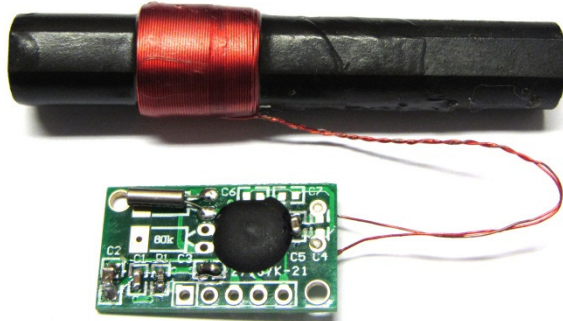


TIME SIGNAL RECEIVER MODULE



- Tuned ferrite antenna
- AM receiver IC board
- Reception of:
 - German DCF77
 - US WWVB
 - British MSF
 - Japanese JJY60

INTRODUCTION

The time signal receiver module comprises of a ferrite antenna and an AM receiver IC printed circuit board. The board includes a MAS6180B1 AM receiver IC accompanied with necessary filter crystal and capacitor components. The circuitry includes also an RC-filter for the supply voltage. The EB6180B1COB77K5A1 module is tuned for 77.5 kHz and suitable for receiving German DCF77 time signal transmission whereas the EB6180B1COB60K0A1 and A2 modules are tuned for 60 kHz suitable for receiving US WWVB, British

MSF and Japanese JJY60 time signal transmissions. The A2 module with 100mm antenna bar is especially suited for WWVB to cover the weak signal areas.

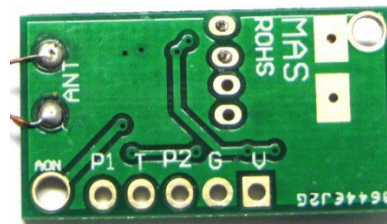
The MAS6180B1 AM receiver IC includes amplifier, demodulator and comparator blocks that transforms the received AM transmission into series of pulse width coded digital pulses which can be directly processed by an appropriate digital circuitry such as a micro controller unit (MCU).

PIN DESCRIPTION

| Pin ID | Type | Function | Note |
|--------|------|-------------------------------|--|
| P1 | DI | PDN (power down) control pin | HIGH = receiver off LOW = receiver on Do not leave this pin floating |
| T | DO | Time pulse output | |
| P2 | NC | - | Leave unconnected |
| G | G | Supply ground | |
| V | P | Supply voltage | |
| AON | DI | AGC on/off control (optional) | Leave unconnected when not used |

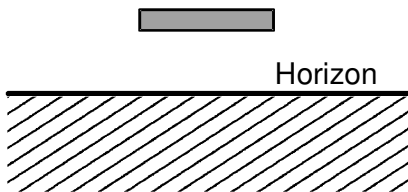
D = Digital, P = Power, G = Ground, I = Input, O = Output, NC = Not Connected

PCB backside pin marking



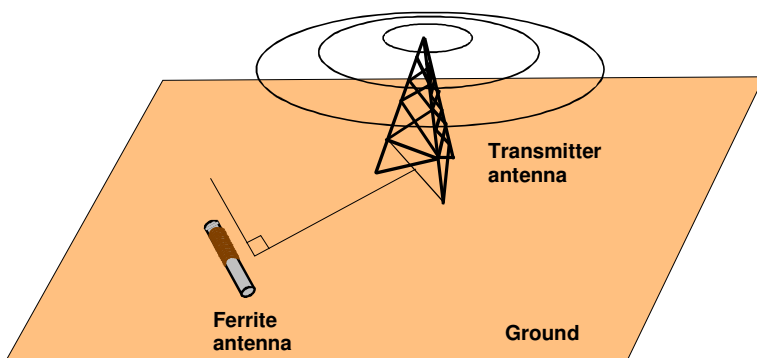
APPLICATION INFORMATION

Antenna orientation



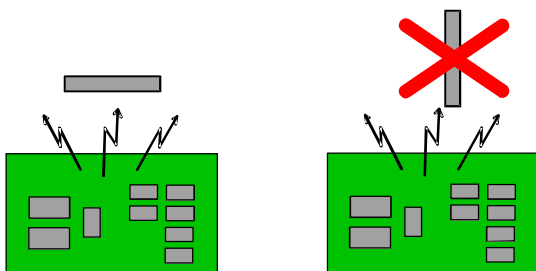
The magnetic field component of the propagating long wave time signal transmission has a horizontal polarization thus the ferrite antenna should be oriented horizontally to maximize the signal (see figure 1).

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 a 1875th 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 moving PDN control from power down (PDN=VDD) to power up (PDN=VSS) 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 setting PDN=VDD (power down) to PDN=VSS (power up).

Please note that if PDN control is not used but the P1 pin (PDN) is permanently tied to GND (receiver on), the start-up time before the receiver finds the signal can take a few minutes.

ELECTRICAL CHARACTERISTICS

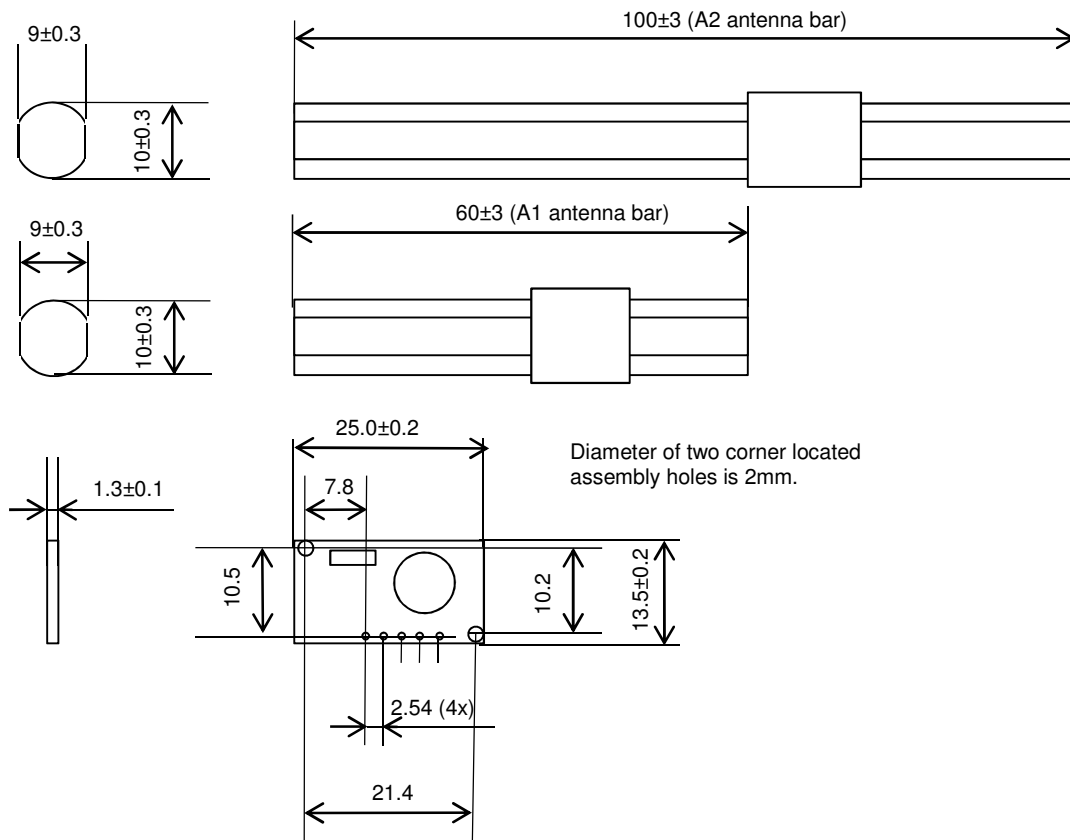
Operating Conditions: VDD = 1.5V, Temperature = 27°C, unless otherwise specified.

| 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} | module EB6180B1COB77K5A1 module EB6180B1COB60K0A1 module EB6180B1COB60K0A2 See ordering information below. | | 77.5 60 60 | | kHz |
| Sensitivity | E _{MIN} | | | 25 | | μV/m |

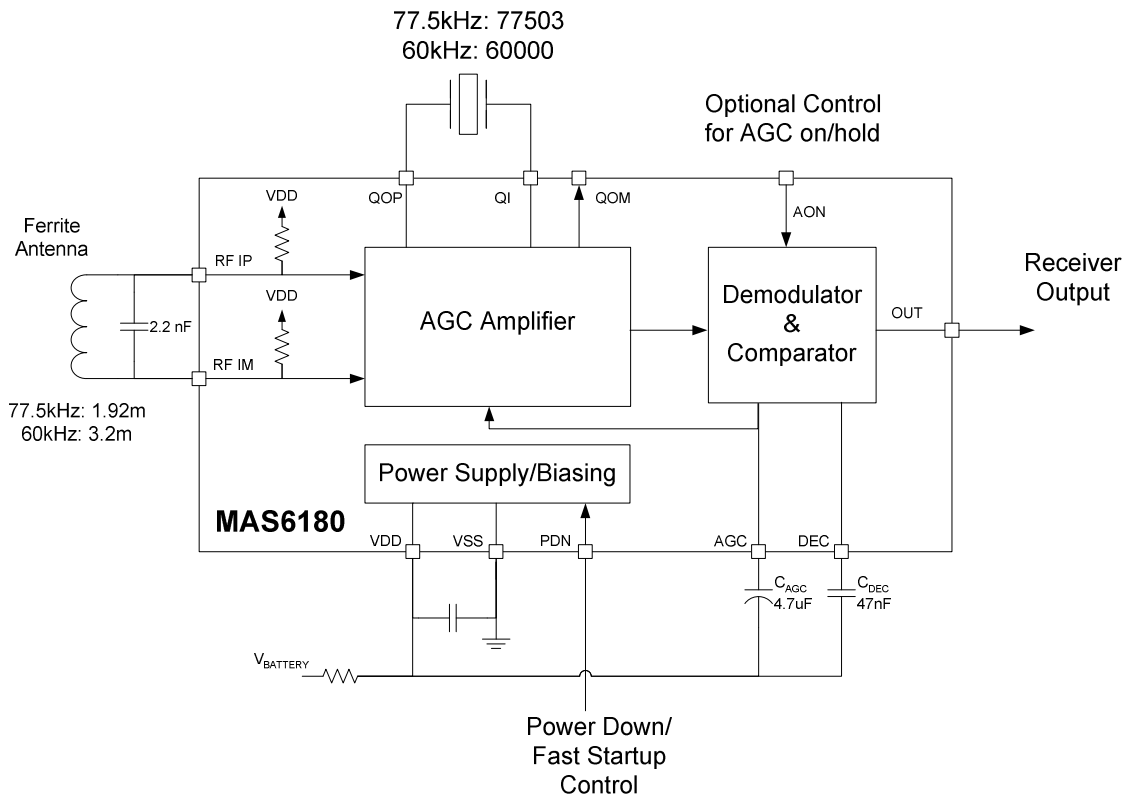
Note: For more detailed electrical characteristics see MAS6180B1 AM receiver IC datasheet

MECHANICAL DIMENSIONS

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|-----------|-----------|------------------|------|------|------|------|
| Antenna | length | L _A | -3 | 60 | +3 | mm |
| | width | W _A | -0.3 | 10 | +0.3 | |
| | height | H _A | -0.3 | 9 | +0.3 | |
| 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 | |



CIRCUIT SCHEMATIC



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

ORDERING INFORMATION

| Product Code | Product | Antenna |
|-------------------|--------------------------------------|-----------------|
| EB6180B1COB77K5A1 | 77.5kHz DCF77 receiver module | A1: 60x10x9 mm |
| EB6180B1COB60K0A1 | 60kHz WWVB/MSF/JJY60 receiver module | A1: 60x10x9 mm |
| EB6180B1COB60K0A2 | 60kHz WWVB/MSF/JJY60 receiver module | A2: 100x10x9 mm |

Note: Modules are RoHS compliant.

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