

N-channel 800 V, 0.95 Ω typ., 5 A MDmesh™ K5 Power MOSFET in a PowerFLAT™ 5x6 VHV package

Datasheet - production data

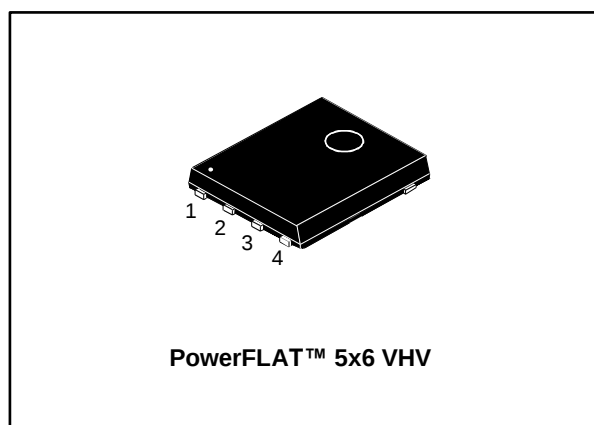
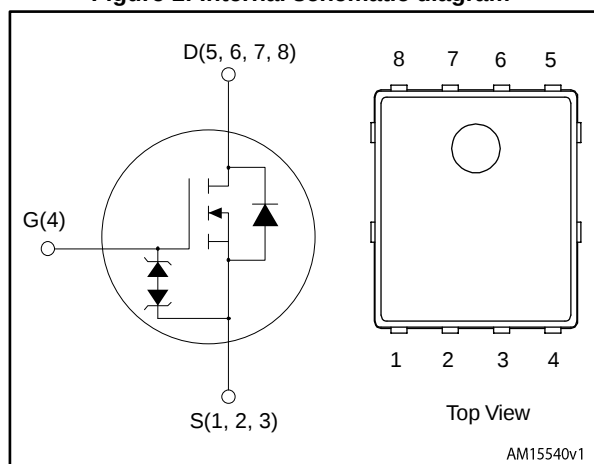


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL7LN80K5	800 V	1.15 Ω	5 A

- Industry's lowest R_{DS(on)} X area
- Industry's best FoM (figure of merit)
- Ultra-low gate charge
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

This very high voltage N-channel Power MOSFET is designed using MDmesh™ K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.

Table 1: Device summary

Order code	Marking	Package	Packing
STL7LN80K5	7LN80K5	PowerFLAT™ 5x6 VHV	Tape and reel

Contents

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	5	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	3.4	A
$I_D^{(2)}$	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	42	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(4)}$	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature range	- 55 to 150	$^\circ\text{C}$
T_J	Operating junction temperature range		

Notes:

⁽¹⁾Limited by maximum junction temperature.

⁽²⁾Pulse width limited by safe operating area.

⁽³⁾ $I_{SD} \leq 5\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$, $V_{DD} = 640\text{ V}$.

⁽⁴⁾ $V_{DS} \leq 640\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	3	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	59	$^\circ\text{C}/\text{W}$

Notes:

⁽¹⁾When mounted on 1inch² FR-4 board, 2 oz Cu.

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	1.5	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	200	mJ

2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

Table 5: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	800			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$ ⁽¹⁾			50	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 2.5\text{ A}$		0.95	1.15	Ω

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	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	270	-	pF
C_{oss}	Output capacitance		-	22	-	pF
C_{rss}	Reverse transfer capacitance		-	0.5	-	pF
$C_{o(er)}^{(1)}$	Equivalent capacitance energy related	$V_{DS} = 0\text{ to }640\text{ V}$, $V_{GS} = 0\text{ V}$	-	17	-	nC
$C_{o(tr)}^{(2)}$	Equivalent capacitance time related		-	48	-	nC
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	7.5	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 5\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 15: "Test circuit for gate charge behavior")	-	12	-	nC
Q_{gs}	Gate-source charge		-	2.6	-	nC
Q_{gd}	Gate-drain charge		-	8.6	-	nC

Notes:

⁽¹⁾Energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

⁽²⁾Time related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 2.5\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Test circuit for resistive load switching times" and Figure 19: "Switching time waveform")	-	9.3	-	ns
t_r	Rise time		-	6.7	-	ns
$t_{d(off)}$	Turn-off-delay time		-	23.6	-	ns
t_f	Fall time		-	17.4	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		20	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	276		ns
Q_{rr}	Reverse recovery charge		-	2.13		μC
I_{RRM}	Reverse recovery current		-	15.4		A
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	402		ns
Q_{rr}	Reverse recovery charge		-	2.79		μC
I_{RRM}	Reverse recovery current		-	13.9		A

Notes:

(1)Pulse width is limited by safe operating area

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

Table 9: Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	$I_{GS} = \pm 1\text{ mA}$, $I_D = 0\text{ A}$	30	-		V

The built-in back-to-back Zener diodes are specifically designed to enhance the ESD performance of the device. The Zener voltage facilitates efficient and cost-effective device integrity protection, thus eliminating the need for additional external componentry.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

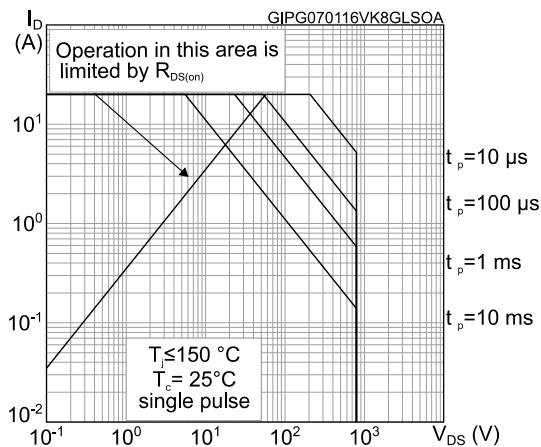


Figure 3: Thermal impedance

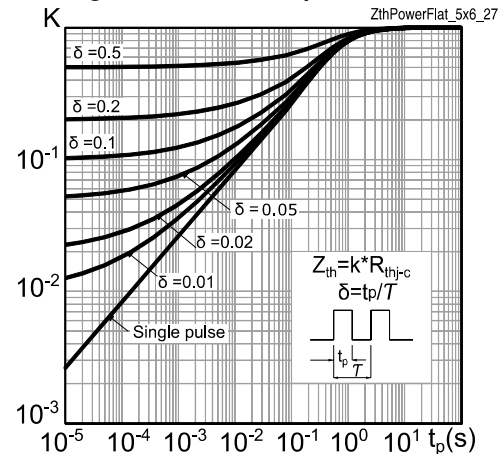


Figure 4: Output characteristics

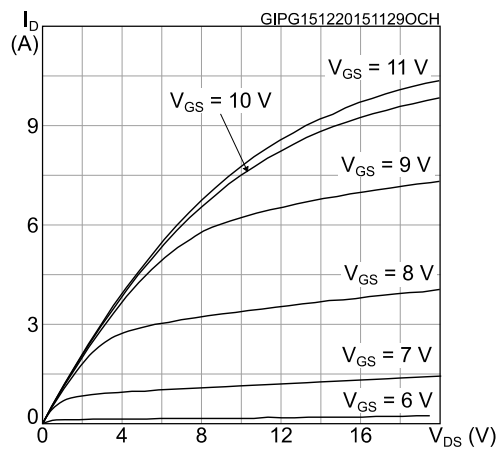


Figure 5: Transfer characteristics

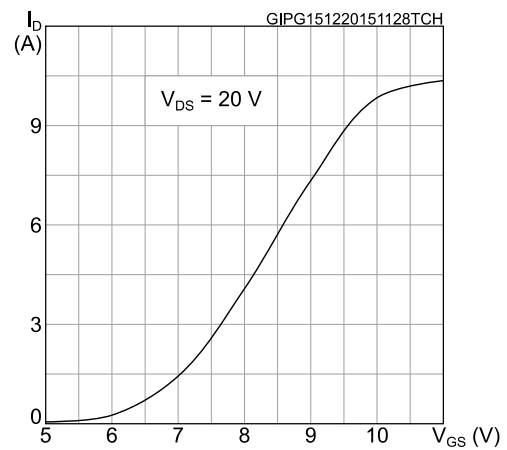


Figure 6: Gate charge vs gate-source voltage

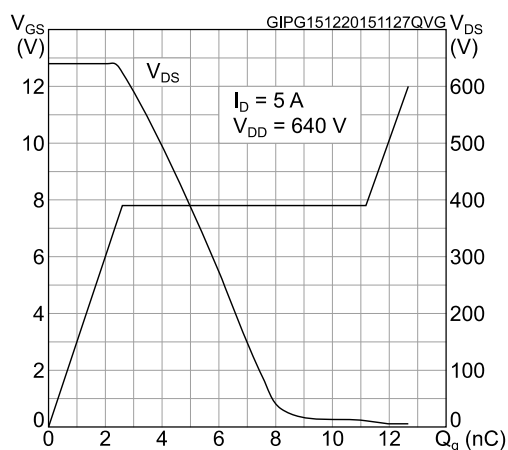


Figure 7: Static drain-source on-resistance

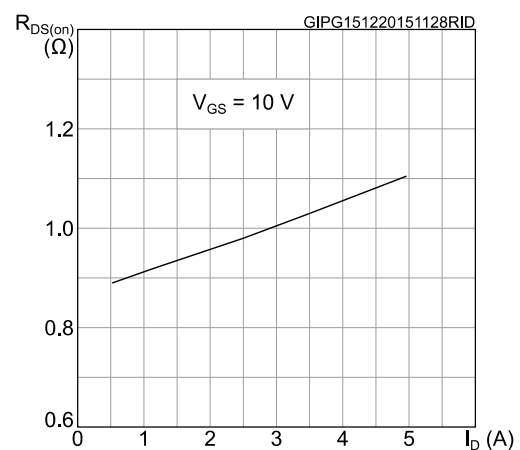


Figure 8: Capacitance variations

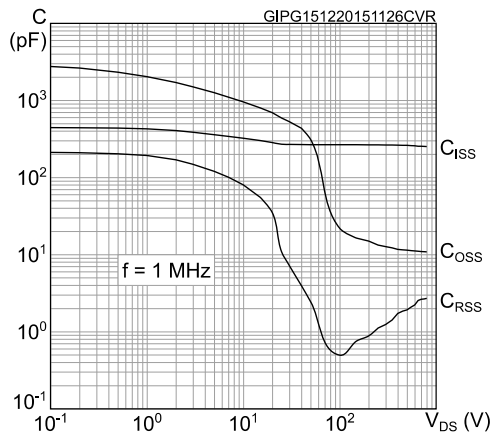


Figure 9: Normalized gate threshold voltage vs temperature

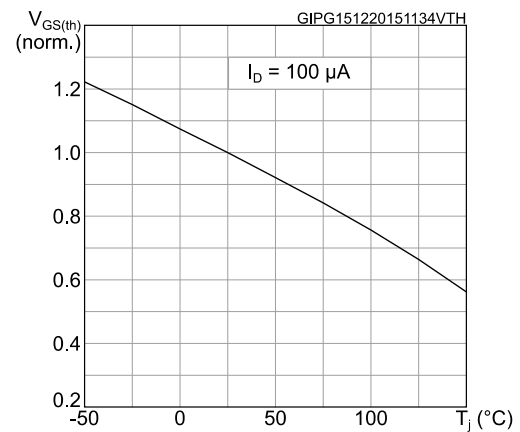
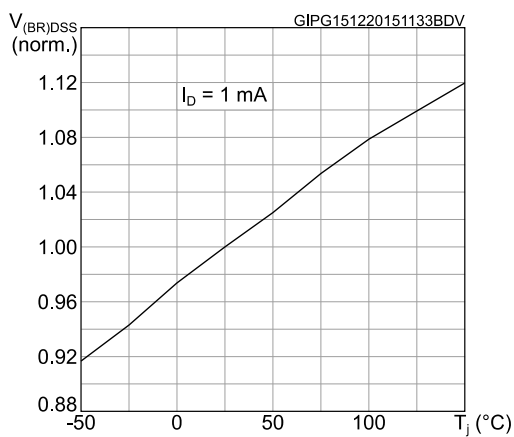
Figure 10: Normalized $V_{(BR)DSS}$ vs temperature

Figure 11: Normalized on-resistance vs temperature

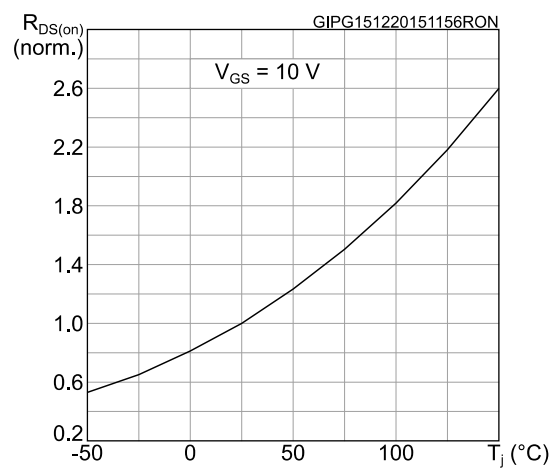
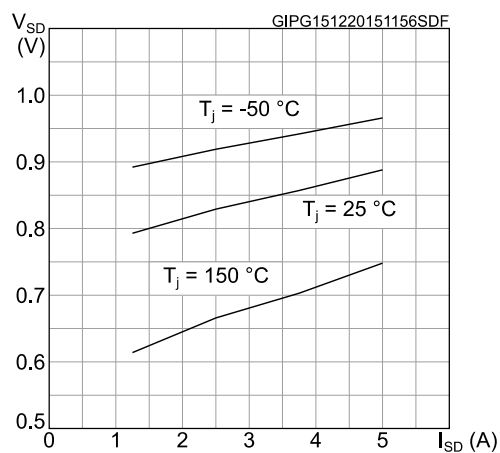
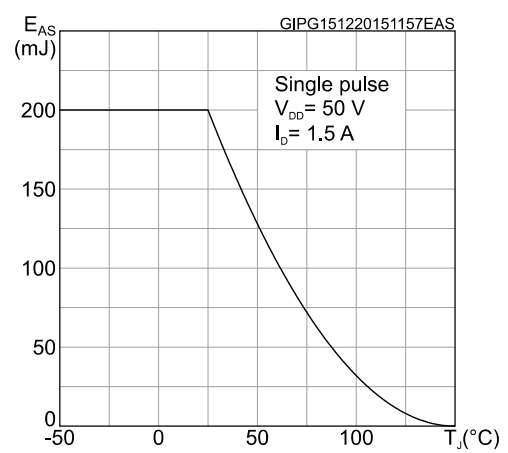


Figure 12: Source-drain diode forward characteristics

Figure 13: Maximum avalanche energy vs starting T_J 

3 Test circuits

Figure 14: Test circuit for resistive load switching times



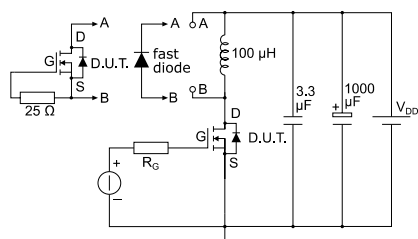
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Figure 15: Test circuit for gate charge behavior



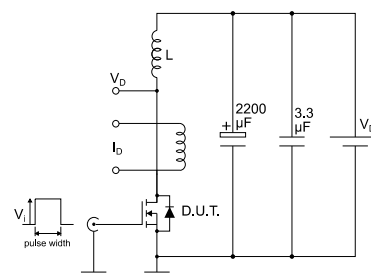
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Figure 16: Test circuit for inductive load switching and diode recovery times



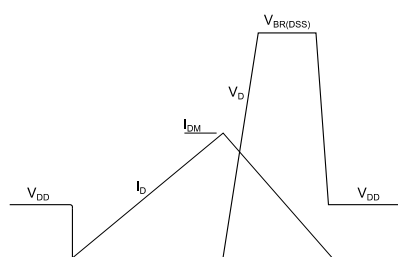
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Figure 17: Unclamped inductive load test circuit



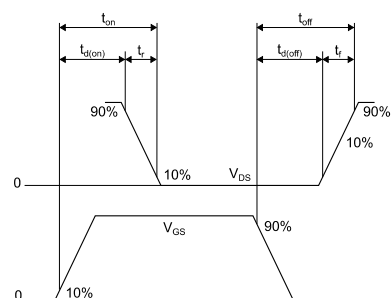
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Figure 18: Unclamped inductive waveform



AM01472v1

Figure 19: 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 VHV package information

Figure 20: PowerFLAT™ 5x6 VHV package outline

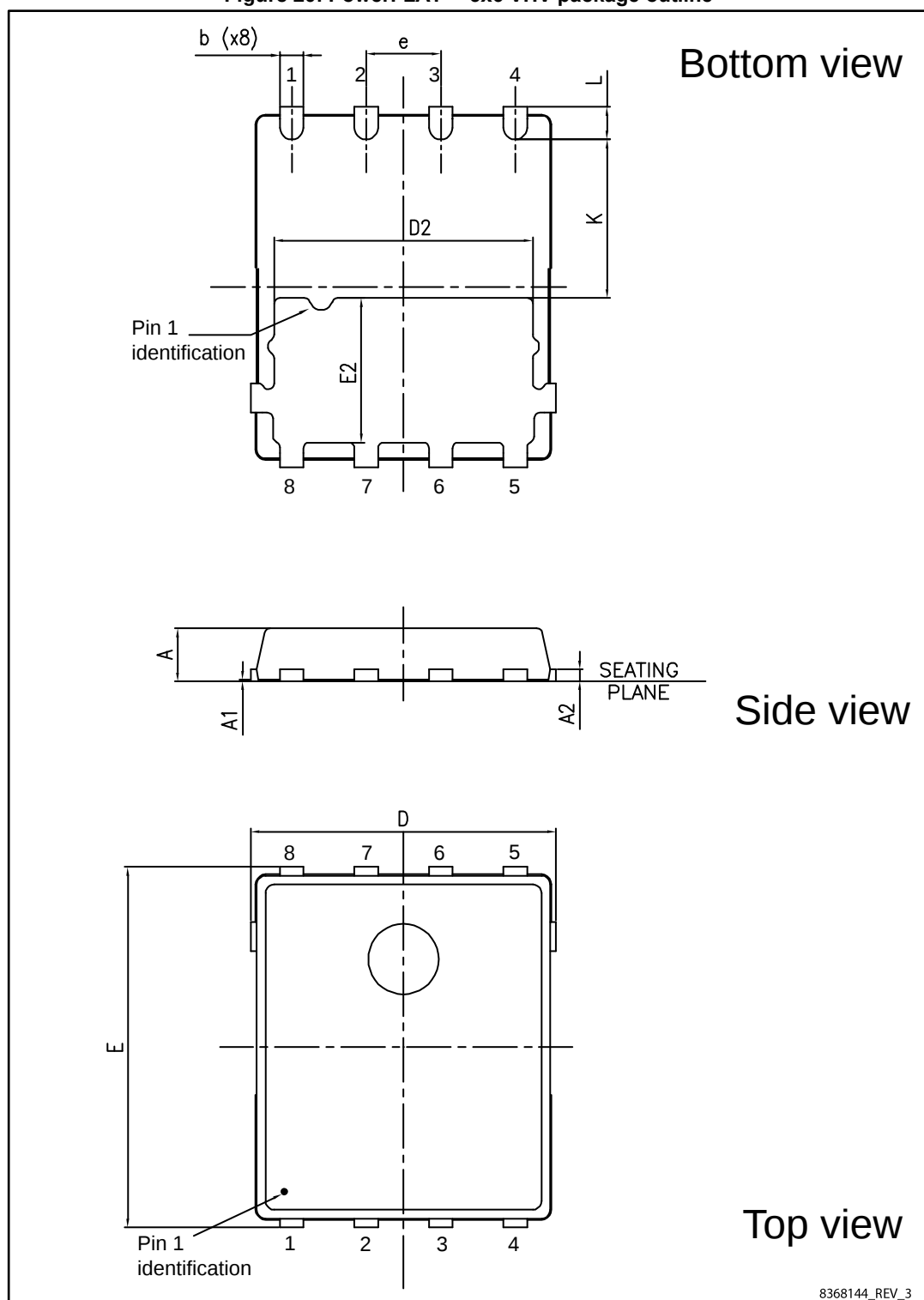
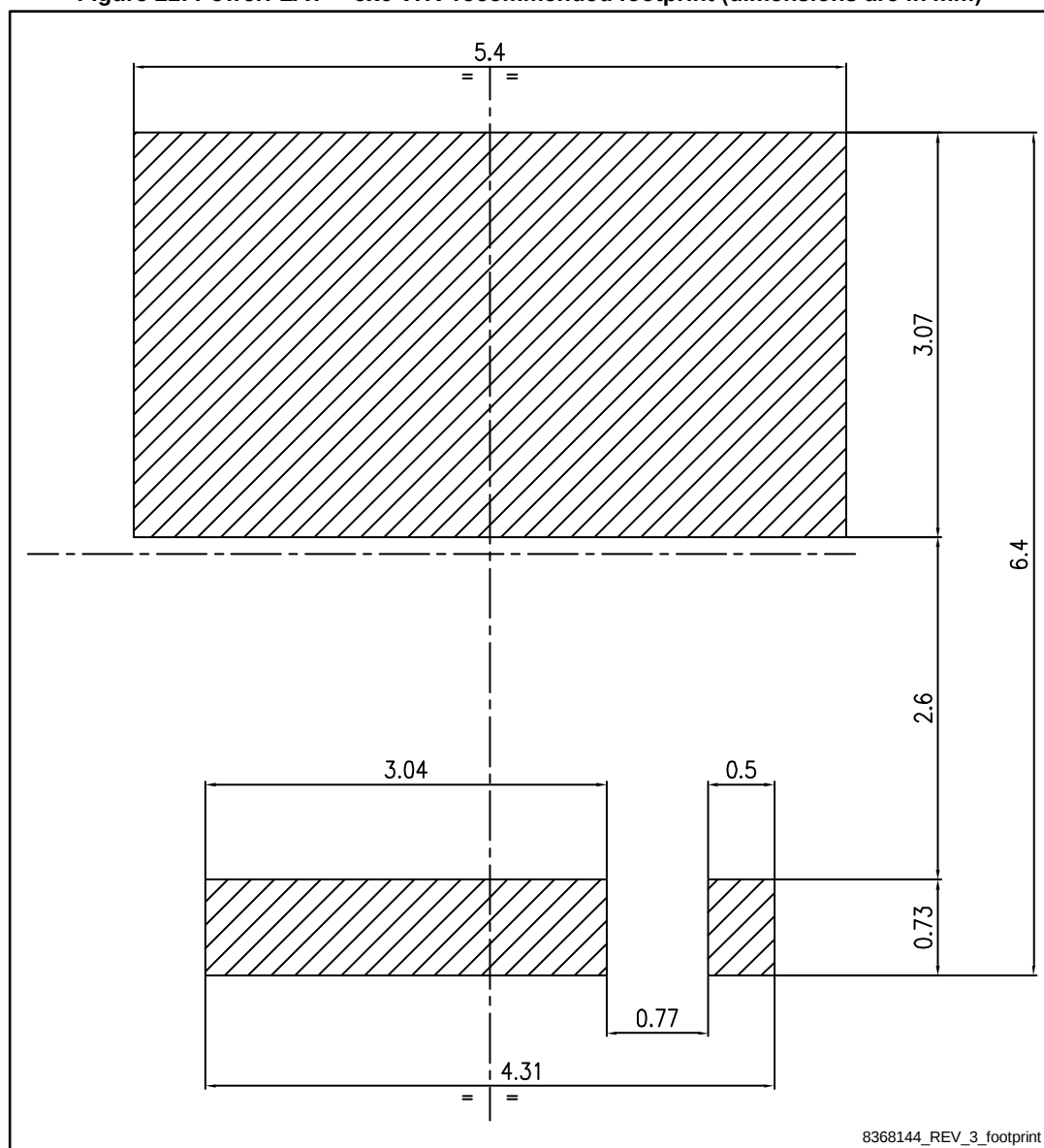


Table 10: PowerFLAT™ 5x6 VHV package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D	5.00	5.20	5.40
E	5.95	6.15	6.35
D2	4.30	4.40	4.50
E2	2.40	2.50	2.60
e		1.27	
L	0.50	0.55	0.60
K	2.60	2.70	2.80

Figure 21: PowerFLAT™ 5x6 VHV recommended footprint (dimensions are in mm)



4.2 PowerFLAT™ 5x6 packing information

Figure 22: PowerFLAT™ 5x6 tape (dimensions are in mm)

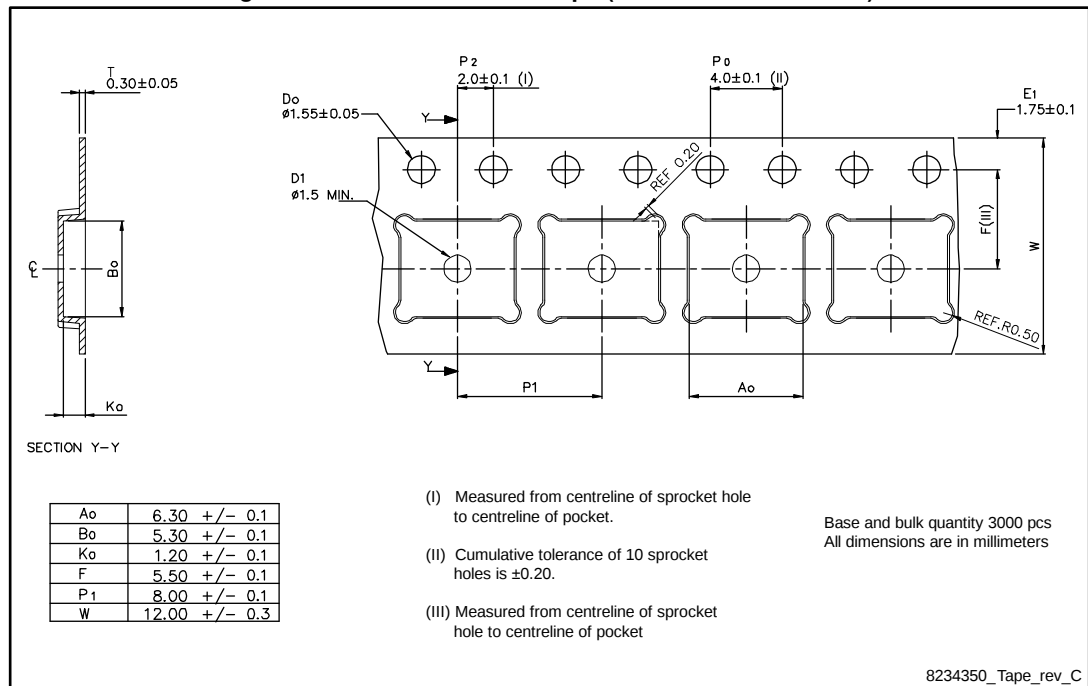
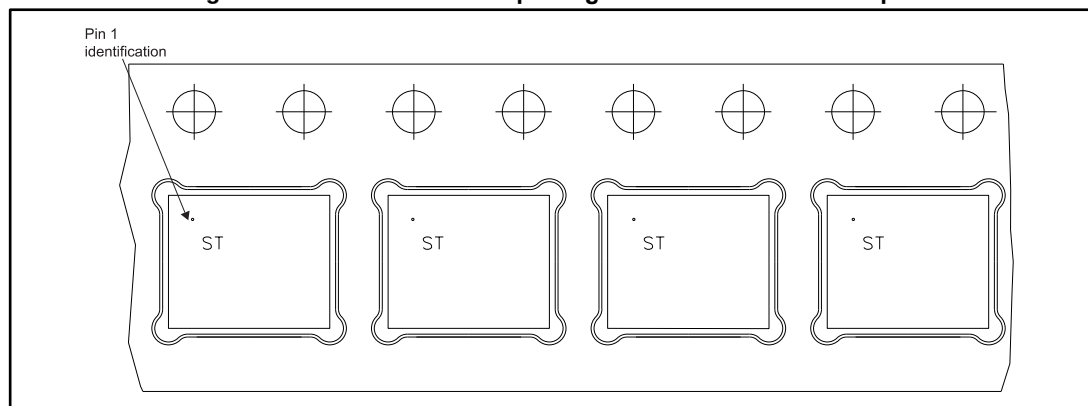


Figure 23: PowerFLAT™ 5x6 package orientation in carrier tape



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

Top View (Left): Shows the reel's layout with a central hub and six compartments. Key dimensions include:

- Inner hub diameter: $\varnothing 2.50$
- Hub radius: R25.00
- Hub-to-compartment distance: 4.00
- Compartment width: 2.50
- Reel radius: R25.00
- Reel diameter: $\varnothing 50.00$

Top View (Right): Shows the reel's layout with a central hub and six compartments. Key dimensions include:

- Reel diameter: $\varnothing 50.00$
- Reel radius: R25.00
- Reel-to-compartment distance: 4.00
- Compartment width: 2.50
- Reel diameter: $\varnothing 50.00$

Side View (Center): Shows the reel's profile with dimensions:

- W1: 12.4 (+2/-0)
- W2: 18.4 (max)
- W3: 11.9/15.4
- W4: 17.8 (+2.0/-0)
- W5: 17.8 (+2.0/-0)
- W6: 17.8 (+2.0/-0)
- W7: 17.8 (+2.0/-0)
- W8: 17.8 (+2.0/-0)
- W9: 17.8 (+2.0/-0)
- W10: 17.8 (+2.0/-0)
- W11: 17.8 (+2.0/-0)
- W12: 17.8 (+2.0/-0)
- W13: 17.8 (+2.0/-0)
- W14: 17.8 (+2.0/-0)
- W15: 17.8 (+2.0/-0)
- W16: 17.8 (+2.0/-0)
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- W18: 17.8 (+2.0/-0)
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- W25: 17.8 (+2.0/-0)
- W26: 17.8 (+2.0/-0)
- W27: 17.8 (+2.0/-0)
- W28: 17.8 (+2.0/-0)
- W29: 17.8 (+2.0/-0)
- W30: 17.8 (+2.0/-0)
- W31: 17.8 (+2.0/-0)
- W32: 17.8 (+2.0/-0)
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- W84: 17.8 (+2.0/-0)
- W85: 17.8 (+2.0/-0)
- W86: 17.8 (+2.0/-0)
- W87: 17.8 (+2.0/-0)
- W88: 17.8 (+2.0/-0)
- W89: 17.8 (+2.0/-0)
- W90: 17.8 (+2.0/-0)
- W91: 17.8 (+2.0/-0)
- W92: 17.8 (+2.0/-0)
- W93: 17.8 (+2.0/-0)
- W94: 17.8 (+2.0/-0)
- W95: 17.8 (+2.0/-0)
- W96: 17.8 (+2.0/-0)
- W97: 17.8 (+2.0/-0)
- W98: 17.8 (+2.0/-0)
- W99: 17.8 (+2.0/-0)
- W100: 17.8 (+2.0/-0)

Core Detail (Bottom Left): Shows the core's internal structure with dimensions:

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

ESD LOGO: A logo indicating Electrostatic Discharge (ESD) protection, located on the side view of the reel.

Dimensions: All dimensions are in millimeters.

5 Revision history

Table 11: Document revision history

Date	Revision	Changes
07-Jan-2016	1	First release.
26-Jan-2016	2	Modified: <i>Table 2: "Absolute maximum ratings"</i> Minor text changes
24-Apr-2017	3	Updated silhouette on cover page. Updated Section 4.1: "PowerFLAT™ 5x6 VHV package information" . Minor text changes.

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