



# BUL128D-B

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- n STMicroelectronics PREFERRED SALES TYPE
- n NPN TRANSISTOR
- n HIGH VOLTAGE CAPABILITY
- n LOW SPREAD OF DYNAMIC PARAMETERS
- n MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- n VERY HIGH SWITCHING SPEED
- n INTEGRATED ANTIPARALLEL COLLECTOR- EMITTER DIODE

### APPLICATIONS

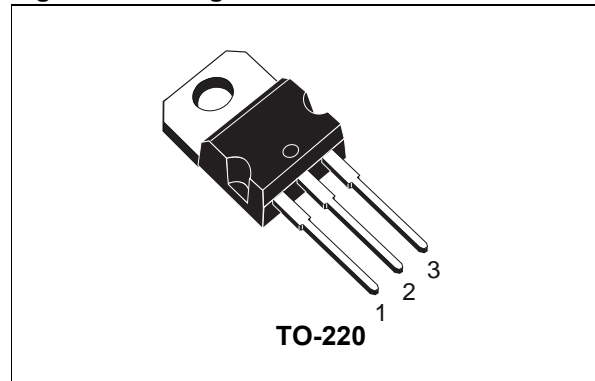
- n ELECTRONIC BALLAST FOR FLUORESCENT LIGHTING
- n FLYBACK AND FORWARD SINGLE TRANSISTOR LOW POWER CONVERTERS

### DESCRIPTION

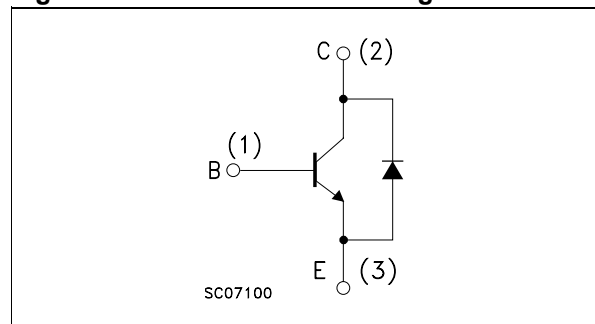
The device is manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds and medium voltage capability. It uses a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.

The device is designed for use in lighting applications and low cost switch-mode power supplies.

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 1: Order Codes**

Part Number	Marking	Package	Packaging
BUL128D-B	BUL128D-B	TO-220	Tube

**Table 2: Absolute Maximum Ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{BE} = 0$ )	700	V
$V_{CEO}$	Collector-Emitter Voltage ( $I_B = 0$ )	400	V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ , $I_B = 2$ A, $t_p < 10$ $\mu$ s, $T_J = 150$ °C)	$V_{(BR)EBO}$	V
$I_C$	Collector Current	4	A
$I_{CM}$	Collector Peak Current ( $t_p < 5$ ms)	8	A
$I_B$	Base Current	2	A
$I_{BM}$	Base Peak Current ( $t_p < 5$ ms)	4	A

## BUL128D-B

Symbol	Parameter	Value	Unit
$P_{tot}$	Total Dissipation at $T_C = 25\text{ °C}$	70	W
$T_{stg}$	Storage Temperature	-65 to 150	°C
$T_J$	Max. Operating Junction Temperature	150	°C

**Table 3: Thermal Data**

$R_{thj-case}$	Thermal Resistance Junction-Case	Max	1.78	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-Ambient	Max	62.5	°C/W

**Table 4: Electrical Characteristics ( $T_{case} = 25\text{ °C}$  unless otherwise specified)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CES}$	Collector Cut-off Current ( $V_{BE} = 0\text{ V}$ )	$V_{CE} = 700\text{ V}$			100	$\mu\text{A}$
		$V_{CE} = 700\text{ V}$ $T_J = 125\text{ °C}$			500	$\mu\text{A}$
$I_{CEO}$	Collector Cut-off Current ( $I_B = 0$ )	$V_{CE} = 400\text{ V}$			250	$\mu\text{A}$
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage ( $I_C = 0$ )	$I_E = 10\text{ mA}$	9		18	V
$V_{CEO(sus)}^*$	Collector-Emitter Sustaining Voltage ( $I_B = 0$ )	$I_C = 100\text{ mA}$ $L = 25\text{ mH}$	400			V
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 0.5\text{ A}$ $I_B = 0.1\text{ A}$			0.7	V
		$I_C = 1\text{ A}$ $I_B = 0.2\text{ A}$			1	V
		$I_C = 2.5\text{ A}$ $I_B = 0.5\text{ A}$			1.5	V
		$I_C = 4\text{ A}$ $I_B = 1\text{ A}$		0.5		V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 0.5\text{ A}$ $I_B = 0.1\text{ A}$			1.1	V
		$I_C = 1\text{ A}$ $I_B = 0.2\text{ A}$			1.2	V
		$I_C = 2.5\text{ A}$ $I_B = 0.5\text{ A}$			1.3	V
$h_{FE}^*$	DC Current Gain	$I_C = 10\text{ mA}$ $V_{CE} = 5\text{ V}$	10			
		$I_C = 2\text{ A}$ $V_{CE} = 5\text{ V}$	12		32	
$t_s$ $t_f$	RESISTIVE LOAD	$V_{CC} = 200\text{ V}$ $I_C = 2\text{ A}$				
	Storage Time Fall Time	$I_{B1} = 0.4\text{ A}$ $V_{BE(off)} = -5\text{ V}$ $R_{BB} = 0\ \Omega$ $L = 200\ \mu\text{H}$ (see figure 15)		0.6 0.1		$\mu\text{s}$ $\mu\text{s}$
$t_s$ $t_f$	INDUCTIVE LOAD	$V_{CC} = 250\text{ V}$ $I_C = 2\text{ A}$				
	Storage Time Fall Time	$I_{B1} = 0.4\text{ A}$ $I_{B2} = -0.4\text{ A}$ $T_p = 30\ \mu\text{s}$ (see figure 14)	2	0.2	2.9	$\mu\text{s}$ $\mu\text{s}$

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

Figure 3: Safe Operating Area

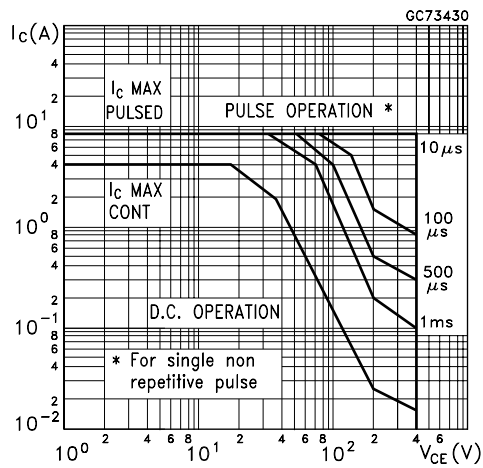


Figure 4: DC Current Gain

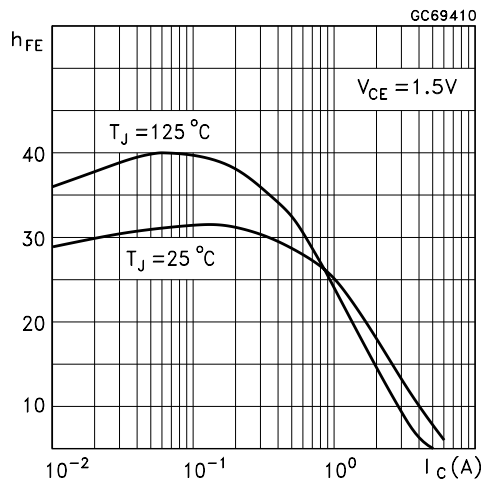


Figure 5: Collector-Emitter Saturation Voltage

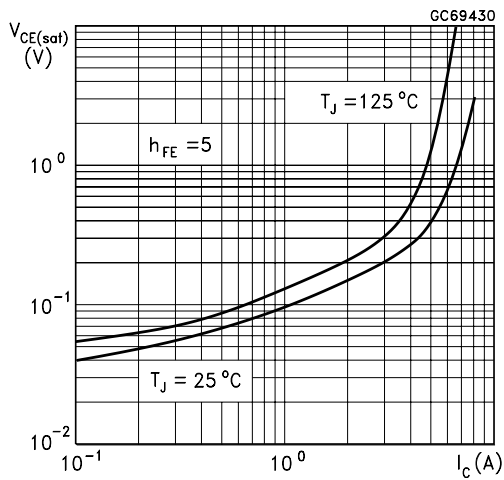


Figure 6: Derating Current

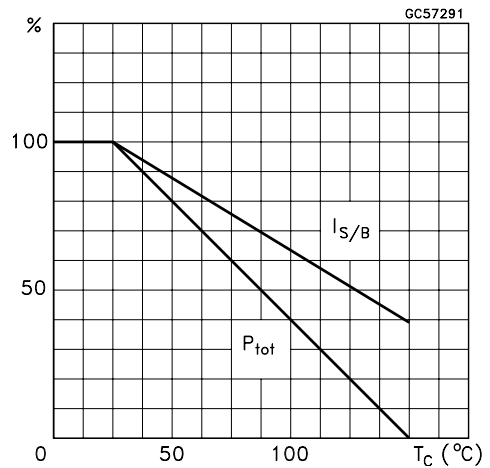


Figure 7: DC Current Gain

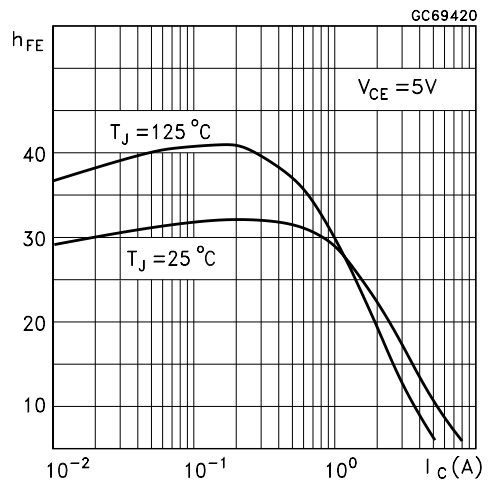


Figure 8: Base-Emitter Saturation Voltage

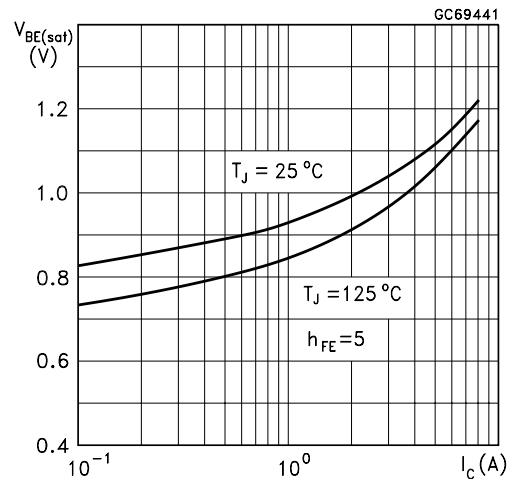


Figure 9: Inductive Load Fall Time

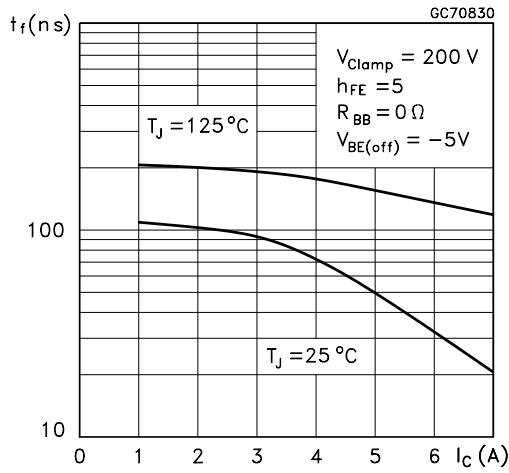


Figure 10: Resistive Load Fall Time

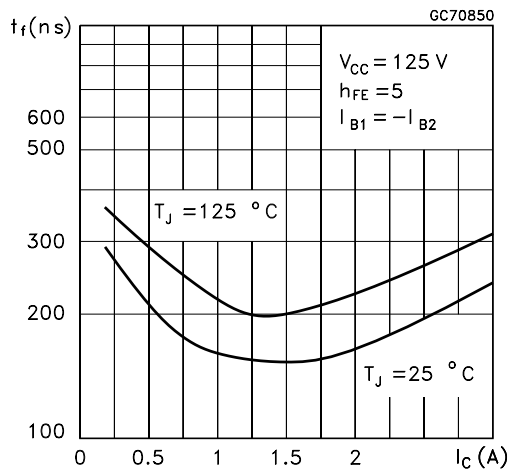


Figure 11: Reverse Biased Operating Area

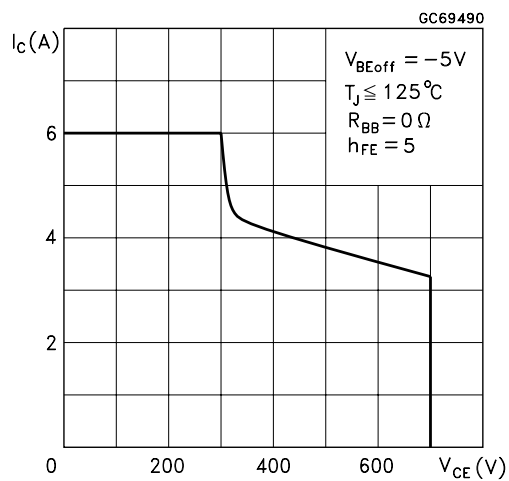


Figure 12: Inductive Load Storage Time

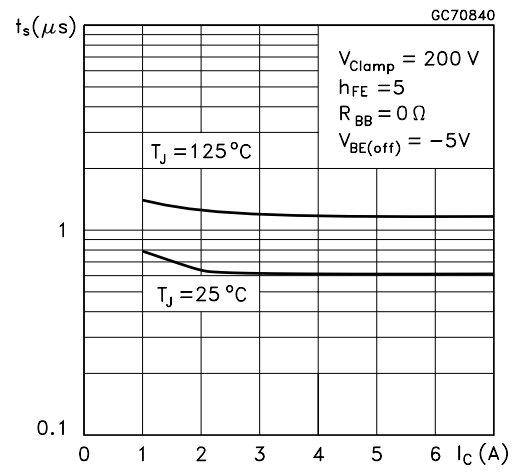


Figure 13: Resistive Load Storage Time

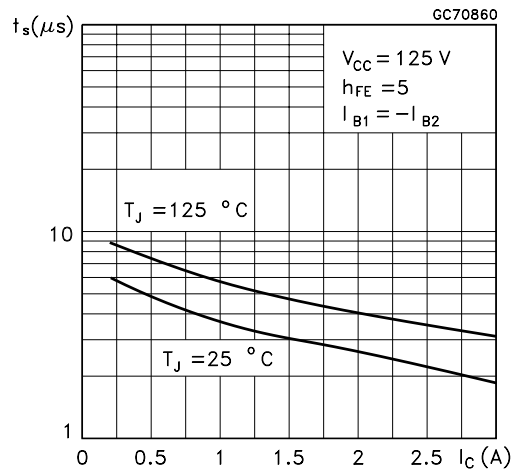


Figure 14: Inductive Load Switching Test Circuit

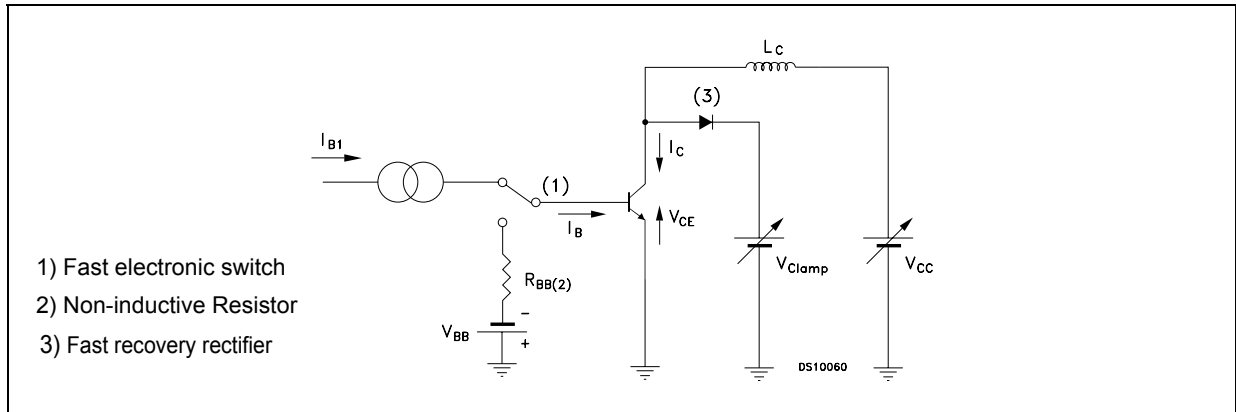
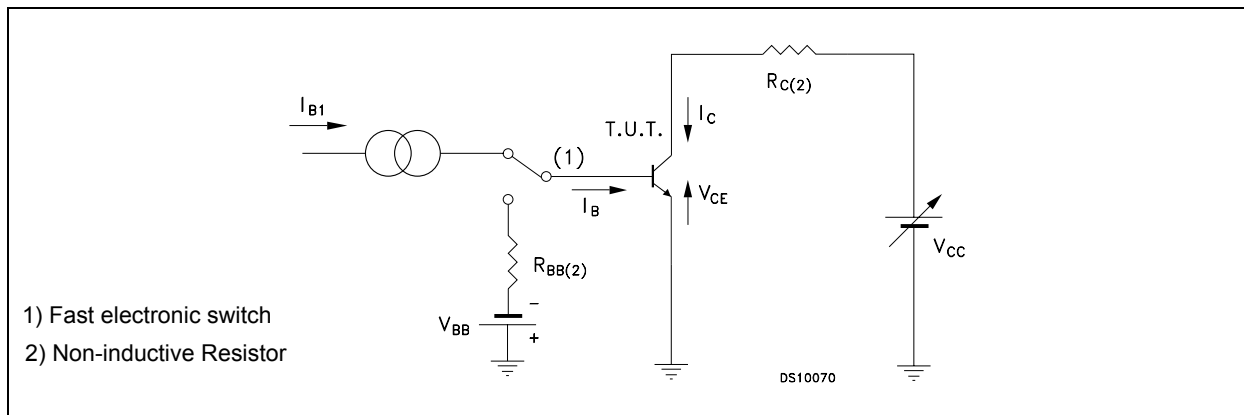
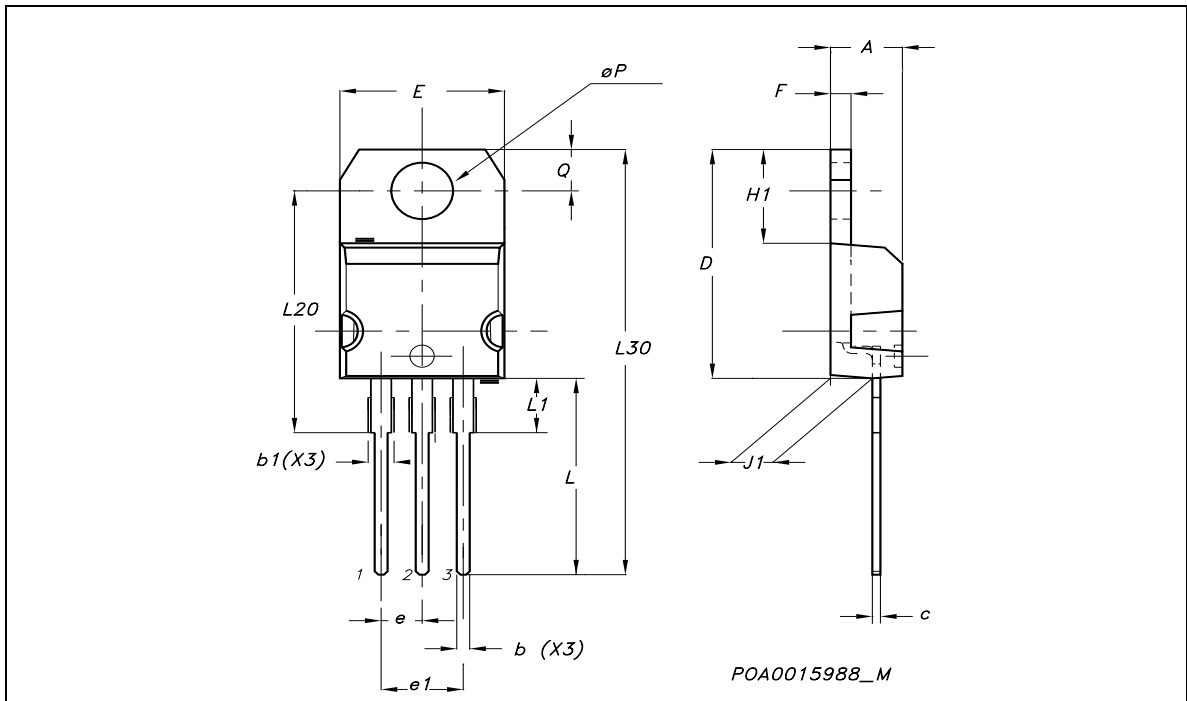


Table 15: Resistive Load Switching Test Circuit



**TO-220 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



**Table 5:**

<b>Version</b>	<b>Release Date</b>	<b>Change Designator</b>
01-Oct-2002	1	First Release.
15-Feb-2005	1	Added table 1 on page 1.

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