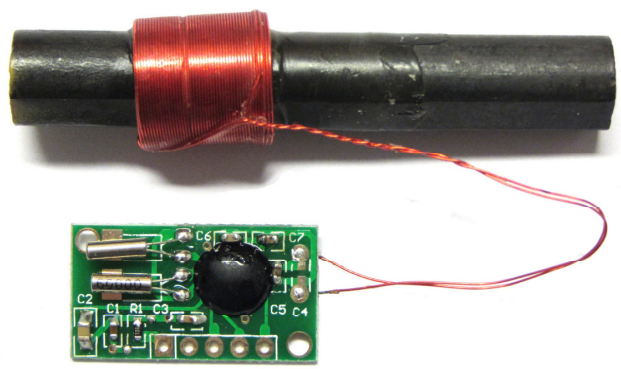
DUAL BAND TIME SIGNAL RECEIVER MODULE

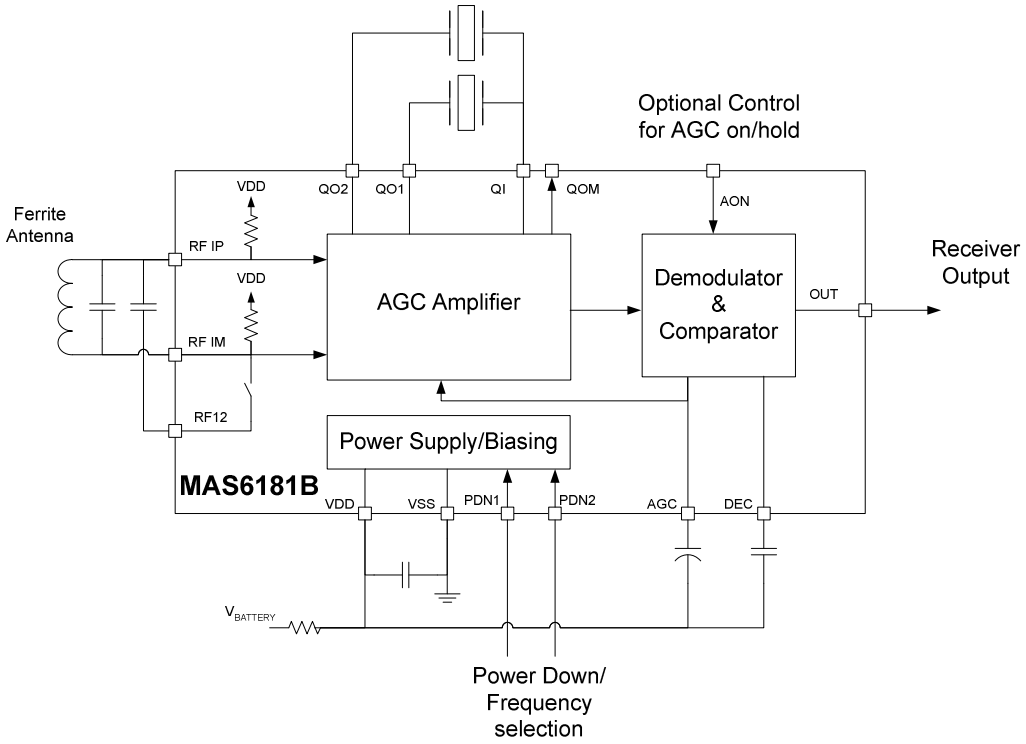


- **Tuned ferrite antenna**
- **AM receiver IC board**
- **Reception of:**
  - DCF77 / MSF
  - JJY60 / JJY40

INTRODUCTION

The dual band time signal receiver module comprises of a ferrite antenna and an AM receiver IC printed circuit board. The board includes a MAS6181B1 AM receiver IC accompanied with necessary filter crystals and capacitor components. The circuitry includes also an RC-filter for the supply voltage. The EB6181B1COB77K60KA1 module is tuned for 77.5kHz and 60kHz and is suitable for receiving the German DCF77 time signal and the MSF signal in UK. The EB6181B1COB60K40KA1 module is tuned for 60kHz and 40 kHz suitable for receiving the Japanese JJY60 and JJY40 time signal transmissions.

The MAS6181B1 AM receiver IC includes amplifier, demodulator and comparator blocks that transforms the received AM transmission into series of pulse width coded digital pulses which can be directly processed by an appropriate digital circuitry such as a micro controller unit (MCU).

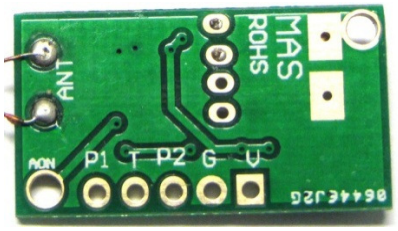


PIN DESCRIPTION

Pin ID	Type	Function	Note
P1	DI	PDN1 (power down) control pin	Do not leave this pin floating
T	DO	Time pulse output	HIGH = carrier signal reduced LOW = carrier signal full
P2	DI	PDN2 (power down) control pin	Do not leave this pin floating
G	G	Supply ground	
V	P	Supply voltage	
AON	DI	AGC on/off control (optional)	Leave unconnected when not used (AON pin has internal pull up)

D = Digital, P = Power, G = Ground, I = Input, O = Output, NC = Not Connected

PCB backside pin marking



Note: The two attachment holes on the PCB corners have electrical connection to AON and GND. Ensure proper isolation when attaching to conductive enclosure.

FREQUENCY SELECTION

Power down control and frequency selection is achieved by two digital control pins P1 (PDN1) and P2 (PDN2). The control logic is presented in table 1.

Table 1. Frequency selection and power down control

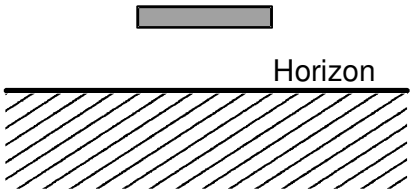
PDN1	PDN2	Description
High	High	Power down
High	Low	Antenna frequency 1
Low	High	Antenna frequency 2
Low	Low	Antenna frequency 2

Frequency 2 is the lowest frequency of the two selected frequencies.

It is recommended to switch the device to power down for at least 50ms before switching to another frequency. This guarantees fast startup when switching to another frequency. During minimum 50ms power down time the AGC capacitor voltage is completely pulled to VDD to initialize proper startup conditions for the AGC. Without the described proper fast startup control the startup time can be several minutes. With fast startup it is shortened typically to a few seconds.

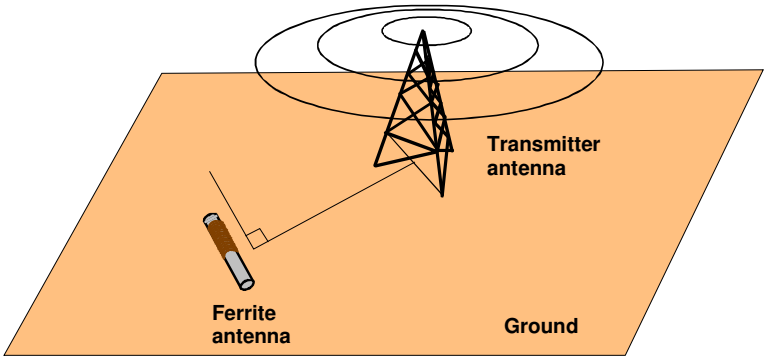
APPLICATION INFORMATION

Antenna orientation



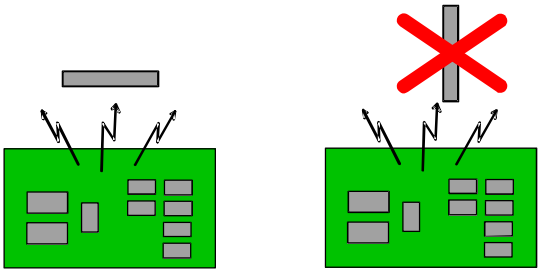
The magnetic field component of the propagating long wave time signal transmission has a horizontal polarization thus the ferrite antenna should be oriented horizontally to maximize the signal (see figure 1).

Figure 1. Antenna orientation relative to ground



The ferrite antenna should also be pointing orthogonally relative to the transmitter (see figure 2).

Figure 2. Antenna orientation relative to transmitter station



The ferrite bar antenna should be located as far as possible from conductive metal walls, PCB ground plane or ferromagnetic objects (speakers). All those objects affect the antenna tuning and can attenuate the received signal. To avoid noise coupling the ferrite antenna should also not be pointing towards noisy electronic circuits (figure 3). It is a good practice to turn off all unnecessary electronic circuits when receiving the weak radio transmission.

Figure 3. Antenna orientation relative to noisy electric circuits

Getting a signal

The antenna is sensitive for magnetic and electric disturbances. As an example, in digital radio controlled clocks it is known that LCD displays, refreshed using a 32Hz signal, has a1875th odd harmonic hitting exactly at 60kHz and its amplitude can be strong enough (µVrms level) to reduce the sensitivity. The antenna and module placement is critical and one should maximize distance to other disturbing electronics and metal/ferrous parts which might affect the antenna and the reception.

A good place to start is to put the module close to a window and turn the antenna to an optimal position relative the transmitter (see the figure 2 above). As the second step trigger the fast startup by switching P1 and P2 from power down (P1=P2=VDD) to power up (See the section Frequency selection) which will make the AGC find its level within a few seconds if the receiving conditions are sufficient. Initially the OUT signal should be high but soon after finding a signal (or disturbance in case of poor SNR) the output goes low and after a few seconds it should start receiving pulses. If the output stays low all the time there is probably some disturbance stronger than the signal. If the signal is bad, change location and repeat the fast startup by sequence.

Please note that if P1 and P2 are not switched to VDD (power down) for at least 50 ms when changing frequency the start-up time before the receiver finds the signal can take a few minutes.

ELECTRICAL CHARACTERISTICS

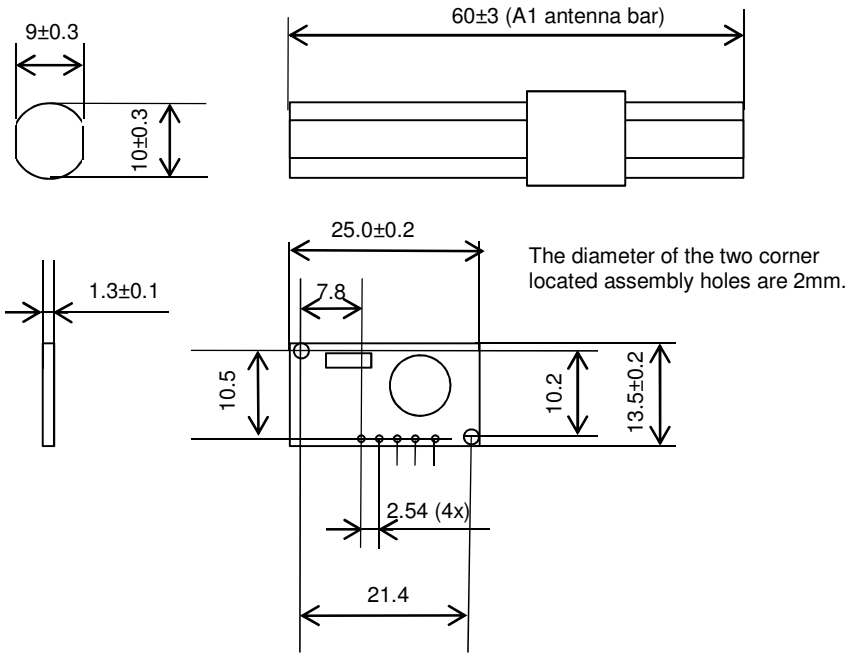
Operating Conditions: VDD = 1.5V, Temperature = 27°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Voltage	V_{DD}		1.1	1.5	3.6	V
Current Consumption	I_{DD}	VDD=1.5 V, weak signal VDD=1.5 V, strong signal VDD=3.6 V, weak signal VDD=3.6 V, strong signal	31 24	66 40 68 42	85 65	µA
Stand-By Current	I_{DDoff}				0.1	µA
Receiving Frequency	f_{IN}	EB6181B1COB77K60A1 EB6181B1COB60K40A1 See ordering information below.		77.5 &60 60& 40		kHz
Sensitivity	E_{MIN}			25		µV/m

Note: For more detailed electrical characteristics see MAS6181B1 AM receiver IC datasheet

MECHANICAL DIMENSIONS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Antenna						
length	L_A	A1 antenna bar	-3	60	+3	mm
			-0.3	10	+0.3	
width	W_A		-0.3	9	+0.3	
height	H_A					
PCB						
length	L_{PCB}		-0.2	25.0	+0.2	mm
width	W_{PCB}		-0.2	13.5	+0.2	
thickness	T_{PCB}		-0.1	1.3	+0.1	



ORDERING INFORMATION

Product Code	Product	Antenna
EB6181B1COB77K60KA1	77.5kHz / 60kHz receiver module	A1: 60x10x9 mm
EB6181B1COB60K40KA1	60kHz / 40kHz receiver module	A1: 60x10x9 mm

Note: Modules are RoHS compliant.

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