

N-channel 800 V, 2.1 Ω typ., 3 A MDmesh™ K5 Power MOSFET in a PowerFLAT™ 5x6 VHV package

Datasheet - preliminary data

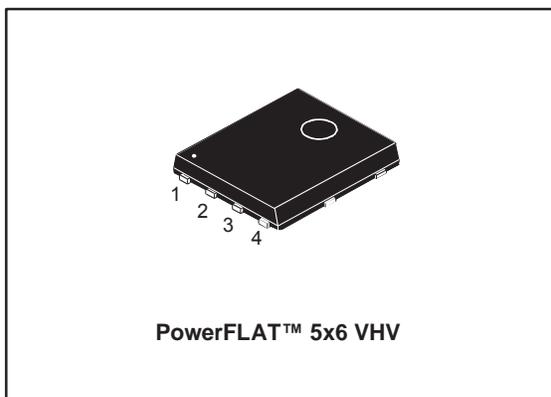
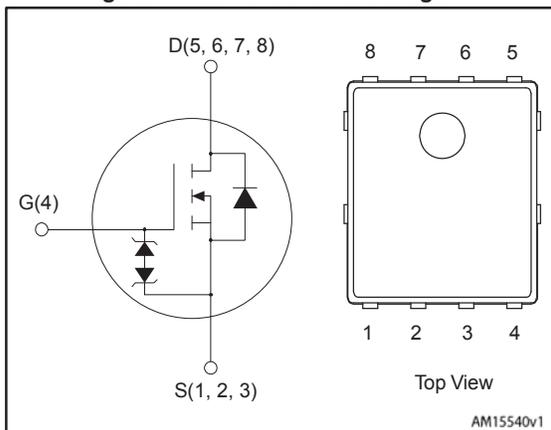


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STL4LN80K5	800 V	2.6 Ω	3 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.

Table 1: Device summary

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

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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	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	3	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	1.9	A
$I_{DM}^{(1)}$	Drain current (pulsed)	12	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	38	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	
T_j	Operating junction temperature	- 55 to 150	$^\circ\text{C}$
T_{stg}	Storage temperature		

Notes:

⁽¹⁾Pulse width limited by safe operating area

⁽²⁾ $I_{SD} \leq 3\text{ A}$, $dv/dt \leq 100\text{ A}/\mu\text{s}$; $V_{DS}\text{ peak} < V_{(BR)DSS}$

⁽³⁾ $V_{DS} \leq 640\text{ V}$

Table 3: Thermal data

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

Notes:

⁽¹⁾When mounted on 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 T_{jmax})	TBD	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	TBD	mJ

2 Electrical characteristics

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

Table 5: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	800			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$ $T_C = 125\text{ }^\circ\text{C}$			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	$V_{GS} = 10\text{ V}$, $I_D = 1.2\text{ A}$		2.1	2.6	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	110	-	pF
C_{oss}	Output capacitance		-	9.5	-	pF
C_{riss}	Reverse transfer capacitance		-	0.4	-	pF
$C_{oss(eq)}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }640\text{ V}$, $V_{GS} = 0\text{ V}$	-	TBD	-	pF
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	18	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 2\text{ A}$ $V_{GS} = 10\text{ V}$, see Figure 3: "Gate charge test circuit"	-	4	-	nC
Q_{gs}	Gate-source charge		-	TBD	-	nC
Q_{gd}	Gate-drain charge		-	TBD	-	nC

Notes:

⁽¹⁾ $C_{oss\ eq}$ is defined as a constant equivalent capacitance giving the same charging time 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	$V_{DD} = 400\text{ V}$, $I_D = 1.6\text{ A}$, $R_G = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$ (See Figure 2: "Switching times test circuit for resistive load" and Figure 7: "Switching time waveform")	-	TBD	-	ns
t_r	Rise time		-	TBD	-	ns
$t_{d(off)}$	Turn-off delay time		-	TBD	-	ns
t_f	Fall time		-	TBD	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		3	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		12	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 3 \text{ A}$, $V_{GS} = 0 \text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 3 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$, (see <i>Figure 4: "Test circuit for inductive load switching and diode recovery times"</i>)	-	TBD		ns
Q_{rr}	Reverse recovery charge		-	TBD		μC
I_{RRM}	Reverse recovery current		-	TBD		A
t_{rr}	Reverse recovery time	$I_{SD} = 3 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ (<i>Figure 4: "Test circuit for inductive load switching and diode recovery times"</i>)	-	TBD		ns
Q_{rr}	Reverse recovery charge		-	TBD		μC
I_{RRM}	Reverse recovery current		-	TBD		A

Notes:

⁽¹⁾Pulse width limited by safe operating area

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

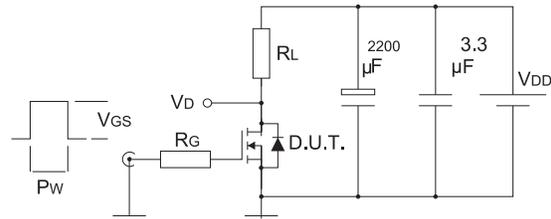
Table 9: Gate source-Zener diode

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

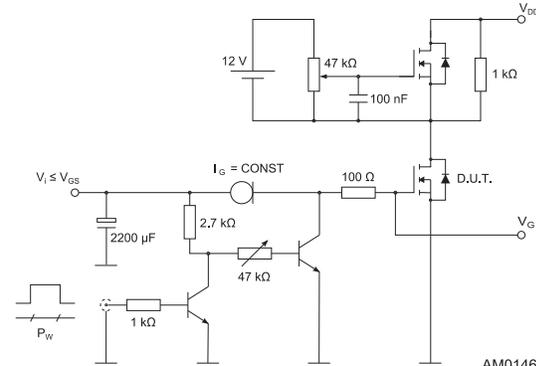
3 Test circuits

Figure 2: Switching times test circuit for resistive load



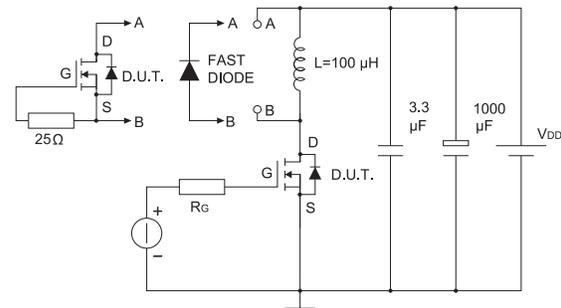
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Figure 3: Gate charge test circuit



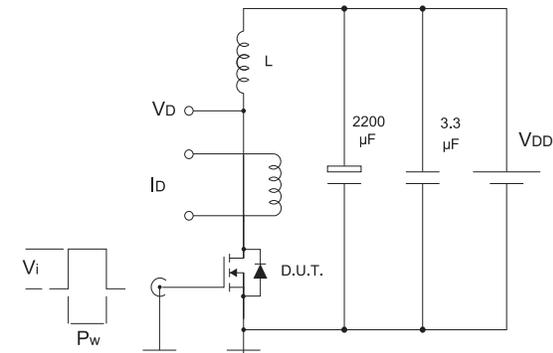
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Figure 4: Test circuit for inductive load switching and diode recovery times



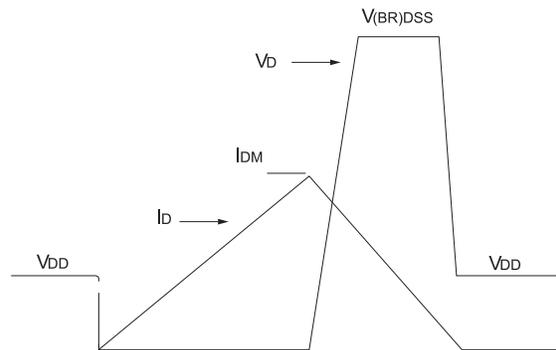
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Figure 5: Unclamped inductive load test circuit



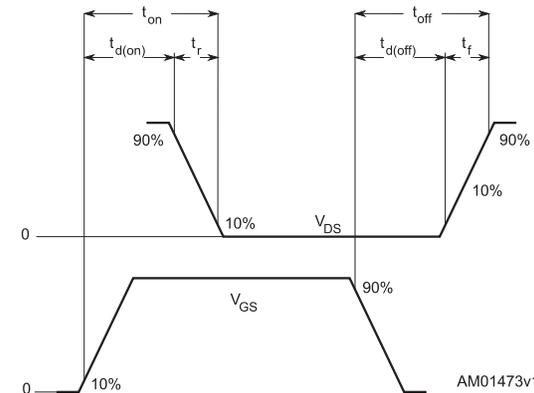
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Figure 6: Unclamped inductive waveform



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Figure 7: 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 VHV package information

Figure 8: PowerFLAT™ 5x6 VHV Package outline

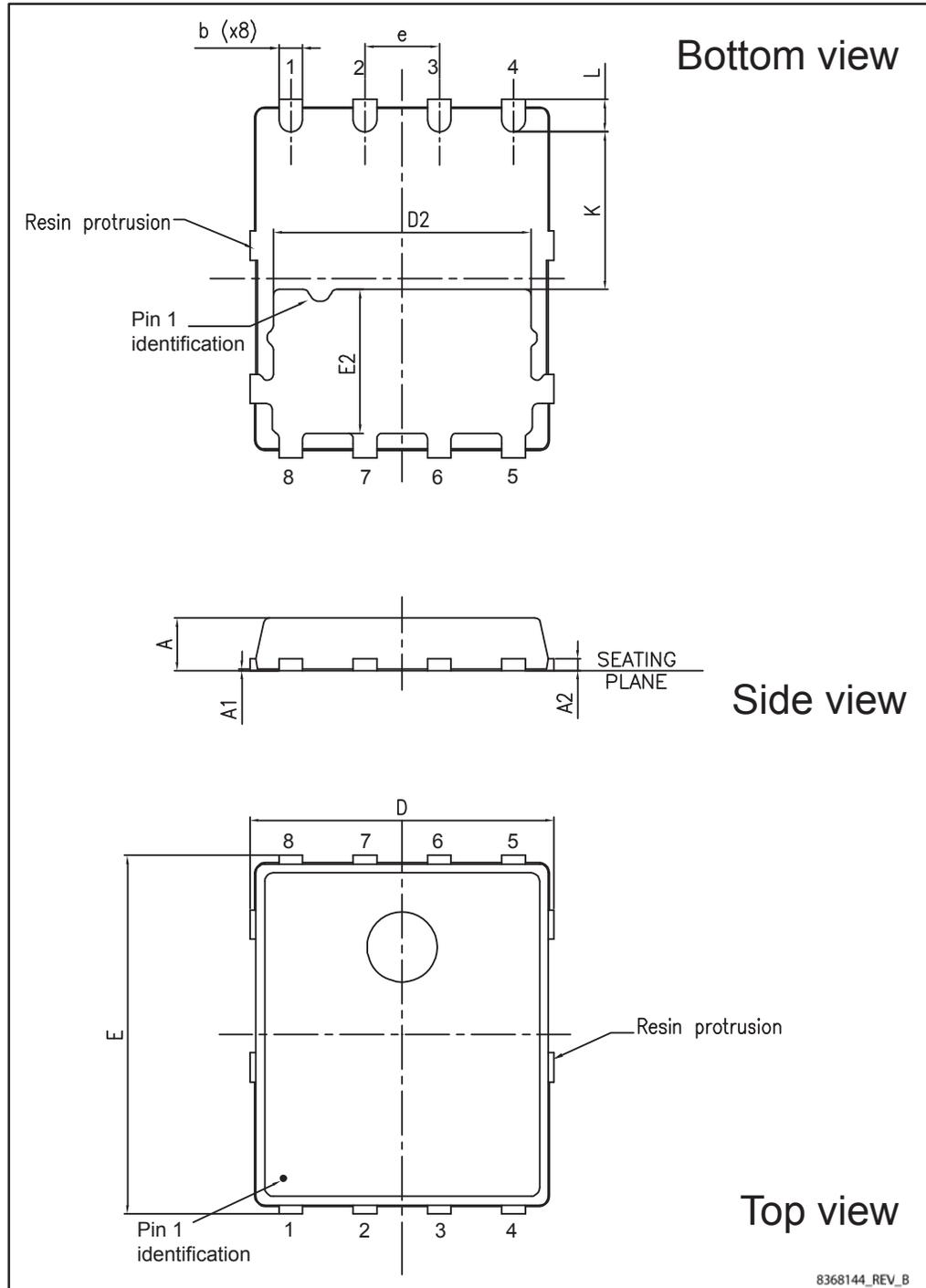
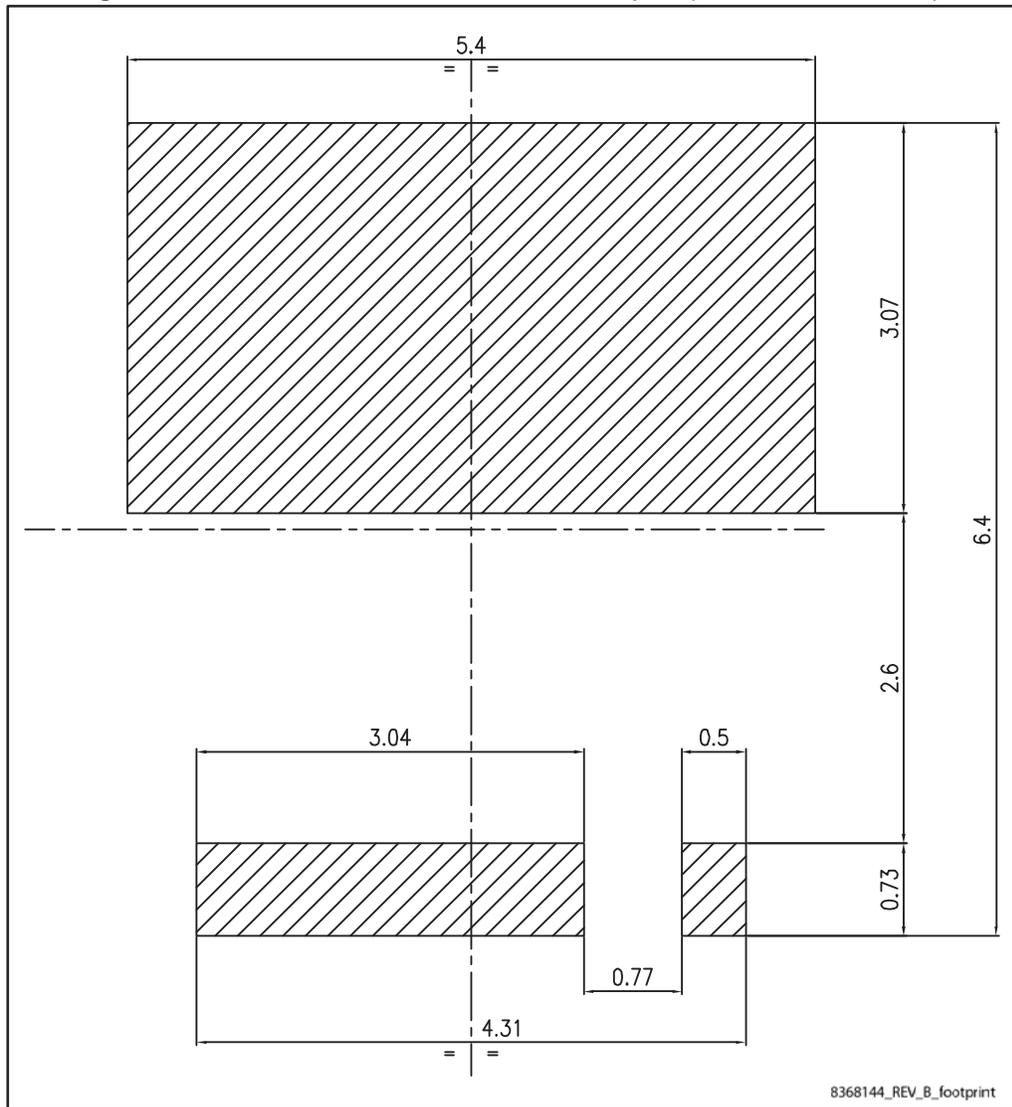


Table 10: PowerFLAT™ 5x6 VHV package mechanical data

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



4.2 PowerFLAT™ 5x6 packing information

Figure 10: PowerFLAT™ 5x6 tape (dimensions are in mm)

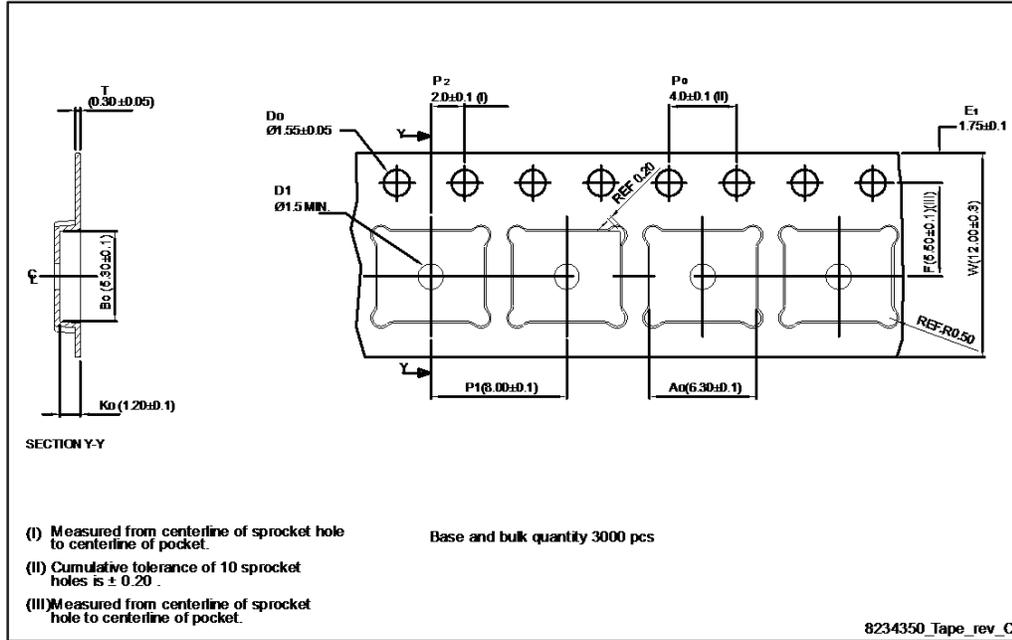


Figure 11: PowerFLAT™ 5x6 package orientation in carrier tape

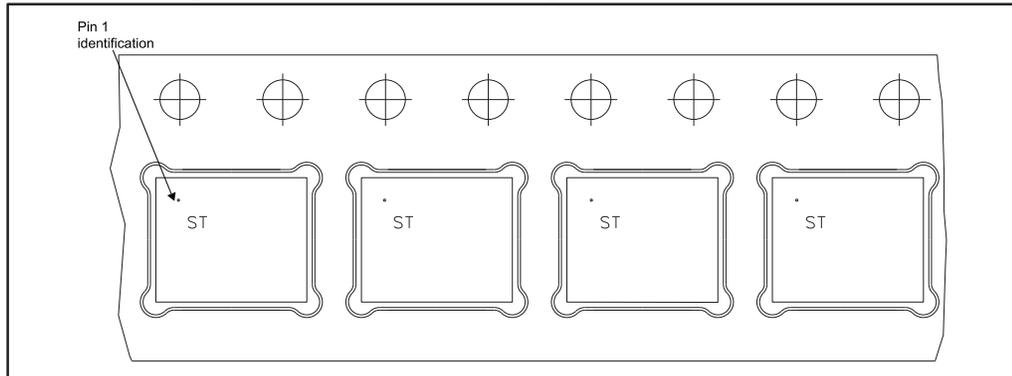
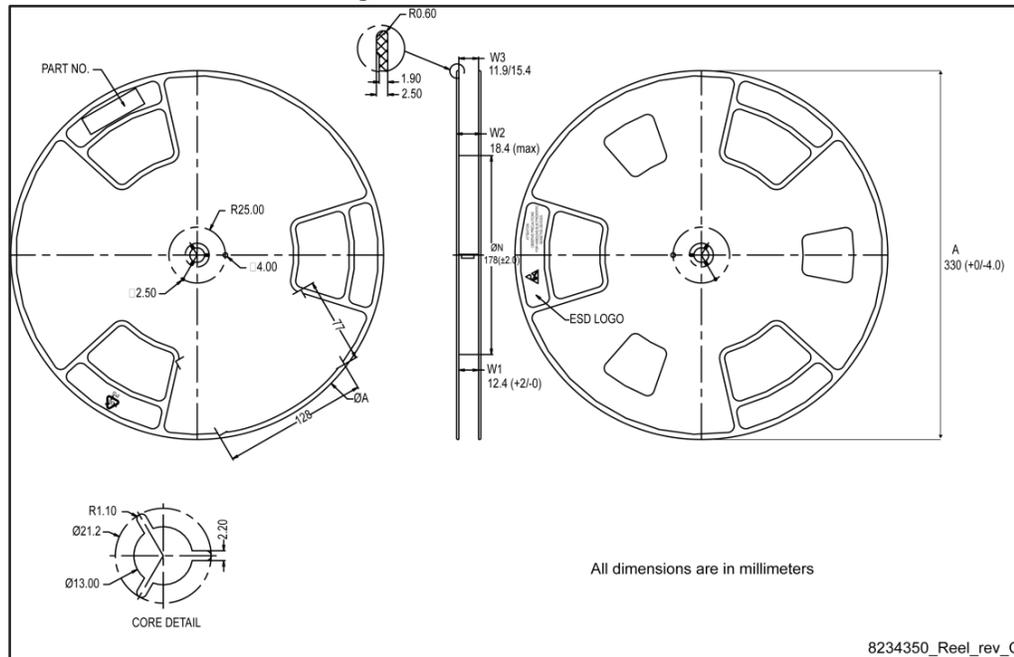


Figure 12: PowerFLAT™ 5x6 reel



5 Revision history

Table 11: Document revision history

Date	Revision	Changes
29-May-2015	1	First release.

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