THOMSON COMPONENTS SEMICONDUCTEURS

TEA7868

LINE INTERFACE

Designed to interface an equipment with the telephone line, this 8 pins IC provides:
- Line adaptation.
- Ring detection.

It is particularly convenient for modem applications and fulfils a wide range of international specifications.

Line adaptation: (DC characteristic)
- Zener characteristic with adjustable slope.
- Adjustable dynamic impedance.
- Adjustable maximum amplitude of the signal.
- Use only a low cost dry transformer.
- Need no dialling relay.

Ring detection:
- Adjustable detection level.
- Adjustable AC impedance.
- Very low line distortion.
- Logic signal output.

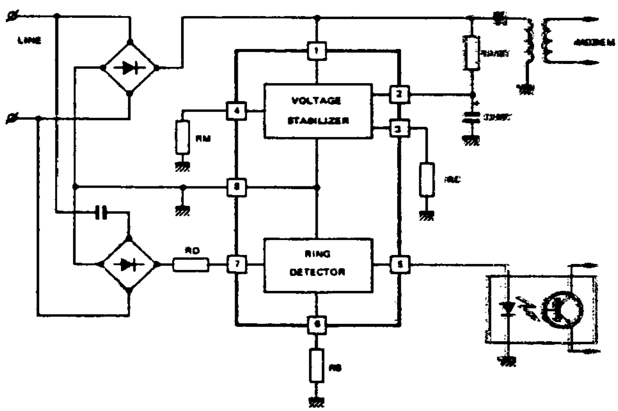
Other:
- Low working voltage.
- Wide operating current range.

LINE INTERFACE

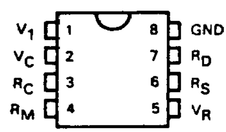
CASE CB-98

PLASTIC PACKAGE

BLOCK DIAGRAM



PIN ASSIGNMENT



PIN DESCRIPTION

VOLTAGE STABILIZER

Name	No.	Description
V_1	1	Voltage over the IC
V_C	2	C_{VST} decouples the voltage stabilizer and R_{VST} fixes the impedance
R_C	3	R_C fixes the voltage through R_{VST}
R_M	4	R_M fixes the slope of the DC characteristic
GND	8	Ground

RING DETECTOR

Name	No.	Description
V_R	5	Ring detection output connected to an optocoupling device
R_S	6	R_S fixes the ring detection level
R_D	7	Ring detection input. R_D fixes the impedance of the ring detector

Outlines

Specially designed for the modem applications, this 8 pins IC provides line adaptation, ring detection and easy pulse dialling. It is a Direct Connect Circuit (DCC) which has been designed to fulfill a wide range of AC and DC specifications for various countries.

Ring dectection

This circuit detects the incoming ringing signal and generates a logic signal to the microcomputer via an optocoupling device. The detection level can be fixed by an external resistor. The dynamic impedance of the ring detector is also fixed by an external resistor. The line distortion of the ringing signal is very low compared to the distortion introduced by a zener detector.

Line adaptation

The DC characteristic can fulfill a wide range of DC specifications:

— zener characteristic with adjustable slope fixed by an external resistor,

— line current limitation using an external CTP.

The dynamic impedance is fixed by an external resistor R_{VST} so as to match with different line impedances.

The maximum amplitude of the signal is fixed by two external resistors R_{VST} and R_C.

This circuit has been designed to be connected to a low cost dry transformer.

The application has been studied to avoid the use of dialling relay.

With its possibility of ring detection, off-hook and dialling this circuit is adapted to the application in smart modems. Is also satisfies the FCC Rules Part 68.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply voltage	V_1 V_7	16 16	V V
Power dissipation	P_{tot}	600	mW
Operating temperature	T_{oper}	− 25 to + 65	°C
Storage temperature	T_{stg}	− 55 to + 150	°C

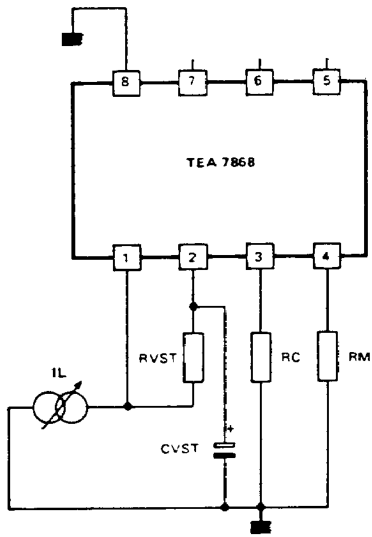
STATIC ELECTRICAL CHARACTERISTICS:
$T_{amb} = 25°C$

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Line current (Pin 1)	I_L	10	—	120	mA
Voltage over the IC (Pin 1) See note 1 I_L = 10 mA I_L = 100 mA	 V_1 V_1	 — —	 3 4.5	 — —	 V V
Voltage stabilizer (Pin 2) See note 1 I_L = 10 mA I_L = 100 mA	 V_C V_C	 — —	 2.1 3.5	 — —	 V V

DYNAMIC ELECTRICAL CHARACTERISTICS:
$T_{amb} = 25°C$

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Impedance of the transmission part. See note 2 Return loss compared to 600 Ω: 300 Hz < f < 5 kHz	R.L.	15	—	—	dB
Ring detection level (See note 3) For a low level on pin 5 (< 0.3 V) : no detection For a high level on pin 5 (> 0.8 V) : ring detection	V_R	 18 —	 20 20	 — 22	Vpp
Impedance of the ring detection part: Typically $R_S + R_D/13$ (See note 3)	Z_R	9.5	10.5	11.5	kΩ
Distortion in ring mode: f_{Ring} = 50 Hz (See note 4)		—	—	—	—

Note 1: Static electrical characteristic test diagram:



External components:

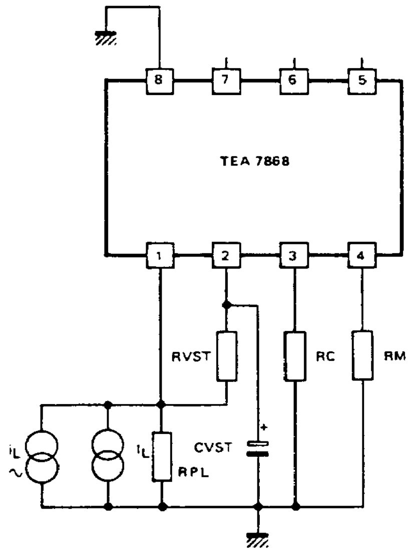
$C_{VST} = 100\ \mu F$ $R_{VST} = 1.2\ k\Omega$
$R_C = 2.7\ k\Omega$ $R_M = 12\ \Omega$

Test conditions:

for: $I_L = 10$ mA $V_1 = 3.2$ V
and $V_C = 2.1$ V

for: $I_L = 100$ mA $V_1 = 4.5$ V
and $V_C = 3.4$ V

Note 2: Impedance measurement:



External components:

$C_{VST} = 100\ \mu F$ $R_{VST} = 1200\ \Omega$
$R_C = 2.7\ k\Omega$ $R_M = 12\ \Omega$
$RPL = 1200\ \Omega$

Test conditions:

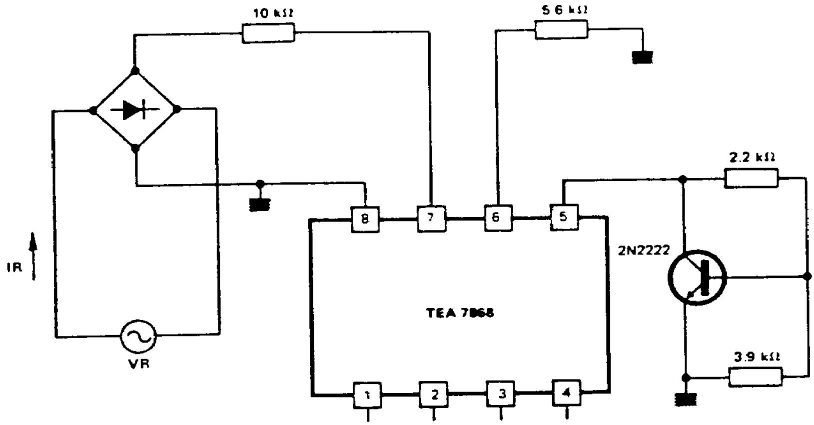
$I_L = 20\ mA$

$$Z_{out} = \frac{V_1}{i_L}$$

Return loss is defined by:

$$R.L. = 20 \log \left(\frac{|Z_{out} + 600|}{|Z_{out} - 600|} \right)$$

Note 3: Ring detection part:



Test conditions:

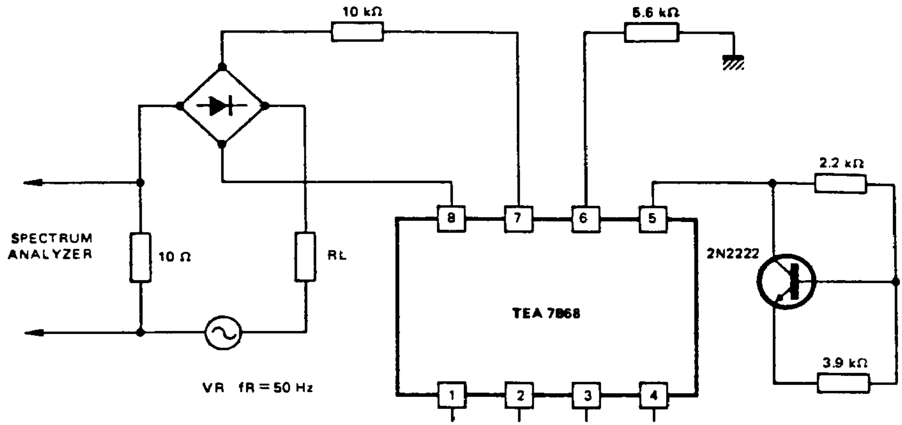
- Ring detection level

for: $V_R = 18$ Vpp $\quad V(5) < 0.3$ V
for: $V_R = 22$ Vpp $\quad V(5) > 0.8$ V

- Impedance of the ring detection part:

$$Z_R = \frac{V_R}{I_R}$$

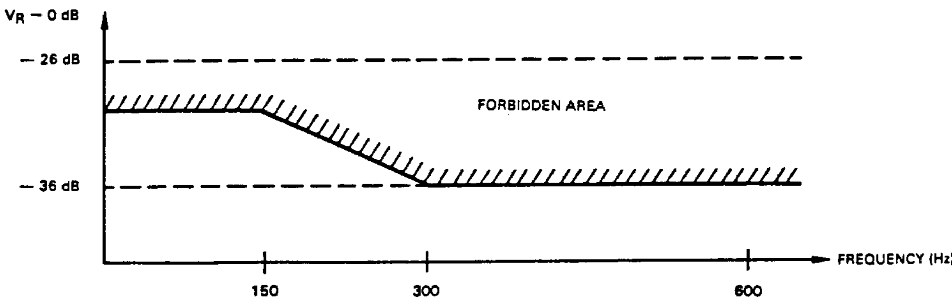
Note 4: Ring detection distortion:



Test conditions:

$V_R = 90\ V_{RMS}$ $300\ \Omega < R_L < 1400\ \Omega$

No distortion peaks appear in the forbidden area of the following shape:



APPLICATIONS INFORMATION

RING DETECTION:

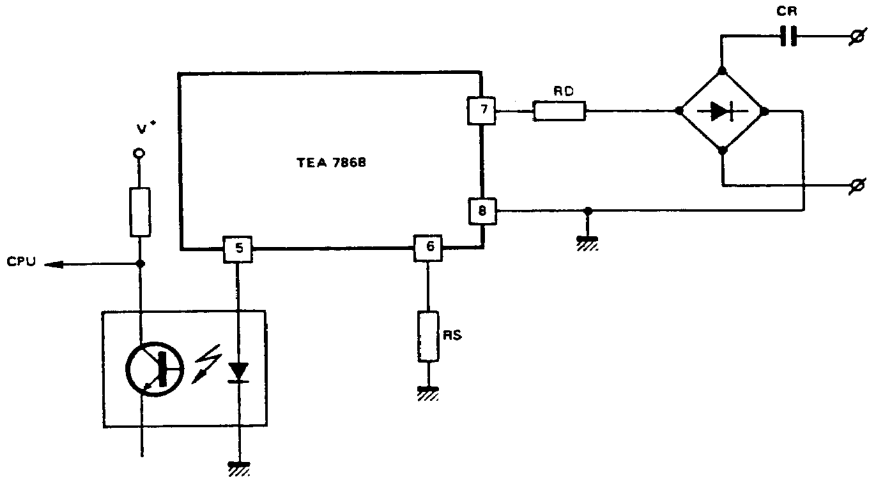


FIGURE 1

The ringing signal coming from the line is rectified by the diode bridge; the circuit compares the peak amplitude of the signal to a predeterminated detection level fixed by R_S. On the output transistor of the optocoupling device a logic signal is generated which frequency is twice the frequency of the ringing signal.

"0" = the amplitude of the ringing signal is greater than the detection level.

"1" = the amplitude of the ringing signal is lower than the detection level.

The ring detection circuit is fully linear; so the distortion on the line is very low compared to the distorsion introduced by a zener detector as usually used.

Three external components affect the characteristic of the ring detection circuit. The capacitor C_R provides the DC solation from the line.

The AC impedance of the circuit at the ringing frequency is given by the formula:

$$\dot{Z}_{AC} = Z_{CR}(f) + R_D + R_S/13$$

Z_{CR} is the impedance of the capacitor C_R at the ringing frequency.

The ring detection level is fixed by the external resistor R_S with the following formula:

$$R_S = \frac{11 \text{ volts}}{V_R\text{-}V_D\text{-}3 \text{ volts}} R_D$$

V_R is the peak amplitude of the ringing signal at the detection level.

V_D is the voltage over the diode bridge and the capacitor C_R at the ringing frequency.

AC/DC LINE ADAPTATION:

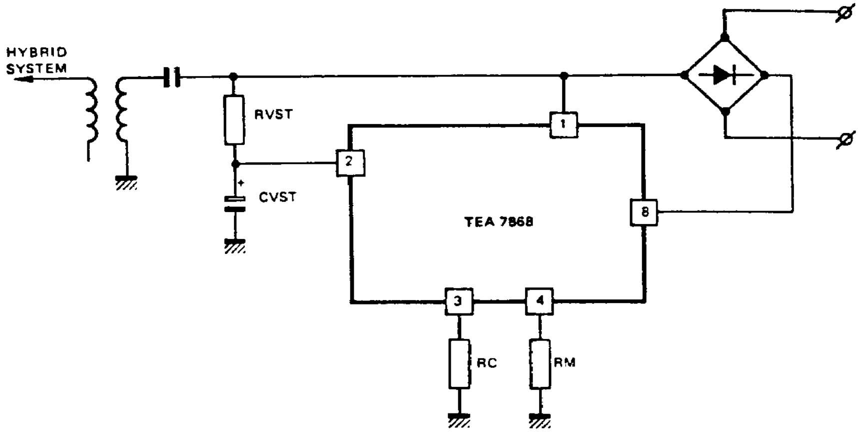


FIGURE 2

This part of the TEA7868 is used for line adaptation.

An equivalent diagram of the circuit is given at fig. 3.

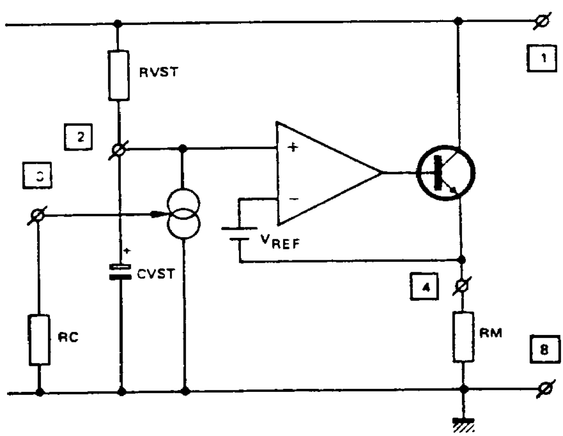


FIGURE 3

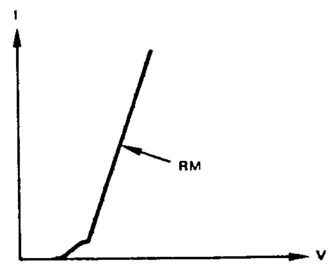


FIGURE 4

The DC characteristic is a zener characteristic which slope is fixed by R_M (see fig. 4). The voltage over the circuit (pin 1) is fixed via a current source driven through R_{VST}. The value of this current source is fixed by the external resistor R_C with the formula:

$$V(R_{VST}) = V(pin1) - V(pin2) = \frac{R_{VST}}{R_C} \times 2.45 \text{ volts}$$

Note that the voltage through R_{VST} also limits the amplitude of the emitted signal.

The external resistor R_{VST} also defines the AC impedance of the circuit:

$Z_{AC} = R_{VST}$ // impedance seen from the transformer (see hybrid system)

- When a current limitation is required for the DC characteristic (as for the French specification), an external TPE is connected between the telephone line and the circuit (see application diagram).

PULSE DIALLING:

Pulse dialling is easily done using a high voltage optocoupling device and a high voltage PNP transistor as shown on the typical application diagram.

HYBRID SYSTEM:

This system uses an operational amplifier to prevent from injecting the emitted signal in the receiving path of the modem IC. A typical diagram is given at fig. 5.

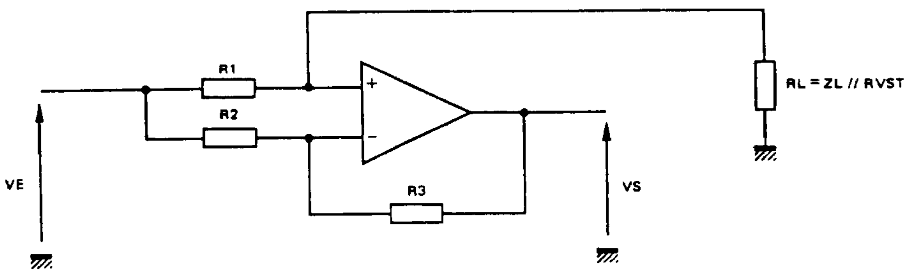


FIGURE 5

R_L represents the impedance of the telephone line Z_L in parallel with R_{VST}. Typically we take $Z_L = 600$ ohms.
The hybrid gain of the system is given by:

$$G_D = \frac{V_S}{V_E} = 1 - \frac{R_2+R_3}{R_2}\,\frac{R_1}{R_1+R_L}$$

For a maximum efficiency you must have $G_D = 0$ and this gives:

$$\frac{R_3}{R_2} = \frac{R_L}{R_1}$$

The impedance seen from the line must be 600 ohms, this impedance is given by:

$Z_{out} = R_1 // R_{VST}$

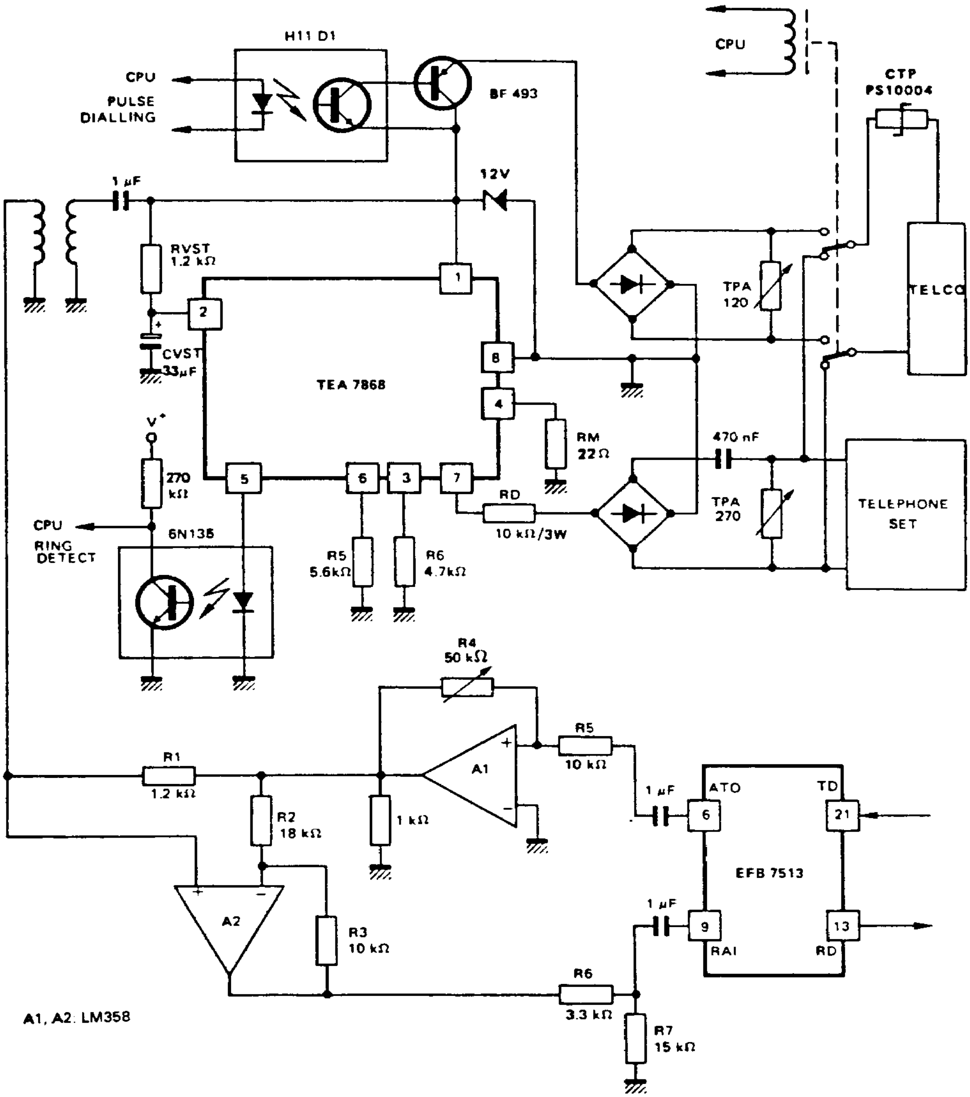
So, if R_{VST} is fixed, R_1 is also fixed by $Z_{out} = 600$ ohms.
The gain between the online signal and the modem input is:

$$G_E = \frac{R_L}{R_1+R_L}$$

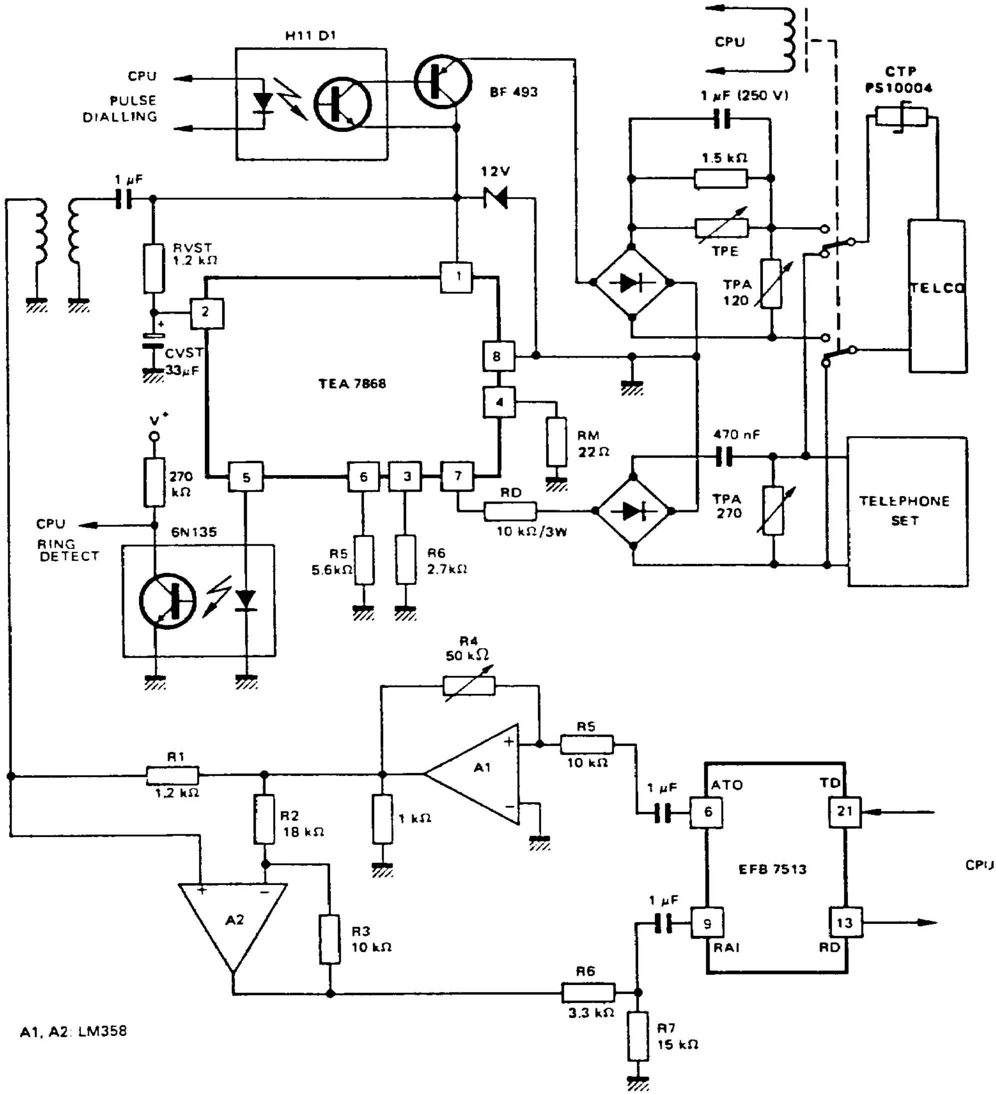
The gain between the line and the modem input is:

$$G_R = 1 + \frac{R_3}{R_2}$$

Those calculations are purely theoretical; really the line impedance has a complex component, so there will be little changes in the value of R_1, R_2, R_3 to adapt the hybrid system.



COMPLETE DAA INTERFACE CIRCUIT WITH TEA7868



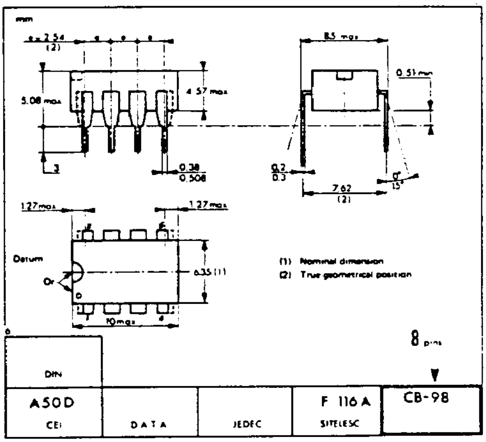
COMPLETE DAA INTERFACE CIRCUIT WITH TEA7868

with current limitation (French specification)

PHYSICAL DIMENSIONS

CB-98

PLASTIC PACKAGE



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