



LC73861, LC73862

DTMF Receiver LSI

Overview

The LC73861 and LC73862 are DTMF signal detector receiver that incorporates all the necessary filters for telephone answering machines.

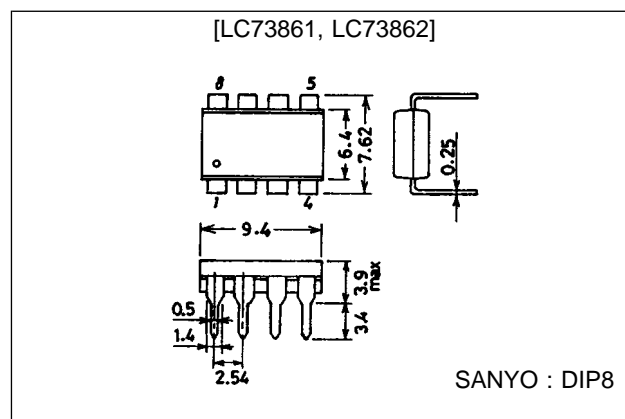
Features

- 16-DTMF tone signal decoder
- DTMF receiver with all necessary filters built-in
 - Dial tone filter
 - High-group bandpass filter
 - Low-group bandpass filter
- Extended dynamic range
- Serial data output
- Microcontroller guard-time compatible
- 4.5 to 5.5 V operating supply voltage range

Package Dimensions

unit : mm

3001B-DIP8



Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$, $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{DD\text{ max}}$		-0.3 to +6.0	V
Maximum input voltage	$V_{IN\text{ max}}$		-0.3 to $V_{DD} + 0.3$	V
Maximum input current	$I_{IN\text{ max}}$		-10 to +10	mA
Maximum output voltage	$V_{OUT\text{ max}}$		-0.3 to $V_{DD} + 0.3$	V
Allowable power dissipation	$Pd\text{ max}$	$T_a \leq 85^\circ\text{C}$	500	mW
Operating temperature	T_{opr}		-40 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-50 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$, $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating supply voltage	V_{DD}		4.5		5.5	V
High-level input voltage	V_{IH}	ACK pin	$0.7V_{DD}$			V
Low-level input voltage	V_{IL}	ACK pin			$0.3V_{DD}$	V

DC Electrical Characteristics at $T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$, $V_{DD} = 5\text{ V}$, $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating supply current	$I_{DD(op)}$			3	7	mA
High-level output current	I_{OH}	$V_{OUT} = 4.6\text{ V}$, SD and EST pins			-0.4	mA
Low-level output current	I_{OL}	$V_{OUT} = 0.4\text{ V}$, SD and EST pins	1			mA
Input impedance	Z_{in}	INPUT pin	10			$k\Omega$

LC73861, LC73862

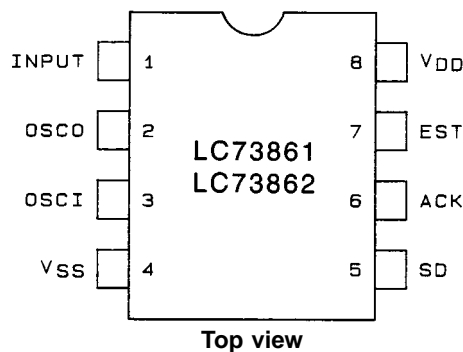
AC Electrical Characteristics at $T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$, $V_{DD} = 5\text{ V}$, $V_{SS} = 0\text{ V}$, $f_{OSC} = 4.194304\text{ MHz}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Valid input signal level		See notes 1, 2, 3, 5, 6 and 9.	-49.5		0	dBm
Positive twist accept		See notes 2, 3, 4, 9 and 11.		6		dB
Frequency deviation accept		See notes 2, 3, 5 and 9.	$\pm 1.5\% \pm 2$			Hz
Frequency deviation reject		See notes 2, 3 and 5.	± 3.5			%
Third tone tolerance		See notes 2, 3, 4, 5, 9 and 10.		-16		dB
Dial tone tolerance		See notes 2, 3, 4, 5, 8, 9 and 10.		22		dB
Noise tolerance		See notes 2, 3, 4, 5, 7, 9 and 10.		-12		dB
Tone present detect time	t_{DP}	See Timing Chart.	3		20	ms
Tone absent detect time	t_{DA}	See Timing Chart.	0.5		20	ms
Data shift rate					1	MHz
Data output delay time	t_{PAD}	See Timing Chart.		100		ns
Setup time delay	t_{DL}	See Timing Chart.	0			ns
Data hold time	t_{DH}	See Timing Chart.	30			ns
Oscillator frequency	f_{OSC}	LC73861	4.190109	4.194304	4.198498	MHz
		LC73862	3.5759	3.5795	3.5831	MHz
Load capacitance	C_{XO}	OSCI and OSCO			30	pF

Notes

1. 0 dBm = 1 mW power when driving a 600 Ω load.
2. All 16 DTMF signal frequencies.
3. 40 ms DTMF signal period and 40 ms pause period.
4. Nominal DTMF frequency.
5. Low-frequency group and High-frequency group signal levels are the same.
6. DTMF signal frequency deviation is within $\pm 1.5\% \pm 2$ Hz.
7. Bandwidth limited (0 to 3 kHz) Gaussian noise.
8. 350 Hz and 440 Hz dial tone frequencies.
9. Error rate of less than 1 in 10,000.
10. Referenced to the lowest frequency component of the DTMF signal.
11. Twist = High-frequency group tone level \div Low-frequency group tone level.

Pin Assignment



Pin Description

Number	Name	I/O	Description
1	INPUT	I	Input coupling capacitor required. Biased internally to $V_{DD}/2$.
2	OSCO	O	An oscillating circuit is formed by connecting a 4.194304 MHz (LC73861) / 3.579545 MHz (LC73862) oscillator and a capacitor (if needed) between these pins. (To determine whether an external capacitor is needed or not, contact the manufacturer of the oscillator.)
3	OSCI	I	
4	V_{SS}		Supply pin, normally 0 V
5	SD	O	Outputs 4-bit serial decoded DTMF output, least significant bit first.
6	ACK	I	The ACK pin is used to shift out data to the SD pin. Four pulses are needed in order to shift out the 4-bit DTMF code. The data is latched by the shift register before the rising edge of the first pulse.
7	EST	O	Indicates the presence of a DTMF signal when HIGH. (This pin can be monitored and after a short delay, data can be accessed by 4 pulses to ACK.)
8	V_{DD}	O	Supply pin, normally 4.5 V to 5.5 V

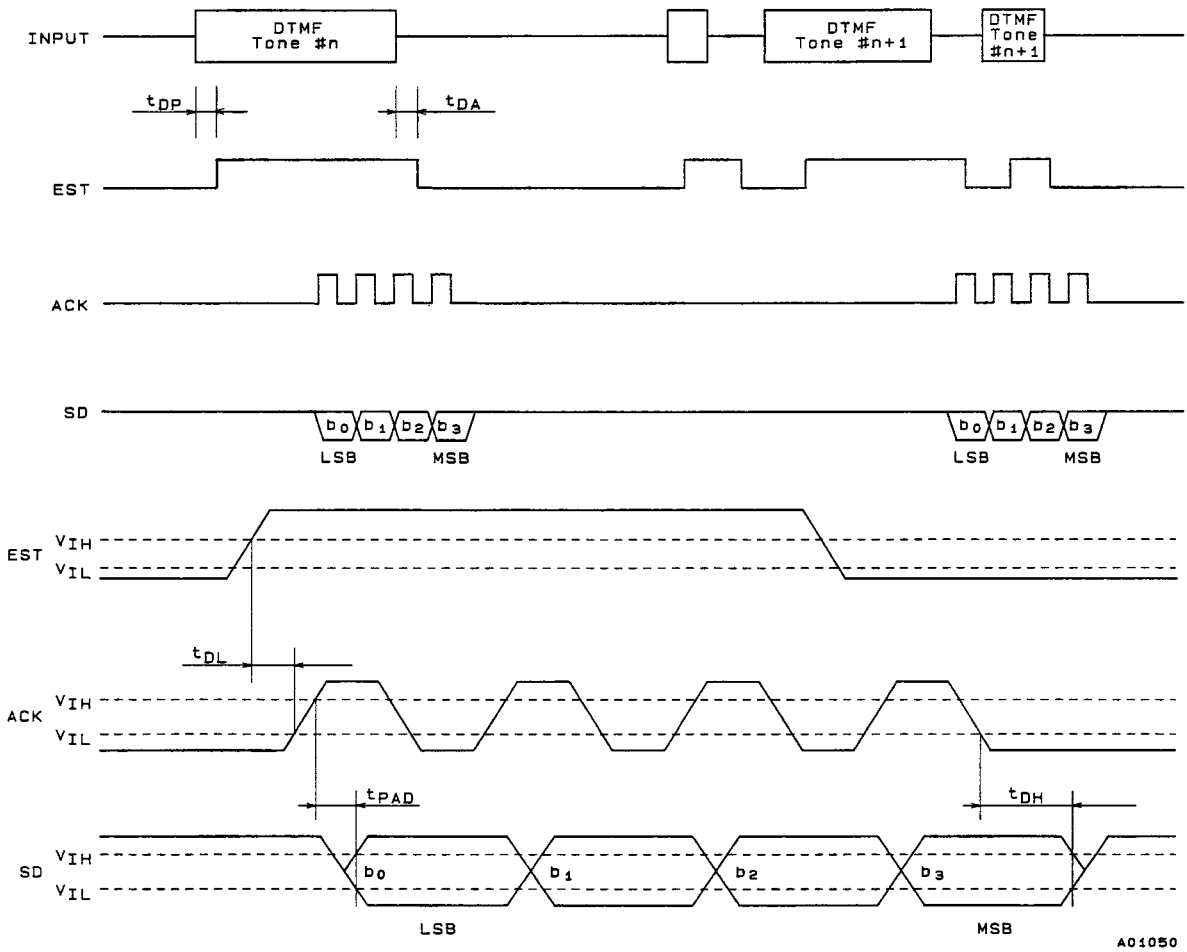
Output Code Table

F _L	F _H	KEY	b3	b2	b1	b0
697	1209	1	L	L	L	H
697	1336	2	L	L	H	L
697	1477	3	L	L	H	H
770	1209	4	L	H	L	L
770	1336	5	L	H	L	H
770	1477	6	L	H	H	L
852	1209	7	L	H	H	H
852	1336	8	H	L	L	L
852	1477	9	H	L	L	H
941	1336	0	H	L	H	L
941	1209	*	H	L	H	H
941	1477	#	H	H	L	L
697	1633	A	H	H	L	H
770	1633	B	H	H	H	L
852	1633	C	H	H	H	H
941	1633	D	L	L	L	L

DTMF Dialing Matrix

	C1	C2	C3	C4
R1	1	2	3	A
R2	4	5	6	B
R3	7	8	9	C
R4	*	0	#	D

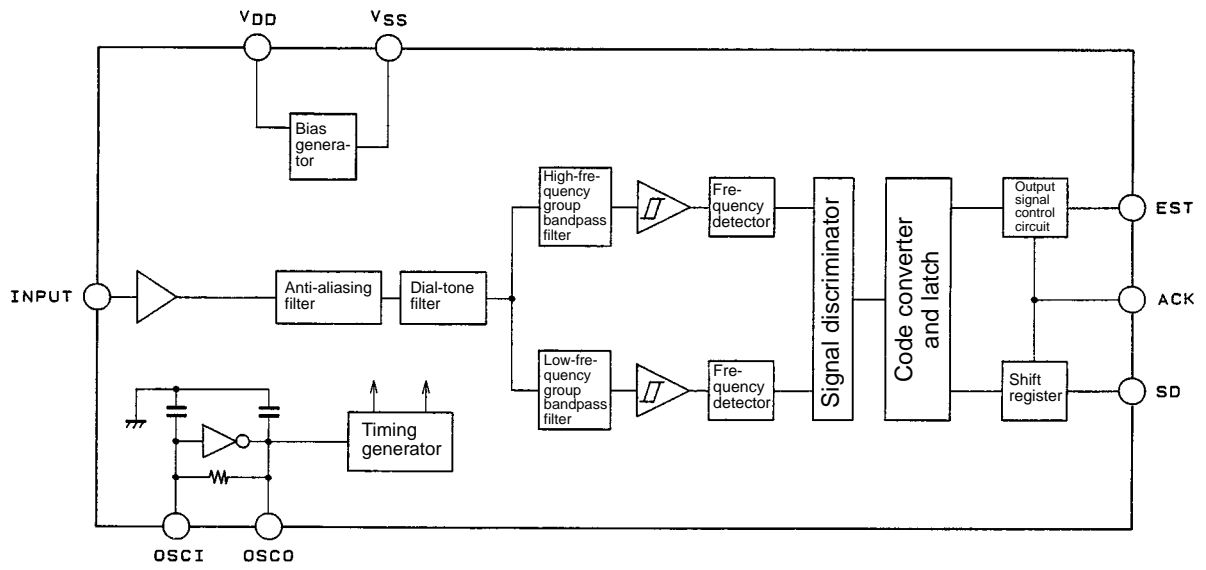
Timing Chart



A01050

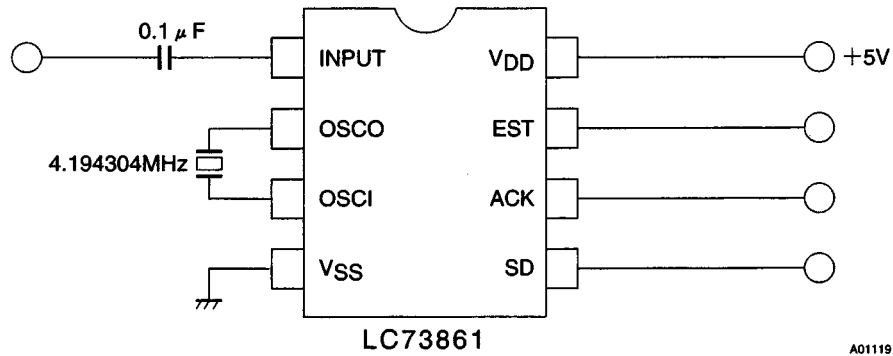
LC73861, LC73862

Equivalent Block Diagram

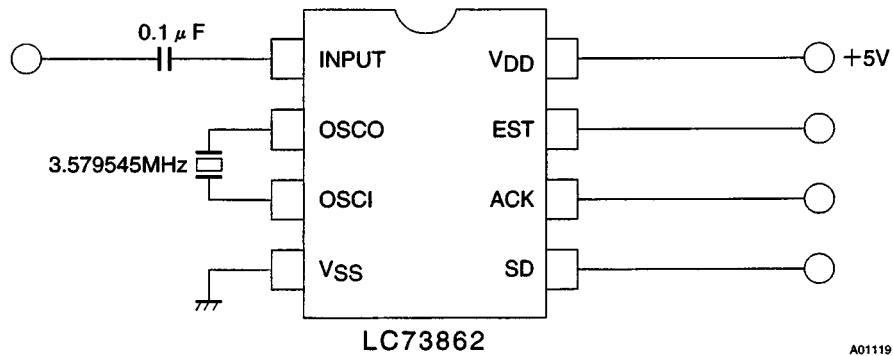


A01118

Test Circuit / Sample Application Circuit



A01119



A01119

- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
- Anyone purchasing any products described or contained herein for an above-mentioned use shall:
 - ① Accept full responsibility and indemnify and defend SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors and all their officers and employees, jointly and severally, against any and all claims and litigation and all damages, cost and expenses associated with such use:
 - ② Not impose any responsibility for any fault or negligence which may be cited in any such claim or litigation on SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors or any of their officers and employees jointly or severally.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of September, 1997. Specifications and information herein are subject to change without notice.