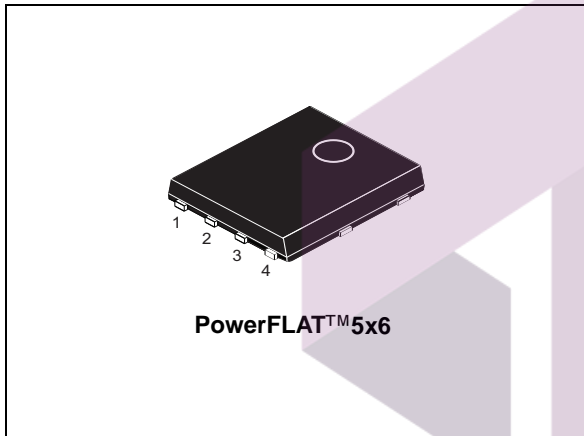


N-channel 30 V, 0.0016  $\Omega$  typ., 160 A STripFET™ H7  
Power MOSFET plus monolithic Schottky in a PowerFLAT™ 5x6

Datasheet - production data



## Features

| Order code    | V <sub>DS</sub> | R <sub>DS(on)</sub> max | I <sub>D</sub> |
|---------------|-----------------|-------------------------|----------------|
| STL160NS3LLH7 | 30 V            | 0.0021 $\Omega$         | 160 A          |

- Very low on-resistance
- Very low Q<sub>g</sub>
- High avalanche ruggedness
- Embedded Schottky diode

## Applications

- Switching applications

## Description

This device exhibits low on-state resistance and capacitance for improved conduction and switching performance.

Figure 1. Internal schematic diagram

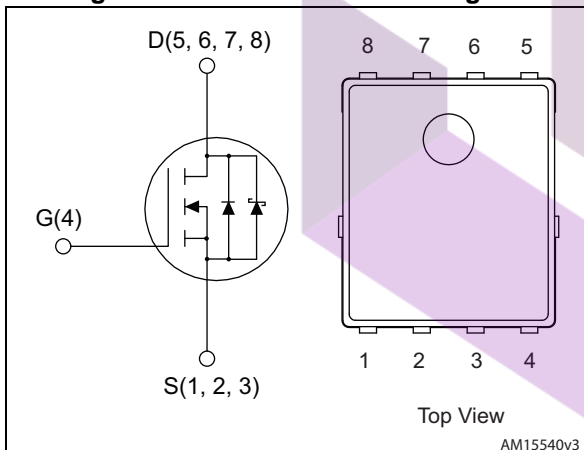


Table 1. Device summary

| Order code    | Marking  | Package        | Packaging     |
|---------------|----------|----------------|---------------|
| STL160NS3LLH7 | 160NS3LL | PowerFLAT™ 5x6 | Tape and reel |

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## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol            | Parameter   | Value      | Unit             |
|-------------------|---|------------|------------------|
| $V_{DS}$          | Drain-source voltage  | 30         | V                |
| $V_{GS}$          | Gate-source voltage   | $\pm 20$   | V                |
| $I_D^{(1)}$       | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$      | 160        | A                |
| $I_D^{(1)}$       | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$     | 115        | A                |
| $I_{DM}^{(1)(2)}$ | Drain current (pulsed)  | 640        | A                |
| $I_D^{(3)}$       | Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$  | 36         | A                |
| $I_D^{(3)}$       | Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$ | 26         | A                |
| $I_{DM}^{(2)(3)}$ | Drain current (pulsed)  | 144        | A                |
| $P_{TOT}^{(1)}$   | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$               | 84         | W                |
| $P_{TOT}^{(3)}$   | Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$           | 4          | W                |
| $E_{AS}^{(4)}$    | Single pulse avalanche energy                                       | 200        | mJ               |
| $T_j$             | Operating junction temperature                                      | -55 to 150 | $^\circ\text{C}$ |
| $T_{stg}$         | Storage temperature   |            | $^\circ\text{C}$ |

1. This value is rated according to  $R_{thj-c}$
2. Pulse width limited by safe operating area
3. This value is rated according to  $R_{thj-pcb}$
4.  $L=1\text{ mH}$ ,  $I_D=20\text{ A}$ ,  $V_{DD}=25\text{ V}$

**Table 3. Thermal data**

| Symbol              | Parameter                            | Value | Unit               |
|---------------------|--------------------------------------|-------|--------------------|
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max  | 31.3  | $^\circ\text{C/W}$ |
| $R_{thj-case}$      | Thermal resistance junction-case max | 1.5   | $^\circ\text{C/W}$ |

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2oz Cu,  $t < 10\text{ sec}$

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## 2 Electrical characteristics

( $T_C = 25\text{ °C}$  unless otherwise specified).

**Table 4. On /off states**

| Symbol        | Parameter                         | Test conditions                            | Min. | Typ.   | Max.      | Unit          |
|---------------|-----------------------------------|--|------|--------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS} = 0, I_D = 1\text{ mA}$            | 30   |        |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS} = 0, V_{DS} = 24\text{ V}$         |      |        | 500       | $\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current         | $V_{DS} = 0, V_{GS} = \pm 20\text{ V}$     |      |        | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}, I_D = 1\text{ mA}$       | 1.2  |        | 2.3       | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 10\text{ V}, I_D = 18\text{ A}$  |      | 0.0016 | 0.0021    | $\Omega$      |
|               |                                   | $V_{GS} = 4.5\text{ V}, I_D = 18\text{ A}$ |      | 0.0025 | 0.0031    | $\Omega$      |

**Table 5. Dynamic**

| Symbol    | Parameter                    | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{GS} = 0, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$  | -    | 3245 | -    | pF   |
| $C_{oss}$ | Output capacitance           |   | -    | 970  | -    | pF   |
| $C_{rss}$ | Reverse transfer capacitance |   | -    | 52   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{DD} = 15\text{ V}, I_D = 36\text{ A},$<br>$V_{GS} = 4.5\text{ V}$<br>(see <a href="#">Figure 13</a> ) | -    | 20   | -    | nC   |
| $Q_{gs}$  | Gate-source charge           |   | -    | 9.3  | -    | nC   |
| $Q_{gd}$  | Gate-drain charge            |   | -    | 5.7  | -    | nC   |

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions  | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 15\text{ V}, I_D = 18\text{ A},$<br>$R_G = 4.7\text{ }\Omega, V_{GS} = 4.5\text{ V}$ | -    | 12.4 | -    | ns   |
| $t_r$        | Rise time           |  | -    | 21.3 | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |  | -    | 50.7 | -    | ns   |
| $t_f$        | Fall time           |  | -    | 19.5 | -    | ns   |

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Table 7. Source drain diode

| Symbol          | Parameter                     | Test conditions  | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| $I_{SD}$        | Source-drain current          |  | -    |      | 120  | A    |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |  | -    |      | 480  | A    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $V_{GS} = 0, I_{SD} = 2 \text{ A}$   | -    | 0.4  | 0.7  | V    |
| $t_{rr}$        | Reverse recovery time         | $V_{GS} = 0 \text{ V}, I_D = 36 \text{ A},$<br>$di/dt = 100 \text{ A}/\mu\text{s}$ | -    | 46   |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |  | -    | 46   |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |  | -    | 2    |      | A    |

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



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## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

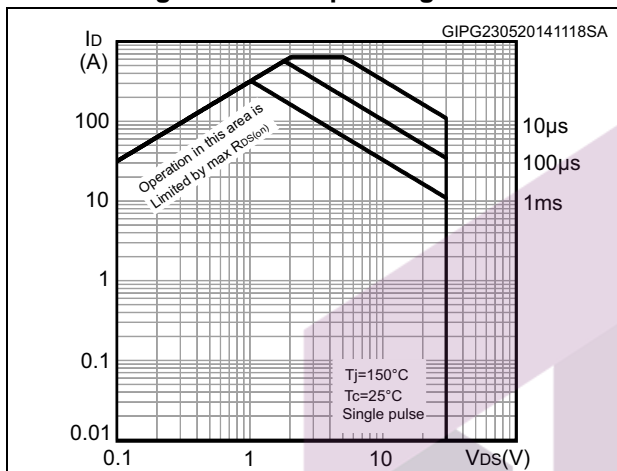


Figure 3. Thermal impedance

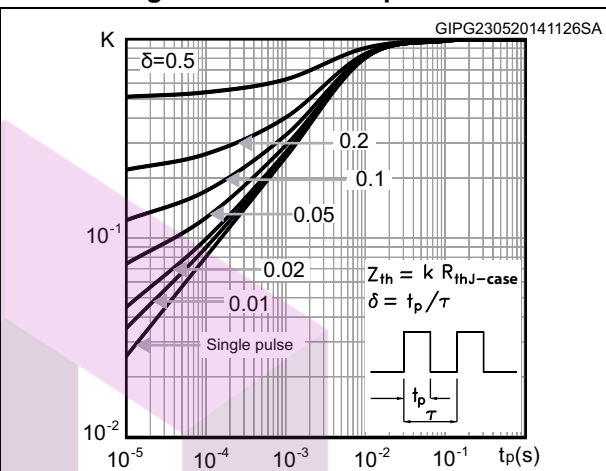


Figure 4. Output characteristics

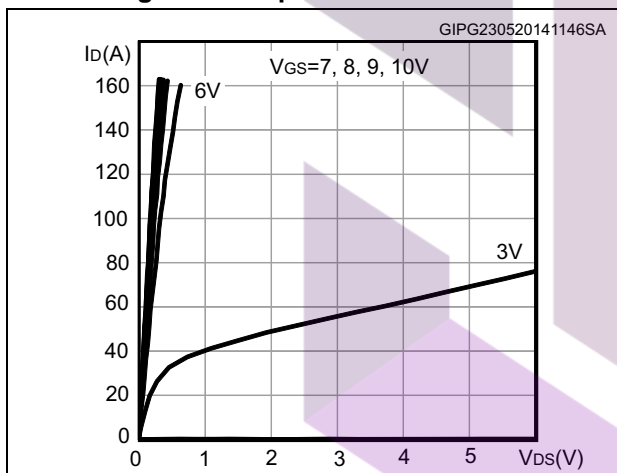


Figure 5. Transfer characteristics

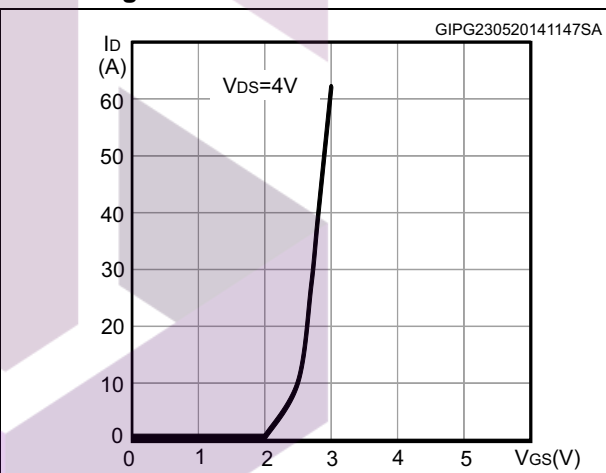


Figure 6. Gate charge vs gate-source voltage

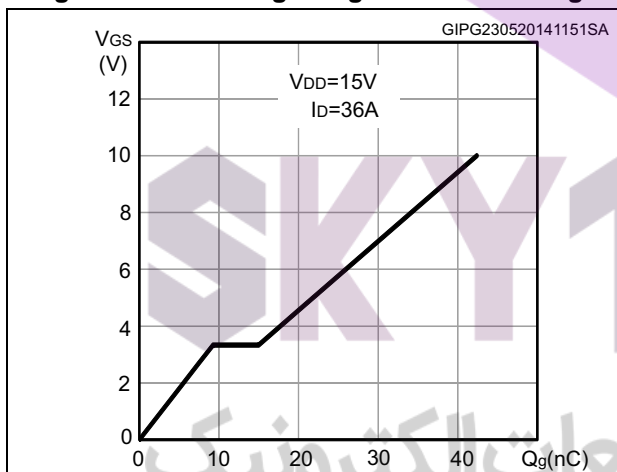


Figure 7. Static drain-source on-resistance

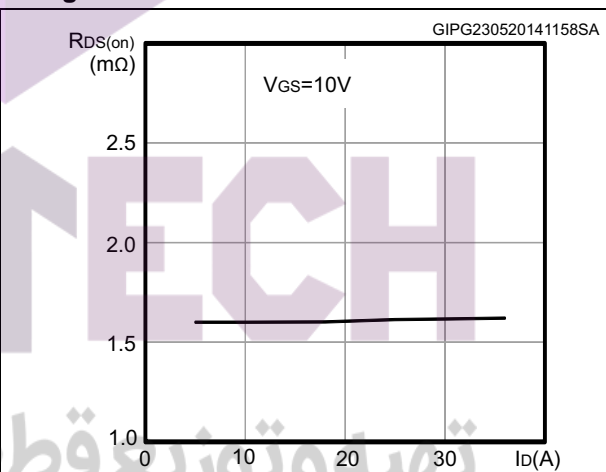


Figure 8. Capacitance variations

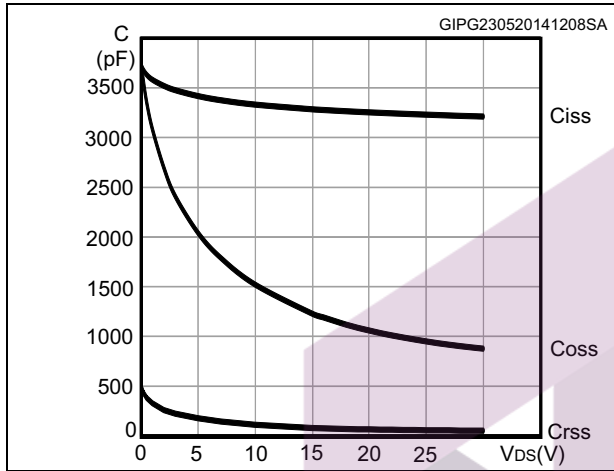


Figure 9. Normalized gate threshold voltage vs temperature

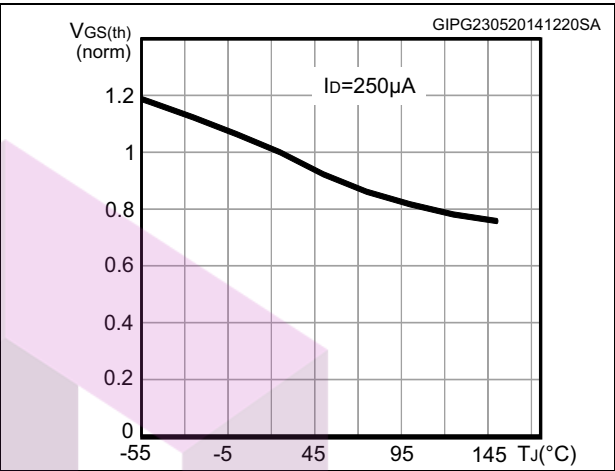


Figure 10. Normalized on-resistance vs temperature

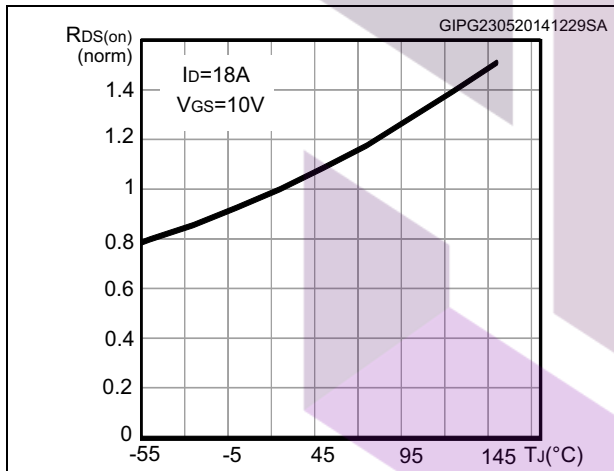
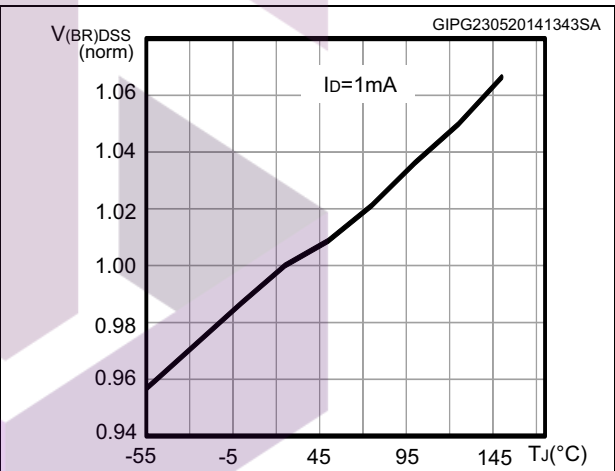


Figure 11. Normalized V(BR)DSS vs temperature



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### 3 Test circuits

Figure 12. Switching times test circuit for resistive load

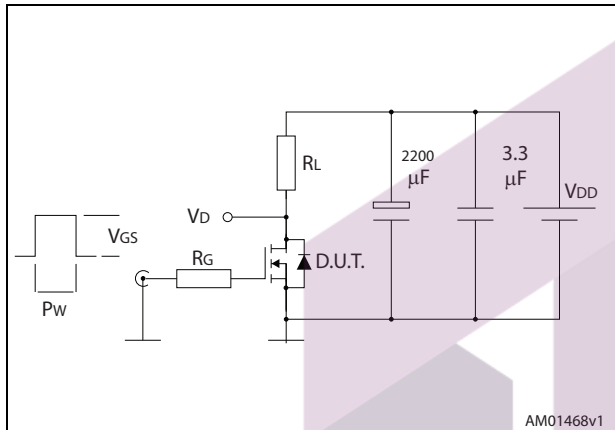


Figure 13. Gate charge test circuit

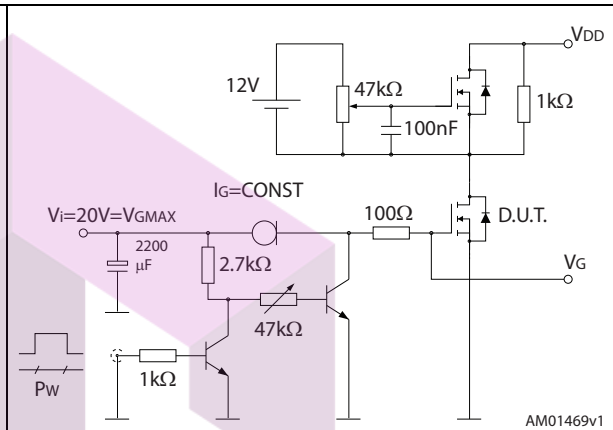


Figure 14. Test circuit for inductive load switching and diode recovery times

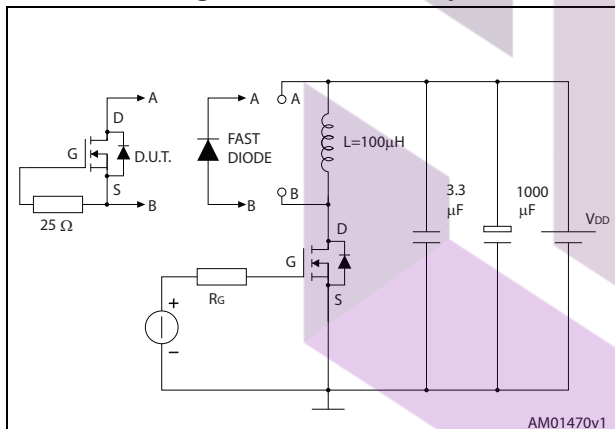


Figure 15. Unclamped inductive load test circuit

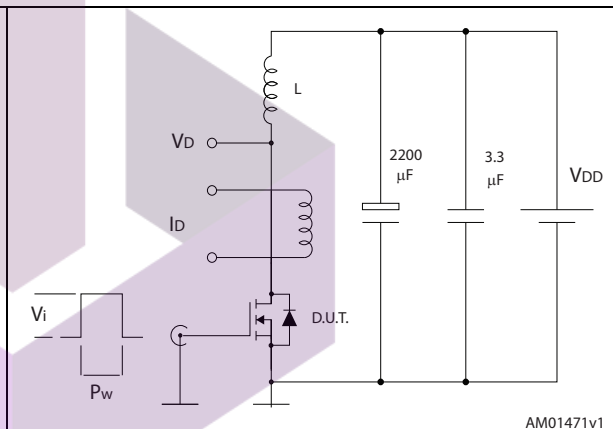


Figure 16. Unclamped inductive waveform

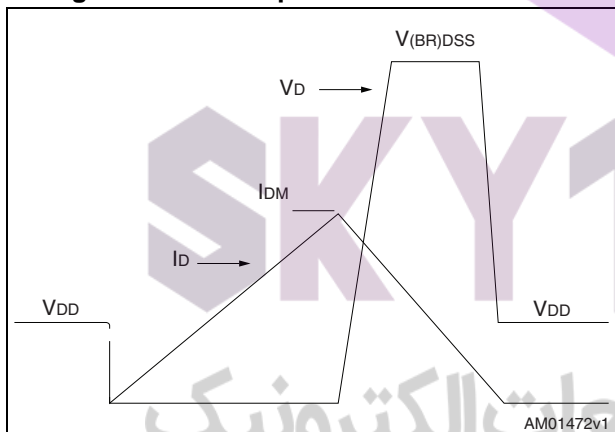
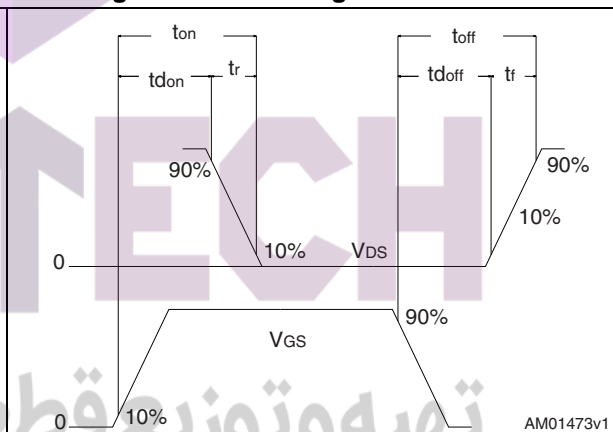


Figure 17. Switching time waveform





## 4 Package mechanical data

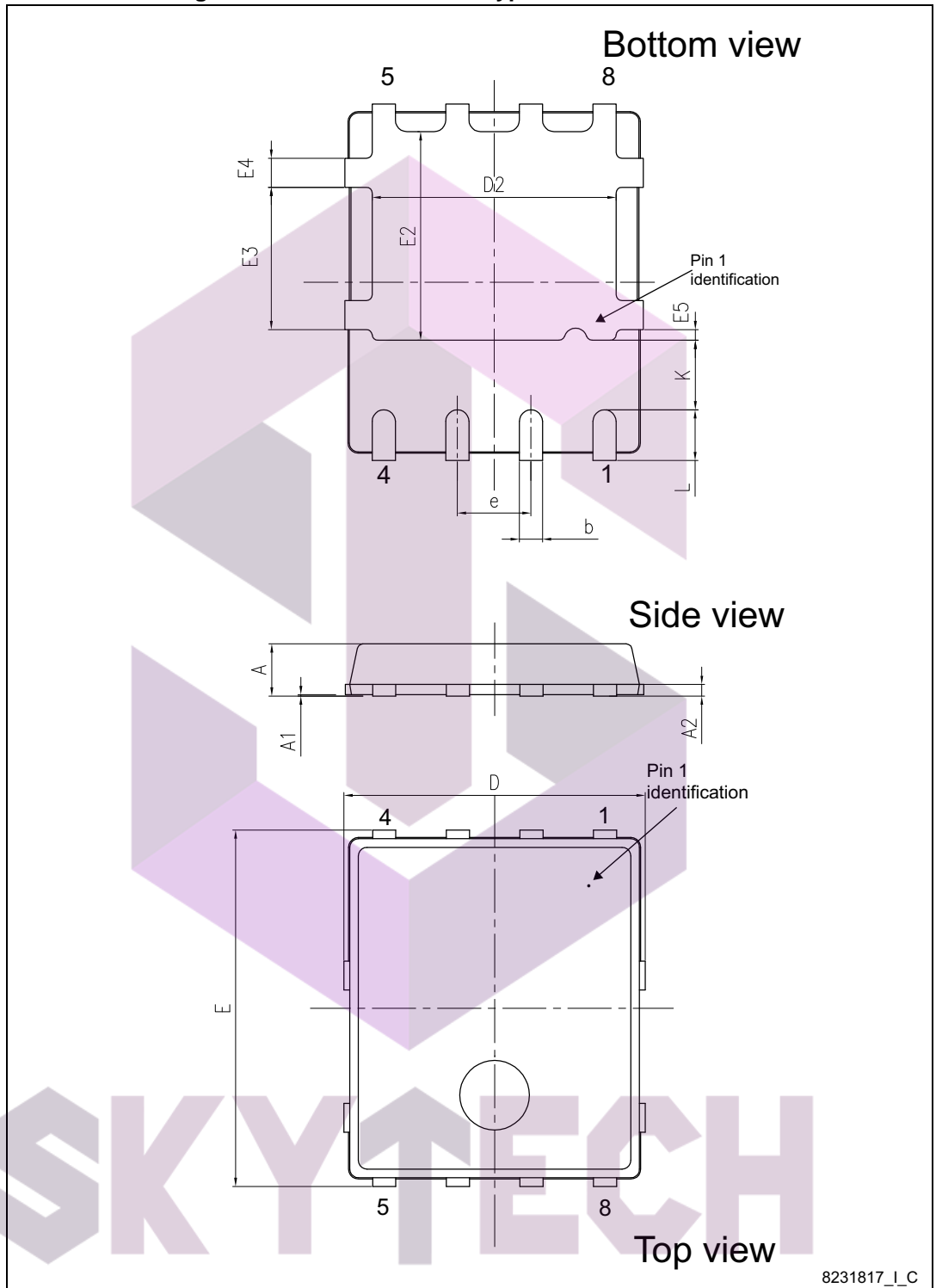
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Figure 18. PowerFLAT™ 5x6 type S-C mechanical data

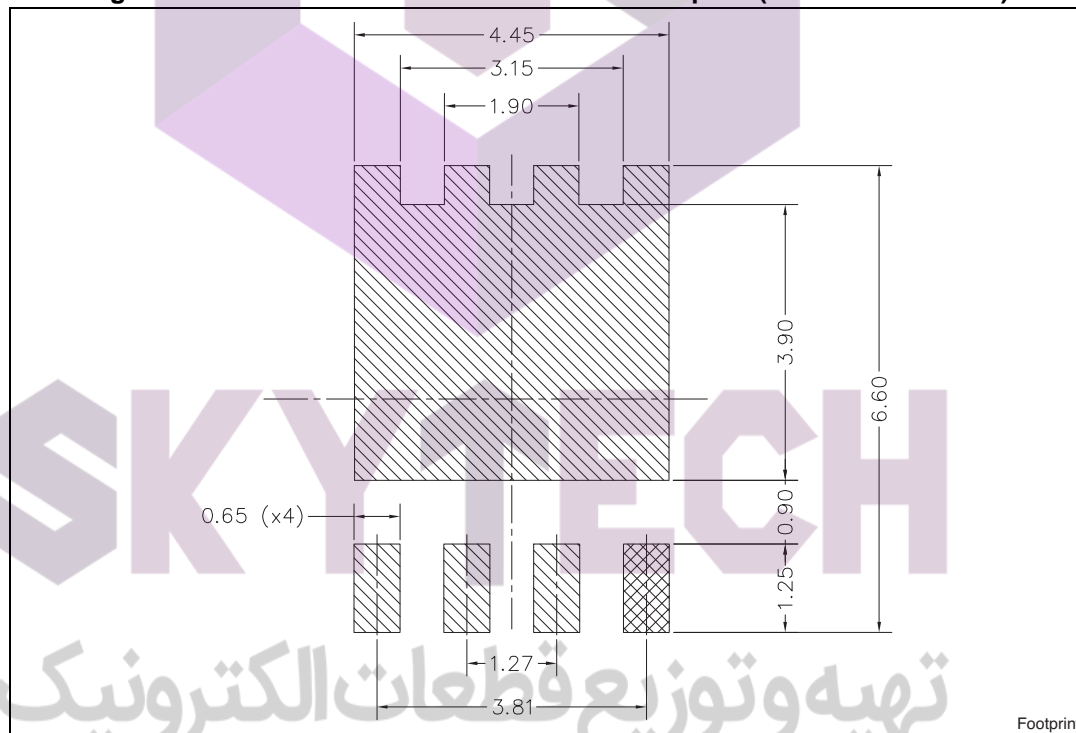


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Table 8. PowerFLAT™ 5x6 type S-C mechanical data

| 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 |       |
| D2   | 4.11  |      | 4.31  |
| E    |       | 6.15 |       |
| e    |       | 1.27 |       |
| e1   |       | 0.65 |       |
| E2   | 3.50  |      | 3.70  |
| E3   | 2.35  |      | 2.55  |
| E4   | 0.40  |      | 0.60  |
| E5   | 0.08  |      | 0.28  |
| K    | 1.05  |      | 1.35  |
| L    | 0.715 |      | 1.015 |

Figure 19. PowerFLAT™ 5x6 recommended footprint (dimensions in mm)



## 5 Packaging mechanical data

Figure 20. PowerFLAT™ 5x6 tape<sup>(a)</sup>

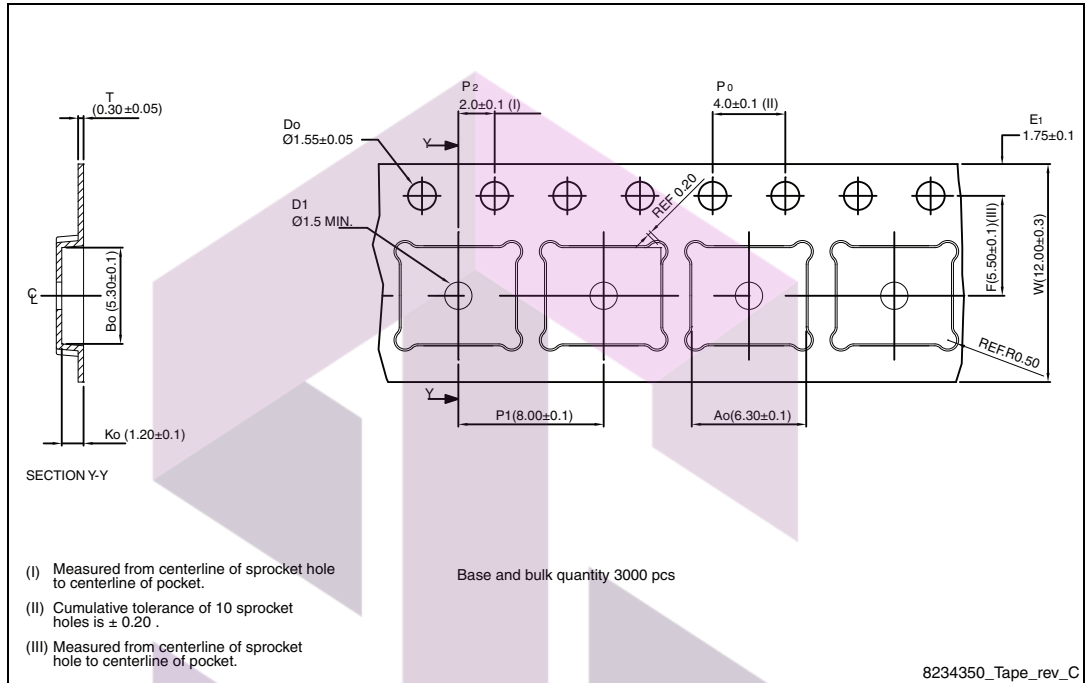
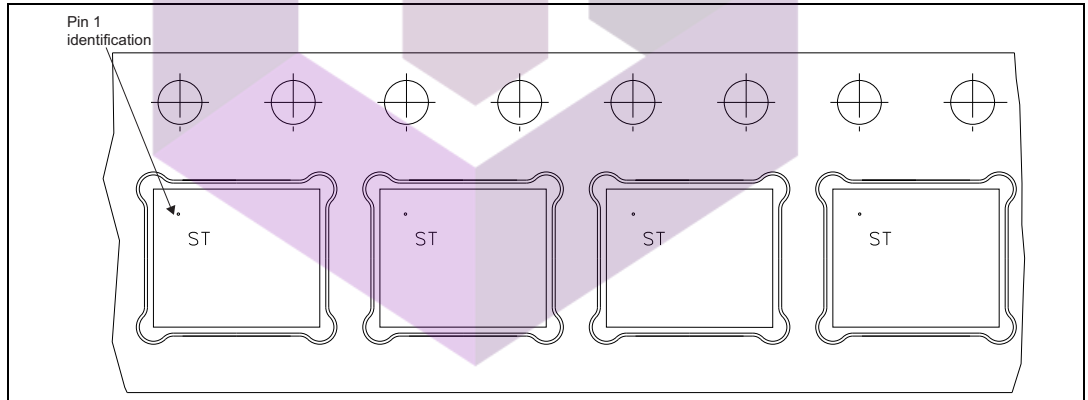


Figure 21. PowerFLAT™ 5x6 package orientation in carrier tape

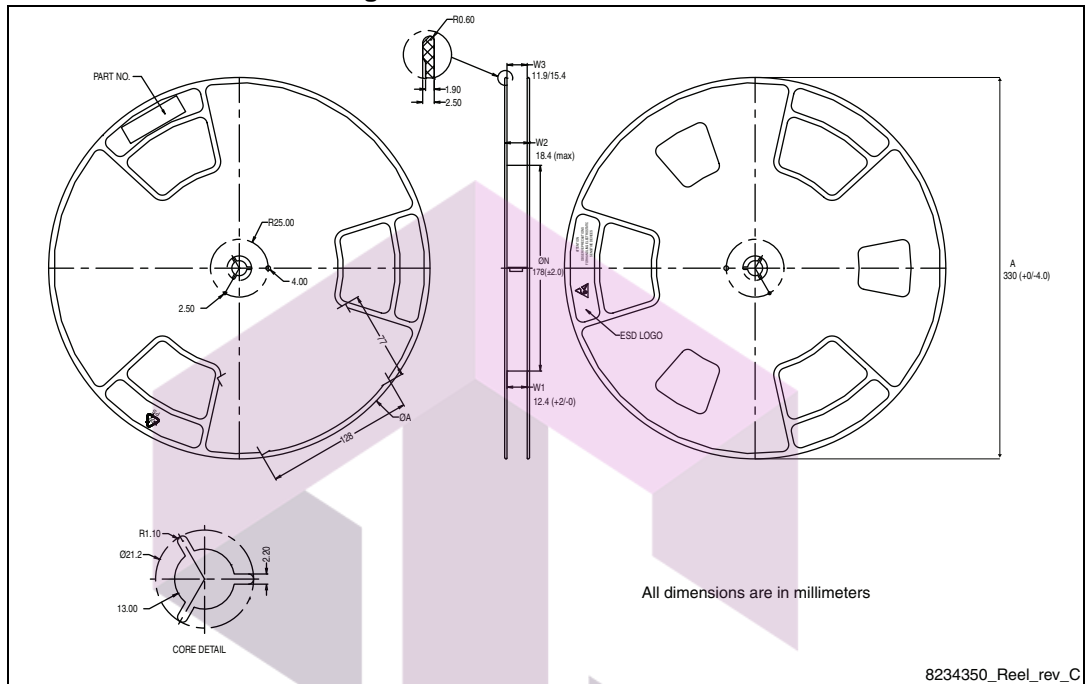


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a. All dimensions are in millimeters.

Figure 22. PowerFLAT™ 5x6 reel



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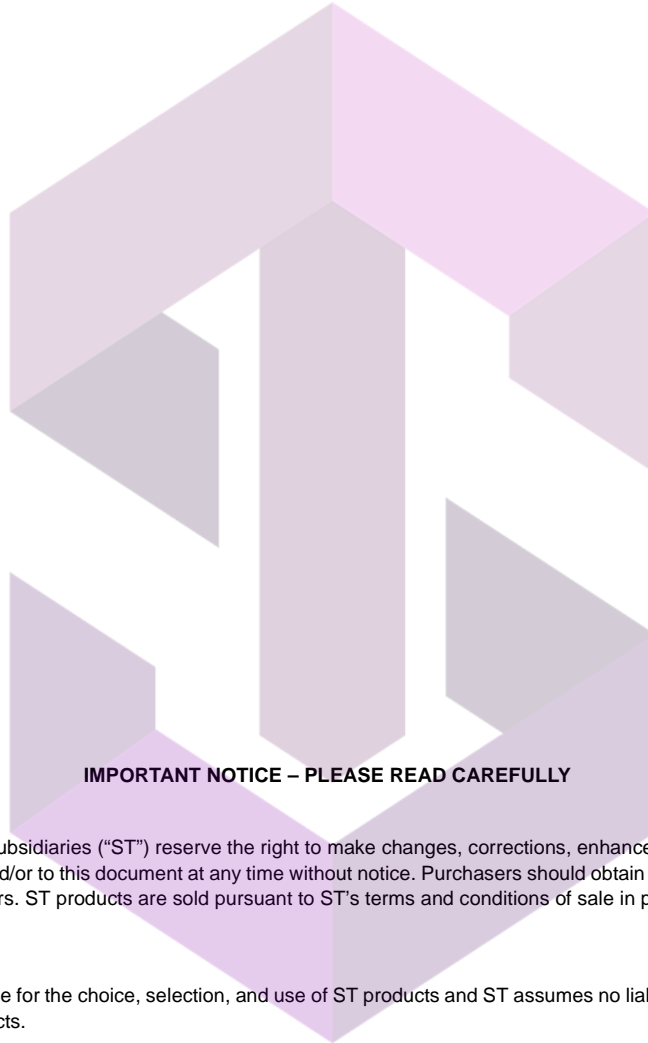
## 6 Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 11-Jun-2013 | 1        | First release.   |
| 26-May-2014 | 2        | <ul style="list-style-type: none"> <li>– Document status promoted from target to production data</li> <li>– Modified: <math>T_J</math> value in <a href="#">Table 2</a></li> <li>– Modified: the entire typical values in <a href="#">Table 5, 6, 7</a></li> <li>– Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Minor text changes</li> </ul> |
| 18-Jun-2014 | 3        | <ul style="list-style-type: none"> <li>– Added: <math>E_{AS}</math> value in <a href="#">Table 2</a></li> <li>– Updated: <a href="#">Section 4: Package mechanical data</a></li> <li>– Minor text changes</li> </ul>   |
| 24-Jul-2014 | 4        | <ul style="list-style-type: none"> <li>– Modified: title and features</li> <li>– Modified: <math>P_{TOT}</math> values in <a href="#">Table 2</a></li> <li>– Modified: <math>I_{SD}</math> and <math>I_{SDM}</math> max values in <a href="#">Table 7</a></li> <li>– Minor text changes</li> </ul>   |

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