

DATA SHEET

TEA1112; TEA1112A

Low voltage versatile telephone
transmission circuits with dialler
interface

Product specification
Supersedes data of 1996 Feb 16
File under Integrated Circuits, IC03

1997 Mar 26

Low voltage versatile telephone transmission circuits with dialler interface

TEA1112; TEA1112A

FEATURES

- Low DC line voltage; operates down to 1.6 V (excluding polarity guard)
- Voltage regulator with adjustable DC voltage
- Provides a supply for external circuits
- Symmetrical high impedance inputs (64 k Ω) for dynamic, magnetic or piezo-electric microphones
- Asymmetrical high impedance input (32 k Ω) for electret microphones
- DTMF input with confidence tone
- Mute input for pulse or DTMF dialling (MUTE for TEA1112 and MUTE for TEA1112A)
- Receiving amplifier for dynamic, magnetic or piezo-electric earpieces
- AGC line loss compensation for microphone and earpiece amplifiers
- LED on-hook/off-hook status indication
- Microphone mute function (MMUTE for TEA1112 and MMUTE for TEA1112A).

APPLICATION

- Line powered telephone sets, cordless telephones, fax machines and answering machines.

GENERAL DESCRIPTION

The TEA1112; TEA1112A are bipolar integrated circuits that perform all speech and line interface functions required in fully electronic telephone sets. They perform electronic switching between speech and dialling. The ICs operate at a line voltage down to 1.6 V DC (with reduced performance) to facilitate the use of telephone sets connected in parallel.

A current (proportional to the line current and internally limited to a typical value of 19.5 mA) is available to drive an LED which indicates the on-hook/off-hook status.

The microphone amplifier can be disabled during speech condition by means of a microphone mute function.

All statements and values refer to all versions unless otherwise specified.

QUICK REFERENCE DATA

$I_{line} = 15$ mA; $V_{EE} = 0$ V; $R_{SLPE} = 20$ Ω ; AGC pin connected to V_{EE} ; $Z_{line} = 600$ Ω ; $f = 1$ kHz; $T_{amb} = 25$ $^{\circ}$ C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT	
I_{line}	line current operating range	normal operation	11	–	140	mA	
		with reduced performance	1	–	11	mA	
$I_{LED(max)}$	maximum supply current available	$I_{line} = 18$ mA	–	0.5	–	mA	
		$I_{line} > 76$ mA	–	19.5	–	mA	
V_{LN}	DC line voltage		3.35	3.65	3.95	V	
I_{CC}	internal current consumption	$V_{CC} = 2.9$ V	–	1.15	1.4	mA	
V_{CC}	supply voltage for peripherals	$I_p = 0$ mA	–	2.9	–	V	
G_{vtrx}	typical voltage gain range	microphone amplifier	$V_{MIC} = 2$ mV (RMS)	38.8	–	51.8	dB
		receiving amplifier	$V_{IR} = 6$ mV (RMS)	19.2	–	31.2	dB
ΔG_{vtrx}	gain control range for microphone and receiving amplifiers with respect to $I_{line} = 15$ mA	$I_{line} = 85$ mA	–	5.8	–	dB	
ΔG_{vtxm}	microphone amplifier gain reduction		–	80	–	dB	

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ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TEA1112	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
TEA1112A	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
TEA1112T	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
TEA1112AT	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

BLOCK DIAGRAM

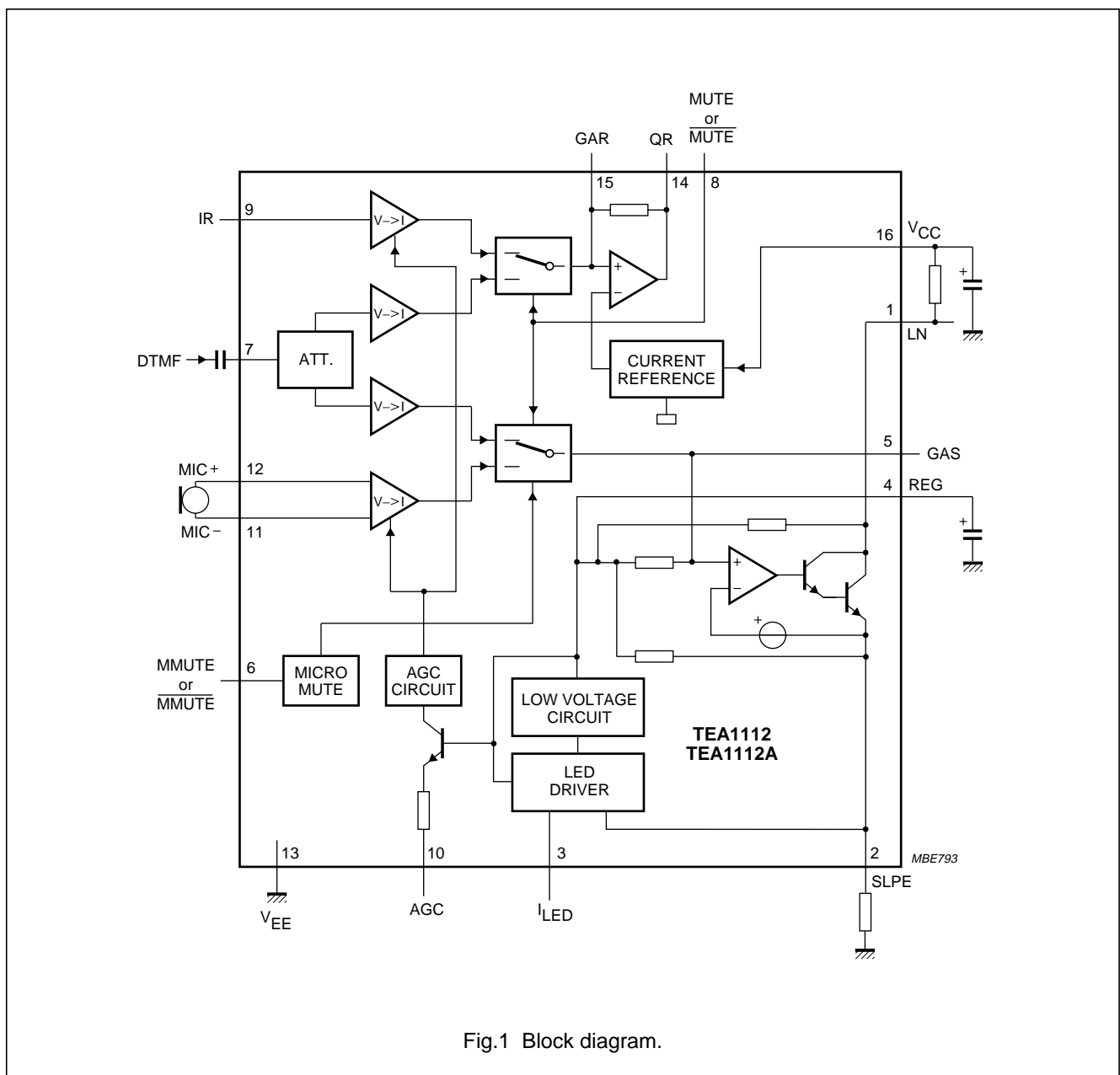


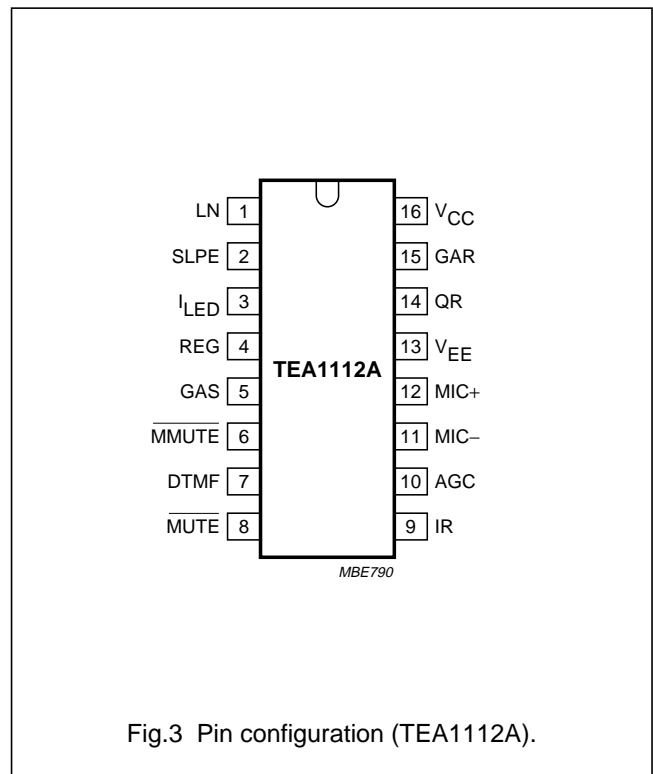
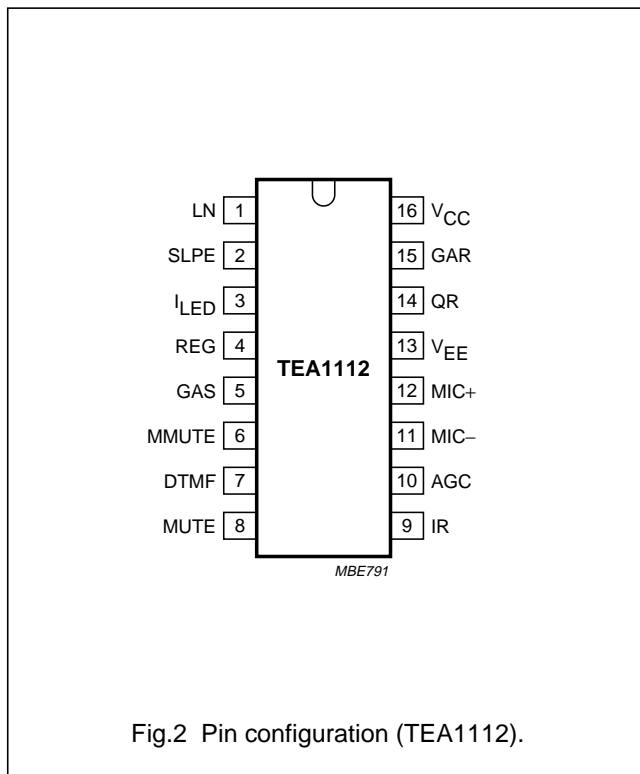
Fig.1 Block diagram.

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PINNING

SYMBOL	PIN		DESCRIPTION
	TEA1112	TEA1112A	
LN	1	1	positive line terminal
SLPE	2	2	slope (DC resistance) adjustment
I _{LED}	3	3	available output current to drive a LED
REG	4	4	line voltage regulator decoupling
GAS	5	5	sending gain adjustment
MMUTE	6	–	microphone mute input
MMUTE	–	6	microphone mute input (active LOW)
DTMF	7	7	dual-tone multi-frequency input
MUTE	8	–	mute input to select speech or dialling mode
MUTE	–	8	mute input to select speech or dialling mode (active LOW)
IR	9	9	receiving amplifier input
AGC	10	10	automatic gain control/line loss compensation
MIC–	11	11	inverting microphone amplifier input
MIC+	12	12	non-inverting microphone amplifier input
V _{EE}	13	13	negative line terminal
QR	14	14	receiving amplifier output
GAR	15	15	receive gain adjustment
V _{CC}	16	16	supply voltage for speech circuit and peripherals



Low voltage versatile telephone transmission circuits with dialler interface

TEA1112; TEA112A

FUNCTIONAL DESCRIPTION

All data given in this chapter are typical values, except when otherwise specified.

Supply (pins LN, SLPE, V_{CC} and REG)

The supply for the TEA1112; TEA112A and their peripherals is obtained from the telephone line.

The ICs generate a stabilized reference voltage (V_{ref}) between pins LN and SLPE. This reference voltage is equal to 3.35 V, is temperature compensated and can be adjusted by means of an external resistor (R_{VA}). It can be increased by connecting the R_{VA} resistor between pins REG and SLPE (see Fig.5), or decreased by connecting the R_{VA} resistor between pins REG and LN. The voltage at pin REG is used by the internal regulator to generate the stabilized reference voltage and is decoupled by a capacitor (C_{REG}) which is connected to V_{EE} . This capacitor, converted into an equivalent inductance (see Section "Set impedance"), realizes the set impedance conversion from its DC value (R_{SLPE}) to its AC value (R_{CC} in the audio-frequency range). The voltage at pin SLPE is proportional to the line current. Figure 4 illustrates the supply configuration.

The ICs regulate the line voltage at pin LN, and can be calculated as follows:

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

$$I_{SLPE} = I_{line} - I_{CC} - I_p - I^* = I_{LED} + I_{sh}$$

Where:

I_{line} = line current

I_{CC} = current consumption of the IC

I_p = supply current for peripheral circuits

I^* = current consumed between LN and V_{EE}

I_{LED} = supply current for the LED component

I_{sh} = the excess line current shunted to SLPE (and V_{EE}) via LN.

The preferred value for R_{SLPE} is 20 Ω . Changing R_{SLPE} will affect more than the DC characteristics; it also influences the microphone and DTMF gains, the LED supply current characteristic, the gain control characteristics, the sidetone level and the maximum output swing on the line.

The internal circuitry of the TEA1112; TEA112A is supplied from pin V_{CC} . This voltage supply is derived from the line voltage by means of a resistor (R_{CC}) and must be decoupled by a capacitor C_{VCC} . It may also be used to supply peripheral circuits such as dialling or control circuits. The V_{CC} voltage depends on the current consumed by the IC and the peripheral circuits as shown by the formula (see also Figs.6 and 7). R_{CCint} is the internal impedance of the voltage supply point, and I_{rec} is the current consumed by the output stage of the earpiece amplifier.

$$V_{CC} = V_{CC0} - R_{CCint} \times (I_p - I_{rec})$$

$$V_{CC0} = V_{LN} - R_{CC} \times I_{CC}$$

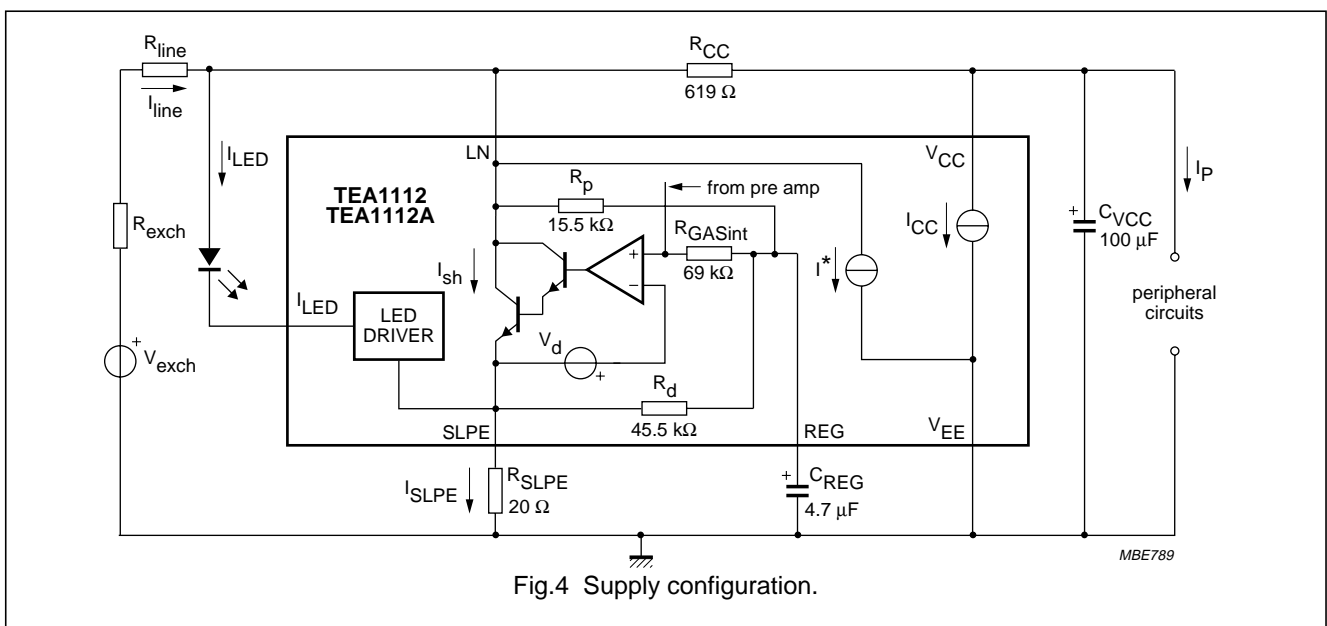
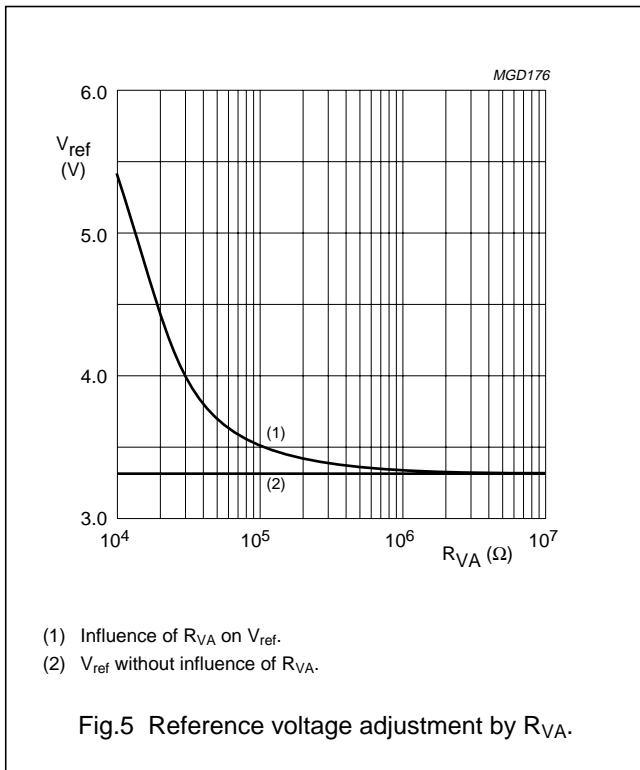


Fig.4 Supply configuration.

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The DC line 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 reference voltage (V_{ref}). With line currents below 7.5 mA, the internal reference voltage (generating V_{ref}) is automatically adjusted to a lower value. This means that more sets can operate in parallel with DC line voltages (excluding the polarity guard) down to an absolute minimum voltage of 1.6 V. At currents below 7.5 mA, the circuit has limited sending and receiving levels. This is called the low voltage area.

Set impedance

In the audio frequency range, the dynamic impedance is mainly determined by the R_{CC} resistor. The equivalent impedance of the circuits is illustrated in Fig.8.

LED supply (pin I_{LED})

The TEA1112; TEA1112A give an on-hook/off-hook status indication. This is achieved by a current made available to drive an LED connected between pins I_{LED} and LN. In the low voltage area, which corresponds to low line current conditions, no current is available for this LED.

For line currents higher than a threshold, $I_{LEDstart}$, the I_{LED} current increases proportionally to the line current (with a ratio of one third). The I_{LED} current is internally limited to 19.5 mA (see Fig.9). If no LED device is used in the application, the I_{LED} pin should be shorted to pin SLPE.

$$\text{For } 17 \text{ mA} < I_{line} < 77 \text{ mA: } I_{LED} = \frac{I_{line} - 17}{3}$$

This LED driver is referenced to SLPE. Consequently, all the I_{LED} supply current will flow through the R_{SLPE} resistor. The AGC characteristics are not disturbed (see Fig.4).

Microphone amplifier (pins MIC+, MIC- and GAS)

The TEA1112; TEA1112A have symmetrical microphone inputs. The input impedance between pins MIC+ and MIC- is 64 kΩ ($2 \times 32 \text{ k}\Omega$). The voltage gain from pins MIC+/MIC- to pin LN is set at 51.8 dB (typ). The gain can be decreased by connecting an external resistor R_{GAS} between pins GAS and REG. The adjustment range is 13 dB. A capacitor C_{GAS} connected between pins GAS and REG can be used to provide a first-order low-pass filter. The cut-off frequency corresponds to the time constant $C_{GAS} \times (R_{GASint} // R_{GAS})$. R_{GASint} is the internal resistor which sets the gain with a typical value of 69 kΩ.

Automatic gain control is provided on this amplifier for line loss compensation.

Microphone mute (pin MMUTE; TEA1112)

The microphone amplifier can be disabled by activating the microphone mute function. When MMUTE is LOW, the normal speech mode is entered, depending on the level on MUTE (see Table 1). When MMUTE is HIGH, the microphone amplifier inputs are disabled while the DTMF input is enabled (no confidence tone is provided). The voltage gain between LN and MIC+/MIC- is attenuated; the gain reduction is 80 dB (typ).

Microphone mute (pin \overline{MMUTE} ; TEA1112A)

The microphone amplifier can be disabled by activating the microphone mute function. When \overline{MMUTE} is LOW, the microphone amplifier inputs are disabled while the DTMF input is enabled (no confidence tone is provided). The voltage gain between LN and MIC+/MIC- is attenuated; the gain reduction is 80 dB (typ). When \overline{MMUTE} is HIGH, the normal speech mode is entered, depending on the level on MUTE (see Table 1).

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Receiving amplifier (pins IR, GAR and QR)

The receiving amplifier has one input (IR) and one output (QR). The input impedance between pin IR and pin V_{EE} is 20 k Ω . The voltage gain from pin IR to pin QR is set at 31.2 dB (typ). The gain can be decreased by connecting an external resistor R_{GAR} between pins GAR and QR; the adjustment range is 12 dB. Two external capacitors C_{GAR} (connected between GAR and QR) and C_{GARS} (connected between GAR and V_{EE}) ensure stability. The C_{GAR} capacitor provides a first-order low-pass filter. The cut-off frequency corresponds to the time constant $C_{GAR} \times (R_{GARint} // R_{GAR})$. R_{GARint} is the internal resistor which sets the gain with a typical value of 100 k Ω . The relationship $C_{GARS} = 10 \times C_{GAR}$ must be fulfilled to ensure stability.

The output voltage of the receiving amplifier is specified for continuous wave drive. The maximum output swing depends on the DC line voltage, the R_{CC} resistor, the I_{CC} current consumption of the circuit, the I_p current consumption of the peripheral circuits and the load impedance.

Automatic gain control is provided on this amplifier for line loss compensation.

Automatic gain control (pin AGC)

The TEA1112; TEA1112A perform automatic line loss compensation. The automatic gain control varies the gain of the microphone amplifier and the gain of the receiving amplifier in accordance with the DC line current. The control range is 5.8 dB (which corresponds approximately to a line length of 5 km for a 0.5 mm diameter twisted-pair copper cable with a DC resistance of 176 Ω /km and an average attenuation of 1.2 dB/km). The ICs can be used with different configurations of feeding bridge (supply voltage and bridge resistance) by connecting an external resistor R_{AGC} between pins AGC and V_{EE} . This resistor enables the I_{start} and I_{stop} line currents to be increased (the ratio between I_{start} and I_{stop} is not affected by the resistor). The AGC function is disabled when pin AGC is left open-circuit.

Mute function (pin MUTE; TEA1112)

The mute function performs the switching action between the speech mode and the dialling mode. When MUTE is LOW or open-circuit, the microphone and receiving amplifiers inputs are enabled while the DTMF input is disabled, depending on the MMUTE level (see Table 1). When MUTE is HIGH, the DTMF input is enabled and the microphone and receiving amplifiers inputs are disabled.

Mute function (pin \overline{MUTE} ; TEA1112A)

The mute function performs the switching between the speech mode and the dialling mode. When \overline{MUTE} is LOW or open-circuit, the DTMF input is enabled and the microphone and receiving amplifiers inputs are disabled. When \overline{MUTE} is HIGH, the microphone and receiving amplifiers inputs are enabled while the DTMF input is disabled, depending on the MMUTE level (see Table 1).

DTMF amplifier (pin DTMF)

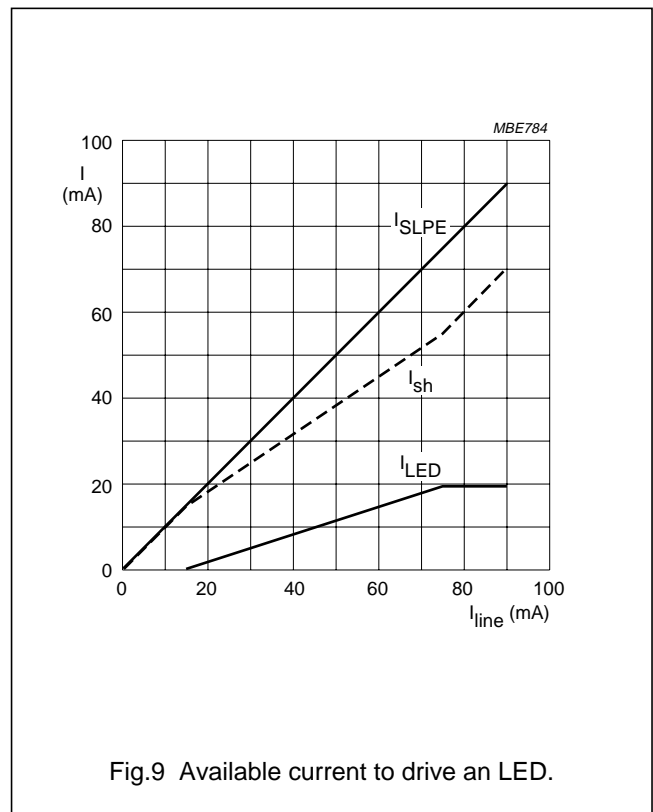
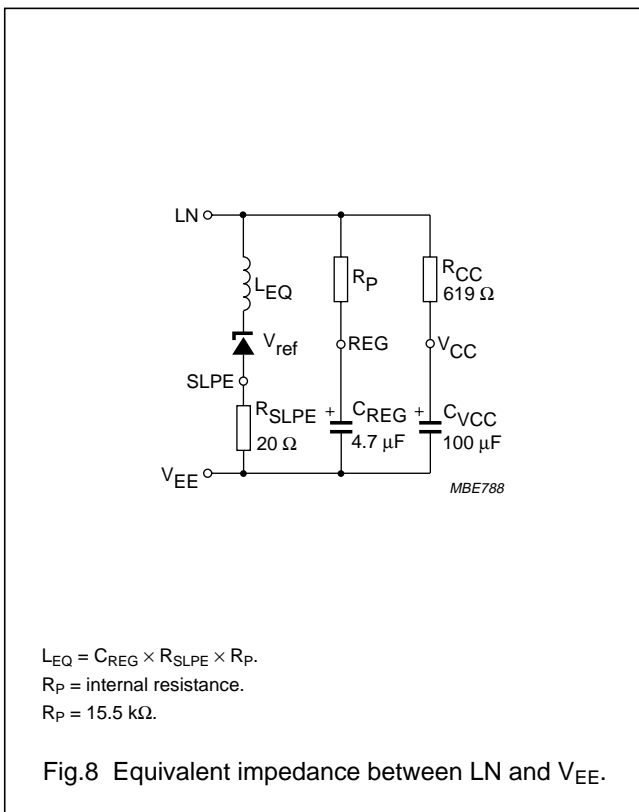
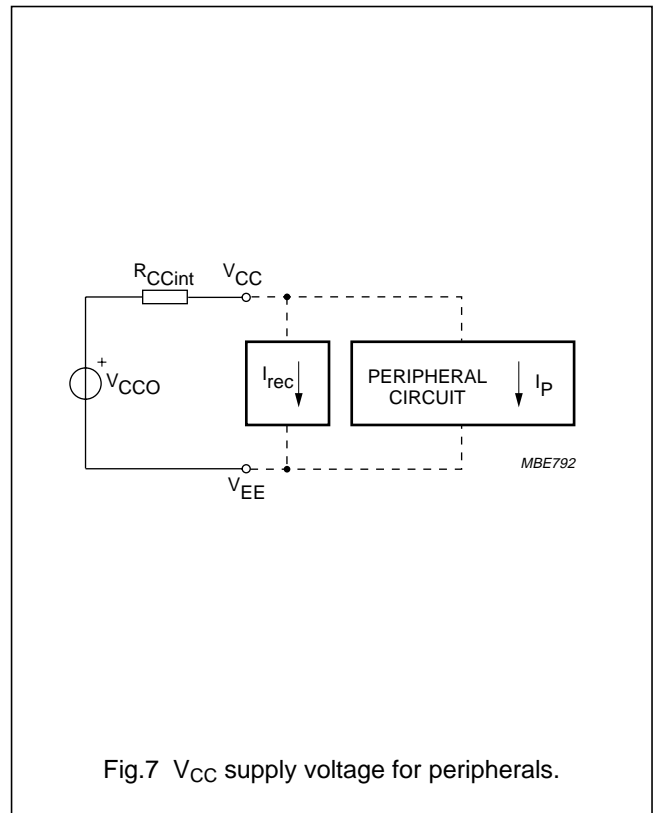
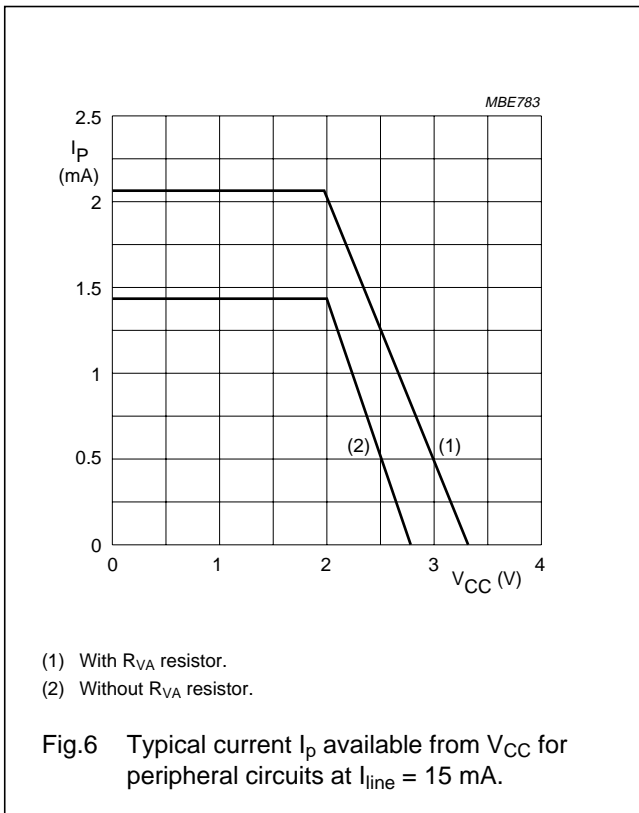
When the DTMF amplifier is enabled, dialling tones may be sent on line. These tones can be heard in the earpiece at a low level (confidence tone).

The TEA1112; TEA1112A have an asymmetrical DTMF input. The input impedance between DTMF and V_{EE} is 20 k Ω . The voltage gain from pin DTMF to pin LN is 25.5 dB. When an external resistor is connected between pins REG and GAS to decrease the microphone gain, the DTMF gain varies in the same way (the DTMF gain is 26.3 dB lower than the microphone gain with no AGC control).

The automatic gain control has no effect on the DTMF amplifier.

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MUTE and MMUTE levels for different modes

Table 1 Required MUTE and MMUTE levels to enable the different possible modes

IC	TEA1112		TEA1112A	
	MUTE	MMUTE	$\overline{\text{MUTE}}$	$\overline{\text{MMUTE}}$
Speech	L	L	H	H
DTMF dialling	H	X	L	X
Microphone mute	L	H	H	L

SIDETONE SUPPRESSION

The TEA1112; TEA1112A anti-sidetone network comprising $R_{CC} // Z_{line}$, R_{ast1} , R_{ast2} , R_{ast3} , R_{SLPE} and Z_{bal} (see Fig.10) suppresses the transmitted signal in the earpiece. Maximum compensation is obtained when the following conditions are fulfilled:

$$R_{SLPE} \times R_{ast1} = R_{CC} \times (R_{ast2} + R_{ast3})$$

$$k = \frac{(R_{ast2} \times (R_{ast3} + R_{SLPE}))}{(R_{ast1} \times R_{SLPE})}$$

$$Z_{bal} = k \times Z_{line}$$

The scale factor k is chosen to meet the compatibility with a standard capacitor from the E6 or E12 range for Z_{bal} .

In practice, Z_{line} varies considerably with the line type and the line length. Therefore, the value chosen for Z_{bal} should

be for an average line length which gives satisfactory sidetone suppression with short and long lines. The suppression also depends on the accuracy of the match between Z_{bal} and the impedance of the average line.

The anti-sidetone network for the TEA1112; TEA1112A (as shown in Fig.14) attenuates the receiving signal from the line by 32 dB before it enters the receiving amplifier. The attenuation is almost constant over the whole audio frequency range. A Wheatstone bridge configuration (see Fig.11) may also be used.

More information on the balancing of an anti-sidetone bridge can be obtained in our publication "Applications Handbook for Wired Telecom Systems, IC03b", order number 9397 750 00811.

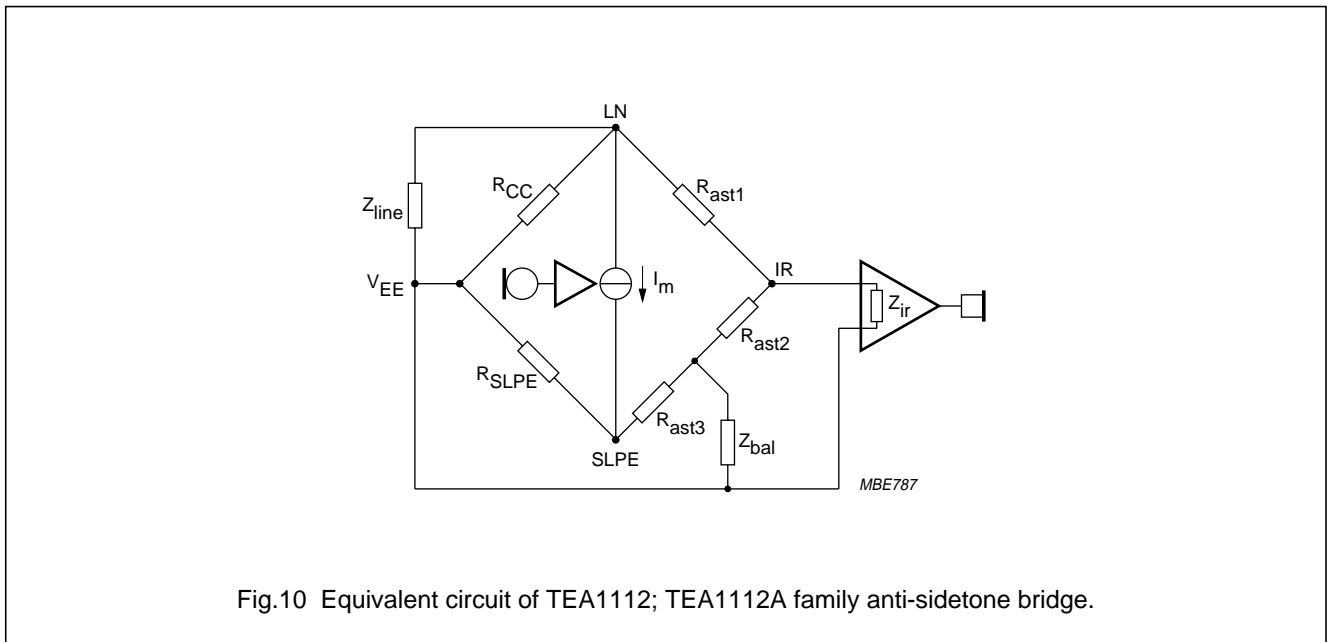


Fig.10 Equivalent circuit of TEA1112; TEA1112A family anti-sidetone bridge.

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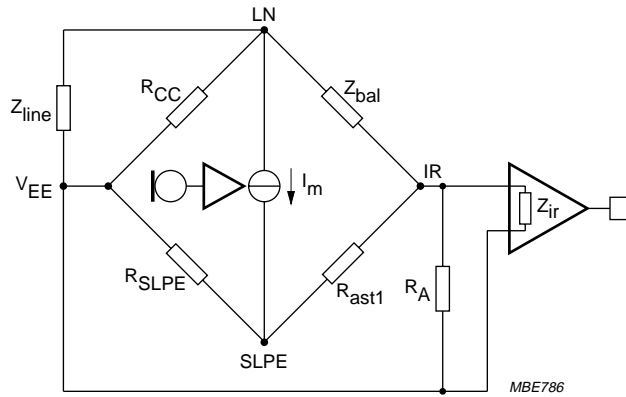


Fig.11 Equivalent circuit of an anti-sidetone network in a Wheatstone bridge configuration.

LIMITING VALUES

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

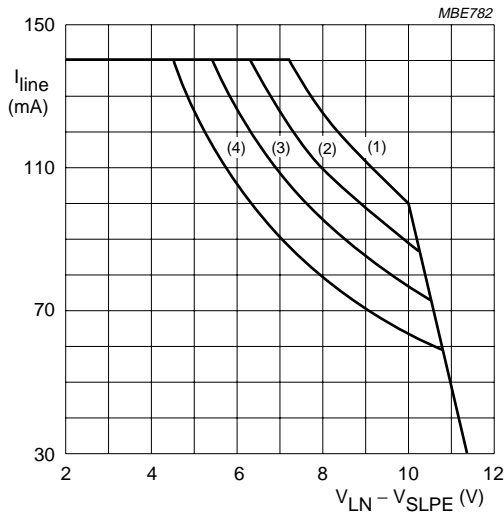
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V _{LN}	positive continuous line voltage		V _{EE} - 0.4	12	V
	repetitive line voltage during switch-on or line interruption		V _{EE} - 0.4	13.2	V
V _{n(max)}	maximum voltage on pins I _{LED} , SLPE		V _{EE} - 0.4	V _{LN} + 0.4	V
	maximum voltage on all other pins		V _{EE} - 0.4	V _{CC} + 0.4	V
I _{line}	line current	R _{SLPE} = 20 Ω; see Figs 12 and 13	-	140	mA
P _{tot}	total power dissipation TEA1112; TEA1112A	T _{amb} = 75 °C; see Figs 12 and 13	-	625	mW
	TEA1112T; TEA1112AT		-	416	mW
T _{stg}	IC storage temperature		-40	+125	°C
T _{amb}	operating ambient temperature		-25	+75	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
R _{th j-a}	thermal resistance from junction to ambient in free air (TEA1112; TEA1112A)	80	K/W
	thermal resistance from junction to ambient in free air mounted on epoxy board 40.1 × 19.1 × 1.5 mm (TEA1112T; TEA1112AT)	130	K/W

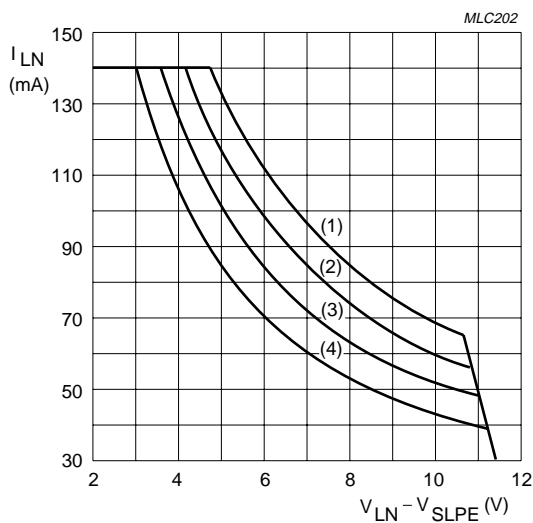
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LINE	T _{amb} (°C)	P _{tot} (W)
(1)	45	1.000
(2)	55	0.875
(3)	65	0.750
(4)	75	0.625

Fig.12 Safe operating area (TEA1112; TEA112A).



LINE	T _{amb} (°C)	P _{tot} (W)
(1)	45	0.666
(2)	55	0.583
(3)	65	0.500
(4)	75	0.416

Fig.13 Safe operating area (TEA1112T; TEA112AT).

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CHARACTERISTICS

$I_{line} = 15 \text{ mA}$; $V_{EE} = 0 \text{ V}$; $R_{SLPE} = 20 \text{ } \Omega$; AGC pin connected to V_{EE} ; $Z_{line} = 600 \text{ } \Omega$; $f = 1 \text{ kHz}$; $T_{amb} = 25 \text{ } ^\circ\text{C}$; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (pins V_{LN}, V_{CC}, SLPE and REG)						
V_{ref}	stabilized voltage between LN and SLPE		3.1	3.35	3.6	V
V_{LN}	DC line voltage	$I_{line} = 1 \text{ mA}$	–	1.6	–	V
		$I_{line} = 4 \text{ mA}$	–	2.45	–	V
		$I_{line} = 15 \text{ mA}$	3.35	3.65	3.95	V
		$I_{line} = 140 \text{ mA}$	–	–	6.9	V
$V_{LN(exR)}$	DC line voltage with an external resistor R_{VA}	$R_{VA(SLPE-REG)} = 27 \text{ k}\Omega$	–	4.4	–	V
$\Delta V_{LN(T)}$	DC line voltage variation with temperature referred to $25 \text{ } ^\circ\text{C}$	$T_{amb} = -25 \text{ to } +75 \text{ } ^\circ\text{C}$	–	± 30	–	mV
I_{CC}	internal current consumption	$V_{CC} = 2.9 \text{ V}$	–	1.15	1.4	mA
V_{CC}	supply voltage for peripherals	$I_p = 0 \text{ mA}$	–	2.9	–	V
R_{CCint}	equivalent supply voltage impedance	$I_p = 0.5 \text{ mA}$	–	550	620	Ω
LED supply (pin I_{LED})						
$I_{line(h)}$	highest line current for $I_{LED} < 0.5 \text{ mA}$		–	18	–	mA
$I_{line(l)}$	lowest line current for maximum I_{LED}		–	76	–	mA
$I_{LED(max)}$	maximum supply current available		–	19.5	–	mA
Microphone amplifier (pins MIC+, MIC– and GAS)						
$ Z_i $	input impedance		–	64	–	$\text{k}\Omega$
	differential between pins MIC+ and MIC– single-ended between pins MIC+/MIC– and V_{EE}		–	32	–	$\text{k}\Omega$
G_{vtx}	voltage gain from MIC+/MIC– to LN	$V_{MIC} = 2 \text{ mV (RMS)}$	50.6	51.8	53	dB
$\Delta G_{vtx(f)}$	gain variation with frequency referred to 1 kHz	$f = 300 \text{ to } 3400 \text{ Hz}$	–	± 0.2	–	dB
$\Delta G_{vtx(T)}$	gain variation with temperature referred to $25 \text{ } ^\circ\text{C}$	$T_{amb} = -25 \text{ to } +75 \text{ } ^\circ\text{C}$	–	± 0.3	–	dB
CMRR	common mode rejection ratio		–	80	–	dB
ΔG_{vtxr}	gain voltage reduction range	external resistor connected between GAS and REG	–	–	13	dB
$V_{LN(max)}$	maximum sending signal (RMS value)	$I_{line} = 15 \text{ mA}$; THD = 2%	1.4	1.7	–	V
		$I_{line} = 4 \text{ mA}$; THD = 10%	–	0.8	–	V
V_{notx}	noise output voltage at pin LN; pins MIC+/ MIC– shorted through $200 \text{ } \Omega$	psophometrically weighted (P53 curve)	–	–70.5	–	dBmp

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Microphone mute (pins MMUTE; TEA1112 and $\overline{\text{MMUTE}}$; TEA1112A)						
ΔG_{vtxm}	gain reduction in microphone MUTE mode		–	80	–	dB
V_{IL}	LOW level input voltage		$V_{\text{EE}} - 0.4$	–	$V_{\text{EE}} + 0.3$	V
V_{IH}	HIGH level input voltage		$V_{\text{EE}} + 1.5$	–	$V_{\text{CC}} + 0.4$	V
I_{MMUTE}	input current	input level = HIGH	–	1.25	3	μA
Receiving amplifier (pins IR, QR and GAR)						
$ Z_{\text{i}} $	input impedance		–	20	–	$\text{k}\Omega$
G_{vrx}	voltage gain from IR to QR	$V_{\text{IR}} = 6 \text{ mV (RMS)}$	29.7	31.2	32.7	dB
$\Delta G_{\text{vrx}(f)}$	gain variation with frequency referred to 1 kHz	$f = 300 \text{ to } 3400 \text{ Hz}$	–	± 0.2	–	dB
$\Delta G_{\text{vrx}(T)}$	gain variation with temperature referred to 25 °C	$T_{\text{amb}} = -25 \text{ to } +75 \text{ }^\circ\text{C}$	–	± 0.3	–	dB
ΔG_{vrxr}	gain voltage reduction range	external resistor connected between GAR and QR	–	–	12	dB
$V_{\text{O(rms)}}$	maximum receiving signal (RMS value)	$I_{\text{p}} = 0 \text{ mA sine wave drive; } R_{\text{L}} = 150 \Omega; \text{ THD} = 2\%$	–	0.25	–	V
		$I_{\text{p}} = 0 \text{ mA sine wave drive; } R_{\text{L}} = 450 \Omega; \text{ THD} = 2\%$	–	0.35	–	V
$V_{\text{norx(rms)}}$	noise output voltage at pin QR (RMS value)	IR open-circuit; $R_{\text{L}} = 150 \Omega$; psophometrically weighted (P53 curve)	–	–86	–	dBVp
Automatic gain control (pin AGC)						
ΔG_{vtrx}	gain control range for microphone and receiving amplifiers with respect to $I_{\text{line}} = 15 \text{ mA}$	$I_{\text{line}} = 85 \text{ mA}$	–	5.8	–	dB
I_{start}	highest line current for maximum gain		–	26	–	mA

Low voltage versatile telephone transmission circuits with dialler interface

TEA1112; TEA1112A

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{stop}	lowest line current for minimum gain		–	61	–	mA
DTMF amplifier (pin DTMF)						
$ Z_i $	input impedance		–	20	–	k Ω
G_{vdtmf}	voltage gain from DTMF to LN in DTMF dialling or microphone MUTE mode	$V_{DTMF} = 20$ mV (RMS)	24.3	25.5	26.7	dB
$\Delta G_{vdtmf(f)}$	gain variation with frequency referred to 1 kHz	$f = 300$ to 3400 Hz	–	± 0.2	–	dB
$\Delta G_{vdtmf(T)}$	gain variation with temperature referred to 25 °C	$T_{amb} = -25$ to +75 °C	–	± 0.4	–	dB
G_{vct}	voltage gain from DTMF to QR (confidence tone)	$V_{DTMF} = 20$ mV (RMS); $R_L = 150$ Ω	–	–18	–	dB
Mute function (pins MUTE; TEA1112 and MUTE; TEA1112A)						
V_{IL}	LOW level input voltage		$V_{EE} - 0.4$	–	$V_{EE} + 0.3$	V
V_{IH}	HIGH level input voltage		$V_{EE} + 1.5$	–	$V_{CC} + 0.4$	V
I_{MUTE}	input current	input level = HIGH	–	1.25	3	μ A
ΔG_{trxm}	gain reduction for microphone and receiving amplifiers in DTMF dialling mode		–	80	–	dB

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APPLICATION INFORMATION

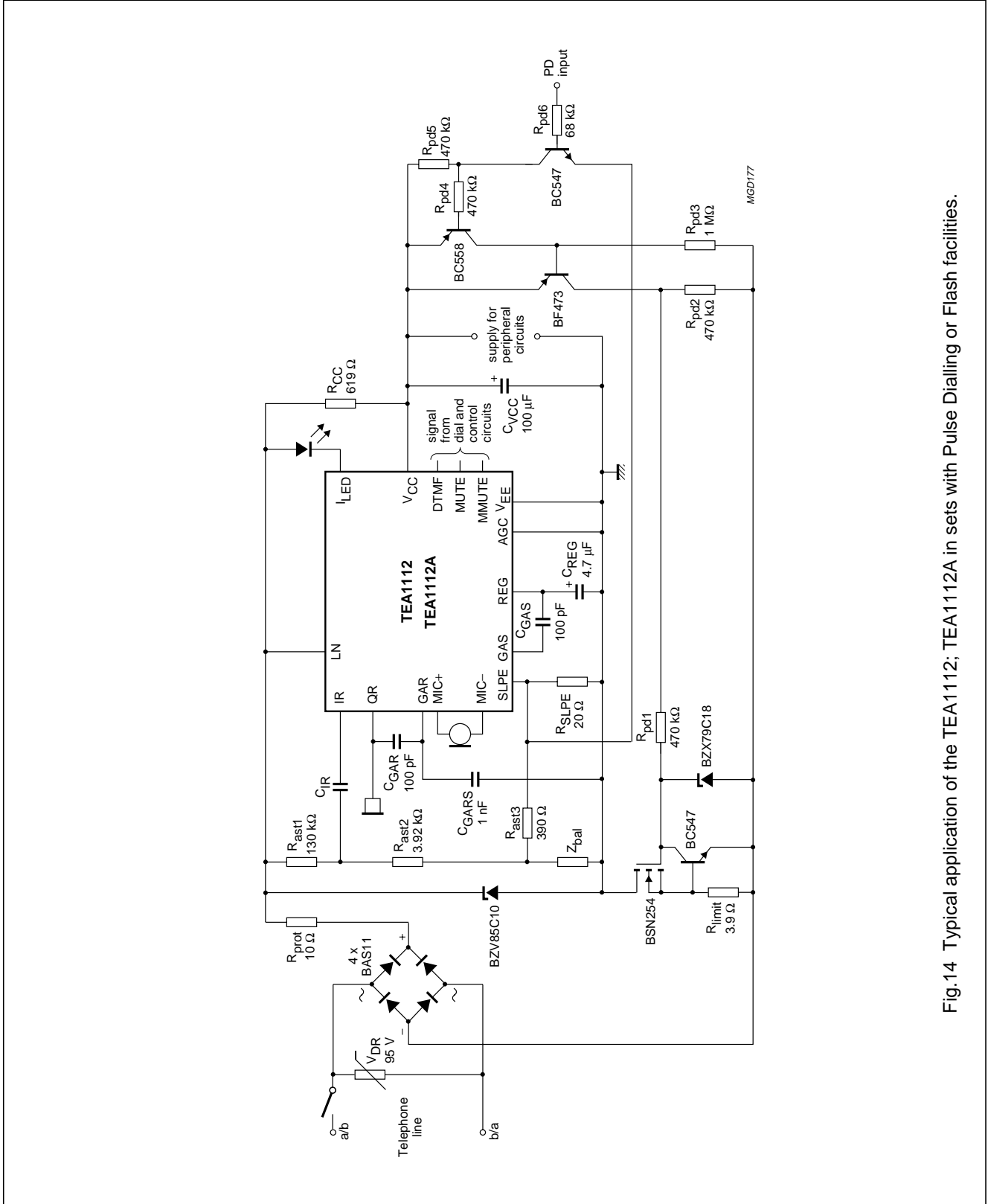


Fig. 14 Typical application of the TEA1112; TEA112A in sets with Pulse Dialling or Flash facilities.

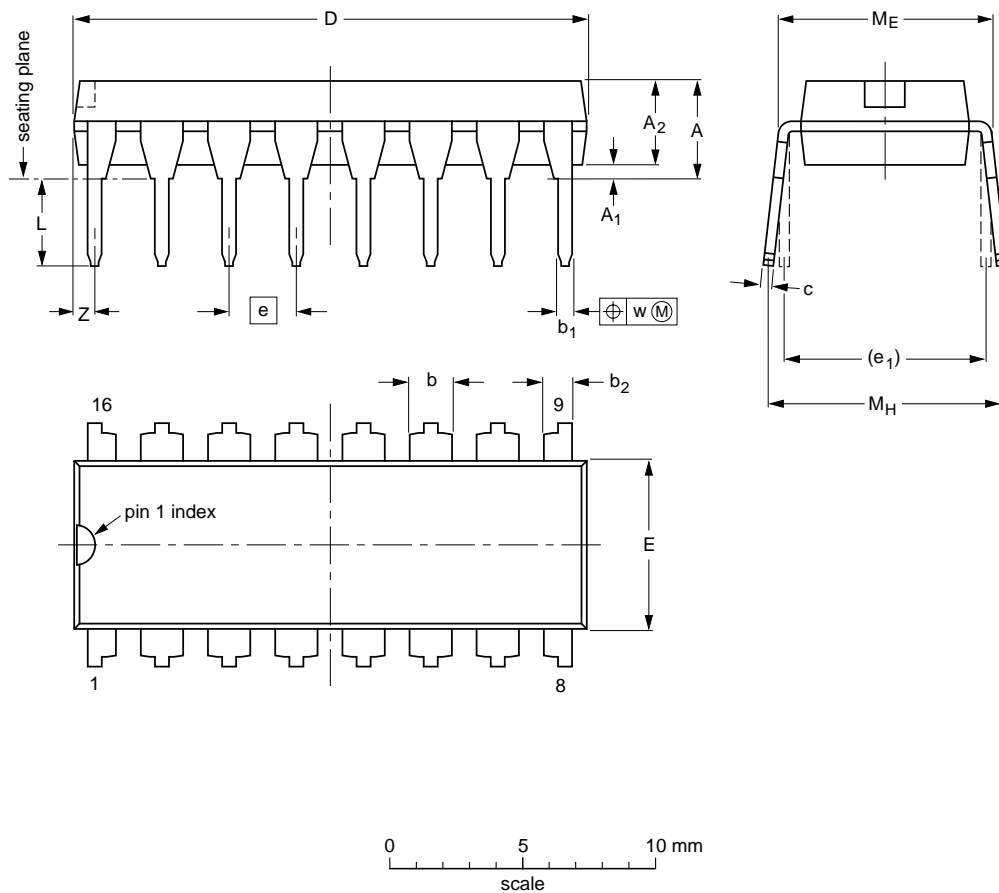
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PACKAGE OUTLINES

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	b ₂	c	D ⁽¹⁾	E ⁽¹⁾	e	e ₁	L	M _E	M _H	w	Z ⁽¹⁾ max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

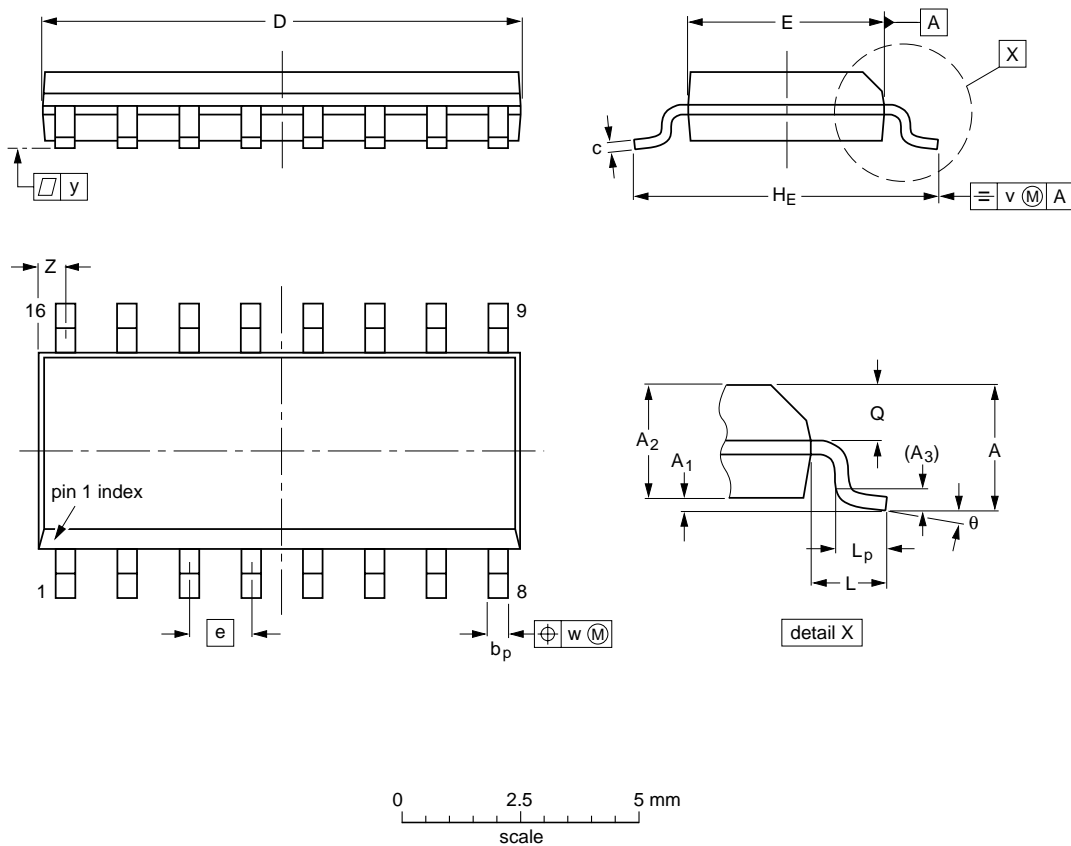
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						92-11-17 95-01-14

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SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

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		
SOT109-1	076E07S	MS-012AC			95-01-23 97-05-22

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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).

DIP

SOLDERING BY DIPPING OR BY WAVE

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

REPAIRING SOLDERED JOINTS

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

SO

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.

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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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