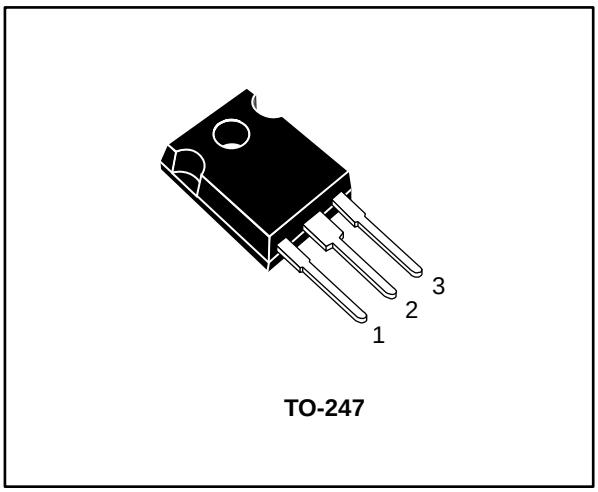
# BU931P

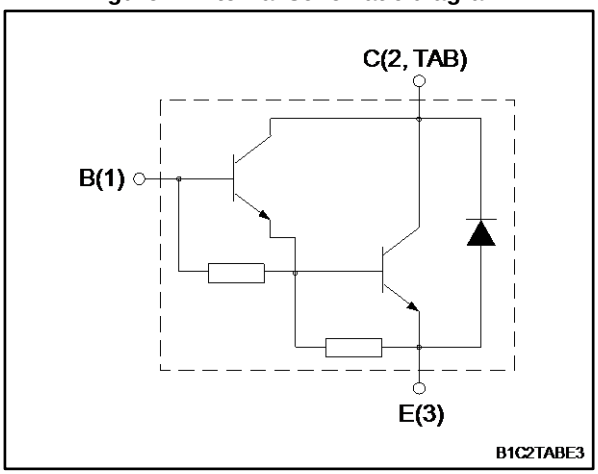
## Automotive-grade high voltage ignition coil driver NPN power Darlington transistor

Datasheet - production data




**TO-247**

**Figure 1: Internal schematic diagram**




## Features

- AEC-Q101 qualified
- Very rugged Bipolar technology
- High operating junction temperature

## Applications

- High ruggedness electronic ignitions

## Description

This is a high voltage power Darlington transistor developed using multi-epitaxial planar technology. It has been properly designed for automotive environment as electronic ignition power actuators.

**Table 1: Device summary**

| Order code | Marking | Package | Packing |
|---|---|---|---|
| BU931P | BU931P | TO-247 | Tube |

# Contents

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-emitter voltage ($V_{BE}$ = 0) | 500 | V |
| $V_{CEO}$ | Collector-emitter voltage ($I_B$ = 0) | 400 | V |
| $V_{EBO}$ | Emitter-base voltage ($I_C$ = 0) | 5 | V |
| $I_C$ | Collector current | 15 | A |
| $I_{CM}$ | Collector peak current | 30 | A |
| $I_B$ | Base current | 1 | A |
| $I_{BM}$ | Base peak current | 5 | A |
| $P_{TOT}$ | Total dissipation at Tc = 25 °C | 135 | W |
| $T_{stg}$ | Storage temperature range | -65 to 175 | °C |
| $T_j$ | Operating junction temperature range | | °C |

**Table 3: Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | 1.1 | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 50 | °C/W |

# 2 Electrical characteristics

($T_C$ = 25 °C unless otherwise specified)

**Table 4: Electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CES}$ | Collector cut-off current | $V_{BE}$ = 0 V, $V_{CE}$ = 500 V | | - | 100 | µA |
| | | $V_{BE}$ = 0 V, $V_{CE}$ = 500 V, $T_C$ = 125 °C (1) | | - | 0.5 | mA |
| $I_{CEO}$ | Collector cut-off current | $I_B$ = 0 A, $V_{CE}$ = 450 V | | - | 100 | µA |
| | | $I_B$ = 0 A, $V_{CE}$ = 450 V, $T_C$ = 125 °C (1) | | - | 0.5 | mA |
| $I_{EBO}$ | Emitter cut-off current | $I_C$= 0 A, $V_{EB}$ = 5 V | | - | 20 | mA |
| $V_{CEO(sus)}$(2) | Collector-emitter sustaining voltage | $I_B$= 0 A, $I_C$ = 100 mA | 400 | - | | V |
| $V_{CE(sat)}$(2) | Collector-emitter saturation voltage | $I_C$ = 7 A, $I_B$ = 70 mA | | - | 1.6 | V |
| | | $I_C$ = 8 A, $I_B$ = 100 mA | | - | 1.8 | V |
| | | $I_C$ = 10 A, $I_B$ = 250 mA | | - | 1.8 | V |
| $V_{BE(sat)}$(2) | Base-emitter saturation voltage | $I_C$ = 7 A, $I_B$ = 70 mA | | - | 2.2 | V |
| | | $I_C$ = 8 A, $I_B$ = 100 mA | | - | 2.4 | V |
| | | $I_C$ = 10 A, $I_B$ = 250 mA | | - | 2.5 | V |
| $h_{FE}$(2) | DC current gain | $I_C$ = 5 A, $V_{CE}$ = 10 V | 300 | - | | |
| $V_F$ | Diode forward voltage | $I_F$ = 10 A | | - | 2.5 | V |
| | Functional test | $V_{CC}$ = 24 V, L = 7 mH, $V_{clamp}$ = 400 V (see *Figure 10: "Functional test circuit"*) | 8 | - | | A |

**Notes:**

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

(2)Pulse test: pulse duration ≤ 300 µs, duty cycle ≤ 2 %.

**Table 5: Inductive load switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_s$ | Storage time | $V_{BE}$=0, $V_{CC}$ = 12 V, $V_{clamp}$ = 300 V, L = 7 mH, $R_{BE}$ = 47 Ω, $I_C$ = 7 A, $I_B$ = 70 mA (see *Figure 12: "Switching time test circuit"*) | - | 15 | - | µs |
| $t_f$ | Fall time | | - | 0.5 | - | µs |

## 2.1 Electrical characteristics (curves)

**Figure 2: Safe operating area**

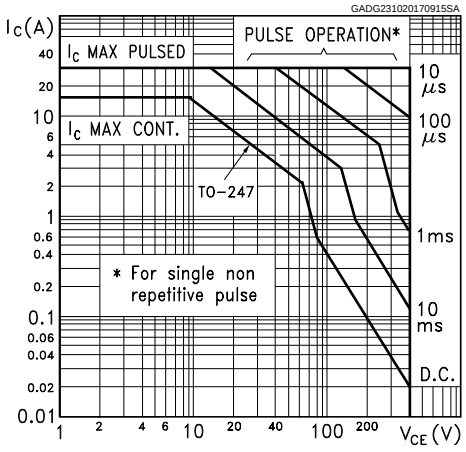



**Figure 3: DC current gain**

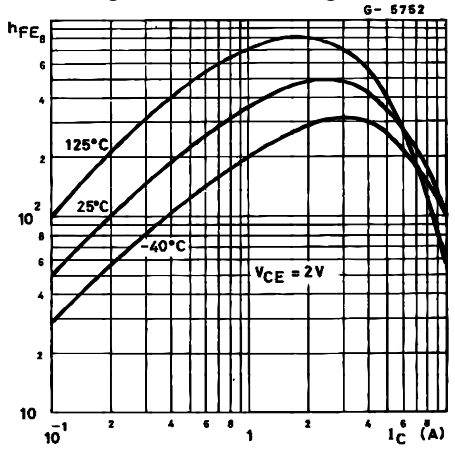



**Figure 4: Switching time inductive load**

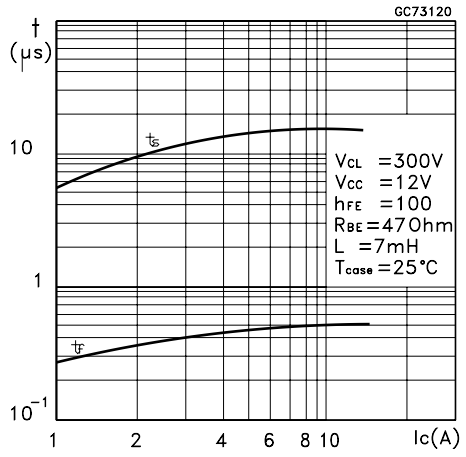



**Figure 5: Collector-emitter saturation voltage @ hFE = 50**

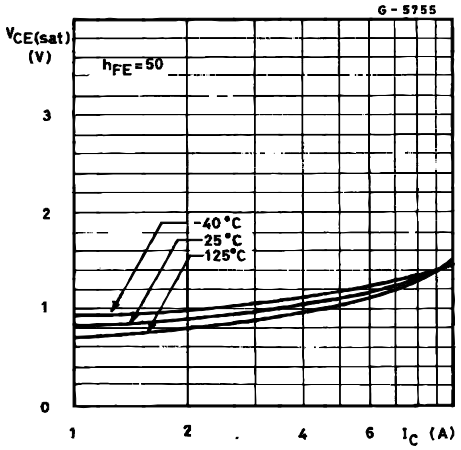



**Figure 6: Collector-emitter saturation voltage @ $h_{FE}$ = 100**

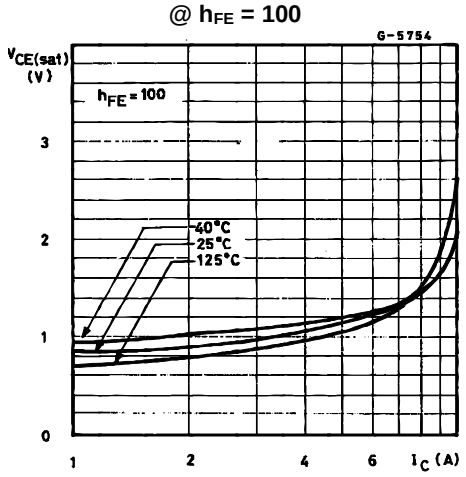



**Figure 7: Collector-emitter saturation voltage**

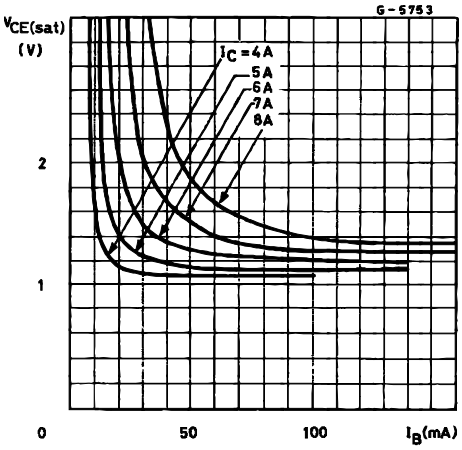


**Figure 8: Base-emitter saturation voltage @ $h_{FE}$ = 50**

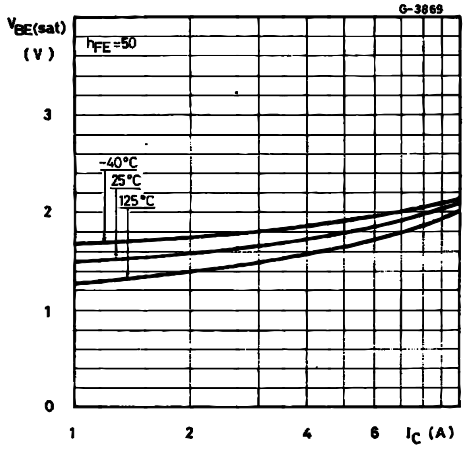
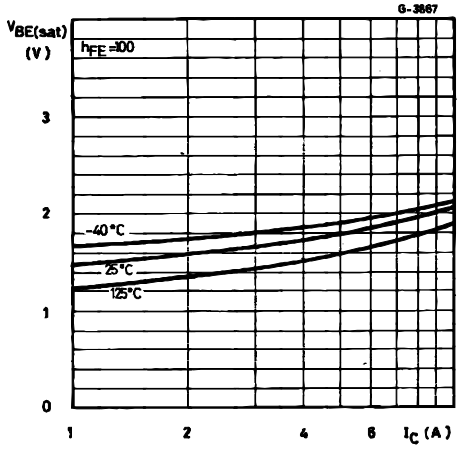



**Figure 9: Base-emitter saturation voltage @ hFE = 100**



# 3 Test circuits

**Figure 10: Functional test circuit**

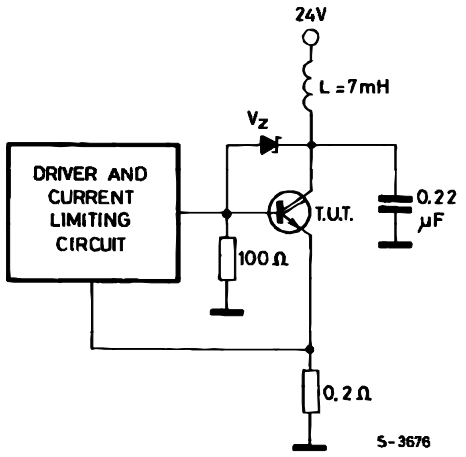



**Figure 11: Functional test waveforms**

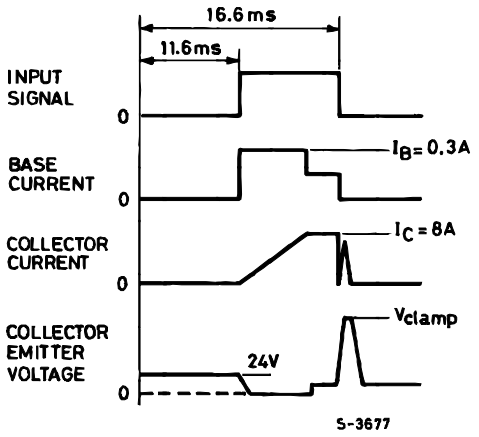



**Figure 12: Switching time test circuit**

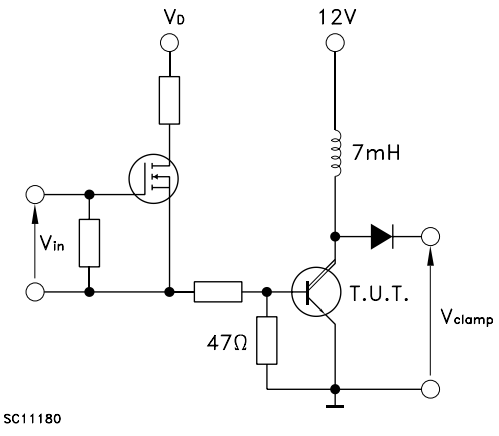
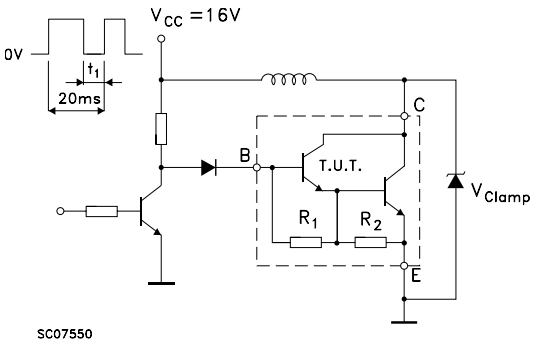



**Figure 13: Sustaining voltage test circuit**



# 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 TO-247 package information

**Figure 14: TO-247 package outline**

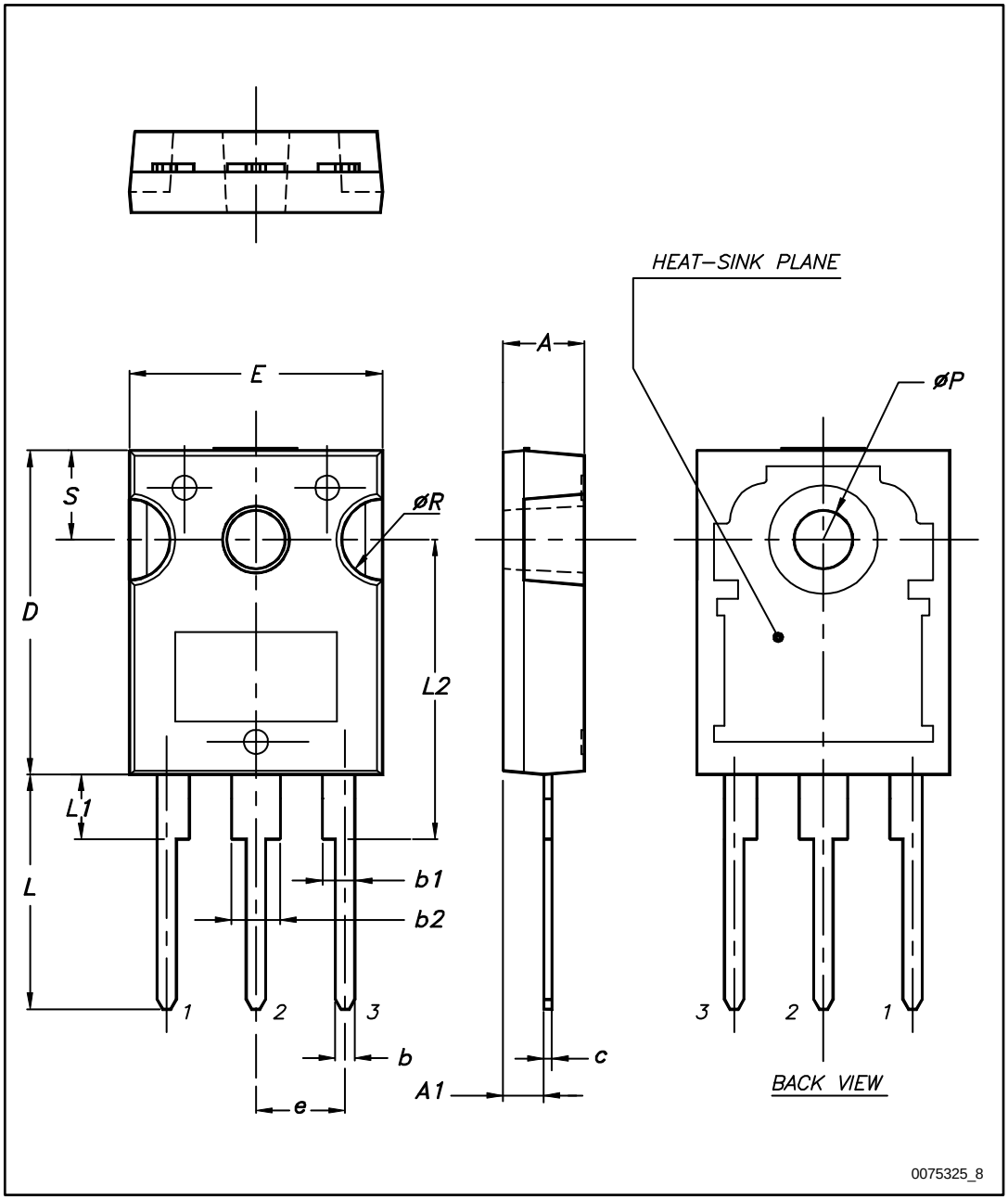


Table 6: TO-247 package mechanical data

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.85 | | 5.15 |
| A1 | 2.20 | | 2.60 |
| 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 |

# 5 Revision history

Table 7: Document revision history

| Date | Revision | Changes |
|---|---|---|
| 23-Oct-2017 | 1 | Initial release. Part number previously included in datasheet DocID1004. |

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