

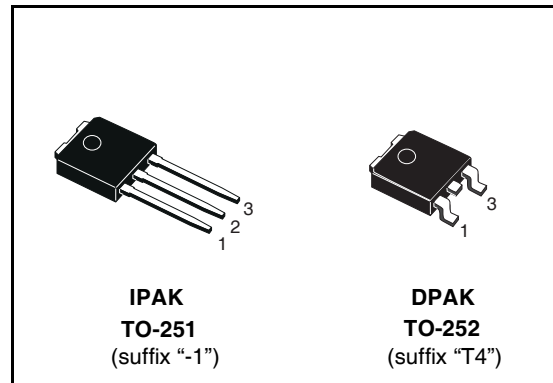


# BULD39D-1 BULD39DT4

## High Voltage Fast-Switching NPN Power Transistor

### General features

- NPN transistor
- High voltage capability
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed
- High ruggedness
- Surface-mounting DPAK (TO-252) power package in tape & reel (suffix "T4")
- Through-hole IPAK (TO-251) power package in tube (suffix "-1")
- In compliance with the 2002/93/EC European Directive



### Description

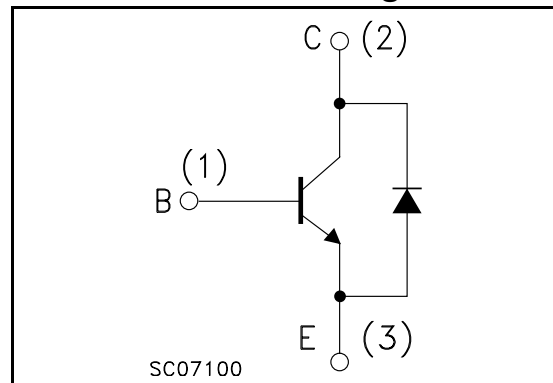
The device is manufactured using high voltage Multi-epitaxial Planar technology to enhance switching speeds while maintaining wide RBSOA.

The BUL series is designed for use in electronics transformer for halogen lamps.

### Applications

- Electronics transformer for halogen lamps
- Switch mode power supplies

### Internal schematic diagram



### Order codes

Part Number	Marking	Package	Packing
BULD39D-1		IPAK	Tube
BULD39DT4		DPAK	Tape & reel

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# 1 Electrical ratings

**Table 1. Absolute maximum rating**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{BE} = 0$ )	850	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	450	V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	9	V
$I_C$	Collector current	4	A
$I_{CM}$	Collector peak current ( $t_P < 5\text{ms}$ )	8	A
$I_B$	Base current	2	A
$I_{BM}$	Base peak current ( $t_P < 5\text{ms}$ )	4	A
$P_{tot}$	Total dissipation at $T_C = 25^\circ\text{C}$	35	W
$T_{stg}$	Storage temperature	-65 to 150	$^\circ\text{C}$
$T_J$	Max. operating junction temperature	150	$^\circ\text{C}$

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	3.57	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-amb max	62.5	$^\circ\text{C/W}$

## 2 Electrical characteristics

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

**Table 3. Electrical characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{\text{CES}}$	Collector cut-off current ( $V_{\text{BE}} = 0$ )	$V_{\text{CE}} = 850\text{V}$ $V_{\text{CE}} = 850\text{V}$ $T_j = 125^{\circ}\text{C}$			100 500	$\mu\text{A}$ $\mu\text{A}$
$I_{\text{EBO}}$	Emitter cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 9\text{V}$			100	$\mu\text{A}$
$V_{\text{CEO(sus)}}$	Collector-emitter sustaining voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 100\text{mA}$ $L = 25\text{ mH}$	450			V
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 1\text{A}$ $I_{\text{B}} = 0.2\text{A}$ $I_{\text{C}} = 2.5\text{A}$ $I_{\text{B}} = 0.5\text{A}$		0.13	0.5 1.1	V V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 1\text{A}$ $I_{\text{B}} = 0.2\text{A}$ $I_{\text{C}} = 2.5\text{A}$ $I_{\text{B}} = 0.5\text{A}$			1.1 1.3	V V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 10\text{mA}$ $V_{\text{CE}} = 5$ $I_{\text{C}} = 5\text{A}$ $V_{\text{CE}} = 10\text{V}$	10 4			
$V_{\text{CEW}}$	Maximum collector emitter voltage without snubber	$I_{\text{C}} = 6\text{A}$ $R_{\text{BB}} = 0\Omega$ $V_{\text{BB}} = -2.5\text{V}$ $L = 50\mu\text{H}$ $t_{\text{p}} \geq 10\mu\text{s}$	450			V
$t_{\text{s}}$ $t_{\text{f}}$	Inductive load Storage time Fall time	$I_{\text{C}} = 2.5\text{A}$ $I_{\text{B(on)}} = 0.5\text{A}$ $V_{\text{BE(off)}} = -5\text{V}$ $R_{\text{BB}} = 0\Omega$ $V_{\text{CL}} = 300\text{V}$ $L = 1\text{mH}$		0.7 50	1.5 100	$\mu\text{s}$ ns
$V_{\text{f}}$	Diode forward voltage	$I_{\text{C}} = 2\text{A}$			1.5	V

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

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

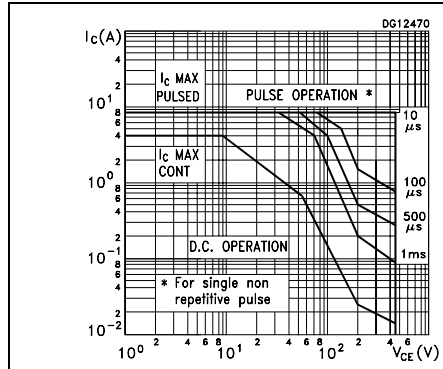


Figure 2. Derating curve

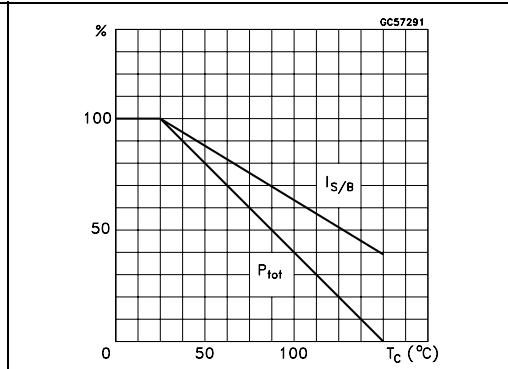
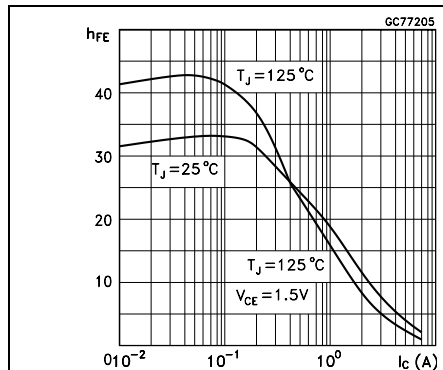


Figure 3. DC current gain



DC current gain

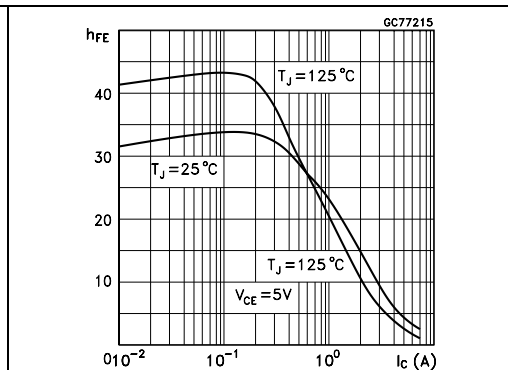


Figure 4. Collector-emitter saturation voltage

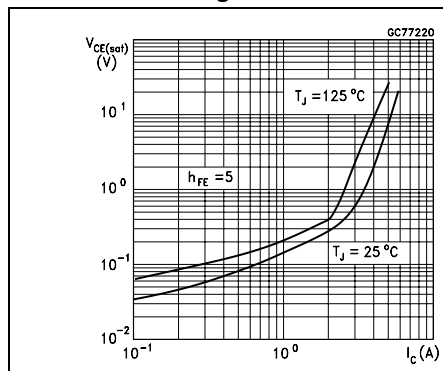


Figure 5. Base-emitter saturation voltage

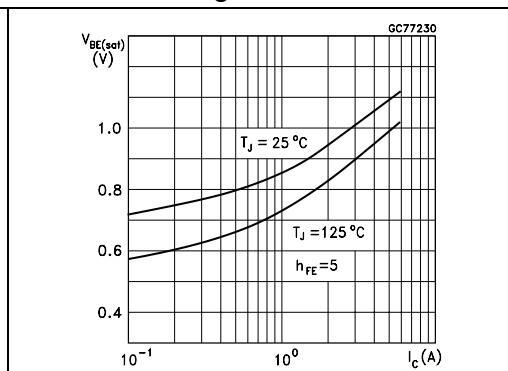


Figure 6. Inductive load fall time

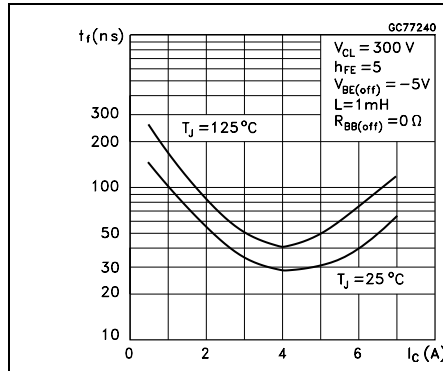


Figure 7. Inductive load storage time

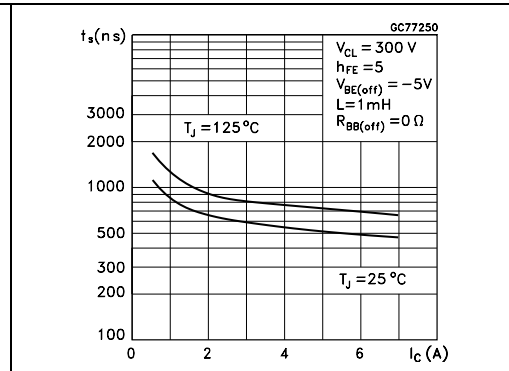
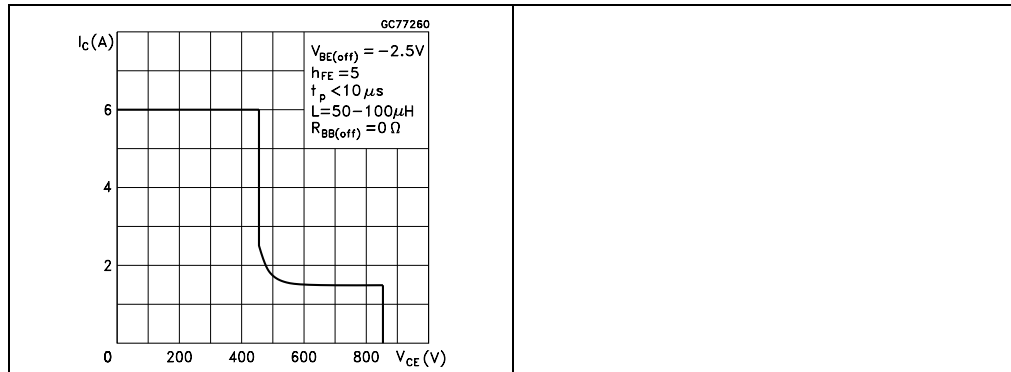
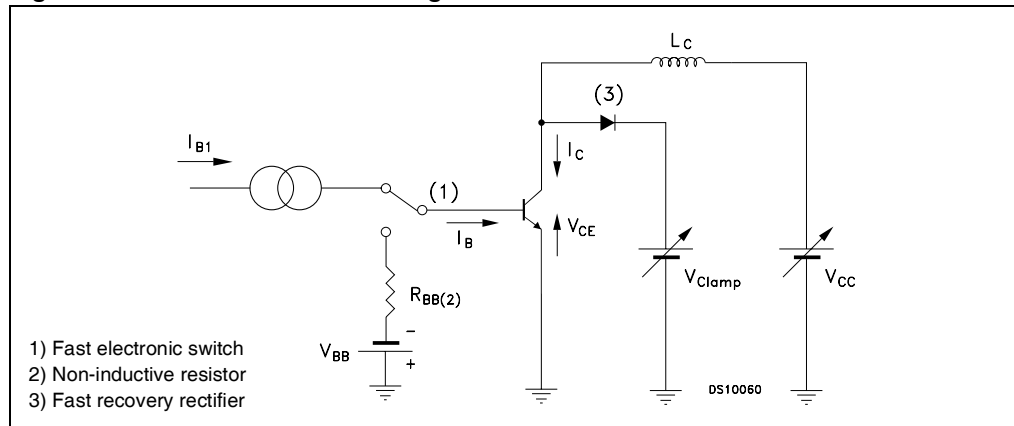


Figure 8. Reverse biased SOA



## 2.2 Test circuits

Figure 9. Inductive load switching test circuit



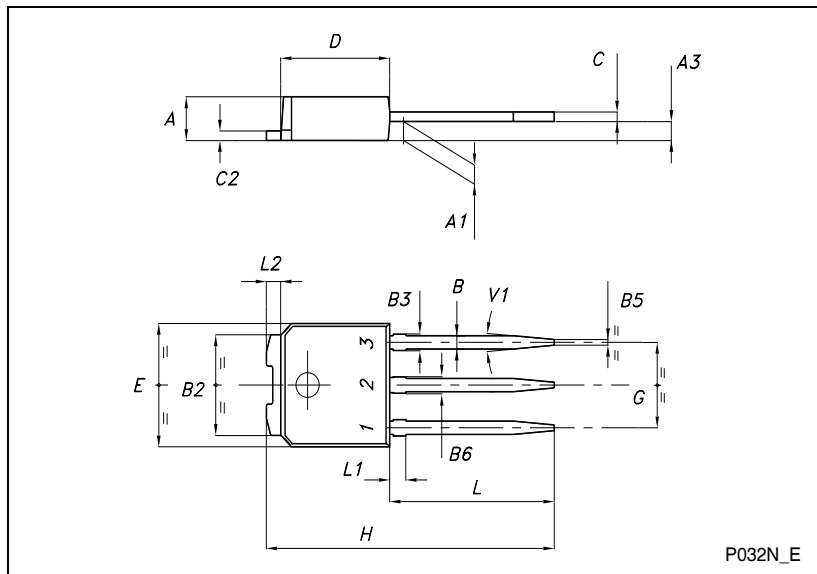
### 3 Package mechanical data

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)



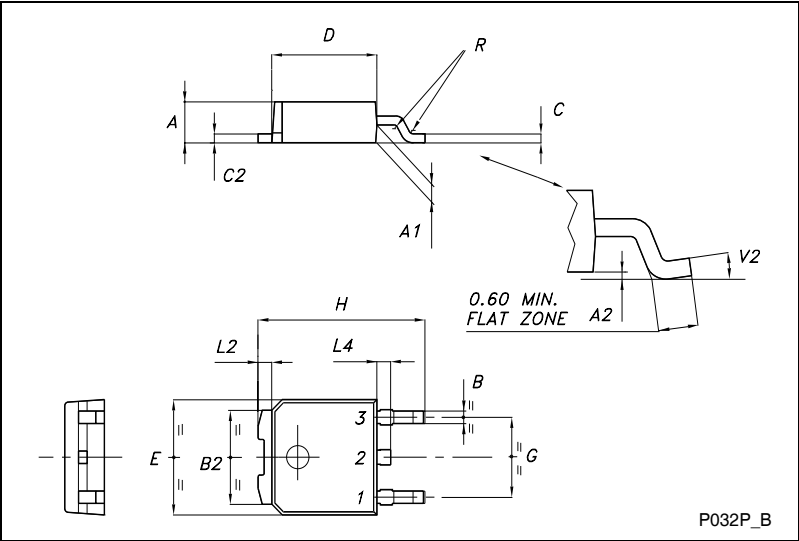
TO-251 (IPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A3	0.70		1.30	0.028		0.051
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
B3			0.85			0.033
B5		0.30			0.012	
B6			0.95			0.037
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.237		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	15.90		16.30	0.626		0.642
L	9.00		9.40	0.354		0.370
L1	0.80		1.20	0.031		0.047
L2		0.80	1.00		0.031	0.039
V1		10°			10°	



**TO-252 (DPAK) MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0°		8°	0°		0°



## 4 Revision history

Table 4. Revision history

Date	Revision	Changes
09-May-2006	1	Initial release.

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