SGS-THOMSON MICROELECTRONICS

BUH515FP

HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

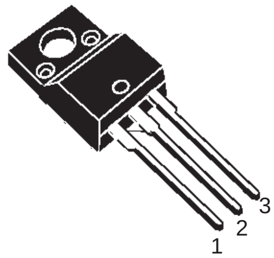
- HIGH VOLTAGE CAPABILITY
- FULLY MOLDED ISOLATED PACKAGE
- 2000 V DC ISOLATION (U.L. COMPLIANT)

APPLICATIONS:
- HORIZONTAL DEFLECTION FOR COLOUR TV AND MONITORS
- SWITCH MODE POWER SUPPLIES

DESCRIPTION

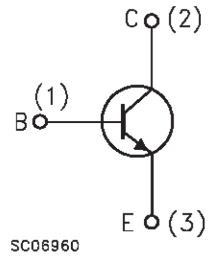
The BUH515FP is manufactured using Multiepitaxial Mesa technology for cost-effective high performance and uses a Hollow Emitter structure to enhance switching speeds.

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



TO-220FP

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 ($I_C = 0$)	10	V
I_C	Collector Current	8	A
I_{CM}	Collector Peak Current ($t_p < 5$ ms)	12	A
I_B	Base Current	5	A
I_{BM}	Base Peak Current ($t_p < 5$ ms)	8	A
P_{tot}	Total Dissipation at $T_c = 25\ ^oC$	38	W
T_{stg}	Storage Temperature	-65 to 150	^oC
T_j	Max. Operating Junction Temperature	150	^oC

THERMAL DATA

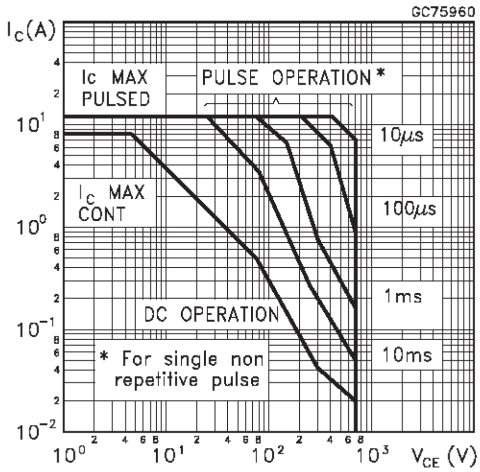
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	3.3	$^oC/W$

ELECTRICAL CHARACTERISTICS (T_{case} = 25 ^oC unless otherwise specified)

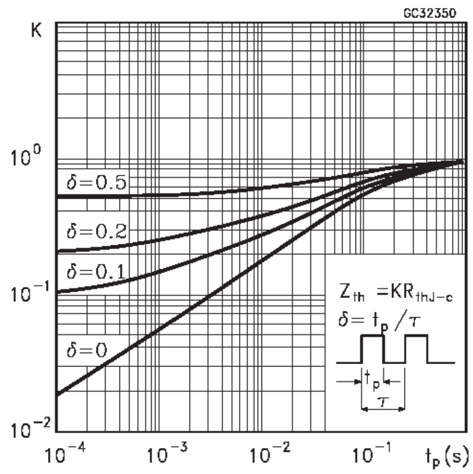
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector Cut-off Current (V_{BE} = 0)	V_{CE} = 1500 V V_{CE} = 1500 V T_j = 125 ^oC			0.2 2	mA mA
I_{EBO}	Emitter Cut-off Current (I_C = 0)	V_{EB} = 5 V			100	μA
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage	I_C = 100 mA	700			V
V_{EBO}	Emitter-Base Voltage (I_C = 0)	I_E = 10 mA	10			V
$V_{CE(sat)}$*	Collector-Emitter Saturation Voltage	I_C = 5 A I_B = 1.25 A			1.5	V
$V_{BE(sat)}$*	Base-Emitter Saturation Voltage	I_C = 5 A I_B = 1.25 A			1.3	V
h_{FE}*	DC Current Gain	I_C = 5 A V_{CE} = 5 V I_C = 5 A V_{CE} = 5 V T_j = 100 ^oC	6 4		12	
t_s t_f	RESISTIVE LOAD Storage Time Fall Time	V_{CC} = 400 V I_C = 5 A I_{B1} = 1.25 A I_{B2} = 2.5 A		2.7 190	3.9 280	μs ns
t_s t_f	INDUCTIVE LOAD Storage Time Fall Time	I_C = 5 A f = 15625 Hz I_{B1} = 1.25 A I_{B2} = -1.5 A $V_{ceflyback} = 1050 \sin\left(\frac{\pi}{5} 10^6\right) t$ V		2.3 350		μs ns
t_s t_f	INDUCTIVE LOAD Storage Time Fall Time	I_C = 5A f = 31250 Hz I_{B1} = 1.25 A I_{B2} = -1.5 A $V_{ceflyback} = 1200 \sin\left(\frac{\pi}{5} 10^6\right) t$ V		2.3 200		μs ns

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

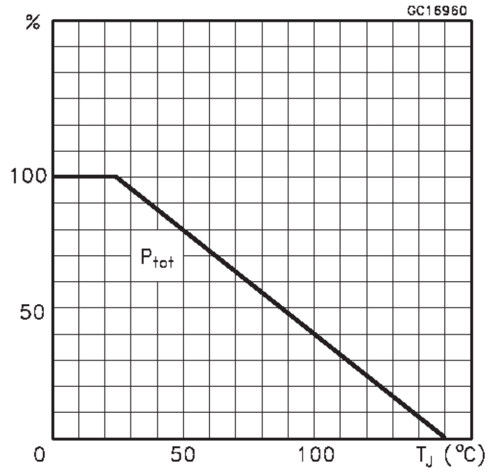
Safe Operating Area



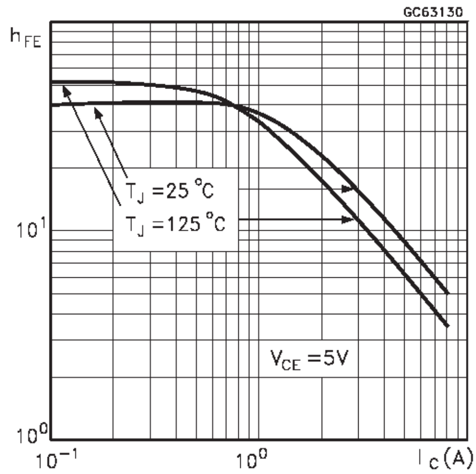
Thermal Impedance



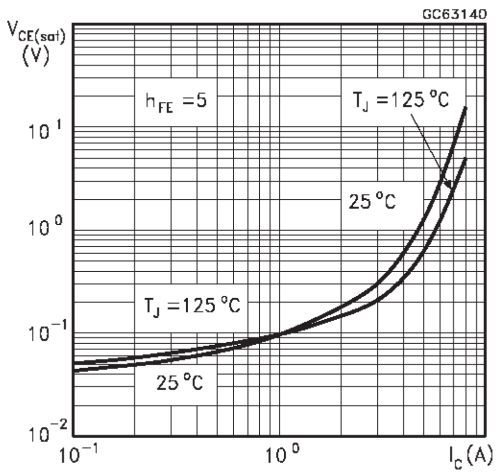
Derating Curve



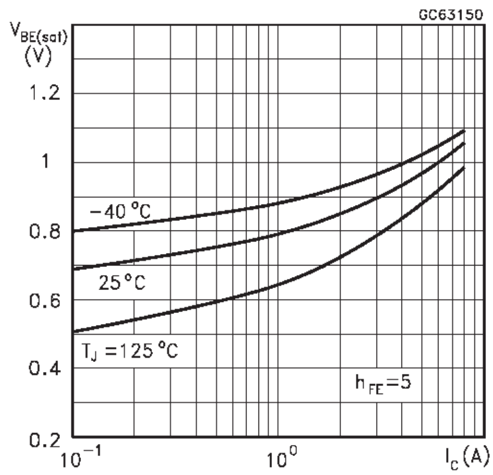
DC Current Gain



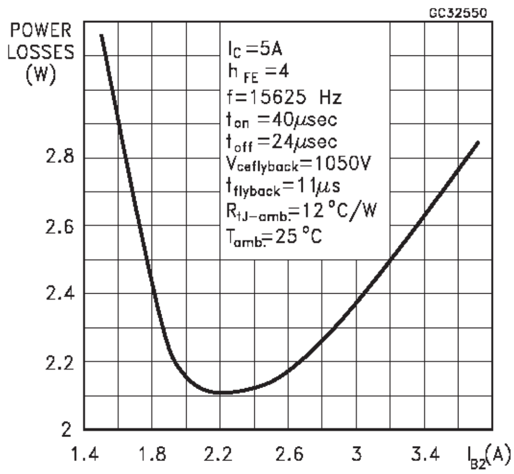
Collector Emitter Saturation Voltage



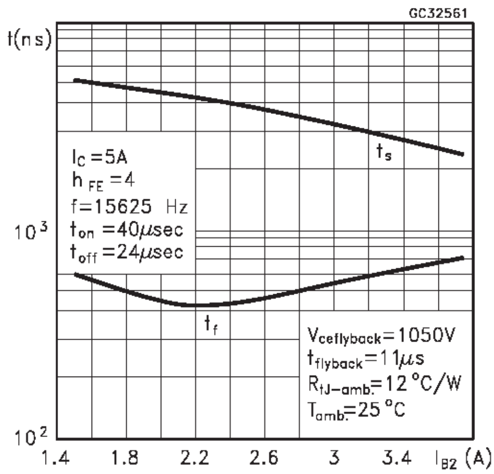
Base Emitter Saturation Voltage



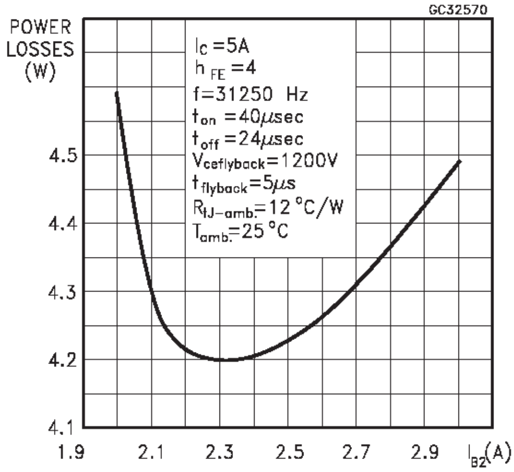
Power Losses at 16 KHz



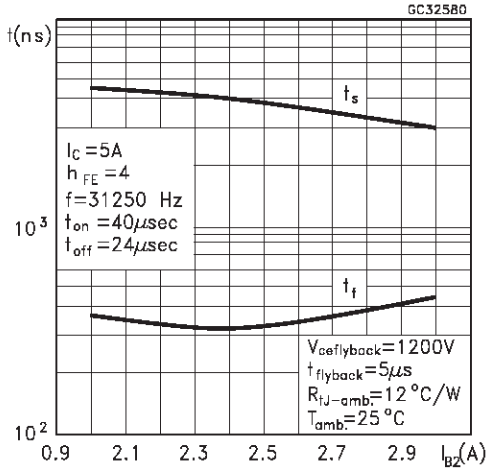
Switching Time Inductive Load at 16KHz
(see figure 2)



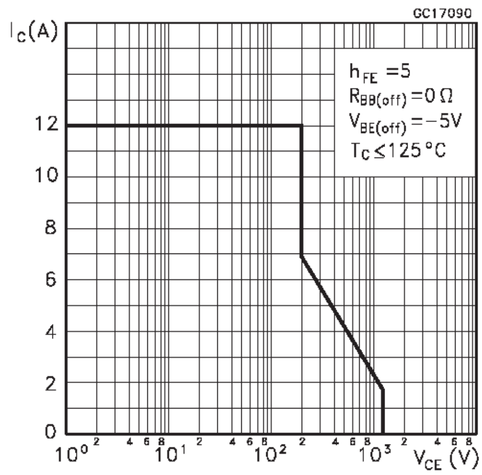
Power Losses at 32 KHz



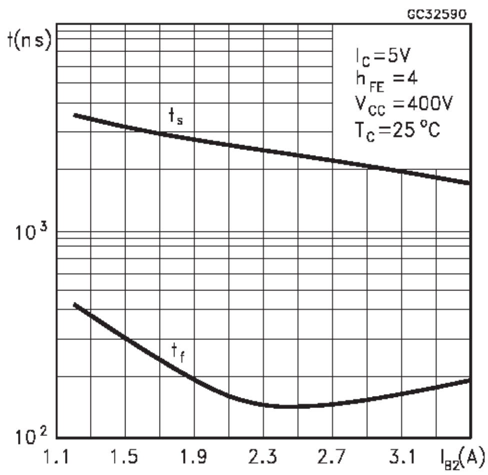
Switching Time Inductive Load at 32 KHz (see figure 2)



Reverse Biased SOA



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 ^{o}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:

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

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

Figure 1: Inductive Load Switching Test Circuit.

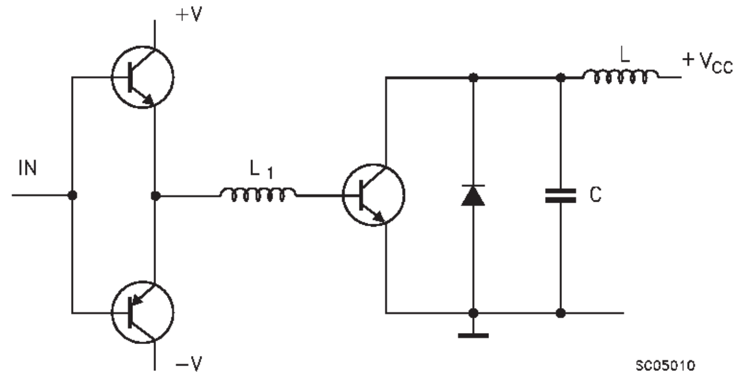
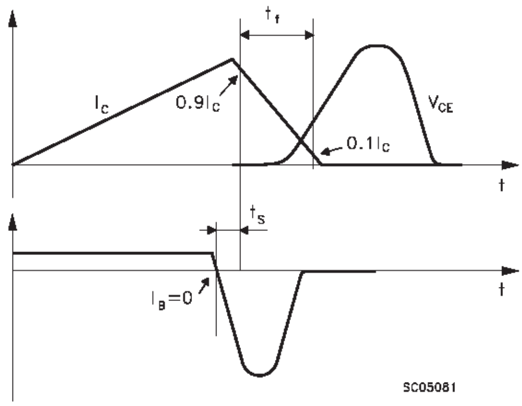


Figure 2: Switching Waveforms in a Deflection Circuit



TO-220FP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126