

**ST(意法) STF10N62K3 PDF**

**深圳创唯电子有限公司**

**<http://www.rohm-chip.com>**



# STF10N62K3, STFI10N62K3, STI10N62K3, STP10N62K3

N-channel 620 V, 0.68  $\Omega$  typ., 8.4 A SuperMESH3™  
Power MOSFET in TO-220FP, I<sup>2</sup>PAKFP, I<sup>2</sup>PAK, TO-220 packages

Datasheet — production data

## Features

| Type        | V <sub>DSS</sub> | R <sub>DS(on)</sub><br>max | I <sub>D</sub>       | P <sub>w</sub> |
|-------------|------------------|----------------------------|----------------------|----------------|
| STF10N62K3  | 620 V            | < 0.75 $\Omega$            | 8.4 A <sup>(1)</sup> | 30 W           |
| STFI10N62K3 |                  |                            |                      |                |
| STI10N62K3  |                  |                            | 8.4 A                | 125 W          |
| STP10N62K3  |                  |                            |                      |                |

1. Limited by package

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

## Applications

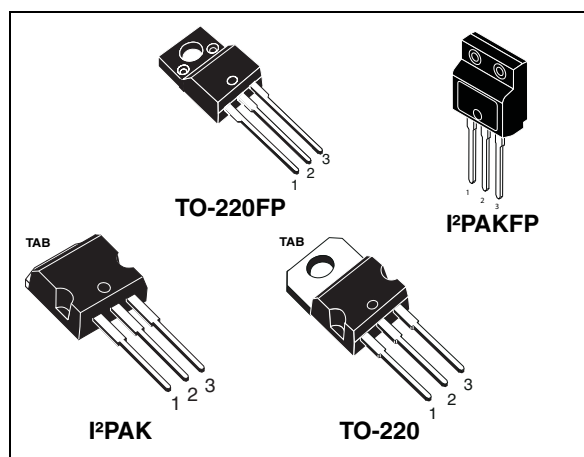
- Switching applications

## Description

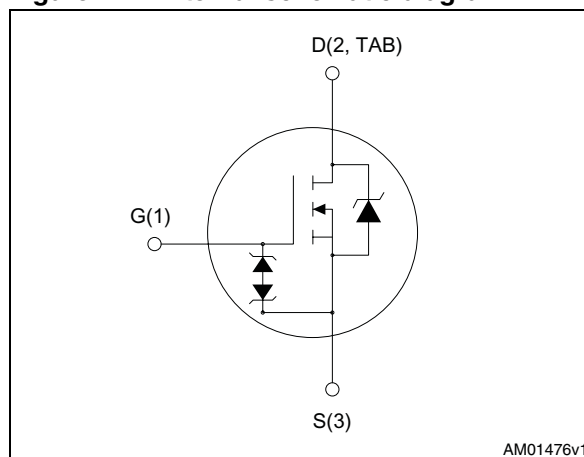
These SuperMESH3™ Power MOSFETs are the result of improvements applied to STMicroelectronics' SuperMESH™ technology, combined with a new optimized vertical structure. These devices boast an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering them suitable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

**Table 1. Device summary**

| Order codes | Marking | Package              | Packaging |
|-------------|---------|----------------------|-----------|
| STF10N62K3  | 10N62K3 | TO-220FP             | Tube      |
| STFI10N62K3 | 10N62K3 | I <sup>2</sup> PAKFP |           |
| STI10N62K3  | 10N62K3 | I <sup>2</sup> PAK   |           |
| STP10N62K3  | 10N62K3 | TO-220               |           |



**Figure 1. Internal schematic diagram**



AM01476v1

Contents

1      **Electrical ratings** ..... 3

2      **Electrical characteristics** ..... 4

      2.1    Electrical characteristics (curves) ..... 6

3      **Test circuits** ..... 9

4      **Package mechanical data** ..... 10

5      **Revision history** ..... 16



# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol                             | Parameter                                                                                                    | Value                            |                              | Unit |
|------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------|------|
|                                    |                                                                                                              | TO-220FP<br>I <sup>2</sup> PAKFP | I <sup>2</sup> PAK<br>TO-220 |      |
| V <sub>DS</sub>                    | Drain source voltage                                                                                         | 620                              |                              | V    |
| V <sub>GS</sub>                    | Gate-source voltage                                                                                          | ± 30                             |                              | V    |
| I <sub>D</sub>                     | Drain current (continuous) at T <sub>C</sub> = 25 °C                                                         | 8.4 <sup>(1)</sup>               | 8.4                          | A    |
| I <sub>D</sub>                     | Drain current (continuous) at T <sub>C</sub> = 100 °C                                                        | 5.2 <sup>(1)</sup>               | 5.2                          | A    |
| I <sub>DM</sub> <sup>(2)</sup>     | Drain current (pulsed)                                                                                       | 33.6 <sup>(1)</sup>              | 33.6                         | A    |
| P <sub>TOT</sub>                   | Total dissipation at T <sub>C</sub> = 25 °C                                                                  | 30                               | 125                          | W    |
| I <sub>AR</sub>                    | Max current during repetitive or single pulse avalanche (pulse width limited by T <sub>JMAX</sub> )          | 8                                |                              | A    |
| E <sub>AS</sub>                    | Single pulse avalanche energy <sup>(3)</sup>                                                                 | 220                              |                              | mJ   |
| dv/dt <sup>(4)</sup>               | Peak diode recovery voltage slope                                                                            | 12                               |                              | V/ns |
| ESD                                | Gate-source human body model (R = 1.5 kΩ, C = 100 pF)                                                        | 2.5                              |                              | kV   |
| V <sub>ISO</sub>                   | Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T <sub>C</sub> =25 °C) | 2500                             |                              | V    |
| T <sub>j</sub><br>T <sub>stg</sub> | Operating junction temperature<br>Storage temperature                                                        | -55 to 150                       |                              | °C   |

1. Limited by maximum junction temperature

2. Pulse width limited by safe operating area

3. Starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = I<sub>AR</sub>, V<sub>DD</sub> = 50 V

4. I<sub>SD</sub> ≤ 8.4 A, di/dt = 400 A/μs, V<sub>DD</sub> = 80% V<sub>(BR)DSS</sub>, V<sub>DS peak</sub> ≤ V<sub>(BR)DSS</sub>

**Table 3. Thermal data**

| Symbol                | Parameter                               | Value                            |                              | Unit |
|-----------------------|-----------------------------------------|----------------------------------|------------------------------|------|
|                       |                                         | TO-220FP<br>I <sup>2</sup> PAKFP | I <sup>2</sup> PAK<br>TO-220 |      |
| R <sub>thj-case</sub> | Thermal resistance junction-case max    | 4.17                             | 1.00                         | °C/W |
| R <sub>thj-amb</sub>  | Thermal resistance junction-ambient max | 62.5                             |                              | °C/W |

## 2 Electrical characteristics

(T<sub>case</sub> = 25 °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 ( $V_{GS} = 0$ ) | $V_{DS} = 620 \text{ V}$<br>$V_{DS} = 620 \text{ V}$ , $T_C = 125 \text{ °C}$ |      |      | 1<br>50  | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20 \text{ V}$                                                   |      |      | $\pm 10$ | $\mu\text{A}$                  |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 100 \mu\text{A}$                                   | 3    | 3.75 | 4.5      | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10 \text{ V}$ , $I_D = 4 \text{ A}$                                 |      | 0.68 | 0.75     | $\Omega$                       |

**Table 5. Dynamic**

| Symbol                              | Parameter                                                               | Test conditions                                                                                                 | Min. | Typ.              | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------|-------------------|------|----------------|
| $g_{fs}^{(1)}$                      | Forward transconductance                                                | $V_{DS} = 15 \text{ V}$ , $I_D = 4 \text{ A}$                                                                   | -    | 6                 | -    | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS} = 50 \text{ V}$ , $f = 1 \text{ MHz}$ ,<br>$V_{GS} = 0$                                                 | -    | 1250<br>138<br>16 | -    | pF<br>pF<br>pF |
| $C_{o(tr)}^{(2)}$                   | Equivalent capacitance time related                                     | $V_{DS} = 0 \text{ to } 496 \text{ V}$ , $V_{GS} = 0$                                                           | -    | 56                | -    | pF             |
| $C_{o(er)}^{(3)}$                   | Equivalent capacitance energy related                                   | $V_{DS} = 0 \text{ to } 496 \text{ V}$ , $V_{GS} = 0$                                                           | -    | 38                | -    | pF             |
| $R_G$                               | Gate input resistance                                                   | $f = 1 \text{ MHz}$ Gate DC Bias=0 Test signal level = 20 mV open drain                                         | -    | 3.5               | -    | $\Omega$       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 496 \text{ V}$ , $I_D = 8 \text{ A}$ ,<br>$V_{GS} = 10 \text{ V}$<br>(see <a href="#">Figure 18</a> ) | -    | 42<br>7.4<br>23   | -    | nC<br>nC<br>nC |

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

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

3.  $C_{oss \text{ eq.}}$  energy related is defined as a constant equivalent capacitance giving the same stored energy 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  | $V_{DD} = 310\text{ V}$ , $I_D = 4\text{ A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 17</a> ) | -    | 14.5 | -    | ns   |
| $t_r$        | Rise time           |                                                                                                                                    |      | 15   |      | ns   |
| $t_{d(off)}$ | Turn-off-delay time |                                                                                                                                    |      | 41   |      | ns   |
| $t_f$        | Fall time           |                                                                                                                                    |      | 31   |      | ns   |

**Table 7. Source drain diode**

| Symbol          | Parameter                     | Test conditions                                                                                                                                              | Min. | Typ. | Max. | Unit          |
|-----------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{SD}$        | Source-drain current          |                                                                                                                                                              | -    |      | 8.4  | A             |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |                                                                                                                                                              |      |      | 33.6 | A             |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 8\text{ A}$ , $V_{GS} = 0$                                                                                                                         | -    |      | 1.5  | V             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 8\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 60\text{ V}$ (see <a href="#">Figure 22</a> )                                        | -    | 320  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                              |      | 2    |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                              |      | 13   |      | A             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 8\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$<br>(see <a href="#">Figure 22</a> ) | -    | 410  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                              |      | 2.9  |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                              |      | 14   |      | A             |

1. Pulse width limited by safe operating area

2. Pulsed: Pulse duration = 300  $\mu\text{s}$ , 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-220FP, I<sup>2</sup>PAKFP

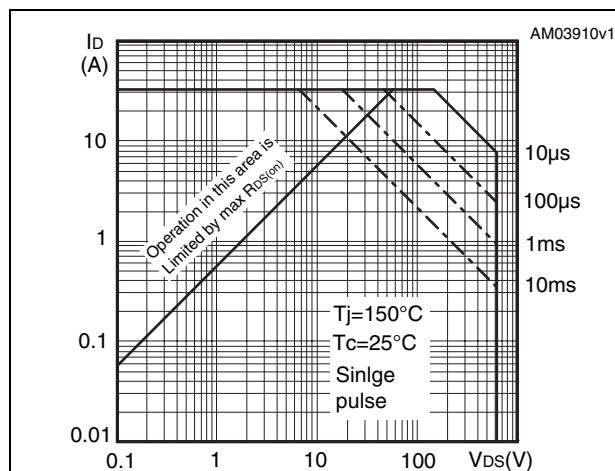


Figure 3. Thermal impedance for TO-220FP, I<sup>2</sup>PAKFP

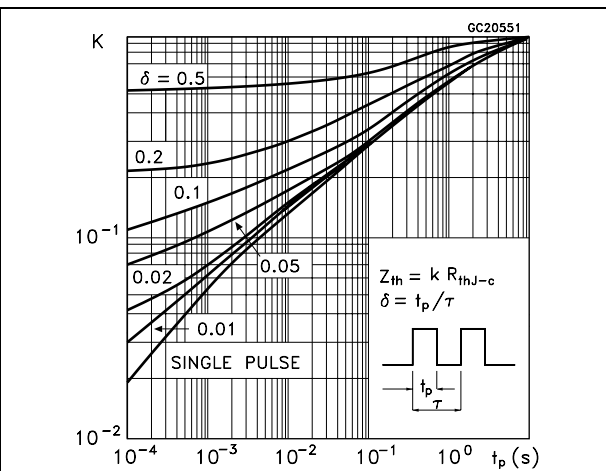


Figure 4. Safe operating area for I<sup>2</sup>PAK, TO-220

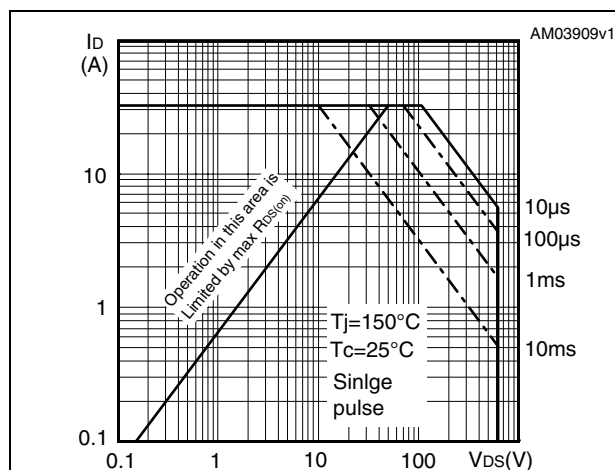


Figure 5. Thermal impedance for I<sup>2</sup>PAK, TO-220

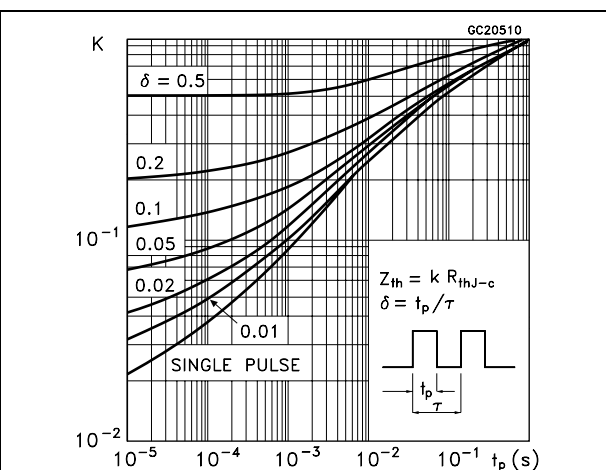


Figure 6. Output characteristics

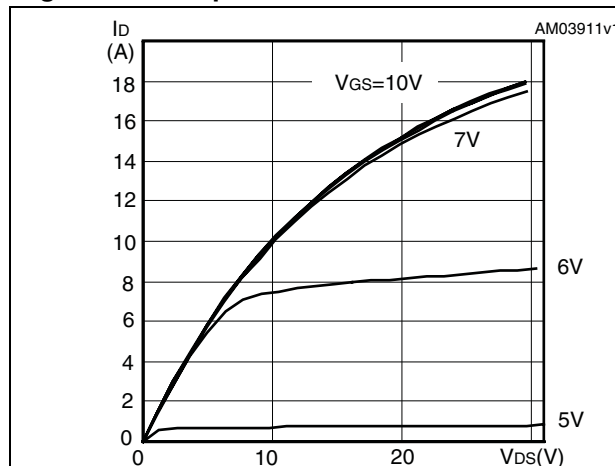


Figure 7. Transfer characteristics

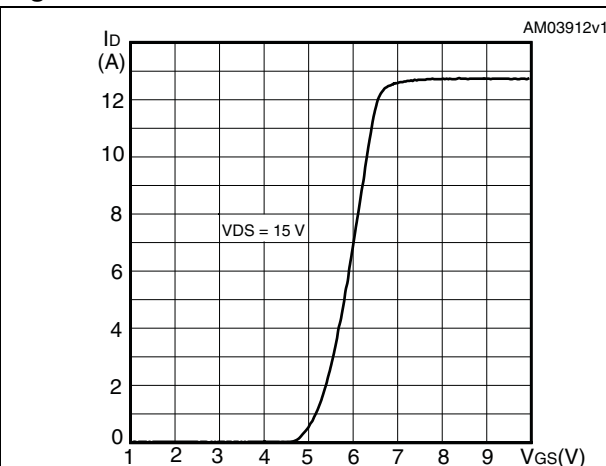


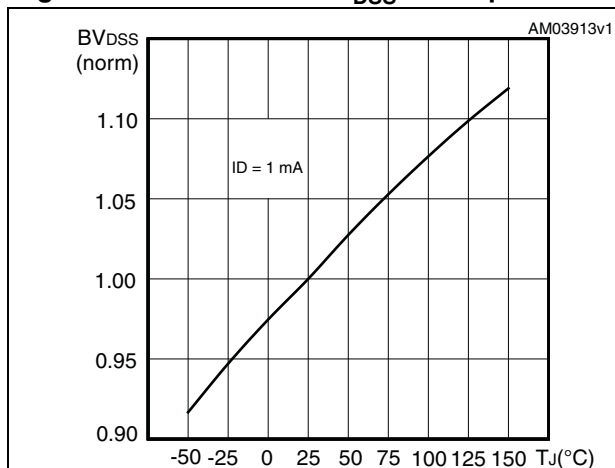
Figure 8. Normalized  $BV_{DSS}$  vs temperature

Figure 9. Static drain-source on-resistance

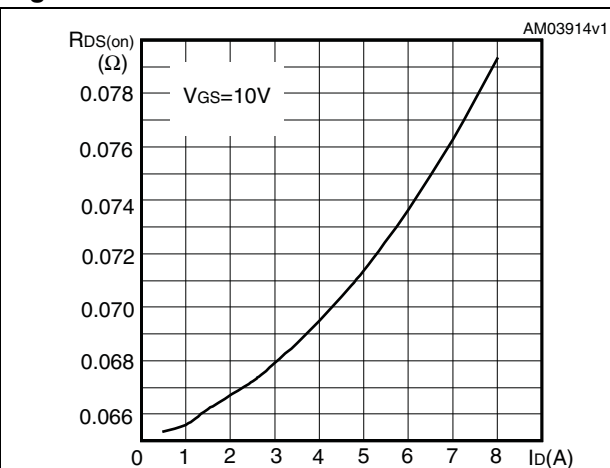


Figure 10. Output capacitance stored energy

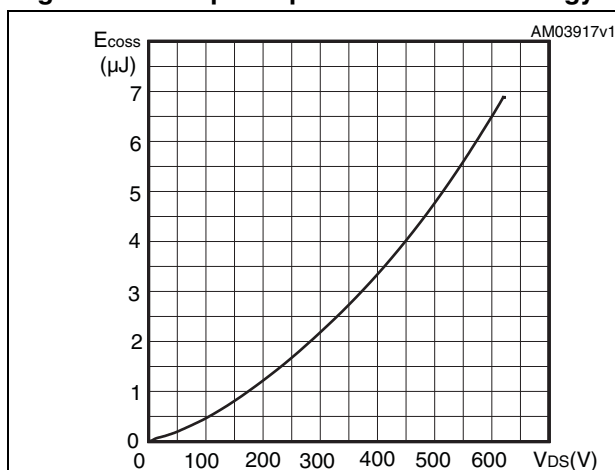


Figure 11. Capacitance variations

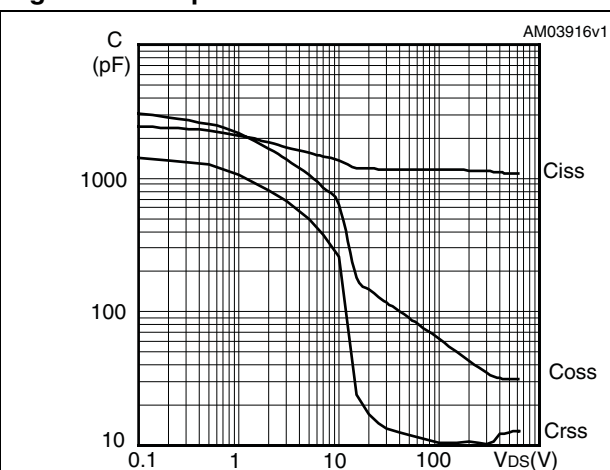


Figure 12. Gate charge vs gate-source voltage

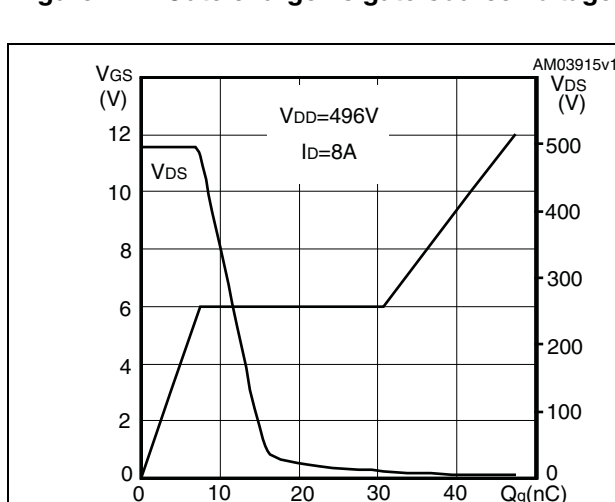


Figure 13. Normalized on-resistance vs temperature

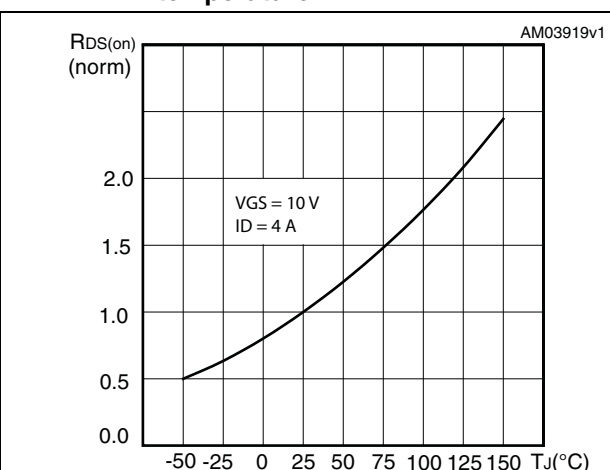


Figure 14. Normalized gate threshold voltage vs temperature

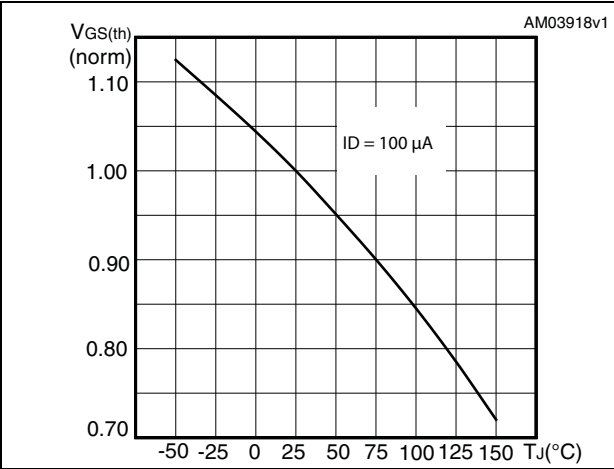


Figure 15. Maximum avalanche energy vs temperature

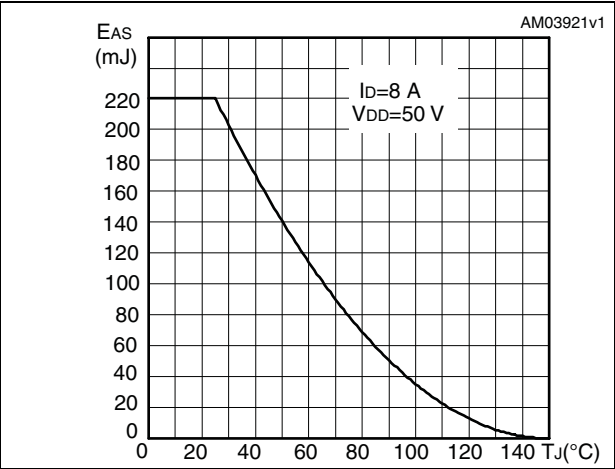
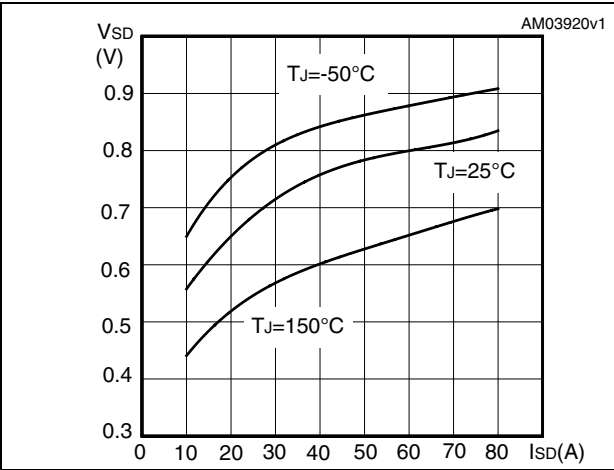
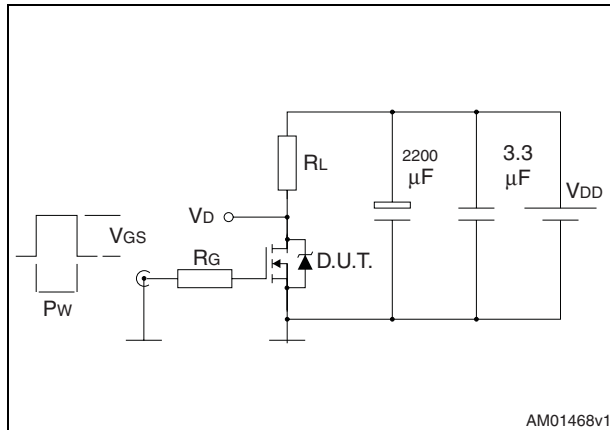


Figure 16. Source-drain diode forward characteristics

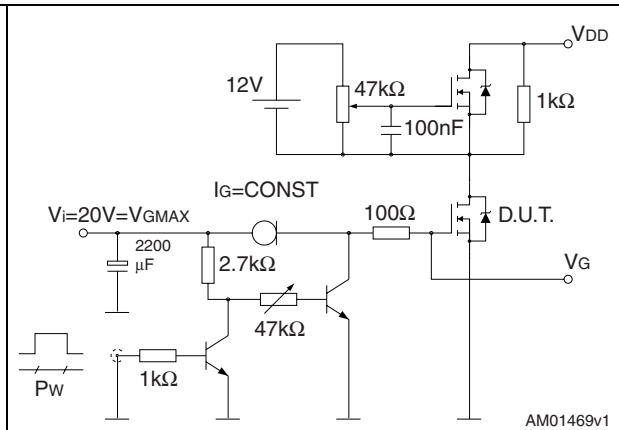


### 3 Test circuits

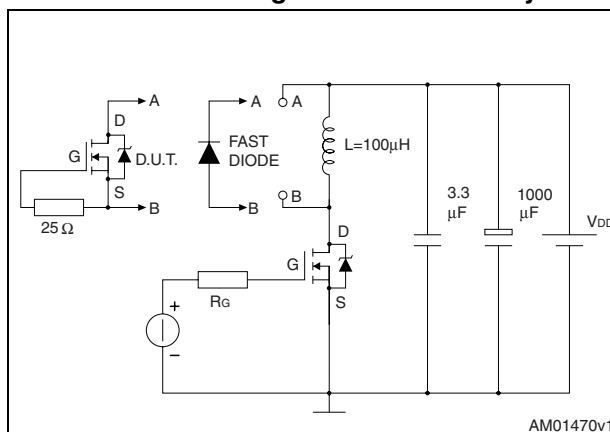
**Figure 17. Switching times test circuit for resistive load**



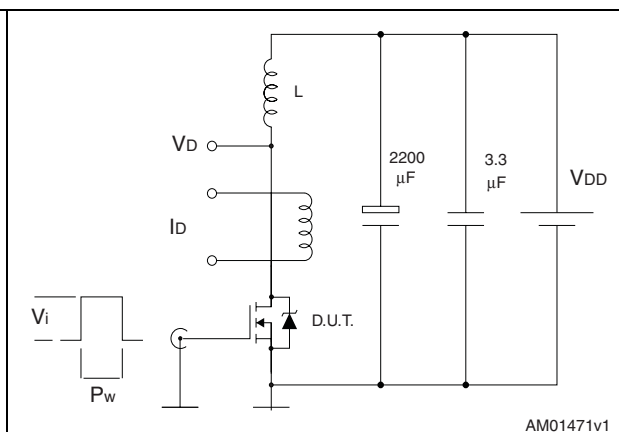
**Figure 18. Gate charge test circuit**



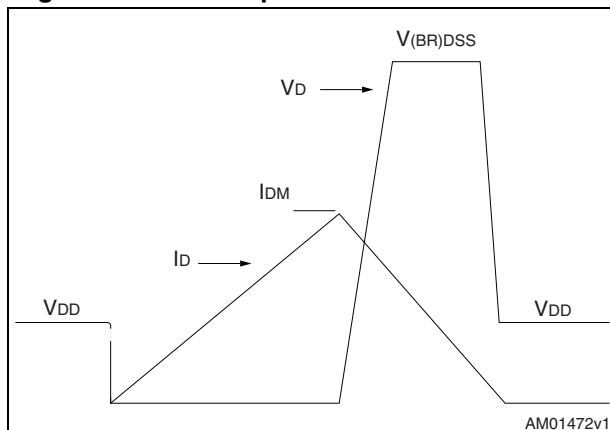
**Figure 19. Test circuit for inductive load switching and diode recovery times**



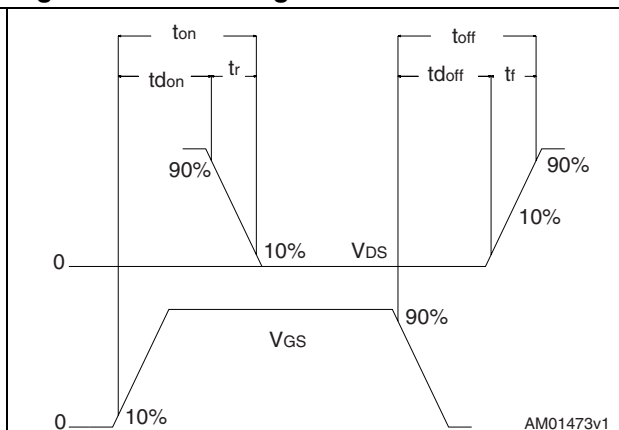
**Figure 20. Unclamped inductive load test circuit**



**Figure 21. Unclamped inductive waveform**



**Figure 22. Switching time waveform**



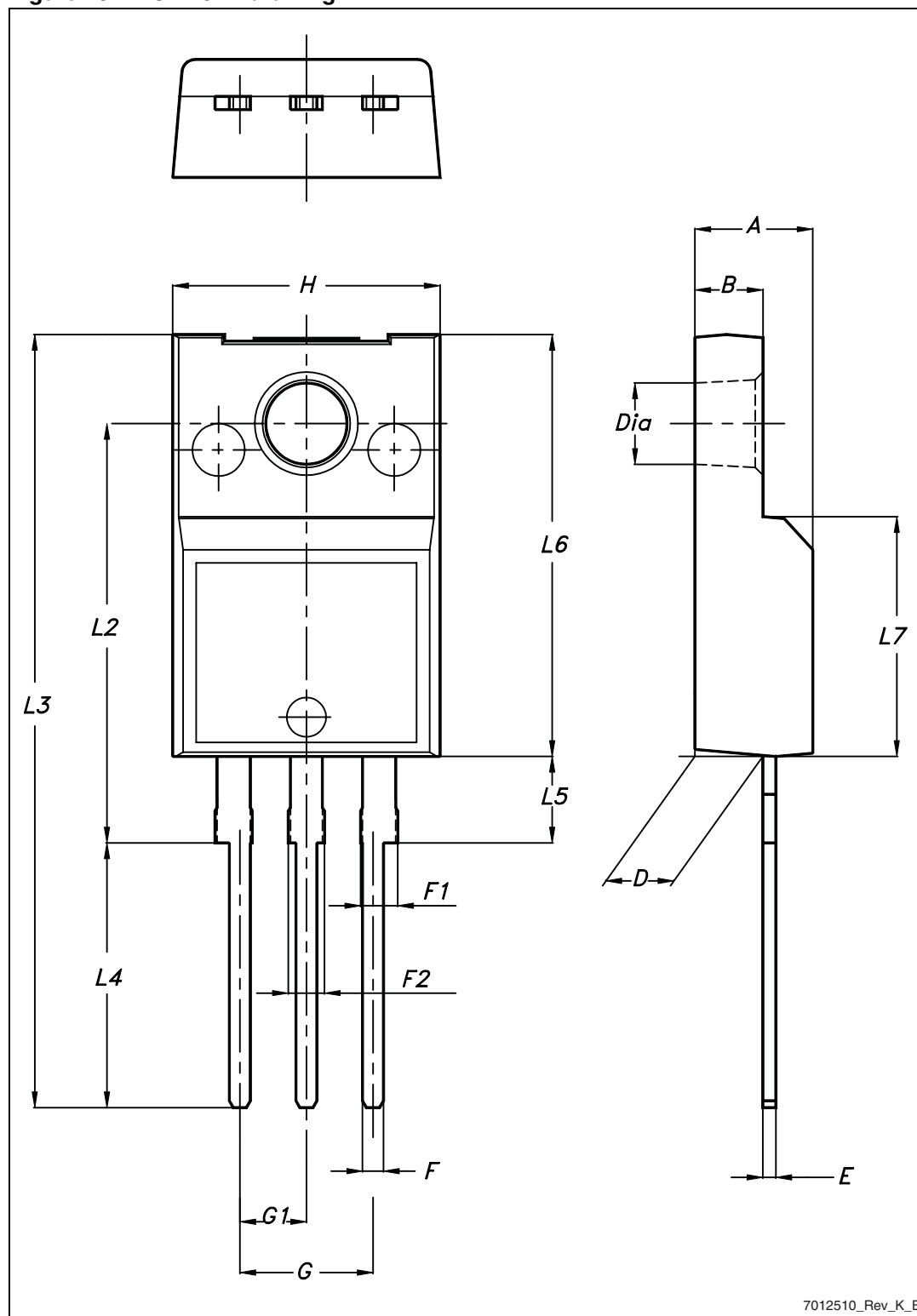
## 4 Package mechanical data

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](http://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 23. TO-220FP drawing

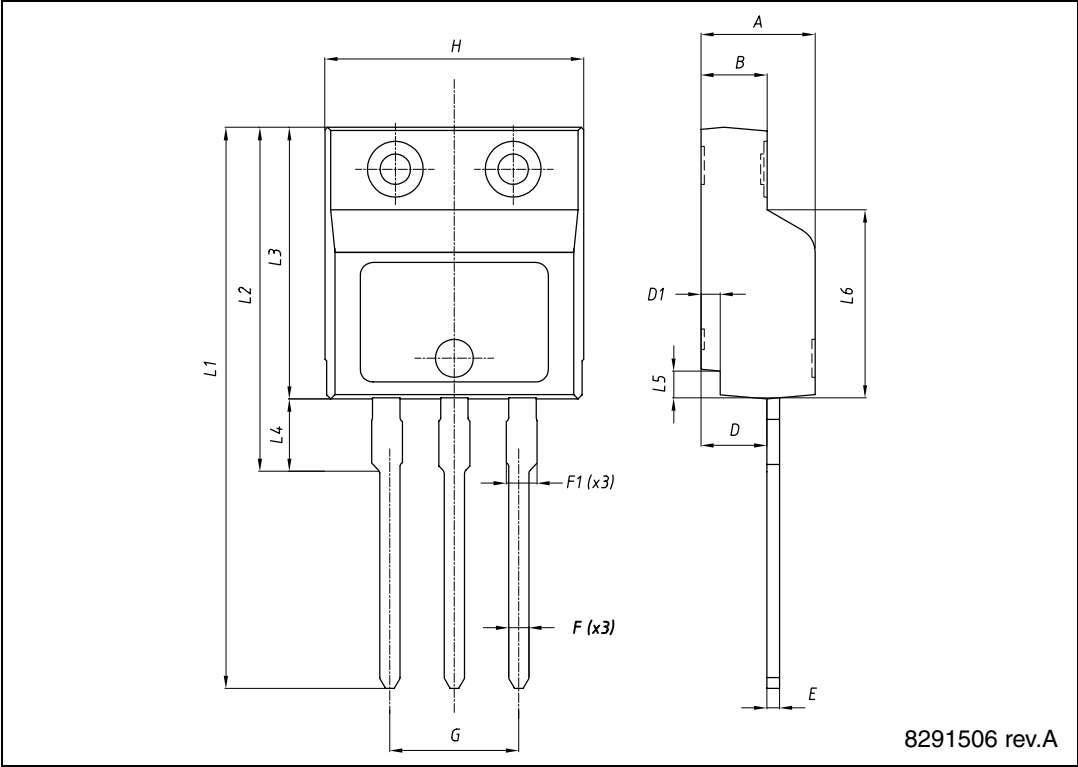


7012510\_Rev\_K\_B

Table 10. I<sup>2</sup>PAKFP (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 24. I<sup>2</sup>PAKFP (TO-281) drawing



8291506 rev.A

Table 11. I<sup>2</sup>PAK (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  |

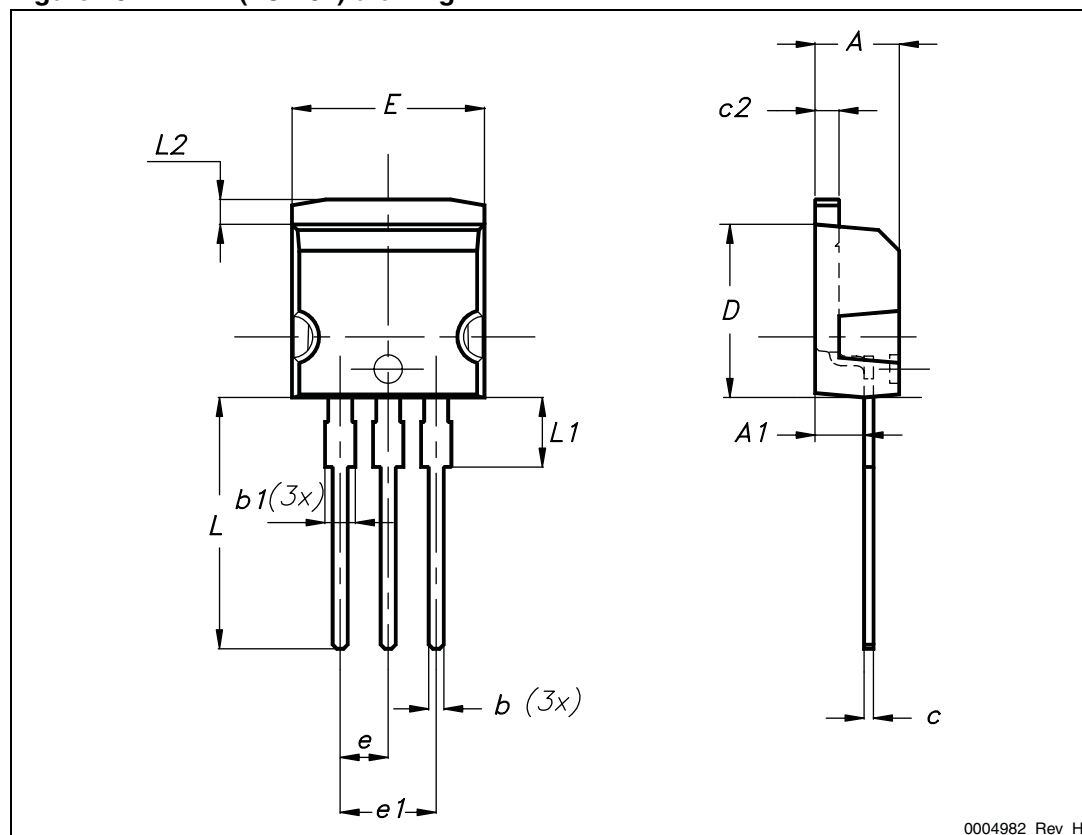
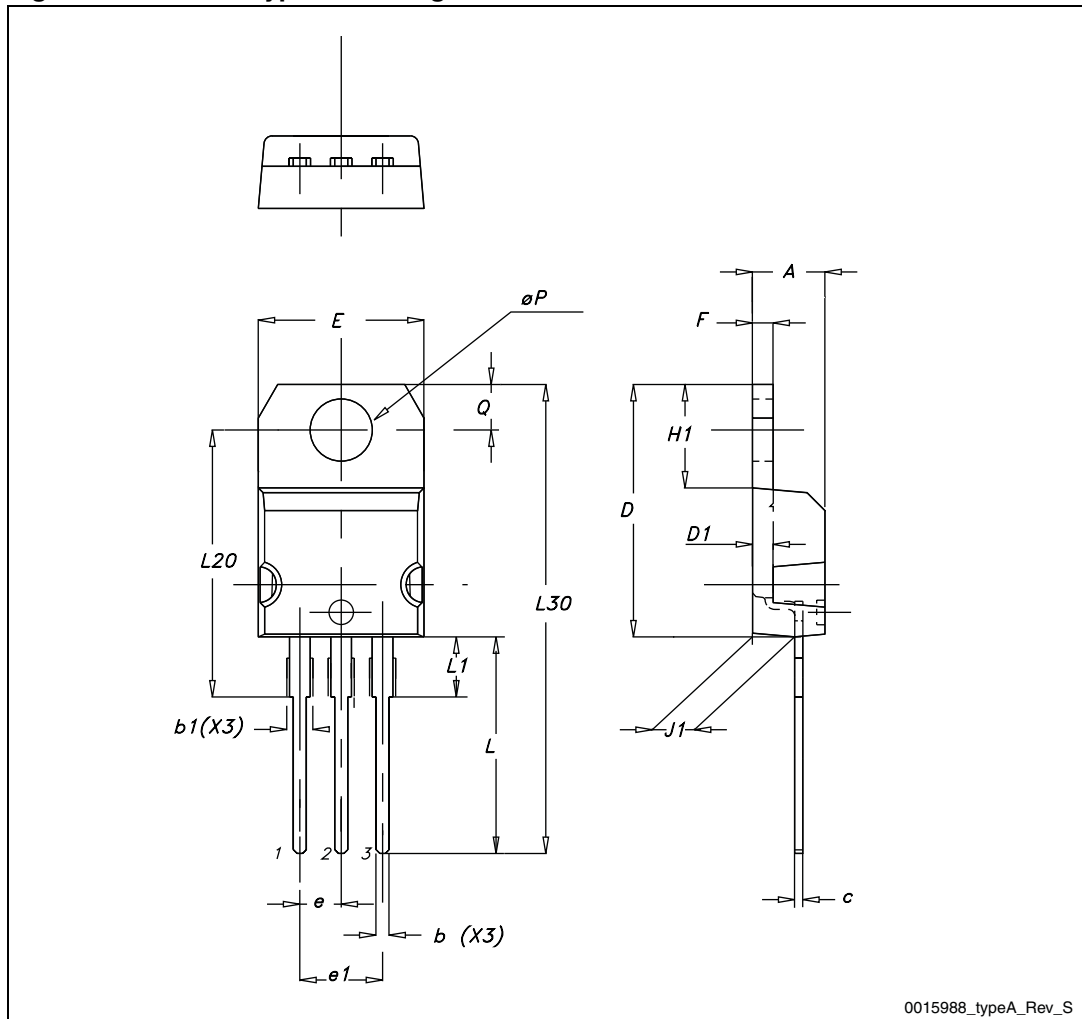
Figure 25. I<sup>2</sup>PAK (TO-262) drawing

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 26. TO-220 type A drawing



## 5 Revision history

**Table 13. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 08-Jun-2009 | 1        | First release.                                                                                                                                                                                                                                                         |
| 22-Jun-2009 | 2        | Added new package, mechanical data: I <sup>2</sup> PAK                                                                                                                                                                                                                 |
| 06-Aug-2012 | 3        | Added package, mechanical data: I <sup>2</sup> PAKFP<br>Updated <a href="#">Table 1: Device summary</a> , <a href="#">Table 2: Absolute maximum ratings</a> , <a href="#">Table 3: Thermal data</a> , <a href="#">Table 4: On /off states</a> .<br>Minor text changes. |
| 13-Sep-2012 | 4        | Changed value in the title from 3.8 A to 8.4 A.                                                                                                                                                                                                                        |

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2012 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)

