LINEAR INTEGRATED CIRCUIT

TDA 1170

TV VERTICAL DEFLECTION SYSTEM

The TDA 1170 is a monolithic integrated circuit in a 12-lead quad in-line plastic package. It is designed mainly for use in large and small screen black and white TV receivers.
The functions incorporated are:

- oscillator
- voltage ramp generator
- high power gain amplifier
- flyback generator

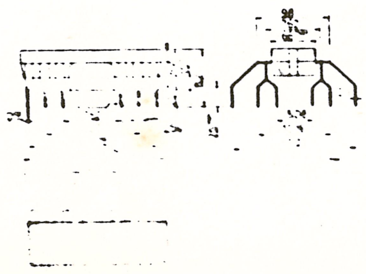
ABSOLUTE MAXIMUM RATINGS

V_s	Supply voltage (pin 2)	27	V
V_4-V_5	Flyback peak voltage	58	V
V_8	Sync. input voltage	± 12	V
V_{10}	Power amplifier input voltage	{ 10	V
		-0.5	V
I_o	Output peak current (non-repetitive) @ t = 2 ms	2	A
I_o	Output peak current @ f = 50 Hz, t ≤ 10 µs	2.5	A
	@ f = 50 Hz, t > 10 µs	1.5	A
P_{tot}	Power dissipation: at T_{tab} = 90°C	5	W
	at T_{amb} = 80°C (free air)	1	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

ORDERING NUMBER: TDA 1170

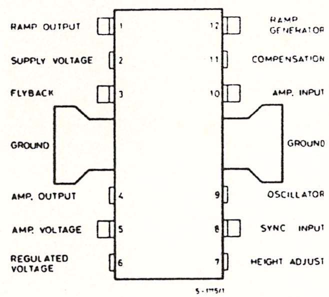
MECHANICAL DATA

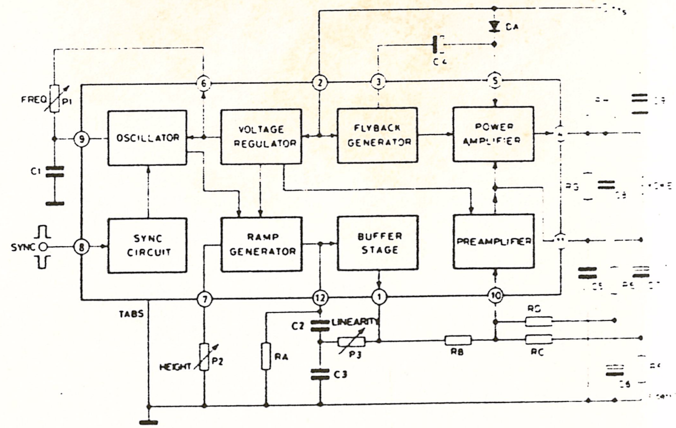
Dimensions in mm



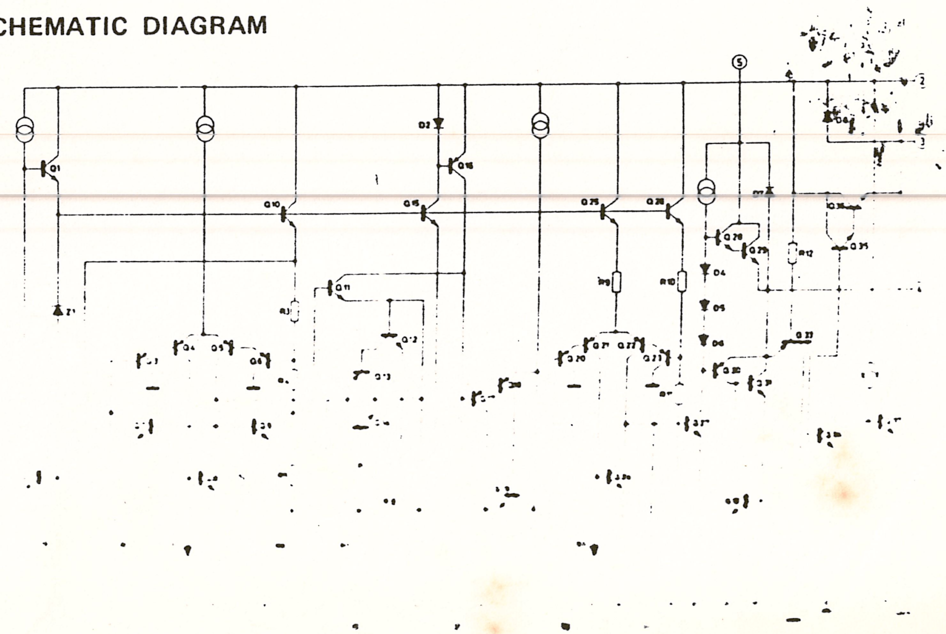
CONNECTION AND BLOCK DIAGRAM

(top view)





SCHEMATIC DIAGRAM



THERMAL DATA

$R_{th\ j\text{-}tab}$	Thermal resistance junction-tab	max	12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70*	°C/W

* Obtained with tabs soldered to printed circuit with minimized area.

ELECTRICAL CHARACTERISTICS (Refer to the test circuits, V_s = 25V, T_{amb} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit	Fig.
DC CHARACTERISTICS							
$-I_9$	Oscillator bias current	V_9 = 1V		0.2	1	μA	1a
$-I_{10}$	Amplifier input bias current	V_{10} = 1V		0.15	1	μA	1b
$-I_{12}$	Ramp generator bias current			0.05	0.5	μA	1a
V_s	Supply voltage		10			V	–
V_4	Quiescent output voltage	R2 = 10 kΩ V_s = 25V R1 = 30 kΩ V_s = 10V R1 = 10 kΩ	 8 4	 8.8 4.4	 9.6 4.8	 V V	1a
V_6, V_7	Regulated voltage		6	6.5	7	V	1b
$\frac{\Delta V_6}{\Delta V_s}$ $\frac{\Delta V_7}{\Delta V_s}$	Line regulation	V_s = 10 to 27V		1.5		mV/V	
AC CHARACTERISTICS (f = 50 Hz)							
I_s	Supply current	I_Y = 1A		140		mA	2
I_Y	Peak to peak yoke current (pin 4)				1.6	A	
V_4	Flyback voltage	I_Y = 1A		51		V	
V_8	Peak sync. input voltage (positive or negative)		1			V	

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit	Fig.
V_9	Peak to peak oscillator sawtooth voltage			2.4		V	2
R_8	Sync. input resistance	V_8 = 1V		3.5		kΩ	
t_{fly}	Flyback time	I_Y = 1A		0.6	0.8	ms	
δf	Pull-in range (below 50 Hz)			7		Hz	
$\frac{\delta f}{\Delta V_s}$	Oscillator frequency drift with supply voltage	V_s = 10 to 27V		0.01		Hz/V	
$\frac{\delta f}{\Delta T_{tab}}$	Oscillator frequency drift with tab temperature	T_{tab} = 40 to 120 °C		0.015		Hz/°C	

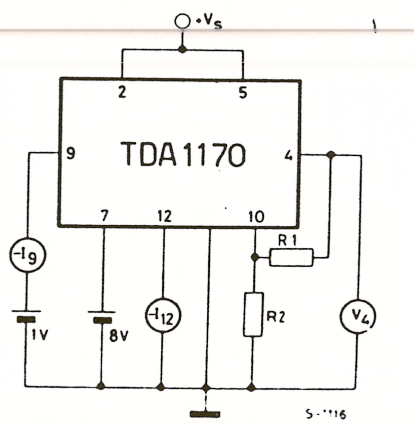


Fig. 1a - DC test circuit for measurement of $-I_9$, $-I_{12}$ and V_4

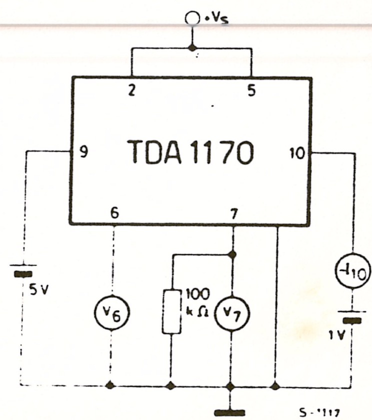


Fig. 1b - DC test circuit for measurement of $-I_{10}$, V_6, V_7, $\Delta V_6/\Delta V_s$ and $\Delta V_7/\Delta V_s$

TDA 1170

Fig. 2 - AC test circuit

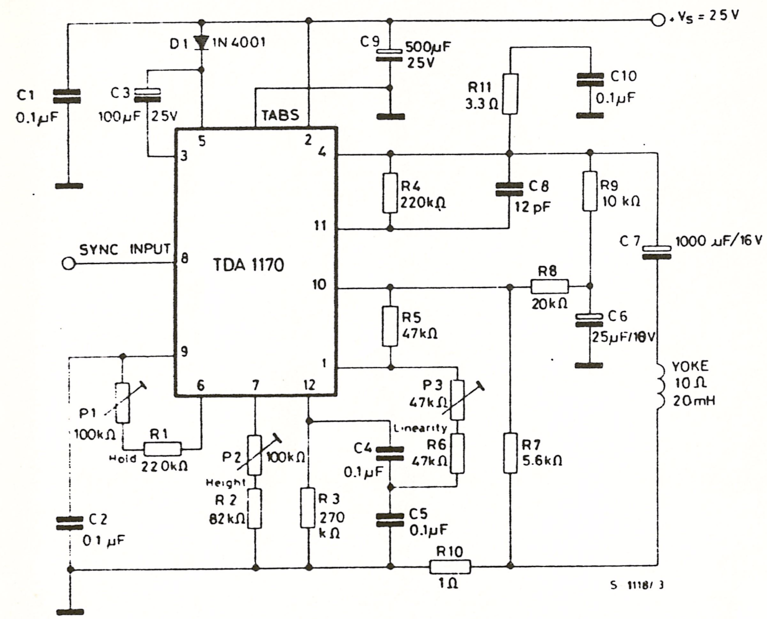


Fig. 3 - Relative quiescent voltage variation vs. supply voltage

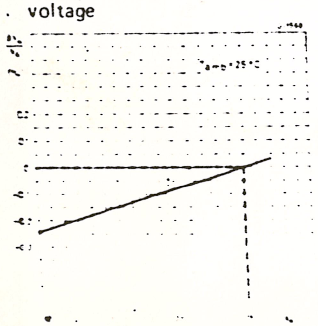


Fig. 4 - Relative quiescent voltage variation vs. tab temperature

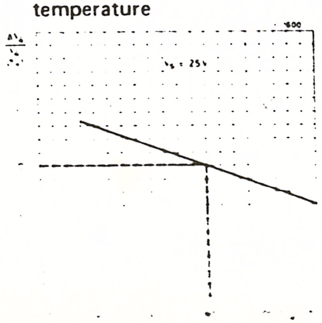


Fig. 5 - Regulated voltage vs. supply voltage

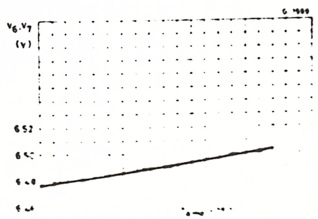


Fig. 6 - Regulated voltage vs. tab temperature

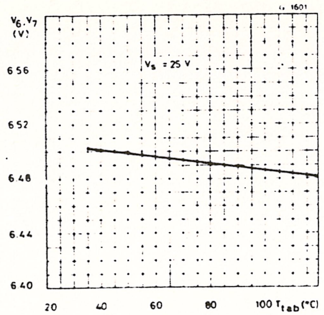


Fig. 7 - Frequency variation of unsynchronized oscillator vs. supply voltage

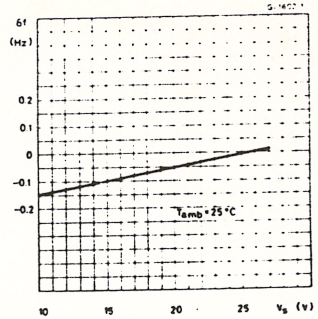
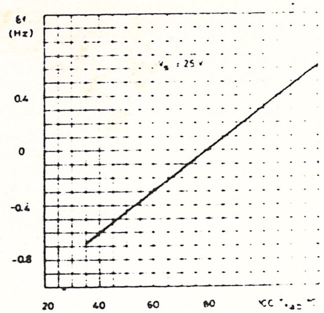


Fig. 8 - Frequency variation of unsynchronized oscillator vs. tab temperature



APPLICATION INFORMATION

The thermistor in series to the yokè is not required because the current feedback enables the yoke current to be independent of yoke resistance variations due to thermal effects. The oscillator is directly synchonized by the sync. pulses (positive or negative), therefore its free frequency must be lower than the sync. frequency. The flyback generator applies a voltage, about twice the supply voltage, to the yoke. This produces short flyback time together with a high useful power to dissipated power ratio.

The flyback time is:

$$t_{fly} \cong \frac{2}{3} \frac{L_Y I_Y}{V_s}$$

where: L_Y = Yoke inductance
V_s = Supply voltage
I_Y = Peak to peak yoke current

The supply current is:

$$I_s \cong \frac{I_Y}{8} + 0.02 \text{ (A)}$$

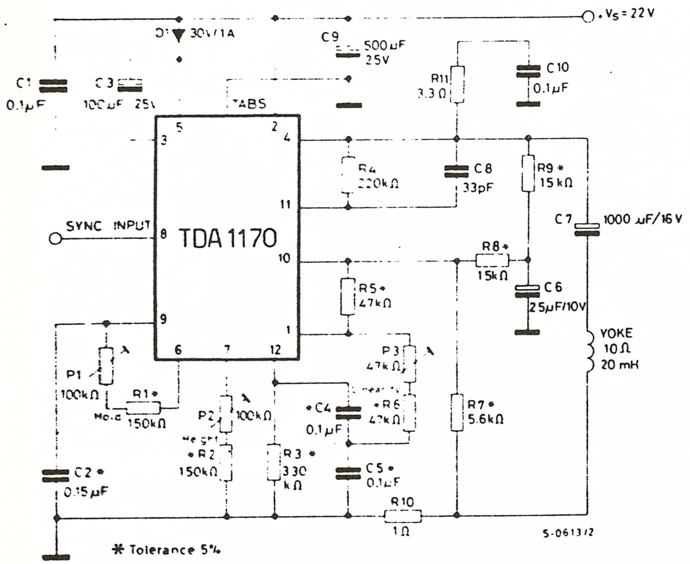
It does not depend on the value of V_s but only on yoke characteristics. The minimum value of V_s necessary for the required output current permits the maximum efficiency.
The quiescent output voltage (pin 4) is fixed by the voltage feedback network R7, R8 and R9 (refer to fig. 2) according to:

$$V_4 = V_{10} \frac{R7 + R8 + R9}{R7}$$

... nverting input of the amplifier and its voltage is $V_{10} \cong 2V$.

TDA 1170

Fig. 9 – Typical application circuit for B & W 24" 110° TV sets

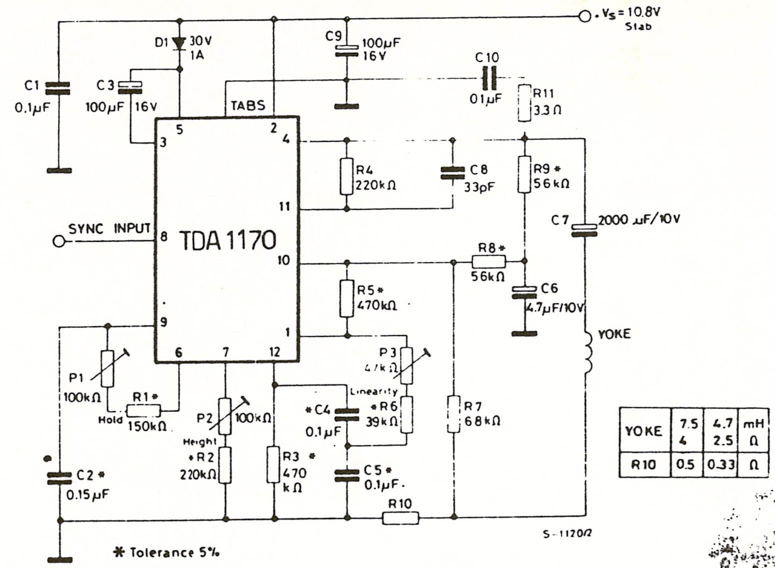


Typical performance (V_s = 22V; I_Y = 1A; R_Y = 10Ω; L_Y = 20 mH)

I_s	Supply current	140	mA
t_{fly}	Flyback time	0.75	ms
I_y	Maximum scanning current (peak to peak)	1.2	A
V_s	Operating supply voltage	20 to 24	V
P_{tot}	TDA 1170 power dissipation	2.2	W

For safe working up to T_{amb} = 50°C a heatsink of R_{th} = 40 °C/W is required and each tab of TDA 1170 must be soldered to 1 cm² copper area of the printed circuit board.

Fig. 10 – Typical application circuit for B & W small screen TV sets

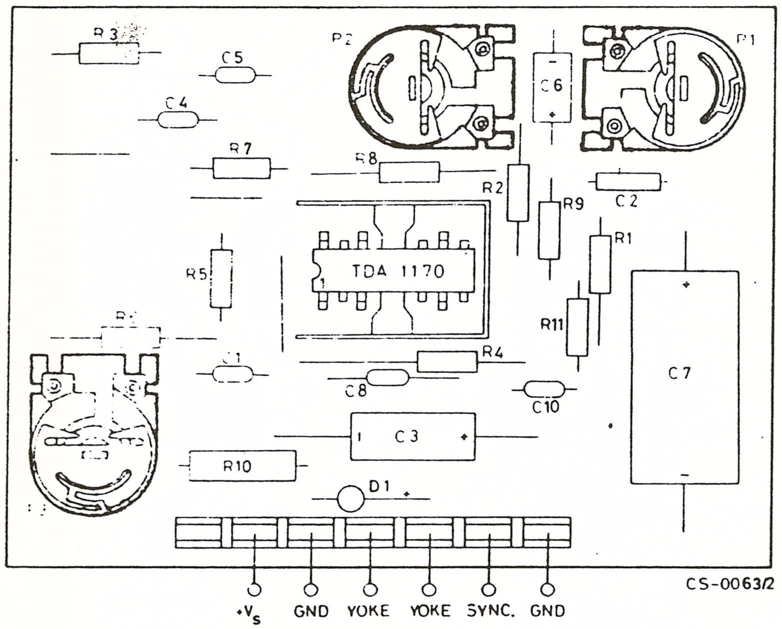


Typical performance (V_s = 10.8V; I_Y = 1A; R_Y = 4Ω; L_Y = 7.5 mH)

I_s	Supply current	150	mA
t_{fly}	Flyback time	0.7	ms
I_y	Maximum scanning current (peak to peak)	1.15	A
V_s	Operating supply voltage	10.8	V
P_{tot}	TDA 1170 power dissipation	1.3	W

For safe working up to T_{amb} = 50°C a heatsink of R_{th} = 30 °C/W is required and each tab of the TDA 1170 must be soldered to 1 cm² copper area of the printed circuit board.

Fig. 11 - P.C. board and component layout for the circuit of fig. 9 and fig. 10 (1:1 scale)



C9 is not mounted on the P.C. board.

Fig. 12 - Example of P.C. board copper area used as heatsink

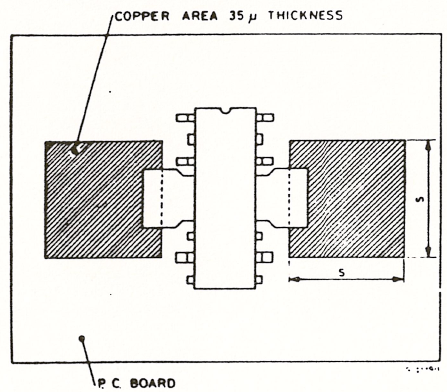


Fig. 13 - Example of TDA 1170 with external heatsink

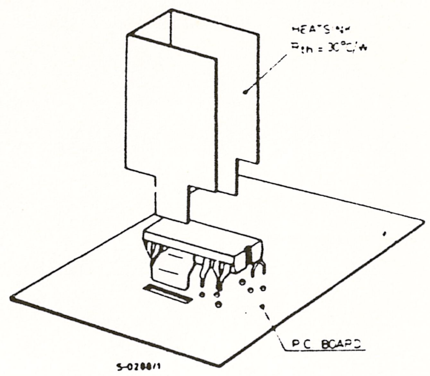


Fig. 14 - Maximum power dissipation and junction-ambient thermal resistance vs. "s"

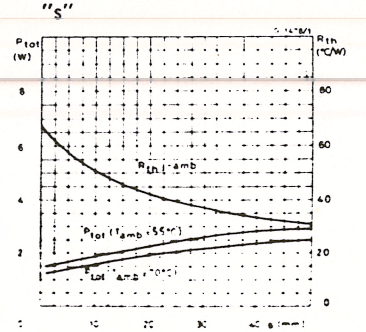
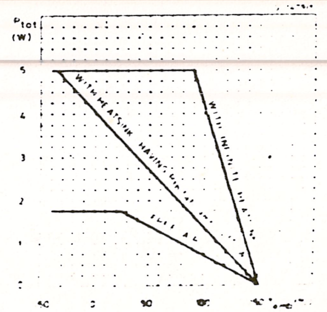


Fig. 15 - Maximum allowable power dissipation vs. ambient temperature



MOUNTING INSTRUCTIONS

The junction to ambient thermal resistance of the TDA 1170 can be reduced by soldering the tabs to a suitable copper area of the printed circuit board (fig. 12) or to an external heatsink (fig. 13).
The diagram of fig. 16 shows the maximum dissipable power P_{tot} and the $R_{th\,j-amb}$ as a function of the side "s" of two equal square copper areas having a thickness of 35 μ (1.4 mil).
During soldering the tab temperature must not exceed 260 °C and the [illegible] than 12 seconds.
The external heatsink or printed circuit copper area must be connected to electrical ground.

TDA 1170 S
TDA 1170 SH

TV VERTICAL DEFLECTION SYSTEM

The TDA 1170S is a monolithic integrated circuit in a 12-lead quad in-line plastic package. It is intended for use in black and white and colour TV receivers.
The functions incorporated are:

- synchronization circuit
- oscillator and ramp generator
- high power gain amplifier
- flyback generator
- voltage regulator

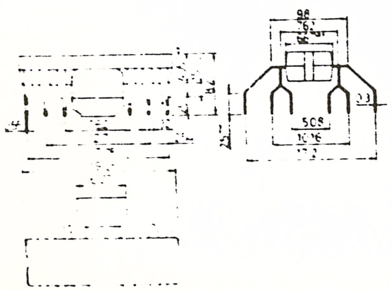
ABSOLUTE MAXIMUM RATINGS

V_s	Supply voltage at pin 2	35	V
V_4, V_5	Flyback peak voltage	60	V
V_{10}	Power amplifier input voltage	+ 10	V
		− 0.5	V
I_o	Output peak current (non repetitive) at t = 2 msec	2	A
I_o	Output peak current at f = 50 Hz t ⩽ 10 μsec	2.5	A
I_o	Output peak current at f = 50 Hz t > 10 μsec	1.5	A
I_3	Pin 3 DC current at $V_4 < V_2$	100	mA
I_3	Pin 3 peak to peak flyback current for f = 50 Hz, t_{fly} ⩽ 1.5 msec	1.8	A
I_8	Pin 8 current	± 20	mA
P_{tot}	Power dissipation: at T_{tab} = 90°C (TDA1170S)	5	W
	at T_{amb} = 80°C (TDA1170S)	1	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

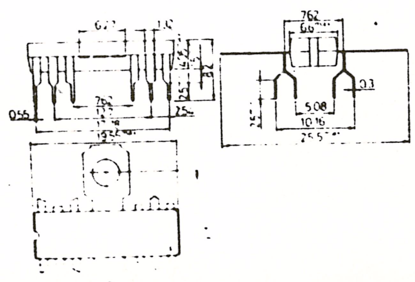
ORDERING NUMBERS: TDA 1170 S
TDA 1170 SH

MECHANICAL DATA

Dimensions in mm

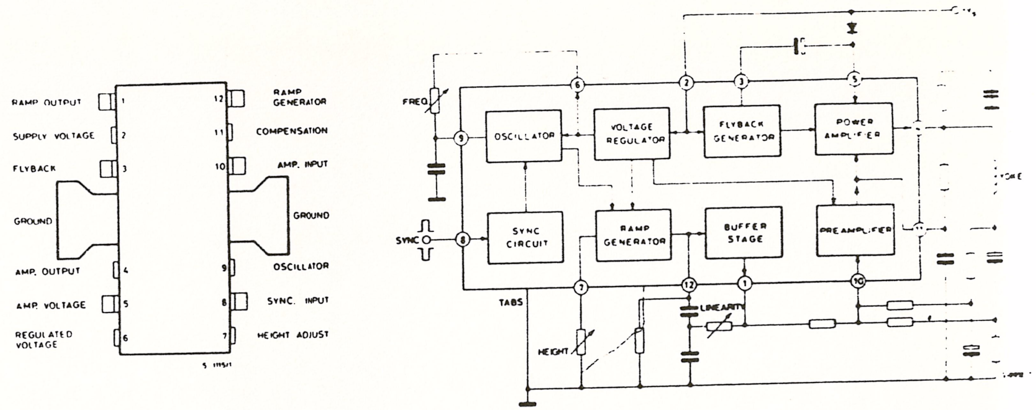


TDA 1170 S

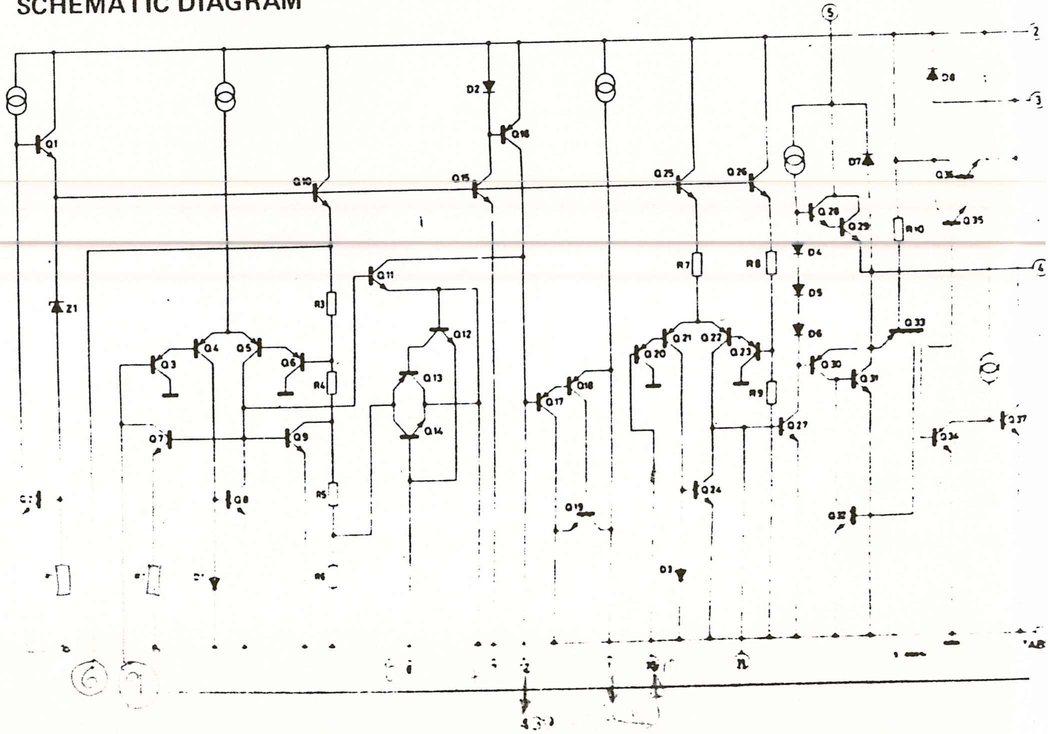


TDA 1170 SH

CONNECTION AND BLOCK DIAGRAMS



SCHEMATIC DIAGRAM



TDA 1170 S
TDA 1170 SH

THERMAL DATA

		TDA 1170S	TDA 1170SH
$R_{th\ j\text{-}tab}$	Thermal resistance junction-tab	max 12°C/W	max 10°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max 70°C/W(°)	max 80°C/W

(°) Obtained with tabs soldered to printed circuit with minimized copper area.

ELECTRICAL CHARACTERISTICS (Refer to the test circuits, V_s= 35V; T_{amb}= 25°C, unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit	Fig.
DC CHARACTERISTICS							
I_2	Pin 2 quiescent current	I_3 = 0		7	14	mA	1b
I_5	Pin 5 quiescent current	I_4 = 0		8	15	mA	1b
$-I_9$	Oscillator bias current	V_9 = 1V		0.1	1	μA	1a
$-I_{10}$	Amplifier input bias current	V_{10}= 1V		0.1	1	μA	1b
$-I_{12}$	Ramp generator bias current	V_{12}= 0		0.02	0.3	μA	1a
$-I_{12}$	Ramp generator current	I_7 = 20 μA V_{12}= 0	19	20	24	μA	1b
$\frac{\Delta I_{12}}{I_{12}}$	Ramp generator non-linearity	ΔV_{12}= 0 to 12V, I_7 = 20 μA		0.2	1	%	1b
V_s	Supply voltage range		10		36	V	–
V_1	Pin 1 saturation voltage to ground	I_1 = 1 mA		1	1.4	V	–
V_3	Pin 3 saturation voltage to ground	I_3 = 10 mA		1.7	2.6	V	1a
V_4	Quiescent output voltage	V_s= 10V R_1= 10 KΩ R_2= 10 KΩ	4.17	4.4	4.63	V	1a
		V_s= 35V R_1= 30 KΩ R_2= 10 KΩ	8.35	8.8	9.25	V	1a
V_{4L}	Output saturation voltage to ground	$-I_4$ = 0.1A		0.9	1.2	V	1c
		$-I_4$ = 0.8A		1.9	2.3	V	[illegible]
V_{4H}	Output saturation voltage to supply	I_4 = 0.1A		1.4	2.1	V	[illegible]
		I_4 = 0.8A		[illegible]	[illegible]	[illegible]	[illegible]
V_6	Regulated voltage at pin 6		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
V_7	Regulated voltage at pin 7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
$\frac{\Delta V_7}{\Delta V_s}$	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Fig. 1 - DC test circuits

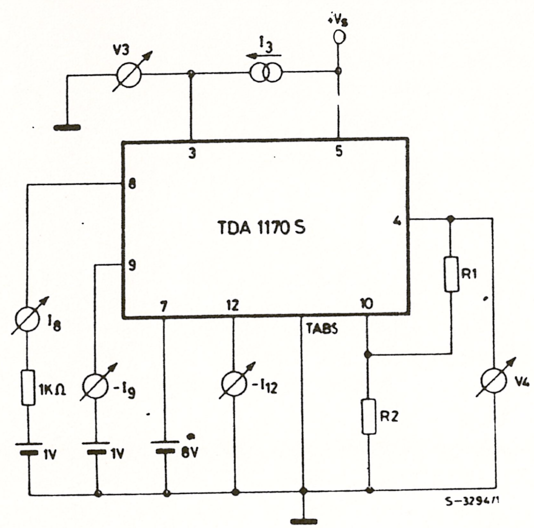


Fig. 1a

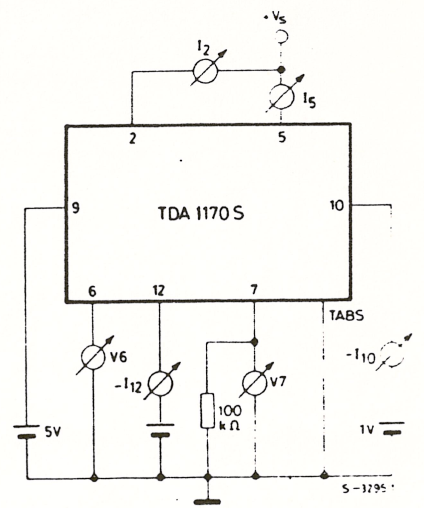
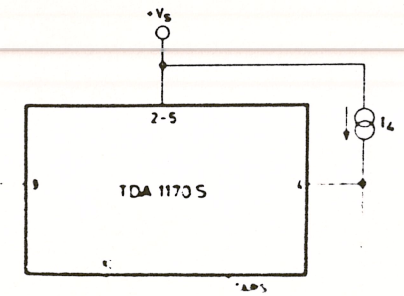
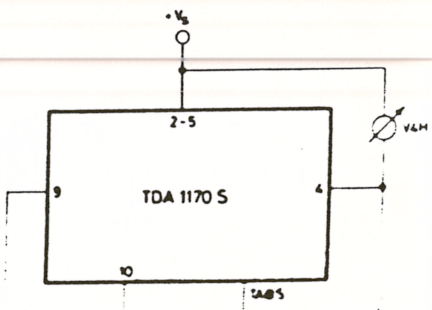


Fig. 1b





AC CHARACTERISTICS (Refer to the test circuit, $V_S = 25V$; f = 50 Hz; $T_{amb} = 25°C$, unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit	Fig.
I_s	Supply current	I_y = 1 App		140		mA	2
I_8	Sync. input current (positive or negative)		500			μA	2
V_4	Flyback voltage	I_y = 1 App		51		V	2
V_9	Peak to peak oscillator sawtooth voltage			2.4		V	2
t_{fly}	Flyback time	I_y = 1 App		0.7		ms	2
f_o	Free running frequency	$(P_1 + R_1)$ = 300 KΩ C_2 = 100 nF		44		Hz	2
		$(P_1 + R_1)$ = 260 KΩ C_2 = 100 nF		52		Hz	2
Δf	Synchronization range	I_8 = 0.5 mA	14			Hz	2
$\frac{\Delta f}{\Delta V_s}$	Frequency drift with supply voltage	V_s = 10 to 35V		0.005		Hz/V	2
$\frac{\Delta f}{\Delta T_{tab}}$	Frequency drift with tab temperature	T_{tab} = 40 to 120°C		0.01		Hz/°C	2

Fig. 2 - AC test circuit

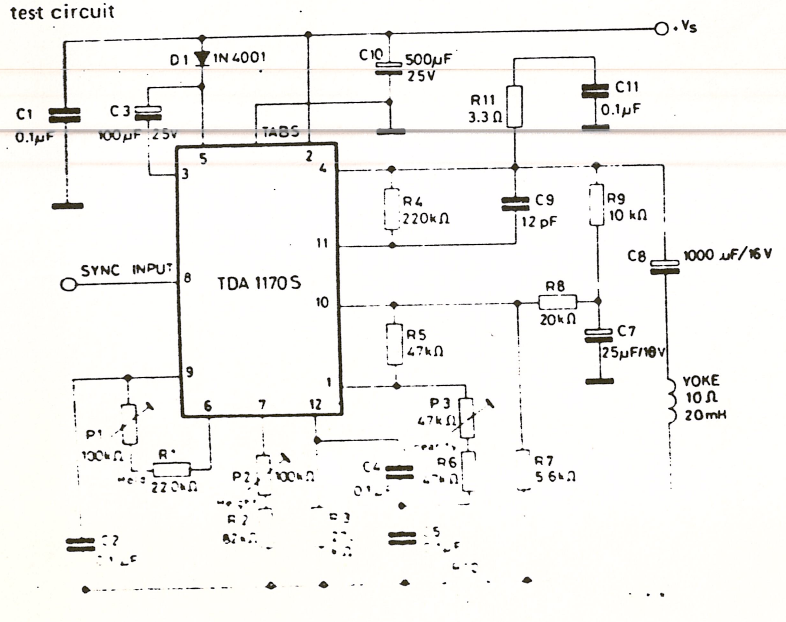
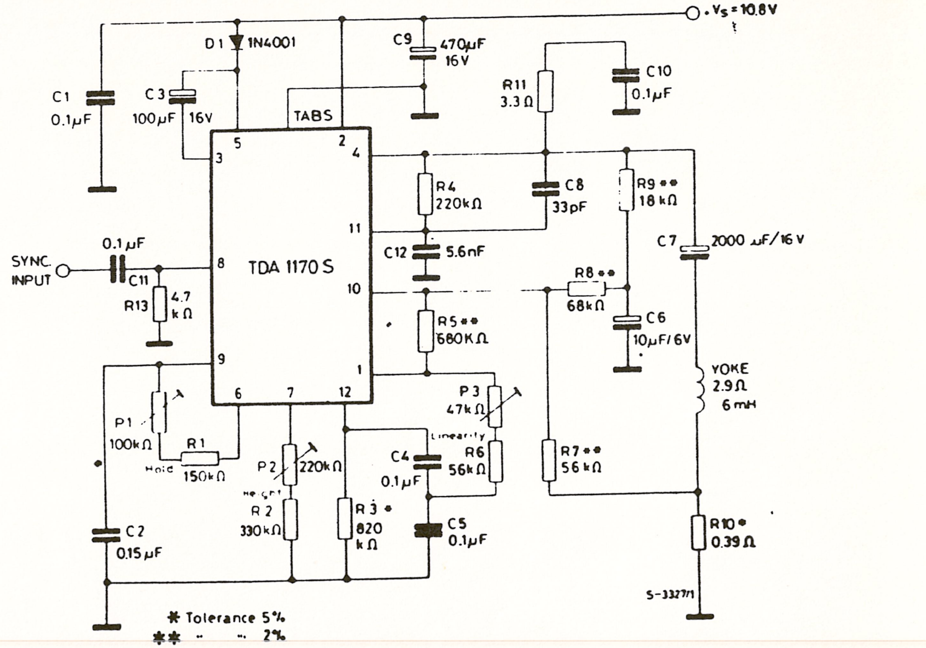


Fig. 3 - Typical application circuit for small screen B/W TV set (R_y = 2.9Ω, L_y = 6 mH; I_y = 1.1 App)

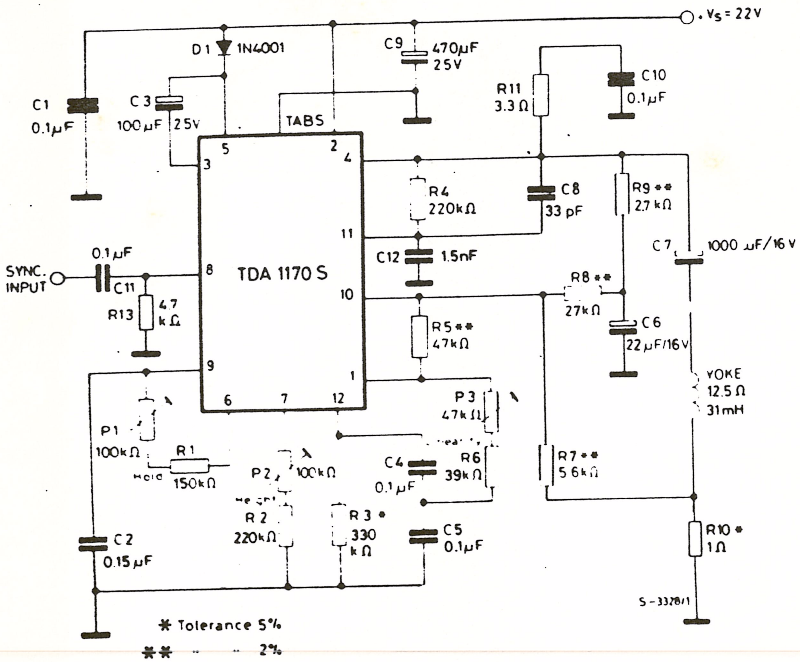


Typical performance

V_s	Operating supply voltage	10.8	V
I_s	Supply current	155	mA
t_{fly}	Flyback time	0.5	ms
P_{tot}	TDA 1170S power dissipation	1.35	W
I_y	Maximum scanning current (peak to peak)	1.30	A

... up to T_{amb} 60°C a heatsink of R_{th} = 30°C/W is required.

Fig. 4 - Typical application circuit for small screen 90° PIL TVC set (R_y = 12.5Ω ; L_y = 31 mH; I_y = 0.8 App).

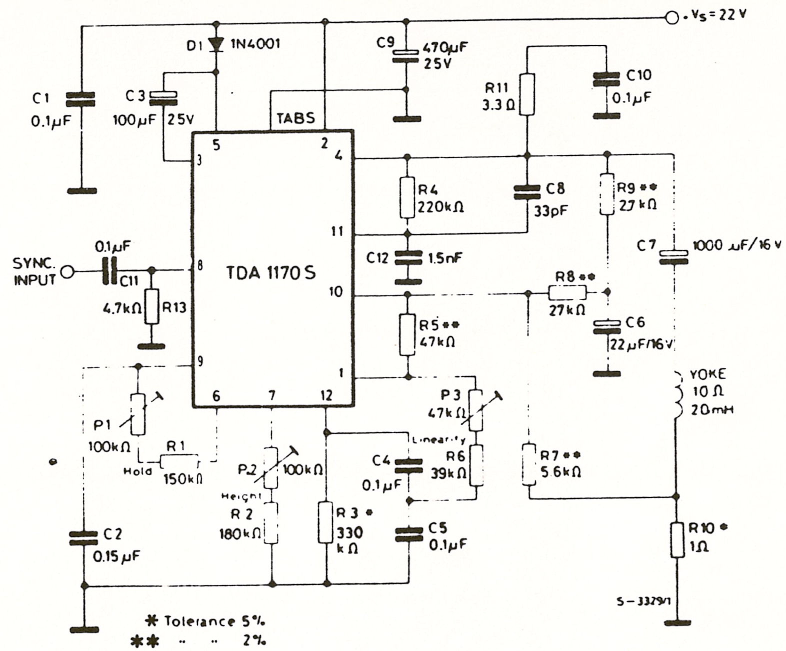


Typical performance

V_s	Operating supply voltage	22	V
I_s	Supply current	120	mA
t_{fly}	Flyback time	0.8	ms
P_{tot}	TDA 1170S power dissipation	1.95	W
I_y	Maximum scanning current (peak to peak)	1.0	A

For safe working up to T_{amb} = 60°C a heatsink of R_{th} = 18°C/W is required.

Fig. 5 - Typical application circuit for large screen B/W TV set (R_y = 10Ω ; L_y = 20 mH; I_y = 1 App)



Typical performance

V_s	Operating supply voltage	22	V
I_s	Supply current	145	mA
t_{fly}	Flyback time	0.7	ms
P_{tot}	TDA 1170S power dissipation	2.3	W
I_y	Maximum scanning current (peak to peak)	1.2	A

For safe working up to T_{amb} = 60°C a heatsink of R_{th} = 14°C/W is required.

TDA 1170 S
TDA 1170 SH

Fig. 6 - Typical application circuit for large screen 110° PIL TVC set (R_y= 10Ω ; L_y= 25 mH; I_y= 1.25 App)

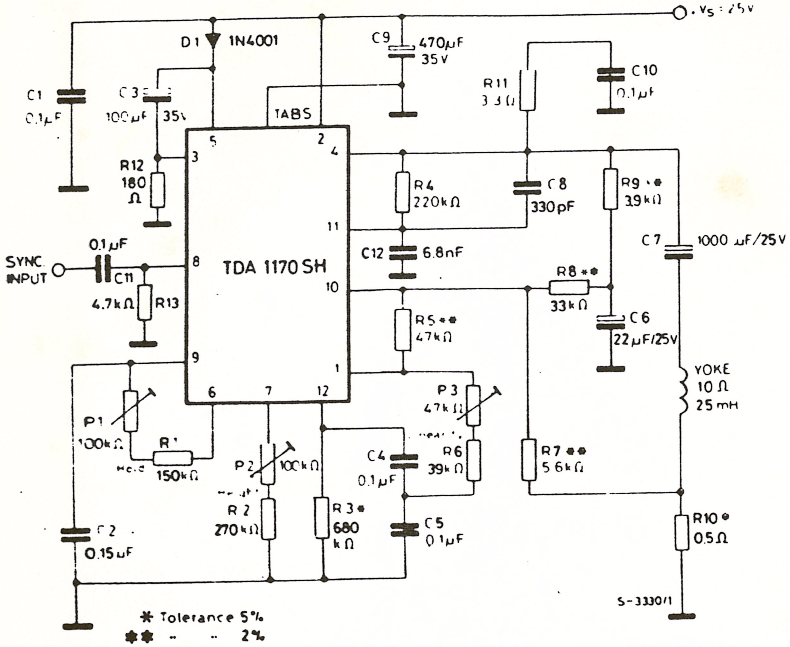
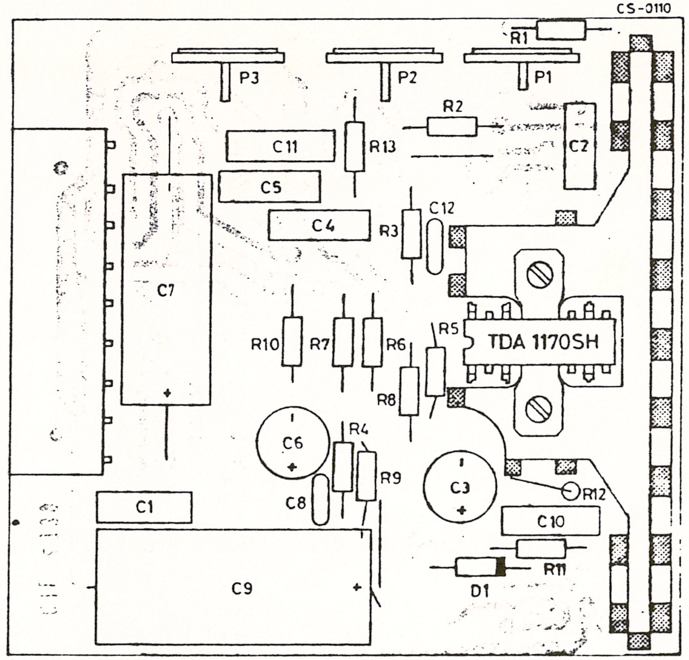


Fig. 7 - P.C. board and component layout of the circuit of fig. 6 (1 : 1 scale)



Note: For the heatsink (1170 S and 1170 SH) see mounting instructions

Typical performance

V_s	Operating supply voltage	25	V
I_s	Supply current	175	mA
t_{fly}	Flyback time	1	ms
P_{tot}	TDA 1170SH power dissipation	3.25	W
I_y	Maximum scanning current (peak to peak)	1.4	A

For safe working up to T_{amb}= 60°C a heatsink of R_{th}= 8.5°C/W is required.

MOUNTING INSTRUCTIONS

During soldering the tab temperature must not exceed 260°C and the soldering time must not be longer than 12 seconds.

The external heatsink or printed circuit copper area must be connected to electrical ground.

TDA 1170S

The junction to ambient thermal resistance of the TDA 1170S can be reduced by soldering the tabs to a suitable copper area of the printed circuit board (fig. 8) or to an external heatsink (fig. 9).

The diagram of fig 10 shows the maximum dissipable power P_{tot} and the $R_{th\ j\text{-}amb}$ as a function of the side of two equal square copper areas having a thickness of 35 μ (1.4 mil).

MOUNTING INSTRUCTIONS (continued)

Fig. 8 – Example of P.C. board copper area used as heatsink.

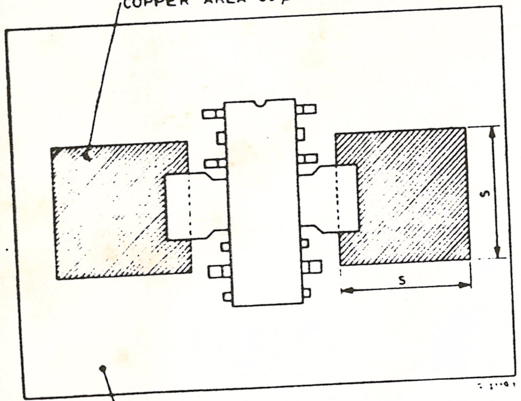


Fig. 9 – Example of TDA 1170 S with external heatsink.

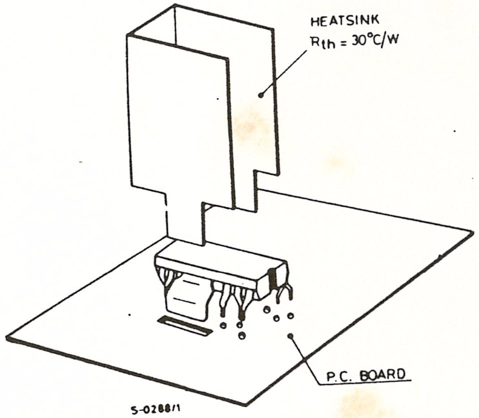


Fig. 10 – Maximum Power dissipation and junctional-ambient thermal resistance vs. "S"

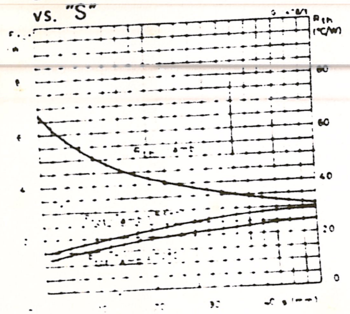


Fig. 11 – Maxim. allowable power dissipation vs. ambient temp. (TDA1170S)

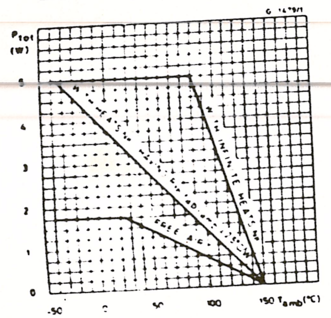
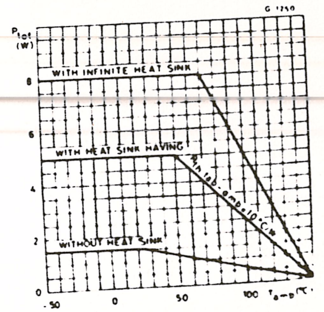


Fig. 12 – Maxim. allowable power dissipation vs. ambient temp. (TDA1170SH)



TDA 1170SH

The power dissipated in the circuit may be removed by connecting the tabs to an external heatsink according to fig. 12. The desired thermal resistance may be obtained by fixing the TDA1170SH to a suitable dimensioned plate as shown in fig. 13

MOUNTING INSTRUCTIONS (continued)

Fig. 13 – Mounting example.