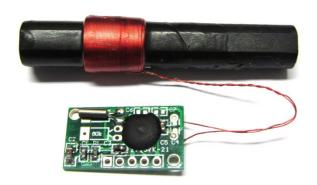


# TIME SIGNAL RECEIVER MODULE



- 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.

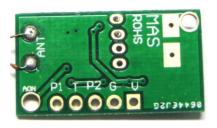
The MAS6180B1 AM receiver IC includes amplifier, demodulator and comparator blocks that transforms the received AM transmission into series of pulse width coded digital pulses which can be directly processed by an appropriate digital circuitry such as a micro controller unit (MCU).

### PIN DESCRIPTION

Pin ID	Туре	Function	Note
P1	DI	PDN (power down) control pin	HIGH = receiver off LOW = receiver on Do not leave this pin floating
Т	DO	Time pulse output	·
P2	NC	-	Leave unconnected
G	G	Supply ground	
V	Р	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

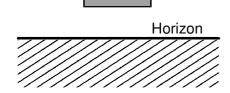
PCB backside pin marking





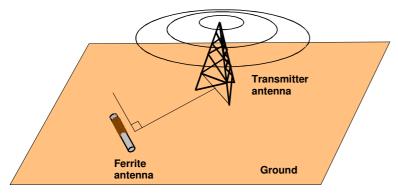
## **APPLICATION INFORMATION**

### **Antenna orientation**



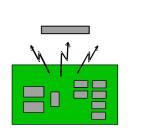
The magnetic field component of the propagating long wave time signal transmission has a horizontal polarization thus the ferrite antenna should be oriented horizontally to maximize the signal (see figure 1).

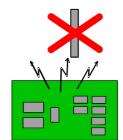
Figure 1. Antenna orientation relative to ground



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 a1875th odd harmonic hitting exactly at 60kHz and its amplitude can be strong enough ( $\mu$ Vrms 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.



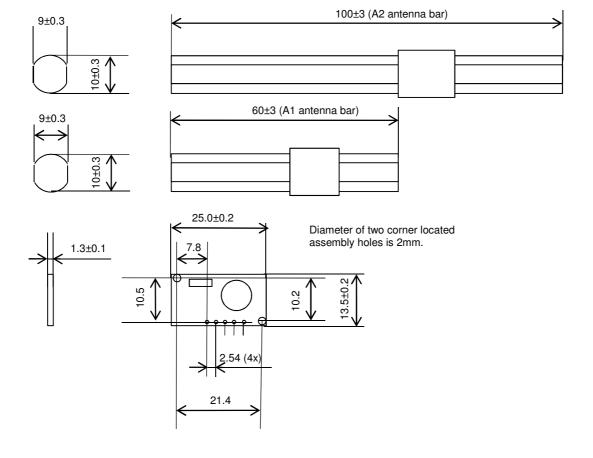
## **ELECTRICAL CHARACTERISTICS**

Parameter	Symbol	Operating Conditions: VDD = 1.5V, Tem  Conditions	Min		Max	Unit
Parameter	Syllibol	Conditions	IVIIII	Тур	IVIAX	Ullit
Operating Voltage	$V_{DD}$		1.1	1.5	3.6	V
Current Consumption	I <sub>DD</sub>	VDD=1.5 V, weak signal VDD=1.5 V, strong signal		66 40		μА
		VDD=3.6 V, weak signal VDD=3.6 V, strong signal	31 24	68 42	85 65	
Stand-By Current	I <sub>DDoff</sub>				0.1	μΑ
Receiving Frequency	f <sub>IN</sub>	module EB6180B1COB77K5A1 module EB6180B1COB60K0A1 module EB6180B1COB60K0A2 See ordering information below.		77.5 60 60		kHz
Sensitivity	E <sub>MIN</sub>			25		μV/m

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

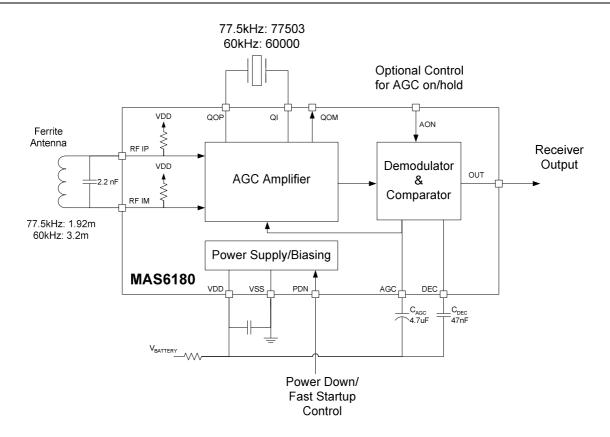
## **MECHANICAL DIMENSIONS**

Parameter		Symbol	Conditions	Min	Тур	Max	Unit
Antenna							
	length	$L_A$	A1 antenna bar	-3	60	+3	mm
	J		A2 antenna bar	-3	100	+3	
	width	$W_A$		-0.3	10	+0.3	
	height	$H_A$		-0.3	9	+0.3	
PCB							
	length	L <sub>PCB</sub>		-0.2	25.0	+0.2	mm
	width	W <sub>PCB</sub>		-0.2	13.5	+0.2	
	thickness	T <sub>PCB</sub>		-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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