



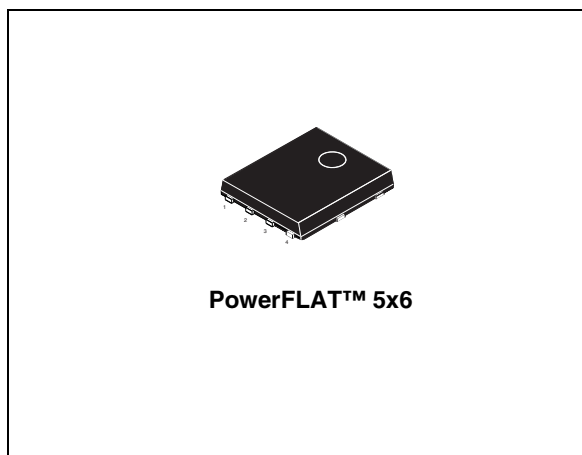
# STL120N2VH5

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

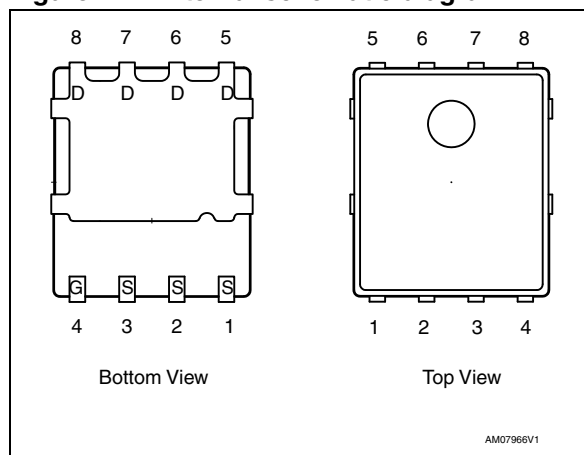


Table 1. Device summary

| Order code  | Marking  | Package        | Packaging     |
|-------------|----------|----------------|---------------|
| STL120N2VH5 | 120N2VH5 | PowerFLAT™ 5x6 | Tape and reel |

Contents

1      **Electrical ratings** ..... 3

2      **Electrical characteristics** ..... 4

      2.1    Electrical characteristics (curves) ..... 6

3      **Test circuits** ..... 8

4      **Package mechanical data** ..... 9

5      **Packaging mechanical data** ..... 15

6      **Revision history** ..... 17



# 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 $T_C = 25\text{ }^\circ\text{C}$     | 120         | A                   |
| $I_D^{(1)}$        | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$    | 75          | A                   |
| $I_D^{(2)}$        | Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$ | 28          | A                   |
| $I_{DM}^{(2),(3)}$ | Drain current (pulsed)                                             | 112         | A                   |
| $P_{TOT}^{(1)}$    | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$              | 80          | W                   |
| $P_{TOT}^{(2)}$    | Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$          | 4           | W                   |
|                    | Derating factor <sup>(2)</sup>                                     | 0.03        | W/ $^\circ\text{C}$ |
| $T_j$<br>$T_{stg}$ | Operating junction temperature<br>storage temperature              | - 55 to 150 | $^\circ\text{C}$    |

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  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max.  | 31.25 | $^\circ\text{C}/\text{W}$ |

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<br>(pulse width limited by $T_j$ max)                                   | 20        | A    |
| $E_{AS}$ | Single pulse avalanche energy<br>(starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 14\text{ V}$ ) | 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 ( $V_{GS} = 0$ ) | $V_{DS} = 20\text{ V}$<br>$V_{DS} = 20\text{ V}$ , $T_C = 125\text{ °C}$                       |      |                 | 1<br>10        | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | 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                | $V_{GS} = 4.5\text{ V}$ , $I_D = 14\text{ A}$<br>$V_{GS} = 2.5\text{ V}$ , $I_D = 14\text{ A}$ |      | 0.002<br>0.0028 | 0.003<br>0.004 | $\Omega$<br>$\Omega$           |

**Table 6. Dynamic**

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

**Table 7. Source drain diode**

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

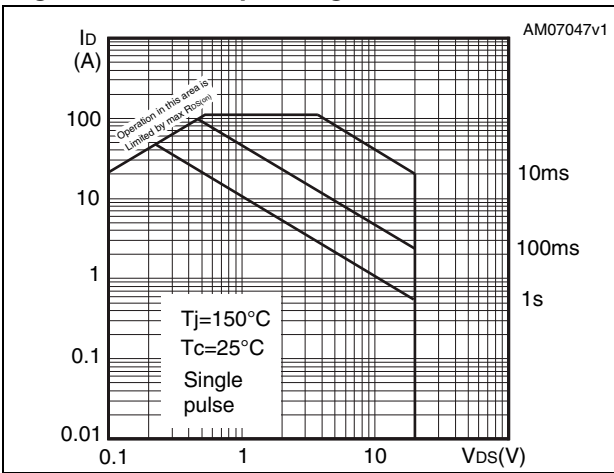


Figure 3. Thermal impedance

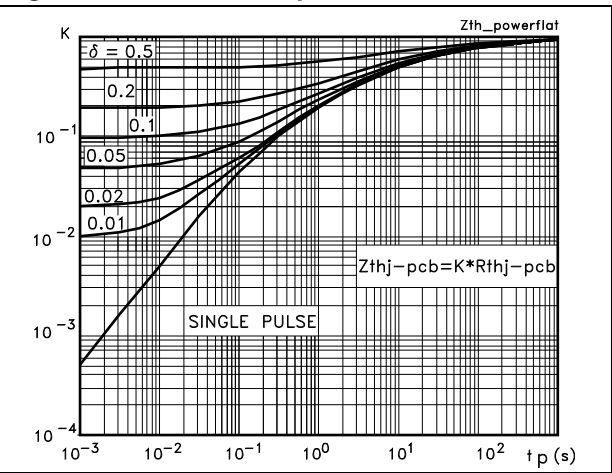


Figure 4. Output characteristics

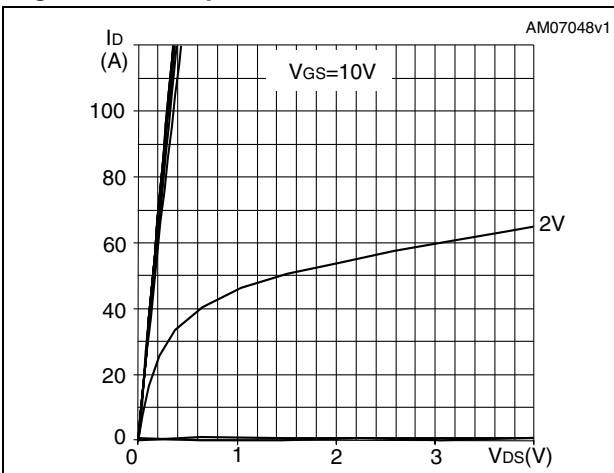


Figure 5. Transfer characteristics

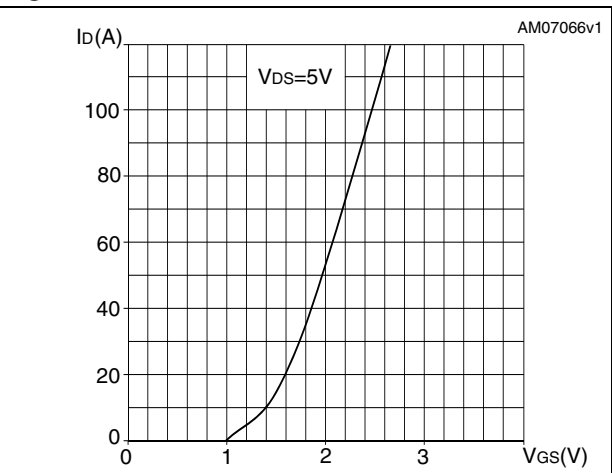


Figure 6. Normalized  $B_{V_{DS}}$  vs temperature

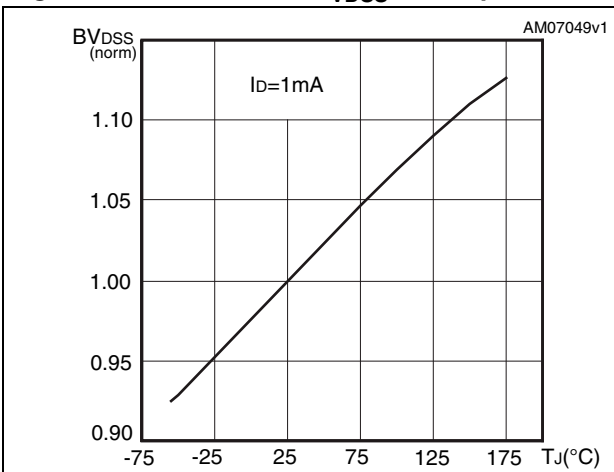


Figure 7. Static drain-source on resistance

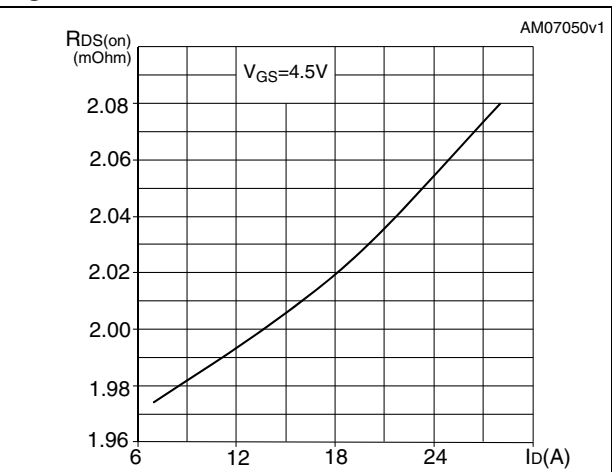


Figure 8. Gate charge vs gate-source voltage

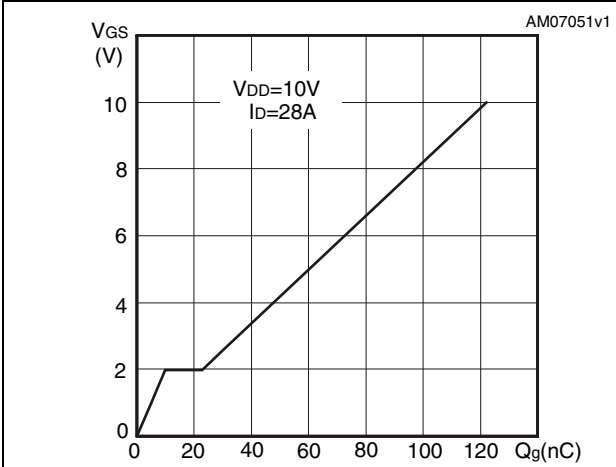


Figure 9. Capacitance variations

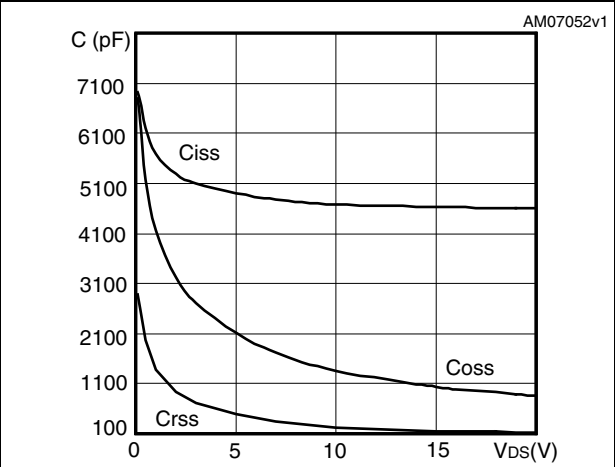


Figure 10. Normalized gate threshold voltage vs temperature

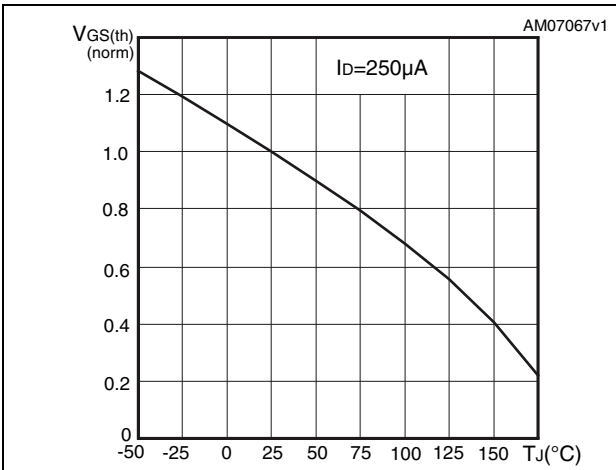


Figure 11. Normalized on resistance vs temperature

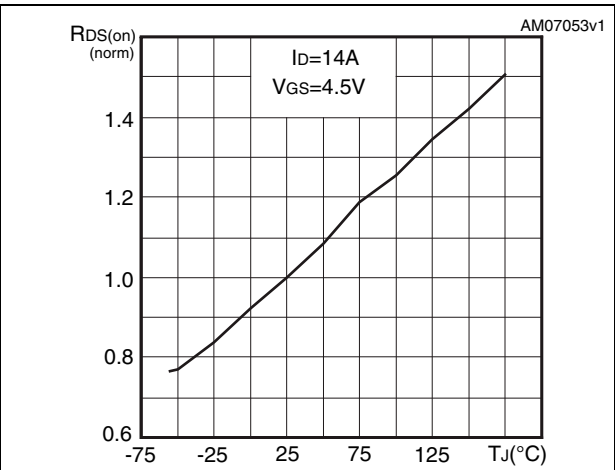
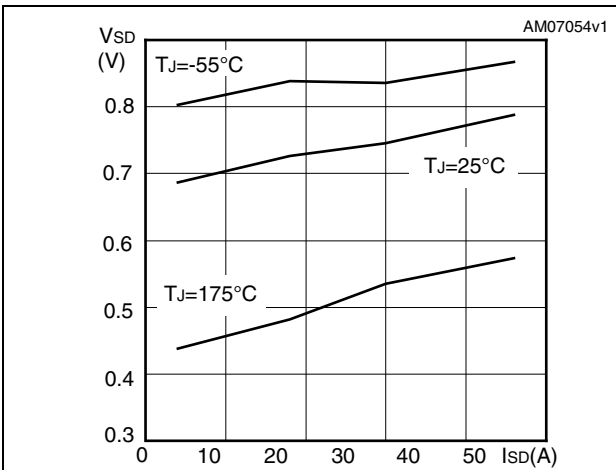


Figure 12. Source-drain diode forward characteristics



### 3 Test circuits

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

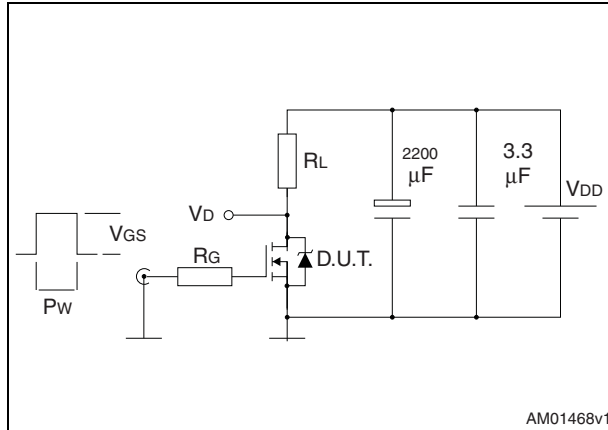


**Figure 14. Gate charge test circuit**

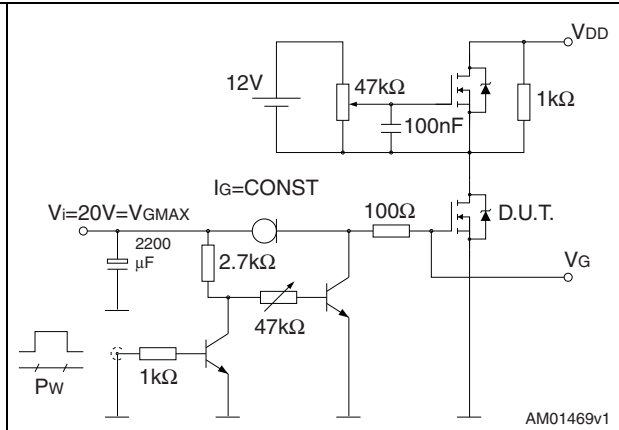


**Figure 15. Test circuit for inductive load switching and diode recovery times**

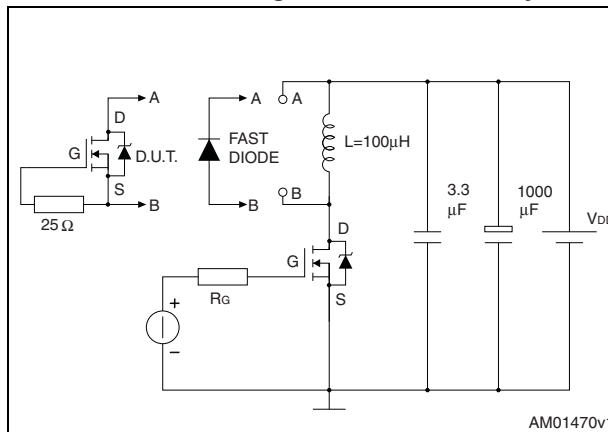


**Figure 16. Unclamped inductive load test circuit**

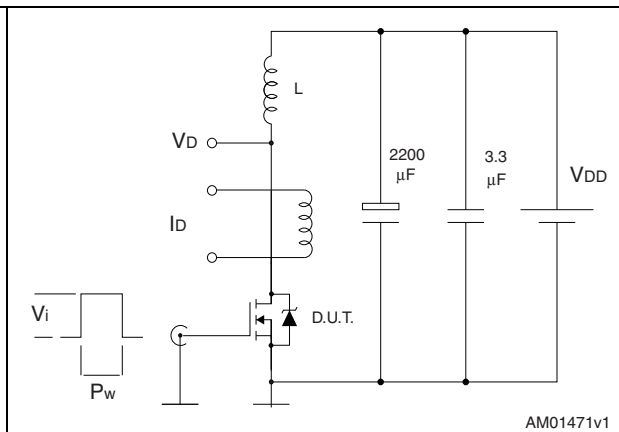


**Figure 17. Unclamped inductive waveform**

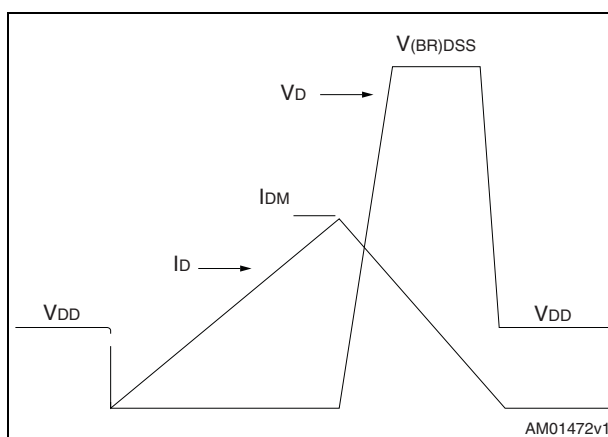
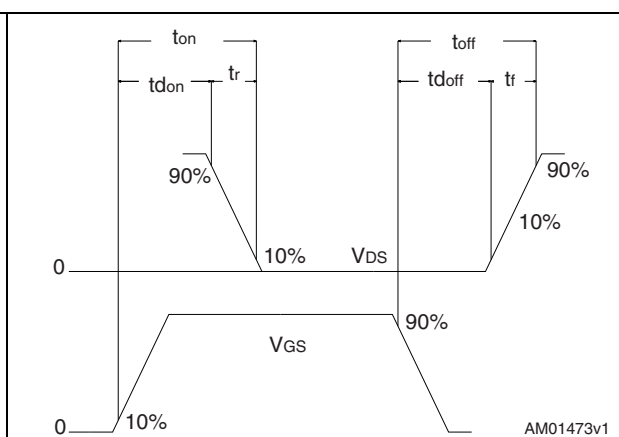


**Figure 18. Switching time waveform**



## 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](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

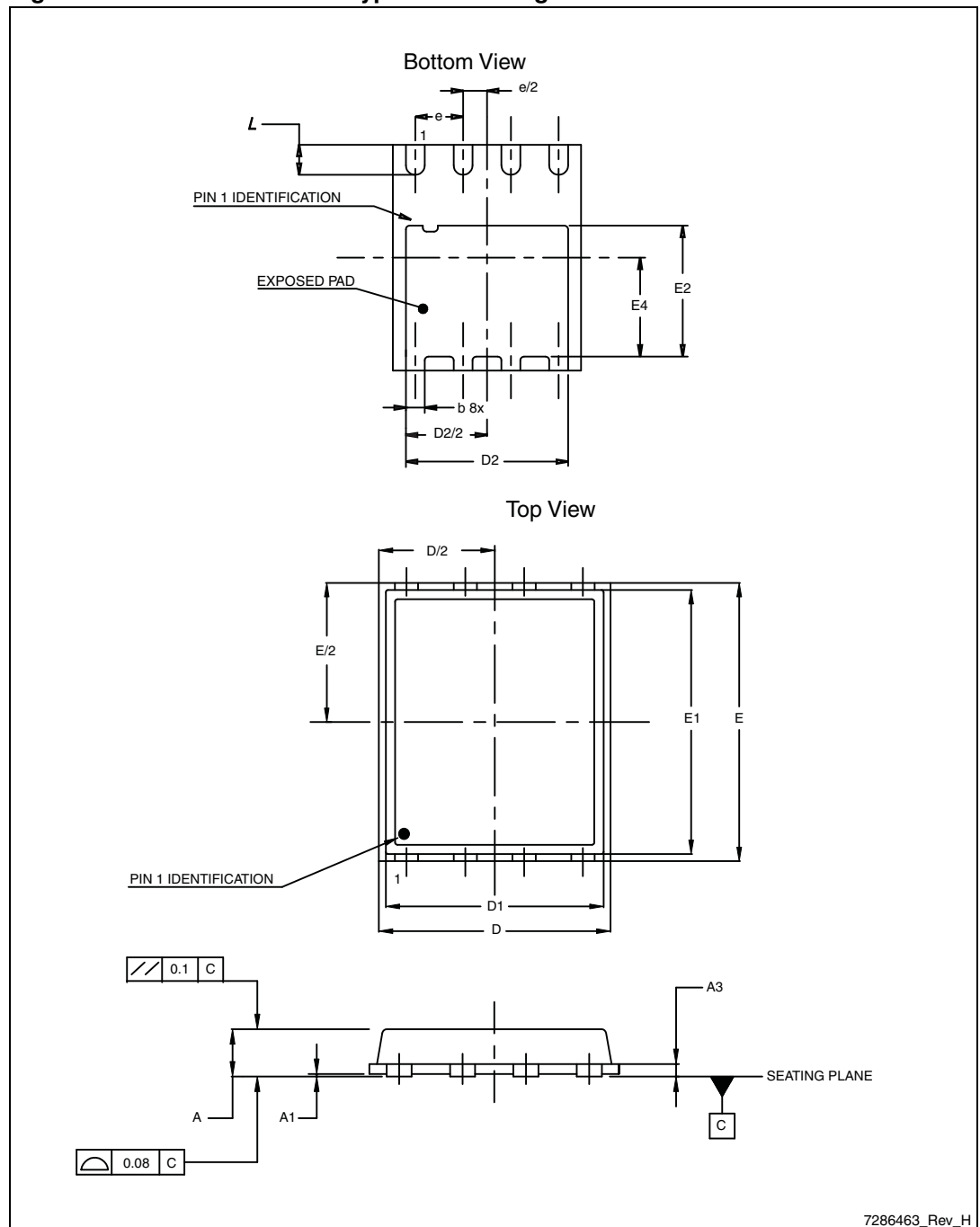


**Table 9. PowerFLAT™ 5x6 type S-C mechanical data**

| 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

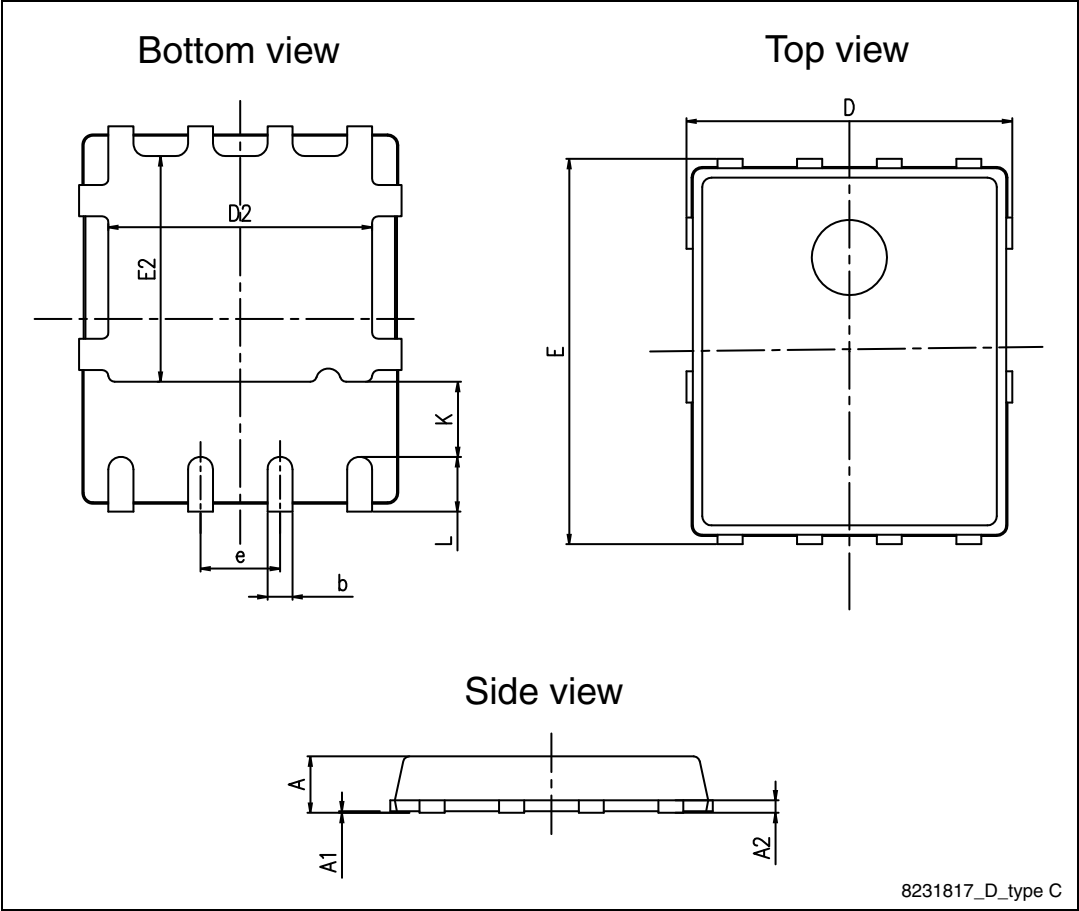
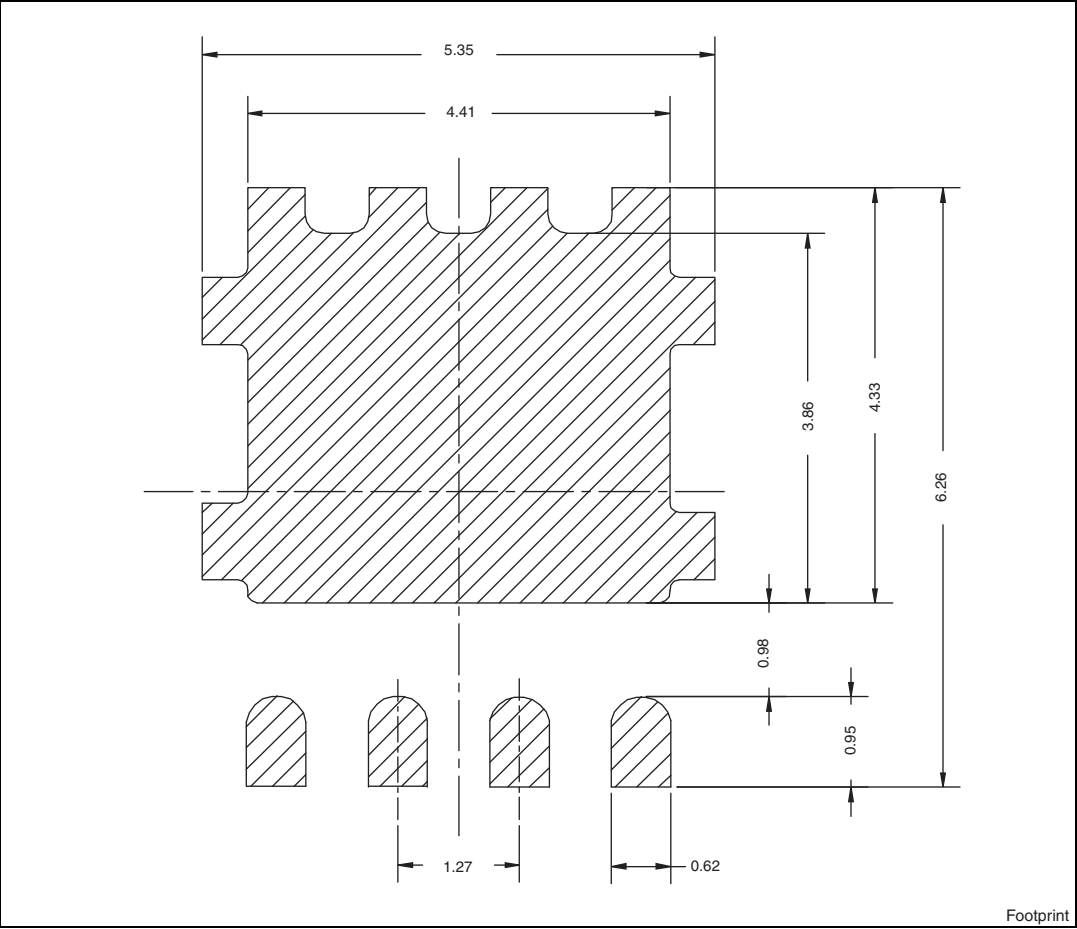


Figure 21. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



# 5 Packaging mechanical data

Figure 22. PowerFLAT™ 5x6 tape

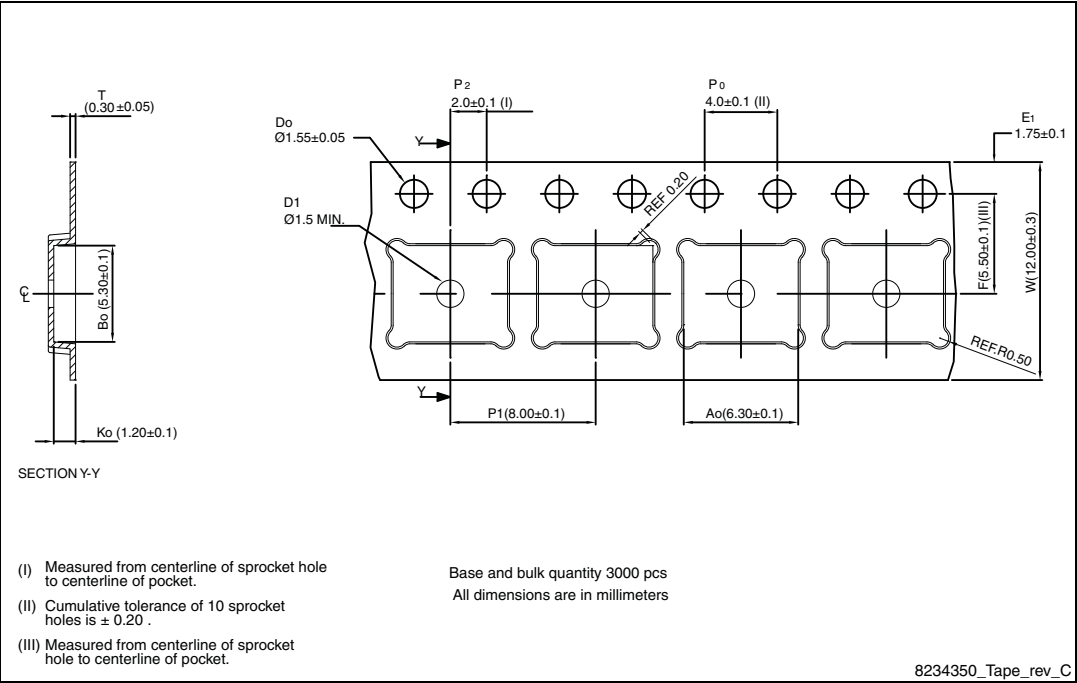


Figure 23. PowerFLAT™ 5x6 package orientation in carrier tape.

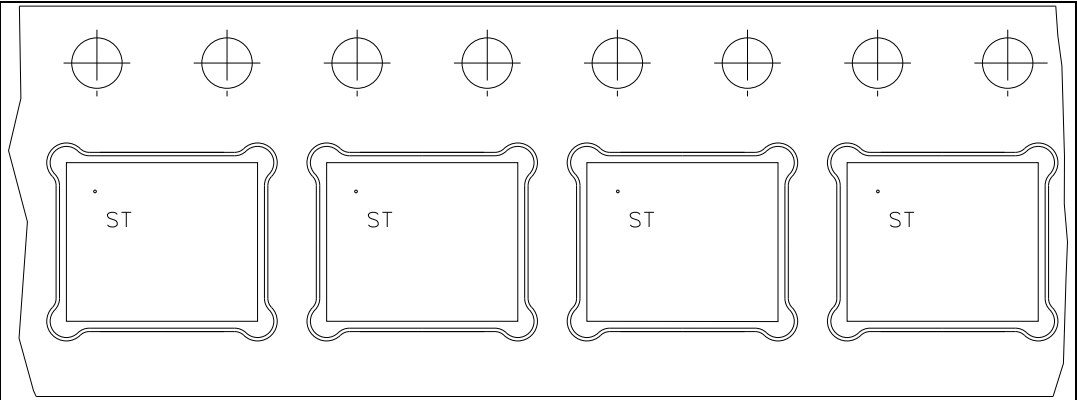
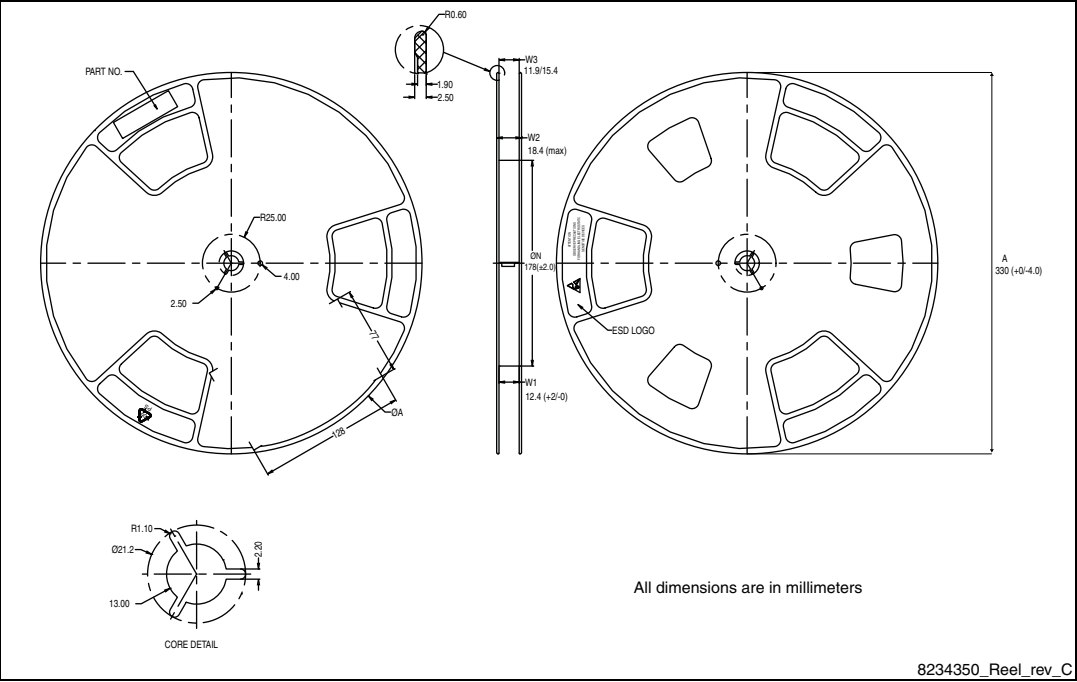


Figure 24. PowerFLAT™ 5x6 reel



## 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<br><i>Section 4: Package mechanical data</i> has been modified:<br>– <i>Table 8: PowerFLAT™ 5x6 type C-B mechanical data</i> ,<br><i>Table 9: PowerFLAT™ 5x6 type S-C mechanical data</i> ,<br><i>Figure 19: PowerFLAT™ 5x6 type C-B drawing</i> , <i>Figure 20: PowerFLAT™ 5x6 type S-C mechanical data</i> and <i>Figure 21: PowerFLAT™ 5x6 recommended footprint (dimensions in mm)</i> have been added. |

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