

### Features

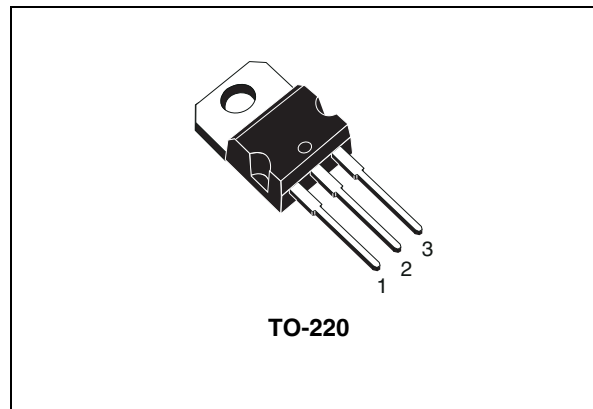
- Integrated antiparallel collector-emitter diode
- High voltage capability
- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

### Application

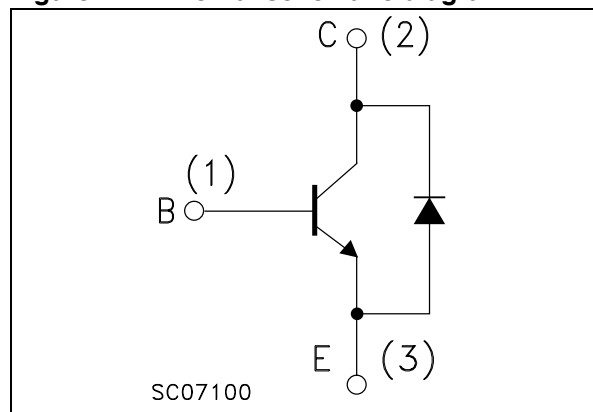
- Electronic transformer for halogen lamp

### Description

The device is manufactured using high voltage multi-epitaxial planar technology for high switching speeds while maintaining the wide RBSOA. The device is designed for use in electronic transformer for halogen lamp.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
BUL39D	BUL39D	TO-220	Tube

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	5
<b>3</b>	<b>Test circuit</b> .....	<b>7</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>8</b>
<b>5</b>	<b>Revision history</b> .....	<b>10</b>

# 1 Electrical ratings

**Table 2. 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 ( $t_P < 5$ ms)	8	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	70	W
$T_{stg}$	Storage temperature	-65 to 150	°C
$T_J$	Max. operating junction temperature	150	°C

**Table 3. Thermal data**

Symbol	Parameter	Max value	Unit
$R_{thj-case}$	Thermal resistance junction - case	1.8	°C/W

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CES}}$	Collector cut-off current ( $V_{\text{BE}} = 0$ )	$V_{\text{CE}} = 850\text{ V}$			100	$\mu\text{A}$
		$V_{\text{CE}} = 850\text{ V}$ $T_{\text{C}} = 125\text{ °C}$			500	$\mu\text{A}$
$I_{\text{EBO}}$	Emitter cut-off current ( $I_{\text{C}} = 0$ )	$V_{\text{EB}} = 9\text{ V}$			100	$\mu\text{A}$
$V_{\text{CEO(sus)}}^{(1)}$	Collector-emitter sustaining voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 100\text{ mA}$	450			V
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$			0.5	V
		$I_{\text{C}} = 2.5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$			1.1	V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$			1.1	V
		$I_{\text{C}} = 2.5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$			1.3	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$	10			
		$I_{\text{C}} = 5\text{ A}$ $V_{\text{CE}} = 10\text{ V}$	4			
$t_{\text{s}}$ $t_{\text{f}}$	Inductive load Storage time	$I_{\text{C}} = 2.5\text{ A}$ $V_{\text{clamp}} = 300\text{ V}$			1.5	$\mu\text{s}$
	Fall time	$I_{\text{B1}} = 0.5\text{ A}$ $V_{\text{BE(off)}} = -5\text{ V}$ $R_{\text{BB}} = 0$ $L = 1\text{ mH}$			0.1	$\mu\text{s}$
$V_{\text{F}}$	Diode forward voltage	$I_{\text{F}} = 2\text{ A}$			1.5	V

1. Pulsed duration = 300 ms, duty cycle  $\leq 1.5\%$

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

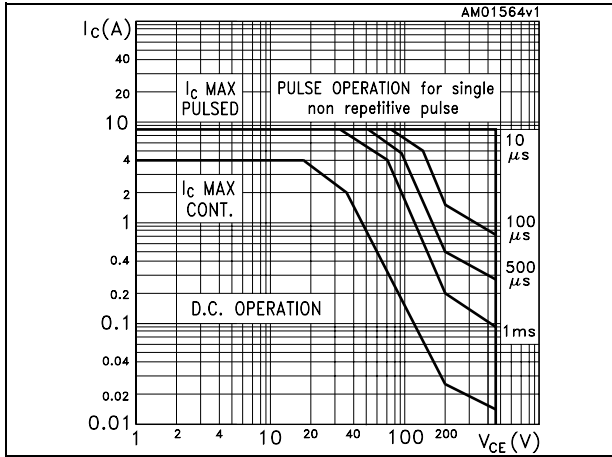


Figure 3. Derating

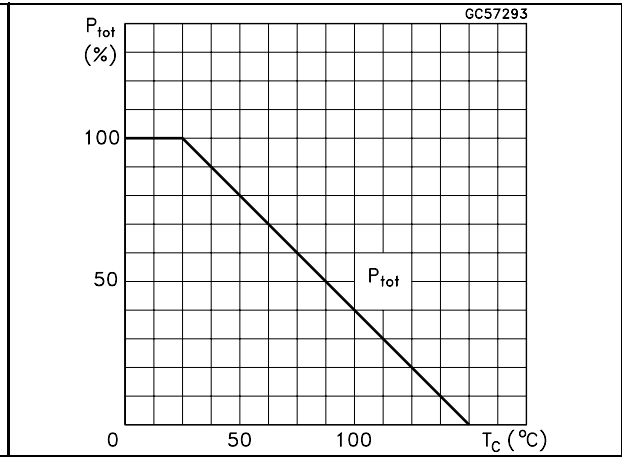


Figure 4. DC current gain (1 V)

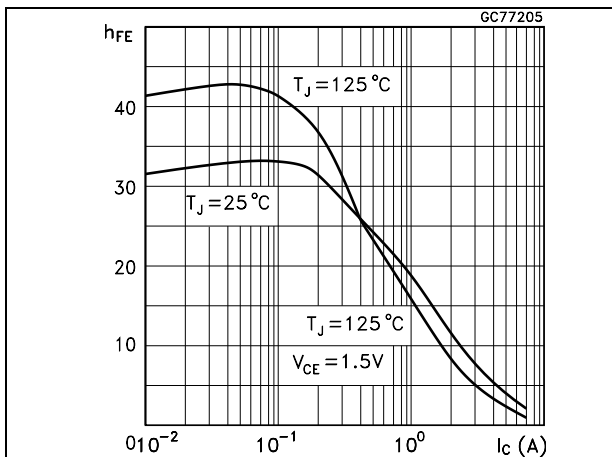


Figure 5. DC current gain (5 V)

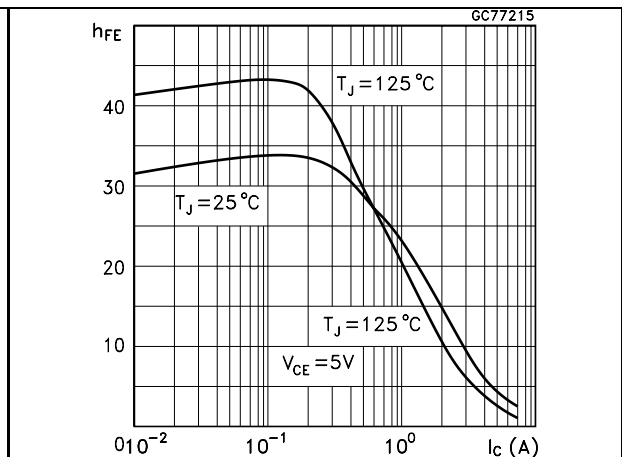


Figure 6. Collector emitter saturation voltage Figure 7. Base emitter saturation voltage

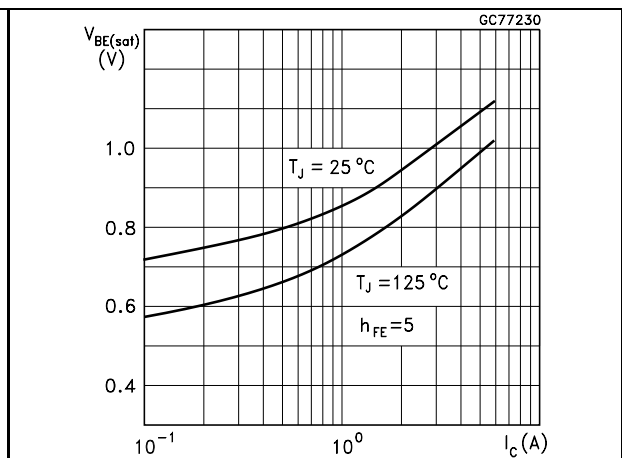
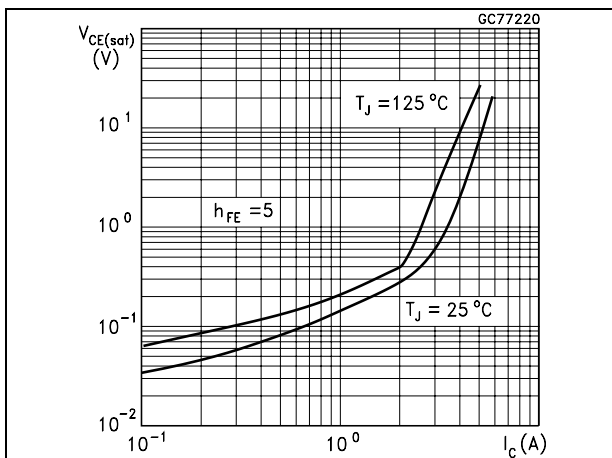


Figure 8. Inductive load fall time

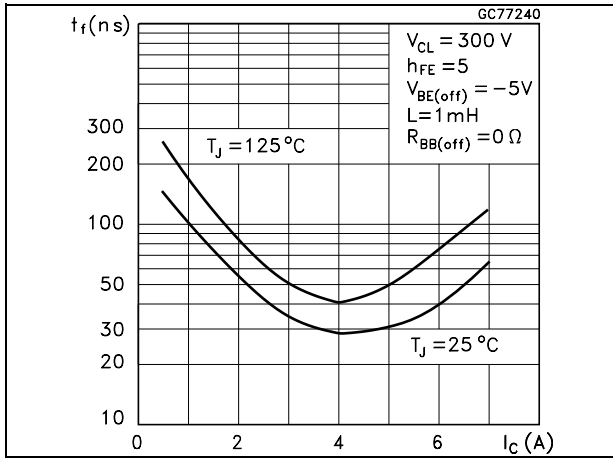


Figure 9. Inductive load storage time

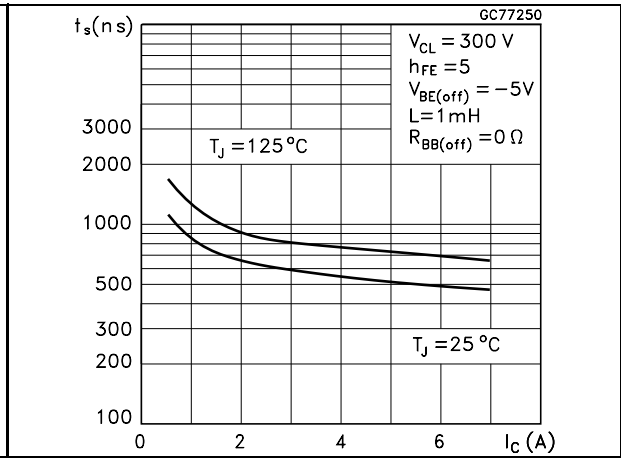
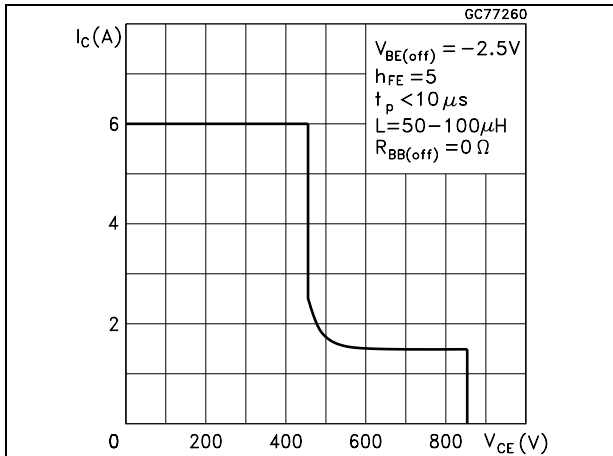
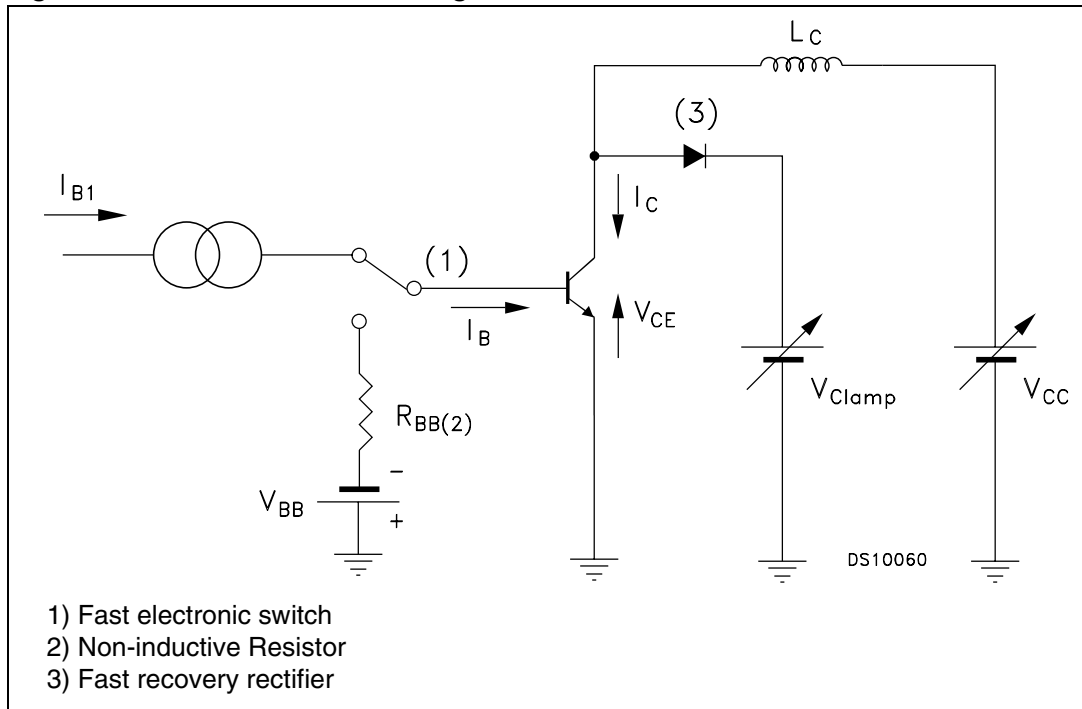


Figure 10. Reverse biased safe operating area



### 3 Test circuit

Figure 11. Inductive load switching test circuit



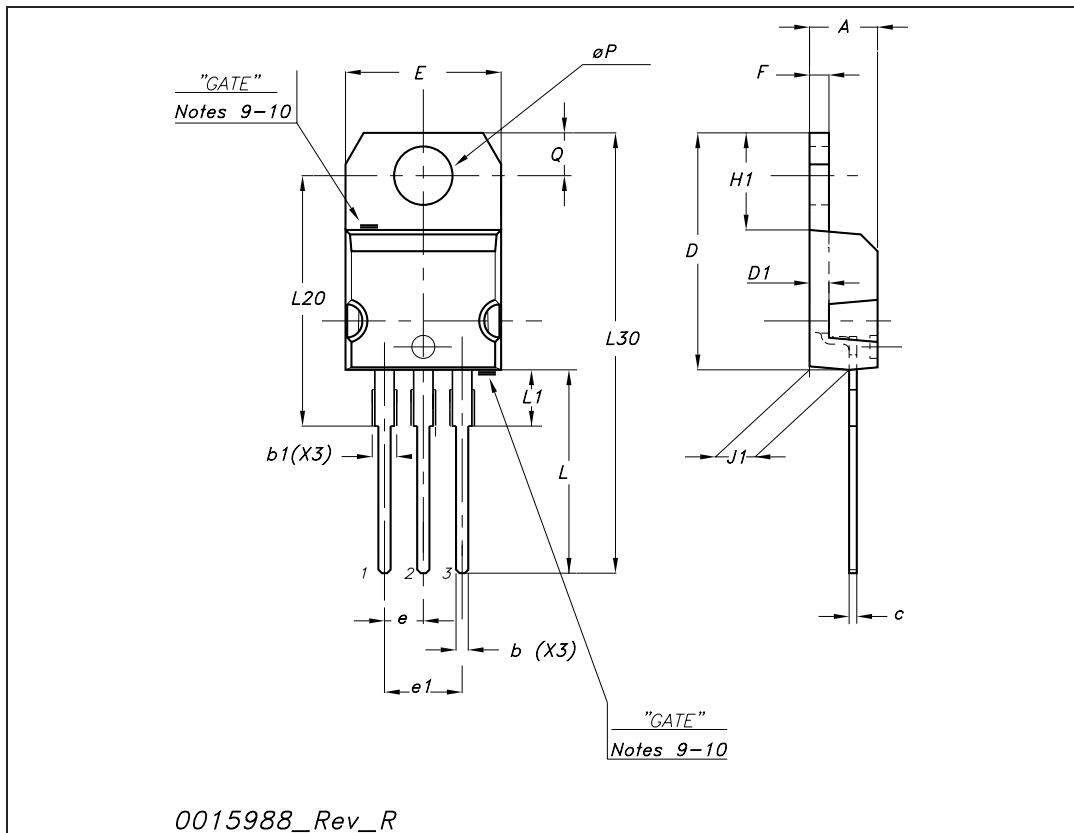
## 4 Package mechanical data

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-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	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
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		0.051
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	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



## 5 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
21-Jun-2004	4	No history because migration
27-Oct-2008	5	Mechanical data updated.

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