

Low-Voltage Electronic Speech Circuit with Dialer Interface

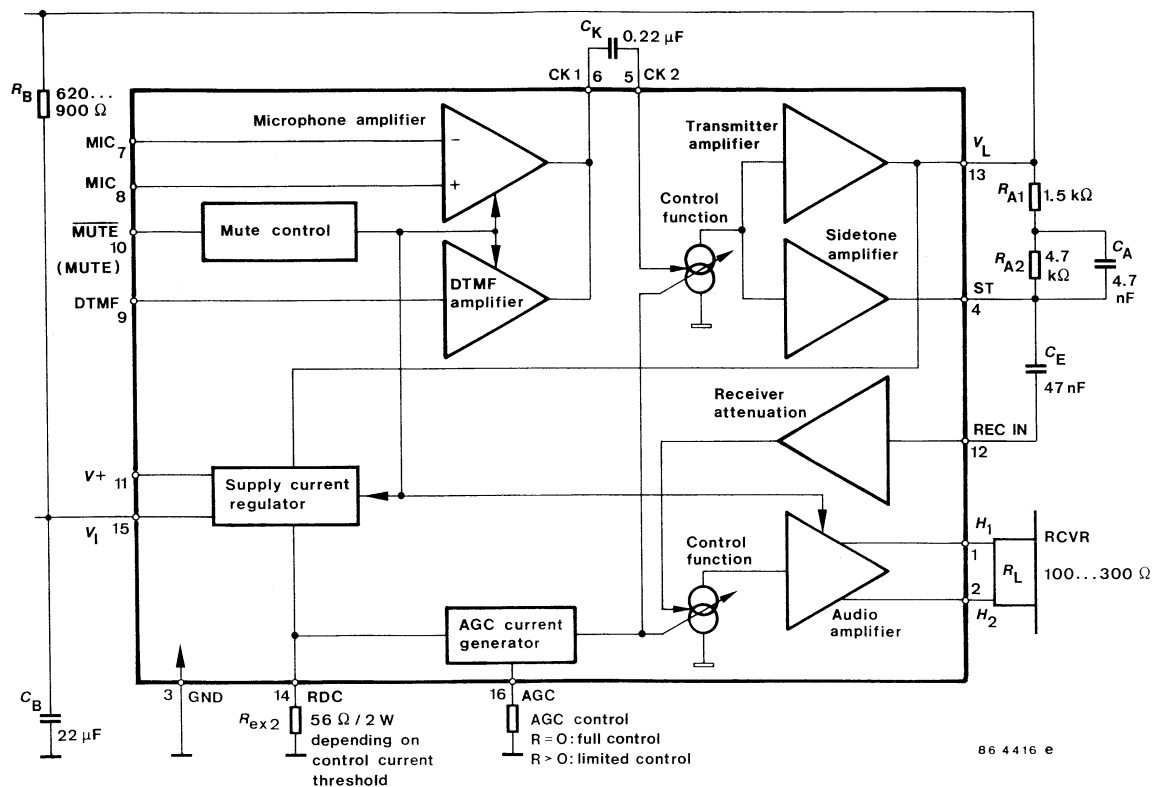
Description

The U4055B electronic speech circuit is a linear integrated circuit for use in telephone and other line fed terminal equipment. It replaces the common speech circuit with carbon microphone, hybrid transformer,

sidetone equivalent and ear protection rectifiers. A low-cost electrodynamic transducer is used as the earphone. It contains all components necessary for amplification of signals and adaption to the line.

Features

- An electronic circuit replaces the microphone hybrid transformer
- Symmetrical input for dynamic or piezo microphone
- High performance through the use of dynamic transducers as the earphone (non-linear distortion $\leq 2\%$)
- Automatic line loss compensation
- DTMF interface with muting
- Supply voltage for dialer
- High range of line feeding current
- Input resistance independent of line current and sidetone suppression circuit.
- Built-in ear protection by earphone voltage limiter
- Operation possible from 8 mA



U4055B1: High level mute; **U4055B:** Low level mute

Figure 1. Block diagram and pin connection

Pin Description

Pin	Symbol	Function
1, 2	H ₁ and H ₂	The push-pull complementary outputs of the receive amplifier. Dynamic transducers with a minimum impedance of 100 Ω can be directly driven by these outputs.
3	GND	Ground.
4	ST	The output of the sidetone cancellation signal, which requires a balanced impedance of 8–10 times the subscribers line impedance to be connected to Pin 13.
5	CK2	Input to the line output driver amplifier. Transmit a.g.c. applied to this stage.
6	CK1	The transmit pre-amp output respective of the DTMF output which is normally capacitively coupled to Pin 5.
7, 8	MIC 1, MIC 2	Inputs of symmetrical microphone amplifier with high common mode rejection ratio.
9	DTMF IN	The DTMF input has an internal resistor connected to ground. It provides the load resistor for the emitter of a CMOS DTMF generator. This input is only active when MUTE (Pin 10) is pulled high or MUTE is pulled low.
10	MUTE or $\overline{\text{MUTE}}$	The MUTE input must be pulled at least at 1.5 V (MUTE) or at less than 0.5 V ($\overline{\text{MUTE}}$) to mute the MIC Amp. and Audio Amp. and enable DTMF IN.

Pin	Symbol	Function
11	V+	Regulated output voltage of 2.7 V for biasing a DTMF generator activated by MUTE.
12	REC IN	The receive amplifier input. The receiving amplification is regulated of an a.g.c.
13	V _L	Positive supply voltage input to the device. This input should be connected to the positive output of the polarity guard. The current through this pin is modulated by the transmit signal.
14	R _{DC}	An external resistor (2 W) is required from this pin to GND to control the dc input impedance of the circuit. It has a nominal value of 56 Ω for low voltage operation. Values up to 100 Ω may be used to increase the available transmit output voltage swing at the expense of low-voltage operation.
15	V _I	This internal voltage bias line must be connected to V _L via an external resistor, R _B , which dominates the ac input impedance of the circuit and should be 620 Ω for an 600 Ω input impedance or 910 Ω for a 900 Ω input impedance.
16	R _{AGC}	The range of transmit and receive gain variations between short and long loops may be adjusted by connecting a resistor R _{EX1} from this pin to Pin 3 (GND). This pin can be left open to set a.g.c. out of action.

Pin Connection

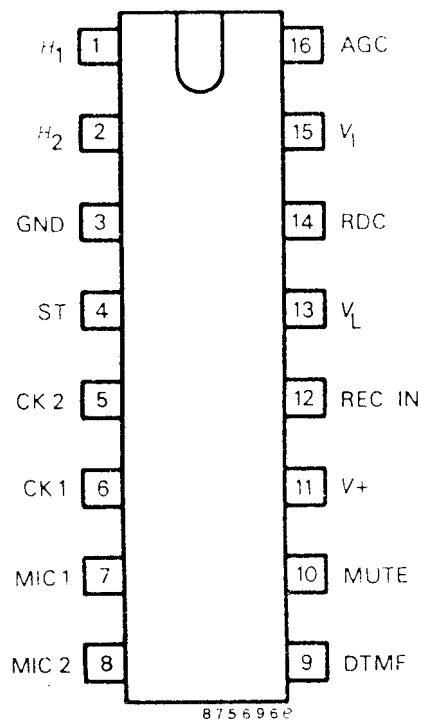


Figure 2.

Absolute Maximum Ratings

Reference point Pin 3, unless otherwise specified.

Parameters	Symbol	Value	Unit
Line current	I_L	200	mA
DC line voltage, $t_p = 3$ ms	V_L	20	V
Power dissipation, $I_L = 100$ mA	P_{tot}	560	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_{amb}	-28 to +80	°C
Storage temperature range	T_{stg}	-55 to +150	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	85	K/W

Electrical Characteristics

Reference point Pin 3, cable equivalent $l = 1 \text{ km}$, $\varnothing 0.5 \text{ mm}$, $R' = 184 \Omega$, $C' = 37 \text{ nF}$, $f = 1300 \text{ Hz}$, $0 \text{ dBm} = 775 \text{ mV}_{\text{rms}}$, $R_{\text{DC}} = 56 \Omega / 2 \text{ W}$, $T_{\text{amb}} = 25^\circ\text{C}$, unless otherwise specified.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Line voltage	$I_L = 8 \text{ mA}$	V_L	1.8	2.1	2.6	V
	$I_L = 20 \text{ mA}$		3.0	3.3	3.6	V
	$I_L = 30 \text{ mA}$		3.6		4.5	V
	$I_L = 73 \text{ mA}$, see figure 4		7.7		9.7	V
Transmit and sidetone see figure 5						
Input resistance	Pin 7 - 8	R_i	7	10	13	k Ω
Gain	$I_L = 30 \text{ mA} \cong l = 5 \text{ km}$ adjustable with R_{AGC} $I_L = 30 \text{ to } 73 \text{ mA} \cong l = 5 \text{ km to } 0 \text{ km}$	G_s	57	59	61	dB
		ΔG_s	-7		-9	dB
Noise at line weighted psophometrically	$I_L = 73 \text{ mA} \cong l = 0 \text{ km}$ $V_{MIC} = 0 \text{ V}$	n_o		-70	-68	dBm
Sidetone reduction	$I_L \geq 20 \text{ mA}$	G_{STA}	10	15	20	dB
DTMF-Amplifier see figure 6						
Input resistance	Pin 8 - 3	R_D	8	10	13	k Ω
DTMF Gain	$I_L = 30 \text{ mA} \cong l = 5 \text{ km}$ $R_{ex1} = 0$ adjustable with R_{ex1} $I_L = 31 \text{ mA to } 78 \text{ mA} = l = 5 \text{ km to } 0 \text{ km}$	G_D	9		13	dB
		ΔG_D	-7		-9	dB
Volume range $d \geq 5\%$		V_0	1			V_{RMS}
Receiving amplifier see figure 4						
Input resistance	Pin 12 - 3	R_i		50		k Ω
Gain	$R_{HH} = 300 \Omega$, $I_L = 30 \text{ mA} \cong l = 5 \text{ km}$ $R_{HH} = 300 \Omega$ adjustable with R_{AGC} , $I_L = 31 \text{ mA to } 78 \text{ mA}$ $l = 5 \text{ km to } 0 \text{ km}$	G_R	-1	-3	-5	dB
		ΔG_R	-5	-6	-7	dB
Receiving noise at earphone weighted psophometrically	$I_L = 78 \text{ mA} = l = 0 \text{ km}$ $S_2 = 0$	n_i		-80	-71	dBm
Gain change when muted	$I_L \geq 20 \text{ mA}$	G_{RM}	15	20	24	dB
Output saturation threshold	$I_L \geq 20 \text{ mA}$	V_0	0.8	1	1.5	V_{pp}
MUTE or MUTE-input						
MUTE-input current	Pin 9 = 0 V	$\overline{I_M}$	20	50	80	μA
MUTE off input voltage		V_{Moff}	1.5			V
MUTE on input voltage		V_{Mon}			0.3	V
MUTE-input current	Pin 9 = 1.5 V	I_M	10	20	30	μA
MUTE off input voltage		V_{Moff}			0.3	V
MUTE on input voltage		V_{Mon}	1.5			V
Supply voltage see figure 4						
Output voltage	$I_L \geq 20 \text{ mA}$ $\overline{\text{MUTE}}$ or MUTE switched off switched on Pin 10	V+	3		6.1	V
			2.5	2.9	3.1	V
Output current	$I_L \geq 20 \text{ mA}$ $\overline{\text{MUTE}}$ or MUTE switched off switched on Pin 10	I+			30	μA
			1			mA

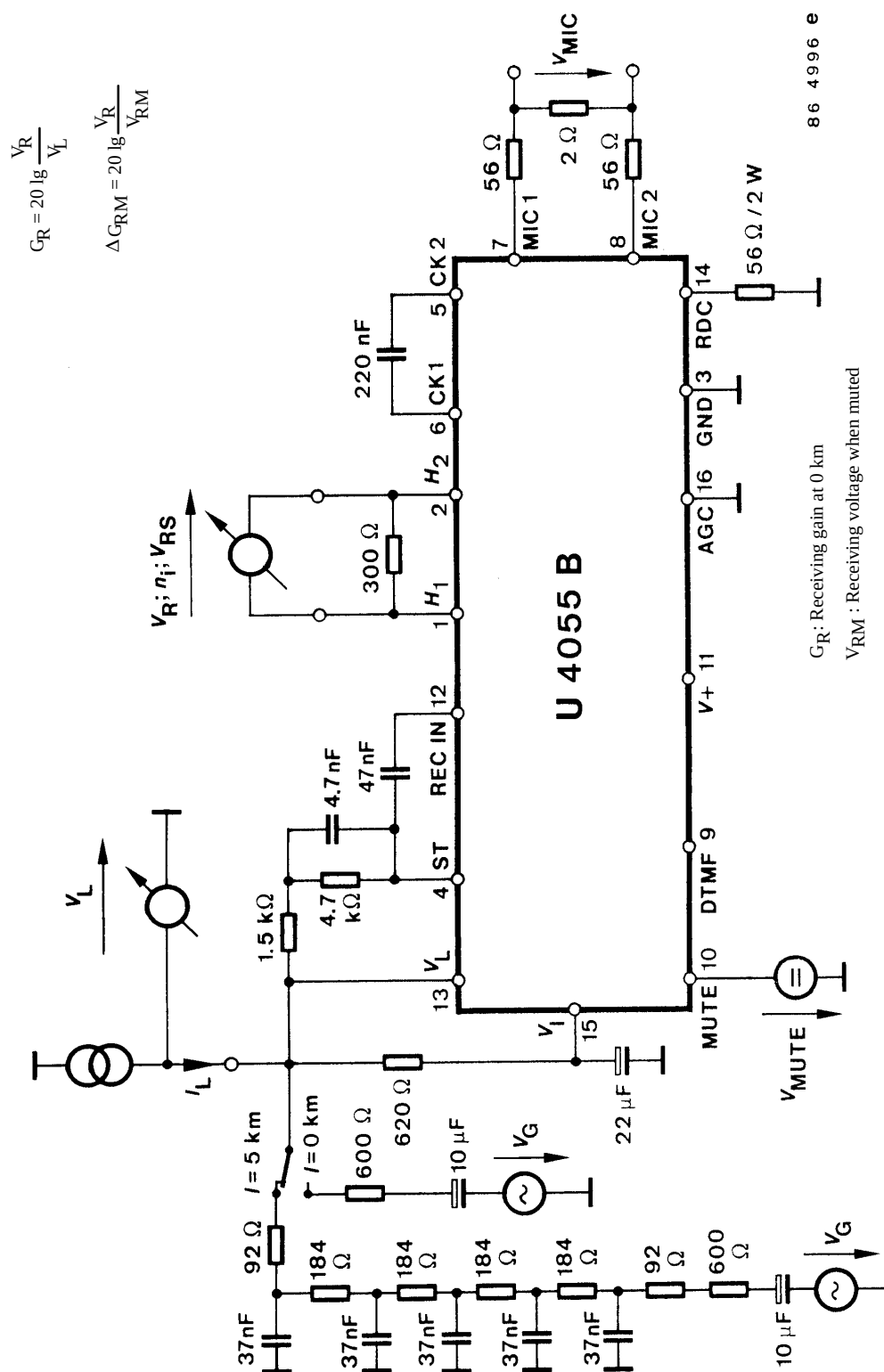


Figure 3. Receiving amplifier

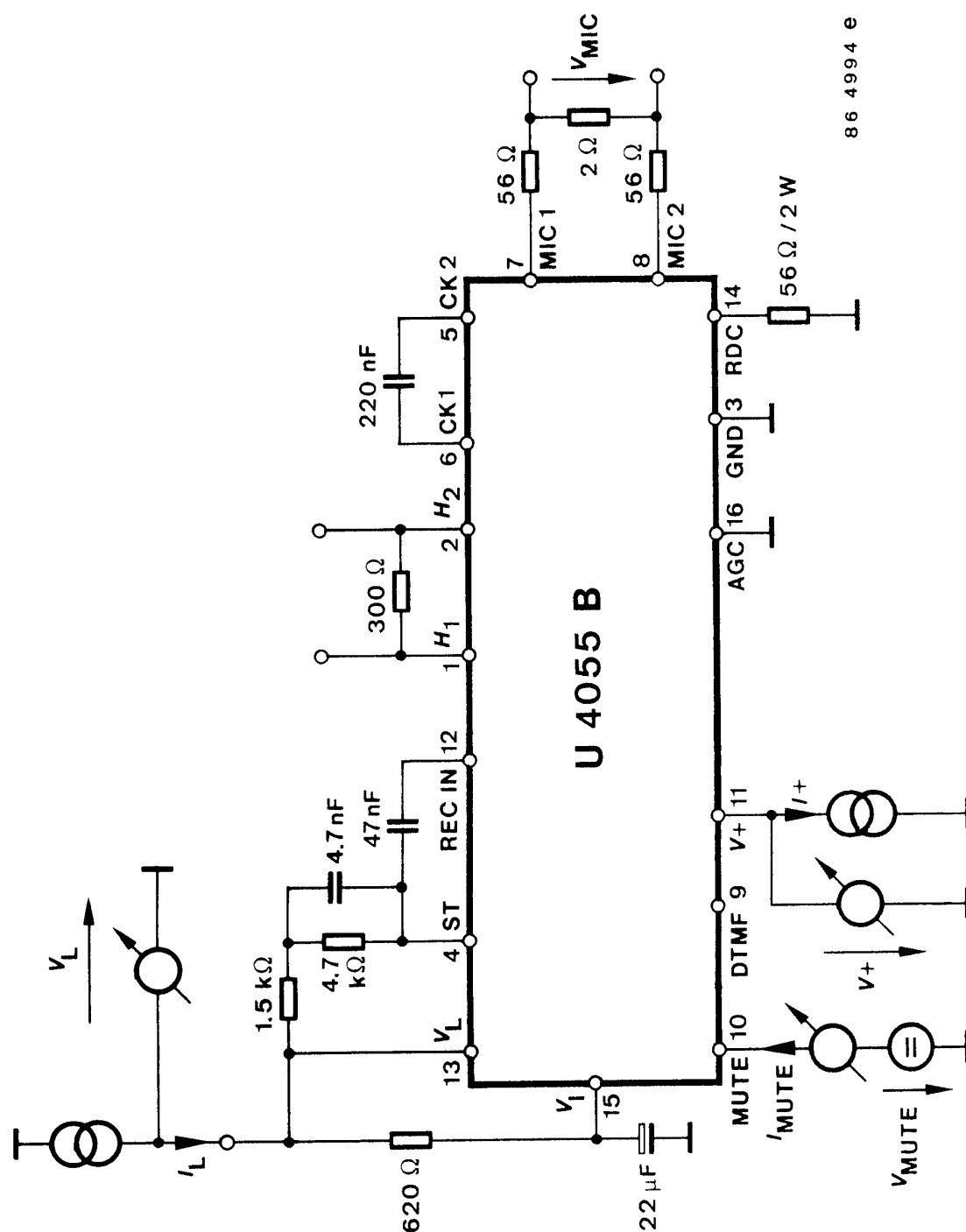


Figure 4. Line and supply voltage characteristics

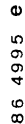


Figure 5. Transmitting amplification

 G_c : Sending gain at 0 km

G_{S5} : Sending gain at 5 km

$$G_S = 20 \log \frac{V_L}{V_{MIC}}$$
$$\Delta G_S = G_S - G_{S5}$$

Measurement point pin 13

 ΔG_S Typical = - 7.5 dB

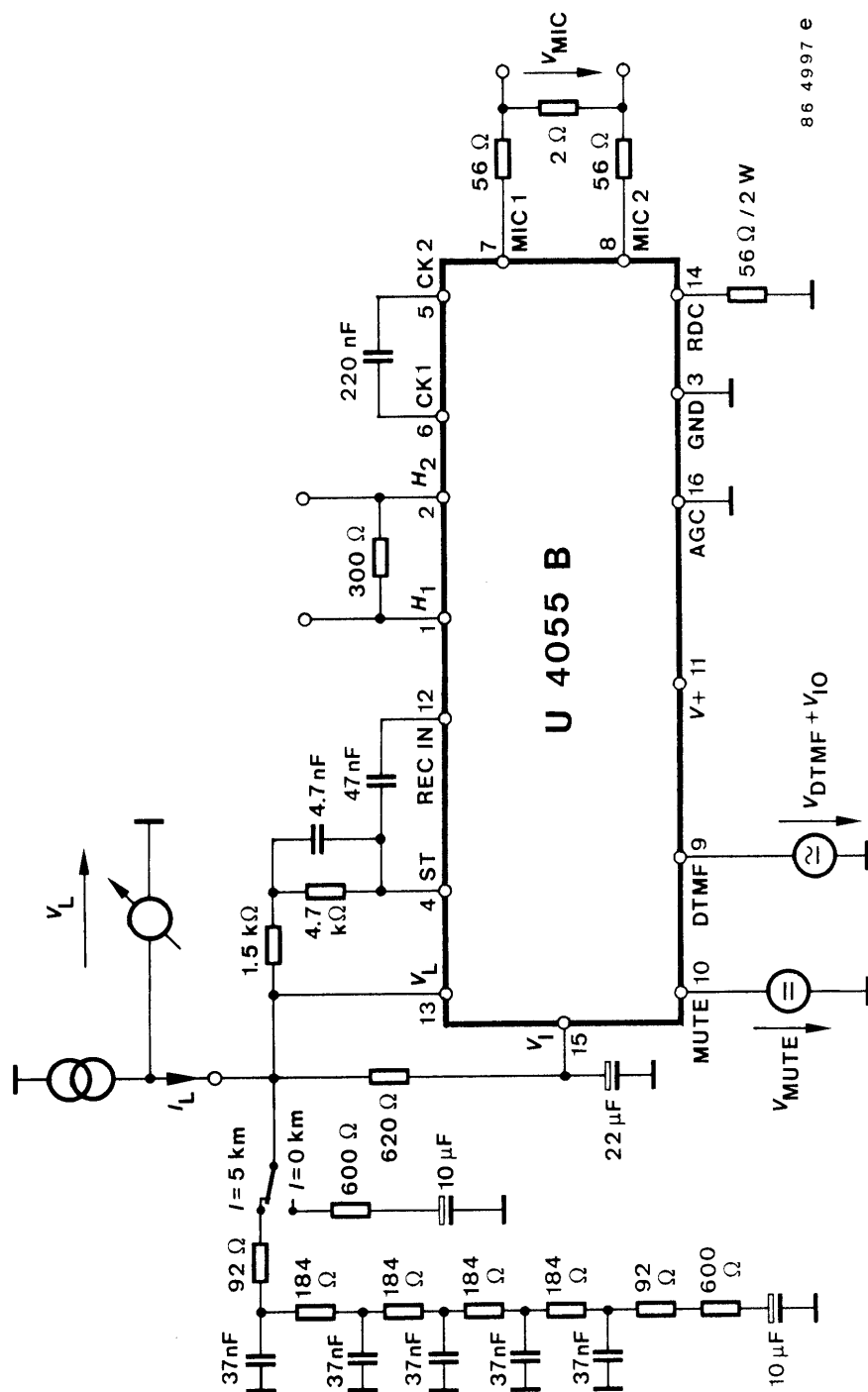


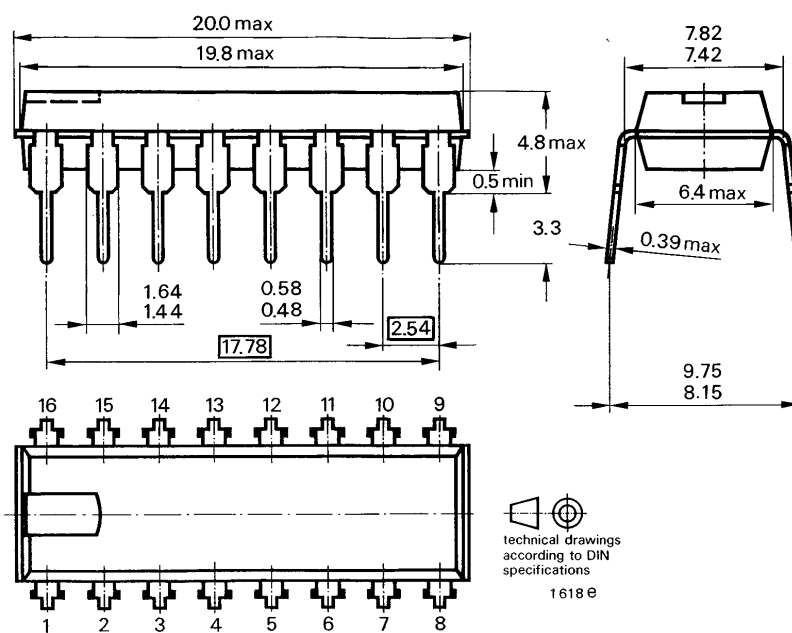
Figure 6. DTMF amplifier

Volume range
(dB $\leq 5\%$) min $V_O = 850 \text{ mV}_{\text{rms}}$
 $G_D = 20 \log \frac{V_L}{V_{\text{DTMF}}}$

Ordering Information

Extended Type Number	Package	Remarks
U4055B1	DIP16	High level mute
U4055B	DIP16	Low level mute

Dimensions in mm



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