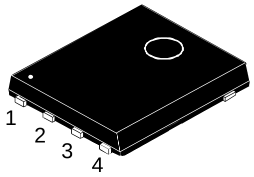
STL4LN80K5

N-channel 800 V, 2.1 Ω typ., 2 A MDmesh™ K5 Power MOSFET in a PowerFLAT™ 5x6 VHV package

Datasheet - production data



PowerFLAT™ 5x6 VHV

Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STL4LN80K5	800 V	2.6 Ω	2 A

- Industry's lowest $R_{DS(on)}$ * 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.

Figure 1: Internal schematic diagram

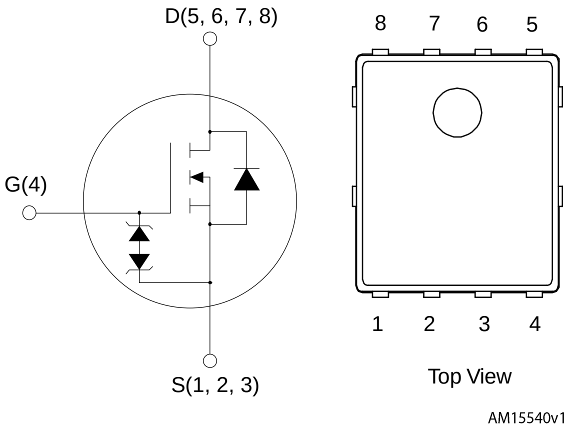


Table 1: Device summary

Order code	Marking	Package	Packing
STL4LN80K5	4LN80K5	PowerFLAT™ 5x6 VHV	Tape and reel

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current (continuous) at T_C = 25 °C	2	A
I_D	Drain current (continuous) at T_C = 100 °C	1.2	A
I_{DM} (1)	Drain current (pulsed)	8	A
P_{TOT}	Total dissipation at T_C = 25 °C	38	W
dv/dt (2)	Peak diode recovery voltage slope	4.5	V/ns
dv/dt (3)	MOSFET dv/dt ruggedness	50	
T_j	Operating junction temperature range	- 55 to 150	°C
T_{stg}	Storage temperature range		

Notes:

(1) Pulse width limited by safe operating area

(2) $I_{SD} \leq 2$ A, dv/dt ≤ 100 A/µs; V_{DS} peak < $V_{(BR)DSS}$

(3) $V_{DS} \leq 640$ V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	3.3	°C/W
$R_{thj\text{-}pcb}$ (1)	Thermal resistance junction-pcb	59	°C/W

Notes:

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

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by Tjmax)	0.8	A
E_{AS}	Single pulse avalanche energy (starting Tj = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	160	mJ

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 5: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	800			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 800 V			1	µA
		V_{GS} = 0 V, V_{DS} = 800 V T_C = 125 °C(1)			50	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 100 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 1.25 A		2.1	2.6	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 V, f = 1 MHz, V_{GS} = 0 V	-	110	-	pF
C_{oss}	Output capacitance		-	9.5	-	pF
C_{rss}	Reverse transfer capacitance		-	0.4	-	pF
$C_{o(tr)}$(1)	Equivalent capacitance time related	V_{DS} = 0 to 640 V, V_{GS} = 0 V	-	23	-	pF
$C_{o(er)}$(2)	Equivalent capacitance energy related		-	9	-	pF
R_g	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	18	-	Ω
Q_g	Total gate charge	V_{DD} = 640 V, I_D = 2.5 A V_{GS} = 0 to 10 V, see *Figure 15: "Test circuit for gate charge behavior"*	-	3.7	-	nC
Q_{gs}	Gate-source charge		-	1	-	nC
Q_{gd}	Gate-drain charge		-	2.2	-	nC

Notes:

(1)Time related is defined as a constant equivalent capacitance giving the same charging time as Coss when VDS increases from 0 to 80 % V_{DSS}.

(2)Energy related is defined as a constant equivalent capacitance giving the same stored energy as Coss when VDS 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 V, I_D = 1.25 A, R_G = 4.7 Ω V_{GS} = 10 V (See *Figure 14: "Test circuit for resistive load switching times"* and *Figure 19: "Switching time waveform"*)	-	7	-	ns
t_r	Rise time		-	9	-	ns
$t_{d(off)}$	Turn-off delay time		-	31	-	ns
t_f	Fall time		-	25	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		2	A
I_{SDM}(1)	Source-drain current (pulsed)		-		8	A
V_{SD}(2)	Forward on voltage	I_{SD} = 2 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 2.5 A, di/dt = 100 A/µs, V_{DD} = 60 V, (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	230		ns
Q_{rr}	Reverse recovery charge		-	1.04		µC
I_{RRM}	Reverse recovery current		-	9		A
t_{rr}	Reverse recovery time	I_{SD} = 2.5 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	368		ns
Q_{rr}	Reverse recovery charge		-	1.53		µC
I_{RRM}	Reverse recovery current		-	8		A

Notes:

(1)Pulse width limited by safe operating area

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

Table 9: Gate source-Zener diode

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit.
$V_{(BR)GS0}$	Gate-source breakdown voltage	I_{GS}= ± 1mA, I_D= 0 A	30	-	-	V

The built-in back-to-back Zener diodes have specifically been designed to enhance the device's ESD capability. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

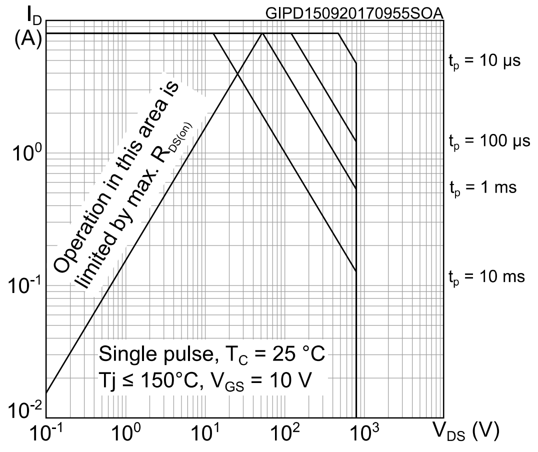


Figure 3: Thermal impedance

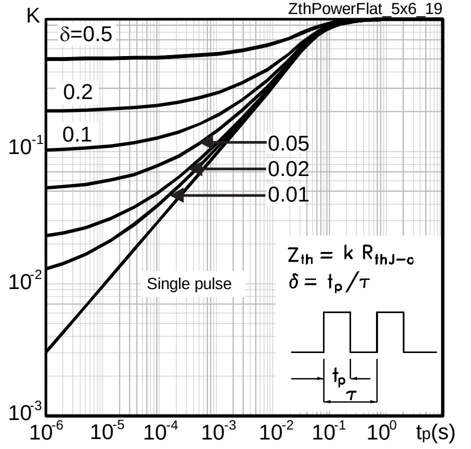


Figure 4: Output characteristics

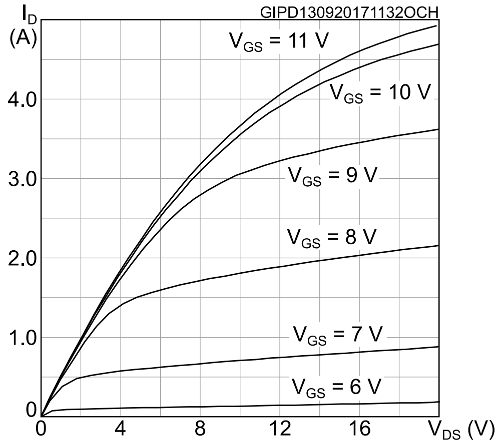


Figure 5: Transfer characteristics

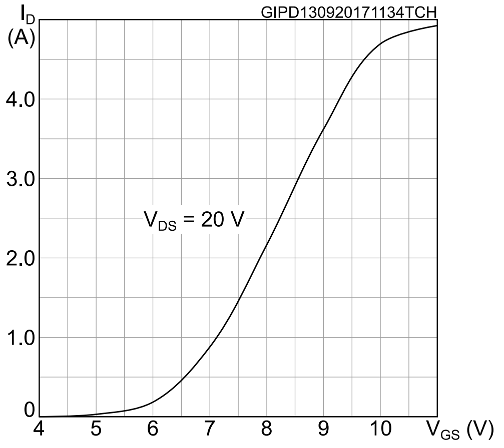


Figure 6: Gate charge vs gate-source voltage

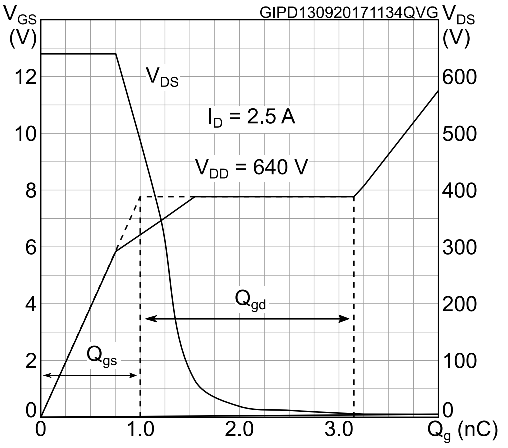


Figure 7: Static drain-source on-resistance

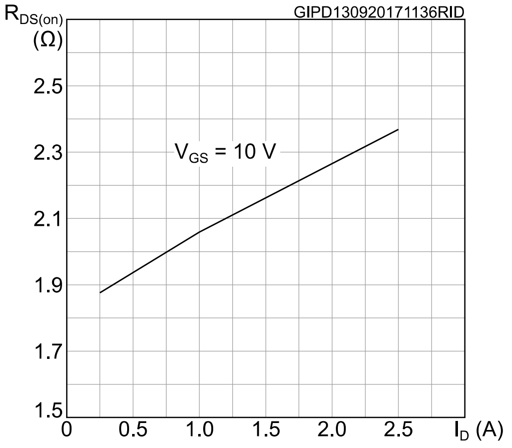


Figure 8: Capacitance variations

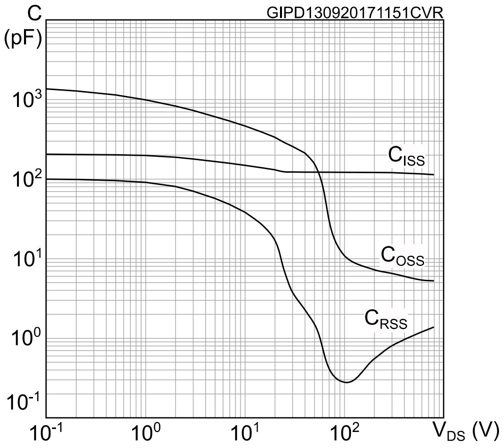


Figure 9: Normalized gate threshold voltage vs temperature

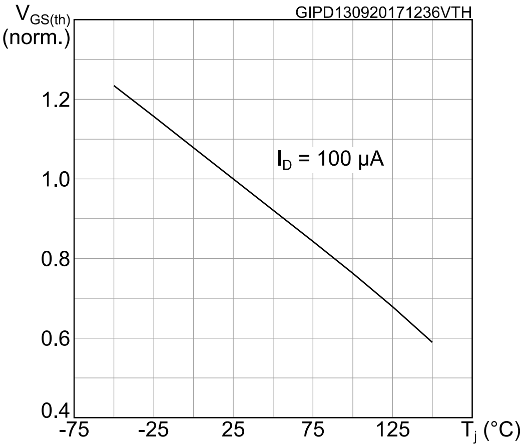


Figure 10: Normalized on-resistance vs temperature

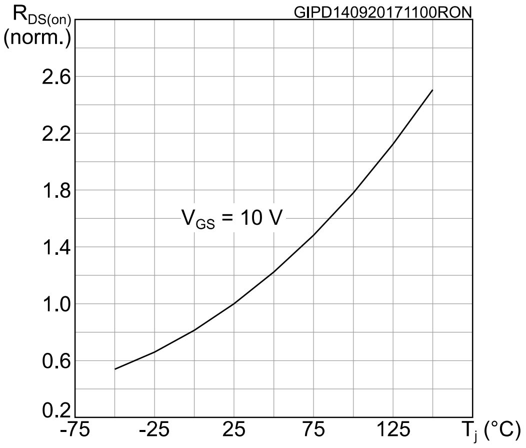


Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

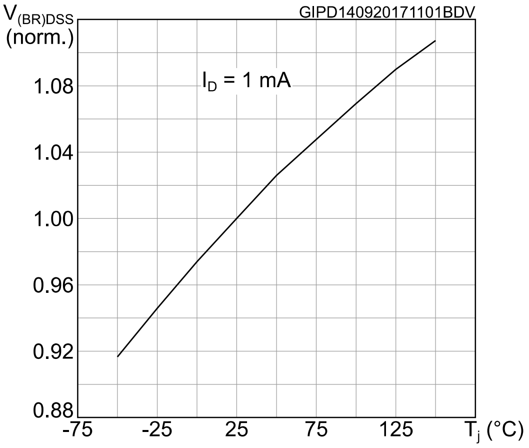


Figure 12: Maximum avalanche energy vs starting T_J

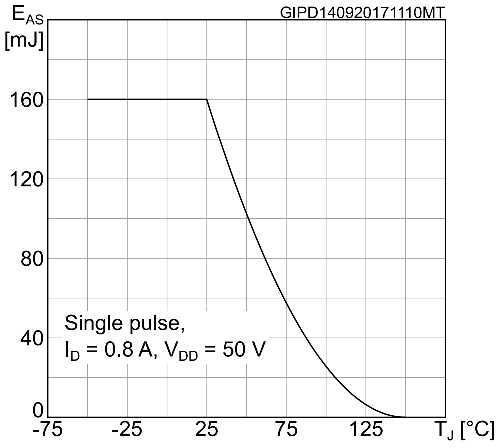
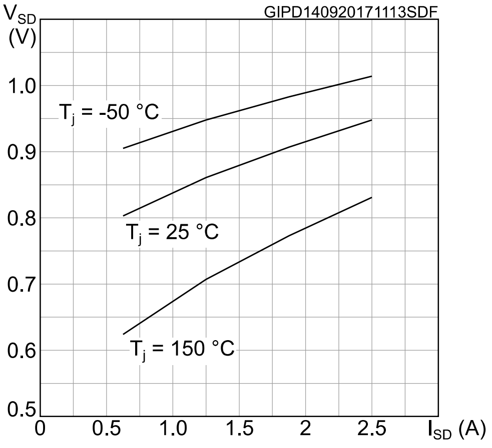


Figure 13: Source-drain diode forward characteristics



3 Test circuits

Figure 14: Test circuit for resistive load switching times

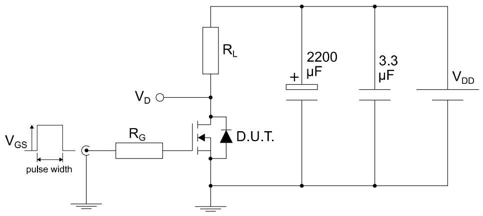


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Figure 15: Test circuit for gate charge behavior

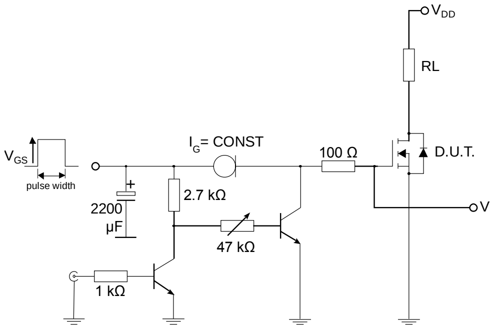

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Figure 16: Test circuit for inductive load switching and diode recovery times

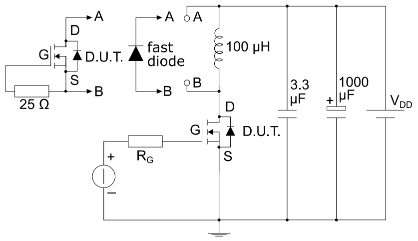

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Figure 17: Unclamped inductive load test circuit

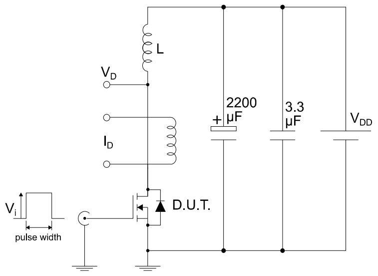

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Figure 18: Unclamped inductive waveform

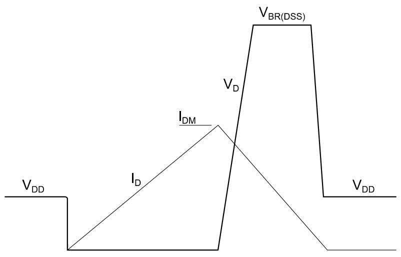

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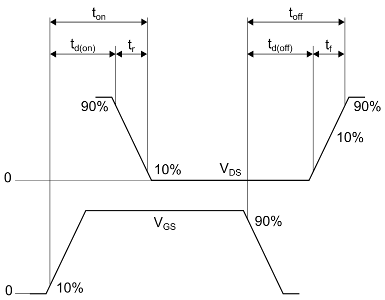
Figure 19: Switching time waveform



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

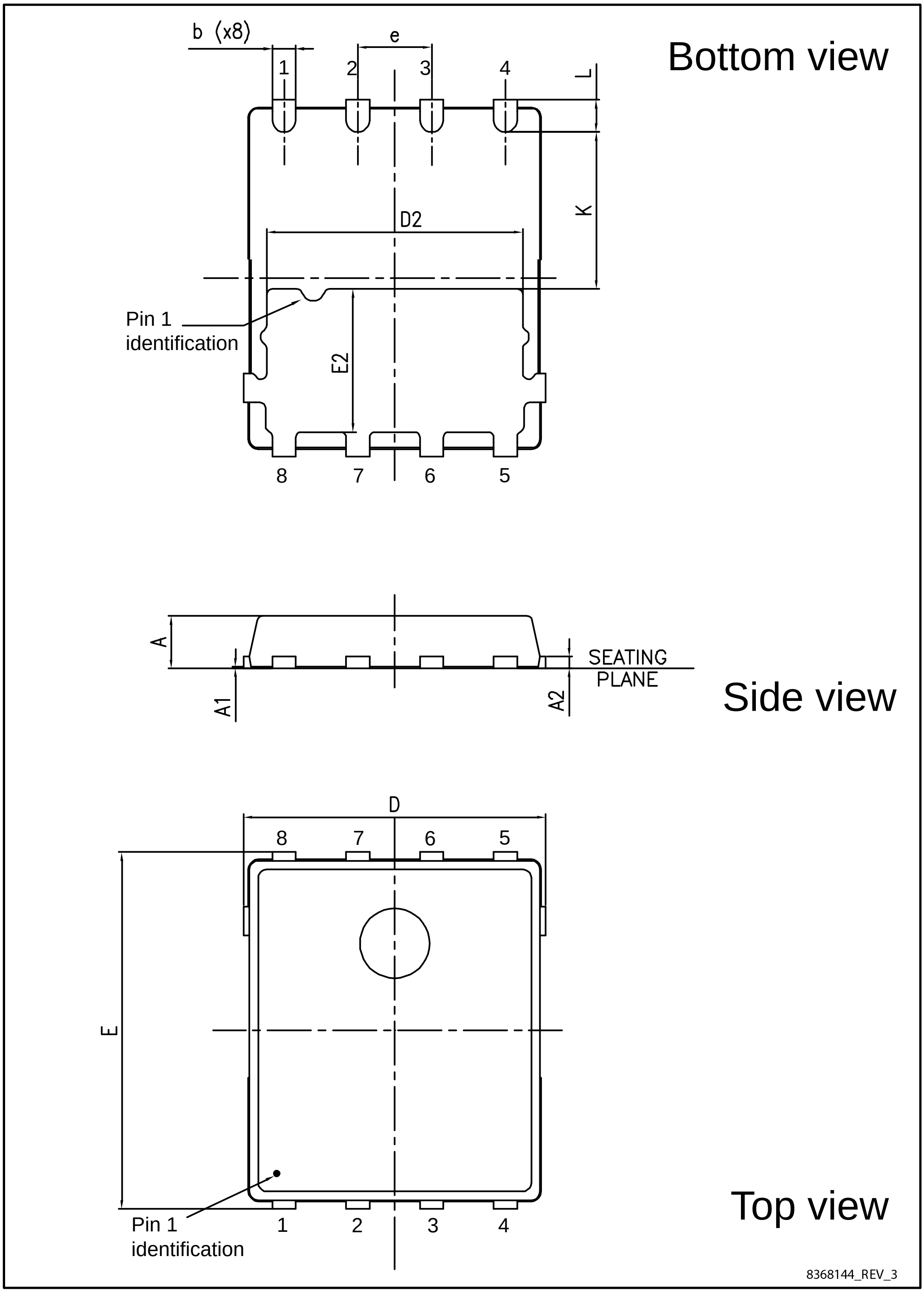
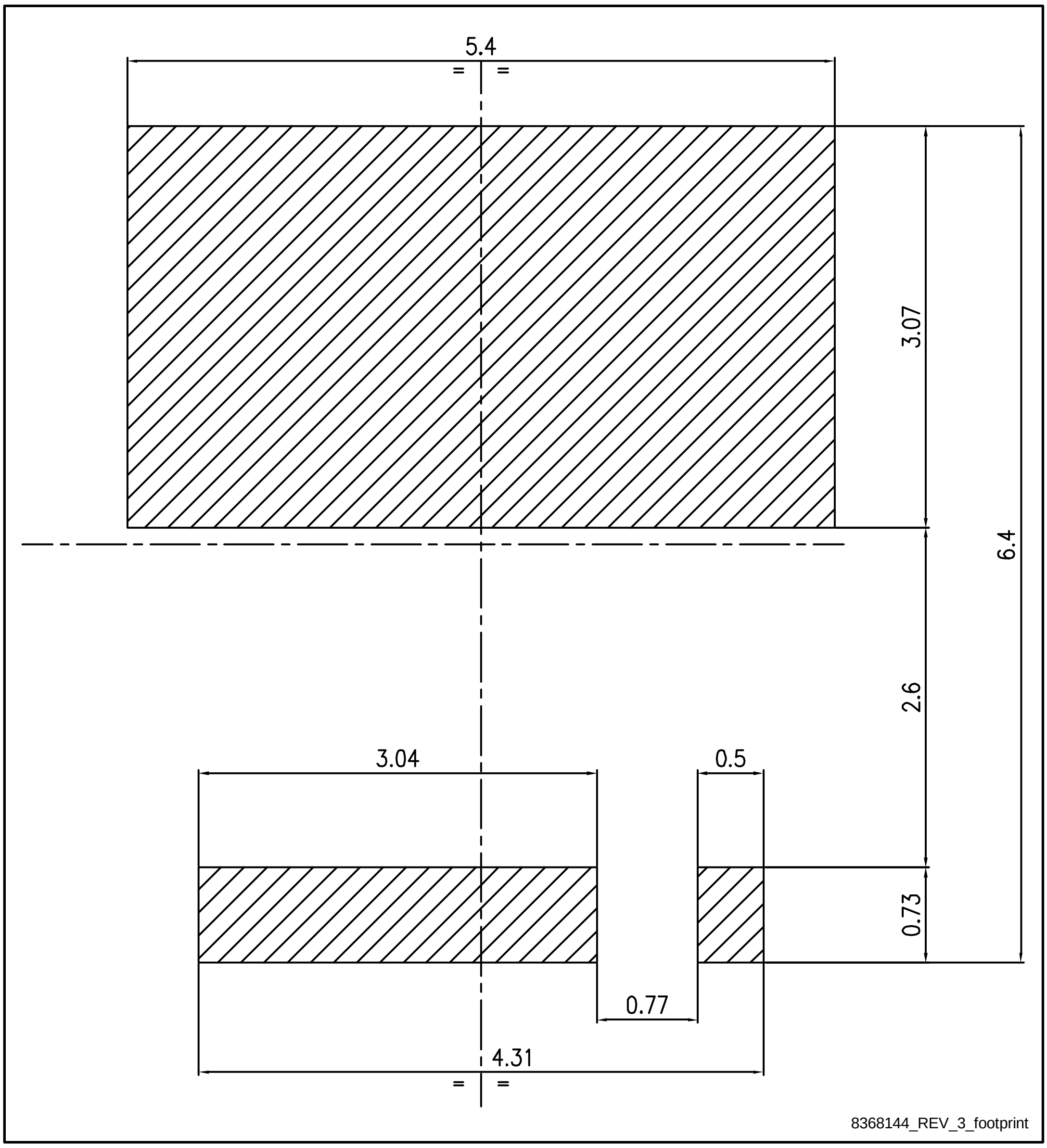


Table 10: PowerFLAT™ 5x6 VHV package mechanical data

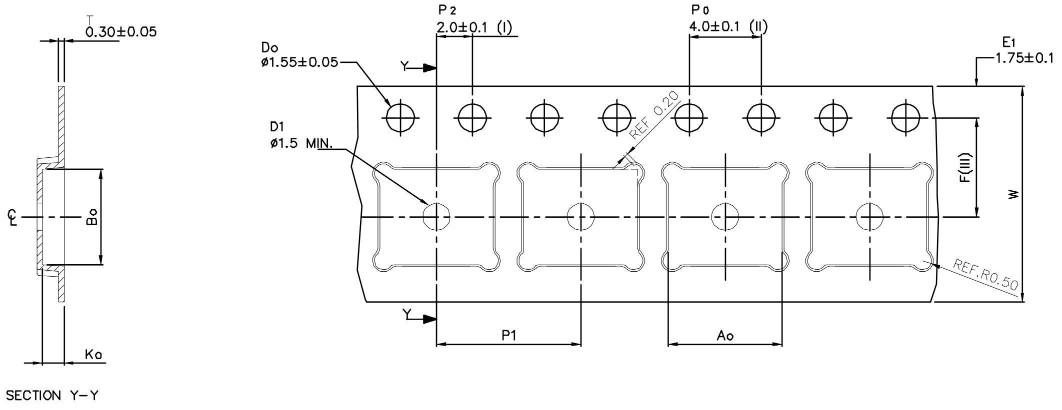
Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D	5.00	5.20	5.40
E	5.95	6.15	6.35
D2	4.30	4.40	4.50
E2	2.40	2.50	2.60
e		1.27	
L	0.50	0.55	0.60
K	2.60	2.70	2.80

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)



Ao	6.30 +/− 0.1
Bo	5.30 +/− 0.1
Ko	1.20 +/− 0.1
F	5.50 +/− 0.1
P1	8.00 +/− 0.1
W	12.00 +/− 0.3

(I) Measured from centreline of sprocket hole to centreline of pocket.

(II) Cumulative tolerance of 10 sprocket holes is ±0.20.

(III) Measured from centreline of sprocket hole to centreline of pocket

Base and bulk quantity 3000 pcs
All dimensions are in millimeters

8234350_Tape_rev_C

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

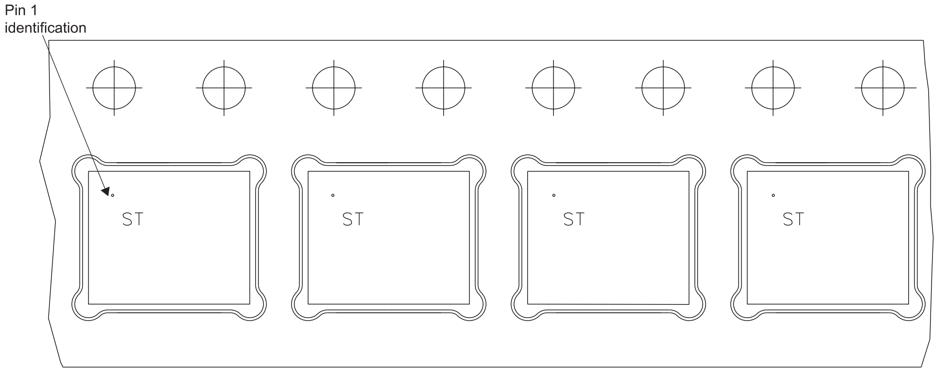
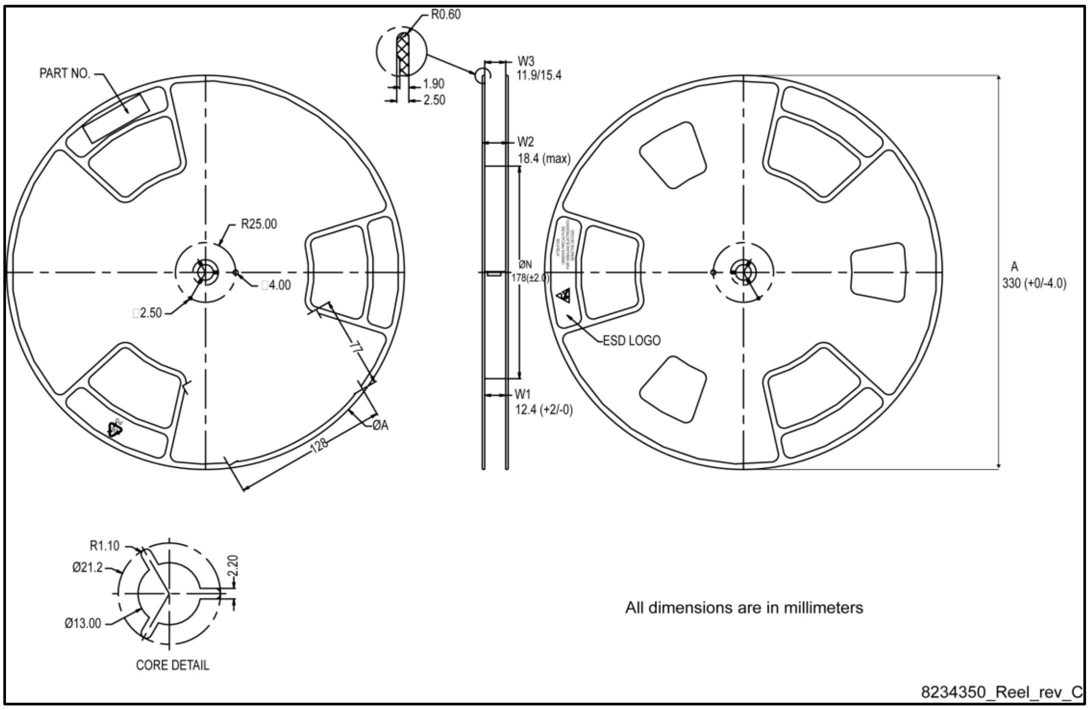


Figure 24: PowerFLAT™ 5x6 reel



5 Revision history

Table 11: Document revision history

Date	Revision	Changes
29-May-2015	1	First release.
02-Oct-2017	2	Updated title and features in cover page. Updated *Section 1: "Electrical ratings"*, *Section 2: "Electrical characteristics"*. Added *Section 2.1: "Electrical characteristics (curves)"*. Minor text changes.

IMPORTANT NOTICE – PLEASE READ CAREFULLY