



STF4N62K3, STF14N62K3, STI4N62K3, STP4N62K3, STU4N62K3

N-channel 620 V, 1.7 Ω typ., 3.8 A SuperMESH3™ Power MOSFET
in TO-220FP, I²PAKFP, I²PAK, TO-220 and IPAK packages

Datasheet — production data

Features

| Order codes | V _{DSS} | R _{DS(on)} max | I _D | P _{TOT} |
|-------------|------------------|-------------------------|----------------|------------------|
| STF4N62K3 | 620 V | < 2 Ω | 3.8 A | 25 W |
| STF14N62K3 | | | | 25 W |
| STI4N62K3 | | | | 70 W |
| STP4N62K3 | | | | 70 W |
| STU4N62K3 | | | | 70 W |

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

Applications

- Switching applications

Description

These SuperMESH3™ Power MOSFETs are the result of improvements applied to STMicroelectronics' SuperMESH™ technology, combined with a new optimized vertical structure. These devices boast an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering them suitable for the most demanding applications.

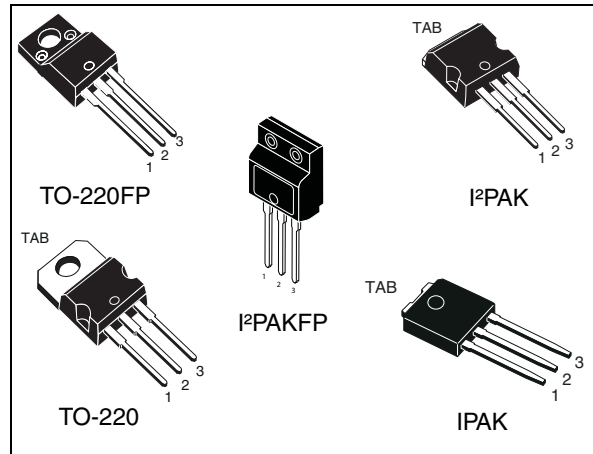
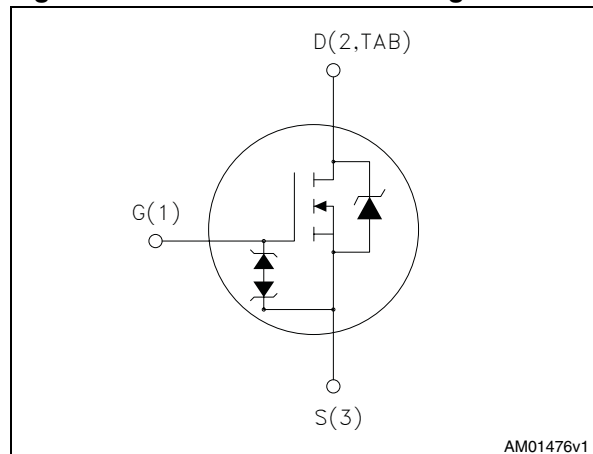


Figure 1. Internal schematic diagram



AM01476v1

Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|---------|----------------------|-----------|
| STF4N62K3 | 4N62K3 | TO-220FP | Tube |
| STF14N62K3 | | I ² PAKFP | |
| STI4N62K3 | | I ² PAK | |
| STP4N62K3 | | TO-220 | |
| STU4N62K3 | | IPAK | |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | | | Unit |
|--------------------------------|--|----------------------------------|------------------------------|------|------|
| | | TO-220FP I ² PAKFP | I ² PAK TO-220 | IPAK | |
| V _{DS} | Drain-source voltage | 620 | | | V |
| V _{GS} | Gate- source voltage | ± 30 | | | V |
| I _D | Drain current (continuous) at T _C = 25 °C | 3.8 ⁽¹⁾ | 3.8 | | A |
| I _D | Drain current (continuous) at T _C = 100 °C | 2 ⁽¹⁾ | 2 | | A |
| I _{DM} ⁽²⁾ | Drain current (pulsed) | 15.2 ⁽¹⁾ | 15.2 | | A |
| P _{TOT} | Total dissipation at T _C = 25 °C | 25 | 70 | | W |
| I _{AR} | Avalanche current, repetitive or not-repetitive (pulse width limited by T _j max) | 3.8 | | | A |
| E _{AS} | Single pulse avalanche energy (starting T _j = 25°C, I _D = I _{AR} , V _{DD} = 50V) | 115 | | | mJ |
| ESD | Gate-source human body model (R = 1.5 kΩ, C = 100 pF) | 2.5 | | | kV |
| dv/dt ⁽³⁾ | Peak diode recovery voltage slope | 12 | | | V/ns |
| V _{ISO} | Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25 °C) | 2500 | | | V |
| T _{stg} | Storage temperature | - 55 to 150 | | | °C |
| T _j | Max. operating junction temperature | 150 | | | °C |

1. Limited by maximum junction temperature.

2. Pulse width limited by safe operating area.

3. I_{SD} ≤ 3.8 A, di/dt = 400 A/μs, V_{DD} = 80% V_{(BR)DSS}, V_{DS peak} ≤ V_{(BR)DSS}.

Table 3. Thermal data

| Symbol | Parameter | Value | | | Unit |
|-----------------------|---|----------------------------------|------------------------------|------|------|
| | | TO-220FP I ² PAKFP | I ² PAK TO-220 | IPAK | |
| R _{thj-case} | Thermal resistance junction-case max | 5 | 1.79 | | °C/W |
| R _{thj-amb} | Thermal resistance junction-ambient max | 62.5 | | | °C/W |

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 | $I_D = 1\text{ mA}$, $V_{GS} = 0$ | 620 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 620\text{ V}$ $V_{DS} = 620\text{ V}$, $T_C = 125\text{ °C}$ | | | 1 50 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\text{ V}$ | | | ± 10 | μA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$ | 3 | 3.75 | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10\text{ V}$, $I_D = 1.9\text{ A}$ | | 1.7 | 2 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|-------------------------------|---|------|------|------|----------|
| C_{iss} | Input capacitance | | | 550 | | pF |
| C_{oss} | Output capacitance | $V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | | 42 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 7 | | pF |
| $C_{oss\text{ eq.}}^{(1)}$ | Equivalent output capacitance | $V_{DS} = 0\text{ to }496\text{ V}$, $V_{GS} = 0$ | | 27 | | pF |
| R_G | Intrinsic gate resistance | $f = 1\text{ MHz}$ open drain | 2 | 5 | 10 | Ω |
| Q_g | Total gate charge | $V_{DD} = 496\text{ V}$, $I_D = 3.8\text{ A}$, | | 22 | | nC |
| Q_{gs} | Gate-source charge | $V_{GS} = 10\text{ V}$ | | 4 | | nC |
| Q_{gd} | Gate-drain charge | (see Figure 20) | | 13 | | nC |

1. $C_{oss\text{ eq.}}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 300\text{ V}$, $I_D = 1.9\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 19) | - | 10 | - | ns |
| t_r | Rise time | | | 9 | | ns |
| $t_{d(off)}$ | Turn-off-delay time | | | 29 | | ns |
| t_f | Fall time | | | 19 | | ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|---------------|
| I_{SD} | Source-drain current | | - | | 3.8 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | | | 15.2 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 3.8\text{ A}$, $V_{GS} = 0$ | - | | 1.6 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 3.8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$ (see Figure 24) | - | 220 | | ns |
| Q_{rr} | Reverse recovery charge | | | 1.4 | | μC |
| I_{RRM} | Reverse recovery current | | | 13 | | A |
| t_{rr} | Reverse recovery time | $I_{SD} = 3.8\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 24) | - | 270 | | ns |
| Q_{rr} | Reverse recovery charge | | | 1.9 | | μC |
| I_{RRM} | Reverse recovery current | | | 14 | | A |

1. Pulse width limited by safe operating area

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

Table 8. Gate-source Zener diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|---|----------------------------|------|------|------|------|
| $V_{(BR)GSO}$ | Gate-source breakdown voltage ($I_D = 0$) | $I_{gs} = \pm 1\text{ mA}$ | 30 | - | | V |

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, I²PAK

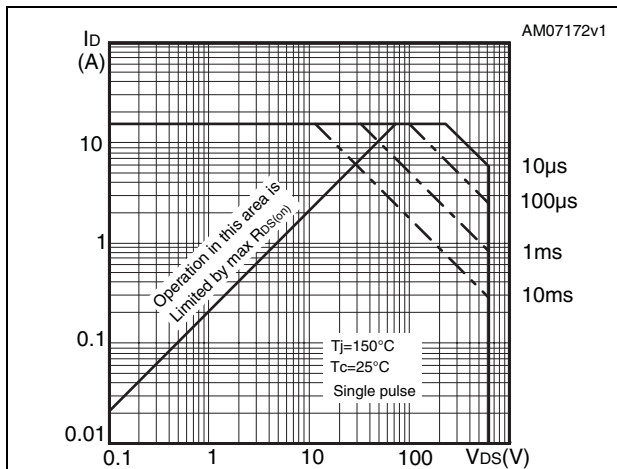


Figure 3. Thermal impedance for TO-220, I²PAK

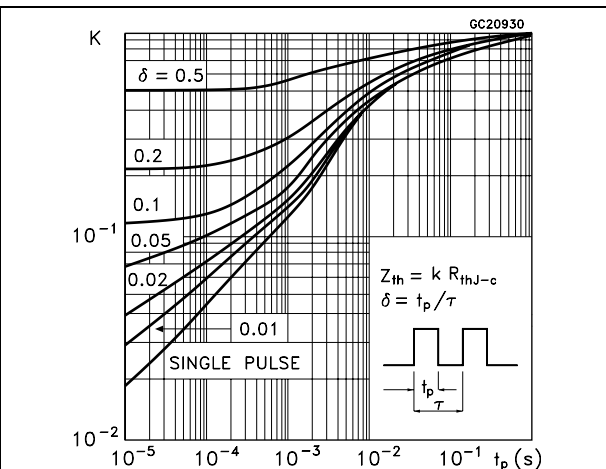


Figure 4. Safe operating area for TO-220FP, I²PAKFP

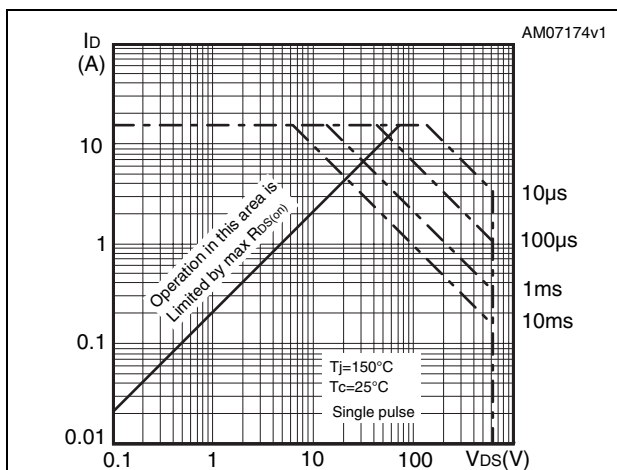


Figure 5. Thermal impedance for TO-220FP, I²PAKFP

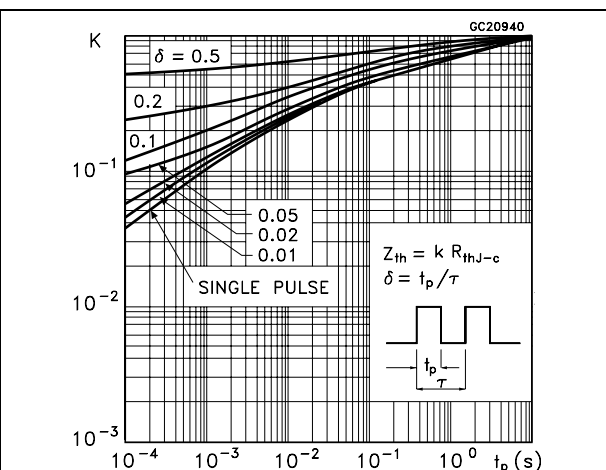


Figure 6. Safe operating area for IPAK

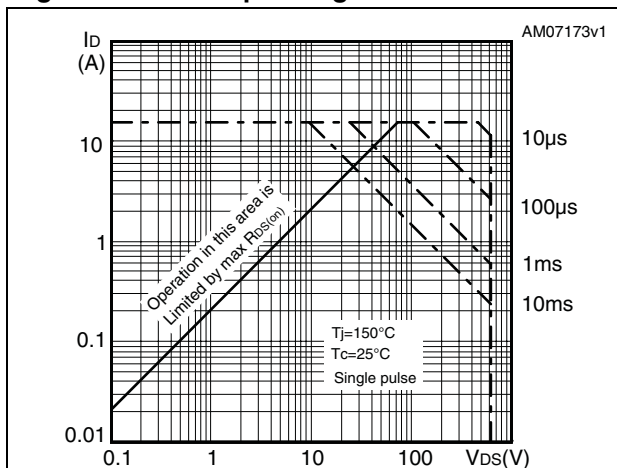


Figure 7. Thermal impedance for IPAK

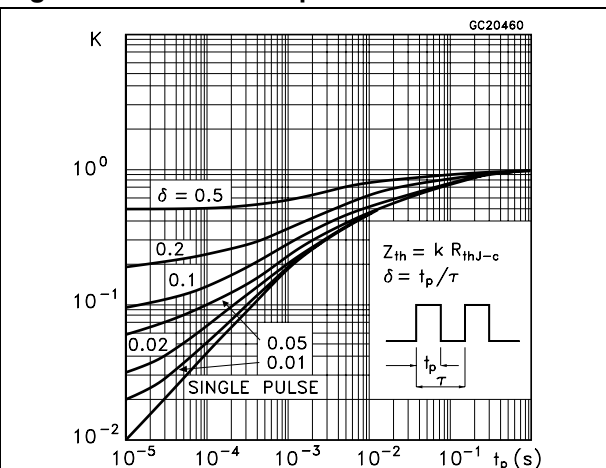


Figure 8. Output characteristics

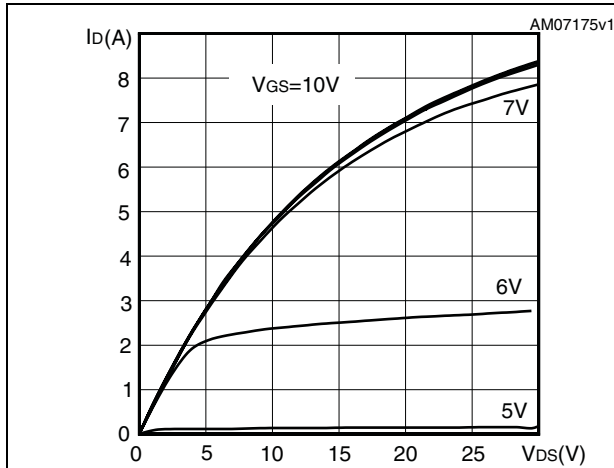


Figure 9. Transfer characteristics

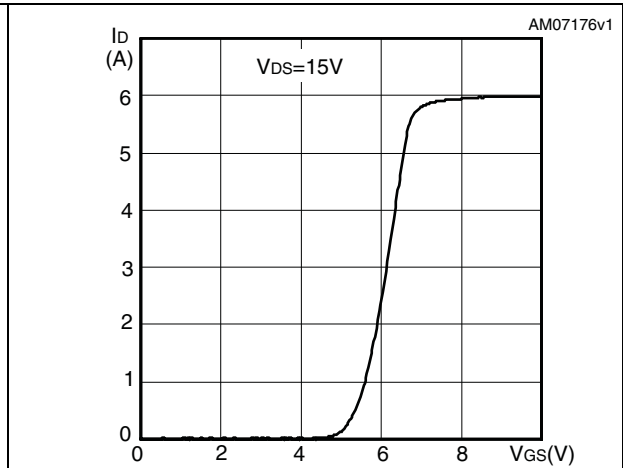


Figure 10. Gate charge vs gate-source voltage

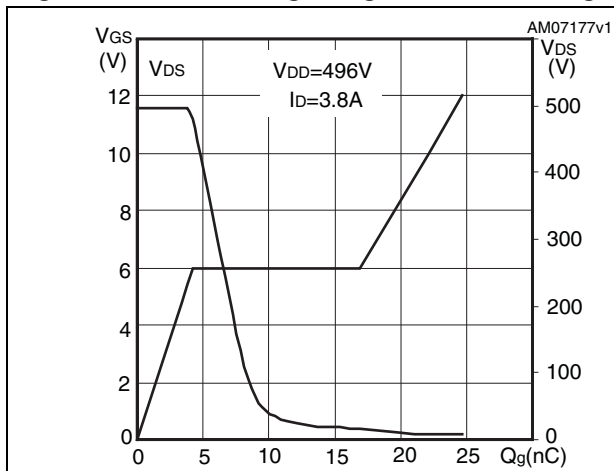


Figure 11. Static drain-source on resistance

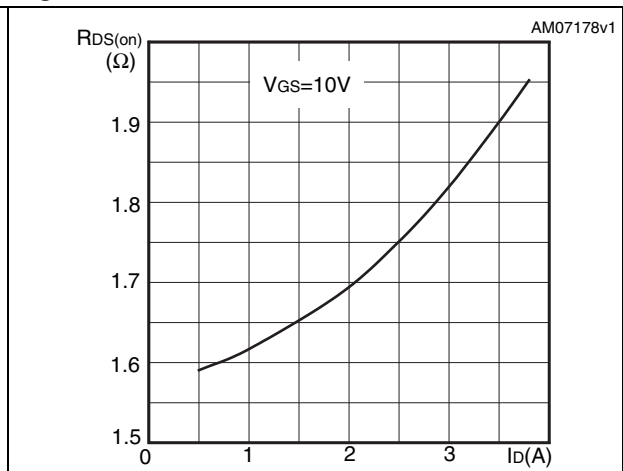


Figure 12. Capacitance variations

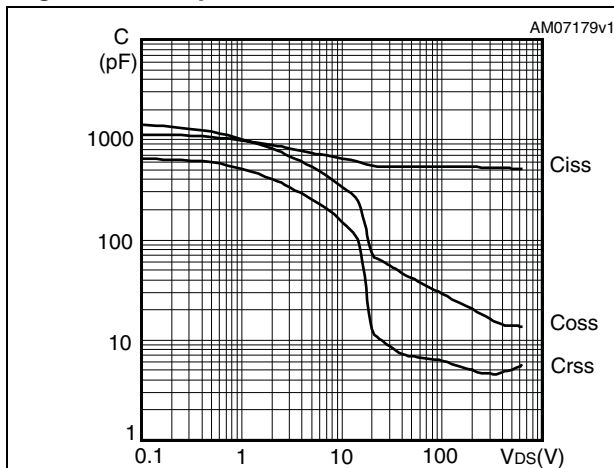


Figure 13. Output capacitance stored energy

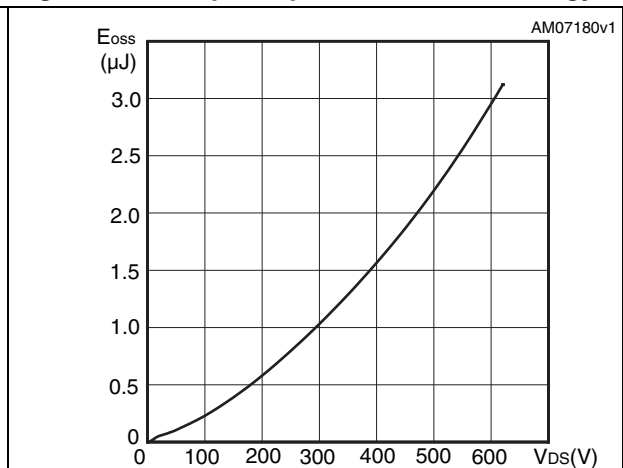


Figure 14. Normalized gate threshold voltage vs temperature

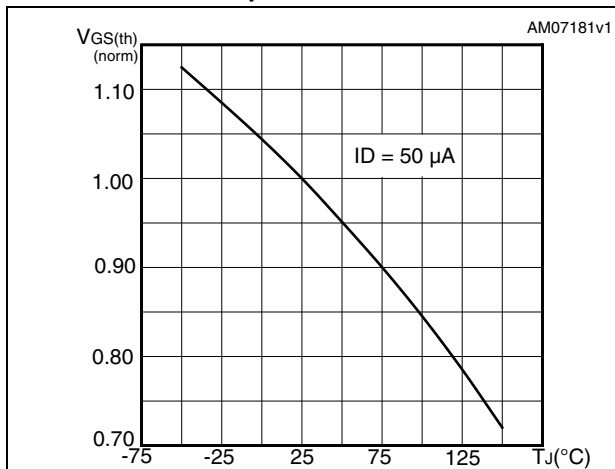


Figure 15. Normalized on resistance vs temperature

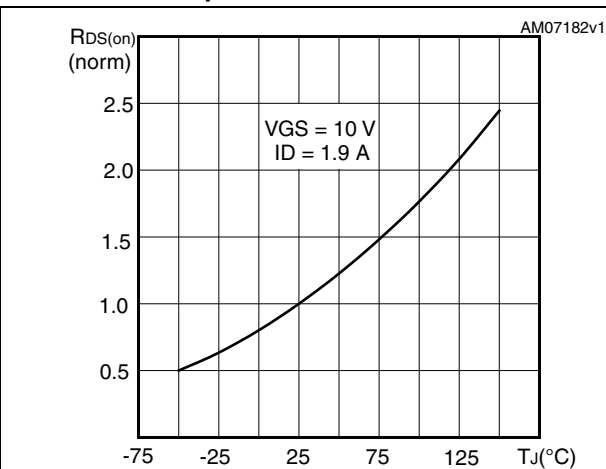


Figure 16. Maximum avalanche energy vs starting Tj

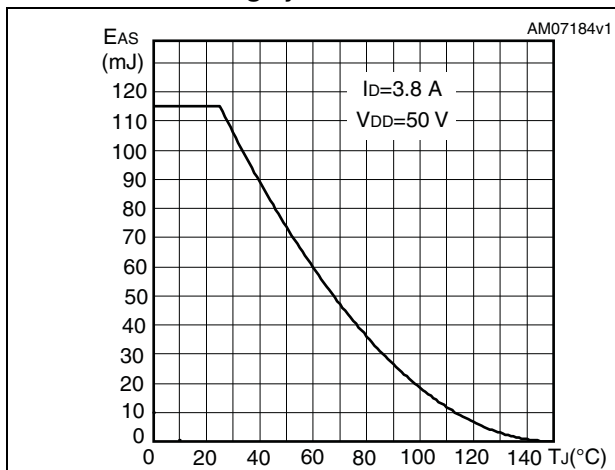


Figure 17. Normalized B_{VDSS} vs temperature

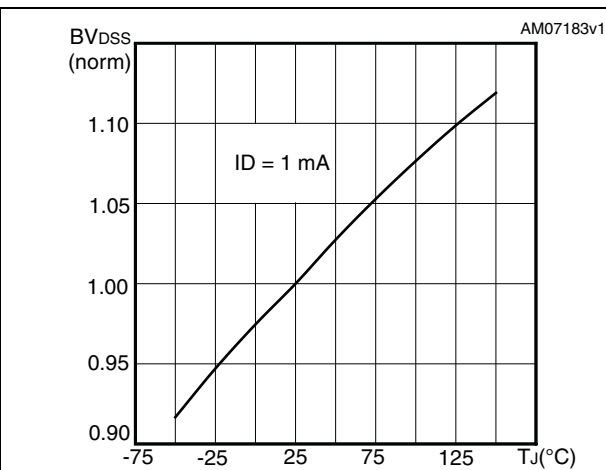
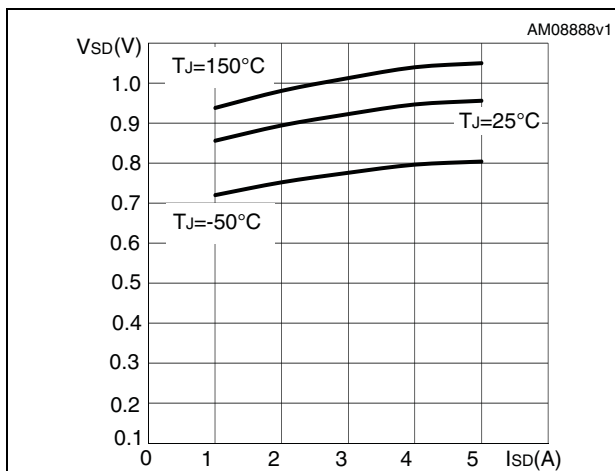
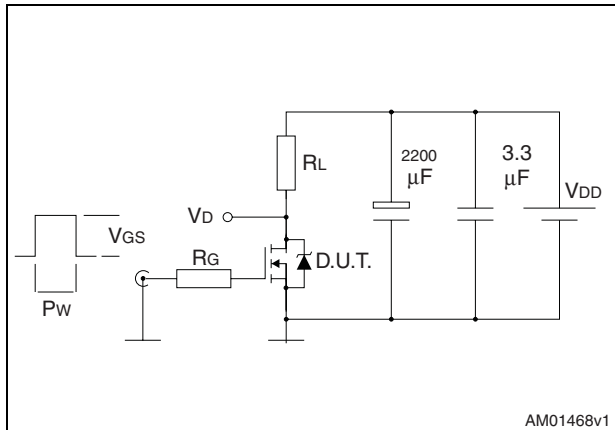


Figure 18. Source-drain diode forward characteristics



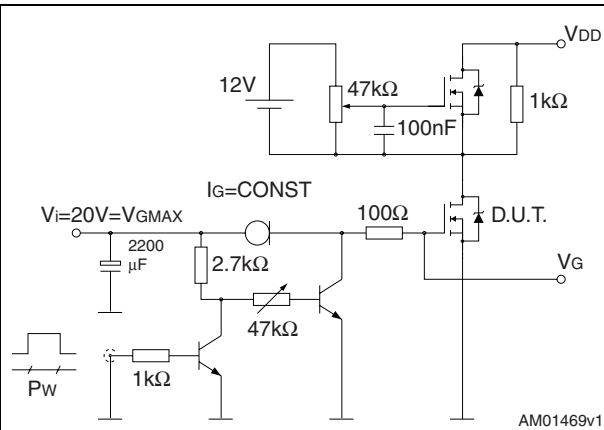
3 Test circuits

Figure 19. Switching times test circuit for resistive load



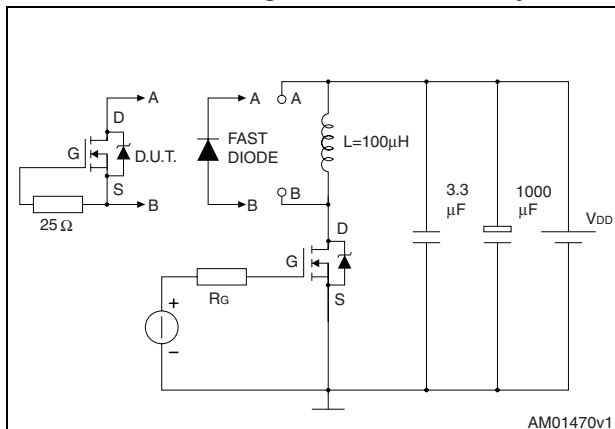
AM01468v1

Figure 20. Gate charge test circuit



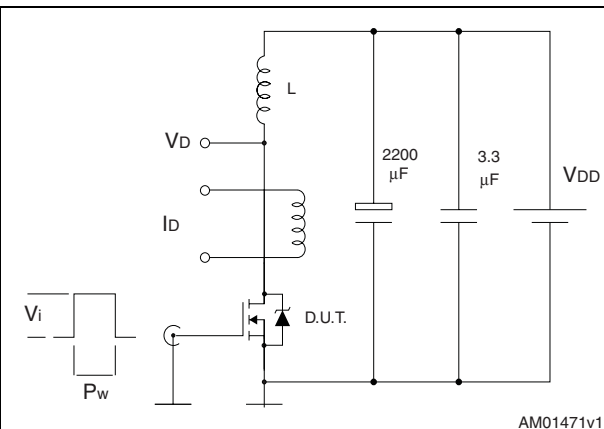
AM01469v1

Figure 21. Test circuit for inductive load switching and diode recovery times



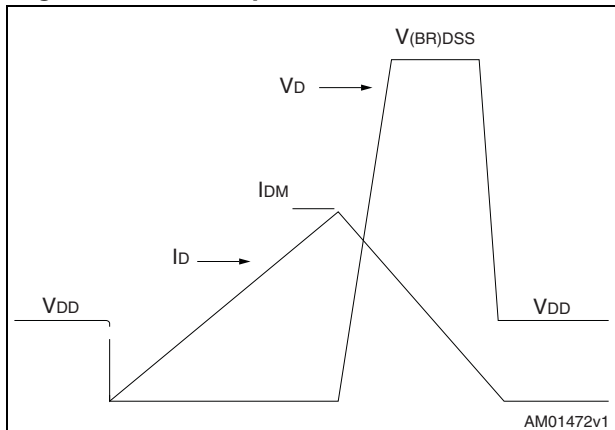
AM01470v1

Figure 22. Unclamped inductive load test circuit



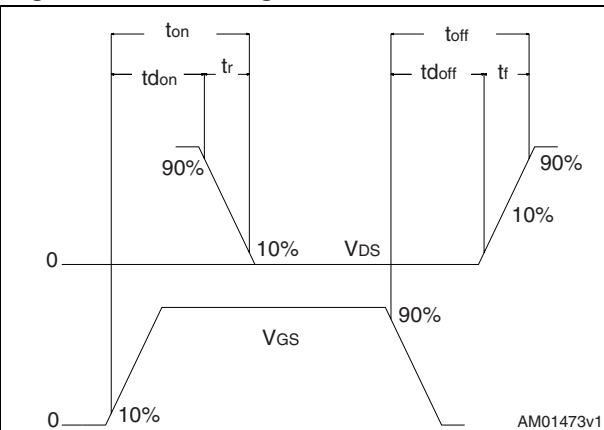
AM01471v1

Figure 23. Unclamped inductive waveform



AM01472v1

Figure 24. Switching time waveform



AM01473v1

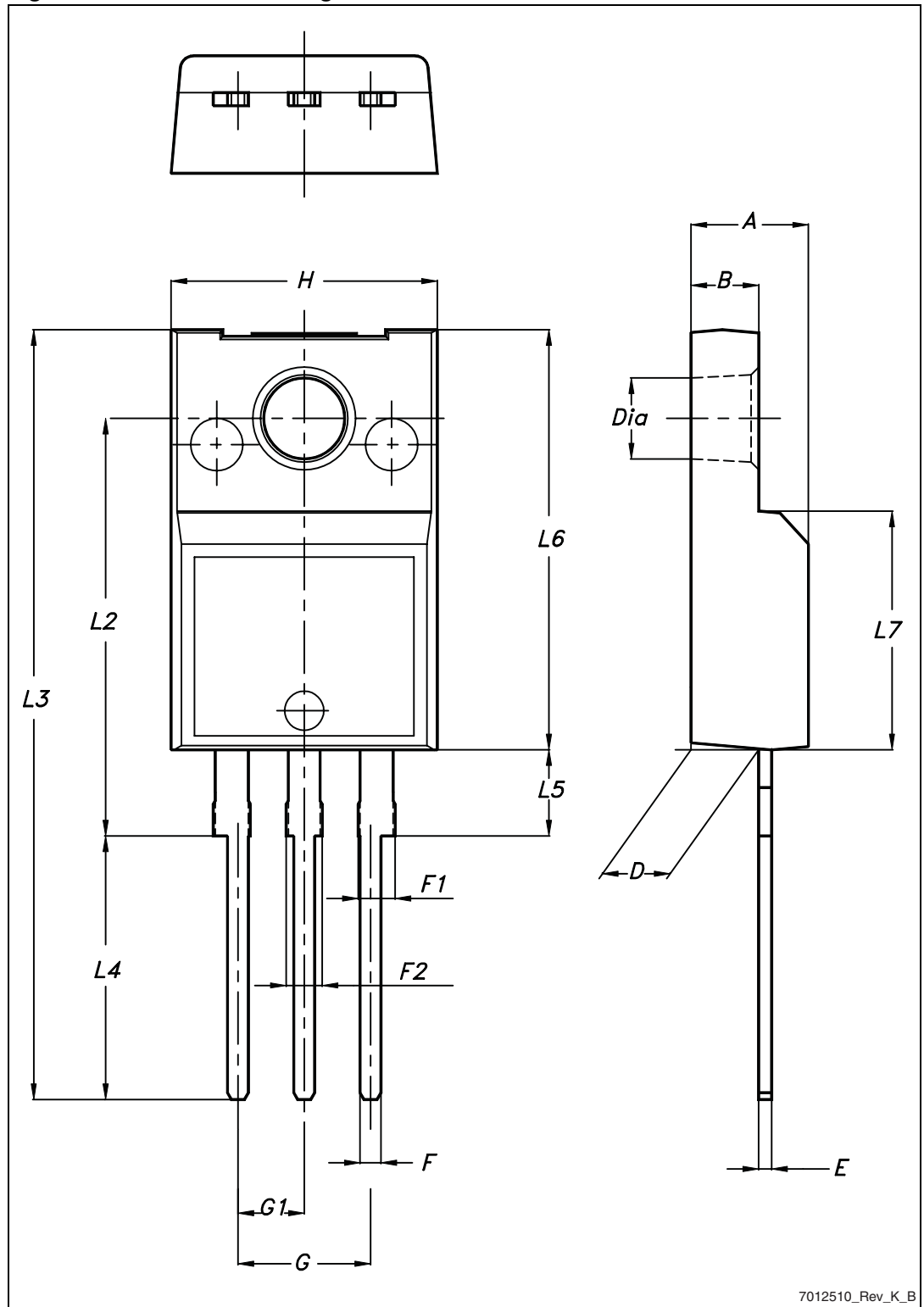
4 Package mechanical data

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 9. 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 |
| Dia | 3 | | 3.2 |

Figure 25. TO-220FP drawing



7012510_Rev_K_B

Table 10. I²PAKFP (TO-281) mechanical data

| Dim. | mm | | |
|------|-------|------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| B | 2.50 | | 2.70 |
| D | 2.50 | | 2.75 |
| D1 | 0.65 | | 0.85 |
| E | 0.45 | | 0.70 |
| F | 0.75 | | 1.00 |
| F1 | | | 1.20 |
| G | 4.95 | - | 5.20 |
| H | 10.00 | | 10.40 |
| L1 | 21.00 | | 23.00 |
| L2 | 13.20 | | 14.10 |
| L3 | 10.55 | | 10.85 |
| L4 | 2.70 | | 3.20 |
| L5 | 0.85 | | 1.25 |
| L6 | 7.30 | | 7.50 |

Figure 26. I²PAKFP (TO-281) drawing

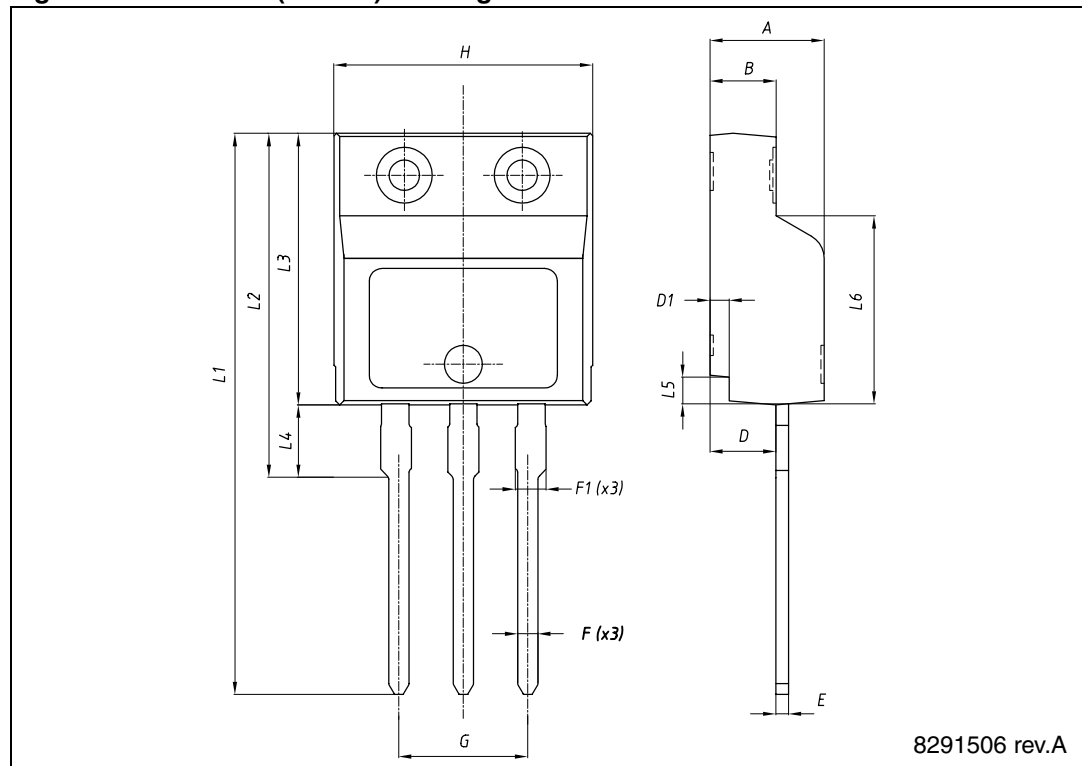


Table 11. I²PAK (TO-262) mechanical data

| DIM. | mm. | | |
|------|------|-----|-------|
| | min. | typ | max. |
| A | 4.40 | | 4.60 |
| A1 | 2.40 | | 2.72 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.49 | | 0.70 |
| c2 | 1.23 | | 1.32 |
| D | 8.95 | | 9.35 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| E | 10 | | 10.40 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L2 | 1.27 | | 1.40 |

Figure 27. I²PAK (TO-262) drawing

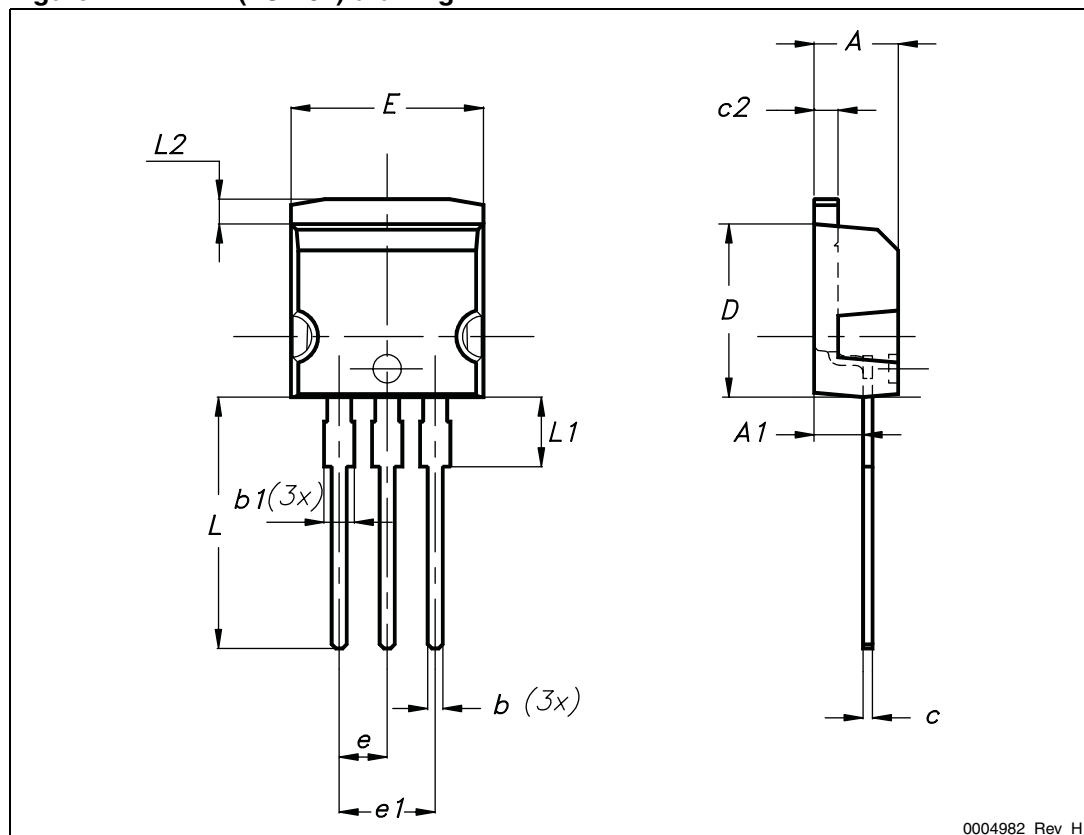


Table 12. TO-220 type A mechanical data

| 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 28. TO-220 type A drawing

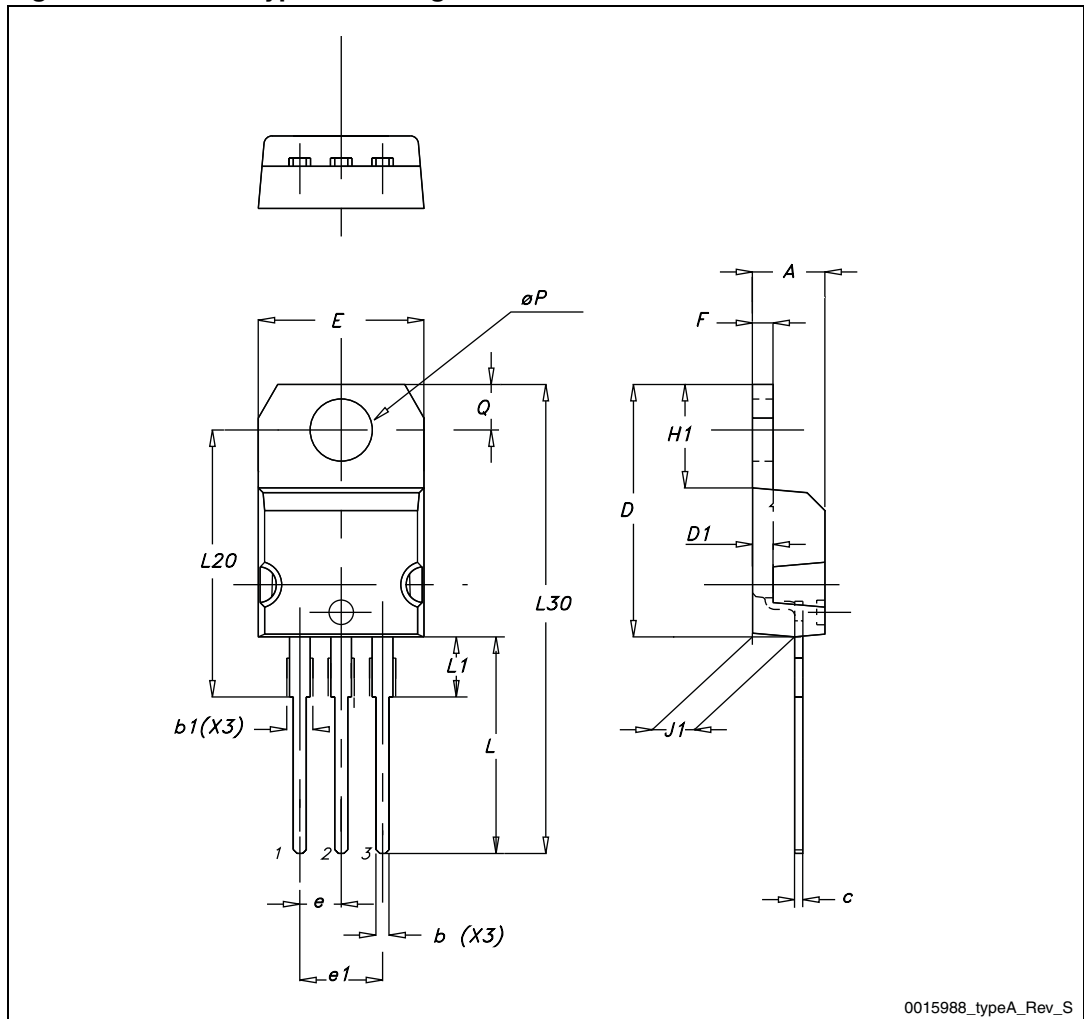
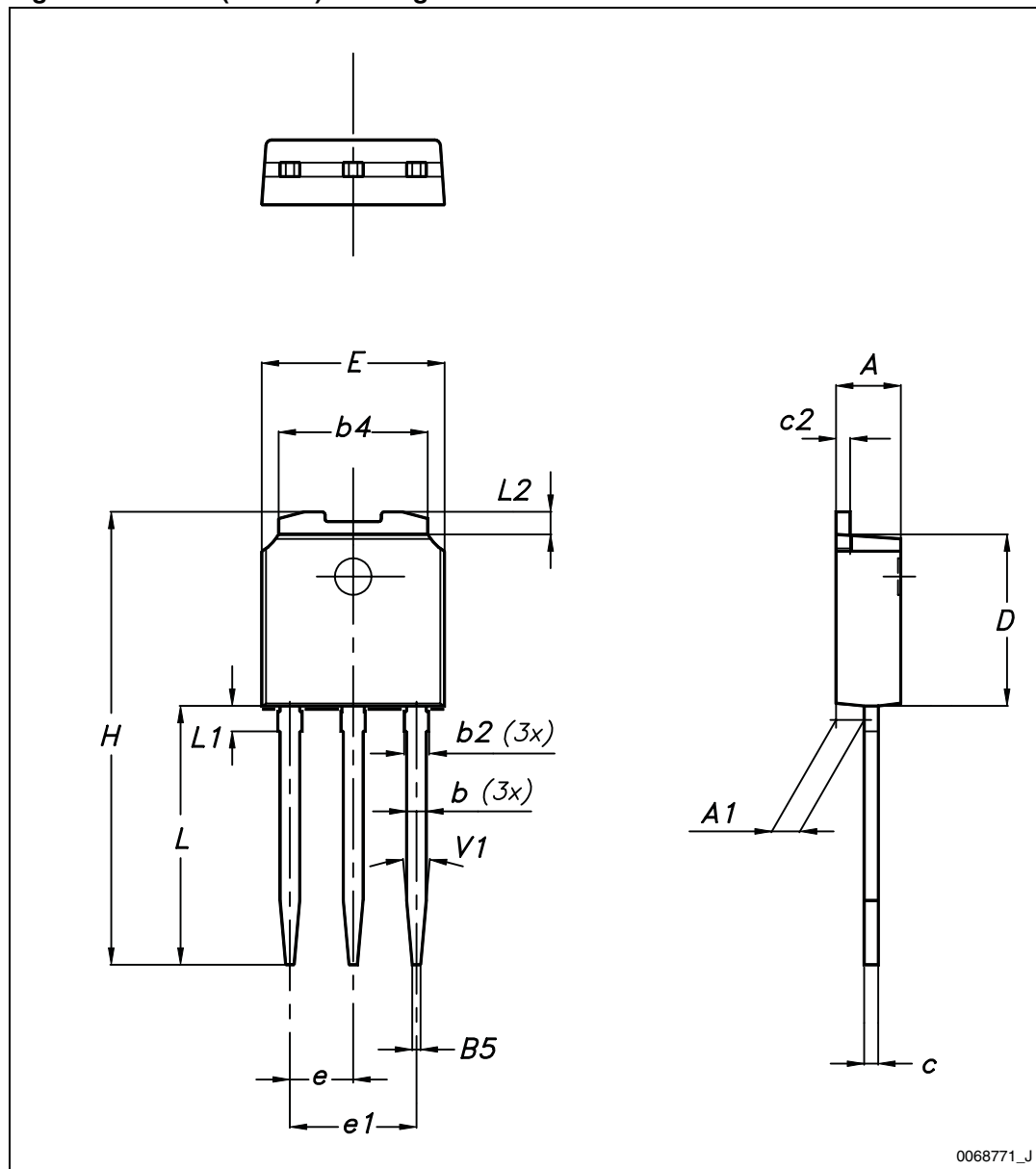


Table 13. IPAK (TO-251) mechanical data

| DIM | mm. | | |
|-----|------|-------|------|
| | min. | typ. | max. |
| A | 2.20 | | 2.40 |
| A1 | 0.90 | | 1.10 |
| b | 0.64 | | 0.90 |
| b2 | | | 0.95 |
| b4 | 5.20 | | 5.40 |
| B5 | | 0.30 | |
| c | 0.45 | | 0.60 |
| c2 | 0.48 | | 0.60 |
| D | 6.00 | | 6.20 |
| E | 6.40 | | 6.60 |
| e | | 2.28 | |
| e1 | 4.40 | | 4.60 |
| H | | 16.10 | |
| L | 9.00 | | 9.40 |
| L1 | 0.80 | | 1.20 |
| L2 | | 0.80 | 1.00 |
| V1 | | 10° | |

Figure 29. IPAK (TO-251) drawing



5 Revision history

Table 14. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 05-May-2010 | 1 | First release |
| 16-Dec-2010 | 2 | Document status promoted from preliminary data to datasheet. |
| 27-Mar-2012 | 3 | Inserted max and min. values for R_G in Table 5 . Updated Section 4: Package mechanical data . |
| 07-Aug-2012 | 4 | Added package, mechanical data: I ² PAKFP. Updated Table 1: Device summary , Table 2: Absolute maximum ratings , Table 3: Thermal data , Table 4: On /off states , Table 13: IPAK (TO-251) mechanical data and Figure 29: IPAK (TO-251) drawing Minor text changes. |

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