

SANYO

No.3257A

LC73710

CMOS LSI

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

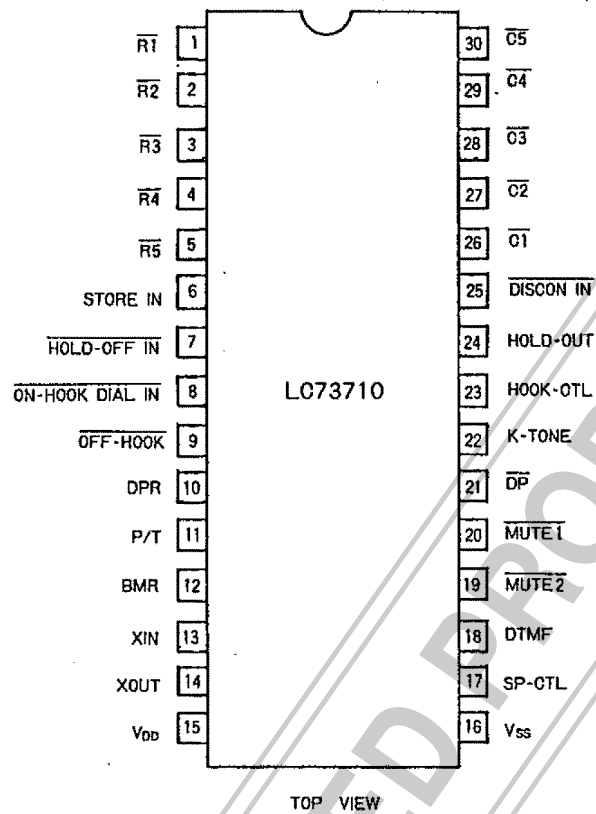
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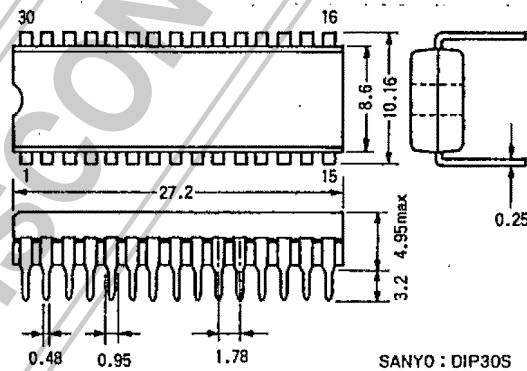
2140TA/O129TA, TS No.3257-1/8

LC73710

Pin Assignment



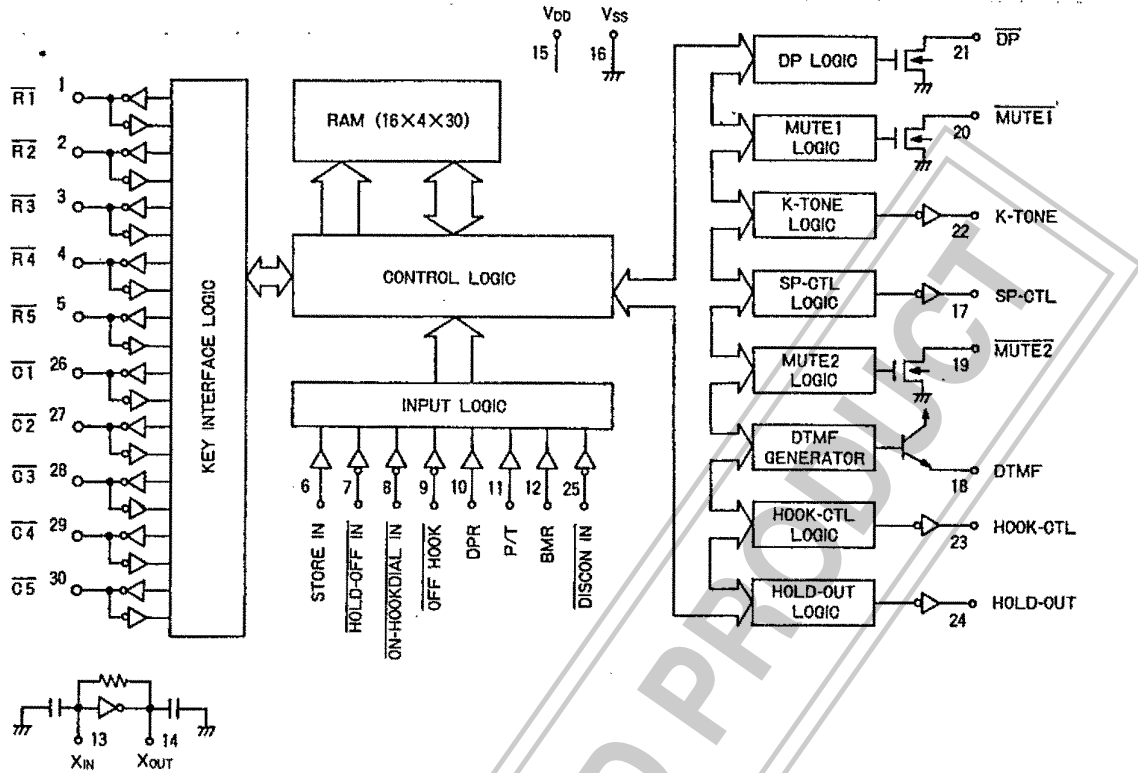
Case Outline 3061-D30SIC
(unit : mm)



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	$\overline{\text{HOLD-OFF-IN}}$	HOLD mode release input	Detection on the falling edge
8	$\overline{\text{ON-HOOKDIAL-IN}}$	ON-HOOK-DIAL input	Detection on the falling edge
9	$\overline{\text{OFF-HOOK}}$	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	$\overline{\text{MUTE2}}$	DTMF mute output	N-channel open drain output
20	$\overline{\text{MUTE1}}$	DP mute output	N-channel open drain output
21	$\overline{\text{DP}}$	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	$\overline{\text{DISCON IN}}$	DISCONNECT input	
26	$\overline{C1}$	Column input	
27	$\overline{C2}$		
28	$\overline{C3}$		
29	$\overline{C4}$		
30	$\overline{C5}$		

LC73710 Block Diagram



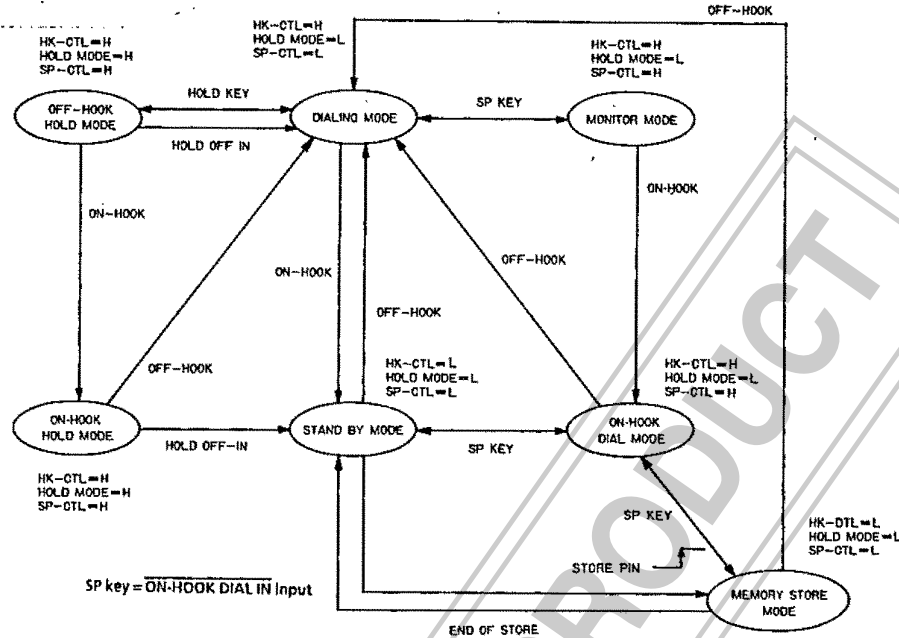
Key Board Assignment

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

Key (Matrix) Description

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

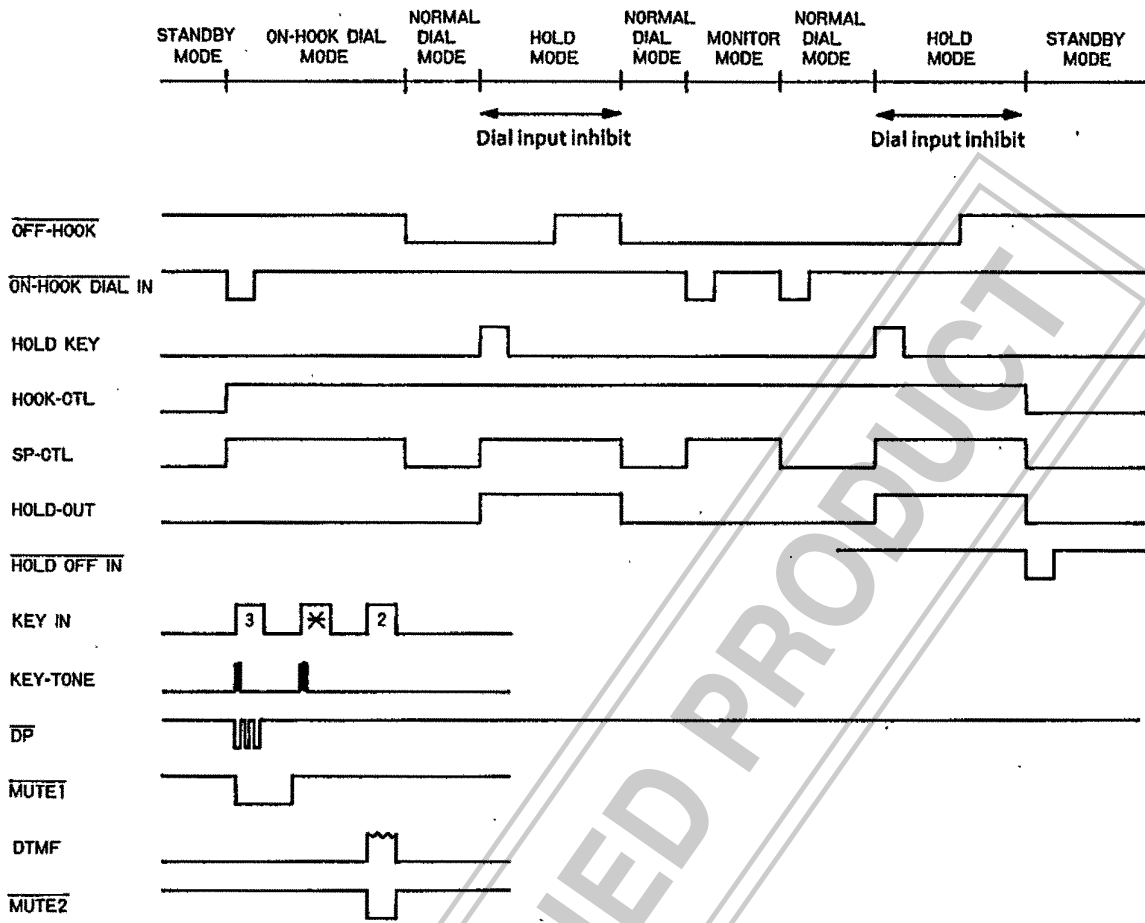
LC73710 State Diagram



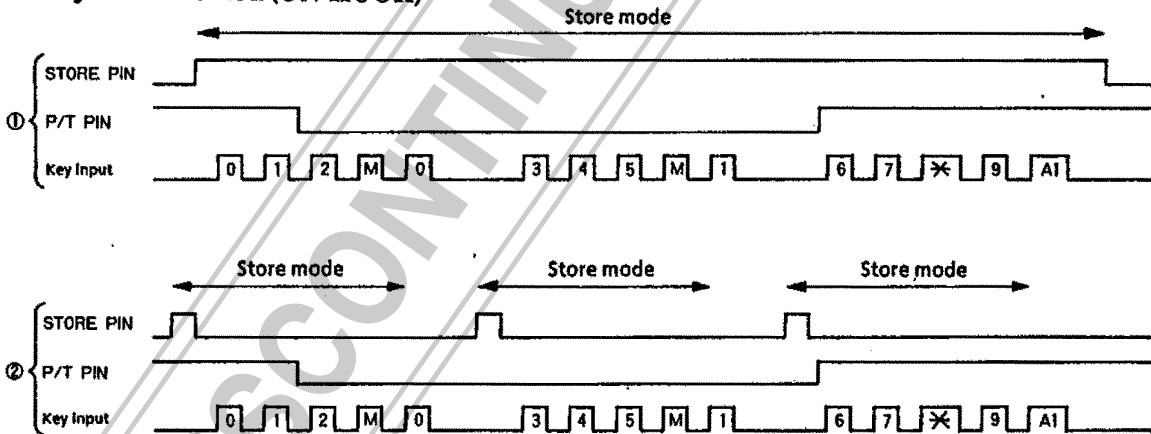
Key Operation

- ↓ : 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 , $\xrightarrow{4\text{sec}}$ 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	$\xrightarrow{4\text{sec}}$ D ₁ , D ₂ , D ₃	
	Using P/T SW	↑ □ D ₁ , (P/T ↓) , □ D ₂ , □ D ₃	$\xrightarrow{4\text{sec}}$ D ₁ , 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	① ② MC ③
M1	T	④ ⑤
A1	P	⑥ ⑦ MC ⑧ ⑨

ⓂC : Mode change data

Absolute Maximum Ratings at Ta=25°C

			unit
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 _{IOLK1}	All key pins, V _{DD} = 1.5V, V _{IHL} = V _{SS}	200			μA
	I _{IOLK2}	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

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AC Characteristics at $T_a = 25^\circ\text{C}$, $f_{\text{osc}} = 3.579545\text{MHz}$

		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} $V_{\text{DD}} = 3.5\text{V}$, $R_{\text{L}} = 10\text{k}\Omega$	165	200	240	mV _{rms}	
Tone Output Ratio	dBCR $V_{\text{DD}} = 2.0$ to 5.5V , $R_{\text{L}} = 10\text{k}\Omega$	1	2	3	dB	
Tone Output Distortion	%DIS $V_{\text{DD}} = 2.0$ to 5.5V , $R_{\text{L}} = 10\text{k}\Omega$			10	%	
Oscillation Start Time	T_{START} $V_{\text{DD}} = 1.5$ to 5.5V			30	ms	
		$V_{\text{DD}} = 3.0\text{V}$		1	ms	

Dial Pulse Output/ $f_{\text{osc}} = 3.579545\text{MHz}$

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/ $f_{\text{osc}} = 3.579545\text{MHz}$

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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