

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

Datasheet - production data

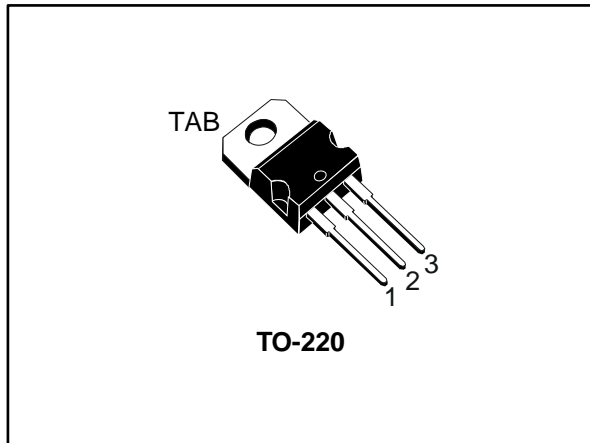


Figure 1: Internal schematic diagram

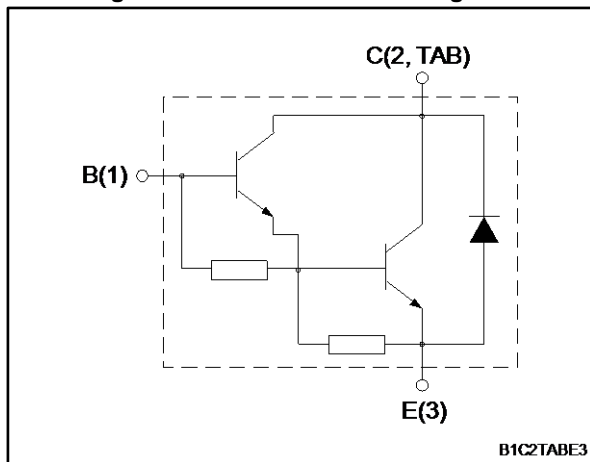


Table 1: Device summary

Order code	Marking	Package	Packing
BU931T	BU931T	TO-220	Tube

### 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.

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# 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	10	A
$I_{CM}$	Collector peak current	20	A
$I_B$	Base current	1	A
$I_{BM}$	Base peak current	5	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	125	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	1.2	°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: Electrical characteristics**

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

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

<sup>(2)</sup>Pulse test: pulse duration  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

**Table 5: Inductive load switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_s$	Storage time	$V_{CC} = 12\text{ V}, V_{clamp} = 300\text{ V}, L = 7\text{ mH}, R_{BE} = 47\text{ }\Omega, I_C = 7\text{ A}, I_B = 70\text{ mA}$	-	15	-	$\mu\text{s}$
$t_f$	Fall time		-	0.5	-	$\mu\text{s}$

## 2.1 Electrical characteristics (curves)

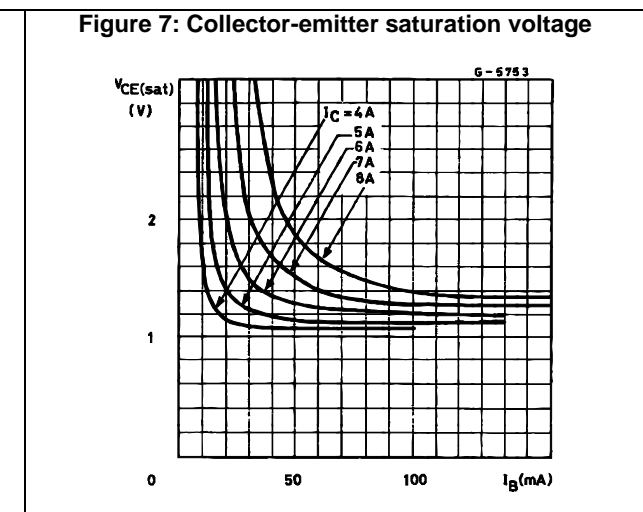
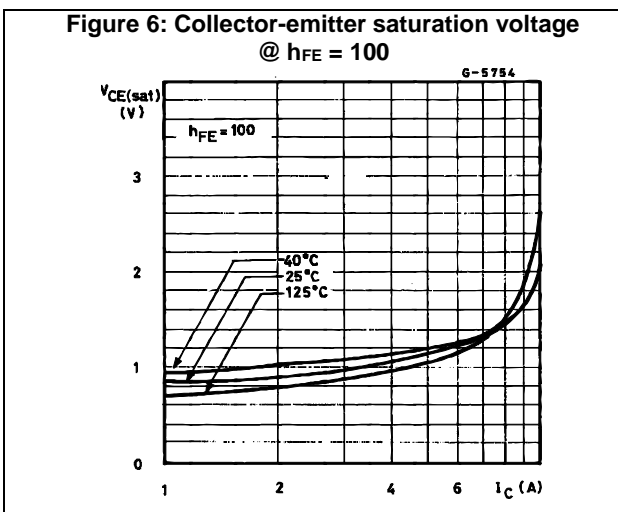
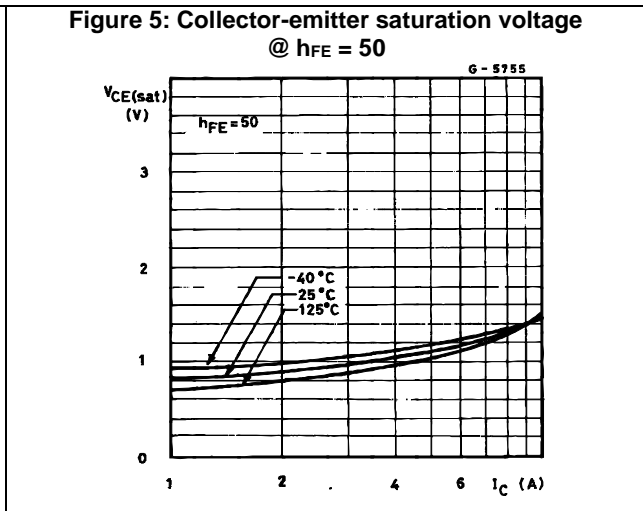
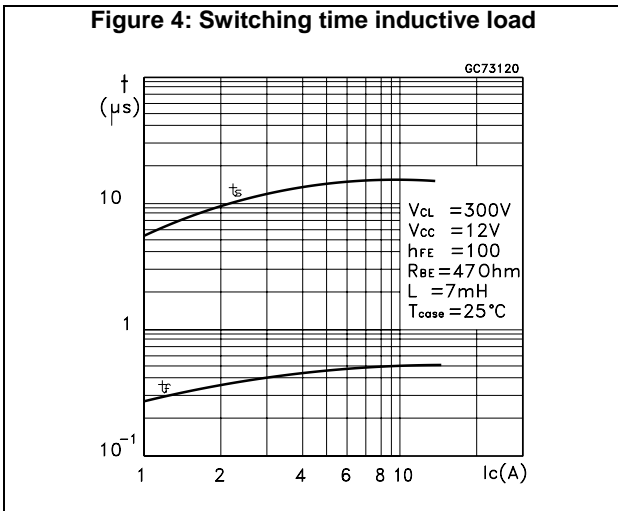
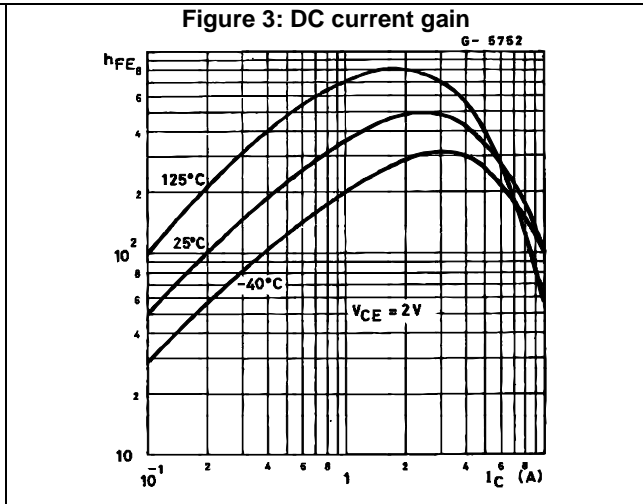
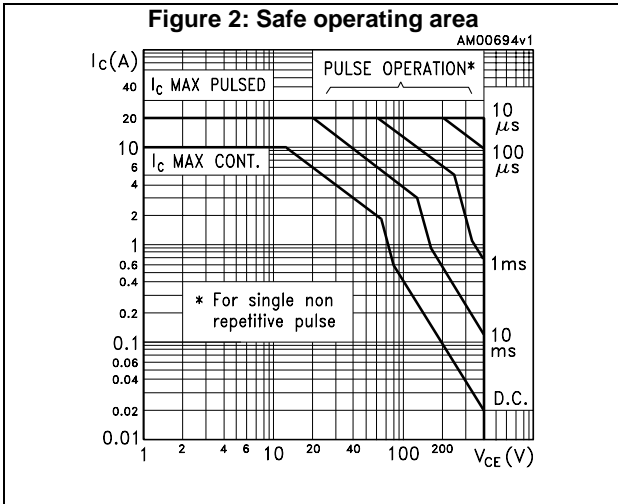


Figure 8: Base-emitter saturation voltage @  $h_{FE} = 50$

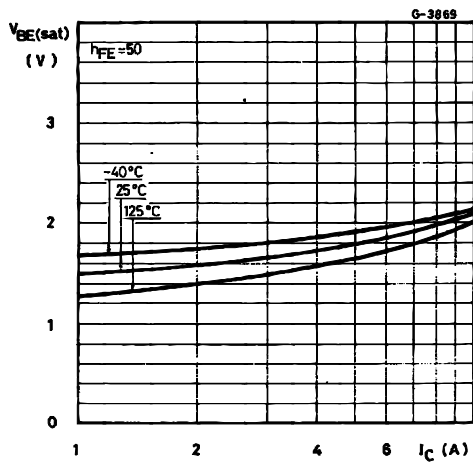
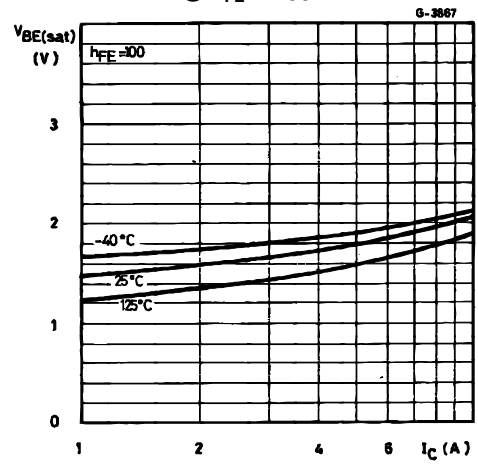


Figure 9: Base-emitter saturation voltage @  $h_{FE} = 100$



### 3 Test circuits

Figure 10: Functional test circuit

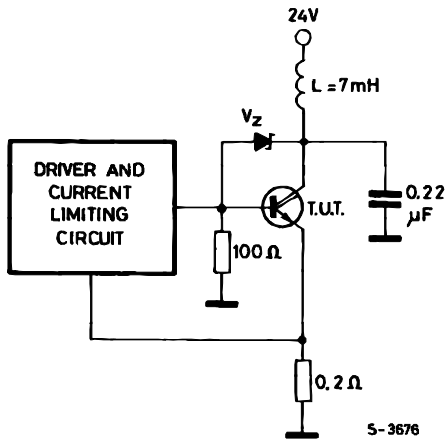


Figure 11: Functional test waveforms

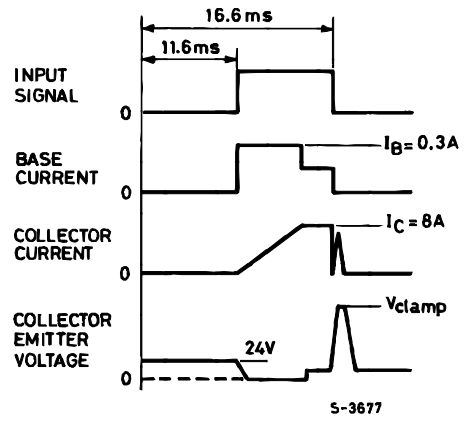


Figure 12: Switching time test circuit

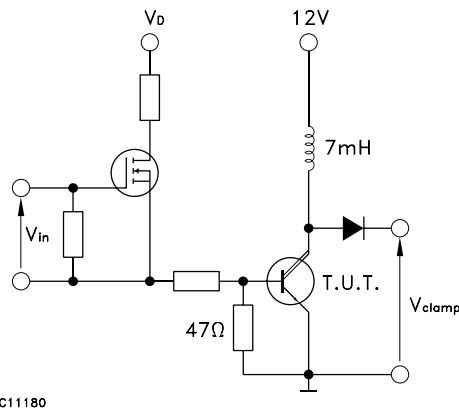
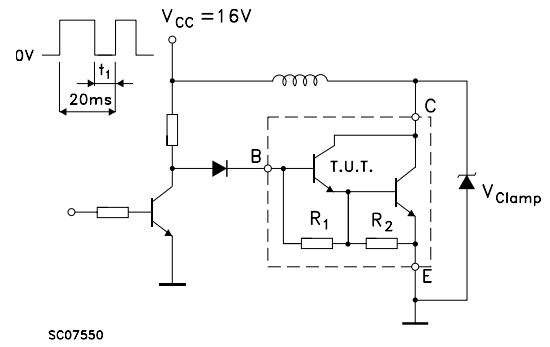


Figure 13: Sustaining voltage test circuit



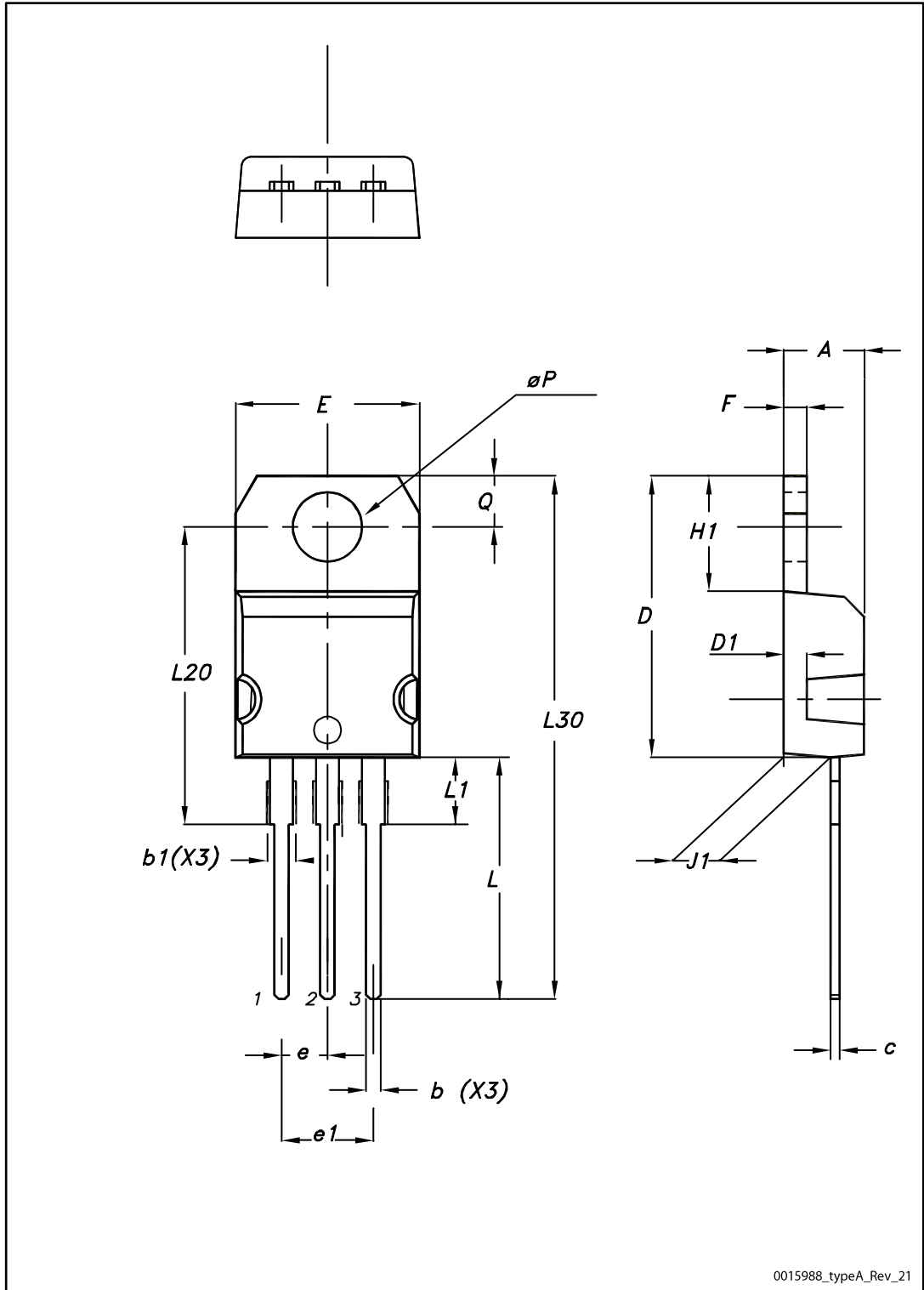
## 4 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.



### 4.1 TO-220 type A package information

Figure 14: TO-220 type A package outline



0015988\_typeA\_Rev\_21

Table 6: 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 Revision history

**Table 7: Document revision history**

Date	Revision	Changes
18-Nov-2008	3	Package changed from TO-218 to TO-247 for BU931P. Inserted type in TO-220 (BU931T).
02-Dec-2009	4	Modified I <sub>c</sub> test condition value of V <sub>CEO(sus)</sub> parameter <i>Table 4 on page 4</i> , updated TO-220 package mechanical data.
12-Oct-2017	5	The part numbers BU931 and BU931P have been moved to two separate datasheets. Modified <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 3: "Thermal data"</i> and <i>Table 4: "Electrical characteristics"</i> . Updated <i>Section 4: "Package information"</i> . Minor text changes.

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