



# BUL416

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- n STMicroelectronics PREFERRED SALES TYPE
- n NPN TRANSISTOR
- n HIGH VOLTAGE CAPABILITY
- n VERY HIGH SWITCHING SPEED
- n FULLY CHARACTERISEZ AT 125 °C
- n LOW SPREAD OF DYNAMIC PARAMETERS

### APPLICATIONS

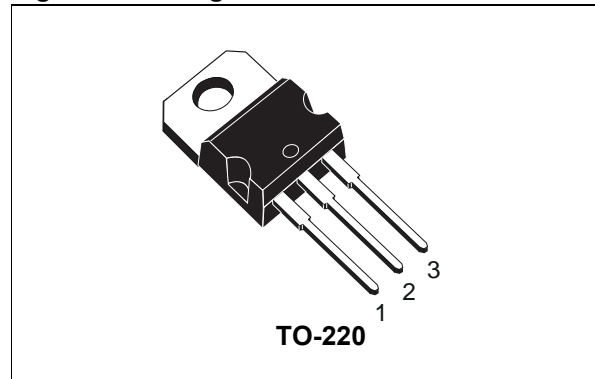
- n ELECTRONIC BALLAST FOR FLUORESCENT LIGHTING
- n SWITCH MODE POWER SUPPLIES

### DESCRIPTION

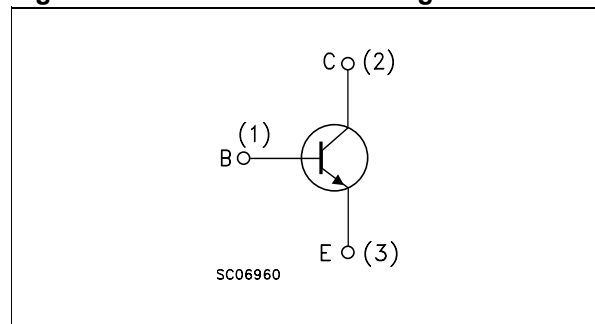
The device is manufactured using high voltage Multi-Epitaxial Mesa technology for cost-effective high performance. It uses a Hollow Emitter structure to enhance switching speeds.

The BUL series 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
BUL416	BUL416A or (#) BUL416B	TO-220	Tube

# See:note on page 2

**Table 2: Absolute Maximum Ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{BE} = 0$ )	1600	V
$V_{CEO}$	Collector-Emitter Voltage ( $I_B = 0$ )	800	V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	9	V
$I_C$	Collector Current	6	A
$I_{CM}$	Collector Peak Current ( $t_p < 5ms$ )	9	A
$I_B$	Base Current	5	A
$I_{BM}$	Base Peak Current ( $t_p < 5ms$ )	8	A
$P_{tot}$	Total Dissipation at $T_C = 25\text{ °C}$	110	W
$T_{stg}$	Storage Temperature	-65 to 150	°C

Symbol	Parameter	Value	Unit
$T_J$	Max. Operating Junction Temperature	150	°C

**Table 3: Thermal Data**

$R_{thj-case}$	Thermal Resistance Junction-Case	Max	1.14	°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 ( $V_{BE} = 0\text{ V}$ )	$V_{CE} = 1600\text{ V}$				100	$\mu\text{A}$
		$V_{CE} = 1600\text{ V}$	$T_J = 125\text{ °C}$			500	$\mu\text{A}$
$I_{CEO}$	Collector Cut-off Current ( $I_B = 0$ )	$V_{CE} = 800\text{ V}$				250	$\mu\text{A}$
$V_{CEO(sus)}^*$	Collector-Emitter Sustaining Voltage ( $I_B = 0$ )	$I_C = 100\text{ mA}$	$L = 25\text{ mH}$	800			V
$V_{EBO}$	Emitter-Base Voltage ( $I_C = 0$ )	$I_E = 10\text{ mA}$		9			V
$V_{CE(sat)}^*$	Collector-Emitter Saturation Voltage	$I_C = 2\text{ A}$	$I_B = 0.4\text{ A}$			1.5	V
		$I_C = 4\text{ A}$	$I_B = 1.33\text{ A}$			3	V
$V_{BE(sat)}^*$	Base-Emitter Saturation Voltage	$I_C = 2\text{ A}$	$I_B = 0.4\text{ A}$			1.2	V
		$I_C = 4\text{ A}$	$I_B = 1.33\text{ A}$			1.5	V
$h_{FE}^*$	DC Current Gain	$I_C = 10\text{ mA}$	$V_{CE} = 5\text{ V}$	10			
		$I_C = 0.7\text{ A}$	$V_{CE} = 5\text{ V}$	12		27	
		Group A		25		40	
$t_s$ $t_f$	INDUCTIVE LOAD Storage Time Fall Time	$I_C = 3\text{ A}$	$I_{B1} = 1\text{ A}$		2.3		$\mu\text{s}$
		$V_{BE(off)} = -5\text{ V}$	$R_{BB} = 0\ \Omega$		650		ns
		$V_{clamp} = 200\text{ V}$	$L = 200\ \mu\text{H}$				
		(see figure 12)					
$t_s$ $t_f$	INDUCTIVE LOAD Storage Time Fall Time	$I_C = 3\text{ A}$	$I_{B1} = 1\text{ A}$		3		$\mu\text{s}$
		$V_{BE(off)} = -5\text{ V}$	$R_{BB} = 0\ \Omega$		680		ns
		$V_{clamp} = 200\text{ V}$	$L = 200\ \mu\text{H}$				
		$T_J = 100\text{ °C}$	(see figure 12)				

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

# Note: Product is pre-selected in DC current gain (Group A and Group B). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

Figure 3: Safe Operating Area

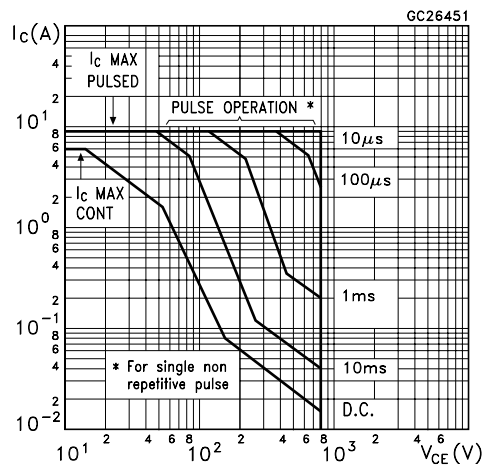


Figure 4: DC Current Gain

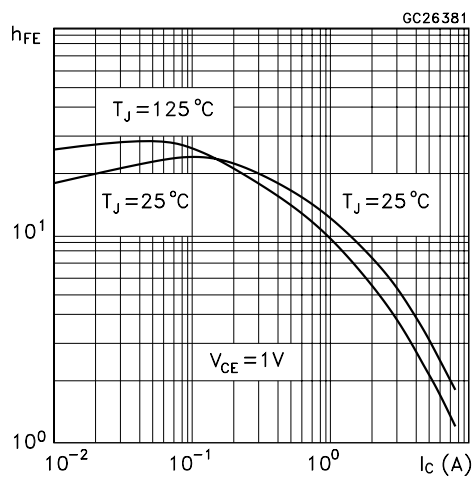


Figure 5: Collector-Emitter Saturation Voltage

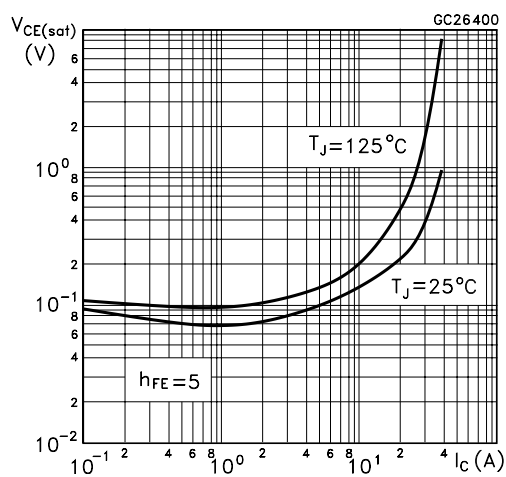


Figure 6: Derating Curve

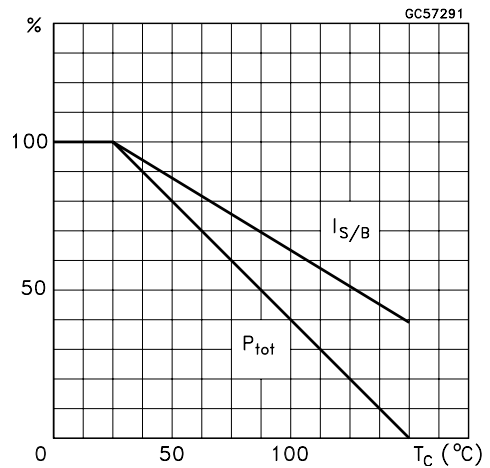


Figure 7: DC Current Gain

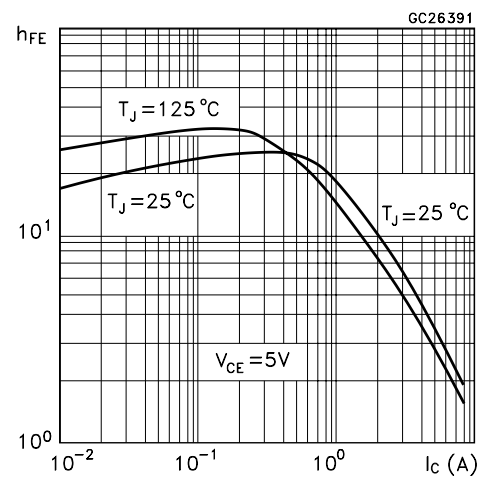


Figure 8: Base-Emitter Saturation Voltage

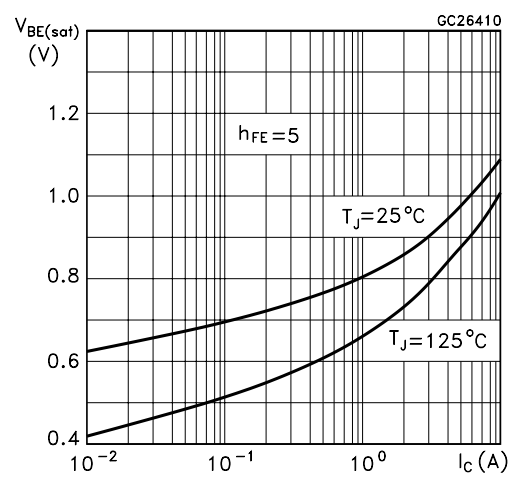


Figure 9: Inductive Load Fall Time

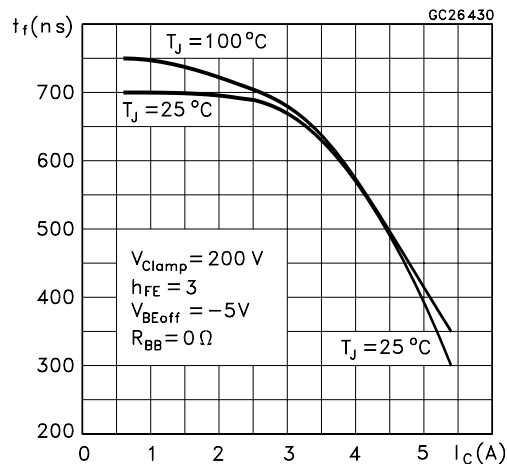


Figure 11: Resistive Load Storage Time

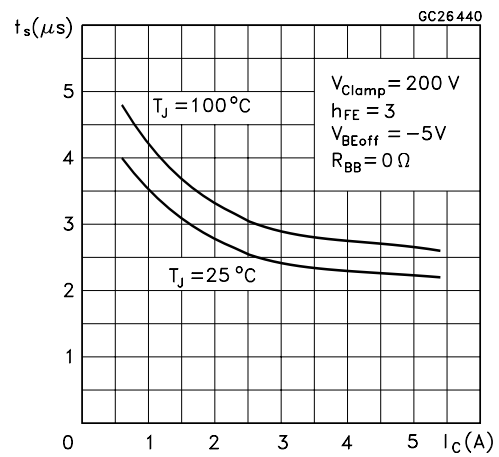


Figure 10: Reverse Biased SOA

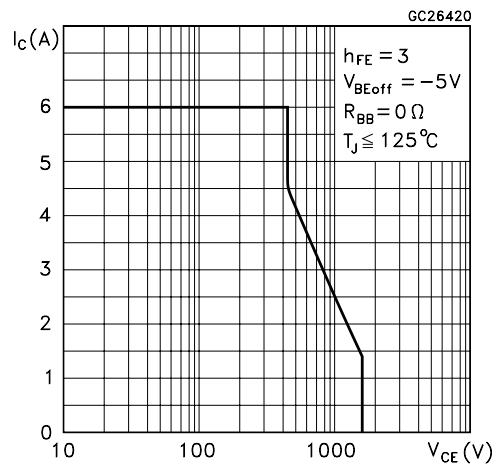
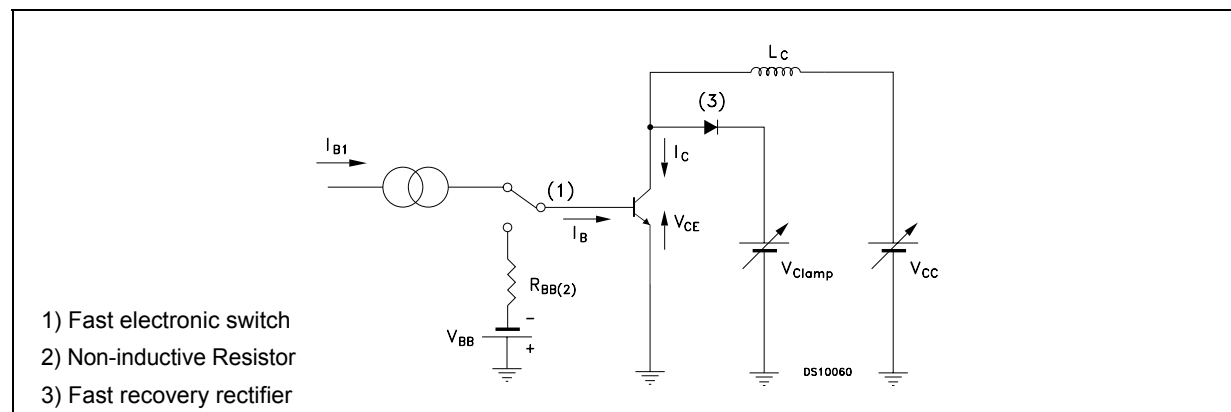
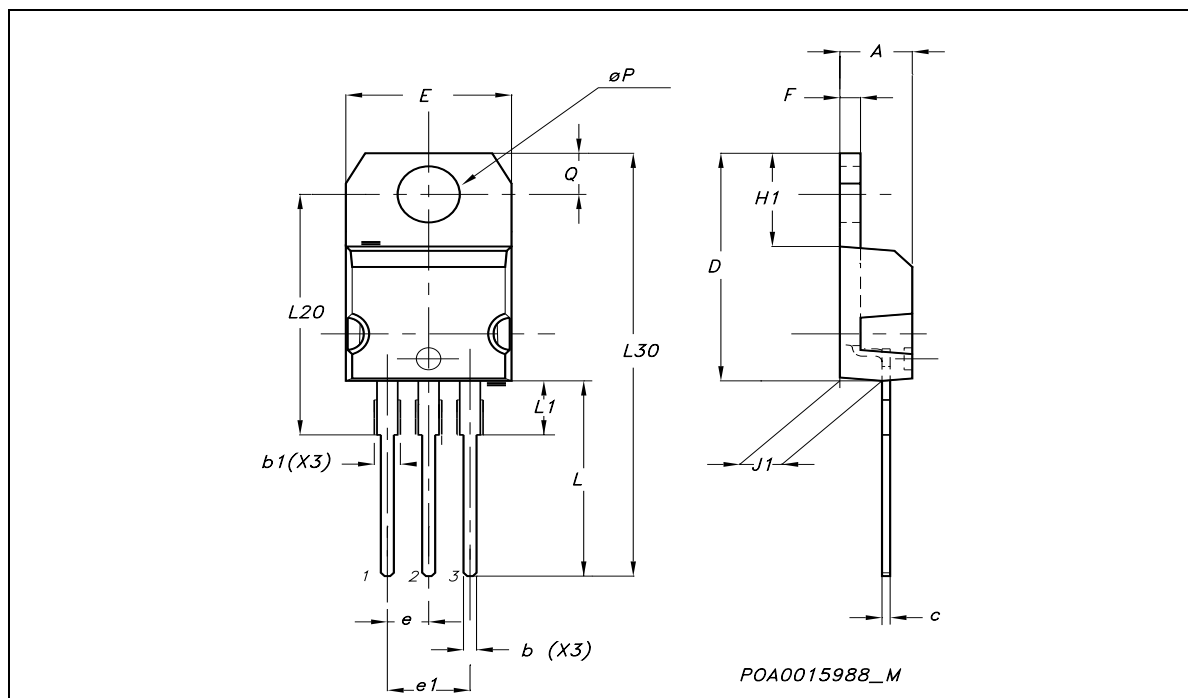


Figure 12: Inductive Load Switching Test Circuit



## 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>
14-Jan-2004	1	First Release.
09-Sep-2004	2	Second Release.
26-Jan-2005	3	Third Release.

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