BUL128D-B

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

n STMicroelectronics PREFERRED SALES
TYPE
n NPN TRANSISTOR
n HIGH VOLTAGE CAPABILITY
n LOW SPREAD OF DYNAMIC PARAMETERS
n MINIMUM LOT-TO-LOT SPREAD FOR
RELIABLE OPERATION
n VERY HIGH SWITCHING SPEED
n INTEGRATED ANTIPARALLEL COLLECTOR- EMITTER DIODE

## APPLICATIONS

n ELECTRONIC BALLAST FOR FLUORESCENT LIGHTING
n FLYBACK AND FORWARD SINGLE TRANSISTOR LOW POWER CONVERTERS

## DESCRIPTION

The device is manufactured using high voltage 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.

Figure 1: Package


TO-220

Figure 2: Internal Schematic Diagram


Table 1: Order Codes

| Part Number | Marking | Package | Packaging |
| :---: | :---: | :---: | :---: |
| BUL128D-B | BUL128D-B | TO-220 | Tube |

Table 2: Absolute Maximum Ratings

| Symbol | Parameter | Value | Unit |
| :---: | :--- | :---: | :---: |
| $\mathrm{V}_{\mathrm{CES}}$ | Collector-Emitter Voltage $\left(\mathrm{V}_{\mathrm{BE}}=0\right)$ | 700 | V |
| $\mathrm{~V}_{\mathrm{CEO}}$ | Collector-Emitter Voltage $\left(\mathrm{I}_{\mathrm{B}}=0\right)$ | 400 | V |
| $\mathrm{~V}_{\text {EBO }}$ | Emitter-Base Voltage <br> $\left(\mathrm{I}_{\mathrm{C}}=0, \mathrm{I}_{\mathrm{B}}=2 \mathrm{~A}, \mathrm{t}_{\mathrm{p}}<10 \mu \mathrm{~s}, \mathrm{~T}_{J}=150^{\circ} \mathrm{C}\right)$ | $\mathrm{V}_{(\mathrm{BR}) \text { EBO }}$ | V |
| $\mathrm{I}_{\mathrm{C}}$ | Collector Current |  | 4 |
| $\mathrm{I}_{\mathrm{CM}}$ | Collector Peak Current $\left(\mathrm{t}_{\mathrm{p}}<5 \mathrm{~ms}\right)$ | 8 | A |
| $\mathrm{I}_{\mathrm{B}}$ | Base Current | 2 | A |
| $\mathrm{I}_{\mathrm{BM}}$ | Base Peak Current $\left(\mathrm{t}_{\mathrm{p}}<5 \mathrm{~ms}\right)$ | 4 | A |

BUL128D-B

| Symbol | Parameter | Value | Unit |
| :---: | :--- | :---: | :---: |
| $\mathrm{P}_{\text {tot }}$ | Total Dissipation at $\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}$ | 70 | W |
| $\mathrm{~T}_{\text {stg }}$ | Storage Temperature | -65 to 150 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{T}_{\mathrm{J}}$ | Max. Operating Junction Temperature | 150 | ${ }^{\circ} \mathrm{C}$ |

Table 3: Thermal Data

| $\mathrm{R}_{\text {thj-case }}$ | Thermal Resistance Junction-Case | Max | 1.78 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| :---: | :---: | :---: | :---: | :---: |
| $\mathrm{R}_{\text {thj-amb }}$ | Thermal Resistance Junction-Ambient | Max | 62.5 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |

Table 4: Electrical Characteristics ( $\mathrm{T}_{\text {case }}=25^{\circ} \mathrm{C}$ unless otherwise specified)

| Symbol | Parameter | Test Conditions |  | Min. | Typ. | Max. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $I_{\text {CES }}$ | Collector Cut-off Current $\left(V_{B E}=0 \mathrm{~V}\right)$ | $\begin{aligned} & \mathrm{V}_{\mathrm{CE}}=700 \mathrm{~V} \\ & \mathrm{~V}_{\mathrm{CE}}=700 \mathrm{~V} \end{aligned}$ | $\mathrm{T}_{\mathrm{j}}=125^{\circ} \mathrm{C}$ |  |  | $\begin{aligned} & 100 \\ & 500 \end{aligned}$ | $\mu \mathrm{A}$ $\mu \mathrm{A}$ |
| $\mathrm{I}_{\text {CEO }}$ | Collector Cut-off Current $\left(I_{B}=0\right)$ | $\mathrm{V}_{\text {CE }}=400 \mathrm{~V}$ |  |  |  | 250 | $\mu \mathrm{A}$ |
| $\mathrm{V}_{(\mathrm{BR}) \text { EBO }}$ | Emitter-Base Breakdown Voltage $\left(I_{C}=0\right)$ | $\mathrm{I}_{\mathrm{E}}=10 \mathrm{~mA}$ |  | 9 |  | 18 | V |
| $\mathrm{V}_{\text {CEO(sus) }}{ }^{*}$ | Collector-Emitter Sustaining Voltage $\left(I_{B}=0\right)$ | $\mathrm{I}_{\mathrm{C}}=100 \mathrm{~mA}$ | $\mathrm{L}=25 \mathrm{mH}$ | 400 |  |  | V |
| $\mathrm{V}_{\mathrm{CE} \text { (sat) }}{ }^{\text {* }}$ | Collector-Emitter Saturation Voltage | $\begin{aligned} & \mathrm{I}_{\mathrm{C}}=0.5 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{C}}=1 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{C}}=2.5 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{C}}=4 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & \mathrm{I}_{\mathrm{B}}=0.1 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{B}}=0.2 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{B}}=0.5 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{B}}=1 \mathrm{~A} \end{aligned}$ |  | 0.5 | $\begin{gathered} 0.7 \\ 1 \\ 1.5 \end{gathered}$ | $\begin{aligned} & \mathrm{V} \\ & \mathrm{~V} \\ & \mathrm{~V} \\ & \mathrm{~V} \end{aligned}$ |
| $\mathrm{V}_{\mathrm{BE} \text { (sat) }}{ }^{\text {* }}$ | Base-Emitter Saturation Voltage | $\begin{aligned} & \mathrm{I}_{\mathrm{C}}=0.5 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{C}}=1 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{C}}=2.5 \mathrm{~A} \end{aligned}$ | $\begin{aligned} \mathrm{I}_{\mathrm{B}} & =0.1 \mathrm{~A} \\ \mathrm{I}_{\mathrm{B}} & =0.2 \mathrm{~A} \\ \mathrm{I}_{\mathrm{B}} & =0.5 \mathrm{~A} \end{aligned}$ |  |  | $\begin{aligned} & 1.1 \\ & 1.2 \\ & 1.3 \end{aligned}$ | $\begin{aligned} & \mathrm{V} \\ & \mathrm{~V} \\ & \mathrm{~V} \end{aligned}$ |
| $\mathrm{h}_{\text {FE }}{ }^{*}$ | DC Current Gain | $\begin{aligned} & \mathrm{I}_{\mathrm{C}}=10 \mathrm{~mA} \\ & \mathrm{I}_{\mathrm{C}}=2 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & \mathrm{V}_{\mathrm{CE}}=5 \mathrm{~V} \\ & \mathrm{~V}_{\mathrm{CE}}=5 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 10 \\ & 12 \end{aligned}$ |  | 32 |  |
| $\begin{aligned} & \mathrm{t}_{\mathrm{s}} \\ & \mathrm{t}_{\mathrm{f}} \end{aligned}$ | RESISTIVE LOAD <br> Storage Time <br> Fall Time | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=200 \mathrm{~V} \\ & \mathrm{I}_{\mathrm{B} 1}=0.4 \mathrm{~A} \\ & \mathrm{R}_{\mathrm{BB}}=0 \Omega \\ & \text { (see figure 15) } \end{aligned}$ | $\begin{aligned} & I_{C}=2 \mathrm{~A} \\ & V_{B E(\text { off })}=-5 \mathrm{~V} \\ & L=200 \mu \mathrm{H} \end{aligned}$ |  | $\begin{aligned} & 0.6 \\ & 0.1 \end{aligned}$ |  | $\begin{aligned} & \mu \mathrm{s} \\ & \mu \mathrm{~s} \end{aligned}$ |
| $\mathrm{t}_{\mathrm{s}}$ | INDUCTIVE LOAD <br> Storage Time <br> Fall Time | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=250 \mathrm{~V} \\ & \mathrm{I}_{\mathrm{B} 1}=0.4 \mathrm{~A} \\ & \mathrm{Tp}=30 \mu \mathrm{~s} \end{aligned}$ | $\begin{aligned} & \mathrm{I}_{\mathrm{C}}=2 \mathrm{~A} \\ & \mathrm{I}_{\mathrm{B} 2}=-0.4 \mathrm{~A} \end{aligned}$ <br> (see figure 14) | 2 | 0.2 | 2.9 |  |

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

Figure 3: Safe Operating Area


Figure 4: DC Current Gain


Figure 5: Collector-Emitter Saturation Voltage


Figure 6: Derating Current


Figure 7: DC Current Gain


Figure 8: Base-Emitter Saturation Voltage


Figure 9: Inductive Load Fall Time


Figure 10: Resistive Load Fall Time


Figure 11: Reverse Biased Operating Area


Figure 12: Inductive Load Stoarage Time


Figure 13: Resistive Load Stoarage Time


Figure 14: Inductive Load Switching Test Circuit


Table 15: Restistive 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 |  | 2.72 | 0.094 |  | 0.107 |
| J1 | 2.40 |  | 14 | 0.511 |  | 0.551 |
| L | 13 |  | 3.93 | 0.137 |  | 0.154 |
| L1 | 3.50 |  |  |  | 0.645 |  |
| L20 |  |  |  |  |  |  |
| L30 |  |  | 28.90 |  |  |  |
| ØP | 3.75 |  |  |  | 0.135 |  |
| Q | 2.65 |  |  | 0.104 |  | 0.151 |



## Table 5:

| Version | Release Date | Change Designator |
| :---: | :---: | :--- |
| $01-$ Oct-2002 | 1 | First Release. |
| 15-Feb-2005 | 1 | Added table 1 on page 1. |

BUL128D-B

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a registered trademark of STMicroelectronics
All other names are the property of their respective owners
© 2005 STMicroelectronics - All Rights Reserved

STMicroelectronics group of companies
Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America www.st.com

## Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery \& Lifecycle Information:

STMicroelectronics:
BUL128D-B

