

9325812 UNITED MICROELECTRONICS

92D 00384 92-75-07-07



UM91255/256

10 Memory Tone/Pulse Dialer

Features

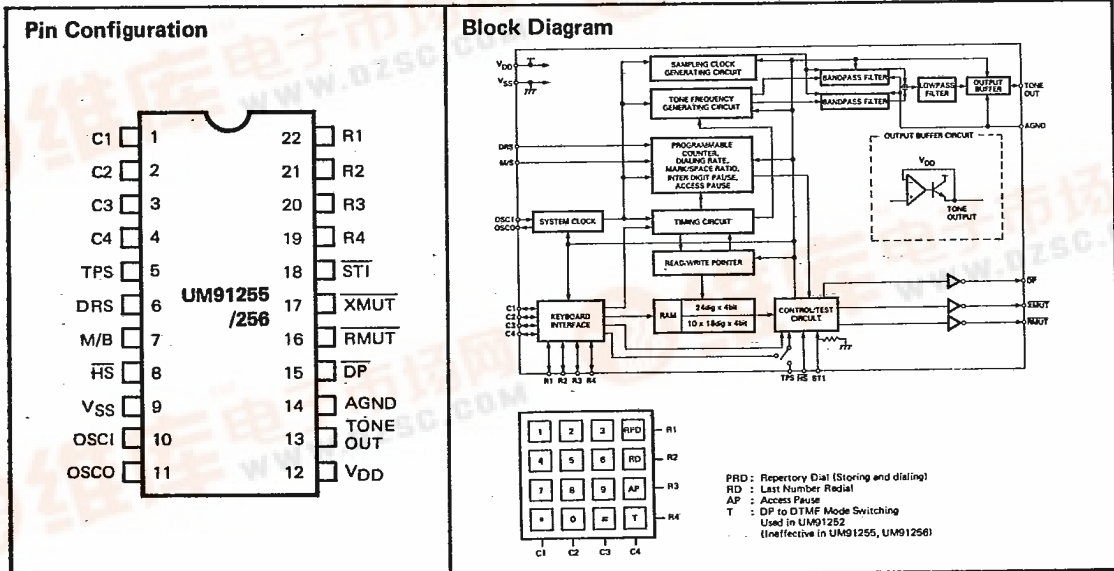
- The ten 18-digit repertory memory and 24-digit redialing memory can be used in either tone or pulse mode
- Low-voltage CMOS process for direct operation from telephone line
- Independent inputs for selection of pulse dialing rate; interdigit pause (10PPS/617.9ms or 20PPS/463.4ms) and make/break ratio ($33\frac{1}{3}/66\frac{2}{3}$ or 40 - 60)
- Can be attached to inexpensive XY matrix keyboard
- Uses inexpensive TV crystal (3.58 MHz)
- Transmute and Receivemuter on chip
- The repertory memory can be stored in ON-Hook status (UM91256) or OFF-Hook status (UM91255)
- A built-in SCF-type BPF makes tone signal with low THD (typically 2.5% at 5V) without the use of external filters
- PABX auto-pause for 3.97 sec, can also be canceled during sending

General Description

The UM91255/256 series is a CMOS LSI which provides a memory for telephone numbers, and makes Tone/pulse dialing possible on one chip.

The LSI contains Band Pass Filters (BPF) and switched capacitor filter (SCF) technology, so that the tone output has less distortion than the D/A conversion system used in a conventional tone dialer.

The UM91255/256 series can be used in lines connected to general mechanical-type rotary dial telephones. In such applications it first produces a dialing pulse train to call up a remote computer, then selects the DTMF mode and sends data, such as product codes, and DTMF signals. This LSI can be used effectively for general telephones or automatic order receiving and issuing systems.



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Absolute Maximum Ratings*

***Comments**

Power supply voltage ($V_{SS} - V_{DD}$) -7.5V to 0.3V
 Input voltage (V_I) $V_{SS} - 0.3V$ to $V_{DD} + 0.3V$
 Output voltage (V_O) $V_{SS} - 0.3V$ to $V_{DD} + 0.3V$
 Operating temperature (T_{opr}) -20°C to 70°C
 Storage temperature (T_{stg}) -65°C to 150°C
 Soldering temperature and time
 (T_{sol}) 260°C, 10s (at leads)

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

D.C. Characteristics

($T_a = -20$ to 70°C)

Item	Symbol	Conditions	Min.	Typ.	Max.	Units	
Operating Voltage	V_{DD}	DP mode	-6.0	-	-1.5	V	
		DTMF mode	-6.0	-	-2.5	V	
Data Retention Voltage	V_{DDR}	$\overline{HS} = V_{DD}$	-6.0	-	-1.0	V	
Average Operating Current	I_{DDA}	$V_{SS} = -5.0V$, $\overline{HS} = V_{SS}$ DP, TONE, RMUT, XMUT are not loaded	Key input stand-by status	-	-	800	μA
			DP mode and dial pulse output	-	-	1.0	mA
			DTMF mode and DTMF signal output	-	-	8.0	mA
Data Retention Current	I_{DDR}	$V_{SS} = -1.0V$, $\overline{HS} = V_{DD}$, $\overline{STI} = V_{SS}$, $TPS = DRS = M/S =$ V_{DD} or V_{SS}	-	-	0.75	μA	
Input Voltage High	V_{IH}	TPS, DRS, M/S, \overline{HS} , \overline{STI}	$V_{SS} + 0.4$	-	V_{DD}	V	
Input Voltage Low	V_{IL}	TPS, DRS, M/S, \overline{HS} , \overline{STI}	V_{SS}	-	$V_{DD} - 0.4$	V	
Input Voltage High (1)	I_{IH1}	TPS, DRS, M/S, \overline{HS} , $V_{SS} =$ $-5.0V$, $V_{IH1} = V_{DD}$	-	-	0.1	μA	
Input Voltage High (2)	I_{IH2}	\overline{STI} , $V_{SS} = -5.0V$, $V_{IH2} = V_{DD}$	-	-	300	μA	
Input Current Low	I_{IL1}	TPS, DRS, M/S, \overline{HS} , $\overline{STI} = -5.0V$, $V_{IL1} = V_{SS}$	-	-	0.1	μA	
Input Current Low	I_{IL2}	$\overline{COL1} - \overline{COL4}$, $\overline{ROW1} - \overline{ROW4}$, $V_{SS} = -5.0V$, $V_{IL2} = V_{SS}$	10	23	50	μA	
High Level Output Current (Source)	I_{OH1}	\overline{DP} , XMUT, RMUT $V_{SS} = -5.0V$, $V_{OL1} = -1.0V$	4.0	-	-	mA	
Low Level Output Current (Sink)	I_{OL2}	\overline{DP} , XMUT, RMUT $V_{SS} = -5.0V$, $V_{OH1} = -4.5V$	4.0	-	-	mA	

TonePulse Dialer

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AC Characteristics

(Ta = 25°C Fosc = 3.579545MHz)

Item	Symbol	Conditions		Min.	Typ.	Max.	Units
Key input ON effective period	t_{ON1}^{*1}	DP and DTMF mode non-normal dialing	No chattering	15.45	—	—	ms
	t_{ON2}^{*2}	DTMF mode normal dialing		77.24	—	—	
Key input OFF effective period	t_{OFF}	No chattering		1.72	—	—	ms
Pulse width of allowable noise at input terminal	t_N			—	—	14.37	ms
Oscillator start-up time	t_{OS}	$V_{SS} = -5.0V$ $C_I < 100\Omega$		—	—	5.0	ms
Key judgement time	t_{KJ1}	DP mode normal dialing		30.25	30.90	31.97	ms
	t_{KJ2}	DTMF mode normal dialing		17.37	18.02	19.10	
	t_{KJ3}	DP/DTMF mode auto dialing *3		19.95	20.60	21.67	
Pre-mute time	t_{MP1}	DTMF mode normal dialing		—	9.01	—	ms
	t_{MP2}	DTMF mode auto dialing		—	9.87	—	
Mute delay time	t_{MD1}	DP and DTMF mode auto dialing		—	9.87	—	ms
	t_{MD2}	DTMF mode normal dialing		9.22	9.33	9.44	
Dial pulse mark/break ratio	—	$M/S = V_{DD}$		—	40/60	—	—
	—	$M/S = V_{SS}$		—	33.3/66.6	—	
Dial pulse rate	—	$DRS = V_{DD}$		—	19.42	—	pps
	—	$DRS = V_{SS}$		—	9.71	—	
Inter-digit pause	t_{1DP1}	DP mode	Dial rate = 19.42 PPS	—	463.4	—	—
			Dial rate = 9.71 PPS	—	617.9	—	ms
	t_{1DP2}	DTMF mode auto dialing		—	61.36	—	
DTMF make time	t_{TM}	DTMF mode auto dialing		—	93.12	—	ms
Auto access pause	t_{AP}			—	3.965	—	s

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A.C. Characteristics (Continued)

Item	Symbol	Conditions	Min.	Typ.	Max.	Units
Oscillator frequency	f_{OSC}		—	3.579545	—	MHz
Oscillator frequency/voltage variance	$\Delta f/f$	$V_{SS} = -1.5$ to $-6.0V$	—	—	30	ppm/v
Tone output voltage (single tone)	V_{TONE}	COL	—	-10	—	dBm
		ROW	—	-11	—	
COL-ROW tone output voltage ratio **	d_{BCR}	$V_{SS} = -3.0$ to $-6.0V$	—	—	2	dB
Tone distortion	$\%DIS$	$V_{SS} = -5.0V$	—	—	5.0	%
Tone output frequency	f_{R1}	ROW1	—	699.13	—	Hz
	f_{R2}	ROW2	—	766.17	—	
	f_{R3}	ROW3	—	847.43	—	
	f_{R4}	ROW4	—	947.97	—	
	f_{C1}	COL1	—	1215.88	—	
	f_{C2}	COL2	—	1331.68	—	
	f_{C3}	COL3	—	1471.85	—	
Minimum assured key detection time	t_{MOP}	$t_{ON1} < t_{MOP}$ key to be free of chattering	42.91	44.63	46.35	ms
Oscillator stop time	t_{OD}	$t_{ON1} > t_{MOP}$ and t_{DT} to be free of chattering	1.28	—	3.01	ms
Memory address specification time	t_{DT}	$t_{ON1} < t_{DT}$ key to be free of chattering	*5 3.433xn + 18.88	—	3.44xn + 20.60	ms
Noise judgement time	t_{NJ}	$t_N < t_{NJ}$	—	3.433	—	ms

Notes:

- *1 Key input On effective time
When writing data to the repertory memory while in ON-Hook status (UM91256), it is necessary to add the oscillator starting time to the effective time t_{ON3} .
 $t_{ON3} = t_{ON1} + t_{OS}$ (no key chattering)
- *2 Key input ON effective time (DTMF mode normal dialing)

This is the key read time + mute time + engineering reference signal sending time of 50 ms.

- *3 Auto dialing
Indicates redialing and repertory dialing.
- *4 COL-ROW tone output voltage ratio
The output gain of COL is higher than that of ROW.
- *5 Indicates the number of digits of the telephone number to be stored in the repertory memory.

Tone/Pulse Dialer



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Pin Description

Key Board (R1, R2, R3, R4, C1, C2, C3, C4)

These input can be attached to an XY matrix or 2 of 8 keyboard. C1 ~ C4 are set to High and R1 ~ R4 are set to low at OFF-Hook, enabling the key-input to operate. Scanning signals will be produced to R1 ~ R4 and C1 ~ C4 when a key is pressed. For the UM91255, there is no need to accept key inputs in the ON-Hook status. Each COL and ROW is made identical in order to prevent current flowing when a key is held down. The UM91256 is designed for ON-Hook storing repertory memory. Each COL and ROW has the same state in OH-Hook and OFF-Hook Status enabling the ON-Hook storing to operate.

* and # keys are invalid in DP mode

Tone Pulse Selection (TPS)

DTMF/DP mode select input for UM91255, 91256, DP mode correspond V_{SS} level, DTMF mode correspond V_{DD} . T key is an invalid input.

Dialing Rate Selection (DRS)

The pulse dialing rate can be selected via this input.

DRS Input	Dialing Rate	Inter Digit Pause
V_{DD}	19.42 pps	463.4 ms
V_{SS}	9.71 pps	617.9 ms

Make/Break Ratio (M/B)

The pulse make/break ratio can be selected via this input.

M/B Input	Make/Break Ratio
V_{DD}	40/60 (2/3)
V_{SS}	33.3/66.6 (1/2)

Oscillator (OSCI, OSCO)

These Pins are connected across the terminals of a 3.58 MHz crystal oscillator which is used for the reference signal generator. Oscillator starts running during OFF-Hook status.

Power Supply (V_{DD} , V_{SS})

These pins are the power supply input. This device is designed to operate on 2.0 to 5.5V.

Hook Switch (\overline{HS})

This input is provided to detect the ON/OFF Status of the hook switch. On hook Corresponded to V_{DD} Condition. Off hook corresponds to V_{SS} condition.

Analog Ground (AGND)

This output is the grounding point of switching capacitor filter (SCF) section by connecting a capacitor (Typ: 0.1 μ F) to this point, which stabilizes the level.

DTMF Signal Output (Tone Output)

This output is an emitter-follower structure, DTMF signal is generated when a keypress is detected in DTMF mode. Tone out is off state in DP mode. Tone Duration/inter tone pause is-93.12ms/61.36ms. (in redialing or repertory dialling)

Dialing Pulse Output (\overline{DP})

This output is an inverterstructure. The output level is V_{SS} during ON-Hook or break period, V_{DD} during OFF-Hook or make period.

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Receiver Mute Output (RMUT)

This output is valid in the DP mode. In the DTMF mode, muting is not applicable. The level of this pin is:

Mode	ON-Hook	OFF-Hook	Dialing
DTMF	V _{SS}	V _{DD}	V _{DD}
Pulse	V _{SS}	V _{DD}	V _{SS}

* Inverter output structure.

Transmitter Mute Output (TMUT)

This output provides mute signal for the transmitter, which is usable in both the DP mode and DTMF mode, during dialing in DP and DTMF mode → V_{SS} level and during OFF-Hook: V_{DD} level.

Single Tone Inhibit (STI)

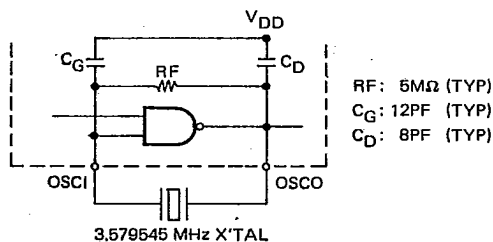
This input consists of a pull down resistor. (Typical: 50kΩ) which inhibits the single tone operation when this pin is floating or common to the V_{SS} level. The single tone generating mode is selected by applying the V_{DD} level which makes single tone generation possible. To generate a single Column tone. Press two or three keys in the column simultaneously.

To generate a single Row tone: Press two or three keys in the Correspond Row simultaneously.

If this chip is in the single tone mode. Redialing and DP are invalid providing no operation.

Function Description

System Clock



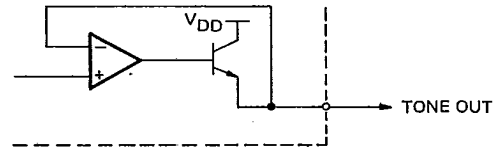
As figure shown above, these pins are simply connecting a 3.579545MHz crystal oscillator which form a refer-

ence signal generators circuit with UM91255. There is no need to accept key-in during ON-Hook status when the Oscillator is OFF.

With UM91256, it is necessary to accept key-in while in ON-HOOK status, so the oscillator circuit will operate when the key is pressed.

Tone Signal Output

The DTMF Signal is produced from the tone frequency generator circuit and is passed through the S.C.F. type band pass filter. The output buffer is an NPN transistor-emitter-follower.

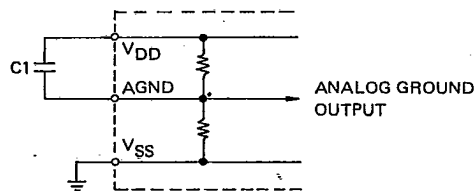


The idle status in the case of the NPN is ON and the level rises to the bias point (≈ 1/2 V_{DD}). The DTMF signal is generated on the bias point. During redialing or repertory dialing, the make period and inter-tone pause are fixed, 93.12ms/61.36ms.

Redialing Inhibit

- This LSI has three redialing inhibit functions, as follows:
- (a) More than 24-digit during normal dialing.
 - (b) If the DTMF/DP mode are switched during normal dialing, subsequent dialing is continued.
 - (c) First key-in was from the **AP** key.

Generation of Operation Bias for Analog Circuit



To increase the stability and noise-immunity of the internal analog circuit, connecting a capacitor is necessary. The resistance-voltage divider, together with the NPN transistor output section, reduce power consumption.



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Key Operation

Normal Dialing

Normal dialing can be performed in either the DP mode or the DTMF mode. In the case of UM91255, 91256, mode is detected and fixed by pin TPS.

Example: OFF-HOOK [D₁] [D_N]
 ([* , #] keys are disabled in DP mode)

Redialing

Redialing is performed by pressing the [RD] key in the OFF-Hook mode to repeat up to 24-digit. [AP] key is considered one digit.

When [0] to [9] keys and [AP] key are pressed for normal dialing, redialing can be done in either the DP or DTMF mode. But there are some difference as shown in the following examples:

< Example > DP mode normal dialing
 [1] [2] [3] [*] [4] [#] [5]
 DTMF mode redialing = "1", "2", "3", "4", "5"

< Example > DTMF mode Normal dialing
 [1] [2] [3] [*] [4] [#] [5]
 DP mode redialing = "1", "2", "3"

The key operation is:

OFF-Hook [RD]

Repertory Dialing

OFF-Hook [RPD] [LOC] (LOC = 0, ..., 9).
 Repertory memory has 18-digit data storing capacity.
 [AP] key is treated as one digit.

Repertory Memory Storage

In case of UM91256. (ON-Hook stored version)

ON-Hook [RPD] [D₁] ... [D_N] [RPD] [LOC]
 ([D] = 0, ..., 9, *, #, AP, [LOC] = 0, ..., 9).

In case of UM91255 (OFF-Hook stored version).

OFF-Hook [AP] [RPD] [D₁] ... [D_N] [RPD] [LOC1]
 (first storage operation)
 [RPD] [D_{N+1}] ... [DM] [RPD] [LOC2]
 (Second storage operation).

Tone/Pulse Mixed Dialing

There are three kinds of dialing sequence.

1. Normal Dialing (Symbolize [ND]).
2. Redialing ([RD]).
3. Repertory dialing ([RPD] [LOC]).

These can be combined in as many types as possible except for "Normal dialing + redialing" which is not possible. Some examples of mixed dialing are shown below.

Normal dialing + repertory dialing

OFF-Hook [ND] [T/P] [RPD] [LOC] ([T/P] means mode switching, it can be accomplished via [T] key or TPS Pin).

Redialing + repertory dialing

OFF-Hook [RD] [T/P] [RPD] [LOC]

Repertory dialing + normal dialing

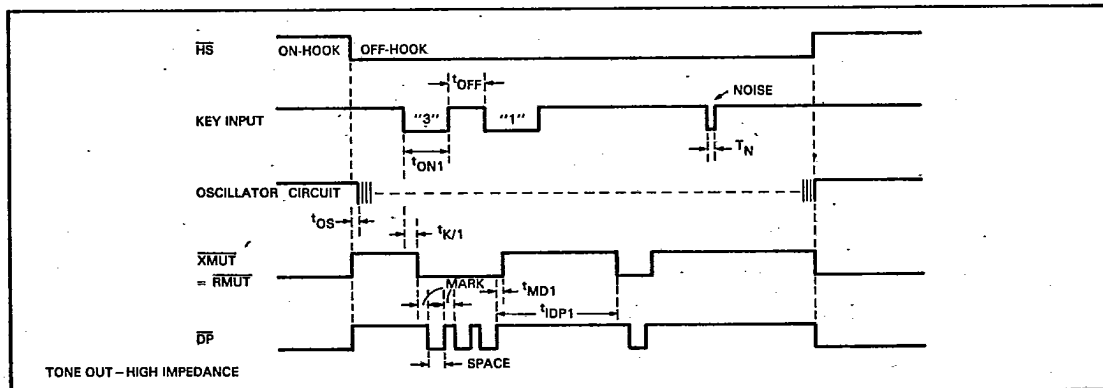
OFF-Hook [RPD] [LOC] [T/P] [ND]

Repertory dialing + Repertory dialing

OFF-Hook [RPD] [LOC1] [T/P] [RPD] [LOC2]

Timing Diagram

NORMAL DIALING (DP MODE)



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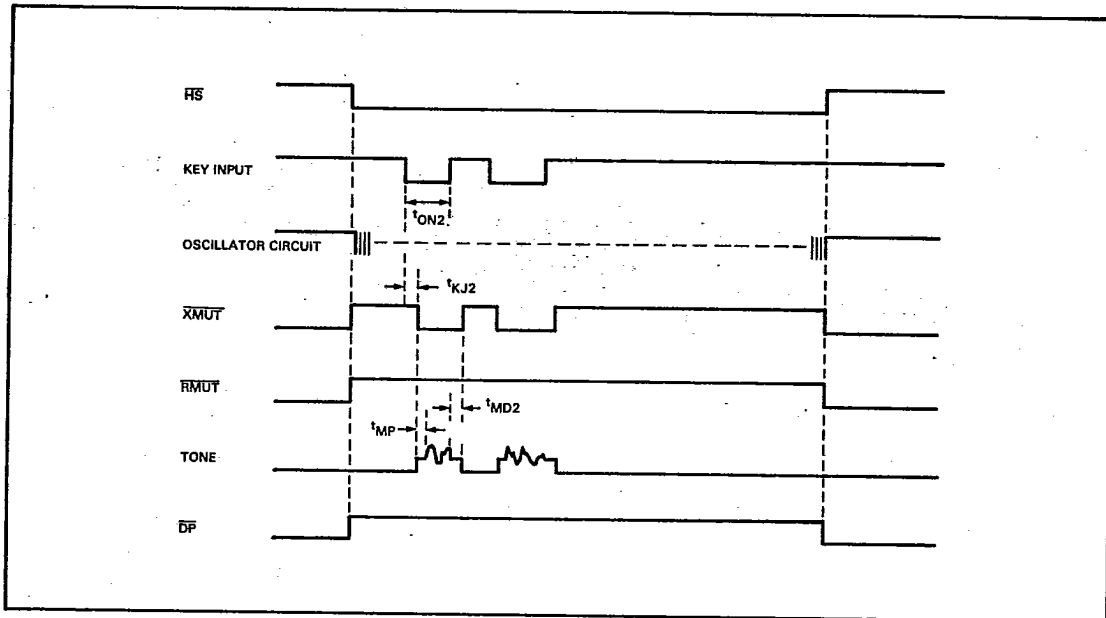
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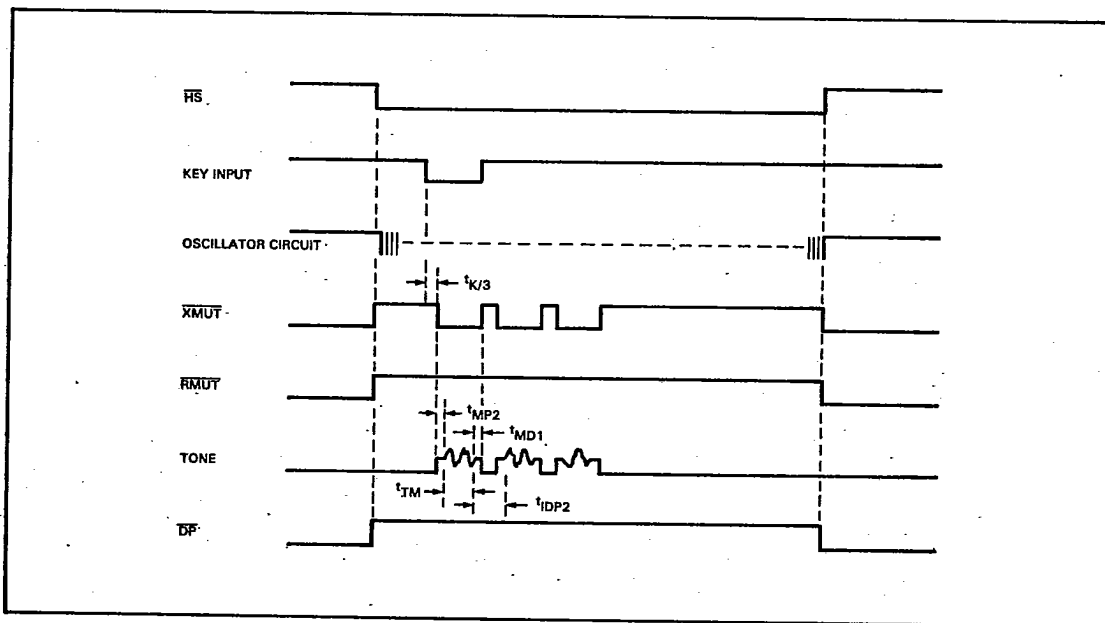
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NORMAL DIALING (TONE MODE)



Tone/Pulse Dialer

REDIALING AND REPERTORY DIALING (TONE MODE)



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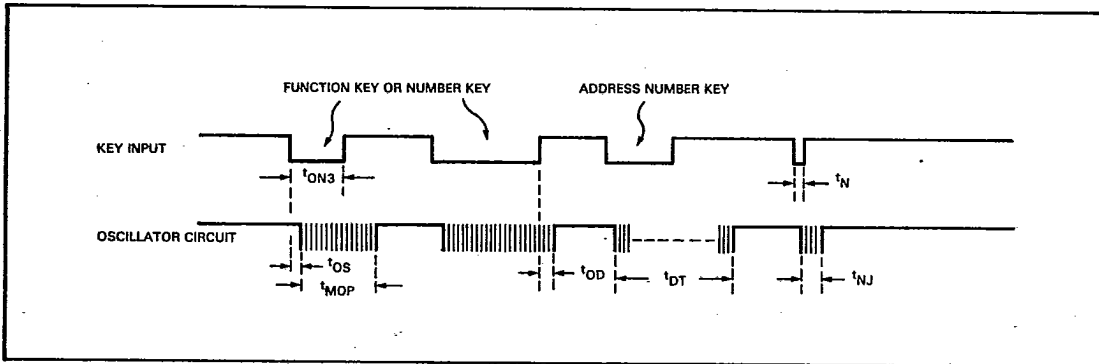
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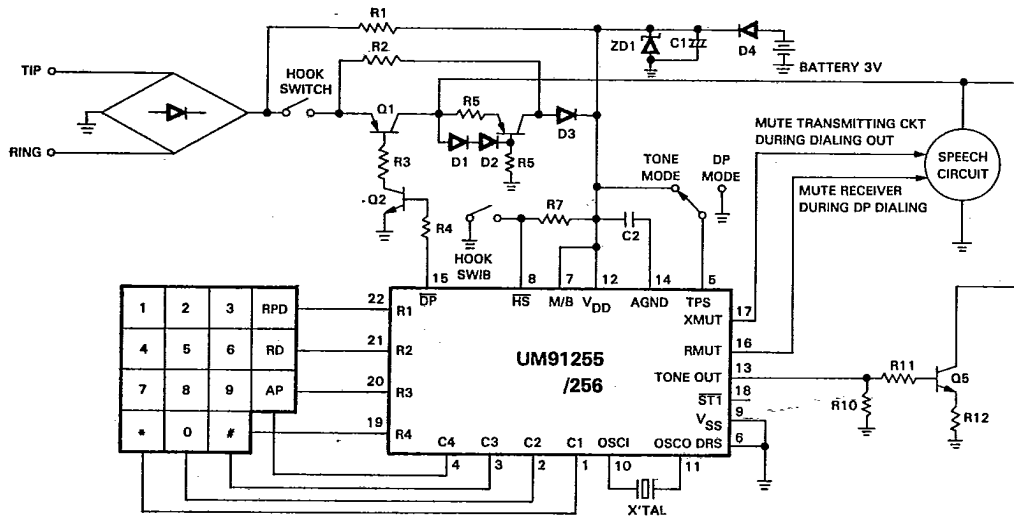


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STORAGE IN REPERTORY MEMORY IN ON-HOOK MODE (UM91256)



UM91255, UM91256 VERSION (M/B = 40/60, DRS = 10PPS, IN THIS EXAMPLE)



Order Information

Type	Repertory Storage	Tone/Pulse Mode Section
UM91255	OFF-Hook Store	Via Tone/Pulse Selection Pin
UM91256	ON-Hook Store	Via Tone/Pulse Selection Pin