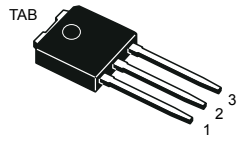
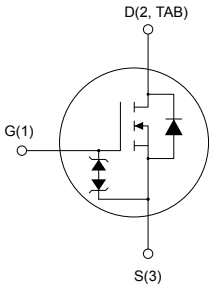
# N-channel 620 V, 0.95 Ω typ., 5.5 A MDmesh K3 Power MOSFET in an IPAK package




**IPAK**




AM01476v1_tab

## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ |
|---|---|---|---|
| STU6N62K3 | 620 V | 1.2 Ω | 5.5 A |

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

## Applications

- Switching applications

## Description

This MDmesh K3 Power MOSFET is the result of improvements applied to STMicroelectronics' MDmesh technology, combined with a new optimized vertical structure. This device boasts an extremely low on-resistance, superior dynamic performance and high avalanche capability, rendering it suitable for the most demanding applications.

| Product status link |
|---|
| STU6N62K3 |

| Product summary | |
|---|---|
| **Order code** | STU6N62K3 |
| **Marking** | 6N62K3 |
| **Package** | IPAK |
| **Packing** | Tube |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage | 620 | V |
| $V_{GS}$ | Gate-source voltage | ±30 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 5.5 | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 3 | |
| $I_{DM}$ (1) | Drain current (pulsed) | 22 | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 90 | W |
| ESD | Gate-source human body model (R=1.5 kΩ, C=100 pF) | 2.5 | kV |
| dv/dt (2) | Peak diode recovery voltage slope | 12 | V/ns |
| $T_{stg}$ | Storage temperature range | -55 to 150 | °C |
| $T_J$ | Operating junction temperature range | | °C |

1. *Pulse width limited by safe operating area.*
2. *$I_{SD}$ ≤ 5.5 A, di/dt ≤ 400 A/µs, $V_{DS}$ (peak) ≤ $V_{(BR)DSS}$, $V_{DD}$ = 80% $V_{(BR)DSS}$.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance, junction-to-case | 1.39 | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 100 | °C/W |

**Table 3. Avalanche characteristics**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche current, repetitive or not repetitive (pulse width is limited by $T_J$ max.) | 5.5 | A |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V) | 140 | mJ |

# 2 Electrical characteristics

$T_C$ = 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 mA, $V_{GS}$ = 0 V | 620 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 620 V | | | 0.8 | 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 | | | ±9 | 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, $I_D$ = 2.8 A | | 0.95 | 1.2 | 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 | - | 875 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 100 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 17 | - | pF |
| $C_{oss(er)}$(1) | Equivalent output capacitance energy related | $V_{DS}$ = 0 to 480 V, $V_{GS}$ = 0 V | - | 28 | - | pF |
| $C_{oss(tr)}$(2) | Equivalent output capacitance time related | | - | 63 | - | pF |
| $R_G$ | Intrinsic gate resistance | f = 1 MHz open drain | - | 3.5 | - | Ω |
| $Q_g$ | Total gate charge | $V_{DD}$ = 496 V, $I_D$ = 5.5 A, $V_{GS}$ = 0 to 10 V (see Figure 15. Test circuit for gate charge behavior) | - | 34 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 4 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 22 | - | nC |

1. *$C_{oss(er)}$ is a constant capacitance value that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.*
2. *$C_{oss(tr)}$ is a constant capacitance value that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising 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 V, $I_D$ = 2.75 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform) | - | 22 | - | ns |
| $t_r$ | Rise time | | - | 12 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 49 | - | ns |
| $t_f$ | Fall time | | - | 20 | - | ns |

**Table 7. Source-drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 5.5 | A |
| $I_{SDM}$ (1) | Source-drain current (pulsed) | | - | | 27 | A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$ = 5.5 A, $V_{GS}$ = 0 V | - | | 1.5 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 5.5 A, di/dt = 100 A/µs | - | 290 | | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 60 V | - | 1.9 | | µC |
| $I_{RRM}$ | Reverse recovery current | (see Figure 16. Test circuit for inductive load switching and diode recovery times) | - | 13.5 | | A |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 5.5 A, di/dt = 100 A/µs | - | 335 | | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 60 V, $T_J$ = 150 °C | - | 2.4 | | µC |
| $I_{RRM}$ | Reverse recovery current | (see Figure 16. Test circuit for inductive load switching and diode recovery times) | - | 14.5 | | 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 1. Safe operating area**

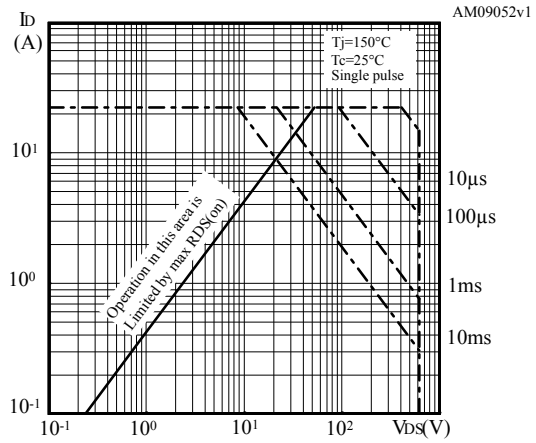



**Figure 2. Normalized transient thermal impedance**

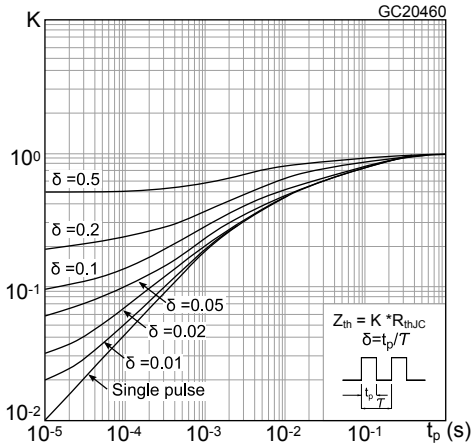



**Figure 3. Typical output characteristics**

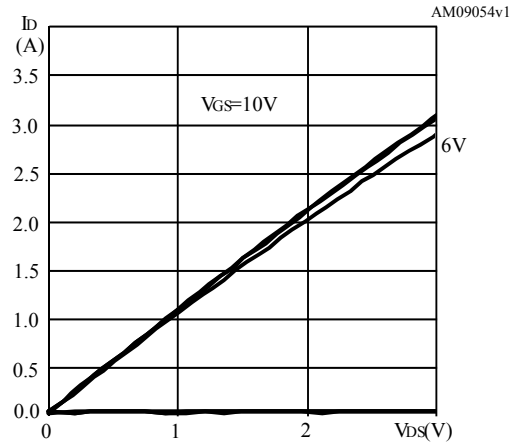



**Figure 4. Typical transfer characteristics**

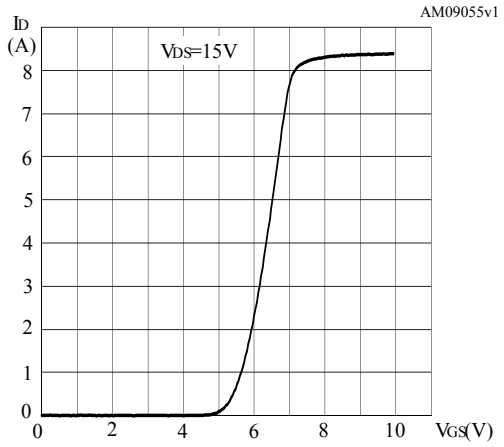



**Figure 5. Typical gate charge characteristics**

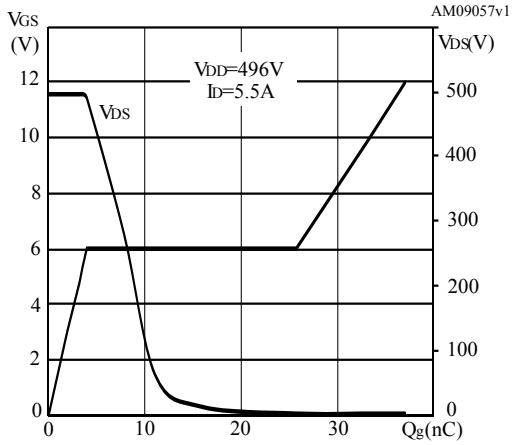



**Figure 6. Typical capacitance characteristics**

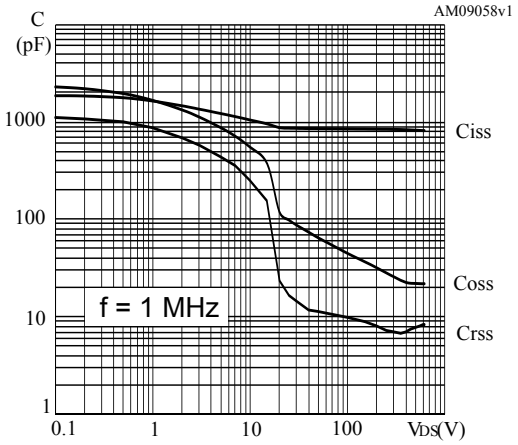


**Figure 7. Normalized gate threshold vs temperature**

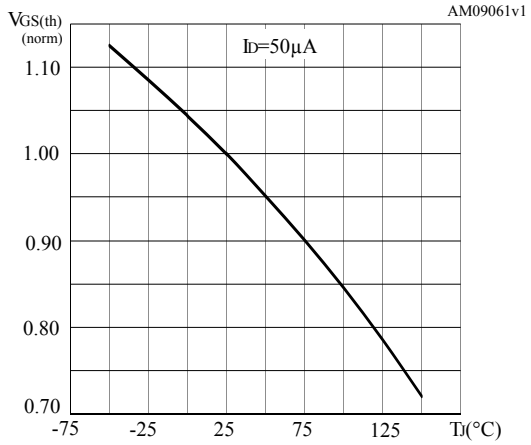



**Figure 8. Normalized breakdown voltage vs temperature**

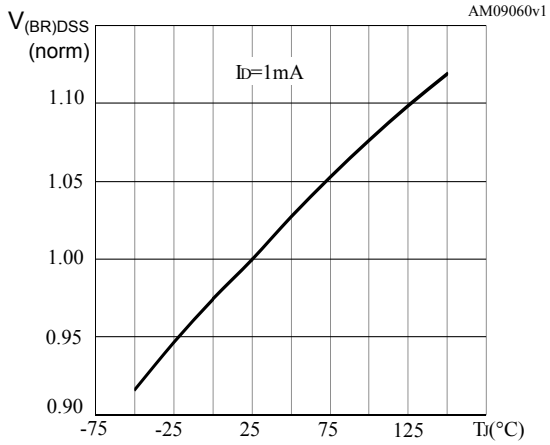



**Figure 9. Typical drain-source on-resistance**

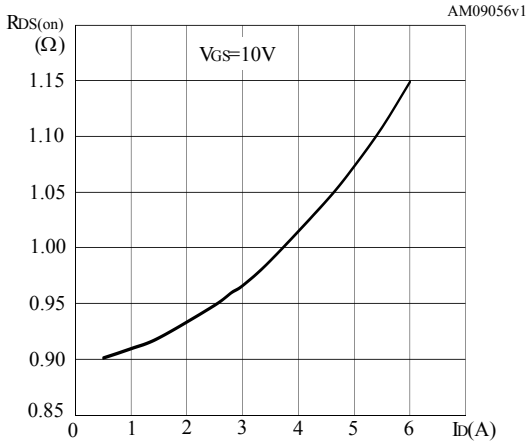



**Figure 10. Normalized on-resistance vs temperature**

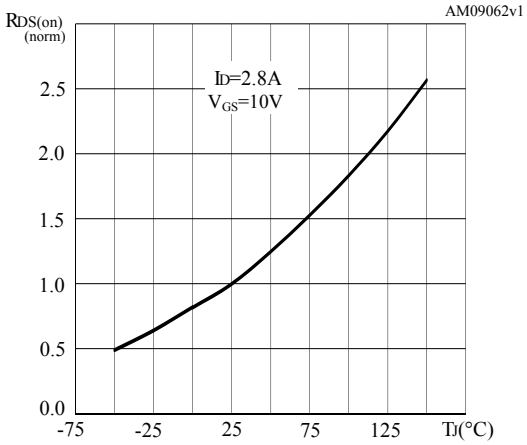



**Figure 11. Typical output capacitance stored energy**

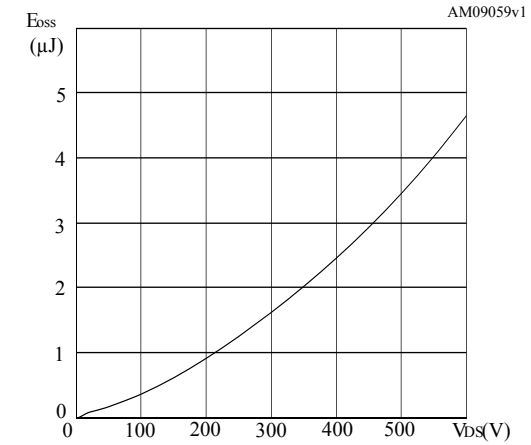



**Figure 12. Typical reverse diode forward characteristics**

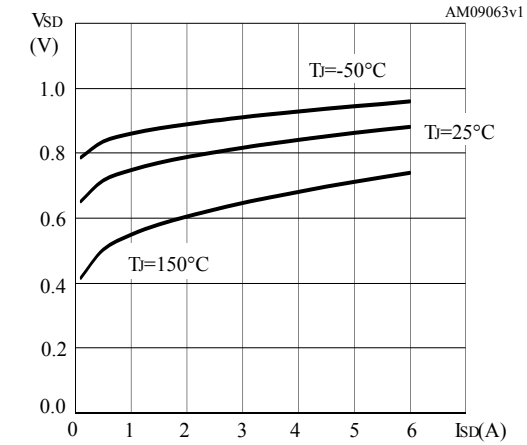
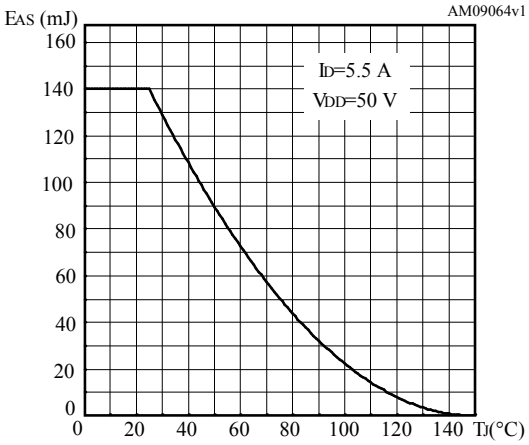
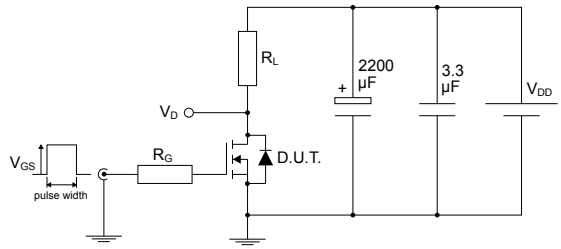


**Figure 13. Maximum avalanche energy vs temperature**



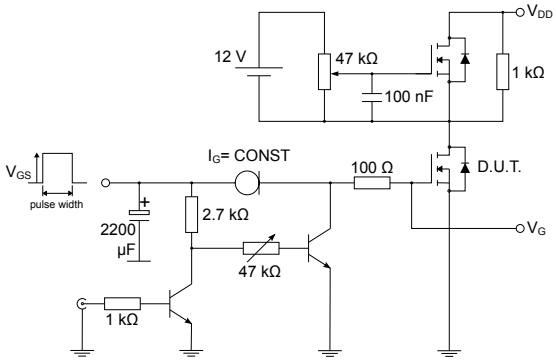
# 3 Test circuits

**Figure 14. Test circuit for resistive load switching times**



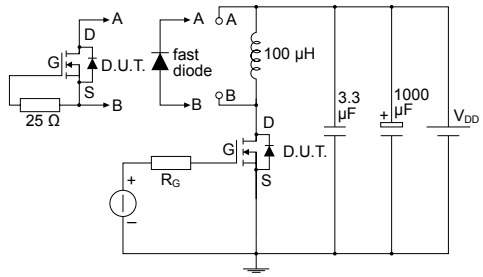

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**Figure 15. Test circuit for gate charge behavior**



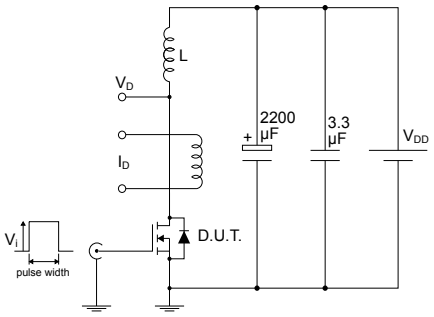

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**Figure 16. Test circuit for inductive load switching and diode recovery times**



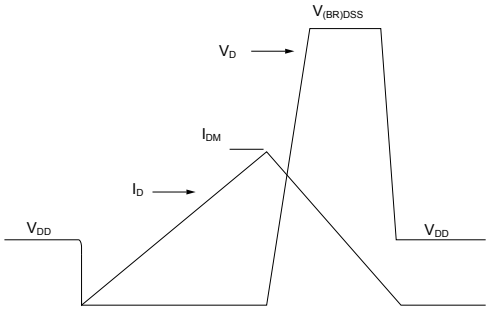

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**Figure 17. Unclamped inductive load test circuit**



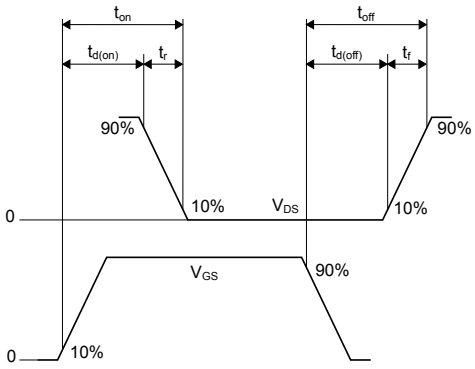

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**Figure 18. Unclamped inductive waveform**




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**Figure 19. Switching time waveform**



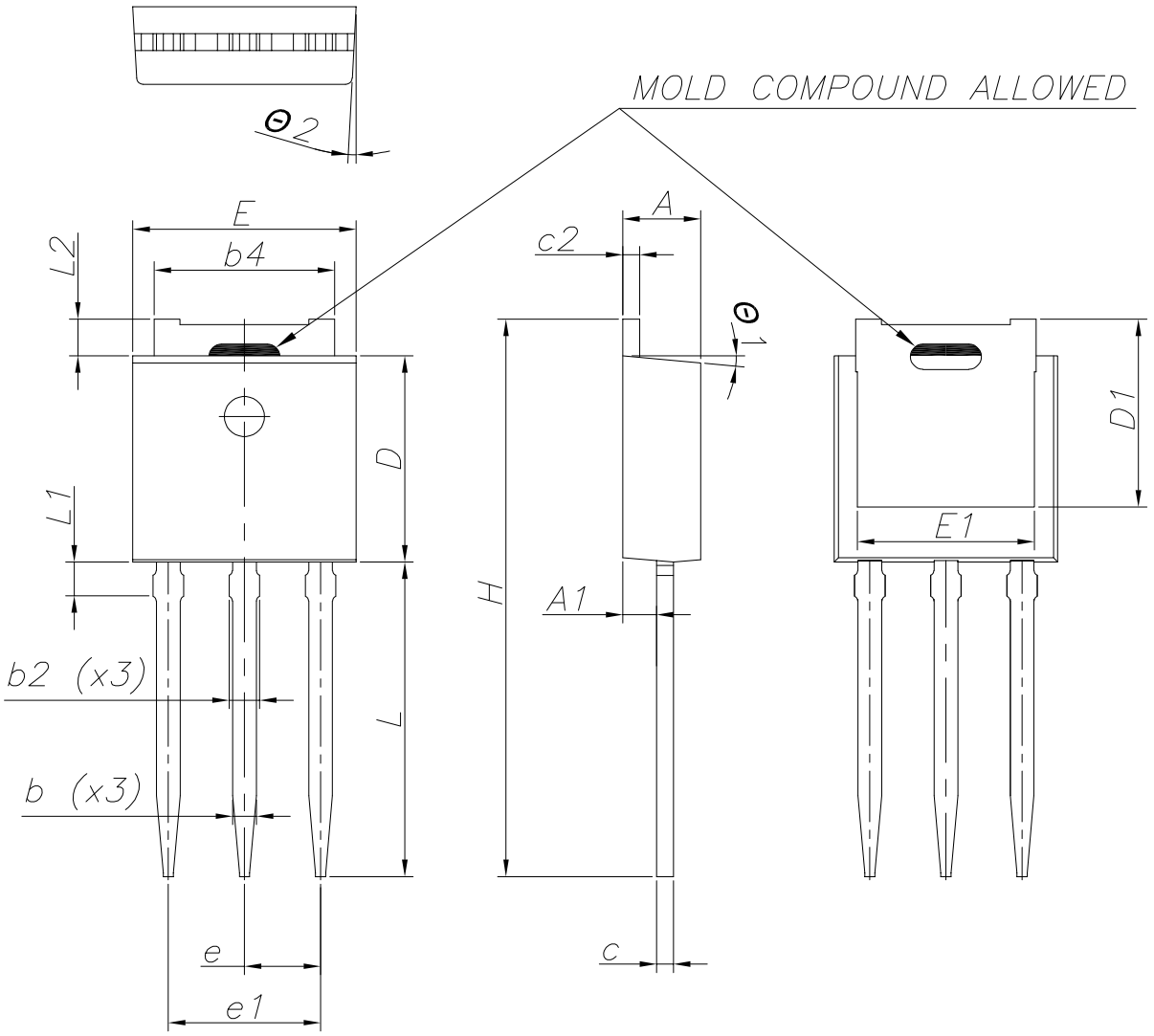

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# 4 Package information

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.

## 4.1 IPAK (TO-251) type E package information

**Figure 20. IPAK (TO-251) type E package outline**




0068771_E_rev.16

Table 8. **IPAK (TO-251) type E package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 2.20 | 2.30 | 2.35 |
| A1 | 0.90 | 1.00 | 1.10 |
| b | 0.66 | | 0.79 |
| b2 | | | 0.90 |
| b4 | 5.23 | 5.33 | 5.43 |
| c | 0.46 | | 0.59 |
| c2 | 0.46 | | 0.59 |
| D | 6.00 | 6.10 | 6.20 |
| D1 | 5.30 | 5.53 | 5.75 |
| E | 6.50 | 6.60 | 6.70 |
| E1 | 5.05 | 5.23 | 5.40 |
| e | 2.20 | 2.25 | 2.30 |
| e1 | 4.40 | 4.50 | 4.60 |
| H | 16.18 | 16.48 | 16.78 |
| L | 9.00 | 9.30 | 9.60 |
| L1 | 0.80 | 1.00 | 1.20 |
| L2 | 0.90 | 1.08 | 1.25 |
| Θ1 | 3° | 5° | 7° |
| Θ2 | 1° | 3° | 5° |

## Revision history

Table 9. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 19-May-2006 | 1 | First release. |
| 02-May-2011 | 2 | $R_G$ value has been updated. |
| 06-Dec-2011 | 3 | Removed p/n STD6N62K3 in DPAK. |
| 03-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. |
| 16-Oct-2023 | 5 | The part numbers STF6N62K3, STFI6N62K3, STI6N62K3 and STP6N62K3 have been moved to separate datasheets and the document has been updated accordingly.<br>Removed Gate-source Zener diode table.<br>Updated Section 4 Package information.<br>Minor text changes. |

# Contents

1 **Electrical ratings** . . . . . 2
2 **Electrical characteristics** . . . . . 3
2.1 Electrical characteristics (curves) . . . . . 5
3 **Test circuits** . . . . . 8
4 **Package information** . . . . . 9
4.1 IPAK (TO-251) type E package information . . . . . 9
**Revision history** . . . . . 11

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