

## N-channel 80 V, 6.4 mΩ typ., 80 A, STripFET™ F7 Power MOSFET in a TO-220 package

Datasheet - production data

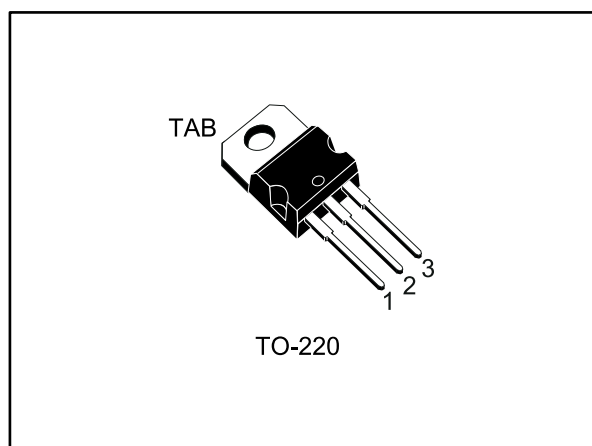


Figure 1: Internal schematic diagram

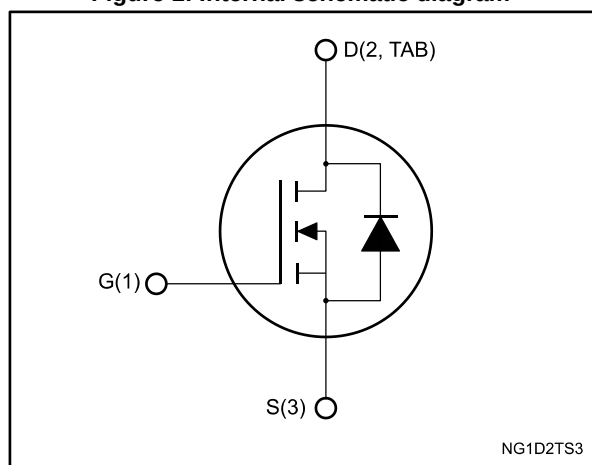


Table 1: Device summary

| Order code | Marking | Package | Packaging |
|------------|---------|---------|-----------|
| STP110N8F7 | 110N8F7 | TO-220  | Tube      |

### Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)max</sub> | I <sub>D</sub> | P <sub>TOT</sub> |
|------------|-----------------|------------------------|----------------|------------------|
| STP110N8F7 | 80 V            | 7.5 mΩ                 | 80 A           | 170 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.

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol                  | Parameter                                                         | Value             | Unit               |
|-------------------------|-------------------------------------------------------------------|-------------------|--------------------|
| $V_{DS}$                | Drain-source voltage                                              | 80                | V                  |
| $V_{GS}$                | Gate-source voltage                                               | $\pm 20$          | V                  |
| $I_D$                   | Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$  | 80 <sup>(1)</sup> | A                  |
| $I_D$                   | Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$ | 76                | A                  |
| $I_{DM}$ <sup>(2)</sup> | Drain current (pulsed)                                            | 320               | A                  |
| $P_{TOT}$               | Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$           | 170               | W                  |
| $E_{AS}$ <sup>(3)</sup> | Single pulse avalanche energy                                     | 220               | mJ                 |
| $T_J$                   | Operating junction temperature                                    | -55 to 175        | $^{\circ}\text{C}$ |
| $T_{stg}$               | Storage temperature                                               |                   | $^{\circ}\text{C}$ |

**Notes:**<sup>(1)</sup>Limited by package<sup>(2)</sup>Pulse width is limited by safe operating area<sup>(3)</sup>Starting  $T_J = 25^{\circ}\text{C}$ ,  $I_d = 25\text{ A}$ ,  $V_{dd} = 40\text{ V}$ 

Table 3: Thermal data

| Symbol         | Parameter                               | Value | Unit                 |
|----------------|-----------------------------------------|-------|----------------------|
| $R_{thj-case}$ | Thermal resistance junction-case max    | 0.88  | $^{\circ}\text{C/W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max | 62.5  | $^{\circ}\text{C/W}$ |

## 2 Electrical characteristics

( $T_C = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

Table 4: On /off states

| Symbol        | Parameter                          | Test conditions                                                       | Min. | Typ. | Max.      | Unit          |
|---------------|------------------------------------|-----------------------------------------------------------------------|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage     | $V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$                            | 80   |      |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current    | $V_{GS} = 0, V_{DS} = 80\text{ V}$                                    |      |      | 1         | $\mu\text{A}$ |
|               |                                    | $V_{GS} = 0, V_{DS} = 80\text{ V}, T_C = 125\text{ }^{\circ}\text{C}$ |      |      | 10        | $\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current          | $V_{DS} = 0, V_{GS} = \pm 20\text{ V}$                                |      |      | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate threshold voltage             | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                       | 2.5  |      | 4.5       | V             |
| $R_{DS(on)}$  | Static drain-source on- resistance | $V_{GS} = 10\text{ V}, I_D = 40\text{ A}$                             |      | 6.4  | 7.5       | m $\Omega$    |

Table 5: Dynamic

| Symbol    | Parameter                    | Test conditions                                                                                                                              | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{GS} = 0, V_{DS} = 40\text{ V}, f = 1\text{ MHz}$                                                                                         | -    | 3435 | -    | pF   |
| $C_{oss}$ | Output capacitance           |                                                                                                                                              | -    | 653  | -    | pF   |
| $C_{rss}$ | Reverse transfer capacitance |                                                                                                                                              | -    | 57   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{DD} = 40\text{ V}, I_D = 80\text{ A}, V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> ) | -    | 46.8 | -    | nC   |
| $Q_{gs}$  | Gate-source charge           |                                                                                                                                              | -    | 23.4 | -    | nC   |
| $Q_{gd}$  | Gate-drain charge            |                                                                                                                                              | -    | 11.2 | -    | nC   |

Table 6: Switching times

| Symbol       | Parameter           | Test conditions                                                                                                                                                                                                                          | Min. | Typ. | Max. | Unit |
|--------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 40\text{ V}, I_D = 40\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 13: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 18: "Switching time waveform"</a> ) | -    | 49   | -    | ns   |
| $t_r$        | Rise time           |                                                                                                                                                                                                                                          | -    | 95   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                                                                                                                                                                          | -    | 60   | -    | ns   |
| $t_f$        | Fall time           |                                                                                                                                                                                                                                          | -    | 32   | -    | ns   |

Table 7: Source drain diode

| Symbol         | Parameter                | Test conditions                                                                                                                                                              | Min. | Typ. | Max. | Unit |
|----------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $V_{SD}^{(1)}$ | Forward on voltage       | $V_{GS} = 0$ , $I_{SD} = 80$ A                                                                                                                                               | -    |      | 1.2  | V    |
| $t_{rr}$       | Reverse recovery time    | $I_{SD} = 80$ A, $di/dt = 100$ A/ $\mu$ s<br>$V_{DD} = 60$ V (see <a href="#">Figure 15</a> :<br>"Test circuit for inductive<br>load switching and diode<br>recovery times") | -    | 48.6 |      | ns   |
| $Q_{rr}$       | Reverse recovery charge  |                                                                                                                                                                              | -    | 58.6 |      | nC   |
| $I_{RRM}$      | Reverse recovery current |                                                                                                                                                                              | -    | 2.4  |      | A    |

**Notes:**

<sup>(1)</sup>Pulsed: pulse duration = 300  $\mu$ s, duty cycle 1.5%

## 2.2 Electrical characteristics (curves)

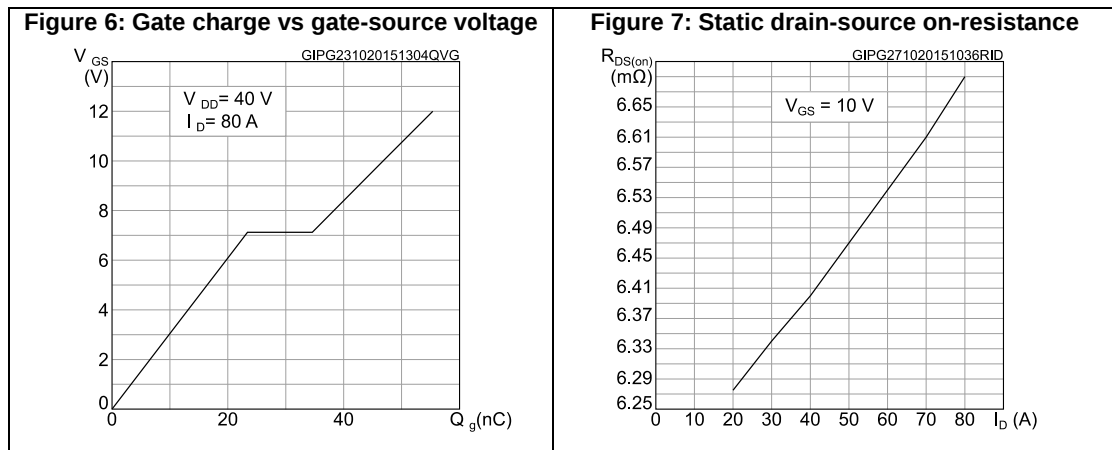
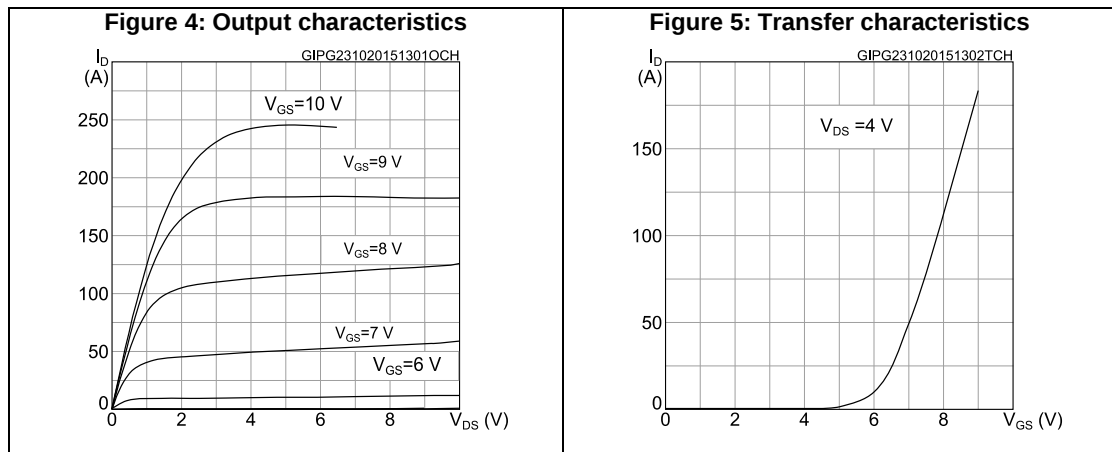
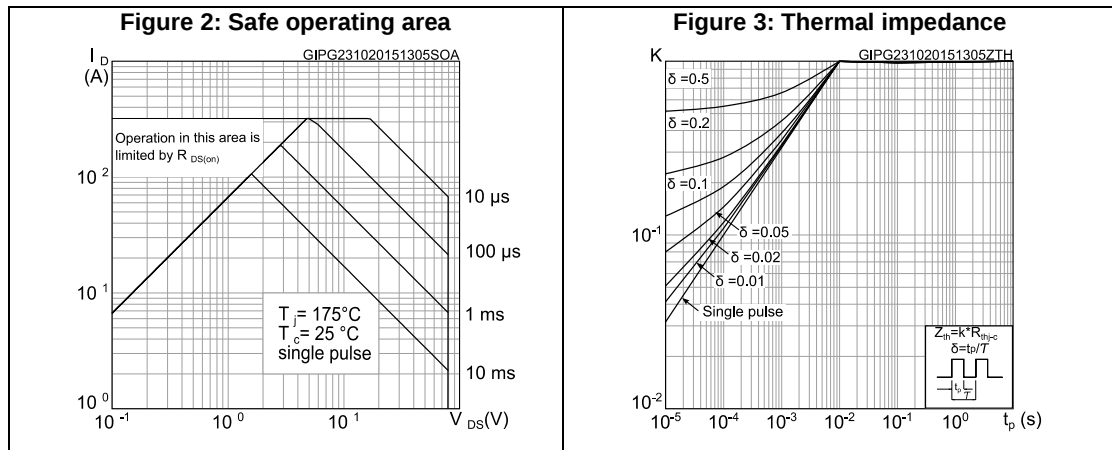


Figure 8: Capacitance variations

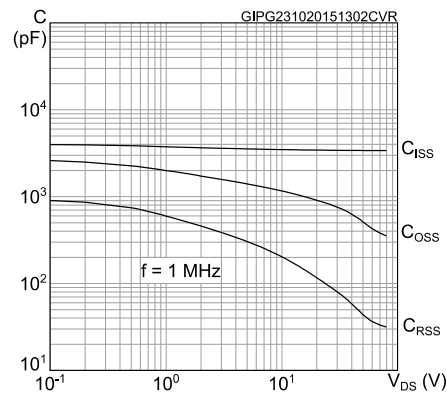


Figure 9: Normalized gate threshold voltage vs temperature

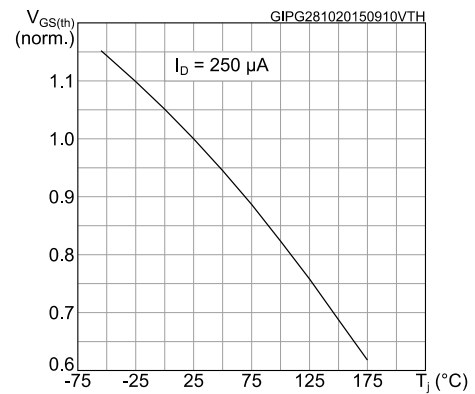


Figure 10: Normalized on-resistance vs temperature

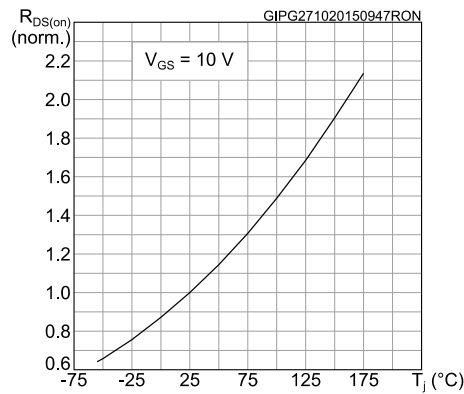
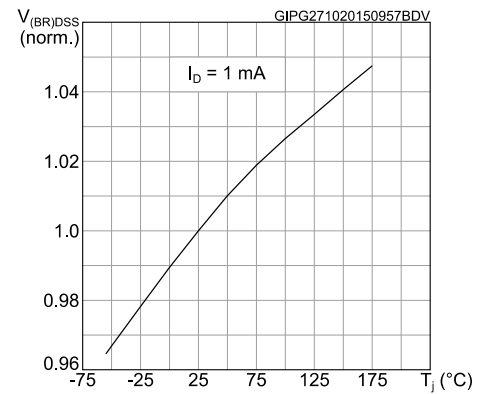
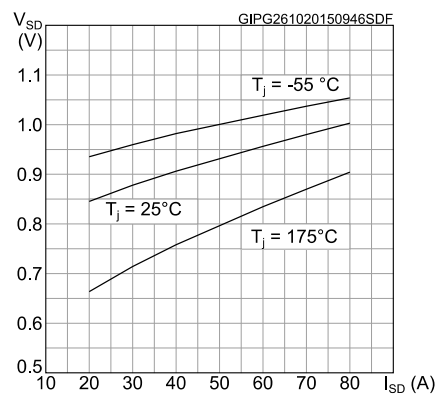
Figure 11: Normalized  $V_{(BR)DSS}$  vs temperature

Figure 12: Source-drain diode forward characteristics



### 3 Test circuits

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



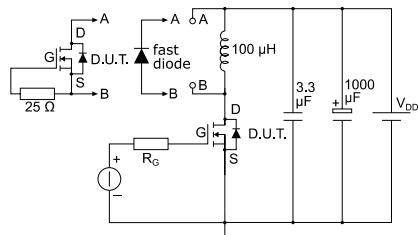
AM01468v1

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



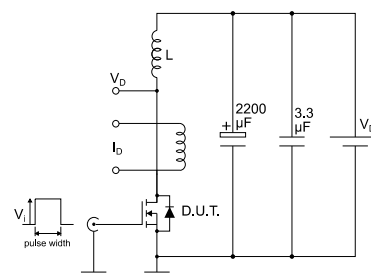
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



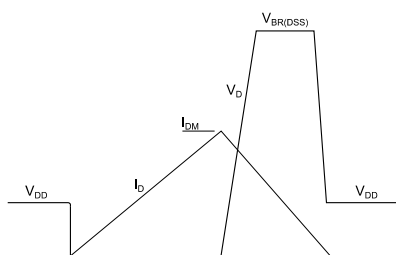
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**Figure 16: Unclamped inductive load test circuit**



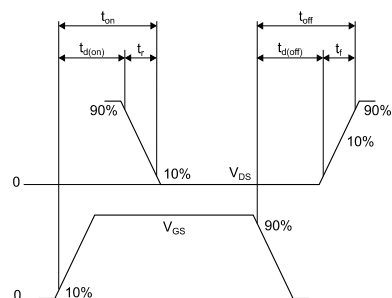
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**Figure 17: Unclamped inductive waveform**



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<sup>®</sup> is an ST trademark.

## 4.1 TO-220 package mechanical data

Figure 19: TO-220 type A package outline

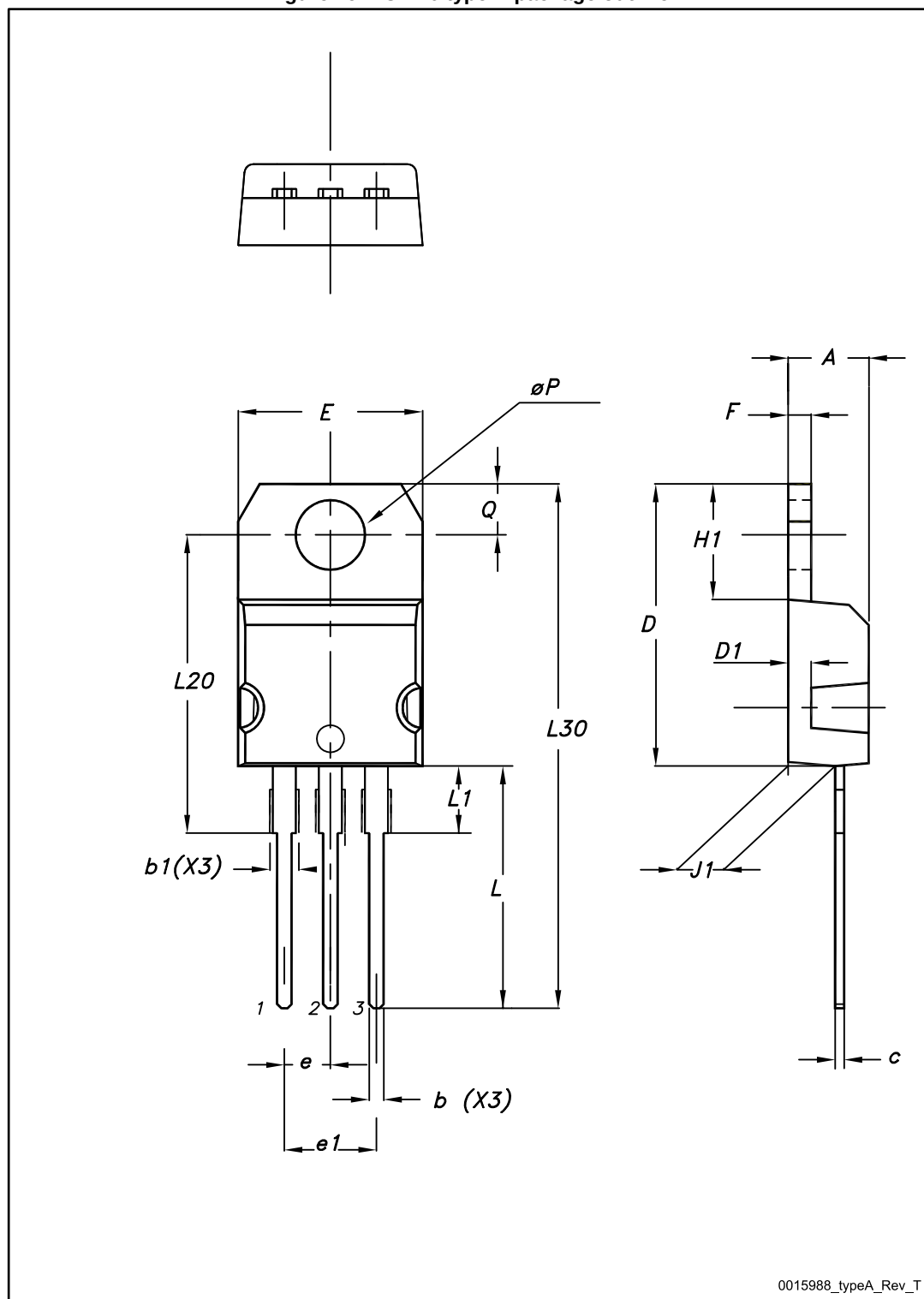


Table 8: TO-220 type A mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.40  |       | 4.60  |
| b    | 0.61  |       | 0.88  |
| b1   | 1.14  |       | 1.70  |
| c    | 0.48  |       | 0.70  |
| D    | 15.25 |       | 15.75 |
| D1   |       | 1.27  |       |
| E    | 10    |       | 10.40 |
| e    | 2.40  |       | 2.70  |
| e1   | 4.95  |       | 5.15  |
| F    | 1.23  |       | 1.32  |
| H1   | 6.20  |       | 6.60  |
| J1   | 2.40  |       | 2.72  |
| L    | 13    |       | 14    |
| L1   | 3.50  |       | 3.93  |
| L20  |       | 16.40 |       |
| L30  |       | 28.90 |       |
| øP   | 3.75  |       | 3.85  |
| Q    | 2.65  |       | 2.95  |

## 5 Revision history

**Table 9: Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                        |
|-------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10-Nov-2014 | 1        | Initial release.                                                                                                                                                                                                                                                                                                                                               |
| 04-Nov-2015 | 2        | Datasheet promoted from target to production data.<br>Modified: <a href="#">Table 2: "Absolute maximum ratings"</a> , <a href="#">Table 5: "Dynamic"</a> ,<br><a href="#">Table 6: "Switching times"</a> and <a href="#">Table 7: "Source drain diode"</a><br>Added: <a href="#">Section 4.1: "Electrical characteristics (curves)"</a><br>Minor text changes. |

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