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**
- **2-bit D/A for Volume Control**
- **Supply Voltages for All Functional Blocks of a Subscriber Set**
- **Operation Possible from 8-mA Line Currents**

Pb Lead Free

Applications

- **Telephone Sets**

Benefits

- **Complete System Integration of Analog Signal Processing on One Chip**
- **Very Few External Components**

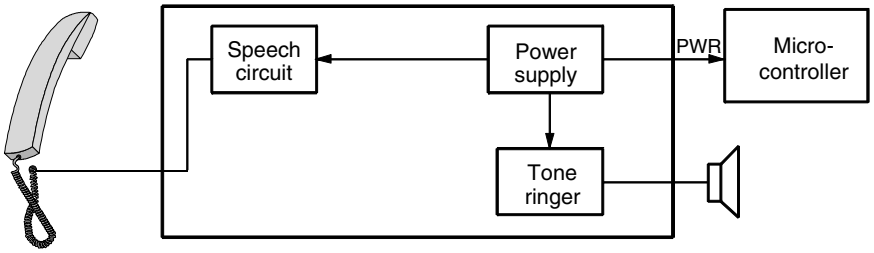
Microcontroller-controlled Speech and Ringer Circuit

U4037B-N

1. Description

The microcontroller-controlled telephone circuit U4037B-N 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.

Figure 1-1. Block Diagram



Rev. 4742B–CORD–11/05

2. Pin Configuration

Figure 2-1. Pinning SO24

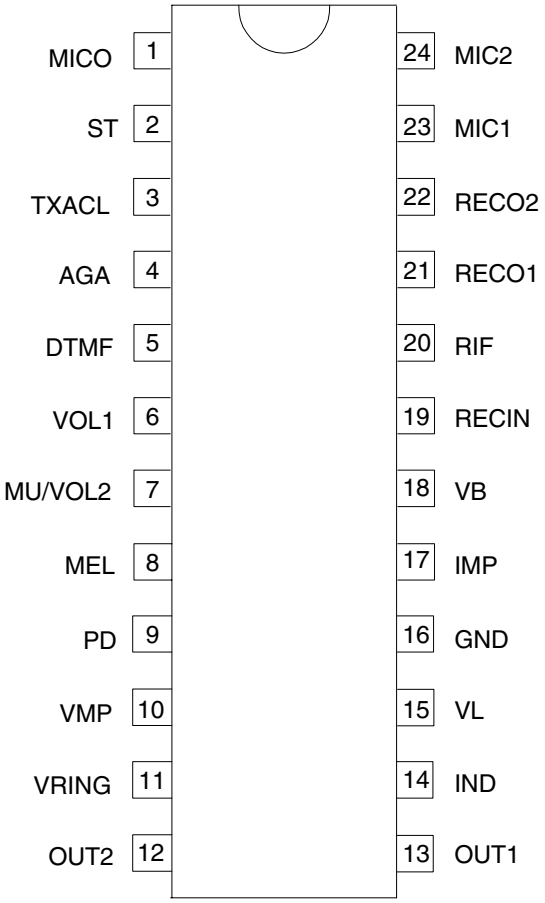
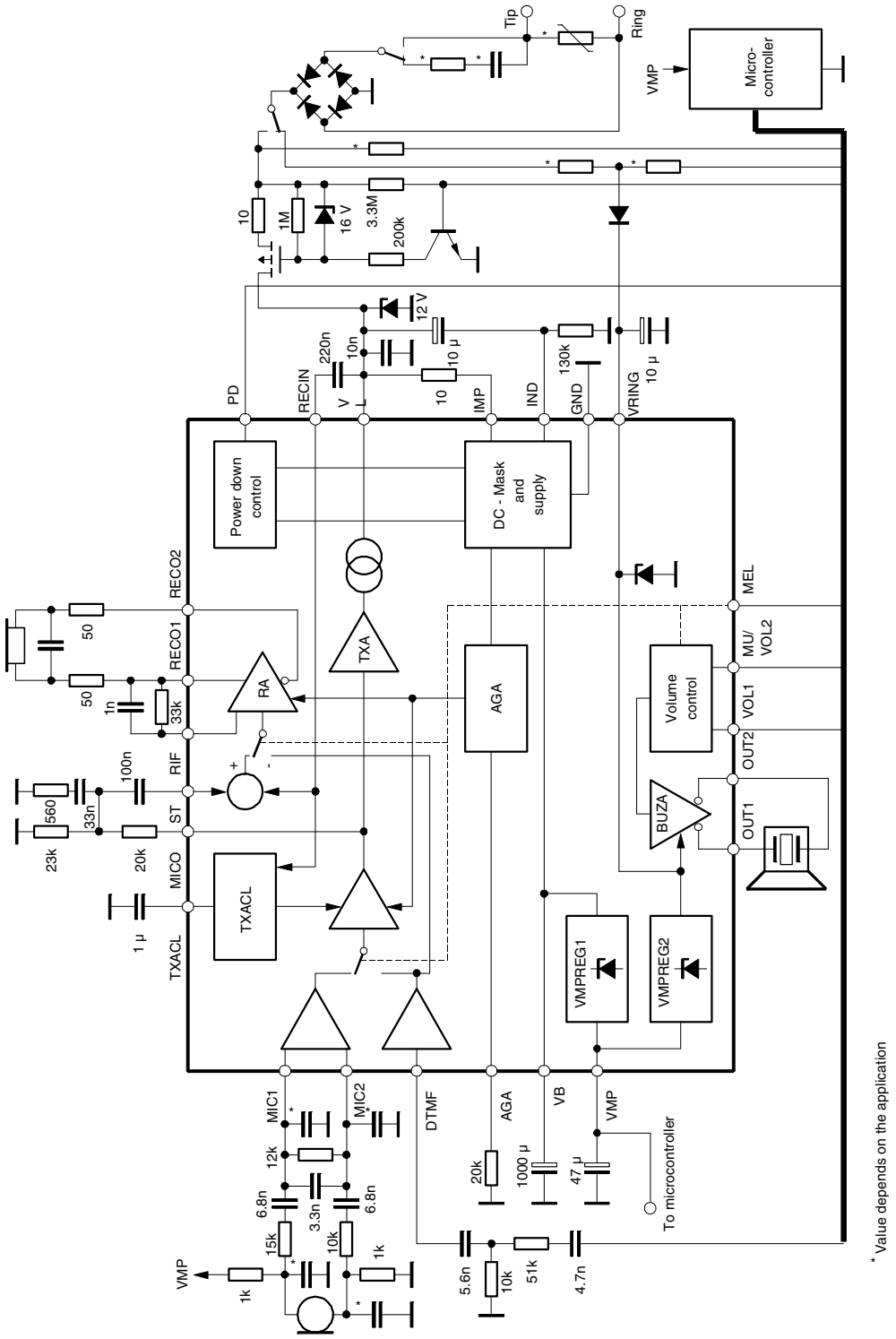


Table 2-1. Pin Description

Pin	Symbol	Function
1	MICO	Output of microphone preamplifier
2	ST	Sidetone reduction input, input resistance is approximately 25 kΩ
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
6	VOL1	2-bit volume adjustment for tone ringer
7	MU/VOL2	1) 2-bit volume adjustment for tone ringer 2) Mute of microphone amplifier: - Speech condition, input MU/VOL2 low - DTMF condition input MU/VOL2 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
8	MEL	Input for melody
9	PD	Active high input for reducing the current consumption of the circuit, V_L simultaneously is shorted by an internal switch
10	VMP	3.4V regulated supply voltage for peripheral circuits (especially microprocessors), minimum output current: 2 mA (ringing), 4 mA (speech mode)
11	VRING	Input for ringer supply voltage
12	OUT2	Differential 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 7V
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 amplifier
23	MIC1	Inverting input of microphone amplifier
24	MIC2	Non-inverting input of microphone amplifier

Figure 2-2. Detailed Block Diagram with External Components



3. Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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°C	P_{tot}	520	W

4. Thermal Resistance

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

5. Electrical Characteristics

f = 1 kHz, 0 dBm = 775 mV_{rms}, I_{MP} = 2 mA, T_{amb} = 25°C, Z_{ear} = 68 nF + 100Ω, Z_M = 68 nF, unless otherwise specified

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
DC Characteristics						
DC voltage drop over circuit	I_L = 2 mA I_L = 14 mA I_L = 60 mA I_L = 100 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 mA, V_{MIC} = 2 mV, Unless Otherwise Specified						
Transmitting amplification		G_T	47	48	49	dB
Frequency response	$I_L \geq$ 14 mA f = 300 to 3400 Hz	ΔG_T			±0.5	dB
Gain change with current	I_L = 14 to 100 mA	ΔG_T			±0.5	dB
Gain deviation	T_{amb} = –10 to +60°C	ΔG_T			±0.5	dB
CMRR of microphone amplifier		CMRR	60	80		dB
Input resistance of MIC amplifier		R_i		50		kW
Distortion at line	I_L > 14 mA V_L = 700 mV_{rms}	d_t			2	%
Maximum output voltage	I_L > 19 mA, d < 5% V_{MIC} = 10 mV CTXA = 1 µF	V_{Lmax}	1.8	3	4.2	dBm
Noise at line psophometrically weighted	I_L > 14 mA G_T = 48 dB	no		–80	–72	dBmp
Anti-clipping attack time release time	CTXA = 1 µF each 3 dB overdrive			0.5 9		ms
Line-loss compensation	I_L = 100 mA, RAGA = 20 kΩ	ΔG_{TI}	–6.4	–5.8	–5.2	dB
Mute suppression	$I_L \geq$ 14 mA	G_{TM}	60	80		dB

5. Electrical Characteristics (Continued)

f = 1 kHz, 0 dBm = 775 mV_{rms}, I_{MP} = 2 mA, T_{amb} = 25°C, Z_{ear} = 68 nF + 100Ω, Z_M = 68 nF, unless otherwise specified

Parameters	Test Conditions	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°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 ≤ 2% differential	I_L = 14 mA, Z_{ear} = 68 nF + 100Ω		0.775			V_{rms}
Output voltage d ≤ 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	Ro			40	Ω
Line-loss compensation	RAGA = 20 kΩ 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 µA V_{GEN} = 100 mV RDC = 68 kΩ	G_R	10.5	12	13.5	dB
DTMF-amplifier Test Conditions: IMP = 2 mA						
DTMF amplification	I_L = 15 mA V_{DTMF} = 8 mV Mute active	G_D	40.7	41.7	42.7	dB
Gain deviaton	I_L = 15 mA T_{amb} = –10 to +60°C	G_D			±0.5	dB
Input resistance	RGT = 15 kΩ	R_i	15	20	25	kΩ
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	ΔGD			±0.5	dB
Supply Voltages, V_{MIC} = 10 mV, T_{amb} = –10 to +60°C						
V_{MP}	I_L = 8 mA RDC = 130 kΩ I_{MP} = 1 mA	V_{MP}	3.1	3.4	3.6	V
Ringing Part, I_{VMP} = 1 mA						
Maximum output voltage	V_{RING} = 20V	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			kΩ

5. Electrical Characteristics (Continued)

f = 1 kHz, 0 dBm = 775 mV_{rms}, I_{MP} = 2 mA, T_{amb} = 25°C, Z_{ear} = 68 nF + 100Ω, Z_M = 68 nF, unless otherwise specified

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

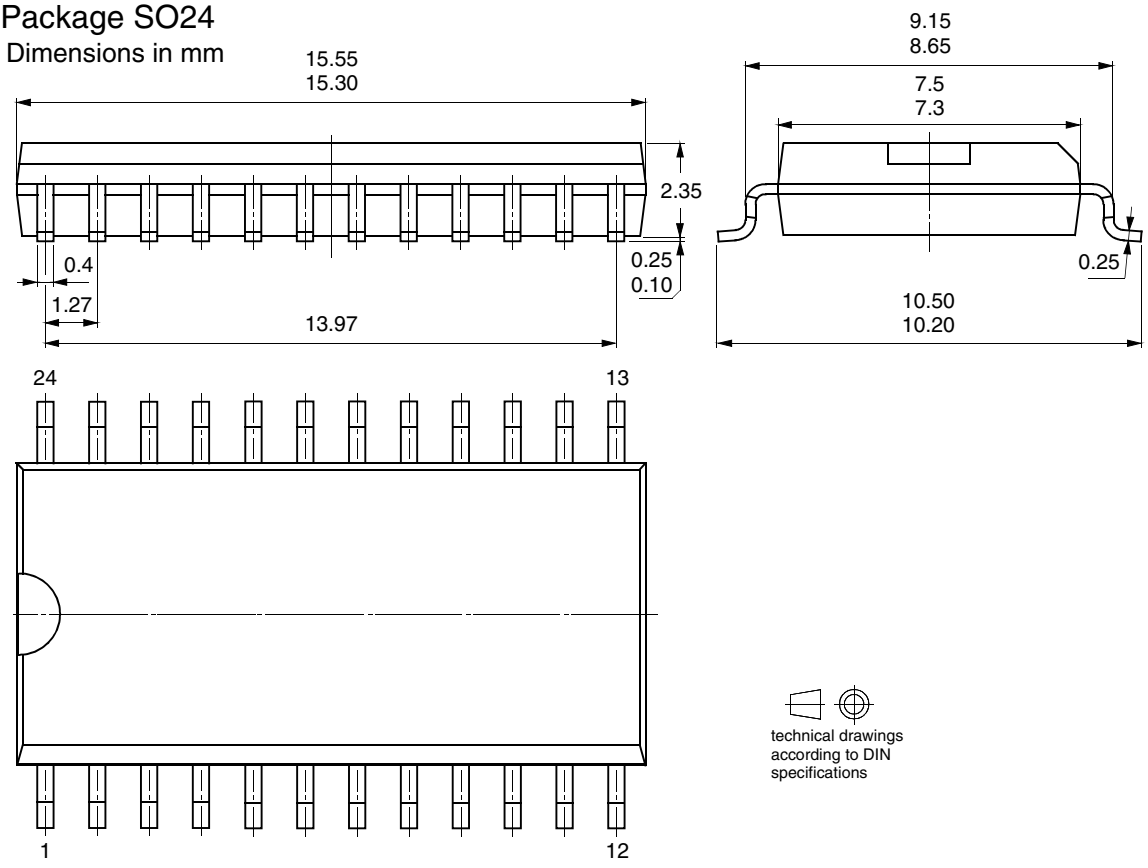
6. Ordering Information

Extended Type Number	Package	Remarks
U4037B-NFLY	SO24	Pb-free
U4037B-NFLG3Y	SO24	Taped and reeled, Pb-free

7. Package Information

Package SO24

Dimensions in mm



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