Low Voltage Standard Telephone Circuit with 13 Memories

Description

TELEFUNKEN microelectronic's low voltage telephone circuit, U 3761 MB performs all the speech and line interface functions required in an electronic telephone set, the tone ringer, the pulse and DTMF dialing with redial, notice function, and 13 memories.

Features

Speech Circuit

- Adjustable dc characteristic
- Symmetrical input of microphone amplifier
- Receiving amplifier for dynamic or piezo-electric earpieces
- Automatic line loss compensation

Dialer

- DTMF / pulse switchable
- Pulse dialling 66/33 or 60/40 or DTMF dialling selectable by pin
- Selectable flashing duration by key pad
- Pause function
- Last number redial up to 32 digits
- Three direct (one touch) memory
- Ten indirect (two touch) memory
- Notice function
- Standard low-cost crystal 3.57 MHz or ceramic resonator

Tone Ringer

- 2 Tone ringer
- Adjustable volume
- RC oscillator
- Adjustable threshold

Benefits

- Low number of external components
- High quality through one IC solution

Block Diagram / Applications

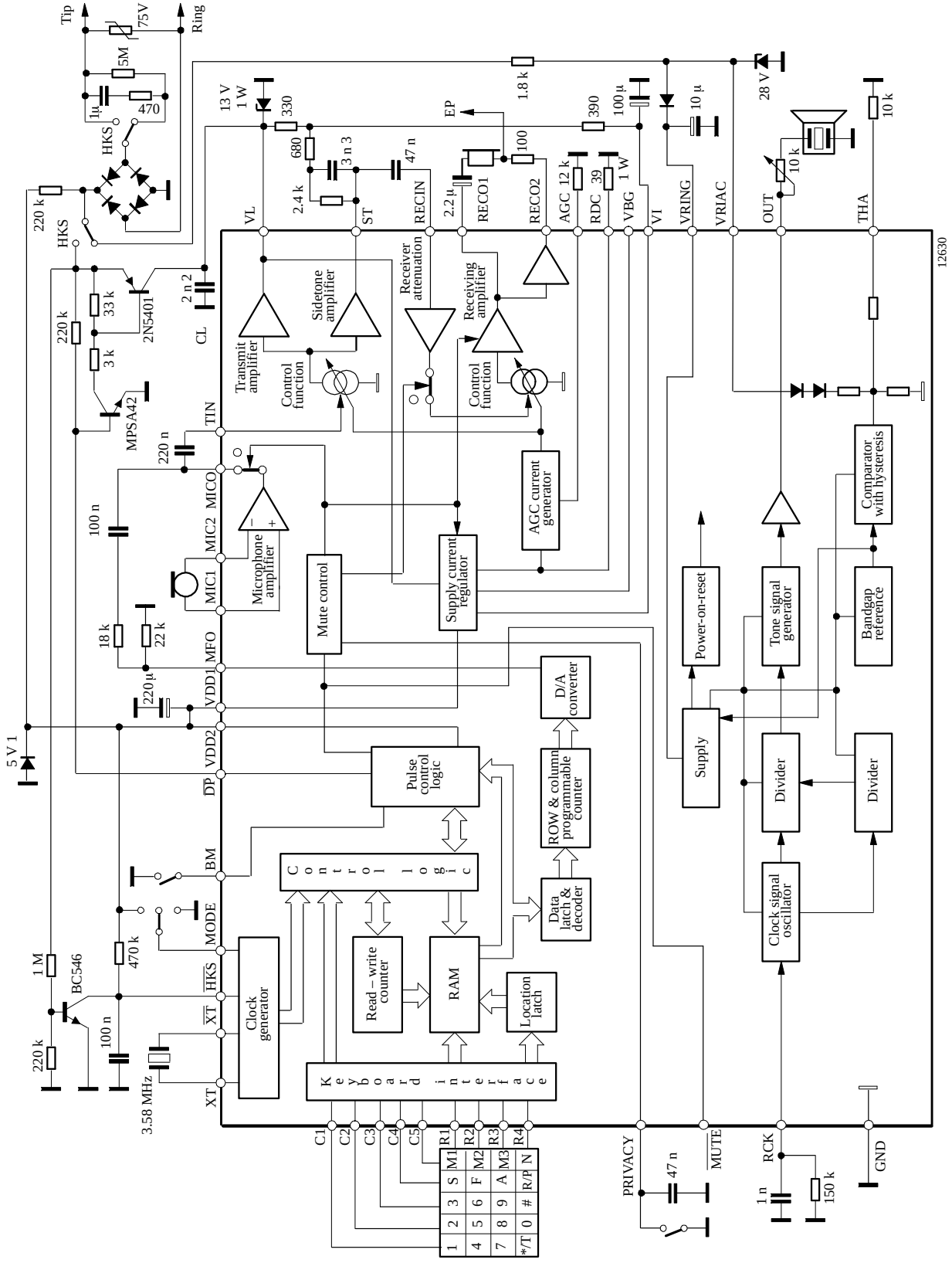
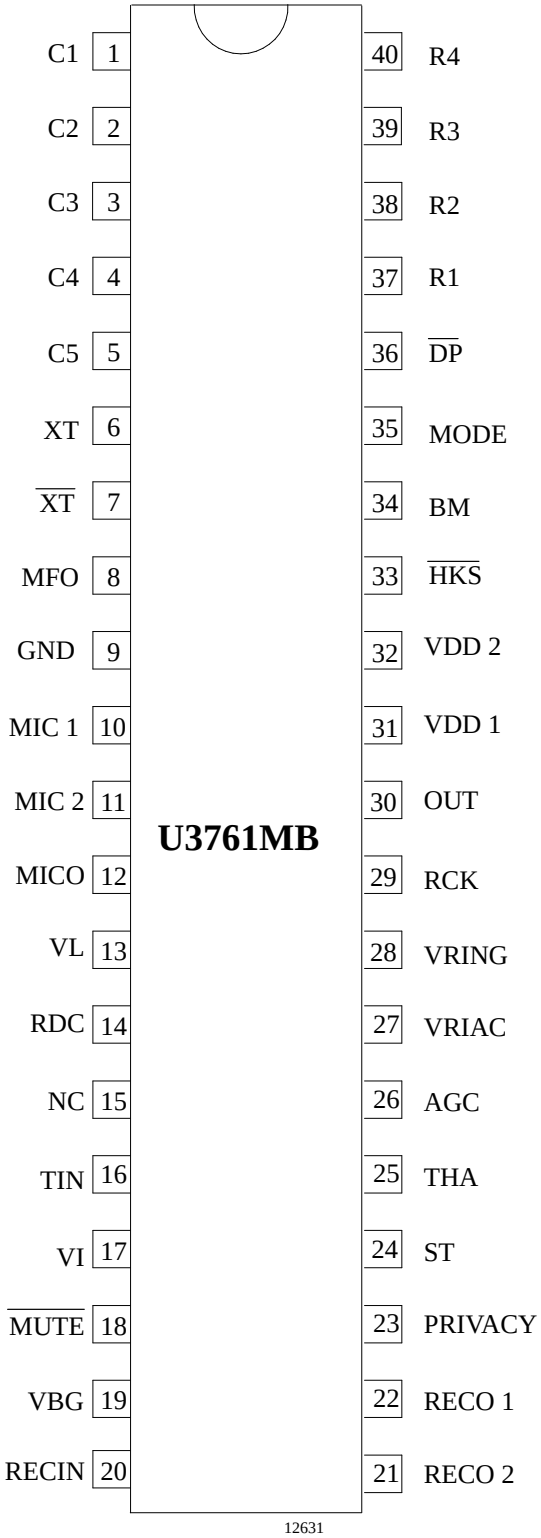
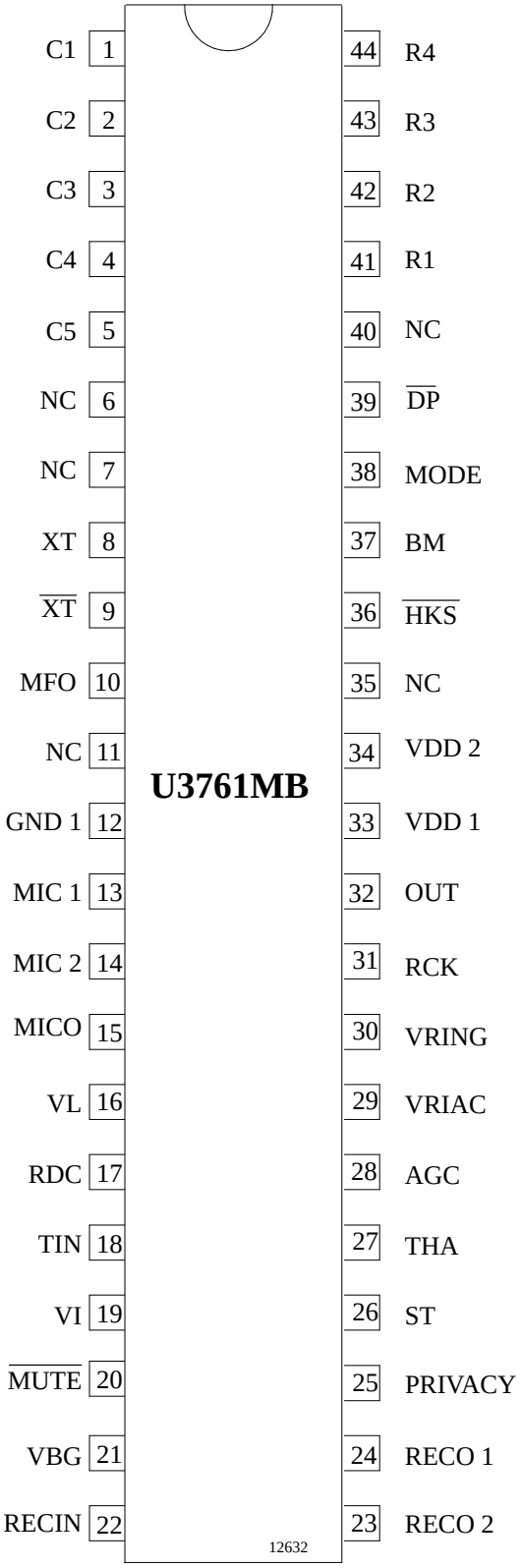


Figure 1.

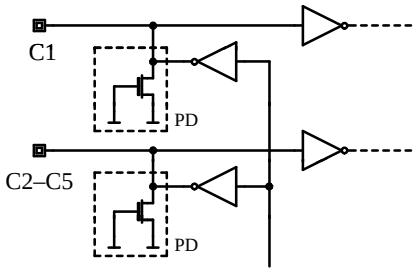
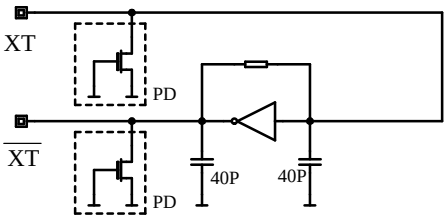
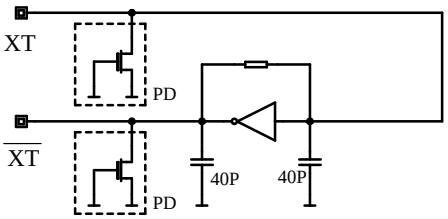
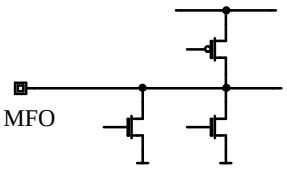
SDIP40

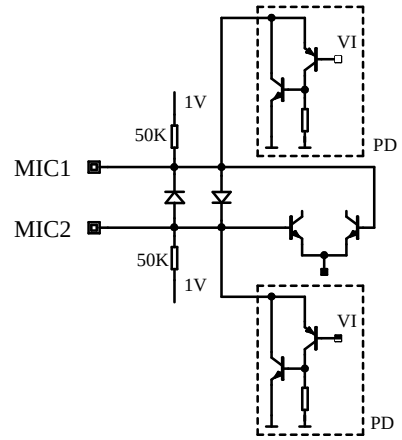
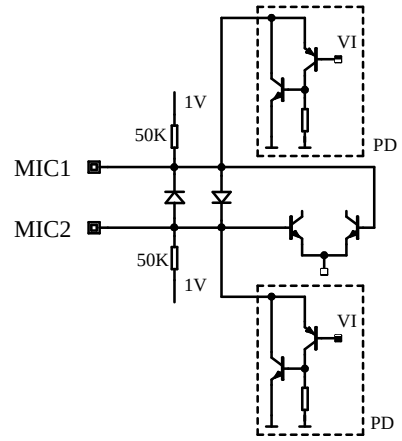
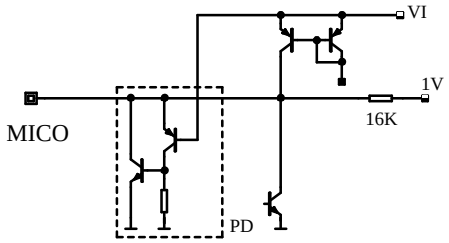
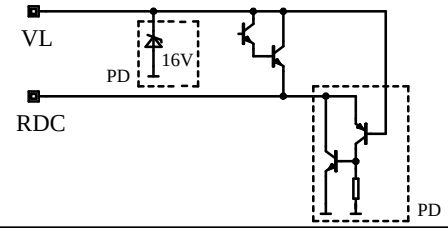


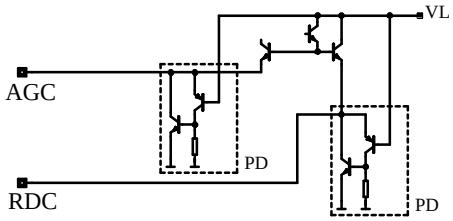
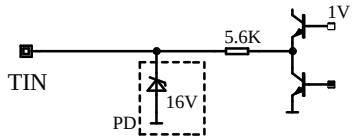
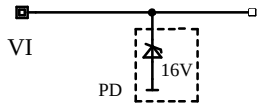
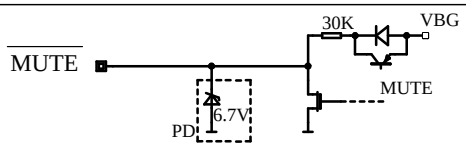
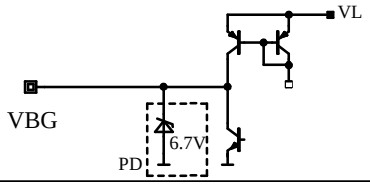
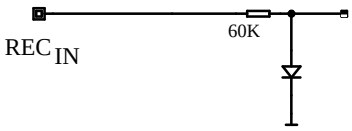
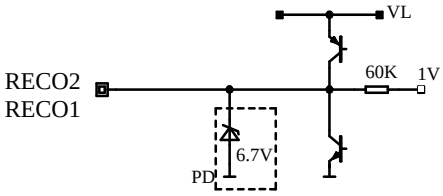
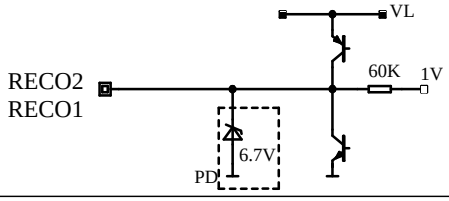
SSO44

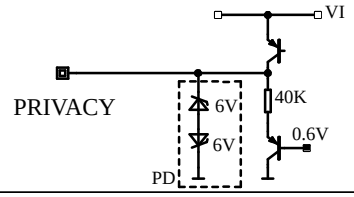
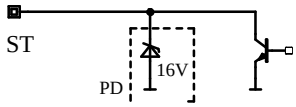
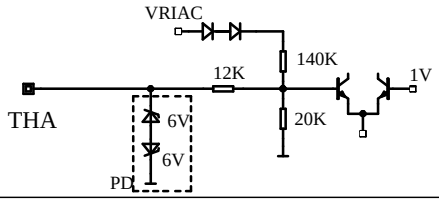
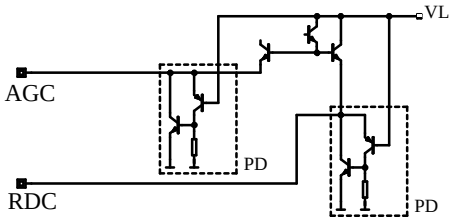
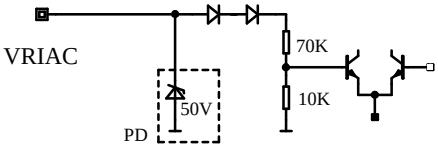
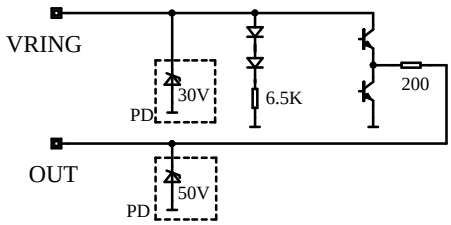
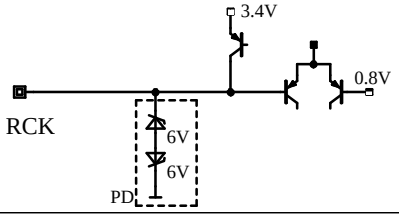


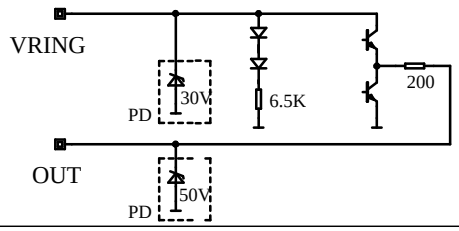
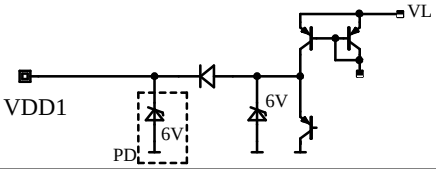
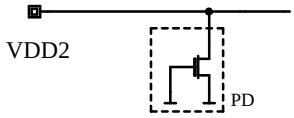
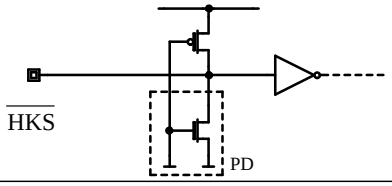
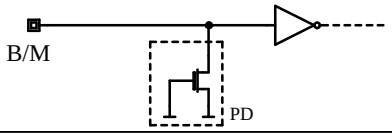
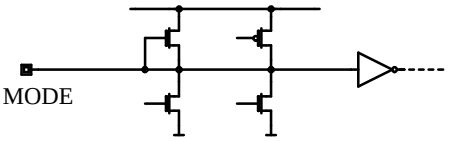
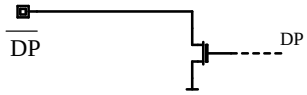
Pin Description

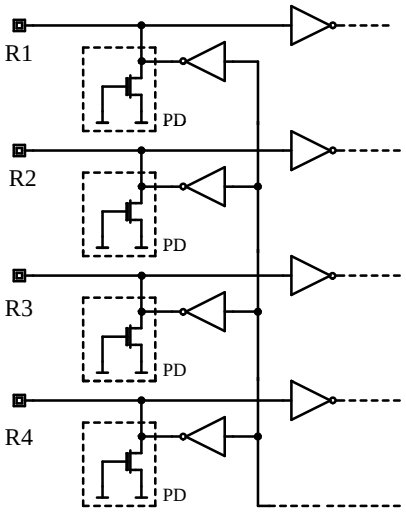
SDIP40	SSO44	Symbol	Configuration	Function
1	1	C1		Keyboard input
2	2	C2		
3	3	C3		
4	4	C4		
5	5	C5		
15	7, 6, 35	NC		Not connected
6	8	XT		A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator
7	9	$\overline{XT}$		
8	10	MFO		Output of DTMF DTMF output frequency Specified (HZ) / Actual (Hz) / Error (%) R1 697 699 +0.28 R2 770 766 –0.52 R3 852 848 –0.47 R4 941 948 +0.74 C1 1209 1216 +0.57 C2 1336 1332 –0.30 C3 1477 1472 –0.34
9	12	GND		Ground

SDIP40	SSO44	Symbol	Configuration	Function
10	13	MIC 1		Inverting input of microphone amplifier
11	14	MIC 2		Non-inverting input of microphone amplifier
12	15	MICO		Transmit pre-amp output which is normally capacitively coupled to Pin TIN
13	16	VL		Positive supply voltage input to the device. The current through this pin is modulated by the transmit signal.

SDIP40	SSO44	Symbol	Configuration	Function
14	17	RDC		An external resistor (1 W) is required from this pin to GND to control the dc input impedance of the circuit. It has a nominal value of 39 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.
16	18	TIN		Input to the line output driver amplifier. Transmit AGC applied to this stage.
17	19	V_I		This internal voltage bias line must be connected to VL via an external resistor, R_B, which dominates the ac input impedance of the circuit and should be 680 Ω for an 600 Ω input impedance or 1.2 kΩ for a 900 Ω input impedance.
18	20	$\overline{\text{MUTE}}$		Pin for testing
19	21	VBG		Pin for test mode
20	22	RECIN		Receive amplifier input. The receiving amplification is regulated by an AGC.
22	24	RECO1		Output of the receive amplifier. Dynamic transducers with a minimum impedance of 100 Ω can be directly driven by these outputs.
21	23	RECO2		

SDIP40	SSO44	Symbol	Configuration	Function
23	25	PRIVACY		Input for handset mute
24	26	ST		The output of the sidetone cancellation signal, which requires a balanced impedance of 8 to 10 times the subscribers line impedance to be connected to Pin VL.
25	27	THA		Ringer threshold adjustment
26	28	AGC		The range of transmit and receive gain variations between short and long loops may be adjusted by connecting a resistor R_{AGC} from this pin to (GND). This pin can be left open to set AGC out of action.
27	29	VRIAC		Ringing supply
28	30	VRING		DC supply voltage for the tone ringer is limited to 30 V with integrated Z-diode.
29	31	RCK		RC clock oscillator for ringer

SDIP40	SSO44	Symbol	Configuration	Function
30	32	OUT		Buzzer output
31	33	VDD 1		Supply output for dialer part
32	34	VDD 2		Supply input of dialer section
33	36	$\overline{\text{HKS}}$		Hook switch input. $\overline{\text{HKS}}$ = 1: On-hook state. Chip in sleep mode, no operation. $\overline{\text{HKS}}$ = 0: Off-hook state. Chip enable for normal operation.
34	37	BM		If BM = floating pulse dialing with 3:2 B/M ratio If BM is connected to ground pulse dialing with a B/M ratio of 2:1
35	38	MODE		Pulling mode pin to V_{DD} places the dialer in tone mode. Pulling mode pin to GND places the dialer in pulse mode (20 ppS). If the mode pin is left floating, the dialer is in pulse mode (10 ppS)
36	39	$\overline{\text{DP}}$		N-channel open drain pulse dialing output. Flash key will cause $\overline{\text{DP}}$ to be active in either DTMF mode or pulse mode.

SDIP40	SSO44	Symbol	Configuration	Function
37	41	R1		Keyboard input
38	42	R2		
39	43	R3		
40	44	R4		

Keyboard Operation

C1	C2	C3	C4	C5	
1	2	3	S	M1	R1
4	5	6	F	M2	R2
7	8	9	A	M3	R3
⁎/T	0	#	R/P	SAVE	R4
F1	F2	F3			VX

- S: Store function key
- A: Indirect repertory dialing function key (LA 0 to 9)
- R/P: Redial and pause function key
- SAVE: Save function key
- ⁎/T: ⁎ and pulse-to-tone key
- M1 to M3: One-touch memory
- F1, F2, F3: Flash keys

Normal Dialing

OFF HOOK , D1 , D2 , ..., Dn

1. D1, D2, ..., Dn will be dialed out.
2. Dialing length is unlimited, but redial is inhibited if length oversteps 32 digits.
3. If redialing length oversteps 32 digits, the redialing function will be inhibited.

Redialing

OFF HOOK , D1 , D2 , ..., Dn BUSY, Come ON HOOK , OFF HOOK , R/P

The R/P key can execute the redial function only as the first key-in after off-hook; otherwise, it executes the pause function.

Number Store

OFF HOOK , D1 , D2 , ..., Dn , S , S , Mn (or Ln)

1. If the sequence of the dialed digits D1, D2, ..., Dn has not finished S will be ignored.
2. D1, D2, ..., Dn will be stored in memory location and dialed out.

OFF HOOK , S , D1 , D2 , ..., Dn , S , Mn (or Ln)

3. D1, D2, ..., Dn will be stored in memory location but will not be dialed out.
4. R/P and ✳/T keys can be stored as a digit in memory.

   In store mode, R/P is the pause function key; ✳/T is the pulse-to-tone function key.
5. The store mode is released after the store function is executed or when the state of the hook switch is changed.

Reportery Dialing

1. OFF HOOK , Mn

2. OFF HOOK , A , Ln

Notice (N)

OFF HOOK , D1 , D2 , ..., Dn , N

1. If the dialing of D1 to Dn is finished, pressing the N key will cause D1 to Dn to be copied to the N memory.

OFF HOOK , N

2. D1 to Dn will be diabled out after the N key is pressed.

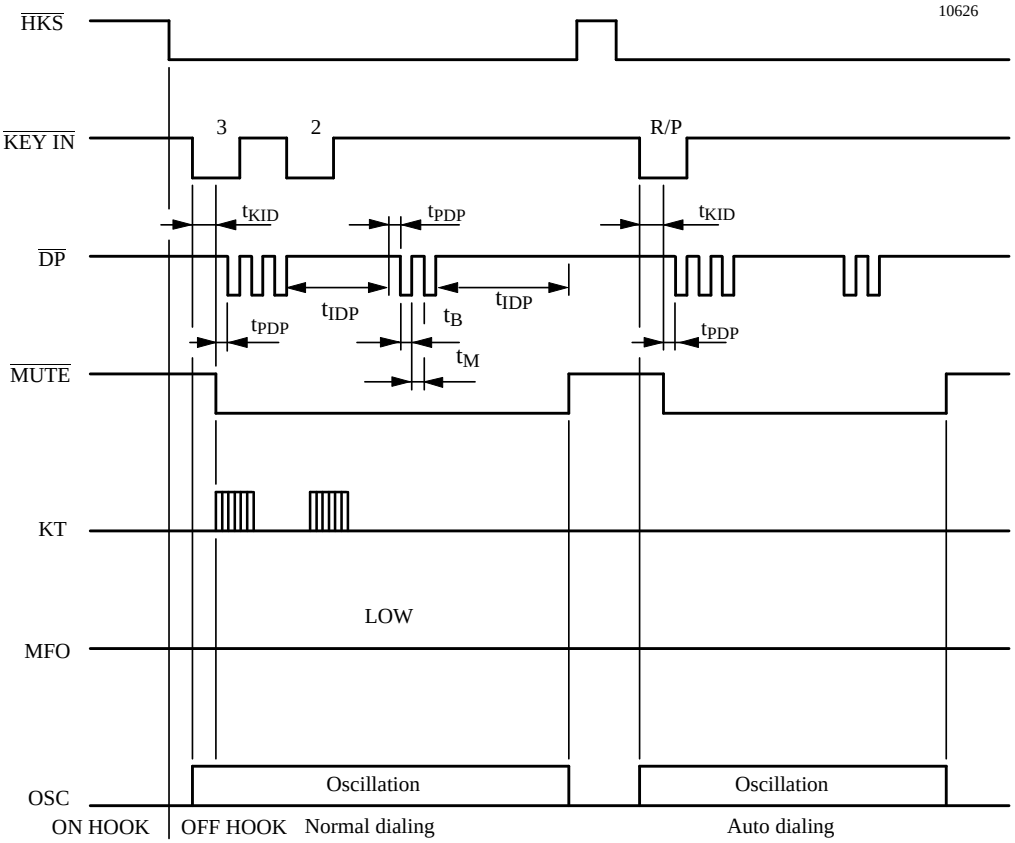


Figure 2. Pulse mode

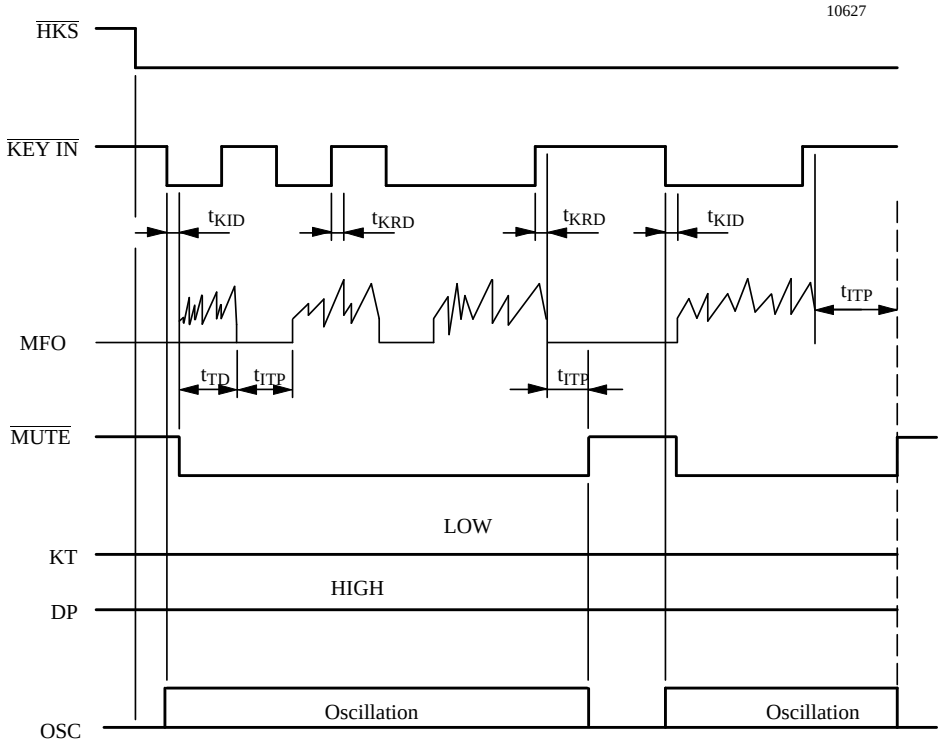


Figure 3. DTMF mode normal dialing

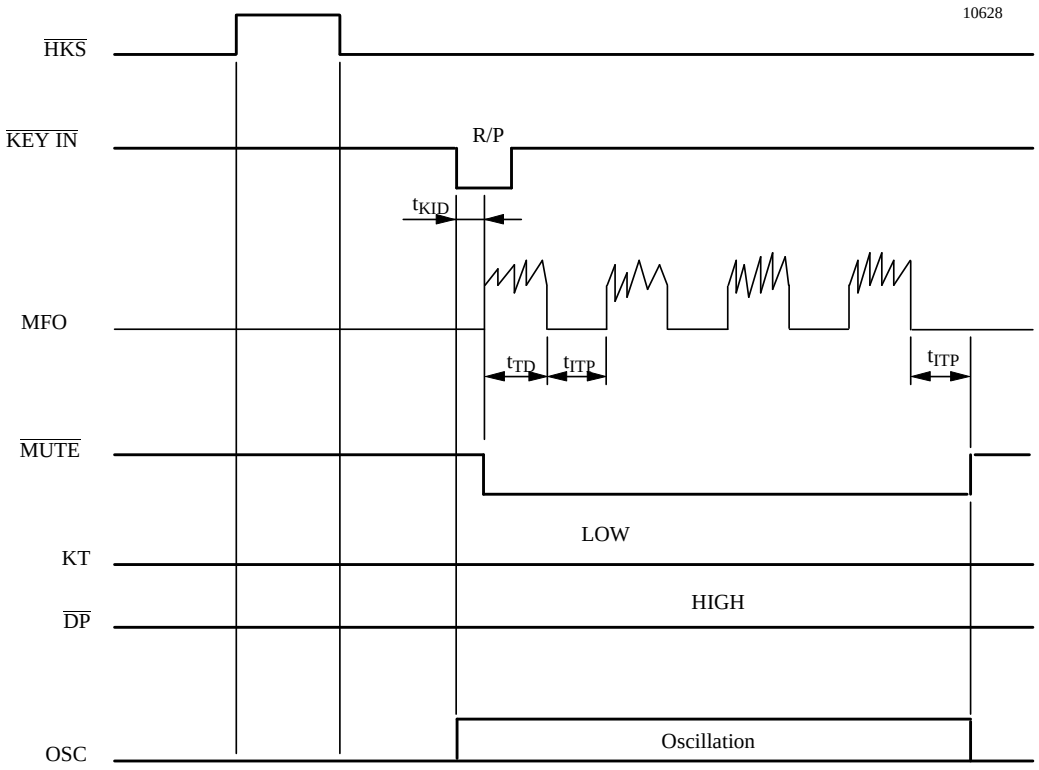


Figure 4. DTMF auto dialing

Access Pause

OFF HOOK , D1 , D2 , R/P , D3 , ..., Dn’

1. The pause function can be stored in memory.
2. The pause function is executed in normal dialing and redialing.

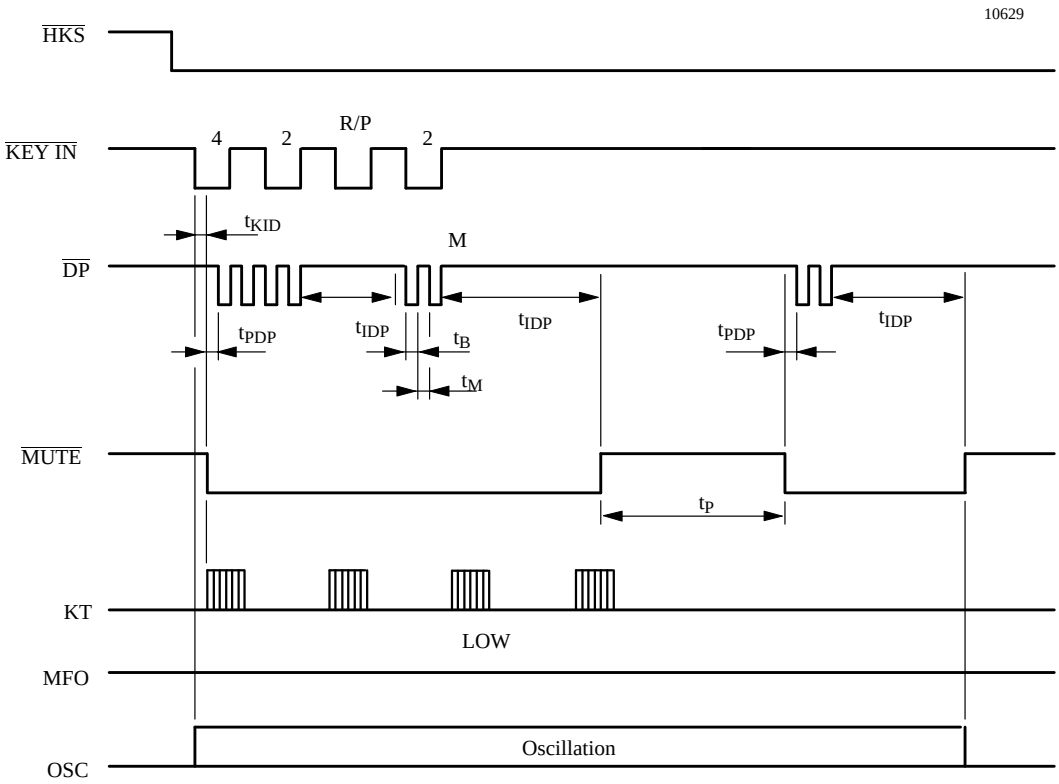


Figure 5. Pause function

Pulse-to-Tone (⁎/T)

OFF HOOK	,	D1	,	D2	, ...,	Dn	,	⁎/T	,	D1’	,	D2’	, ...,	Dn’

1. If the mode switch is set to pulse mode, then the output signal will be:

   D1, D2, ..., Dn, Pause (3.6 s), D1’, D2’ ,..., Dn’

   (Pulse) (Tone)

2. If the mode switch is set to tone mode, then the output signal will be:

   D1, D2, ..., Dn, * , D1’, D2’, ..., Dn’

   (Tone) (Tone) (Tone)

3. The dialer remains in tone mode when the digits have been dialed out and can be reset to pulse mode only by going on-hook.

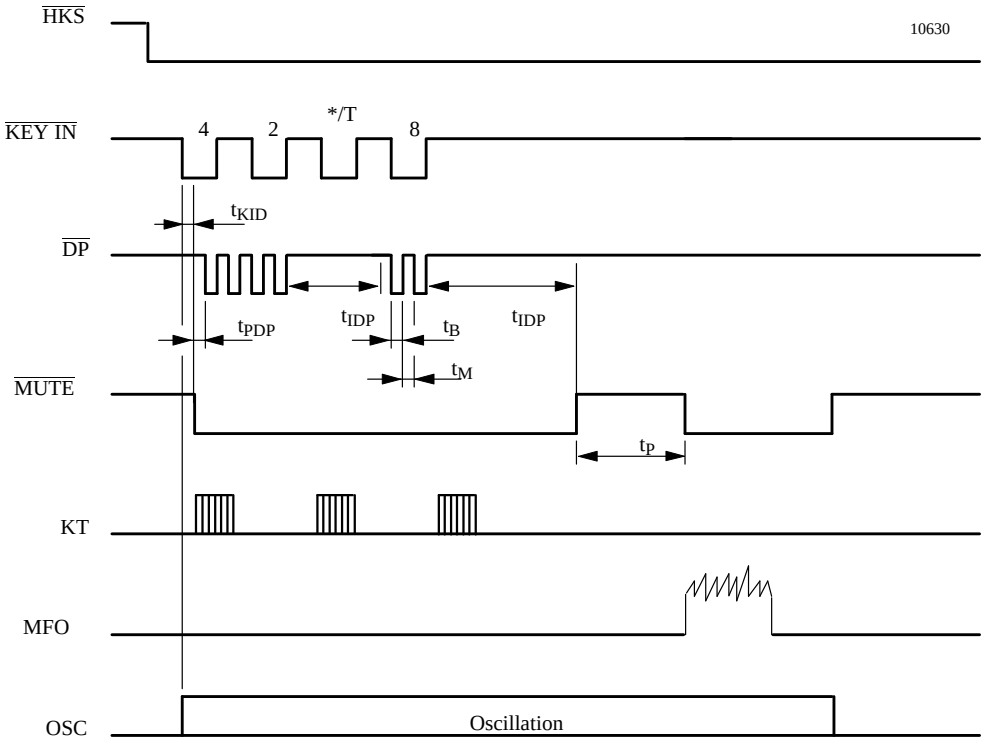


Figure 6. Pulse-to-tone operation

Flash (F1 or F2 or F3)

OFF HOOK , F_n

1. The flash key cannot be stored as a digit in memory. The flash key has first priority among the keyboard functions.
2. The system will return to the initial state after the flash pause time is finished.

OFF HOOK , F_n , D1 , D2 , D3 , ..., Dn

LNB = D1, D2, D3, ..., Dn

OFF HOOK , D1 , D2 , F_n , D3 , ..., Dn

LNB = D3, ..., Dn

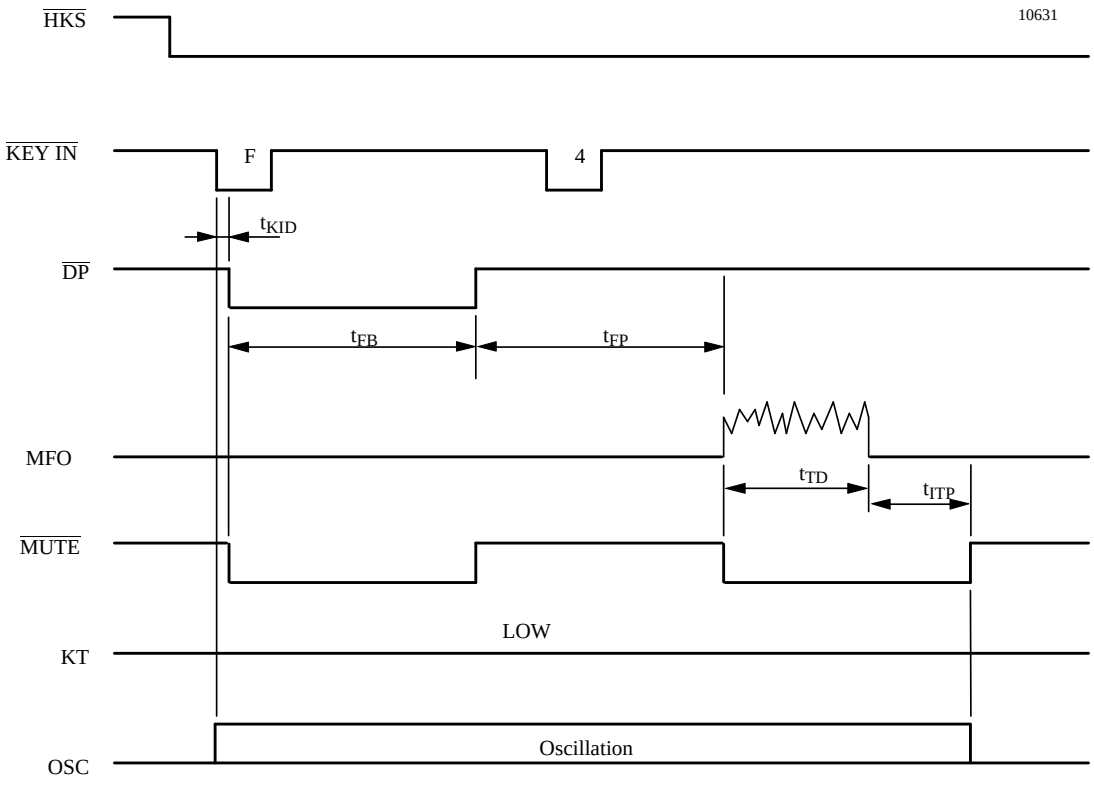


Figure 7. Flash operation

t_{KID} = key active in debounce
t_{KRD} = key release debounce
t_{PDP} = pre-digit pause
t_{IDP} = inter-digit pause
t_{TD} = DTMF output duration
t_{ITP} = intertone pause
t_{FB} = flash break time
t_{FP} = flash pause time
t_P = pause time

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Line current	I_L	140	mA
DC line voltage	V_L	14	V
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 SSO44 SDIP40	P_{tot}	 0.9 1.3	W
Junction ambient SSO44 SDIP40	R_{thJA}	 70 50	k/W

Electrical Characteristics Speech Circuit

Reference point Pin GND, f = 1000 Hz, 0 dBm = 775 mV_{rms}, R_{DC} = 39 Ω / 1 W, T_{amb} = 25°C, unless otherwise specified

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Line voltage	I_L = 5 mA I_L = 20 mA I_L = 30 mA I_L = 73 mA	V_L	1.2	 4.0 4.5 6.4	1.5	V V V V
Transmit and sidetone						
Input resistance	R_i	R_i	45	80	120	kΩ
Gain	I_L = 20 mA, S5 = open	G_s	46.8	47.8	48.8	dB
Line-loss compensation	R_{AGC} = 12 kΩ, I_L = 73 mA	ΔG_s	−4.8	–6	–7	dB
Noise at line weighted psophometrically	I_L > 20 mA, G_S = 48dB	n_o			– 72	dBmp
Sidetone reduction	$I_L \geqq$ 20 mA	G_{STA}	10	15	20	dB
DTMF amplifier						
Volume range d < 5%	Single tone, $I_L \geq$ 20 mA	V_L	1.3			dBm
DTMF output level low frequency group	I_L = 20 mA, S5 = closed	V_L	–8		–4	dBm
Pre-emphasis between high and low level frequency group	$P_{PRE} = P_{HLG} - P_{LLG}$, S5 = closed	P_{PRE}	1		3	dB
Receiving amplifier						
Gain	IL ≥ 20 mA	G_R	3		5	dB
Line-loss compensation	I_L = 73 mA	ΔG_R	−4.7	–6	–7	dB
Receiving noise at ear-phone weighted psophome-trially	I_L = 73 mA	n_i		–77.5	–71	dBm
Gain change when muted	$I_L \geqq$ 20 mA	G_{RM}	24	29	34	dB
Output voltage push-pull	$I_L \geqq$ 20 mA, Z_{ear} = 68 nF, 100 Ω in series	V_{RECO}	0.8	0.9		V_{RMS}
Supply voltage (for internal use only)						
Output voltage	$I_L \geqq$ 20 mA dialing mode	$V_{DD\,1}$	2.3		6.3	V

DC Characteristics Dialer

V_{DD2} = 2.7 V, f_{OSC} = 3.58 MHz, all outputs unloaded, S9b

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Memory rentention current	$\overline{HKS}$ = 1, V_{DD2} = 1.0 V	I_{MR}			0.2	µA
Pre-emphases	Column/Row		1	2	3	dB
DTMF distortion	R_L = 5 kΩ	d		−30	−23	dB
DP output sink current	V_{PO} = 0.5 V	I_{PL}	0.5			mA
Keyboard input drive current	V_I = 0 V	I_{KD}	30			µA
Keyboard input sink current	V_I = 2.7 V	I_{KS}	200	400		µA
Keyboard resistance					5	kΩ
Key tone output current				± 1		mA
Key tone frequency	t = 50 ms			1240		Hz

AC Characteristics Dialer

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Keypad active in debounce		t_{KID}		20		ms
Key release debounce		t_{KRD}		20		ms
Pre-digit pause	B/M pin = floating 10 ppS B/M pin = low	t_{PDP} t_{PDP}		40 33.3		ms ms
Inter-digit pause (auto dialing)	10 ppS 20 ppS	t_{IDP} t_{IDP}		800 500		ms ms
Make/break ratio	B/M pin = floating B/M pin = low	M/B		40:60 33:67		% %
DTMF output duration	Auto dialing	t_{TD}		87		ms
Inter-tone pause	Auto dialing	t_{ITP}		87		ms
Flash break time F1 F2 F3	 R_1 grounded R_2 grounded R_3 grounded	t_{FB}		 94 250 600		 ms ms ms
Flash pause time	F1 F2 F3	t_{FP}		 3.6		s s s
Pause time		t_P		3.6		

Electrical Characteristics Tone Ringer

f_{RCK} = 4 kHz, V_{RING} = 20 V, T_{amb} = 25°C, reference point GND, unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply current, outputs open	V_{RIAC} = 20 V	I_{RING}	2.1		3.8	mA
Switch-on threshold	V_{RIAC}	V_{RON}		23.5		V
Switch-off threshold	V_{RIAC}	V_{ROFF}		5.6		V
Ringing frequency	R = 150 kΩ, C = 1 nF $V_{RIAC} > V_{RON}$	f_{1H} f_{1L}	937 752	1010 808	1083 868	Hz
Audio sequence frequency		f_2	11.5	12.5	14.0	Hz
Turn-off delay	See figure 8	t_{off}		65		ms

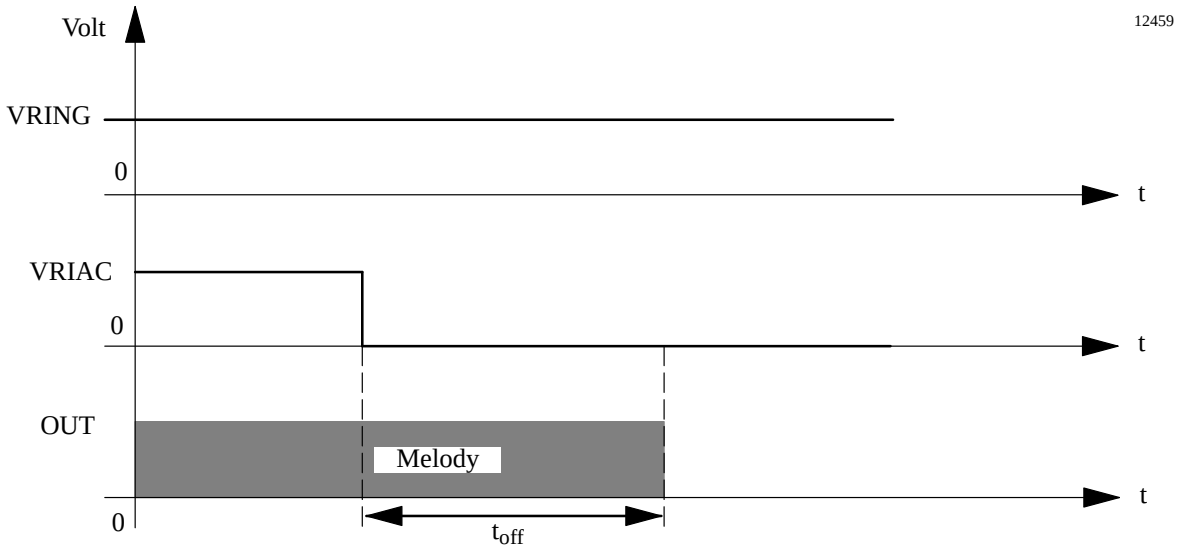
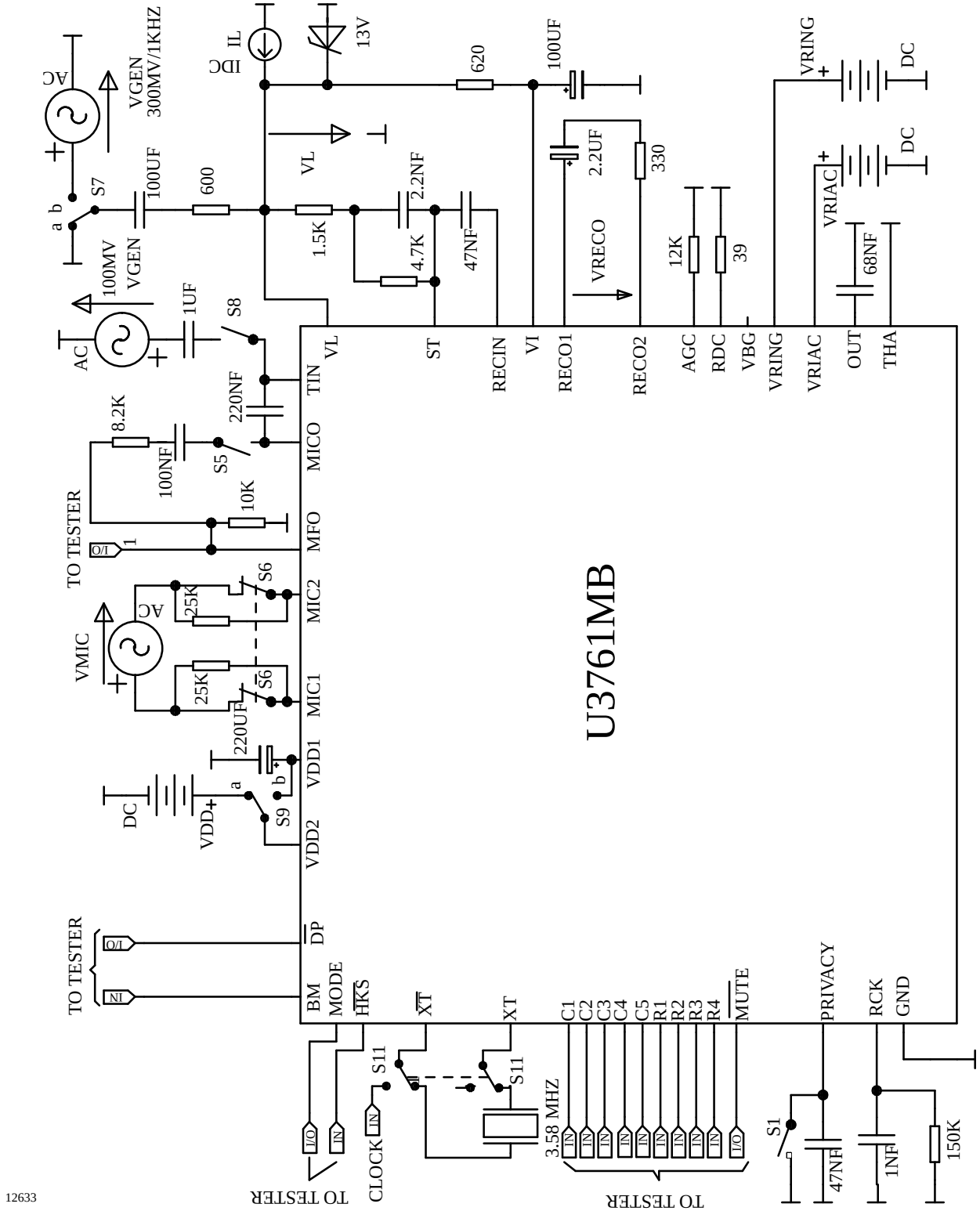


Figure 8. Turn off delay time

Ordering Information

Type	Package
U3761MB-ASD	SDIP40
U3761MB-AFN	SSO44
U3761MB-AFNG3	SSO44 tape and reel

Basic Test Circuit



Formulas for Parameters of Elecrtrical Characteristics of Speech Circuit

Formulas referred to the basic test circuit. If not otherwise specified switches in basic test circuit are inactive.

Transmit gain

$$GS = 20 \times \log\left(\frac{VL}{VMIC}\right)$$

VMIC = 3 mV/1 kHz, S5 = open

Receiving gain

$$GR = 20 \times \log\left(\frac{VRECO}{VL}\right)$$

RX-mode: VGEN = 300 mV/1 kHz, S7b

Line loss compensation transmit

$\Delta GS = GS(\text{at } IL = 73 \text{ mA}) - GS(\text{at } IL = 20 \text{ mA})$

TX-mode: VMIC = 3 mV/1 kHz, S5 = open

Sidetone reduction

$$GSTA = 20 \times \log\left(\frac{VL}{VRECO}\right)(\text{in TX–mode}) + GR$$

TX-mode: VMIC = 3 mV/1 kHz, S5 = open

Line loss compensation receive

$\Delta GR = GR(\text{at } IL = 73 \text{ mA}) - GR(\text{at } IL = 20 \text{ mA})$

RX-mode: VGEN = 300 mV/1 kHz, S7b

Gain change when muted

$$GRM = 20 \times \log\frac{VRECO}{VL}\ (\text{Mute} = \text{inactive}) - 20 \times \log\frac{VRECO}{VL}\ (\text{Mute} = \text{active})$$

VGEN = 100 mV/1 kHz, S5 = open, S8 = open

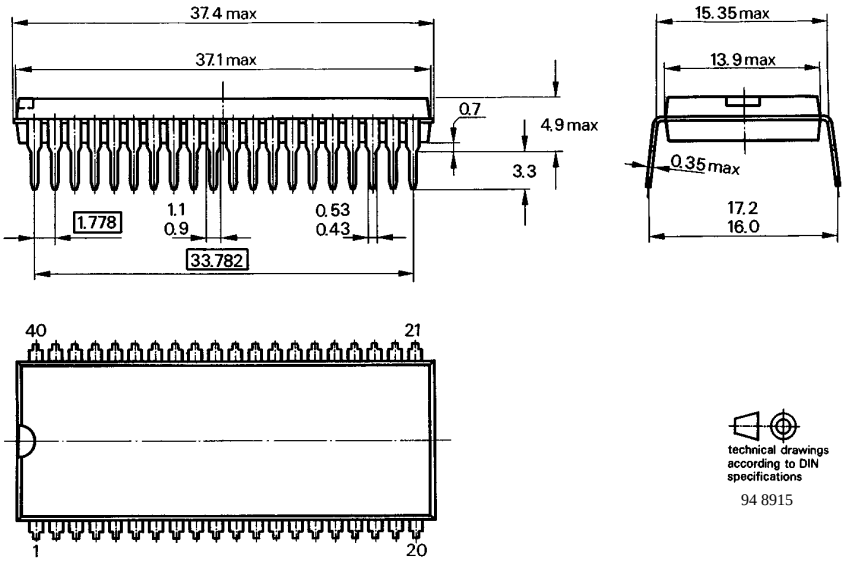
Input impedance of microphone amplifier

$$Ri = \frac{50\ \text{k}}{\left(\frac{VL_{(s6\ =\ \text{closed})}}{VL_{(S6\ =\ \text{open})}} - 1\right)}$$

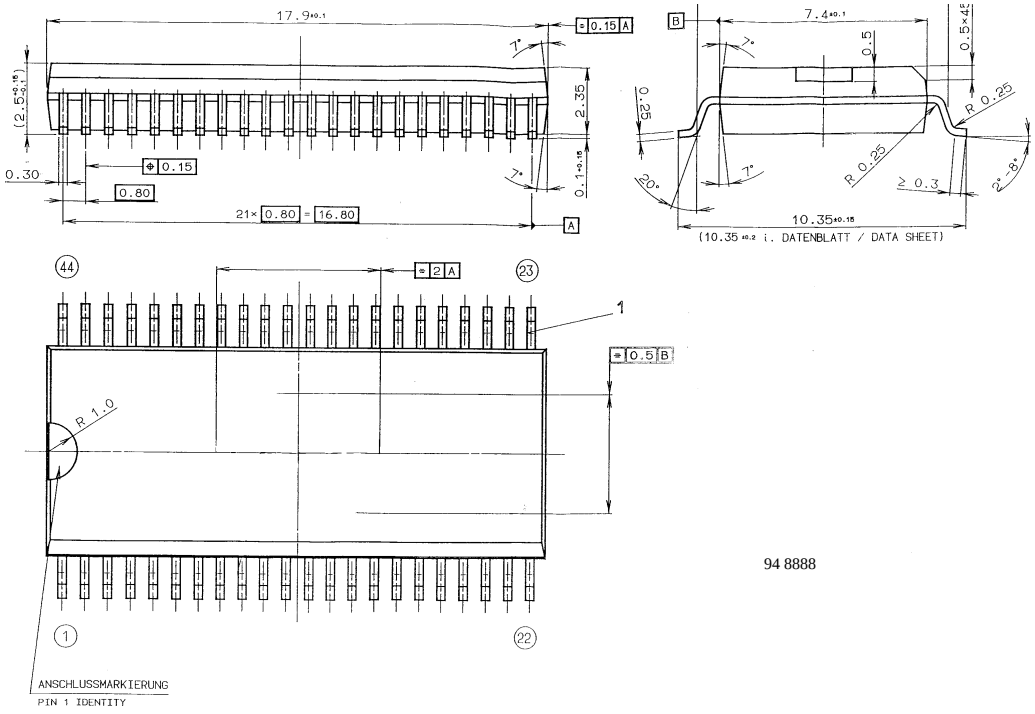
TX-mode: VMIC = 3 mV/1 kHz, S5 = open

Dimensions in mm

Package: SDIP40



Package: SSO44



Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC TELEFUNKEN microelectronic GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

TEMIC TELEFUNKEN microelectronic GmbH semiconductor division has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

TEMIC can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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