# PARALLEL INPUT TONE/PULSE DIALER
HIGH-PERFORMANCE SILICON-GATE CMOS

The IN91531N provides a 4-bit data input and a handshaking signal to serve as microcomputer interfaces. Under microcomputer control the IN91531N generates both a DTMF signal and a pulse output for telephone dialing. All necessary dual-tone frequencies and dial pulse outputs are derived from the widely used TV crystal standard, providing high accuracy and stability. The required sinusoidal waveform for individual tones is digitally synthesized on the chip, resulting in a waveform with very low total harmonic distortion.

N SUFFIX
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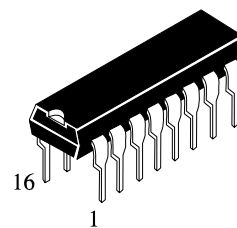
ORDERING INFORMATION
IN91531N
T_A = -10° to 70° C

Main features

- 4-bit parallel data input from microcomputer
- TTL compatible inputs and outputs
- Uses TV crystal standard (3.58 MHz) to derive all frequencies, providing high accuracy and stability
- Operating voltage: 2.5 to 5.5 Volts
- Selectable M/B ratio
- 10 PPS dial rate
- DTMF signaling of digits 0 9, *, #, A, B, C, and D
- Pulse signaling of 0 ~ 9, *, #, and A
- High group tone pre-emphasis: 2 dB
- Low total harmonic distortion in DTMF signaling
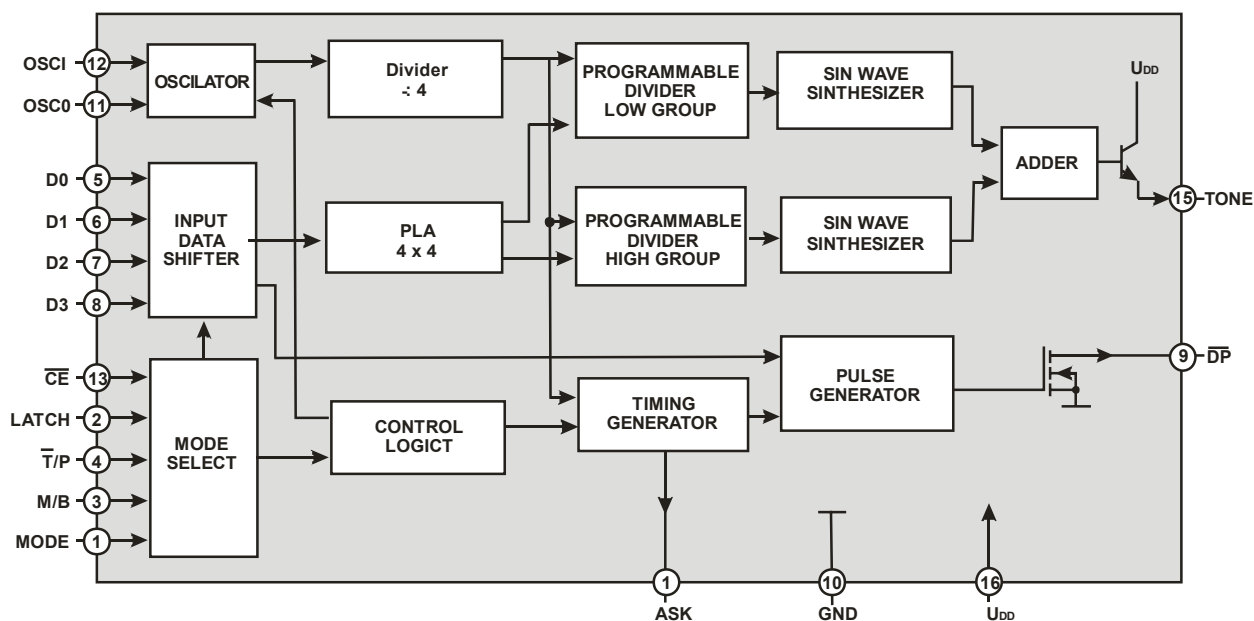
Block diagramm

DC ELECTRICAL CHARACTERISTICS(V_{CC}=3.5V, F_{OSC}=3.579545MHz, T_A = +25°C)

Symbol	Parameter	Test Conditions	Guaranteed Limits		Unit
			Min	Max	
V_{CC}	Operating Voltage		2.5	5.5	V
V_{IH}	High-Level Input Voltage		0.8	1	V_{CC}
V_{IL}	Low-Level Input Voltage		0	0.2	V_{CC}
I_{OL1} I_{OL2}	Minimum Output Sink Current, $\overline{DP}$	V_{CC} =2.5 V, V_{OL} = 0.4V V_{CC} =5.0 V, V_{OL} = 0.4V	1 3		mA mA
I_{CC}	Maximum Supply Current (Stand-by)	$\overline{CE}$=V_{CC} All outputs unloaded		8	µA
I_{CCP}	Maximum Supply Current (Pulse)	$\overline{CE}$=GND All outputs unloaded		1	mA
I_{CCT}	Maximum Supply Current (Tone)	CE=GND All outputs unloaded		1	mA
I_{OHACK}	Minimum Output Current, ACK Source	V_{CC} = 5.0 V, V_{OH} = 2.4 V	1.6		mA
I_{OLACK}	Minimum Output Current, ACK Sink	V_{CC} = 5.0 V, V_{OL} = 0.4 V	4.0		mA
V_{OR}	Single Row Tone	V_{CC} = 2.5 V, R_L = 2.2 kΩ	500		mVp-p
	Output Amplitude	V_{CC} = 5.5 V, R_L = 2.2 kΩ		1500	
V_{OC}	Single Column Tone	V_{CC} = 2.5 V, R_L = 2.2 kΩ	500		mVp-p
	Output Amplitude	V_{CC} = 5.5 V, R_L = 2.2 kΩ		1600	

AC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Guaranteed Limits			Unit
			Min	Typ	Max	
Make/break Ratio	M/B	M/B = V_{CC}		1/2		
		M/B = GND		2/3		
Make Time	T_M	M/B = 1/2		33.3		ms
		M/B = 2/3		40		
Break Time	T_B	M/B = 1/2		66.6		ms
		M/B = 2/3		60		
Inter-Digit Pause Time	T_{IDP}	M/B = 1/2		791		ms
		M/B = 2/3		763		
Predigit Pause	T_{PDP}	M/B = 1/2		35		ms
		M/B = 2/3		21		
Minimum Tone Duration	T_{MFD}			70		ms
Minimum Tone Inter-digit Pause	T_{TIDP}			70		ms
Tone Output Pre-digit Pause	T_{TPDP}			0		ms
Oscillator Set-up Time	T_{START}			5		ms

Pin Description

4-bit Parallel Input (DO, D1, D2, D3)
These 4 bit parallel input data are generated by the microcomputer. The input data versus output signal is shown in Table 1. The valid input data should be presented at these inputs before and during the rising edge of the LATCH signal.

LATCH
IL91531 latches the 4-bit input data and $\overline{T}$/P input when the LATCH signal goes from low to high (at the rising edge). The LATCH input must not change from high to low immediately until ACK output falls low. Also, a new data must not be latched when the ACK output is low.

Acknowledge (ACK)
This pin provides an acknowledge signal to the microcomputer. This output is high when IL91531 is ready to dial out the next digit. And this output falls low immediately after the rising edge of the LATCH signal.

Chip Enable ($\overline{CE}$)
The $\overline{CE}$ (chip enable) input controls the onset of oscillation, and serves as the master reset of this device.

Dial Pulse Output ($\overline{DP}$)
This dial pulse output stage consists of an N-channel open drain device. During dial pulse BREAK periods the output device is switched on (sinking current to V_{SS}) and is switched off during the other states. The DPR (dial pulse rate) is 9.71 PPS and the PDP (post digit pause) is 823 ms. The output of this pin at TEST mode will be discussed later.

Tone Output (TONE)
This pin consists of an npn transistor output whose collector is connected to VDD and this pin is connected to the emitter output. The internally generated DTMF signaling is delivered to the base of the npn transistor and is amplified as the transistor connected in common collector or darlington output forms. The DTMF signaling output time is 70 ms and the inter-digit interval is 70 ms. The output impedance of the DTMF signaling is typically 1.25K Ohm, and the hFE of the npn transistor is at least 30atlc = 3mA.

Tone/Pulse Switch ($\overline{T}$/P)
This input determines whether pulse dialing or DTMF dialing should be implemented. And it is latched together with the 4-bit data.

Make/Break Ratio (M/B)
The M/B input selects the two make/break ratio available. A high input selects the M/B ratio of 2/3 and a low input selects the M/B ratio of 1/2. The M/B input is to be connected to V_{DD} or V_{SS} only. Changing state when $\overline{CE}$ is active (low) would enable the test mode.

Oscillator (OSCI, OSCO)
IL91531 contains an oscillator circuit with the necessary parasitic capacitance and feedback resistor on chip so that it is only necessary to connect a standard 3.58 MHz TV crystal across the OSCI and OSCO terminals to implement the oscillator function. An external clock input can be applied to the OSCI pin directly. The Oscillator is enabled when $\overline{CE}$ input low.
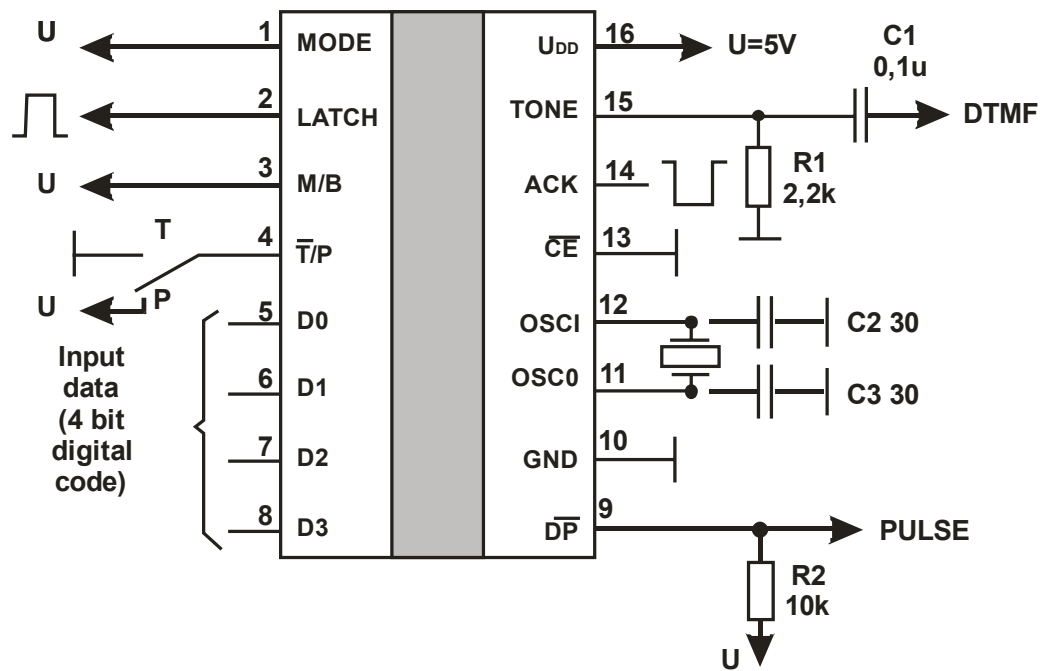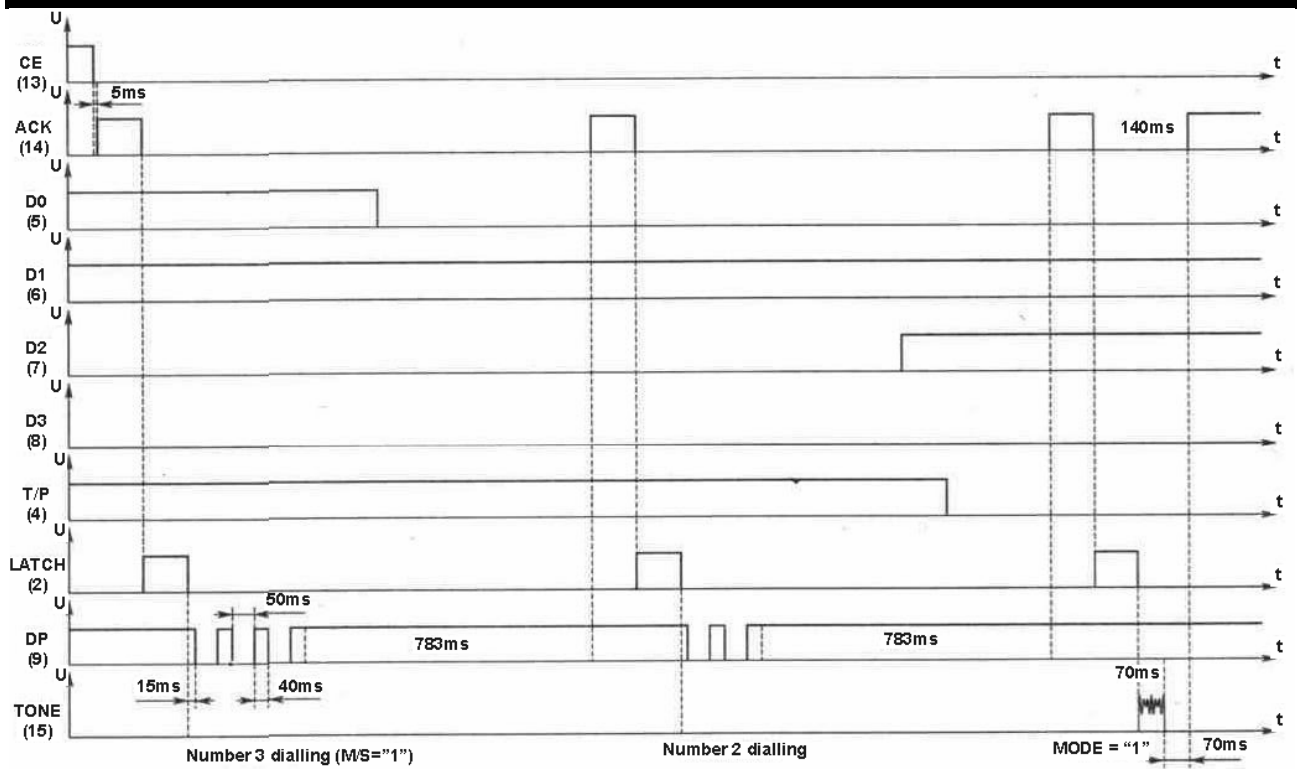
Power ($V_{DD,}$ GND)

These are the power supply input. The IL91531 is designed to operate from 2.5 to 5.5 Volts.

INPUT DATA VS. OUTPUT SIGNALING

D3	02	D1	D0	DTMF Signaling	PULSE Signal (0/P Pulse No.)
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	0	0	0	3	8
1	0	0	1	9	9
1	0	1	0	*	10
1	0	1	1	#	11
1	1	0	0	A	12
1	1	0	1	B	13
1	1	1	0	C	14
1	1	1	1	D	Forbidden input

Application diagramm

Timing diagram

Dimensional package sizes

Dimensional sizes of the DIP-package MS-001BB
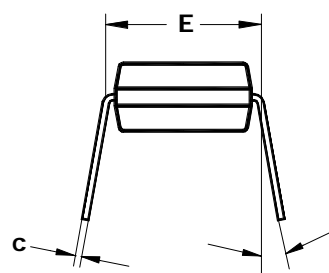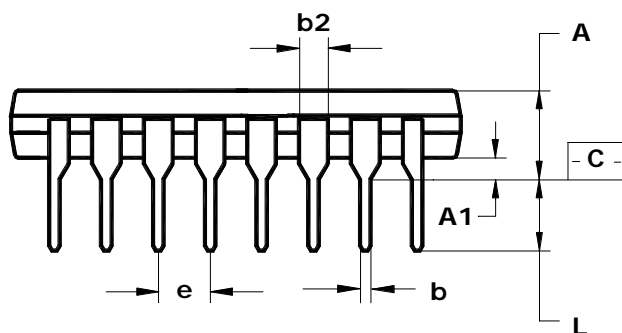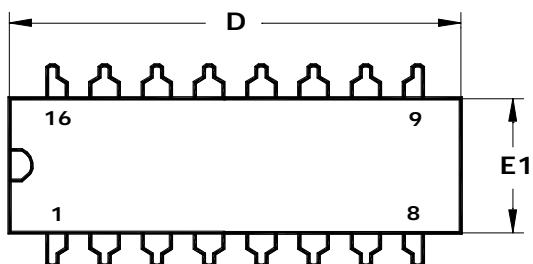
Note - Dimensions D, E1 do not include the fin value, which should not exceed 0.25 mm (0.010) per side.

	D	E1	A	b	b2	e	α	L	E	c	A1
						mm					
min	18.93	6.07	—	0.36	1.14	2.54	0°	2.93	7.62	0.20	0.38
max	19.43	7.11	5.33	0.56	1.78		15°	3.81	8.26	0.36	—
						Inches					
min	0.355	0.240	—	0.014	0.045	0.1	0°	0.115	0.300	0.008	0.015
max	0.400	0.280	0.210	0.022	0.070		15°	0.150	0.325	0.014	—