

**BUL116D**

## MEDIUM VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

PRELIMINARY DATA

- INTEGRATED ANTIPARALLEL COLLECTOR- EMITTER DIODE
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- VERY HIGH SWITCHING SPEED

**APPLICATIONS:**

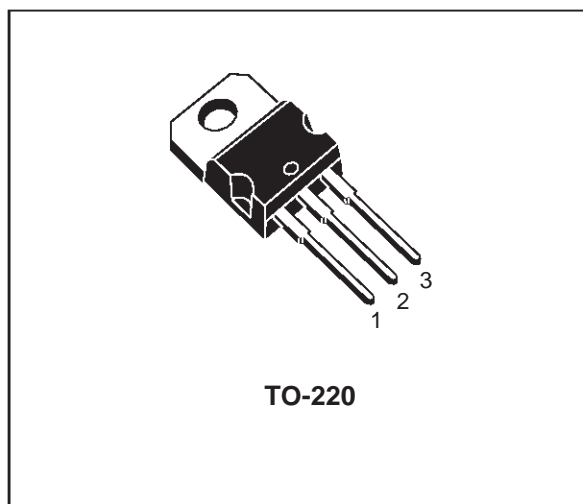
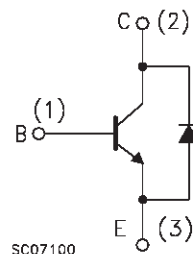
- COMPACT FLUORESCENT LAMPS UP TO 23 W AT 110 V A.C. MAINS
- FLYBACK AND FORWARD SINGLE TRANSISTOR LOW POWER CONVERTERS AT 110 V A.C. MAINS

**DESCRIPTION**

The device is manufactured using 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.

**INTERNAL SCHEMATIC DIAGRAM****ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{BE} = 0$ )	400	V
$V_{CEO}$	Collector-Emitter Voltage ( $I_B = 0$ )	200	V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	9	V
$I_C$	Collector Current	5	A
$I_{CM}$	Collector Peak Current ( $t_p < 5$ ms)	10	A
$I_B$	Base Current	2	A
$I_{BM}$	Base Peak Current ( $t_p < 5$ ms)	4	A
$P_{tot}$	Total Dissipation at $T_c = 25$ °C	60	W
$T_{stg}$	Storage Temperature	-65 to 150	°C
$T_j$	Max. Operating Junction Temperature	150	°C

## THERMAL DATA

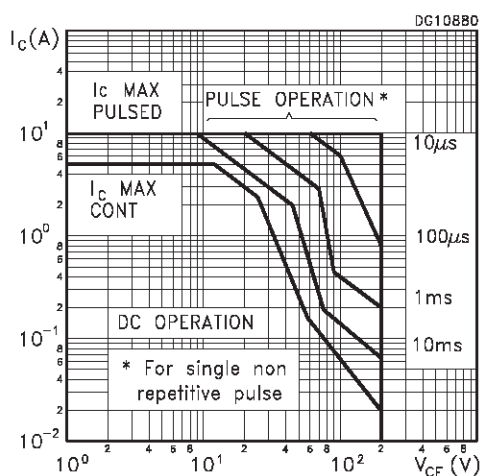
$R_{thj-case}$	Thermal Resistance Junction-Case	Max	2.08	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-Ambient	Max	62.5	$^{\circ}C/W$

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

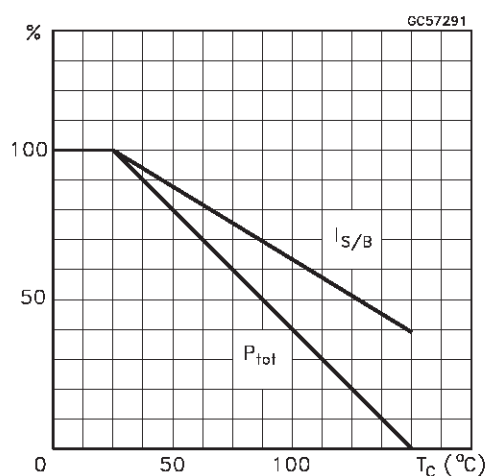
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CES}$	Collector Cut-off Current ( $V_{BE} = 0$ )	$V_{CE} = 400\text{ V}$ $V_{CE} = 400\text{ V}$ $T_J = 125^{\circ}C$			100 500	$\mu A$ $\mu A$
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	$I_E = 10\text{ mA}$	9			V
$V_{CEO(sus)}^*$	Collector-Emitter Sustaining Voltage ( $I_B = 0$ )	$I_C = 100\text{ mA}$ $L = 25\text{ mH}$	200			V
$I_{CEO}$	Collector-Emitter Leakage Current	$V_{CE} = 200\text{ V}$			250	$\mu A$
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 0.5\text{ A}$ $I_B = 50\text{ mA}$ $I_C = 1\text{ A}$ $I_B = 0.1\text{ A}$ $I_C = 3\text{ A}$ $I_B = 0.6\text{ A}$ $I_C = 5\text{ A}$ $I_B = 1\text{ A}$			0.25 0.4 0.7 1.2	V V V V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 1\text{ A}$ $I_B = 0.1\text{ A}$ $I_C = 5\text{ A}$ $I_B = 1\text{ A}$			1.1 1.5	V V
$h_{FE}^*$	DC Current Gain	$I_C = 10\text{ mA}$ $V_{CE} = 5\text{ V}$ $I_C = 5\text{ A}$ $V_{CE} = 5\text{ V}$	10 8		20	
$t_r$ $t_f$ $t_s$	RESISTIVE LOAD Rise Time Fall Time Storage Time	$V_{CC} = 125\text{ V}$ $I_C = 2\text{ A}$ $I_{B1} = 0.4\text{ A}$ $I_{B2} = -0.4\text{ A}$ $t_p = 300\text{ }\mu s$ (see figure 2)		0.2 0.2 1.4	0.4	$\mu s$ $\mu s$ $\mu s$
$t_s$ $t_f$	INDUCTIVE LOAD Storage Time Fall Time	$I_C = 2\text{ A}$ $I_{B1} = 0.4\text{ A}$ $V_{BE} = -5\text{ V}$ $L = 500\text{ }\mu H$ $V_{clamp} = 180\text{ V}$ (see figure 1)		0.5 0.10		$\mu s$ $\mu s$
$V_F$	Diode Forward Voltage	$I_C = 2\text{ A}$			1.5	V

\* Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %

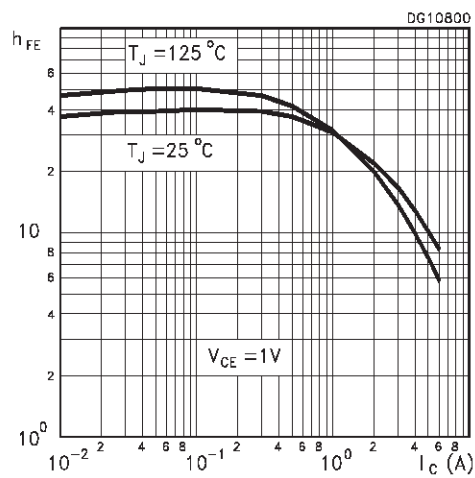
## Safe Operating Area



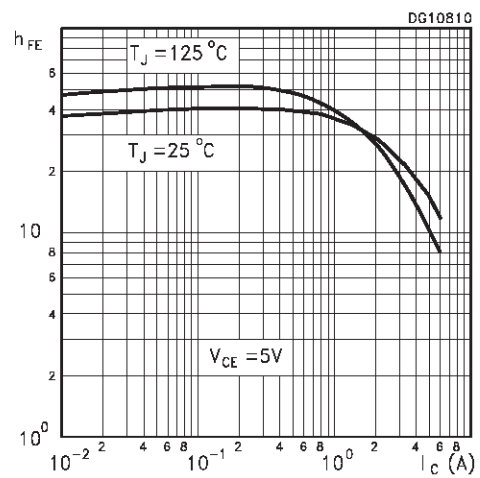
## Derating Curve



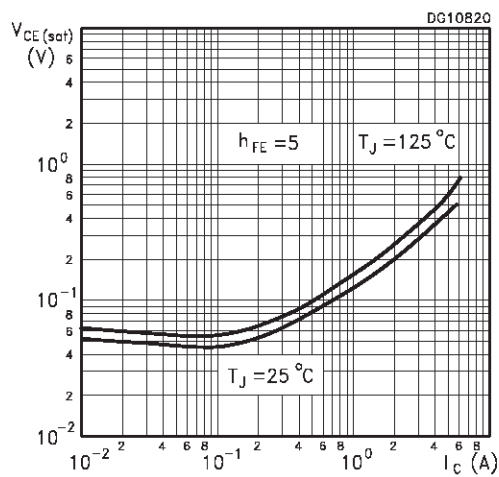
DC Current Gain



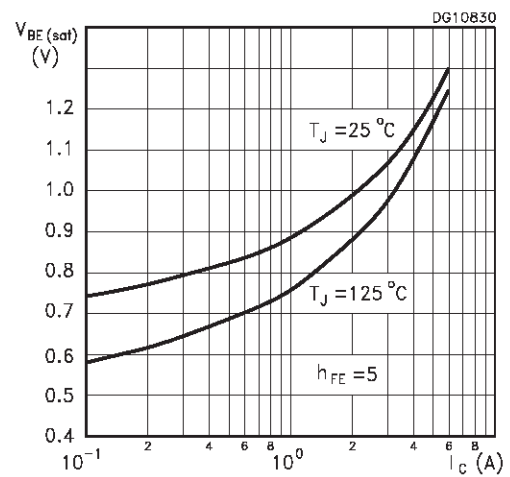
DC Current Gain



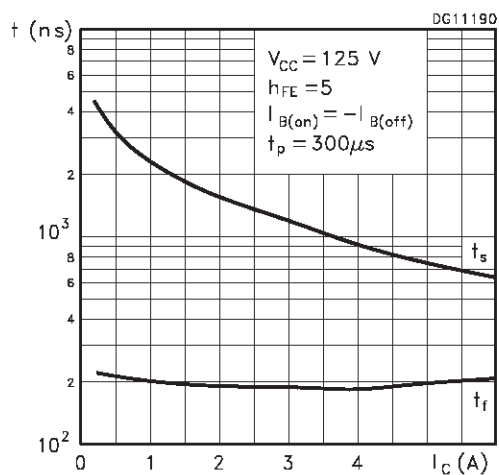
Collector-Emitter Saturation Voltage



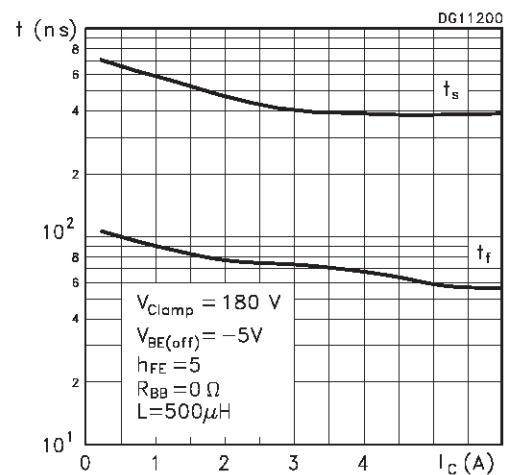
Base-Emitter Saturation Voltage



Switching Time Resistive Load



Switching Time Inductive Load



Reverse Biased SOA

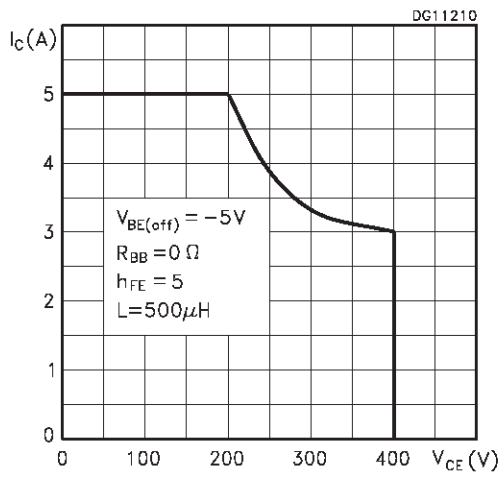


Figure 1: Inductive Load Switching Test Circuit.

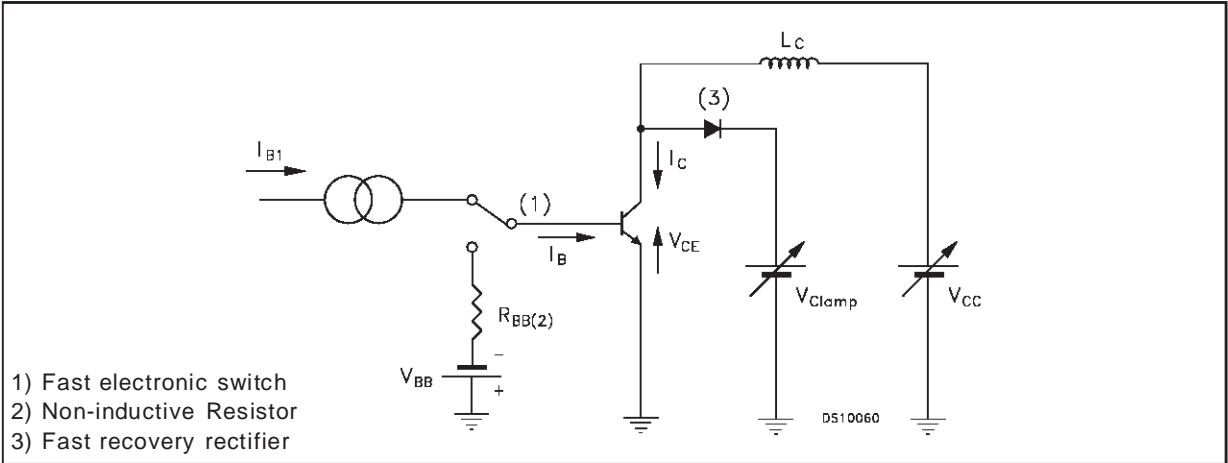
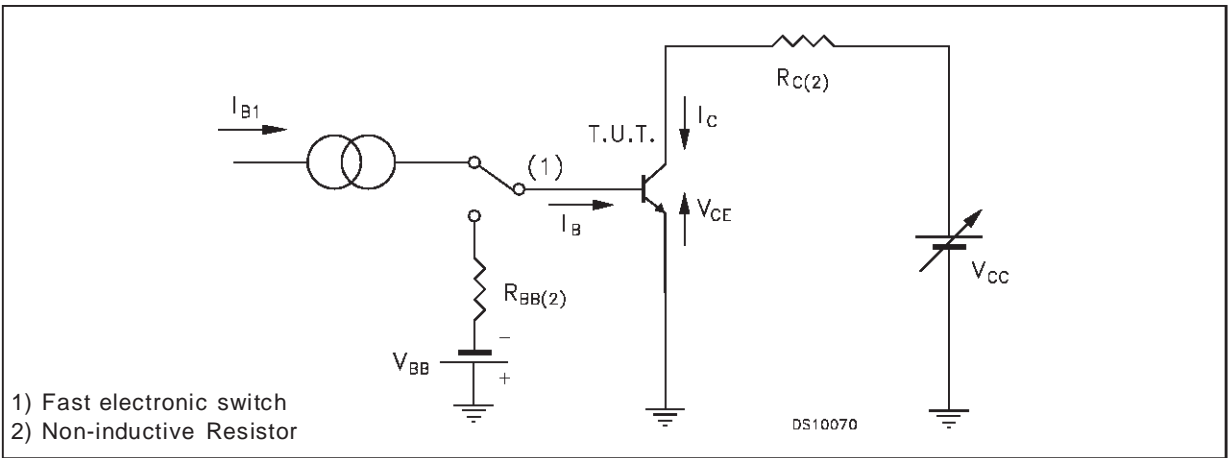
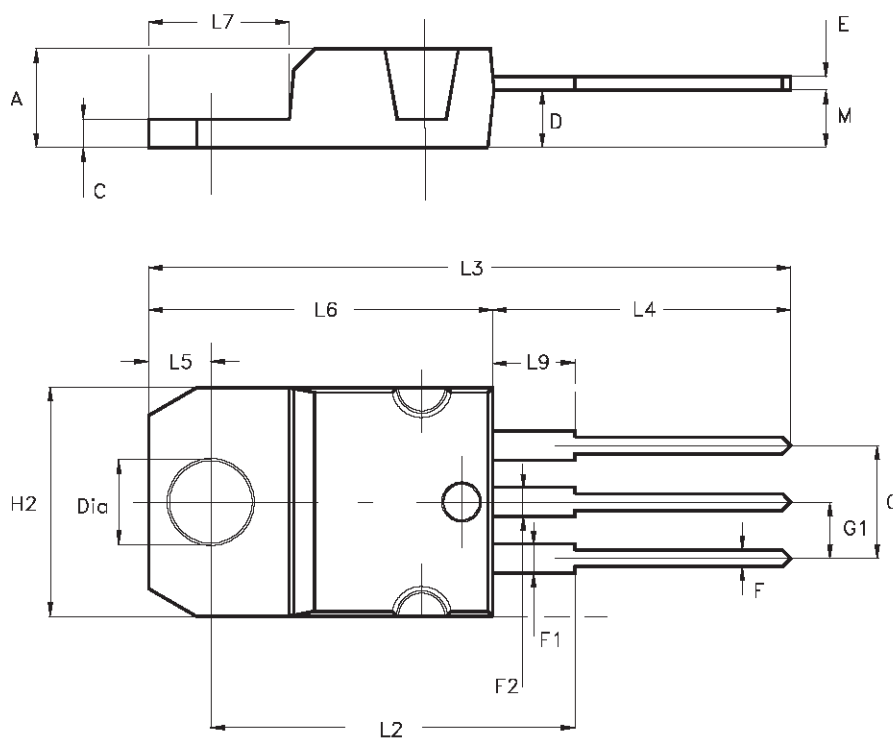


Figure 2: Resistive Load Switching Test Circuit.



## TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.052
D	2.40		2.72	0.094		0.107
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.202
G1	2.40		2.70	0.094		0.106
H2	10.00		10.40	0.394		0.409
L2		16.40			0.645	
L4	13.00		14.00	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.20		6.60	0.244		0.260
L9	3.50		3.93	0.137		0.154
M		2.60			0.102	
DIA.	3.75		3.85	0.147		0.151



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