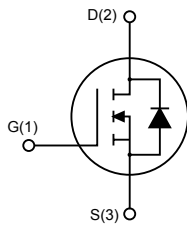
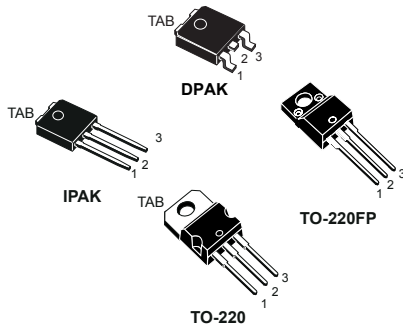


N-channel 800 V, 0.95 Ω typ., 6.5 A MDmesh™ II Power MOSFETs in DPAK, IPAK, TO-220FP and TO-220 packages



AM01475v1_noZen_noTab

Features

| Order codes | V_{DS} | $R_{DS(on)max.}$ | I_D |
|-------------|----------|------------------|-------|
| STD7NM80 | 800 V | 1.05 Ω | 6.5 A |
| STD7NM80-1 | | | |
| STF7NM80 | | | |
| STP7NM80 | | | |

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Applications

- Switching applications

Description

These devices are N-channel Power MOSFETs developed using the second generation of MDmesh™ technology. These revolutionary Power MOSFETs associate a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. They are therefore suitable for the most demanding high-efficiency converters.

Product status

| |
|------------|
| STD7NM80 |
| STD7NM80-1 |
| STF7NM80 |
| STP7NM80 |

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | | Unit |
|----------------|---|--------------------|--------------------|------|
| | | DPAK, IPAK, TO-220 | TO-220FP | |
| V_{DS} | Drain-source voltage | 800 | | V |
| V_{GS} | Gate-source voltage | ±30 | | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ °C}$ | 6.5 | 6.5 ⁽¹⁾ | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ °C}$ | 4 | 4 ⁽¹⁾ | A |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 26 | 26 ⁽¹⁾ | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ °C}$ | 90 | 25 | W |
| V_{ISO} | Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ °C}$) | | 2.5 | kV |
| T_j | Operating junction temperature range | -55 to 150 | | °C |
| T_{stg} | Storage temperature range | | | |

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area.

Table 2. Thermal data

| Symbol | Parameter | Value | | | | Unit |
|---------------------|-------------------------------------|-------|------|----------|--------|------|
| | | DPAK | IPAK | TO-220FP | TO-220 | |
| $R_{thj-case}$ | Thermal resistance junction-case | 1.4 | | 5 | 1.4 | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | | 100 | 62.5 | | °C/W |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 50 | | | | °C/W |

1. When mounted on 1inch² FR-4 board, 2 oz Cu.

Table 3. Avalanche characteristics

| Symbol | Parameter | Value | Unit |
|----------|--|-------|------|
| I_{AS} | Avalanche current, repetitive or not-repetitive (pulse width limited by T_{jmax}) | 1 | A |
| E_{AS} | Single pulse avalanche energy (starting $T_j = 25\text{ °C}$, $I_D = I_{AS}$, $V_{DD} = 50\text{ V}$) | 240 | mJ |

2 Electrical characteristics

($T_{CASE} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 4. On/off states

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---------------|-----------------------------------|--|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$ | 800 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$ | | | 10 | μA |
| | | $V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$ | | | 100 | μA |
| I_{GSS} | Gate body leakage current | $V_{DS} = 0\text{ V}$, $V_{GS} = \pm 30\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 3 | 4 | 5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$, $I_D = 3.25\text{ A}$ | | 0.95 | 1.05 | Ω |

1. Defined by design, not subject to production test.

Table 5. Dynamic

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|------------|------------------------------|---|------|------|------|---------------|
| C_{iss} | Input capacitance | $V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$ | - | 620 | - | μF |
| C_{oss} | Output capacitance | | | 460 | | |
| C_{riss} | Reverse transfer capacitance | | | 15 | | |
| R_g | Gate input resistance | $f = 1\text{ MHz}$ open drain | - | 7 | - | Ω |
| Q_g | Total gate charge | $V_{DD} = 640\text{ V}$, $I_D = 6.5\text{ A}$, $V_{GS} = 0$ to 10 V (see Figure 17. Test circuit for gate charge behavior) | - | 18 | - | nC |
| Q_{gs} | Gate-source charge | | | 4 | | |
| Q_{gd} | Gate-drain charge | | | 11 | | |

Table 6. Switching times

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 400\text{ V}$, $I_D = 3.25\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 16. Test circuit for resistive load switching times and Figure 21. Switching time waveform) | - | 20 | - | ns |
| t_r | Rise time | | | 8 | | |
| $t_{d(off)}$ | Turn-off delay time | | | 35 | | |
| t_f | Fall time | | | 10 | | |

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 | |

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|----------------|--------------------------|--|------|------|------|---------------|
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 6.5 \text{ A}$, $V_{GS} = 0 \text{ V}$ | - | | 1.3 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 6.5 \text{ A}$, $di/dt = 100 \text{ V}$ $V_{DD} = 50 \text{ V}$ (see Figure 18. Test circuit for inductive load switching and diode recovery times) | - | 460 | | ns |
| Q_{rr} | Reverse recovery charge | | | 4 | | μC |
| I_{RRM} | Reverse recovery current | | | 17 | | A |
| t_{rr} | Reverse recovery time | $I_{SD} = 6.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 50 \text{ V}$ (see Figure 18. Test circuit for inductive load switching and diode recovery times) | - | 680 | | ns |
| Q_{rr} | Reverse recovery charge | | | 6 | | μC |
| I_{RRM} | Reverse recovery current | | | 17 | | A |

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

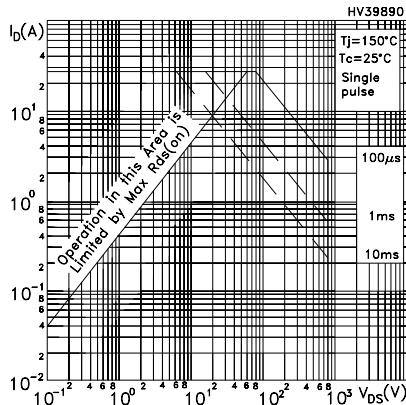
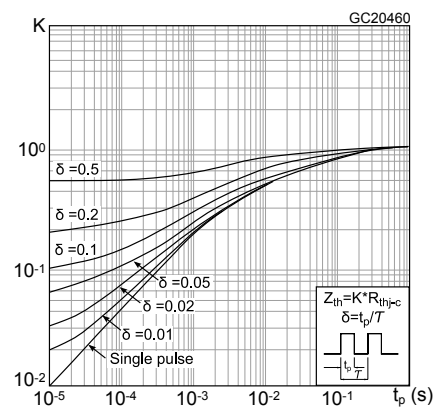
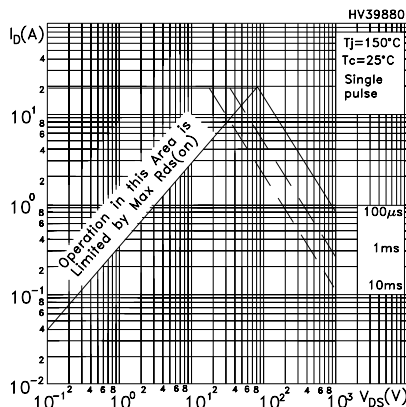
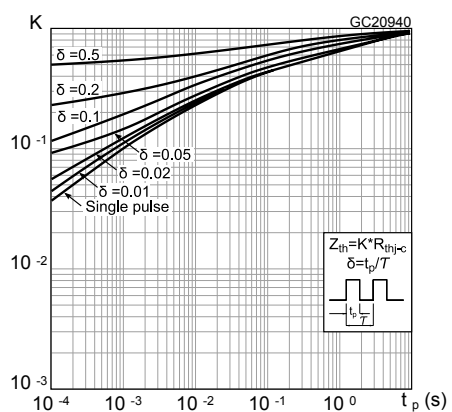
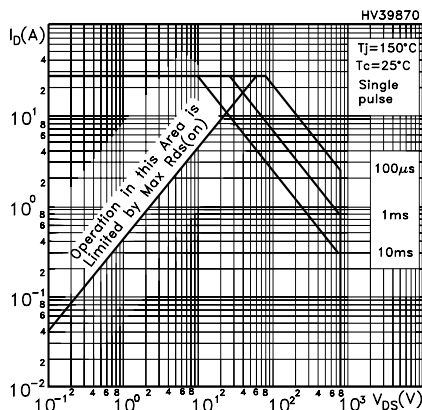
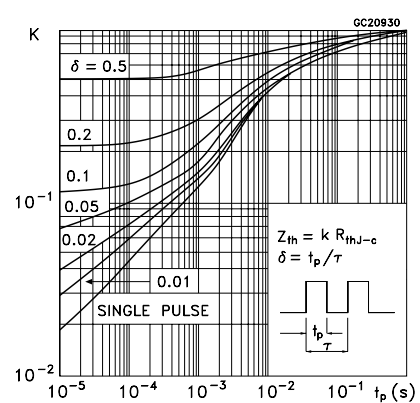
2.1 Electrical characteristics (curves)
Figure 1. Safe operating area for DPAK and IPAK

Figure 2. Thermal impedance for DPAK and IPAK

Figure 3. Safe operating area for TO-220FP

Figure 4. Thermal impedance for TO-220FP

Figure 5. Safe operating area for TO-220

Figure 6. Thermal impedance for TO-220


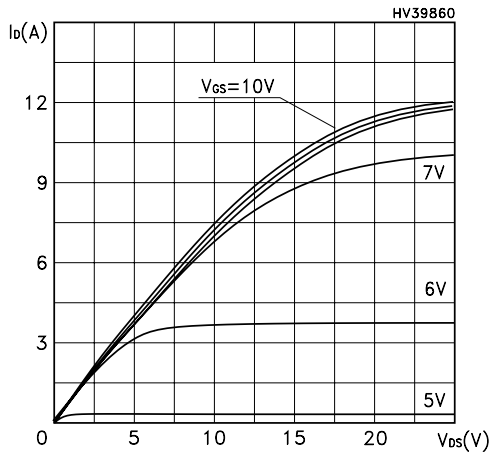
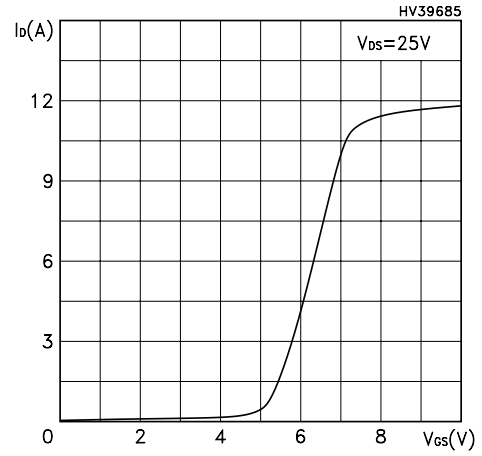
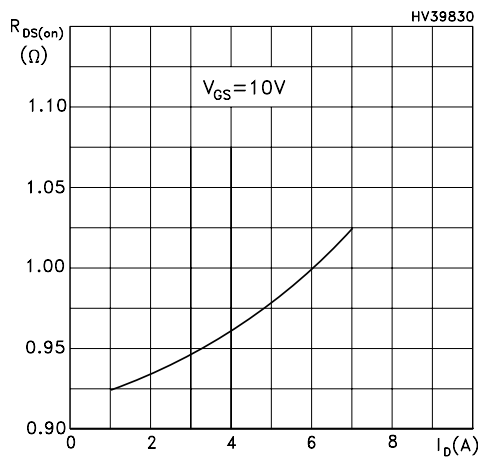
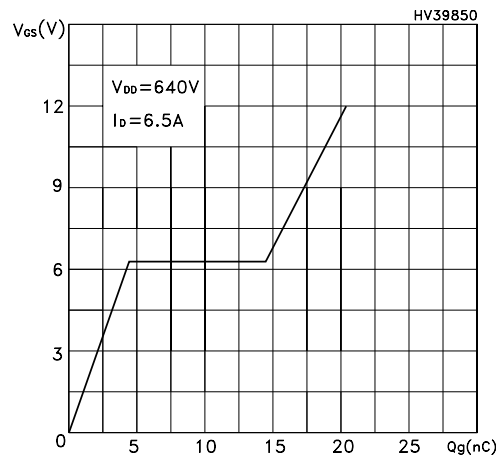
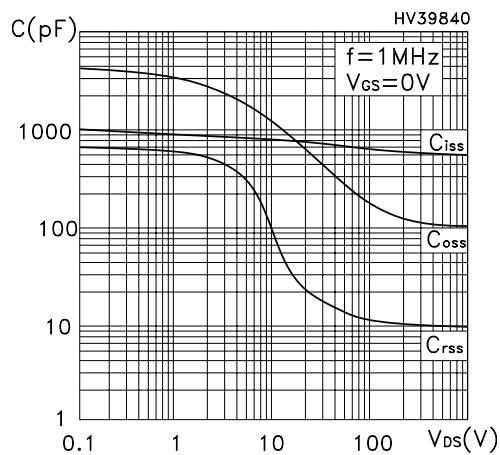
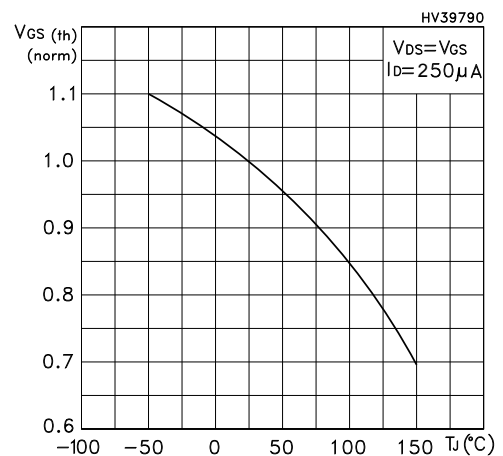
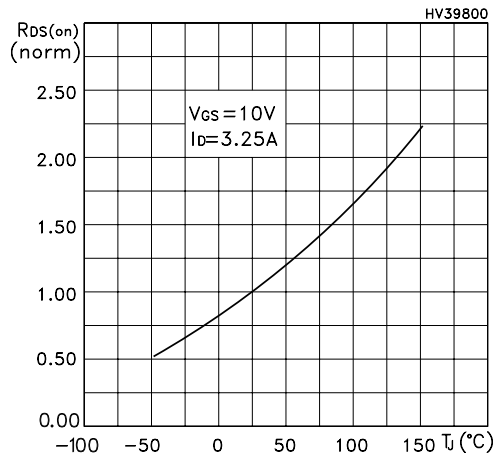
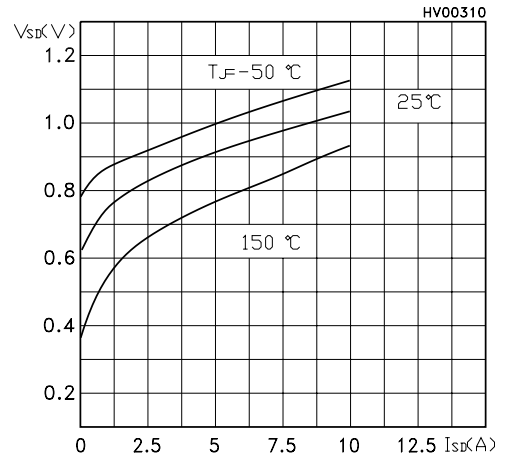
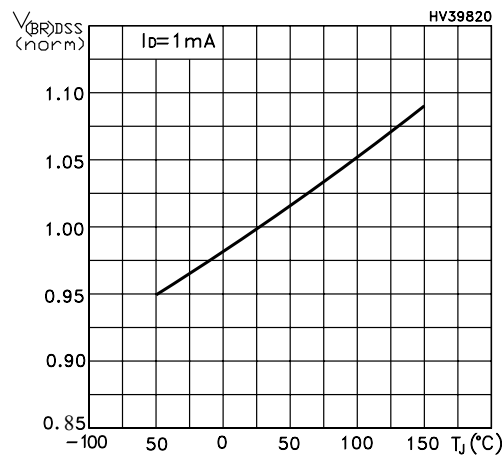
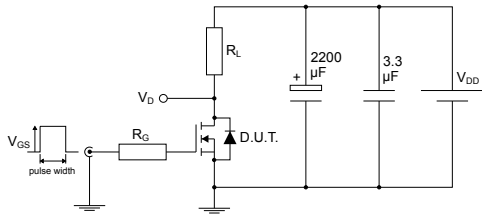
Figure 7. Output characteristics

Figure 8. Transfer characteristics

Figure 9. Static drain-source on-resistance

Figure 10. Gate charge vs gate-source voltage

Figure 11. Capacitance variations

Figure 12. Normalized gate threshold voltage vs temperature


Figure 13. Normalized on-resistance vs temperature

Figure 14. Source-drain diode forward characteristics

Figure 15. Normalized $V_{(BR)DSS}$ vs temperature


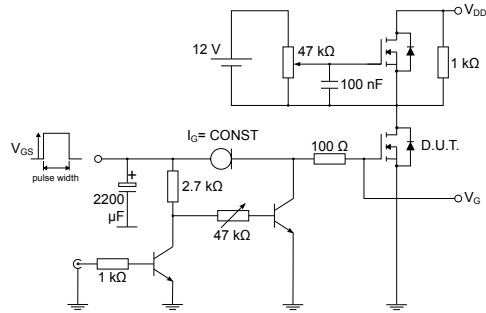
3 Test circuits

Figure 16. Test circuit for resistive load switching times



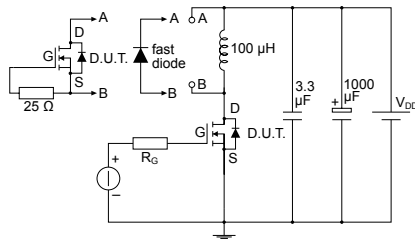
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Figure 17. Test circuit for gate charge behavior



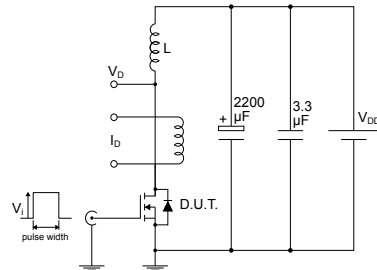
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Figure 18. Test circuit for inductive load switching and diode recovery times



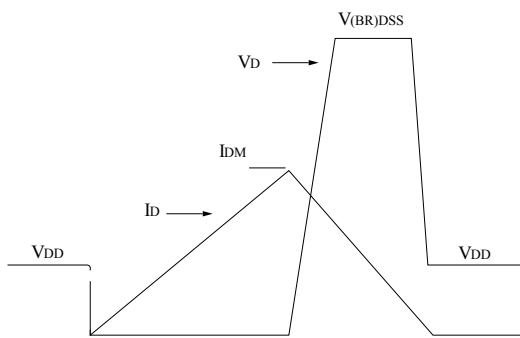
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Figure 19. Unclamped inductive load test circuit



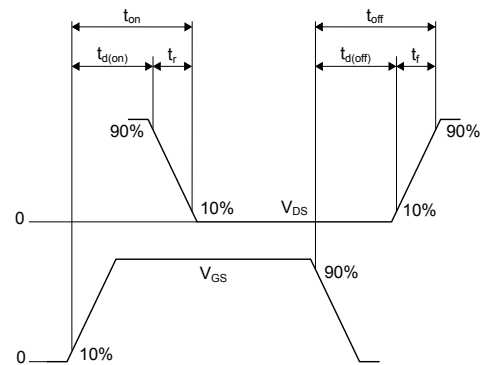
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Figure 20. Unclamped inductive waveform



AM01472v1

Figure 21. Switching time waveform



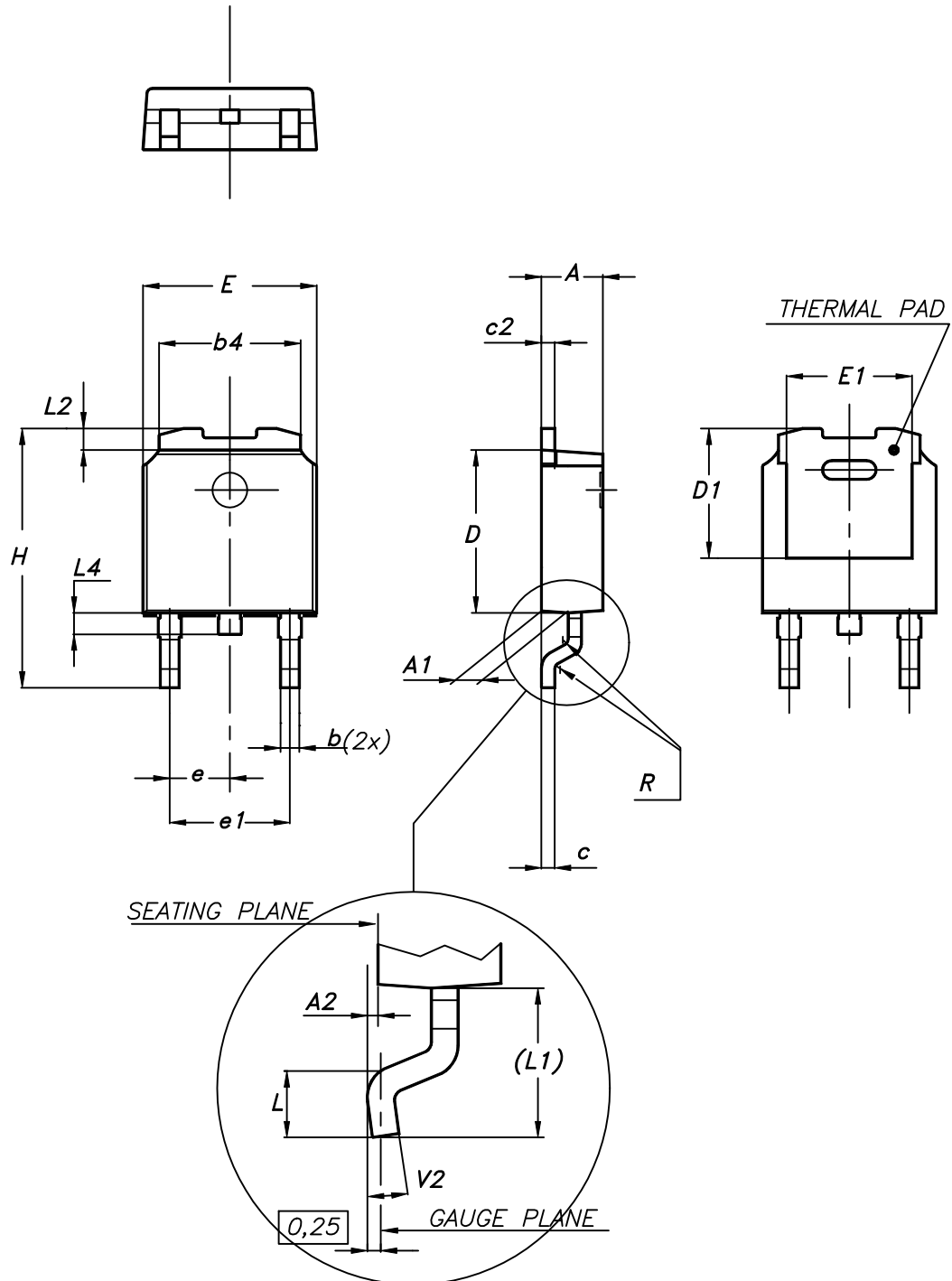
AM01473v1

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 DPAK (TO-252) type A2 package information

Figure 22. DPAK (TO-252) type A2 package outline

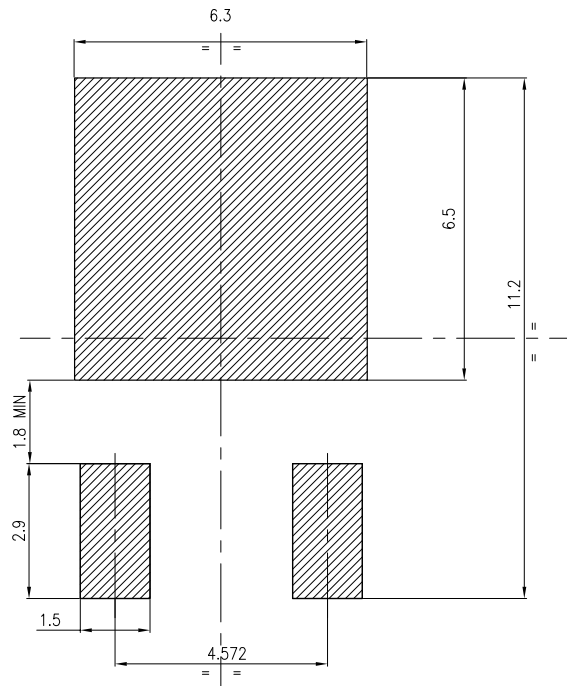


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Table 8. DPAK (TO-252) type A2 mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 |
| A1 | 0.90 | | 1.10 |
| A2 | 0.03 | | 0.23 |
| b | 0.64 | | 0.90 |
| b4 | 5.20 | | 5.40 |
| c | 0.45 | | 0.60 |
| c2 | 0.48 | | 0.60 |
| D | 6.00 | | 6.20 |
| D1 | 4.95 | 5.10 | 5.25 |
| E | 6.40 | | 6.60 |
| E1 | 5.10 | 5.20 | 5.30 |
| e | 2.159 | 2.286 | 2.413 |
| e1 | 4.445 | 4.572 | 4.699 |
| H | 9.35 | | 10.10 |
| L | 1.00 | | 1.50 |
| L1 | 2.60 | 2.80 | 3.00 |
| L2 | 0.65 | 0.80 | 0.95 |
| L4 | 0.60 | | 1.00 |
| R | | 0.20 | |
| V2 | 0° | | 8° |

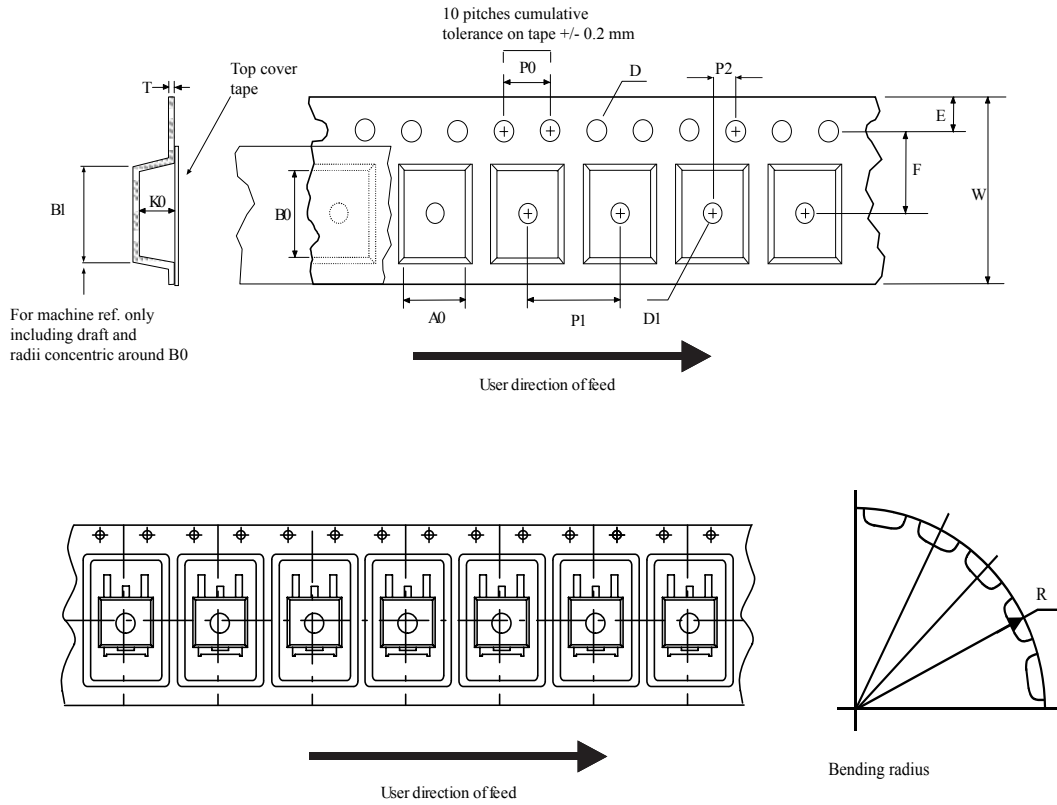
Figure 23. DPAK (TO-252) recommended footprint (dimensions are in mm)



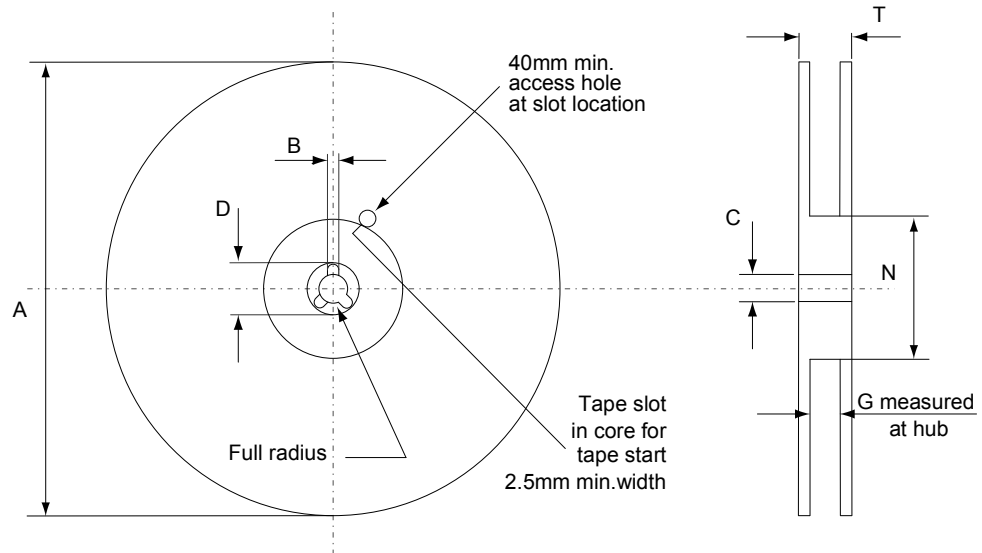
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4.2 DPAK (TO-252) packing information

Figure 24. DPAK (TO-252) tape outline



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Figure 25. DPAK (TO-252) reel outline


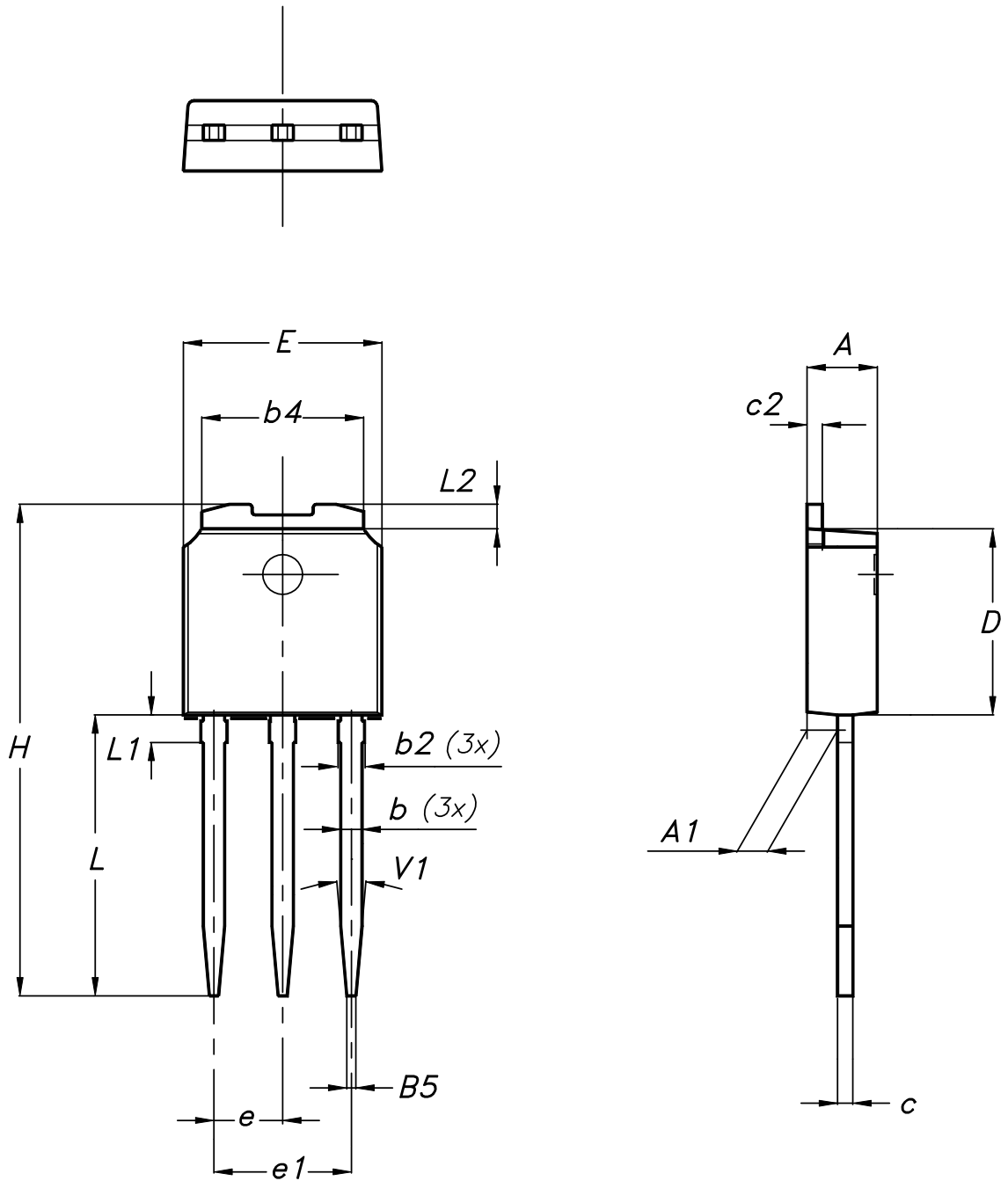
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Table 9. DPAK (TO-252) tape and reel mechanical data

| Tape | | | Reel | | |
|------|------|------|-----------|------|------|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 6.8 | 7 | A | | 330 |
| B0 | 10.4 | 10.6 | B | 1.5 | |
| B1 | | 12.1 | C | 12.8 | 13.2 |
| D | 1.5 | 1.6 | D | 20.2 | |
| D1 | 1.5 | | G | 16.4 | 18.4 |
| E | 1.65 | 1.85 | N | 50 | |
| F | 7.4 | 7.6 | T | | 22.4 |
| K0 | 2.55 | 2.75 | | | |
| P0 | 3.9 | 4.1 | Base qty. | | 2500 |
| P1 | 7.9 | 8.1 | Bulk qty. | | 2500 |
| P2 | 1.9 | 2.1 | | | |
| R | 40 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 15.7 | 16.3 | | | |

4.3 IPAk (TO-251) type A package information

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



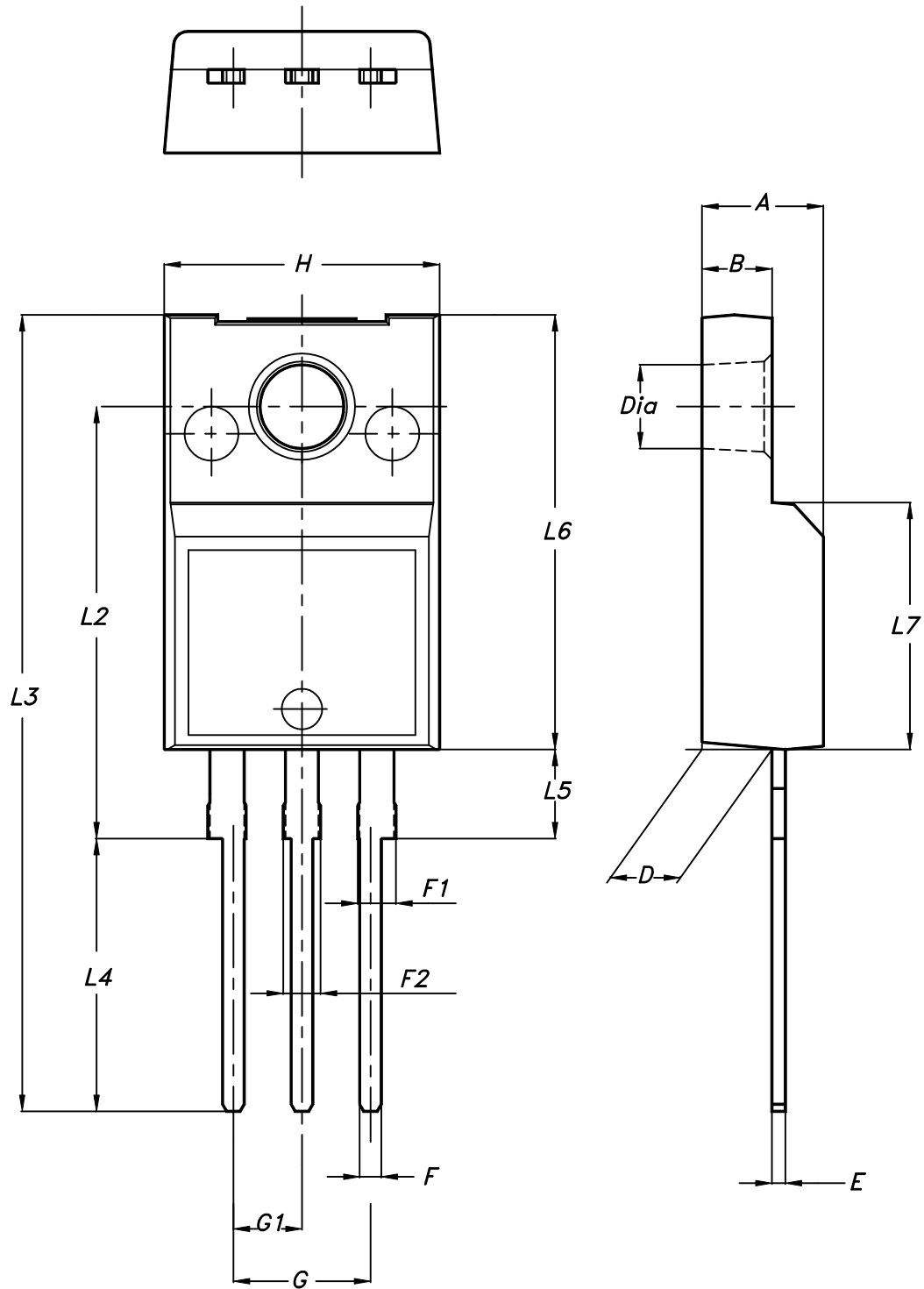
0068771_IK_typeA_rev14

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° | |

4.4 TO-220FP package information

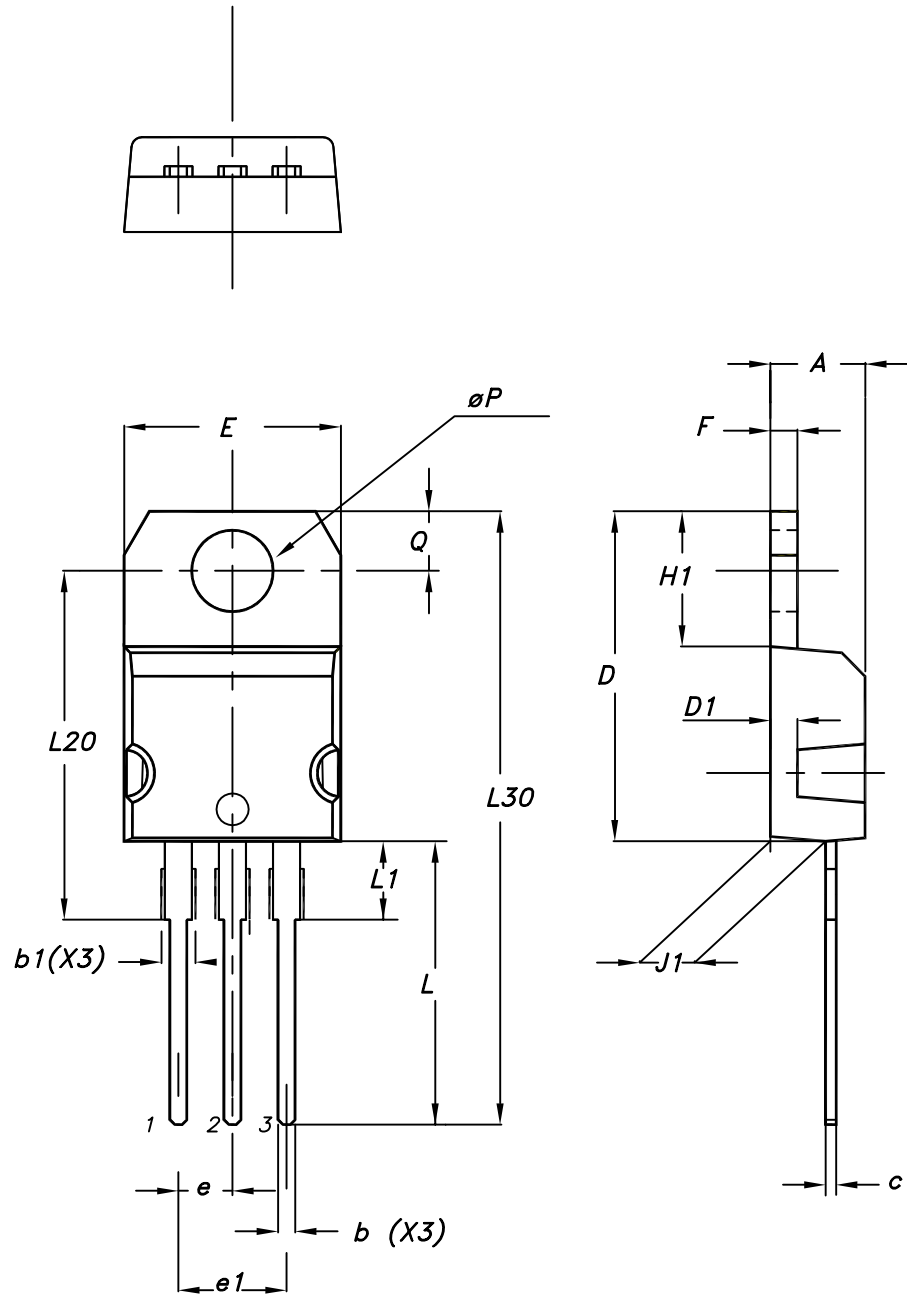
Figure 27. TO-220FP package outline



7012510_Rev_12_B

Table 11. TO-220FP package 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 |

4.5 TO-220 type A package information
Figure 28. TO-220 type A package outline


0015988_typeA_Rev_21

Table 12. 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 |

5 Ordering information

Table 13. Order codes

| Order code | Marking | Package | Packing |
|------------|---------|----------|---------------|
| STD7NM80 | D7NM80 | DPAK | Tape and reel |
| STD7NM80-1 | D7NM80 | IPAK | Tube |
| STF7NM80 | F7NM80 | TO-220FP | |
| STP7NM80 | P7NM80 | TO-220 | |

Revision history

Table 14. Document revision history

| Date | Version | Changes |
|-------------|---------|--|
| 22-Sep-2006 | 1 | First release. |
| 09-Oct-2007 | 2 | Added new section: <i>Electrical characteristics (curves)</i> . |
| 02-Oct-2009 | 3 | Corrected marking and description on first page. |
| 20-Aug-2018 | 4 | Updated Section 4 Package information . 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 | DPAK (TO-252) type A2 package information | 9 |
| 4.2 | DPAK (TO-252) packing information | 12 |
| 4.3 | IPAK (TO-251) type A package information | 14 |
| 4.4 | TO-220FP package information | 16 |
| 4.5 | TO-220 type A package information | 18 |
| 5 | Ordering information | 21 |
| | Revision history | 22 |



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