TEA3046

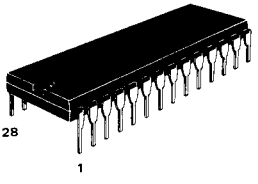
TELEPHONE LOW-COST MONOCHIP

Specially designed for a basic low cost telephone set application, this 28-pin IC provides transmission and line adaptation, DTMF generation and power supply for peripheral circuits. Interface is also possible with a microcomputer for a more sophisticated set.

- Low working voltage
- Wide operation current range
- Adjustable automatic line length receiving and sending gain control
- Adjustable automatic line length tracking anti-sidetone system
- Adjustable dynamic impedance
- Microphone preamplifier compatible with both symmetrical and asymmetrical inputs
- Adjustable microphone amplifier gain
- Adjustable earphone amplifier gain
- Low send and receive noise
- Click-free switch-over from speech mode to dialling mode & vice-versa
- Silent position facility
- Single-tone facility
- Two keys roll over provided
- Switch bounce elimination
- Microcomputer interface available
- Adjustable output tone level
- Temperature independent output level
- Inputs protected against electrostatic discharge
- Power supply for peripheral circuits.
- Soon available in SO28 plastic micropackage

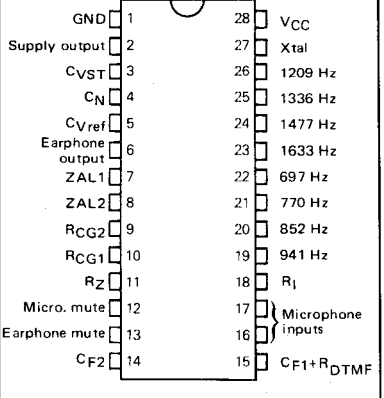
TELEPHONE LOW-COST
MONOCHIP

CASE CB-132



DP SUFFIX
PLASTIC PACKAGE

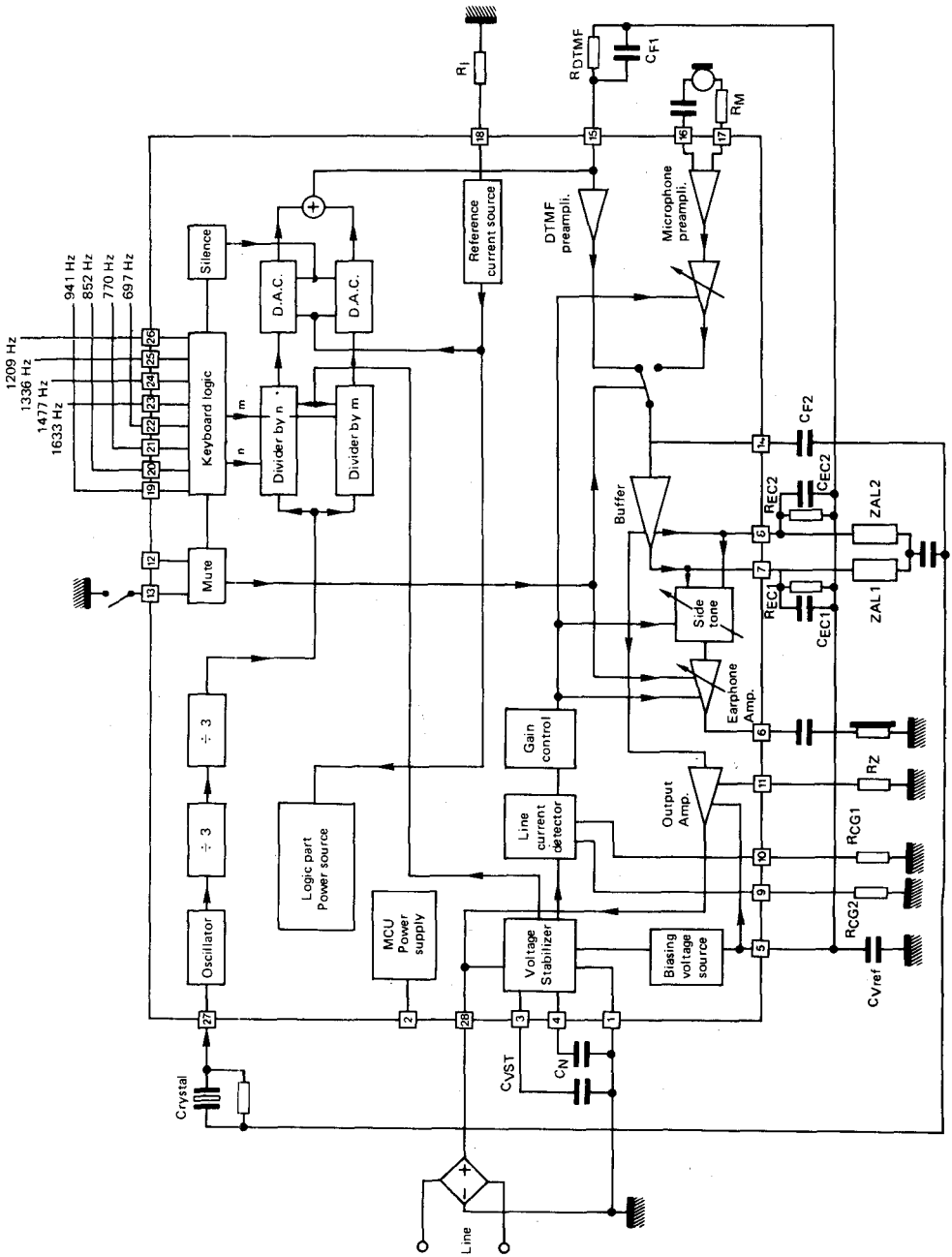
PIN ASSIGNMENT



Ref.00625

43-45, Avenue de l'Europe - 78140 VÉLIZY-FRANCE - Tél. (1) 39.46.97.19 Télex 240780F

BLOCK DIAGRAM



PIN DESCRIPTION

Name	No	Description
G_{ND}	1	Ground
Supply output	2	Power supply output
C_{VST}	3	C_{VST} decouples the voltage stabilizer
C_N	4	Capacitor to reduce the noise
C_{Vref}	5	C_{Vref} decouples the biasing voltage. This reference biasing voltage is temperature independant.
Earphone output	6	Earphone amplifier output
Z_{AL1}	7	Short line antisidetone circuit Z_{AL1} and earphone amplifier input.
Z_{AL2}	8	Long line antisidetone circuit Z_{AL2} and earphone amplifier input.
R_{CG2} R_{CG1}	9 10	R_{CG2} fixes gain control (see note 4). R_{CG1} fixes gain control (see note 4).
R_Z	11	R_Z fixes the impedance value of the circuit.
Earphone output	12	A short circuit to the ground on this pin mutes the earphone signal.
Micro mute	13	A short circuit to the ground on this pin mutes the microphone signal.
C_{F2}	14	C_{F2} filters both microphone and DTMF signals.
$C_{F1} + R_{DTMF}$	15	C_{F1} and R_{DTMF} filter the DTMF signal & set DTMF signal level..
Microphone inputs	16-17	
R_I	18	$V_{ref.}$ voltage on this pin is temperature stable.
941 Hz	19	"D" logic input. 941 Hz keyboard row.
852 Hz	20	"C" logic input. 852 Hz keyboard row.
770 Hz	21	"B" logic input. 770 Hz keyboard row.
697 Hz	22	"A" logic input. 697 Hz keyboard row.
1633 Hz	23	"H" logic input. 1633 Hz keyboard column.
1477 Hz	24	"G" logic input. 1477 Hz keyboard column.
1336 Hz	25	"F" logic input. 1336 Hz keyboard column.
1209 Hz	26	"E" logic input, 1209 Hz keyboard column.
X_{tal}	27	Oscillator input
V_{CC}	28	

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply voltage	V_{CC}	+8.5	V
Power dissipation	P_{tot}	700	mW
Operating temperature range	T_{aper}	−25 to 65	°C
Storage temperature range	T_{stg}	−55 to 150	°C

STATIC ELECTRICAL CHARACTERISTICS

$-25°C \leq T_{amb} \leq +65°C$
Line impedance $Z_L = 600\ \Omega$

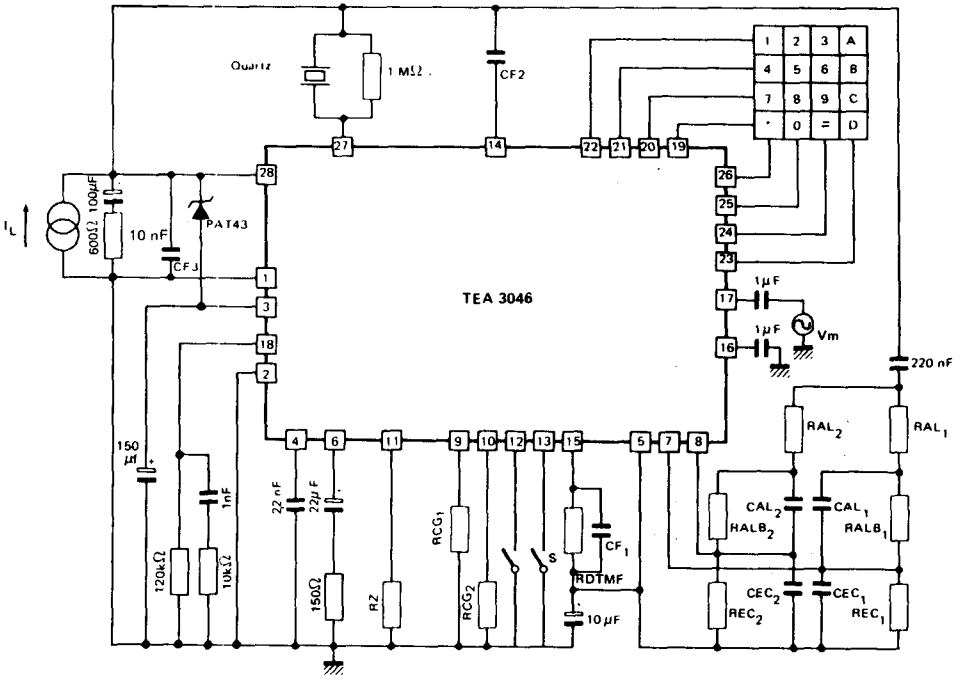
Characteristic	Symbol	Min	Typ	Max	Unit
Line current (pin 28)	–	–	–	–	mA
MPU supply OFF	I_L	15	–	150	
MPU supply ON	I_L	17	–	150	–
Voltage over the I_C (pin 28)	–	–	–	–	V
$I_L = 15$ mA	V28	3.9	4.6	5.1	–
$I_L = 100$ mA	V28	–	–	7	–
Voltage stabilizer (pin 3)	–	–	–	–	V
$I_L = 15$ mA	V_C	–	2.7	–	–
$I_L = 100$ mA	V_C	–	3.7	–	–
Power supply (pin 2)	–	–	–	–	mA
max current (V2 = 3.2 V)					
Sending mode V28 = 5dBm	I2	0.6	–	–	–
Without A_C line signal	I2	1	1.2	–	–

DYNAMIC ELECTRICAL CHARACTERISTICS

T_{amb} = + 25°C
Line impedance Z_L = 600 Ω
F = 1 kHz

Characteristic	Symbol	Min	Typ	Max	Unit
Max sending gain R_M = 0 (No gain control action note 1)	– G_S max	– 49.5	– 50.5	– 51.5	dB
Gain control Sending gain decrease (Note 1)	–	5	6	7	dB
Common mode rejection ratio (G_S max)	C_{MR}	50	60	–	dB
Line signal distortion MPU supply ON V28 ⩽ 3.5 dBm V28 ⩽ 5.5 dBm	 – –	 – –	 – –	 5 10	 % –
Line signal distortion MPU supply OFF V28 ⩽ 3.5 dBm V28 ⩽ 5.5 dBm	 – –	 – –	 – –	 2 10	 % –
Imput impedance Symetrical mode (pin 16.17) Asymetrical mode (pin 16) Asymetrical mode (pin 17)	 Zes Zea Zea	 1.5 0.7 5	 2 1 7	 2.5 1.3 9	kΩ – – –
Transmission noise level (pin 28) (Psyphometric R_M = 200 Ω	–	–	– 65	–	dBmp
Gain reduction during dialing (Note 1)	–	50	–	–	dB
2 wires to 4 wires conversion efficiency (Note 2 – Reception gain from line to earphone is o dB: V28/ V26 = 1) I_L = 30 mA • Z_L = 600 Ω I_L = 87 mA • Z_L = Z_{LL}	 E E	 15 15	 – –	 – –	dB – –
Earphone amplifier (Note 3) Max gain (no gain control I_L = 30 mA • G_R = V6/ V8) Gain control (Reception gain decrease)	 G_R max GR	 19 5	 20 6	 21 7	dB – –
Earphone signal distortion (R earphone > 150 Ω • V6 = – 10 dBV)	–	–	–	3	%
Output noise level	–	–	65	–	dBmp
Impedance: depends on external component, R_Z (Z = (V28/ I28) A_C and R_Z pin 11 = 75 Ω)	Z	500	600	700	Ω
DTMF Grenerat or (note 4) Crystal oscillator frequency Tone frequency accuracy Low group tone level (depends on external components) High group tone level (depends on external components) Preemphasis (depends on external components) Distortion DTMF signal (depends on external components) DTMF signal level spread (depends on external components)	 – – – – – – –	 – – 1.5 – 11 – 9 + 1 – – 2	 3.579545 – – – + 2 – –	 – + 1.5 – 6 – 4 + 3 – 26 + 2	MHz % dBm dBm dB dB dB
Logic inputs (note 5) keyboard mode Switch bounce elimination Keyboard contact resistance "ON" Keyboard contact resistance "OFF"	 – – –	 0.5 – 500	 – – –	 – 10 –	ms kΩ kΩ
Logic inputs (note 6) M_{PU} mode Current drawn by A.B.C. and D input to go low Current to force inputs E.F.G and H to go high Input impedance	 – – –	 – – –	 20 20 5	 50 50 –	 µA µA kΩ
Input max voltage on A.B.C.D. or E.F.G.H. inputs	–	0	–	V28	V

Note 1: Transmission mode - test diagram



External components:

RAL1 = RAL2 = 0
CAL1 = CAL2 = 47 pF
RALB1 = RALB2 = 56 kΩ
REC1 = REC2 = 6.2 kΩ
CEC1 = CEC2 = 2.2 nF
RDTMF = 511 Ω CF1 = 106 nF CF2 = 10 nF
RZ = 75 Ω
RCG1 = 60 kΩ RCG2 = 14 kΩ

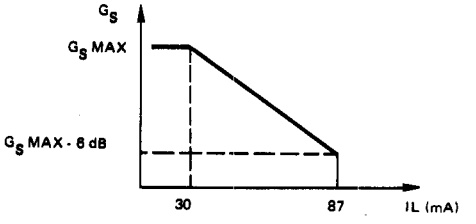
Note 1: test conditions (continued)

Maximum transmission gain for IL = 30 mA

$$GS_{max} = \frac{V28}{Vm}$$

Gain control:

- For IL = 30 mA: GS = GS_{max}.
- For IL = 87 mA: GS = GS_{max} — 6 dB.



- For other values of line current and corresponding values of RCG1 and RCG2: see application note.

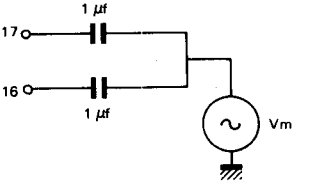
Gain reduction during dialing

- Close swith S (pin 13).

CMRR

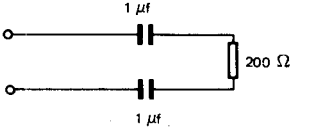
- For IL = 30 mA.

$$GSCM = \frac{V28}{Vm} \quad CMRR = \frac{GS_{max}}{GSCM}$$

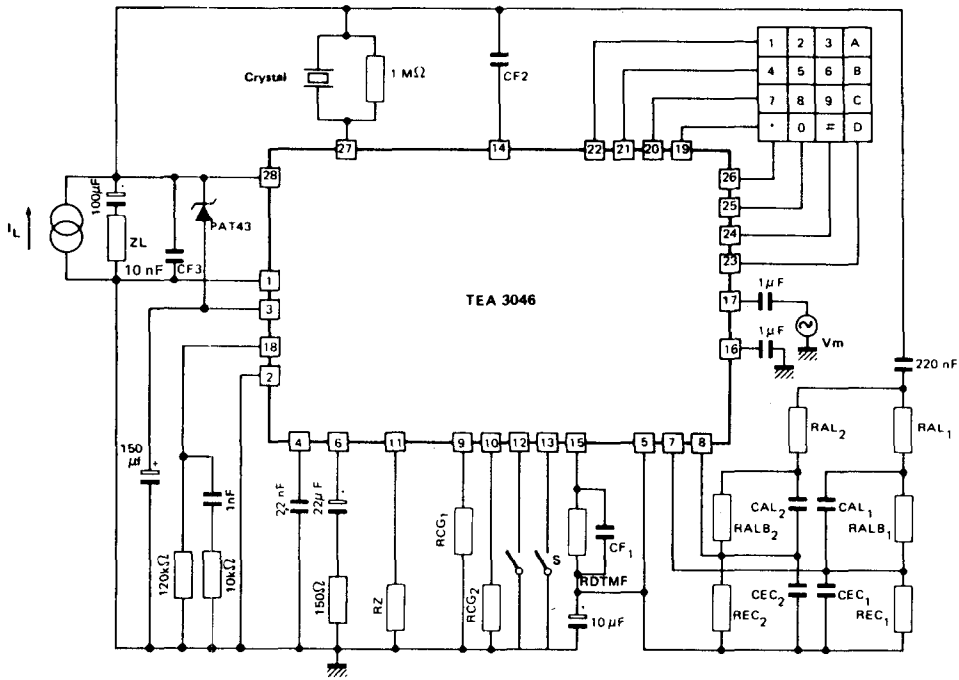


Transmission noise level:

- Measured on pin 28 with IL = 30 mA and the corresponding diagram on the microphone inputs.



Note 2: Antisidetone - test diagram



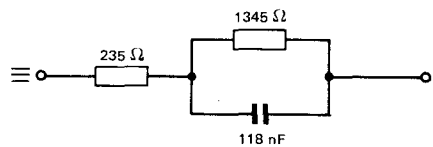
External components:

RZ = 75 Ω RDTMF = 511 Ω CF1 = 106 nF CF2 = 10 nF
RCG1 = 60 kΩ RCG2 = 14 kΩ
RAL1 = 0 RALB1 = 56 kΩ CAL1 = 47 pF REC1 = 6.2 kΩ CEC1 = 2.2 nF
RAL2 = 28 kΩ RALB2 = 51 kΩ CAL2 = 1.15 nF REC2 = 2.7 kΩ CEC2 = 2.2 nF

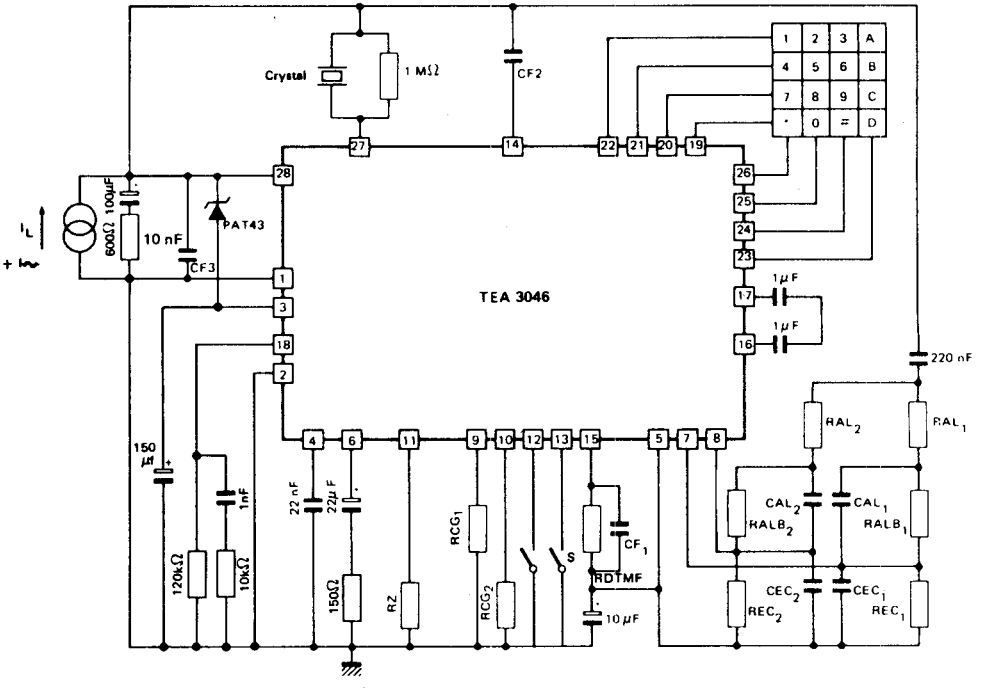
Test conditions:

- Short line: IL = 87 mA ZL = 600 Ω
- Long line: IL = 30 mA ZL = ZLL
  ZLL represents a line 3.5 kilometers long with a diameter = 0.4 mm.
  Antisidetone efficiency:

$$E = 20 \log_{10} \left(\frac{V6}{V28} \right)$$



Note 3: Receiving mode - Test diagram



External conponents:

RAL1 = RAL2 = 0 CAL1 = CAL2 = 47 pF RALB1 = RALB2 = 56 kΩ CEC1 = CEC2 = 62 kΩ
REC1 = REC2 = 2.2 nF RZ = 75 Ω RCG1 = 60 kΩ RCG2 = 14 kΩ RDTMF = 511 Ω
CF1 =106 nF CF2 = 10 nF

Test conditions:

Maximum receiving gain:

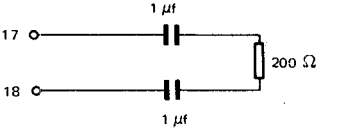
- For I_L = 30 mA $GR_{max} = \frac{V6}{V8}$

Gain control:

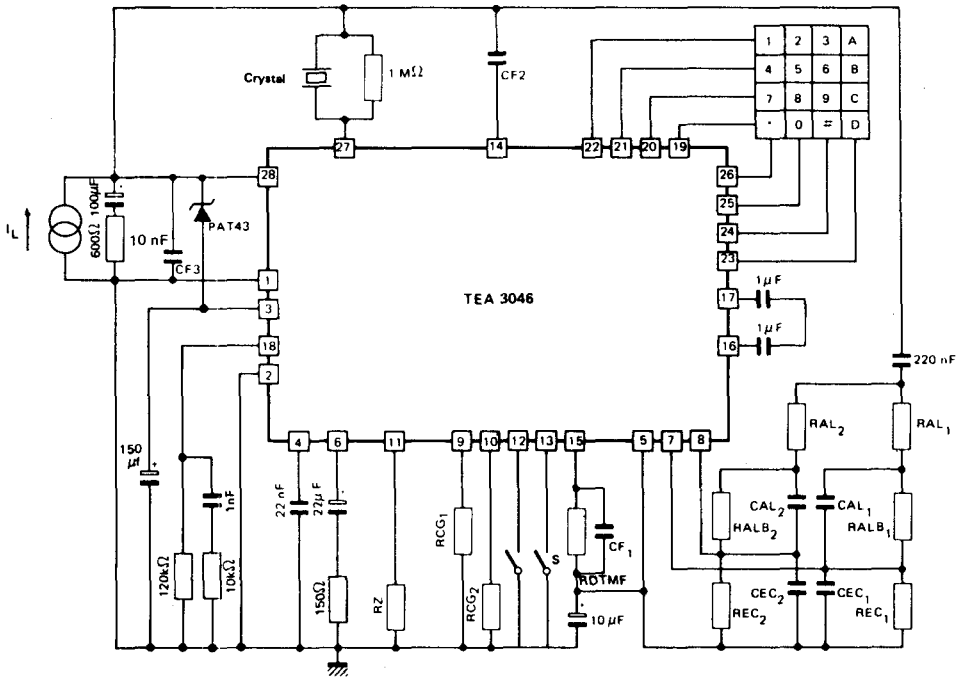
- For IL = 30 mA GR = GR_{max}
- For IL = 87 mA GR = GR_{max} — 6 dB

Output noise level:

- Measured on pin 6, with the corresponding diagram on microphone inputs.



Note 4: DTMF - Test diagram



External conponents:

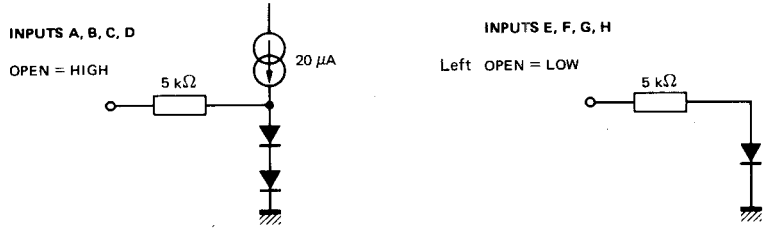
RAL1 = RAL2 = 0 CAL1 = CAL2 = 47 pF RALB1 = RALB2 = 56 kΩ
CEC1 = CEC2 = 62 kΩ REC1 = REC2 = 2.2 nF
RZ = 75 Ω RCG1 = 60 kΩ RCG2 = 14 kΩ
RDTMF = 511 Ω CF1 = 100 nF CF2 = 10 nF
IL = 30 mA

Frequency accuracy, tone levels, preemphasis, distortion can be measured by putting the right code on the logic inputs for every couple of frequencies. See note 5 and 6.

Remaining receiving gain during dialing: the circuit must be in test mode (single-tone).
Remaining gain = 20 $\log_{10}$ (V6/V28).

Note 5: Logic inputs table - Keypad mode

EQUIVALENT DRAWING OF LOGIC INPUTS



Inputs								Generated tones (Hz)	Symbol	Mute	Notes
A	B	C	D	E	F	G	H				
H	H	H	H	L	L	L	L	–	–	off	5.1
L	H	H	H	L	L	L	L	697	–	on	5.2
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	1 209	–	on	5.3
H	H	H	H	L	H	L	L	1 336	–	on	
H	H	H	H	L	L	H	L	1 447	–	on	
H	H	H	H	L	L	L	H	1 633	–	on	
L				H				697 + 120	"1"	on	5.4
L					H			697 + 1 336	"2"	on	
L						H		697 + 1 477	"3"	on	
L							H	697 + 1 633	"A"	on	
	L			H				770 + 1 209	"4"	on	
	L				H			770 + 1 336	"5"	on	
	L					H		770 + 1 477	"6"	on	
	L						H	770 + 1 633	"B"	on	
		L		H				852 + 1 209	"7"	on	
		L			H			852 + 1 336	"8"	on	
		L				H		852 + 1 477	"9"	on	
		L					H	852 + 1 633	"C"	on	
			L	H				941 + 1 209	"*"	on	
			L		H			941 + 1 336	"0"	on	
			L			H		941 + 1 477	"#"	on	
			L				H	941 + 1 633	"D"		

Note 5.1: Speech mode.

Note 5.2: Test mode.
Low group tones.

Note 5.3: Test mode.
High group tones.

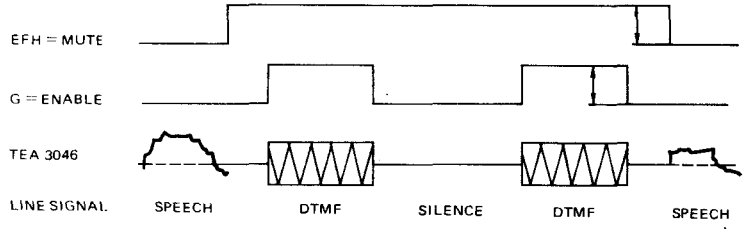
Note 5.4: This table is only valid if E,F,H, = low.
As soon as one of the inputs E,F,G,H, is high, the others are considered low.
As soon as one of the inputs A,B,C,D, is low, the others are considered high.

Note 6: Logic inputs table - Microprocessor mode

Inputs								Generated tones (Hz)	Symbol	Mute	Notes
A	B	C	D	E	F	H	G				
H	H	H	H		L		L	–	–	off	6.1
X	X	X	X		H		L	–	–	on	6.2
H	H	H	H		H		H	697 + 1 209	"1"	on	6.3
H	H	H	L		H		H	697 + 1 336	"2"	on	
H	H	L	H		H		H	697 + 1 477	"3"	on	
H	H	L	L		H		H	697 + 1 633	"A"	on	
H	L	H	H		H		H	770 + 1 209	"4"	on	
H	L	H	L		H		H	770 + 1 336	"5"	on	
H	L	L	H		H		H	770 + 1 477	"6"	on	
H	L	L	L		H		H	770 + 1 633	"B"	on	
L	H	H	H		H		H	852 + 1 209	"7"	on	
L	H	H	L		H		H	852 + 1 336	"8"	on	
L	H	L	H		H		H	852 + 1 477	"9"	on	
L	H	L	L		H		H	852 + 1 633	"C"	on	
L	L	H	H		H		H	941 + 1 209	"*"	on	
L	L	H	L		H		H	941 + 1 336	"0"	On	
L	L	L	H		H		H	941 + 1 477	"#"	on	
L	L	L	L		H		H	941 + 1 633	"D"	on	

Note 6.1: Speeck mode.
Note 6.2: Silence position.
Note 6.3: Mute coincides with tone borsts.

Impedance mute or silent setting



FUNCTIONAL DESCRIPTION

TRANSMISSION AND LINE ADAPTATION

Includes microphone and telephone amplification, both with line length depending gain control and a line impedance automatic matching 2-wire to 4-wire conversion.

The microphone preamplifier performs high CMRR, for crosstalk and radio detection immunity and low noise characteristic. Its architecture allows symmetrical and asymmetrical inputs and external adjustment of gain to fit difference microphone capsules. A single pole filter limits the amplifier bandwidth for a best high frequency figure.

The earphone amplifier is a low consumption type. It is click free when muted and its gain can be externally adjusted.

2-wire to 4-wire conversion is performed by subtracting microphone signal from line before applying it to earphone amplifier. An automatic line impedance tracking antisidetone circuit provides excellent sidetone efficiency for every line length.

The dynamic impedance of the circuit is set by an external resistor to match with different line impedances.

The line length is sensed through the line current. 2 external components allow the gain control to compensate any kind of line length and feeding bridge.

DTMF SIGNAL GENERATION

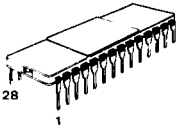
Tones are obtained from a crystal controlled oscillator followed by two independent programmable dividers and 2 sinewave synthetizers. The crystal is a low-cost TV model 3.58 MHz oscillator.

The amplitude of the multi-frequency signal is set by an external resistor.
The required tone frequencies are selected by either an inexpensive single contact 4 x 4 keypad or by a microcomputer. Single-tone operation for testing is also provided.

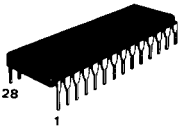
THE POWER SUPPLY

This is 0.6 mA current source with a typ max voltage compliance of a 3.2 V.
It can power either and electret microphone or a microprocessor.
If this source is not used, pin 2 is connected to ground to reduce the ICC (pin 28) current.

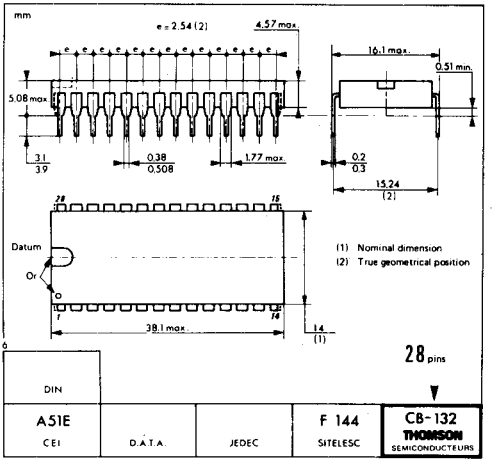
CASE CB-132



C SUFFIX
CERAMIC PACKAGE



P SUFFIX
PLASTIC PACKAGE



These specifications are subject to change without notice.
Please inquire with our sales offices about the availability of the different packages.