Ordering number: EN 4367

CMOS LSI

No. 4367

LC73860

DTMF Receiver IC

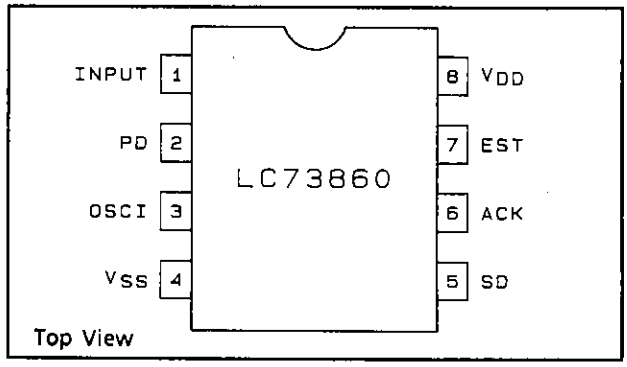
OVERVIEW

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

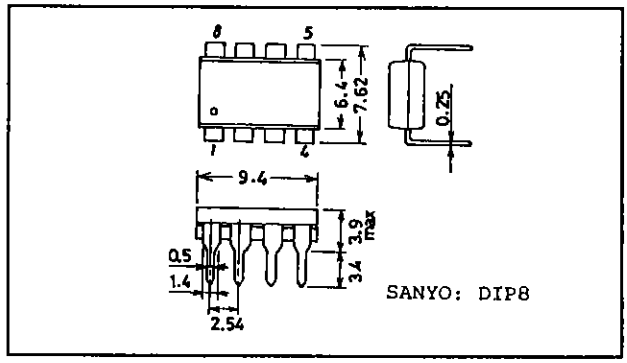
PIN ASSIGNMENT



PACKAGE DIMENSIONS

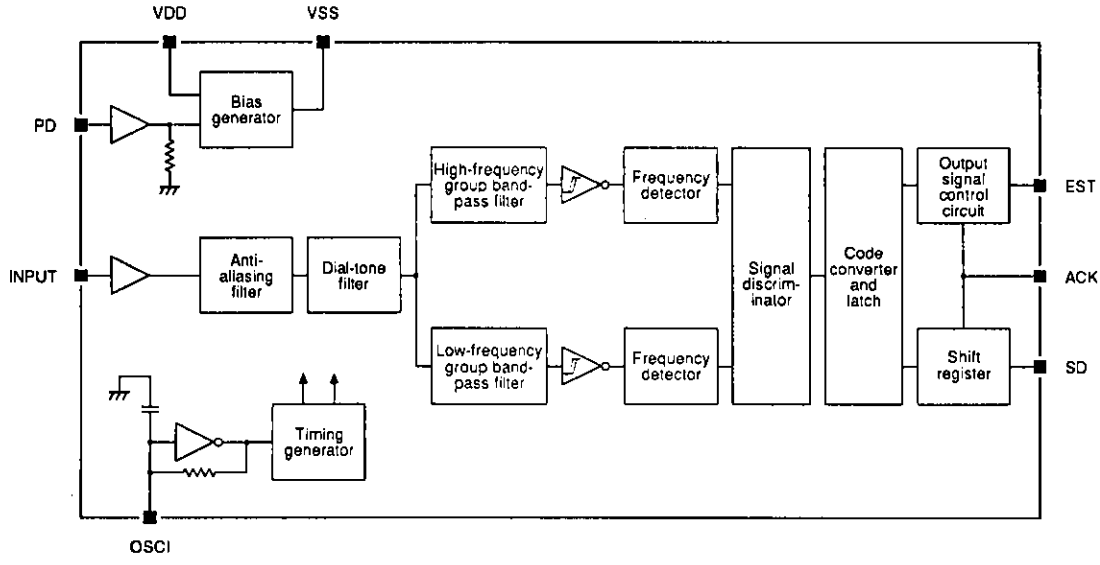
Unit: mm

3001B-DIP8



SANYO Electric Co.,Ltd. Semiconductor Business Headquarters
TOKYO OFFICE Tokyo Bldg., 1-10,1 Chome, Ueno, Taito-ku, TOKYO, 110 JAPAN

BLOCK DIAGRAM



PIN DESCRIPTION

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	4.194304 MHz external clock input
4	V_{SS}		Ground (0 V)
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	V_{DD}	O	4.5 to 5.5 V supply voltage

SPECIFICATIONS

Absolute Maximum Ratings

T_a = 25 ±2 °C, V_{SS} = 0 V

Parameter	Symbol	Rating	Unit
Supply voltage range	V_{DD} max	−0.3 to +6.0	V
Input voltage range	V_{IN} max	−0.3 to V_{DD} + 0.3	V
Input current range	I_{IN} max	−10 to +10	mA
Output voltage range	V_{OUT} max	−0.3 to V_{DD} + 0.3	V
Power dissipation	P_D max	500 ($T_a \leq 85$ °C)	mW
Operating temperature range	Topr	−40 to +85	°C
Storage temperature range	T_{stg}	−50 to +125	°C

Recommended Operating Conditions

T_a = −40 to 85 °C, V_{SS} = 0 V

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

DC Electrical Characteristics

T_a = 25 ±2 °C, V_{DD} = 5 V, V_{SS} = 0 V

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Operating supply current	$I_{DD(op)}$		–	3.0	7.0	mA
Standby supply current	$I_{DD(st)}$	V_{PD} = 5 V	–	–	10	µA
HIGH-level output current	I_{OH}	V_{OUT} = 4.6 V, SD and EST pins	–	–	−0.4	mA
LOW-level output current	I_{OL}	V_{OUT} = 0.4 V, SD and EST pins	1	–	–	mA
Input impedance	Z_{IN}	INPUT pin	10	–	–	kΩ

AC Electrical Characteristics

T_a = 25 ±2 °C, V_{DD} = 5 V, V_{SS} = 0 V, f_{OSC} = 4.194304 MHz

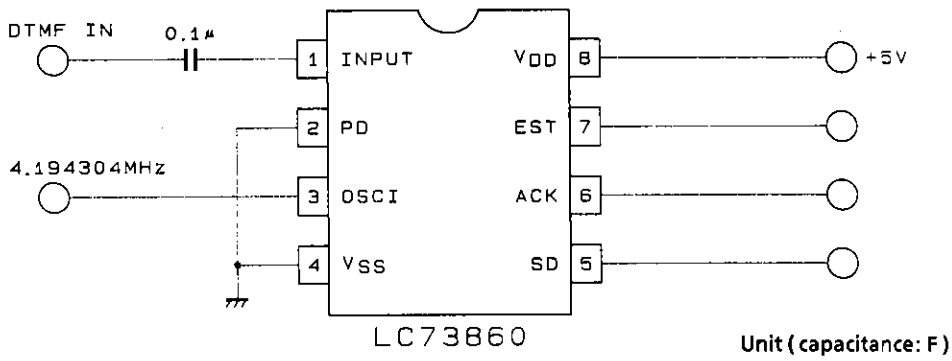
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Valid input signal level		See notes 1, 2, 3, 5, 6 and 9.	−49.5	–	0	dBm
Positive twist accept		See notes 2, 3, 4, 9 and 11.	–	6	–	dB
Frequency deviation accept		See notes 2, 3, 5 and 9.	±1.5% ±2	–	–	Hz
Frequency deviation reject		See notes 2, 3 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

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
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

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 ±1.5% ±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 ÷ Low-frequency group tone level.

Measurement/Application Circuit



Unit (capacitance: F)

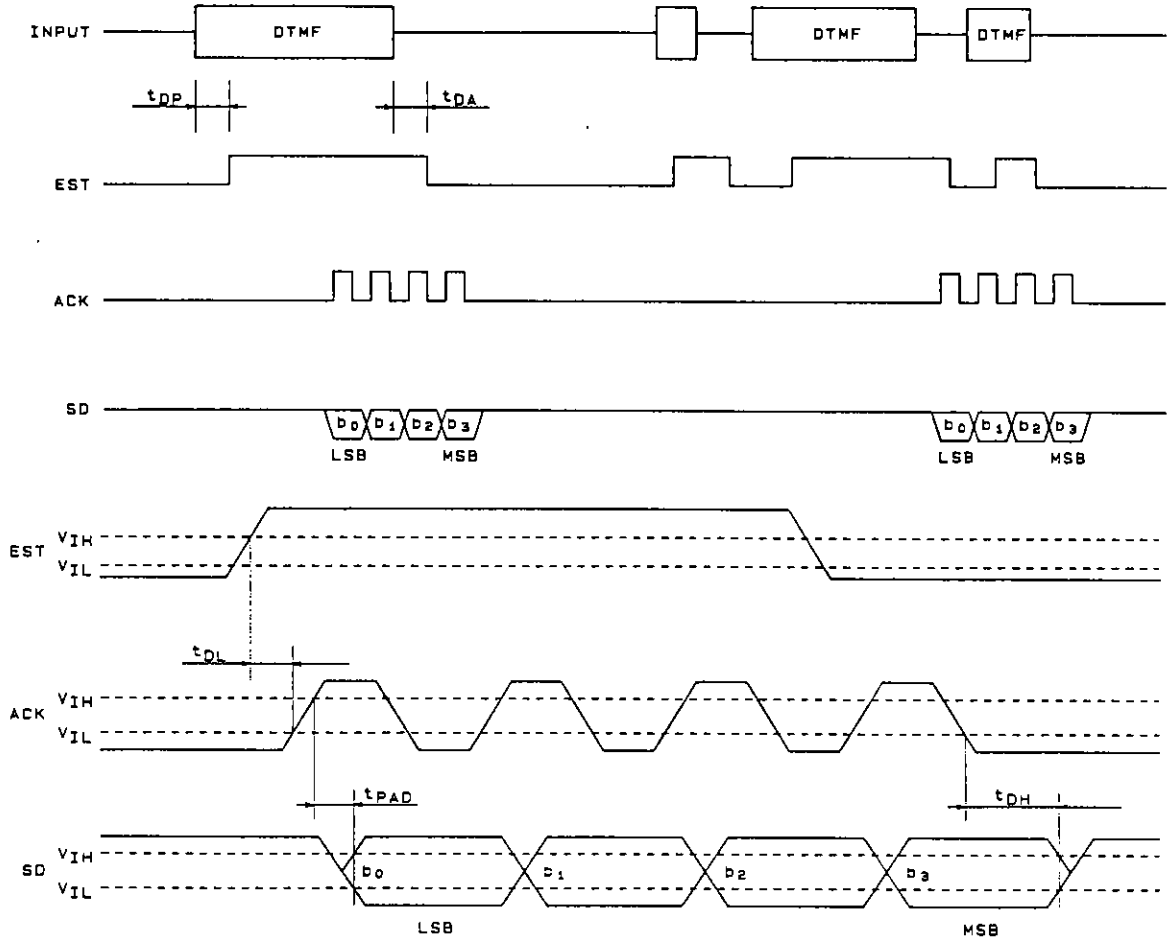
Output Code Table

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



- 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.