



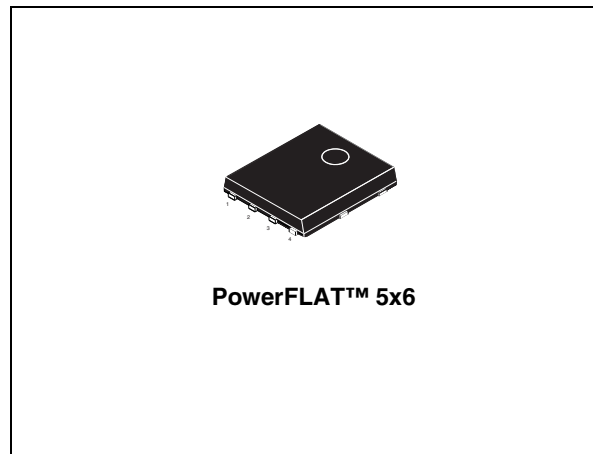
# STL120N2VH5

N-channel 20 V, 0.002  $\Omega$ , 28 A STripFET™ V Power MOSFET in PowerFLAT™ 5x6 package

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STL120N2VH5	20 V	< 0.003 $\Omega$	28 A

- Improved die-to-footprint ratio
- Very low profile package
- Very low thermal resistance
- Conduction losses reduced
- Switching losses reduced
- 2.5 V gate drive
- Very low threshold device



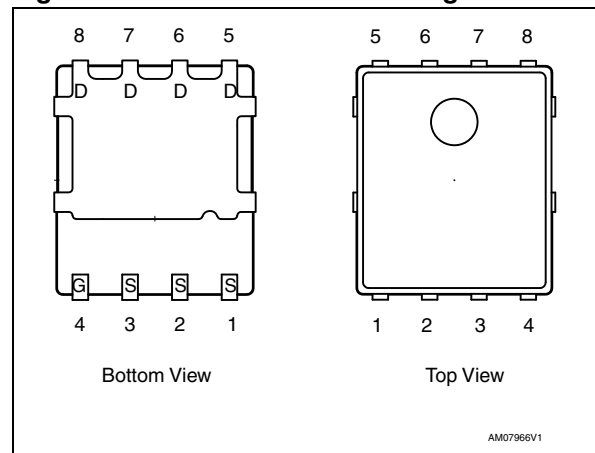
## Applications

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using STMicroelectronics' STripFET™V technology. The device has been optimized to achieve very low on-state resistance, contributing to an FOM that is among the best in its class.

**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
STL120N2VH5	120N2VH5	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	20	V
$V_{GS}$	Gate-source voltage	$\pm 8$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	120	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	75	A
$I_D^{(2)}$	Drain current (continuous) at $T_{pcb} = 25\text{ °C}$	28	A
$I_{DM}^{(2),(3)}$	Drain current (pulsed)	112	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ °C}$	80	W
$P_{TOT}^{(2)}$	Total dissipation at $T_{pcb} = 25\text{ °C}$	4	W
	Derating factor <sup>(2)</sup>	0.03	W/°C
$T_j$ $T_{stg}$	Operating junction temperature storage temperature	- 55 to 150	°C

1. The value is rated according to Rthj-case
2. When mounted on FR-4 board of 1in<sup>2</sup>, 2oz Cu. t < 10 sec
3. Pulse width limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max.	1.56	°C/W
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max.	31.25	°C/W

1. When mounted on FR-4 board of 1in<sup>2</sup>, 2oz Cu. t < 10 sec

**Table 4. Avalanche characteristics**

Symbol	Parameter	Max value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	20	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ °C}$ , $I_D = I_{AR}$ , $V_{DD} = 14\text{ V}$ )	300	mJ

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  unless otherwise specified)

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	20			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 20\text{ V}$ $V_{DS} = 20\text{ V}$ , $T_C = 125\text{ °C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 8\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	0.70			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 4.5\text{ V}$ , $I_D = 14\text{ A}$ $V_{GS} = 2.5\text{ V}$ , $I_D = 14\text{ A}$		0.002 0.0028	0.003 0.004	$\Omega$ $\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 15\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	4660	-	$\mu\text{F}$
$C_{oss}$	Output capacitance			870		
$C_{rss}$	Reverse transfer capacitance			130		
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 10\text{ V}$ , $I_D = 14\text{ A}$ $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 4.5\text{ V}$ (see <a href="#">Figure 13</a> )	-	21	-	ns
$t_r$	Rise time			60		
$t_{d(off)}$	Turn-off delay time			76		
$t_f$	Fall time			55		
$Q_g$	Total gate charge	$V_{DD} = 10\text{ V}$ , $I_D = 28\text{ A}$ , $V_{GS} = 2.5\text{ V}$ (see <a href="#">Figure 14</a> )	-	29	-	nC
$Q_{gs}$	Gate-source charge			9.8		
$Q_{gd}$	Gate-drain charge			13		

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)		-		28 112	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 28 \text{ A}$ , $V_{GS} = 0$	-		1.1	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 28 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 16 \text{ V}$ (see <a href="#">Figure 15</a> )	-	34 30 1.4		ns nC A
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 28 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 16 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 15</a> )	-	35 31 1.8		ns nC A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

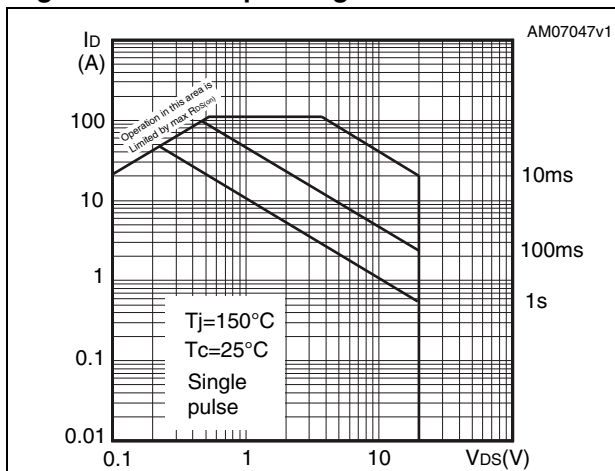


Figure 3. Thermal impedance

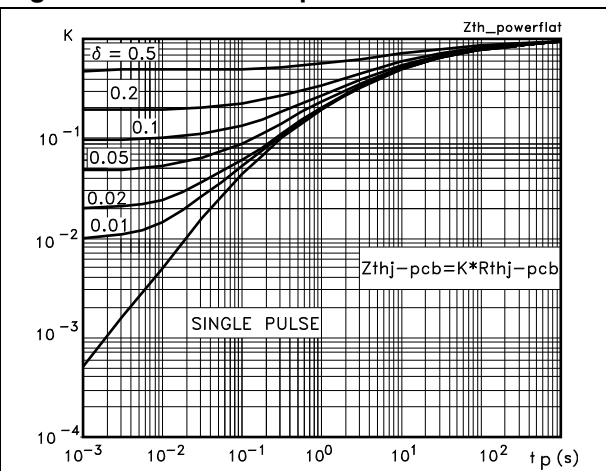


Figure 4. Output characteristics

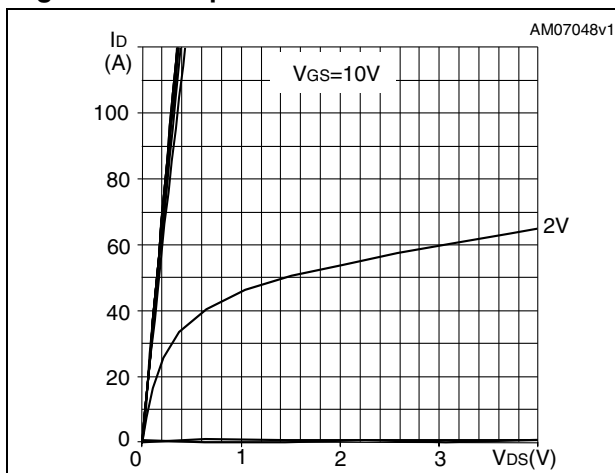


Figure 5. Transfer characteristics

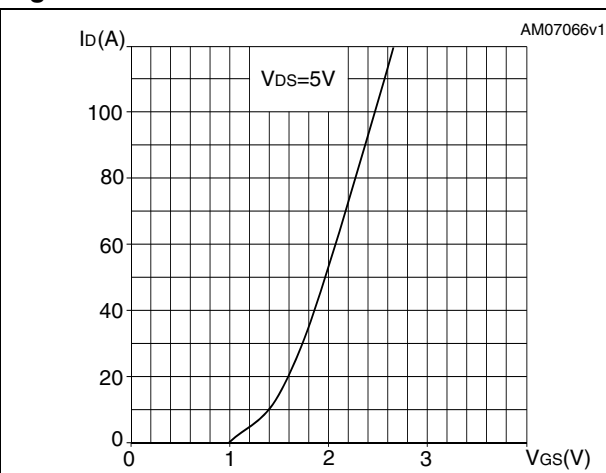


Figure 6. Normalized  $B_{V_{DSS}}$  vs temperature

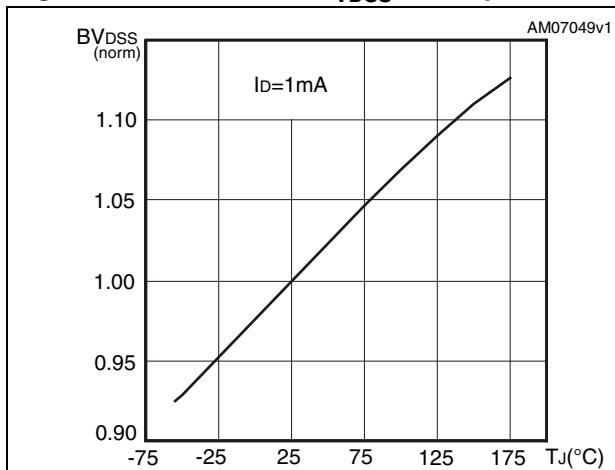


Figure 7. Static drain-source on resistance

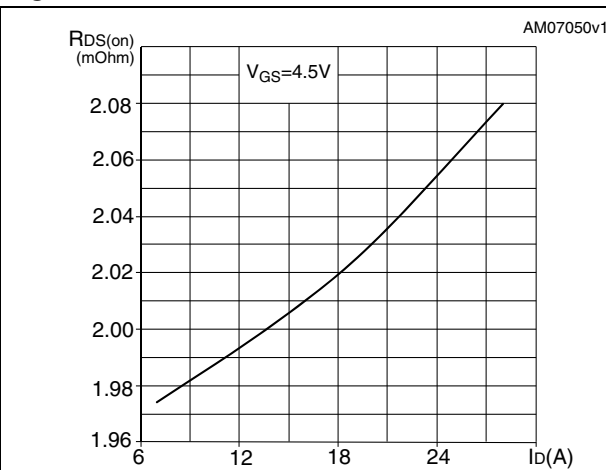


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

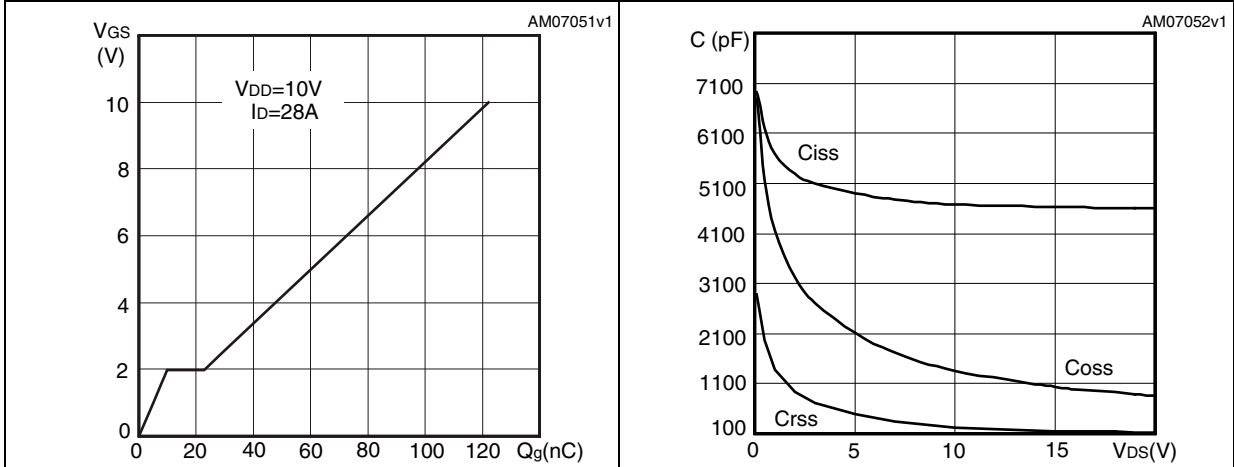


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

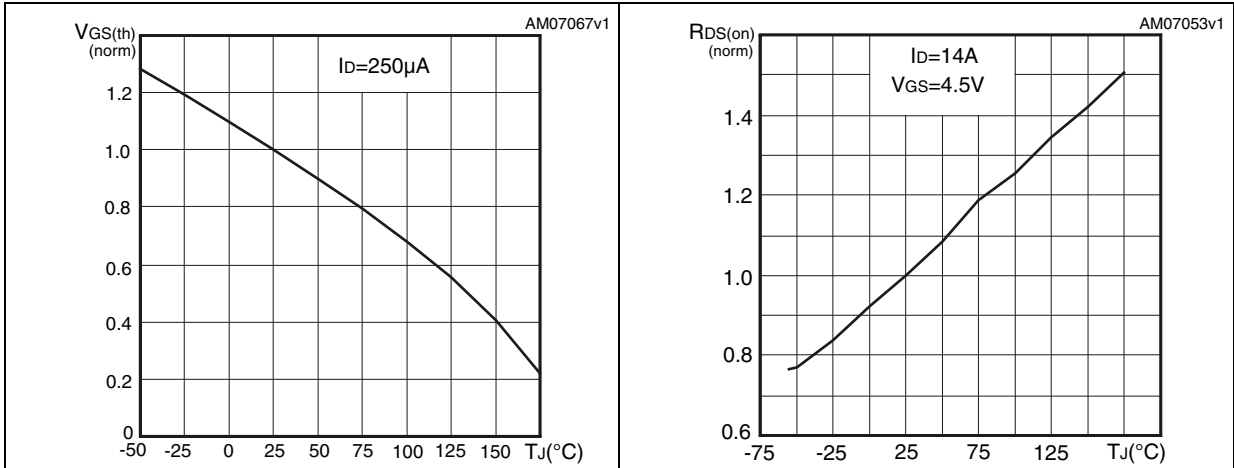
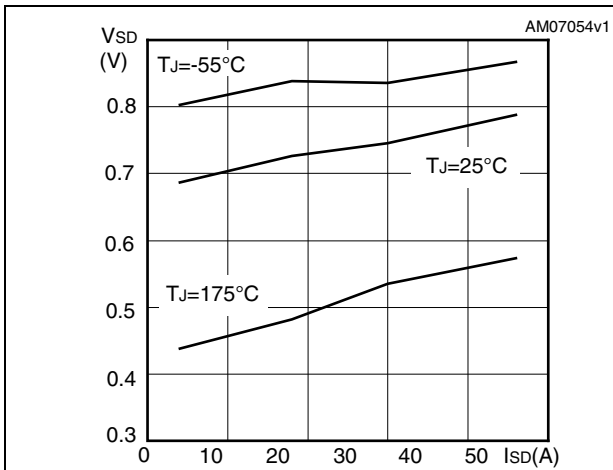


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



AM01468v1

**Figure 14. Gate charge test circuit**



AM01469v1

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



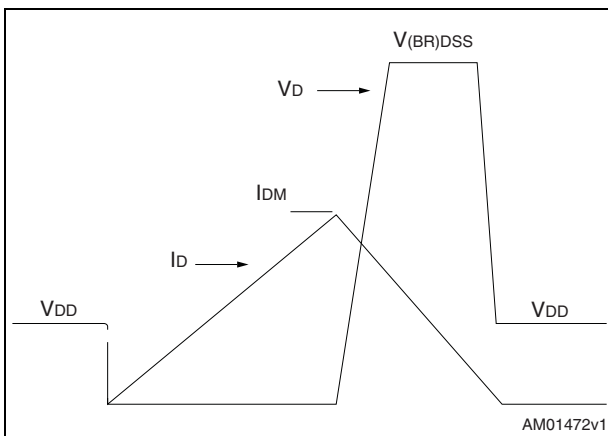
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**Figure 16. Unclamped inductive load test circuit**



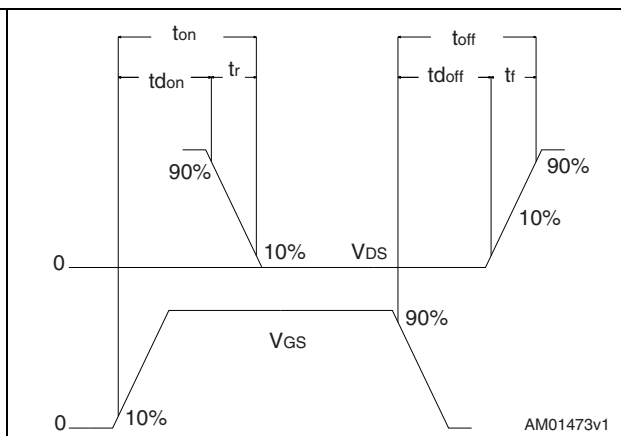
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



AM01473v1



## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 8. PowerFLAT™ 5x6 type C-B mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80	0.83	0.93
A1	0	0.02	0.05
A3		0.20	
b	0.35	0.40	0.47
D		5.00	
D1		4.75	
D2	4.15	4.20	4.25
E		6.00	
E1		5.75	
E2	3.43	3.48	3.53
E4	2.58	2.63	2.68
e		1.27	
L	0.70	0.80	0.90

Figure 19. PowerFLAT™ 5x6 type C-B drawing

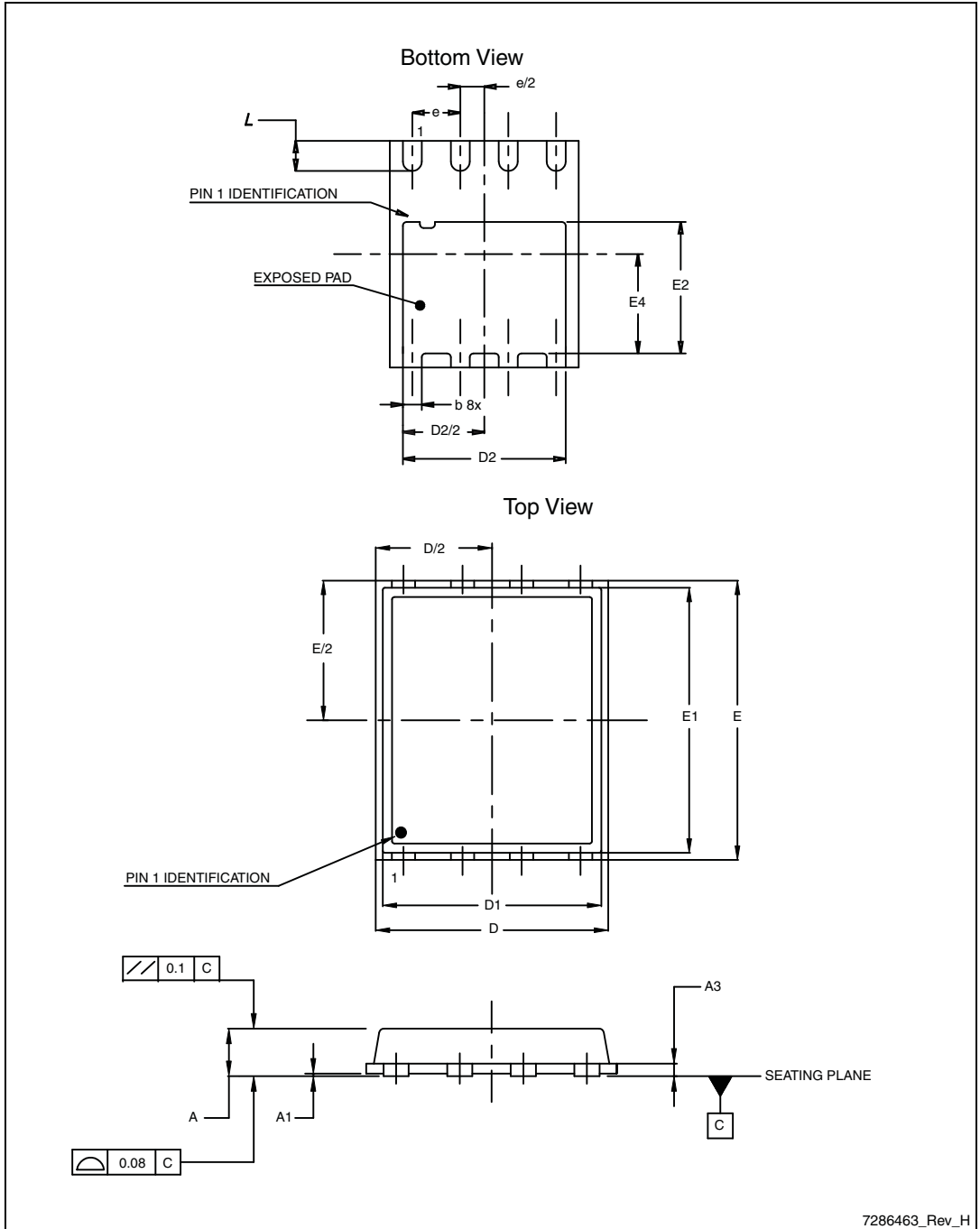


Table 9. PowerFLAT™ 5x6 type S-C mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1	0.02		0.05
A2		0.25	
b	0.30		0.50
D		5.20	
E		6.15	
D2	4.11		4.31
E2	3.50		3.70
e		1.27	
e1		0.65	
L	0.715		1.015
K	1.05		1.35

Figure 20. PowerFLAT™ 5x6 type S-C mechanical data

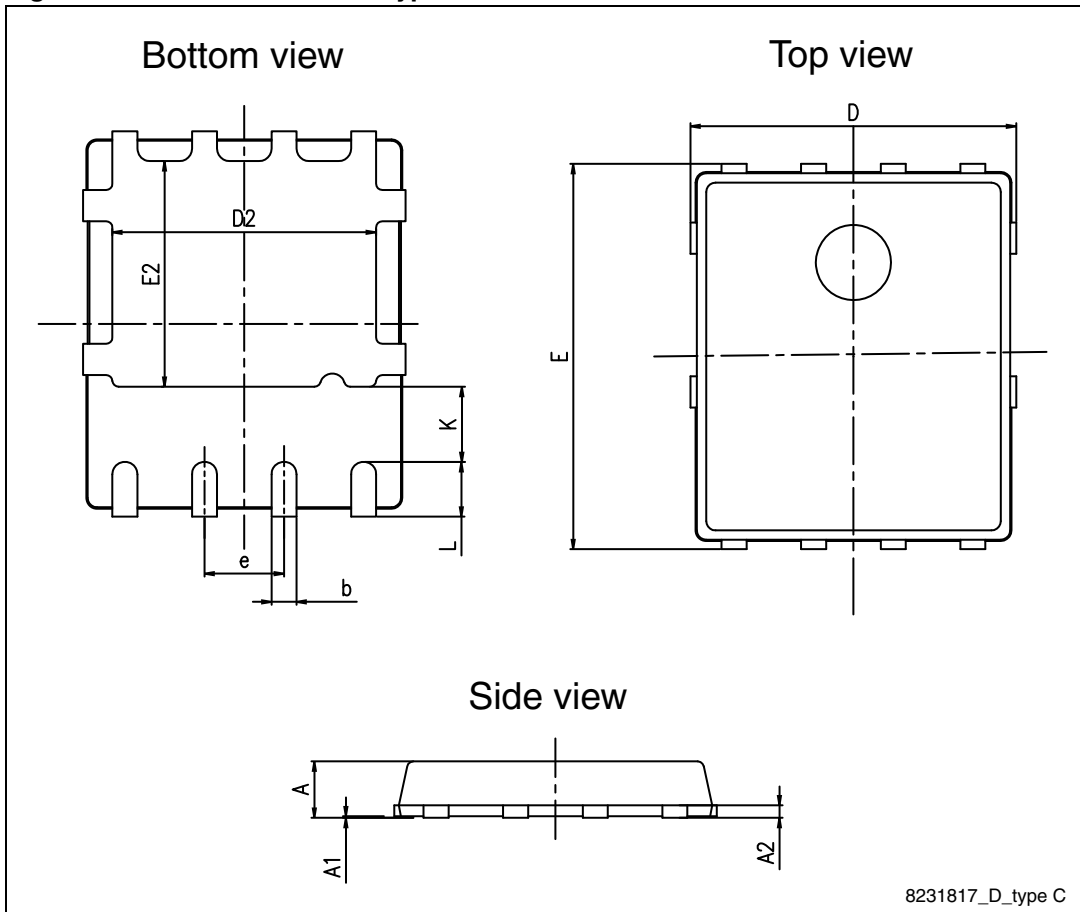
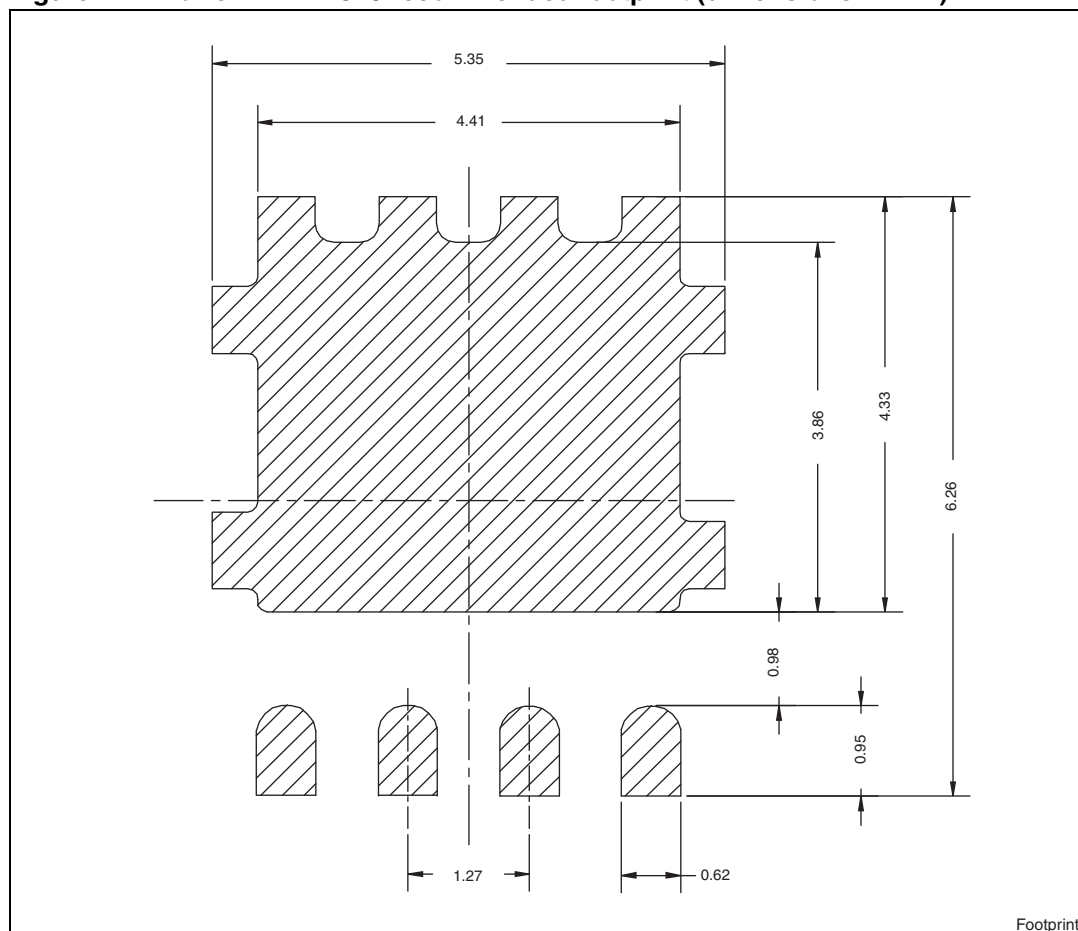


Figure 21. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



## 5 Packaging mechanical data

Figure 22. PowerFLAT™ 5x6 tape

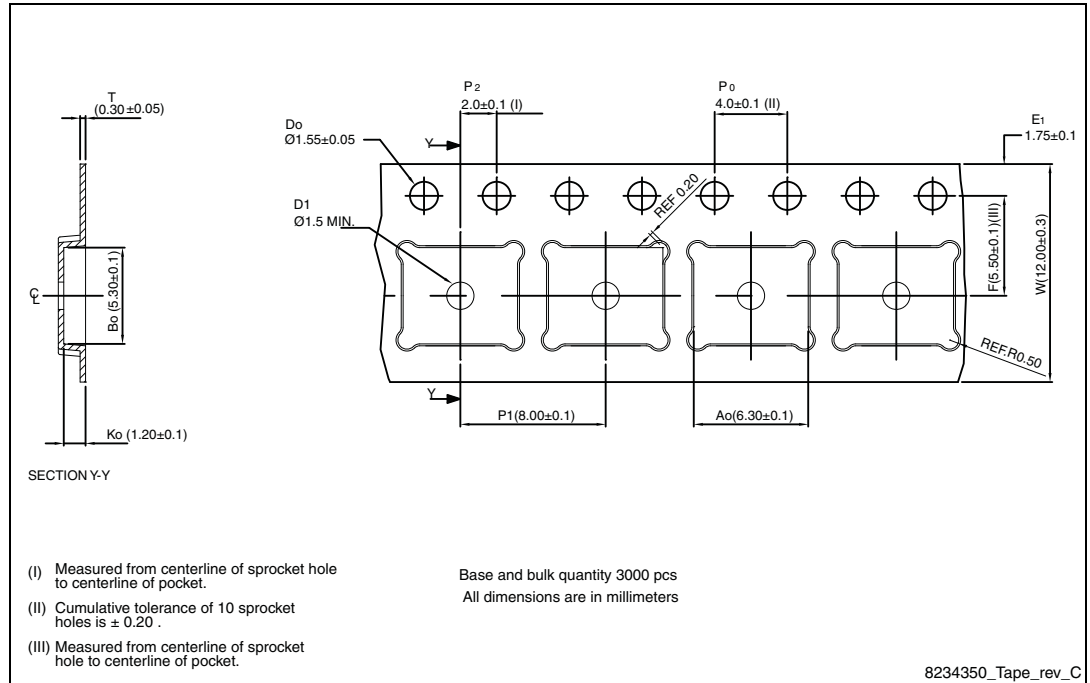


Figure 23. PowerFLAT™ 5x6 package orientation in carrier tape.

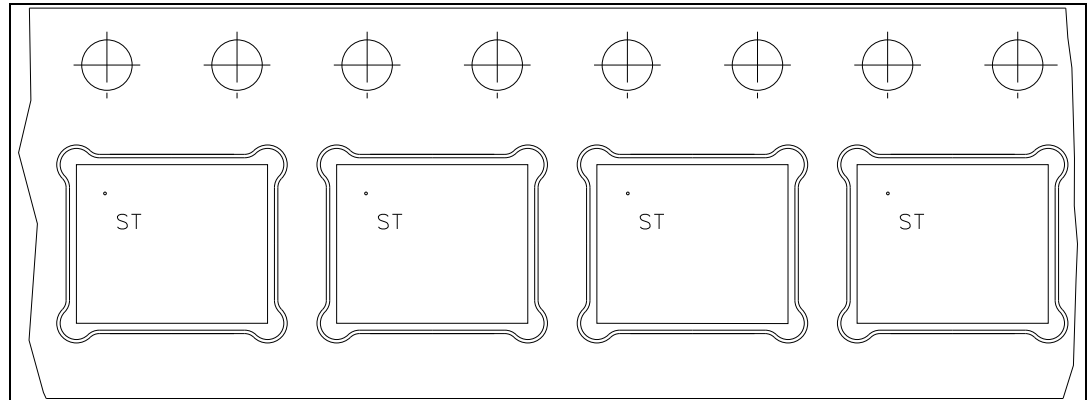
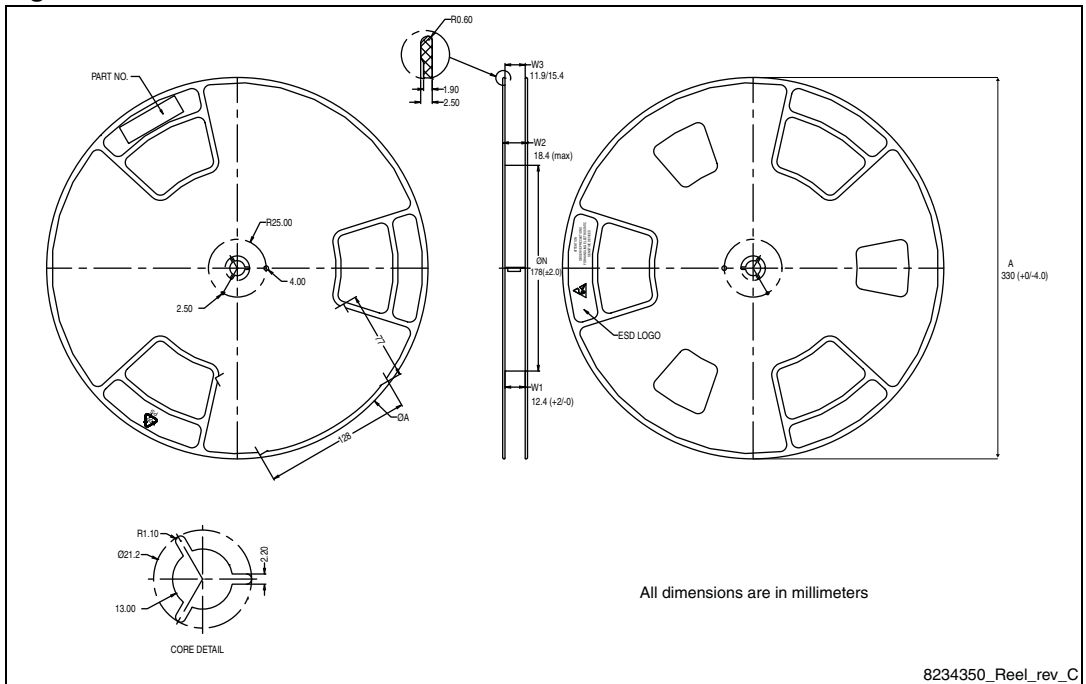


Figure 24. PowerFLAT™ 5x6 reel





## 6 Revision history

Table 10. Document revision history

Date	Revision	Changes
20-Apr-2009	1	First issue.
01-Mar-2012	2	Document status promoted from preliminary data to datasheet <i>Section 4: Package mechanical data</i> has been modified: – <i>Table 8: PowerFLAT™ 5x6 type C-B mechanical data</i> , <i>Table 9: PowerFLAT™ 5x6 type S-C mechanical data</i> , <i>Figure 19: PowerFLAT™ 5x6 type C-B drawing</i> , <i>Figure 20:</i> <i>PowerFLAT™ 5x6 type S-C mechanical data</i> and <i>Figure 21:</i> <i>PowerFLAT™ 5x6 recommended footprint (dimensions in mm)</i> have been added.

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