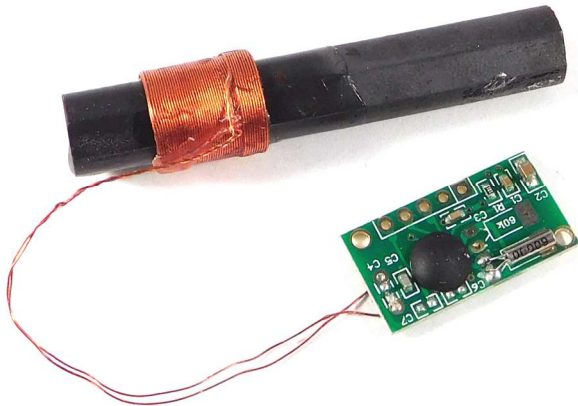




TIME SIGNAL RECEIVER MODULE



- Tuned ferrite antenna
- AM receiver IC board
- Reception of:
 - German DCF77

INTRODUCTION

The time signal receiver module comprises of a ferrite antenna and an AM receiver IC printed circuit board. The board includes a MAS6180C AM receiver IC accompanied with necessary filter crystal and capacitor components. The circuitry includes also an RC-filter for the supply voltage. The US6180C1COB77K5A1 module is tuned for 77.5 kHz and suitable for receiving German DCF77 time signal transmission.

The length of the loopstick antenna is 60 mm and good for a strong signal reception within a 2000 km radius of the sender in Braunschweig.

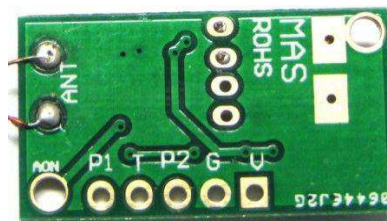
The MAS6180C AM receiver IC includes amplifier, demodulator and comparator blocks that transforms the received AM transmission into series of pulse width coded digital pulses which can be directly processed by an appropriate digital circuitry such as a micro controller unit (MCU).

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

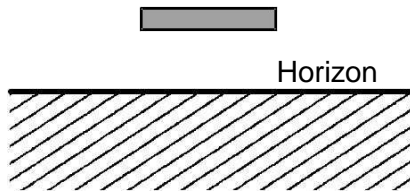
PCB backside
pin marking





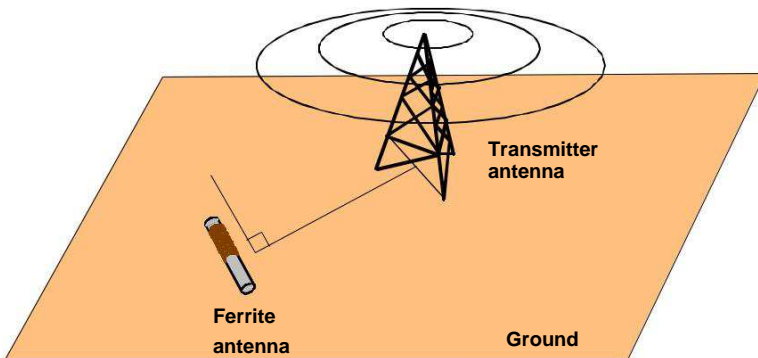
APPLICATION INFORMATION

Antenna orientation



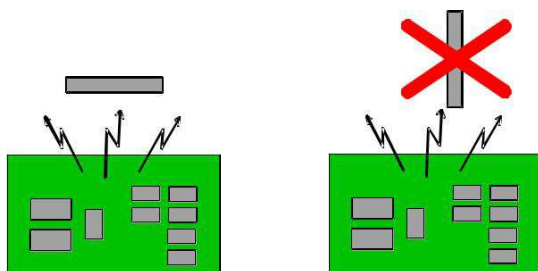
The magnetic field component of the propagating long wave time signal transmission has a horizontal polarization thus the ferrite antenna should be oriented horizontally to maximize the signal (see figure 1).

Figure 1. Antenna orientation relative to ground



The ferrite antenna should also be pointing orthogonally relative to the transmitter.

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 = 5.0V, Temperature = 25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Voltage	V _{DD}	T _A = -40°C...+85°C	1.5	5.0	5.5	V
Current Consumption	I _{DD}	VDD=1.5 V, weak signal		66	80	μA
		VDD=1.5 V, strong signal		43	65	μA
		VDD=5.0 V, weak signal		68	80	μA
		VDD=5.0 V, strong signal		45	65	μA
Stand-By Current	I _{DDoff}				0.1	μA
Receiving Frequency	f _{IN}			77.5		kHz
Sensitivity	E _{MIN}			25		μV/m

Note: For more detailed electrical characteristics see MAS6180C AM receiver IC datasheet

MECHANICAL DIMENSIONS

Parameter	Symbol	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	

