



STP78N75F4

N-channel 75 V, 0.0092 Ω typ., 78 A STripFET™ DeepGATE™ Power MOSFET in TO-220 package

Datasheet — production data

Features

| Type | V _{DSS} | R _{DS(on)} max | I _D |
|------------|------------------|-------------------------|----------------|
| STP78N75F4 | 75 V | < 0.011 Ω | 78 A |

- N-channel enhancement mode
- 100% avalanche rated
- Low gate charge
- Very low on-resistance

Application

- Switching applications

Description

This device is an N-channel Power MOSFET developed using ST's STripFET™ DeepGATE™ technology. The device has a new gate structure and is specially designed to minimize on-state resistance to provide superior switching performance.

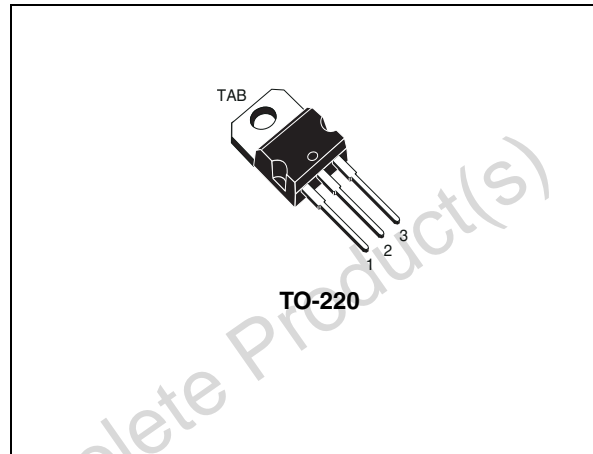


Figure 1. Internal schematic diagram

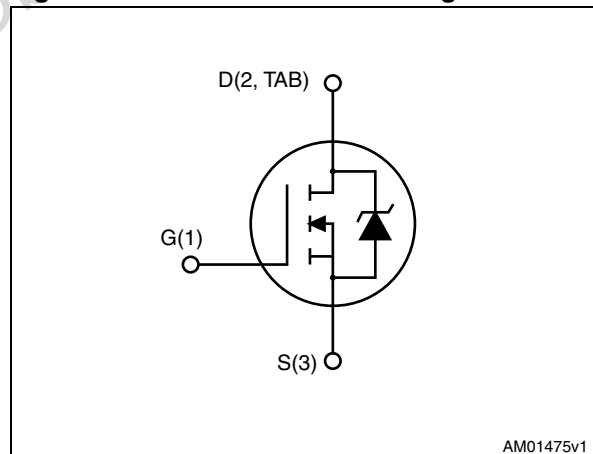


Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|---------|---------|-----------|
| STP78N75F4 | 78N75F4 | TO-220 | Tube |

Contents

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Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---|-------------|---------------------|
| V_{DS} | Drain-source voltage | 75 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 78 | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 55 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 312 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 150 | W |
| | Derating factor | 1 | W/ $^\circ\text{C}$ |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy | 185 | mJ |
| T_{stg} | Storage temperature | - 55 to 175 | $^\circ\text{C}$ |
| T_j | Operating junction temperature | | |

1. Pulse width limited by safe operating area

2. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 35\text{ A}$, $V_{DD} = 50\text{ V}$

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|----------------|---|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case max | 1 | $^\circ\text{C}/\text{W}$ |
| R_{thj-a} | Thermal resistance junction-ambient max | 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 | $I_D = 250\ \mu\text{A}$, $V_{GS} = 0$ | 75 | | | V |
| I_{DSS} | Zero gate voltage Drain current ($V_{GS} = 0$) | $V_{DS} = 75\text{ V}$ | | | 1 | μA |
| | | $V_{DS} = 75\text{ V}$, $T_C = 125\text{ °C}$ | | | 100 | μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$ | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$, $I_D = 39\text{ A}$ | | 0.0092 | 0.011 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| C_{iss} | Input capacitance | | | 5015 | | pF |
| C_{oss} | Output capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | - | 382 | - | pF |
| C_{rss} | Reverse transfer capacitance | | | 218 | | pF |
| Q_g | Total gate charge | $V_{DD} = 37.5\text{ V}$, $I_D = 78\text{ A}$, | | 76 | | nC |
| Q_{gs} | Gate-source charge | $V_{GS} = 10\text{ V}$ | - | 23 | - | nC |
| Q_{gd} | Gate-drain charge | (see Figure 14) | | 18.5 | | nC |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 37.5\text{ V}$, $I_D = 39\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13) | - | 25 | - | ns |
| t_r | Rise time | | - | 33 | - | ns |
| $t_{d(off)}$ | Turn-off-delay time | (see Figure 13) | - | 61 | - | ns |
| t_f | Fall time | | - | 14 | - | ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|-----------------|-------------------------------|--|------|------|-----|------|
| I_{SD} | Source-drain current | | - | | 78 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 312 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 78 \text{ A}, V_{GS} = 0$ | - | | 1.5 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 78 \text{ A}, V_{DD} = 60 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s},$ $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 15)</i> | - | 67 | | ns |
| Q_{rr} | Reverse recovery charge | | | 183 | | nC |
| I_{RRM} | Reverse recovery current | | | 5.5 | | A |

1. Pulse width limited by safe operating area.

2. Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

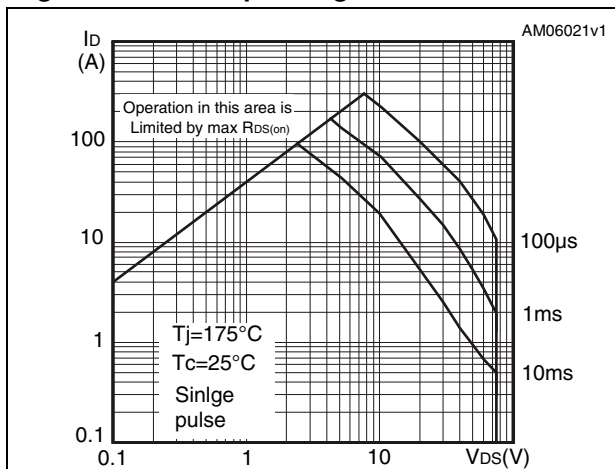


Figure 3. Thermal impedance

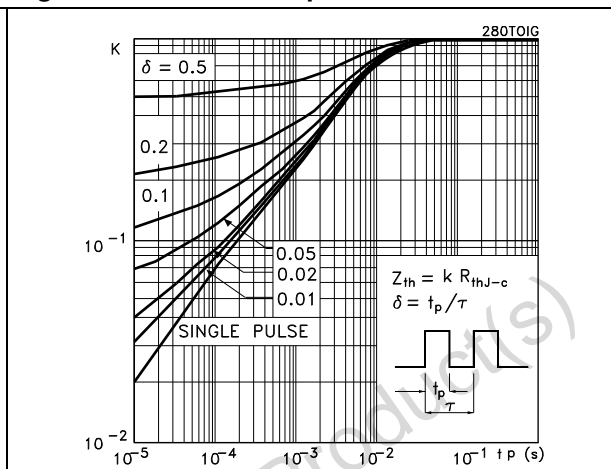


Figure 4. Output characteristics

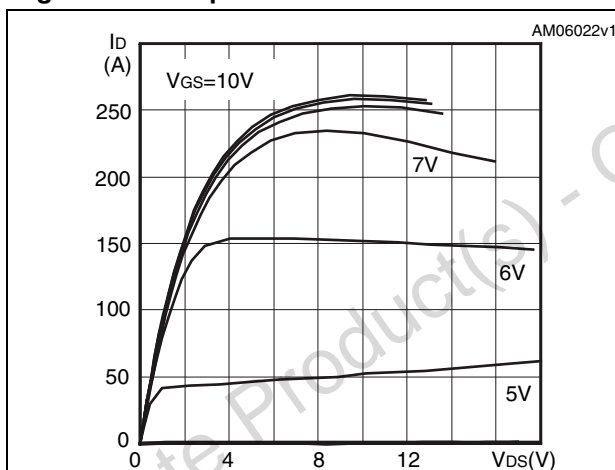


Figure 5. Transfer characteristics

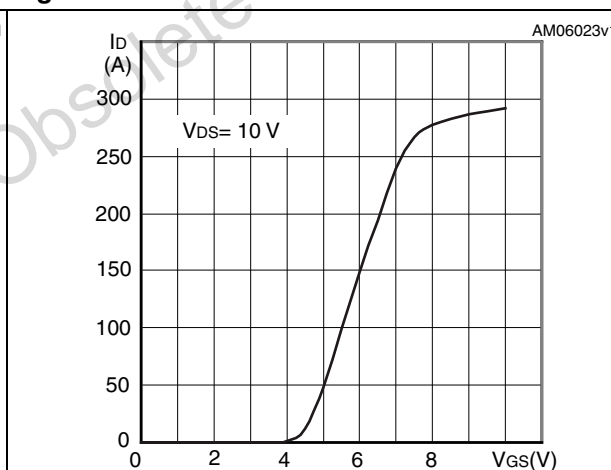


Figure 6. Normalized BV_{DSS} vs temperature

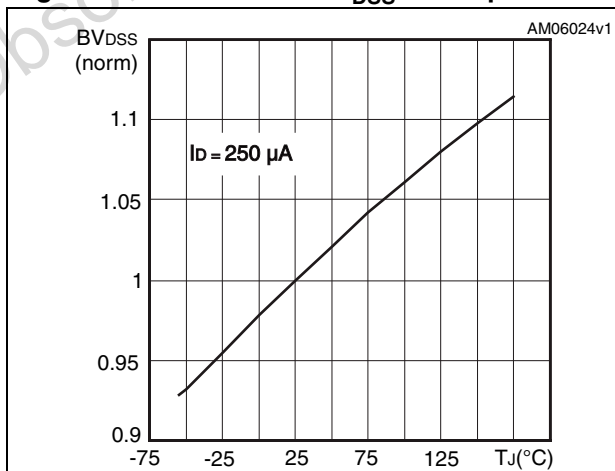


Figure 7. Static drain-source on-resistance

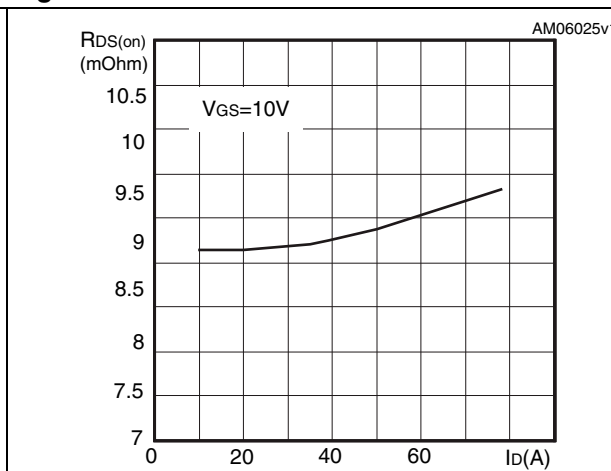


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

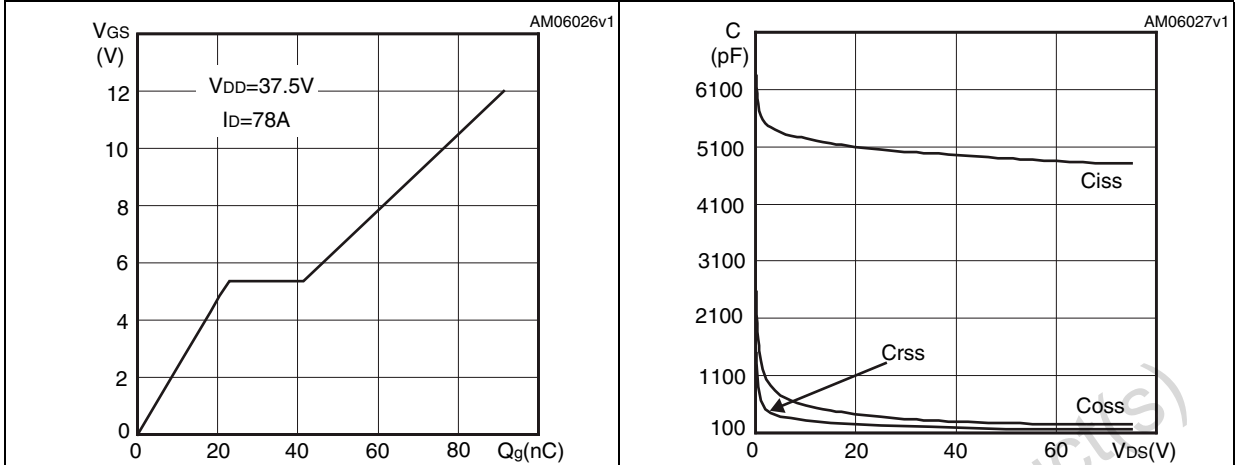


Figure 10. Normalized on-resistance vs temperature

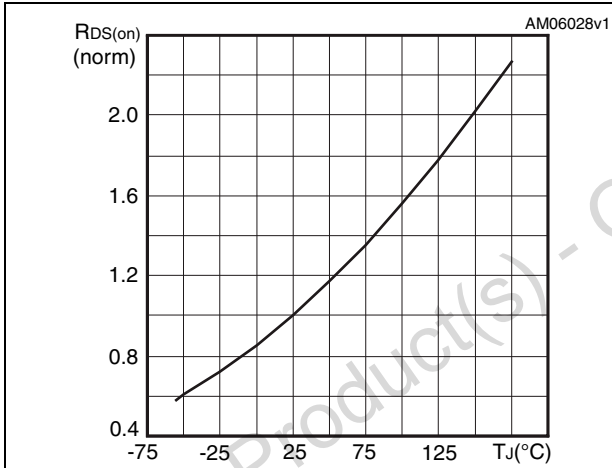


Figure 11. Normalized gate threshold voltage vs temperature

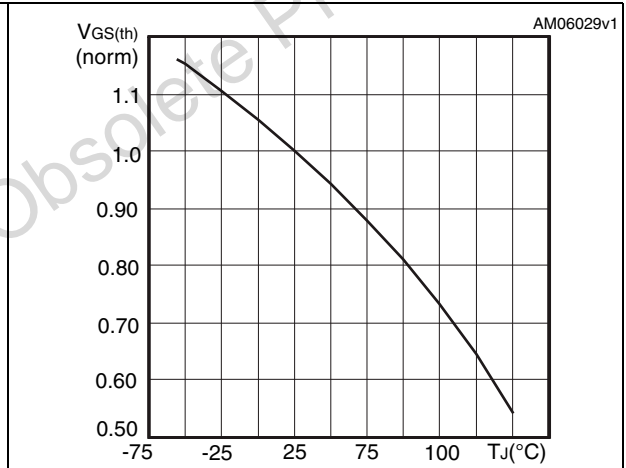
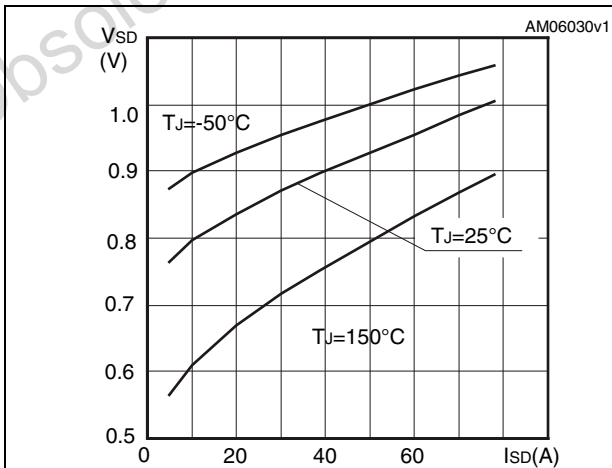
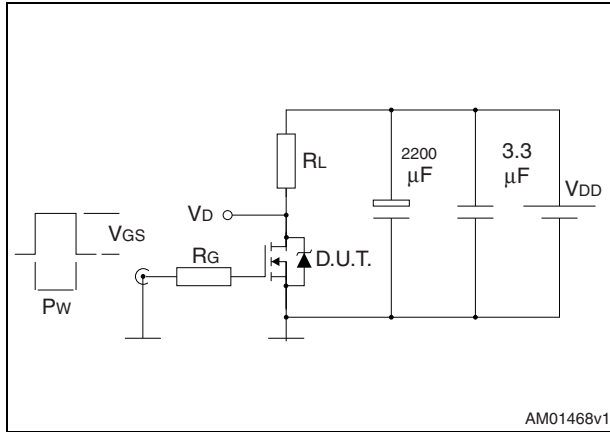


Figure 12. Source-drain diode forward characteristics



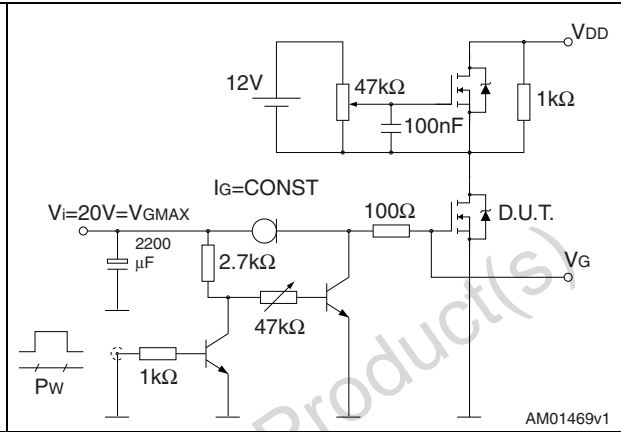
3 Test circuits

Figure 13. Switching times test circuit for resistive load



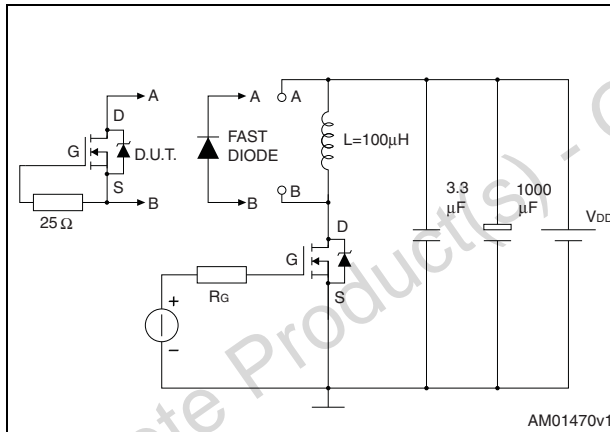
AM01468v1

Figure 14. Gate charge test circuit



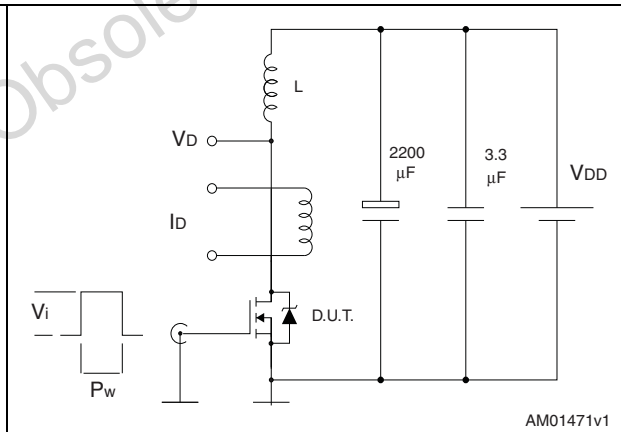
AM01469v1

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



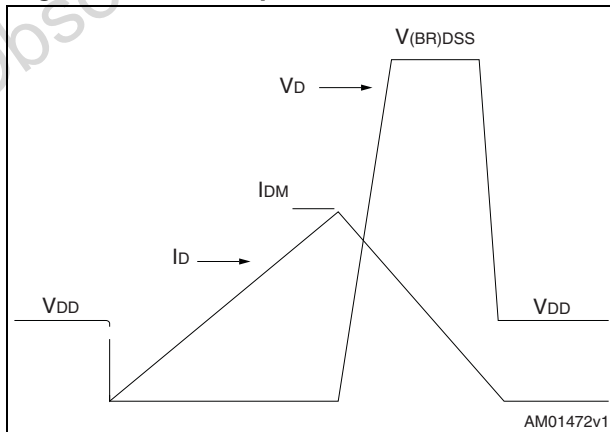
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Figure 16. Unclamped inductive load test circuit



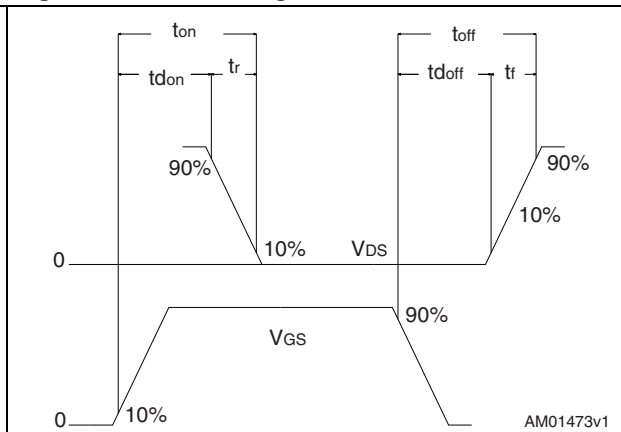
AM01471v1

Figure 17. Unclamped inductive waveform



AM01472v1

Figure 18. Switching time waveform



AM01473v1

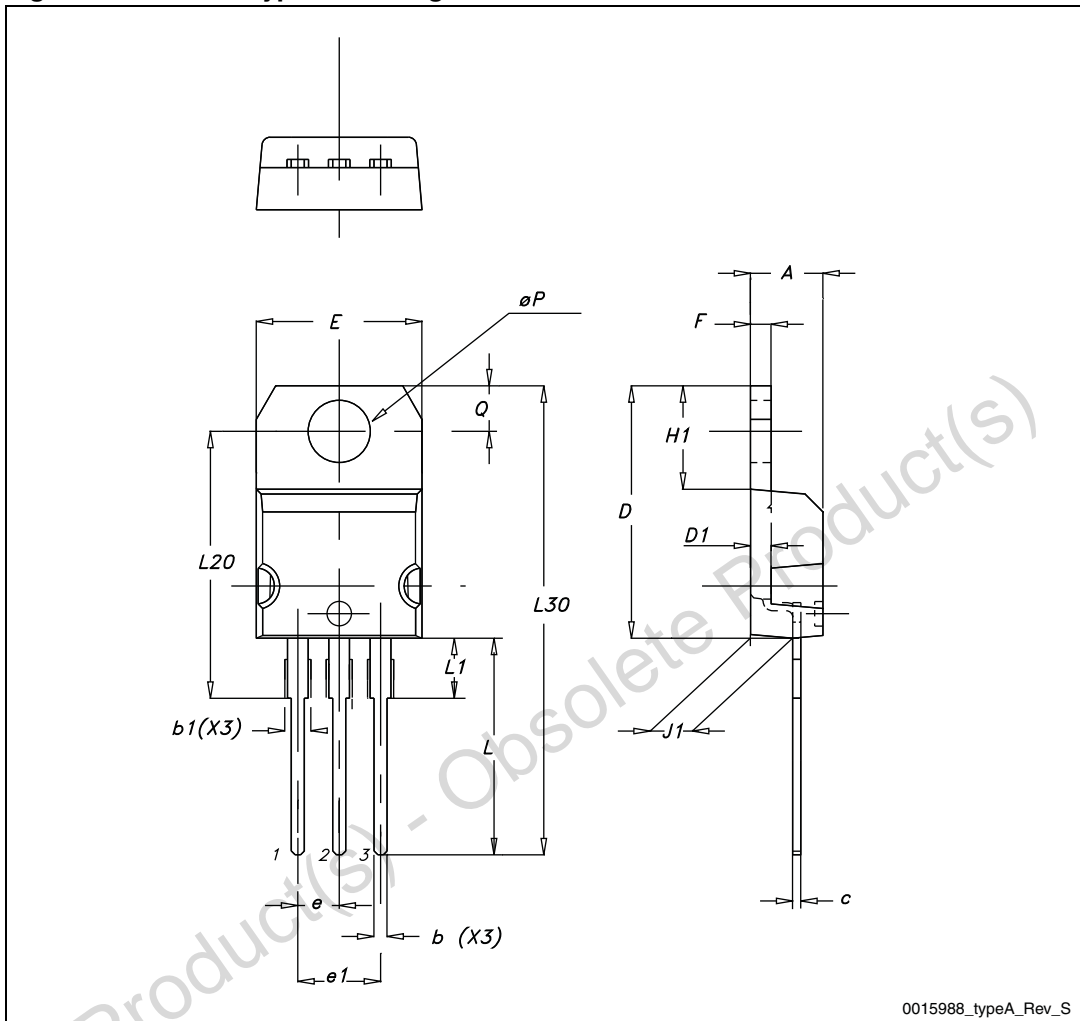
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

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 |

Figure 19. TO-220 type A drawing



5 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 12-May-2009 | 1 | First release. |
| 26-Nov-2009 | 2 | Document status promoted from preliminary data to datasheet (see Section 2.1: Electrical characteristics (curves)). |
| 24-Jul-2012 | 3 | Minor text changes on the cover page. Updated Section 4: Package mechanical data . |

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