

Dialer with Memory

Overview

The LC73710 is a single-chip DTMF/OUTPUT-PULSE dialer CMOS LSI designed for use in pushbutton telephones.

The LC73710 contains a 10-channel two-touch dial memory, a 31-digit 8-channel one-touch automatic dial memory (5 channels of which are shared with two-touch dial memories), a 63-digit redial memory and is capable of providing the ON-hook dial mode and the hold control mode.

Features

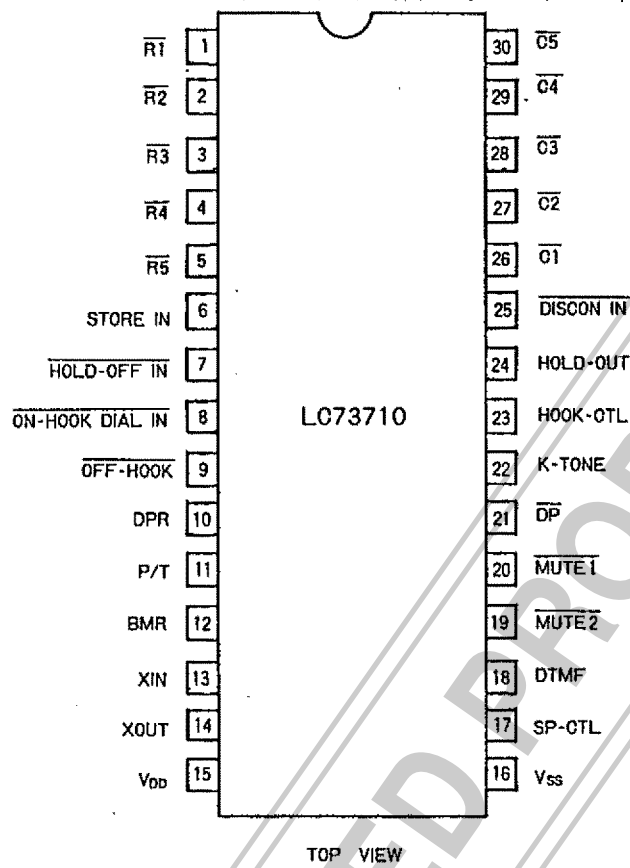
- (1) Low voltage CMOS process for direct operation from telephone line
- (2) Possible to use single contact key board
- (3) Possible to use color-burst crystal resonator or ceramic resonator for on-chip oscillator ($f_{OSC} = 3.58\text{MHz}$)
- (4) Easy to select a ceramic resonator because a high-accuracy DTMF signal frequency generator ($\pm 0.1\%$) is used
- (5) On-chip 10-channel repertory dial memory and 31-digit 8-channel one-touch automatic dial memory (5 channels of which are shared with repertory dial memories)
- (6) Memory store is made at the ON-hook mode
- (7) Data on mode change, pause can be stored in the dial memory.
- (8) On-chip 63-digit redial memory
- (9) A pause is inserted automatically at the time of mode change (4 seconds).
- (10) A pause is inserted automatically after flash operation (1.0 second).
- (11) Mode change is made in one direction only - from pulse mode to tone mode.
- (12) A key touch tone is output at the time of effective key-in (other than DTMF key).
1036Hz, 31ms
- (13) A completion check tone is output at the completion of memory store. (For each channel)
2072Hz, 279ms
- (14) Delivers 12 DTMF signals.
- (15) Provides the ON-hook dial mode.
- (16) Provides the hold mode.
- (17) Possible to select 10pps or 20pps of dial pulse rate
- (18) Possible to use the P/T pin or MC key for mode change
- (19) Possible to select 33% or 39% of dial pulse make rate
- (20) Wide operating voltage range
PULSE mode $V_{DD} = 1.5$ to 5.5V
DTMF mode $V_{DD} = 2.0$ to 5.5V
- (21) Low supply current
PULSE mode $I_{DD} = 0.5\text{mA max}$ ($V_{DD} = 3.0\text{V}$)
DTMF mode $I_{DD} = 1.0\text{mA max}$ ($V_{DD} = 3.0\text{V}$)
- (22) Low standby current
 $I_{DR} = 0.5\mu\text{A max}$ ($V_{DD} = 1.0\text{V}$)
- (23) Dual-in-line plastic 30-pin shrink package

Specifications and information herein are subject to change without notice.

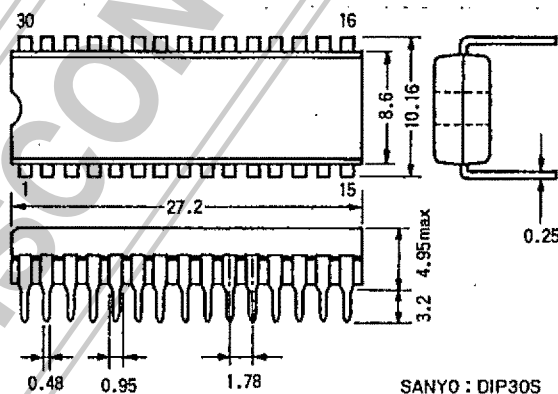
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2140TA/O129TA, TS No.3257-1/8

Pin Assignment



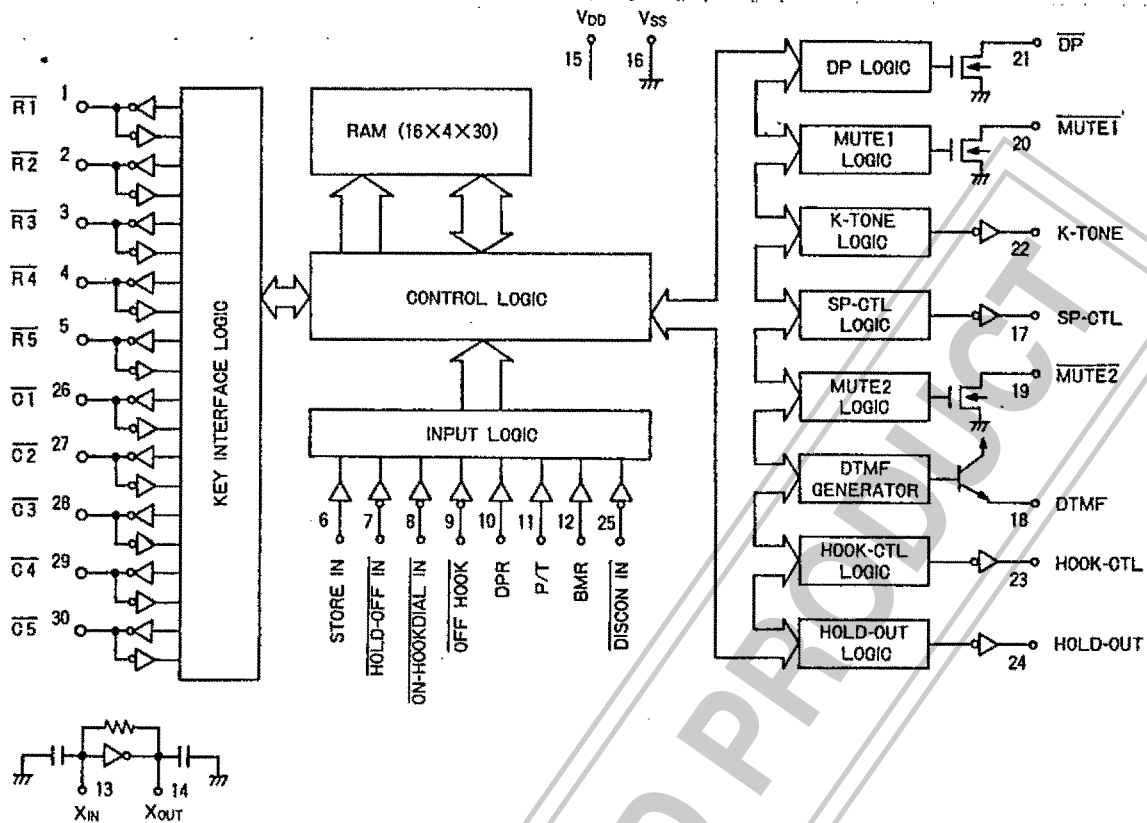
Case Outline 3061-D30SIC
(unit: mm)



Pin Description

Pin No.	Pin Name	Function	
1	$\overline{R1}$	Row input	
2	$\overline{R2}$		
3	$\overline{R3}$		
4	$\overline{R4}$		
5	$\overline{R5}$		
6	STORE IN	Memory store mode input	Detection on the rising edge
7	HOLD-OFF-IN	HOLD mode release input	Detection on the falling edge
8	$\overline{ON-HOOKDIAL-IN}$	ON-HOOK-DIAL input	Detection on the falling edge
9	$\overline{OFF-HOOK}$	HOOK-SW input	
10	DPR	Dial pulse rate select	H = 20pps, L = 10pps
11	P/T	Pulse tone select	H = Pulse, L = Tone
12	BMR	Make rate select input	H = 33%, L = 39%
13	X IN	OSC circuit. A crystal or ceramic resonator is connected. 3.58MHz	
14	X OUT		
15	V _{DD}	Power supply pin	
16	V _{SS}		
17	SP-CTL	Speaker control output	Complementary output
18	DTMF	DTMF output	NPN emitter follower output
19	$\overline{MUTE2}$	DTMF mute output	N-channel open drain output
20	$\overline{MUTE1}$	DP mute output	N-channel open drain output
21	$\overline{DP}$	Dial pulse output	N-channel open drain output
22	K-TONE	K-TONE output	Complementary output
23	HOOK-CTL	HOOK control output	Complementary output
24	HOLD-OUT	HOLD mode output	Complementary output
25	$\overline{DISCON IN}$	DISCONNECT input	
26	$\overline{C1}$	Column input	
27	$\overline{C2}$		
28	$\overline{C3}$		
29	$\overline{C4}$		
30	$\overline{C5}$		

LC73710 Block Diagram



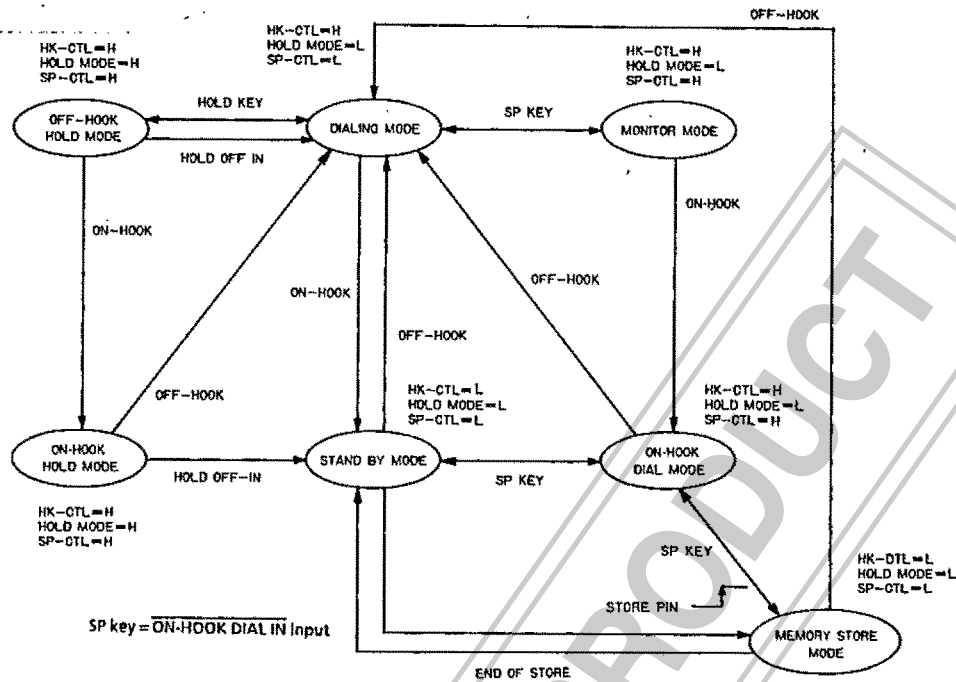
Key Board Assignment

$\overline{R1}$	1	2	3	F	M5
	4	5	6	M	M6
	7	8	9	R/P	M7
	*	0	#	CLR	M8
$\overline{R5}$	A1	A2	A3	HOLD ON/OFF	M9
	$\overline{C1}$				$\overline{C5}$

Key (Matrix) Description

1 to 0	Dial data
*	DTMF dial data (in DTMF dialing mode)
	Mode change data (Pulse → DTMF)
#	DTMF dial data (in DTMF dialing mode)
F	Flash (0.65 second)
CLR	Memory clear, redial inhibit
M	Repertory dial address select
HOLD ON/OFF	Hold mode ON/OFF control
R/P	Redial, pause
A1	One-touch dial key
A2	One-touch dial key
A3	One-touch dial key
M5 to M9	Share addresses with repertory dials M5 to M9.

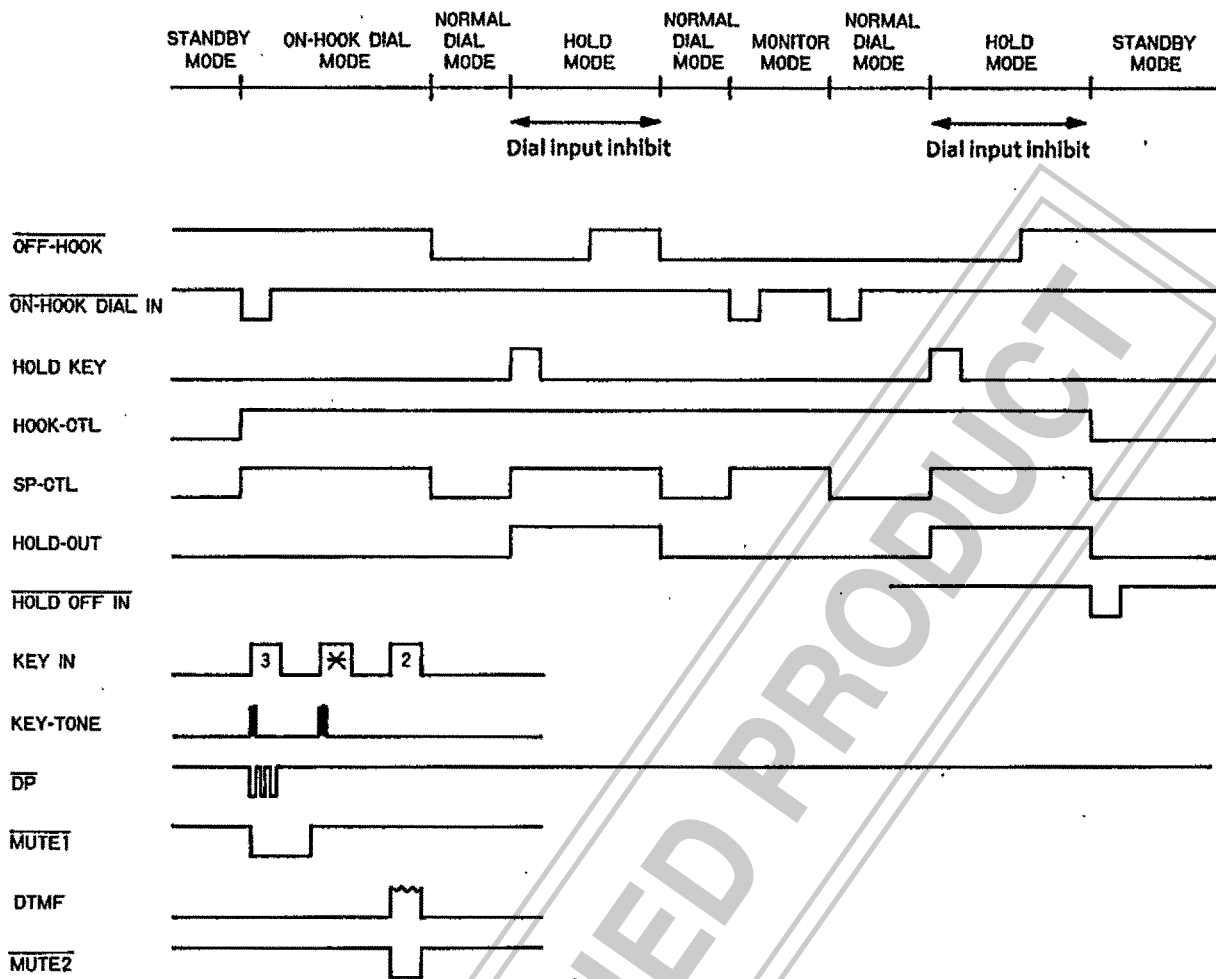
LC73710 State Diagram



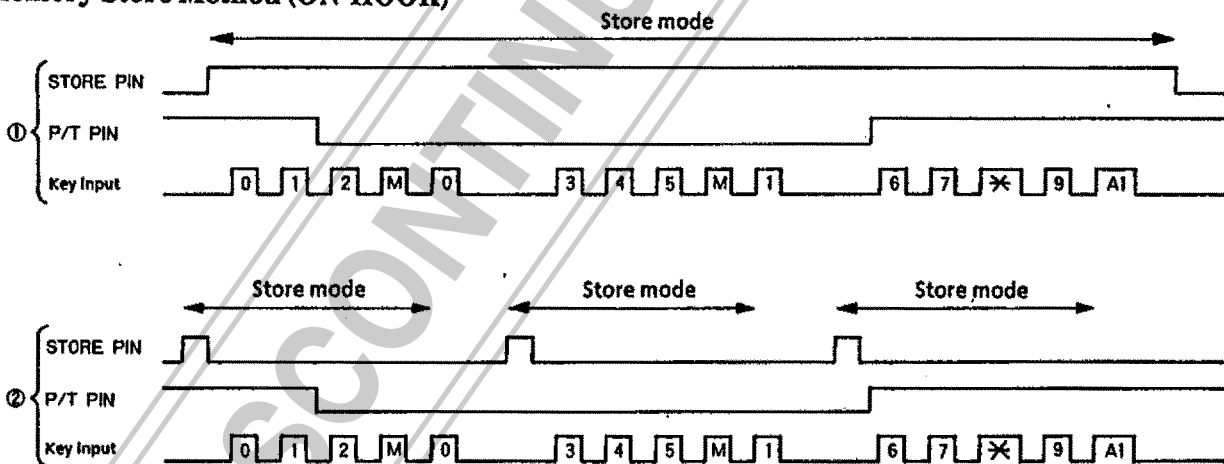
Key Operation

↓ : ON-hook, ↑ : OFF-hook
 [Dn] : Key input
 Dn : Pulse output, Dn : Tone output

Parameter		Key input	Dial output
Normal dial (Pulse mode)		↑ [D ₁] , [D ₂] [D _n]	D ₁ , D ₂ D _n
Normal dial Using [P] key (Pulse mode)		↑ [D ₁] , [D ₂] , [P] , [D ₃]	D ₁ , D ₂ , $\frac{4\text{sec}}{\text{---}}$, D ₃
Normal dial and redial (Pulse mode)	Normal	↑ [D ₁] , [D ₂] [D _n]	D ₁ , D ₂ D _n
	Redial	↓ ↑ [RD]	D ₁ , D ₂ D _n
Normal dial including mode change (Pulse mode at the time of start)	Using key	↑ [D ₁] , [×] , [D ₂] , [D ₃]	D ₁ , $\frac{4\text{sec}}{\text{---}}$, D ₂ , D ₃
	Using P/T SW	↑ [D ₁] , (P/T ↓) , [D ₂] , [D ₃]	D ₁ , $\frac{4\text{sec}}{\text{---}}$, D ₂ , D ₃
Memory store and read	Repertory dial	Store (Pulse mode)	↓ [STO] [D ₁] [D ₂] [D ₃] [M] [D ₄]
		Read	↑ [M] , [D ₄] D ₁ , D ₂ , D ₃
	One-touch dial	Store (Tone mode)	↓ [STO] [D ₁] [D ₂] [D ₃] [A ₁]
		Read	↑ [A ₁] D ₁ , D ₂ , D ₃



Memory Store Method (ON-HOOK)



① Store mode setting method using slide SW, etc.

② Store mode setting method using pushbutton

Memory address	Dial start flag	Dial data			
M0	P	0	1	MC	2
M1	T	3	4	5	
A1	P	6	7	MC	9

MC : Mode change data

Absolute Maximum Ratings at Ta = 25°C

Maximum Supply Voltage max	V _{DD} max	-0.3 to +6.5	V
Maximum Input Voltage	V _{IN} max	-0.3 to V _{DD} + 0.3	V
Maximum Output Voltage	V _{OUT} max	-0.3 to V _{DD} + 0.3	V
Allowable Power Dissipation	P _d max	Ta ≤ 70°C	250 mW
Minimum Load Resistance	R _L min	Across DTMF pin and V _{SS} pin	1 kΩ
Operating Temperature	T _{opg}	-30 to +70	°C
Storage Temperature	T _{stg}	-40 to +125	°C

Allowable Operating Conditions at Ta = 25°C

			min	typ	max	unit
Supply Voltage	V _{DDP}	Pulse mode	1.5		5.5	V
	V _{DDT}	DTMF mode	2.0		5.5	V
Input 'H'-Level Voltage	V _{IH}	All input pins	0.7V _{DD}		V _{DD}	V
Input 'L'-Level Voltage	V _{IL}	All input pins	V _{SS}		0.3V _{DD}	V
Key Contact Resistance	R _{KI}				3.0	kΩ
Keyboard Capacitance	C _{KI}				330	pF
Resonator Specification	f	Center frequency = 3.579545MHz	-1.3		+1.3	%
	R _S				100	Ω

Electrical Characteristics at Ta = 25°C

			min	typ	max	unit
Operating Current	I _{DDP}	Dial pulse output mode, output open, V _{DD} = 3.0V		0.3	0.5	mA
	I _{DDT}	DTMF output mode, output open, V _{DD} = 3.0V		0.5	1.0	mA
Quiescent Current	I _{DD(ST)}	Standby mode, output open, V _{DD} = 1.5 to 5.5V			1	μA
Data Retention Voltage	V _{DR}				1	V
Data Retention Current	I _{DR}	V _{DD} = 1V			0.5	μA
Input 'H'-Level Current	I _{IH1}	STO IN, OFF-HOOK, DPR, P/T, BMR, ON-HOOK-DIAL IN, HOLD-OFF, DISCON IN pins, V _{IH} = V _{DD}			1	μA
Input 'L'-Level Current	I _{IL1}	STO IN, OFF-HOOK, DPR, P/T, BMR, ON-HOOK-DIAL IN, HOLD-OFF, DISCON IN pins, V _{IL} = V _{DD}	-1			μA
Key Pin Current	I _{ILK1}	All key pins, V _{DD} = 1.5V, V _{IHK} = V _{DD}	-20			μA
	I _{ILK2}	All key pins, V _{DD} = 5.5V, V _{IHK} = V _{DD}	-300			μA
	I _{OLK1}	All key pins, V _{DD} = 1.5V, V _{IHL} = V _{SS}	200			μA
	I _{OLK2}	All key pins, V _{DD} = 5.5V, V _{IHL} = V _{SS}	700			μA
Output OFF-State Leakage Current	I _{OFF}	V _O = V _{DD} , V _{DD} = 5.5V, output OFF, DP, MUTE1, MUTE2 pins			1	μA
Output Pin Voltage	V _{OH1}	K-TONE, HOLD-OUT, HOOK-CTL, SP-CTL pins, V _{DD} = 1.5V, I _{OH} = -250μA		V _{DD} - 0.5		V
	V _{OH2}	K-TONE, HOLD-OUT, HOOK-CTL, SP-CTL pins, V _{DD} = 5.5V, I _{OH} = -1mA		V _{DD} - 1		V
	V _{OL1}	K-TONE, DP, MUTE1, MUTE2, SP-CTL, HOLD-OUT, HOOK-CTL pins, V _{DD} = 1.5V, I _{OL} = 250μA			0.4	V
	V _{OL2}	K-TONE, DP, MUTE1, MUTE2, SP-CTL, HOLD-OUT, HOOK-CTL pins, V _{DD} = 5.5V, I _{OL} = 1mA			0.4	V

LC73710

AC Characteristics at Ta=25°C, f_{OSC}=3.579545MHz

		min	typ	max	unit
Key Debounce Time	T _{KD}	16.4	17.5	18.4	ms
PIN Chattering Rejection Time	T _{PCHT}	28.9	30	30.9	ms
Key Scan Frequency	f _{KSC}		258.9		Hz
Key Tone Frequency	f _{KT}		1035.7		Hz
Key Tone Output Time	T _{KT}		30.9		ms
Auto Pause Time	T _{AP}	At 10PPS pulse mode	3.98	4.0	4.03 sec
		At 20PPS pulse mode	3.98	4.0	4.03 sec
		DTMF mode	3.98	4.0	4.03 sec
DTMF Output Time	T _{MFON}	98	100	102	ms
DTMF Interdigit Pause Time	T _{MFOFF}	93	95	97	ms
Hooking Time	T _{HK}	640	650	660	ms
Hooking Pause Time	T _{HKP}	0.98	1.0	1.02	s
Memory Store Confirmed Frequency	f _{KST}		2071.4		Hz
Memory Store Confirmed Time	T _{KSTON}		278.1		ms
Low Tone Amplitude	V _{OR}	V _{DD} =3.5V, R _L =10kΩ	165	200	240 mVrms
Tone Output Ratio	dBCR	V _{DD} =2.0 to 5.5V, R _L =10kΩ	1	2	3 dB
Tone Output Distortion	%DIS	V _{DD} =2.0 to 5.5V, R _L =10kΩ			10 %
Oscillation Start Time	T _{START}	V _{DD} =1.5 to 5.5V			30 ms
		V _{DD} =3.0V		1	ms

Dial Pulse Output/f_{osc}=3.579545MHz

DPR Pin	BMR Pin	Dial pulse rate	Interdigit pause	Make ratio
Vss	VDD	9.94PPS	834.2ms	33.2%
VDD	VDD	19.89PPS	525.2ms	33.2%
Vss	Vss	9.94PPS	834.2ms	39.2%
VDD	Vss	19.89PPS	525.2ms	39.2%

DTMF Output/f_{osc}=3.579545MHz

Input	Output frequency [Hz]		Deviation [%]
	Standard	LC73710	
R1	697	697.0	+0.01
R2	770	770.1	-0.02
R3	852	852.3	-0.03
R4	941	942.0	-0.11
C1	1209	1209.3	-0.03
C2	1336	1335.7	+0.03
C3	1477	1476.7	+0.02

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