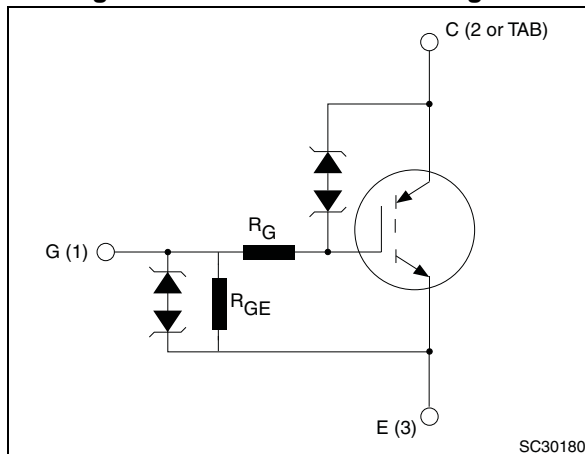


Figure 1. Internal schematic diagram



Features

- Designed for automotive applications and AEC-Q101 qualified
- 180 mJ of avalanche energy @ $T_C = 150\text{ }^\circ\text{C}$, $L = 3\text{ mH}$
- ESD gate-emitter protection
- Gate-collector high voltage clamping
- Logic level gate drive
- Low saturation voltage
- High pulsed current capability
- Gate and gate-emitter resistor

Application

- Pencil coil electronic ignition driver

Description

This application-specific IGBT utilizes the most advanced PowerMESH™ technology. The built-in Zener diodes between gate-collector and gate-emitter provide overvoltage protection capabilities. The device also exhibits low on-state voltage drop and low threshold drive for use in automotive ignition system.

Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|---------------|-----------|--------------------|---------------|
| STGB18N40LZT4 | GB18N40LZ | D ² PAK | Tape and reel |
| STGD18N40LZ-1 | GD18N40LZ | IPAK | Tube |
| STGD18N40LZT4 | GD18N40LZ | DPAK | Tape and reel |
| STGP18N40LZ | GP18N40LZ | TO-220 | Tube |

Contents

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|------------------|--|---------------------------|------|
| V_{CES} | Collector-emitter voltage ($V_{GE} = 0$) | $V_{CES(\text{clamped})}$ | V |
| V_{ECS} | Emitter collector voltage ($V_{GE} = 0$) | 20 | V |
| $I_C^{(1)}$ | Collector current (continuous) at $T_C = 100\text{ °C}$ | 30 | A |
| $I_{CP}^{(2)}$ | Pulsed collector current | 40 | A |
| V_{GE} | Gate-emitter voltage | $V_{GE(\text{clamped})}$ | V |
| P_{TOT} | Total dissipation at $T_C = 25\text{ °C}$ | 150 | W |
| $E_{SCIS}^{(3)}$ | Single pulse energy $T_C = 25\text{ °C}$, $L = 3\text{ mH}$, $V_{CC} = 50\text{ V}$ | 300 | mJ |
| | Single pulse energy $T_C = 150\text{ °C}$, $L = 3\text{ mH}$, $V_{CC} = 50\text{ V}$ | 180 | mJ |
| ESD | Human body model, $R = 1.5\text{ k}\Omega$, $C = 100\text{ pF}$ | 8 | kV |
| | Machine model, $R = 0$, $C = 100\text{ pF}$ | 800 | V |
| | Charged device model | 2 | kV |
| T_{stg} | Storage temperature | - 55 to 175 | °C |
| T_j | Operating junction temperature | | |

1. Calculated according to the iterative formula

$$I_C(T_C) = \frac{T_{j(\text{max})} - T_C}{R_{thj-c} \times V_{CE(\text{sat})(\text{max})}(T_{j(\text{max})}, I_C(T_C))}$$

- Pulse width limited by max. junction temperature
- For E_{SCIS} test circuit refer to [Figure 16.: Inductive load switching and \$E_{SCIS}\$ test circuit](#) with A and B not connected.

Table 3. Thermal data

| Symbol | Parameter | Value | | Unit |
|----------------|-------------------------------------|--------------|------------------------------|------|
| | | DPAK IPAK | D ² PAK TO-220 | |
| $R_{thj-case}$ | Thermal resistance junction-case | 1 | | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | 100 | 62.5 | °C/W |

2 Electrical characteristics

($T_J=25\text{ °C}$ unless otherwise specified)

Table 4. Static electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------------|---|---|------|------|------|---------------|
| $V_{CES(\text{clamped})}$ | Collector emitter clamped voltage ($V_{GE} = 0$) | $I_C = 2\text{ mA}$ $T_J = -40\text{ °C to }150\text{ °C}$ | 360 | 390 | 420 | V |
| $V_{(BR)ECS}$ | Emitter collector break-down voltage ($V_{GE} = 0$) | $I_C = 75\text{ mA}$ | 20 | 28 | | V |
| $V_{GE(\text{clamped})}$ | Gate emitter clamped voltage | $I_G = \pm 2\text{ mA}$ | 12 | | 16 | V |
| I_{CES} | Collector cut-off current ($V_{GE} = 0$) | $V_{CE} = 15\text{ V}, T_J = 150\text{ °C}$ | | | 10 | μA |
| | | $V_{CE} = 200\text{ V}, T_J = 150\text{ °C}$ | | | 100 | μA |
| I_{GES} | Gate-emitter leakage current ($V_{CE} = 0$) | $V_{GE} = \pm 10\text{ V}$ | 450 | 625 | 830 | μA |
| R_{GE} | Gate emitter resistance | | 12 | 16 | 22 | k Ω |
| R_G | Gate resistance | | | 1.6 | | k Ω |
| $V_{GE(\text{th})}$ | Gate threshold voltage | $V_{GE} = V_{CE}, I_C = 1\text{ mA}, T_J = -40\text{ °C}$ | 1.4 | | | V |
| | | $V_{GE} = V_{CE}, I_C = 1\text{ mA}$ | 1.2 | 1.6 | 2.3 | V |
| | | $V_{GE} = V_{CE}, I_C = 1\text{ mA}, T_J = 150\text{ °C}$ | 0.7 | | | V |
| $V_{CE(\text{sat})}$ | Collector emitter saturation voltage | $V_{GE} = 4.5\text{ V}, I_C = 10\text{ A}$ | | 1.35 | 1.7 | V |
| | | $V_{GE} = 4.5\text{ V}, I_C = 10\text{ A}, T_J = 150\text{ °C}$ | | 1.30 | | V |
| | | $V_{GE} = 3.8\text{ V}, I_C = 6\text{ A}$ | | 1.30 | | V |

Table 5. Dynamic electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| C_{ies} | Input capacitance | $V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0$ | - | 490 | - | pF |
| C_{oes} | Output capacitance | | - | 90 | - | pF |
| C_{res} | Reverse transfer capacitance | | - | 5 | - | pF |
| Q_g | Gate charge | $V_{CE} = 280\text{ V}, I_C = 10\text{ A}, V_{GE} = 5\text{ V}$ | - | 29 | - | nC |

Table 6. Resistive load switching time

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------|--------------------|---|------|------|------|---------------|
| $t_{d(on)}$ | Turn-on delay time | $V_{CC} = 14\text{ V}$, $R_L = 1\ \Omega$, $V_{GE} = 5\text{ V}$ | - | 0.65 | - | μs |
| t_r | Rise time | | - | 3.5 | - | μs |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC} = 14\text{ V}$, $R_L = 1\ \Omega$, $V_{GE} = 5\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ | - | 0.65 | - | μs |
| t_r | Rise time | | - | 3.8 | - | μs |

Table 7. Inductive load switching time

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|------------------------|---|------|------|------|------------------------|
| $t_{d(off)}$ | Turn-off delay time | $V_{CC} = 300\text{ V}$, $L = 1\text{ mH}$ $I_C = 10\text{ A}$, $V_{GE} = 5\text{ V}$ | - | 13.5 | - | μs |
| t_f | Fall time | | - | 5.5 | - | μs |
| dv/dt | Turn-off voltage slope | | - | 105 | - | $\text{V}/\mu\text{s}$ |
| $t_{d(off)}$ | Turn-off delay time | $V_{CC} = 300\text{ V}$, $L = 1\text{ mH}$ $I_C = 10\text{ A}$, $V_{GE} = 5\text{ V}$ $T_J = 150\text{ }^\circ\text{C}$ | - | 14.2 | - | μs |
| t_f | Fall time | | - | 8 | - | μs |
| dv/dt | Turn-off voltage slope | | - | 97 | - | $\text{V}/\mu\text{s}$ |

2.1 Electrical characteristics (curves)

Figure 2. Collector-emitter on voltage vs temperature

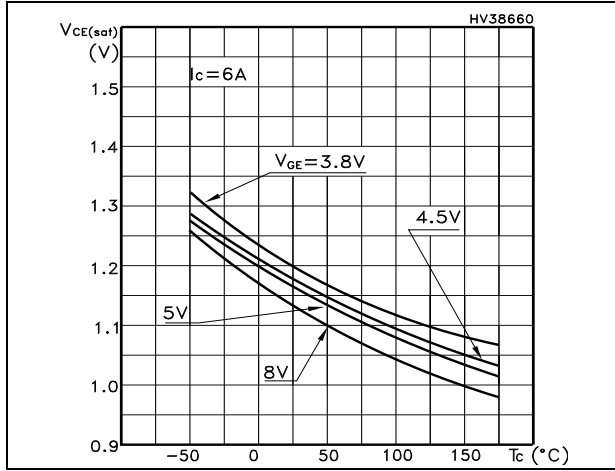


Figure 3. Collector-emitter on voltage vs temperature

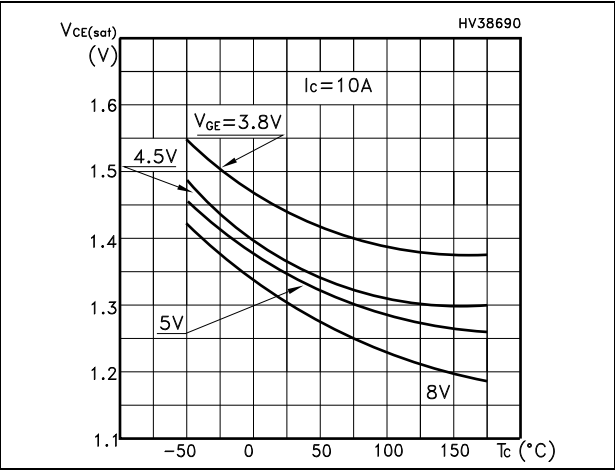


Figure 4. Collector-emitter on voltage vs temperature

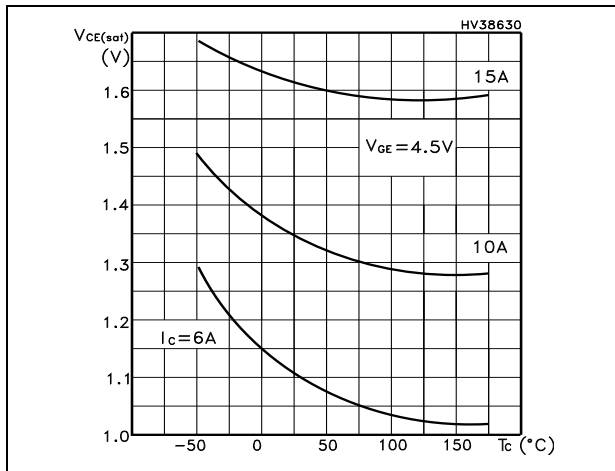


Figure 5. Self clamped inductive switch

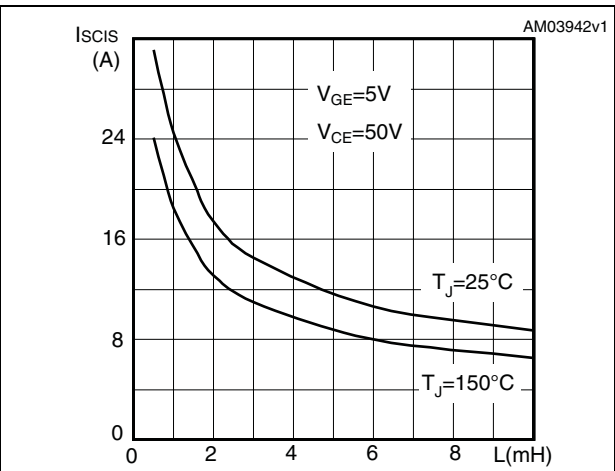


Figure 6. Output characteristics @ 25 °C

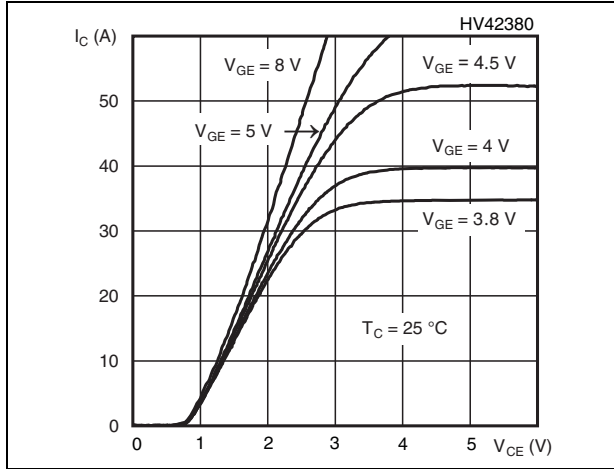


Figure 7. Output characteristics @ -40 °C

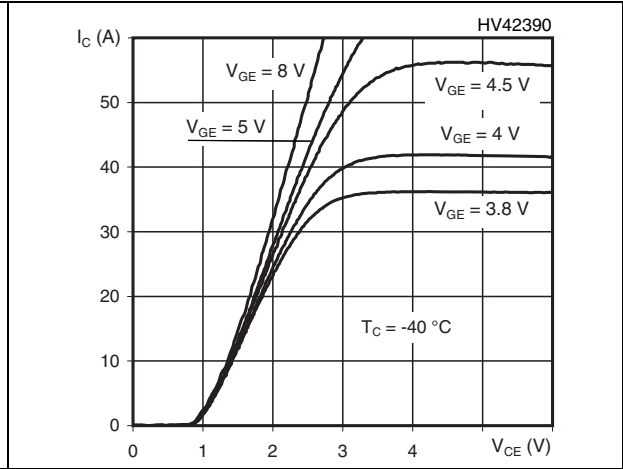


Figure 8. Output characteristics @ 175 °C

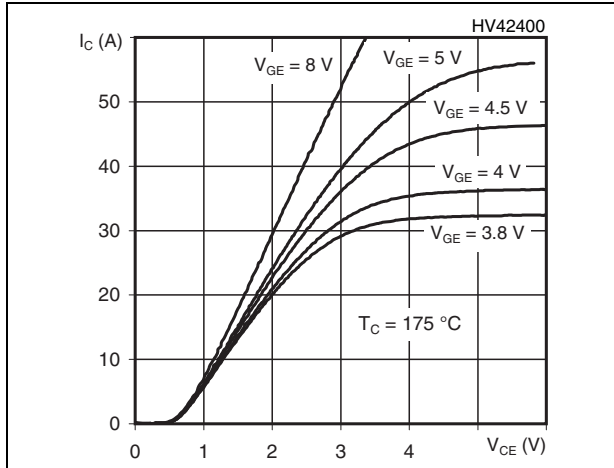


Figure 9. Transfer characteristics

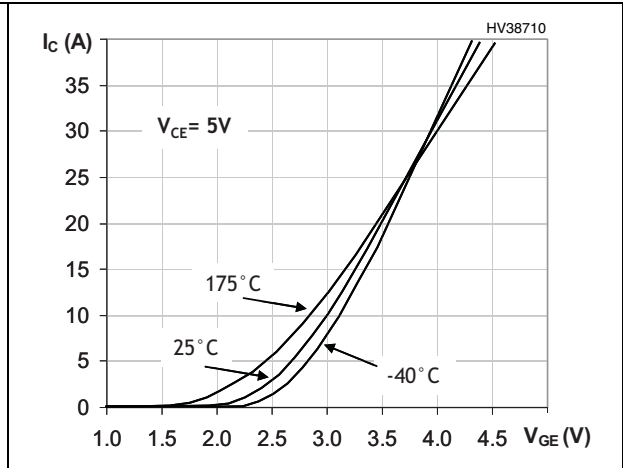


Figure 10. Collector cut-off current vs. temperature

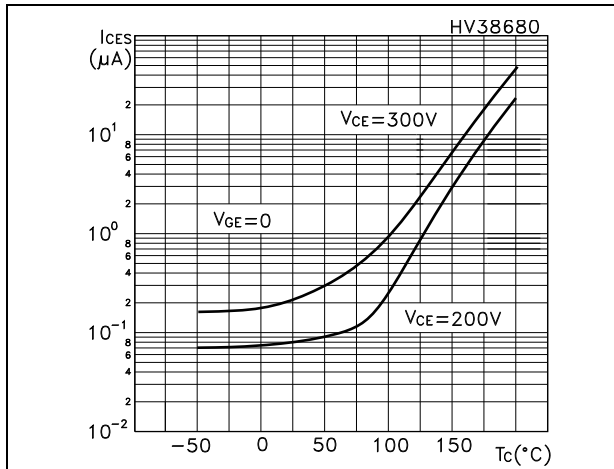


Figure 11. Normalized collector emitter voltage vs temperature

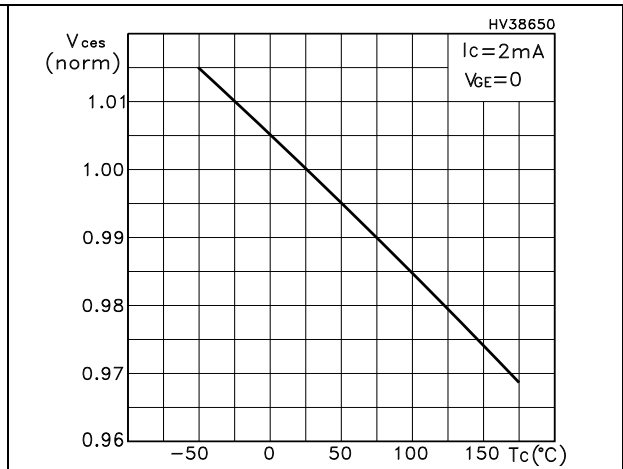


Figure 12. Normalized gate threshold voltage vs temperature

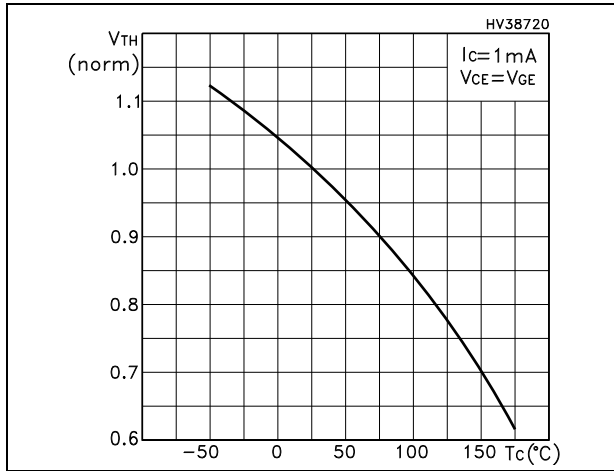


Figure 13. Normalized collector emitter on voltage vs temperature

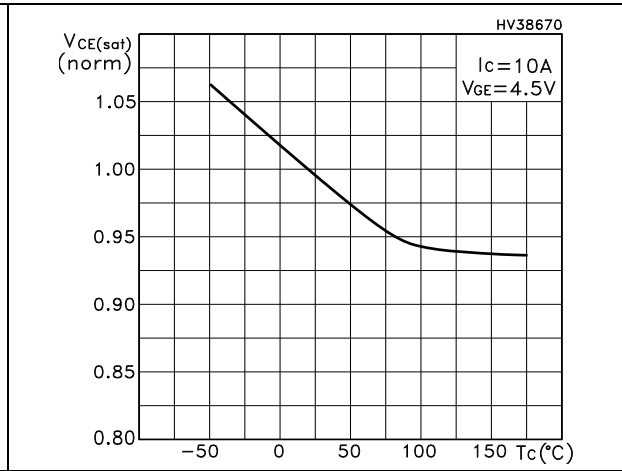


Figure 14. Thermal impedance for D²PAK, I²PAK, TO-220

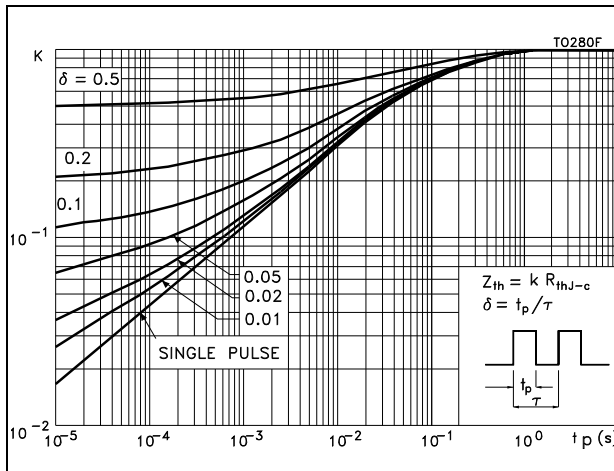
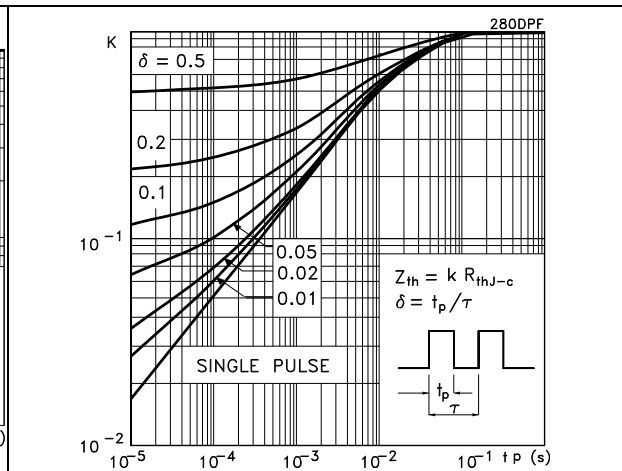


Figure 15. Thermal impedance for DPAK, IPAK



3 Test circuits

Figure 16. Inductive load switching and E_{SCIS} test circuit



Figure 17. Resistive load switching

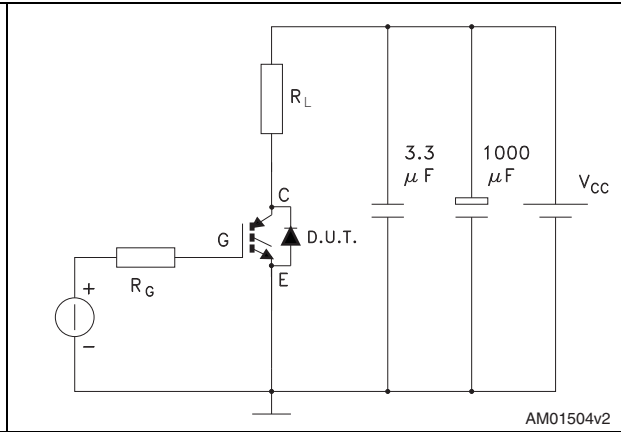


Figure 18. Gate charge test circuit

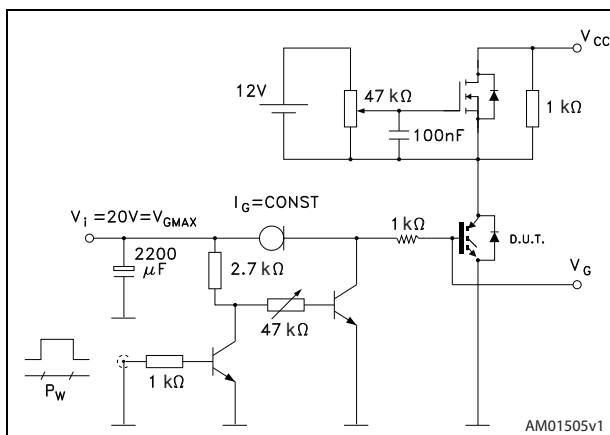
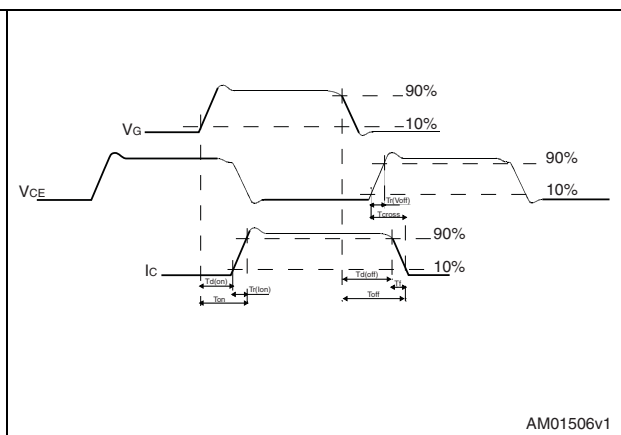


Figure 19. Switching waveform

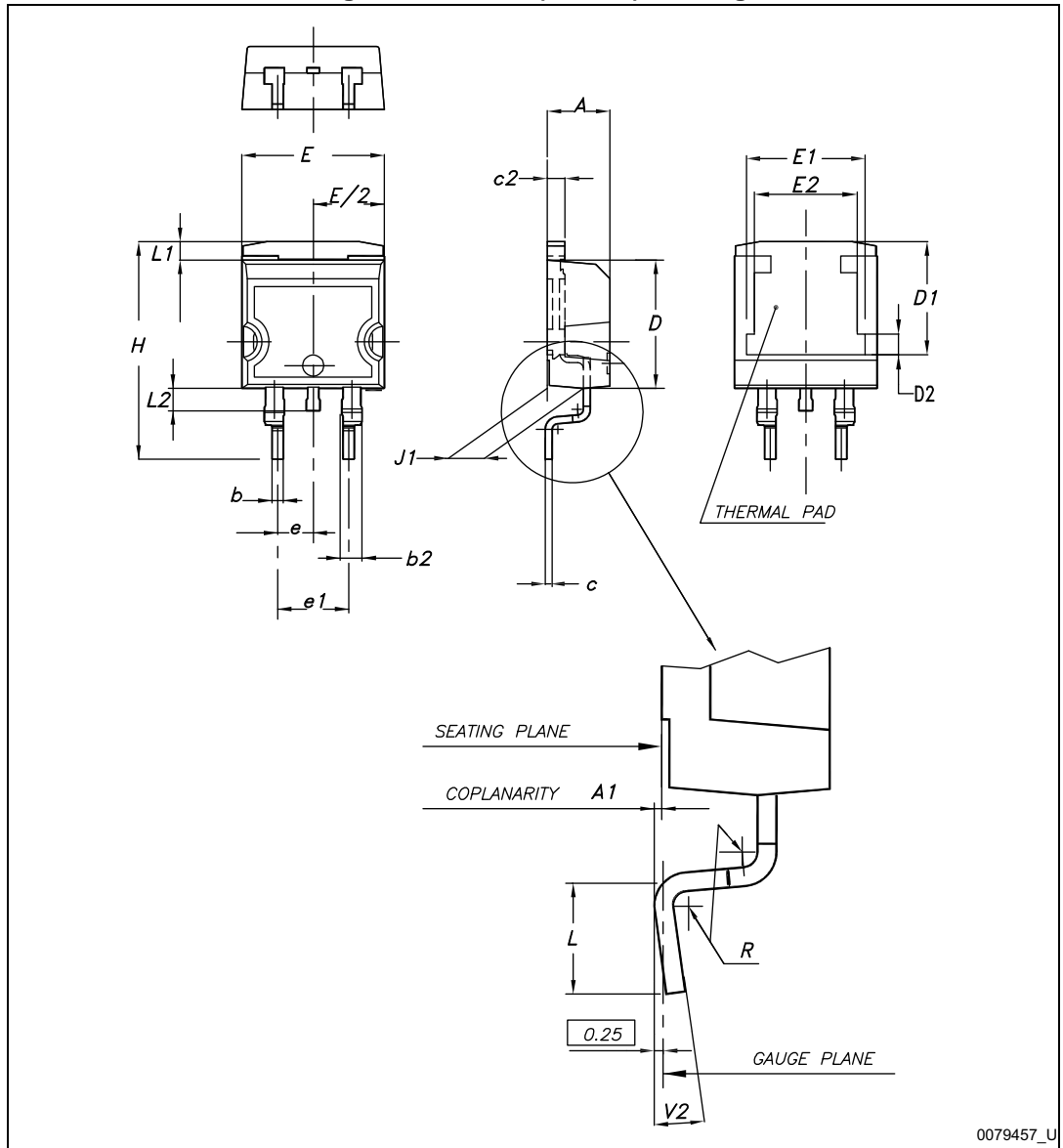


4 Package mechanical data

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 STGB18N40LZT4, D²PAK

Figure 20. D²PAK (TO-263) drawing

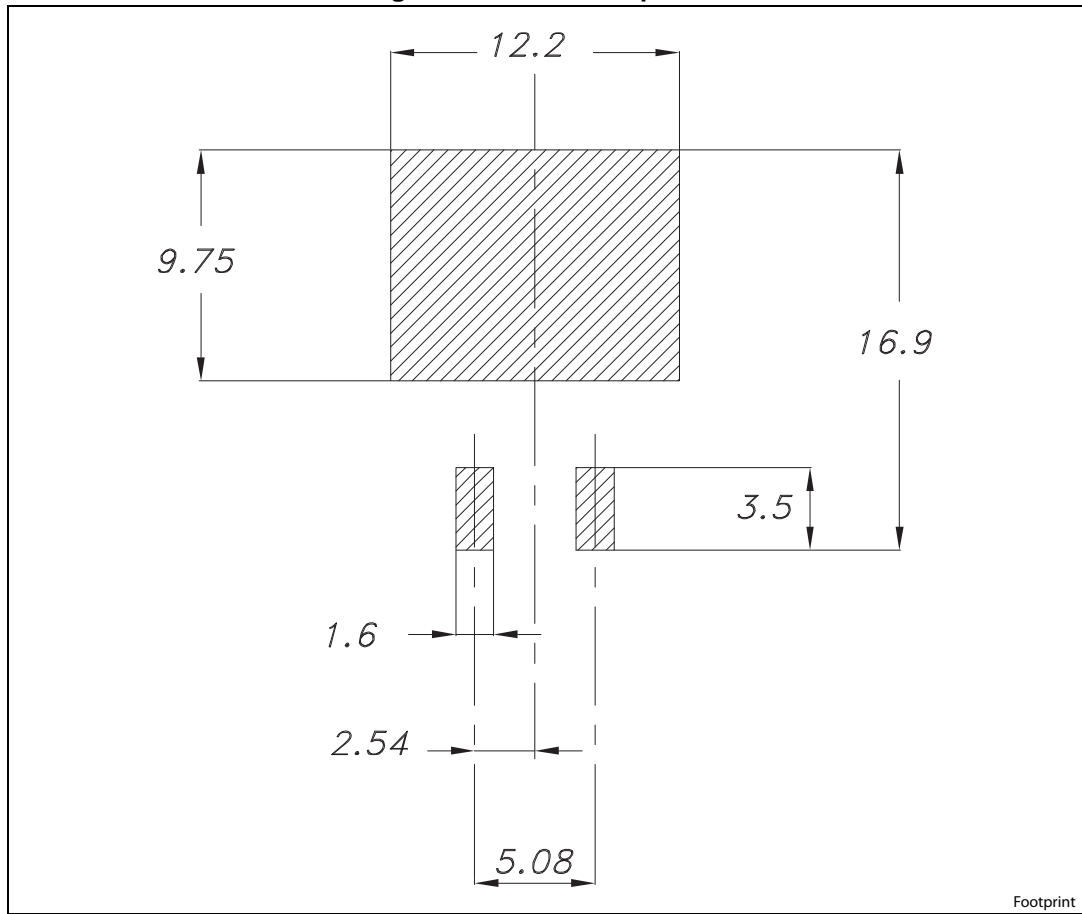


0079457_U

Table 8. D²PAK (TO-263) 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 | | 10.40 |
| E1 | 8.50 | 8.70 | 8.90 |
| E2 | 6.85 | 7.05 | 7.25 |
| e | | 2.54 | |
| e1 | 4.88 | | 5.28 |
| H | 15 | | 15.85 |
| J1 | 2.49 | | 2.69 |
| L | 2.29 | | 2.79 |
| L1 | 1.27 | | 1.40 |
| L2 | 1.30 | | 1.75 |
| R | | 0.4 | |
| V2 | 0° | | 8° |

Figure 21. D²PAK footprint^(a)



a. All dimension are in millimeters

4.2 STGD18N40LZ-1, IPAK

Figure 22. IPAK (TO-251) type A drawing

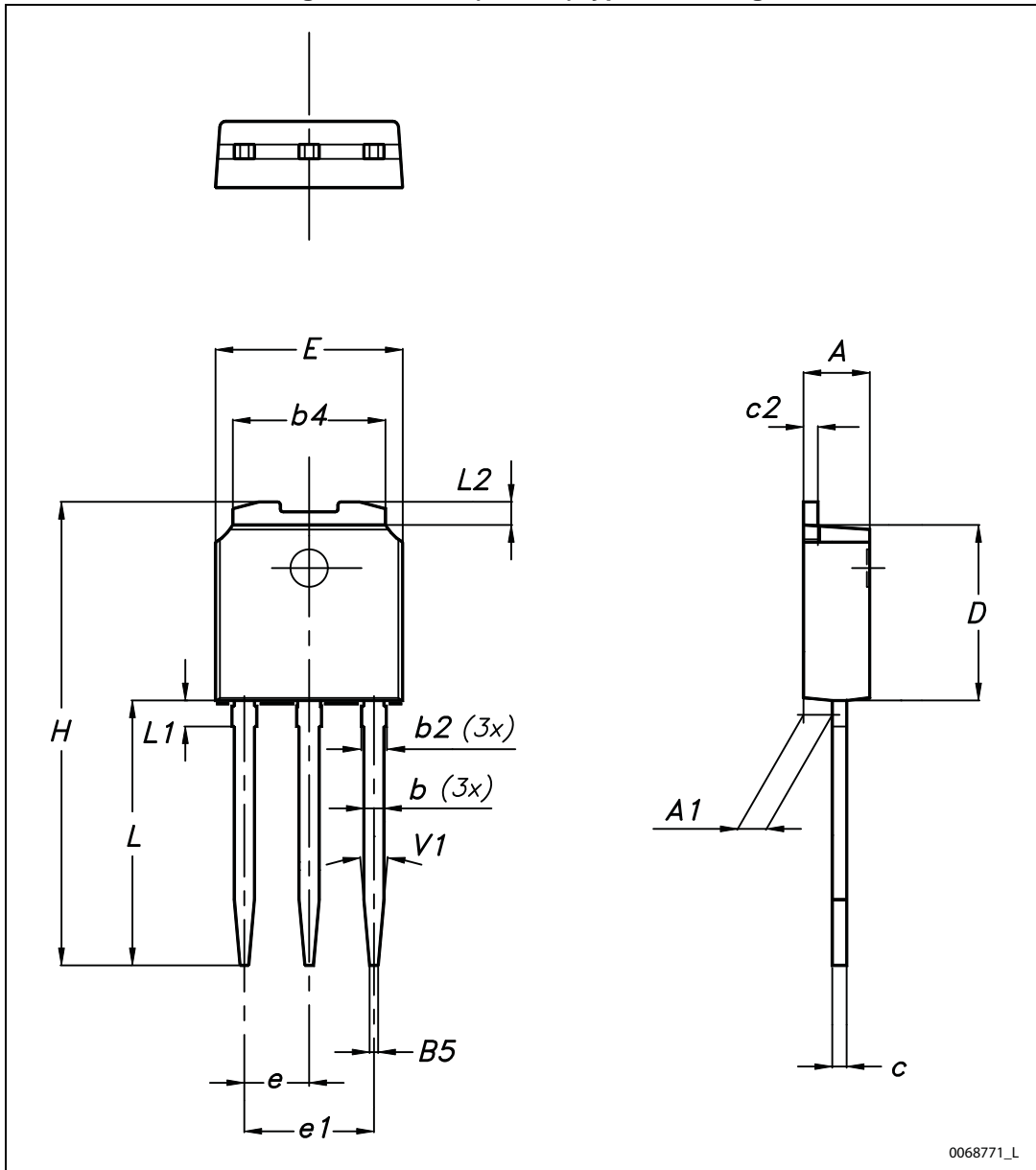


Table 9. IPAK (TO-251) type A mechanical data

| 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° | |

4.3 STGD18N40LZT4, DPAK

Figure 23. DPAK (TO-252) type A drawing

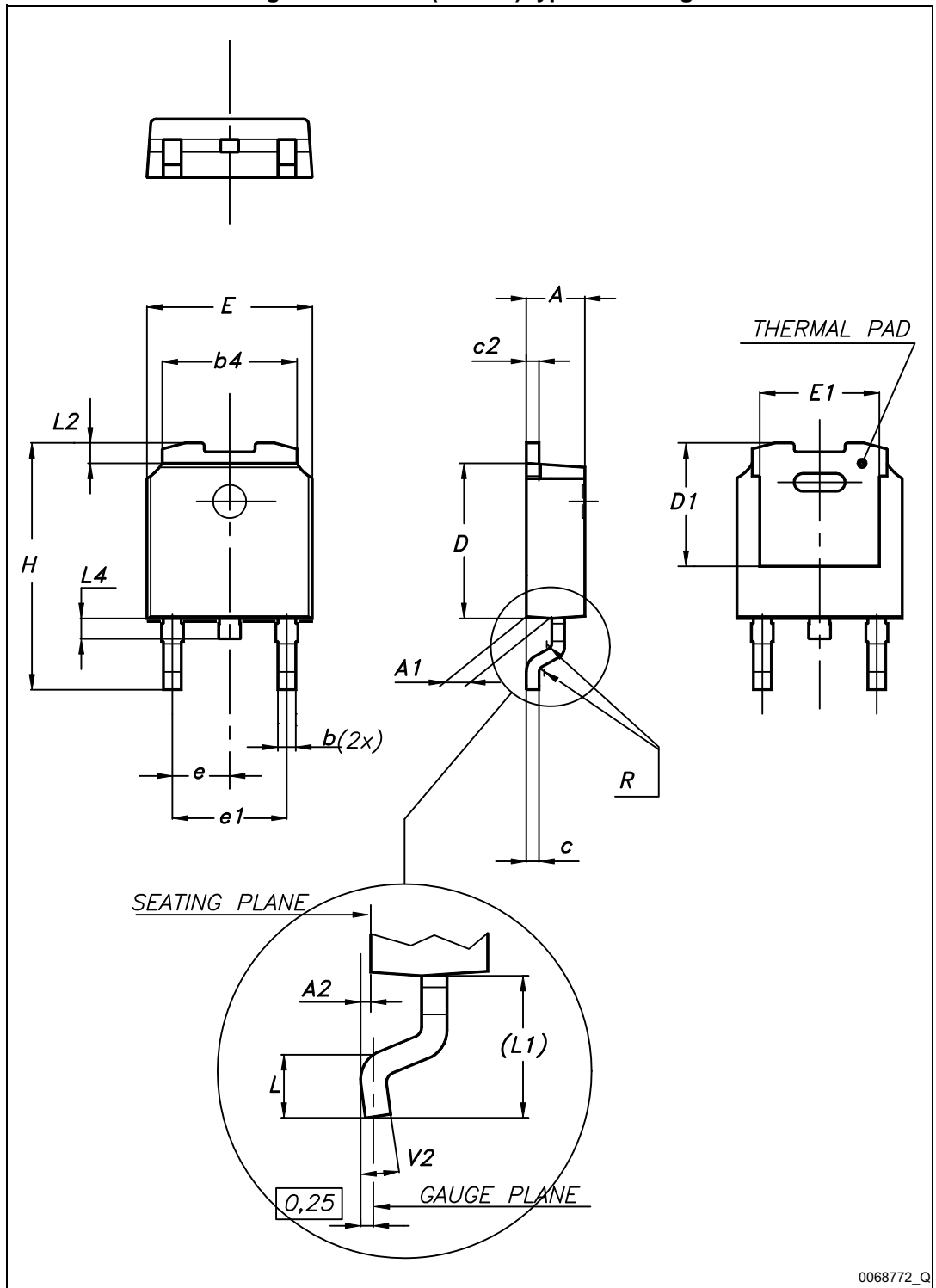
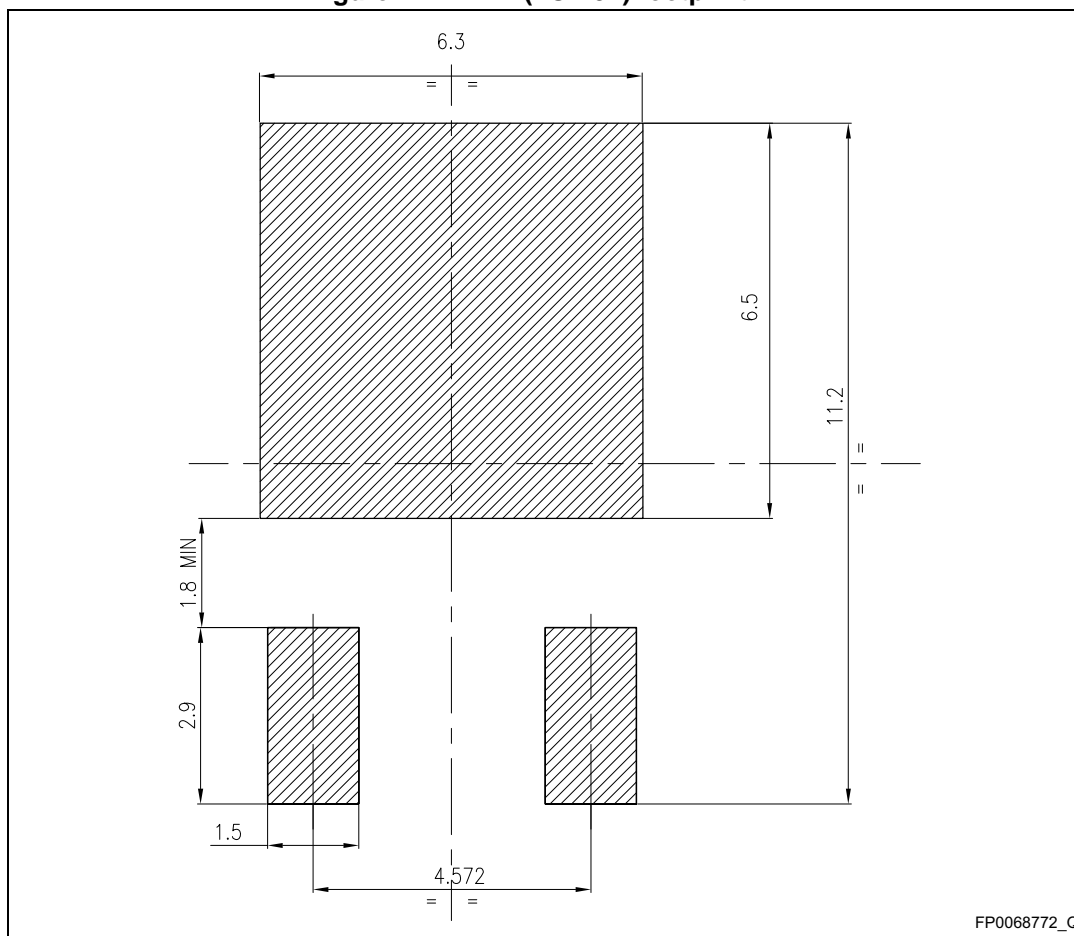


Table 10. DPAK (TO-252) type A mechanical data

| 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 | | 5.10 | |
| E | 6.40 | | 6.60 |
| E1 | | 4.70 | |
| e | | 2.28 | |
| e1 | 4.40 | | 4.60 |
| H | 9.35 | | 10.10 |
| L | 1.00 | | 1.50 |
| L1 | | 2.80 | |
| L2 | | 0.80 | |
| L4 | 0.60 | | 1.00 |
| R | | 0.20 | |
| V2 | 0° | | 8° |

Figure 24. DPAK (TO-252) footprint (b)



b. All dimensions are in millimeters

4.4 STGP18N40LZ, TO-220

Figure 25. TO-220 type A drawing

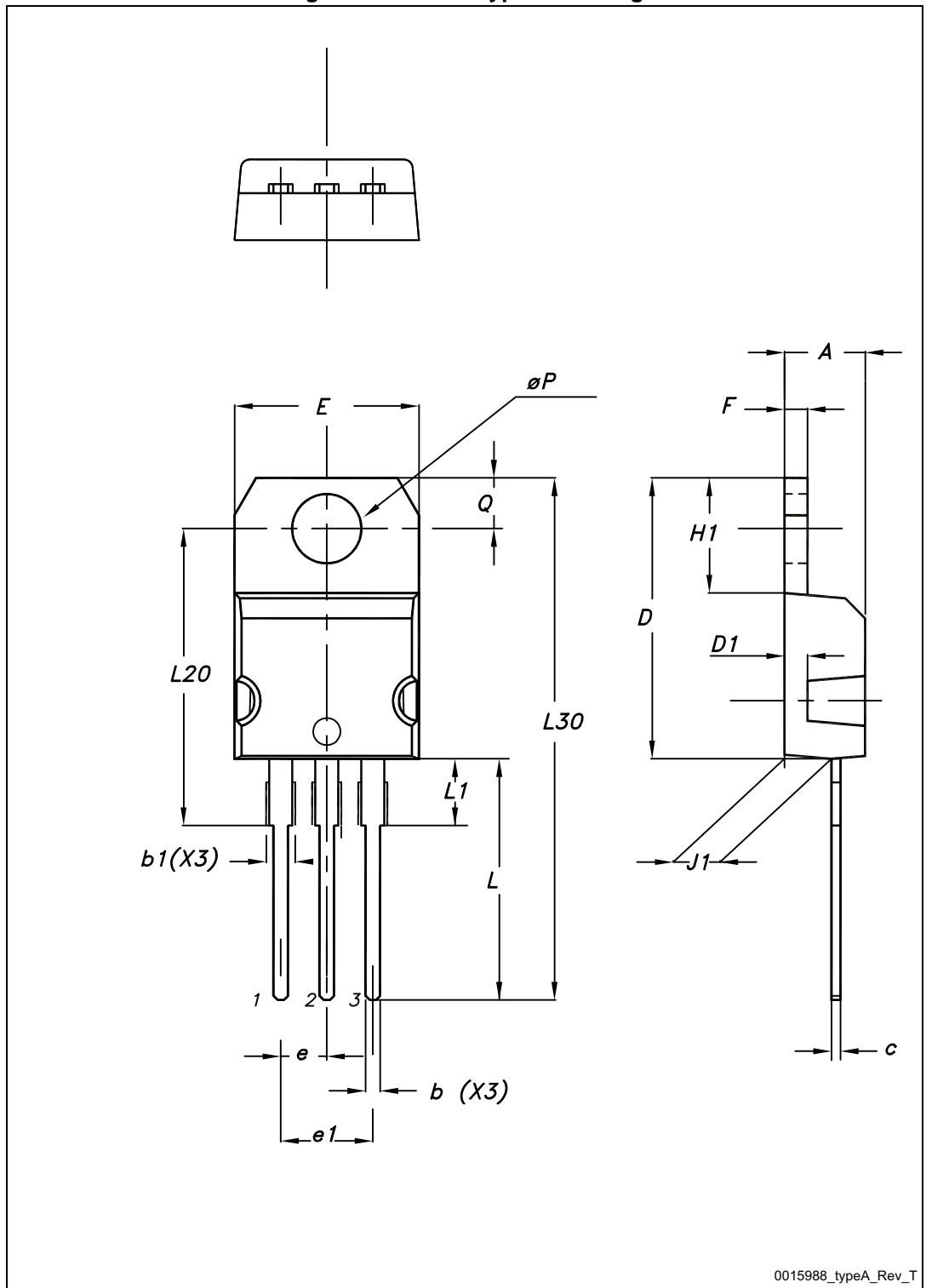


Table 11. TO-220 type A mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 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 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| øP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

5 Packaging mechanical data

Figure 26. Tape for DPAK and D²PAK

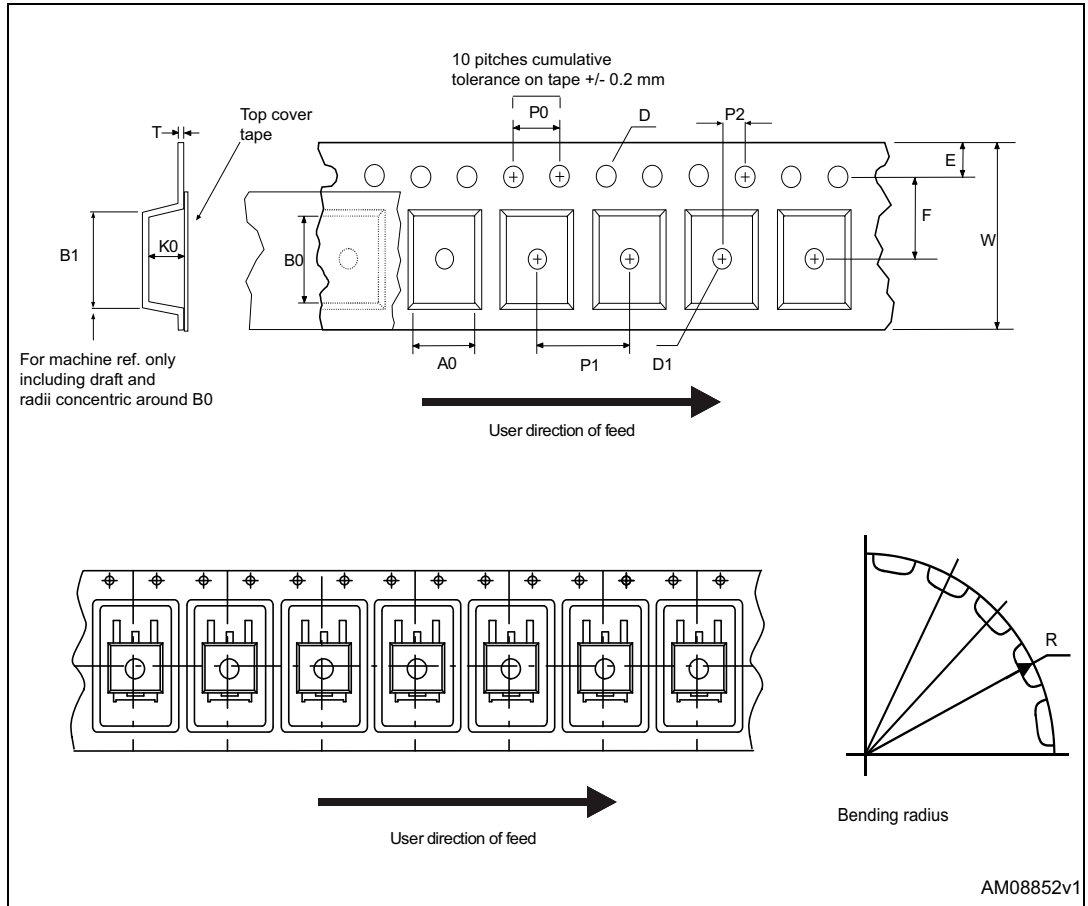


Figure 27. Reel for DPAK and D²PAK

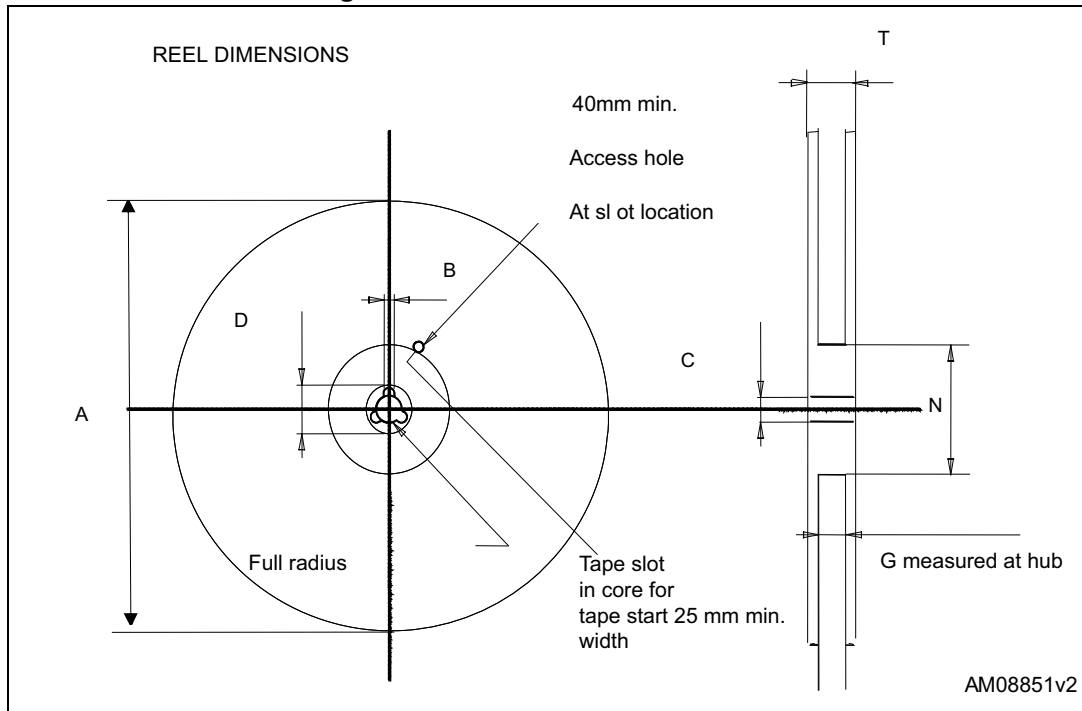


Table 12. DPAK (TO-252) tape and reel mechanical data

| 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 | | | |

Table 13. D²PAK (TO-263) tape and reel mechanical data

| Tape | | | Reel | | |
|------|------|------|----------|------|------|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 10.5 | 10.7 | A | | 330 |
| B0 | 15.7 | 15.9 | B | 1.5 | |
| D | 1.5 | 1.6 | C | 12.8 | 13.2 |
| D1 | 1.59 | 1.61 | D | 20.2 | |
| E | 1.65 | 1.85 | G | 24.4 | 26.4 |
| F | 11.4 | 11.6 | N | 100 | |
| K0 | 4.8 | 5.0 | T | | 30.4 |
| P0 | 3.9 | 4.1 | | | |
| P1 | 11.9 | 12.1 | Base qty | | 1000 |
| P2 | 1.9 | 2.1 | Bulk qty | | 1000 |
| R | 50 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 23.7 | 24.3 | | | |

6 Revision history

Table 14. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 18-Jan-2008 | 1 | Initial release. |
| 07-Mar-2008 | 2 | Modified Figure 7 , Figure 8 , Figure 10 . |
| 07-May-2008 | 3 | Modified Figure 9 |
| 31-Mar-2009 | 4 | Added new package, mechanical data: TO-220 |
| 18-May-2009 | 5 | Modified Figure 5 |
| 12-Nov-2014 | 6 | Updated Table 1: Device summary , Table 2: Absolute maximum ratings and Table 3: Thermal data Updated 3: Test circuits Updated Section 4: Package mechanical data Updated Section 5: Packaging mechanical data Minor text changes |

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