

## High voltage ignition coil driver NPN power Darlington transistors

### Features

- Very rugged bipolar technology
- Built in clamping Zener
- High operating junction temperature
- Fully insulated package (U.L. compliant) for easy mounting

### Applications

- High ruggedness electronic ignitions

### Description

The devices are bipolar Darlington transistors manufactured using Multi-Epitaxial Planar technology. They have been properly designed to be used in Automotive environment as electronic ignition power actuators.

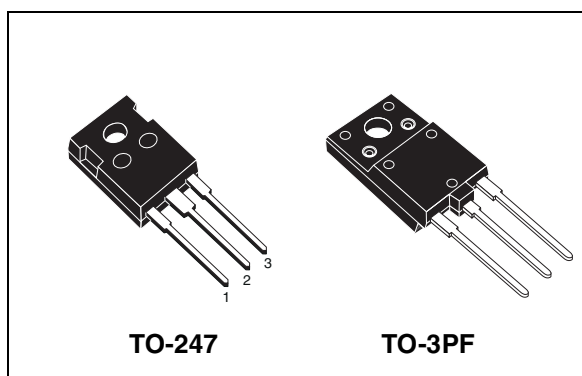


Figure 1. Internal schematic diagram

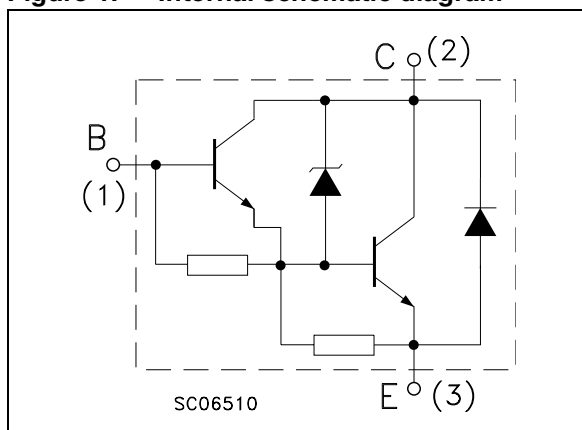


Table 1. Device summary

Order code	Marking	Packages	Packaging
BU941ZP	BU941ZP	TO-247	Tube
BU941ZPFI	BU941ZPFI	TO-3PF	Tube

# 1 Absolute maximum ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		BU941ZP	BU941ZPFI	
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	350		V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	5		V
$I_C$	Collector current	15		A
$I_{CM}$	Collector peak current ( $t_p < 5\text{ms}$ )	30		A
$I_B$	Base current	1		A
$I_{BM}$	Base peak current ( $t_p < 5\text{ms}$ )	5		A
$P_{tot}$	Total dissipation at $T_c \leq 25\text{ °C}$	155	65	W
$V_{isol}$	Insulation withstand voltage (RMS) from all three leads to external heatsink		2500	V
$T_{stg}$	Storage temperature	-65 to 175	-65 to 175	°C
$T_J$	Max. operating junction temperature	175	175	°C

**Table 3. Thermal data**

Symbol	Parameter	TO-247	TO-3PF	Unit
$R_{thj-case}$	Thermal resistance junction-case	max 0.97	2.3	°C/W

## 2 Electrical characteristics

( $T_{\text{case}} = 25^{\circ}\text{C}$ ; unless otherwise specified)

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CEO}}$	Collector cut-off current ( $I_{\text{B}} = 0$ )	$V_{\text{CE}} = 300 \text{ V}$ $V_{\text{CE}} = 300 \text{ V}$ $T_{\text{J}} = 125^{\circ}\text{C}$			100 0.5	$\mu\text{A}$ $\text{mA}$
$I_{\text{EBO}}$	Emitter cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 5 \text{ V}$			20	$\text{mA}$
$V_{\text{Clamp}}^{(1)}$	Clamping voltage	$I_{\text{C}} = 100 \text{ mA}$	350		500	$\text{V}$
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 8 \text{ A}$ $I_{\text{B}} = 100 \text{ mA}$ $I_{\text{C}} = 10 \text{ A}$ $I_{\text{B}} = 250 \text{ mA}$ $I_{\text{C}} = 12 \text{ A}$ $I_{\text{B}} = 300 \text{ mA}$			1.8 1.8 2	$\text{V}$ $\text{V}$ $\text{V}$
$V_{\text{BE(sat)}}^{(1)}$	Collector-emitter base voltage	$I_{\text{C}} = 8 \text{ A}$ $I_{\text{B}} = 100 \text{ mA}$ $I_{\text{C}} = 10 \text{ A}$ $I_{\text{B}} = 250 \text{ mA}$ $I_{\text{C}} = 12 \text{ A}$ $I_{\text{B}} = 300 \text{ mA}$			2.2 2.5 2.7	$\text{V}$ $\text{V}$ $\text{V}$
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 5 \text{ A}$ $V_{\text{CE}} = 10 \text{ V}$	300			
	Functional test	$V_{\text{CC}} = 24 \text{ V}$ $L = 7 \text{ mH}$ <i>Figure 13.</i>	10			$\text{A}$
$t_{\text{s}}$ $t_{\text{f}}$	Inductive load Storage time Fall time	$V_{\text{CC}} = 12 \text{ V}$ $L = 7 \text{ mH}$ $V_{\text{BE(off)}} = 0 \text{ V}$ $R_{\text{BE}} = 47 \Omega$ $V_{\text{Clamp}} = 300 \text{ V}$ $I_{\text{C}} = 7 \text{ A}$ $I_{\text{B1}} = 70 \text{ mA}$		15 0.5		$\mu\text{s}$ $\mu\text{s}$
$V_{\text{F}}$	Diode forward voltage	$I_{\text{F}} = 10 \text{ A}$			2.5	$\text{V}$

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1.5\%$ .

## 2.1 Electrical characteristic (curves)

Figure 2. Safe operating area

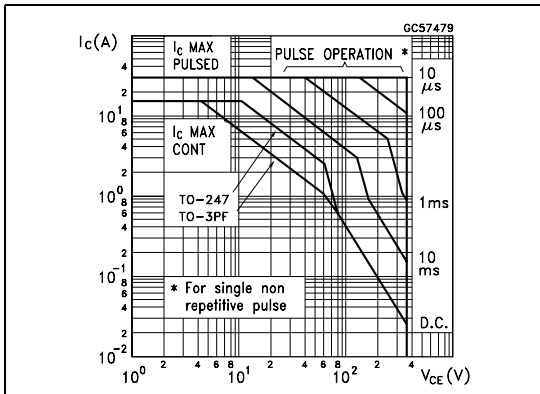


Figure 3. Derating curve

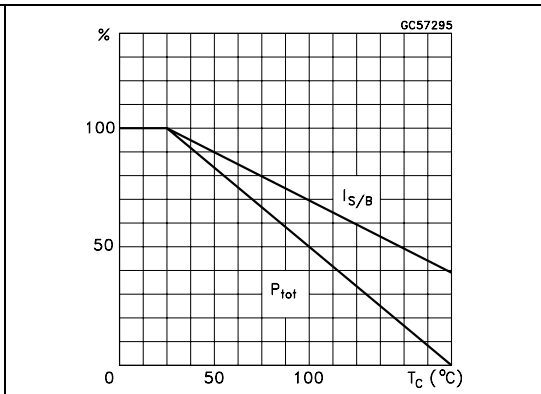


Figure 4. DC current gain

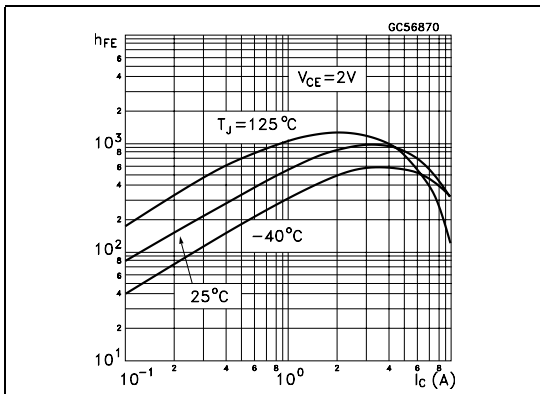


Figure 5. DC current gain

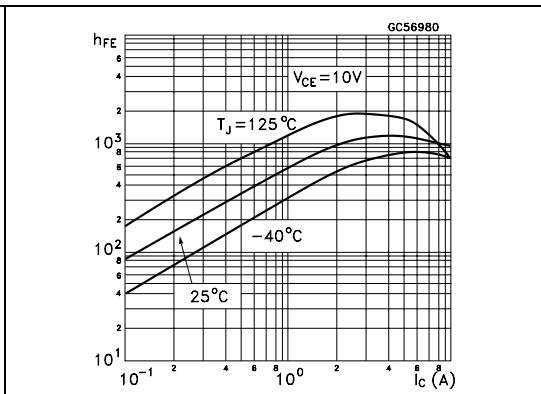


Figure 6. Collector-emitter saturation voltage

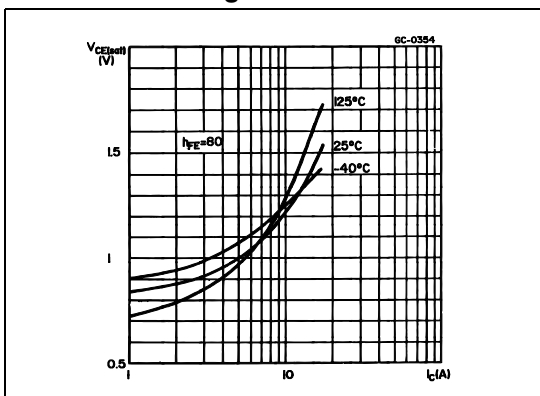


Figure 7. Base-emitter saturation voltage

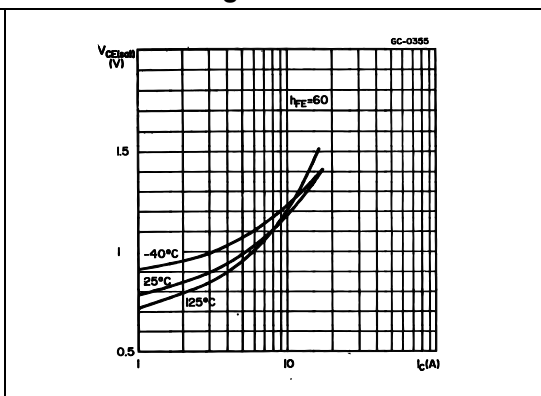


Figure 8. Base-emitter saturation voltage

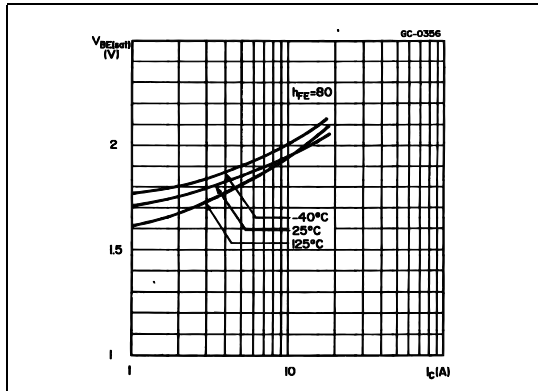


Figure 9. Base-emitter saturation voltage

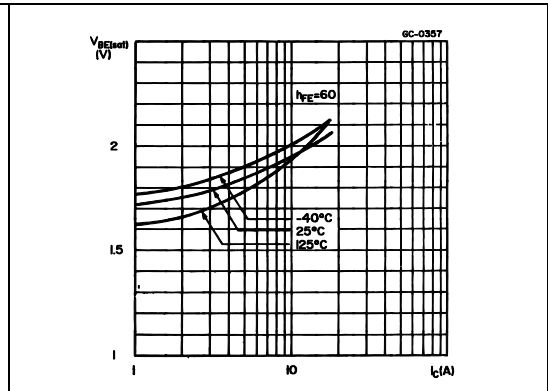
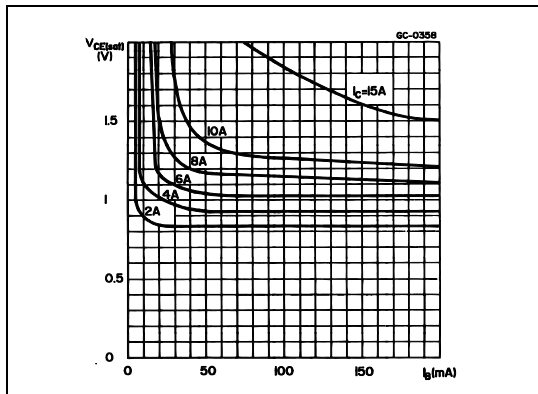


Figure 10. Collector-emitter saturation voltage



## 2.2 Test circuit

Figure 11. Functional test circuit

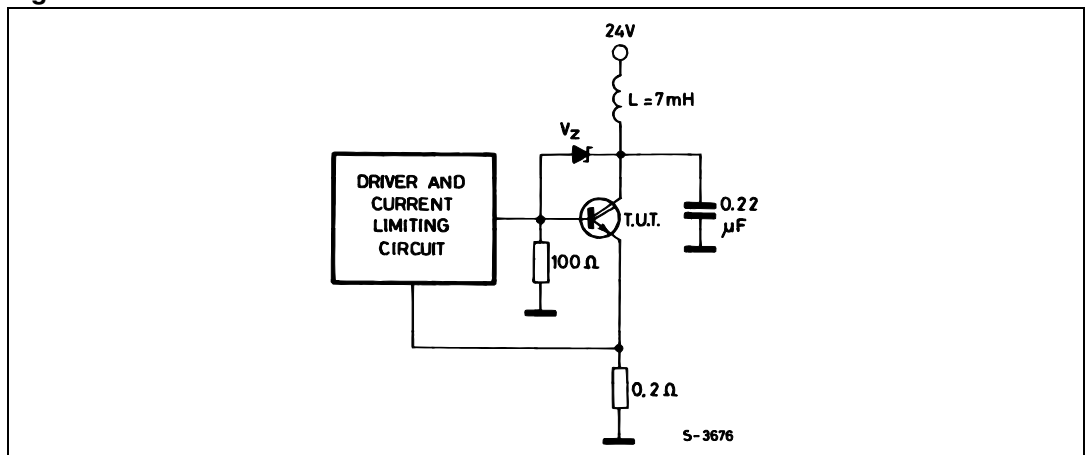


Figure 12. Functional test waveforms

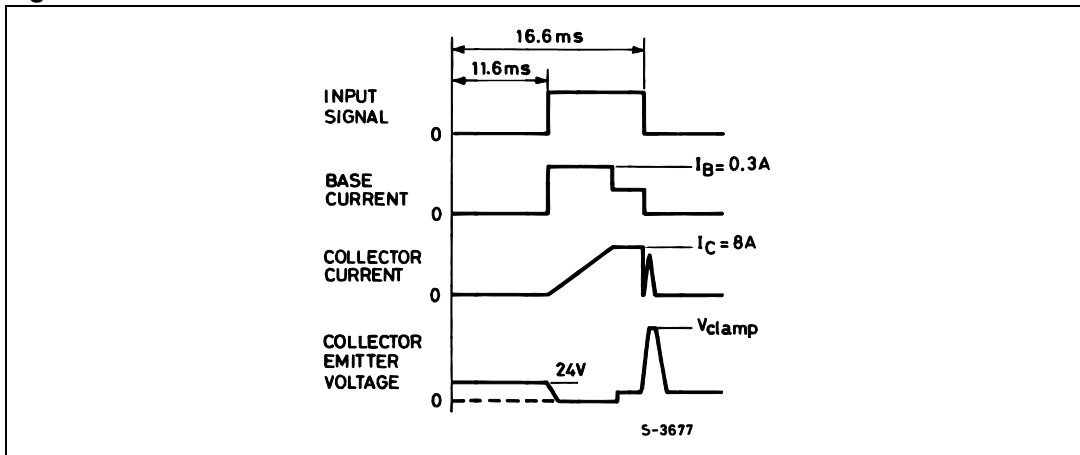
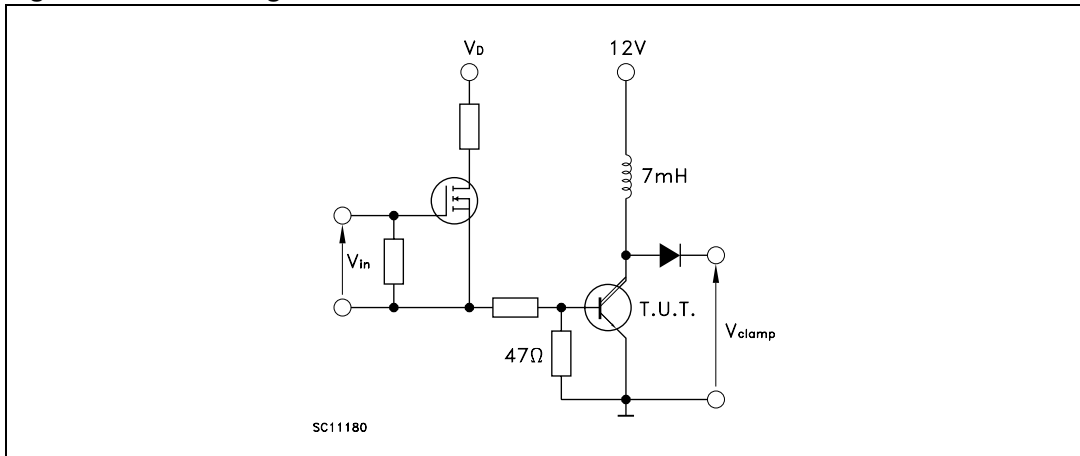


Figure 13. Switching time test circuit

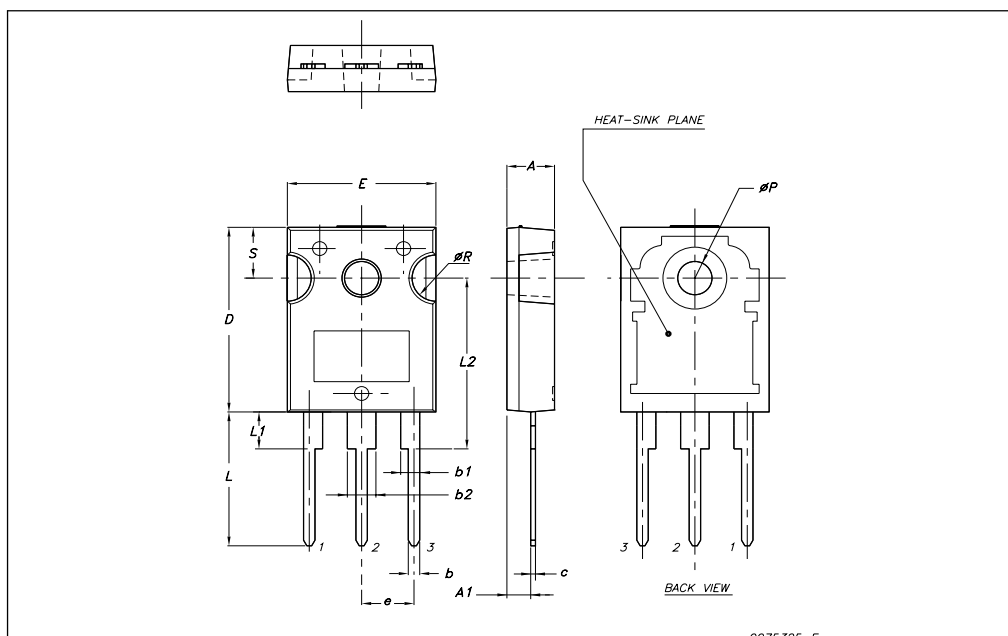


### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

**TO-247 Mechanical data**

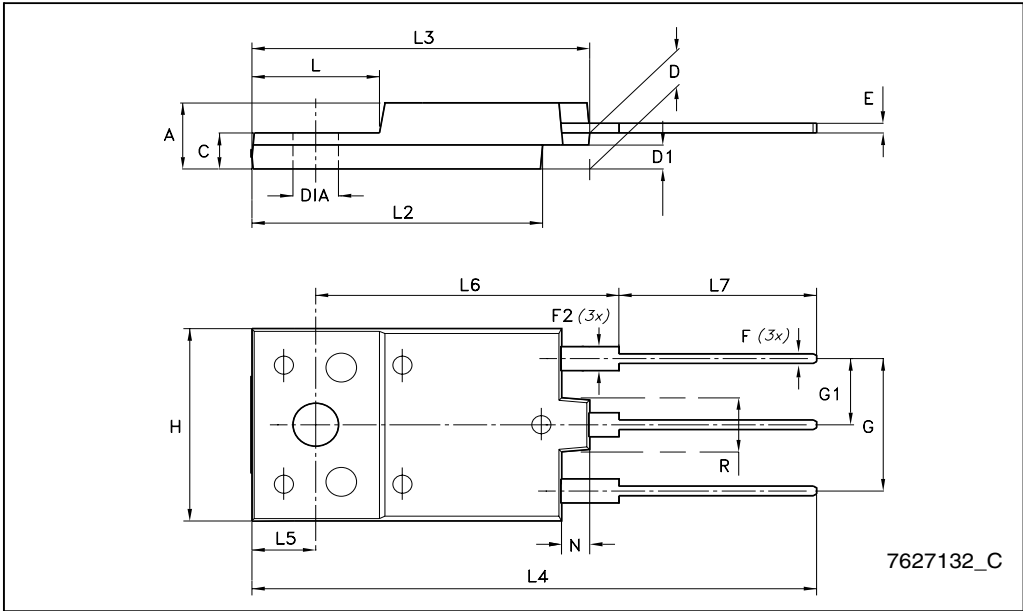
Dim.	mm.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	





**TO-3PF mechanical data**

DIM.	mm.		
	min.	typ	max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80



## 4 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
03-Feb-2005	6	
22-Jan-2008	7	Package change from TO-218 to TO-247 and from ISOWATT218 to TO-3PF.

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