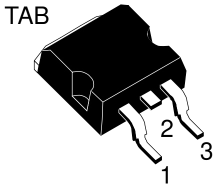
# STGB30H65FB

## Trench gate field-stop IGBT, HB series 650 V, 30 A high speed in a D²PAK package

Datasheet - production data



D²PAK

## Features

- Maximum junction temperature: $T_J$ = 175 °C
- High speed switching series
- Minimized tail current
- $V_{CE(sat)}$ = 1.55 V(typ.) @ $I_C$ = 30 A
- Safe paralleling
- Tight parameter distribution
- Low thermal resistance

## Applications

- Photovoltaic inverters
- High frequency converters

## Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the new HB series of IGBTs, which represents an optimum compromise between conduction and switching loss to maximize the efficiency of any frequency converter. Furthermore, the slightly positive $V_{CE(sat)}$ temperature coefficient and very tight parameter distribution result in safer paralleling operation.

**Figure 1: Internal schematic diagram**

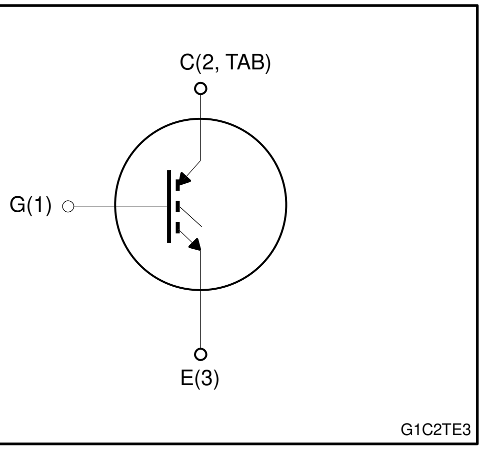


**Table 1: Device summary**

| Order code | Marking | Package | Packing |
|---|---|---|---|
| STGB30H65FB | GB30H65FB | D²PAK | Tape and reel |

# Contents

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-emitter voltage ($V_{GE}$ = 0 V) | 650 | V |
| $I_C$ | Continuous collector current at $T_C$ = 25 °C | 60 | A |
| | Continuous collector current at $T_C$ = 100 °C | 30 | |
| $I_{CP}$(1) | Pulsed collector current | 120 | A |
| $V_{GE}$ | Gate-emitter voltage | ±20 | V |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 260 | W |
| $T_{STG}$ | Storage temperature range | - 55 to 150 | °C |
| $T_J$ | Operating junction temperature range | - 55 to 175 | |

**Notes:**

(1)Pulse width limited by maximum junction temperature.

**Table 3: Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | 0.58 | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 62.5 | |

# 2 Electrical characteristics

$T_C$ = 25 °C unless otherwise specified

**Table 4: Static characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)CES}$ | Collector-emitter breakdown voltage | $V_{GE}$ = 0 V, $I_C$ = 2 mA | 650 | | | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE}$ = 15 V, $I_C$ = 30 A | | 1.55 | 2 | V |
| | | $V_{GE}$ = 15 V, $I_C$ = 30 A, $T_J$ = 125 °C | | 1.65 | | |
| | | $V_{GE}$ = 15 V, $I_C$ = 30 A, $T_J$ = 175 °C | | 1.75 | | |
| $V_{GE(th)}$ | Gate threshold voltage | $V_{CE}$ = $V_{GE}$, $I_C$ = 1 mA | 5 | 6 | 7 | V |
| $I_{CES}$ | Collector cut-off current | $V_{GE}$ = 0 V, $V_{CE}$ = 650 V | | | 25 | µA |
| $I_{GES}$ | Gate-emitter leakage current | $V_{CE}$ = 0 V, $V_{GE}$ = ±20 V | | | ±250 | nA |

**Table 5: Dynamic characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{ies}$ | Input capacitance | $V_{CE}$= 25 V, f = 1 MHz, $V_{GE}$ = 0 V | - | 3659 | - | pF |
| $C_{oes}$ | Output capacitance | | - | 101 | - | |
| $C_{res}$ | Reverse transfer capacitance | | - | 76 | - | |
| $Q_g$ | Total gate charge | $V_{CC}$ = 520 V, $I_C$ = 30 A, $V_{GE}$ = 0 to 15 V (see *Figure 23: "Gate charge test circuit"*) | - | 149 | - | nC |
| $Q_{ge}$ | Gate-emitter charge | | - | 25 | - | |
| $Q_{gc}$ | Gate-collector charge | | - | 62 | - | |

**Table 6: IGBT switching characteristics (inductive load)**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{CE}$ = 400 V, $I_C$ = 30 A, $V_{GE}$ = 15 V, $R_G$ = 10 Ω (see *Figure 22: "Test circuit for inductive load switching"* ) | - | 37 | - | ns |
| $t_r$ | Current rise time | | - | 14.6 | - | |
| $(di/dt)_{on}$ | Turn-on current slope | | - | 1643 | - | A/µs |
| $t_{d(off)}$ | Turn-off-delay time | | - | 146 | - | ns |
| $t_f$ | Current fall time | | - | 23 | - | |
| $E_{on}$(1) | Turn-on switching energy | | - | 151 | - | µJ |
| $E_{off}$(2) | Turn-off switching energy | | - | 293 | - | |
| $E_{ts}$ | Total switching energy | | - | 444 | - | |
| $t_{d(on)}$ | Turn-on delay time | $V_{CE}$ = 400 V, $I_C$ = 30 A, $V_{GE}$ = 15 V, $R_G$ = 10 Ω, $T_J$ = 175 °C (see *Figure 22: "Test circuit for inductive load switching"* ) | - | 35 | - | ns |
| $t_r$ | Current rise time | | - | 16.1 | - | |
| $(di/dt)_{on}$ | Turn-on current slope | | - | 1496 | - | A/µs |
| $t_{d(off)}$ | Turn-off-delay time | | - | 158 | - | ns |
| $t_f$ | Current fall time | | - | 65 | - | |
| $E_{on}$(1) | Turn-on switching energy | | - | 175 | - | µJ |
| $E_{off}$(2) | Turn-off switching energy | | - | 572 | - | |
| $E_{ts}$ | Total switching energy | | - | 747 | - | |

**Notes:**

(1)Including the reverse recovery of the diode. Turn-on times and energy have been measured applying as freewheeling an external SiC diode STPSC206W.

(2)Including the tail of the collector current.

## 2.1 Electrical characteristics (curves)

**Figure 2: Output characteristics ($T_J$ = 25 °C)**

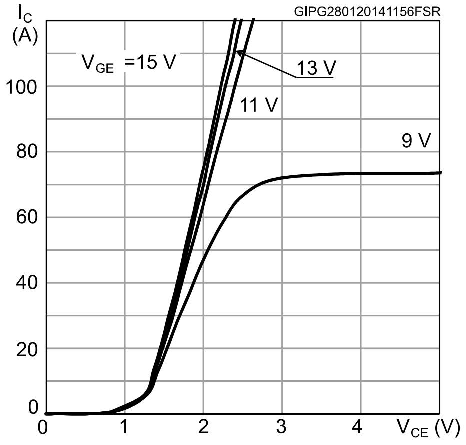


**Figure 3: Output characteristics ($T_J$ = 175 °C)**

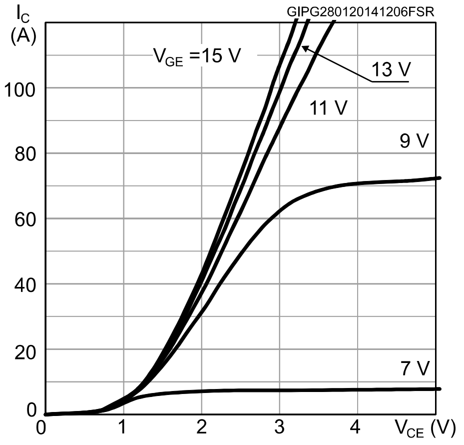


**Figure 4: Transfer characteristics**

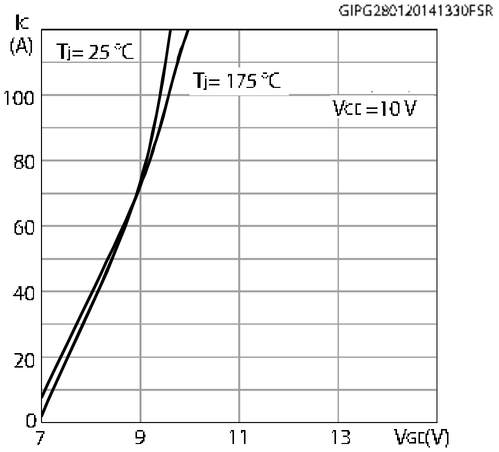


**Figure 5: Collector current vs. case temperature**

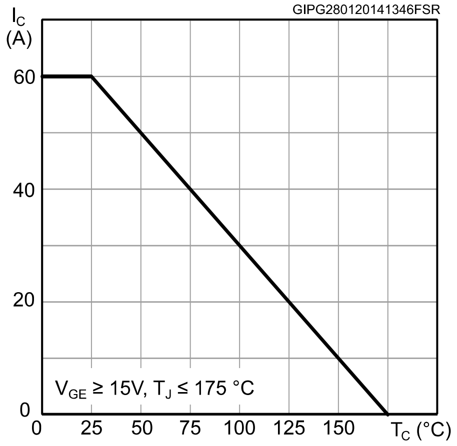


**Figure 6: $V_{CE(sat)}$ vs. junction temperature**

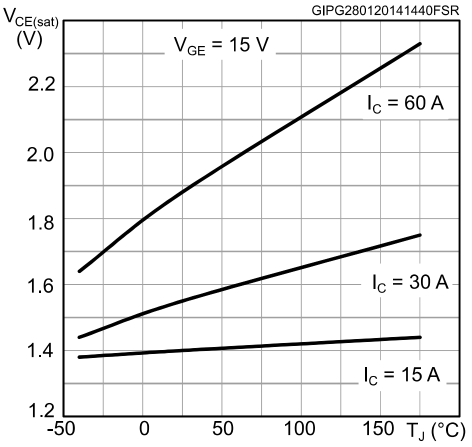


**Figure 7: Power dissipation vs. case temperature**

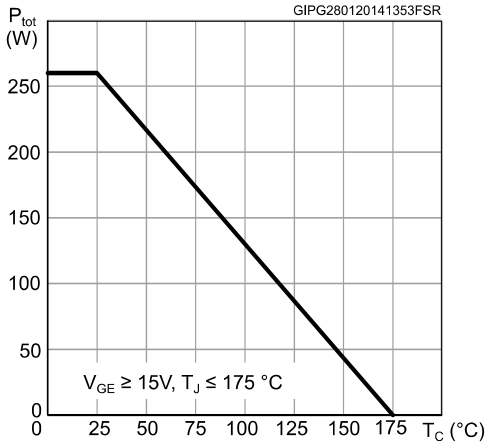


**Figure 8: Forward bias safe operating area**

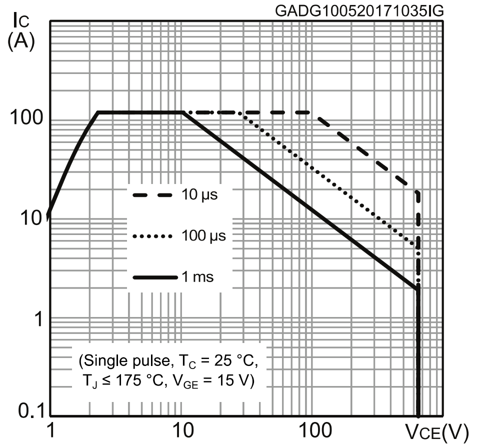


**Figure 9: Collector current vs. switching frequency**

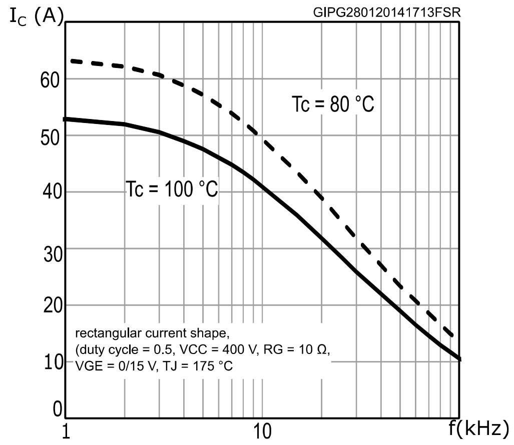


**Figure 10: Normalized $V_{GE(th)}$ vs. junction temperature**

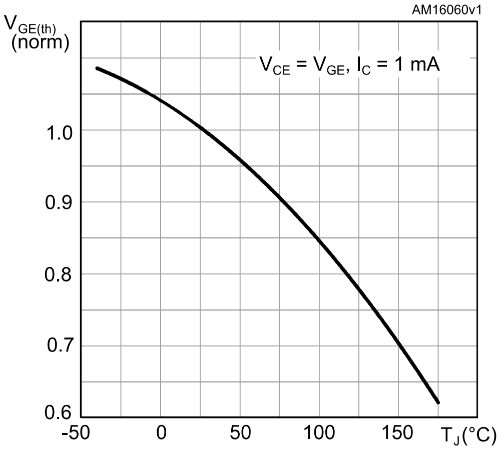


**Figure 11: Normalized $V_{(BR)CES}$ vs. junction temperature**

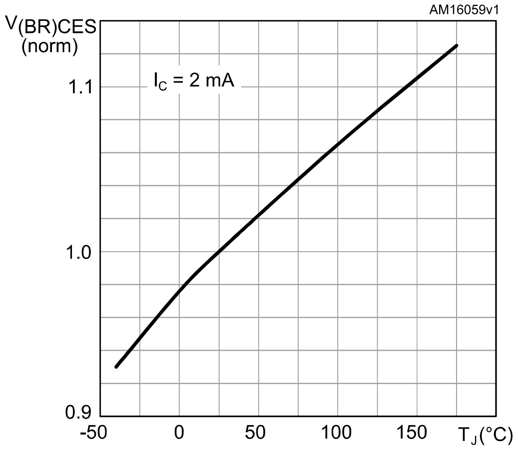


**Figure 12: Switching energy vs. temperature**

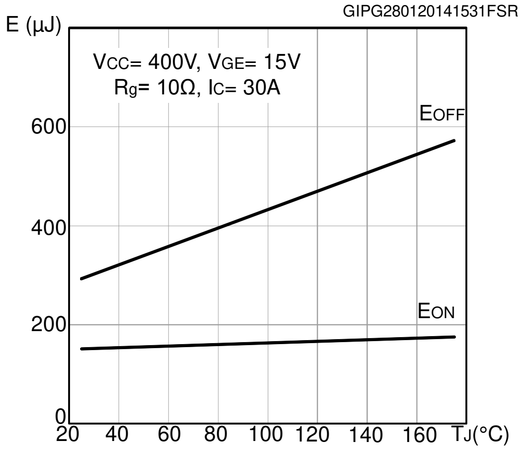


**Figure 13: Switching energy vs. gate resistance**

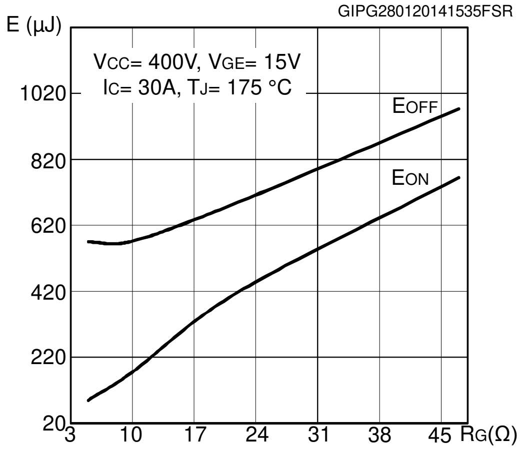


**Figure 14: Switching energy vs. collector current**

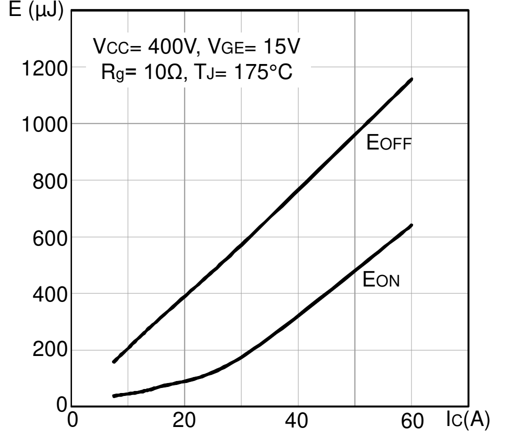


**Figure 15: Switching energy vs. collector emitter voltage**

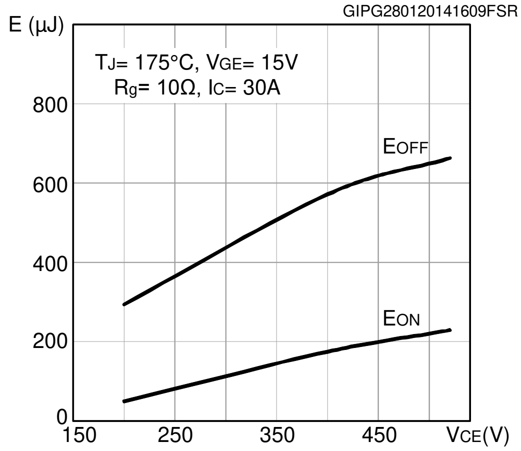


**Figure 16: Switching times vs. collector current**

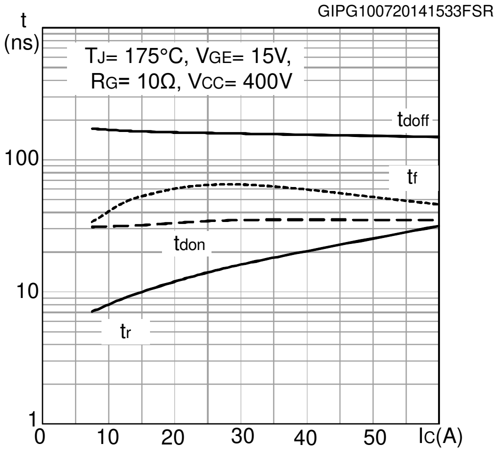


**Figure 17: Switching times vs. gate resistance**

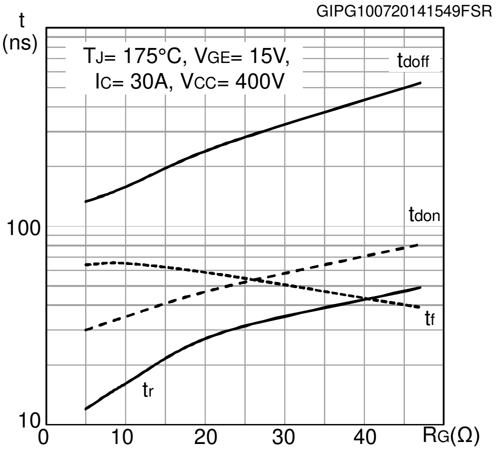


**Figure 18: Capacitance variations**

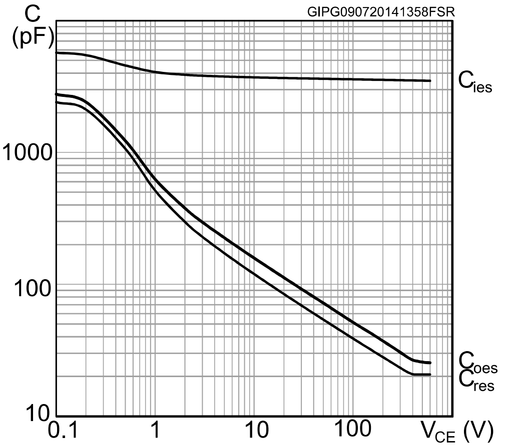


**Figure 19: $V_{CE(sat)}$ vs. collector current**

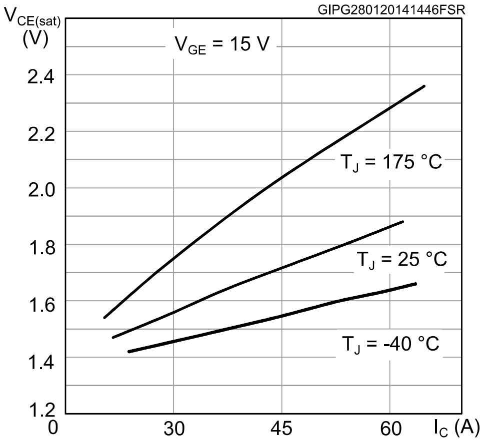


**Figure 20: Gate charge vs. gate-emitter voltage**

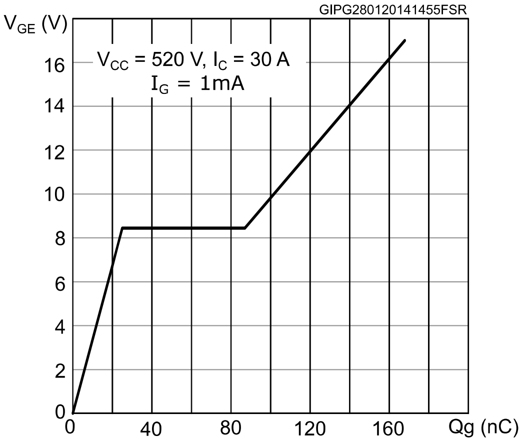
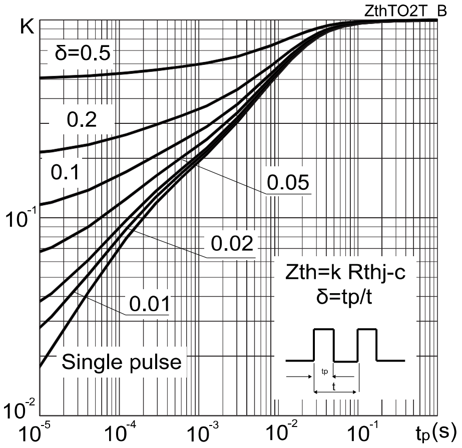


**Figure 21: Thermal impedance**



# 3 Test circuits

**Figure 22: Test circuit for inductive load switching**

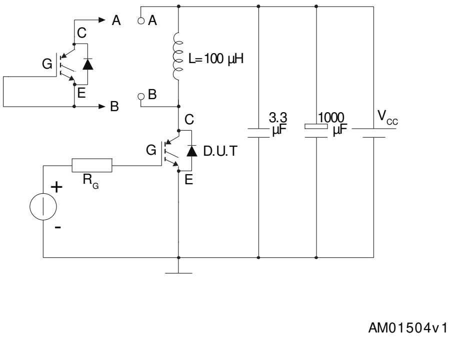


**Figure 23: Gate charge test circuit**

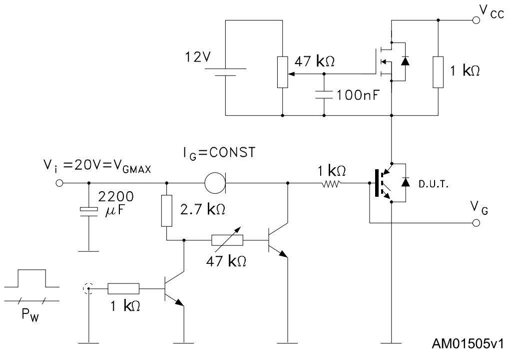
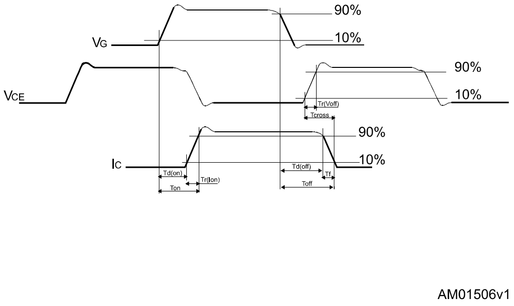


**Figure 24: Switching waveform**



# 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 D²PAK package information

**Figure 25: D²PAK (TO-263) type A package outline**

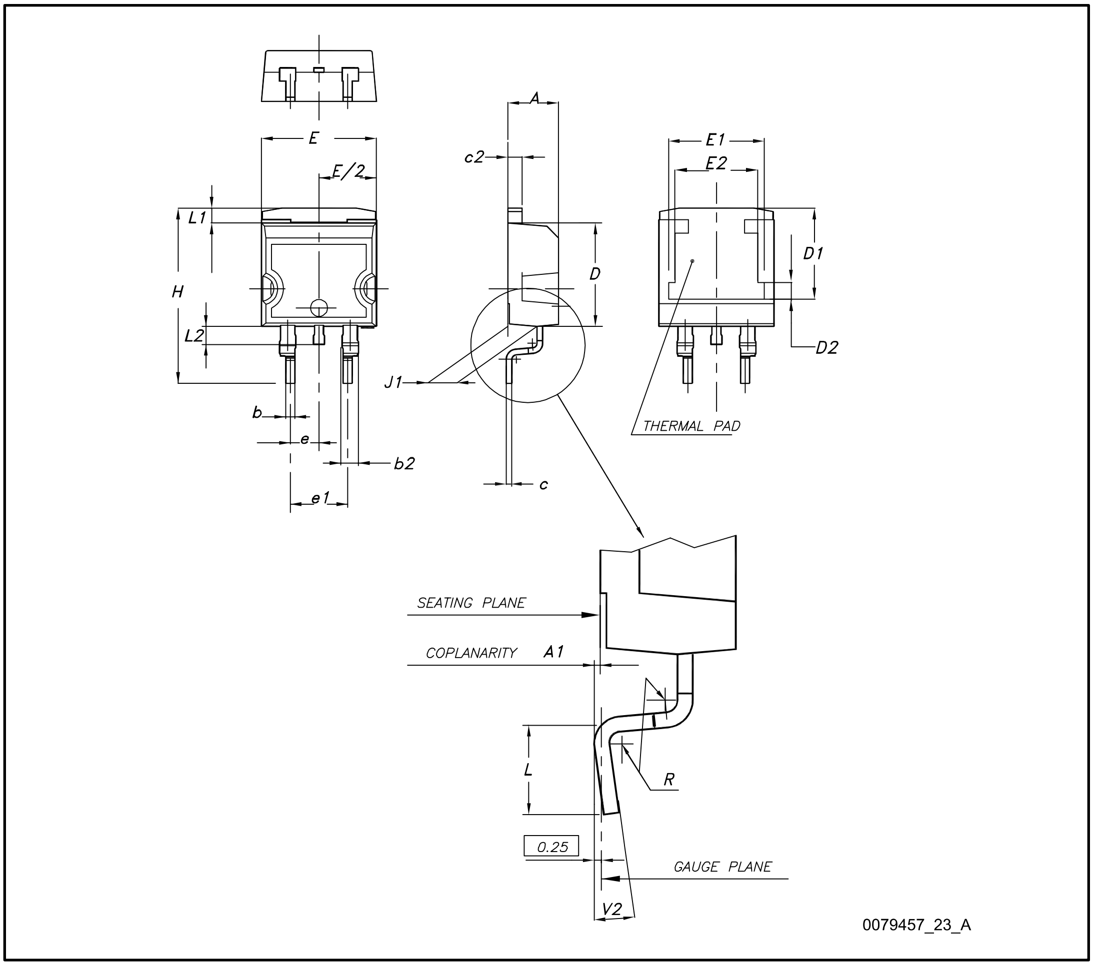
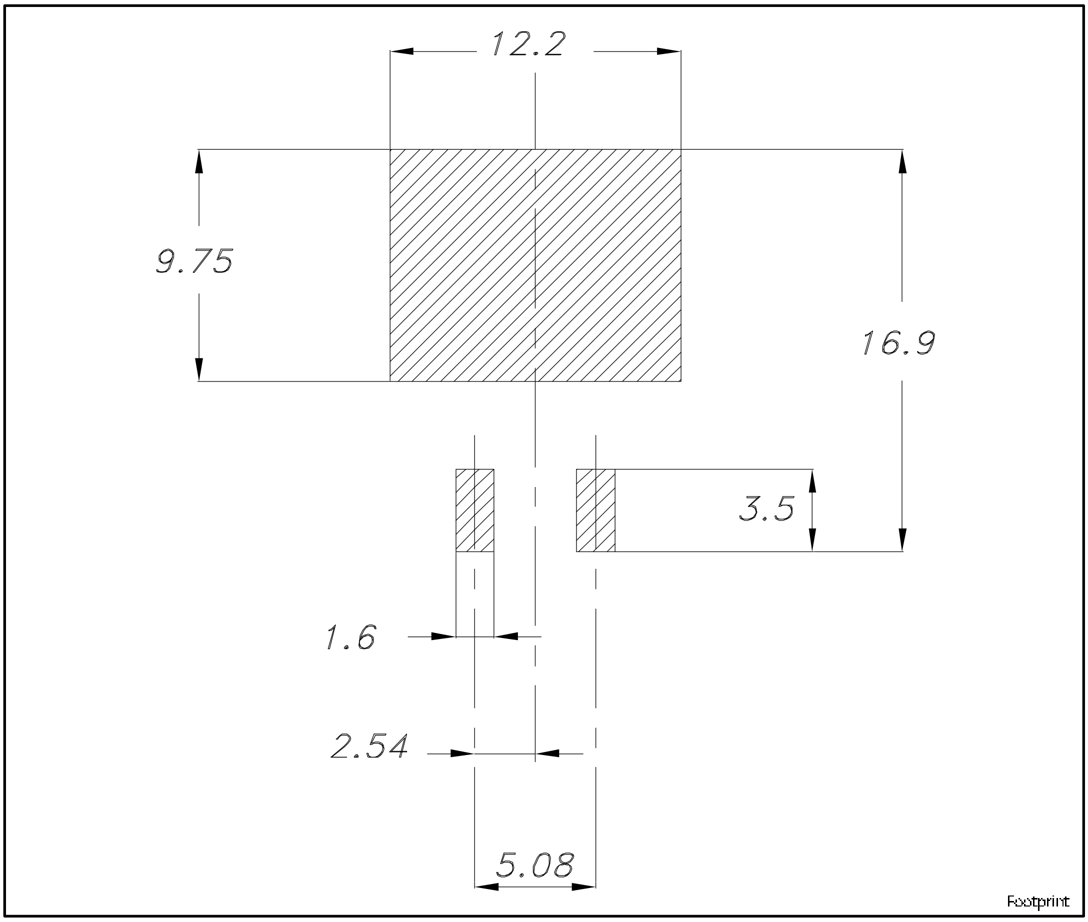


Table 7: $D^2PAK$ (TO-263) type A package mechanical data

| 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 | 8.50 | 8.70 | 8.90 |
| E2 | 6.85 | 7.05 | 7.25 |
| 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 26: D²PAK (TO-263) type A recommended footprint (dimensions are in mm)



## 4.2 D²PAK packing information

Figure 27: D²PAK type A tape outline

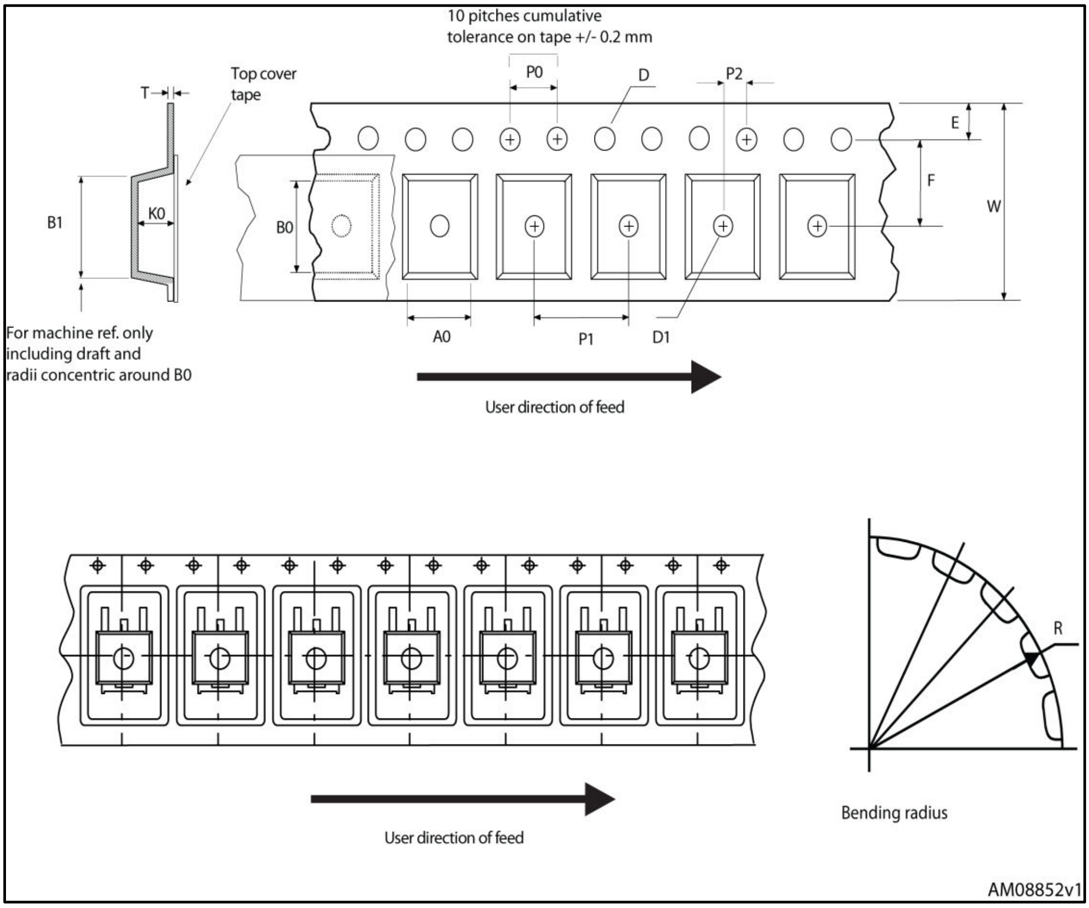


Figure 28: D²PAK type A reel outline

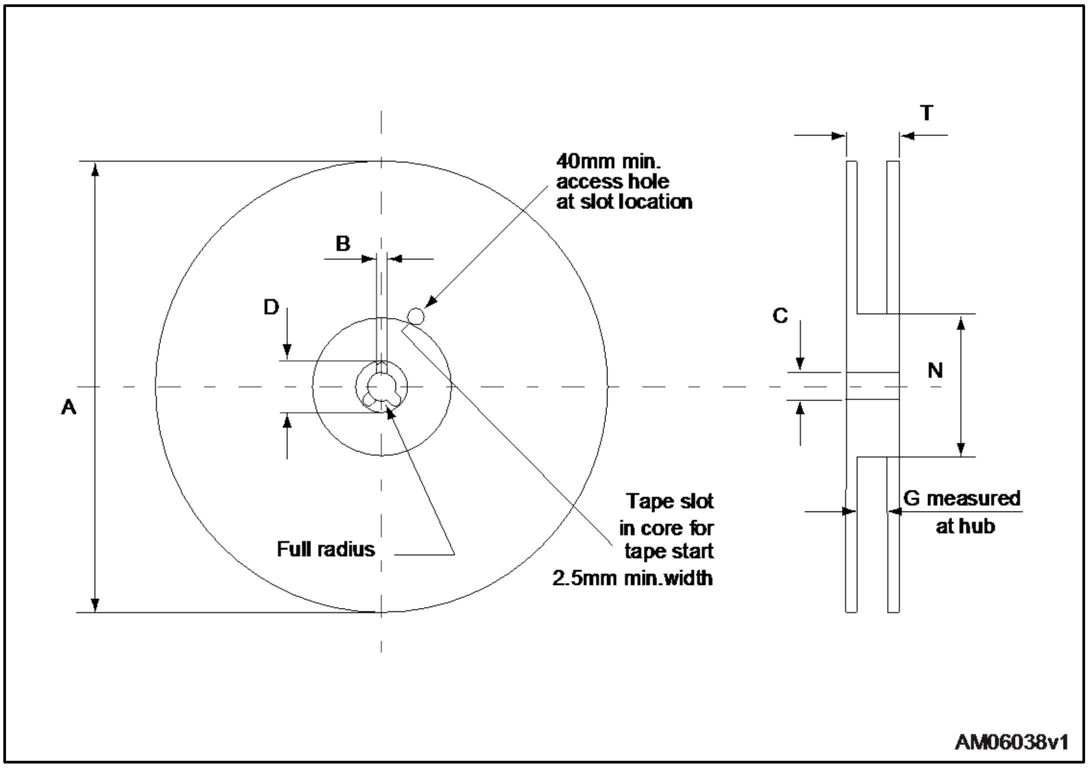


Table 8: D²PAK type A tape and reel mechanical data

| 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 quantity | | 1000 |
| P2 | 1.9 | 2.1 | Bulk quantity | | 1000 |
| R | 50 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 23.7 | 24.3 | | | |

# 5 Revision history

Table 9: Document revision history

| Date | Revision | Changes |
|---|---|---|
| 11-May-2017 | 1 | Initial release. |
| 29-May-2017 | 2 | Document status promoted from preliminary to production data. |

## IMPORTANT NOTICE – PLEASE READ CAREFULLY