

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- STMicroelectronics PREFERRED SALES TYPE
- HIGH VOLTAGE CAPABILITY
- VERY HIGH SWITCHING SPEED
- U.L. RECOGNISED ISOWATT218 PACKAGE (U.L. FILE # E81734 (N))

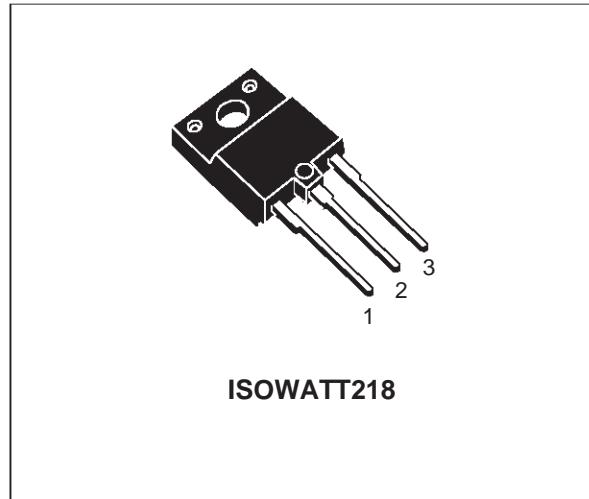
### APPLICATIONS:

- HORIZONTAL DEFLECTION FOR MONITORS

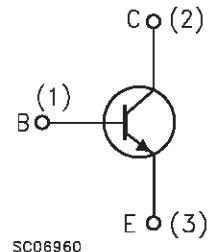
### DESCRIPTION

The THD200FI is manufactured using Multiepitaxial Mesa technology for cost-effective high performance and uses a Hollow Emitter structure to enhance switching speeds.

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



### 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	10	A
$I_{CM}$	Collector Peak Current ( $t_p < 5$ ms)	20	A
$I_B$	Base Current	5	A
$I_{BM}$	Base Peak Current ( $t_p < 5$ ms)	10	A
$P_{tot}$	Total Dissipation at $T_c = 25$ °C	57	W
$T_{stg}$	Storage Temperature	-65 to 150	°C
$T_j$	Max. Operating Junction Temperature	150	°C

## THD200FI

### THERMAL DATA

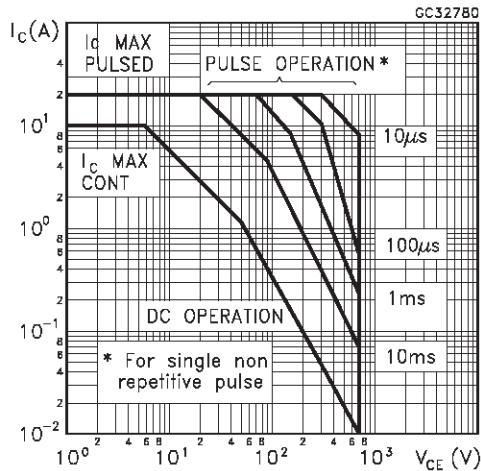
$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.2	$^{\circ}\text{C/W}$
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### ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^{\circ}\text{C}$ unless otherwise specified)

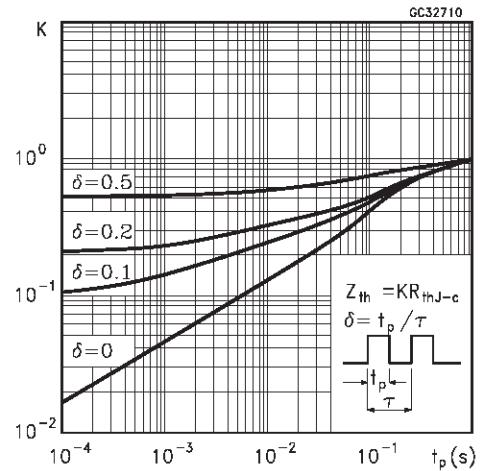
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{CES}$	Collector Cut-off Current ( $V_{BE} = 0$ )	$V_{CE} = 1500 \text{ V}$ $V_{CE} = 1500 \text{ V} \quad T_j = 125^{\circ}\text{C}$			0.2 2	mA mA
$I_{EBO}$	Emitter Cut-off Current ( $I_C = 0$ )	$V_{EB} = 5 \text{ V}$			100	$\mu\text{A}$
$V_{CEO(sus)*}$	Collector-Emitter Sustaining Voltage ( $I_C = 0$ )	$I_C = 100 \text{ mA}$	700			V
$V_{EBO}$	Emitter-Base Voltage ( $I_B = 0$ )	$I_E = 10 \text{ mA}$	10			V
$V_{CE(sat)*}$	Collector-Emitter Saturation Voltage	$I_C = 7 \text{ A} \quad I_B = 1.5 \text{ A}$			1.5	V
$V_{BE(sat)*}$	Base-Emitter Saturation Voltage	$I_C = 7 \text{ A} \quad I_B = 1.5 \text{ A}$			1.3	V
$h_{FE}*$	DC Current Gain	$I_C = 7 \text{ A} \quad V_{CE} = 5 \text{ V}$ $I_C = 7 \text{ A} \quad V_{CE} = 5 \text{ V} \quad T_j = 100^{\circ}\text{C}$	6.5 4		13	
$t_s$ $t_f$	RESISTIVE LOAD Storage Time Fall Time	$V_{CC} = 400 \text{ V} \quad I_C = 7 \text{ A}$ $I_{B1} = 1.5 \text{ A} \quad I_{B2} = 3.5 \text{ A}$		2.1 140	3.1 210	$\mu\text{s}$ ns
$t_s$ $t_f$	INDUCTIVE LOAD Storage Time Fall Time	$I_C = 7 \text{ A} \quad f = 31250 \text{ Hz}$ $I_{B1} = 1.5 \text{ A} \quad I_{B2} = -3.5 \text{ A}$ $V_{ceflyback} = 1200 \sin\left(\frac{\pi}{5} 10^6\right) t \quad \text{V}$		3.5 320		$\mu\text{s}$ ns
$t_s$ $t_f$	INDUCTIVE LOAD Storage Time Fall Time	$I_C = 7 \text{ A} \quad f = 64 \text{ KHz}$ $I_{B1} = 1.5 \text{ A} \quad I_{B2} = -3.5 \text{ A}$ $V_{ceflyback} = 1200 \sin\left(\frac{\pi}{5} 10^6\right) t \quad \text{V}$		1.7 215		$\mu\text{s}$ ns

\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

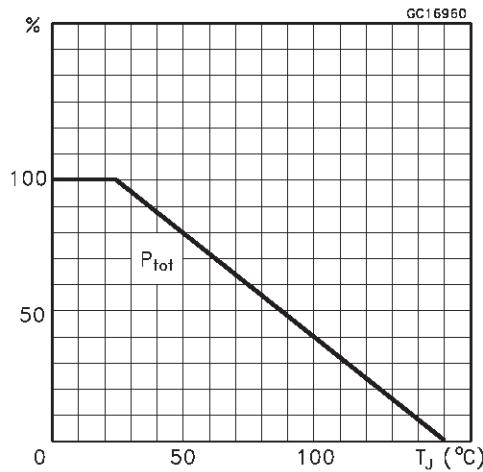
## Safe Operating Area



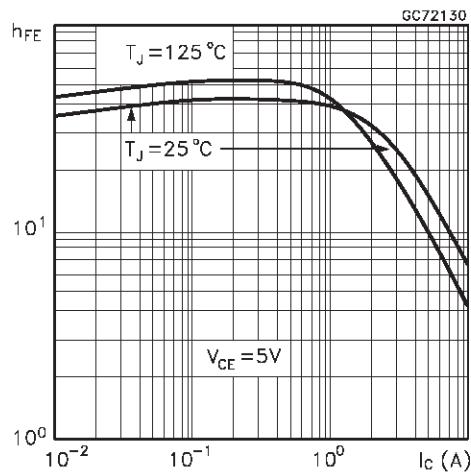
## Thermal Impedance



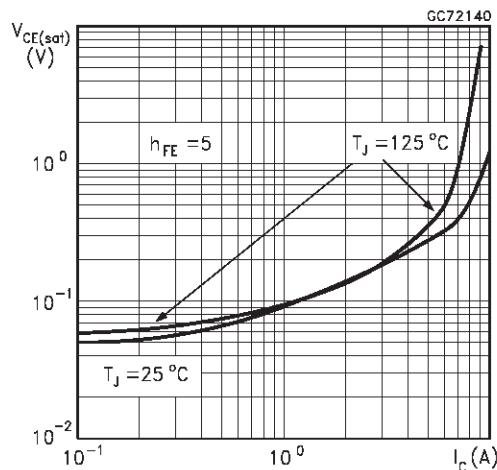
## Derating Curve



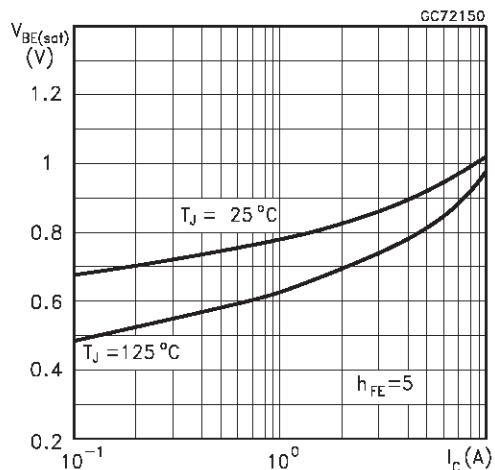
## DC Current Gain



## Collector Emitter Saturation Voltage

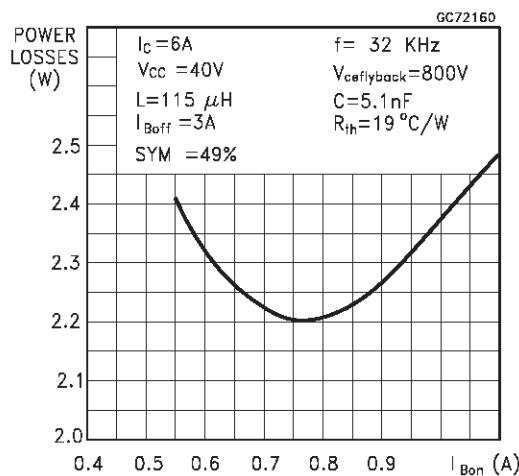


## Base Emitter Saturation Voltage

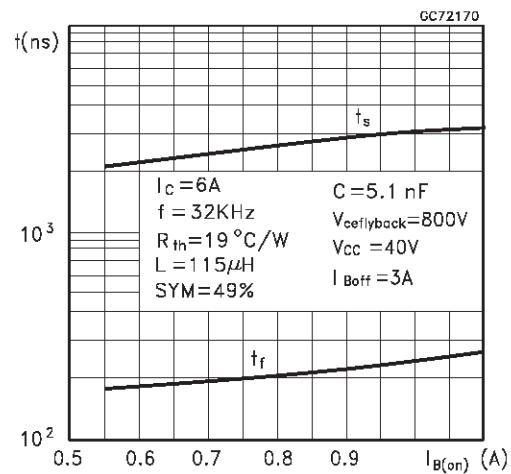


## THD200FI

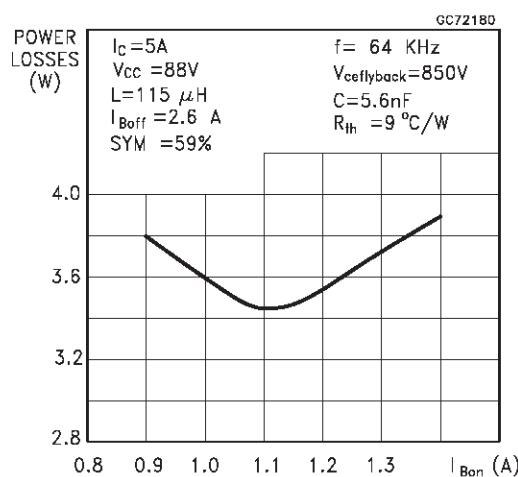
### Power Losses at 32 KHz



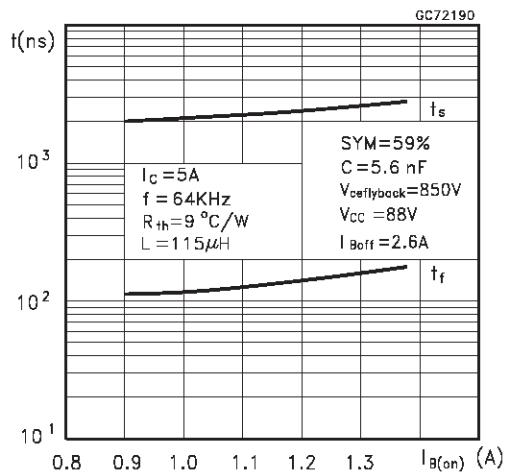
### Switching Time Inductive Load at 32 KHz (see figure 2)



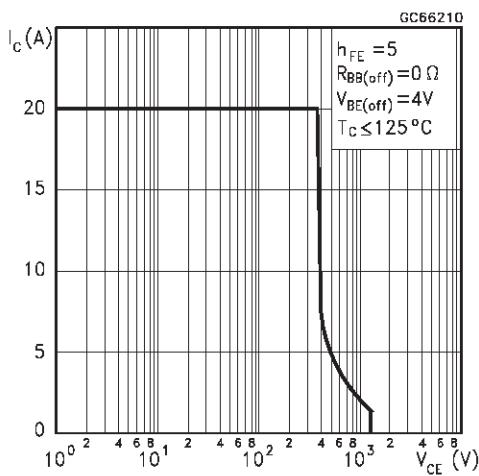
### Power Losses at 64 KHz



### Switching Time Inductive Load at 64 KHz (see figure 2)



### Reverse Biased SOA



## 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  $T_j = 100 \text{ }^\circ\text{C}$  (line scan phase). On the other hand, negative base current  $I_{B2}$  must be provided turn off the power transistor (retrace phase). Most of the dissipation, especially in the deflection application, occurs at switch-off so 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 32 KHz and 64 KHz scanning frequencies in order to choice 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  $I_{B2}$  in order to recombine the excess carriers in the collector when base current is still present, thus avoiding any tailing phenomenon in the collector current.

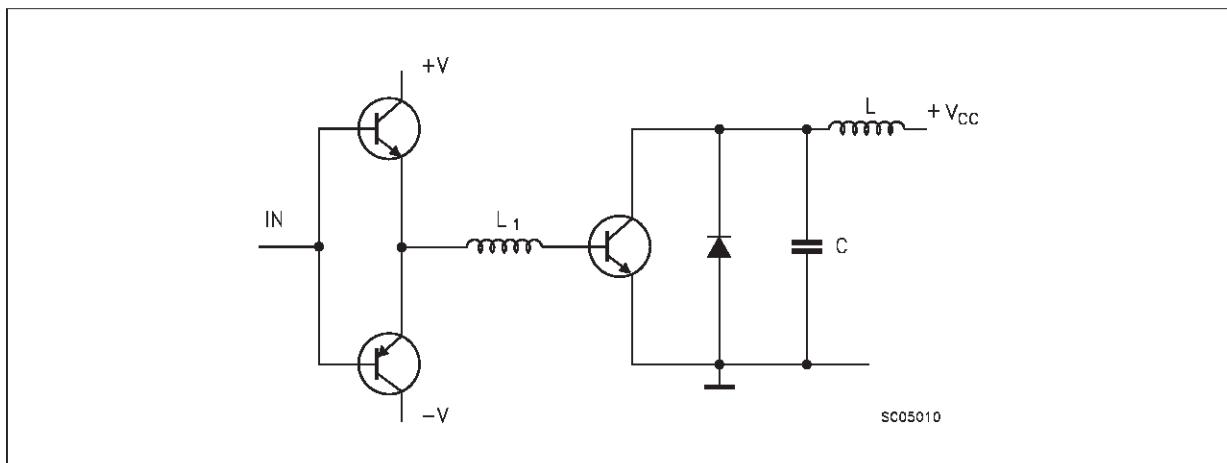
The values of  $L$  and  $C$  are calculated from the following equations:

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

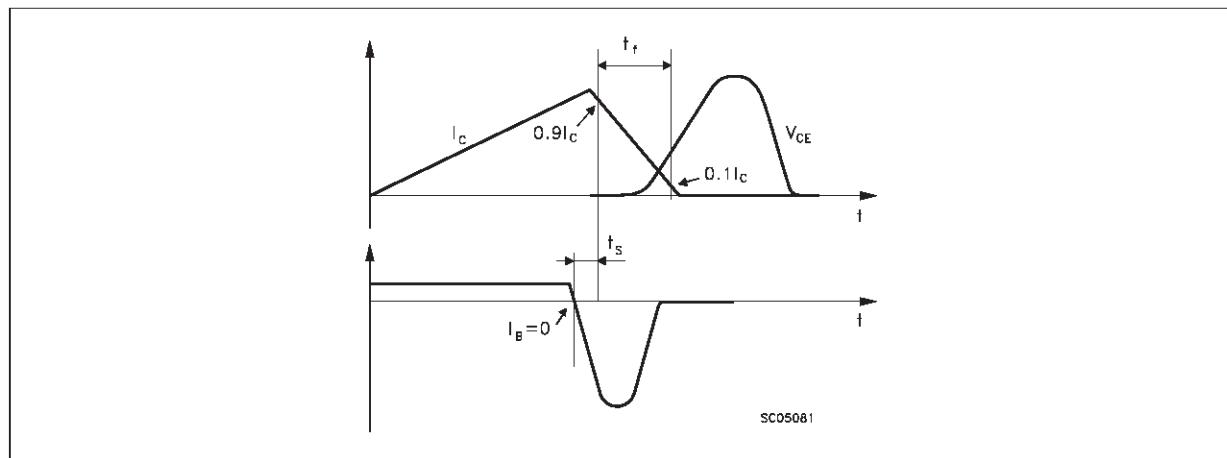
$$\omega = 2 \pi f = \frac{1}{\sqrt{LC}}$$

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

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

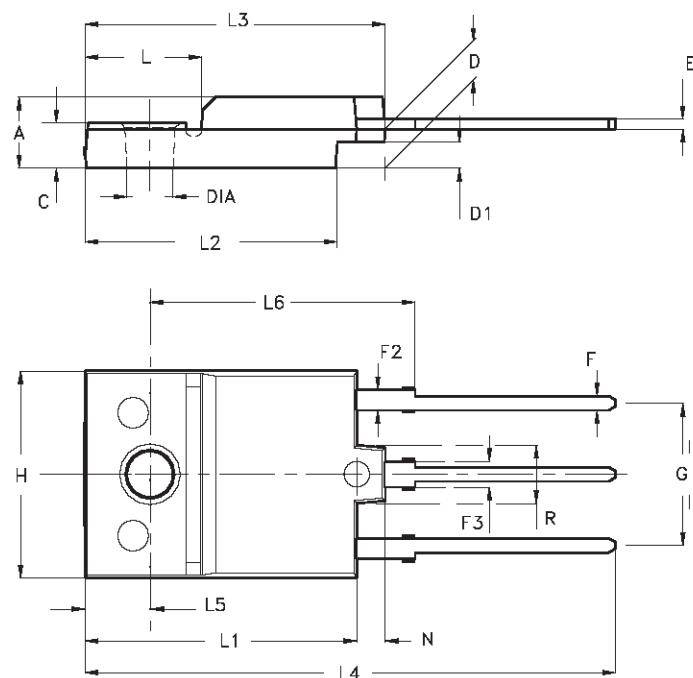


**Figure 2:** Switching Waveforms in a Deflection Circuit.



## 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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