

SANYO

No. 4367

DTMF Receiver IC

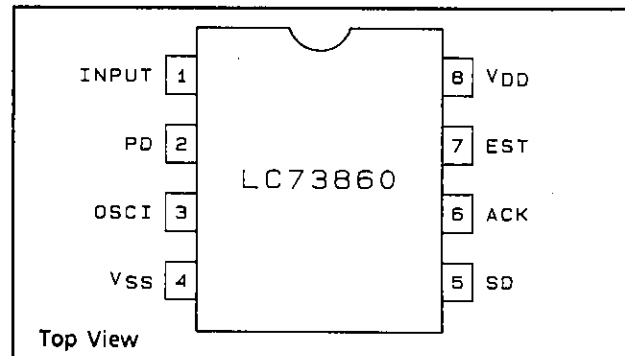
OVERVIEW

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)

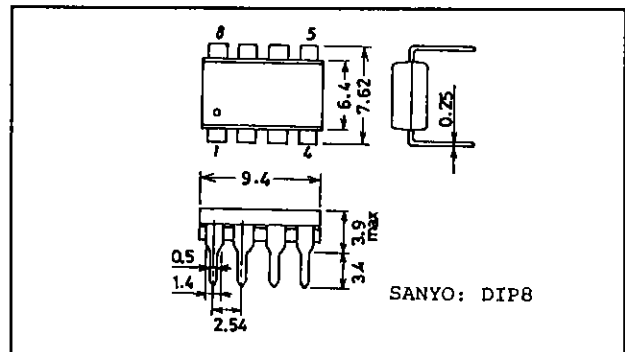
PIN ASSIGNMENT



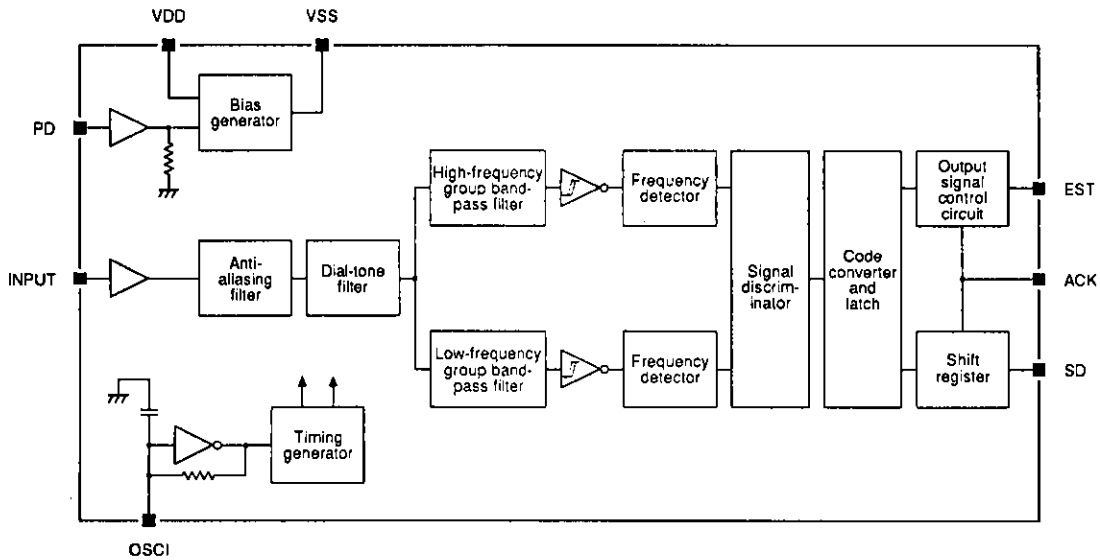
PACKAGE DIMENSIONS

Unit: mm

3001B-DIP8



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

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

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

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

 $T_a = 25 \pm 2$ °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	μ A
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	-	-	k Ω

AC Electrical Characteristics

 $T_a = 25 \pm 2$ °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.	$\pm 1.5\%$ ± 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

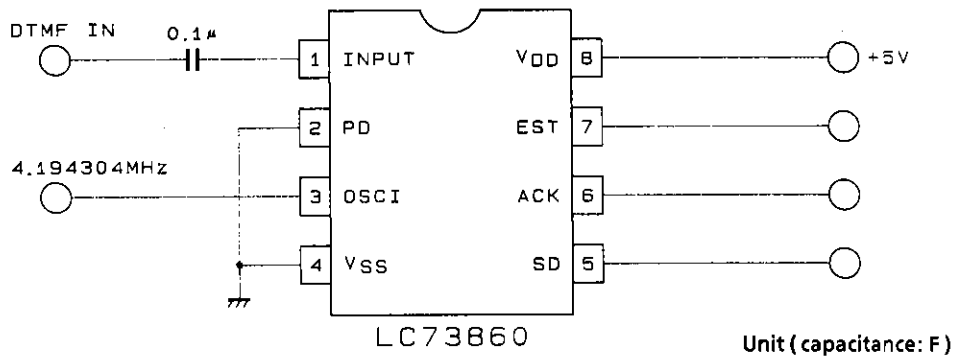
LC73860

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 $\pm 1.5\% \pm 2$ 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 + Low-frequency group tone level.

Measurement/Application Circuit



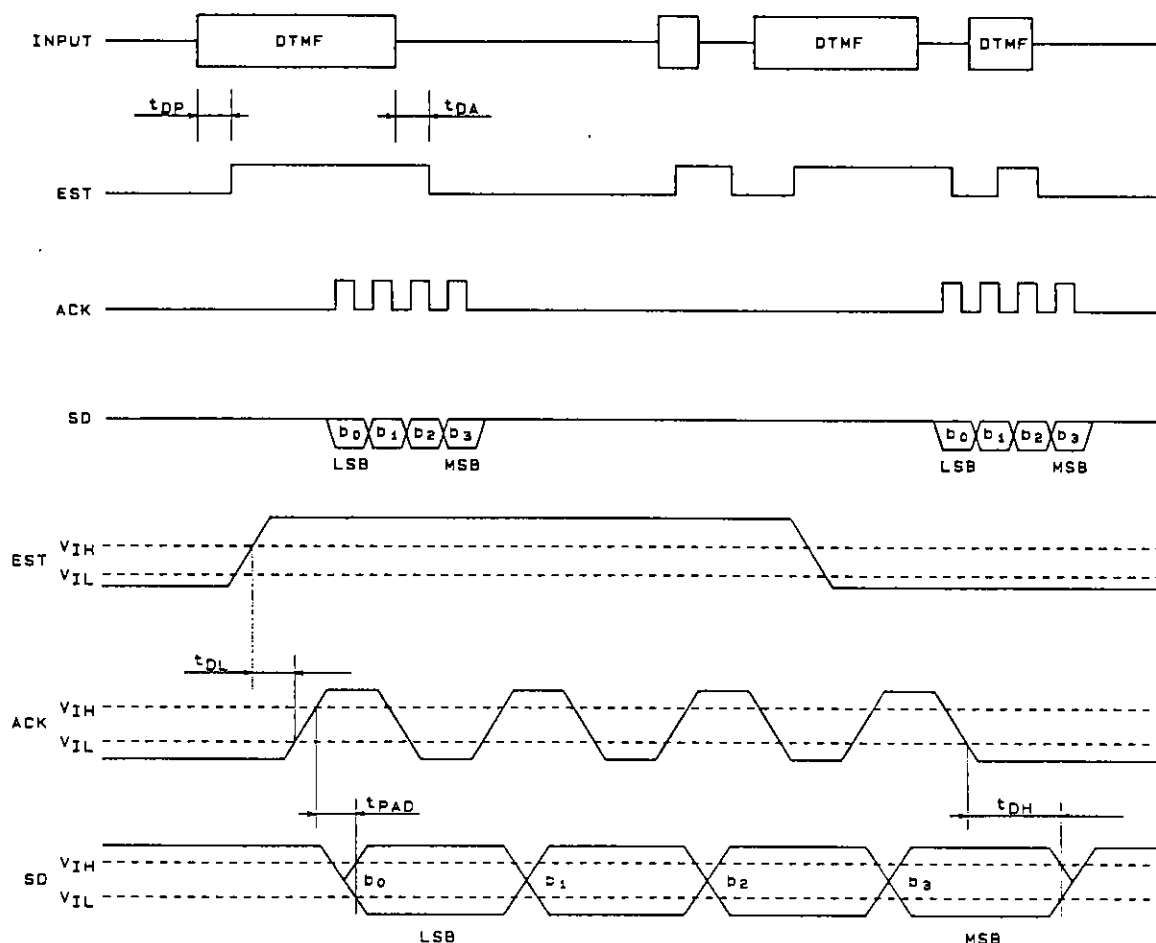
Output Code Table

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



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