Pulse and DTMF dialler with redial   PCD3310 family

FEATURES

- Pulse and DTMF dialling
- 23-digit capacity for redial operation (cursor method)
- Memory clear and electronic notepad
- Mixed-mode dialling: start with PD and end with DTMF dialling
- Dual redial buffers for PABX and public calls
- Four extra function keys; program, flash, redial, PD to DTMF (mixed dialling)
- DTMF timing:
  manual dialling - minimum duration for bursts and pauses
  re-dialling - calibrated timing
- On-chip voltage reference for supply and temperature independent tone output
- On-chip filtering for low output distortion (CEPT CS 203 compatible)
- On-chip oscillator uses low-cost 3.58 MHz (tv colour burst) crystal or piezo resonator
- Uses standard single-contact or double-contact (common left open) keyboard
- Keyboard entries fully debounced
- Flash (register recall) output

GENERAL DESCRIPTION

The PCD3310 family are single-chip silicon gate CMOS integrated circuits with on-chip oscillators suitable for use with 3.58 MHz crystals. They are dual-standard dialling circuits for either pulse dialling (PD) or dual tone multi-frequency (DTMF) dialling.

Input data is derived from any standard matrix keyboard for dialling in either DP or DTMF mode. Numbers of up to 23 digits can be retained in RAM for redial and notepad facilities.

In DTMF mode bursts as well as pauses are timed to a minimum, in manual dialling the maximum depends on the key depression time. For data communication mix mode dialling is also possible.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DD}	operating supply voltage		2.5	-	6.0	V
V_{DDO}	standby supply voltage		1.8	-	6.0	V
I_{DDO}	low standby current (on hook)	$V_{DDO} = 1.8$ V	-	-	2	µA
	operating currents	$V_{DD} = 3.0$ V				
I_{DDC}	conversation mode		-	-	150	µA
I_{DDP}	pulse dialling mode		-	-	200	µA
I_{DDF}	DTMF dialling mode		-	-	0.9	µA
	DTMF output voltage level		-	192	-	mV
$V_{HG(rms)}$	HIGH group		-	150	-	mV
$V_{LG(rms)}$	LOW group					
ΔV_G	pre-emphasis of group		-	2.1	-	dB
THD	total harmonic distortion		-	-25	-	dB
Tamb	operating ambient temperature range		-25	-	+70	°C

Note:

the PCD3310C, PCD3310E, PCD3310F and PCD3310H are not to be used for new design-ins.

Pulse and DTMF dialler with redial

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ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
PCD3310XP*	20	DIL	plastic	SOT146
PCD3310XT*	28	SO28	plastic	SO28; SOT136A

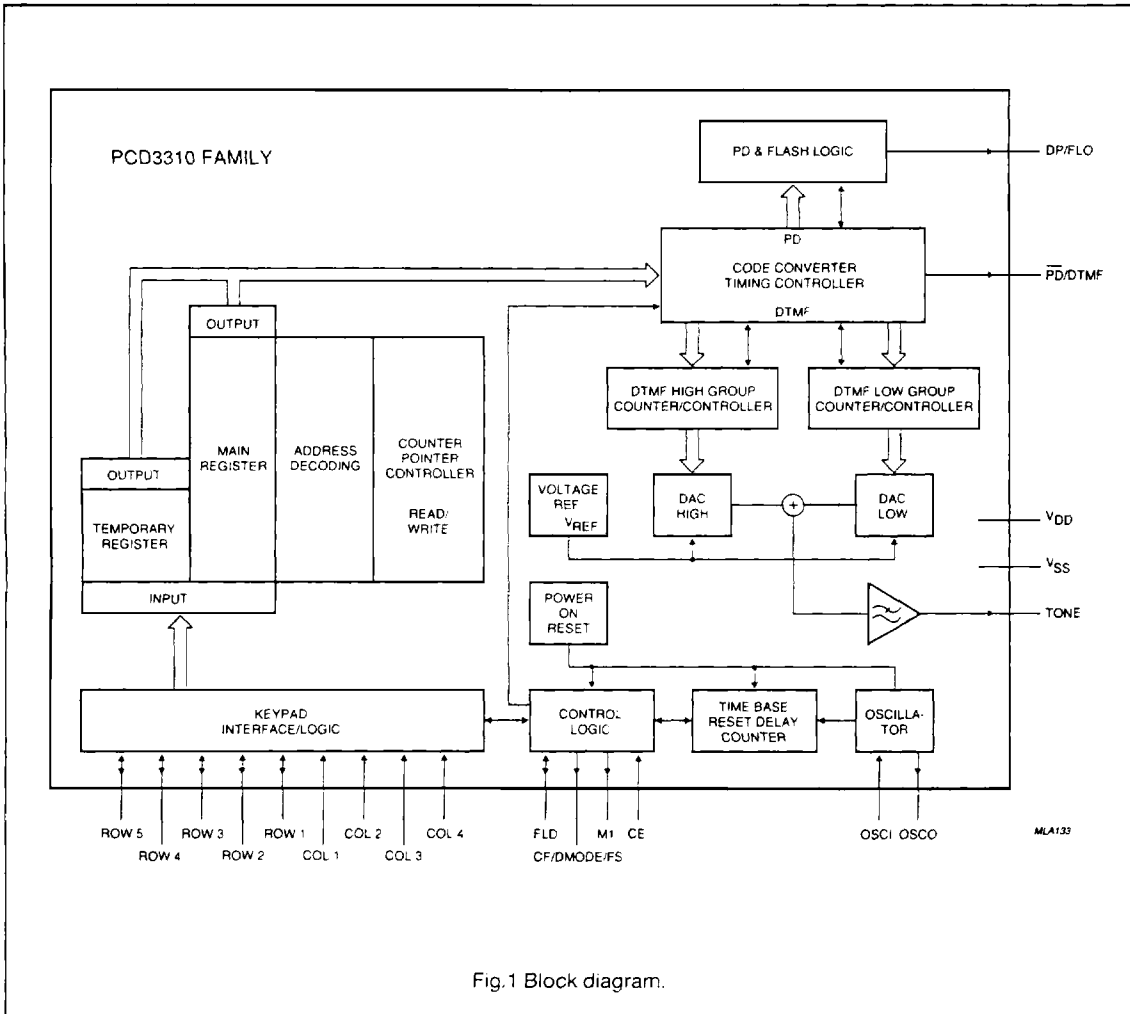* When ordering 'X' is replaced by one of the letters A, C, E, F, G, H or nothing.

Fig.1 Block diagram.

Pulse and DTMF dialler with redial

PCD3310 family

Table 1 The PCD3310 family of ICs.

|	
PCD3310	P/T dialler with redial, notepad, 4 x 5 keypad, flash, mark/space ratio 2:1, PABX register, automatic access pause control access to the cursor method.
PCD3310A	item PCD3310 with 3:2 mark/space ratio
PCD3310C	item PCD3310 with dialling mode output
PCD3310E	item PCD3310 with also 20 Hz pulse dialling
PCD3310F	item PCD3310 with DTMF timing of 60/90 ms
PCD3310G	item PCD3310 during switch over to data mode the '*' and '#' keys do not send out their corresponding tones
PCD3310H	item PCD3310 M1 replaced by M2

PCD3310 FAMILY SURVEY

FUNCTION	PCD3310	PCD3310A	PCD3310C	PCD3310E	PCD3310F	PCD3310G	PCD3310H
Redial key	R	R	R	R	R	R	R
Notepad keys; note 1	P/R	P/R	P/R	P/R	P/R	P/R	P/R
Mixed mode entry PD-DTMF + tone PD-DTMF no tone	* # A-D >	* # A-D >	* # A-D >	* # A-D >	* # A-D >	A-D > * #	* # A-D >
Keypad (4x5, A-D)	3 x 5	3 x 5	3 x 5	3 x 5	3 x 5	3 x 5	3 x 5
Pulse dial; break/make 10 Hz, t_{id} = 840 ms 20 Hz, t_{id} = 504 ms	67, 33	60, 40	67, 33	67, 33 34, 17	67, 33	67, 33	67, 33
DTMF dial: tone/pause (ms) mute hold-over	70, 70 80	70, 70 80	70, 70 80	70, 70 80	60, 90 100	70, 70 80	70, 70 80
Flash (ms)	100+	100+	100+	100+	100+	100+	100+
Pin 15 (SOT146) Pin 20 (SO28; SOT136A)	CF CF	CF CF	DMODE DMODE	FS FS	CF CF	CF CF	CF CF
Memory main, data Memory PABX	23 5	23 5	23 5	23 5	23 5	23 5	23 5
SOT146 package SO28/SOT136A package	20 28	20 28	20 28	20 28	20 28	20 28	20 -

Notes to the Family survey

1. P = program, R = dial.
2. PCD3310H only available in DIL package.

Pulse and DTMF dialler with redial
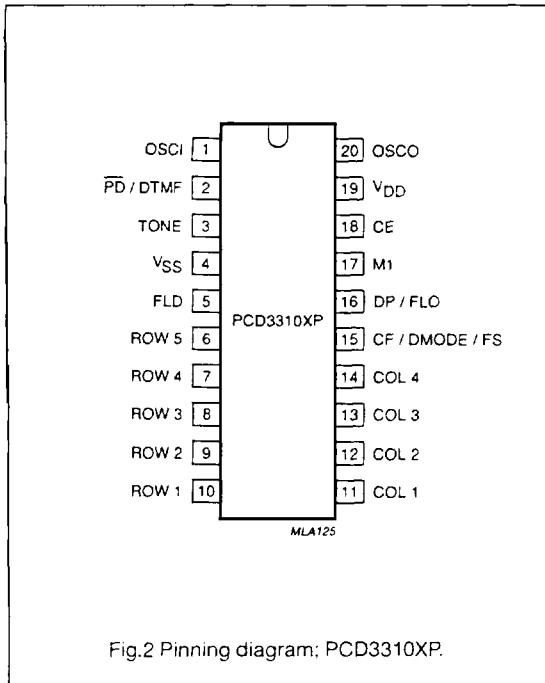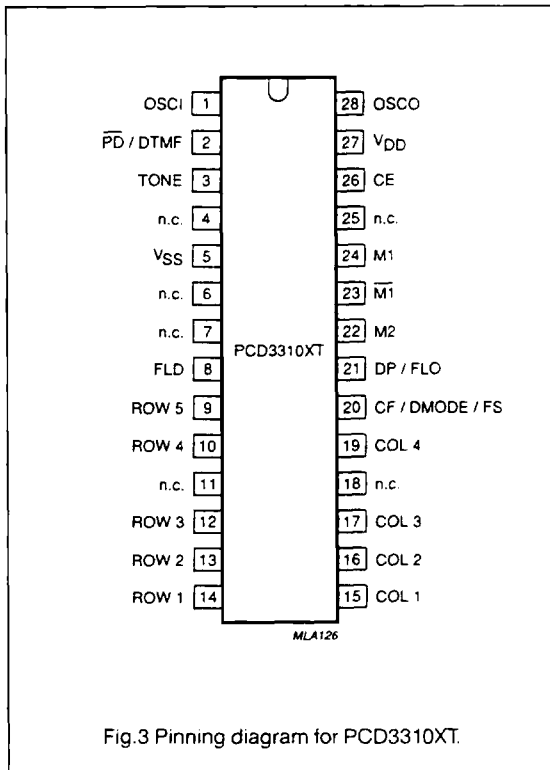
PCD3310 family

Fig.2 Pinning diagram; PCD3310XP.

PINNING

SYMBOL	PIN	DESCRIPTION
OSCI	1	oscillator input
$\overline{PD}$/DTMF	2	select pin; pulse or DTMF dialling
TONE	3	single or dual tone frequency output
V_{SS}	4	negative supply
FLD	5	flash duration control input/output
ROW 5	6	scanning row keyboard input/output
ROW 4	7	scanning row keyboard input/output
ROW 3	8	scanning row keyboard input/output
ROW 2	9	scanning row keyboard input/output
ROW 1	10	scanning row keyboard input/output
COL 1	11	sense column keyboard input
COL 2	12	sense column keyboard input
COL 3	13	sense column keyboard input
COL 4	14	sense column keyboard input
CF/DMODE/FS	15	confidence tone output, dialling mode output, frequency select
DP/FLO	16	dialling pulse and flash output
M1	17	muting output
CE	18	chip enable input
V_{DD}	19	positive supply
OSCO	20	oscillator output

Note: COL1 to COL4 have internal pull-ups.

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Fig.3 Pinning diagram for PCD3310XT.

Pulse and DTMF dialler with redial

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PINNING

SYMBOL	PIN	DESCRIPTION
OSCI	1	oscillator input
$\overline{\text{PD}}$/DTMF	2	select pin; pulse or DTMF dialling
TONE	3	single or dual tone frequency output
n.c.	4	not connected
V_{SS}	5	negative supply
n.c.	6	not connected
n.c.	7	not connected
FLD	8	flash duration control input/output
ROW 5	9	scanning row keyboard input/output
ROW 4	10	scanning row keyboard input/output
n.c.	11	not connected
ROW 3	12	scanning row keyboard input/output
ROW 2	13	scanning row keyboard input/output
ROW 1	14	scanning row keyboard input/output
COL 1	15	sense column keyboard input
COL 2	16	sense column keyboard input
COL 3	17	sense column keyboard input
n.c.	18	not connected
COL 4	19	sense column keyboard input
CF/DMODE/FS	20	confidence tone output, dialling mode output, frequency select
DP/FLO	21	dialling pulse and flash output
M2	22	strobe; active HIGH during transmission
$\overline{\text{M1}}$	23	inverted mute output
M1	24	muting output
n.c.	25	not connected
CE	26	chip enable input
V_{DD}	27	positive supply
OSCO	28	oscillator output

Note: COL1 to COL4 have internal pull-ups.

FUNCTIONAL DESCRIPTION

Power supply (V_{DD}; V_{SS})

The positive supply of the circuit (V_{DD}) must meet the voltage requirements as indicated in the DC characteristics. To avoid undefined states of the device when powered-on, an internal reset circuit clears the control logic and counters. If V_{DD} drops below the minimum standby supply voltage of 1.8 V the power-on reset circuit inhibits re-dialling after hook-off. The power-on reset signal has the highest priority; it blocks and resets the complete circuit without delay regardless of the state of chip enable input (CE).

Clock oscillator (OSCI, OSCO)

The time base for the circuit for both PD and DTMF modes is a crystal controlled on-chip oscillator which is completed by connecting a 3.58 MHz crystal or ceramic resonator between the OSCI and OSCO pins.

Recommended resonator type:

- 3.58 MHz PXE - Murata; CSA 3.58MG310VA.

Chip Enable (CE)

The CE input enables the circuit and is used to initialize the device.

CE = LOW provides the static standby condition. In this state the clock oscillator is disabled, all registers and logic are reset with the exception of the Write Address Counter (WAC) and Temporary WriteAddress Counter (TWAC) which point to the last entered digit (see Fig.6). The keyboard input is inhibited, but data previously entered is saved in the redial register as long as V_{DD} is higher than $V_{DDO\,(min)}$. The current drawn is I_{DDO} (standby current) and serves to retain data in the redial register during hook-on.

CE = HIGH activates the clock oscillator and the circuit changes from static standby condition to the conversation mode. The current consumption is I_{DDC} until the first digit is entered from the keyboard. Then a dialling or re-dialling operation starts. The operating current is I_{DDP} if in the pulse dialling mode, or I_{DDF} if the DTMF dialling mode is selected.

If the CE input is taken to a LOW level for longer than time period t_{rd} (see Fig.10a, Fig.10b and timing data) an internal reset pulse will be generated at the end of the t_{rd} period. The system changes to the static standby state. Short CE pulses of $< t_{rd}$ will not affect the operation of the circuit and reset pulses are not produced.

Mode selection ($\overline{\text{PD}}$/DTMF)

PD mode

If $\overline{\text{PD}}$/DTMF = V_{SS} the pulse mode is selected. Entries of non-numeric keys are neglected, they are neither stored in the redial register nor transmitted.

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DTMF mode

If $\overline{PD}$/DTMF = V_{DD} the dual tone multi-frequency dialling mode is selected. Each non-function key activated corresponds to a combination of two tones, each one out of four possible LOW and HIGH group frequencies. The frequencies are transmitted with a constant amplitude, regardless of power supply variations. Harmonic content is filtered out thus meeting the CEPT CS 203 recommendations.

The transmission time is calibrated for redial. In manual operation the duration of bursts and pauses is the actual key depression time, but not less than the minimum transmission time (t_t) or minimum pause time (t_p).

Mixed mode

When the $\overline{PD}$/DTMF pin is open-circuit the mixed mode is selected. After activation of CE or FL (Flash) the circuit starts as a pulse dialler and remains in this state until a non-numeric key (A, B, C, D, *, # or >) is activated. The circuit then changes to DTMF dialling for data communication and remains in this state until FL is activated or after a static standby condition when CE is re-activated.

A connection between the $\overline{PD}$/DTMF pin and V_{DD} also initiates DTMF dialling. Chip enable. FL or a connection of $\overline{PD}$/DTMF pin to V_{SS} sets the circuit back to pulse dialling.

Keyboard inputs/outputs

The sense column inputs COL 1 to COL 4 and the scanning row outputs ROW 1 to ROW 5 of the circuit are connected to the keyboard as shown in Fig.4. All keyboard entries are debounced on both the leading and trailing edges for approximately time period t_e as shown in Fig.11. Each entry is tested for validity. When a key is depressed, keyboard scanning starts and only returns to the sense mode after release of that key.
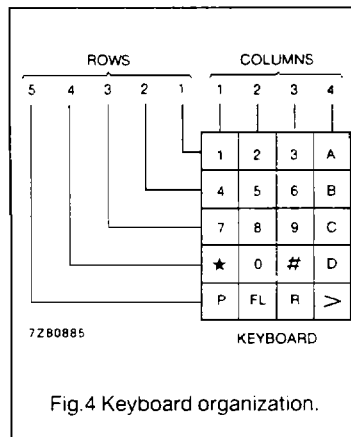

Fig.4 Keyboard organization.

Row 5 of the keyboard contains the following special function keys:

- P   memory clear and programming (notepad)
- FL   flash or register recall
- R   redial
- >   change of dial mode from PD to DTMF in mixed dialling mode

In pulse dialling mode the valid keys are the 10 numeric keys (0 to 9). The non-numeric keys (A, B, C, D, *, #) have no effect on the dialling or the redial storage. Valid function keys are P, R and FL.

In DTMF mode all non-function keys are valid. They are transmitted as a dual tone combination and at the same time stored in the redial register. Valid function keys are P, L and R.

In mixed mode all key entries are valid and executed accordingly.

Flash duration control (FLD)

Flash (or register recall) is activated by the FL key and can be used in DTMF and pulse dialling modes. Pressing the FL key will produce a timed line-break of 100 ms (min.) at the DP/FLO output. During the conversation mode this flash pulse entry will act as a chip enable. The flash pulse duration (t_{FL}) is calibrated and can be prolonged with an external resistor and capacitor connected to the FLD input/output (see Fig.5). The flash pulse resets the Read Address Counter (RAC). Later redial is possible (see redial procedure with the "Flash" inserted telephone number). The counter of the reset delay time is held during the period of t_{FL}.

Pulse and DTMF dialler with redial

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(a)
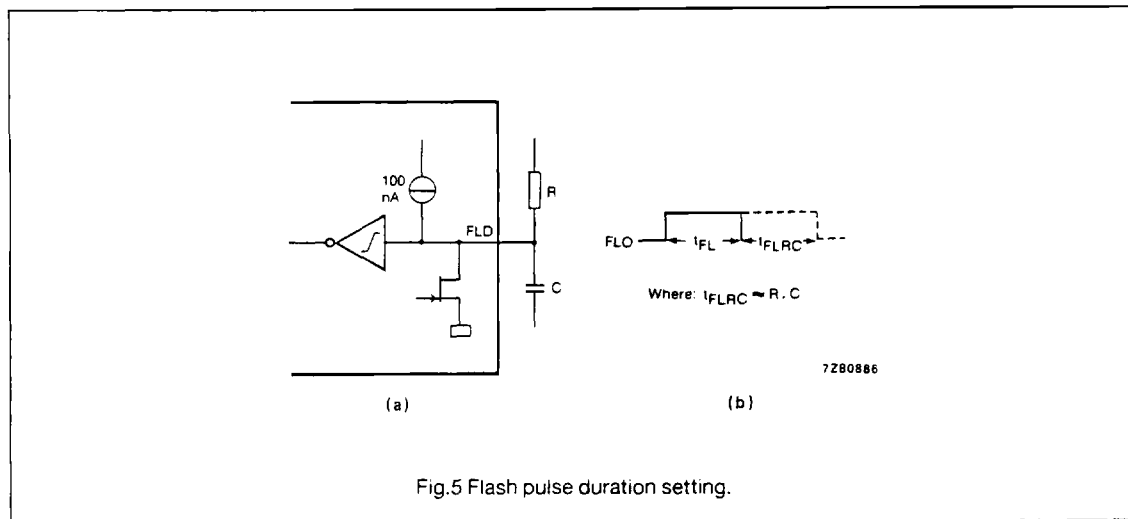
(b)

Where: $I_{FLRC} \sim R \cdot C$

7Z80886

Fig.5 Flash pulse duration setting.

TONE output (DTMF mode)

The single and dual tones which are provided at the TONE output are filtered by an on-chip switched-capacitor filter, followed by an on-chip active RC low-pass filter. Hence, the total harmonic distortion of the DTMF tones meets the CEPT CS 203 recommendations. The tone output has following states:

• tone OFF; 3-state
• tone ON; the associated frequencies are superimposed on a DC level of 1/2 V_{DD}.

When the DTMF mode is selected output tones are timed in manual dialling with a minimum duration of bursts and pauses, and in redial with a calibrated timing. Single tones may be generated for test purposes (CE = HIGH). Each row and column has one corresponding frequency. High group frequencies are generated by connecting the column to V_{SS} and Low group frequencies are generated by forcing the row to

V_{DD}. The single tone frequency will be transmitted during activation time, but it is neither calibrated nor stored.

An on-chip reference voltage provides output-tone levels independent of the supply voltage. Table 1 shows the frequency tolerance of the output tones for DTMF signalling.

Table 1 Frequency tolerance of the output tones for DTMF signalling; f_{XTAL} = 3.579545 MHz.

ROW/ COLUMN	STANDARD FREQUENCY (Hz)	TONE OUTPUT FREQUENCY (Hz)	FREQUENCY DEVIATION	
			%	Hz
Row 1	697	607.90	+ 0.13	+ 0.90
Row 2	770	770.46	+ 0.06	+ 0.46
Row 3	852	850.45	−0.18	−1.55
Row 4	941	943.23	+ 0.24	+ 2.23
Col 1	1209	1206.45	−0.21	−2.55
Col 2	1336	1341.66	+ 0.42	+ 5.66
Col 3	1477	1482.21	+ 0.35	+ 5.21
Col 4	1633	1638.24	+ 0.32	+ 5.25

Pulse and DTMF dialler with redial

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Dial pulse and flash output (DP/FLO)

This is a combined output which provides control signals for timing in pulse dialling or for a calibrated break in both dialling modes (flash or register recall).

Mute output (M1)

During pulse dialling the mute output becomes active HIGH for the period of the inter-digit pause, break time and make time. It remains at this level until the last digit is pulsed out.

During DTMF dialling the mute output becomes active HIGH for the period of tone transmission and remains at this level until the end of hold-over time. It is also active HIGH during flash and flash hold-over time.

Mute output ($\overline{M1}$)

Inverted output of M1. In the PCD3310P it is only available as a bonding option of M1.

Strobe output (M2)

Active HIGH output during actual dialling; i.e. during break or make time in pulse dialling, or during tone ON/OFF in DTMF dialling. It is an open drain p-channel output.

DIALLING PROCEDURES
(see Figs.8 to 10)

Dialling

After CE has risen to V_{DD} the oscillator starts running and the Read Address Counter (RAC) is set to the first address (see Fig.6). By entering the first valid digit, the Temporary

Write Address Counter (TWAC) will be set to the first address, the decoded digit will be stored in the register and the TWAC incremented to the next address. Any subsequent keyboard entry will be decoded and stored in the redial register after validation. The first 5 valid entries have no effect on the main register and its associated Write Address Counter. After the sixth valid digit is entered TWAC indicates an overflow condition. The data from the temporary register will be copied into the 5 least significant places of the main register and TWAC into the WAC. All following digits (including the sixth digit) will be stored in the main register (a total of not more than 23). If more than 23 digits are entered redial will be inhibited. If not more than 5 digits are entered only the temporary register and the associated TWAC are affected. All entries are debounced on both the leading and trailing edges for at least time period t_e as shown in Fig.11. Each entry is tested for validity before being stored in the redial register.

- In DTMF mode all non-function keys are valid
- In PD mode only numeric keys are valid

Simultaneous to their acceptance and corresponding to the selected mode (PD, DTMF or mixed), the entries are transmitted as PD pulse-trains or as DTMF frequencies in accordance with postal requirements. Non-numeric entries are neglected during pulse dialling, they are neither stored nor transmitted.

Re-dialling

After CE has risen to V_{DD} the oscillator starts running and the Read Address Counter (RAC) is set to the first address to be sent. The circuit is in the conversation mode. If "R" is the first keyboard entry the circuit starts re-dialling the contents of the temporary register. If the overflow flag of the TWAC was set in the previous dialling, the re-dialling continues in the main register. If the flag was not set, the number residing in the temporary register will only be redialled until the temporary read and write registers are equal.

Before pressing "R" a dialling sequence with up to 4 digits is possible. If the digits are equal to the corresponding ones in the main register, then redial starts in the main register until the last digit stored is transmitted.

Timing in the DTMF mode is calibrated for both tone bursts and pauses.

In mixed mode only the first part entered (the pulse dialled part of the stored number) can be redialled.

During redial keyboard entries (function or non-function) are not accepted until the circuit returns to the conversation mode after completion of re-dialling. No redial activity takes place if one of the following events occur:

- Power-on reset
- Memory clear ("P" without successive data entry)
- Memory overflow (more than 23 valid data entries)

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Notepad

The redial register can also be used as a notepad. In conversation mode a number with up to 23 digits can be entered and stored for re-dialling. By activating the program key (P) the WAC and TWAC pointers are reset. This acts like a memory clear (redial is inhibited). Afterwards, by entering and storing any digits, re-dialling will be possible after flash or hook on and off.

During notepad programming the numbers entered will neither be transmitted nor is the mute active, only the confidence tone is generated.

Fig.6 Program memory map.
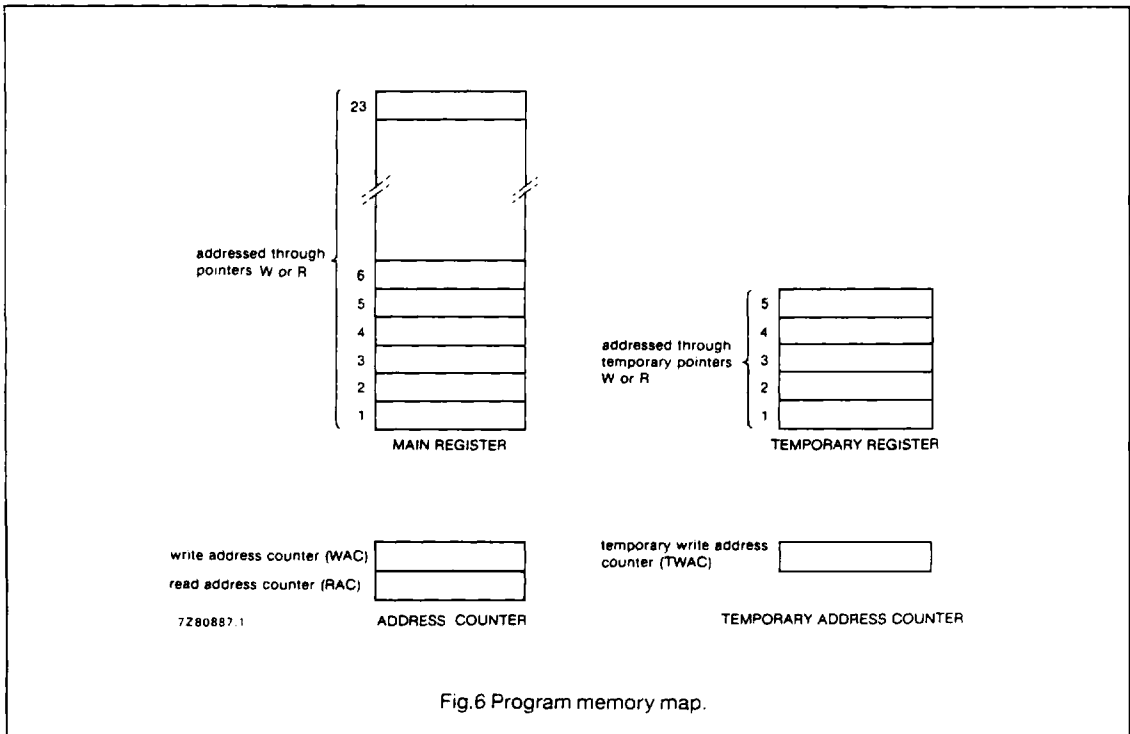
Note to Fig.6

(1). If [access digit(s) + external number] ≤ 23 digits.
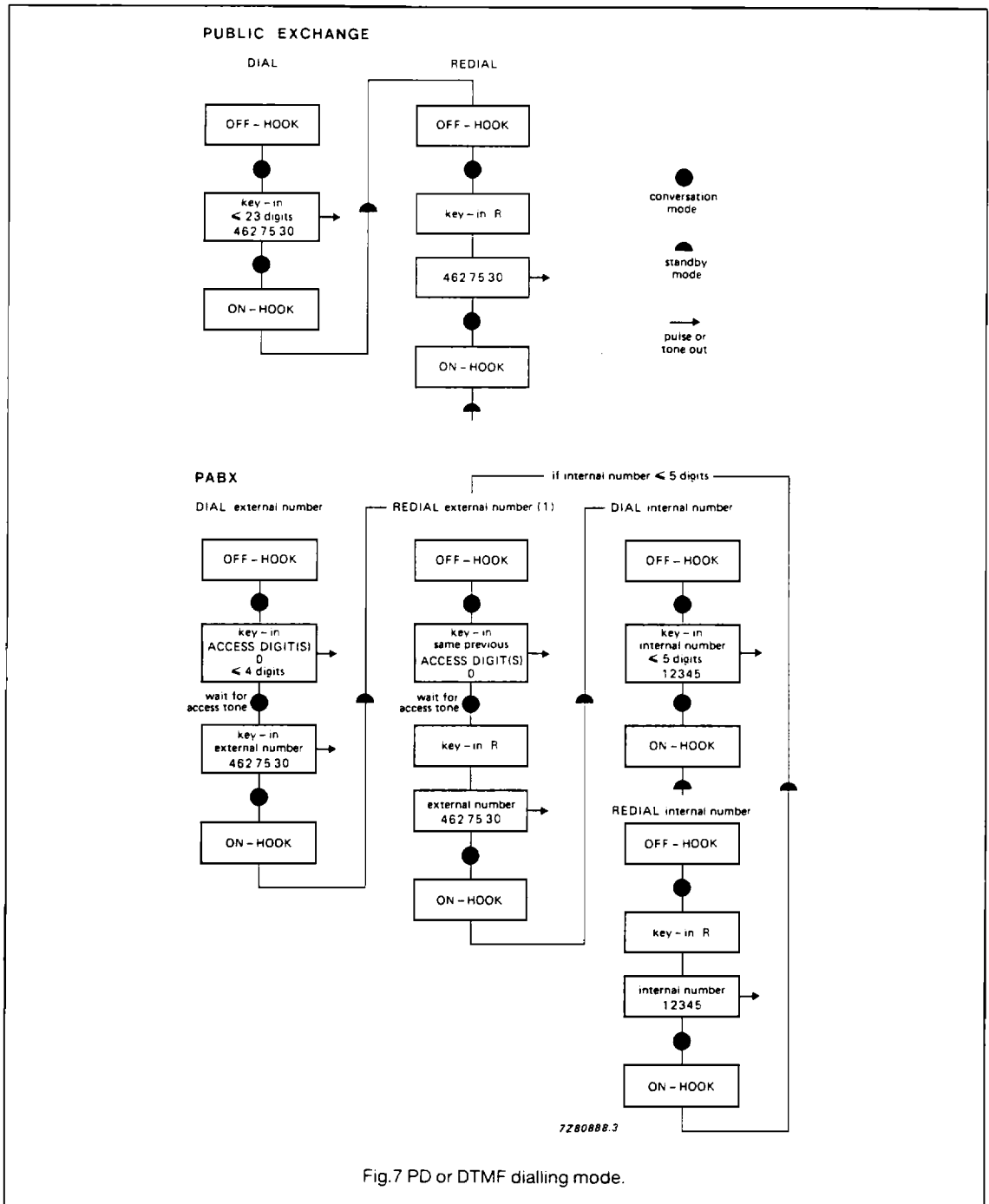
Pulse and DTMF dialler with redial

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Fig.7 PD or DTMF dialling mode.

Pulse and DTMF dialler with redial

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DIAL

```
            ┌──────────────┐
            │  OFF – HOOK  │
            └──────────────┘
                   ●  ◄─── set in pulse dialling
            ┌──────────────┐
pulse dialling │   key – in  │ ──► pulse out
            │   4 6 2 7 5 3 0 │
            └──────────────┘
                   ●    wait for signal
                        (or any voice indication)
                   ───── automatic switch to DTMF or manual by  >
            ┌──────────────┐
DTMF dialling │ * 1 2 3 4 5 6 7 │
            │ 8 9 A B C D #  │ ──► TONE – out
            └──────────────┘
                   ●
            ┌──────────────┐
            │  ON – HOOK   │
            └──────────────┘
```

REDIAL

```
            ┌──────────────┐
            │  OFF – HOOK  │
            └──────────────┘
                   ●
            ┌──────────────┐
pulse dialling │   key – in  R │
            └──────────────┘
            ┌──────────────┐
            │  4 6 2 7 5 3 0 │
            │    if total   │ ──► pulse out
            │  (PD + DTMF)  │
            │  ≤ 23 digits  │
            └──────────────┘
                   ●
            ┌──────────────┐
            │  ON – HOOK   │
            └──────────────┘
```
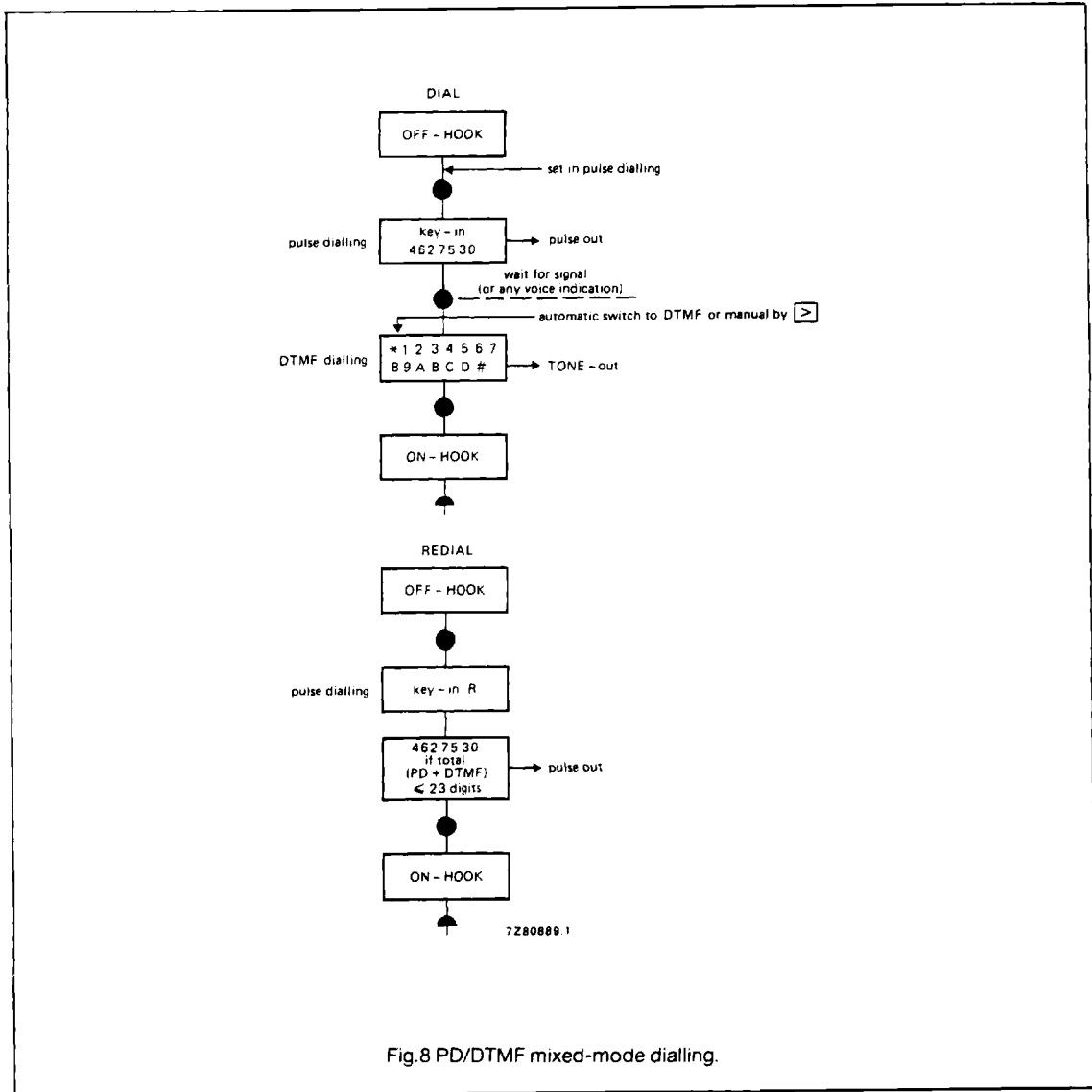
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Fig.8 PD/DTMF mixed-mode dialling.

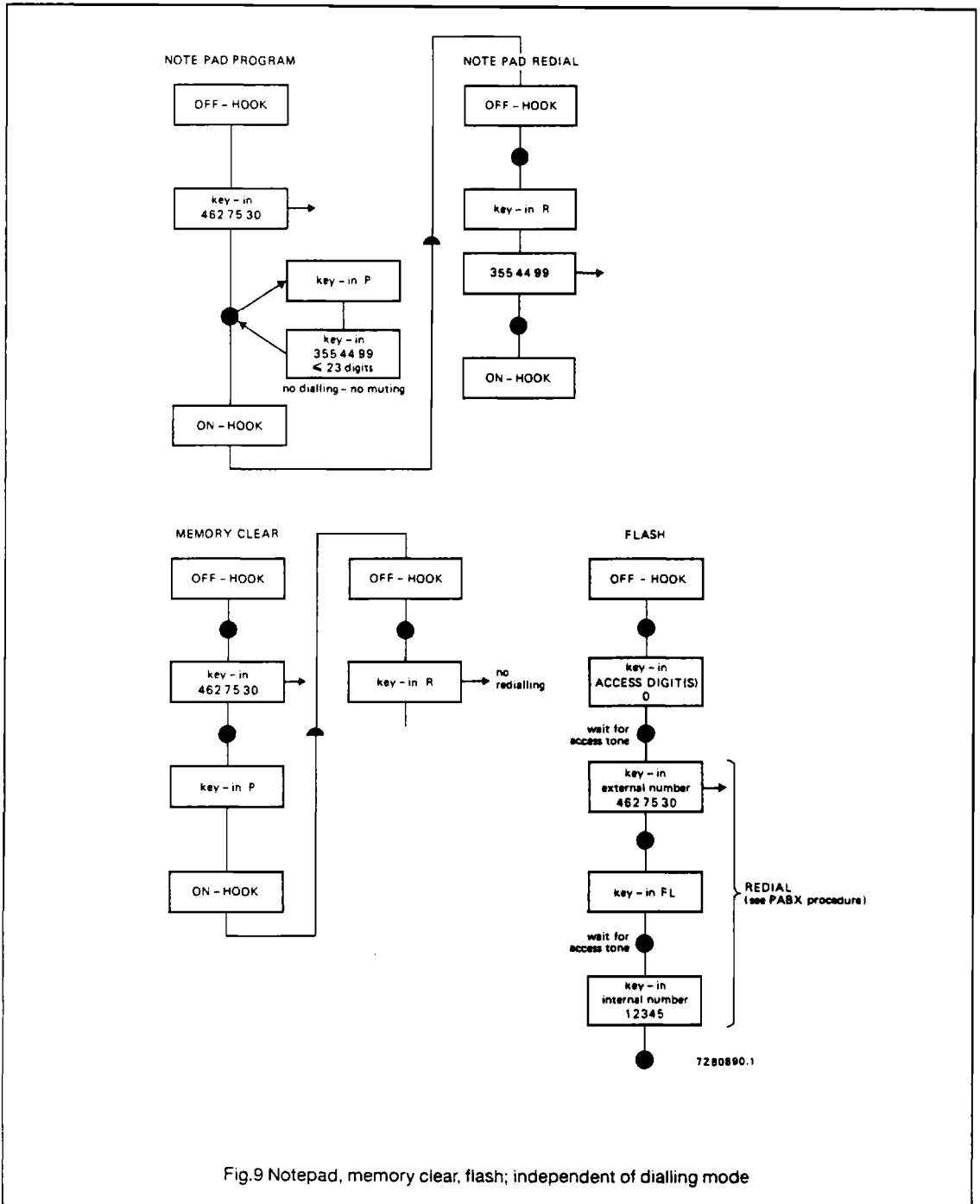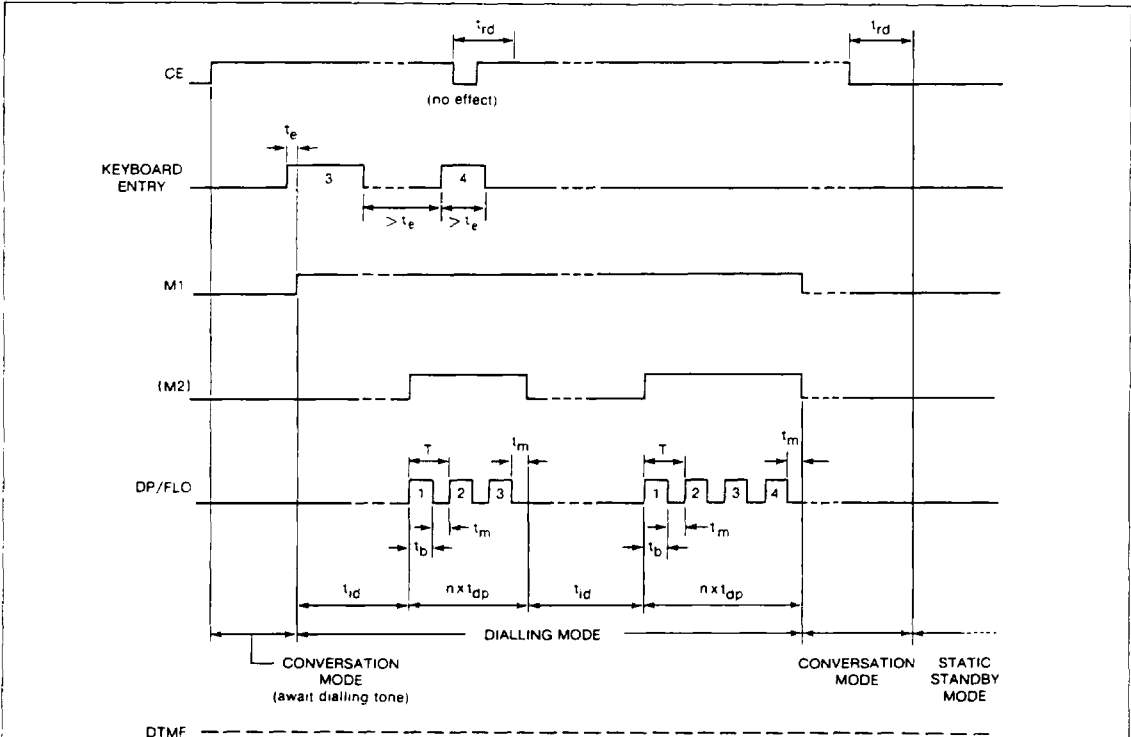# Pulse and DTMF dialler with redial

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Fig.9 Notepad, memory clear, flash; independent of dialling mode
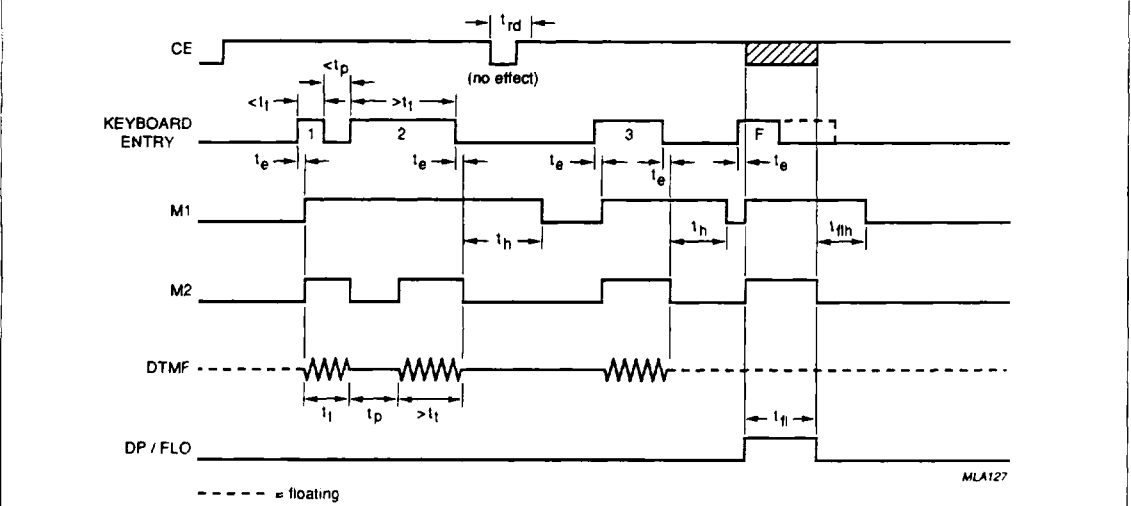
Pulse and DTMF dialler with redial

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TIMING

Fig.10a Timing diagram for pulse dialling ($\overline{PD}$/DTMF = V_{SS})

Fig.10b Timing diagram for DTMF dialling ($\overline{PD}$/DTMF = V_{DD})

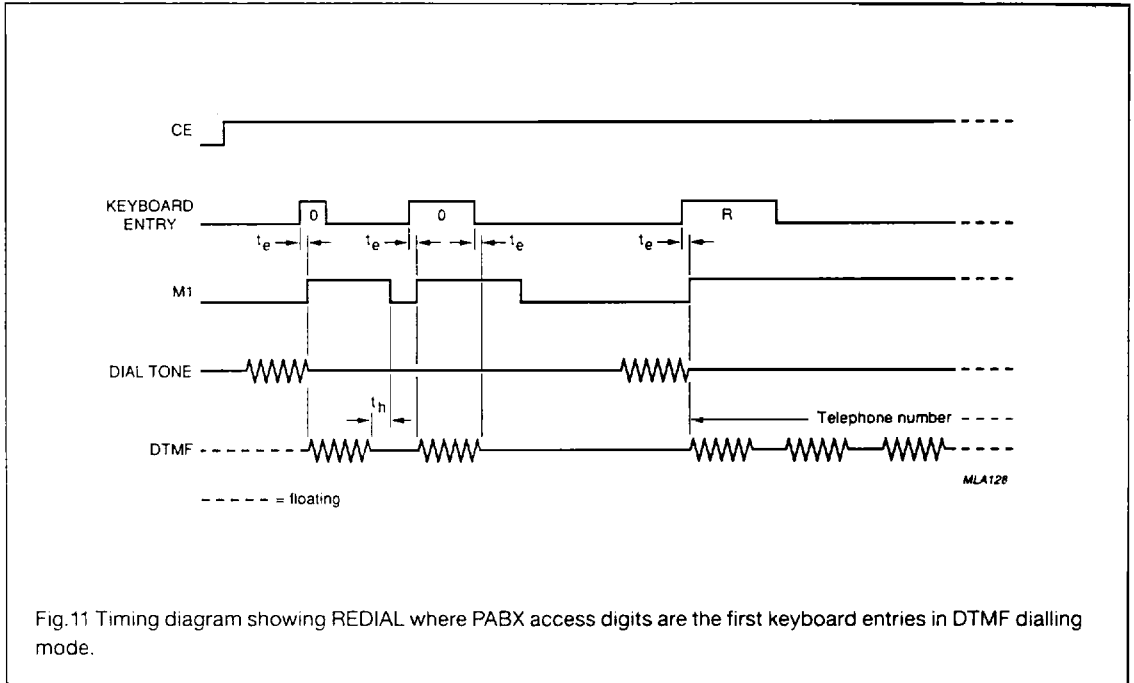# Pulse and DTMF dialler with redial

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Fig.11 Timing diagram showing REDIAL where PABX access digits are the first keyboard entries in DTMF dialling mode.
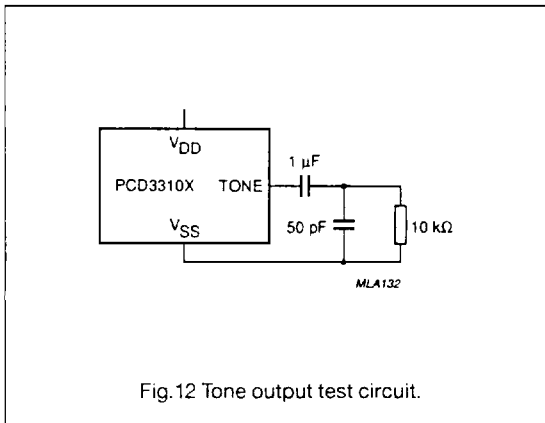

Fig.12 Tone output test circuit.

Pulse and DTMF dialler with redial

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LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{DD}	supply voltage range	−0.8	8	V
I_{DD}	supply current		50	mA
$\pm I_i, \pm I_O$	DC current into any input or output		10	mA
V_I	all input voltages	−0.8	V_{DD} + 0.8	V
P_{tot}	total power dissipation	-	300	mW
P_o	power dissipation per output	-	50	mW
T_{stg}	storage temperature range	−65	+ 150	°C
T_{amb}	operating ambient temperature range	−25	+ 70	°C

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DC CHARACTERISTICS

V_{DD} = 3 V; V_{SS} = 0 V; crystal parameters: f_{osc} = 3.579545 MHz; T_{amb} = –25 to + 70 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_{DD}	operating supply voltage		2.5	-	6.0	V
V_{DDO}	standby supply voltage		1.8	-	6.0	V
	Operating supply current					
I_{DDC}	conversation mode	oscillator ON	-	-	150	μA
I_{DDP}	pulse dialling or flash		-	-	200	μA
I_{DDF}	DTMF dialling	tone ON	-	0.6	0.9	mt
I_{DDF}	DTMF dialling	tone OFF	-	-	200	μA
I_{DDO}	standby supply current	V_{DD} = 1.8 V oscillator OFF; note 1	-	-	2	μA
Inputs						
V_{IL}	input voltage LOW (any pin)		0	-	0.3 V_{DD}	V
V_{IH}	input voltage HIGH (any pin)		0.7 V_{DD}	-	V_{DD}	V
$|I_{IL}|$	input leakage current: CE		-	-	1	μA
Keyboard inputs						
R_{KON}	keyboard ON resistance		-	-	2	kΩ
R_{KOFF}	keyboard OFF resistance		1	-	-	MΩ
Outputs						
	output sink current	V_{OL} = V_{SS} + 0.5 V				
I_{OL}	M1, $\overline{M1}$, DP/FLO, CF, FLD		0.7	-	-	mA
I_{OL}	$\overline{PD}$/DTMF	note 2	-	-	1	mA
	output source current	V_{OH} = V_{DD} – 0.5 V				
$-I_{OH}$	M1, $\overline{M1}$, DP/FLO, CF, M2		0.6	-	-	mA
$-I_{OH}$	$\overline{PD}$/DTMF	note 2	-	-	1	mA
$-I_{OH}$	FLD	note 3	-	60	-	nA
Timing and frequency						
t_{on}	clock start-up time		-	4	-	ms
t_e	debounce time		-	12	-	ms
t_{rd}	reset delay time		-	160	-	ms
Tone output (see Fig.12)						
	DTMF output voltage levels	V_{DD} = 2.5 to 6 V				
$V_{HG(rms)}$	HIGH group		158	192	205	mV
$V_{LG(rms)}$	LOW group		125	150	160	mV
$\Delta f/f$	frequency deviation		–0.6	-	+ 0.6	%
V_{DC}	DC voltage level		-	1/2 V_{DD}	-	V
$|Z_O|$	output impedance		-	0.1	0.5	kΩ
ΔV_G	pre-emphasis of group		1.85	2.1	2.35	dB
THD	total harmonic distortion	T_{amb} = 25 °C, note 4	-	–25	-	dB

Notes to the DC characteristics

1. Crystal connected between OSCI and OSCO; CE at V_{SS} and all other pins open-circuit.

2. < |10 mA| dynamic current to set/reset $\overline{PD}$/DTMF pin (mixed mode).

3. Flash inactive: V_{OH} = V_{SS}.

4. Related to the level of the LOW group frequency component (CEPT CS 203).

Pulse and DTMF dialler with redial

PCD3310 family

TYPE NUMBER DEPENDENT CHARACTERISTICS

PCD3310

Confidence tone output (CF)

The confidence tone output pin is pin 15 for the SOT146 package and pin 20 for the SO28; SOT136A package.

When any key is activated a square-wave (330 Hz) is generated and appears at the CF output to serve as an acoustic feed-back for the user.

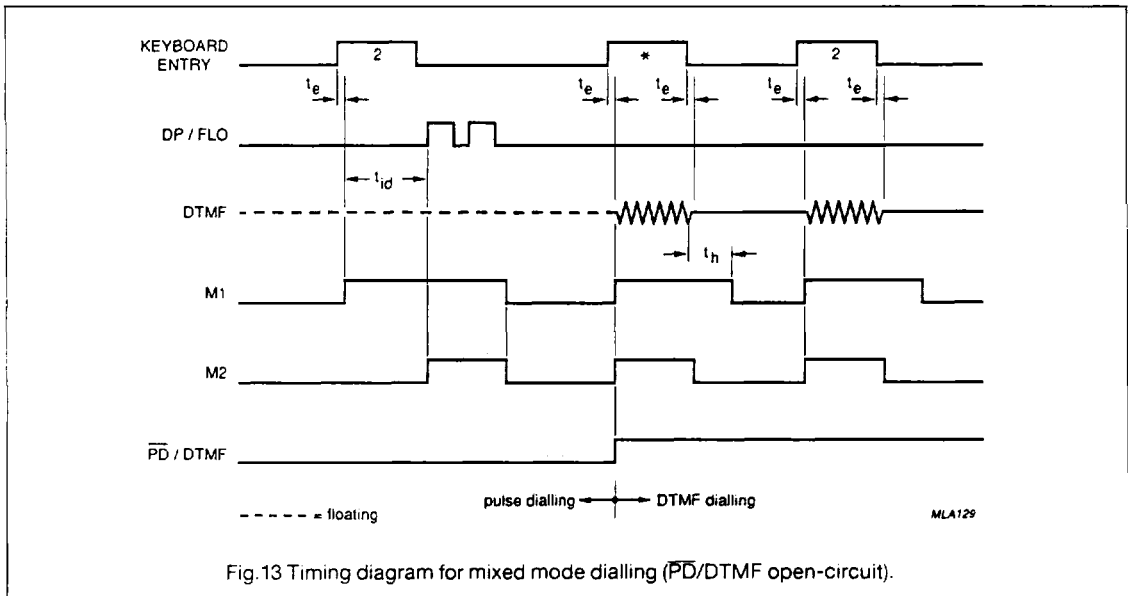| SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
Transmission and pause time					
t_t, t_p	manual dialling	68	-	-	ms
t_t, t_p	redialling	68	70	72	ms
t_{FL}	flash pulse duration	98	100	102	ms
t_{flh}	flash hold-over time	31	33	34	ms
t_h	hold-over time (muting on M1)	78	80	81	ms
Pulse dialling					
f_{dp}	dialling pulse frequency	9.8	10	10.4	Hz
t_{id}	inter-digit pause	828	840	844	ms
t_b	break time	66	67	68	ms
t_m	make time	32	33	34	ms

Fig.13 Timing diagram for mixed mode dialling ($\overline{PD}$/DTMF open-circuit).

Pulse and DTMF dialler with redial

PCD3310 family

PCD3310A

Confidence tone output (CF)

The confidence tone output pin is pin 15 for the SOT146 package and pin 20 for the SO28; SOT136A package.

When any key is activated a square-wave (330 Hz) is generated and appears at the CF output to serve as an acoustic feed-back for the user.

| SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
Transmission and pause time					
t_t, t_p	manual dialling	68	-	-	ms
t_t, t_p	redialling	68	70	72	ms
t_{FL}	flash pulse duration	98	100	102	ms
t_{flh}	flash hold-over time	31	33	34	ms
t_h	hold-over time (muting on M1)	78	80	81	ms
Pulse dialling					
f_{dp}	dialling pulse frequency	9.8	10	10.4	Hz
t_{id}	inter-digit pause	828	840	844	ms
t_b	break time	59	60	61	ms
t_m	make time	39	40	41	ms
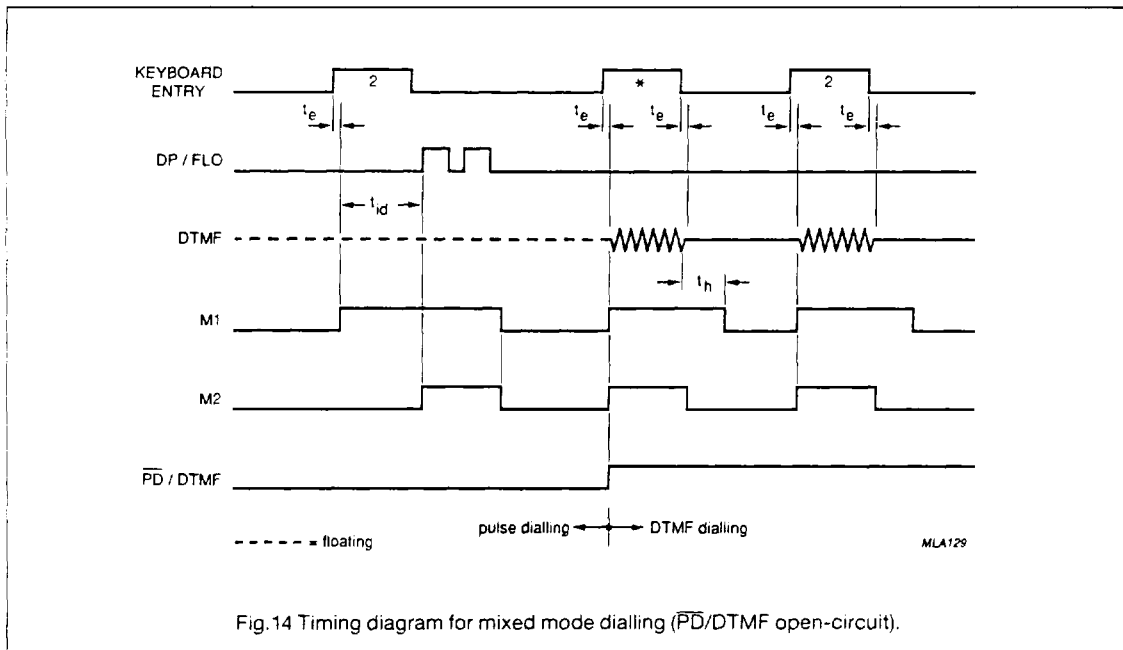
Fig.14 Timing diagram for mixed mode dialling ($\overline{PD}$/DTMF open-circuit).

Pulse and DTMF dialler with redial

PCD3310 family

PCD3310C

Dialling mode output (DMODE)

The dialling mode output is pin 15 for
the SOT146 package and pin 20 for
the SO28; SOT136A package.

The DMODE output represents the
actual dialling status of the dialler. In
pulse mode the output is LOW and in
DTMF mode the output is HIGH.

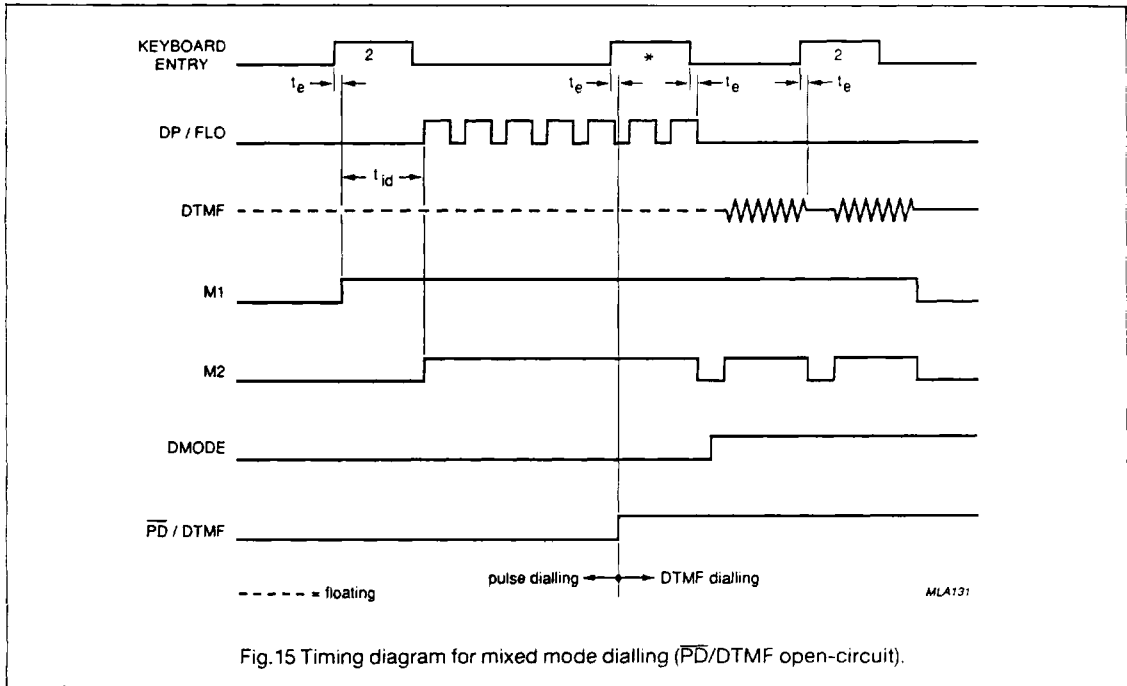| SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
Transmission and pause time					
t_t, t_p	manual dialling	68	-	-	ms
t_t, t_p	redialling	68	70	72	ms
t_{FL}	flash pulse duration	98	100	102	ms
t_{flh}	flash hold-over time	31	33	34	ms
t_h	hold-over time (muting on M1)	78	80	81	ms
Pulse dialling					
f_{dp}	dialling pulse frequency	9.8	10	10.4	Hz
t_{id}	inter-digit pause	828	840	844	ms
t_b	break time	66	67	68	ms
t_m	make time	32	33	34	ms

Fig.15 Timing diagram for mixed mode dialling ($\overline{PD}$/DTMF open-circuit).

Pulse and DTMF dialler with redial

PCD3310 family

PCD3310E

Pulse dialling frequency select (FS)

The frequency select pin is pin 15 for
the SOT146 package and pin 20 for
the SO28; SOT146 package.

If FS = V_{SS}: 10 Hz dialling selected. If
FS = V_{DD}: 30 HZ dialling selected.

| SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
Transmission and pause time					
t_t, t_p	manual dialling	68	-	-	ms
t_t, t_p	retailing	68	70	72	ms
t_{FL}	flash pulse duration	98	100	102	ms
t_{flh}	flash hold-over time	31	33	34	ms
t_h	hold-over time (muting on M1)	78	80	81	ms
Pulse dialling @ 10 Hz					
f_{dp}	dialling pulse frequency	9.8	10	10.4	Hz
t_{id}	inter-digit pause	828	840	844	ms
t_b	break time	66	67	68	ms
t_m	make time	32	33	34	ms
Pulse dialling @ 20 Hz					
f_{dp}	dialling pulse frequency	19.6	20	20.8	Hz
t_{id}	inter-digit pause	496	504	512	ms
t_b	break time	33	34	35	ms
t_m	make time	16	17	18	ms
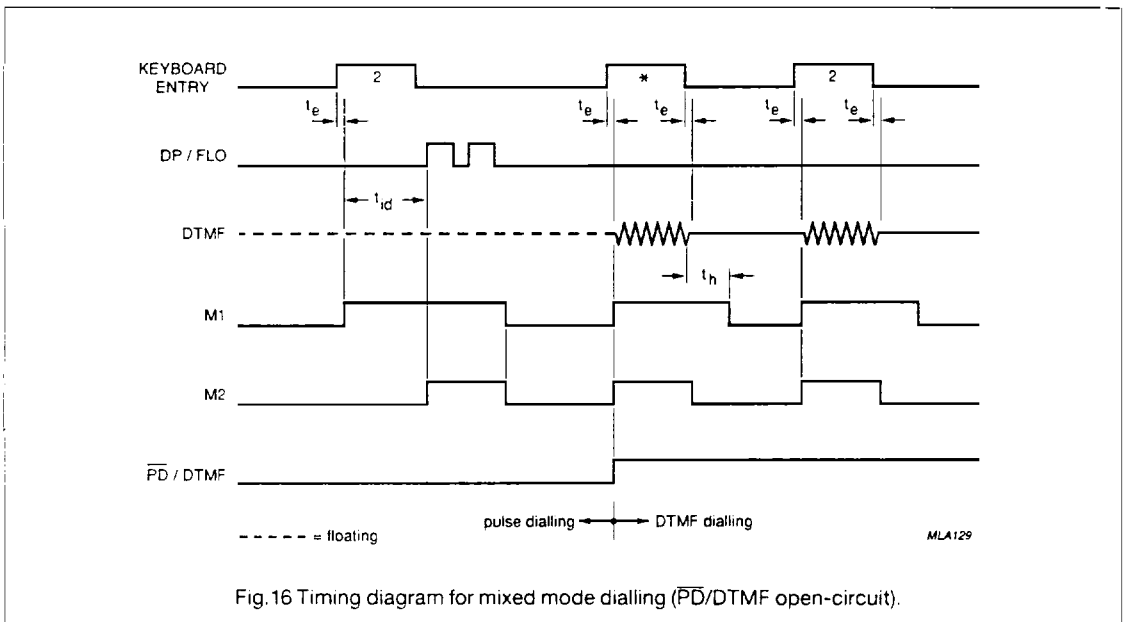
Fig. 16 Timing diagram for mixed mode dialling ($\overline{PD}$/DTMF open-circuit).

Pulse and DTMF dialler with redial

PCD3310 family

PCD3310F

Confidence tone output (CF)

The confidence tone output pin is pin 15 for the SOT146 package and pin 20 for the SO28; SOT136A package.

When any key is activated a square-wave (330 Hz) is generated and appears at the CF output to serve as an acoustic feed-back for the user.

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
Transmission and pause time					
t_l	manual dialling	59	-	-	ms
t_p		89	-	-	ms
t_l	retailing	59	60	61	ms
t_p		89	90	91	ms
t_{FL}	flash pulse duration	98	100	102	ms
t_{flh}	flash hold-over time	31	33	34	ms
t_h	hold-over time (muting on M1)	99	100	101	ms
Pulse dialling					
f_{dp}	dialling pulse frequency	9.8	10	10.4	Hz
t_{id}	inter-digit pause	828	840	844	ms
t_b	break time	66	67	68	ms
t_m	make time	32	33	34	ms

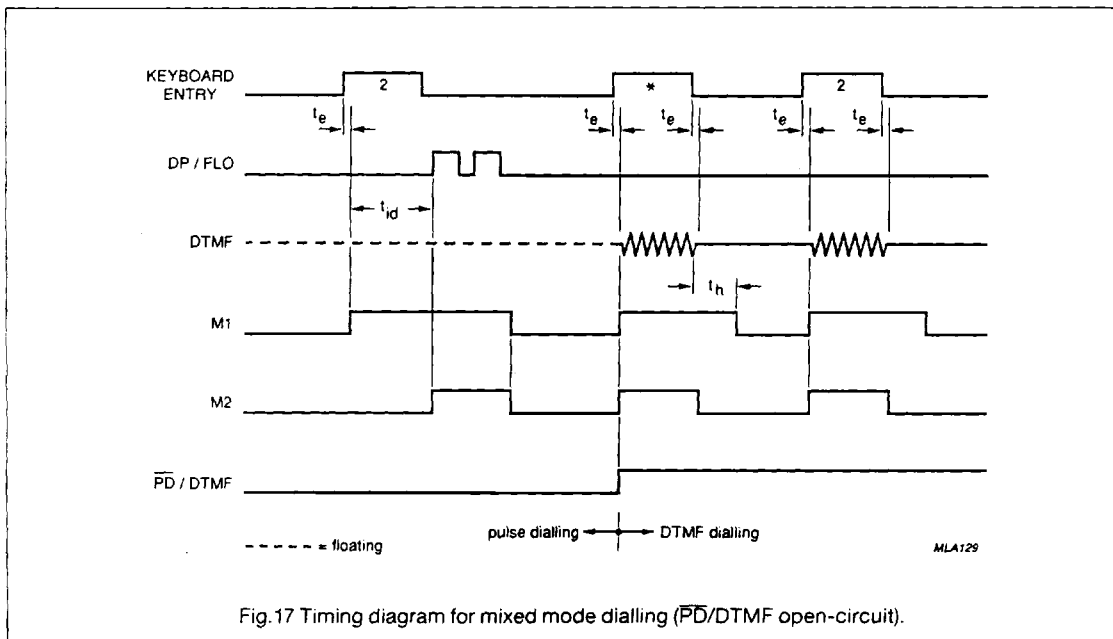Fig.17 Timing diagram for mixed mode dialling ($\overline{PD}$/DTMF open-circuit).

Pulse and DTMF dialler with redial
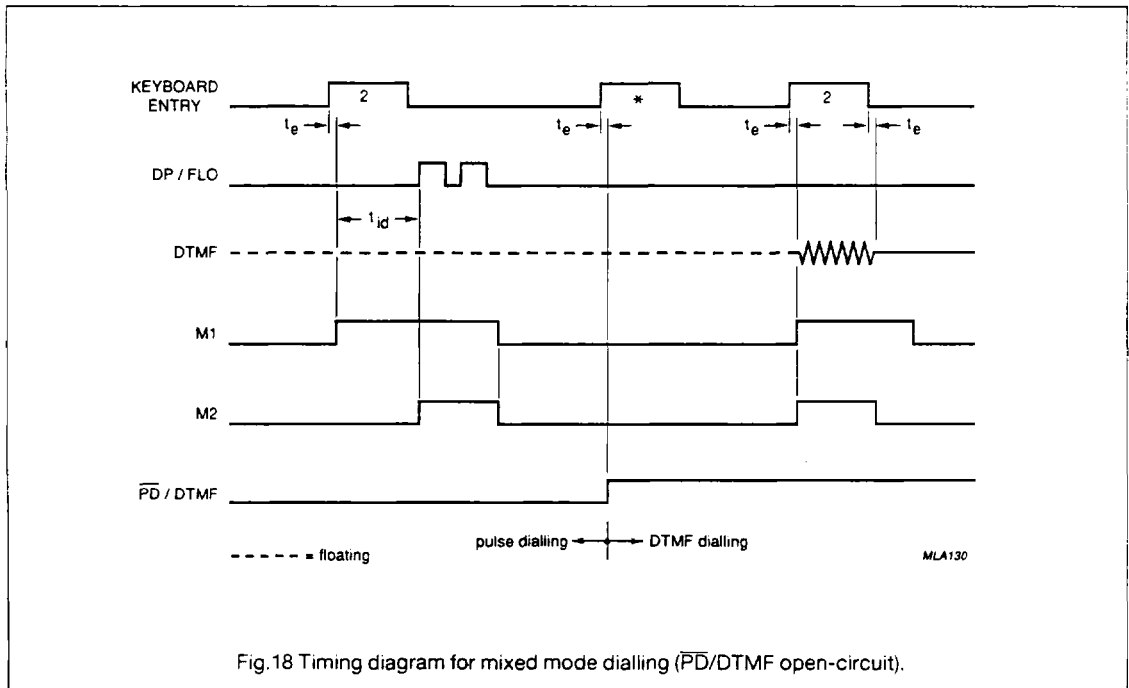
PCD3310 family

PCD3310G

Confidence tone output (CF)

The confidence tone output pin is pin 15 for the SOT146 package and pin 20 for the SO28; SOT136A package.

When any key is activated a square-wave (330 Hz) is generated and appears at the CF output to serve as an acoustic feed-back for the user.

In mixed mode dialling the switch-over from pulse to DTMF mode can be activated by the * and # keys without sending out its corresponding frequencies when activated for the first time.

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
Transmission and pause time					
t_l, t_p	manual dialling	68	-	-	ms
t_l, t_p	retailing	68	70	72	ms
t_{FL}	flash pulse duration	98	100	102	ms
t_{flh}	flash hold-over time	31	33	34	ms
t_h	hold-over time (muting on M1)	78	80	81	ms
Pulse dialling					
f_{dp}	dialling pulse frequency	9.8	10	10.4	Hz
t_{id}	inter-digit pause	828	840	844	ms
t_b	break time	66	67	68	ms
t_m	make time	32	33	34	ms

Fig.18 Timing diagram for mixed mode dialling ($\overline{PD}$/DTMF open-circuit).

Pulse and DTMF dialler with redial

PCD3310 family

APPLICATION INFORMATION

1. Automatic line compensation obtained by connecting R6 to V_{SS}.

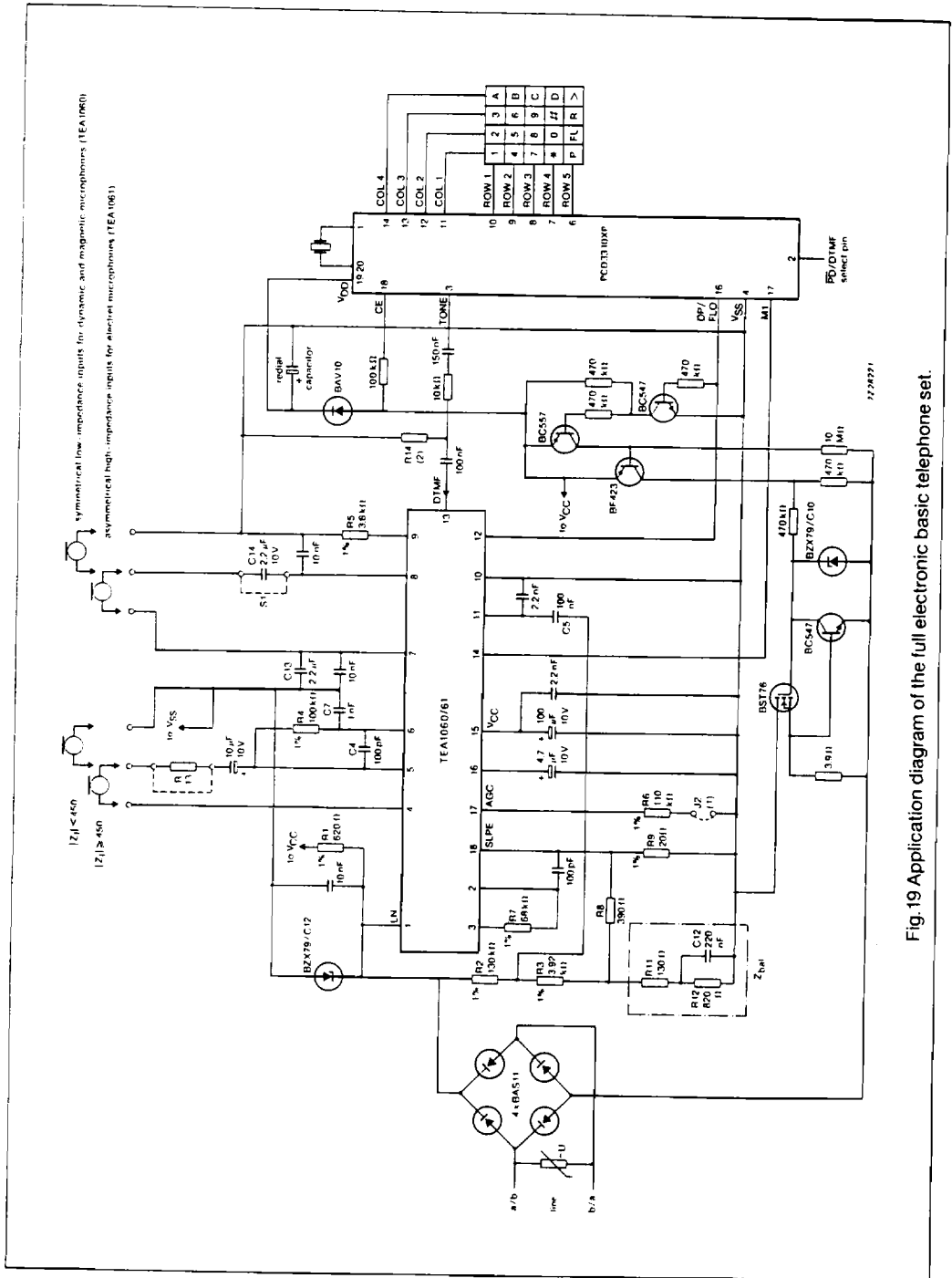2. The value of resistor R14 is determined by the required level at LN and the DTMF gain of the TEA 1060/61.

Fig. 19 Application diagram of the full electronic basic telephone set.