

Universal Telephone IC – All Functions Integrated

Description

Atmel Wireless & Microcontrollers' low-voltage telephone circuit U3761MB-T 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. Operation below 15 mA is possible with reduced performance.

Electrostatic sensitive device.
Observe precautions for handling.



Features

Speech Circuit

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

- Ten by 17 digits indirect (two-touch) memory
- Notice function up to 32 digits
- Standard low-cost crystal 3.58 MHz or ceramic resonator
- Handset Mute (Privacy) with optical indication
- Additional toggle flipflop
- Internal loop interrupt detection

Dialer

- DTMF / pulse switchable
- Pulse dialing 66/33 or 60/40 or DTMF dialing selectable by pin
- Selectable flashing duration by key pad
- Pause function
- Optical indication of temporary DTMF mode
- Keytone for pulse dialing
- Last number redial up to 32 digits
- Three by 17 digits direct (one-touch) memory

Tone Ringer

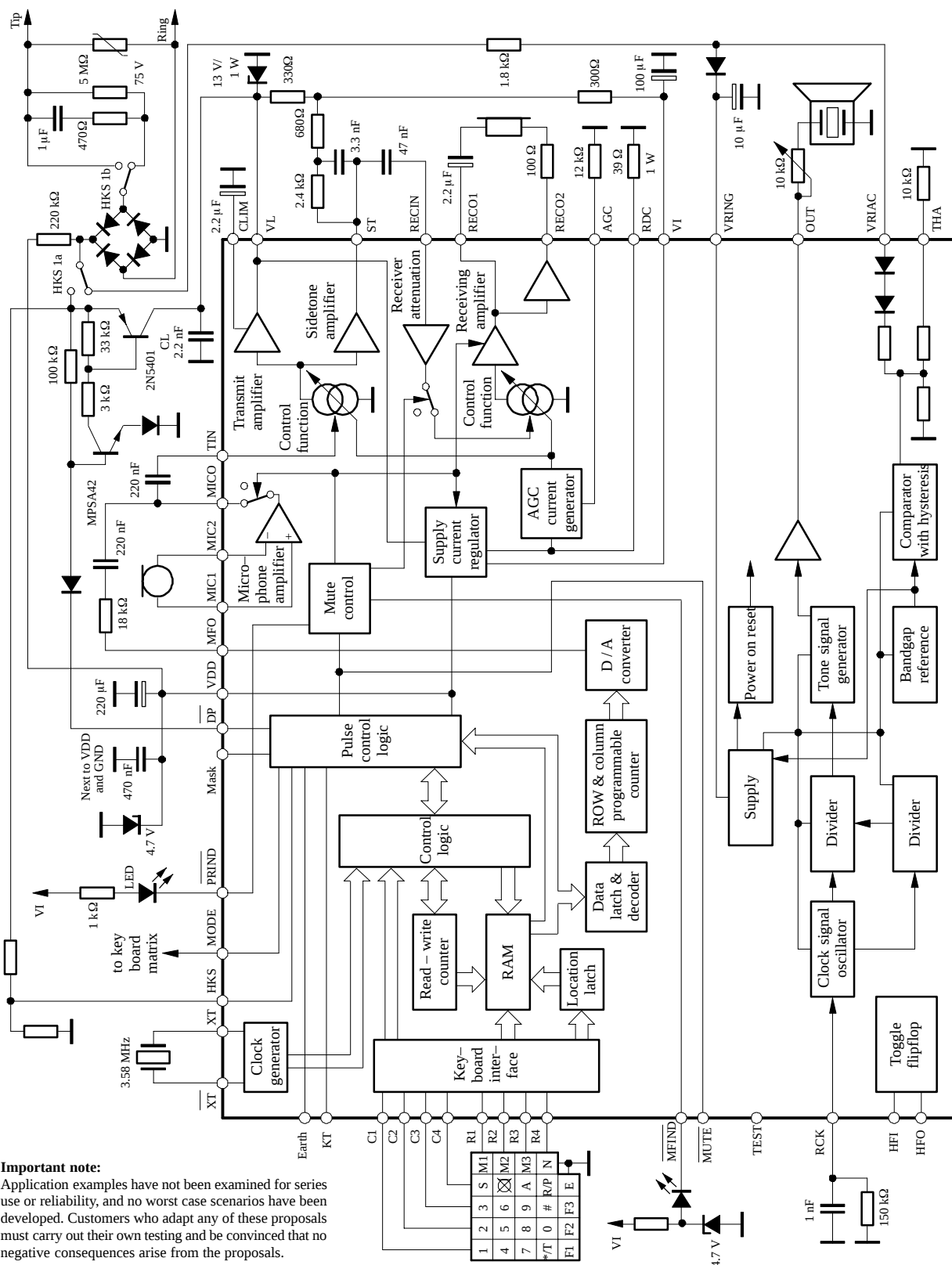
- 2-tone ringer
- Adjustable volume
- RC oscillator
- Adjustable threshold

Benefits

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

Ordering Information

Extended Type Number	Package	Remarks
U3761MB-TFN	SSO44	Tube
U3761MB-TFNG3	SSO44	Taped and reeled



Pin Description

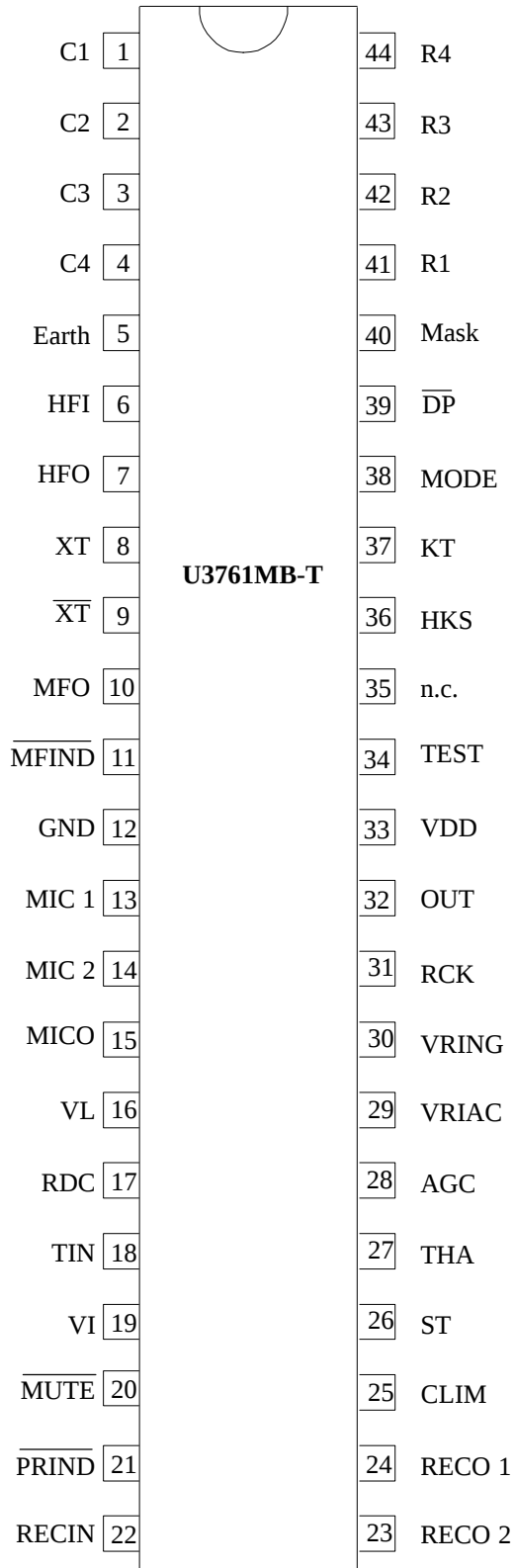
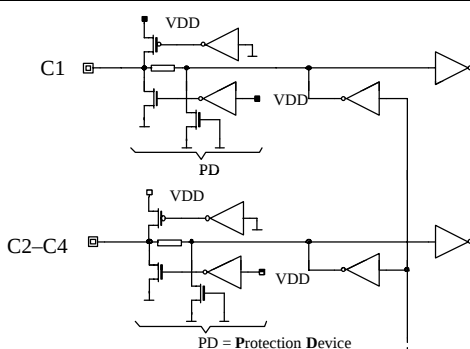
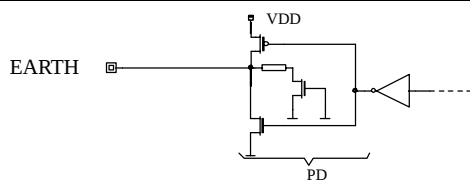
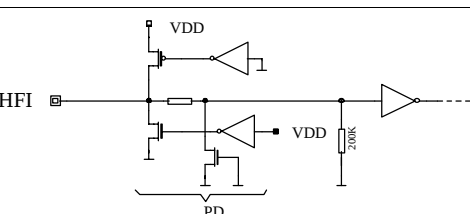
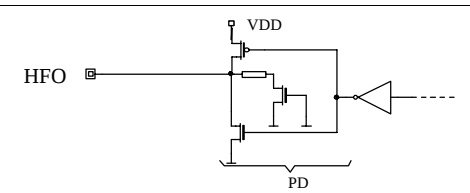
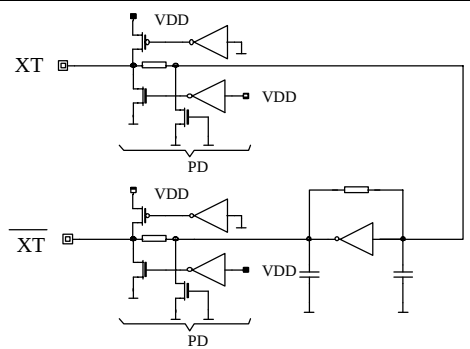
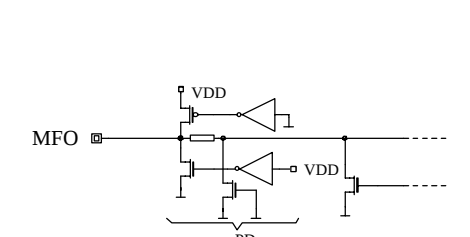
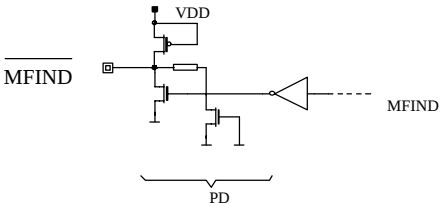
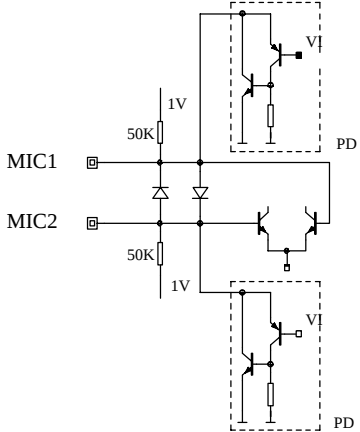
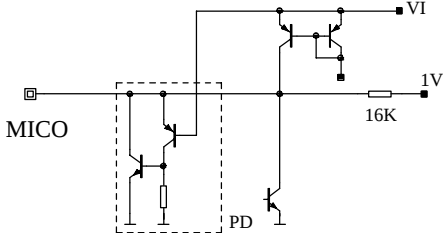
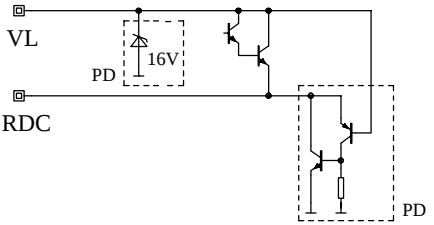
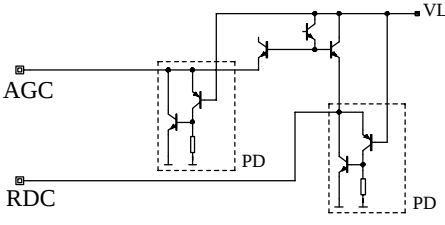
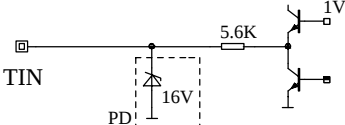
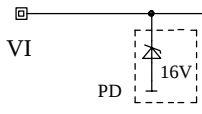
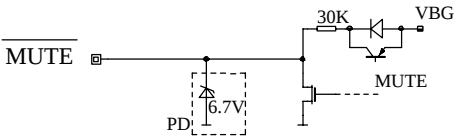
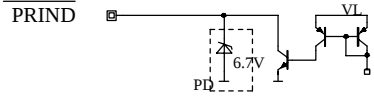
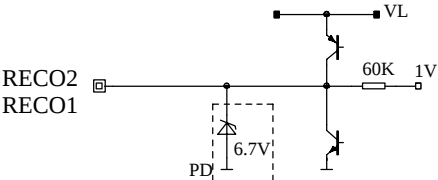
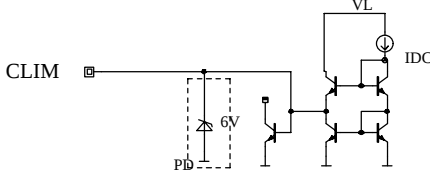
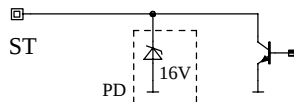
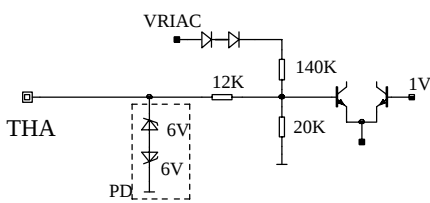
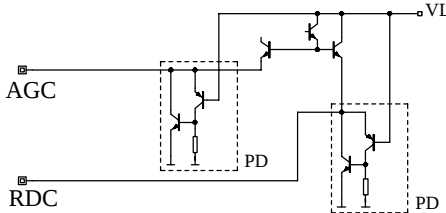
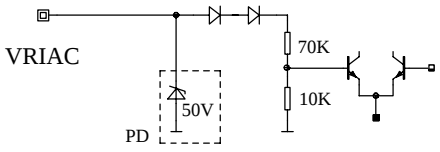
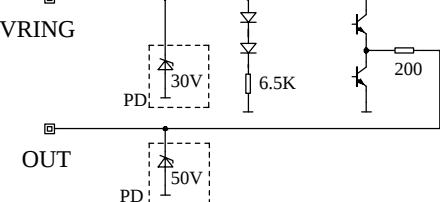
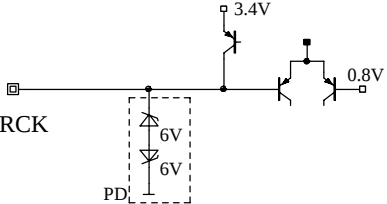
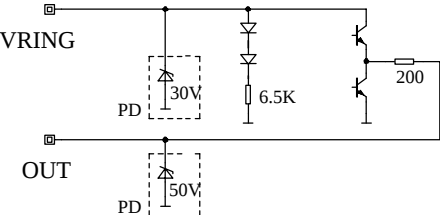
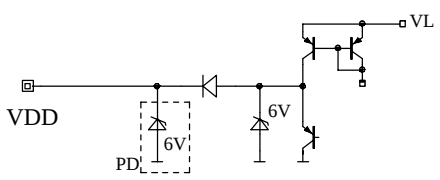
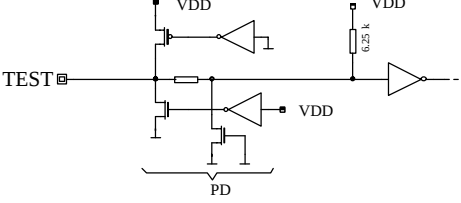
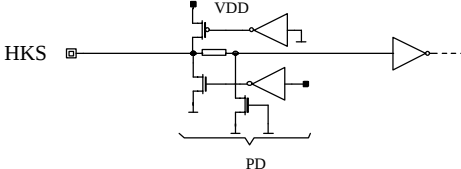


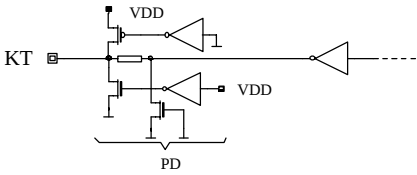
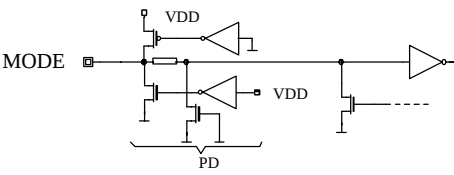
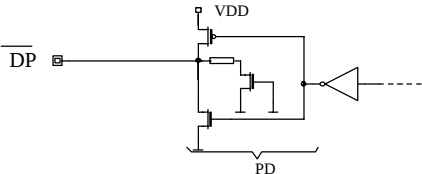
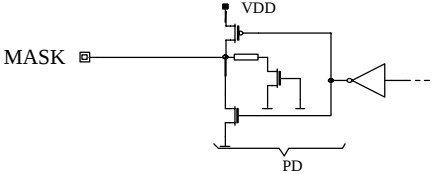
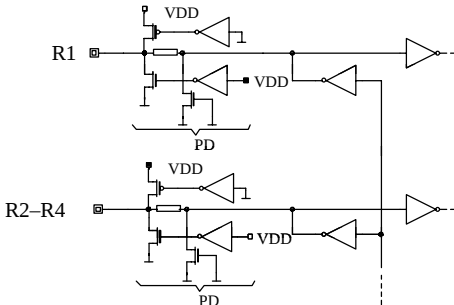
Figure 2. Pinning SSO44

Pin	Symbol	Function	Configuration
1	C1	Keyboard input	
2	C2		
3	C3		
4	C4		
5	Earth	Earth key (604 ms high pulse, 1 s pause)	
6	HFI	Toggle flipflop input Input with 200 kΩ pull-down resistor. HFI triggers HFO with each LOW/ HIGH edge.	
7	HFO	Output will be toggled by each LOW/ HIGH edge at HFI.	
8	XT	A built-in inverter provides oscillation with an inexpensive 3.579545-MHz crystal or ceramic resonator	
9	$\overline{\text{XT}}$		
10	MFO	Output of DTMF DTMF output frequency Specified (Hz)Actual (Hz)Error (%) R ₁ 697 699 +0.28 R ₂ 770 766 -0.52 R ₃ 852 848 -0.47 R ₄ 941 940 -0.10 C ₁ 1209 1216 +0.57 C ₂ 1336 1332 -0.30 C ₃ 1477 1472 -0.34	

Pin	Symbol	Function	Configuration
11	$\overline{\text{MFIND}}$	Output switches to low being in temporary DTMF mode. Reset by on hook condition. Maximum voltage at MFIND = 5.5 V.	
12	GND	Ground	
13	MIC 1	Inverting input of microphone amplifier	
14	MIC 2	Non-inverting input of microphone amplifier	
15	MICO	Transmit pre-amp output which is normally capacitively coupled to Pin TIN	
16	VL	Positive supply voltage input to the device. The current through this pin is modulated by the transmit signal.	
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.	
18	TIN	Input to the line output driver amplifier. Transmit AGC applied to this stage.	

Pin	Symbol	Function	Configuration
19	V_I	This internal voltage bias line must be connected to VL via an external resistor which dominates the AC input impedance of the circuit and should be 680 Ω for an 600- Ω input impedance or 1.2 k Ω for a 900- Ω input impedance.	
20	$\overline{MUTE}$	Pin for testing Forcing $\overline{MUTE}$ to GND mutes the microphone and decreases the earpiece signal by typically 29 dB; no pull up circuit allowed.	
21	$\overline{PRIND}$	PRIVACY indication pin Open collector with minimum 1 mA drive current to GND when PRIVACY = active	
22	RECIN	Receive amplifier input. The receiving amplification is regulated by an AGC.	
23	RECO2	Output of the receive amplifier. Dynamic transducers with a minimum impedance of 100 Ω can be directly driven by these outputs.	
24	RECO1		
25	CLIM	Time constant of anticlipping in transmit path. $CLIM \geq 2.2 \mu F$ $CLIM = GND$: anticlipping inactive	
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.	
27	THA	Ringer threshold adjustment	
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.	

Pin	Symbol	Function	Configuration
29	VRIAC	Ringing supply	
30	VRING	DC supply voltage for the tone ringer is limited to 30 V with integrated Z-diode.	
31	RCK	RC clock oscillator for ringer	
32	OUT	Buzzer output	
33	VDD	Supply output for dialer part	
34	Test	Test input with 6.25 kΩ pull-up resistor	
35	n.c.	Not connected	
36	HKS	Hook switch input. HKS = 0: On-hook state. Chip in sleep mode, no operation (external pull-down resistor recommended). HKS = 1: Off-hook state. Chip enable for normal operation. $I_{HKS} \leq 0.5 \text{ mA}$	

Pin	Symbol	Function	Configuration
37	KT	Keytone output signal which is sent out in pulse dialing mode with a keytone frequency of 582 Hz. KT sink/ drive current is about 100 μ A at $V_{DD} = 2.5$ V	
38	MODE	Pulling MODE pin to: C3 tone mode with 87 ms burst time and 140 ms pause C4 tone mode with 87 ms DTMF burst and 87 ms pause R1 pulse mode with 20 pps, Make/Break = 40/60 R2 pulse mode with 20 pps, Make/Break = 33/66 R3 pulse mode with 10 pps, Make/Break = 40/60 R4 pulse mode with 10 pps, Make/Break = 33/66 C1 pulse mode with 10 pps, Make/Break = 33/66 and temp. DTMF with 87 ms DTMF burst, 140 ms pause MODE pin pulled to R4: with temporary DTMF, 87 ms DTMF burst and 87 ms pause	
39	$\overline{DP}$	Pulse dialing output. Flash key will cause $\overline{DP}$ to be active in either DTMF mode or pulse mode. In on-hook state is $\overline{DP} = V_{DD}$.	
40	Mask	Short mute during pulse dialing, active high During MASK an internal npn-transistor shortens VL against VI.	
41	R1	Keyboard input	
42	R2		
43	R3		
44	R4		

Keyboard Operation

C1	C2	C3	C4		
1	2	3	S	M1	R1
4	5	6	☒	M2	R2
7	8	9	A	M3	R3
* / T	0	#	R / P	N	R4
⌞ ← F1	F2	F3	E	⌞	

- S: Store function key
- A: Indirect repertory dialing function key (LN 0 to 9)
- R/P: Redial and pause function key
- N: Notice function
- * / T: * function; pulse-to-tone function
- 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 (3.6 s).

Keys stored in redial memory: 0 to 9, #, R/P, A, M1, M2, M3, N, * (only tone mode)

Characters F1, F2, F3, Earth, (* in pulse mode) can only be stored in Mn, Ln and N memory.

Characters F1, F2, F3, Earth, (* in pulse mode) will not be dialled out from redial-memory; dialling out was stopped, when recognizing one of the above characters.

Example:

OFF/ HOOK , D1, D2, F1, D4, D5, S, S, M1

- a) ON/OFF-HOOK, R/P only D1, D2 will be dialed out, then dialing out stops
- b) ON/OFF-HOOK, M1 D1, D2, F1, D4, D5 will be dialed out

Content of redial memory can be copied to Mn, Ln, N; but copying memory Mn, Ln, N to itself or to another memory (except redial memory) will erase the destined memory.

Example:

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

a) ON/OFF-HOOK, R/P, N.

D1, ... Dn copied to N

b) ON/OFF-HOOK, R/P, S, S, Mn (or Ln)

D1, ... Dn copied to Mn (or Ln)

but

OFF/ HOOK, M1

content of M1 will be dialed out

a) ON/OFF-HOOK, R/P, S, S, M2

not possible, M2 will be erased

b) ON/OFF-HOOK, M1, S, S, M2

not possible, M2 will be erased

Number Store

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

1. D1, D2, ..., Dn will be stored in memory location only (not in redial memory) and dialed out.

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

2. D1, D2, ..., Dn will be stored in memory location but will not be dialed out.

3. R/P and */T keys can be stored as a digit in memory, also F1, F2, F3, Earth.

In store mode, R/P is the pause function key; */T is the pulse-to-tone function key.

4. The store mode is released after the store function is executed or when the state of the hook switch is changed.

5. Number store can be linked without going ON/OFF-Hook

Example:

OFF/HOOK

S, D1, D2, ... Dn, S, M1

storing D1, D2, ... Dn to M1

S, D1', D2', ... Dn', S, M2 ...

storing D1', D2', ... Dn' to M2

Repertory Dialing

1. OFF HOOK , Mn

2. OFF HOOK , A , Ln

Notice (N)

, , , ..., ,

1. If the dialing of to is finished, pressing the key will cause D1 to Dn to be copied to the N memory.
2. Pressing key N again, after D1, D2, ... Dn was copied to N, N will be dialed out again

,

3. D1 to Dn will be dialed out after the N key is pressed.
4. Notice function is valid as first key only.

Cascaded Dialing

1. + +
2. + +
3. + +
4. Redialing is valid as first key-in only.

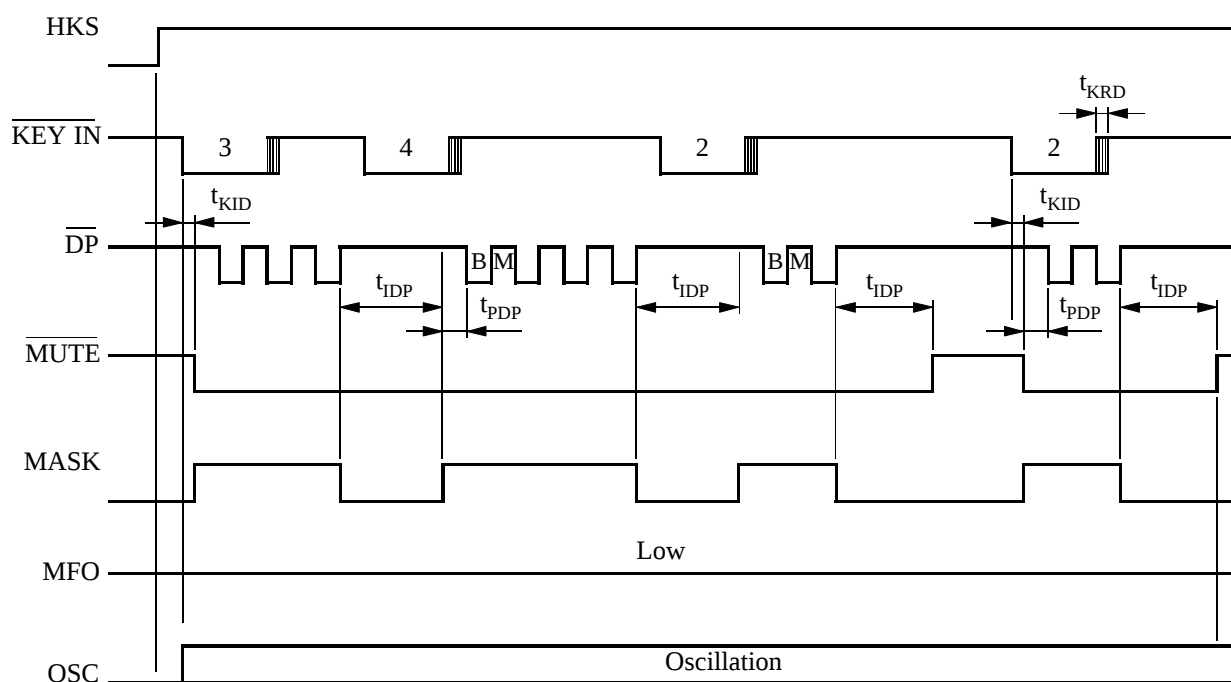


Figure 3. Pulse mode normal dialing

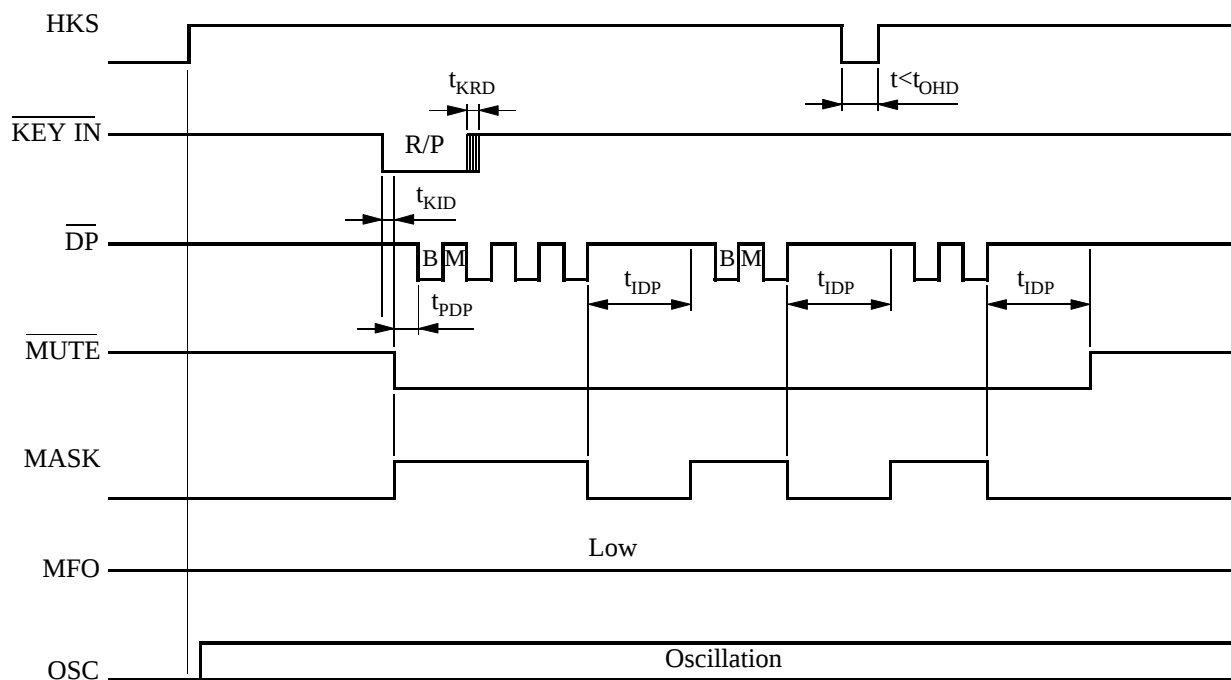


Figure 4. Pulse mode auto dialing

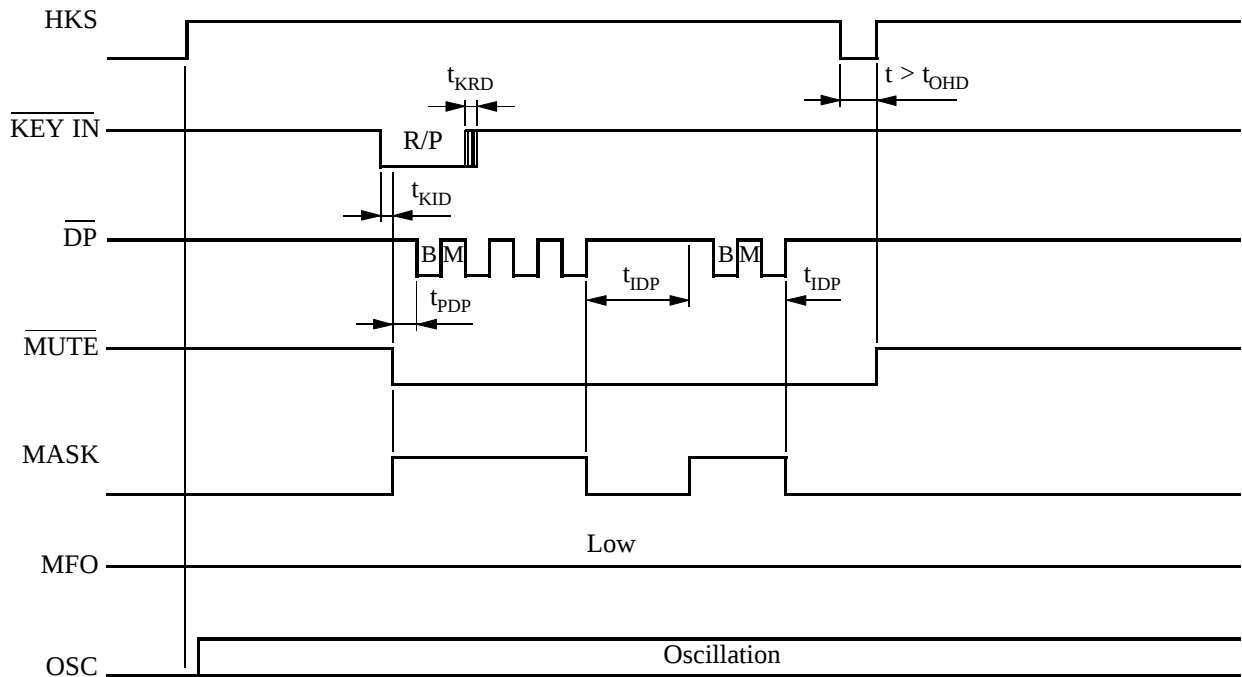


Figure 5. Pulse mode auto dialing

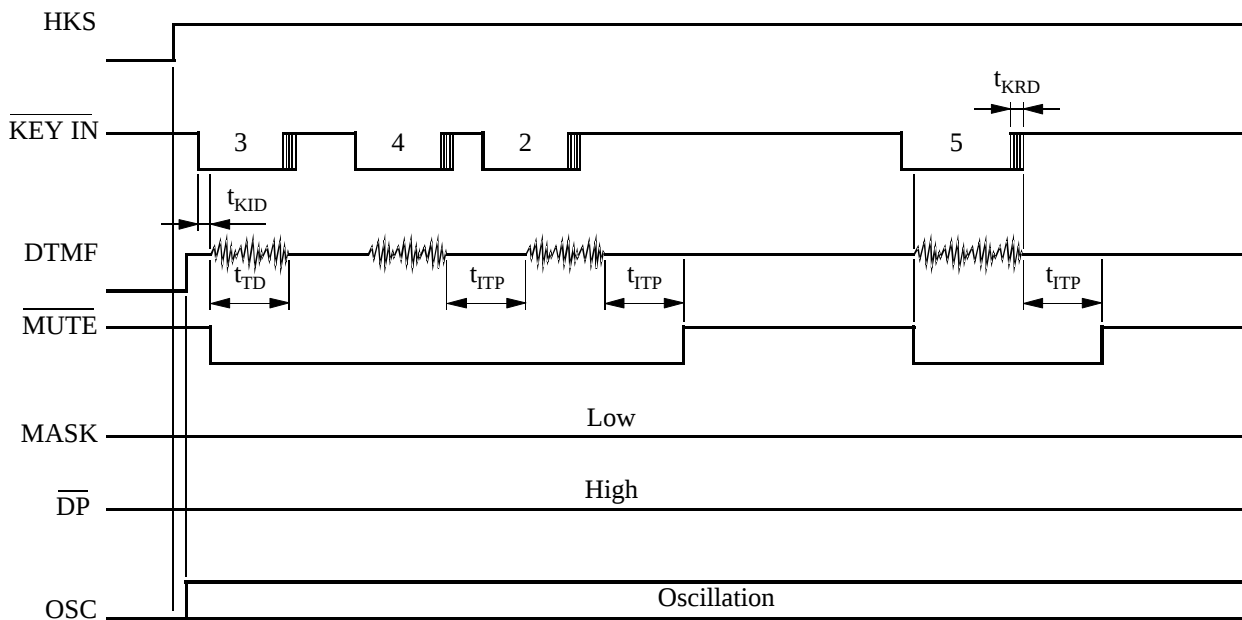


Figure 6. DTMF mode normal dialing

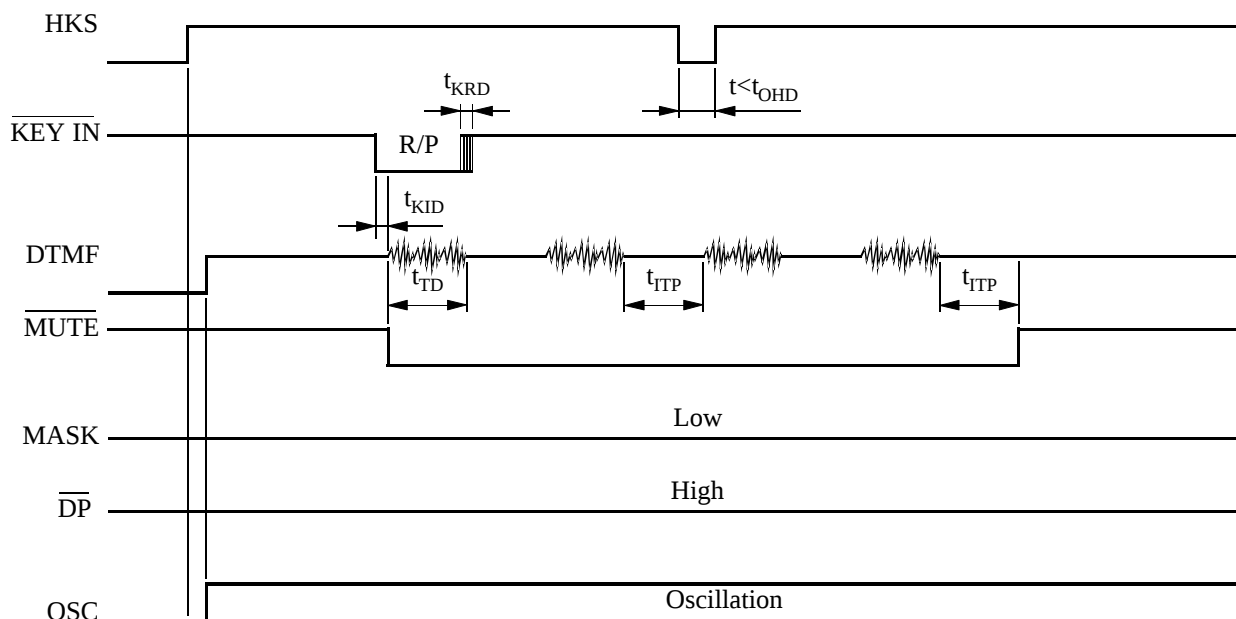


Figure 7. DTMF mode auto dialing ($t < t_{OHD}$)

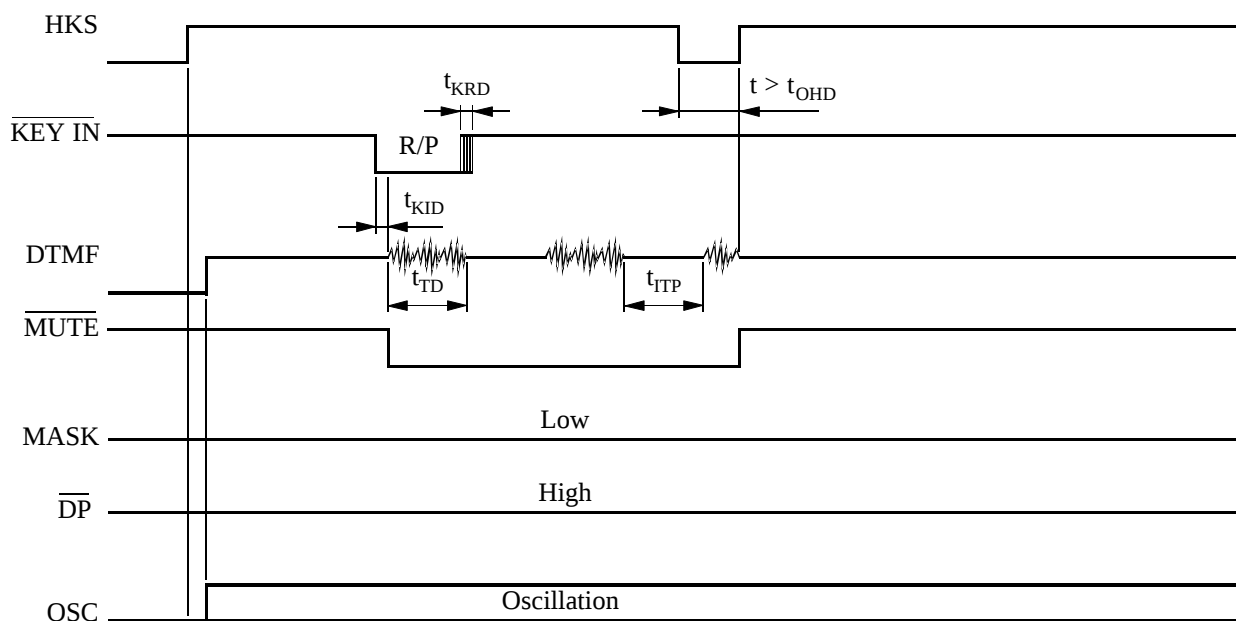


Figure 8. DTMF mode auto dialing ($t > t_{OHD}$)

Access Pause

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

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

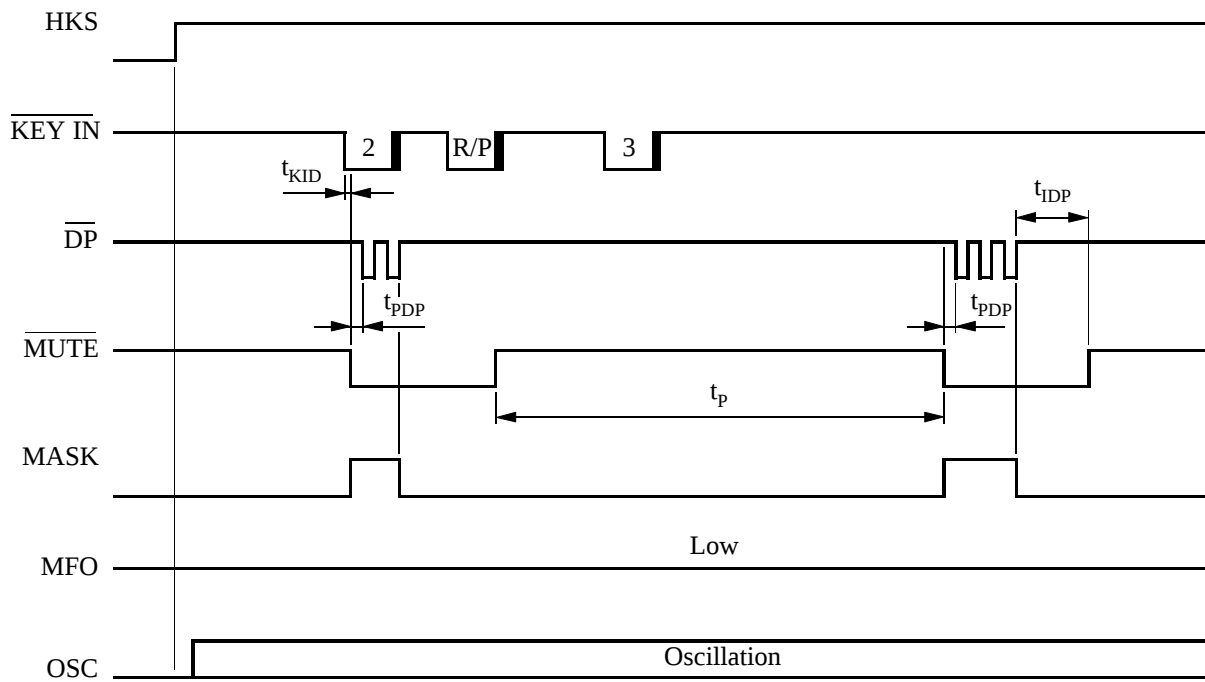


Figure 9. Pause function

Pulse-to-Tone (* /T)

OFF HOOK , D1 , D2 , ..., Dn , * /T , D1' , D2' , ..., Dn'

- 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)
- If the mode switch is set to tone mode, then the output signal will be:
 D1, D2, ..., Dn, * , D1', D2', ..., Dn'
 (Tone) (Tone) (Tone)
- The dialer remains in tone mode when the digits have been dialed out and can be reset to pulse mode by going on-hook only.
- ON/OFF-HOOK, R/P D1, D2, ..., Dn dialed out, then further dialing out stops and remains in pulse mode, when dialling from redial memory.
- If characters are stored in Mn, Ln or N, dialing out be the same in pulse mode as point 1.

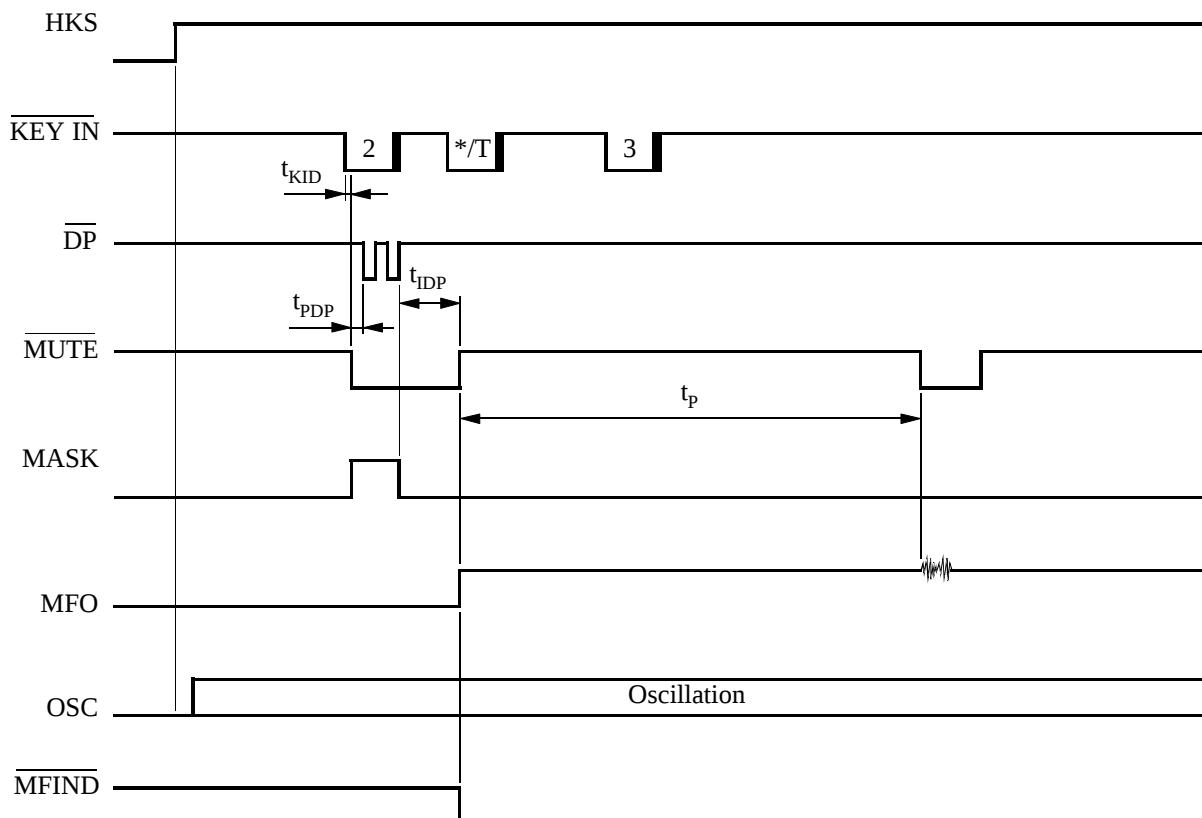


Figure 10. Pulse-to-tone operation

Flash (F1 or F2 or F3)

OFF HOOK

,

F_n

1. The dialer will execute flash break and the entire flash pause time will elapse before the next digits are dialed out.
2. The flash key can be stored as a digit in the memory. Only one flash, however, will be released to the users.
3. The system will return to the initial state after the flash pause time has elapsed.

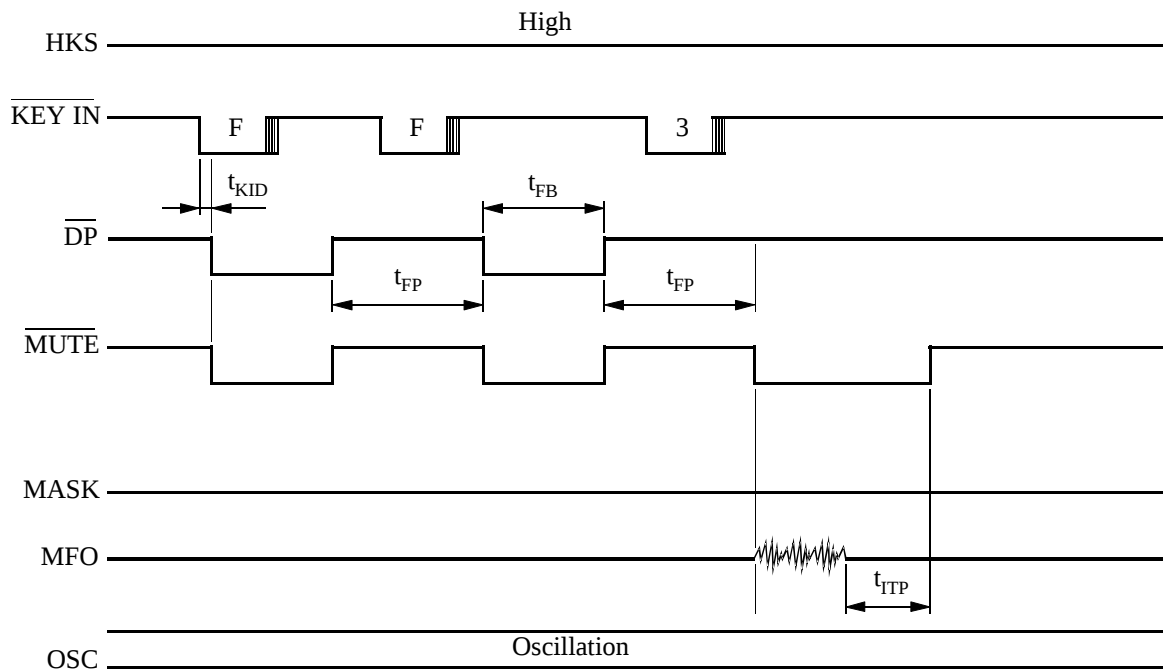


Figure 11. Flash operation

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

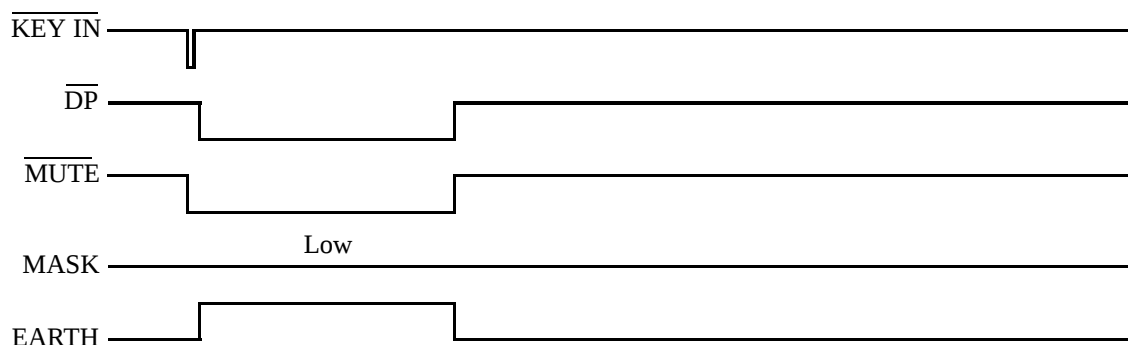


Figure 12. Symbolic timing diagram: Earth function

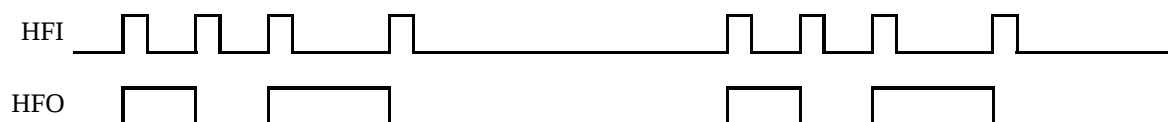


Figure 13. Symbolic timing diagram: HFI, HFO function



Figure 14. Symbolic timing diagram: on hook debounce time

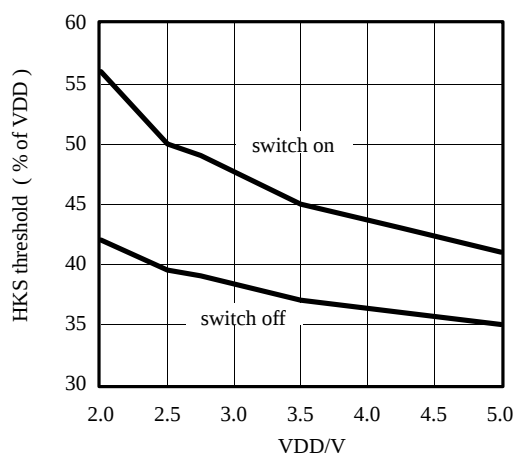


Figure 15. HKS threshold voltage

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Line current	I_L	140	mA
DC line voltage	V_L	14	V
DC voltage at Pins 1 to 11 and 33 to 44	V_{DC}	5.5	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, $T_{amb} = 60^\circ\text{C}$ SSO44	P_{tot}	0.9	W
Junction ambient SSO44	R_{thJA}	70	K/W

ESD withstand voltage 1 kV according to ESD standard S5.1 (HBM)

Electrical Characteristics: Speech Circuit

Reference point Pin GND, $f = 1000 \text{ Hz}$, $0 \text{ dBm} = 775 \text{ mV}_{\text{rms}}$, $R_{\text{DC}} = 39 \Omega / 1 \text{ W}$, $T_{\text{amb}} = 25^\circ\text{C}$, unless otherwise specified, refer to “Basic Test Circuit”. CLIM = GND

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Line voltage	I _L = 8 mA	V _L		1.4		V
	I _L = 20 mA		3.6	3.85	4.1	V
	I _L = 73 mA		5.9	6.55	7.2	V
	I _L = 100 mA		6.9		8.2	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
Gain change with current	I _L = 20 to 60 mA R _{AGC} = infinite	ΔG _S	−0.5		0.5	dB
Gain deviation	T _{amb} = −10 to +60°C I _L = 20 mA	ΔG _S	−0.5		0.5	dB
Line-loss compensation	R _{AGC} = 12 kΩ, I _L = 73 mA	ΔG _s	−7	−6	−4.8	dB
Distortion at line V _L = 0.775 V _{rms}	I _L = 20 mA, S5 = open	d _t			2	%
Max. output voltage at line d ≤ 5%	I _L = 20 mA, V _{mic} = 10 mV, CLIM = 2.2 μF, S ₁ = open	V _{Lmax}		1.2		dBm
Attack time transmit anticlipping	CLIM = 2.2 μF	t _{att}		3.5		ms
Noise at line weighted psophometrically	I _L > 20 mA, G _S = 48dB	n _o			− 72	dBmp
Sidetone reduction	I _L ≥ 20 mA	G _{STA}	10	15	20	dB
DTMF amplifier						
Volume range d < 5%	Single tone, I _L ≥ 20 mA	V _L	1.3			dBm
DTMF output level low frequency group	I _L = 20 mA, S5 = closed T _{amb} = −5°C to +60°C	V _L	−7.6		−4.6	dBm
Pre-emphasis between high- and low-level frequency group	P _{PRE} = P _{HLG} − P _{LLG} , S5 = closed, T _{amb} = −5°C to +60°C	P _{PRE}	1.9	2.5	3.1	dB
Total harmonic distortion relative to sum level of low and high frequency group signal	IL ≥ 20 mA, measured at Pin MFO	THD		−33	−25	dBr
Receiving amplifier						
Gain	I _L ≥ 20 mA	G _R	3		5	dB
Gain change with current	I _L = 20 to 60 mA R _{AGC} = infinite	ΔG _R	−0.5		0.5	dB
Gain deviation	T _{amb} = −10 to +60°C I _L = 20 mA	ΔG _R	−0.3		0.7	dB
Line-loss compensation	I _L = 73 mA	ΔG _R	−7	−6	−4.7	dB

Electrical Characteristics: Speech Circuit (continued)

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Receiving noise at earphone weighted psophometrically	$I_L = 73 \text{ mA}$	n_i		-77.5	-71	dBm
Gain change when muted	$I_L \geq 20 \text{ mA}$	G_{RM}	24	29	34	dB
Output voltage push-pull	$I_L \geq 20 \text{ mA}$, $Z_{ear} = 68 \text{ nF}$, 100Ω in series, $d \leq 2\%$	V_{RECO}	0.8	0.9		V_{rms}
Ear protection differential	$I_L = 40 \text{ mA}$, $V_{gen} = 4 V_{rms}$, $Z_{ear} = 68 \text{ nF} + 100 \Omega$	V_{ear}	1.3	1.6	2.5	V_{rms}
Supply voltage (for internal use only)						
Output voltage Note: Output must be limited externally to max. 5.5 V	$I_L \geq 20 \text{ mA}$ dialing mode	V_{DD}	2.0		6.3	V
Available current for peripherals	$I_L \geq 20 \text{ mA}$ dialing mode	I_{DD}	150			μA
Transmit						
Maximum output voltage swing at line	$I_L = 20 \text{ mA}$, $V_{MIC} = 50 \text{ mV}_{rms}$	V_{Lmax}		3.4	4	V_{pp}
Mute suppression transmit with privacy function	$I_L = 20 \text{ mA}$	G_{SPRIV}	60			dB

DC Characteristics Dialer

$V_{DD} = 2.7 \text{ V}$, $f_{OSC} = 3.58 \text{ MHz}$, all outputs unloaded, S9 closed; HKS = 1

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Memory retention current	HKS = 0, $V_{DD} = 1.0 \text{ V}$	I_{MR}			0.1	μA
Data retention voltage				0.5		V
DTMF distortion	$R_L = 5 \text{ k}\Omega$	d		-30	-23	dB
DP output sink current	$V_{PO} = 0.5 \text{ V}$	I_{PL}	0.5			mA
Keyboard input drive current	$V_I = 0 \text{ V}$	I_{KD}		20		μA
Keyboard input sink current	$V_I = 2.7 \text{ V}$	I_{KS}		500		μA
Key on resistance		R_{KON}			5	$\text{k}\Omega$
Key off resistance		R_{KOFF}	100			$\text{k}\Omega$
Mask sink / drive current		$I_M \text{ H/L}$	0.5			mA
Earth sink / drive current		$I_e \text{ H/L}$	0.5			mA
Isolation resistance XT/ $\overline{\text{XT}}$		R_{iso}	4.7			$\text{M}\Omega$
Maximum voltage at HKS					5.5	V
Maximum input current at HKS					0.5	mA

AC Characteristics Dialer

$V_{DD} = 2.7\text{ V}$, $f_{OSC} = 3.58\text{ MHz}$, all outputs unloaded, S9 closed; HKS = 1

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Keypad active in debounce mode		t_{KID}	15	20	25	ms
Key release debounce		t_{KRD}	15	20	25	ms
Pre-digit pause	MODE pin = R3 (10 pps)	t_{PDP}	37	40	41	ms
	MODE pin = C1, C4 (10 pps)	t_{PDP}	31	33.3	33.5	ms
	MODE pin = R1 (20 pps)	t_{PDP}		20		ms
	MODE pin = R2	t_{PDP}		16.65		ms
Inter-digit pause (auto dialing)	10 pps, $t_{IP} = t_{IDP} + t_{PDP}$	t_{IP}	810	836	860	ms
	20 pps	t_{IP}		512		ms
Make/break ratio	MODE pin = R1 (20 pps), R3 (10 pps)	M/B	40.8:60.2	40:60	39.2:60.8	%
	MODE pin = C1, R4 (10 pps)			33:67		%
	R2 (20 pps)		35.6:64.4		31.2:68.8	
DTMF output duration	Auto dialing, MODE = C4	t_{TD}	84	87	90	ms
	MODE = C3		84	87	90	
Inter-tone pause	Auto dialing, MODE = C4	t_{ITP}	84	87	90	ms
	MODE = C3		135	140	147	
Flash break time F1 F2 F3	C ₁ connected to GND	t_{FB}	95	98	101	ms
	C ₂ connected to GND		245	250	255	ms
	C ₃ connected to GND		590	604	610	ms
Rise time of leading edge at HKS	20 to 70% of VDD	t_{rHKS}			10	ms
Flash pause time	F1, F2, F3	t_{FP}	0.9	1	1.1	s
Pause time		t_p	3.5	3.6	3.7	s
On-hook debounce time		t_{ohd}	145	165	185	ms
Earth time	C ₄ connected to GND	t_{et}		604		ms
Earth pause time		t_{pt}	0.9	1	1.1	s
Break duration	MODE pin = R3	t_B	57.6	60	62.4	ms
	MODE pin = C1, R4		63	66.7	69	ms
	MODE pin = R1 (20 pps)	t_B		30		ms
	MODE pin = R2			33.35		ms
Make duration	MODE pin = R3	t_M	38	40	41	ms
	MODE pin = C1, R4		31	33.3	35	ms
	MODE pin = R1 (20 pps)	t_M		20		ms
	MODE pin = R2			16.65		ms
Break + make duration	MODE pin = C1, R3, R4	t_p	95	100	105	ms
	MODE pin = R1, R2 (20 pps)	t_p		50		ms

Electrical Characteristics Tone Ringer

$f_{RCK} = 4 \text{ kHz}$, $V_{RING} = 20 \text{ V}$, $T_{amb} = 25^\circ \text{C}$, reference point GND, unless otherwise specified

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply current, outputs open	$V_{RIAC} = 20 \text{ V}$	I_{RING}	2.1		3.8	mA
Switch-on threshold	V_{RIAC} , $THA = \text{open}$	V_{RON}	8	9	10	V
Switch-off threshold	V_{RIAC}	V_{ROFF}	5.0	5.6	6.5	V
Ringing frequency	$R = 150 \text{ k}\Omega$, $C = 1 \text{ nF}$ $V_{RIAC} > V_{RON}$	f_{1H}	937	1010	1083	Hz
		f_{1L}	752	808	868	Hz
Range of external capacitor		C	1000		2200	pF
Range of external resistor		R	50		330	k Ω
Audio sequence frequency		f_2	11.5	12.5	14.0	Hz
Output voltage swing	$V_{Ring} = 25 \text{ V}$, $C_{out} = 68 \text{ nF}$	V_{out}	21	23		V _{pp}
Turn-off delay	See figure 15	t_{off}		65	100	ms

Remark: Max. current into internal Zener Diode at Pin VRING = 20 mA

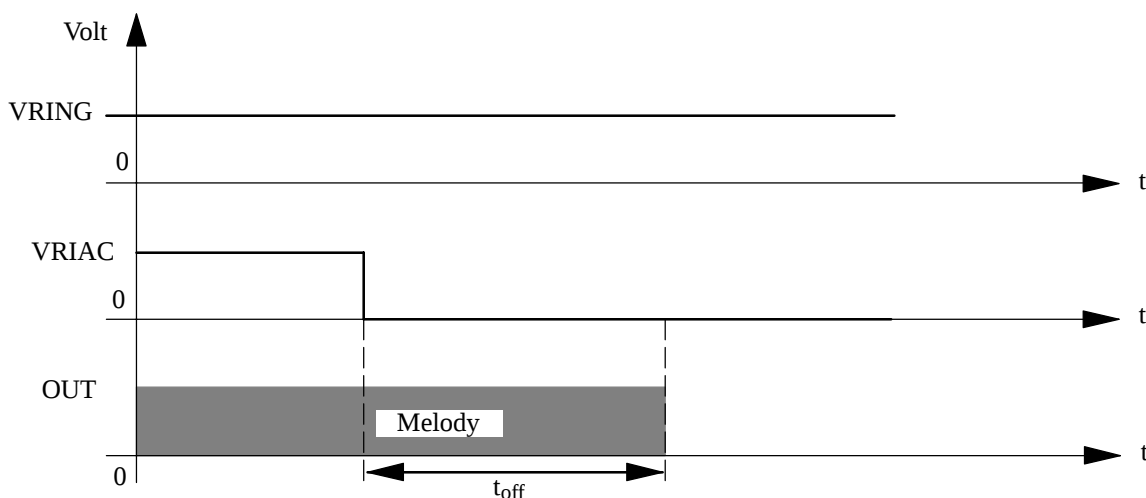


Figure 16. Turn-off delay time

Note

The oscillator frequency is defined by R and C at Pin RCK.

$$f_{Osc} \approx \frac{1}{1.594 \times C \times [R + 3809 \Omega]}$$

The audio sequence frequency f_2 and the ratio of low frequency f_{1L} and high frequency f_{1H} are derived from

oscillator frequency by internal dividers. So f_2 , f_{1H} and f_{1L} are given by:

$$f_2 = \frac{f_{Osc}}{320} ; f_{1H} = \frac{f_{Osc}}{4} ; f_{1L} = \frac{f_{Osc}}{5}$$

For more information of adjusting ringer melody see document "Application and Adjustment Hints"

Basic Test Circuit

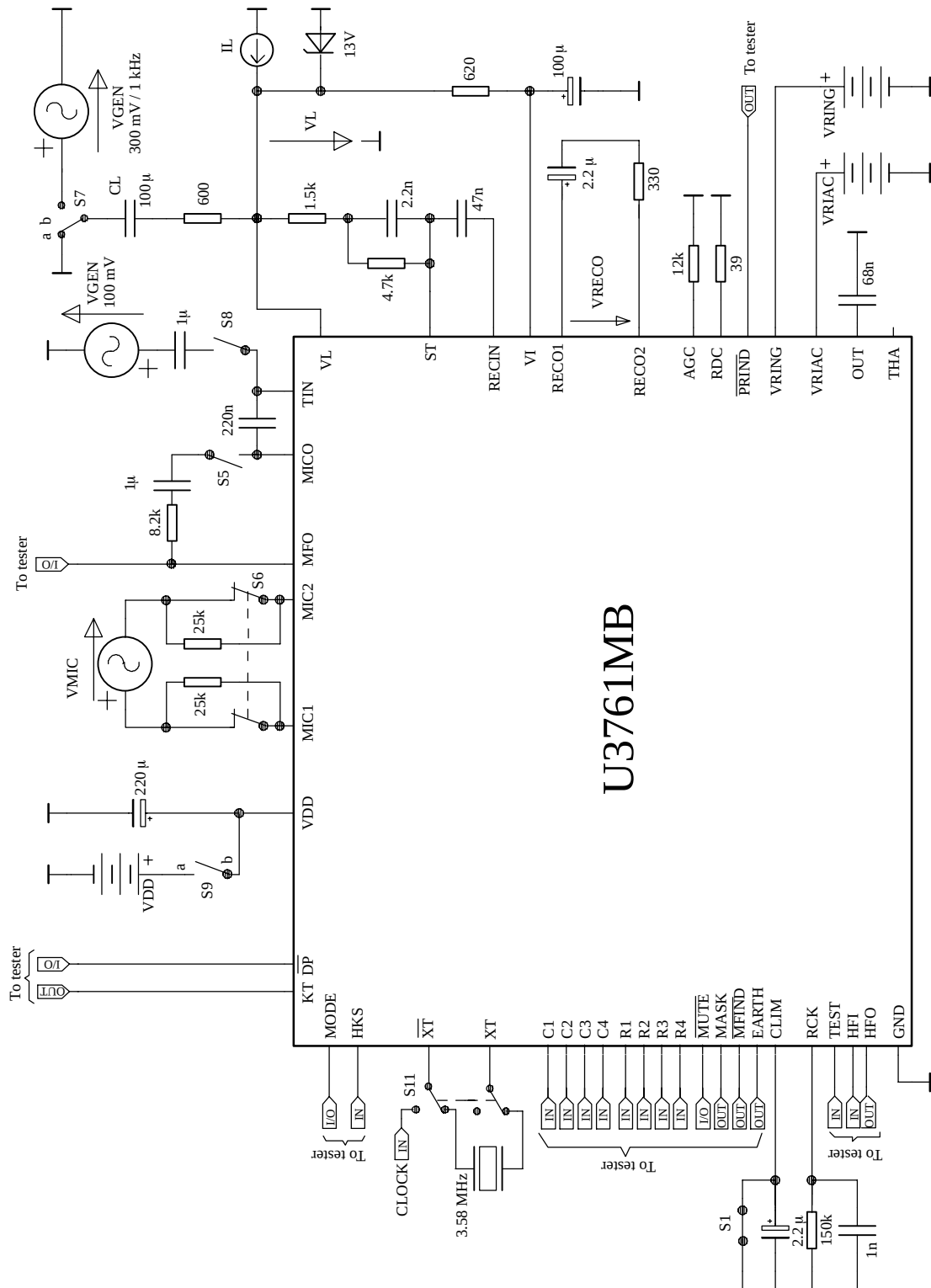


Figure 17. Basic test circuit

Equations for Electrical Characteristic Parameters of the Speech Circuit

The equations refer to the basic test circuit. If not otherwise specified, the switches in the basic test circuit are inactive.

Transmit gain

$$GS = 20 \times \log \left(\frac{V_L}{V_{MIC}} \right)$$

$V_{MIC} = 3 \text{ mV/1 kHz}$, S5 = open

Receiving gain

$$GR = 20 \times \log \left(\frac{V_{RECO}}{V_L} \right)$$

RX-mode: $V_{gen} = 300 \text{ mV/1 kHz}$, S7b

Line-loss compensation transmit

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

TX-mode: $V_{MIC} = 3 \text{ mV/1 kHz}$, S5 = open

Sidetone reduction

$$GSTA = 20 \times \log \left(\frac{V_L}{V_{RECO}} \right) (\text{in TX-mode}) + GR$$

TX-mode: $V_{MIC} = 3 \text{ mV/1 kHz}$, S5 = open

Line-loss compensation receive

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

RX-mode: $V_{gen} = 300 \text{ mV/1 kHz}$, S7b

Input impedance of microphone amplifier

$$R_i = \frac{50 \text{ k}}{\left(\frac{V_{L(S6 = \text{closed})}}{V_{L(S6 = \text{open})}} - 1 \right)}$$

TX-mode: $V_{MIC} = 3 \text{ mV/1 kHz}$, S5 = open

Gain change when muted

$$GRM = 20 \times \log \frac{V_{RECO}}{V_L} (\text{Mute} = \text{inactive}) - 20 \times \log \frac{V_{RECO}}{V_L} (\text{Mute} = \text{active})$$

$V_{gen} = 100 \text{ mV/1 kHz}$, S5 = open, S8 = open

Total Harmonic Distortion (THD)

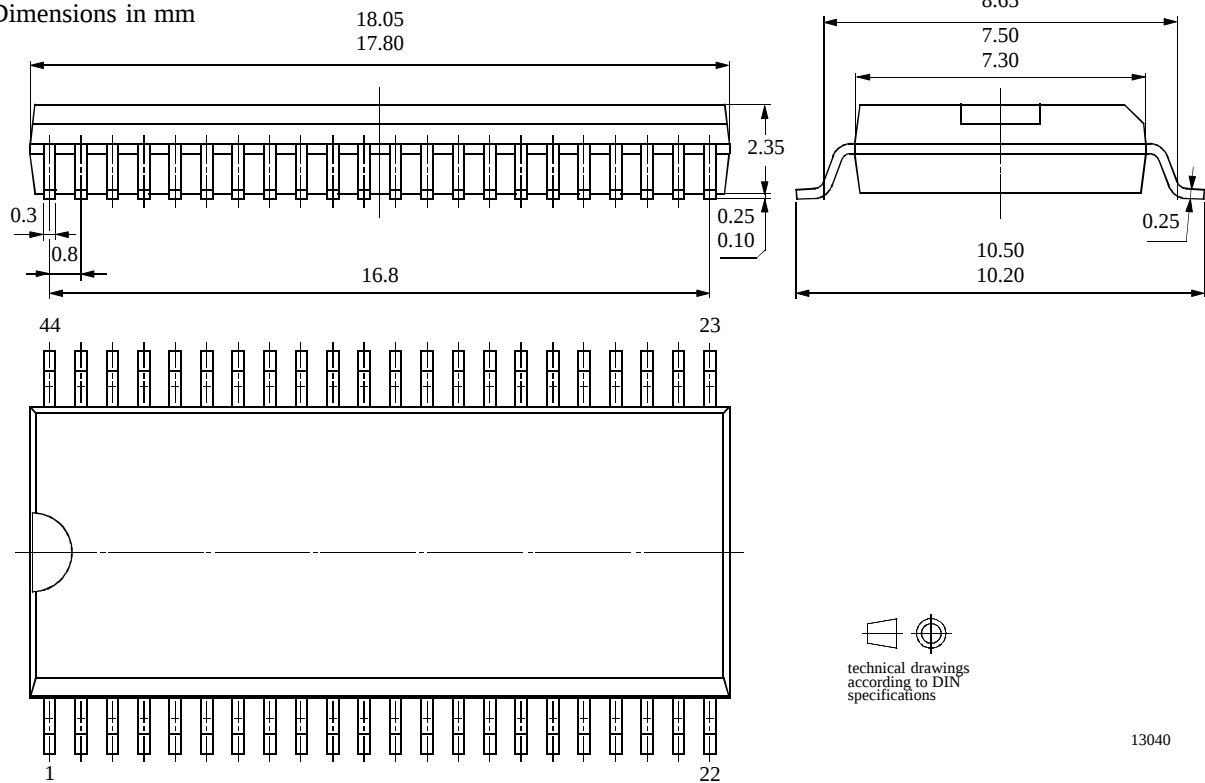
$$THD = 20 \times \log \left[\frac{\sqrt{n_1 \times U_{LG}^2 + n_1 \times U_{HG}^2 + n_2 \times U_{LG}^2 + n_2 \times U_{HG}^2 + \dots + n_n \times U_{LG}^2 + n_n \times U_{HG}^2}}{\sqrt{U_{LG}^2 + U_{HG}^2}} \right]$$

$n_1, \dots, n_n$ = harmonics of high and low frequency group

Packaging Information

Package SSO44

Dimensions in mm



Ozone Depleting Substances Policy Statement

It is the policy of **Atmel Germany 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.

Atmel Germany GmbH 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.

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

We reserve the right to make changes to improve technical design and may do so without further notice.

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