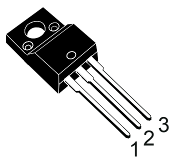
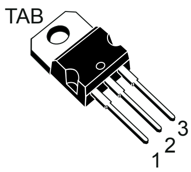
# STF8NK100Z, STP8NK100Z

Datasheet

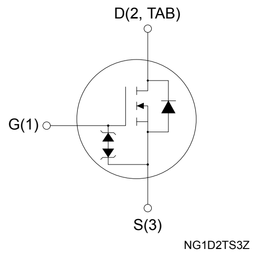
## N-channel 1000 V, 1.45 Ω typ., 6.5 A SuperMESH Power MOSFET in a TO-220FP and TO-220 packages




TO-220FP




TO-220




## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ |
|---|---|---|---|
| STF8NK100Z | 1000 V | 1.85 Ω | 6.5 A |
| STP8NK100Z | | | |

- 100% avalanche tested
- Gate charge minimized
- Very low intrinsic capacitance
- Zener-protected

## Applications

- Switching applications

## Description

These high-voltage devices are Zener-protected N-channel Power MOSFETs developed using the SuperMESH technology by STMicroelectronics, an optimization of the well-established PowerMESH. In addition to a significant reduction in on-resistance, these devices are designed to ensure a high level of dv/dt capability for the most demanding applications.

| Product status links |
|---|
| STF8NK100Z |
| STP8NK100Z |

| Product summary | |
|---|---|
| **Order code** | **STF8NK100Z** |
| **Marking** | F8NK100Z |
| **Package** | TO-220FP |
| **Packing** | Tube |
| **Order code** | **STP8NK100Z** |
| **Marking** | P8NK100Z |
| **Package** | TO-220 |
| **Packing** | Tube |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | TO-220 | TO-220FP | |
| $V_{DS}$ | Drain-source voltage | 1000 | | V |
| $V_{GS}$ | Gate-source voltage | ±30 | | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 6.5 | 6.5[1] | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 4.3 | 4.3[1] | |
| $I_{DM}$[2] | Drain current (pulsed) | 26 | 26[1] | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 160 | 40 | W |
| ESD | Gate-source human body model (C = 100 pF, R = 1.5 kΩ) | 4 | | kV |
| dv/dt[3] | Peak diode recovery voltage slope | 4.5 | | V/ns |
| $V_{ISO}$ | 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 |
| $T_J$ | Operating junction temperature range | | | °C |

1. *Limited by maximum junction temperature.*
2. *Pulse width limited by safe operating area.*
3. *$I_{SD}$ ≤ 6.5 A, di/dt ≤ 200 A/μs, $V_{DS}$ (peak) < $V_{(BR)DSS}$.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | TO-220 | TO-220FP | |
| $R_{thJC}$ | Thermal resistance, junction-to-case | 0.78 | 3.1 | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 62.5 | | °C/W |

**Table 3. Avalanche characteristics**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ max.) | 6.5 | A |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V) | 320 | mJ |

# 2 Electrical characteristics

$T_C$ = 25 °C unless otherwise specified.

**Table 4. On/off states**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown voltage | $I_D$ = 1 mA, $V_{GS}$ = 0 V | 1000 | - | - | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 1000 V | - | - | 1 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 1000 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 | $V_{DS}$ = $V_{GS}$, $I_D$ = 100 µA | 3 | 3.75 | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$ = 3.15 A | - | 1.45 | 1.85 | Ω |

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

**Table 5. Dynamic**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 2180 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 174 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 36 | - | pF |
| $C_{oss\ eq.}$[(1)] | Equivalent output capacitance | $V_{DS}$ = 0 to 800 V, $V_{GS}$ = 0 V | - | 83 | - | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 800 V, $I_D$ = 6.3 A, $V_{GS}$ = 0 to 10 V (see the Figure 16. Test circuit for gate charge behavior) | - | 73 | 102[(2)] | nC |
| $Q_{gs}$ | Gate-source charge | | - | 12 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 40 | - | 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 condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 500 V, $I_D$ = 3.15 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see the Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform) | - | 28 | - | ns |
| $t_r$ | Rise time | | - | 19 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 59 | - | ns |
| $t_f$ | Fall time | | - | 30 | - | ns |

Table 7. **Source drain diode**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | - | 6.5 | A |
| $I_{SDM}$ (1) | Source-drain current (pulsed) | | - | - | 26 | A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$ = 6.3 A, $V_{GS}$ = 0 V | - | - | 1.6 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 6.3 A, di/dt = 100 A/µs, | - | 620 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 50 V | - | 5.3 | - | µC |
| $I_{RRM}$ | Reverse recovery current | (see the Figure 17. Test circuit for inductive load switching and diode recovery times) | - | 17 | - | A |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 6.3 A, di/dt = 100 A/µs, | - | 840 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 50 V, $T_J$ = 150 °C | - | 7.5 | - | µC |
| $I_{RRM}$ | Reverse recovery current | (see the Figure 17. Test circuit for inductive load switching and diode recovery times) | - | 18 | - | A |

1. *Pulse width is 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 for TO-220

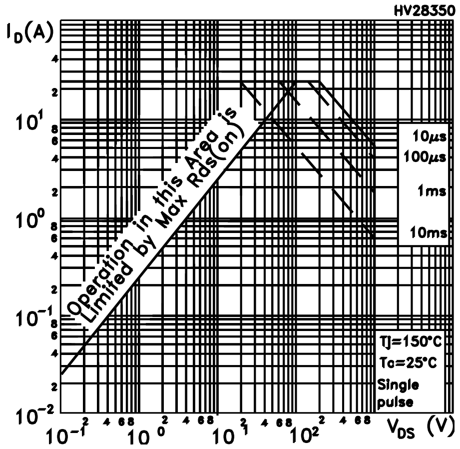



**Figure 2.** Normalized transient thermal impedance for TO-220

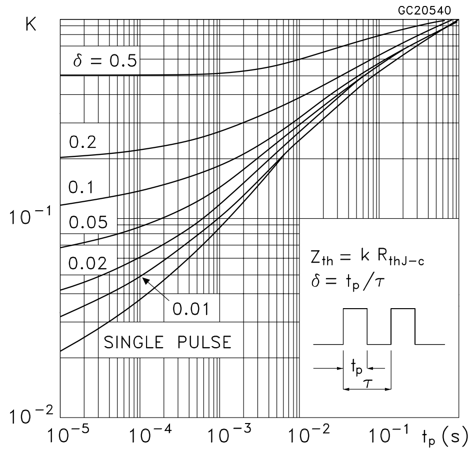



**Figure 3.** Safe operating area for TO-220FP

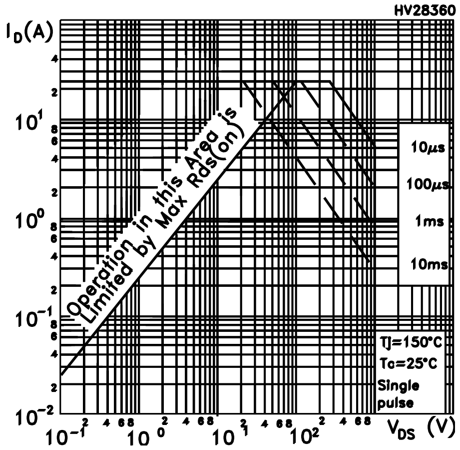



**Figure 4.** Normalized transient thermal impedance for TO-220FP

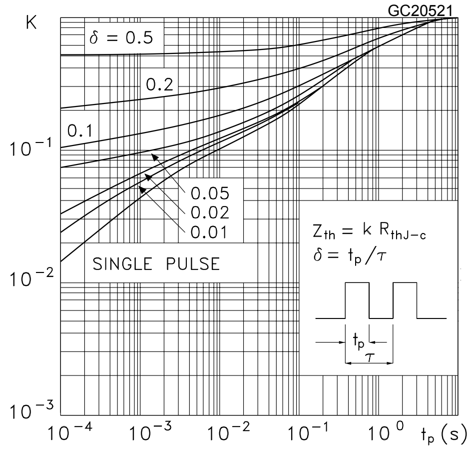



**Figure 5.** Typical output characteristics

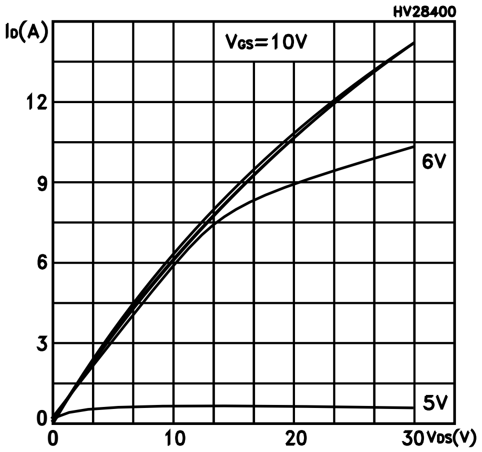



**Figure 6.** Typical transfer characteristics

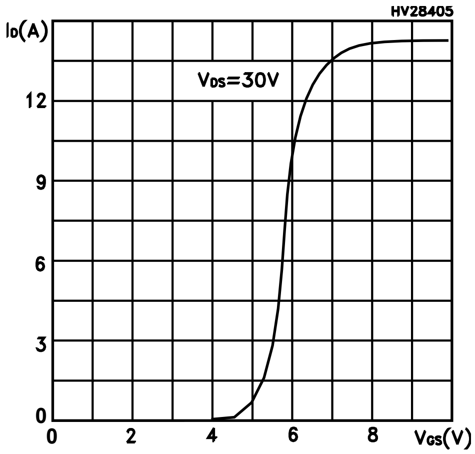


Figure 7. Typical static drain-source on-resistance

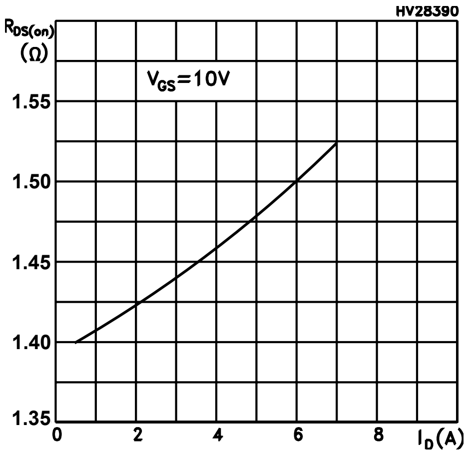



Figure 8. Typical gate charge characteristics

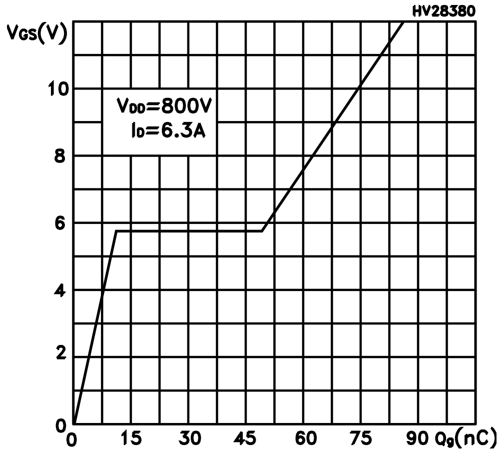



Figure 9. Typical capacitance variations

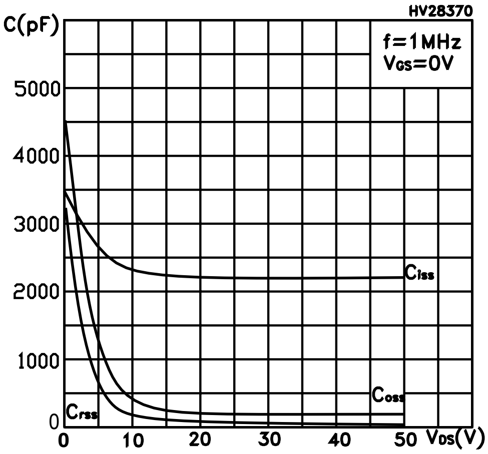



Figure 10. Normalized gate threshold vs temperature

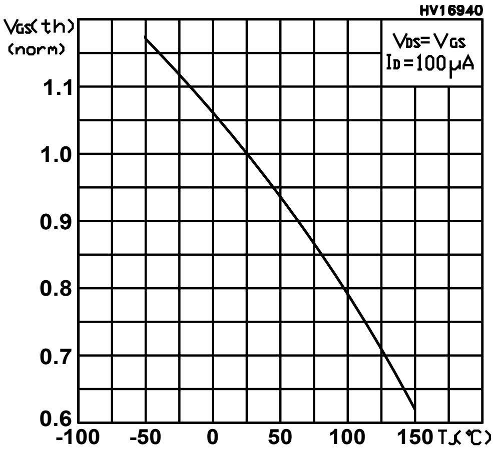



Figure 11. Normalized on-resistance vs temperature

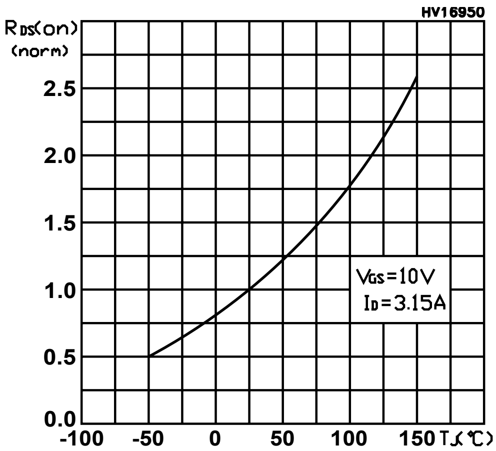



Figure 12. Typical reverse diode forward characteristics

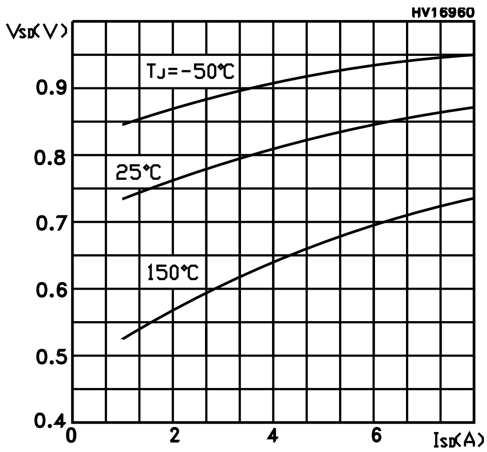


Figure 13. Normalized breakdown voltage vs temperature

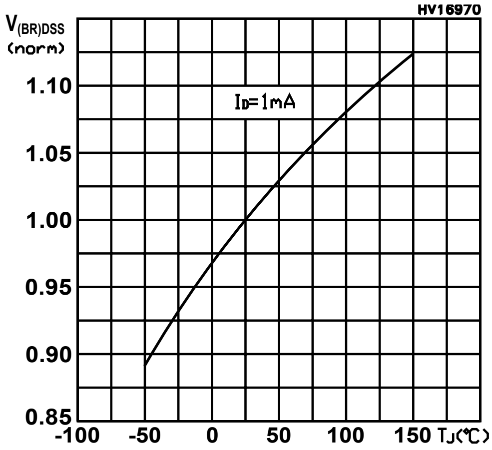
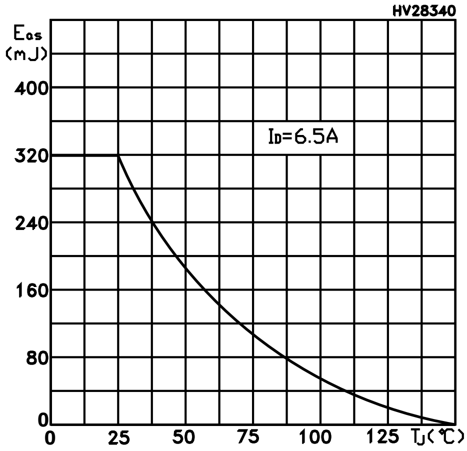



Figure 14. Maximum avalanche energy vs temperature



# 3 Test circuits

**Figure 15.** Test circuit for resistive load switching times

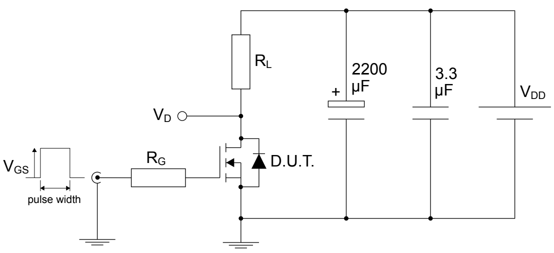



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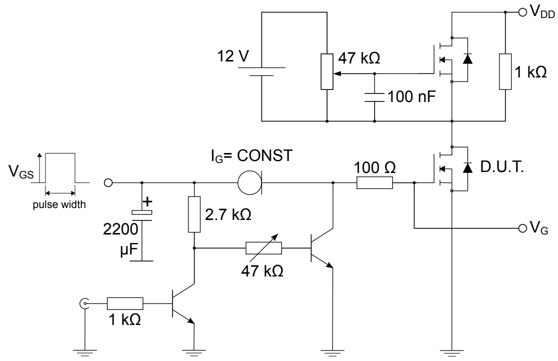
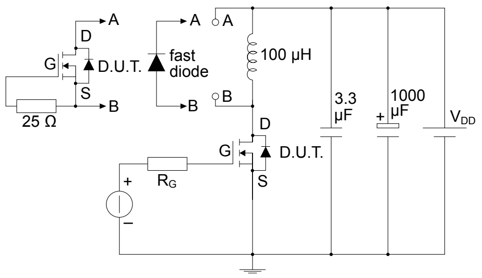
**Figure 16.** Test circuit for gate charge behavior



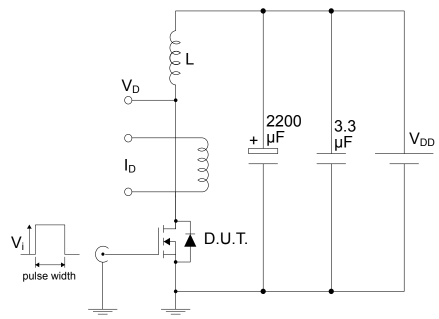

AM01469v1

**Figure 17.** Test circuit for inductive load switching and diode recovery times



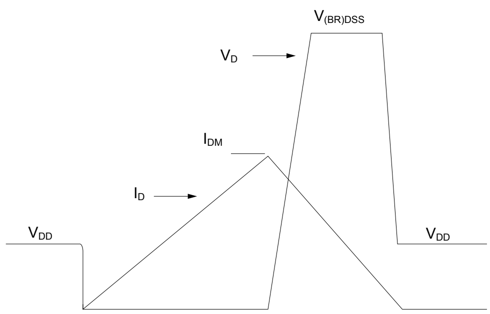

AM01470v1

**Figure 18.** Unclamped inductive load test circuit



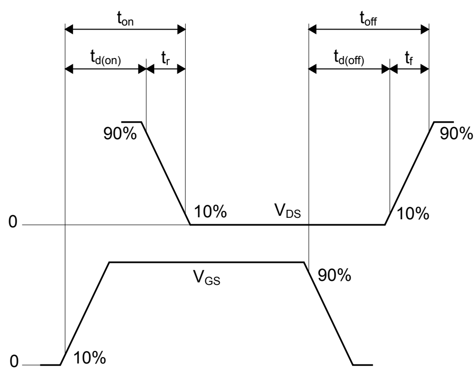

AM01471v1

**Figure 19.** Unclamped inductive waveform




AM01472v1

**Figure 20.** 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 21. TO-220FP type B package outline

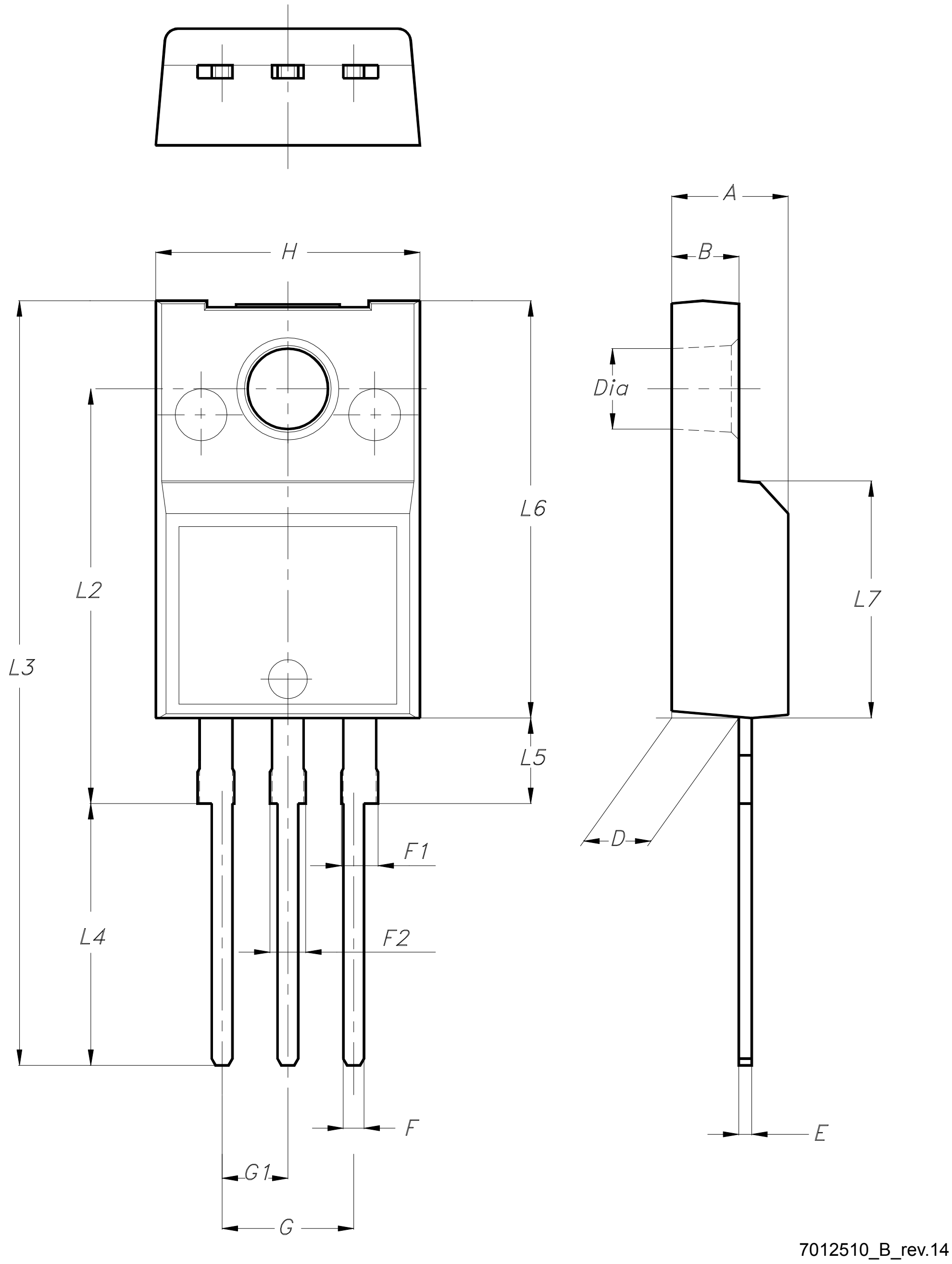


Table 8. **TO-220FP type B package mechanical data**

| 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 TO-220 type A package information

Figure 22. TO-220 type A package outline

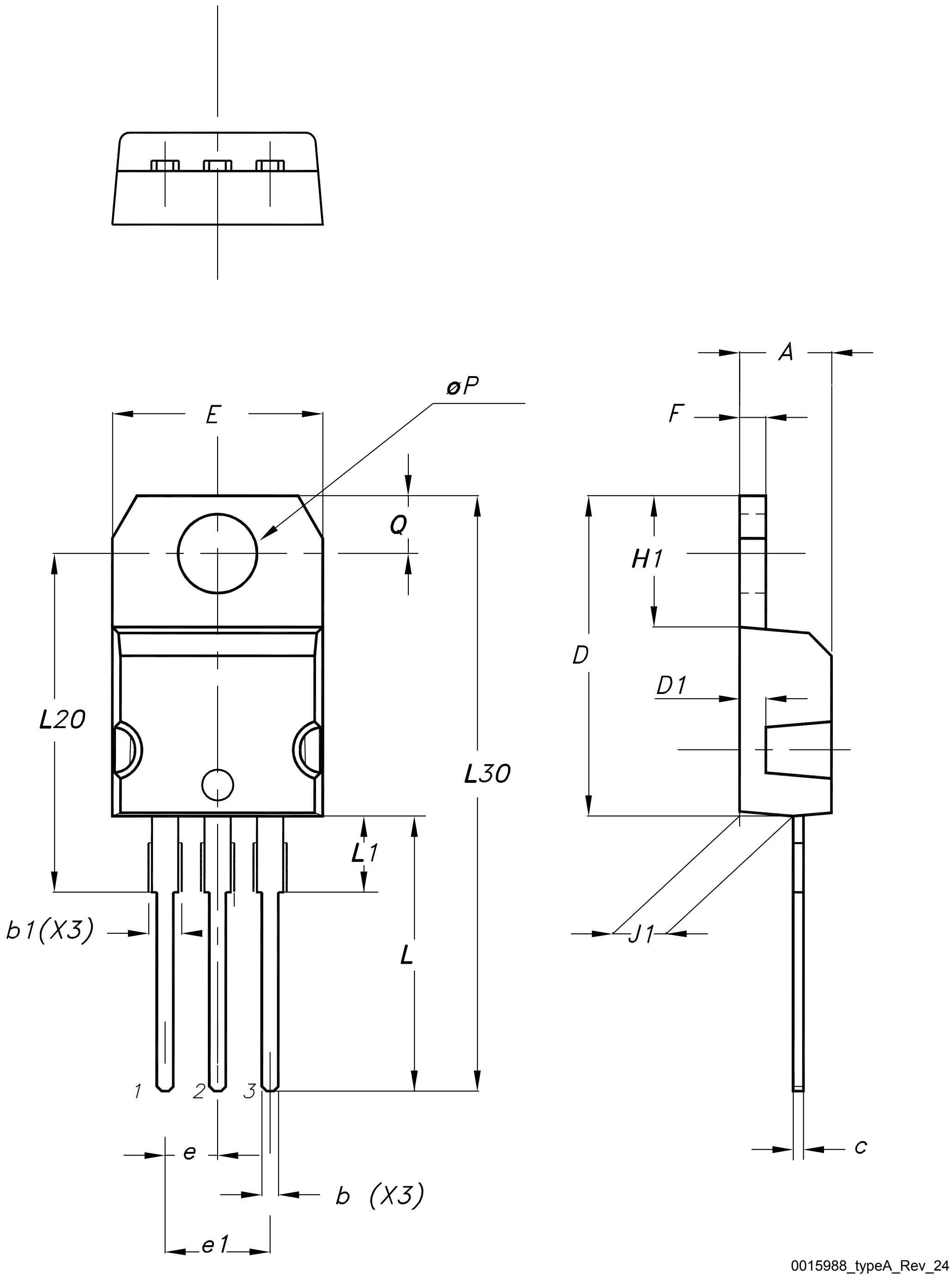


Table 9. **TO-220 type A package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.55 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10.00 | | 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 | 13.00 | | 14.00 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| øP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |
| Slug flatness | | 0.03 | 0.10 |

# Revision history

**Table 10. Document revision history**

| Date | Version | Changes |
|---|---|---|
| 04-Nov-2005 | 1 | First release. |
| 24-Mar-2026 | 2 | Updated Section 4: Package information.<br>Minor text changes. |

# Contents