# ⚡ SGS-THOMSON
## MICROELECTRONICS

# BUH615

# HIGH VOLTAGE FASTSWITCHING NPN
# POWER TRANSISTOR

- SGS-THOMSON PREFERRED SALESTYPE
- HIGH VOLTAGE CAPABILITY
- U.L. RECOGNISED ISOWATT218 PACKAGE
  (U.L. FILE # E81734 (N))

**APPLICATIONS:**
- HORIZONTAL DEFLECTION FOR COLOUR
  TVS AND MONITORS

**DESCRIPTION**
The BUH615 is manufactured using Multiepitaxial
Mesa technology for cost-effective high
performance.
The BUH series is designed for use in horizontal
deflection circuits in televisions and monitors.



**ISOWATT218**



**INTERNAL SCHEMATIC DIAGRAM**

SC06960
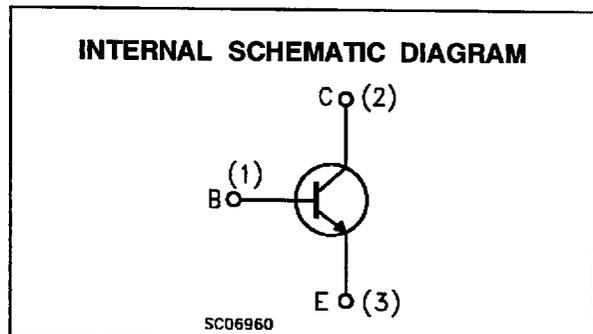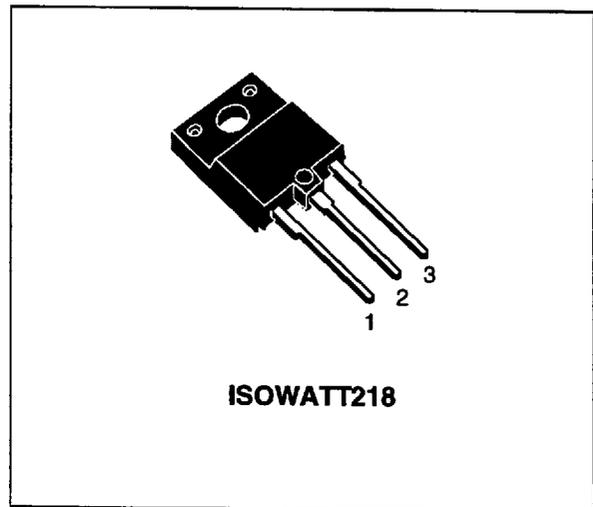
## ABSOLUTE MAXIMUM RATINGS

| 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 ($I_C = 0$) | 10 | 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 $T_c = 25\ ^oC$ | 54 | W |
| $T_{stg}$ | Storage Temperature | -65 to 150 | $^oC$ |
| $T_j$ | Max. Operating Junction Temperature | 150 | $^oC$ |

## THERMAL DATA

| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 2.3 | °C/W |
|---|---|---|---|---|

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CES}$ | Collector Cut-off Current ($V_{BE} = 0$) | $V_{CE} = 1500$ V<br>$V_{CE} = 1500$ V    $T_j = 125$ °C | | | 1<br>2 | mA<br>mA |
| $I_{EBO}$ | Emitter Cut-off Current ($I_C = 0$) | $V_{EB} = 5$ V | | | 100 | µA |
| $V_{CEO(sus)}$ | Collector-Emitter Sustaining Voltage | $I_C = 100$ mA | 700 | | | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C = 0$) | $I_E = 10$ mA | 10 | | | V |
| $V_{CE(sat)}*$ | Collector-Emitter Saturation Voltage | $I_C = 6$ A    $I_B = 1.5$ A | | | 1.5 | V |
| $V_{BE(sat)}*$ | Base-Emitter Saturation Voltage | $I_C = 6$ A    $I_B = 1.5$ A | | | 1.3 | V |
| $h_{FE}*$ | DC Current Gain | $I_C = 5$ A    $V_{CE} = 5$ V | 5 | | | |
| $t_s$<br>$t_f$ | RESISTIVE LOAD<br>Storage Time<br>Fall Time | $V_{CC} = 400$ V    $I_C = 5$ A<br>$I_{B1} = 1.25$ A    $I_{B2} = 2.5$ A | | 2.7<br>190 | 3.9<br>280 | µs<br>ns |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C = 5$ A         $f = 15625$ Hz<br>$I_{B1} = 1.25$ A    $I_{B2} = -2.5$ A<br>$V_{ceflyback} = 1050 \sin\left(\dfrac{\pi}{10} 10^6\right)t$   V | | 2.3<br>370 | | µs<br>ns |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C = 5$ A         $f = 31250$ Hz<br>$I_{B1} = 1.25$ A    $I_{B2} = -2.5$ A<br>$V_{ceflyback} = 1200 \sin\left(\dfrac{\pi}{5} 10^6\right)t$   V | | 2.3<br>210 | | µs<br>ns |

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

Safe Operating Area

Thermal Impedance

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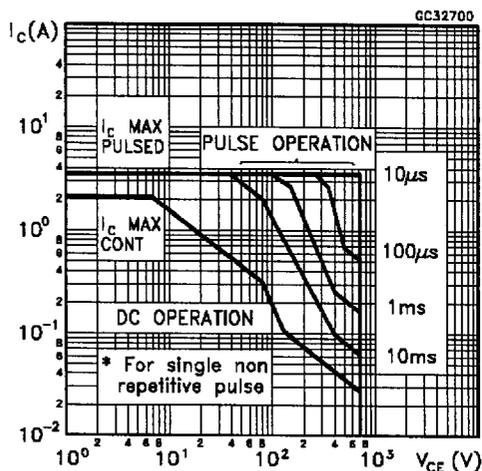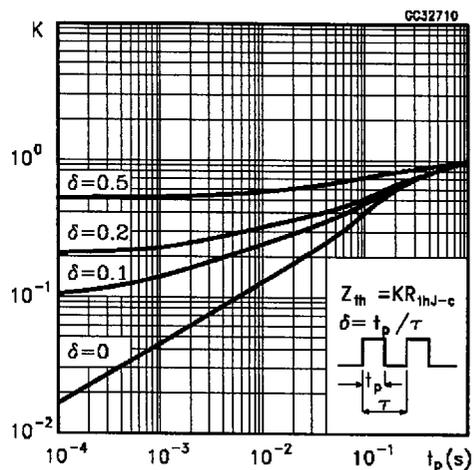
## Derating Curve
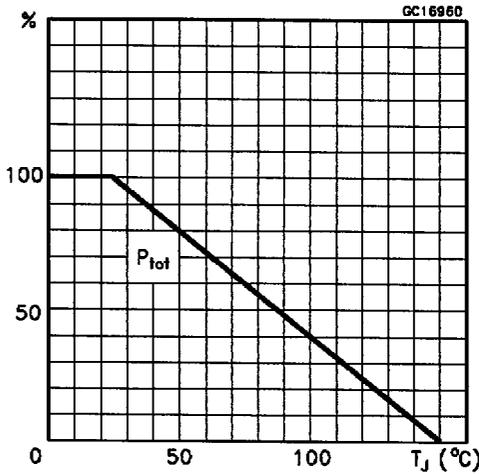


## DC Current Gain
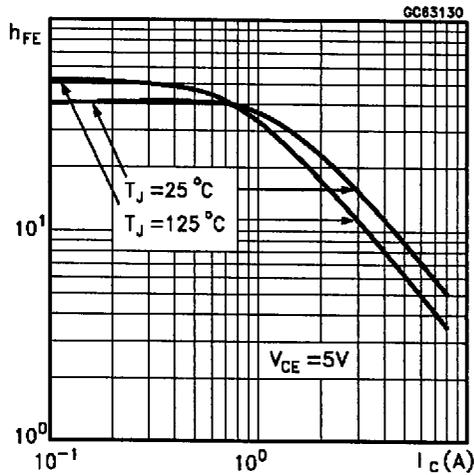


## Collector Emitter Saturation Voltage
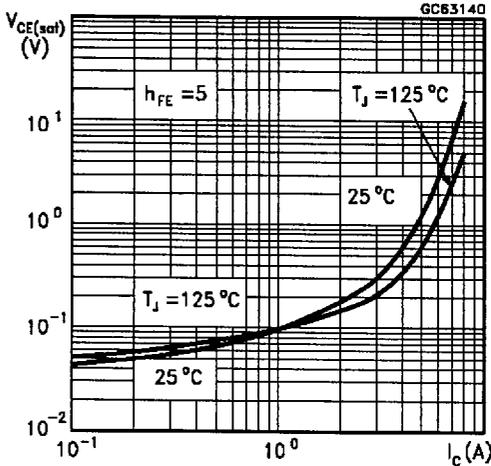


## Base Emitter Saturation Voltage



## Power Losses at 16KHz



$I_C = 5A$
$h_{FE} = 4$
$f = 15625$ Hz
$t_{on} = 40\mu sec$
$t_{off} = 24\mu sec$
$V_{ceflyback} = 1050V$
$t_{flyback} = 1\mu s$
$R_{tJ-amb} = 12°C/W$
$T_{amb} = 25°C$
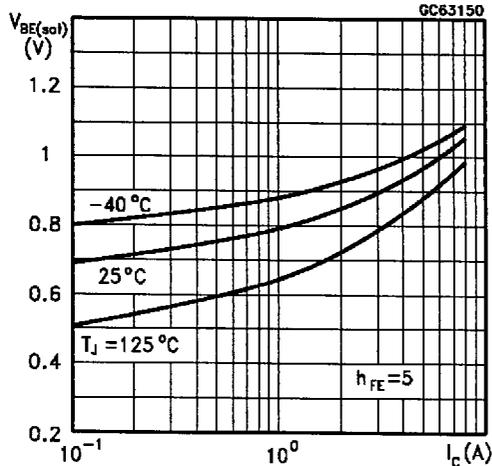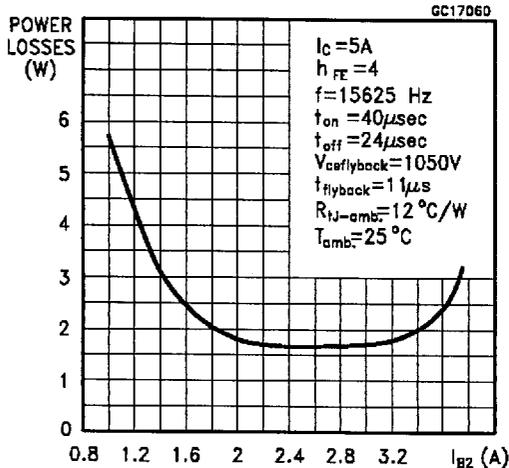
## Switching Time Inductive Load at 16KHz
(see figure 2)



$I_C = 5A$
$h_{FE} = 4$
$f = 15625$ Hz
$t_{on} = 40\mu sec$
$t_{off} = 24\mu sec$

$V_{ceflyback} = 1050V$
$t_{flyback} = 1\mu s$
$R_{tJ-amb} = 12°C/W$
$T_{amb} = 25°C$

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## Power Losses at 32KHz



GC32780

POWER LOSSES (W)

$V_{ceflyback}=1200V$
$t_{flyback}=5\mu s$
$R_{tJ-amb}=12\ ^{\circ}C/W$
$T_{amb}=25\ ^{\circ}C$

$I_c=5A$
$h_{FE}=4$
$f=31250$ Hz
$t_{on}=20\mu sec$
$t_{off}=12\mu sec$

$I_{B2}(A)$
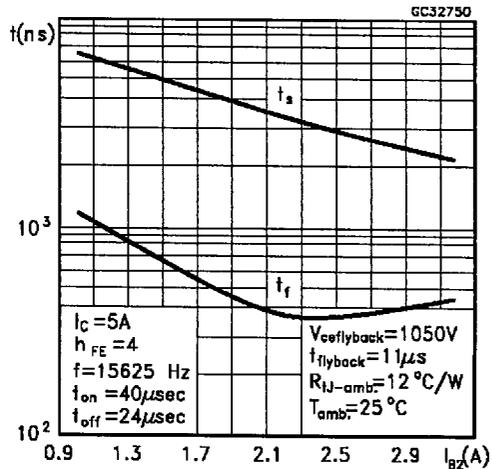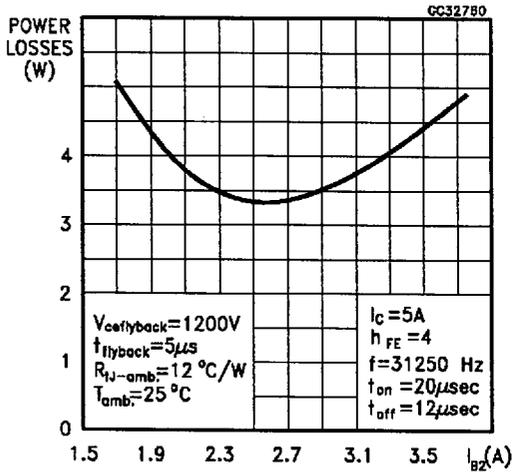
## Switching Time Inductive Load at 32KHz
(see figure 2)



GC32770

t(ns)

$I_c=5A$
$h_{FE}=4$
$f=31250$ Hz
$t_{on}=20\mu sec$
$t_{off}=12\mu sec$

$t_s$

$t_f$

$V_{ceflyback}=1200V$
$t_{flyback}=5\mu s$
$R_{tJ-amb}=12\ ^{\circ}C/W$
$T_{amb}=25\ ^{\circ}C$

$I_{B2}(A)$

## Reverse Biased SOA



GC17080

$I_c(A)$

$h_{FE}=5$
$R_{BB(off)}=0\ \Omega$
$V_{BE(off)}=-5V$
$T_c \leq 125\ ^{\circ}C$

$V_{CE}$ (V)
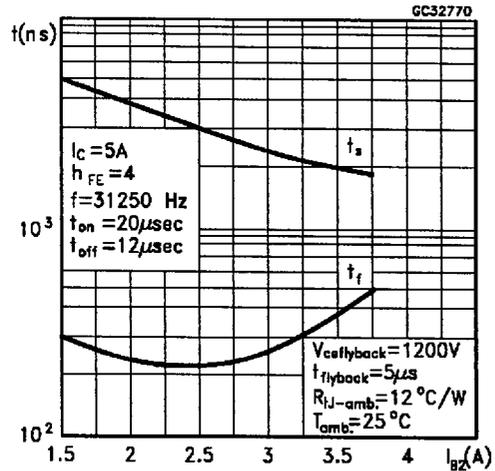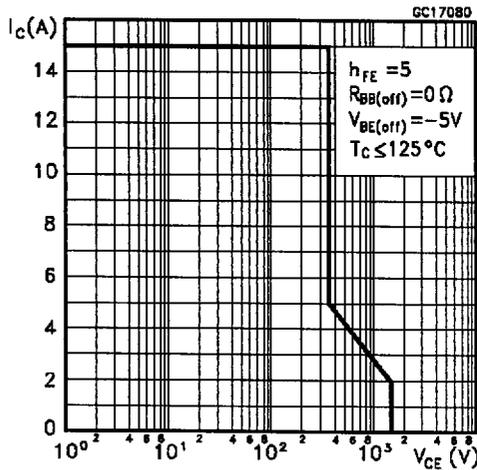
## Switching Time Resistive Load



GC32730

t(ns)

$I_c=5A$
$h_{FE}=4$
$V_{CC}=400V$

$t_s$

$t_f$

$I_{B2}(A)$
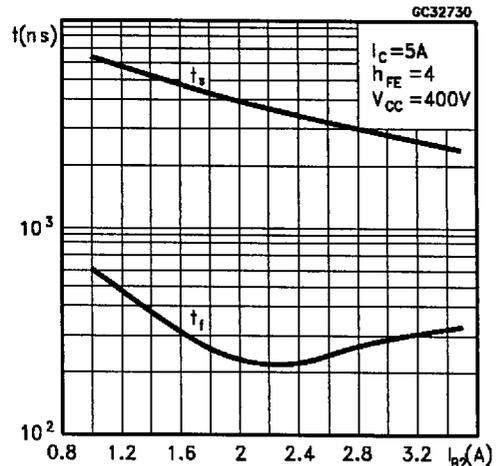
## BASE DRIVE INFORMATION

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, 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 both 16 KHz and 32 KHz scanning frequencies for choosing the optimum negative drive. The test circuit is illustrated in figure 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 would avoid any tailing phenomenon in the collector current.

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

$$\frac{1}{2}\,L\,(I_C)^2 = \frac{1}{2}\,C\,(V_{CEfly})^2 \qquad \omega = 2\,\pi f = \frac{1}{\sqrt{LC}}$$

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

**Figure 1:** Inductive Load Switching Test Circuits.



SC05010
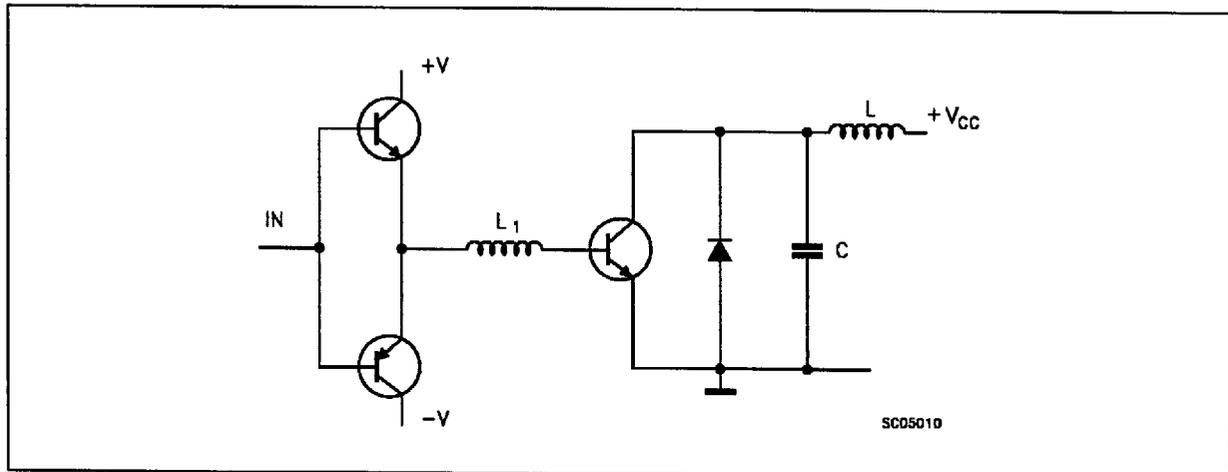
**Figure 2:** Switching Waveforms in a Deflection Circuit



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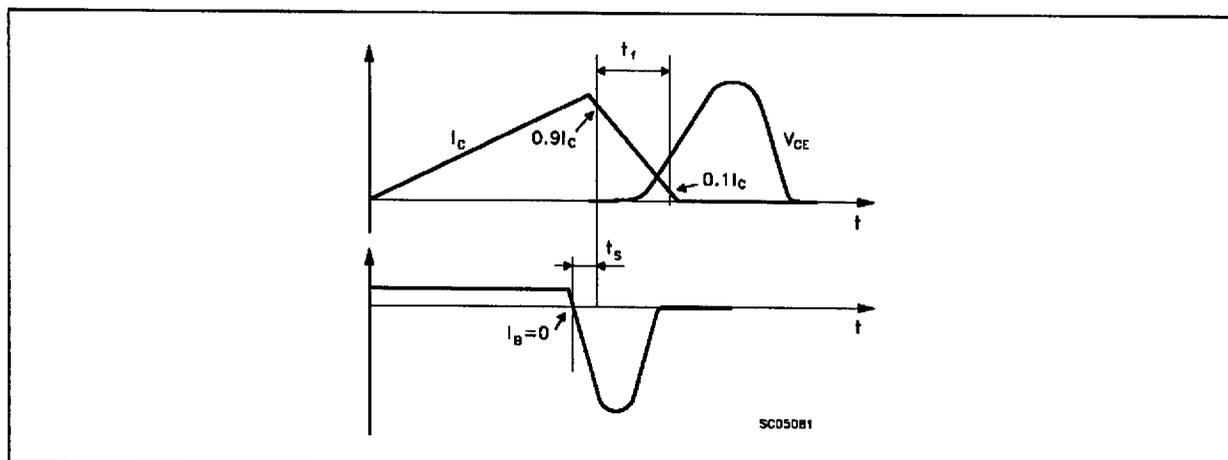
## ISOWATT218 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|------|------|------|------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 5.35 | | 5.65 | 0.210 | | 0.222 |
| C | 3.3 | | 3.8 | 0.130 | | 0.149 |
| D | 2.9 | | 3.1 | 0.114 | | 0.122 |
| D1 | 1.88 | | 2.08 | 0.074 | | 0.081 |
| E | 0.45 | | 1 | 0.017 | | 0.039 |
| F | 1.05 | | 1.25 | 0.041 | | 0.049 |
| G | 10.8 | | 11.2 | 0.425 | | 0.441 |
| H | 15.8 | | 16.2 | 0.622 | | 0.637 |
| L1 | 20.8 | | 21.2 | 0.818 | | 0.834 |
| L2 | 19.1 | | 19.9 | 0.752 | | 0.783 |
| L3 | 22.8 | | 23.6 | 0.897 | | 0.929 |
| L4 | 40.5 | | 42.5 | 1.594 | | 1.673 |
| L5 | 4.85 | | 5.25 | 0.190 | | 0.206 |
| L6 | 20.25 | | 20.75 | 0.797 | | 0.817 |
| M | 3.5 | | 3.7 | 0.137 | | 0.145 |
| N | 2.1 | | 2.3 | 0.082 | | 0.090 |
| U | | 4.6 | | | 0.181 | |



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