

μC-Controlled Speech and Ringer Circuit

Description

The μC-controlled telephone circuit U4037B is a linear integrated circuit for use in telephone sets. It contains the speech circuit, tone-ringer interface, sidetone equivalent

and ear-protection rectifiers. The circuit is line powered and contains all components necessary for amplification of signals and adaptation to the line.

Features

- DC characteristic adjustable
- Receive gain adjustable
- Symmetrical input of microphone amplifier
- Anti-clipping in transmit direction
- Automatic line-loss compensation
- Symmetrical output of earpiece amplifier
- Built-in ear protection
- DTMF and MUTE input
- Adjustable sidetone suppression independent of sending and receiving amplification
- Power down
- Tone-ringer interface
- Zero-crossing detection

- 2-bit D/A for volume control
- Supply voltages for all functional blocks of a subscriber set
- Operation possible from 8-mA line currents

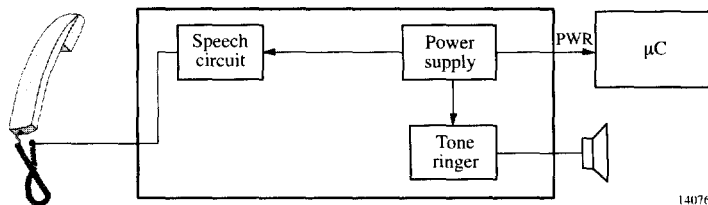
Benefits

- Complete system integration of analog signal processing on one chip
- Very few external components

Applications

Telephone sets

Block Diagram



Ordering Information

Type	Package	Remarks
U4037B-MFL	SO24	
U4037B-MFLG3	SO24	Taped and reeled

Pin Description

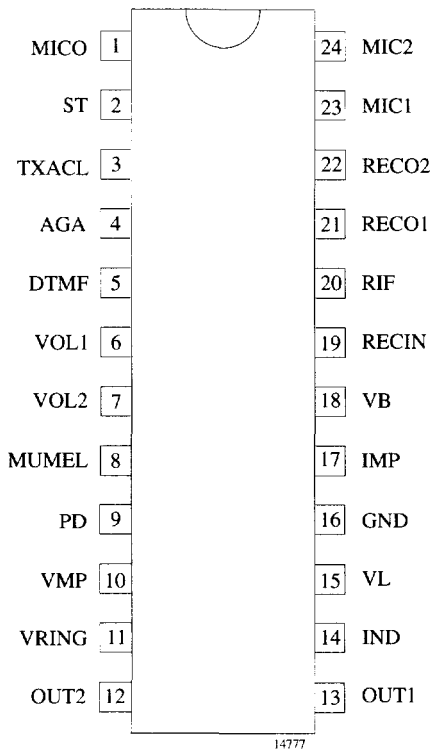
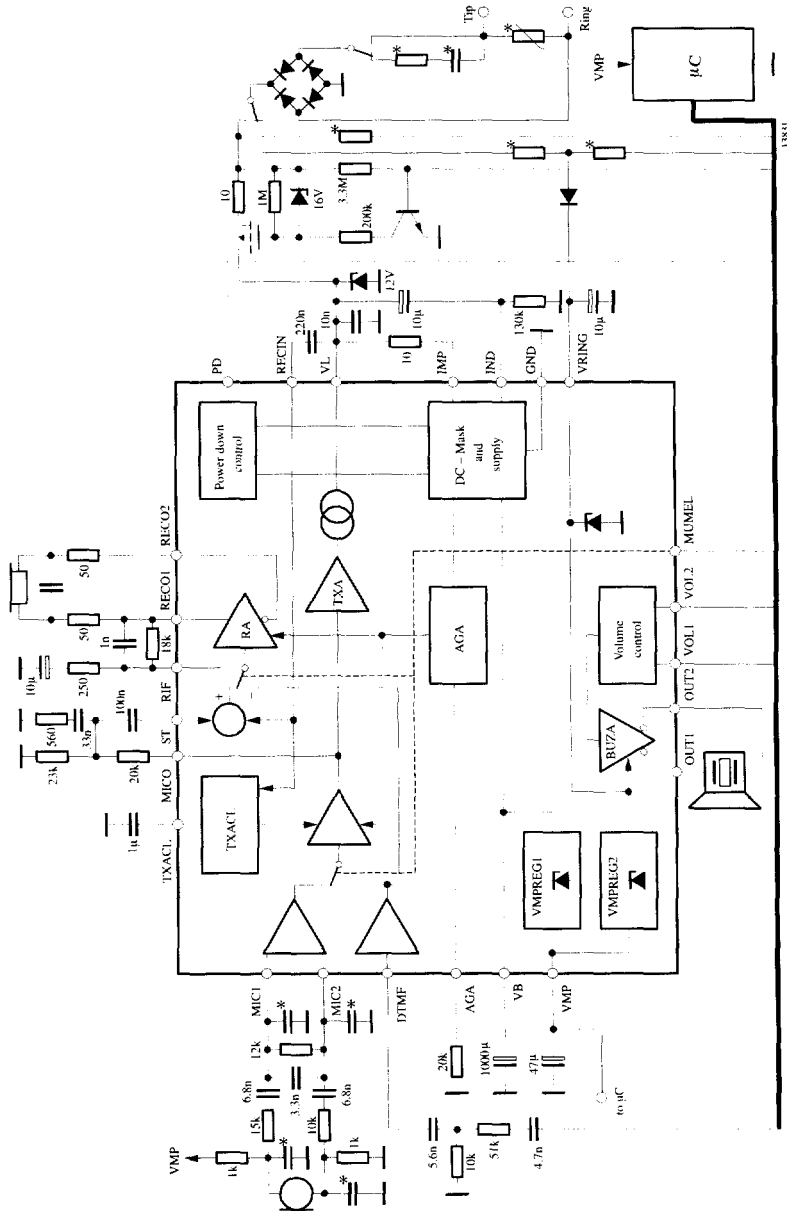


Figure 1. Pinning

Pin	Symbol	Function
1	MICO	Output of microphone preamplifier
2	ST	Sidetone reduction input input resistance is approx. 300 Ω , maximum load impedance: 10 k Ω .
3	TXACL	Time constant of anti-clipping in transmit path
4	AGA	Automatic gain adjustment with line current, a resistor connected from this pin to GND sets the starting point maximum gain change: 6 dB.
5	DTMF	Input for DTMF signals

Pin	Symbol	Function
6	VOL1	2-bit volume adjustment for tone ringer
7	VOL2	
8	MUMEL	1. Input for melody 2. Mute of microphone amplifier: – Speech condition, input MUMEL low – DTMF condition input MUMEL high DTMF signal at Pin 5 is fed to the line. A part of the DTMF- signal is passed to the receiving amplifier as a confidence signal during dialing.
9	PD	Active high input for reducing the current consumption of the circuit, simultaneously V_L is shorted by an internal switch
10	VMP	Regulated supply voltage 3.3 V for peripheral circuits (esp. micropro- cessors), minimum output current: 2 mA (ringing) 4 mA (speech mode)
11	VRING	Input for ringing signal protected by internal Zener diode
12	OUT2	Output for tone ringer
13	OUT1	
14	IND	The internal equivalent inductance of the circuit is proportional to the value of the capacitor at this pin, a resistor connected to ground may be used to reduce the DC line voltage
15	VL	Line voltage
16	GND	Reference point for DC- and AC- output signals
17	IMP	Impedance adjustment
18	VB	Unregulated supply voltage for peripheral circuits (voice switch), limited to typically 7 V
19	RECIN	Receiver input
20	RIF	Pin for adjustment of frequency response and gain of receiver
21	RECO1	Output of receiving amplifier
22	RECO2	Inverting output of receiving ampl.
23	MIC1	Inverting input of microphone ampl.
24	MIC2	Non-inverting input of microphone amplifier

Detailed Block Diagram with External Components



* Value depends on the application

Figure 2. Application circuit

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Line current	I_L	140	mA
DC line voltage	V_L	12	V
Maximum input current	I_{RING}	15	mA
Junction temperature	T_j	125	°C
Ambient temperature	T_{amb}	-25 to +75	°C
Storage temperature	T_{stg}	-55 to +150	°C
Total power dissipation, $T_{amb} = 60^\circ\text{C}$	P_{tot}	520	W

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient SO24	R_{thJA}	75	K/W

Electrical Characteristics

$f = 1 \text{ kHz}$, $0 \text{ dBm} = 775 \text{ mV}_{rms}$, $I_{MP} = 2 \text{ mA}$, $T_{amb} = 25^\circ\text{C}$, $Z_{ear} = 68 \text{ nF} + 100 \Omega$, $Z_M = 68 \text{ nF}$, unless otherwise specified

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
DC characteristics						
DC voltage drop over circuit	$I_L = 2 \text{ mA}$ $I_L = 14 \text{ mA}$ $I_L = 60 \text{ mA}$ $I_L = 100 \text{ mA}$	V_L	4.6 8.8	2.4 5.0 7.5 9.4	5.4 10.0	V
Transmission amplifier, $I_L = 14 \text{ mA}$, $V_{MIC} = 2 \text{ mV}$, unless otherwise specified						
Transmitting amplification		G_T	47	48	49	dB
Frequency response	$I_L \geq 14 \text{ mA}$, $f = 300 \text{ to } 3400 \text{ Hz}$	ΔG_T			± 0.5	dB
Gain change with current	$I_L = 14 \text{ to } 100 \text{ mA}$	ΔG_T			± 0.5	dB
Gain deviation	$T_{amb} = -10 \text{ to } +60^\circ\text{C}$	ΔG_T			± 0.5	dB
CMRR of microphone amplifier		CMRR	60	80		dB
Input resistance of MIC amplifier		R_i		50		k Ω
Distortion at line	$I_L > 14 \text{ mA}$ $V_L = 700 \text{ mV}_{rms}$	d_t			2	%
Maximum output voltage	$I_L > 19 \text{ mA}$, $d < 5\%$ $V_{mic} = 10 \text{ mV}$ $CTXA = 1 \mu\text{F}$	V_{Lmax}	1.8	3	4.2	dBm
Noise at line psophometrically weighted	$I_L > 14 \text{ mA}$ $G_T = 48 \text{ dB}$	no		-80	-72	dBmp
Anti-clipping attack time release time	$CTXA = 1 \mu\text{F}$ each 3 dB overdrive			0.5 9		ms
Line-loss compensation	$I_L = 100 \text{ mA}$, $RAGA = 20 \text{ k}\Omega$	ΔG_{TL}	-6.4	-5.8	-5.2	dB
Mute suppression	$I_L \geq 14 \text{ mA}$	G_{TM}	60	80		dB

Electrical Characteristics (continued)

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Receiving amplifier, $I_L = 14$ mA, unless otherwise specified, $V_{GEN} = 300$ mV						
Receiving amplification		G_R			12	dB
Adjustment range		G_R	-8		12	dB
Amplification of DTMF signal from DTMF IN to RECO 1, 2	$I_L \geq 14$ mA, $V_{DTMF} = 8$ mV	G_{RM}	14		20	dB
Frequency response	$I_L > 14$ mA, $f = 300$ to 3400 Hz	ΔG_{RF}			± 0.5	dB
Gain change with current	$I_L = 14$ to 100 mA	ΔG_R			± 0.5	dB
Gain deviation	$T_{amb} = -10$ to $+60^\circ\text{C}$	ΔG_R			± 0.5	dB
Ear protection differential	$I_L \geq 14$ mA $V_{GEN} = 11 V_{rms}$	EP			2.2	V_{rms}
MUTE suppression	$I_L \geq 14$ mA	ΔG_R	60			dB
Output voltage $d \leq 2\%$ differential	$I_L = 14$ mA $Z_{ear} = 68$ nF + 100Ω		0.775			V_{rms}
Output voltage $d \leq 5\%$ differential	$I_L = 14$ mA $Z_{ear} = 68$ nF + 100Ω RDC = infinite		1.2			V_{rms}
Receiving noise psophometrically weighted	$Z_{ear} = 68$ nF + 100Ω $I_L \geq 14$ mA	ni			-64	dBmp
Output resistance	each output against GND	R_o			40	Ω
Line-loss compensation	RAGA = 20 k Ω , $I_L = 100$ mA	ΔG_{RI}	-7.0	-6.0	-5.0	dB
Gain at low operating current	$I_L = 8$ mA, $I_{MP} = 1$ mA $I_M = 300$ μ A $V_{GEN} = 100$ mV RDC = 68 k Ω	G_R	10.5	12	13.5	dB
DTMF-amplifier test conditions: $I_{MP} = 2$ mA						
DTMF amplification	$I_L = 15$ mA, $V_{DTMF} = 8$ mV Mute active	G_D	40.7	41.7	42.7	dB
Gain deviation	$I_L = 15$ mA $T_{amb} = -10$ to $+60^\circ\text{C}$	G_D			± 0.5	dB
Input resistance	RGT = 15 k Ω	R_i	15	20	25	k Ω
Distortion of DTMF signal	$I_L \geq 15$ mA, $V_L = 0$ dBm	d_D			2	%
Gain deviation with current	$I_L = 15$ to 100 mA	ΔG_D			± 0.5	dB
Supply voltages, $V_{mic} = 10$ mV, $T_{amb} = -10$ to $+60^\circ\text{C}$						
V_{MP}	$I_L = 8$ mA, RDC = 130 k Ω $I_{MP} = 1$ mA	V_{MP}	3.1	3.4	3.6	V
Ringin part, $I_{VMP} = 1$ mA						
Maximum output voltage	$V_{RING} = 20$ V	V_{out}		25		V_{pp}
Input impedance in speech mode	$f = 300$ Hz to 3400 Hz $I_L > 15$ mA, $V_{TIP/RING} = 1.5 V_{rms}$	R_i	50			k Ω

Electrical Characteristics (continued)

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Ringing part: Ringer output voltage	$f = 25 \text{ Hz}$, $C_{BUZ} = 50 \text{ nF}$					
	$V_{TIP/RING} = 63 V_{rms}$	V_{out}	28			V_{pp}
	$V_{TIP/RING} = 45 V_{rms}$	V_{out}		18		V_{pp}
Volume adjustment steps		V_{out}	7			V_{pp}
		11		0		dB
		10		-6		
		01		-12		
	00		-24			
Zener diode voltage	$I_{RING} = 25 \text{ mA}$	$V_{RINGmax}$		28.5		V
PD Input						
PD input current	PD active, $I_L > 14 \text{ mA}$ $V_{PD} = V_{MP}$	I_{pd}		9		μA
Input voltage	PD = active PD = inactive	V_{pd} V_{pd}	2		0.3	V
Voltage drop at V_L	PD = active, $I_L = 14 \text{ mA}$ $I_L = 100 \text{ mA}$,	V_L V_L		1.5 1.9		V
Internal current consumption at V_B	$V_B = 3.5 \text{ V}$, PD = active, $I_L = 0 \text{ mA}$	I_B		300		μA

Package Information

Package SO24

Dimensions in mm

