



LC73860

DTMF Receiver IC

Overview

The LC73860 is a DTMF signal detector receiver that incorporates all the necessary filters for telephone answering machines.

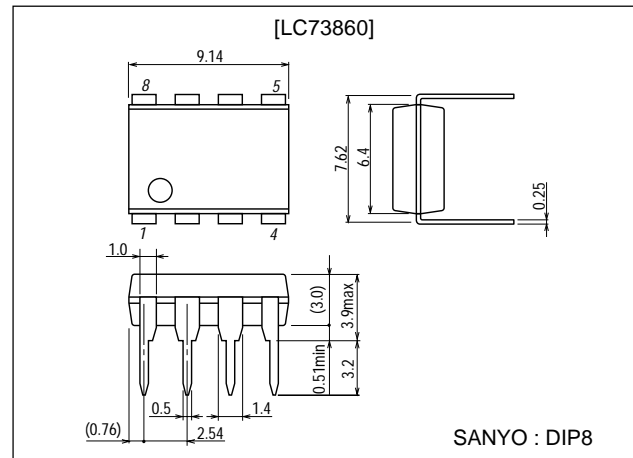
Features

- 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 5.5V operating supply voltage range.
- Available in 8-pin plastic DIPs (300 mil).

Package Dimensions

unit:mm

3001C-DIP8



Specifications

Absolute Maximum Ratings at $T_a=25\pm 2^\circ\text{C}$, $V_{SS}=0\text{V}$

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

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Operating supply voltage	V_{DD}		4.5		5.5	V
Input HIGH-level voltage	V_{IH}	ACK pin		$0.7V_{DD}$		V
		PD pin		$0.85V_{DD}$		V
Input LOW-level voltage	V_{IL}	ACK pin			$0.3V_{DD}$	V
		PD pin			$0.15V_{DD}$	V

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

SANYO Electric Co.,Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

LC73860

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Operating supply current	$I_{DD(op)}$			3.0	7.0	mA
Standby supply current	$I_{DD(st)}$	$V_{PD}=5\text{V}$			10	μA
Output HIGH-level current	I_{OH}	$V_{OUT}=4.6\text{V}$, SD and EST pins			-0.4	mA
Output LOW-level current	I_{OL}	$V_{OUT}=0.4\text{V}$, SD and EST pins	1			mA
Input impedance	Z_{in}	INPUT pin	10			$\text{k}\Omega$

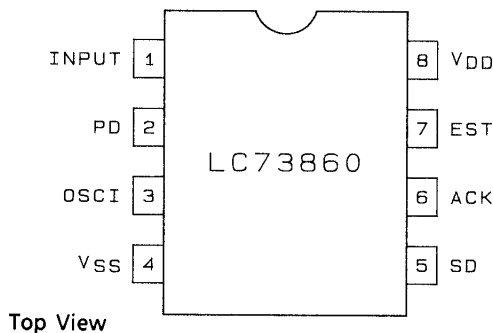
AC Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=5\text{V}$, $V_{SS}=0\text{V}$, $f_{OSC}=4.194304\text{MHz}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
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, 8, 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}		4.152362	4.194304	4.236247	MHz

Notes

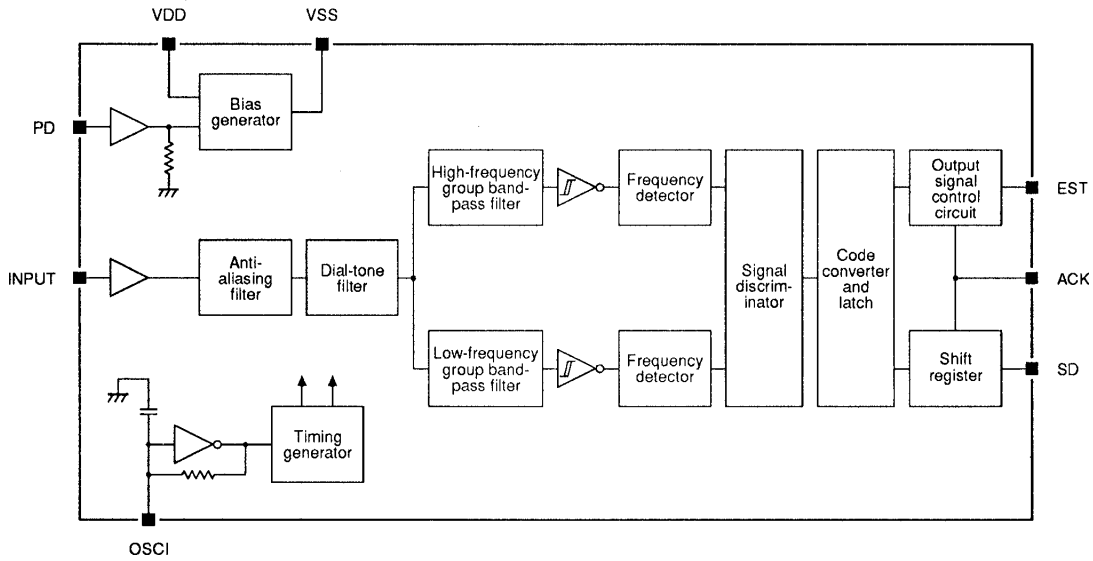
- 0dBm=1mW power when driving a 600 Ω load.
- All 16 DTMF signal frequencies.
- 40ms DTMF signal period and 40ms pause period.
- Nominal DTMF frequency.
- Low-frequency group and High-frequency group signal levels are the same.
- DTMF signal frequency deviation is within $\pm 1.5\% \pm 2\text{Hz}$.
-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

Pin Assignment



LC73860

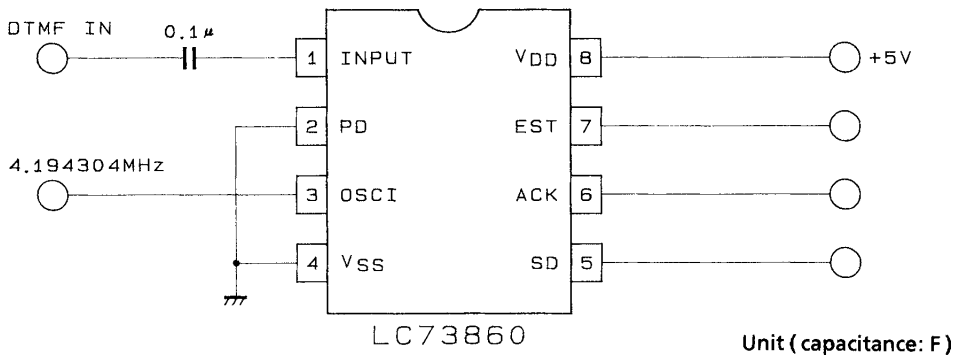
Block Diagram



Pin Functions

Number	Name	I/O	Description
1	INPUT	I	Input coupling capacitor connection. Biased internally to $V_{DD}/2$.
2	PD	I	Power-down mode is selected when HIGH.
3	OSCI	I	4.194304MHz external clock input.
4	VSS		Ground (0V).
5	SD	O	Outputs the 4-bit serial, decoded DTMF output, least significant bit first.
6	ACK	I	Shift data to SD control. Four pulses are used to output the 4-bit DTMF code. Before the first rising edge, the data is latched into the shift register.
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 applying 4 pulses to ACK.
8	VDD	O	4.5 to 5.5V supply voltage.

Test/Application Circuit



LC73860

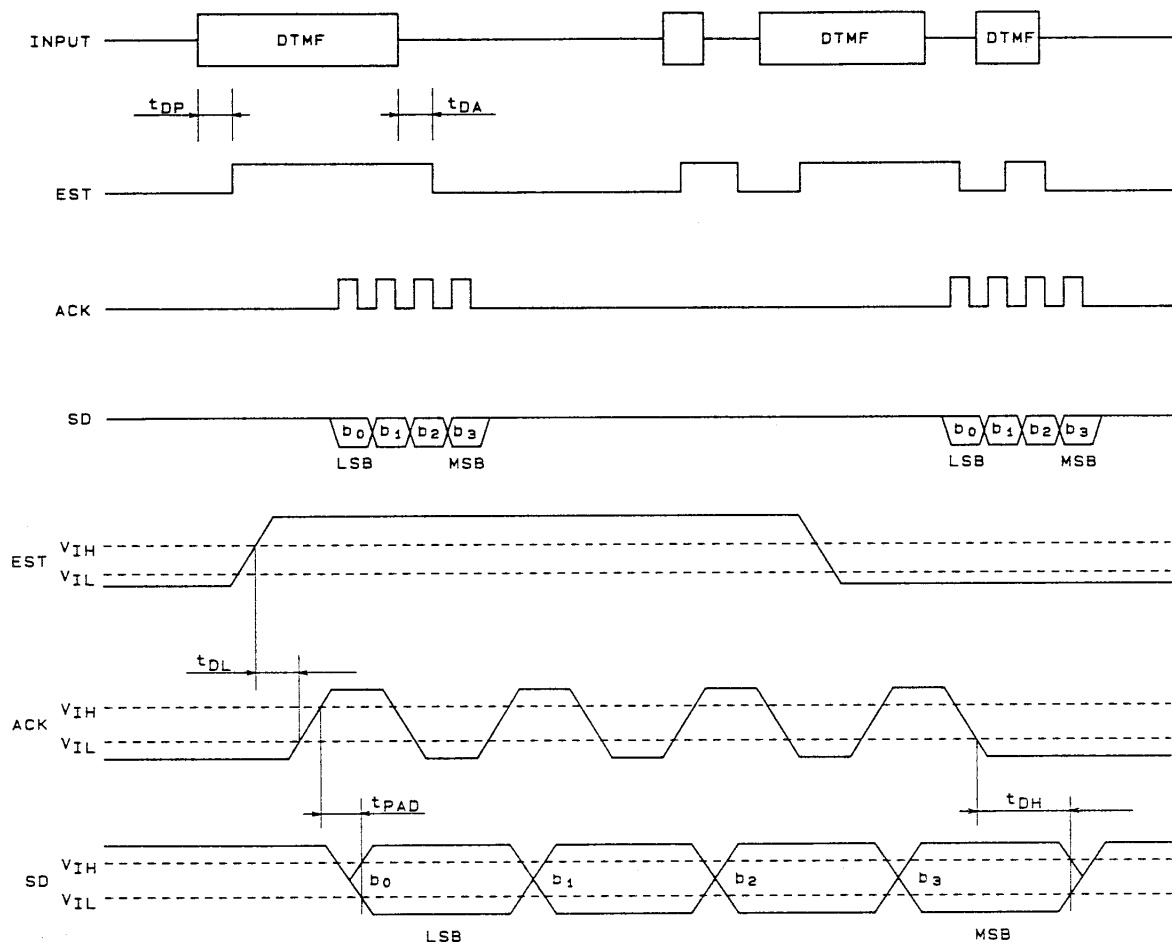
Output Code Table

FL	FH	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



- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- 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 May, 2001. Specifications and information herein are subject to change without notice.