerFLAT™ 5x6 type R mechanical data

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	5.00	5.20
D5	0.25	0.40	0.55
D6	0.15	0.30	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	0.20	0.325	0.45
E7	0.75	0.90	1.05
K	1.275		1.575
L	0.60		0.80
L1	0.05	0.15	0.25
θ	0°		12°

Figure 17: PowerFLAT™ 5x6 recommended footprint (dimensions are in mm)



4.2 PowerFLAT™ 5x6 packing information

Figure 18: PowerFLAT™ 5x6 tape (dimensions are in mm)

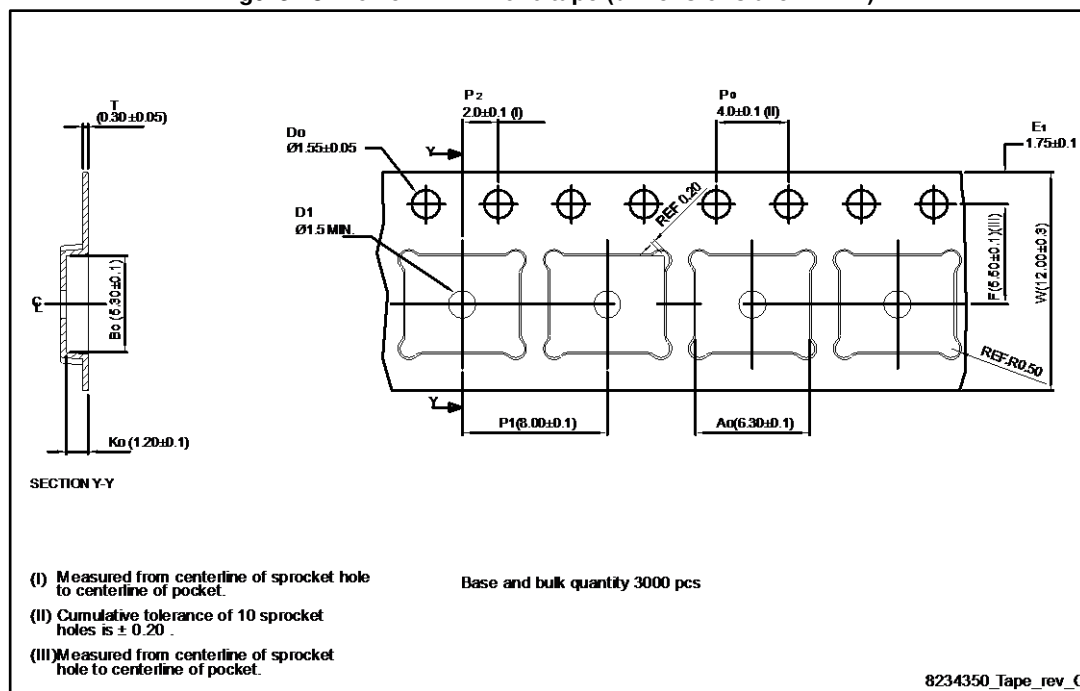
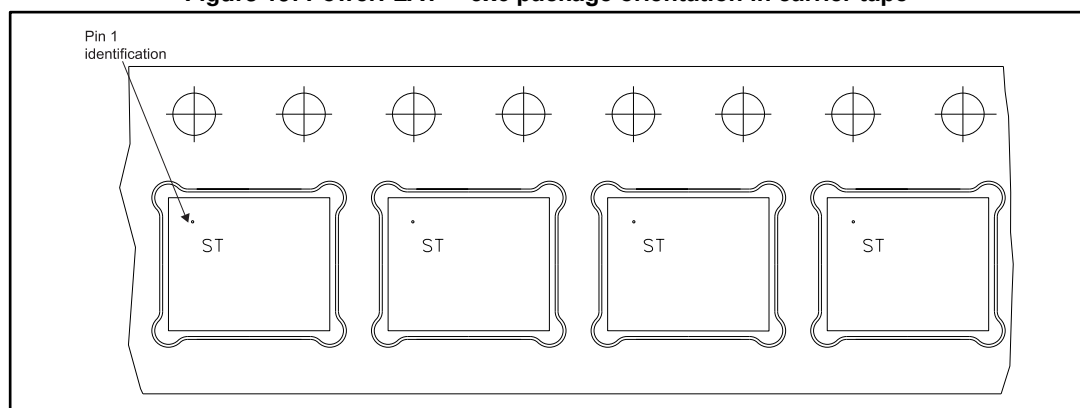


Figure 19: PowerFLAT™ 5x6 package orientation in carrier tape



Technical drawing of a 35mm film reel, showing front, side, and core detail views. Dimensions are in millimeters.

Front View (Left):

- Overall diameter: $\varnothing 13.00$
- Inner diameter: $\varnothing 2.50$
- Radius of inner circle: R25.00
- Radius of outer edge: R0.60
- Width of flange: 1.90
- Width of hub: 2.50
- Part No. label area.

Side View (Right):

- Overall height: A 330 (+0/-4.0)
- Hub width: W3 11.9/15.4
- Flange width: W2 18.4 (max)
- Inner diameter: $\varnothing N 17.8 (\pm 2.0)$
- Flange width: W1 12.4 (+2/-0)
- ESD LOGO label area.

Core Detail (Bottom Left):

- Core diameter: $\varnothing 13.00$
- Core radius: R1.10
- Core thickness: 2.20

All dimensions are in millimeters

8234350 Reel rev

5 Revision history

Table 9: Document revision history

Date	Revision	Changes
28-Oct-2013	1	First release.
25-Aug-2014	2	Modified: <i>Figure 1: "Internal schematic diagram"</i> Updated: <i>Section 10: "Package mechanical data"</i> Minor text changes
24-Feb-2015	3	In title description on cover page, changed 0.02 Ω to 0.023 Ω In features table on cover page, changed 0.028 Ω to 0.026 Ω Updated <i>Table 2: Absolute maximum ratings</i> Updated <i>Table 4: Static</i> – renamed table and updated Static drain-source on-resistance values Updated <i>Table 5: Dynamic</i> – test conditions and all typical values Updated <i>Table 6: Switching times</i> – test conditions and all typical values Updated <i>Table 7: Source-drain diode</i> – test conditions and all typical values Added <i>Section 2.2: Electrical characteristics (curves)</i> Updated <i>Section 4: Package mechanical data</i> Minor text changes
15-Nov-2016	4	Updated title, features table and description on cover page Updated <i>Table 2: "Absolute maximum ratings"</i> Updated <i>Table 4: "Static", Table 5: "Dynamic", Table 6: "Switching times"</i> and <i>Table 7: "Source drain diode"</i> Updated <i>Figure 9: "Normalized on-resistance vs. temperature"</i> Updated <i>Section 4.1: "PowerFLAT™ 5x6 type R package information"</i> Minor text changes

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