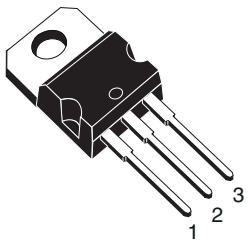
# BUL39D

## High voltage fast-switching NPN power transistor

## 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




TO-220

## 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**

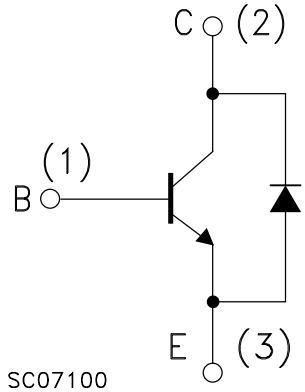



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| BUL39D | BUL39D | TO-220 | Tube |

# Contents

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# 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 |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction - case | 1.8 | °C/W |

# 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CES}$ | Collector cut-off current ($V_{BE}$ = 0) | $V_{CE}$ = 850 V<br>$V_{CE}$ = 850 V $T_C$ = 125 °C | | | 100<br>500 | µA<br>µA |
| $I_{EBO}$ | Emitter cut-off current ($I_C$ = 0) | $V_{EB}$ = 9 V | | | 100 | µA |
| $V_{CEO(sus)}$ (1) | Collector-emitter sustaining voltage ($I_B$ = 0) | $I_C$ =100 mA | 450 | | | V |
| $V_{CE(sat)}$ (1) | Collector-emitter saturation voltage | $I_C$ = 1 A $I_B$ = 0.2 A<br>$I_C$ = 2.5 A $I_B$ = 0.5 A | | | 0.5<br>1.1 | V<br>V |
| $V_{BE(sat)}$ (1) | Base-emitter saturation voltage | $I_C$ = 1 A $I_B$ = 0.2 A<br>$I_C$ = 2.5 A $I_B$ = 0.5 A | | | 1.1<br>1.3 | V<br>V |
| $h_{FE}$ (1) | DC current gain | $I_C$ = 10 mA $V_{CE}$ = 5 V<br>$I_C$ = 5 A $V_{CE}$ = 10 V | 10<br>4 | | | |
| $t_s$<br>$t_f$ | Inductive load<br>Storage time<br>Fall time | $I_C$ = 2.5 A $V_{clamp}$ = 300 V<br>$I_{B1}$ = 0.5 A $V_{BE(off)}$ = -5 V<br>$R_{BB}$ = 0 L=1 mH | | | 1.5<br>0.1 | µs<br>µs |
| $V_F$ | Diode forward voltage | $I_F$ = 2 A | | | 1.5 | V |

1. Pulsed duration = 300 ms, duty cycle ≤ 1.5%

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area**

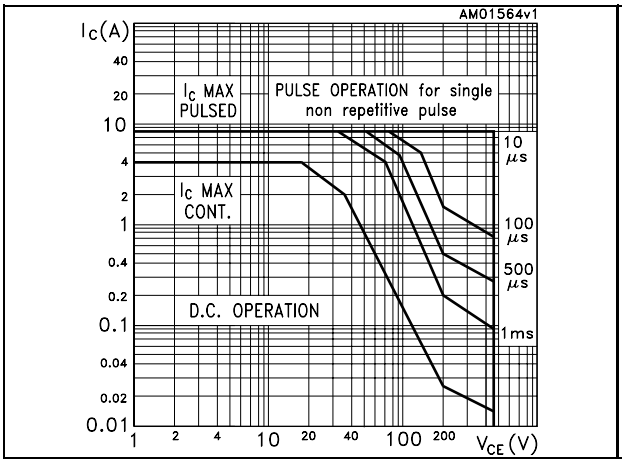



**Figure 3. Derating**

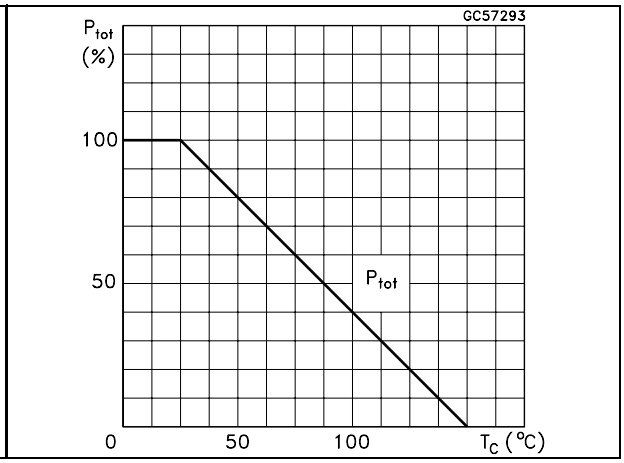



**Figure 4. DC current gain (1 V)**

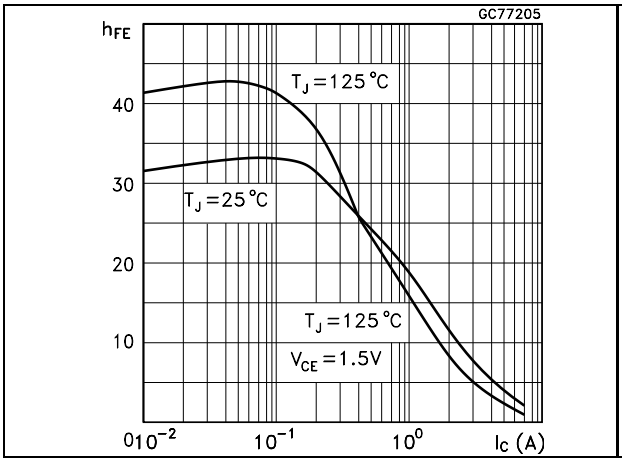



**Figure 5. DC current gain (5 V)**

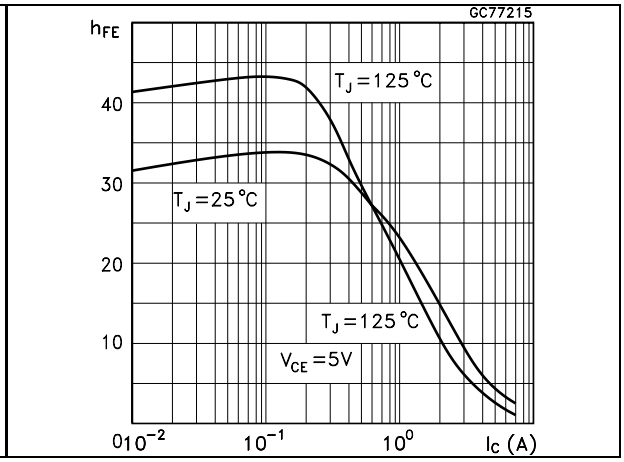



**Figure 6. Collector emitter saturation voltage**

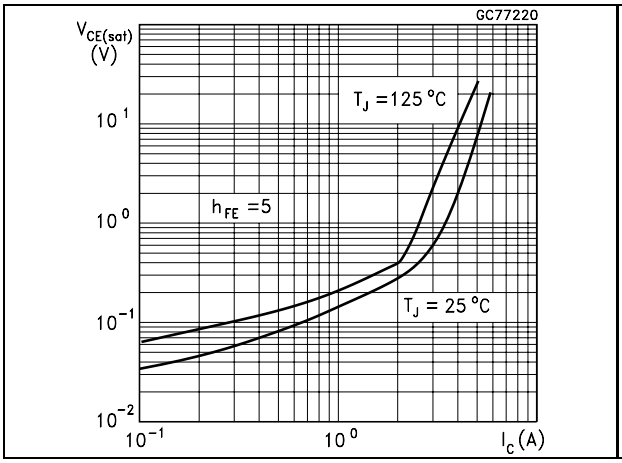



**Figure 7. Base emitter saturation voltage**

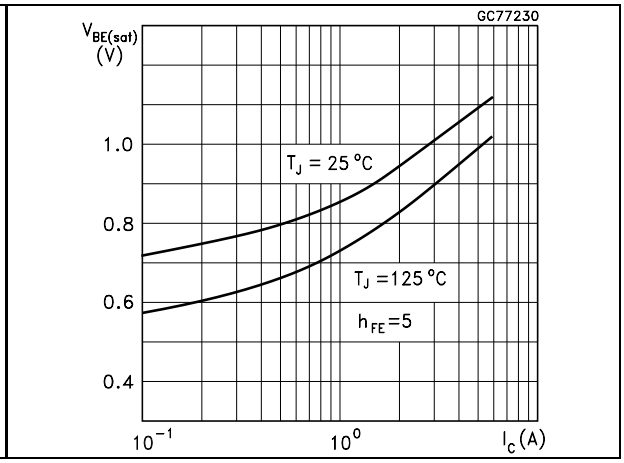


**Figure 8. Inductive load fall time**

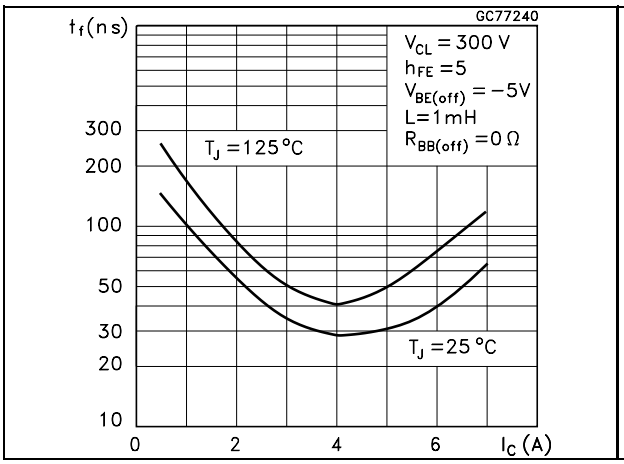



**Figure 9. Inductive load storage time**

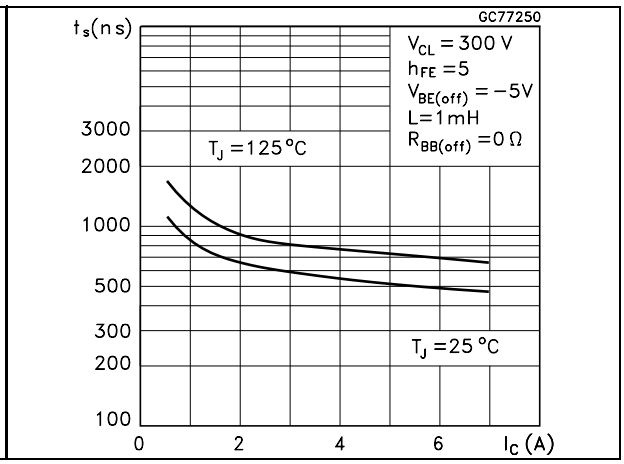
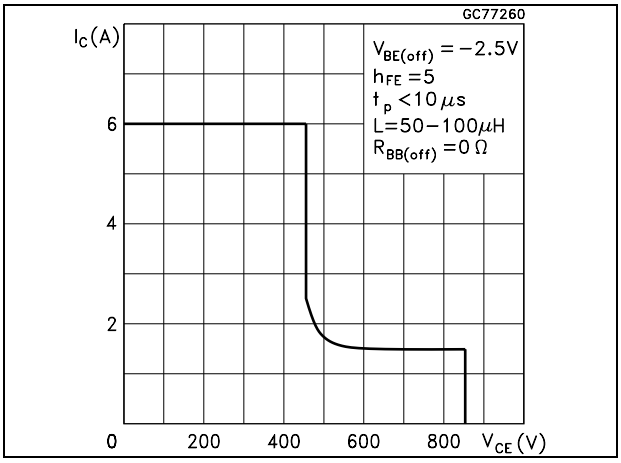
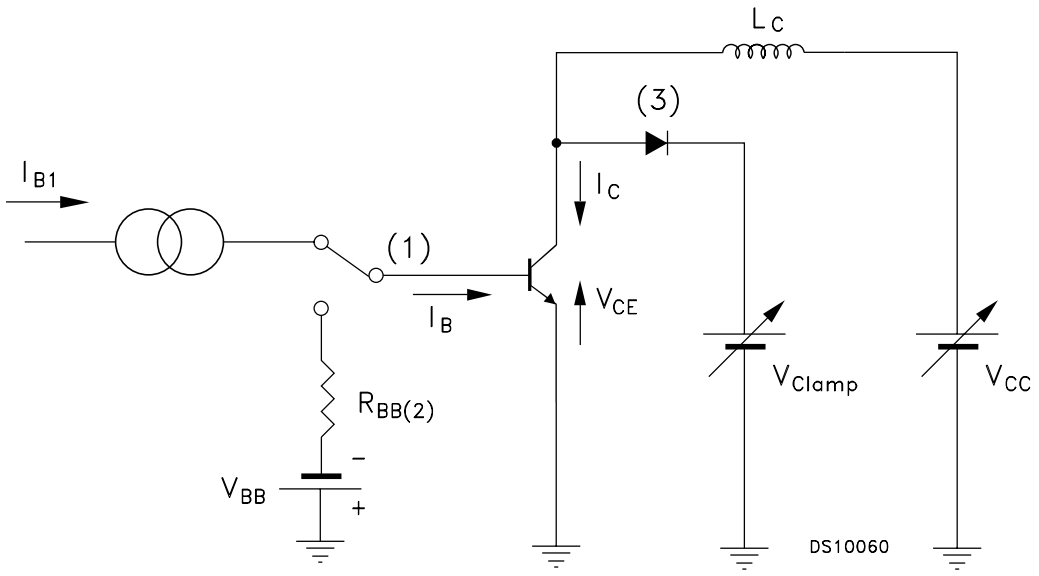



**Figure 10. Reverse biased safe operating area**



# 3 Test circuit

**Figure 11. Inductive load switching test circuit**



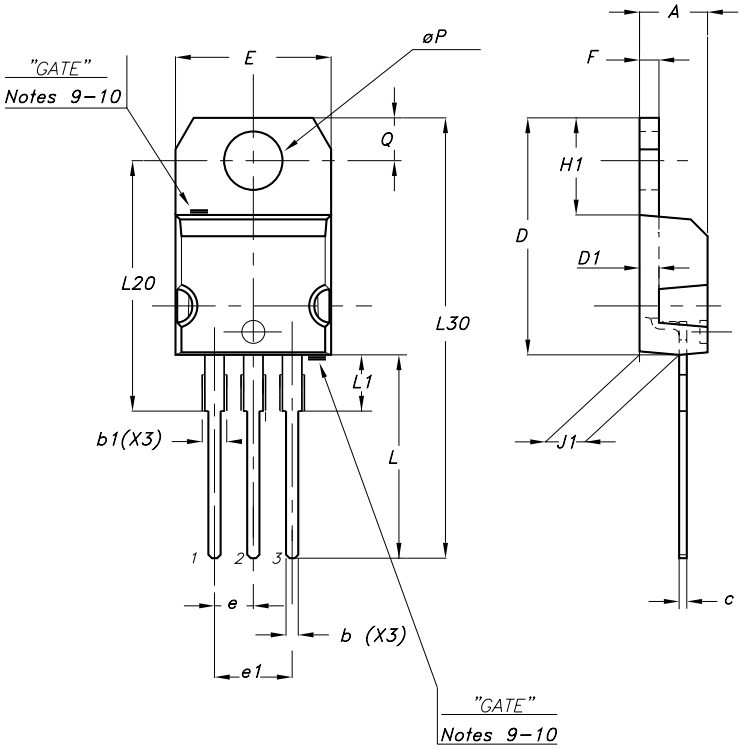

1) Fast electronic switch
2) Non-inductive Resistor
3) Fast recovery rectifier

# 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

## 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 | |
| ØP | 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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