



**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 CHARACTERIZED AT 125 °C
- n LOW SPREAD OF DYNAMIC PARAMETERS

**APPLICATIONS**

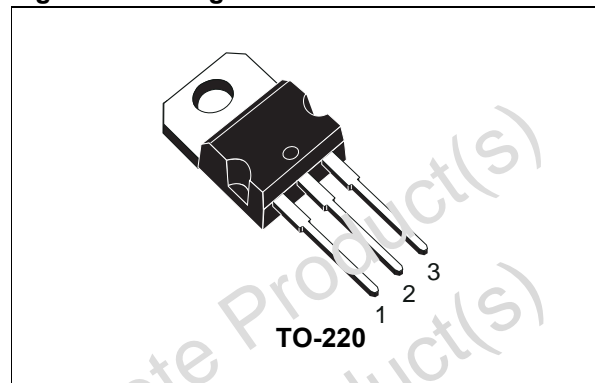
- n ELECTRONIC BALLAST FOR FLUORESCENT LIGHTING
- n SWITCH MODE POWER SUPPLIES

**DESCRIPTION**

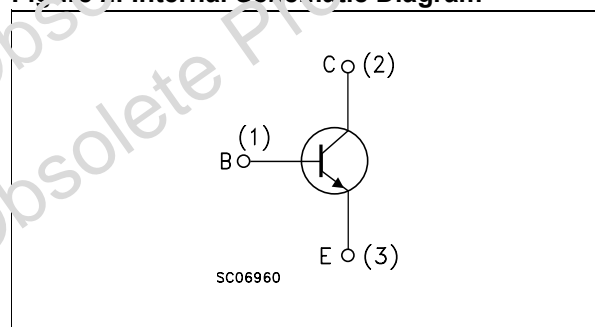
The device is manufactured using high voltage Multi-Epitaxial Mesa technology for cost-effective high performance. It uses a Hollow Emitter structure to enhance switching speeds.

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 ( $I_B = 0$ )	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

## BUL416

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			
		$I_C = 0.7\text{ A}$ $V_{CE} = 5\text{ V}$				
		Group A Group B	12 25		27 40	
$t_s$ $t_f$	INDUCTIVE LOAD Storage time Fall Time	$I_C = 3\text{ A}$ $V_{BE(off)} = -5\text{ V}$ $V_{clamp} = 200\text{ V}$ (see figure 12)			2.3 650	$\mu\text{s}$ ns
		$I_C = 3\text{ A}$ $V_{BE(off)} = -5\text{ V}$ $V_{clamp} = 200\text{ V}$ $T_j = 100\text{ °C}$ (see figure 12)			3 680	$\mu\text{s}$ ns

\* 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

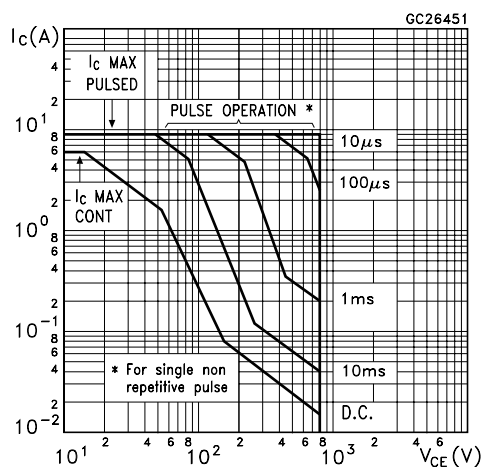


Figure 4: DC Current Gain

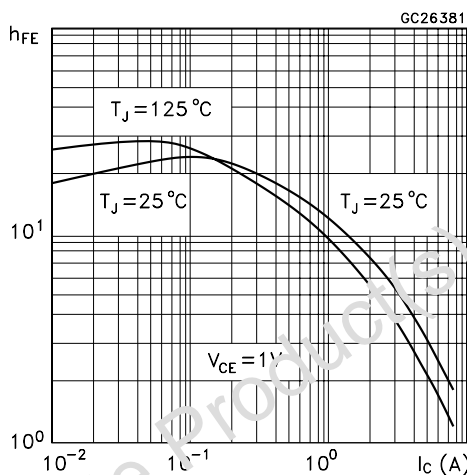


Figure 5: Collector-Emitter Saturation Voltage

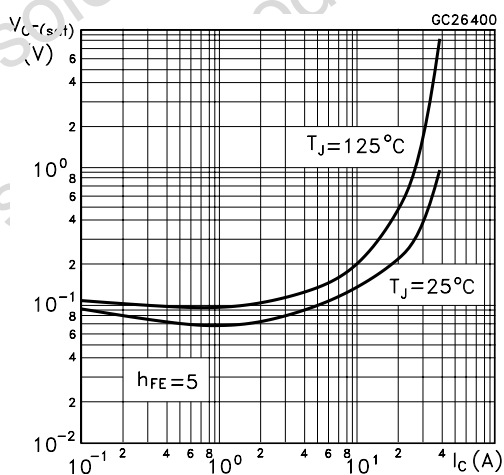


Figure 6: Derating Curve

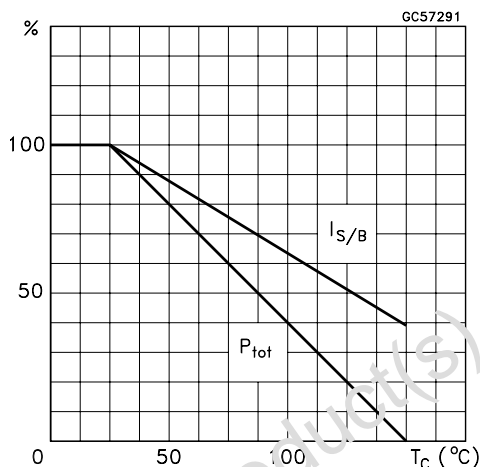


Figure 7: DC Current Gain

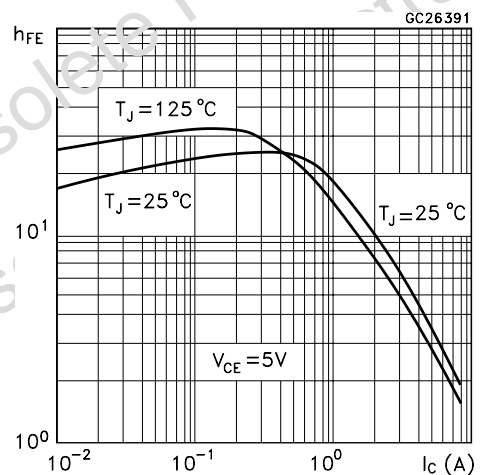


Figure 8: Base-Emitter Saturation Voltage

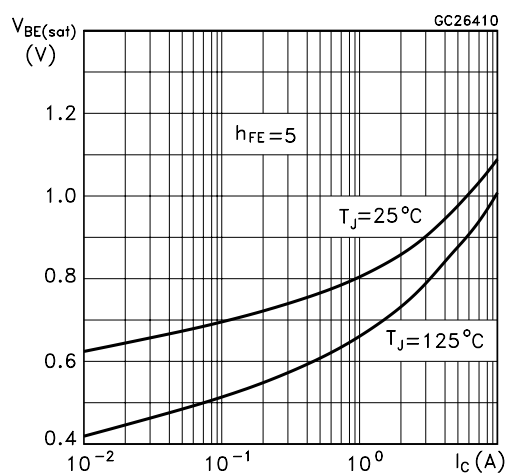


Figure 9: Inductive Load Fall Time

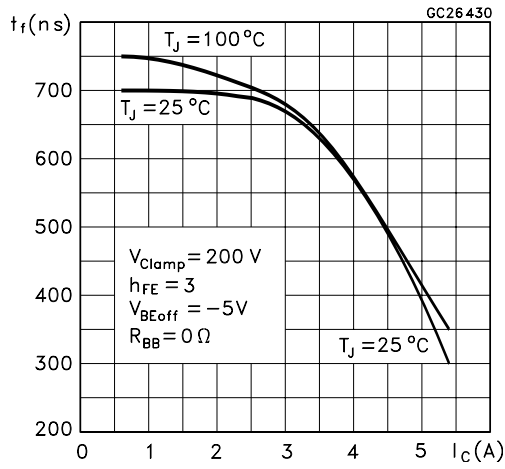


Figure 11: Resistive Load Storage Time

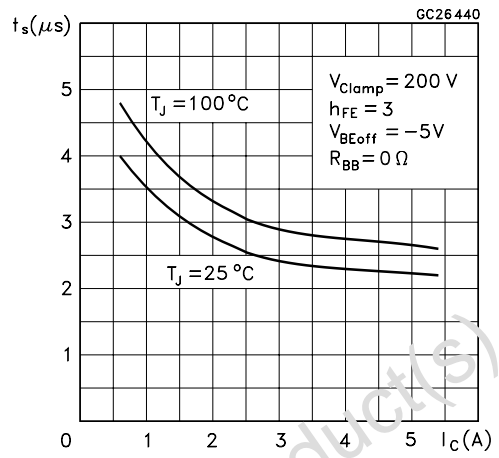
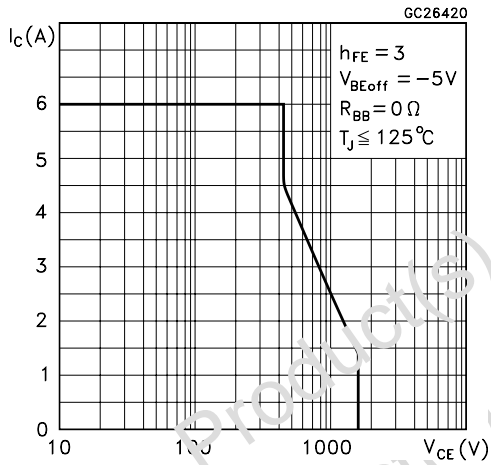
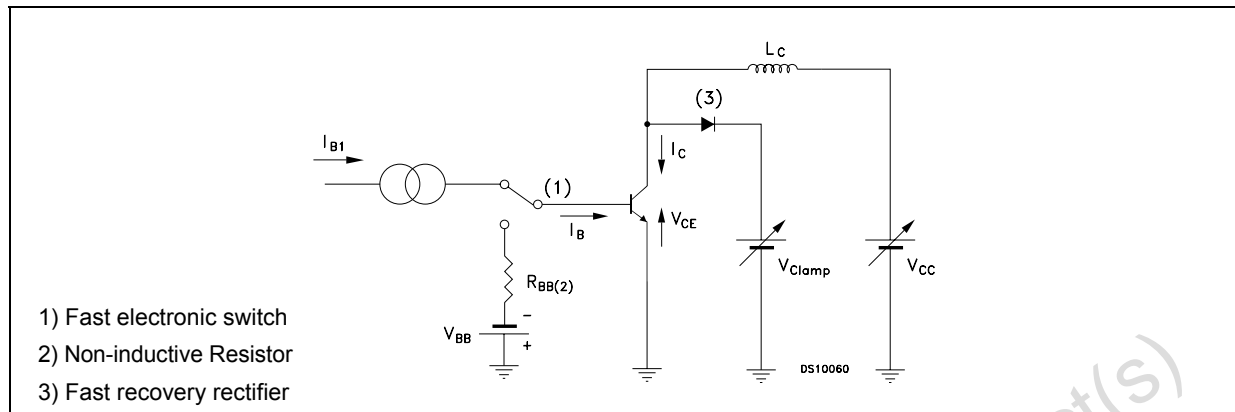


Figure 10: Reverse Biased SOA



Obsolete Product(s) - Obsolete Product(s)  
 Obsolete Product(s) - Obsolete Product(s)

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

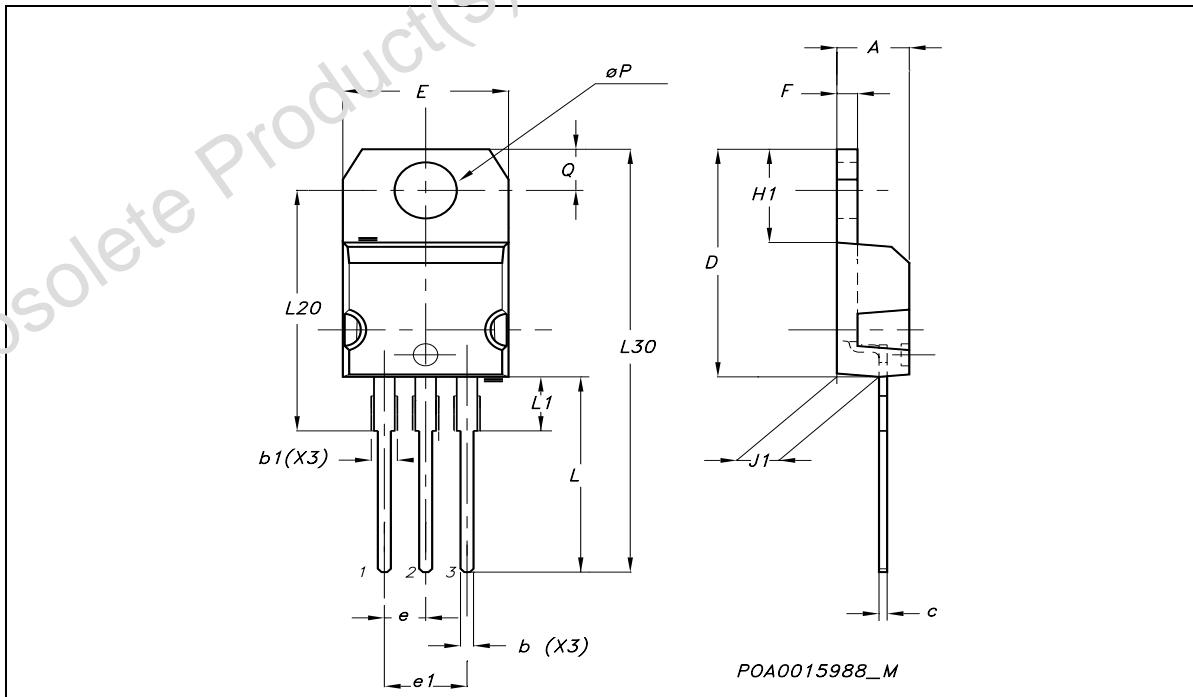


Table 5:

Version	Release Date	Change Designator
14-Jan-2004	1	First Release.
09-Sep-2004	2	Second Release.
26-Jan-2005	3	Third Release.

Obsolete Product(s) - Obsolete Product(s)  
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Obsolete Product(s) - Obsolete Product(s)

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