DATA SHEET

TEA1066T

Versatile telephone transmission circuit with dialler interface

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Versatile telephone transmission circuit with dialler interface

TEA1066T

FEATURES

- Voltage regulator with adjustable static resistance
- Provides supply for external circuitry
- Symmetrical low-impedance inputs for dynamic and magnetic microphones
- Symmetrical high-impedance inputs for piezoelectric microphone
- Asymmetrical high-impedance input for electret microphone
- Dual-tone multi-frequency (DTMF) signal input with confidence tone
- Mute input for pulse or DTMF dialling
- Power down input for pulse dial or register recall
- Receiving amplifier for magnetic, dynamic or piezoelectric earpieces
- Large gain setting range on microphone and earpiece amplifiers
- Line loss compensation facility, line current dependent (microphone and earpiece amplifiers)
- Gain control adaptable to exchange supply
- DC line voltage adjustment facility.

GENERAL DESCRIPTION

The TEA1066T is a bipolar integrated circuit that performs all speech and line interface functions required in fully electronic telephone sets. The circuit performs electronic switching between dialling and speech.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{LN}	line voltage	I_{line} = 15 mA	4.25	4.45	4.65	V
I_{line}	line current	normal operation	10	–	140	mA
I_{CC}	internal supply current	power down input LOW	–	0.96	1.3	mA
		power down input HIGH	–	55	82	μA
V_{CC}	supply voltage for peripherals	I_{line} = 15 mA; MUTE input HIGH; I_p = 1.2 mA	2.8	3.05	–	V
		I_{line} = 15 mA; MUTE input HIGH; I_p = 1.7 mA	2.5	–	–	V
G_v	voltage gain range for microphone amplifier					
	low impedance inputs (pins 7 and 9)		44	–	60	dB
	high impedance inputs (pins 8 and 10)		30	–	46	dB
	receiving amplifier		17	–	39	dB
T_{amb}	operating ambient temperature		–25	–	+75	°C
Line loss compensation						
ΔG_v	gain control		5.5	5.9	6.3	dB
V_{exch}	exchange supply voltage		24	–	60	V
R_{exch}	exchange feeding bridge resistance		400	–	1000	Ω

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TEA1066T	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1

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BLOCK DIAGRAM

The blocks marked 'dB' are attenuators.

Fig.1 Block diagram.
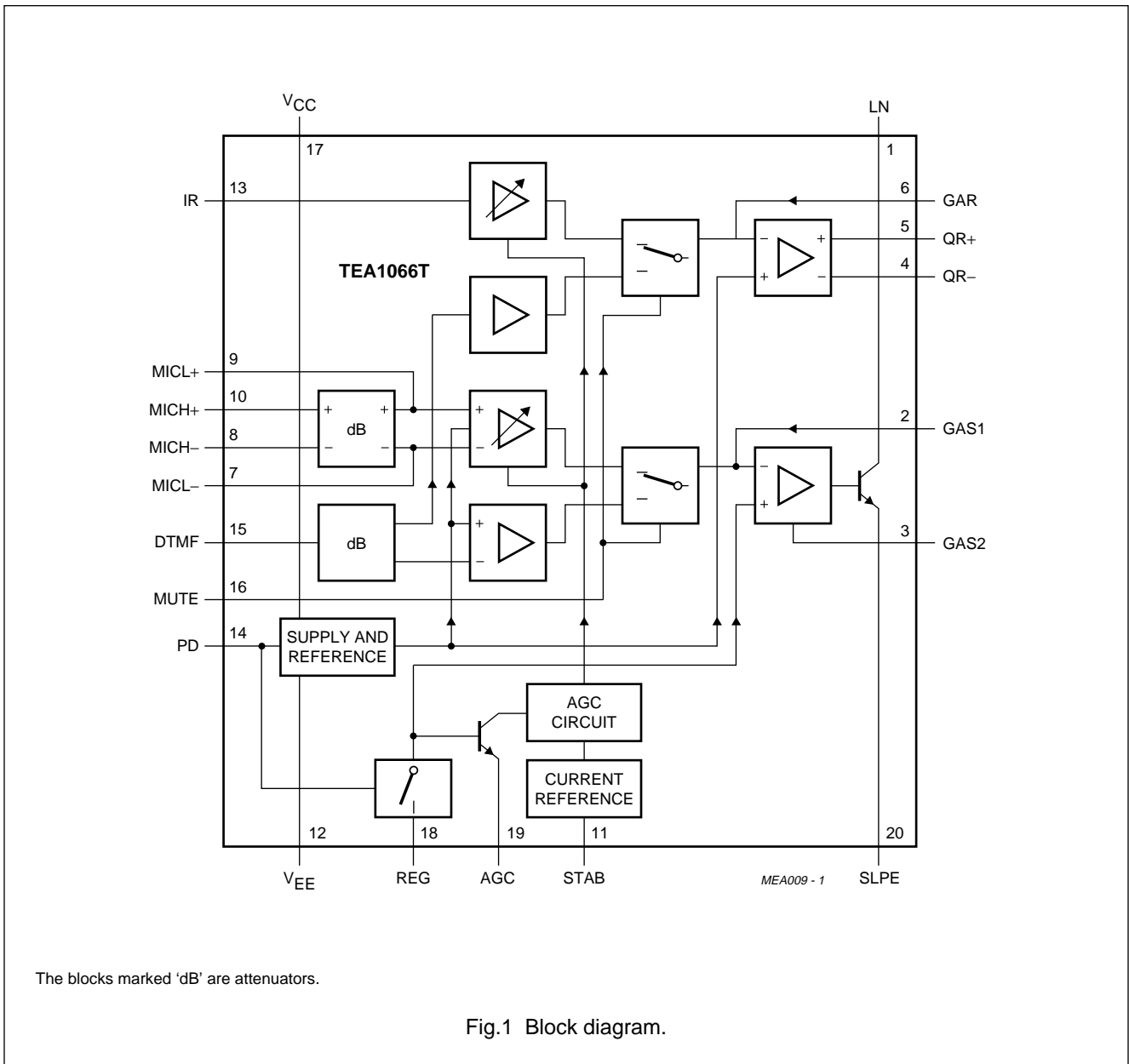
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PINNING

| SYMBOL	PIN	DESCRIPTION
LN	1	positive line terminal
GAS1	2	gain adjustment transmitting amplifier
GAS2	3	gain adjustment transmitting amplifier
QR−	4	inverting output receiving amplifier
QR+	5	non-inverting output receiving amplifier
GAR	6	gain adjustment receiving amplifier
MICL−	7	inverting microphone input, low impedance
MICH−	8	inverting microphone input, high impedance
MICL+	9	non-inverting microphone input, low impedance
MICH+	10	non-inverting microphone input, high impedance
STAB	11	current stabilizer
V_{EE}	12	negative line terminal
IR	13	receiving amplifier input
PD	14	power-down input
DTMF	15	dual-tone multi-frequency input
MUTE	16	mute input
V_{CC}	17	supply voltage decoupling
REG	18	voltage regulator decoupling
AGC	19	automatic gain control input
SLPE	20	slope (DC resistance) adjustment
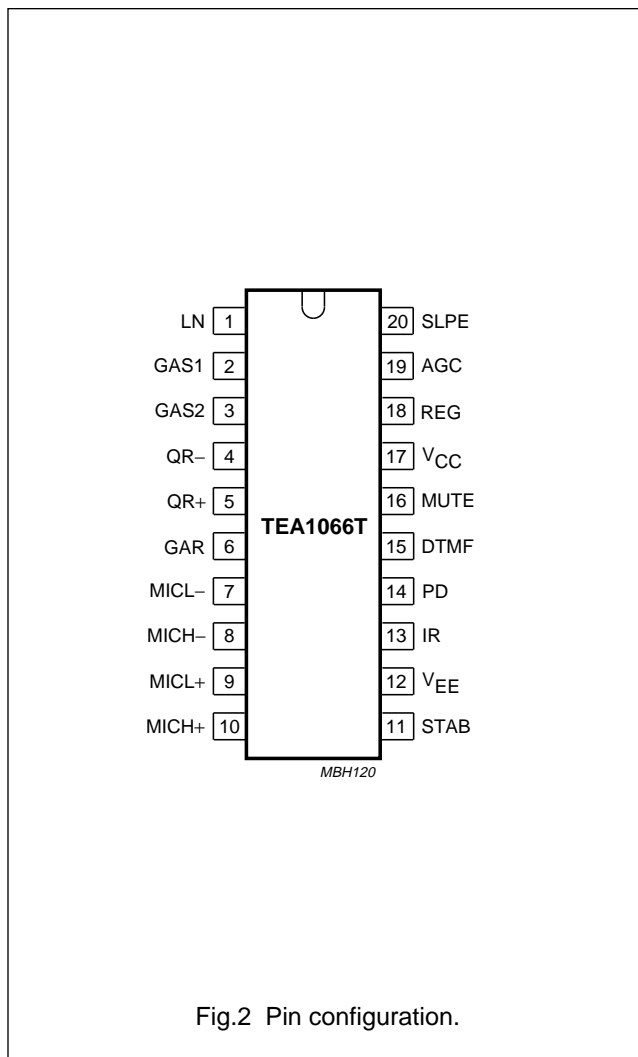
Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

Supplies: V_{CC}, LN, SLPE, REG and STAB

Power for the TEA1066T and its peripheral circuits is usually obtained from the telephone line. The TEA1066T develops its own supply voltage at V_{CC} and regulates its voltage drop. The supply voltage V_{CC} may also be used to supply external peripheral circuits, e.g. dialling and control circuits.

The supply has to be decoupled by connecting a smoothing capacitor between V_{CC} and V_{EE}; the internal voltage regulator has to be decoupled by a capacitor from REG to V_{EE}. An internal current stabilizer is set by a resistor of 3.6 kΩ between STAB and V_{EE}.

The DC current flowing into the set is determined by the exchange supply voltage (V_{exch}), the feeding bridge resistance (R_{exch}), the DC resistance of the telephone line (R_{line}) and the DC voltage on the subscriber set (see Fig.7).

If the line current I_{line} exceeds the current I_{CC} + 0.5 mA required by the circuit itself (approximately 1 mA) plus the current I_p required by the peripheral circuits connected to V_{CC}, then the voltage regulator diverts the excess current via LN.

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The voltage regulator adjusts the average voltage on LN to:

$$V_{LN} = V_{ref} + I_{SLPE} \times R9$$

or

$$V_{LN} = V_{ref} + (I_{line} - I_{CC} - 0.5 \times 10^{-3}A - I_p) \times R9$$

where V_{ref} is an internally generated temperature compensated reference voltage of 4.2 V and R9 is an external resistor connected between SLPE and V_{EE}.

The preferred value for R9 is 20 Ω. Changing the value of R9 will also affect microphone gain, DTMF gain, gain control characteristics, side-tone level and the maximum output swing on LN.

Under normal conditions, when $I_{SLPE} \gg I_{CC} + 0.5$ mA $+ I_p$, the static behaviour of the circuit is that of a 4.2 V regulator diode with an internal resistance equal to that of R9. In the audio frequency range, the dynamic impedance is largely determined by R1 (see Fig.3).
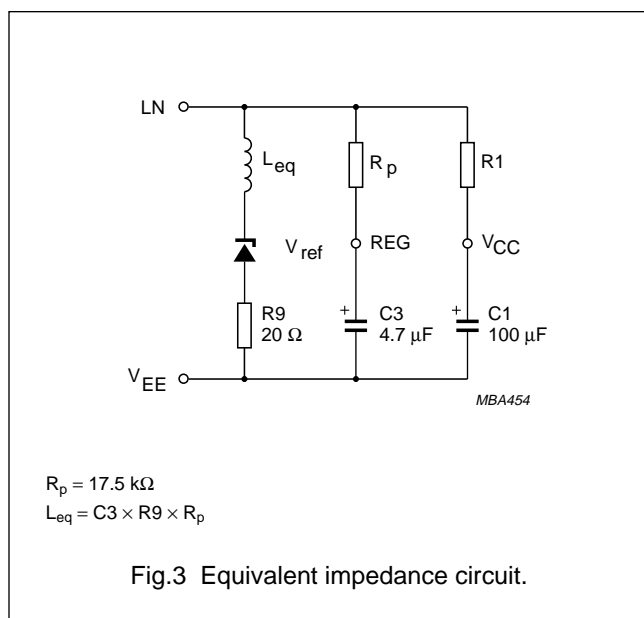

$R_p = 17.5$ kΩ
$L_{eq} = C3 \times R9 \times R_p$

Fig.3 Equivalent impedance circuit.

The internal reference voltage can be adjusted by means of an external resistor R_{VA}. This resistor, connected between LN and REG (pins 1 and 18), will decrease the internal reference voltage; when connected between REG and SLPE (pins 18 and 20) it will increase the internal reference voltage.

Current I_p, available from V_{CC} for supplying peripheral circuits, depends on external components and on the line current. Figure 8 shows this current for $V_{CC} > 2.2$ V

and > 3 V, this being the minimum supply voltage for most CMOS circuits, including voltage drop for an enable diode. If MUTE is LOW, the available current is further reduced when the receiving amplifier is driven.

Microphone inputs MICL+, MICH+, MICL− and MICH− and amplification adjustment connections GAS1 and GAS2

The TEA1066T has symmetrical microphone inputs. The MICL+ and MICL− inputs are intended for low-sensitivity, low-impedance dynamic or magnetic microphones. The input impedance is 8.2 kΩ (2 × 4.1 kΩ) and its voltage gain is typically 52 dB. The MICH+ and MICH− inputs are intended for a piezoelectric microphone or an electret microphone with a built-in FET source follower. Its input impedance is 40.8 kΩ (2 × 20.4 kΩ) and its voltage gain is typical 38 dB.

The arrangements with the microphone types mentioned are shown in Fig.9.

The gain of the microphone amplifier in both types can be adjusted over a range of ±8 dB to suit the sensitivity of the transducer used. The gain is proportional to external resistor R7 connected between GAS1 and GAS2.

An external capacitor C6 of 100 pF between GAS1 and SLPE is required to ensure stability. A larger value may be chosen to obtain a first-order low-pass filter. The cut-off frequency corresponds with the time constant R7 × C6.

Mute input MUTE

A HIGH level at MUTE enables the DTMF input and inhibits the microphone inputs and the receiving amplifier; a LOW level or an open circuit has the reverse effect. Switching the mute input will cause negligible clicks at the earpiece outputs and on the line.

Dual-tone multi frequency input DTMF

When the DTMF input is enabled, dialling tones may be sent onto the line. The voltage gain from DTMF to LN is typically 25.5 dB and varies with R7 in the same way as the gain of the microphone amplifier. The signalling tones can be heard in the earpiece at a low level (confidence tone).

Receiving amplifier: IR, QR+, QR− and GAR

The receiving amplifier has one input IR and two complementary outputs, a non-inverting output QR+ and an inverting output QR−.

These outputs may be used for single-ended or for differential drive, depending on the sensitivity and type of earpiece used (see Fig.10). Gain from IR to QR+ is typically 25 dB. This will be sufficient for low-impedance magnetic or dynamic earpieces, which are suited for single-ended drive. By using both outputs (differential drive), the gain is increased by 6 dB and differential drive becomes possible. This feature can be used when the earpiece impedance exceeds 450 Ω (high-impedance dynamic, magnetic or piezoelectric earpieces).

The output voltage of the receiving amplifier is specified for continuous-wave drive. The maximum output voltage will be higher under speech conditions, where the ratio of peak to RMS value is higher.

The receiving amplifier gain can be adjusted over a range of ±8 dB to suit the sensitivity of the transducer used. The gain is set by the external resistor R4 connected between GAR and QR+.

Two external capacitors, C4 = 100 pF and C7 = 10 × C4 = 1 nF, are necessary to ensure stability. A larger value of C4 may be chosen to obtain a first-order, low-pass filter. The 'cut-off' frequency corresponds with the time constant R4 × C4.

Automatic gain control input AGC

Automatic line loss compensation is obtained by connecting a resistor R6 between AGC and V_{EE}. This automatic gain control varies the microphone amplifier gain and the receiving amplifier gain in accordance with the DC line current.

The control range is 6 dB. This corresponds with a line length of 5 km for a 0.5 mm diameter copper twisted-pair cable with a DC resistance of 176 Ω/km and an average attenuation of 1.2 dB/km.

Resistor R6 should be chosen in accordance with the exchange supply voltage and its feeding bridge resistance (see Fig.11 and Table 1). Different values of R6 give the same ratio of line currents for start and end of the control range.

If automatic line loss compensation is not required, AGC may be left open. The amplifiers then all give their maximum gain as specified.

Power-down input PD

During pulse dialling or register recall (timed loop break) the telephone line is interrupted, as a consequence it provides no supply for the transmission circuit and the peripherals connected to V_{CC}. These gaps have to be bridged by the charge in the smoothing capacitor C1. The requirements on this capacitor are relaxed by applying a HIGH level to the PD input during the time of the loop break, which reduces the supply current from typically 1 mA to typically 55 μA.

A HIGH level at PD further disconnects the capacitor at REG, with the effect that the voltage stabilizer will have no switch-on delay after line interruptions. This results in no contribution of the IC to the current waveform during pulse dialling or register recall. When this facility is not required PD may be left open.

Side-tone suppression

Suppression of the transmitted signal in the earpiece is obtained by the anti-side-tone network consisting of R1//Z_{line}, R2, R3, R8, R9 and Z_{bal} (see Fig.14). Maximum compensation is obtained when the following conditions are fulfilled:

$$R9 \times R2 = R1 (R3 + [R8//Z_{bal}]) \tag{1}$$

$$Z_{bal} / (Z_{bal} + R8) = Z_{line} / (Z_{line} + R1) \tag{2}$$

If fixed values are chosen for R1, R2, R3, and R9, then condition (1) will always be fulfilled, provided that $|R8//Z_{bal}|$ < R3. To obtain optimum side-tone suppression, condition (2) has to be fulfilled, resulting in:

Z_{bal} = (R8/R1) Z_{line} = k × Z_{line}, where k is a scale factor: k = (R8/R1).

Scale factor k (dependent on the value of R8) must be chosen to meet the following criteria:

1. Compatibility with a standard capacitor from the E6 or E12 range for Z_{bal}

2. $|Z_{bal}//R8|$ << R3

3. $|Z_{bal} + R8|$ >> R9.

In practice, Z_{line} varies greatly with line length and cable type; consequently, an average value has to be chosen for Z_{bal}. The suppression further depends on the accuracy with which Z_{bal}/k equals the average line impedance.

Example: The balanced line impedance $|Z_{bal}|$ at which the optimum suppression is preset can be calculated by:

Assume Z_{line} = 210 Ω + (1 265 Ω/140 nF), representing a 5 km line of 0.5 mm diameter, copper, twisted-pair cable matched to 600 Ω (176 Ω/km; 38 nF/km). When k = 0.64, then R8 = 390 Ω; Z_{bal} = 130 Ω + (820 Ω//220 nF).

The anti-side-tone network for the TEA1060 family shown in Fig.4 attenuates the signal received from the line by 32 dB before it enters the receiving amplifier.

The attenuation is almost constant over the whole audio frequency range. Figure 5 shows a conventional Wheatstone bridge anti-side-tone circuit that can be used as an alternative. Both bridge types can be used with either resistive or complex set impedances.

The anti-side-tone network as used in the standard application (see Fig.13) attenuates the signal from the line

with 32 dB. The attenuation is nearly flat over the audio-frequency range.

Instead of the previously-described special TEA1066 bridge, the conventional Wheatstone bridge configuration can be used as an alternative anti-side-tone circuit. Both bridge types can be used with either a resistive set impedance or a complex set impedance.
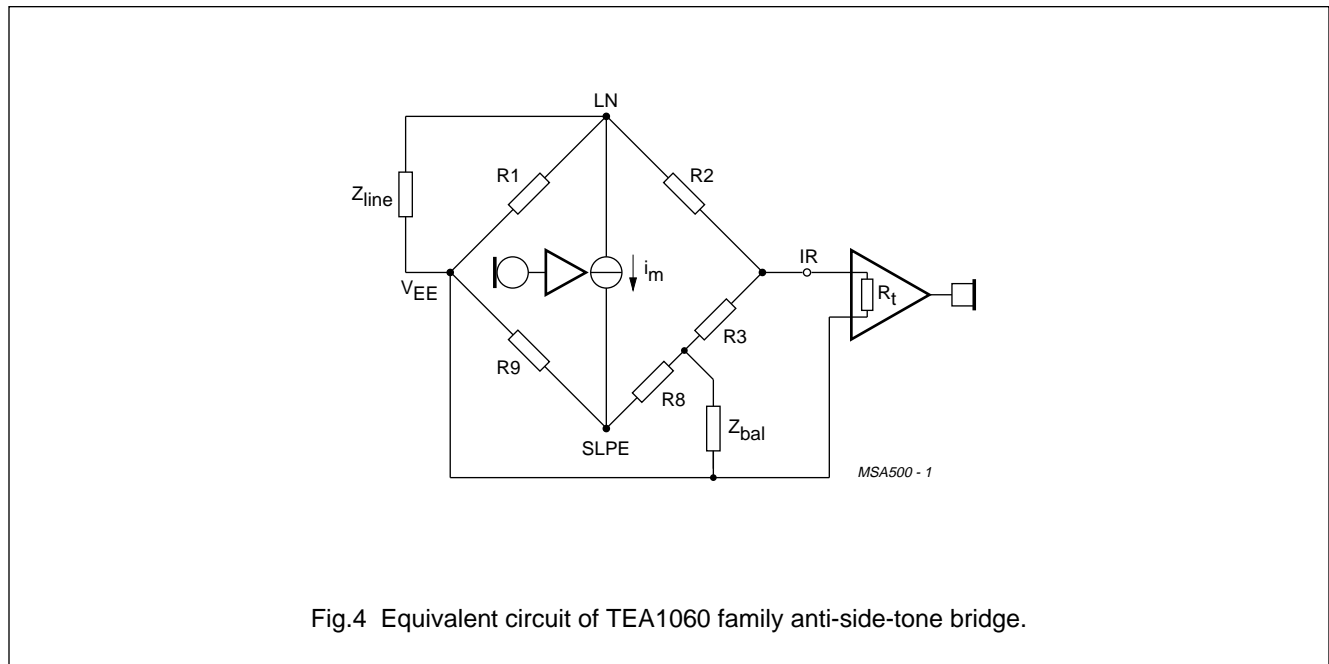
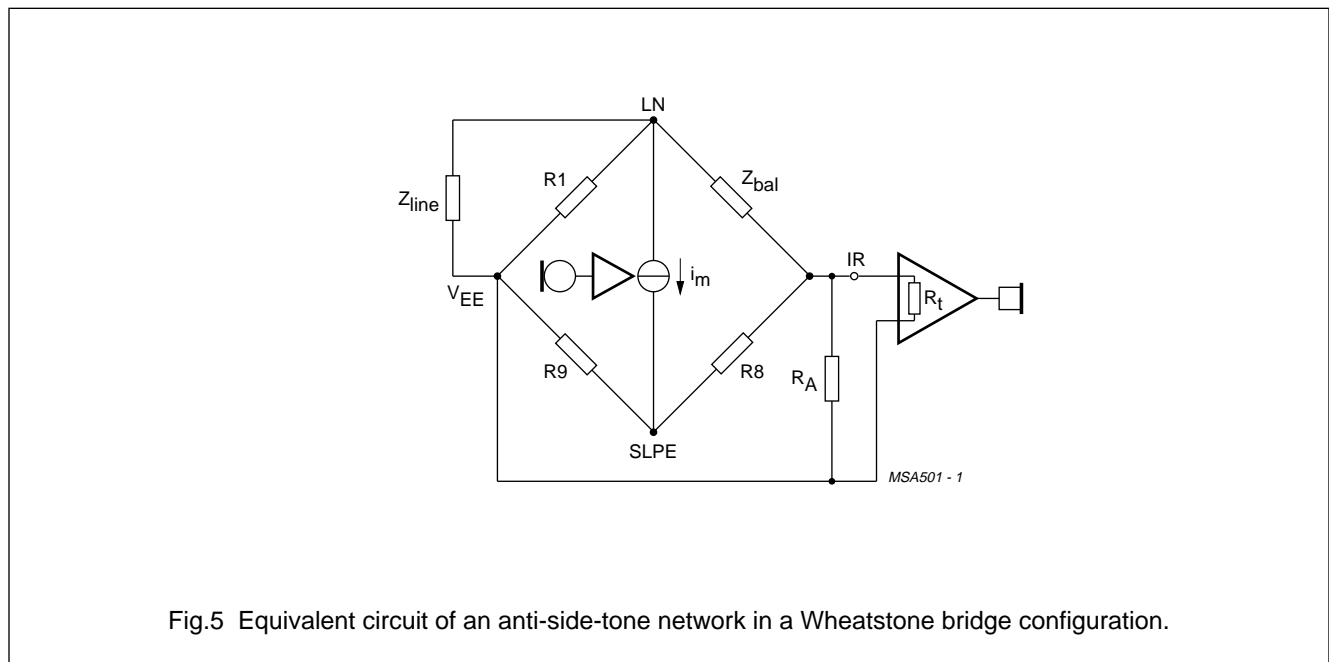Fig.4 Equivalent circuit of TEA1060 family anti-side-tone bridge.

Fig.5 Equivalent circuit of an anti-side-tone network in a Wheatstone bridge configuration.

Versatile telephone transmission circuit with dialler interface

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{LN}	positive continuous line voltage		–	12	V
$V_{LN(R)}$	repetitive line voltage during switch-on or line interruption		–	13.2	V
$V_{LN(RM)}$	repetitive peak line voltage for a 1 ms pulse per 5 s	R9 = 20 Ω; R10 = 13 Ω; (Fig.10)	–	28	V
I_{line}	line current	R9 = 20 Ω; note 1	–	140	mA
V_n	voltage on any other pin		$V_{EE} - 0.7$	$V_{CC} + 0.7$	V
P_{tot}	total power dissipation	R9 = 20 Ω; note 2	–	555	mW
T_{stg}	IC storage temperature		–40	+125	$^\circ$C
T_{amb}	operating ambient temperature		–25	+75	$^\circ$C
T_j	junction temperature		–	125	$^\circ$C

Notes

1. Mostly dependent on the maximum required T_{amb} and on the voltage between LN and SLPE (see Fig.6).

2. Calculated for the maximum ambient temperature specified, $T_{amb} = 75$ $^\circ$C and a maximum junction temperature of 125 $^\circ$C.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient in free air mounted on glass epoxy board 41 $\times$ 19 $\times$ 1.5 mm	90	K/W

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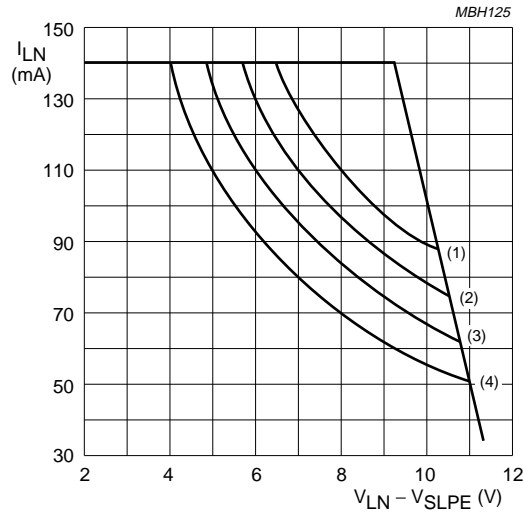
(1) T_{amb} = 45 °C; P_{tot} = 888 mW.
(2) T_{amb} = 55 °C; P_{tot} = 777 mW.
(3) T_{amb} = 65 °C; P_{tot} = 666 mW.
(4) T_{amb} = 75 °C; P_{tot} = 555 mW.

Fig.6 Safe operating area.

CHARACTERISTICS

I_{line} = 10 to 100 mA; V_{EE} = 0 V; f = 800 Hz; R9 = 20 Ω; T_{amb} = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supplies: LN and V_{CC} (pins 1 and 17)						
V_{LN}	voltage drop over circuit between LN and V_{EE}	I_{line} = 5 mA	3.95	4.25	4.55	V
		I_{line} = 15 mA	4.25	4.45	4.65	V
		I_{line} = 100 mA	5.40	6.10	6.70	V
		I_{line} = 140 mA	–	–	7.50	V
$\Delta V_{LN}/\Delta T$	voltage drop variation with temperature	I_{line} = 15 mA	–4	–2	0	mV/K
V_{LN}	voltage drop over circuit between LN and V_{EE} with external resistor R_{VA}	I_{line} = 15 mA; R_{VA} = R1-18 = 68 kΩ	3.50	3.80	4.05	V
		I_{line} = 15 mA; R_{VA} = R18-20 = 39 kΩ	4.70	5	5.30	V
I_{CC}	supply current	PD = LOW; V_{CC} = 2.8 V	–	0.96	1.30	mA
		PD = HIGH; V_{CC} = 2.8 V	–	55	82	μA
V_{CC}	supply voltage available for peripheral circuits	I_{line} = 15 mA; MUTE = HIGH; I_p = 0 mA	3.50	3.75	–	V
		I_{line} = 15 mA; MUTE = HIGH; I_p = 1.2 mA	2.80	3.05	–	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Microphone inputs MICL+ and MICL−; MICH+ and MICH−						
$\|Z_i\|$	input impedance					
	MICL+ (pin 9); MICL− (pin 7)		3.3	4.1	4.9	kΩ
	MICH+ (pin 10); MICH− (pin 8)		16.5	20.4	24.5	kΩ
CMRR	common mode rejection ratio		–	82	–	dB
G_v	voltage gain	I_{line} = 15 mA; R7 = 68 Ω				
	MICL+/MICL− to LN		51	52	53	dB
	MICH+/MICH− to LN		37	38	39	dB
ΔG_{vf}	gain variation with frequency at f = 300 Hz and 3400 Hz	with respect to 800 Hz	−0.5	±0.2	+0.5	dB
ΔG_{vT}	gain variation with temperature at T_{amb} = −25 °C and +75 °C	I_{line} = 50 mA; with respect to 800 Hz	–	±0.2	–	dB
Dual-tone multi-frequency input DTMF (pin 15)						
$\|Z_i\|$	input impedance		16.8	20.7	24.6	kΩ
G_v	voltage gain from DTMF to LN	I_{line} = 15 mA; R7= 68 kΩ	24.5	25.5	26.5	dB
ΔG_{vf}	gain variation with frequency at f = 300 Hz and 3400 Hz	with respect to 800 Hz	−0.5	±0.2	+0.5	dB
ΔG_{vT}	gain variation with temperature at T_{amb} = −25 °C and +75 °C	I_{line} = 50 mA; with respect to 25 °C	–	±0.2	–	dB
Gain adjustment connections GAS1 and GAS2 (pins 2 and 3)						
ΔG_v	gain variation with R7, transmitting amplifier		−8	–	+8	dB
Transmitting amplifier output LN (pin 1)						
$V_{LN(rms)}$	output voltage (RMS value)	I_{line} = 15 mA; THD = 2%	1.9	2.3	–	V
		I_{line} = 15 mA; THD = 10%	–	2.6	–	V
$V_{no(rms)}$	noise output voltage (RMS value)	I_{line} = 15 mA; R7 = 68 kΩ; microphone inputs open; psophometrically weighted (P53 curve)	–	−70	–	dBmp
Receiving amplifier input IR (pin 13)						
$\|Z_i\|$	input impedance		17	21	25	kΩ
Receiving amplifier outputs QR+ and QR− (pins 5 and 4)						
$\|Z_o\|$	output impedance	single-ended	–	4	–	Ω
G_v	voltage gain from IR to QR+ or QR−	I_{line} = 15 mA; R4 = 100 kΩ				
		single-ended; R_L = 300 Ω	24	25	26	dB
		differential; R_L = 600 Ω	30	31	32	dB
ΔG_{vf}	gain variation with frequency at f = 300 Hz and 3400 Hz	with respect to 800 Hz	−0.5	±0.2	+0.5	dB
ΔG_{vT}	gain variation with temperature at T_{amb} = −25 °C and +75 °C	I_{line} = 50 mA; with respect to 25 °C	–	±0.2	–	dB

| SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{o(rms)}$	output voltage (RMS value)	sine-wave drive; I_{line} = 15 mA; I_p = 0 mA; THD = 2%; R4 = 100 kΩ				
		single-ended; R_L = 150 Ω	0.30	0.38	–	V
		single-ended; R_L = 450 Ω	0.40	0.52	–	V
		differential; C_L = 47 nF; R_{series} = 100 Ω; f = 3400 Hz	0.80	1.0	–	V
$V_{no(rms)}$	noise output voltage (RMS value)	I_{line} = 15 mA; R4 = 100 kΩ; pin 13 (IR) open; psophometrically weighted (P53 curve)				
		single-ended; R_L = 300 Ω	–	50	–	μV
		differential; R_L = 600 Ω	–	100	–	μV
Gain adjustment GAR (pin 6)						
ΔG_v	gain variation with R4 connected between pin 6 and pin 5 receiving amplifier		–8	–	+8	dB
MUTE input (pin 16)						
V_{IH}	HIGH level input voltage		1.50	–	V_{CC}	V
V_{IL}	LOW level input voltage		–	–	0.3	V
I_{MUTE}	input current		–	5	10	μA
ΔG_v	voltage gain reduction between MICL+ (pin 9) and MICL− (pin 7) to LN (pin 1)	MUTE = HIGH	–	70	–	dB
G_v	voltage gain from DTMF to QR+ or QR−	MUTE = HIGH; R4 = 100 kΩ; single-ended; R_L = 300 Ω	–21	–19	–17	dB
Power-down input PD (pin 14)						
V_{IH}	HIGH level input voltage		1.5	–	V_{CC}	V
V_{IL}	LOW level input voltage		–	–	0.3	V
I_{PD}	input current in power-down condition		–	5	10	μA

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| SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Automatic gain control input AGC (pin 19)						
ΔG_v	gain control range from IR to QR+/QR− and from MIC+/MIC− to LN	I_{line} = 70 mA; R6 = 110 kΩ between AGC and V_{EE}	−5.5	−5.9	−6.3	dB
$I_{line(H)}$	highest line current for maximum gain	R6 = 110 kΩ between AGC and V_{EE}	−	23	−	mA
$I_{line(L)}$	lowest line current for minimum gain	R6 = 110 kΩ between AGC and V_{EE}	−	61	−	mA
ΔG_v	voltage gain variation	between I_{line} = 15 mA and I_{line} = 35 mA; R6 = 110 kΩ between AGC and V_{EE}	−1.0	−1.5	−2.0	dB
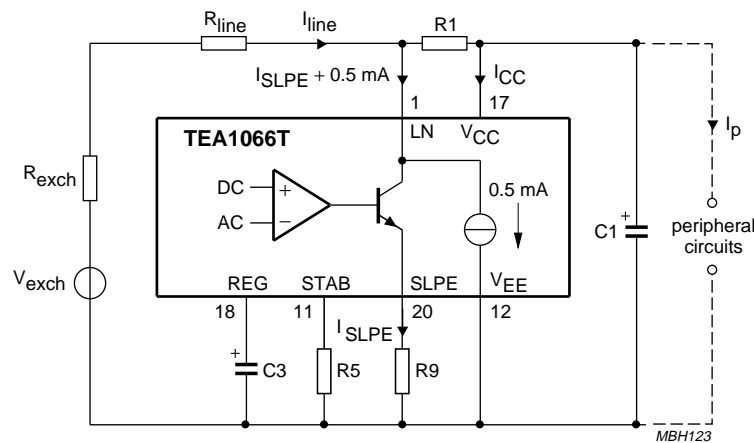
Fig.7 Supply arrangement.
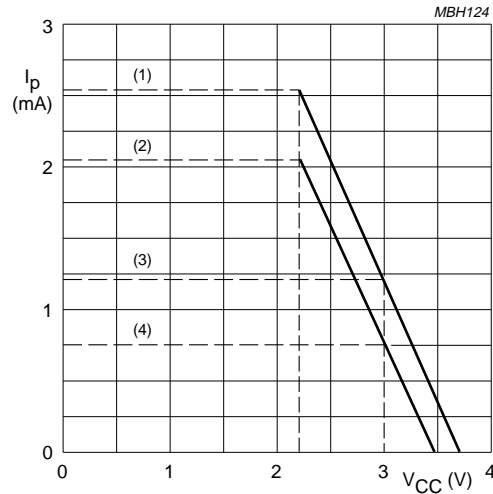
Curves (1) and (3) are valid when the receiving amplifier is not driven or when MUTE = HIGH. Curves (2) and (4) are valid when MUTE = LOW and the receiving amplifier is driven, $V_{o(rms)}$ = 150 mV, R_L = 150 Ω (asymmetrical). I_{line} = 15 mA; V_{LN} = 4.45 V; R1 = 620 Ω and R9 = 20 Ω.

(1) I_p = 2.55 mA.

(2) I_p = 2.1 mA.

(3) I_p = 1.2 mA.

(4) I_p = 0.75 mA.
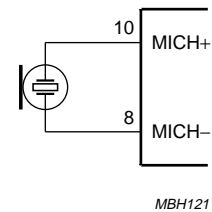
Fig.8 Typical current I_p available from V_{CC} for external (peripheral) circuitry with V_{CC} > 2.2 V and V_{CC} > 3 V.
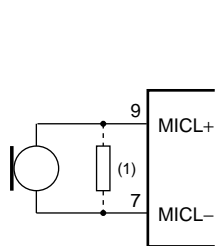
a. Magnetic or dynamic
   microphone.
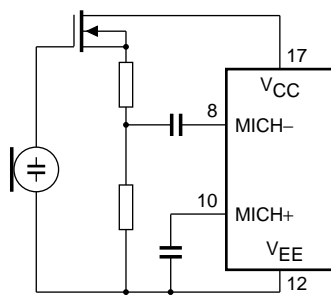
b. Electret microphone.

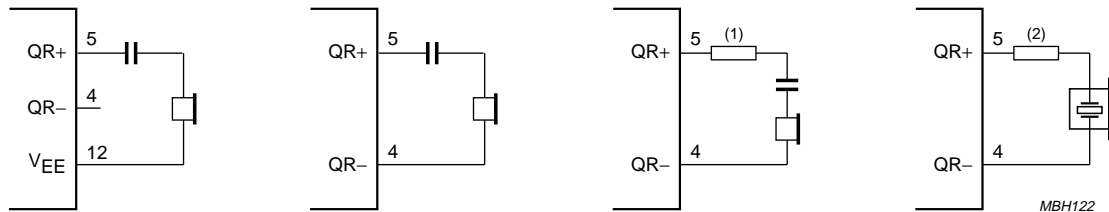c. piezoelectric microphone.

(1) May be connected to lower the terminating impedance.

Fig.9 Alternative microphone arrangements.
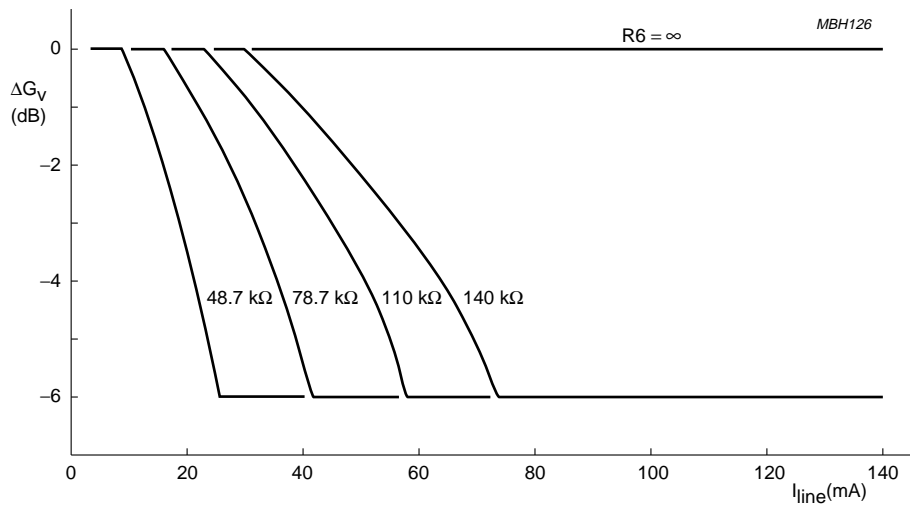
a. Dynamic earpiece with less than 450 Ω impedance.

b. Dynamic earpiece with more than 450 Ω impedance.

c. Magnetic earpiece with more than 450 Ω impedance.

d. piezoelectric earpiece.

(1) May be connected to prevent distortion (inductive load).
(2) Required to increase the phase margin (capacitive load).
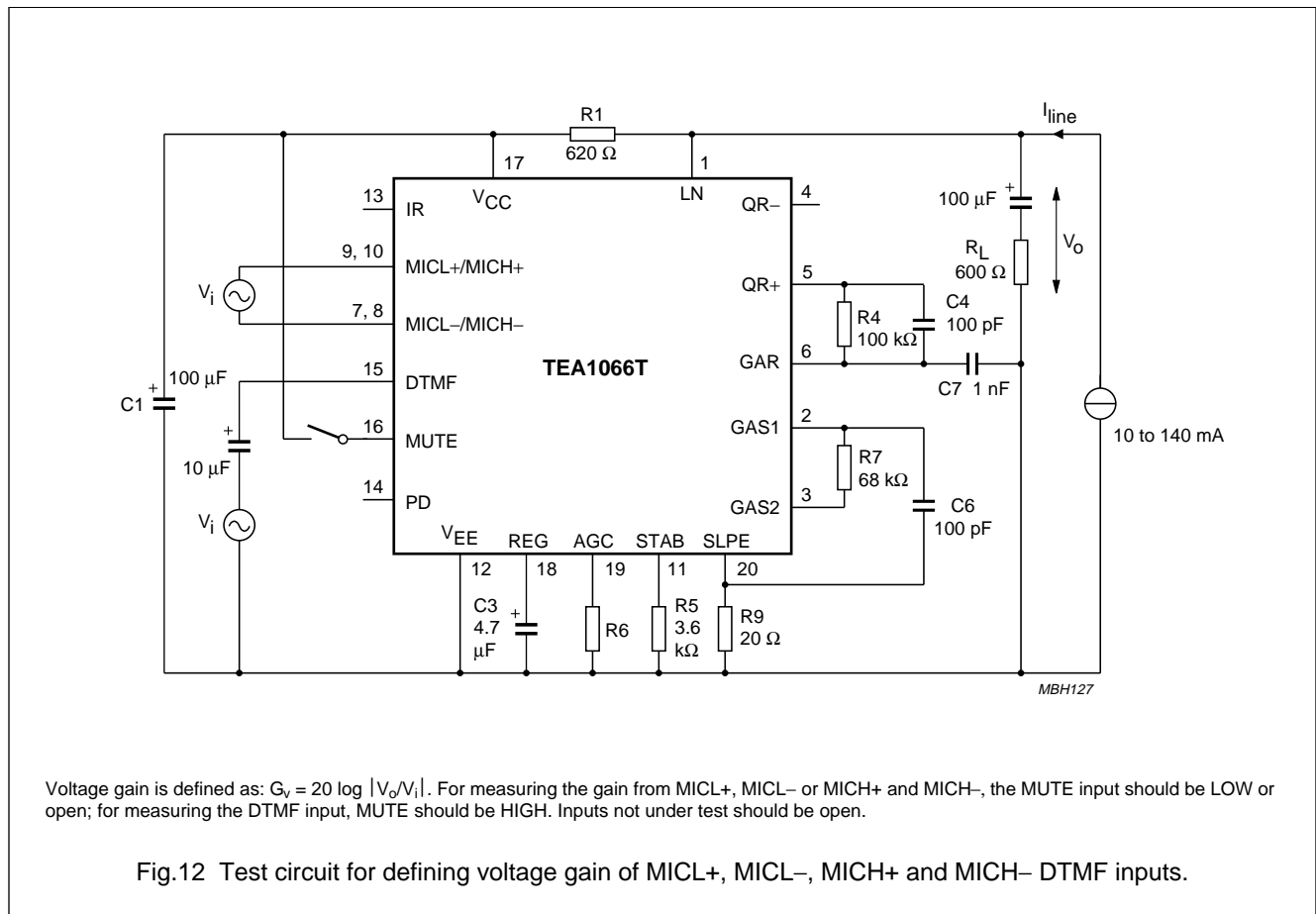
Fig.10 Alternative receiver arrangements.

R9 = 20 Ω.

Fig.11 Variation of gain with line current, with R6 as a parameter.

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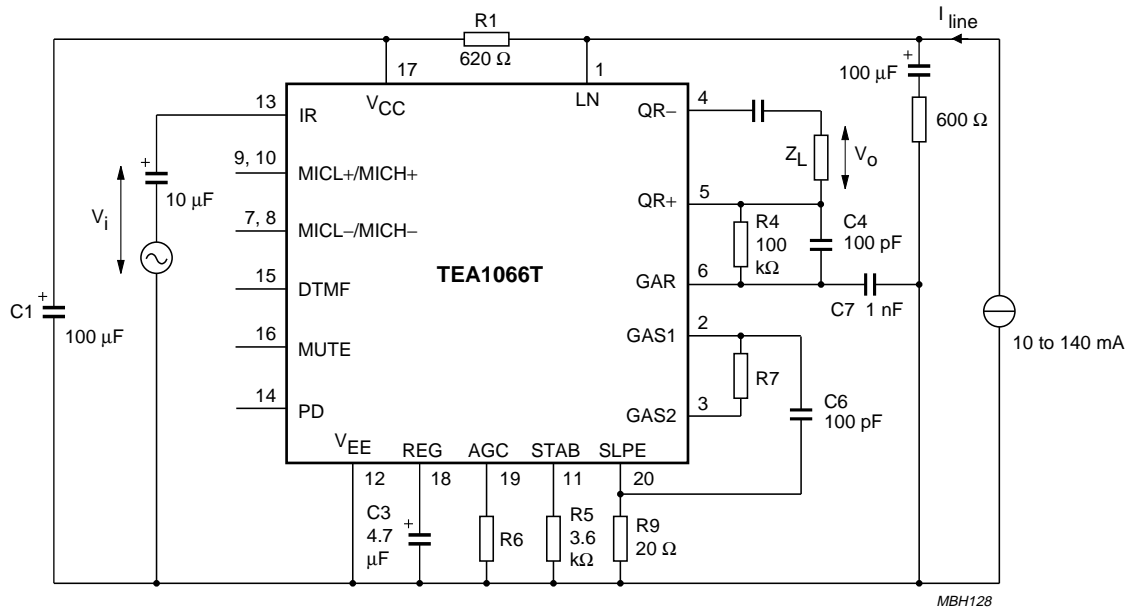
TEA1066T

Table 1 Values of resistor R6 for optimum line loss compensation, for various usual values of exchange supply voltage V_{exch} and exchange feeding bridge resistance R_{exch}; R9 = 20 Ω

V_{exch} (V)	R6 (kΩ)			
	R_{exch} = 400 Ω	R_{exch} = 600 Ω	R_{exch} = 800 Ω	R_{exch} = 1000 Ω
24	61.9	48.7	X	X
36	100	78.7	68	60.4
48	140	110	93.1	82
60	X	X	120	102

Voltage gain is defined as: G_v = 20 log $|V_o/V_i|$. For measuring the gain from MICL+, MICL– or MICH+ and MICH–, the MUTE input should be LOW or open; for measuring the DTMF input, MUTE should be HIGH. Inputs not under test should be open.

Fig.12 Test circuit for defining voltage gain of MICL+, MICL–, MICH+ and MICH– DTMF inputs.

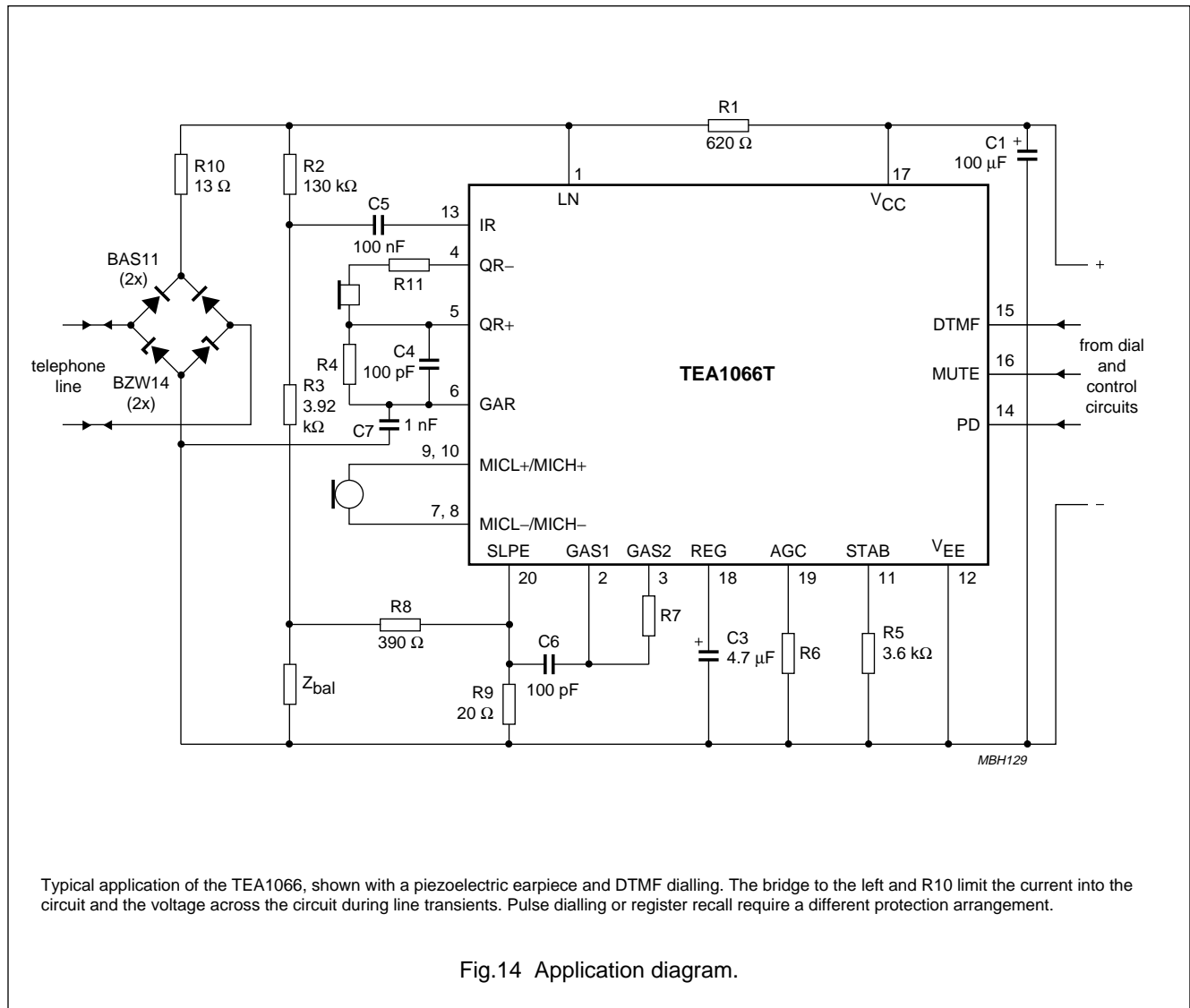## Versatile telephone transmission circuit with dialler interface

Voltage gain is defined as: $G_v = 20 \log |V_o/V_i|$.

Fig.13 Test circuit for defining voltage gain of the receiving amplifier.

Versatile telephone transmission circuit with dialler interface
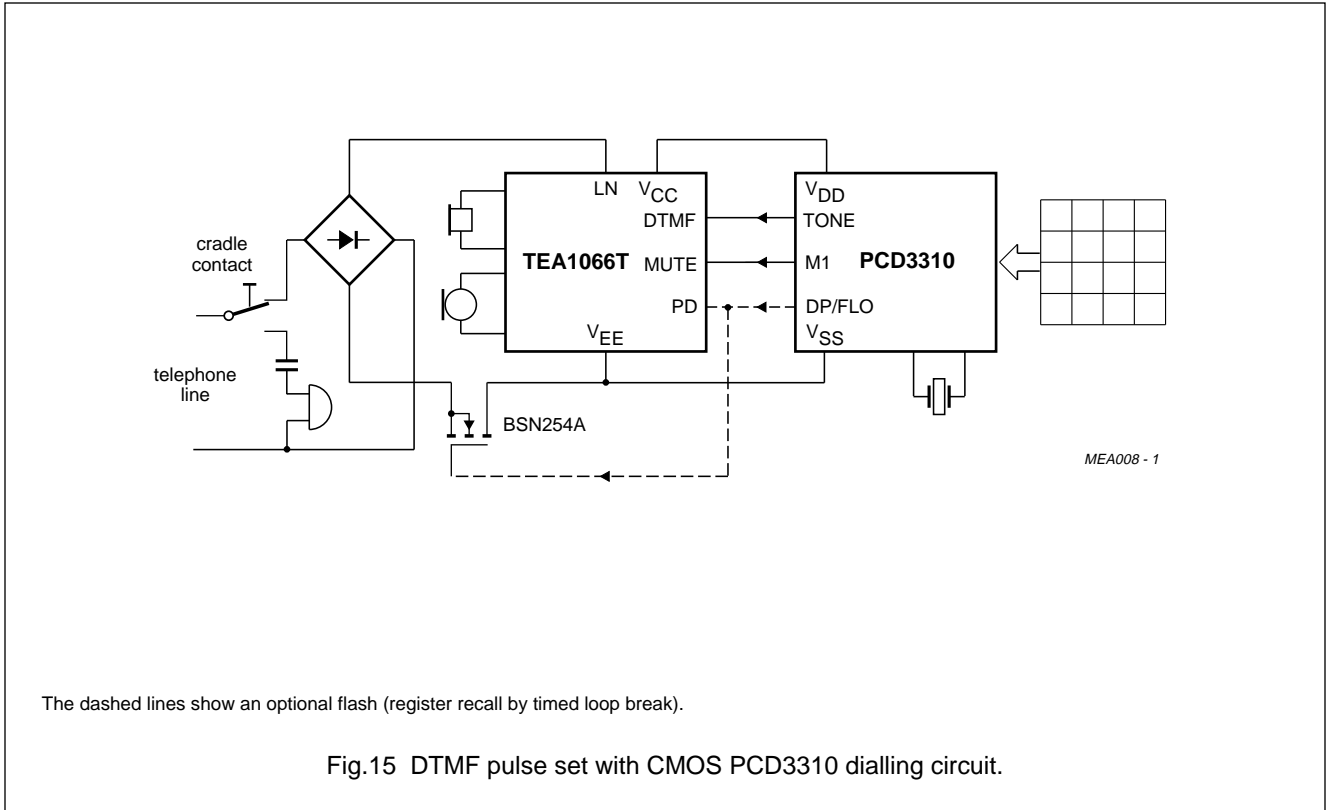
TEA1066T

APPLICATION INFORMATION

Typical application of the TEA1066, shown with a piezoelectric earpiece and DTMF dialling. The bridge to the left and R10 limit the current into the circuit and the voltage across the circuit during line transients. Pulse dialling or register recall require a different protection arrangement.

Fig.14 Application diagram.

# Versatile telephone transmission circuit with dialler interface

The dashed lines show an optional flash (register recall by timed loop break).

Fig.15 DTMF pulse set with CMOS PCD3310 dialling circuit.

Versatile telephone transmission circuit
with dialler interface

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PACKAGE OUTLINE

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

pin 1 index

detail X

```
0        5        10 mm
|_____|_____|
       scale
```
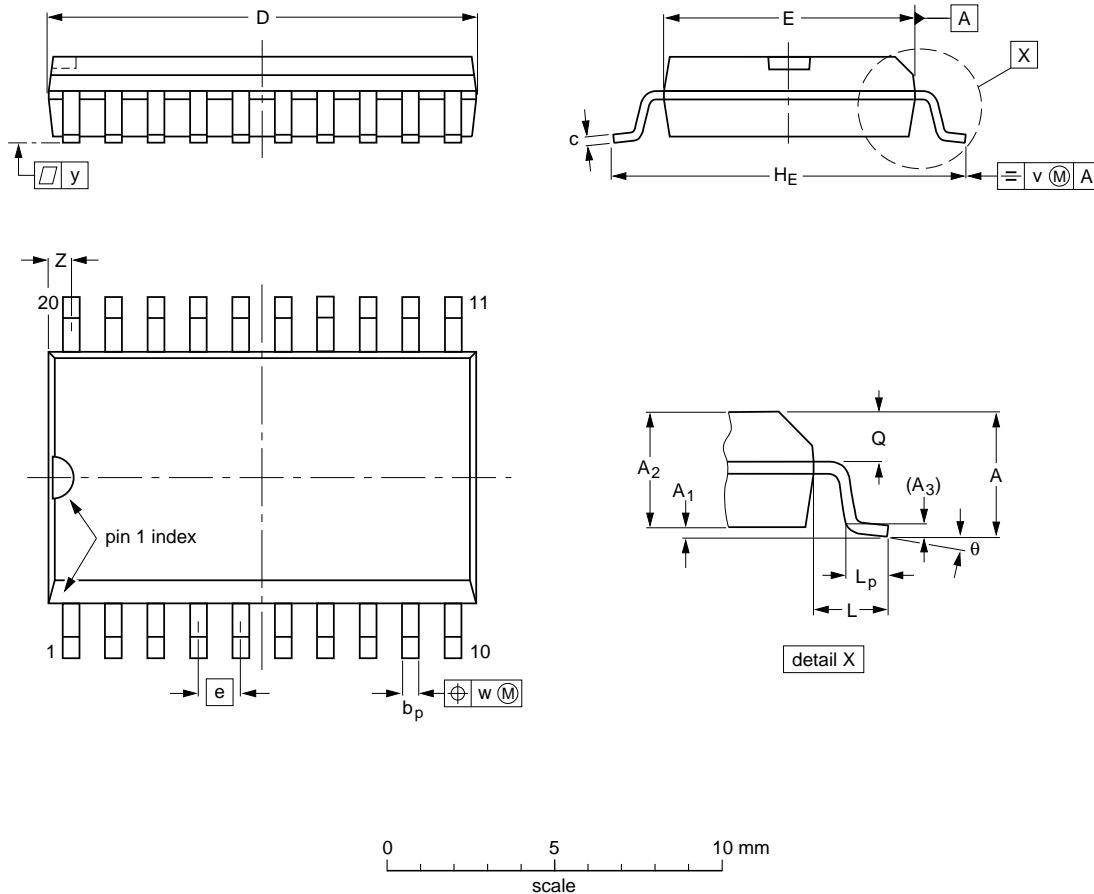
DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A₁	A₂	A₃	b_p	c	D(1)	E(1)	e	H_E	L	L_p	Q	v	w	y	Z(1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				92-11-17 95-01-24

Versatile telephone transmission circuit with dialler interface

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SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

Versatile telephone transmission circuit
with dialler interface

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DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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NOTES

NOTES

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