

## Automotive-grade N-channel 60 V, 21 mΩ typ., 32 A STripFET™ F6 Power MOSFET in a PowerFLAT™ 5x6 package

Datasheet - production data

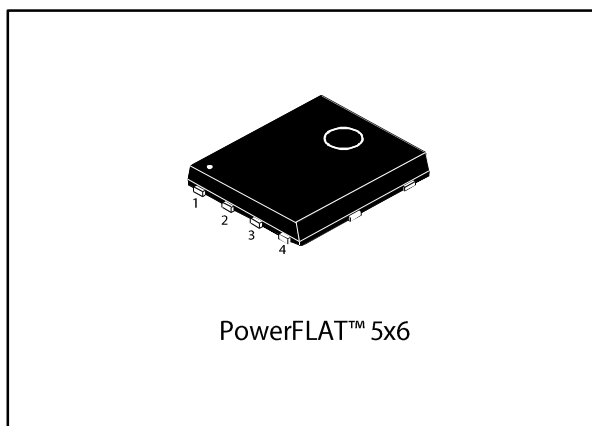


Figure 1: Internal schematic diagram

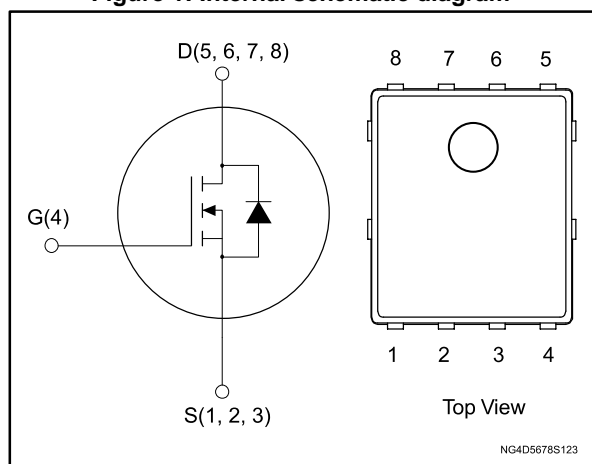


Table 1: Device summary

| Order code  | Marking | Package        | Packing       |
|-------------|---------|----------------|---------------|
| STL8N6LF6AG | 8N6LF6  | PowerFLAT™ 5x6 | Tape and reel |

### Features

| Order code  | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> | P <sub>TOT</sub> |
|-------------|-----------------|--------------------------|----------------|------------------|
| STL8N6LF6AG | 60 V            | 27 mΩ                    | 32 A           | 55 W             |

- Designed for automotive applications and AEC-Q101 qualified
- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss
- Wettable flank package

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R<sub>DS(on)</sub> in all packages.

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

| Symbol            | Parameter                                                            | Value      | Unit             |
|-------------------|----------------------------------------------------------------------|------------|------------------|
| $V_{DS}$          | Drain-source voltage                                                 | 60         | V                |
| $V_{GS}$          | Gate-source voltage                                                  | $\pm 20$   | V                |
| $I_D$             | Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$  | 32         | A                |
|                   | Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$ | 23         |                  |
| $I_D^{(1)}$       | Drain current (continuous) at $T_{pcb} = 25\text{ }^\circ\text{C}$   | 9.6        | A                |
|                   | Drain current (continuous) at $T_{pcb} = 100\text{ }^\circ\text{C}$  | 6.8        |                  |
| $I_{DM}^{(1)(2)}$ | Drain current (pulsed)                                               | 38         | A                |
| $I_{DM}^{(2)}$    | Drain current (pulsed)                                               | 128        | A                |
| $P_{TOT}$         | Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$           | 55         | W                |
| $P_{TOT}$         | Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$            | 4.8        |                  |
| $T_{stg}$         | Storage temperature                                                  | -55 to 175 | $^\circ\text{C}$ |
| $T_j$             | Operating junction temperature                                       |            |                  |

**Notes:**

- (1) When mounted on a 1-inch<sup>2</sup> FR-4, 2 Oz copper board,  $t < 10\text{ s}$ .  
 (2) Pulse width is limited by safe operating area.

**Table 3: Thermal data**

| Symbol              | Parameter                        | Value | Unit               |
|---------------------|----------------------------------|-------|--------------------|
| $R_{thj-case}$      | Thermal resistance junction-case | 2.7   | $^\circ\text{C/W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb  | 31.3  |                    |

**Notes:**

- (1) When mounted on a 1-inch<sup>2</sup> FR-4, 2 Oz copper board,  $t < 10\text{ s}$ .

**Table 4: Avalanche characteristics**

| Symbol         | Parameter                         | Value | Unit |
|----------------|-----------------------------------|-------|------|
| $I_{AV}$       | Avalanche current, not repetitive | 32    | A    |
| $E_{AS}^{(1)}$ | Single pulse avalanche energy     | 120   | mJ   |

**Notes:**

- (1) starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = I_{AV}$ ,  $V_{DD} = 43.5\text{ V}$ .

## 2 Electrical characteristics

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

**Table 5: Static**

| Symbol                      | Parameter                         | Test conditions                                                           | Min. | Typ. | Max.      | Unit          |
|-----------------------------|-----------------------------------|---------------------------------------------------------------------------|------|------|-----------|---------------|
| $V_{(\text{BR})\text{DSS}}$ | Drain-source breakdown voltage    | $V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$    | 60   |      |           | V             |
| $I_{\text{DSS}}$            | Zero gate voltage drain current   | $V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 60\text{ V}$              |      |      | 1         | $\mu\text{A}$ |
| $I_{\text{GSS}}$            | Gate-body leakage current         | $V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = \pm 20\text{ V}$          |      |      | $\pm 100$ | nA            |
| $V_{\text{GS(th)}}$         | Gate threshold voltage            | $V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$ | 1    |      | 2.5       | V             |
| $R_{\text{DS(on)}}$         | Static drain-source on-resistance | $V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 9.6\text{ A}$             |      | 21   | 27        | m $\Omega$    |
|                             |                                   | $V_{\text{GS}} = 4.5\text{ V}$ , $I_{\text{D}} = 9.6\text{ A}$            |      | 25   | 31        |               |

**Table 6: Dynamic**

| Symbol            | Parameter                    | Test conditions                                                                                                                                                                  | Min. | Typ. | Max. | Unit |
|-------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $C_{\text{iss}}$  | Input capacitance            | $V_{\text{DS}} = 25\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{\text{GS}} = 0\text{ V}$                                                                                             | -    | 1340 | -    | pF   |
| $C_{\text{oss}}$  | Output capacitance           |                                                                                                                                                                                  | -    | 90   | -    |      |
| $C_{\text{riss}}$ | Reverse transfer capacitance |                                                                                                                                                                                  | -    | 60   | -    |      |
| $Q_{\text{g}}$    | Total gate charge            | $V_{\text{DD}} = 30\text{ V}$ , $I_{\text{D}} = 9.6\text{ A}$ ,<br>$V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 14</a> :<br>"Test circuit for gate charge<br>behavior") | -    | 27   | -    | nC   |
| $Q_{\text{gs}}$   | Gate-source charge           |                                                                                                                                                                                  | -    | 4.6  | -    |      |
| $Q_{\text{gd}}$   | Gate-drain charge            |                                                                                                                                                                                  | -    | 4.3  | -    |      |

**Table 7: Switching times**

| Symbol              | Parameter           | Test conditions                                                                                                                                                                                                                                                                             | Min. | Typ. | Max. | Unit |
|---------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{\text{d(on)}}$  | Turn-on delay time  | $V_{\text{DD}} = 30\text{ V}$ , $I_{\text{D}} = 12.5\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$ ,<br>$V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 13</a> : "Test<br>circuit for resistive load switching<br>times" and <a href="#">Figure 18</a> : "Switching<br>time waveform") | -    | 9.6  | -    | ns   |
| $t_{\text{r}}$      | Rise time           |                                                                                                                                                                                                                                                                                             | -    | 20   | -    |      |
| $t_{\text{d(off)}}$ | Turn-off delay time |                                                                                                                                                                                                                                                                                             | -    | 56   | -    |      |
| $t_{\text{f}}$      | Fall time           |                                                                                                                                                                                                                                                                                             | -    | 7    | -    |      |

**Table 8: Source-drain diode**

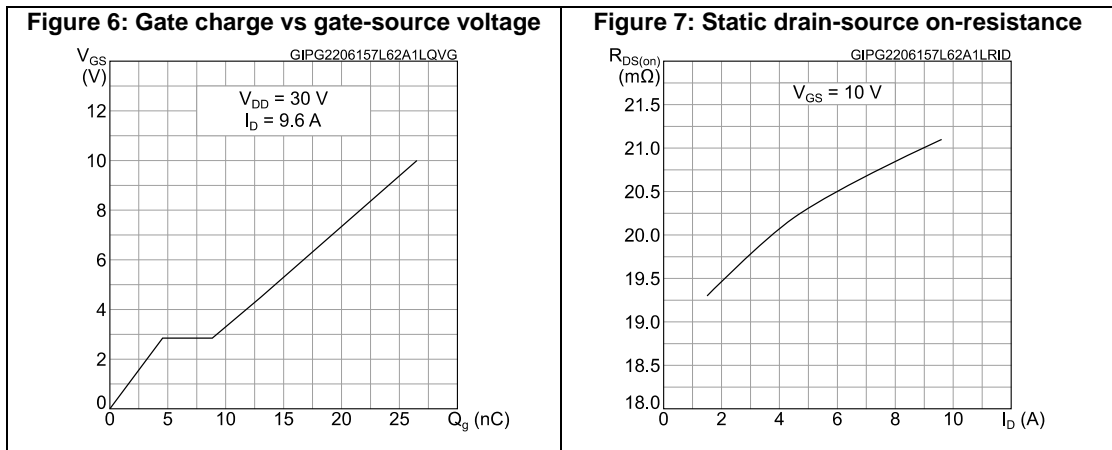
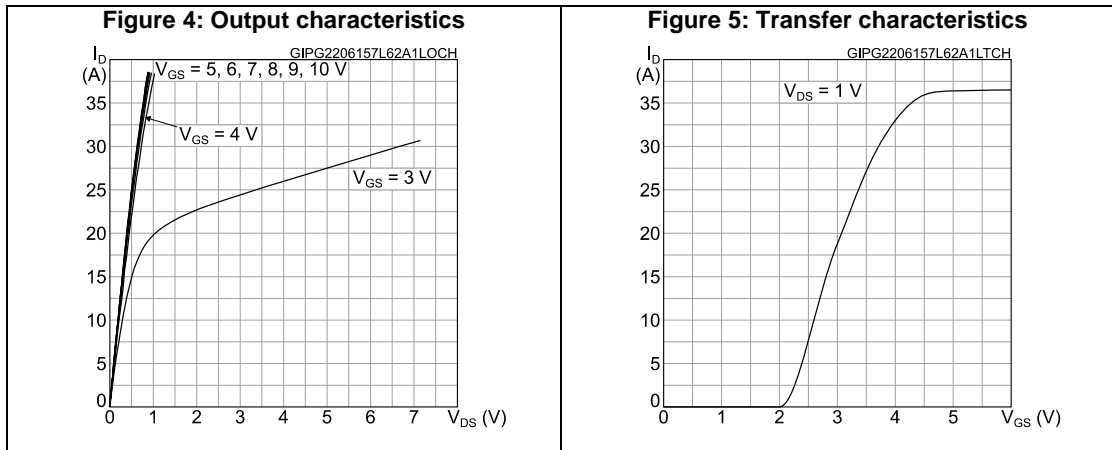
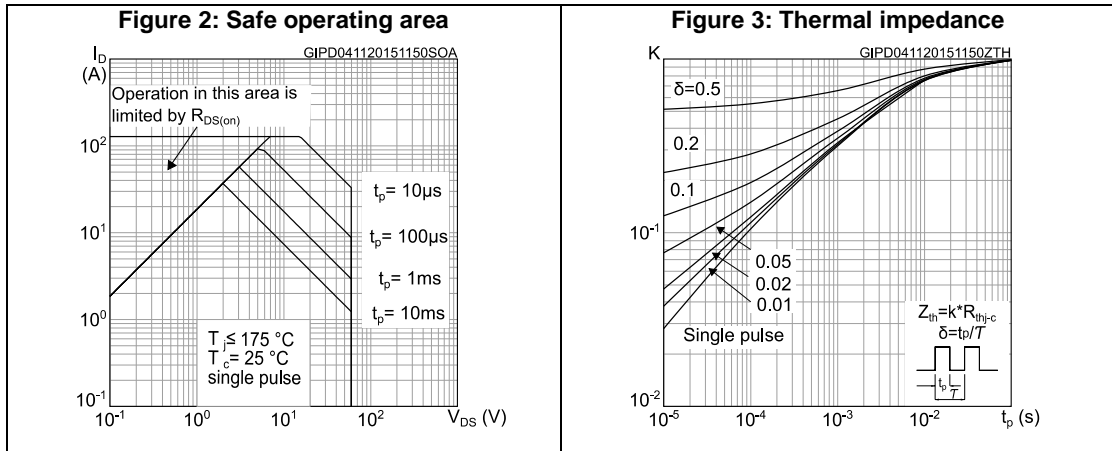
| Symbol                 | Parameter                     | Test conditions                                                                                                                                                                                                       | Min. | Typ. | Max. | Unit |
|------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{\text{SD}}$        | Source-drain current          |                                                                                                                                                                                                                       | -    |      | 9.6  | A    |
| $I_{\text{SDM}}^{(1)}$ | Source-drain current (pulsed) |                                                                                                                                                                                                                       | -    |      | 38   | A    |
| $V_{\text{SD}}^{(2)}$  | Forward on voltage            | $V_{\text{GS}} = 0\text{ V}$ , $I_{\text{SD}} = 9.6\text{ A}$                                                                                                                                                         | -    |      | 1.3  | V    |
| $t_{\text{rr}}$        | Reverse recovery time         | $I_{\text{SD}} = 25\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{\text{DD}} = 48\text{ V}$ (see <a href="#">Figure 15</a> :<br>"Test circuit for inductive<br>load switching and diode<br>recovery times") | -    | 22.5 |      | ns   |
| $Q_{\text{rr}}$        | Reverse recovery charge       |                                                                                                                                                                                                                       | -    | 22.2 |      | nC   |
| $I_{\text{RRM}}$       | Reverse recovery current      |                                                                                                                                                                                                                       | -    | 2.0  |      | A    |

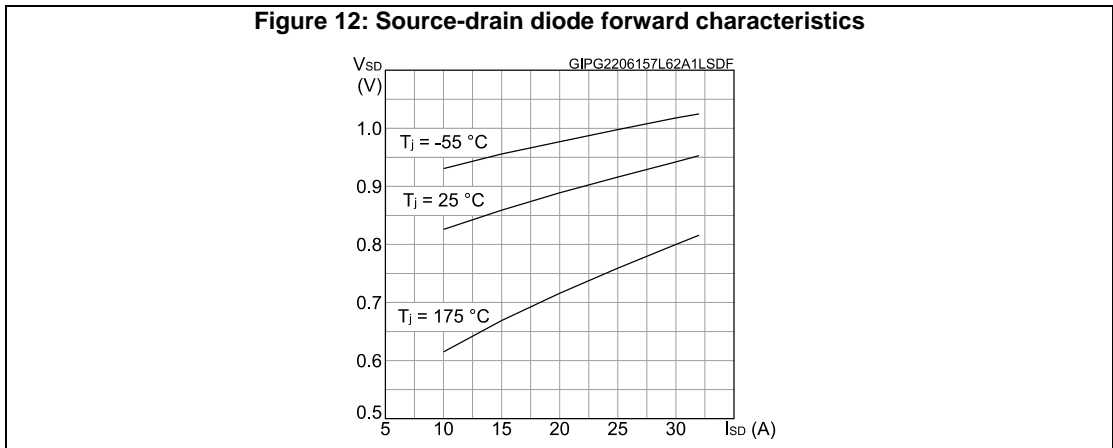
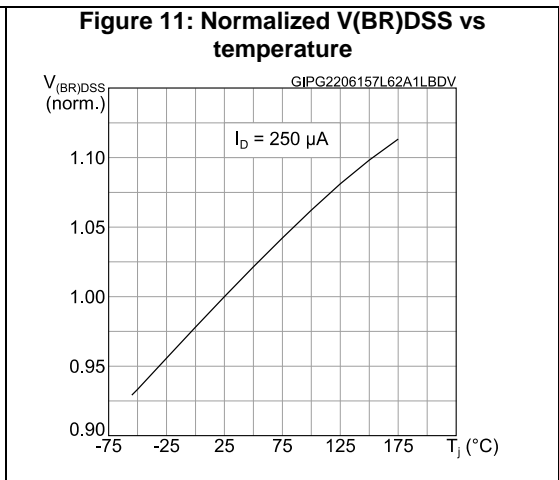
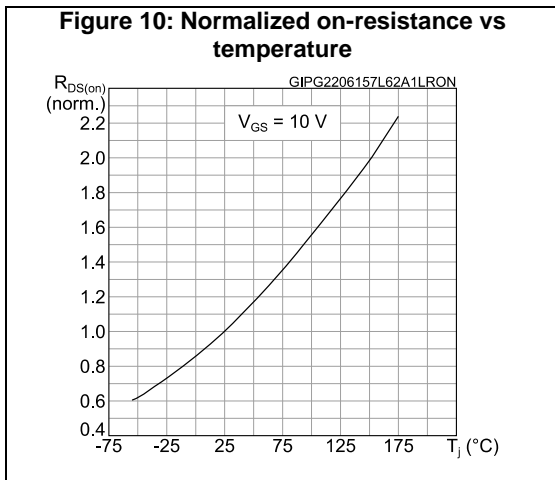
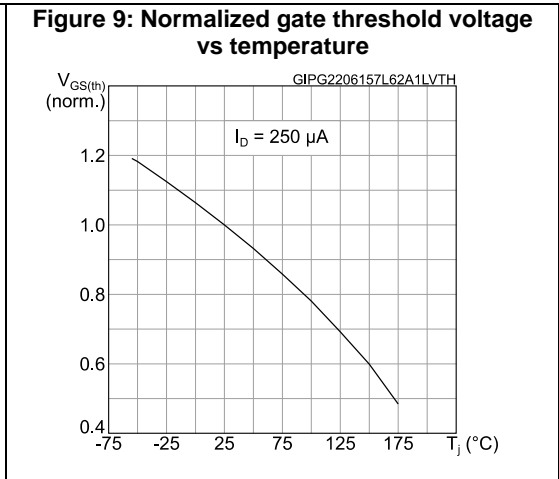
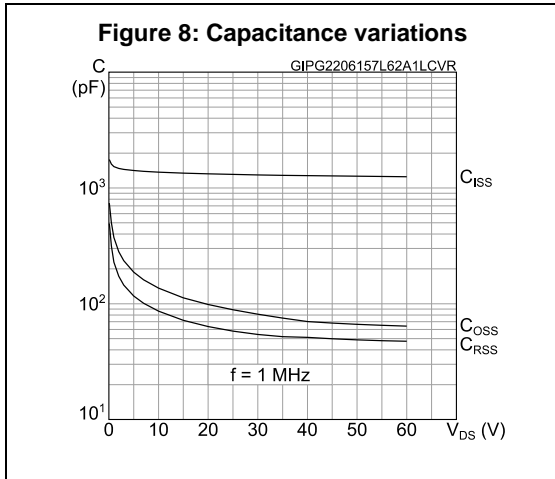
**Notes:**

(1) Pulse width is limited by safe operating area.

(2) Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

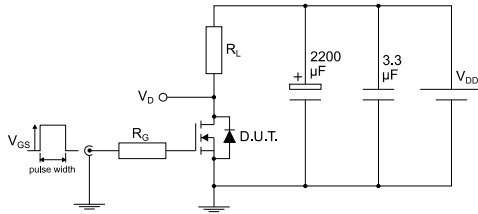
## 2.1 Electrical characteristics (curves)





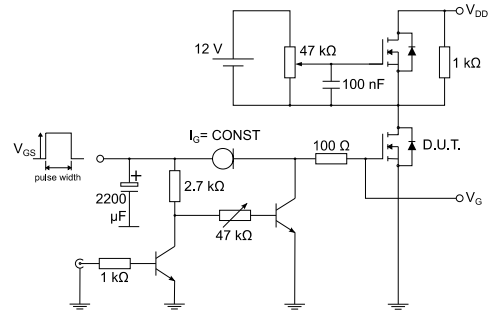
### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



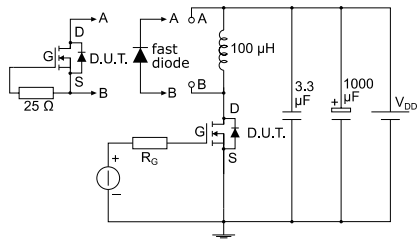
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**Figure 14: Test circuit for gate charge behavior**



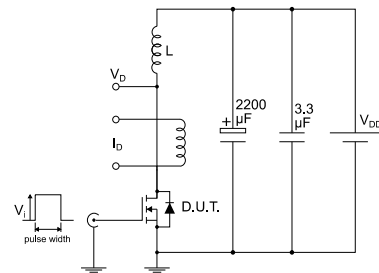
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



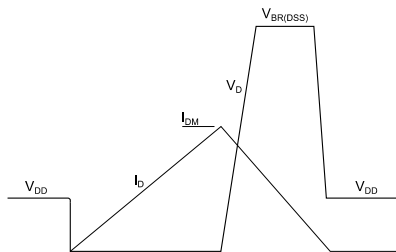
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**Figure 16: Unclamped inductive load test circuit**



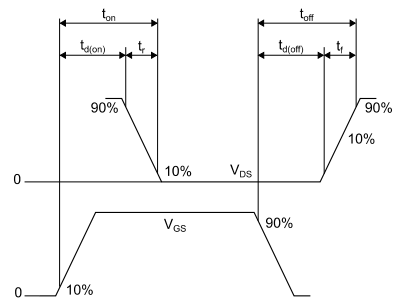
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**Figure 17: Unclamped inductive waveform**



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**Figure 18: Switching time waveform**



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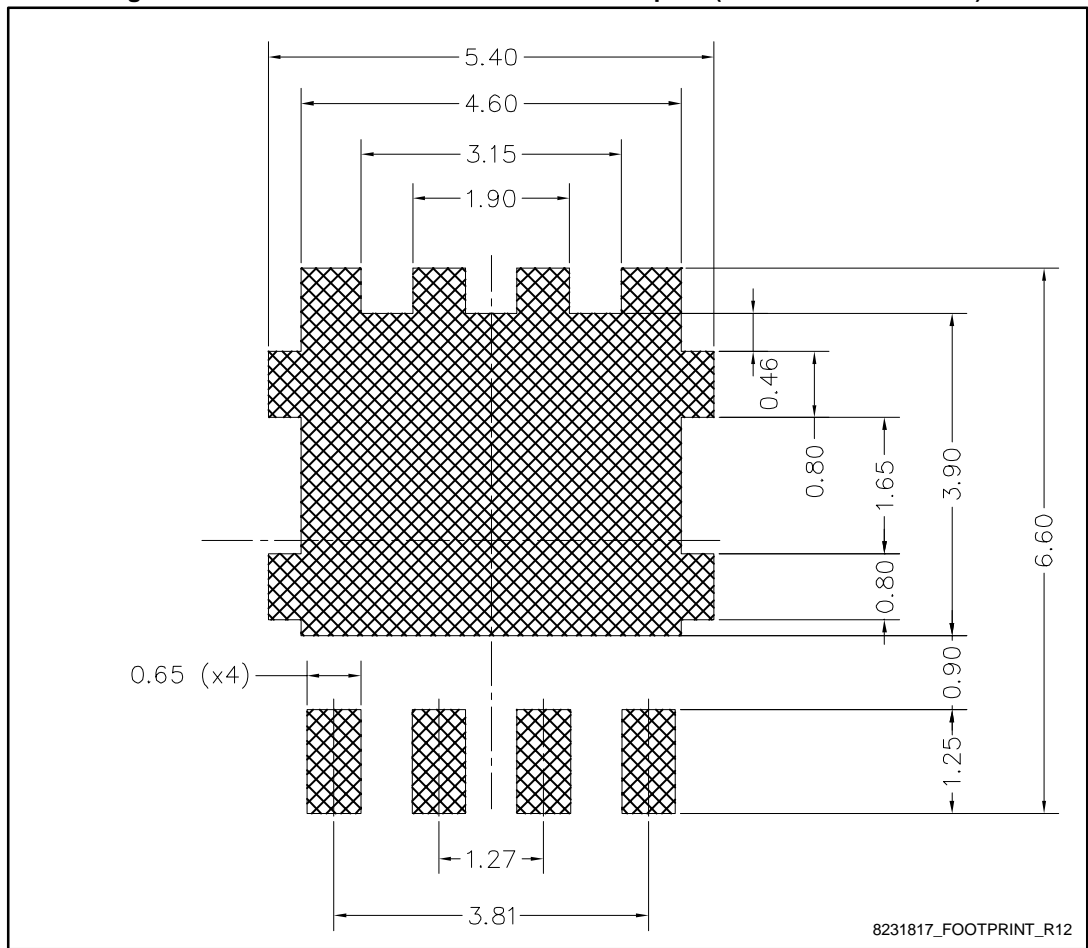




Table 9: PowerFLAT™ 5x6 WF type R mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 0.80  |       | 1.00  |
| A1   | 0.02  |       | 0.05  |
| A2   |       | 0.25  |       |
| b    | 0.30  |       | 0.50  |
| C    | 5.80  | 6.00  | 6.20  |
| D    | 5.00  | 5.20  | 5.40  |
| D2   | 4.15  |       | 4.45  |
| D3   | 4.05  | 4.20  | 4.35  |
| D4   | 4.80  | 5.0   | 5.20  |
| D5   | 0.25  | 0.4   | 0.55  |
| D6   | 0.15  | 0.3   | 0.45  |
| e    |       | 1.27  |       |
| E    | 6.20  | 6.40  | 6.60  |
| E2   | 3.50  |       | 3.70  |
| E3   | 2.35  |       | 2.55  |
| E4   | 0.40  |       | 0.60  |
| E5   | 0.08  |       | 0.28  |
| E6   | 0.175 | 0.325 | 0.450 |
| E7   | 0.85  | 1.00  | 1.15  |
| K    | 1.275 |       | 1.575 |
| L    | 0.725 | 0.825 | 0.925 |
| L1   | 0.175 | 0.275 | 0.375 |
| Θ    | 0°    |       | 12°   |

Figure 20: PowerFLAT™ 5x6 recommended footprint (dimensions are in mm)



4.2 PowerFLAT™ 5x6 WF packing information

Figure 21: PowerFLAT™ 5x6 WF tape

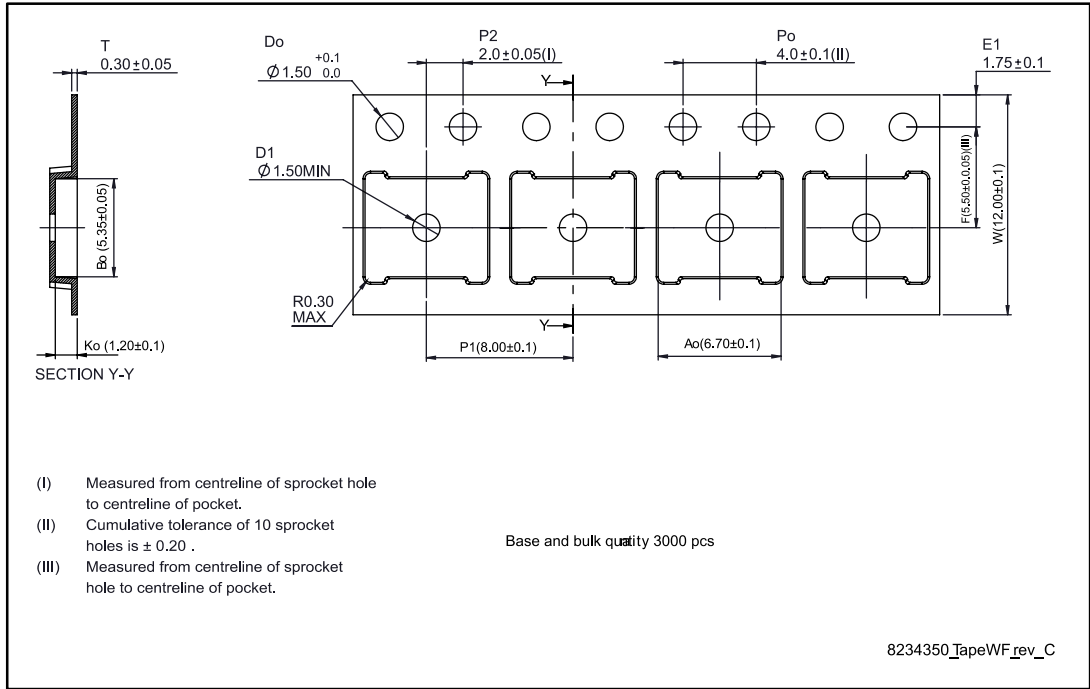


Figure 22: PowerFLAT™ 5x6 package orientation in carrier tape

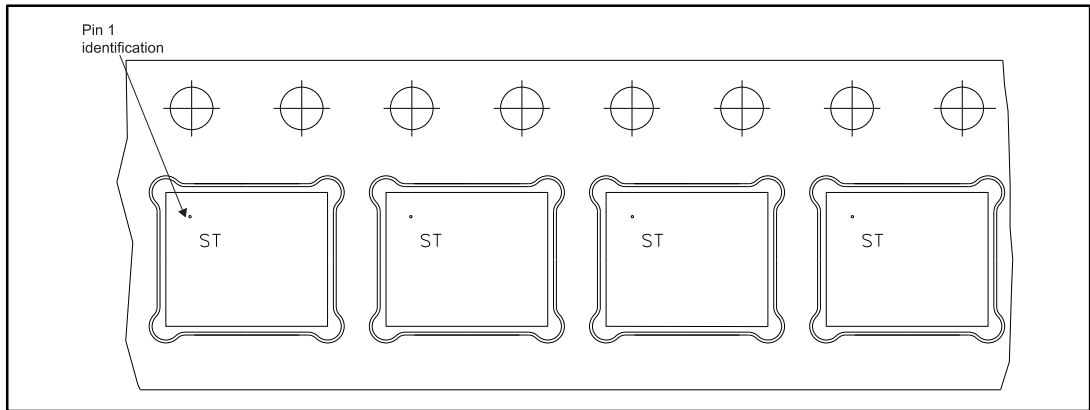
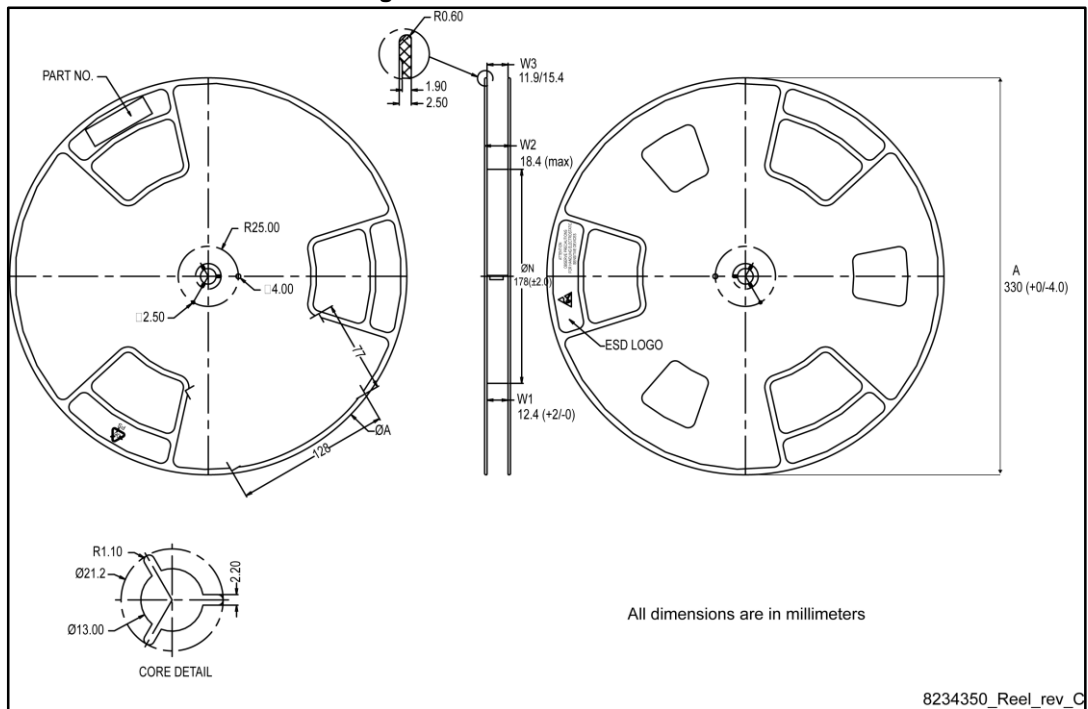


Figure 23: PowerFLAT™ 5x6 reel



## 5 Revision history

Table 10: Document revision history

| Date        | Revision | Changes                                                                                                                                                                                                               |
|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 06-Jul-2015 | 1        | First release.                                                                                                                                                                                                        |
| 07-Jan-2016 | 2        | Updated title and features in cover page.<br>Updated <i>Section 1: "Electrical ratings"</i> , <i>Section 2: "Electrical characteristics"</i> and <i>Section 4.1: "PowerFLAT™ 5x6 WF type R package information"</i> . |

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