Analog Clock IC with Melody

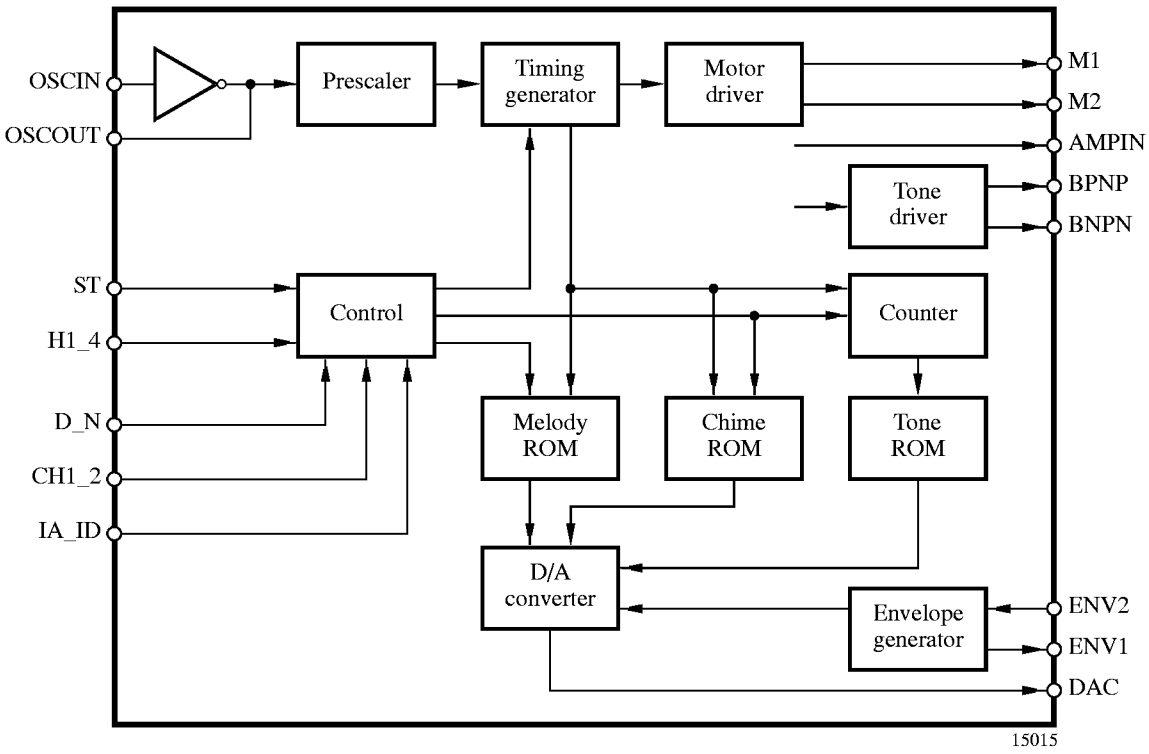
Description

The e5310 is an integrated circuit in low-power CMOS technology for analog timers with high-quality melody and hourly chime output.

Features

- Digital synthesizer for high-quality melody sound
- Mask-programmable melody ROM
- Two sequences with 64 notes each or one sequence with 128 notes
- Hourly chime
- Quarter or half hour melody mode
- Day/ night sound attenuation
- Melody on/ off capability
- 4.192-MHz on-chip quartz oscillator
- Motor pulse output with a pulse lenght of 47 ms (31 ms available as option)

Block Diagram



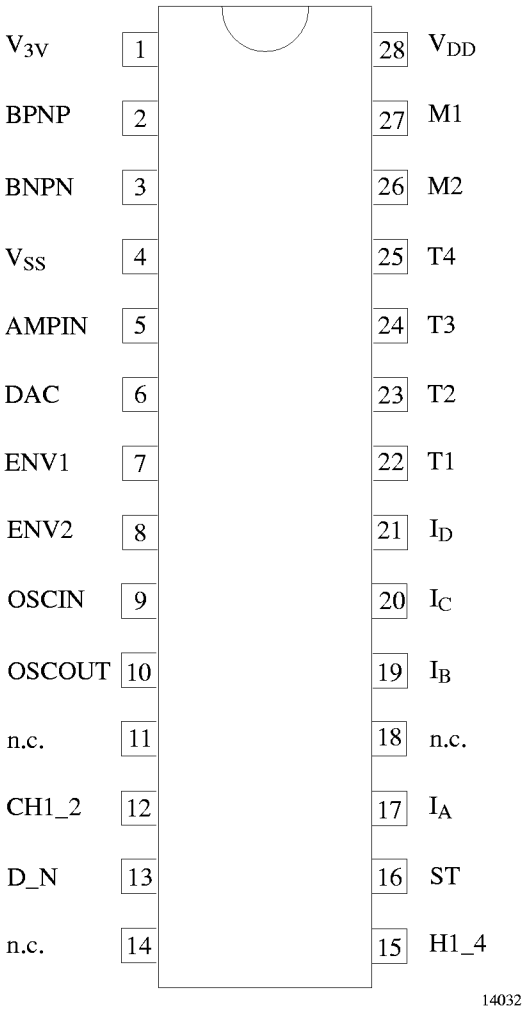


Figure 1. Pinning e5310

Pin	Symbol	Function
1	V_{3V}	
2	BPNP *)	
3	BNPN	
4	V_{SS}	
5	AMPIN *)	
6	DAC	
7	ENV1	
8	ENV2	
9	OSCIN	
10	OSCOUT	
11	n.c.	
12	CH1_2	
13	D_N	
14	n.c.	
15	H1_4	
16	ST	
17	I_A	
18	n.c.	
19	I_B	
20	I_C	
21	I_D	
22	T1	
23	T2	
24	T3	
25	T4	
26	M2	
27	M1	
28	V_{DD}	

*) These pins are not available for type e5310A

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Supply voltage 1	V_{DD}	–0.3 to +2.0 V	V
Supply voltage 2	V_{3V}	–0.3 to +4.0 V	V
Input voltage range (on any pins)	V_{IN}	$(V_{SS} - 0.3\ V) \leqq V_{IN} \leqq (V_{DD} + 0.3\ V)$	V
Output voltage	V_{OUT}	$(V_{SS} - 0.3\ V) \leqq V_{OUT} \leqq (V_{DD} + 0.3\ V)$	V
Output current	I_{OUT}	30	mA
Power dissipation (DIL package)	P_{tot}	125 mW	mW
Operating ambient temperature range	T_{amb}	–10 to +60	°C
Storage temperature range	T_{stg}	–40 to +125	°C
Soldering temperature ($t < 10$ s)	T_{sd}	260	°C

Absolute maximum ratings define parameter limits which, if exceeded, may permanently change or damage the device. All inputs and outputs in this circuit are protected against electrostatic discharges. However, precautions to minimize the build-up of electrostatic charges during handling are recommended. This circuit is protected against supply voltage reversal for typically 5 minutes.

Operating Characteristics

V_{DD} = 1.5 V, V_{SS} = 0 V, T_{amb} = +25°C; unless otherwise specified. All voltage levels are measured with reference to V_{SS}. The current flowing into the device is positive.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage 1		V_{DD}	1.2	1.5	1.8	V
Supply voltage 2		V_{3V}	2.4	3.0	3.6	V
Operating current	Note 1	I_{DD}		60	110	µA
Motor outputs M1 and M2						
Output current	R_L = 200 Ω, V_{DD} = 1.2 V	I_M	3.5	4		mA
Motor period		t_M		1		s
Pulse width *) Mask option		t_{PW}	31.2 *)	46.8		ms
Hour code input pins I_A, I_B, I_C and I_D						
Input current high	V_{IN} = V_{DD}	I_{IH}		4	15	µA
Control input pins D_N anf CH1_2						
Input current high	V_{IN} = V_{DD}	I_{IH}		1	4	µA
Input current low	V_{IN} = V_{SS}	I_{IL}		–1	–4	µA
Quartz oscillator						
Frequency		f_C		4.194		MHz
Start-up time	V_{DD} = 1.2 V	t_{Start}		2	3	s
Frequency stability	ΔV_{DD} = 100 mV	$\Delta f/f$		0.2	0.6	ppm
e5310A Note 2						
Output current	BNPN = V_{SS}	I_{BNPN}	0.2		0.5	mA
e5310B Note 2						
Output current	BNPN = V_{SS}, AMPIN = V_{SS}	I_{BNPN}	0.25			mA
Output current	BPNP = V_{DD}, AMPIN = V_{DD}	I_{BPNP}	–0.3			mA
Output current	DAC = V_{DD}	I_{DAC}	13		28	µA
e5310C with V_{3V} = 3 V Note 2						
Output current	BNPN = V_{SS}, AMPIN = V_{SS}	I_{BNPN}	2.0			mA
Output current	BPNP = 3 V, AMPIN = 3 V	I_{BPNP}	2.5			mA
Output current	DAC = V_{DD}	I_{DAC}	13		28	µA

Note 1: This current is measured when the crystal oscillator is active, not in melody mode and no motor load
Note 2: Output current measured with R_{ENV2} = 560 kΩ and all tone ROM output bits = 1

Table 2. Truth Table for Hourly Chime

I_D	I_C	I_B	I_A	Hour	Chimes
0	0	0	1	1:00	1
0	0	1	0	2:00	2
0	0	1	1	3:00	3
0	1	0	0	4:00	4
0	1	0	1	5:00	5
0	1	1	0	6:00	6
0	1	1	1	7:00	7
1	0	0	0	8:00	8
1	0	0	1	9:00	9
1	0	1	0	10:00	10
1	0	1	1	11:00	11
1	1	0	0	12:00	12

Application Circuit Diagrams Using the e5310

Function select according to switch position:

CH1_2	=	VSS	Melody off
CH1_2	=	VDD	Melody 1 (Westminster)
CH1_2	=	open	Melody 2 (Bim–bam)
D_N	=	VSS	No sound during night time
D_N	=	VDD	Half volume level at night
D_N	=	open	Same volume level for day and nigth
H1_4	=	VDD	Chime on full hour only
H1_4	=	VSS or open	1/4, 2/4, 3/4 and 4/4 h chime
ST	=	VSS>VDD	Positive edge trigger for hourly chime

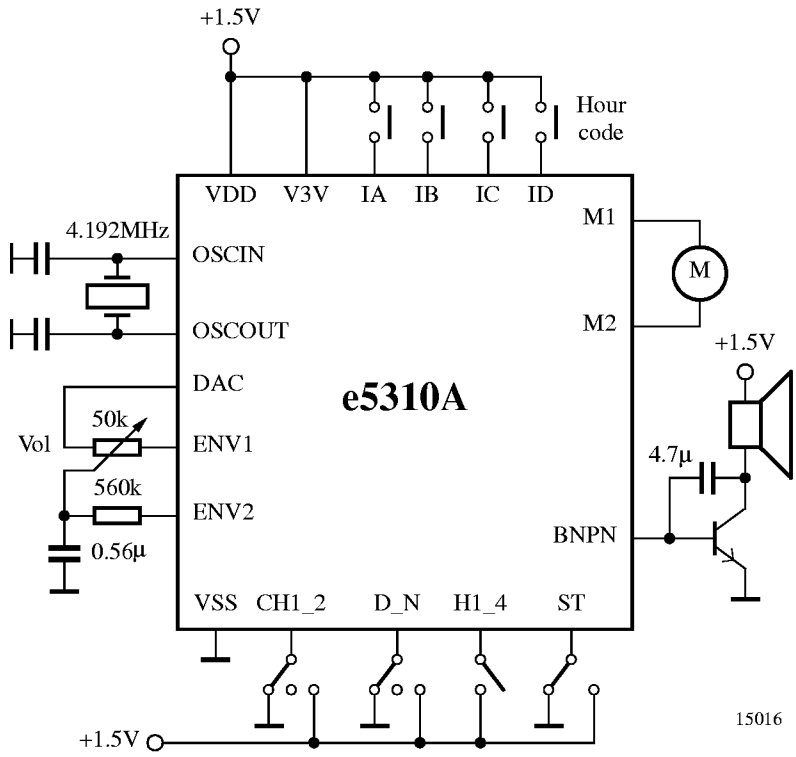


Figure 2. Class A output buffer at supply voltage of 1.5 V

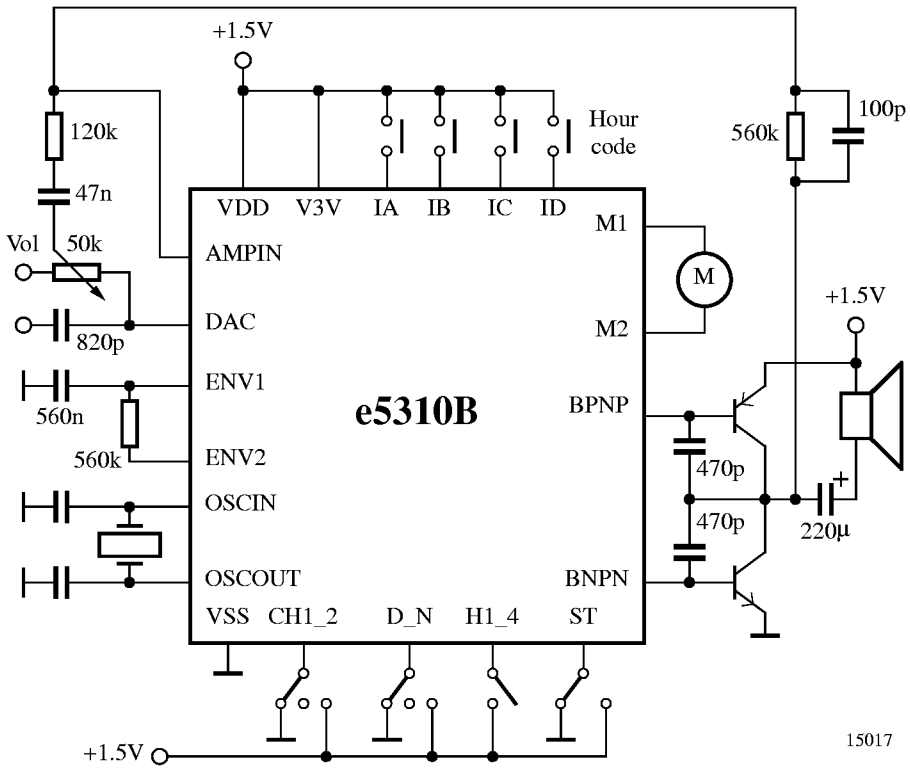


Figure 3. Class B output buffer at supply voltage of 1.5 V

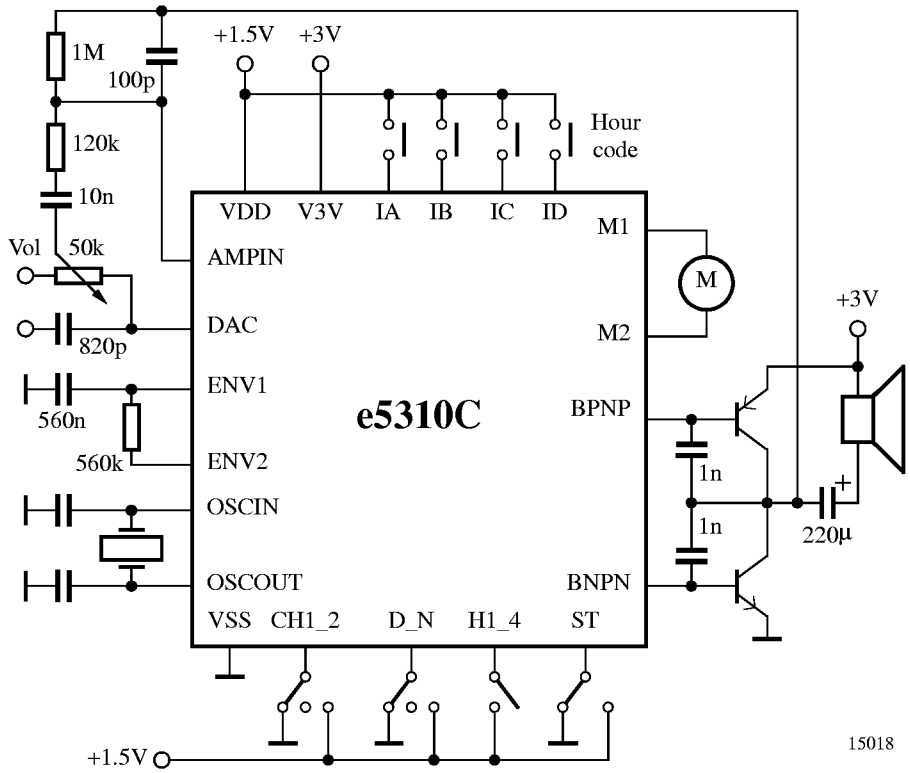
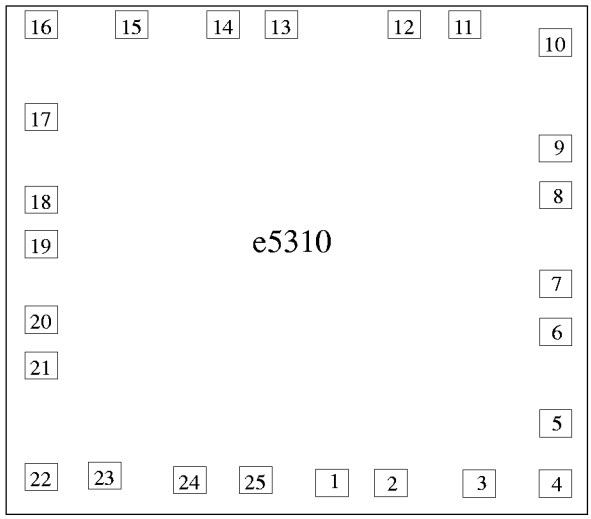


Figure 4. Class B output buffer at supply voltage of 3 V



Pad size = 90 µm × 90 µm
Chip size = 2.33 mm × 2.22 mm = 5.17 mm^2

Figure 5. Pad layout of the e5310 chip

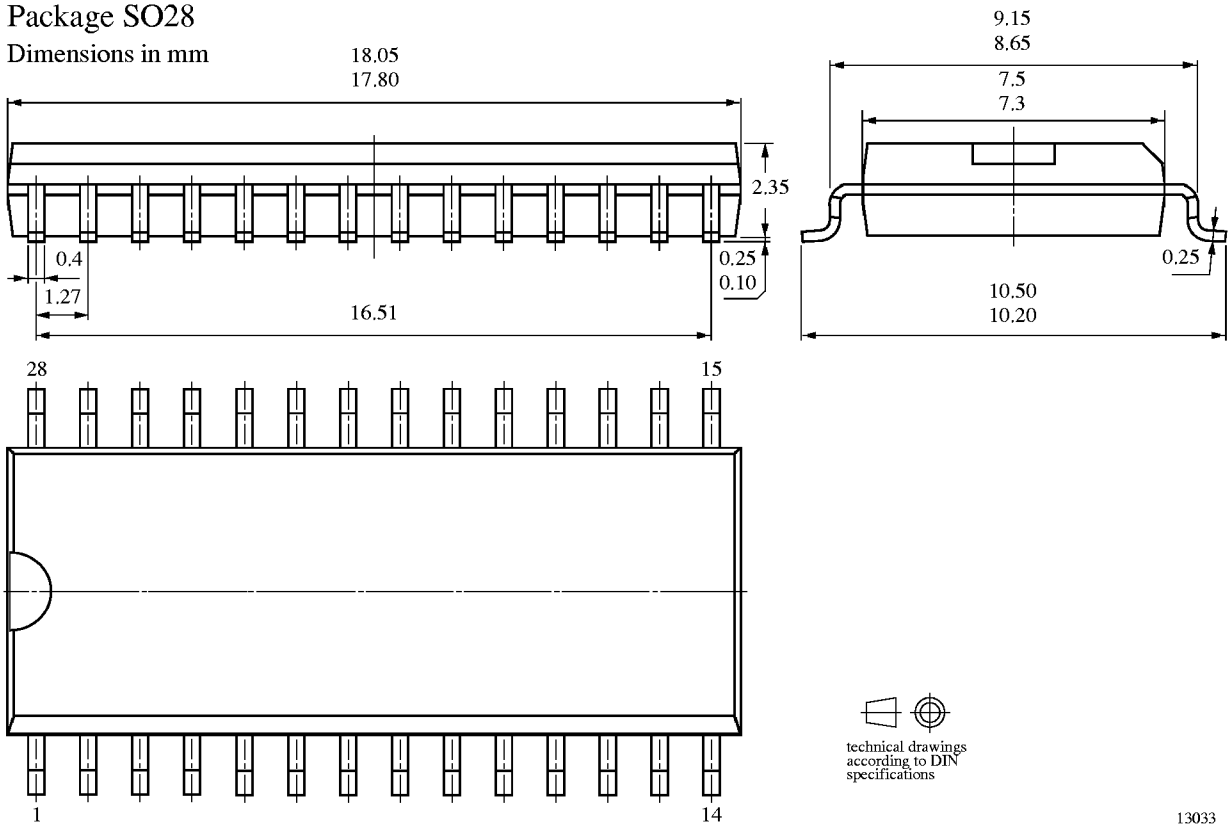
Table 3. Pad coordinates

Pad Number	Pin Name	X Position	Y Position	Pad Number	Pin Name	X Position	Y Position
1	V_{3V}	97	–986	14	ST	–180	985
2	BPNP	266	–986	15	I_A	–557	985
3	BNPN	788	–986	16	I_B	–956	985
4	V_{SS}	952	–986	17	I_C	–954	479
5	AMPIN	954	–803	18	I_D	–954	102
6	DAC	954	–426	19	T1	–954	–66
7	ENV1	954	–258	20	T2	–954	–443
8	ENV2	954	119	21	T3	–954	–611
9	OSCIN	954	287	22	T4	–954	–986
10	OSCOUT	954	845	23	M2	–763	–986
11	CH1_2	602	985	24	M1	–241	–986
12	D_N	434	985	25	V_{DD}	–73	–986
13	H1_4	–12	985				

Package Information

Package SO28

Dimensions in mm



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