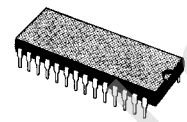
SGS-THOMSON
MICROELECTRONICS

TEA7037

SPEECH AND TONE CIRCUIT

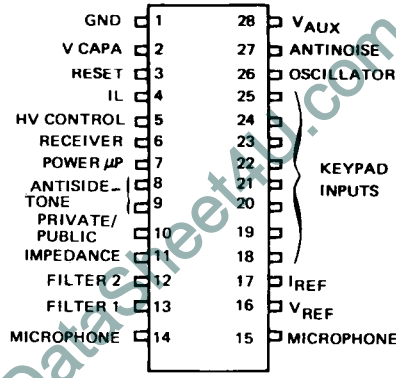
- AUTOMATIC LINE LENGTH RECEIVING AND SENDING GAIN CONTROL
- AUTOMATIC LINE LENGTH TRACKING ANTI-SIDETONE SYSTEM
- ADJUSTABLE MICROPHONE AND EAR-PHONE AMPLIFIER GAIN
- MEETS FRENCH VOLTAGE/CURRENT LIMI-TATIONS IN SPEECH AND RING MODE
- ADAPTED TO EVERY KIND OF EARPHONE TRANSDUCER
- MUTE IN EMISSION AND RECEPTION
- PABX POSITION
- TWO KEYS ROLL OVER PROVIDED
- ADJUSTABLE OUTPUT TONE LEVEL
- CLICK FREE SWITCH OVER FROM SPEECH TO DIALING MODE & VICE-VERSA



DIP-28

ORDER CODE : TEA7037DP

PIN CONNECTION



DESCRIPTION

Specially designed for telephone set applications this 28 pins IC provides :

a) Transmission and line adaptation

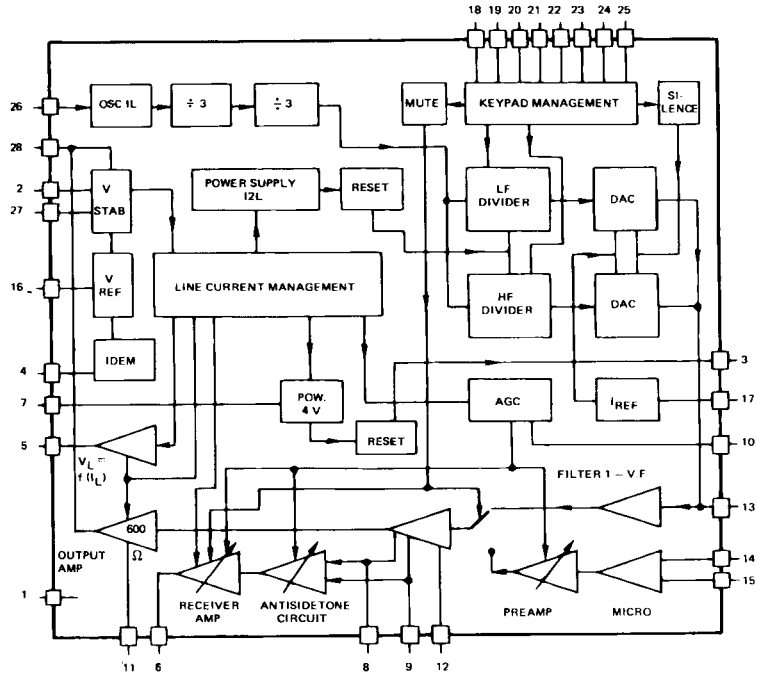
b) F.V. generation

c) Power supply for peripherals

d) Interface with MCU

It meets the French Specifications for handset homologation level 1.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{cse}	Supply Voltage	8.5	V
P_{tot}	Power Dissipation	800	mW
T_{oper}	Operating Temperature Range	– 25 to 65	°C
T_{stg}	Sorage Temperature Range	– 55 to 150	°C

PIN DESCRIPTION

N°	Name	Description
1	G_{ND}	Ground
2	V_{capa}	C7 : Voltage Stabilizer Filtering Capacity
3	Reset	Microprocessor Reset
4	I_L	R17/C6 Sets Call Frame Width
5	H_V Control	Output Controlling HV Stage
6	Receiver	Receiver Output
7	Power Up	Stabilized Power for Peripheral Circuits
8	Antisidetone	Antisedone Network Input for Long Lines (3.5km)
9		Antisedone Network Input for Short Lines (0.5km)
10	Private/Public	Gain Control Inhibition with Respect to line Length
11	Impedance	R7 Sets Dynamic Impedance
12	Filter 2	Second Filter Input for Voice Frequencies
13	Filter 1	First Filter Input for Voice Frequencies
14-15	Microphone	Microphone
16	V_{ref}	Reference Voltage
17	I_{ref}	R9 Sets Internal Source Reference Current
18	Keypad Inputs	" D " 941 Hz Logic Input
19		" C " 852 Hz Logic Input
20		" B " 770 Hz Logic Input
21		" A " 697 Hz Logic Input
22		" E " 1209 Hz Logic Input
23		" F " 1336 Hz Logic Input
24		" G " 1477 Hz Logic Input
25		" H " 1633 Hz Logic Input
26	Oscillator	Oscillator Input
27	Antinoise	C8 Decreases Line Noise Level
28	V_{aux}	V_{CC} : Low Voltage LIne

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_C	Stabilized Voltage (pin 2)	I_L = 28mA (see figs. 9, 10)	2.6	2.8	2.95	V
I_{DEM}	Charging Current(pin 2)			2.6		mA
I_r	Line Current Regulation for HV Control (pin 5)	Pin 4 = Pin 2 = GND I_L = 150mA I_L = 105mA	150		 5	µA
		Pin 4 ON ; Pin 2 = GND I_L = 75mA	150			µA
		Pin 4 ON ; Pin 2 ON I_L = 60mA I_L = 16mA	150		 100	µA nA
I_r/I_L		28mA < I_L < 50mA	0.9	1.0	1.1	µA/mA
I_{int}	Internal Bias Current (pin 28)	I_L = 28mA ; (see figs. 9, 10) R9 = 16.2KΩ (V_{28} = R6 * I_{int} + V_C)	470	510	550	µA
V_{ref}	Reference Voltage	I_L = 28mA	1.35	1.42	1.49	V
I_{ref}	Current at V_{ref}		− 10		100	µA
V_{MP}	Stabilized Supply at Pin 7	(see fig. 11)	3.7	4	4.2	V
I_{CMP}/I_{LI}	Charging Current at Pin 7	Pin 4 = Pin 2 = GND I_{L1} = I_L − I_{dem} (note 2)	0.7			mA/mA
I_{SMP}	Static Current at Pin 7	I_L = 6 mA I_L > 25 mA I_L > 25 mA + AC	0.5 3.15 1.6	− 3.5 1.75	− − −	mA mA mA
I_{IMP}	Internal Consumption	(see fig. 11)	90	110	130	µA

RESET MICROPROCESSOR (see fig. 12)

V_{RH}	High Threshold		0.82 x V_{PM}			V
V_{RB}	Low Threshold		2.83		0.805 x V_{PM}	V
V_{RSH}	Output High	Reset = 1	0.9 x V_{PM}			V
V_{RSB}	Output Low	Reset = 0			0.1 x V_{PM}	V

AC CHARACTERISTICS (see figs. 12, 13, 14 and 15)

G_{EL} G_{EC}	Tx Gain at Long Line Tx Gain at Short Line	I_L = 28 mA I_L = 44 mA	54 47	55 49	56 51	dB dB
DE	Distortion in I_x	I_L = 28 to 44 mA V_L = 1.5 dBm V_L = 4 dBm			 3 10	 % %
Z_E	Microphone Input Impedance	Symmetric Mode	1.82	2.15	2.47	KΩ
B_{EP}	Tx Psophometric Noise	Z_{IN} = 2 K ; I_L > 28 mA		− 69		dBmp
R_E	Tx Attenuation M.F. and Silence Modes	I_L > 28 mA	60			dB
CM_{RR}	Common Mode Rejection Ratio			60		dB

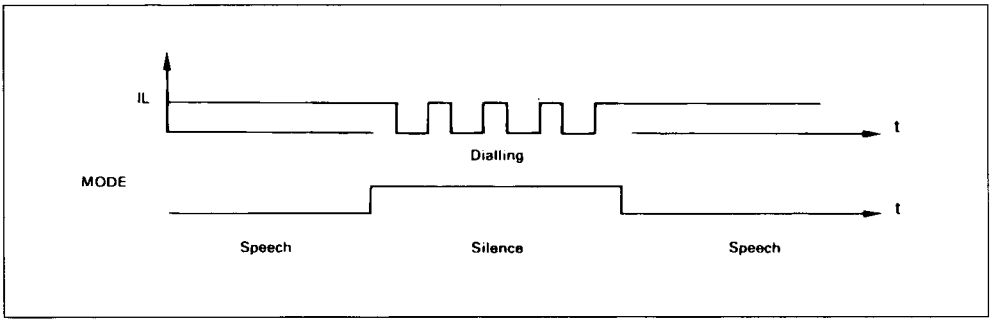
ELECTRICAL CHARACTERISTICS (Continued)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
G_{RL} G_{RC}	Rx Gain at Long Line Rx Gain at Short Line	I_L = 28mA I_L = 44mA	28.5 27.5	29.5 23.5	30.5 25.5	dB dB
D_R	Distortion in R_x	I_L = 28 to 44mA V_{EC} = 440mV V_{EC} = 790mV			 3 10	 % %
B_{RP}	R_x Noise	I_L > 28mA ; R_{EC} = 600Ω		– 74		dB mp
G_{AL}	Side Tone at Long Line	I_L = 28mA	22			dB
G_{AC}	Side Tone at Short Line	I_L = 44mA	26			dB
Z_{AC}	AC Impedance	I_L > 28mA	500	600	700	Ω

DTMF GENERATOR (see fig. 16)

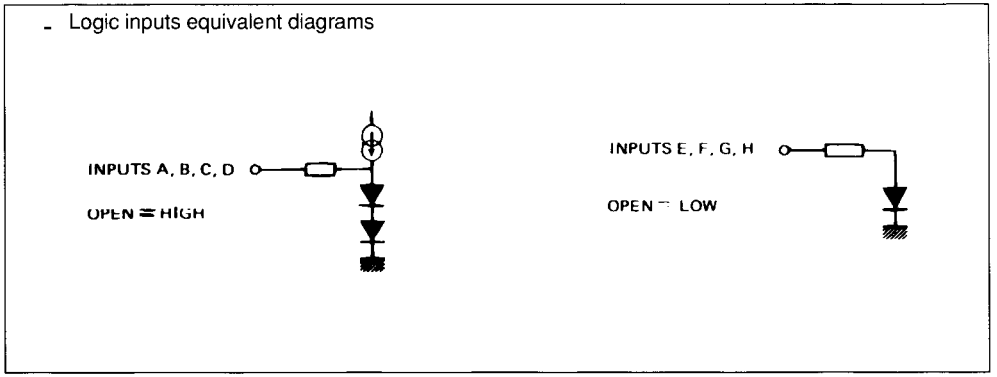
D_{FV}	Frequency Dispersion		– 0.5	–	+ 0.5	%
N_{FB}	Low Frequency Group		– 10	–	– 6	dBm
N_{FH}	High Frequency Group		– 8	–	– 4	dBm
P_{FV}	Pre-Emphasis		1	2	3	dB
C_{FV}	Voice Frequency Monitoring		28	35	42	dB

In pulse dialling the receiver mute is the silence mode.



FUNCTIONAL DESCRIPTION

- Logic inputs equivalent diagrams



LOGIC TABLE - KEYBORD MODE

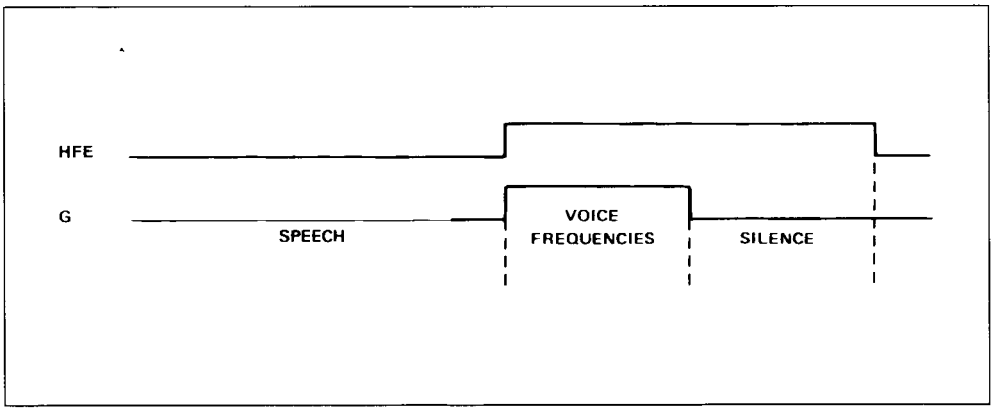
Symbol	Inputs								Voice Frequencies (Hz)	Mute	Notes
	A	B	C	D	E	F	G	H			
–	H	H	H	H	L	L	L	L	–	Off	a
–	L	H	H	H	L	L	L	L	697	On	b
–	H	L	H	H	L	L	L	L	770	On	
–	H	H	L	H	L	L	L	L	852	On	
–	H	H	H	L	L	L	L	L	941	On	
–	H	H	H	H	H	L	L	L	1209	On	c
–	H	H	H	H	L	H	L	L	1336	On	
–	H	H	H	H	L	L	H	L	1447	On	
–	H	H	H	H	L	L	L	H	1633	On	
" 1 "	L				H				697 + 1208	On	d
" 2 "	L					H			697 + 1336	On	
" 3 "	L						H		697 + 1477	On	
" A "	L							H	697 + 1633	On	
" 4 "		L			H				770 + 1209	On	
" 5 "		L				H			770 + 1336	On	
" 6 "		L					H		770 + 1477	On	
" B "		L						H	770 + 1633	On	
" 7 "			L		H				852 + 1209	On	
" 8 "			L			H			852 + 1336	On	
" 9 "			L				H		852 + 1477	On	
" C "			L					H	852 + 1633	On	
" * "				L	H				941 + 1209	On	
" 0 "				L		H			941 + 1336	On	
" # "				L			H		941 + 1477	On	
" D "				L				H	941 + 1633		

Notes : a. Conversation mode.
b. Test mode.
Low frequencies.
c. Test mode.
High frequencies.
d. If one of inputs E, F, G, H, is high, the others are low.
If one of inputs A, B, C, D, is low, the other are ligh.

LOGIC TABLE - MICROPROCESSOR MODE

Symbol	Inputs								Voice Frequencies (Hz)	Mute	Notes
	A	B	C	D	E	F	H	G			
–	H	H	H	H		L		L	–	Off	e
–	X	X	X	X		H		L	–	On	f
" 1 "	H	H	H	H		H		H	697 + 1209	On	
" 2 "	H	H	H	L		H		H	697 + 1336	On	
" 3 "	H	H	L	H		H		H	697 + 1477	On	
" A "	H	H	L	L		H		H	697 + 1633	On	
" 4 "	H	L	H	H		H		H	770 + 1209	On	
" 5 "	H	L	H	L		H		H	770 + 1336	On	
" 6 "	H	L	L	H		H		H	770 + 1477	On	
" B "	H	L	L	L		H		H	770 + 1633	On	
" 7 "	L	H	H	H		H		H	852 + 1209	On	
" 8 "	L	H	H	L		H		H	852 + 1336	On	
" C "	L	H	L	L		H		H	852 + 1477	On	
"C"	L	H	L	L		H		H	852 + 1633	On	
" * "	L	L	H	H		H		H	941 + 1209	On	
" 0 "	L	L	H	L		H		H	941 + 1336	On	
" # "	L	L	L	H		H		H	941 + 1477	On	
" D "	L	L	L	L		H		H	941 + 1633	On	

Notes : e. Conversion mode.
f. Silence setting.



PUBLIC / PRIVATE

When a resistor is inserted between pin 10 and ground, the transmission and receiving efficiency control and antisidetone variation are inhibited with respect to line current.

The transmission and receiving gains may vary from G_{max}(gel) to G_{max} 6 dB (Gec) with respect to the resistance value.

The equivalent antisidetone is related to the gain set by RI_p

Figure 1 : Transmission and Receiving Gain Attenuation.

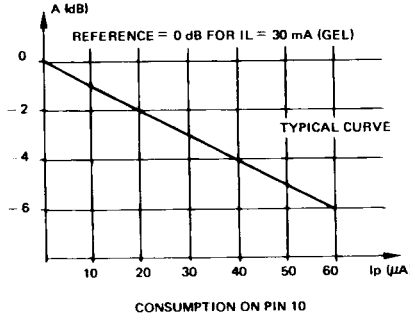


Figure 2 : Equivalent Antilocal Network.

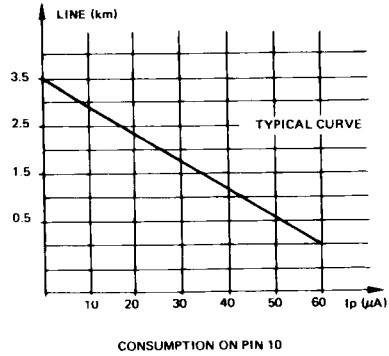
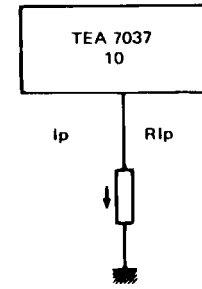


Figure 3 .



$$RIp \text{ in MW} = \frac{7.8}{Ip\mu A}$$

For RIp = 390K to 1%
DG = − 2dB ± 0.4dB

Figure 4.

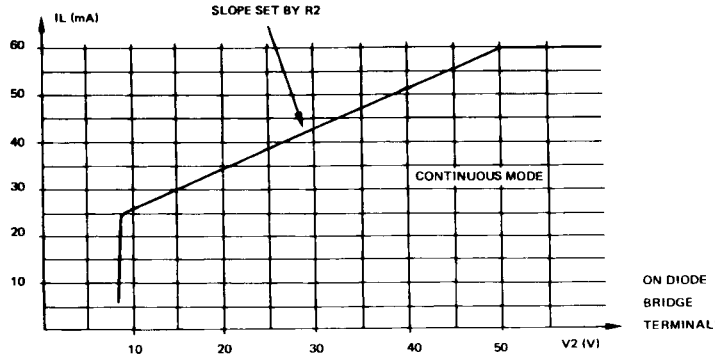


Figure 5.

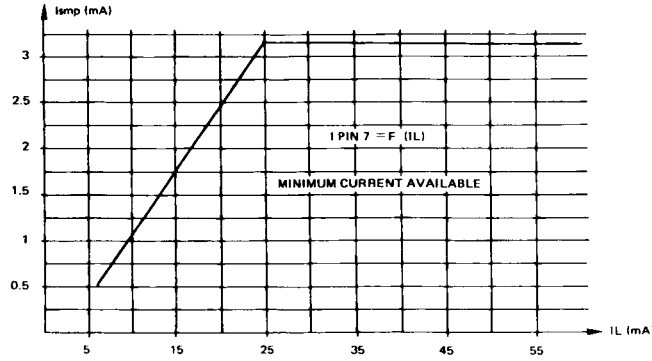


Figure 6.

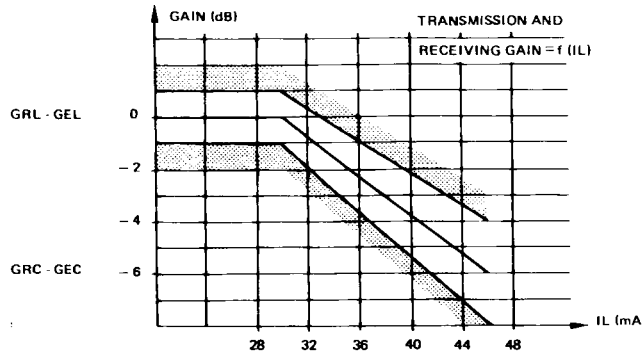
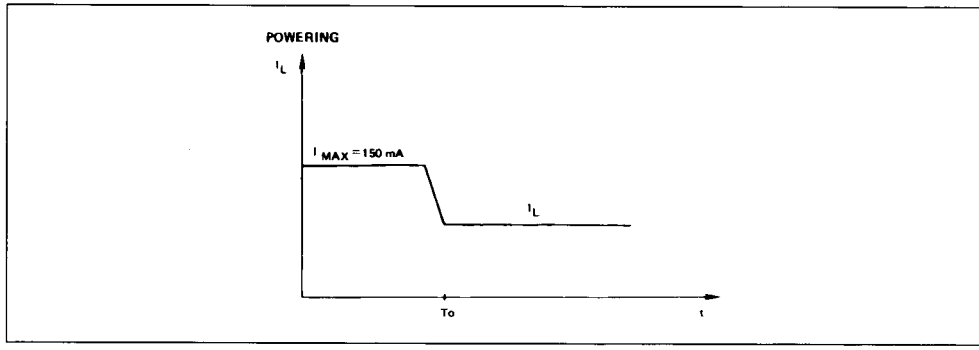


Figure 7 : To it set by : R17 · C6 (pin 4) or C7 (pin 2).

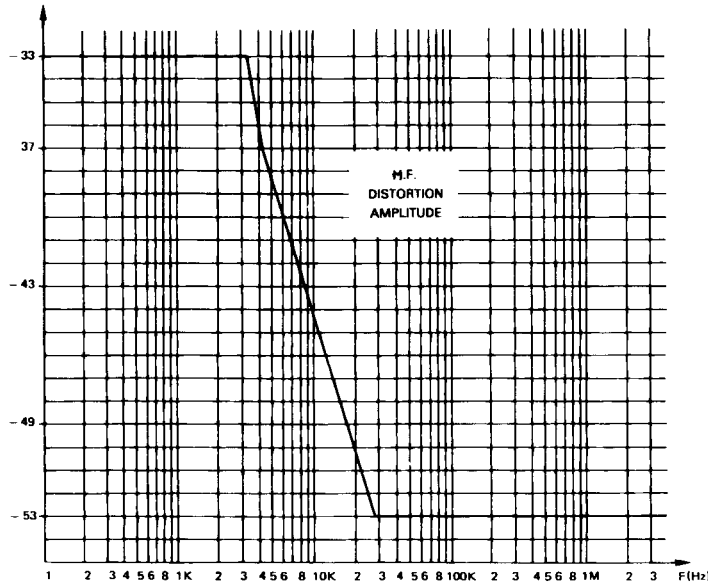


The TEA can stand the capacitive loads an all its pins, except pin 26 (oscillator).

It is obvious that these capacites can change the circuits alterning and/or transient behavior.

Pin	Name	Max. Value (grounded)	Comments
1	Ground		
2	V_{capa}	220µF	
3	Reset	470µF	
4	I_L = 120 or 60ms	2.2µF	
5	H_V Control	Few nF Max.	In parallel with the capacitor across pin 28 and pin 1, hence changes impedance & circuit time constants.
6	Receiver	100nF Max.	In Parallel on the Receiver
7	Pow µP	470µF	
8 9	Anti Local	10nF	Receiver Signal Filter
10	Private/Public	47nF	
11	Impedance	33 pF Max.	Provides a high pass, hence increases DTMF harmonics & noise above cut-out frequency.
12	Filter 2	Few pF Max.	Changes Refilter Impedance & Time CS[1]
13	Filter 1	82nF	Should not be changed (preephasis).
14 15	Microphone	100nF	
16	V_{REF}	10µF	
17	I_{REF}	680pF Max.	
18 19 20 21 22 23 24 25	Keyboard Inputs	10nF Max.	Bear Time Constants in Mind
26	Oscillator	NO	
27	Antinoise	2.2nF	
28	Vaux	Few nF	Cf. Comment Pin 5

Figure 8 : DTMF Harmonic Distortion vs. Frequency.



COMPONENTS VALUES (for figures 9 to 16)

R1	10Ω	C1	2.2nF
R2	12MΩ	C2	4.7nF
R3	100kΩ	C3	1nF
R4	4.7MΩ	C4	100µF
R5	220kΩ	C5	.
R6	5.9kΩ	C6	.
R7	.	C7	.
R8	.	C8	.
R9	16.2kΩ	C9	/ 1µF
R10	.	C10	/ 1µF (depending on µP)
R11	.	C11	68nF
R12	.	C12	1µF
R13	.	C13	= 6.8nF
R14	220kΩ	C14	– 3.3µF
R15	845Ω	C15	– 2.2nF
R16	220Ω	C16	– 2.2nF
R17	820kΩ	C17	= 10µF
R18	75Ω	C18	= 2.2µF
RIP	390kΩ	C19	= 470nF
RuP	5.6kΩ		
Zec	– 220Ω	D1	ZENER 15V
		D2	BAT43
T1	MJE340	D3	BAT43
T2	PBF259		
T3	PBF493S	QUARTZ	3.58MHz

- ZL = 600W

- R7	= 0	- C5	= 27pF
- R8	= 124kΩ	-C6	= 1nF
- R10	= 0	-C7	= 27pF
- R11	= 124kΩ	-C8	= 1nF
- R12	= 3.9kΩ		
- R13	= 3.9kΩ		

- 0.4mm France cable varying between 0km and 3.5km.

- R7	56kΩ	- C5	= 560pF
- R8	124kΩ	- C6	= 4.7nF
- R10	10kΩ	- C7	= 100pF
- R11	115kΩ	- C8	= 2.2nF
- R12	4.99kΩ		
- R13	3.6kΩ		

- R12 and R13 enable reception gain adjustment for adaptation to various transducers/
- R16 enable transmission gain equipment for adaptation to various transducers.

Figure 9 : V_C. I_{int}. V_{ref}.

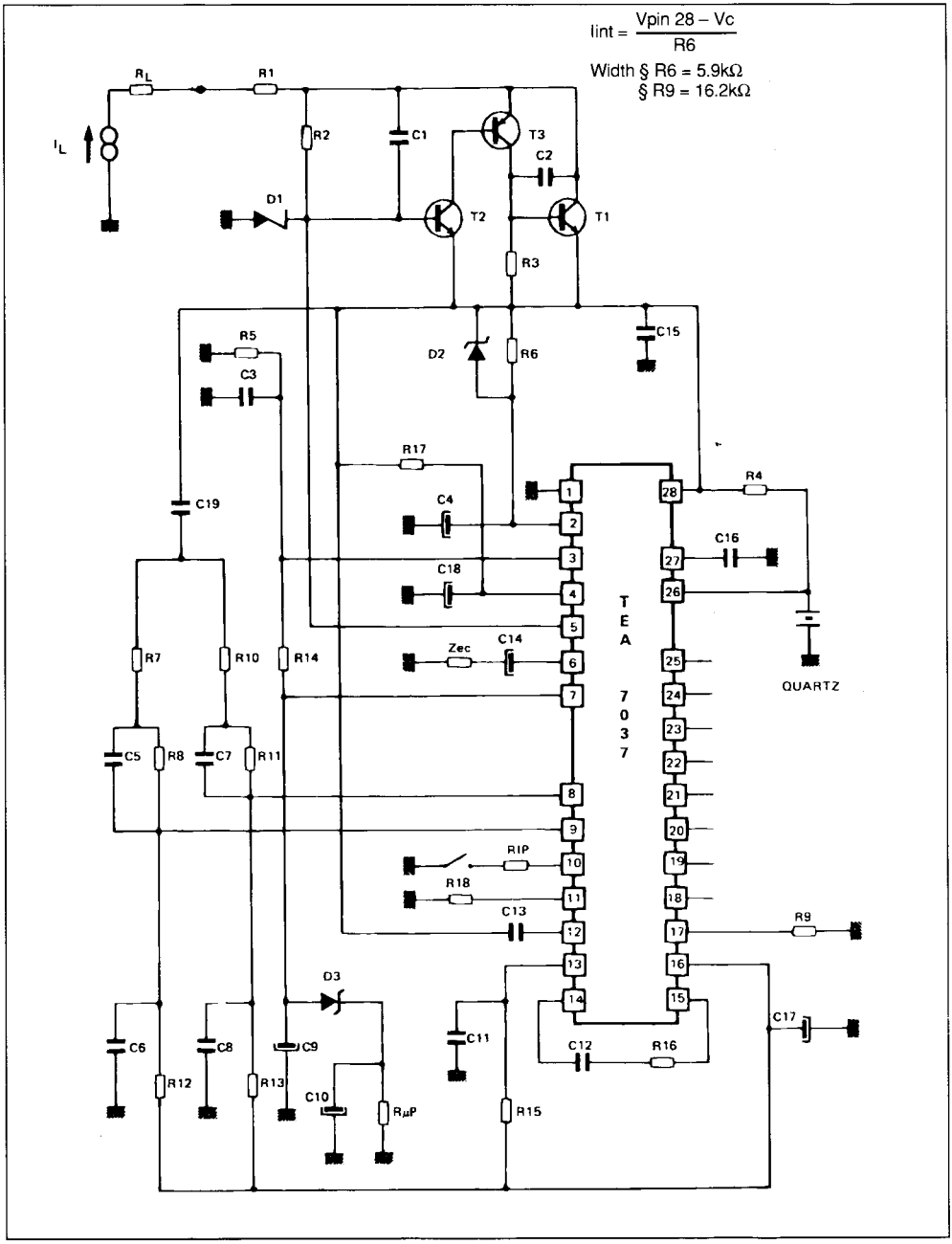


Figure 10 : Idem I_r.

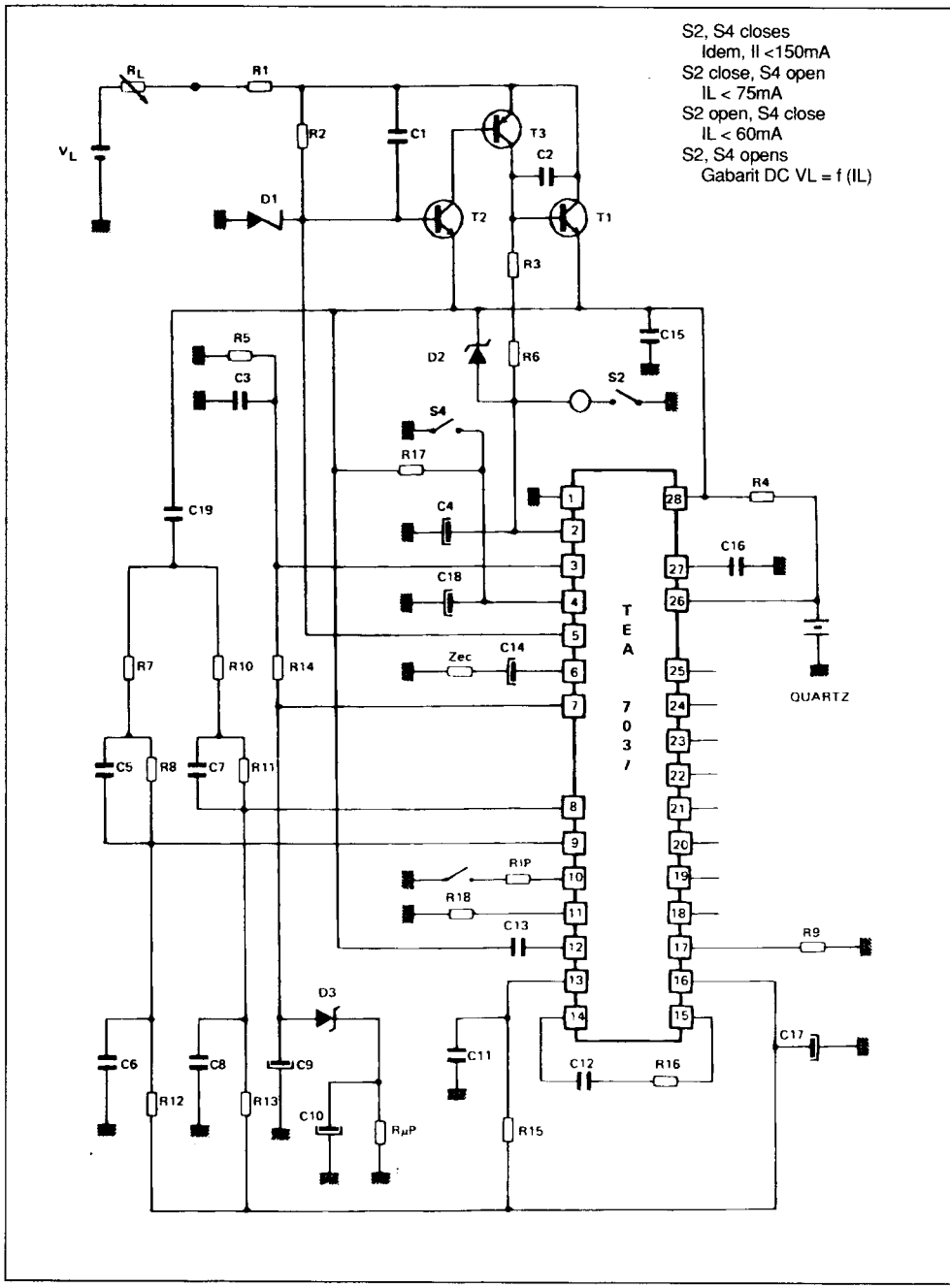


Figure 11.

Icmp, Vmp, Ismp, Iimp,
Vrh, Vrb, Vrsh, Vrsb.
S2, S4, S7 closes
Icmp
S2, S4, S7 opens
Vmp, Ismp
Limp by the time discharge of C9
when the line power is cut off.

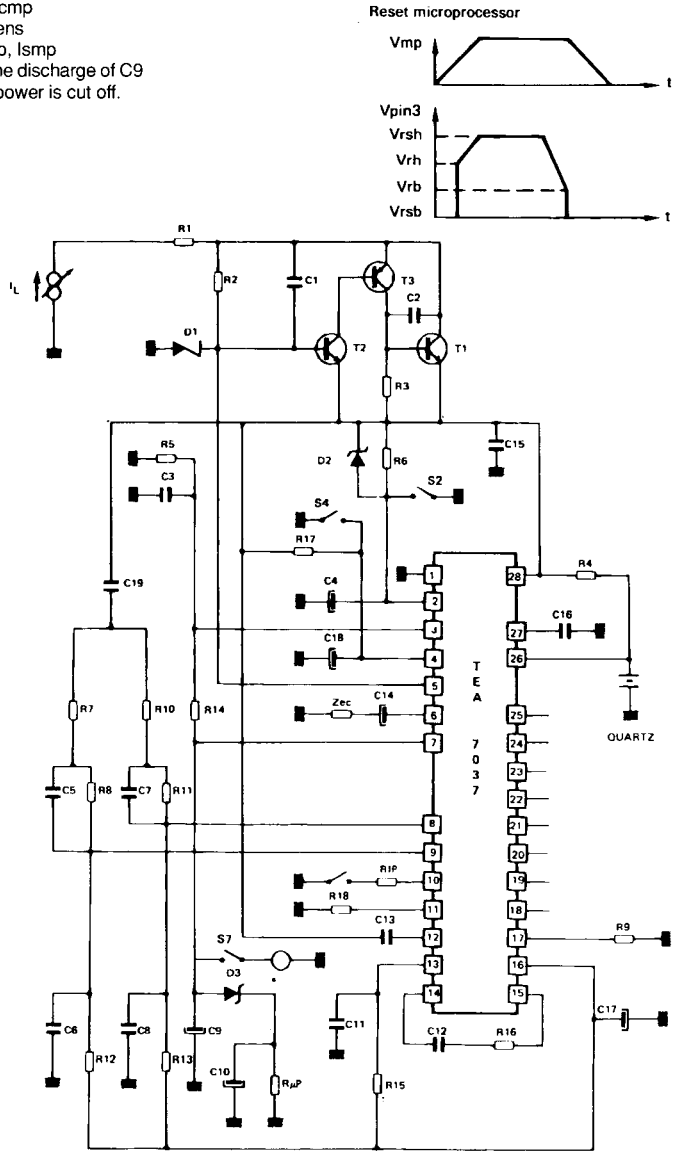


Figure 12 .

Gel. Gec. Re. De. Bep.

S1 open

$$(Gel, Gec) = 20 \log \frac{VL}{VM}$$

$$Re = 20 \log \frac{VL\ (S1\ open)}{VL\ (S1\ close)}$$

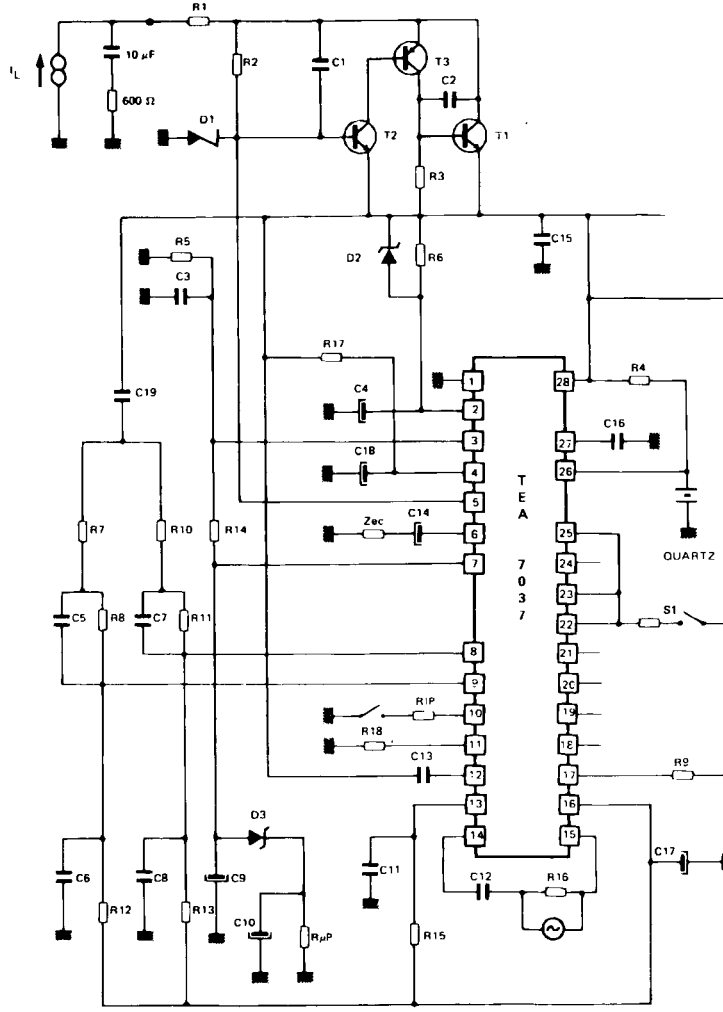


Figure 13 .

Grl, Grc, Dr, Brp,

$$GRL = 20 \log \frac{Vpin6}{Vpin8}$$

$$Grc = 20 \log \frac{Vpin6}{Vpin9}$$

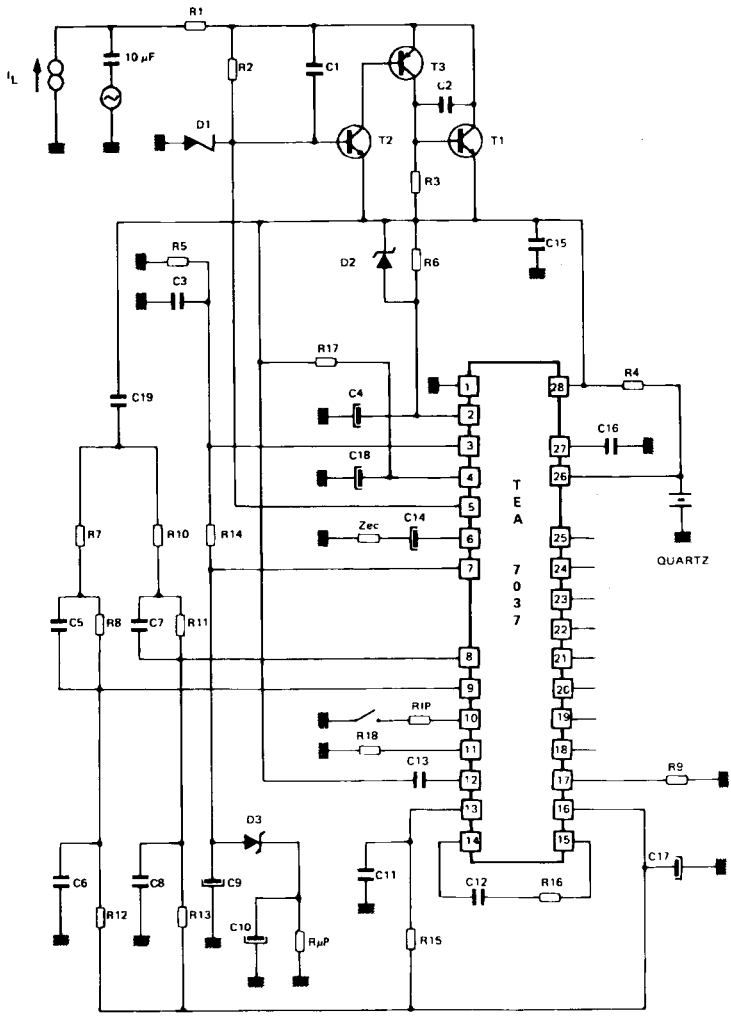


Figure 14 .

Gal, Gac

$$(Gal, Gac) = 20 \log \frac{Vpin28}{Vpin6}$$

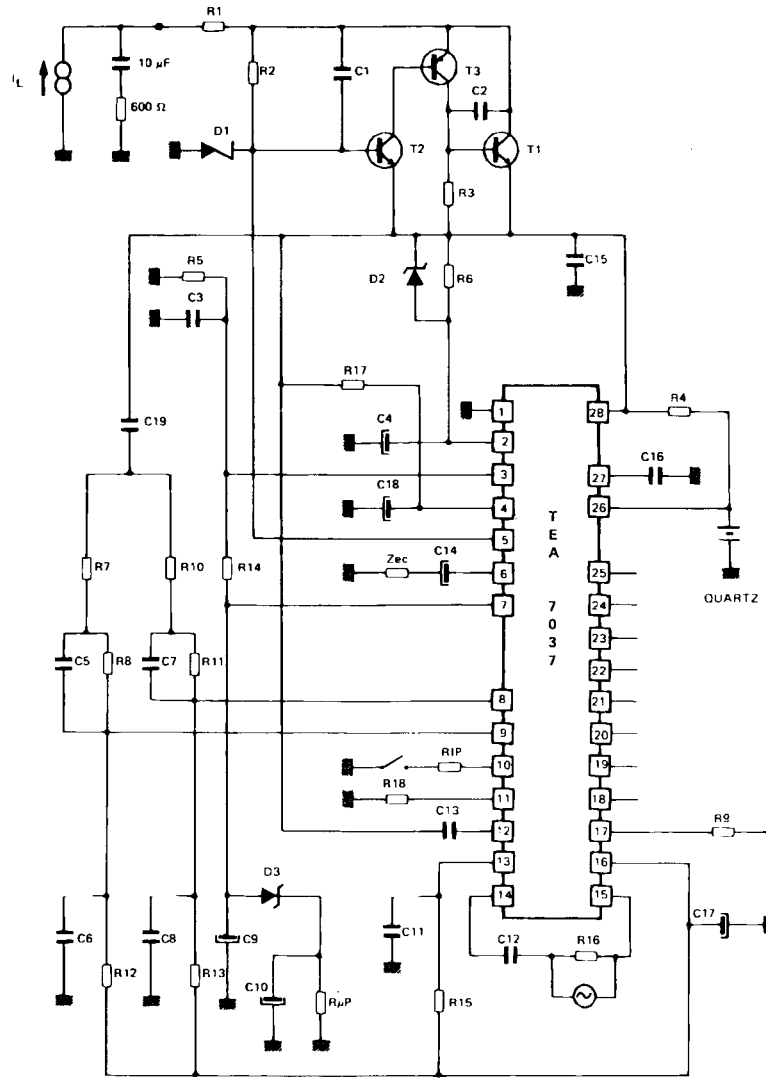


Figure 15 .

Zac

$$Zac = RL1 \times RL2 \frac{VL2 - VL1}{VL1 \times RL2 - VL2 \times RL1}$$

VL1 for RL1 = 300Ω
VL2 for RL2 = 600Ω

$$Zac = 600 \times \frac{VL2 - VL1}{2VL1 - VL2}$$

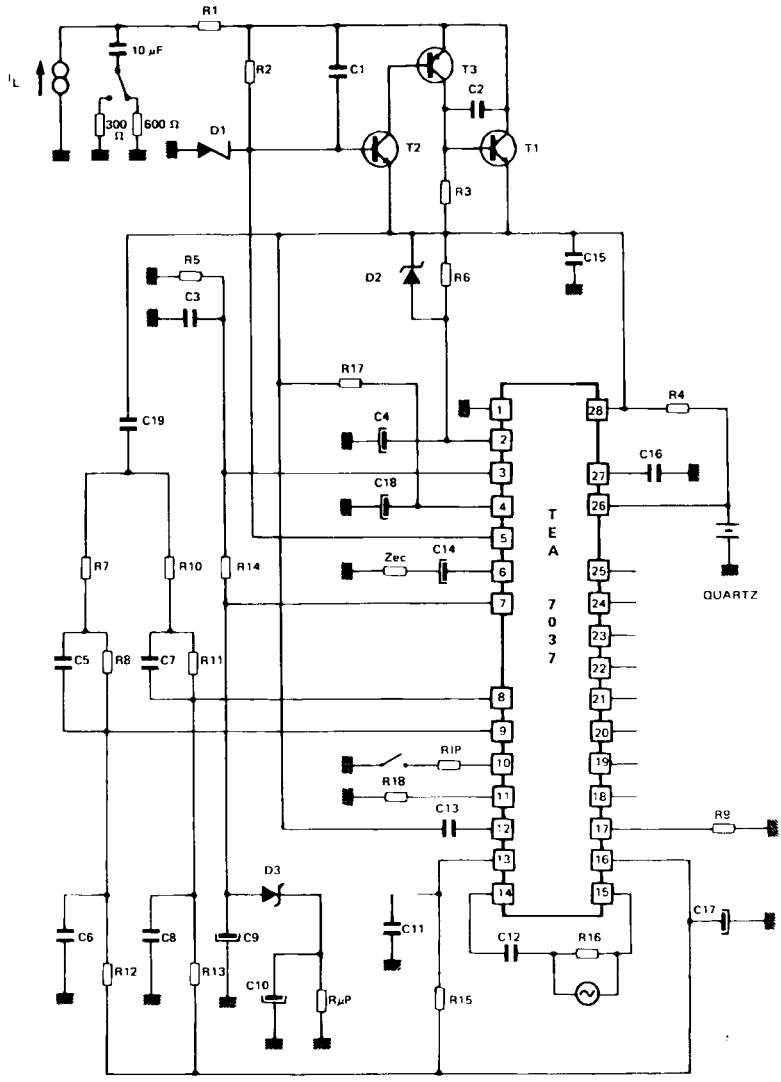


Figure 16 .

Nfb, Nfh, Pfv, Cfv,

697Hz + 1 209Hz
Level and preemphasis are measured on pin 28

$$Cfv = 20 \log \frac{Vpin28}{Vpin6}$$