



# BUH515D

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- STMicroelectronics PREFERRED SALESTYPE
- HIGH VOLTAGE CAPABILITY
- U.L. RECOGNISED ISOWATT218 PACKAGE (U.L. FILE # E81734 (N))
- NPN TRANSISTOR WITH INTEGRATED FREEWHEELING DIODE

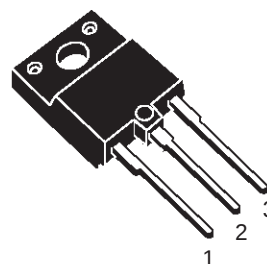
### APPLICATIONS:

- HORIZONTAL DEFLECTION FOR COLOUR TV

### DESCRIPTION

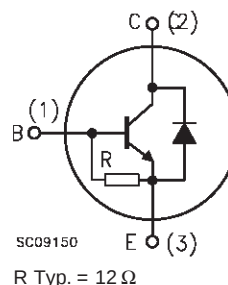
The BUH515D is manufactured using Multiepitaxial Mesa technology for cost-effective high performance and uses a Hollow Emitter structure to enhance switching speeds.

The BUH series is designed for use in horizontal deflection circuits in televisions and monitors.



ISOWATT218

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol    | Parameter                               | Value      | Unit |
|-----------|-----------------------------------------|------------|------|
| $V_{CBO}$ | Collector-Base Voltage ( $I_E = 0$ )    | 1500       | V    |
| $V_{CEO}$ | Collector-Emitter Voltage ( $I_B = 0$ ) | 700        | V    |
| $V_{EBO}$ | Emitter-Base Voltage ( $I_C = 0$ )      | 5          | V    |
| $I_C$     | Collector Current                       | 8          | A    |
| $I_{CM}$  | Collector Peak Current ( $t_p < 5$ ms)  | 15         | A    |
| $I_B$     | Base Current                            | 5          | A    |
| $I_{BM}$  | Base Peak Current ( $t_p < 5$ ms)       | 8          | A    |
| $P_{tot}$ | Total Dissipation at $T_c = 25$ °C      | 50         | W    |
| $T_{stg}$ | Storage Temperature                     | -65 to 150 | °C   |
| $T_j$     | Max. Operating Junction Temperature     | 150        | °C   |

THERMAL DATA

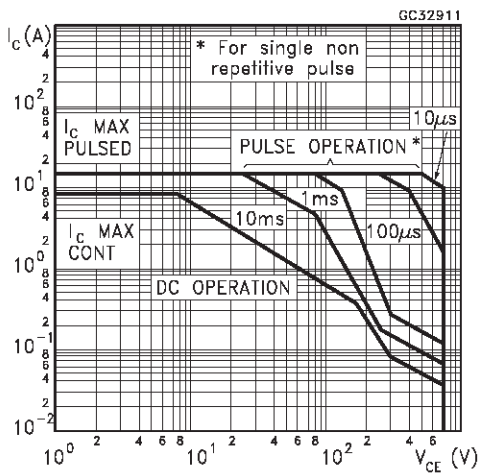
|                       |                                  |     |     |      |
|-----------------------|----------------------------------|-----|-----|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case | Max | 2.5 | °C/W |
|-----------------------|----------------------------------|-----|-----|------|

ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

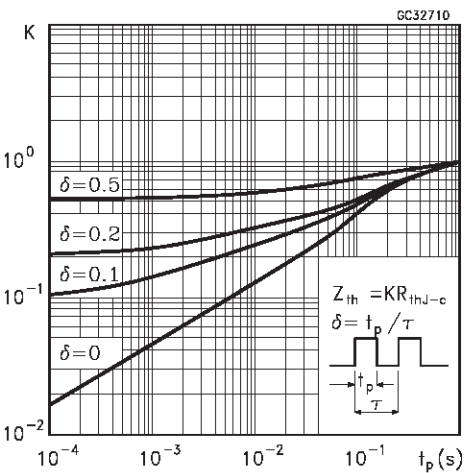
| Symbol                           | Parameter                                       | Test Conditions                                                                                                                                        | Min.   | Typ.       | Max.           | Unit           |
|----------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------|----------------|----------------|
| I <sub>CES</sub>                 | Collector Cut-off Current (V <sub>BE</sub> = 0) | V <sub>CE</sub> = 1300 V<br>V <sub>CE</sub> = 1500 V<br>V <sub>CE</sub> = 1500 V T <sub>j</sub> = 125 °C                                               |        |            | 10<br>0.2<br>2 | μA<br>mA<br>mA |
| I <sub>EBO</sub>                 | Emitter Cut-off Current (I <sub>C</sub> = 0)    | V <sub>EB</sub> = 5 V                                                                                                                                  |        |            | 200            | mA             |
| V <sub>CE(sat)*</sub>            | Collector-Emitter Saturation Voltage            | I <sub>C</sub> = 5 A I <sub>B</sub> = 1.25 A                                                                                                           |        |            | 1.5            | V              |
| V <sub>BE(sat)*</sub>            | Base-Emitter Saturation Voltage                 | I <sub>C</sub> = 5 A I <sub>B</sub> = 1.25 A                                                                                                           |        |            | 1.3            | V              |
| h <sub>FE*</sub>                 | DC Current Gain                                 | I <sub>C</sub> = 5 A V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 5 A V <sub>CE</sub> = 5 V T <sub>j</sub> = 100 °C                                       | 5<br>3 |            | 10             |                |
| t <sub>s</sub><br>t <sub>f</sub> | RESISTIVE LOAD<br>Storage Time<br>Fall Time     | V <sub>CC</sub> = 400 V I <sub>C</sub> = 5 A<br>I <sub>B1</sub> = 1.5 A I <sub>B2</sub> = -2.5 A                                                       |        | 2.4<br>170 | 3.6<br>260     | μs<br>ns       |
| t <sub>s</sub><br>t <sub>f</sub> | INDUCTIVE LOAD<br>Storage Time<br>Fall Time     | I <sub>C</sub> = 5 A f = 15625 Hz<br>I <sub>B1</sub> = 1.25 A I <sub>B2</sub> = -2.5 A<br>V <sub>ceflyback</sub> = 1050 sin(π/10 10 <sup>6</sup> ) t V |        | 3.5<br>450 |                | μs<br>ns       |
| V <sub>F</sub>                   | Diode Forward Voltage                           | I <sub>F</sub> = 5 A                                                                                                                                   |        |            | 2              | V              |

\* Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %

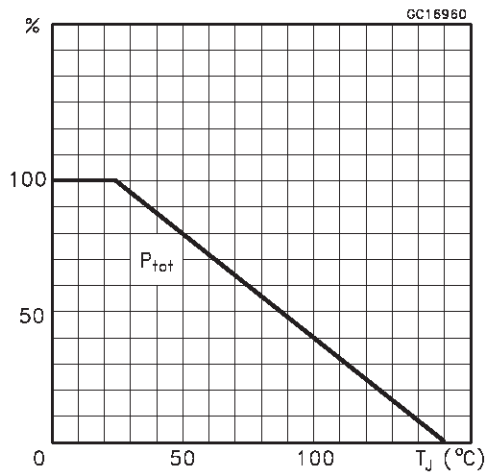
Safe Operating Area



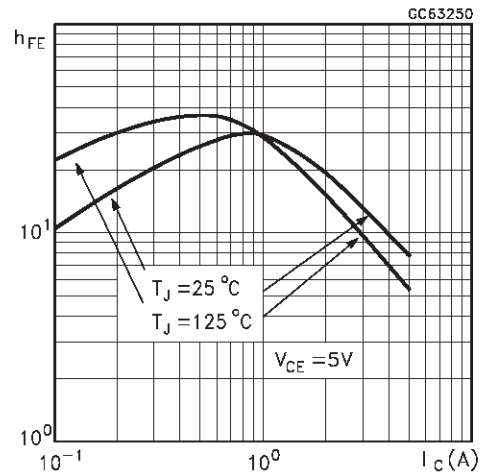
Thermal Impedance



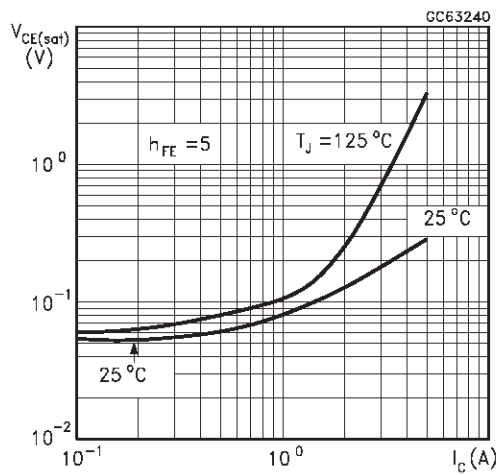
Derating Curve



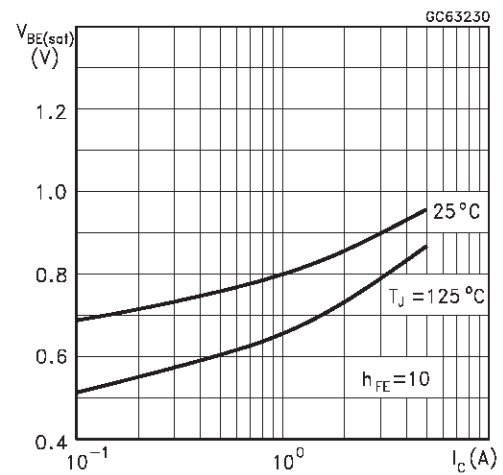
DC Current Gain



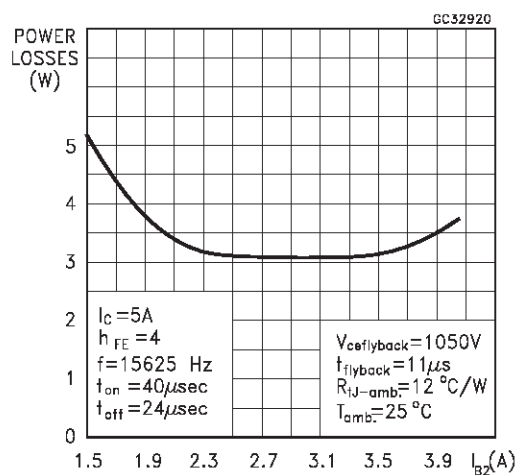
Collector Emitter Saturation Voltage



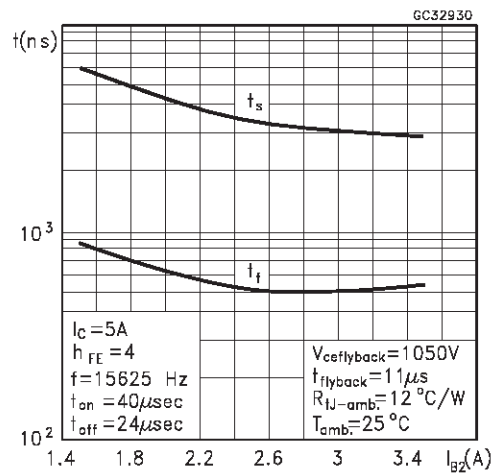
Base Emitter Saturation Voltage



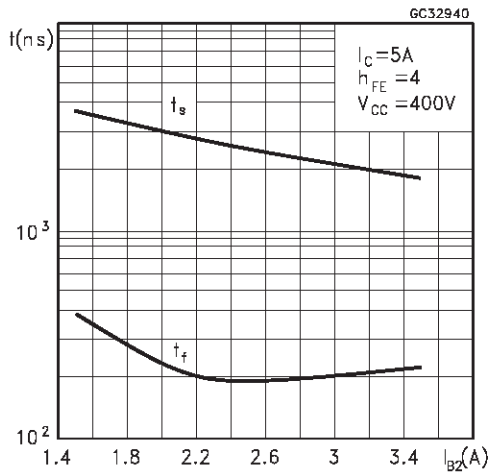
Power Losses at 16 KHz



Switching Time Inductive Load at 16KHz  
(see figure 2)



# Switching Time Resistive Load



## BASE DRIVE INFORMATION

In order to saturate the power switch and reduce conduction losses, adequate direct base current  $I_{B1}$  has to be provided for the lowest gain  $h_{FE}$  at 100 °C (line scan phase). On the other hand, negative base current  $I_{B2}$  must be provided to turn off the power transistor (retrace phase). Most of the dissipation, especially in the deflection application, occurs at switch-off. Therefore it is essential to determine the value of  $I_{B2}$  which minimizes power losses, fall time  $t_f$  and, consequently,  $T_j$ . A new set of curves have been defined to give total power losses,  $t_s$  and  $t_f$  as a function of  $I_{B2}$  at 16 KHz frequencies for choosing the optimum negative drive. The test circuit is illustrated in fig. 1.

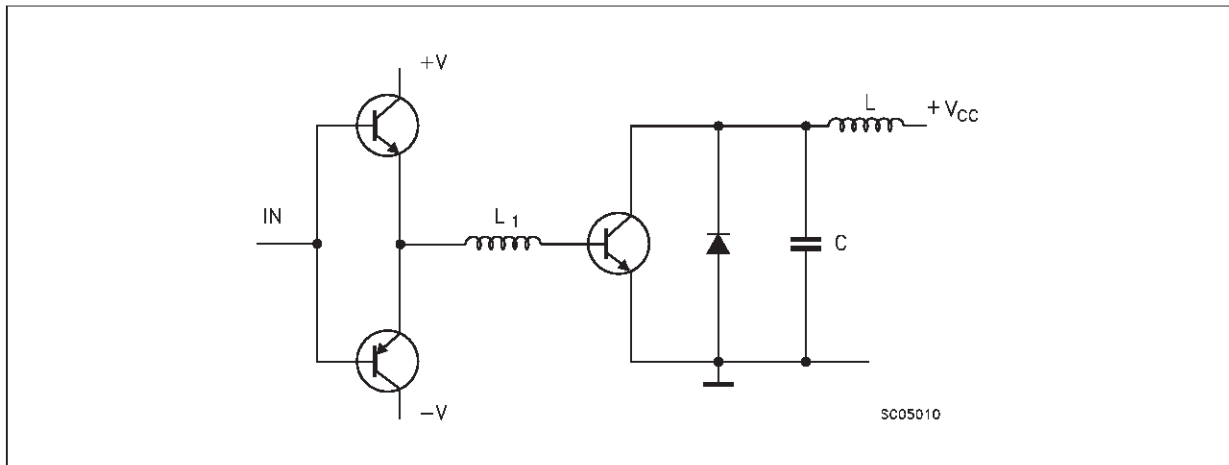
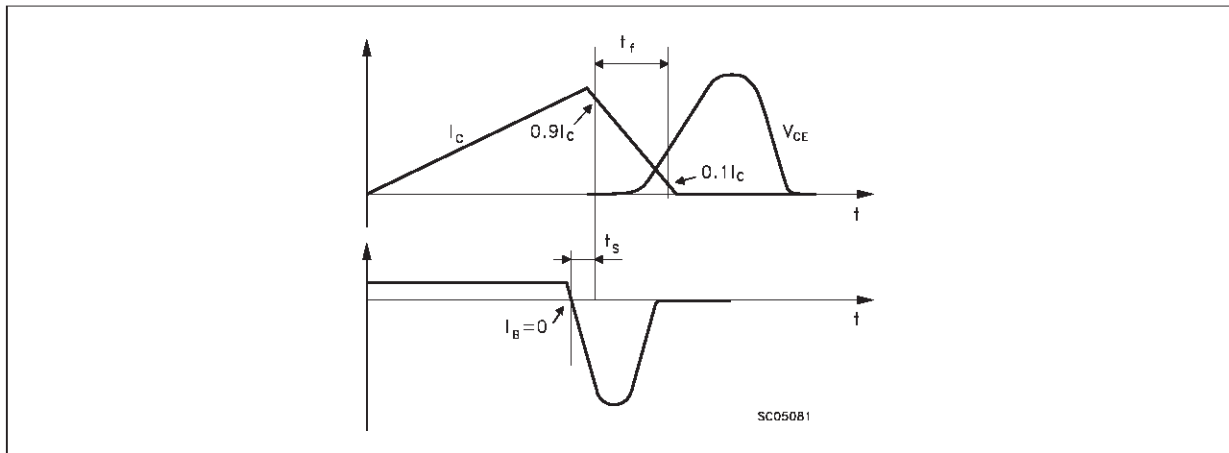
Inductance  $L_1$  serves to control the slope of the negative base current  $I_{B2}$  to recombine the excess carrier in the collector when base current is still present, this avoid any tailing phenomenon in the collector current.

The values of  $L$  and  $C$  are calculated from the following equations:

$$\frac{1}{2} L (I_C)^2 = \frac{1}{2} C (V_{CEfly})^2$$

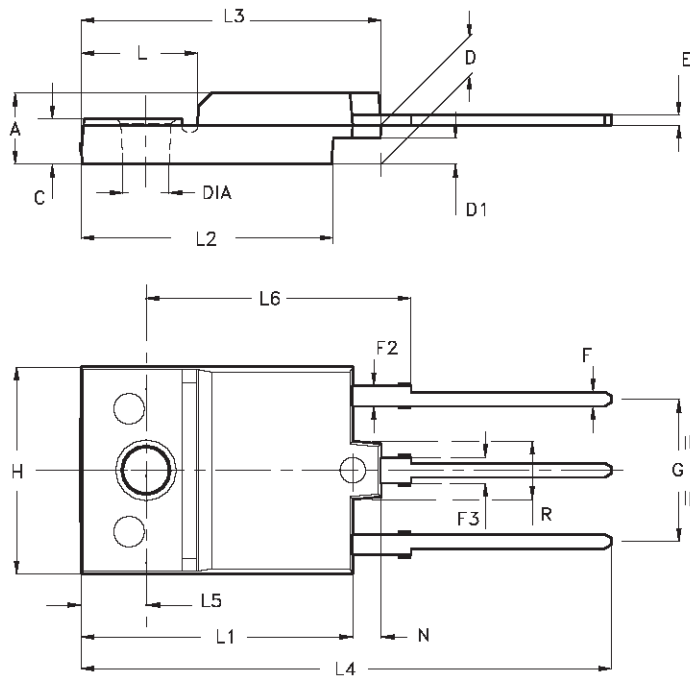
$$\omega = 2 \pi f = \frac{1}{\sqrt{L C}}$$

Where  $I_C$ = operating collector current,  $V_{CEfly}$ = flyback voltage,  $f$ = frequency of oscillation during retrace.

**Figure 1:** Inductive Load Switching Test Circuit**Figure 2:** Switching Waveforms in a Deflection Circuit

ISOWATT218 MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 5.35  |      | 5.65  | 0.211 |       | 0.222 |
| C    | 3.30  |      | 3.80  | 0.130 |       | 0.150 |
| D    | 2.90  |      | 3.10  | 0.114 |       | 0.122 |
| D1   | 1.88  |      | 2.08  | 0.074 |       | 0.082 |
| E    | 0.75  |      | 0.95  | 0.030 |       | 0.037 |
| F    | 1.05  |      | 1.25  | 0.041 |       | 0.049 |
| F2   | 1.50  |      | 1.70  | 0.059 |       | 0.067 |
| F3   | 1.90  |      | 2.10  | 0.075 |       | 0.083 |
| G    | 10.80 |      | 11.20 | 0.425 |       | 0.441 |
| H    | 15.80 |      | 16.20 | 0.622 |       | 0.638 |
| L    |       | 9    |       |       | 0.354 |       |
| L1   | 20.80 |      | 21.20 | 0.819 |       | 0.835 |
| L2   | 19.10 |      | 19.90 | 0.752 |       | 0.783 |
| L3   | 22.80 |      | 23.60 | 0.898 |       | 0.929 |
| L4   | 40.50 |      | 42.50 | 1.594 |       | 1.673 |
| L5   | 4.85  |      | 5.25  | 0.191 |       | 0.207 |
| L6   | 20.25 |      | 20.75 | 0.797 |       | 0.817 |
| N    | 2.1   |      | 2.3   | 0.083 |       | 0.091 |
| R    |       | 4.6  |       |       | 0.181 |       |
| DIA  | 3.5   |      | 3.7   | 0.138 |       | 0.146 |



- Weight : 4.9 g (typ.)
- Maximum Torque (applied to mounting flange) Recommended 0.8 Nm; Maximum: 1 Nm
- The side of the dissipator must be flat within 80  $\mu$ m

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