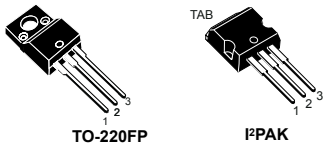
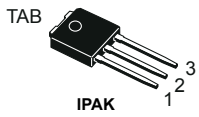
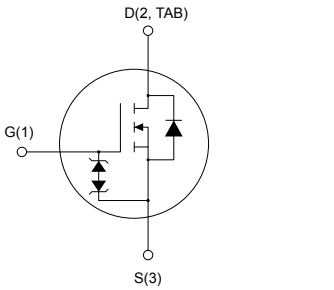
# STF4N62K3, STI4N62K3, STU4N62K3

Datasheet

## N-channel 620 V, 1.7 Ω typ., 3.8 A MDmesh K3 Power MOSFET in a TO-220FP, I²PAK and IPAK packages




## Features

| Order codes | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ |
|---|---|---|---|
| STF4N62K3 | 620 V | 2 Ω | 3.8 A |
| STI4N62K3 | | | |
| STU4N62K3 | | | |

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

## Applications

- Switching applications

## Description

These MDmesh K3 Power MOSFETs are the result of improvements applied to STMicroelectronics' MDmesh 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.

| Product status link |
|---|
| STF4N62K3 |
| STI4N62K3 |
| STU4N62K3 |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | TO-220FP | IPAK<br>I²PAK | |
| $V_{DS}$ | Drain-source voltage | 620 | | V |
| $V_{GS}$ | Gate-source voltage | ±30 | | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 3.8 | | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 2 | | |
| $I_{DM}$(1) | Drain current (pulsed) | 15.2 | | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 25 | 70 | W |
| dv/dt(2) | Peak diode recovery voltage slope | 12 | | V/ns |
| ESD | Gate-source human body model (R = 1.5 kΩ, C = 100 pF) | 2.5 | | kV |
| $V_{ISO}$ | Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, $T_C$ = 25 °C) | 2.5 | - | kV |
| $T_{stg}$ | Storage temperature range | -55 to 150 | | °C |
| $T_J$ | Maximum operating junction temperature | 150 | | °C |

1. *Pulse width is limited by safe operating area.*
2. *$I_{SD}$ ≤ 3.8 A, di/dt = 400 A/µs, $V_{DS}$ (peak) < $V_{(BR)DSS}$, $V_{DD}$ = 496 V.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | | | Unit |
|---|---|---|---|---|---|
| | | TO-220FP | I²PAK | IPAK | |
| $R_{thJC}$ | Thermal resistance, junction-to-case | 5 | 1.79 | | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 62.5 | | 100 | °C/W |

**Table 3. Avalanche characteristics**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche current, repetitive or non-repetitive (pulse width limited by $T_J$ max.) | 3.8 | A |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V) | 115 | mJ |

# 2 Electrical characteristics

$T_C$ = 25 °C unless otherwise specified.

**Table 4. Static**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS}$ = 0 V, $I_D$ = 1 mA | 620 | - | - | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 620 V | - | - | 1 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 620 V, $T_C$ = 125 °C(1) | - | - | 50 | |
| $I_{GSS}$ | Gate-body leakage current | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | - | - | ±10 | µA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 50 µA | 3 | 3.75 | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$ = 1.9 A | - | 1.7 | 2 | Ω |

1. *Specified by design, not tested in production.*

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 50 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 550 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 42 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 7 | - | pF |
| $C_{oss\ eq.}$(1) | Equivalent capacitance time related | $V_{DS}$ = 0 to 496 V, $V_{GS}$ = 0 V | - | 27 | - | pF |
| $R_g$ | Intrinsic gate resistance | f = 1 MHz, $I_D$ = 0 A | 2(2) | 5 | 10(2) | Ω |
| $Q_g$ | Total gate charge | $V_{DD}$ = 496 V, $I_D$ = 3.8 A, $V_{GS}$ = 0 to 10 V (see the Figure 19. Test circuit for gate charge behavior) | - | 22 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 4 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 13 | - | nC |

1. *$C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as $C_{oss}$ when $V_{DS}$ increases from 0 to 80% $V_{DSS}$.*
2. *Specified by design, not tested in production.*

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 300 V, $I_D$ = 1.9 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see the Figure 18. Test circuit for resistive load switching times and Figure 23. Switching time waveform) | - | 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 | $V_{GS}$ = 0 V, $I_{SD}$ = 3.8 A | - | - | 1.6 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 3.8 A, di/dt = 100 A/µs, | - | 220 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 60 V | - | 1.4 | - | µC |
| $I_{RRM}$ | Reverse recovery current | (see the Figure 20. Test circuit for inductive load switching and diode recovery times) | - | 13 | - | A |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 3.8 A, di/dt = 100 A/µs, | - | 270 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 60 V, $T_J$ = 150 °C | - | 1.9 | - | µC |
| $I_{RRM}$ | Reverse recovery current | (see the Figure 20. Test circuit for inductive load switching and diode recovery times) | - | 14 | - | A |

1. *Pulse width is limited by safe operating area.*
2. *Pulse test: pulse duration = 300 µs, duty cycle 1.5%.*

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area for TO-220FP**

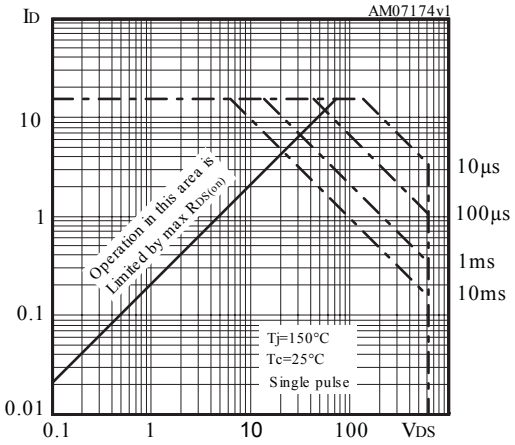



**Figure 2. Normalized transient thermal impedance for TO-220FP**

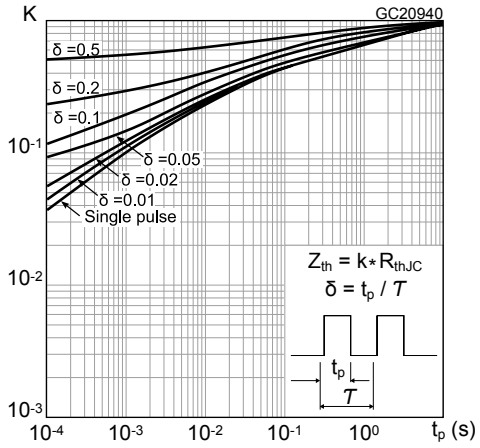



**Figure 3. Safe operating area for I²PAK**

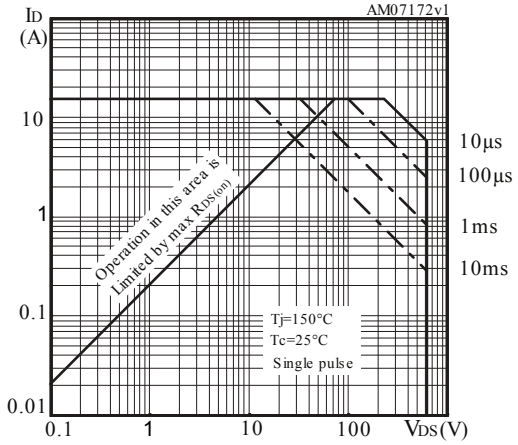



**Figure 4. Normalized transient thermal impedance for I²PAK**

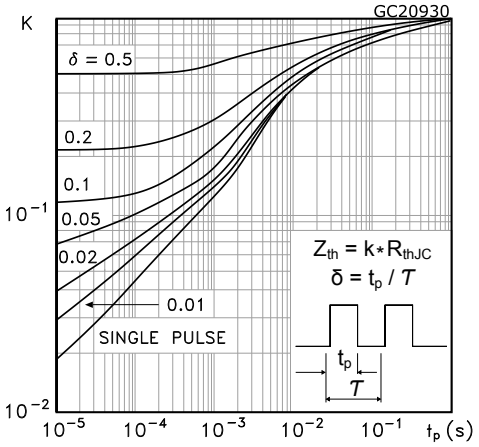



**Figure 5. Safe operating area for IPAK**

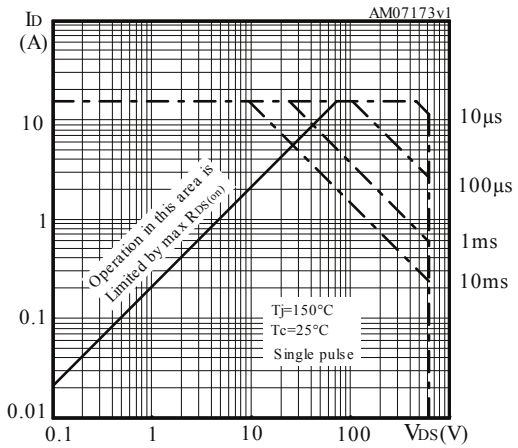



**Figure 6. Normalized transient thermal impedance for IPAK**

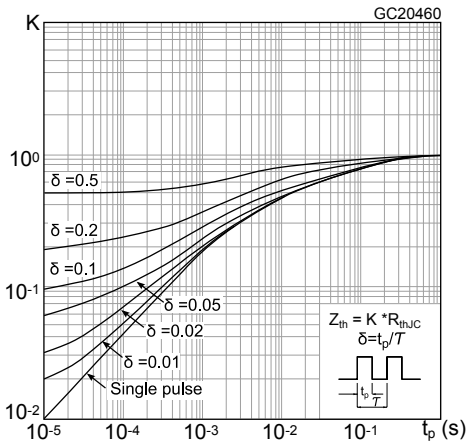


**Figure 7. Typical output characteristics**

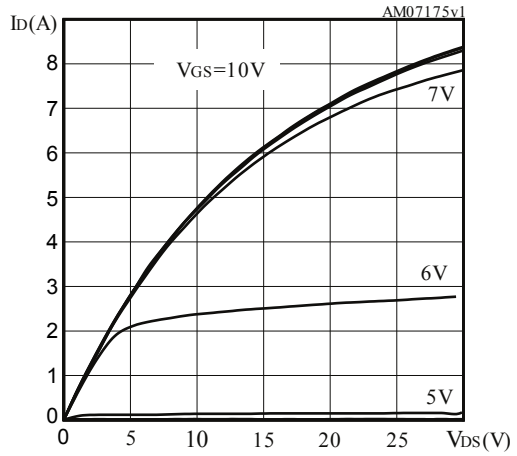



**Figure 8. Typical transfer characteristics**

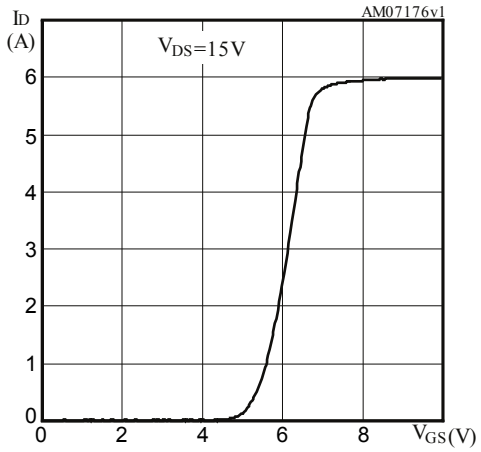



**Figure 9. Typical gate charge characteristics**

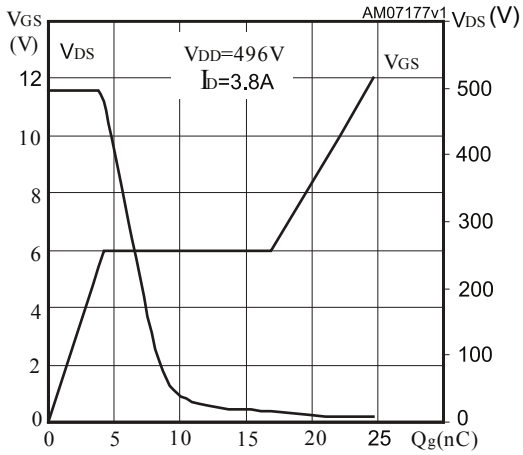



**Figure 10. Typical drain-source on-resistance**

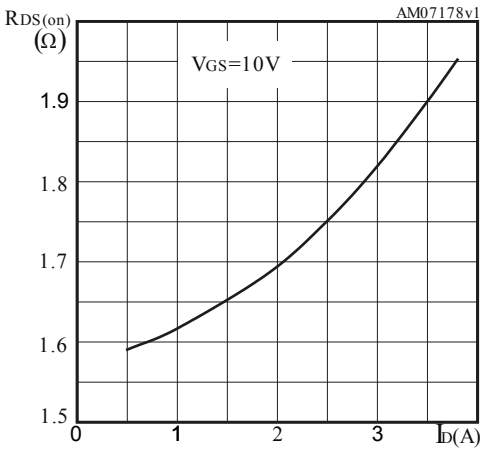



**Figure 11. Typical capacitance characteristics**

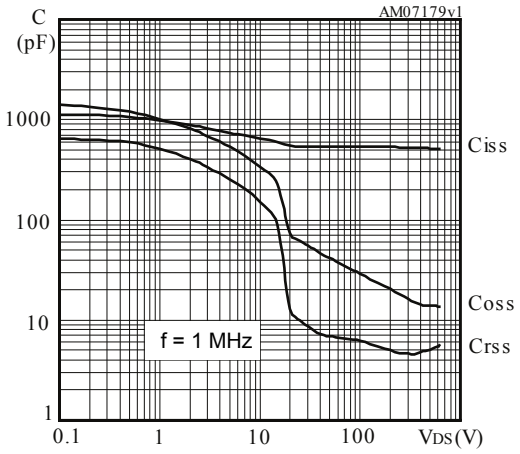



**Figure 12. Typical output capacitance stored energy**

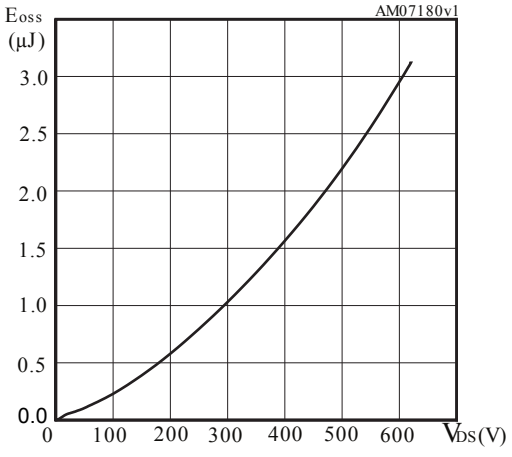


**Figure 13. Normalized gate threshold vs temperature**

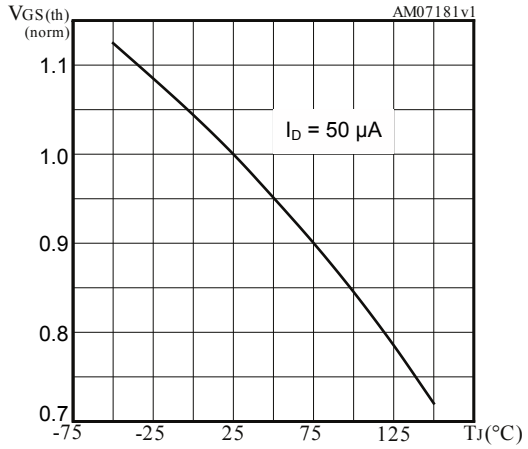



**Figure 14. Normalized on-resistance vs temperature**

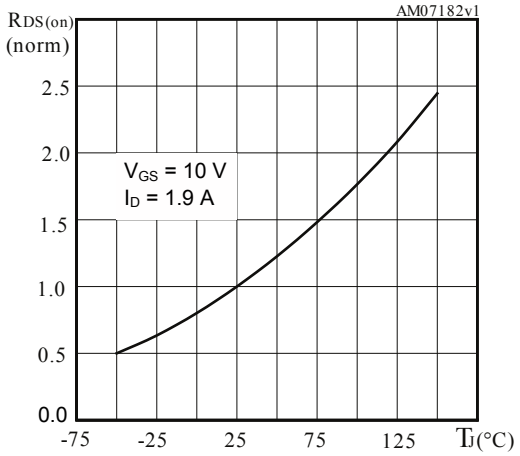



**Figure 15. Maximum avalanche energy vs temperature**

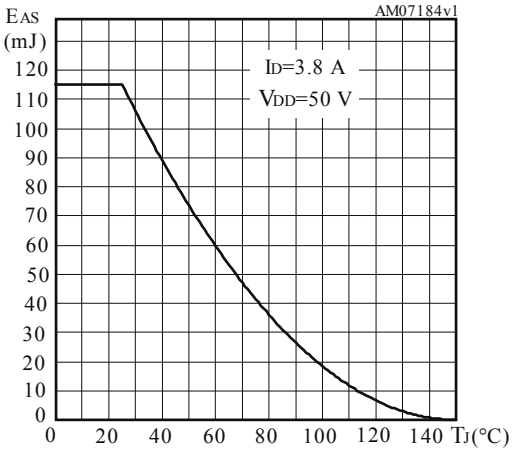



**Figure 16. Normalized breakdown voltage vs temperature**

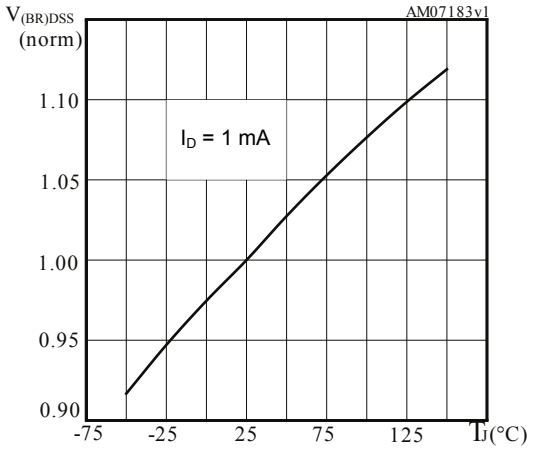
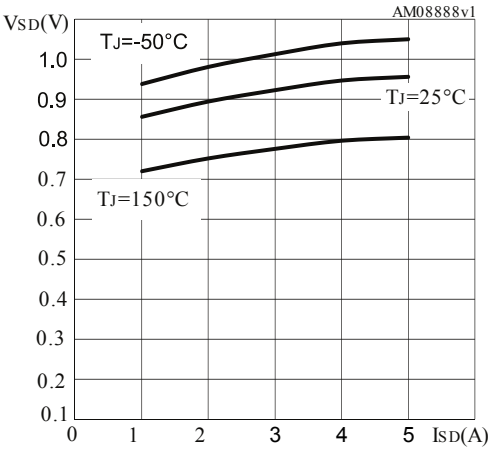
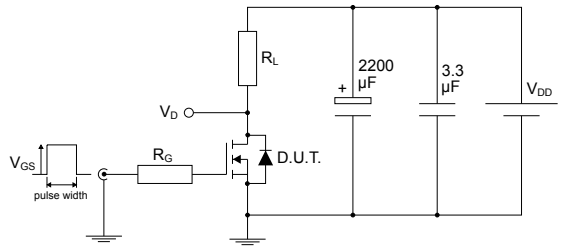



**Figure 17. Typical reverse diode forward characteristics**



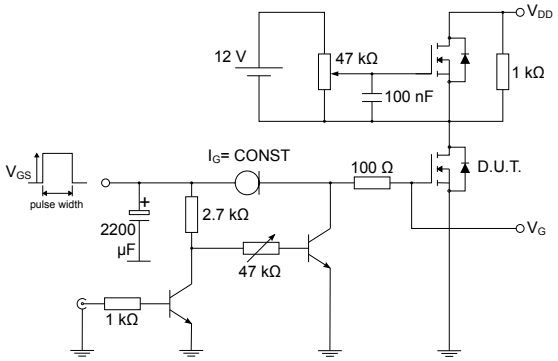
# 3 Test circuits

**Figure 18. Test circuit for resistive load switching times**



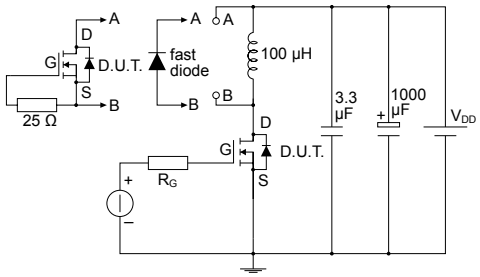

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**Figure 19. Test circuit for gate charge behavior**



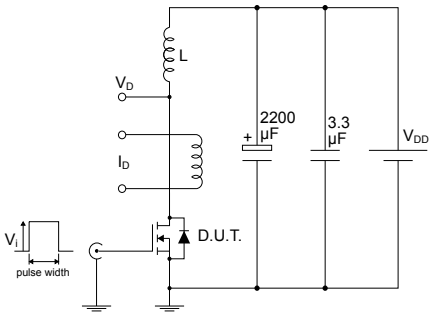

AM01469v1

**Figure 20. Test circuit for inductive load switching and diode recovery times**



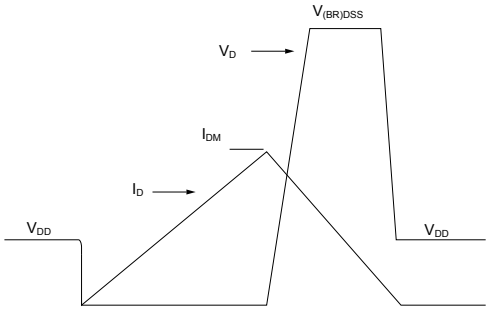

AM01470v1

**Figure 21. Unclamped inductive load test circuit**



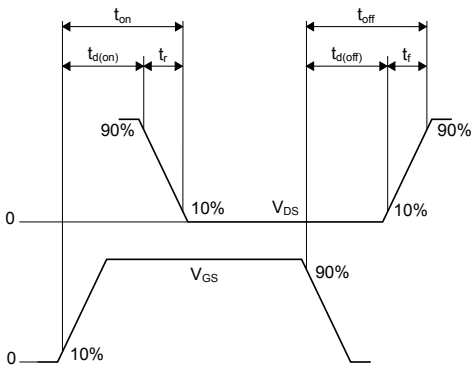

AM01471v1

**Figure 22. Unclamped inductive waveform**




AM01472v1

**Figure 23. Switching time waveform**




AM01473v1

# 4 Package information

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.

## 4.1 TO-220FP type B package information

**Figure 24. TO-220FP type B package outline**

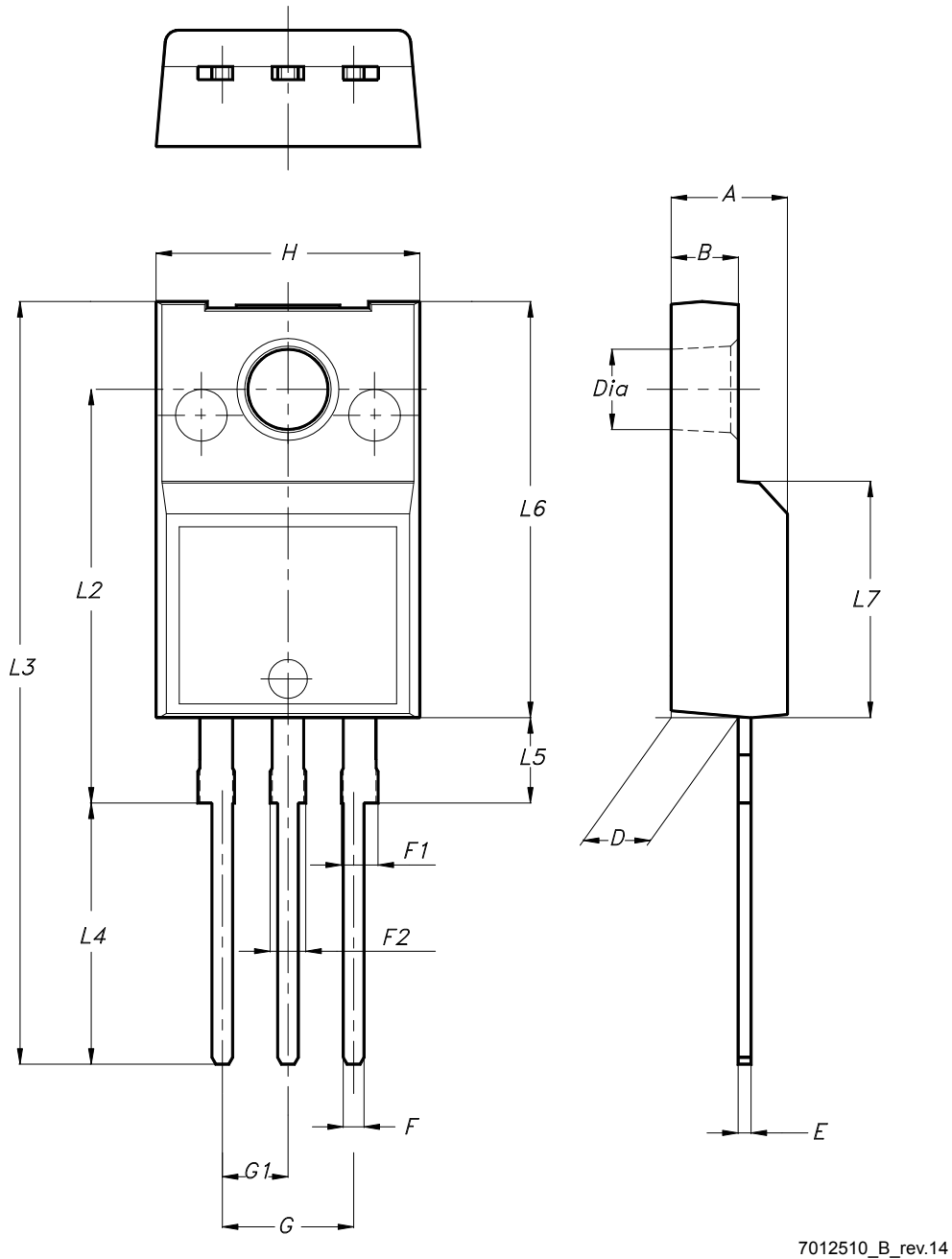
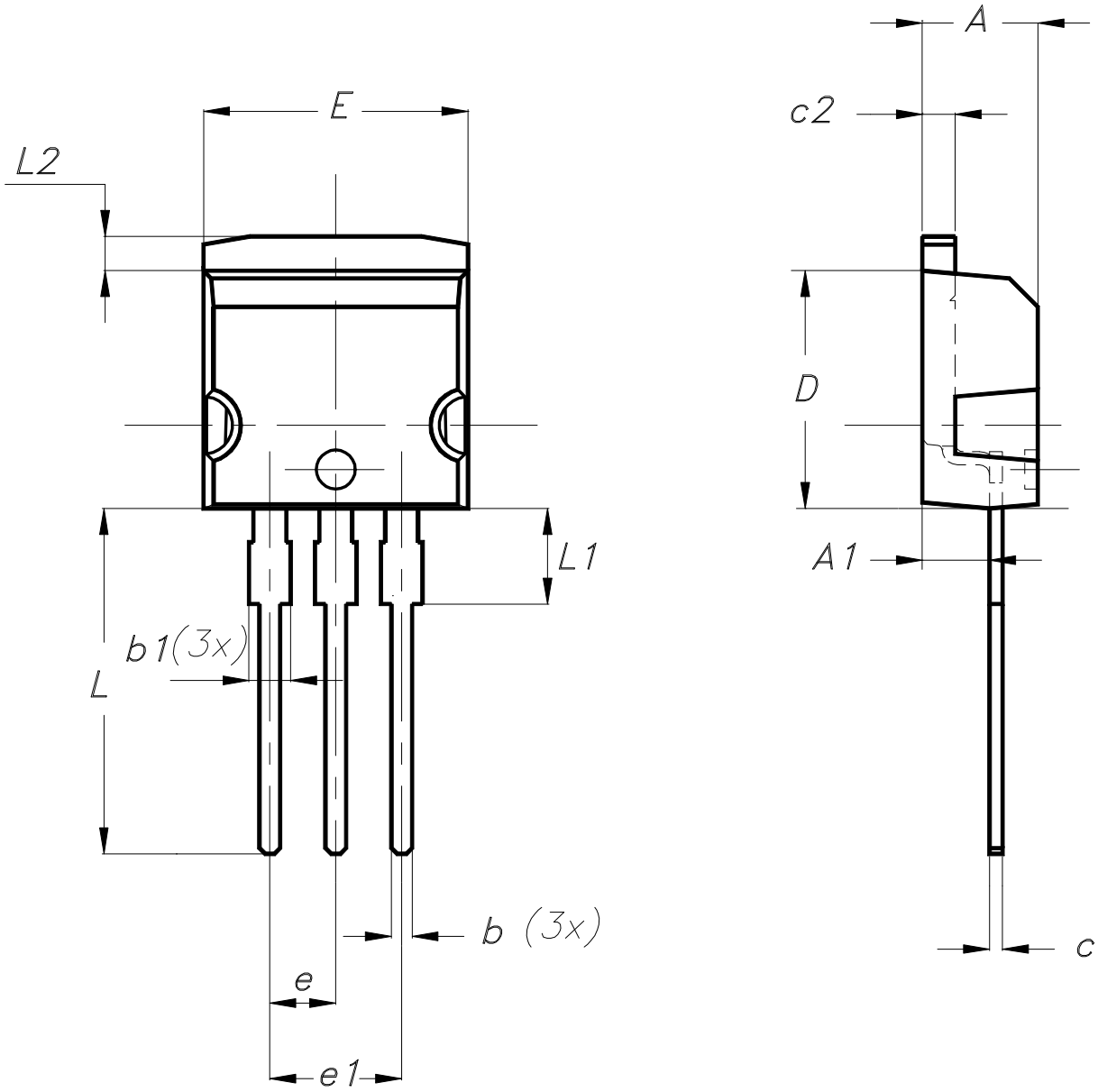


Table 8. **TO-220FP type B package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| B | 2.50 | | 2.70 |
| D | 2.50 | | 2.75 |
| E | 0.45 | | 0.70 |
| F | 0.75 | | 1.00 |
| F1 | 1.15 | | 1.70 |
| F2 | 1.15 | | 1.70 |
| G | 4.95 | | 5.20 |
| G1 | 2.40 | | 2.70 |
| H | 10.00 | | 10.40 |
| L2 | | 16.00 | |
| L3 | 28.60 | | 30.60 |
| L4 | 9.80 | | 10.60 |
| L5 | 2.90 | | 3.60 |
| L6 | 15.90 | | 16.40 |
| L7 | 9.00 | | 9.30 |
| Dia | 3.00 | | 3.20 |

## 4.2 I²PAK package information

Figure 25. I²PAK package outline




0004982_Rev_10

Table 9. I²PAK package mechanical data

| Dim. | mm | |
|---|---|---|
| | Min. | 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 | 10.00 | 10.40 |
| L | 13.00 | 14.00 |
| L1 | 3.50 | 3.93 |
| L2 | 1.27 | 1.40 |

## 4.3 IPAK (TO-251) type A package information

Figure 26. **IPAK (TO-251) type A package outline**

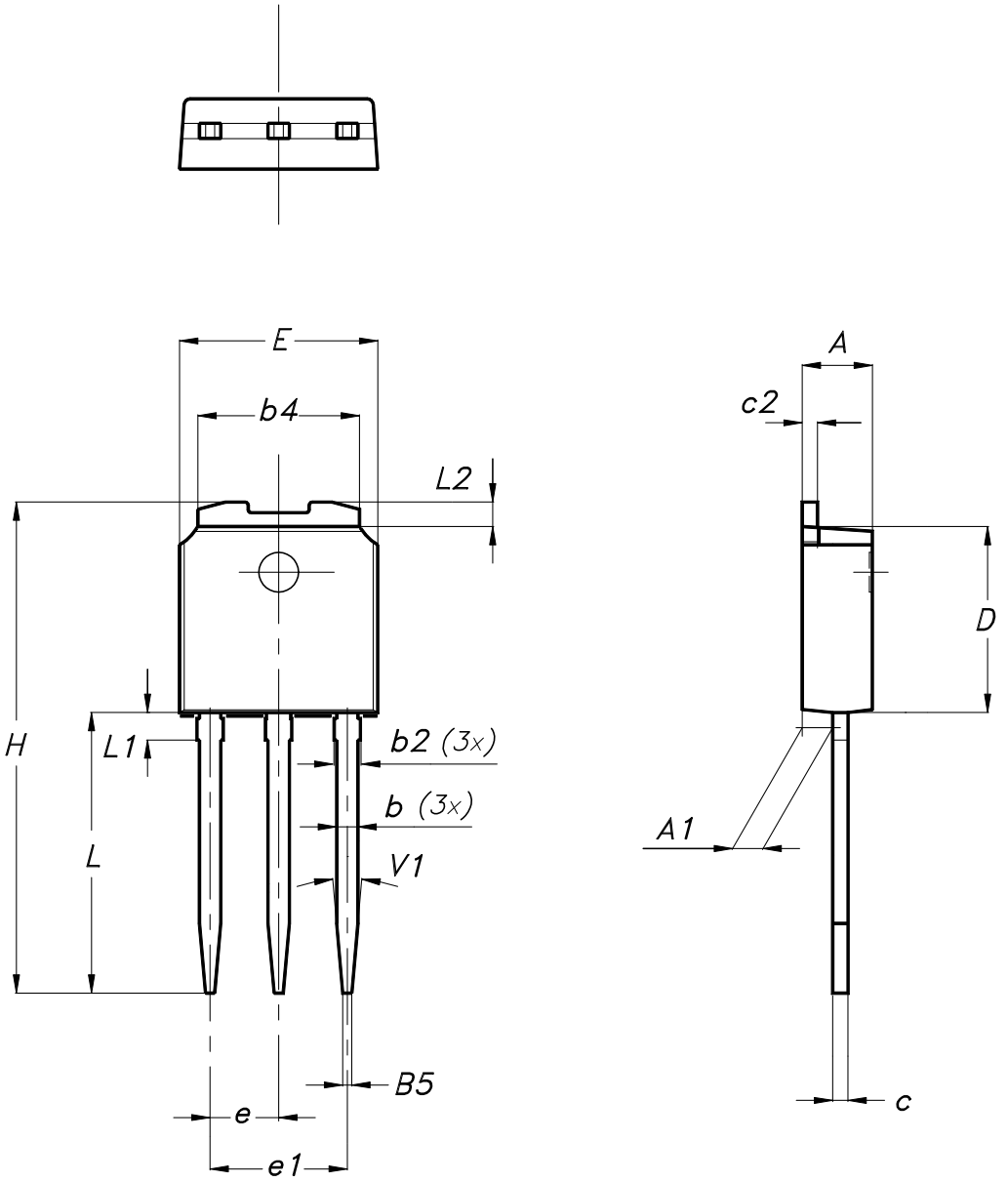


Table 10. **IPAK (TO-251) type A package mechanical data**

| 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° | |

# 5 Ordering information

Table 11. **Order codes**

| Order codes | Marking | Package | Packing |
|---|---|---|---|
| STF4N62K3 | 4N62K3 | TO-220FP | Tube |
| STI4N62K3 | | I²PAK | |
| STU4N62K3 | | IPAK | |

## Revision history

Table 12. **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*.<br>Updated *Section 4: Package mechanical data*. |
| 07-Aug-2012 | 4 | Added package, mechanical data: I²PAKFP.<br>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*.<br>Minor text changes. |
| 27-Jan-2026 | 5 | Removed order code STFI4N62K3 and STP4N62K3.<br>Updated Section 4: Package information.<br>Minor text changes. |

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