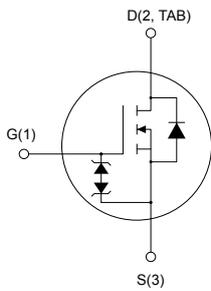
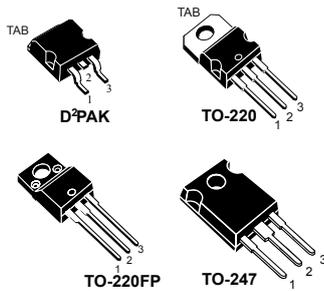




STB14NK50ZT4, STP14NK50Z STP14NK50ZFP, STW14NK50Z

Datasheet

N-channel 500 V, 340 mΩ typ., 14 A SuperMESH Power MOSFETs in a D²PAK, TO-220, TO-220FP and TO-247 packages



AM01476v1_tab

Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D |
|--------------|-----------------|--------------------------|----------------|
| STB14NK50ZT4 | 500 V | 380 mΩ | 14 A |
| STP14NK50Z | | | |
| STP14NK50ZFP | | | |
| STW14NK50Z | | | |

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- 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

[STB14NK50ZT4](#)

[STP14NK50Z](#)

[STP14NK50ZFP](#)

[STW14NK50Z](#)

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | | | Unit |
|--------------------------------|---|------------------------------|--------------------|--------|------|
| | | D ² PAK TO-220 | TO-220FP | TO-247 | |
| V _{DS} | Drain-source voltage | 500 | | | V |
| V _{GS} | Gate-source voltage | ±30 | | | V |
| I _D | Drain current (continuous) at T _C = 25 °C | 14 | 14 ⁽¹⁾ | 14 | A |
| | Drain current (continuous) at T _C = 100 °C | 7.6 | 7.6 ⁽¹⁾ | 7.6 | |
| I _{DM} ⁽²⁾ | Drain current (pulsed) | 48 | 48 ⁽¹⁾ | 48 | A |
| P _{TOT} | Total power dissipation at T _C = 25 °C | 150 | 35 | 150 | 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 | | | | |

1. Limited by maximum junction temperature.
2. Pulse width is limited by safe operating area.
3. I_{SD} ≤ 13 A, di/dt ≤ 200 A/μs, V_{DS (peak)} < V_{(BR)DSS}.

Table 2. Thermal data

| Symbol | Parameter | Value | | | | Unit |
|-------------------|---|--------------------|--------|----------|--------|------|
| | | D ² PAK | TO-220 | TO-220FP | TO-247 | |
| R _{thJC} | Thermal resistance, junction-to-case | 0.83 | | 3.6 | 0.83 | °C/W |
| R _{thJA} | Thermal resistance, junction-to-ambient | 62.5 | | | 50 | °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.) | 12 | A |
| E _{AS} | Single pulse avalanche energy (starting T _J = 25 °C, I _D = I _{AR} , V _{DD} = 50 V) | 400 | mJ |

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 | $I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$ | 500 | - | - | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}$, $V_{DS} = 500\text{ V}$ | - | - | 1 | μA |
| | | $V_{GS} = 0\text{ V}$, $V_{DS} = 500\text{ V}$, $T_C = 125\text{ °C}^{(1)}$ | - | - | 50 | |
| I_{GSS} | Gate body leakage current | $V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$ | - | - | ± 10 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$ | 3.00 | 3.75 | 4.50 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$, $I_D = 6\text{ A}$ | - | 340 | 380 | m Ω |

1. Specified by design, not tested in production.

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|-------------------------------|--|------|------|-------------------|------|
| C_{iss} | Input capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$ | - | 2000 | - | pF |
| C_{oss} | Output capacitance | | - | 238 | - | pF |
| C_{rss} | Reverse transfer capacitance | | - | 55 | - | pF |
| $C_{oss\text{ eq.}}^{(1)}$ | Equivalent output capacitance | $V_{GS} = 0\text{ V}$, $V_{DS} = 0\text{ to }400\text{ V}$ | - | 150 | - | pF |
| Q_g | Total gate charge | $V_{DD} = 400\text{ V}$, $I_D = 12\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see the Figure 18. Test circuit for gate charge behavior) | - | 69 | 92 ⁽²⁾ | nC |
| Q_{gs} | Gate-source charge | | - | 12 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 31 | - | nC |

1. $C_{oss\text{ eq.}}$ is defined as the 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 | $V_{DD} = 250\text{ V}$, $I_D = 6\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ | - | 24 | - | ns |
| t_r | Rise time | | - | 16 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | (see the Figure 17. Test circuit for resistive load switching times and Figure 22. Switching time waveform) | - | 54 | - | ns |
| t_f | Fall time | | - | 12 | - | ns |

Table 7. Source-drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|---|------|------|------|---------------|
| I_{SD} | Source-drain current | | - | - | 12 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | - | 48 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 12\text{ A}$, $V_{GS} = 0\text{ V}$ | - | - | 1.6 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, | - | 470 | - | ns |
| Q_{rr} | Reverse recovery charge | $V_{DD} = 35\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ | - | 3.1 | - | μC |
| I_{RRM} | Reverse recovery current | (see the Figure 19. Test circuit for inductive load switching and diode recovery times) | - | 13.2 | - | A |

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

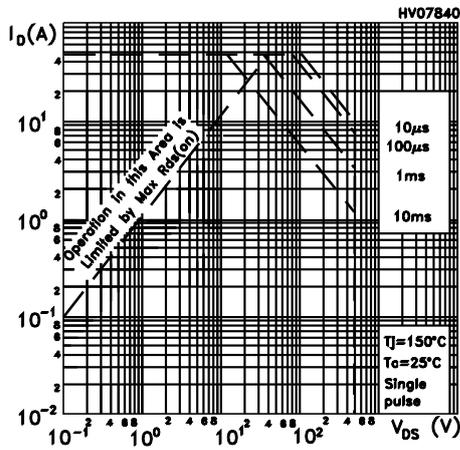
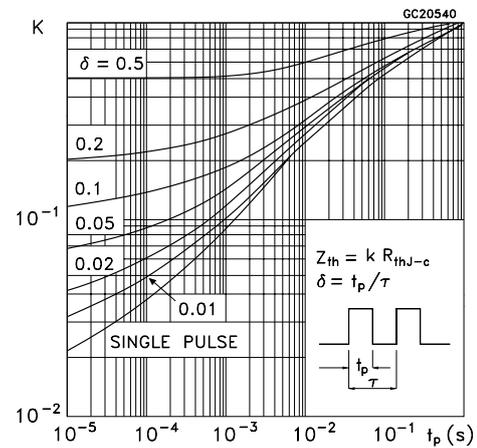
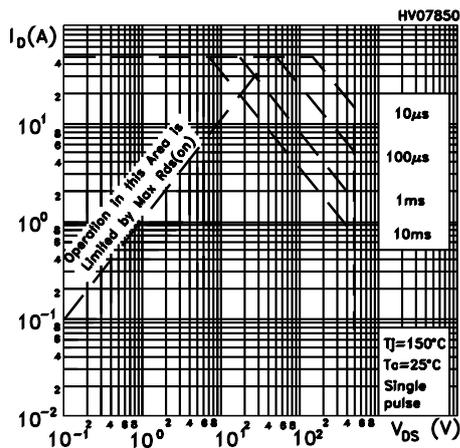
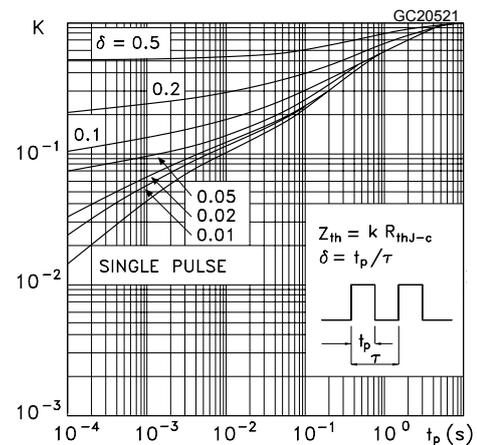
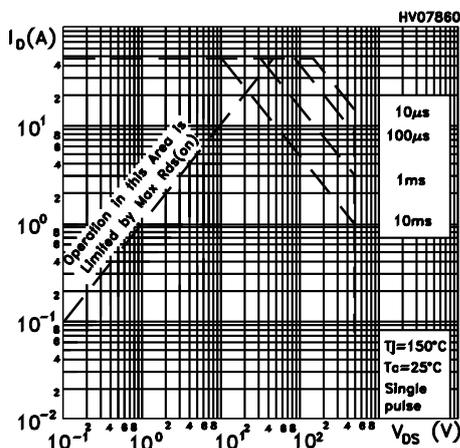
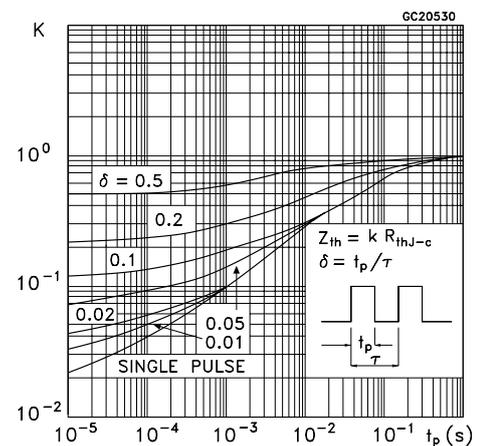
2.1 Electrical characteristics (curves)
Figure 1. Safe operating area for D²PAK and TO-220

Figure 2. Normalized transient thermal impedance for D²PAK and TO-220

Figure 3. Safe operating area for TO-220FP

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

Figure 5. Safe operating area for TO-247

Figure 6. Normalized transient thermal impedance for TO-247


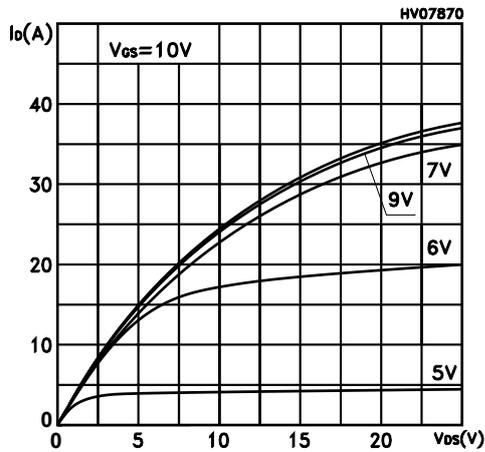
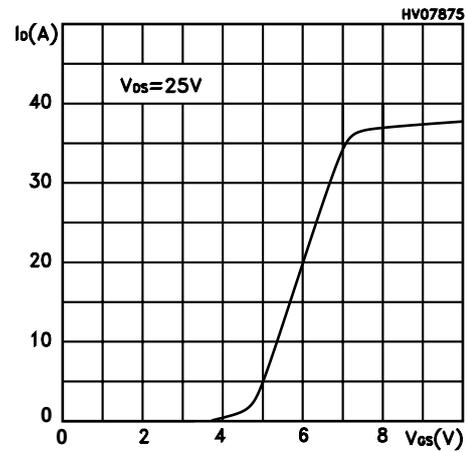
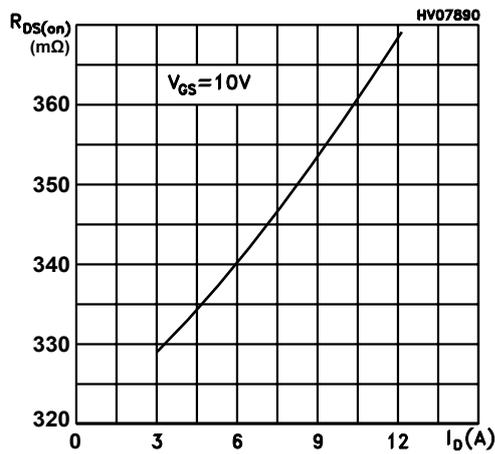
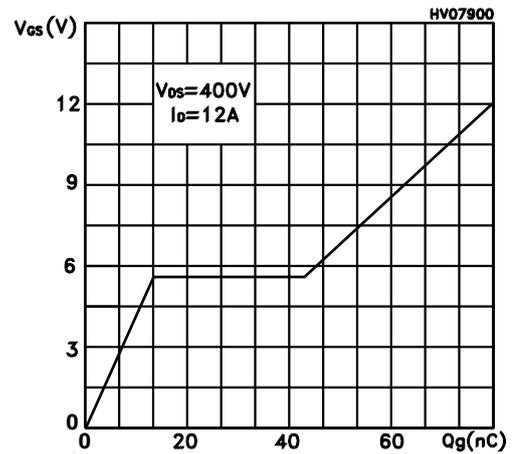
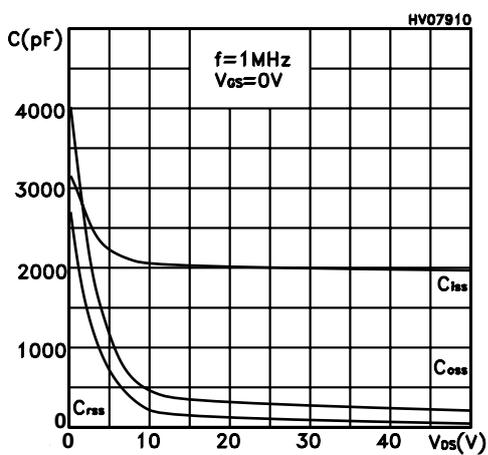
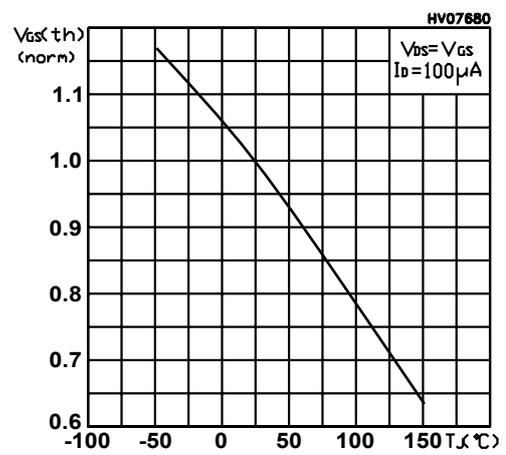
Figure 7. Typical output characteristics

Figure 8. Typical transfer characteristics

Figure 9. Typical drain-source on-resistance

Figure 10. Typical gate charge characteristics

Figure 11. Typical capacitance characteristics

Figure 12. Normalized gate threshold vs temperature


Figure 13. Normalized on-resistance vs temperature

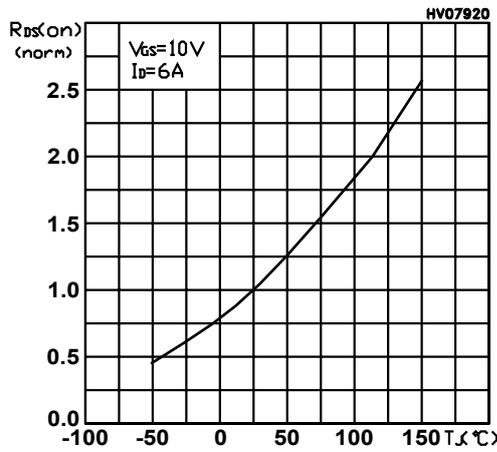


Figure 14. Typical reverse diode forward characteristics

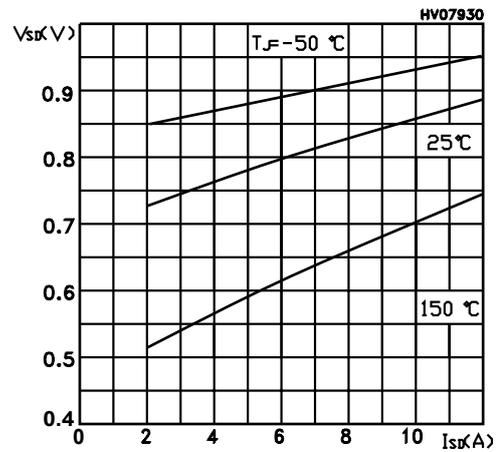


Figure 15. Maximum avalanche energy vs temperature

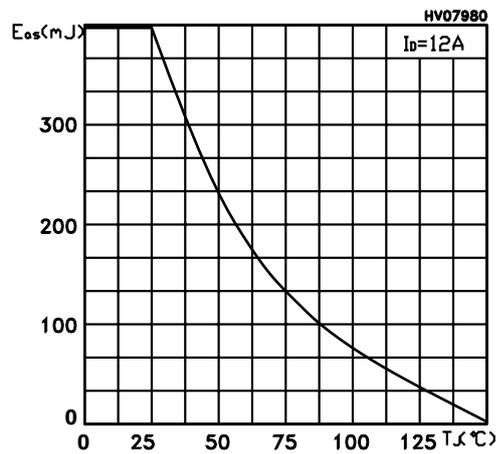
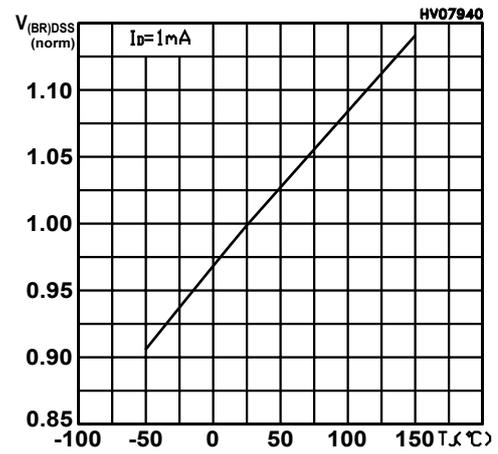
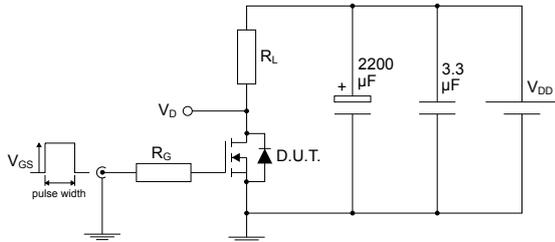


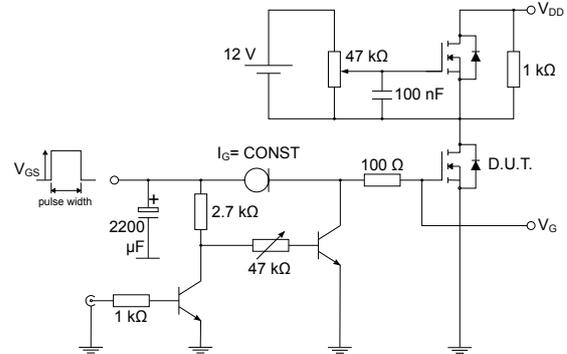
Figure 16. Normalized breakdown voltage vs temperature



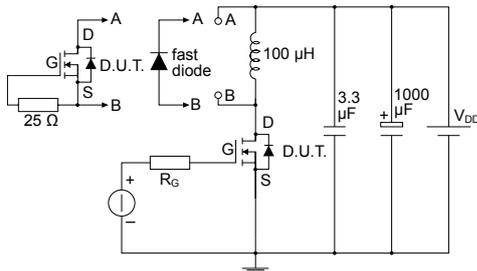
3 Test circuits

Figure 17. Test circuit for resistive load switching times


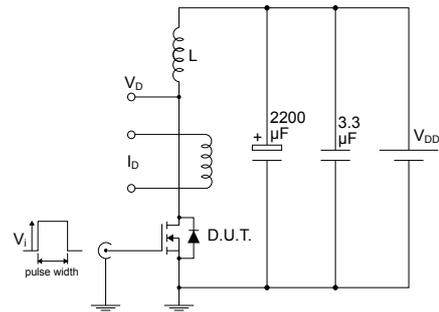
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Figure 18. Test circuit for gate charge behavior


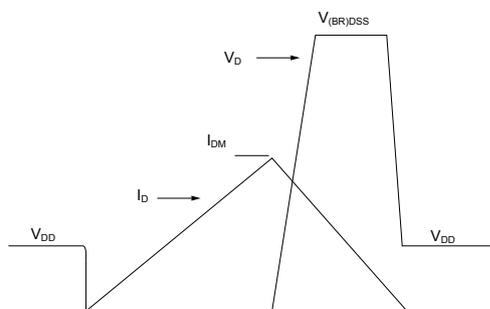
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Figure 19. Test circuit for inductive load switching and diode recovery times


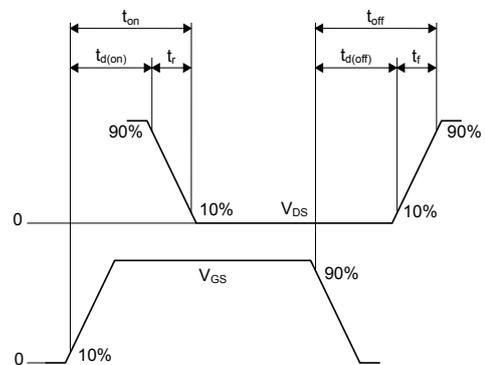
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Figure 20. Unclamped inductive load test circuit


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Figure 21. Unclamped inductive waveform


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Figure 22. Switching time waveform


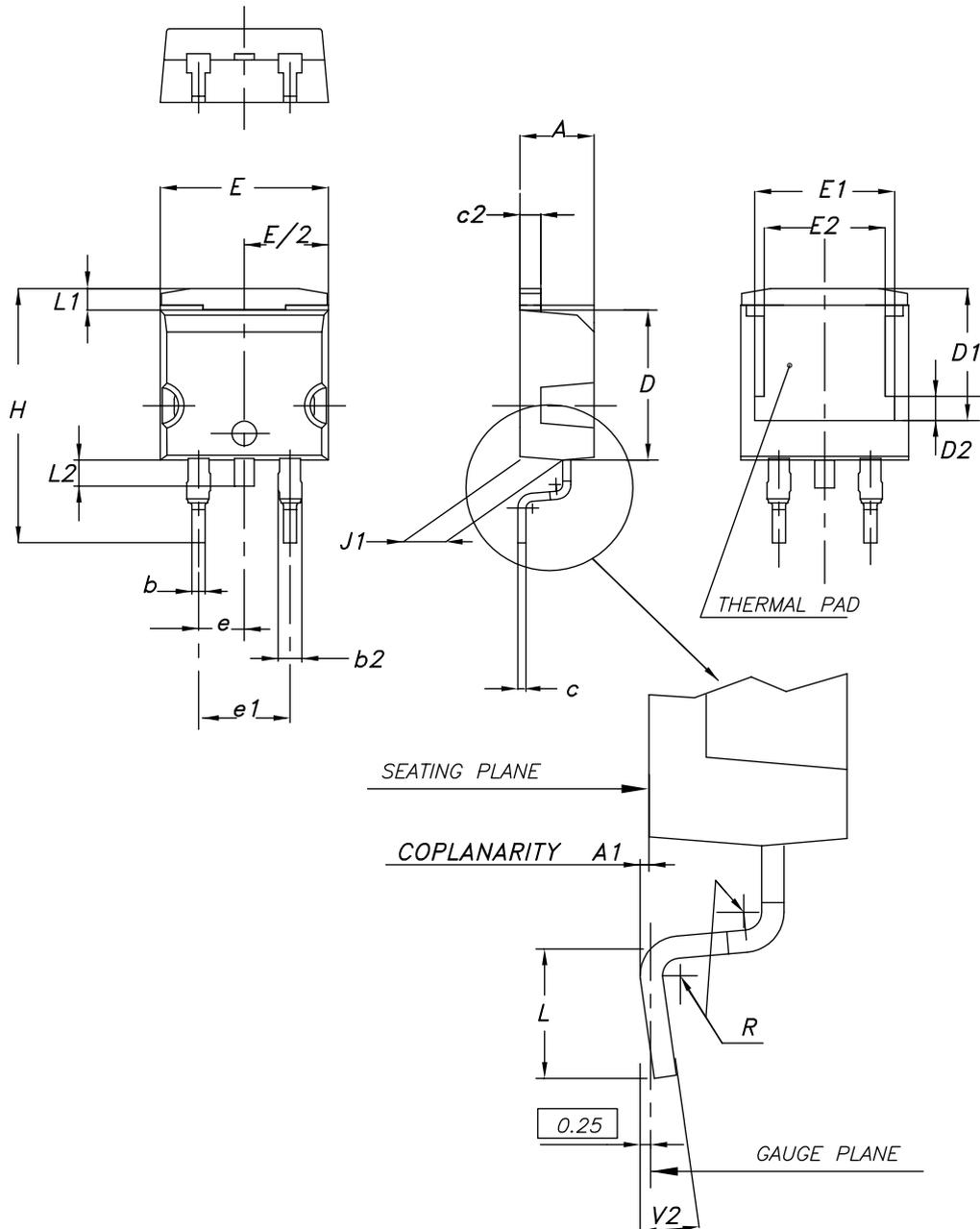
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4 Package information

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 D²PAK (TO-263) type A2 package information

Figure 23. D²PAK (TO-263) type A2 package outline

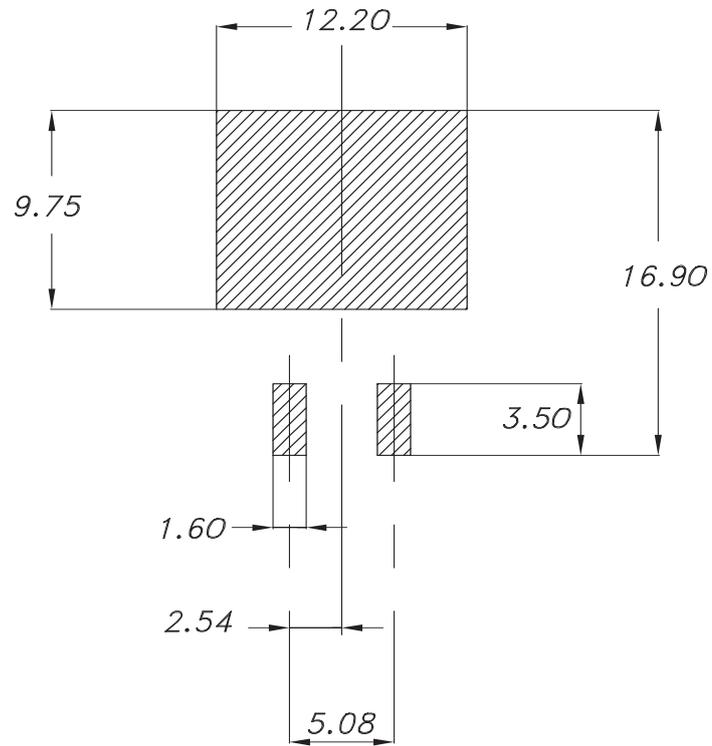


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Table 8. D²PAK (TO-263) type A2 package mechanical data

| Dim. | mm | | |
|------|-------|------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| A1 | 0.03 | | 0.23 |
| b | 0.70 | | 0.93 |
| b2 | 1.14 | | 1.70 |
| c | 0.45 | | 0.60 |
| c2 | 1.23 | | 1.36 |
| D | 8.95 | | 9.35 |
| D1 | 7.50 | 7.75 | 8.00 |
| D2 | 1.10 | 1.30 | 1.50 |
| E | 10.00 | | 10.40 |
| E1 | 8.70 | 8.90 | 9.10 |
| E2 | 7.30 | 7.50 | 7.70 |
| e | | 2.54 | |
| e1 | 4.88 | | 5.28 |
| H | 15.00 | | 15.85 |
| J1 | 2.49 | | 2.69 |
| L | 2.29 | | 2.79 |
| L1 | 1.27 | | 1.40 |
| L2 | 1.30 | | 1.75 |
| R | | 0.40 | |
| V2 | 0° | | 8° |

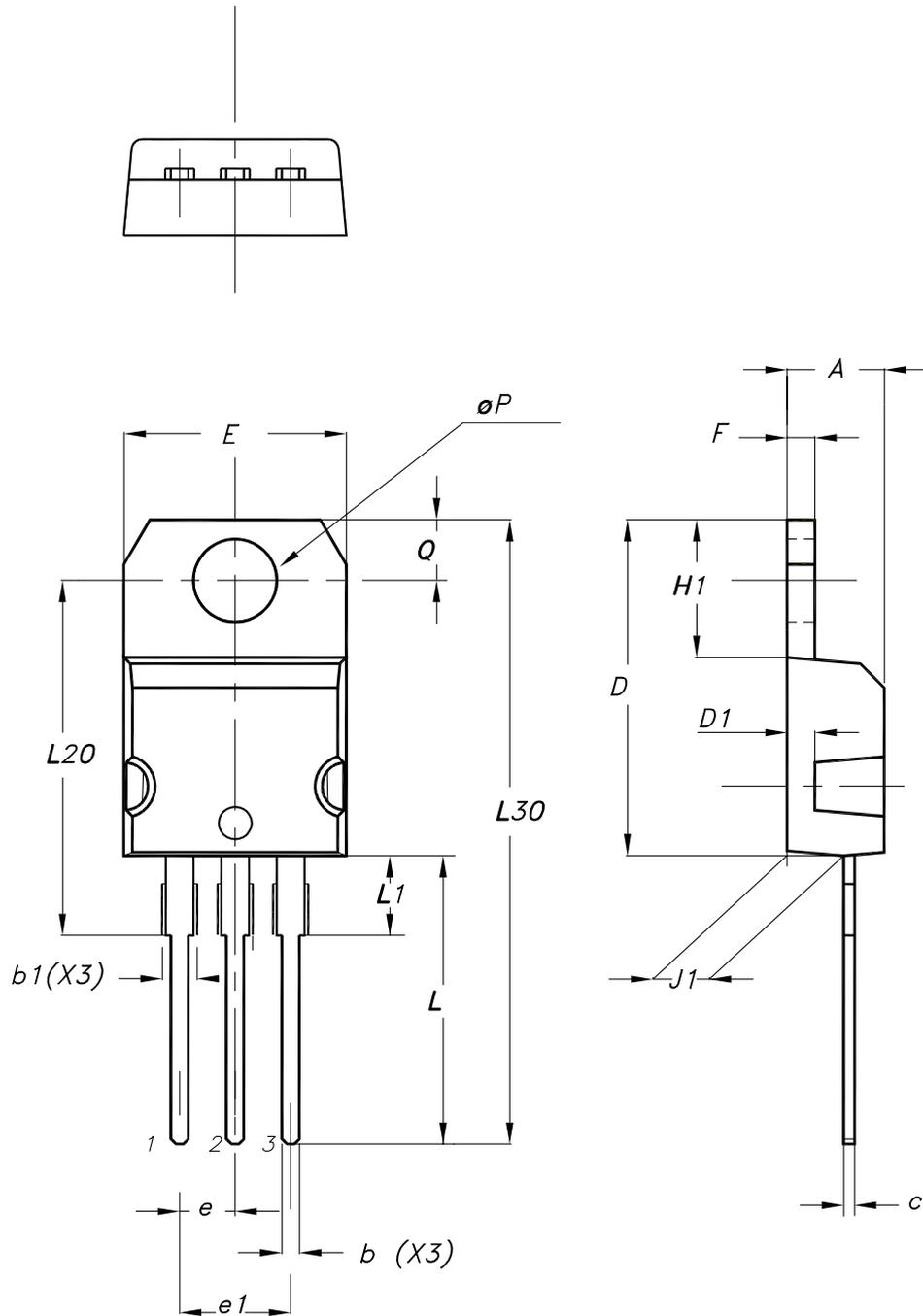
Figure 24. D²PAK (TO-263) recommended footprint (dimensions are in mm)



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4.2 TO-220 type A package information

Figure 25. TO-220 type A package outline



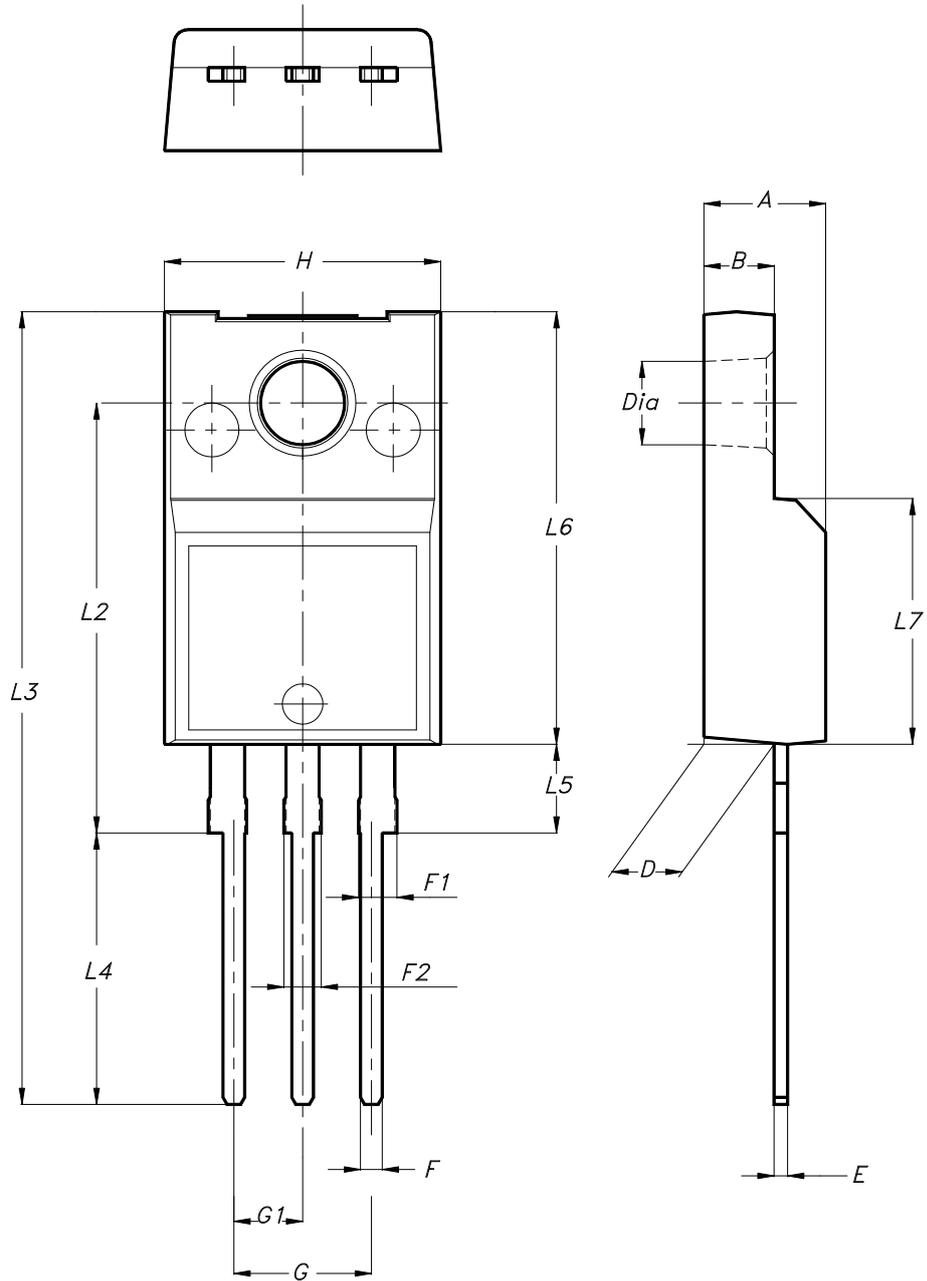
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Table 9. TO-220 type A package mechanical data

| 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 |

4.3 TO-220FP type B package information

Figure 26. TO-220FP type B package outline



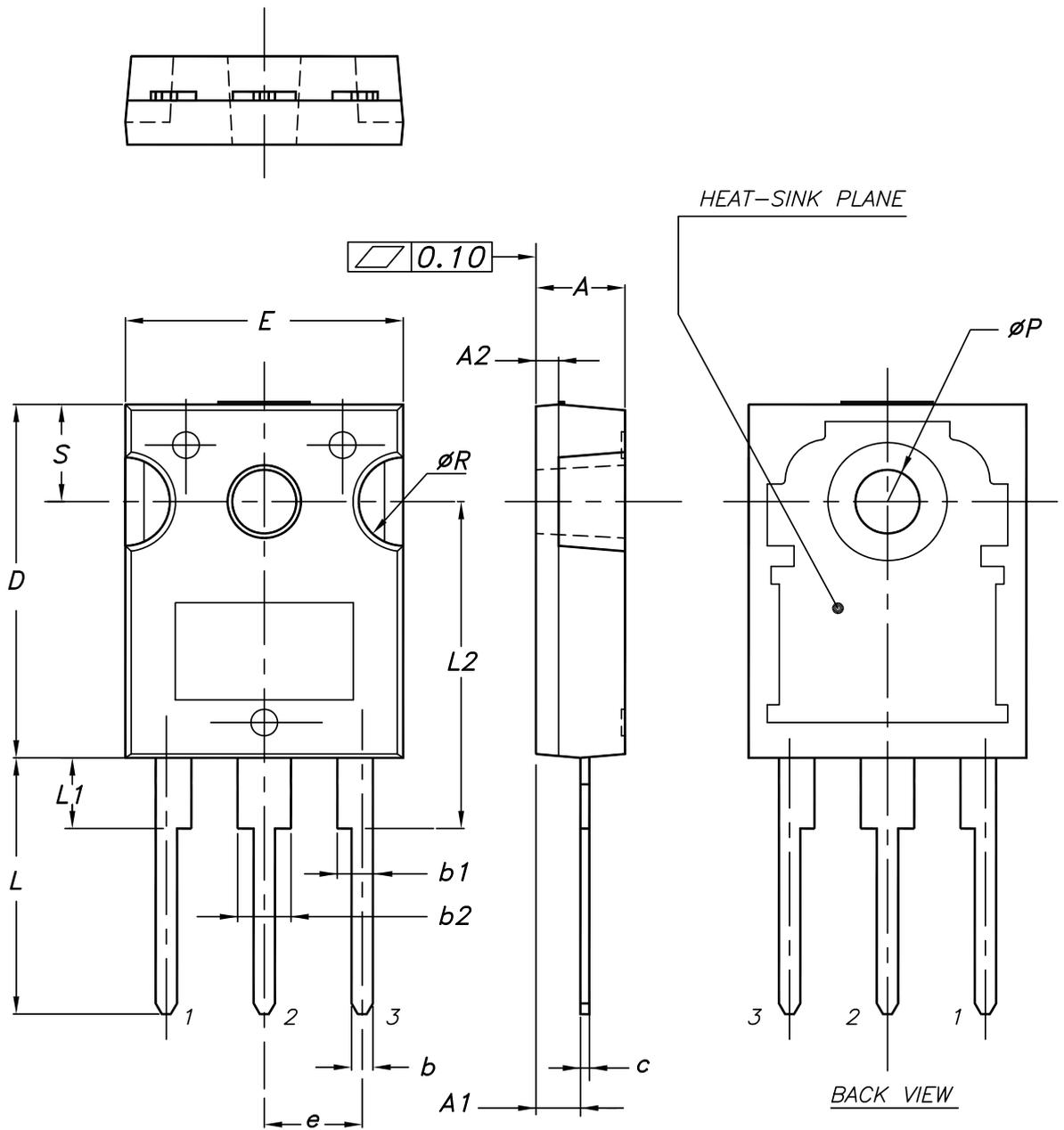
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Table 10. TO-220FP type B package mechanical data

| 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 |

4.4 TO-247 package information

Figure 27. TO-247 package outline



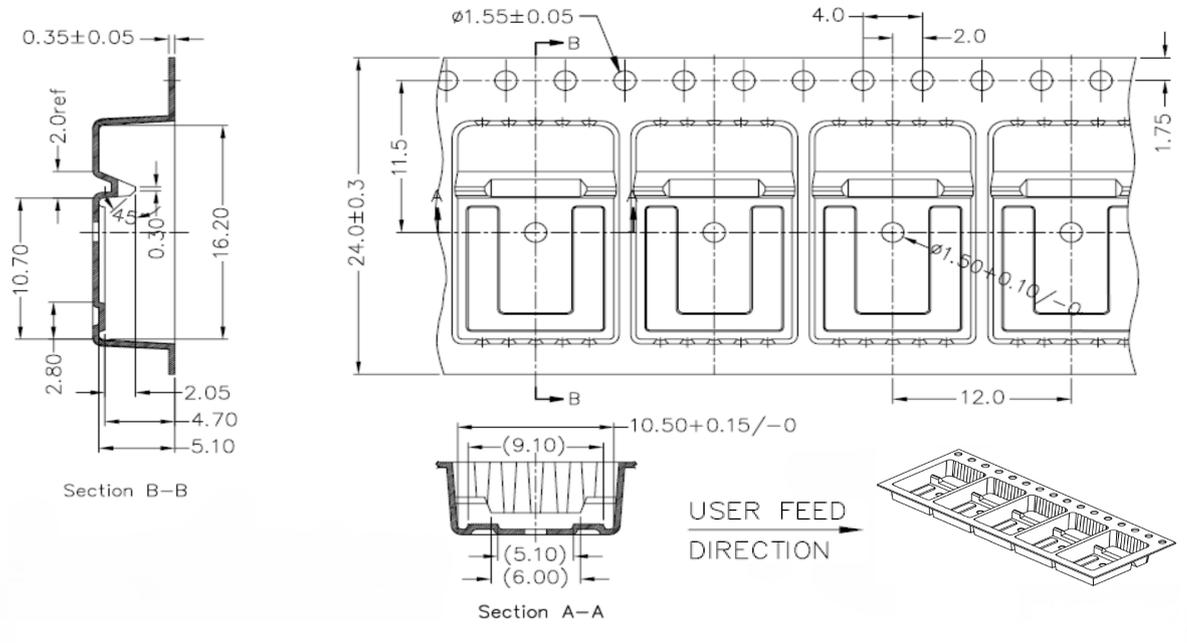
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Table 11. TO-247 package mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.85 | | 5.15 |
| A1 | 2.20 | | 2.60 |
| A2 | | 1.27 | |
| b | 1.0 | | 1.40 |
| b1 | 2.0 | | 2.40 |
| b2 | 3.0 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.85 | | 20.15 |
| E | 15.45 | | 15.75 |
| e | 5.30 | 5.45 | 5.60 |
| L | 14.20 | | 14.80 |
| L1 | 3.70 | | 4.30 |
| L2 | | 18.50 | |
| ØP | 3.55 | | 3.65 |
| ØR | 4.50 | | 5.50 |
| S | 5.30 | 5.50 | 5.70 |

4.5 D²PAK packing information

Figure 28. D²PAK tape drawing (dimensions are in mm)



DM01095771_2



5 Ordering information

Table 12. Order codes

| Order codes | Marking | Package | Packing |
|--------------|------------|--------------------|---------------|
| STB14NK50ZT4 | B14NK50Z | D ² PAK | Tape and reel |
| STP14NK50Z | P14NK50Z | TO-220 | Tube |
| STP14NK50ZFP | P14NK50ZFP | TO-220FP | |
| STW14NK50Z | W14NK50Z | TO-247 | |



Revision history

Table 13. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 21-Jun-2004 | 2 | Complete version with curves. |
| 26-Jul-2006 | 3 | New template, no content change. |
| 10-Feb-2026 | 4 | Removed order code STB14NK50Z-1. Updated Section 4: Package information . Minor text changes. |



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| 4.3 | TO-220FP type B package information | 14 |
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