

GSG 勁力 半導體

Gunter *S*emiconductor GmbH

AK2124

EDITION 09/00

Receiver/Demodulator for time code
signals transmitted by the
transmitters DCF77 (Germany) ,
MSF (UK), or WWVB (USA)

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Radio Controlled Clock Receiver

Short Description

The AK2124 bipolar monolithic integrated circuit receives and demodulates digital time signals emitted by time signal transmitters in the long-wave range. It is designed for low-current battery operation and can be switched in power-down mode. Due to the possibility of connecting two antennas a position-independent stable operation is guaranteed. The circuit is thus capable of the selective reception of various time signal transmitters.

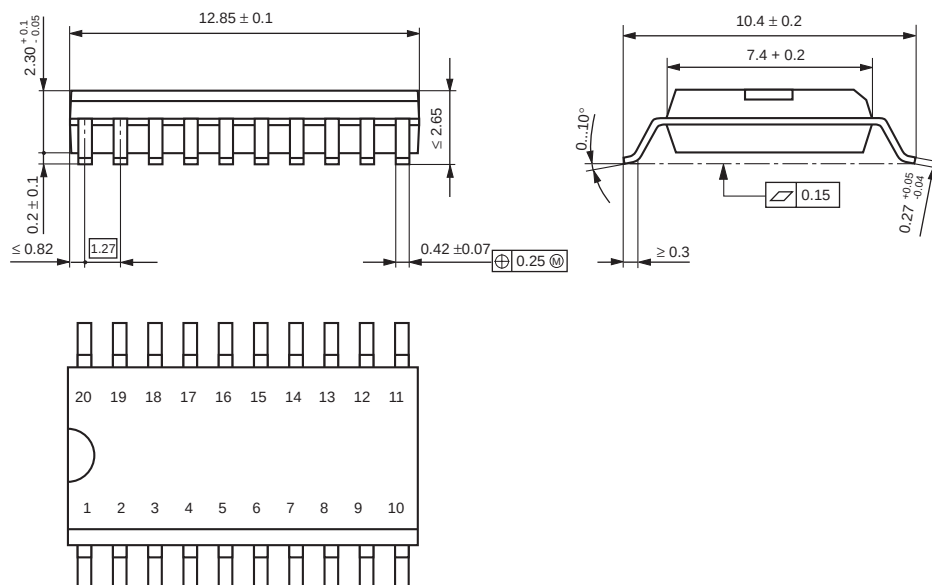
Features

- very low battery drain
- power-down mode
- two antennas connectable
- several transmitters receivable

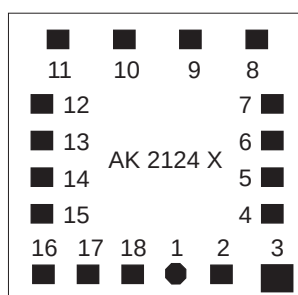
Package

The AK2124 is offered in

- SOP 20



- Die Pad-layout

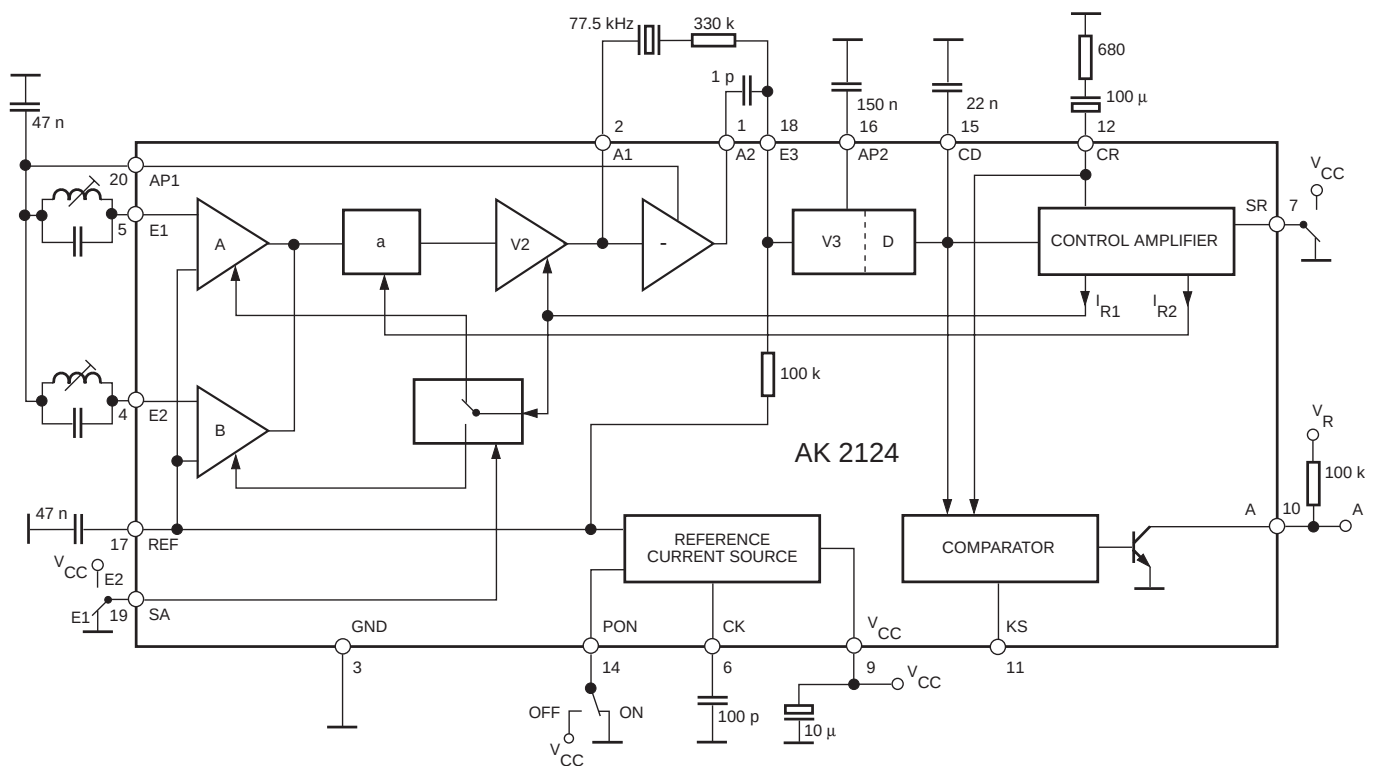


Pinning

Pins 8 and 13 of the SOP 20 package are not connected.

Pad	Pin	Symbol	Pin designation
01	01	A2	RF - output 2
02	02	A1	RF - output 1
03	03	GND	Ground
04	04	E2	Antenna input 2
05	05	E1	Antenna input 1
06	06	CK	Compensation capacity
07	07	SR	Switch controller
08	09	V _{CC}	Supply voltage
09	10	A	Output
10	11	KS	Comparator threshold
11	12	CR	Charging capacitor (for control amplifier)
12	14	PON	Stand - by switch
13	15	CD	Demodulation capacity
14	16	AP2	Operating point regulator 2
15	17	REF	Reference voltage
16	18	E3	Booster amplifier input
17	19	SA	Antenna change-over switch
18	20	AP1	Operating point regulator 1

Block Diagram and Application Circuit



Absolute Maximum Ratings

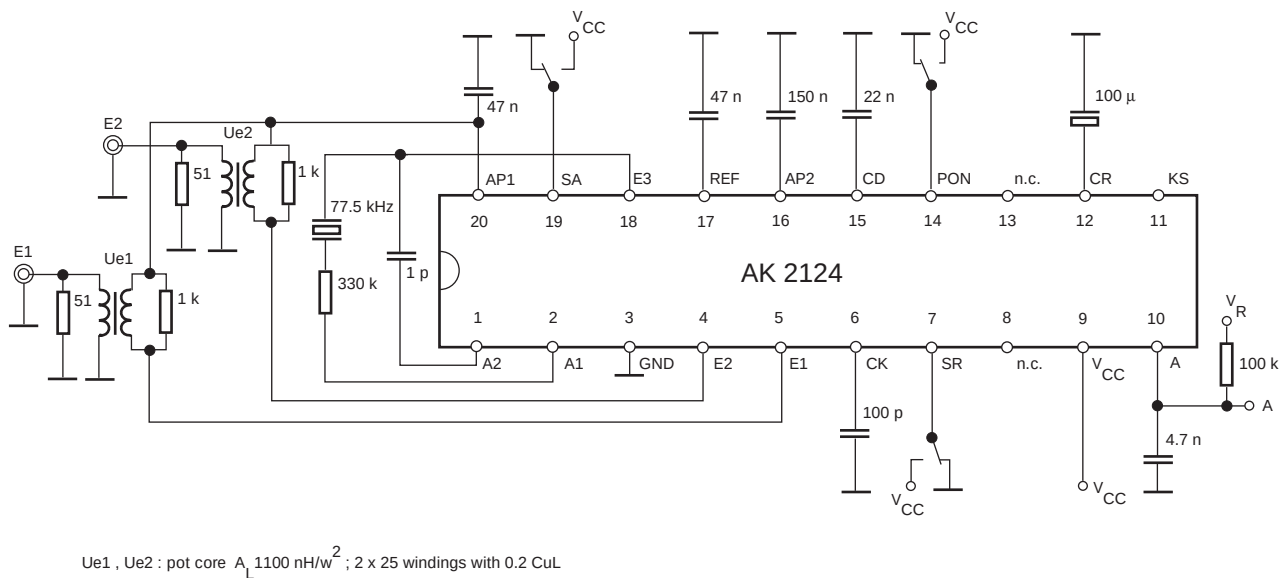
	symbol	min.	max.	unit
Supply voltage	V_{CC}	0	5.25	V
Output voltage	V_O	0	5.25	V
Antenna switch voltage	V_{SA}	0	V_{CC}	V
Switch controller voltage SR	V_{SR}	0	V_{CC}	V
Stand-by switch voltage PON	V_{PON}	0	V_{CC}	V
Junction temperature	T_j		150	°C
Operating temperature	T_a	-25	+85	°C

Recommended operational conditions

Supply voltage	V_{CC}	1.4	V
Frequency	f	50 ... 80	kHz
Operating temperature	T_a	0 ... 55	°C
RF input voltage	V_{iE}	> 3	μV

Electrical Characteristics

1. Test circuits



2. Parameters

Referring to the test circuit with generator signal

$f = 77500 \text{ Hz} \pm 5 \text{ Hz}$

pulse modulation of RF-signal from 100% to 25 %

during modulation time $t = 200 \text{ ms}$,

$V_{CC} = 1.4 \text{ V}$; $V_{PON} = 0 \text{ V}$; $T_a = 25 \text{ }^{\circ}\text{C}$

unless specified otherwise

	min.	typ.	max.	unit
Supply voltage range ($+5^{\circ}\text{C} < T_a < +55^{\circ}\text{C}$)	1.2	1.4	2.2	V
Supply voltage range ($-25^{\circ}\text{C} < T_a < +85^{\circ}\text{C}$)	1.4		2.2	V
Current consumption (normal operation)		600	1000	μA
Current consumption (Stand - by)		<1	10	μA
Switch current I_{PON} ($V_{PON} = \text{ground}$)		-15	-50	μA
Switch current I_{SA} ($V_{SA} = V_{CC}$)		5	10	μA
Switch current I_{SR} ($V_{SR} = V_{CC}$)		10	30	μA
Input voltage	3		100000	μV
Antenna switch attenuation		52		dB
Input impedance of the RF amplifier		750		$\text{k}\Omega$
Input impedance of the booster amplifier		95		$\text{k}\Omega$
Output impedance of the RF segment (A1)		0.3		$\text{k}\Omega$
Output impedance of the RF segment (A2)		7.5		$\text{k}\Omega$
RF segment amplification (on A1 at $V_{SA} = 0 \text{ V}$)		53		dB
Range of input voltage booster amplifier	30		450	μV
Internal resistance of the demodulator		70		$\text{k}\Omega$
Output voltage of the demodulator		200		mVpp

	min.	typ.	max.	unit
Control time ($V_{SR} = V_{CC}$) for $\Delta V_i = 0.1 \text{ mV} - 1 \text{ mV}$ for $\Delta V_i = 1 \text{ mV} - 0.5 \text{ mV}$		0.8 2.0		s s
Control time ($V_{SR} = 0 \text{ V}$) for $\Delta V_i = 0.1 \text{ mV} - 1 \text{ mV}$ for $\Delta V_i = 1 \text{ mV} - 0.5 \text{ mV}$		0.8 5.0		s s
Output pulse width ($V_{SR} = 0 \text{ V}$) at transmitter pulse width 200 ms for $V_R = 1.4 \text{ V}$, $V_{iE} = 3 \mu\text{V}$	180	195	220	ms
Output current I_{OH} ($V_R = 6 \text{ V}$)			10	μA
Output current I_{OL} ($V_R = 6 \text{ V}$)	60	200		μA
Output voltage V_{OL} ($I_{OL} = 15 \mu\text{A}$)		20	200	mV

Application Hints

1. RF Component

An inductive coupling of signals between E1, E2 and AP1 is essential to establishing the given switch-over attenuation.

The SA switch-over point is ca. 0.8 V.

The output A2, with an impedance of 7.5 k Ω , has an inverted output signal ca. 5 dB lower than A1.

The filter band width of the quartz filter between A1 and E3 should be set to 20...25 Hz with a series resistance of 330 k Ω . The associated signal attenuation of ca. 12 dB is also desirable when other filter configurations are applied. When the AK2124 is used as a dual standard receiver, antenna switch-over with SA is necessary, as is filtering with two different crystals from outputs A1 to E3, or A2 to E3.

2. Demodulator, Control time constants

The demodulated time signal impulses are available at CD. The time constant is $CD * 70 \text{ k}\Omega$.

Regulated voltage is attained at the pin CR, whereby the control-time constant is determined by a switchable discharging circuit and CR.

The control rate is regulated at SR. A larger control-time constant functions at $V_{SR} = 0 \text{ V}$ than at $V_{SR} = V_{CC}$.

To reduce oscillating overdrive the additional connection with a series resistor of 680 Ω on the CR is recommended.

3. Receiver circuit

The optimal supply voltage is 1.4 V. At applications with a voltage supply above 1.4 V it is better to connect V_{CC} with a bias resistor so that there is about 1.4 V, whereby there is a simultaneous dynamic decoupling to other components. The output is able to bear load resistance with working voltages of up to 5.25 V independent of V_{CC} .

It is therefore advantageous to block the V_{CC} - pin with a capacitor $> 4.7 \mu\text{F}$.

The usual RF-technical aspects are valid for the PCB layout, whereby special attention should be given to the fact that between A and E3 the greatest possible area is intended for purposes of shielding.