

Automotive-grade 10 A, 410 V internally clamped IGBT

Datasheet - production data

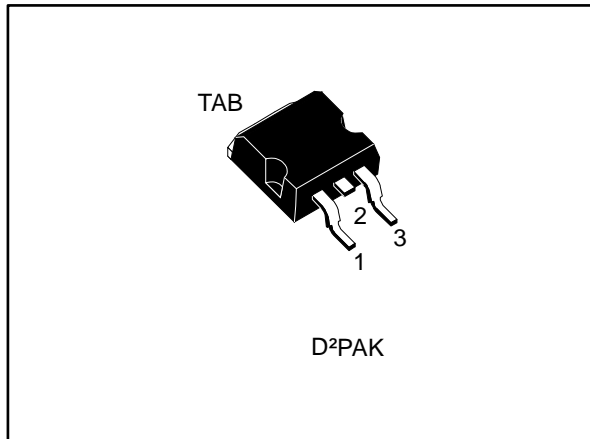


Figure 1: Internal schematic diagram

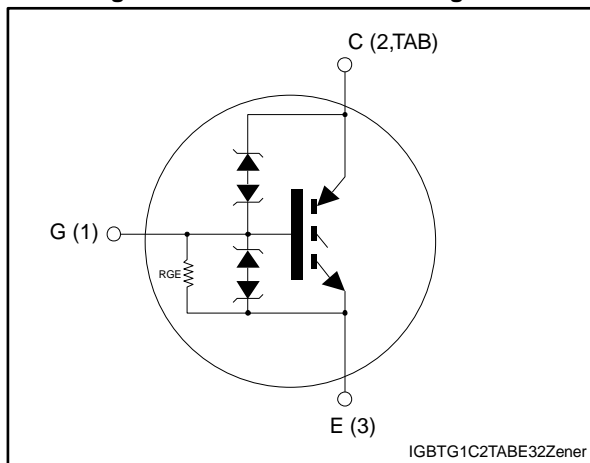


Table 1: Device summary

| Order code | Marking | Package | Packing |
|----------------|------------|--------------------|---------------|
| STGB10NB40LZT4 | GB10NB40LZ | D ² PAK | Tape and reel |

Features

| Order code | V _{CES} | V _{CE(sat)max.} | I _C |
|----------------|------------------|--------------------------|----------------|
| STGB10NB40LZT4 | Clamped | 1.8 V | 20 A |

- AEC-Q101 qualified
- Low threshold voltage
- Low on-voltage drop
- Low gate charge
- High current capability
- High voltage clamping feature



Applications

- Switching applications

Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, PowerMESH™ with an overall outstanding performance. The built-in collector-gate Zener exhibits a very precise active clamping while the gate-emitter Zener supplies the ESD protection.

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1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|--|---------------------------|------|
| V_{CES} | Collector-emitter voltage ($V_{GE} = 0\text{ V}$) | $V_{CES(\text{clamped})}$ | V |
| V_{ECS} | Emitter-collector voltage ($V_{GE} = 0\text{ V}$) | 18 | V |
| I_C | Continuous collector current at $T_C = 25\text{ °C}$ | 20 | A |
| | Continuous collector current at $T_C = 100\text{ °C}$ | 10 | A |
| $I_{CM}^{(1)}$ | Collector current (pulsed) | 40 | A |
| E_{AS} | Single pulse energy $T_C = 25\text{ °C}$ | 300 | mJ |
| V_{GE} | Gate-emitter voltage | $V_{GE(\text{clamped})}$ | V |
| P_{TOT} | Total dissipation at $T_C = 25\text{ °C}$ | 150 | W |
| ESD | Human body model, $R = 1.5\text{ k}\Omega$, $C = 100\text{ pF}$ | 4 | kV |
| T_{STG} | Storage temperature range | - 55 to 175 | °C |
| T_J | Operating junction temperature range | | |

Notes:

⁽¹⁾Pulse width limited by safe operating area.

Table 3: Thermal data

| Symbol | Parameter | Value | Unit |
|------------|-------------------------------------|-------|------|
| R_{thJC} | Thermal resistance junction-case | 1 | °C/W |
| R_{thJA} | Thermal resistance junction-ambient | 62.5 | °C/W |

2 Electrical characteristics

$T_C = 25\text{ °C}$ unless otherwise specified

Table 4: Static characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------------|--------------------------------------|--|------|------|-----------|---------------|
| $V_{CES(\text{clamped})}$ | Collector-emitter clamped voltage | $I_C = 2\text{ mA}$, $V_{GE} = 0\text{ V}$, $T_J = -40\text{ °C}$ to 150 °C | 380 | 410 | 440 | V |
| $V_{(BR)ECS}$ | Emitter-collector break-down voltage | $I_C = 75\text{ mA}$, $V_{GE} = 0\text{ V}$ | 18 | | | V |
| $V_{GE(\text{clamped})}$ | Gate-emitter clamped voltage | $I_G = \pm 2\text{ mA}$ | 12 | | 16 | V |
| $V_{CE(\text{sat})}$ | Collector-emitter saturation voltage | $V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$ | | 1.2 | 1.8 | V |
| | | $V_{GE} = 4.5\text{ V}$, $I_C = 20\text{ A}$ | | 1.3 | | |
| $V_{GE(\text{th})}$ | Gate-threshold voltage | $V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$, $T_J = -40\text{ °C}$ to 150 °C | 0.6 | | 2.2 | V |
| I_{CES} | Collector cut-off current | $V_{CE} = 15\text{ V}$, $V_{GE} = 0\text{ V}$, $T_J = 150\text{ °C}$ | | | 10 | μA |
| | | $V_{CE} = 200\text{ V}$, $V_{GE} = 0\text{ V}$, $T_J = 150\text{ °C}$ | | | 100 | μA |
| I_{GES} | Gate-emitter leakage current | $V_{GE} = \pm 10\text{ V}$, $V_{CE} = 0\text{ V}$ | | | ± 700 | μA |
| R_{GE} | Gate emitter resistance | | | 20 | | k Ω |

Table 5: Dynamic characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|------|
| g_{fs} | Forward transconductance | $V_{CE} = 15\text{ V}$, $I_C = 10\text{ A}$ | - | 18 | - | S |
| C_{ies} | Input capacitance | $V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$ | - | 1300 | - | pF |
| C_{oes} | Output capacitance | | - | 105 | - | |
| C_{res} | Reverse transfer capacitance | | - | 12 | - | |
| Q_g | Total gate charge | $V_{CE} = 328\text{ V}$, $I_C = 10\text{ A}$, $V_{GE} = 5\text{ V}$ | - | 28 | - | nC |

Table 6: Functional characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------|-------------------------------------|---|------|------|------|------|
| I_{CL} | Latching current | $V_{\text{Clamp}} = 328\text{ V}$, $T_C = 125\text{ °C}$ $R_{\text{GOFF}} = 1\text{ k}\Omega$, $V_{GE} = 5\text{ V}$ | | 40 | - | A |
| U.I.S. | Functional test open secondary coil | $R_{\text{GOFF}} = 1\text{ k}\Omega$, $L = 1\text{ mH}$, $T_C = 125\text{ °C}$ | 13 | | - | A |

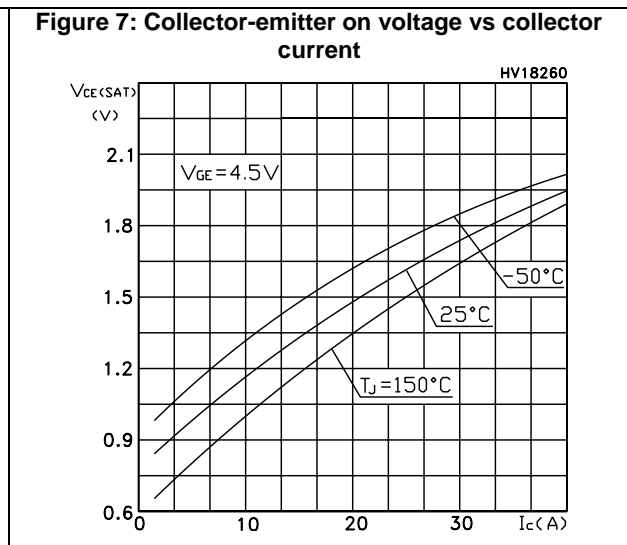
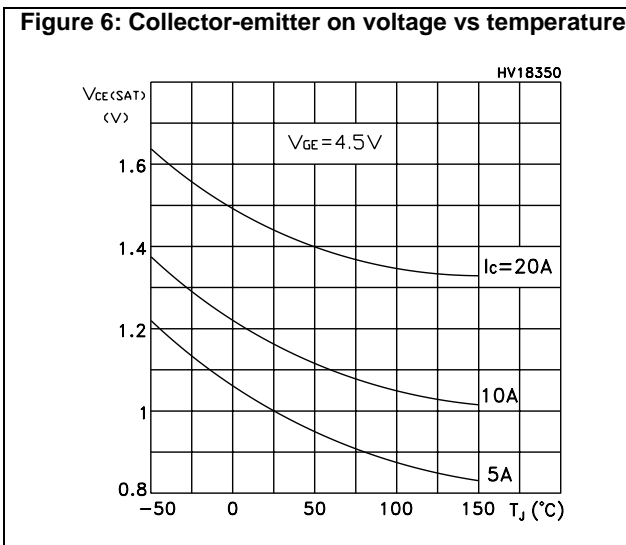
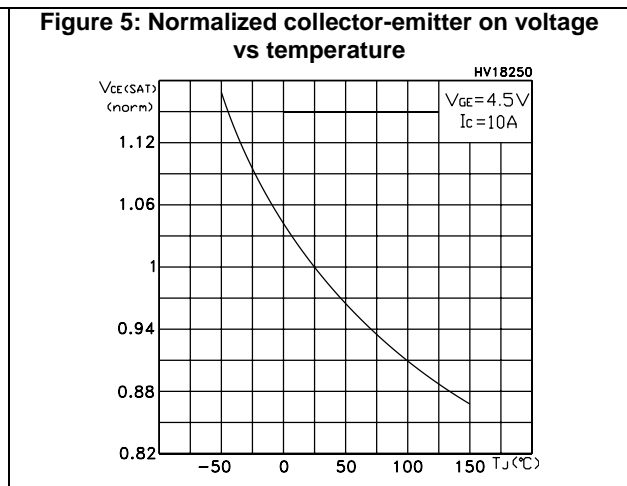
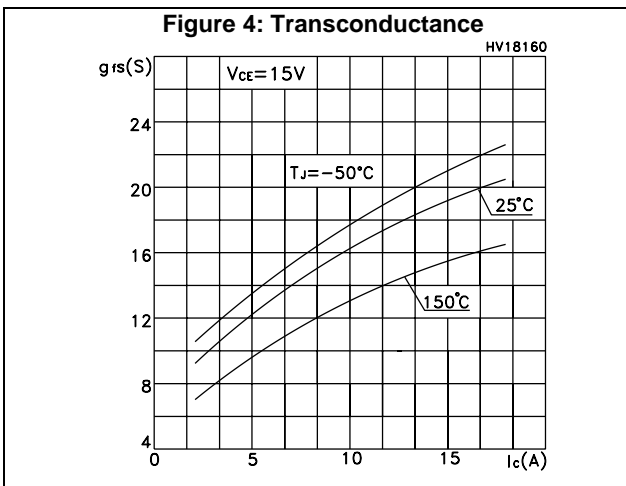
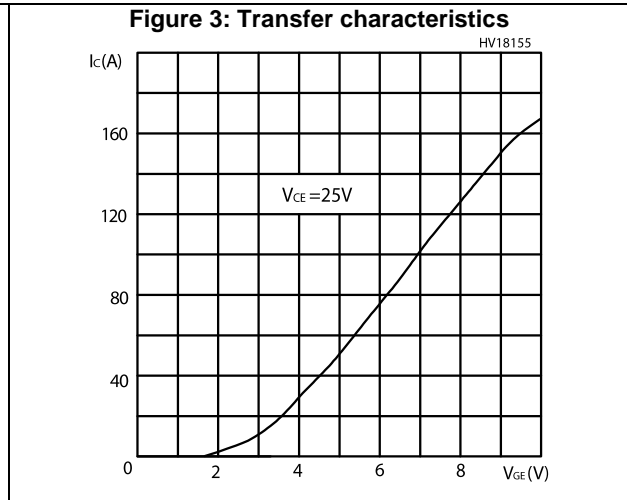
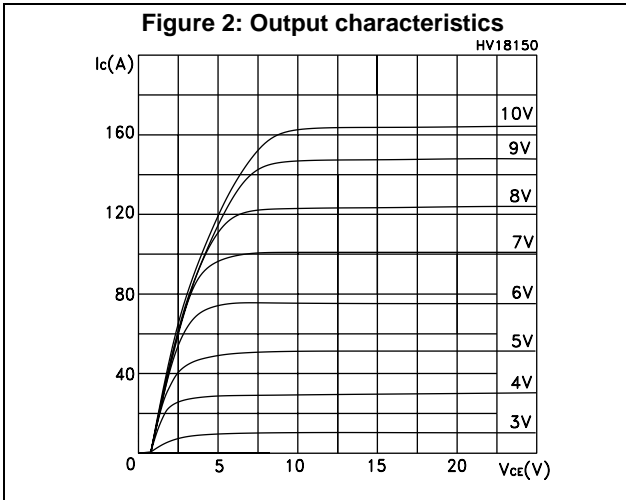
Table 7: IGBT switching characteristics (inductive load)

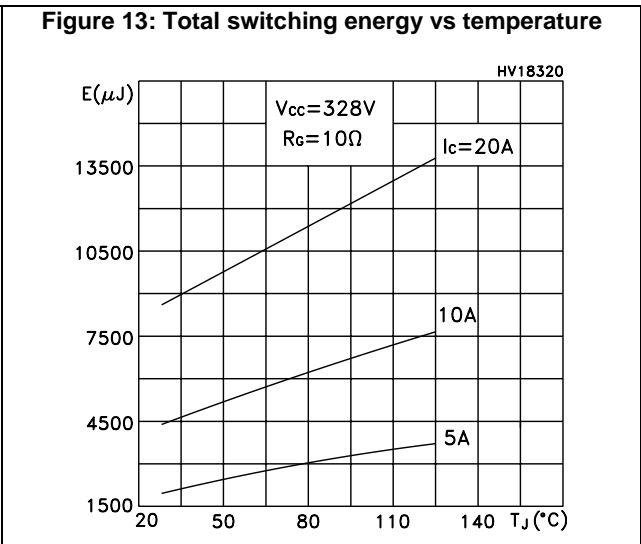
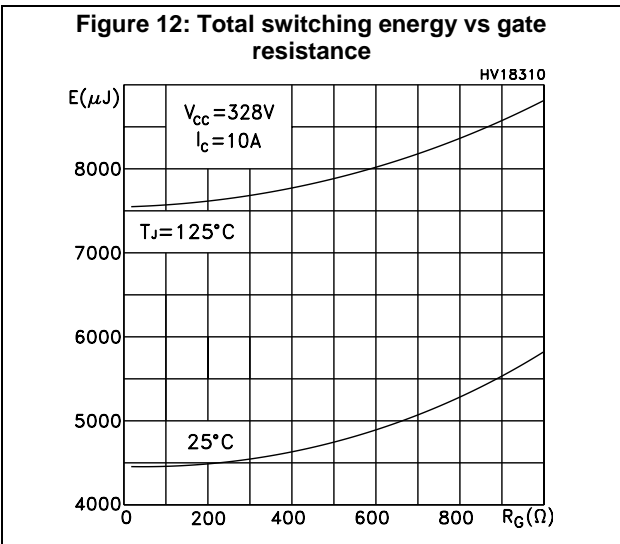
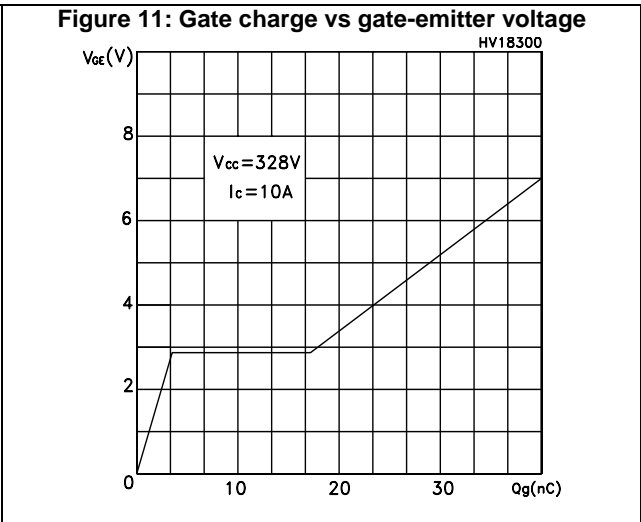
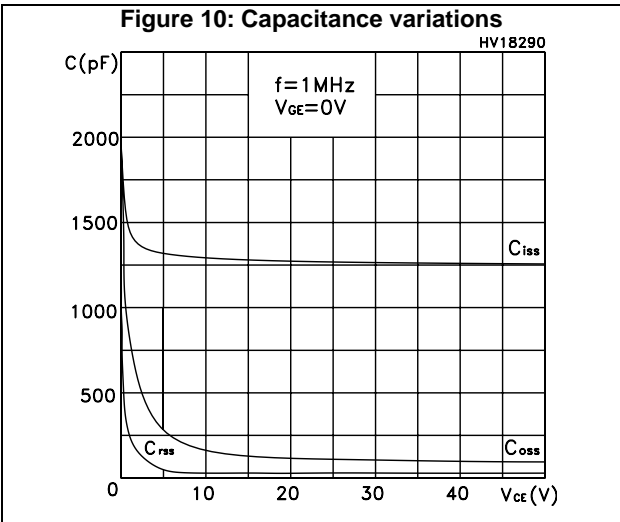
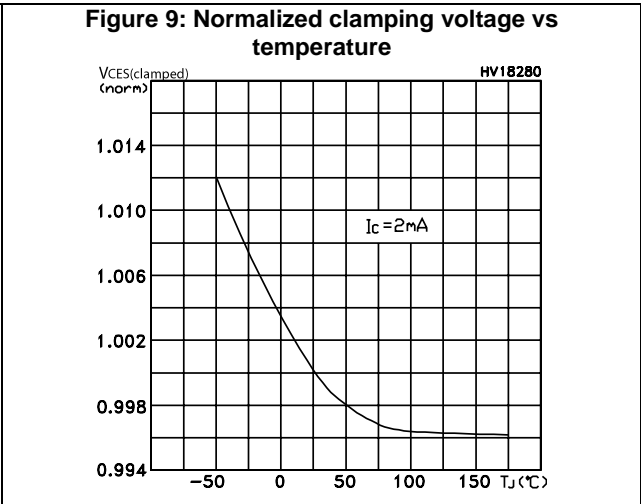
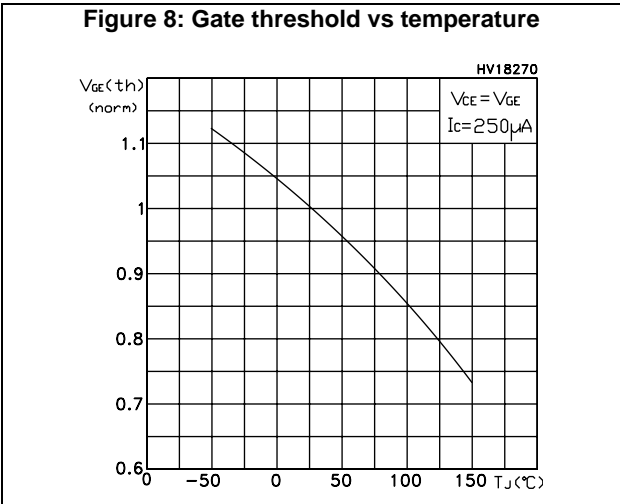
| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---------------------------|--|------|------|------|------------|
| $t_{d(on)}$ | Turn-on delay time | $V_{CC} = 328 \text{ V}$, $I_c = 10 \text{ A}$, $R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$ | - | 1300 | - | ns |
| t_r | Rise time | | - | 270 | - | ns |
| $(di/dt)_{on}$ | Turn-on current slope | | - | 60 | - | A/ μ s |
| E_{on} | Turn-on switching energy | $V_{CC} = 328 \text{ V}$, $I_c = 10 \text{ A}$, $R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$ | - | 2.4 | - | mJ |
| | | $V_{CC} = 328 \text{ V}$, $I_c = 10 \text{ A}$, $R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$, $T_c = 125 \text{ }^\circ\text{C}$ | - | 2.6 | - | mJ |
| t_c | Cross-over time | $V_{CC} = 328 \text{ V}$, $I_c = 10 \text{ A}$, $R_{GE} = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$ | - | 3.6 | - | μ s |
| $t_{r(Voff)}$ | Off voltage rise time | | - | 2 | - | μ s |
| $t_{d(off)}$ | Turn-off-delay time | | - | 8 | - | μ s |
| t_f | Fall time | | - | 1.4 | - | μ s |
| $E_{off}^{(1)}$ | Turn-off switching energy | | - | 5 | - | mJ |
| t_c | Cross-over time | | - | 5.7 | - | μ s |
| $t_{r(Voff)}$ | Off voltage rise time | $V_{CC} = 328 \text{ V}$, $I_c = 10 \text{ A}$, $R_{GE} = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$, $T_J = 125 \text{ }^\circ\text{C}$ | - | 2.7 | - | μ s |
| $t_{d(off)}$ | Turn-off-delay time | | - | 9.2 | - | μ s |
| t_f | Fall time | | - | 2.8 | - | μ s |
| $E_{off}^{(1)}$ | Turn-off switching energy | | - | 8.7 | - | mJ |

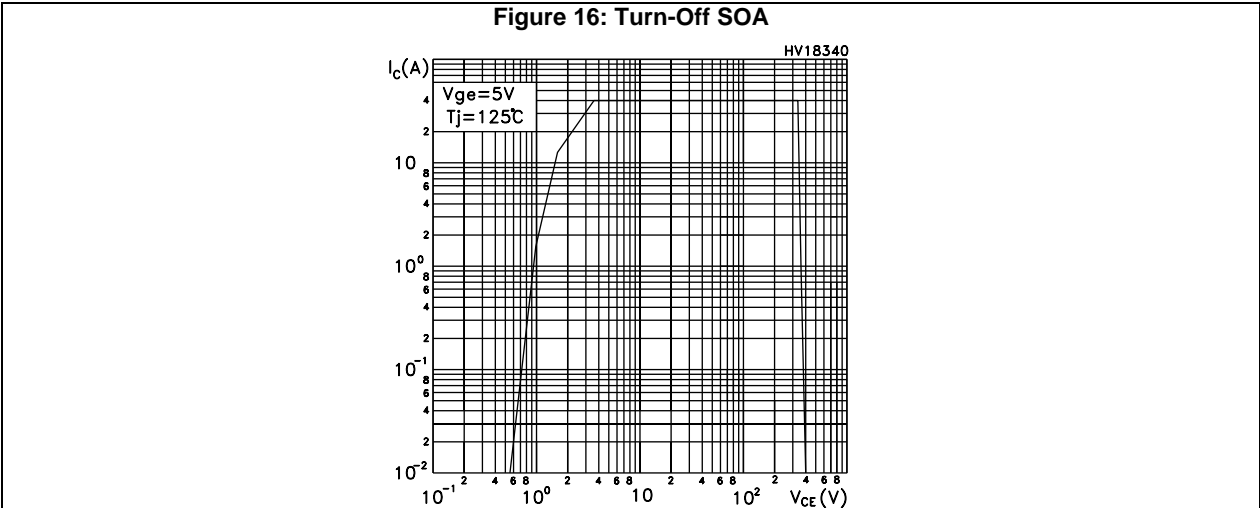
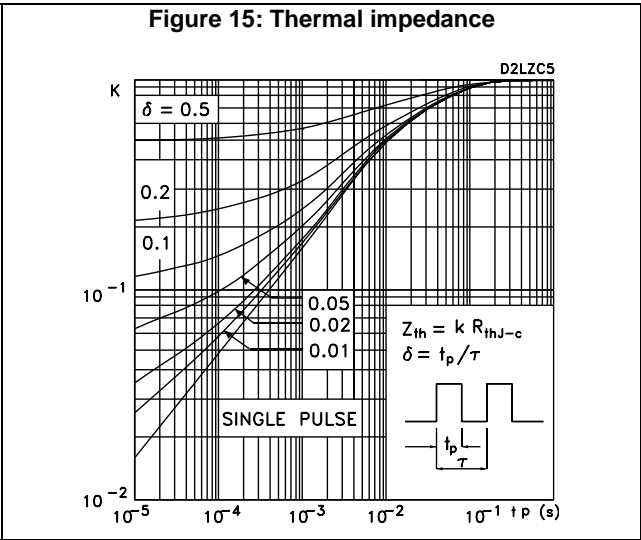
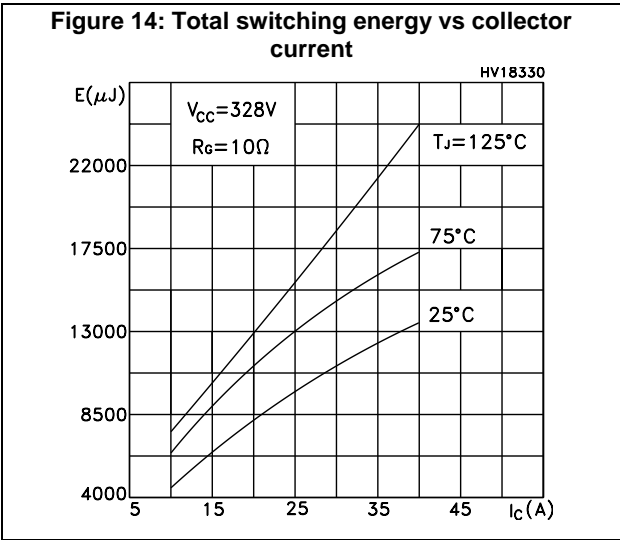
Notes:

⁽¹⁾Including the tail of the collector current.

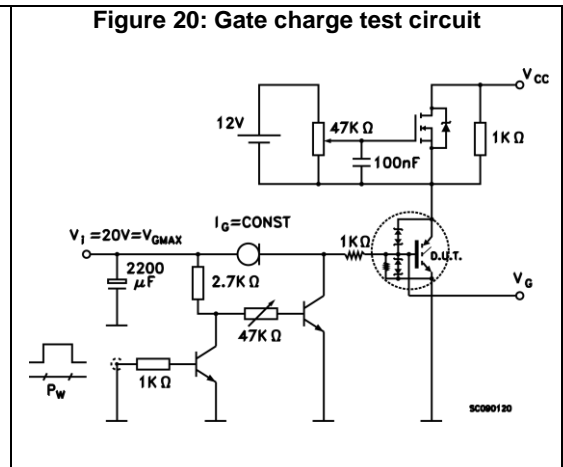
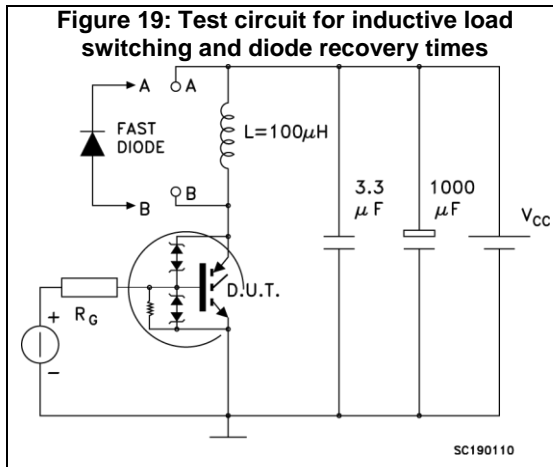
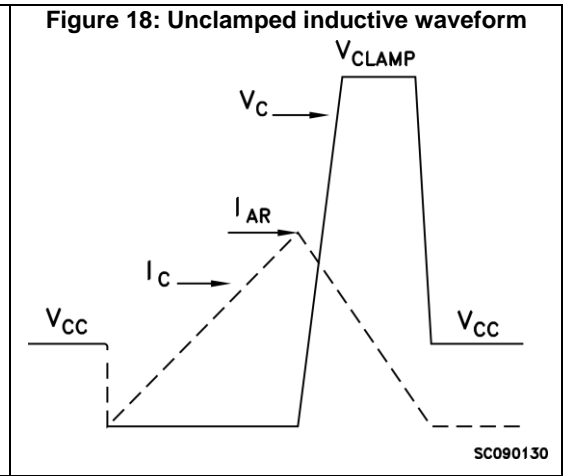
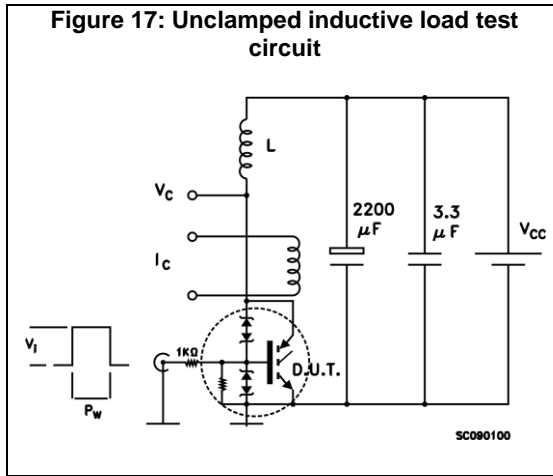
2.1 Electrical characteristics (curves)







3 Test circuits



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 (TO-263) type A package information

Figure 21: D²PAK (TO-263) type A package outline

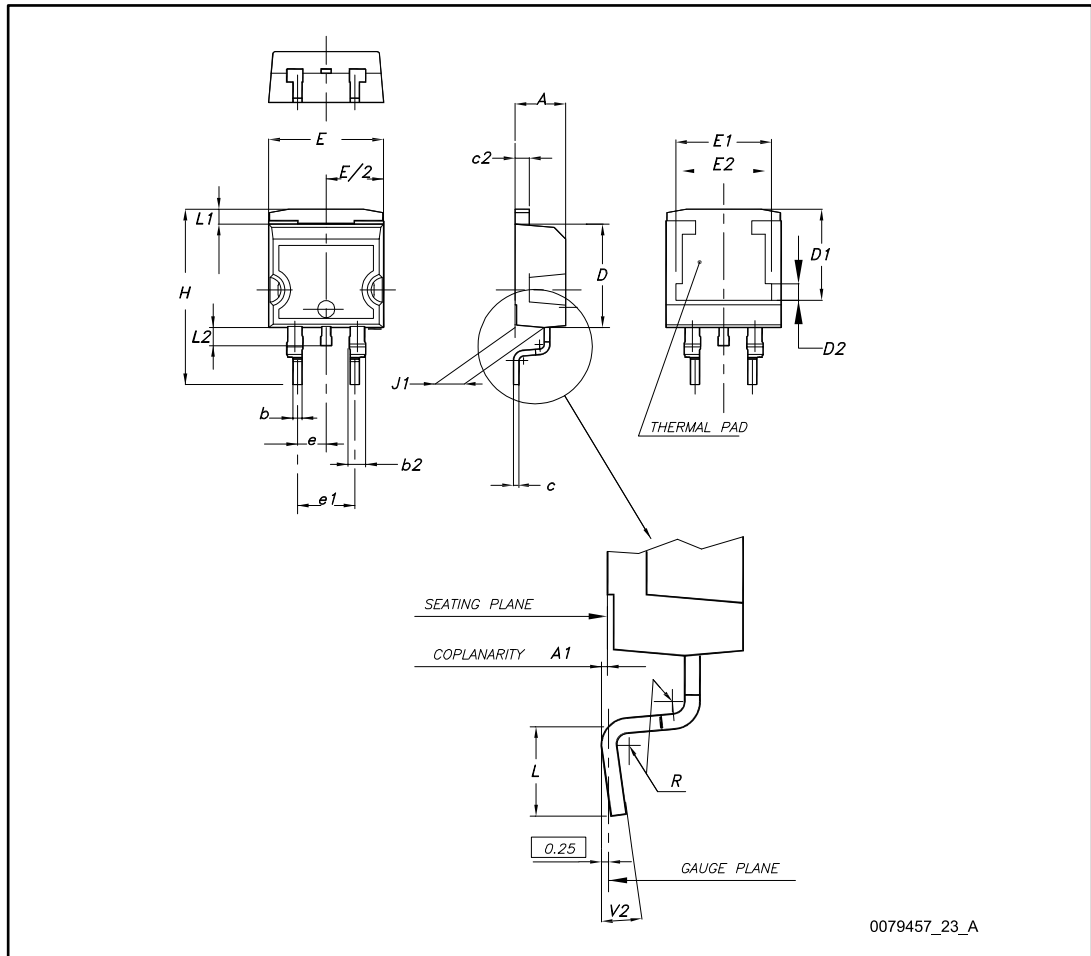
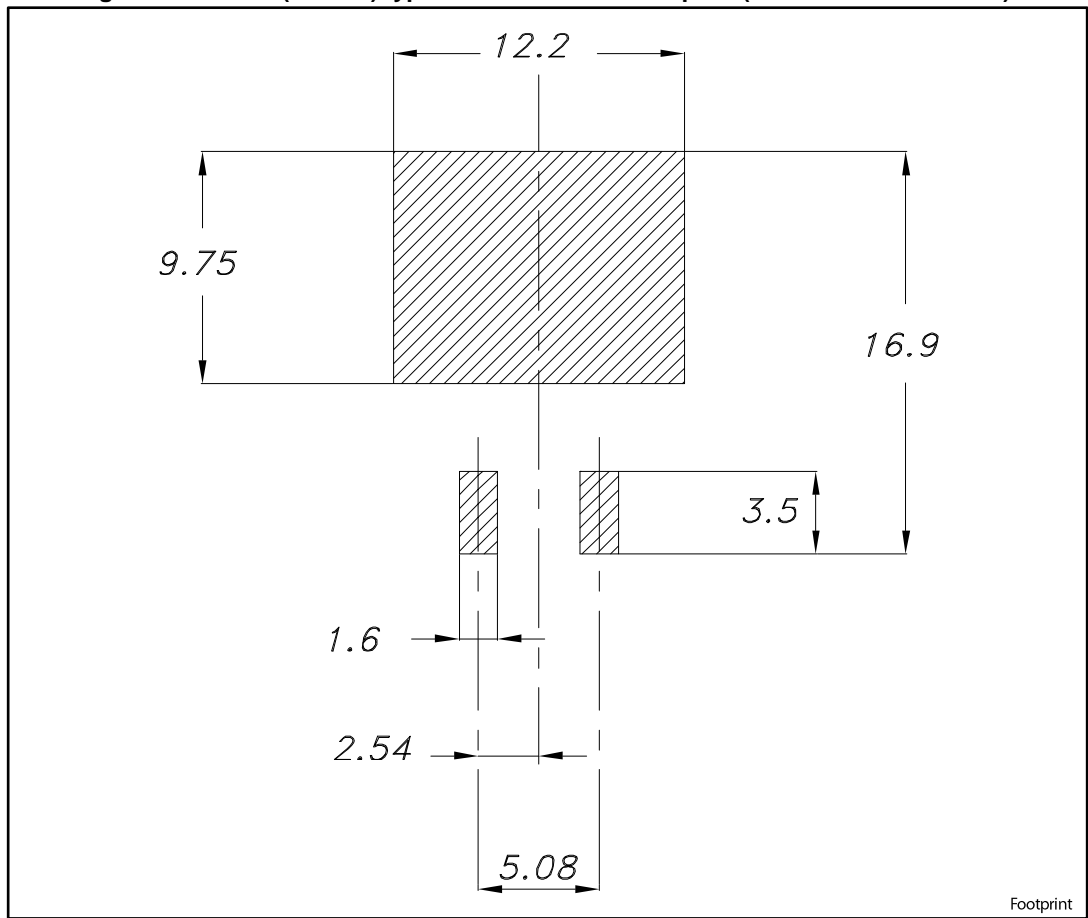


Table 8: D²PAK (TO-263) type A package mechanical data

| 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 22: D²PAK (TO-263) type A recommended footprint (dimensions are in mm)



4.2 Packing information

Figure 23: D2PAK type A tape outline

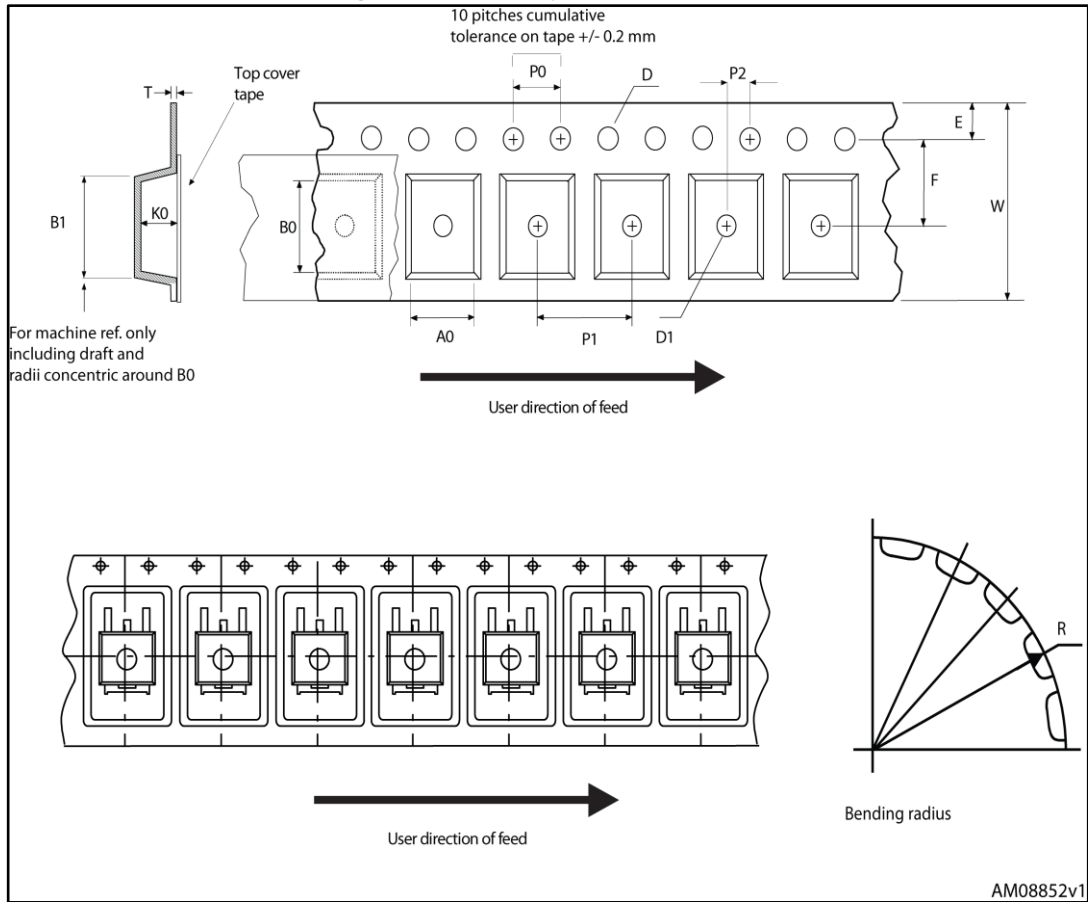


Figure 24: D²PAK type A reel outline

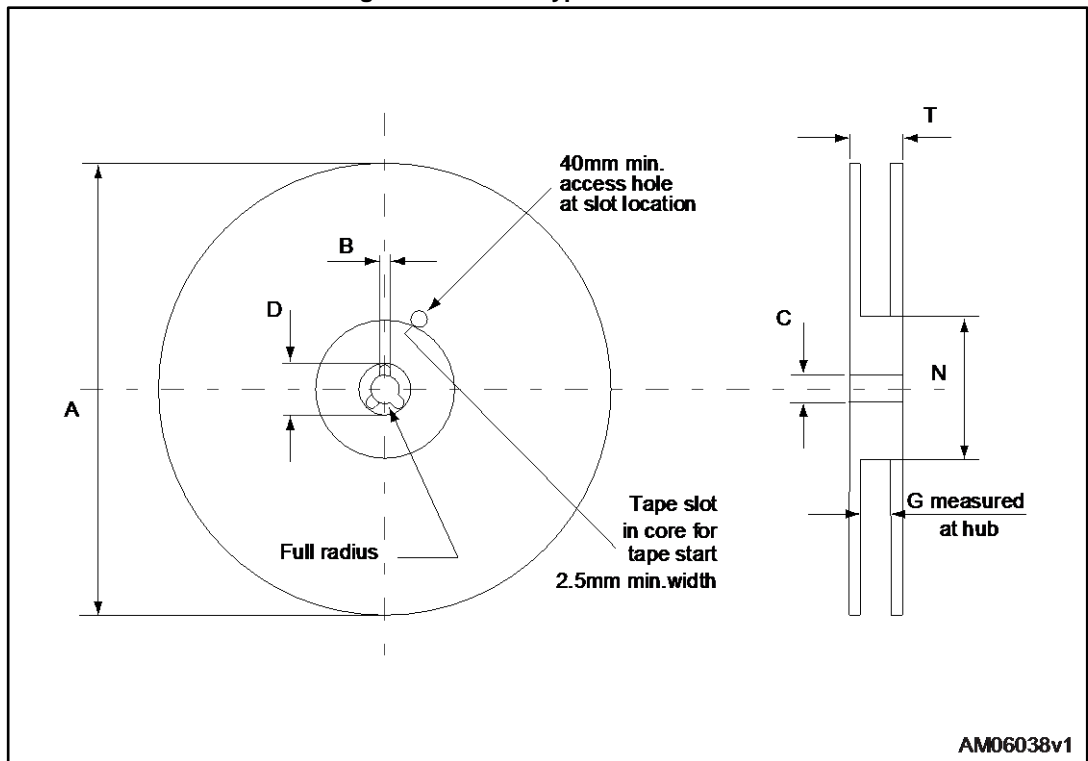


Table 9: D²PAK type A tape and reel mechanical data

| 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 10: Document revision history

| Date | Revision | Changes |
|-------------|----------|----------------|
| 01-Mar-2017 | 1 | First release. |

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