

## N-channel 60 V, 4.6 mΩ typ., 46 A STripFET™ F7 Power MOSFET in a TO-220FP package

Datasheet - production data

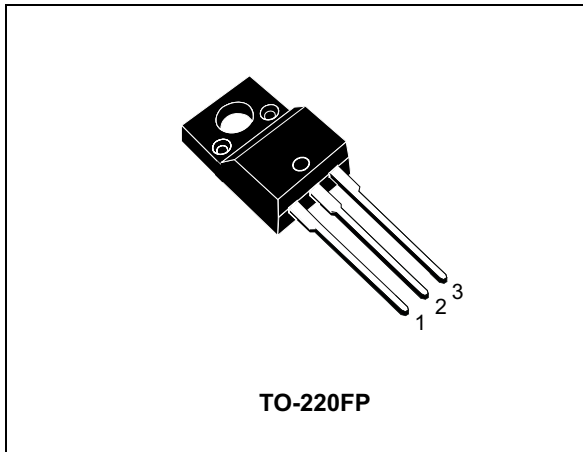
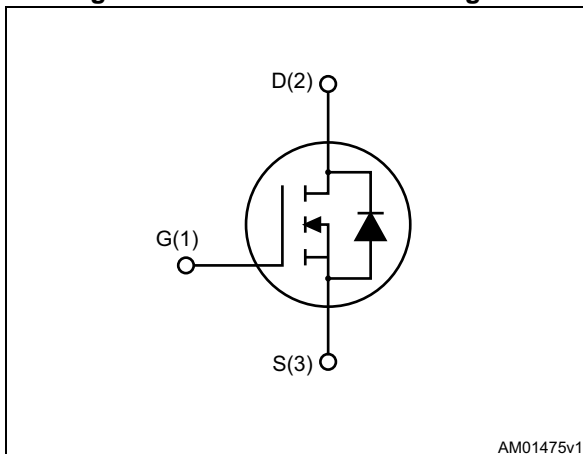


Figure 1. Internal schematic diagram



### Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> | P <sub>TOT</sub> |
|------------|-----------------|--------------------------|----------------|------------------|
| STF100N6F7 | 60 V            | 5.6 mΩ                   | 46 A           | 25 W             |

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent figure of merit (FoM)
- Low C<sub>rss</sub>/C<sub>iss</sub> ratio for EMI immunity
- High avalanche ruggedness

### Applications

- Switching applications

### Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

| Order code | Marking | Package  | Packaging |
|------------|---------|----------|-----------|
| STF100N6F7 | 100N6F7 | TO-220FP | Tube      |

## Contents

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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 $T_C = 25\text{ }^\circ\text{C}$  | 46 <sup>(1)</sup> | A                |
| $I_D$          | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$   | 33 <sup>(1)</sup> | A                |
| $I_{DM}^{(2)}$ | Drain current (pulsed)  | 184               | A                |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$   | 25                | W                |
| $E_{AS}^{(3)}$ | Single pulse avalanche energy   | 200               | mJ               |
| $dV/dt^{(4)}$  | Drain-body diode dynamic $dV/dt$ ruggedness   | 6                 | V/ns             |
| $V_{ISO}$      | Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t = 1\text{ s}$ ; $T_C = 25\text{ }^\circ\text{C}$ ) | 2500              | V                |
| $T_j$          | Operating junction temperature  | -55 to 175        | $^\circ\text{C}$ |
| $T_{stg}$      | Storage temperature   |                   |                  |

1. Limited by package
2. Pulse width is limited by safe operating area
3. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 20\text{ A}$ ,  $V_{DD} = 30\text{ V}$
4.  $I_{SD} = 46\text{ A}$ ;  $di/dt = 600\text{ A}/\mu\text{s}$ ;  $V_{DD} = 48\text{ V}$ ;  $T_j < T_{jmax}$

**Table 3. Thermal data**

| Symbol         | Parameter                           | Value | Unit                      |
|----------------|-------------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case    | 6     | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient | 62.5  | $^\circ\text{C}/\text{W}$ |

## 2 Electrical characteristics

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

**Table 4. On/off states**

| Symbol        | Parameter                         | Test conditions  | Min. | Typ. | Max. | Unit          |
|---------------|-----------------------------------|--|------|------|------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$                         | 60   |      |      | V             |
| $I_{DSS}$     | Zero gate voltage Drain current   | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$                      |      |      | 1    | $\mu\text{A}$ |
|               |                                   | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}, T_J = 125\text{ °C}$ |      |      | 100  | $\mu\text{A}$ |
| $I_{GSS}$     | Gate-source leakage current       | $V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$                      |      |      | 100  | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                  | 2    |      | 4    | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 10\text{ V}, I_D = 23\text{ A}$                        |      | 4.6  | 5.6  | m $\Omega$    |

**Table 5. Dynamic**

| Symbol    | Parameter                    | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$   | -    | 1980 | -    | pF   |
| $C_{oss}$ | Output capacitance           |   | -    | 970  | -    | pF   |
| $C_{rss}$ | Reverse transfer capacitance |   | -    | 86   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{DD} = 30\text{ V}, I_D = 46\text{ A}, V_{GS} = 10\text{ V}$ | -    | 30   | -    | nC   |
| $Q_{gs}$  | Gate-source charge           |   | -    | 12.6 | -    | nC   |
| $Q_{gd}$  | Gate-drain charge            |   | -    | 5.9  | -    | nC   |

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions  | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 30\text{ V}, I_D = 23\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ | -    | 21.6 | -    | ns   |
| $t_r$        | Rise time           |  | -    | 55.5 | -    | ns   |
| $t_{d(off)}$ | Turn-off-delay time |  | -    | 28.6 | -    | ns   |
| $t_f$        | Fall time           |  | -    | 15   | -    | ns   |

Table 7. Source drain diode

| Symbol         | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit |
|----------------|--------------------------|--|------|------|------|------|
| $V_{SD}^{(1)}$ | Forward on voltage       | $V_{GS} = 0 \text{ V}$ , $I_{SD} = 46 \text{ A}$   | -    |      | 1.2  | V    |
| $t_{rr}$       | Reverse recovery time    | $I_{SD} = 46 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 48 \text{ V}$ | -    | 48.4 |      | ns   |
| $Q_{rr}$       | Reverse recovery charge  |  | -    | 47   |      | nC   |
| $I_{RRM}$      | Reverse recovery current |  | -    | 2.0  |      | A    |

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

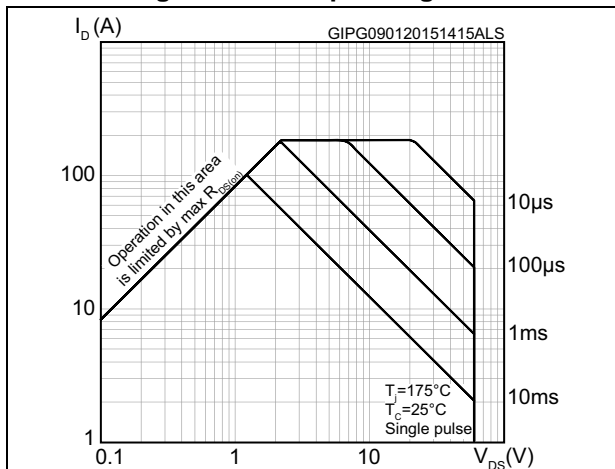


Figure 3. Thermal impedance

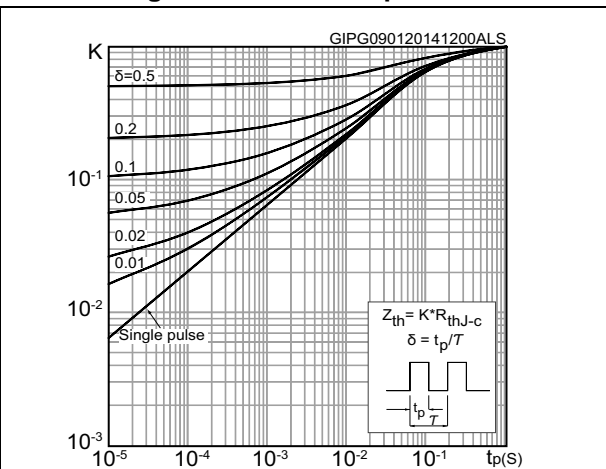


Figure 4. Output characteristics

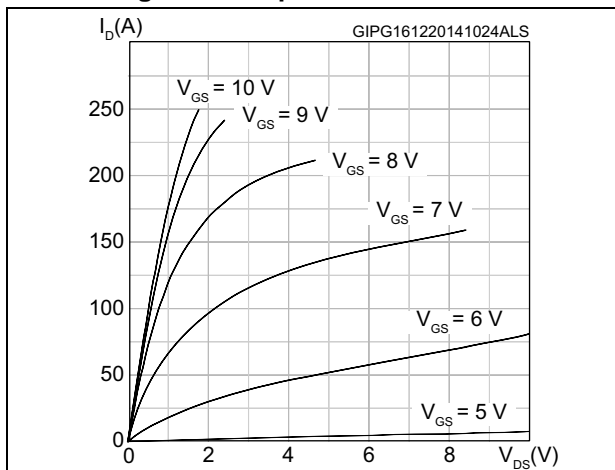


Figure 5. Transfer characteristics

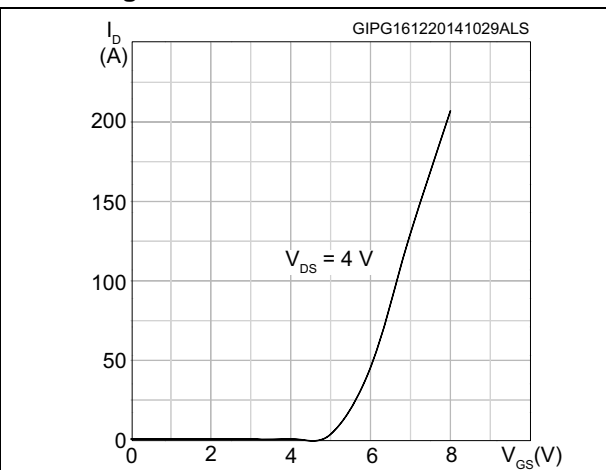


Figure 6. Gate charge vs gate-source voltage

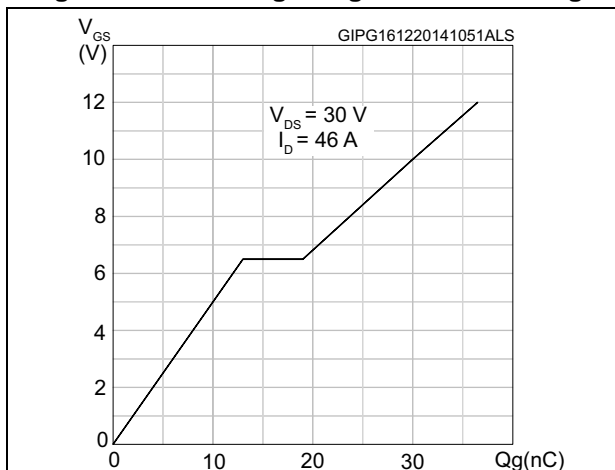


Figure 7. Static drain-source on-resistance

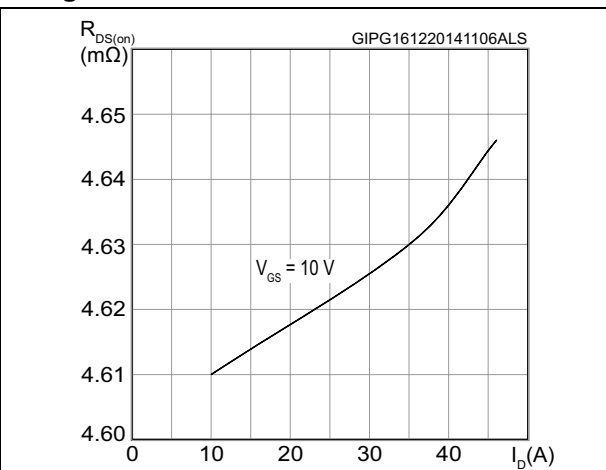


Figure 8. Capacitance variations

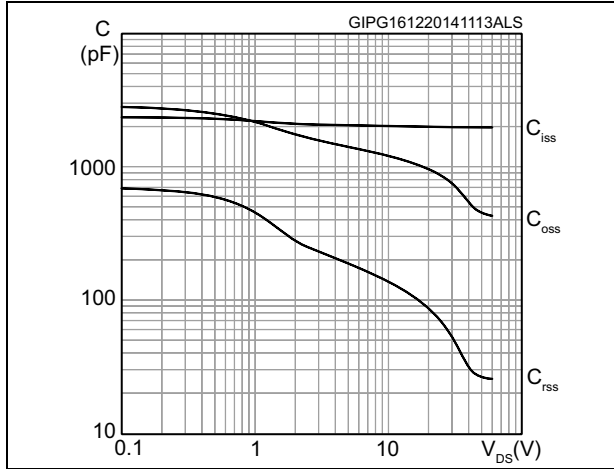


Figure 9. Normalized gate threshold voltage vs temperature

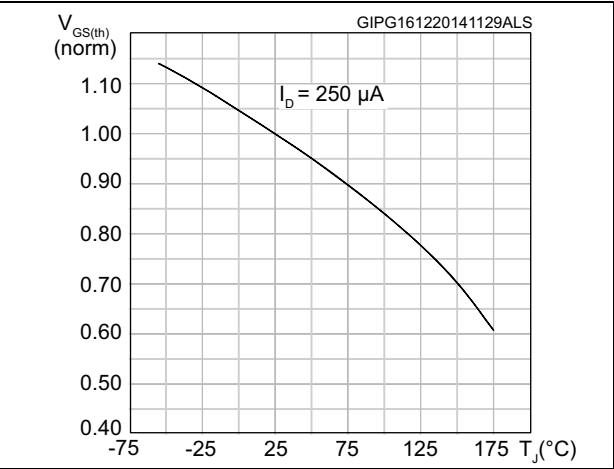


Figure 10. Normalized on-resistance vs temperature

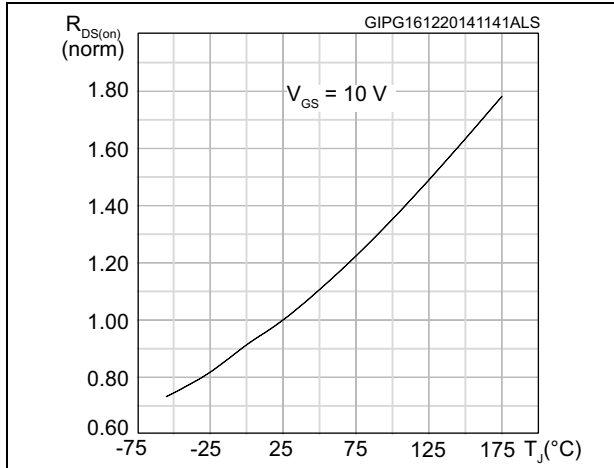


Figure 11. Source-drain diode forward characteristics

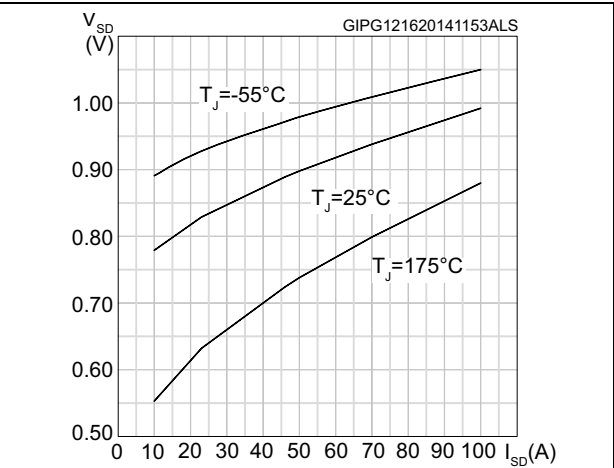
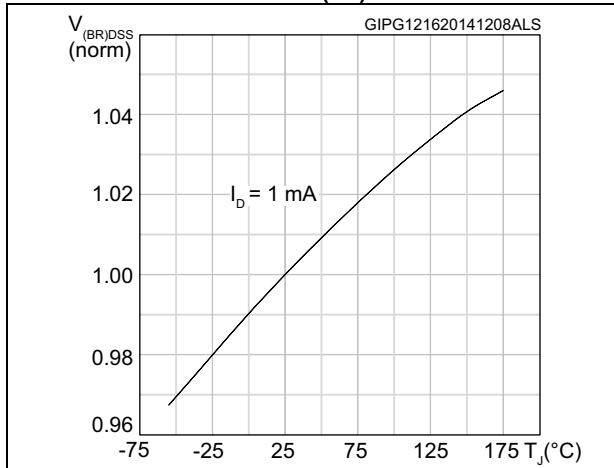


Figure 12. Normalized V\_(BR)DSS vs temperature



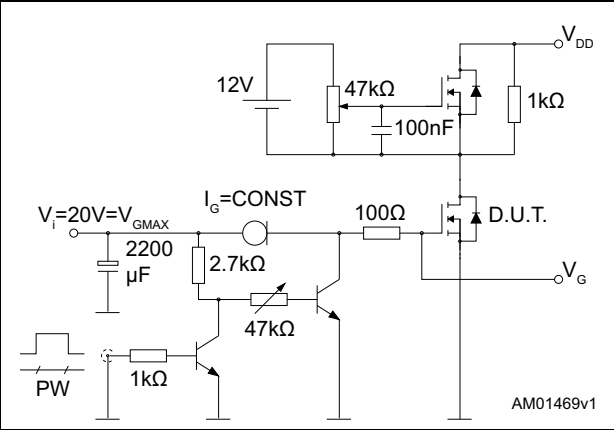
### 3 Test circuits

Figure 13. Switching times test circuit for resistive load



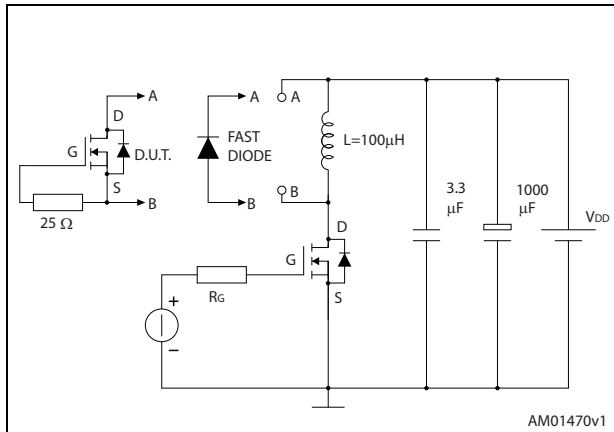
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Figure 14. Gate charge test circuit



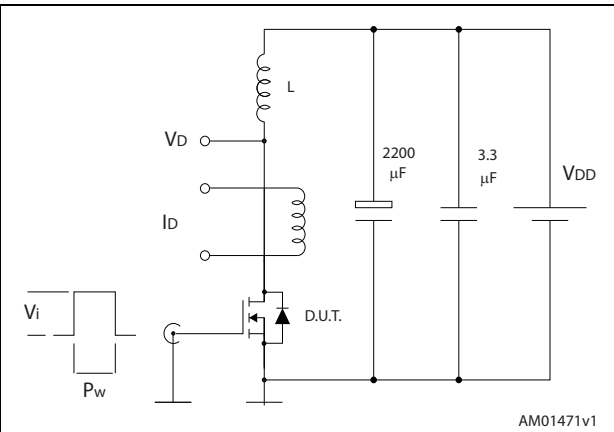
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Figure 15. Test circuit for inductive load switching and diode recovery times



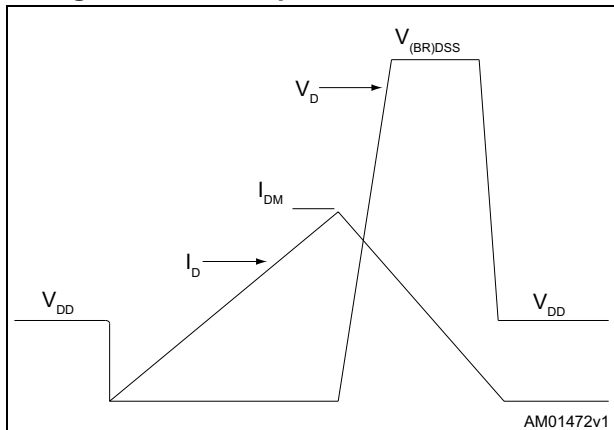
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Figure 16. Unclamped inductive load test circuit



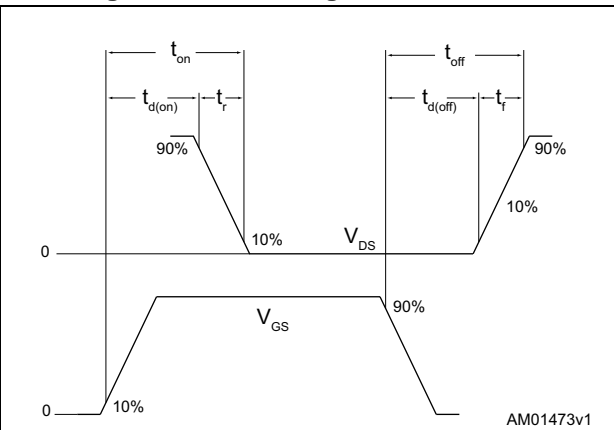
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Figure 17. Unclamped inductive waveform



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Figure 18. Switching time waveform



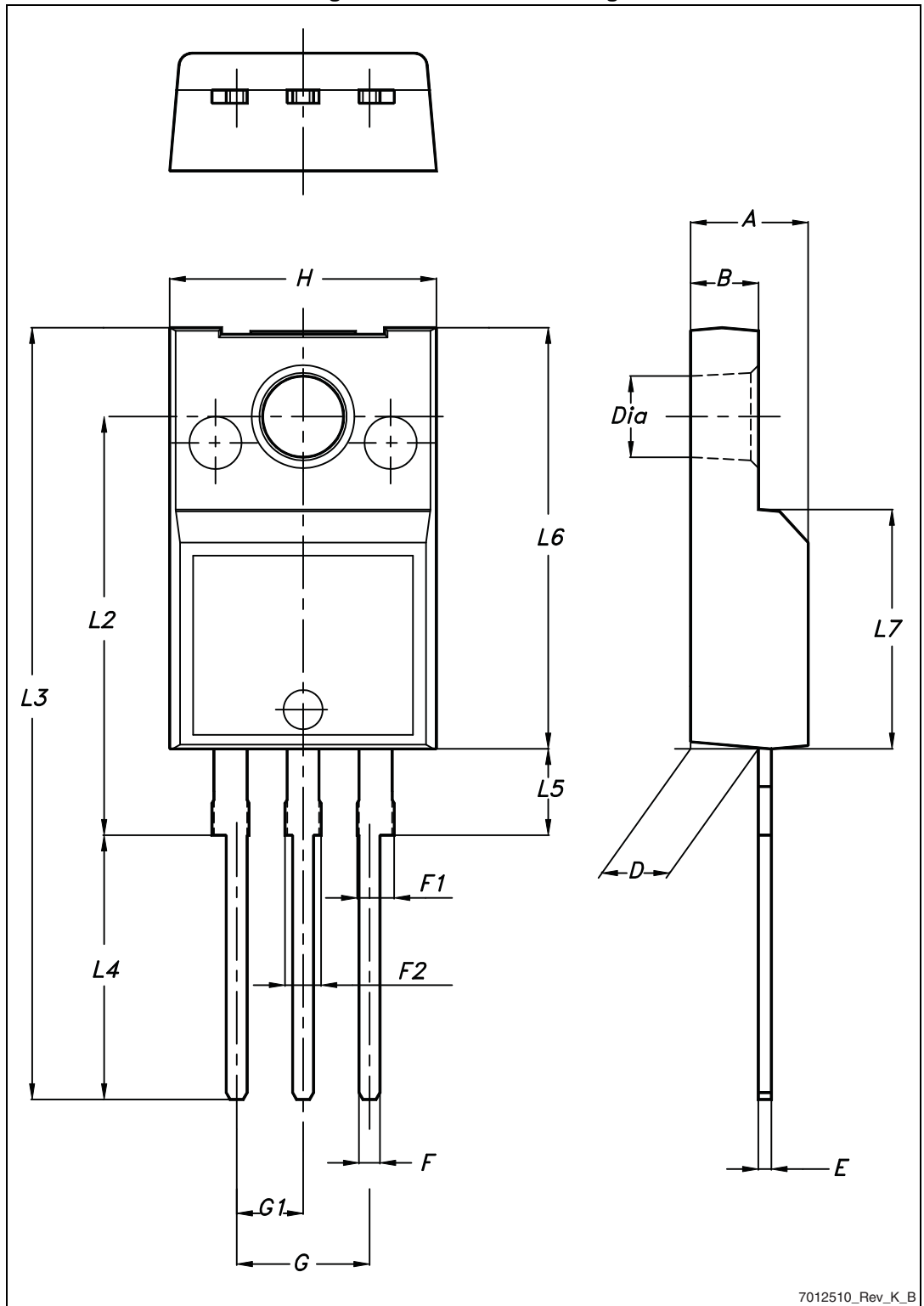
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## 4 Package mechanical data

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<sup>®</sup> is an ST trademark.

Figure 19. TO-220FP drawing



7012510\_Rev\_K\_B

Table 8. TO-220FP mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 4.4  |      | 4.6  |
| B    | 2.5  |      | 2.7  |
| D    | 2.5  |      | 2.75 |
| E    | 0.45 |      | 0.7  |
| F    | 0.75 |      | 1    |
| F1   | 1.15 |      | 1.70 |
| F2   | 1.15 |      | 1.70 |
| G    | 4.95 |      | 5.2  |
| G1   | 2.4  |      | 2.7  |
| H    | 10   |      | 10.4 |
| L2   |      | 16   |      |
| L3   | 28.6 |      | 30.6 |
| L4   | 9.8  |      | 10.6 |
| L5   | 2.9  |      | 3.6  |
| L6   | 15.9 |      | 16.4 |
| L7   | 9    |      | 9.3  |
| Ø    | 3    |      | 3.2  |

## 5 Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 25-Nov-2014 | 1        | First release.  |
| 16-Jan-2015 | 2        | In <a href="#">Section 1</a> , updated <a href="#">Table 2: Absolute maximum ratings</a><br>In <a href="#">Section 2</a> ,<br>– updated <a href="#">Table 4: On/off states</a><br>– updated <a href="#">Table 5: Dynamic</a><br>– updated <a href="#">Table 6: Switching times</a><br>– updated <a href="#">Table 7: Source drain diode</a><br>Added <a href="#">Section 2.1: Electrical characteristics (curves)</a> |
| 10-Feb-2015 | 3        | Inserted dV/dt value in <a href="#">Table 2: Absolute maximum ratings</a> .   |

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