Modification of JR-40MHz module

for operation in modern transmitters

William Meier

Version 0.2, 07/18/2020: HW_1.0

contents

1 Introduction

1.1. license

This document is published under the following *license* released:

1.2. purpose

This document describes the *modification* one Graupner/JR 40MHz- Transmission module for use in modern transmission systems such as a FrSky-X9D, a Jumper T12 or a RadioMaster TX16s.

2. A word of caution

It is*tempting*, the oldGraupner/JR 40MHz-Transmitting module in a modern system of the type aboutJumpers T12orT16orRadioMaster TX16splug in Then*mechanical*the old module fits into the module shaft of the modern system. This is not entirely unintentional, as it has*module housing* or the*module bay*as*de facto*-Standard established in many broadcasting systems.

> *The module bay and the module housing***none***standard.*
>
> Of theGraupner/JR-Module bay is a*mechanical*Quasi standard: many Transmitter systems have such shafts on the back to plug in additional HF transmitter modules. Even the 5-pin connector on the back of the module fits mechanically. However, this quasi-standard does not apply**Not**on the assignment of the plug contacts*in*the 5-pin connector.
>
> In the*old*In the world of 40MHz/35MHz systems, a certain assignment has spread, but this *Not*corresponds to the assignment of the 2.4 GHz modules.

This electrically different assignment of the plug contacts is a**Operation not possible without modification**.

> Becomes a modern transmitter with an old non-rebuilt one plugged in Graupner/JR 40MHz transmitter module*switched on*, so he can*Channel*take damage!

Figure 1. Different versions of the Graupner/JR 40MHz module

So one should resist this temptation. It doesn't work without the conversion.

The conversion itself is simple and associated with little cost. Anyone who can reasonably handle a soldering iron should be able to carry out this conversion on their own.

*Figure 2. The mechanical dimensions allow plugging into a modern system (here: jumper T12). But:***caution***(see text).*

3. Why the conversion?

3.1. motivation

The 40MHz transmission technology can actually be described as outdated today. Nowadays, one expects trouble-free operation, operation without the hassle of having to coordinate channels with other RC model builders in the immediate vicinity, and a number of safety and comfort features such as telemetry. As is well known, none of this is usually possible with 27MHz, 35MHz or 40MHz technology.

With modern 2.4GHz systems you have all of the above features (and much more).

Nevertheless, there is a division that is dependent on 40MHz. And these are the model submarine builders and captains.

The higher the transmission frequency, the worse the electromagnetic waves penetrate the water. At 2.4GHz the penetration is almost zero, at 40MHz it's still good enough to control a model submarine. Of course, even lower transmission frequencies, for example in the long-wave or medium-wave range, would be even better suited. However, the legislator has not released any frequencies for controlling RC models. In addition to the other technical problems that then emerged, the topic has become superfluous.

3.2. result

What can you achieve with the*modification*of such a transmission module and the possible with it*operation* in a modern facility?

Of course, the disadvantages mentioned above remain, and the possibility of RC submarines is added. Other aspects are:

advantages

- *A*transmitter for*Everyone*models
- *A*Transmitter can come with*two*HF modules: one 2.4GHz and one the modified 40MHz module.

• The*significant*better programmability of modern transmitters can be applied to the 40MHz range.

• Possibly bad service for old stations.

Disadvantages:

• The transmission remains*analogue*and therefore prone to failure.

• There is still a need for channel agreements among the model builders.

• The long, unwieldy antenna remains.

The following pictures show how such a converted module can be plugged into a modern sneder.

Figure 3. A modern transmitter (RadioMaster TX16s) with the converted 40MHz JR module (view: from below)

Figure 4. A modern transmitter (RadioMaster TX16s) with the converted 40MHz JR module /view: from above)

Figure 5. A still readily available 40MHz scan receiver

Figure 6. Another modern transmitter (Jumpers T12) with the modified 40MHz JR module (top view)

Figure 7. Another modern transmitter (Jumpers T12) with the converted 40MHz JR module (view: from below)

4. The conversion in detail

The conversion is described step by step below.

4.1. starting material

Unfortunately, over the years, different versions of theGraupner/JR 40MHzmodule below*the same* Order number published. The following pictures show the*inside view*after unscrewing the module cover.

- Note the conductor tracks that lead from the connections of the 5-pin socket strip on the *upper right*go off the edge of the picture.

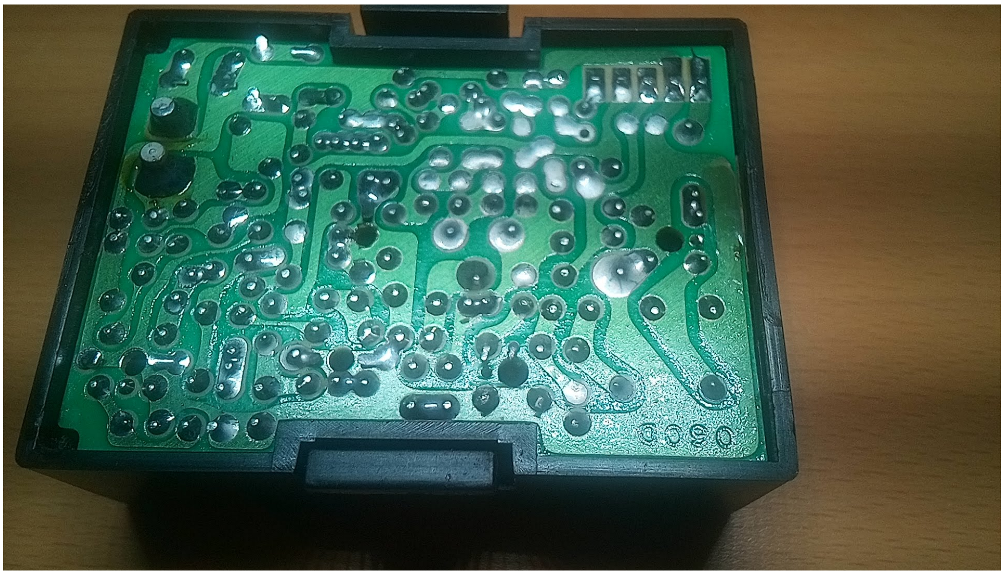


*Figure 8. Version A of the*40MHz*-transmitter module*

*Figure 9. Version B of the*40MHz*-transmitter module*

*Figure 10. Version C of the*40MHz*-transmitter module*

> Decisive for the different versionsA,BandCis only the assignment of the plug contacts of the 5-pin socket strip. This is always the same and therefore easy to identify.

4.2. Interface to the transmitter

A modern transmitter delivers the following signals to the*looking out*long pins of the module bay:

1. Output:PPM-Signal: the composite analog signal with the servo information (8 channels).

2nd entrance: so-called*heartbeat*(depending on the transmitter and the selected function in the transmitter, the meaning may differ)

3rd output: battery voltage (after the on-off switch), unregulated

4. Output: ground

5. Input: telemetry data

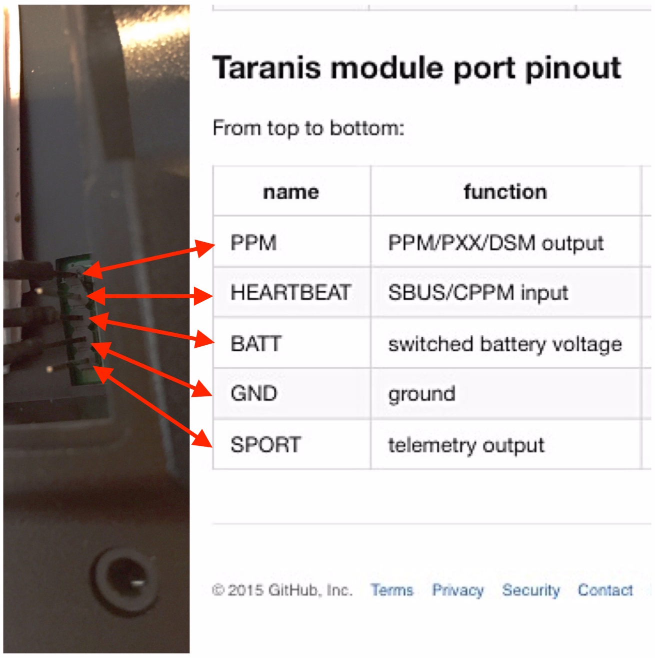


Figure 11. The pin assignment in the module slot of a modern transmitter

That *old* Graupner/JR 40MHz module expects the following signals at its socket strip:

1. Input: PPM-Signal
2. Input: 6V regulated supply voltage for the crystal oscillator
3. Input: Supply voltage in range 7.2V-12V for the HF power amplifier
4. Input: ground
5. Output: antenna signal

*Figure 12. The assignment for the socket strip of the*Graupner/JR 40MHz*transmitter module in an old transmitter*

When comparing the pin assignment of the plug and socket, it is noticeable that

1. Pin2 :*heartbeat*versus6V-Supply voltage
2. Pin5 : Input telemetry data versus antenna signal

apparently*do not match*.

From this the following can be drawn*measures*derive:

- it must be regulated6V-Supply voltage to be generated, and
- The antenna signal must not reach the telemetry data input, but must reach the rod antenna in some other way.

4.3. changes

First, the circuit board is removed from the housing:

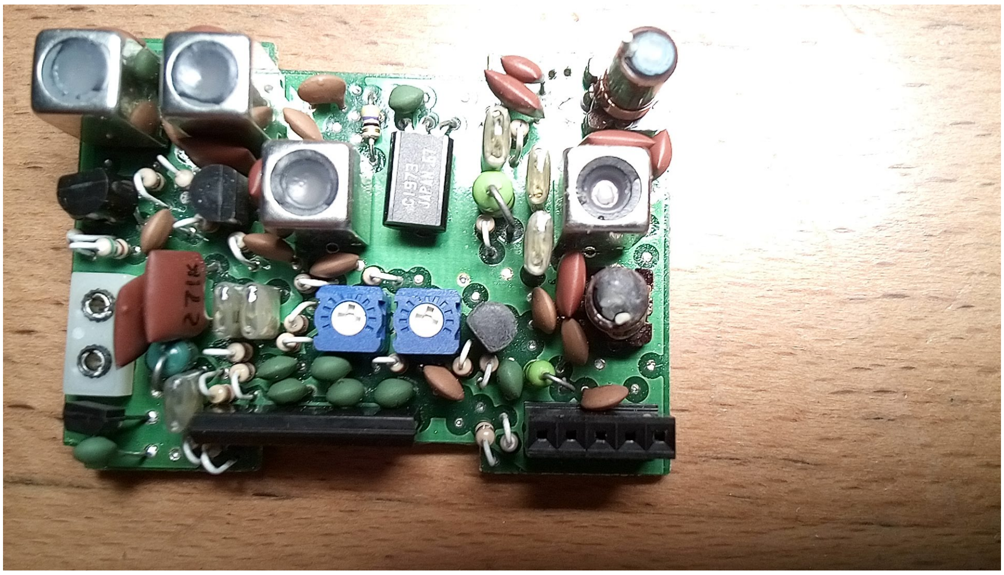


Figure 13. The overall view of the top of the old RF module board

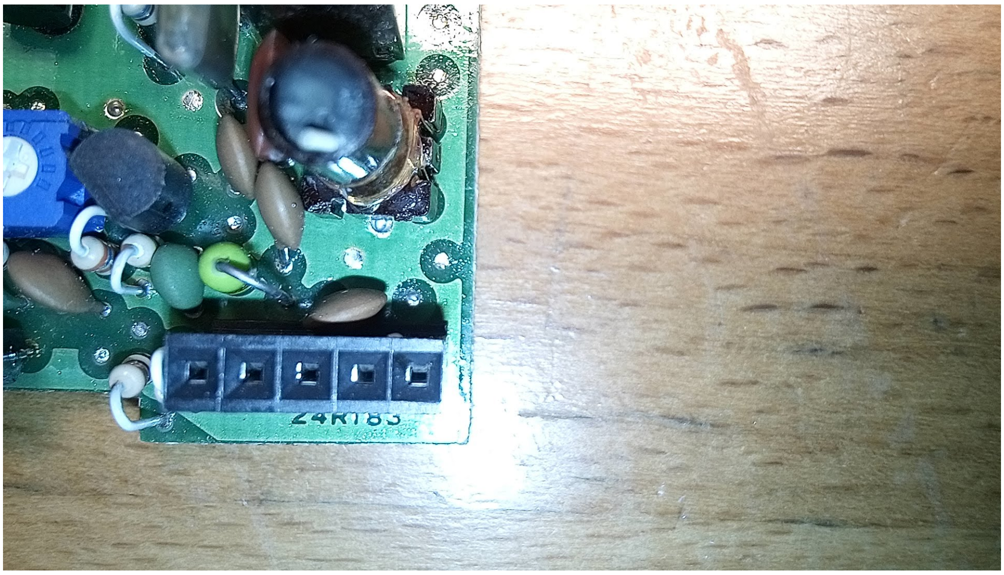


Figure 14. Detailed view of the socket strip area from above (Pin1: far left, Pin5: far right)

The circuit board looks like this from the bottom:

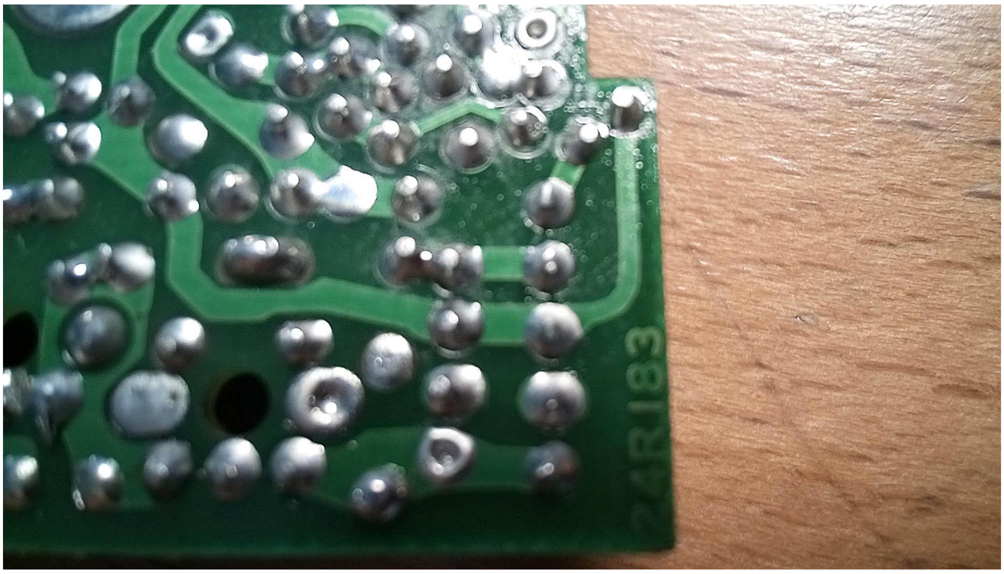


Figure 15. Detailed view of the socket strip area from below (Pin1: top/right, Pin5: bottom/right)

As already shown above, the connections mustPin2 transmitter<→Pin2 moduleandPin5 transmitter<→ Pin5 moduleare first interrupted and then rewired.

First, the conductor tracks are interrupted. This can best be done with a sharp cutter knife. Make sure that the connections have actually been broken, for example by using a*ohm meter*or one*multi meter*or*continuity tester* is measured.

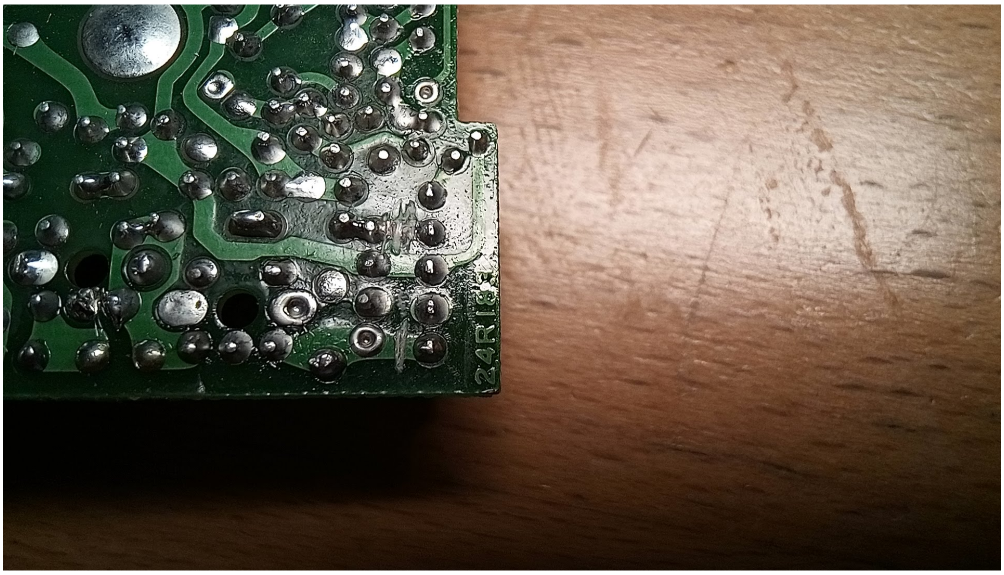


Figure 16. Detailed view: cut traces of Pin2 and on Pin5

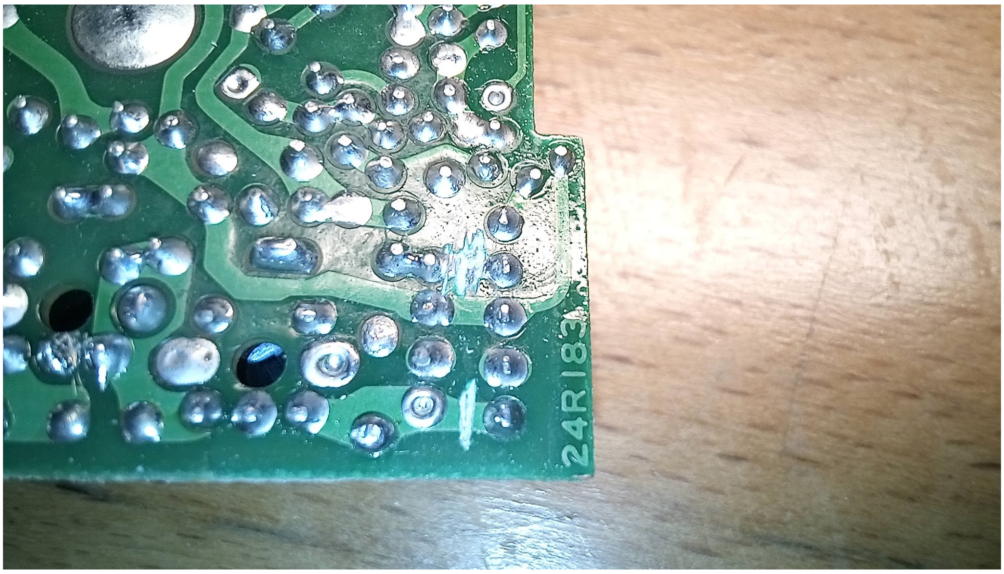


Figure 17. More detailed view: cut traces of Pin2 and on Pin5

The next step is then the necessary*voltage regulator*to generate the regulated6V
- Built-in supply voltage. This is installed in such a way that it consists of*unregulated* Battery voltage the regulated6Vgenerated.

Basically, a very simple, integrated voltage regulator is sufficient here. The best-known voltage regulator family is probably that of the so-called78xx-Be series. So there is7805for5V
- output voltage and the7806for6V-Output voltage. However, these regulators have a disadvantage: they require a between input and output*voltage difference*from approx.2V. If you consider that with a modern transmission system, which has about twoLiIon-Battery is operated, the nominal voltage at7.4Vlies, and that this quite on6.4V allowed to drop, so you can see that you then have a voltage regulator of the type7805operates outside of its regulatory area.

Therefore, we need a voltage regulator, its more necessary*longitudinal voltage drop*smaller than approx. 1Vis. Voltage regulators with a small longitudinal voltage drop are called*low drop out*
- Controller, or simply as an acronym:LDO. Now is6Vrather one*unusual*Voltage, and therefore the selection of LDOs is clear. An example is theLF60CV(satvoltage regulator).

The 6V low-dropout voltage regulator LF60CVgives an overview of the data. And inThe pin assignment of the voltage regulatorwe see the pinout of this type.

First, a place is sought where the unregulated supply voltage can be tapped off on the top of the circuit board. This is easily possible with the documented variant at a connection of a resistor:

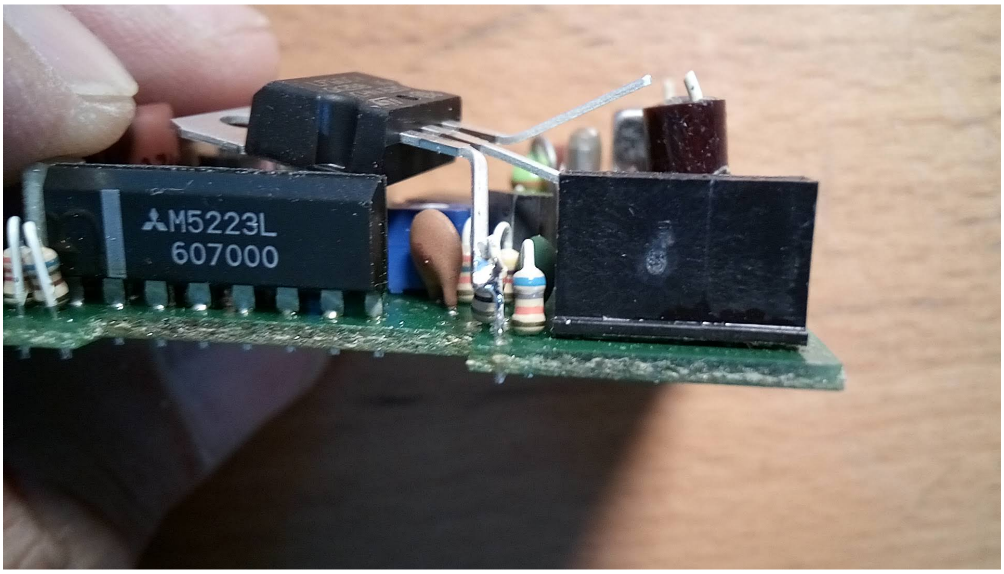


*Figure 18. Wiring of the input of the*LF60CV*with the unregulated supply voltage*

Then the feed point for the regulated6V-Voltage of the wanted. In the documented variants, this can be found at a connection to a longitudinal inductance. The connection on the underside of the circuit board was severed here.

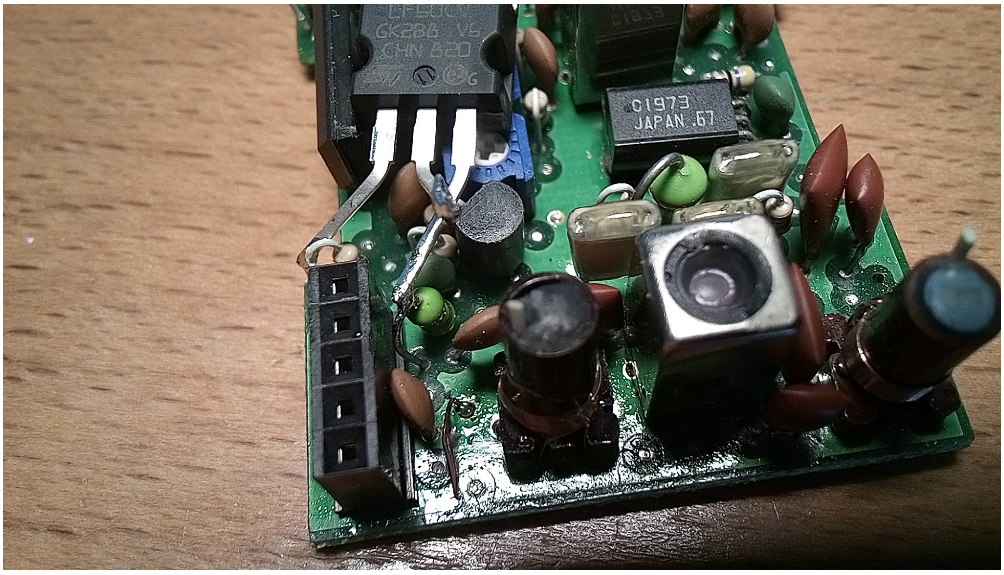


*Figure 19. Feeding the output of the voltage regulator to the feed point*6V*on an inductance*

For the supply of mass to the*LDO*can usually be extended from an unused soldering pad with enamelled copper wire.

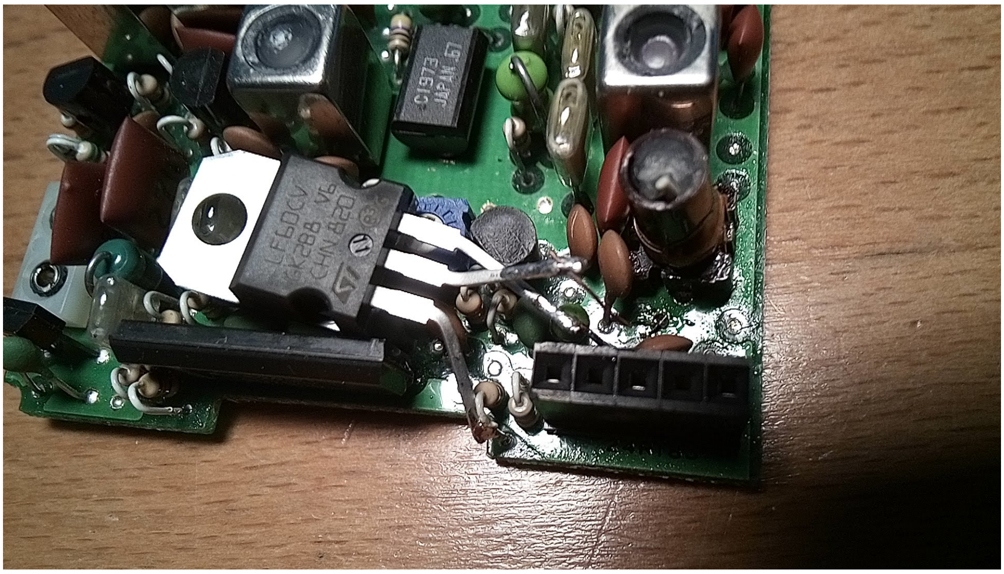


Figure 20. Wiring the ground from a pad: here you have to extend it with a piece of enameled copper wire

With almost all integrated voltage regulators in the so-calledTO-220Housing is the metallic housing back with the output or another of the three pins of the*LDO*conductively connected. Therefore, this area may*Not*come into contact with other components of the module. It is therefore insulated with some tape.

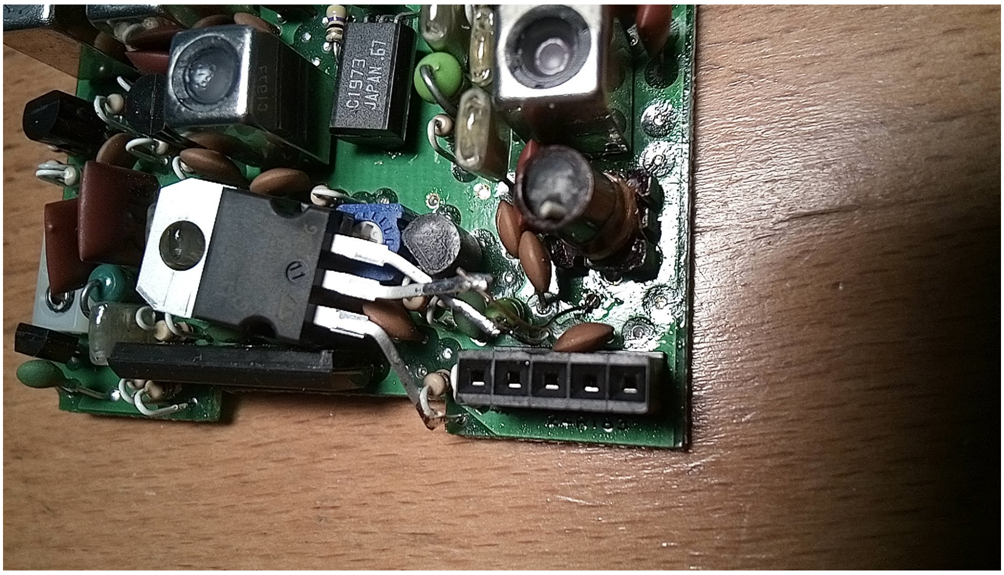


Figure 21. More detailed view.

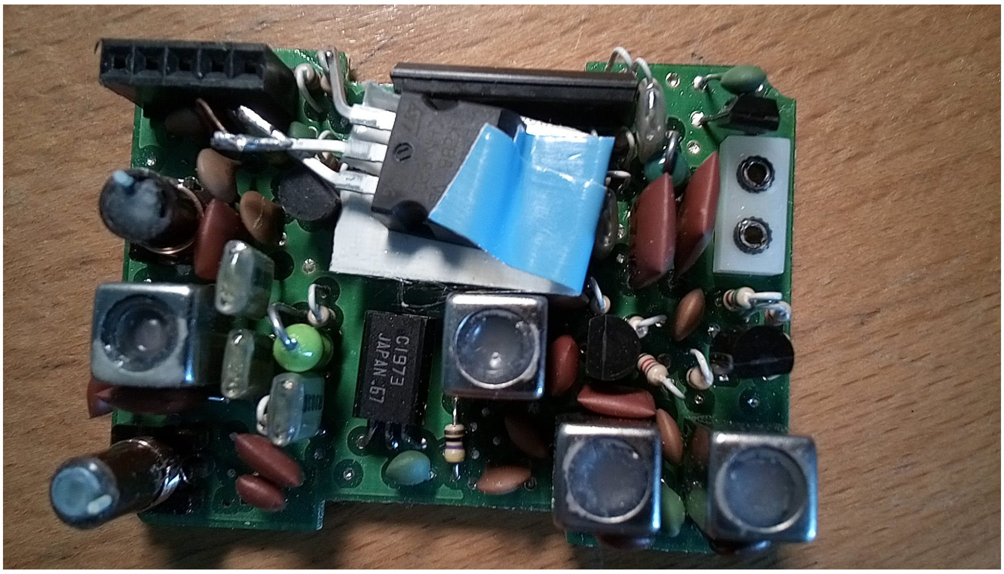


Figure 22. Insulation of the voltage regulator housing

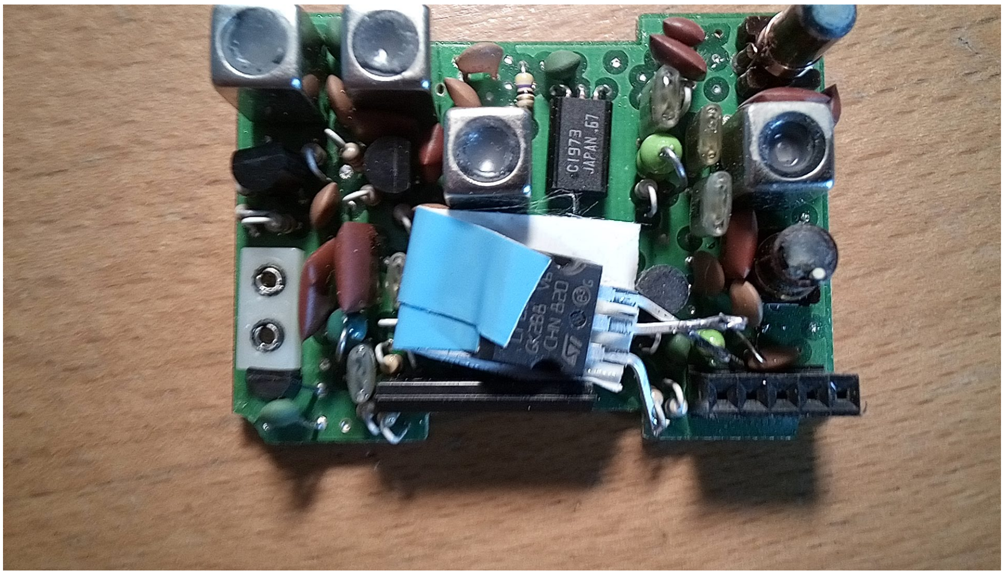


Figure 23. Insulation of the voltage regulator housing

The voltage regulator can be pressed flat onto the other components. Otherwise the module will no longer fit in JR-Housing.

4.4. New case

It is advisable to insert the module board, including the changes, into a new, slightly different module housing. One finds onthingiversedifferent variants for your own 3D printing, all of which are more or less suitable because the screw mounts are often annoying.

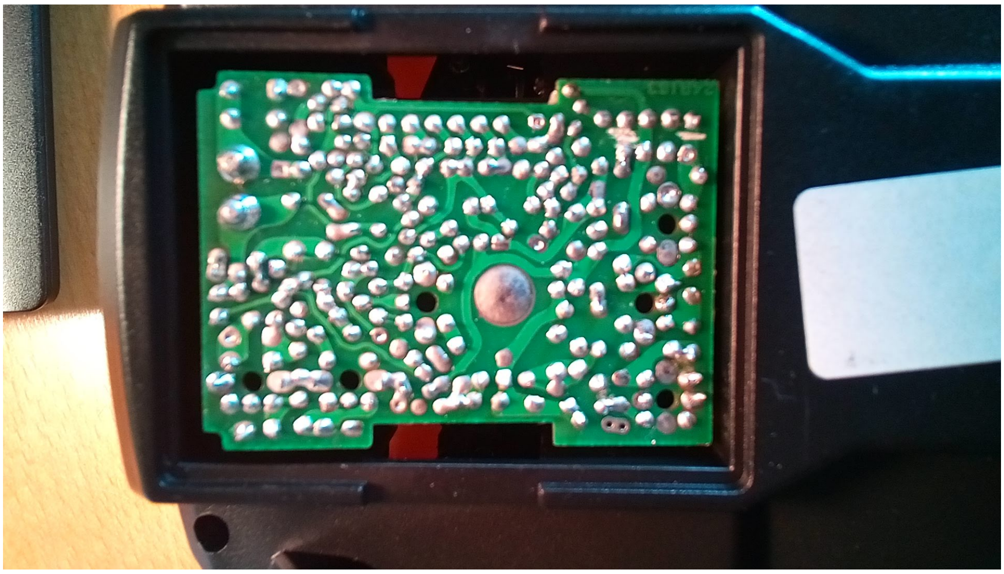


Figure 24. Installation in a new housing

The Company*RadioMaster*delivers to their transmitterTX16san empty, well-suited housing with it. This can also be bought later.

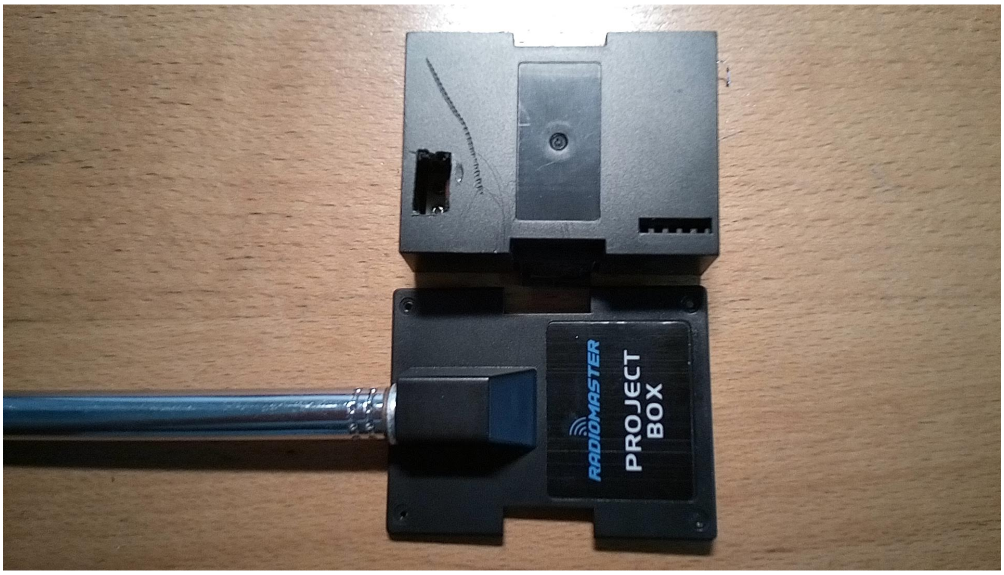


Figure 25. The case from the company RadioMaster is quite suitable

In contrast to the original housing, the replica housings usually have four screw mounts. These disturb something. One can**very carefully**grind down the module board at the corners so that it fits.**danger**: do not cut through any conductors!!!

Figure 26. It may be necessary to adjust the circuit board with a Dremel (or similar) at the screw mounts.

4.5. antenna

The last point of the modification is the assembly of the antenna and its feed line. The replica housings are actually all prepared for the installation of a 2.4 GHz module. So they have one too*humpback*in the lid for a small antenna. The rod antenna for 40MHz operation can also be mounted here, although the mechanical load of the long rod antenna is of course much greater. That's why here**caution**required.

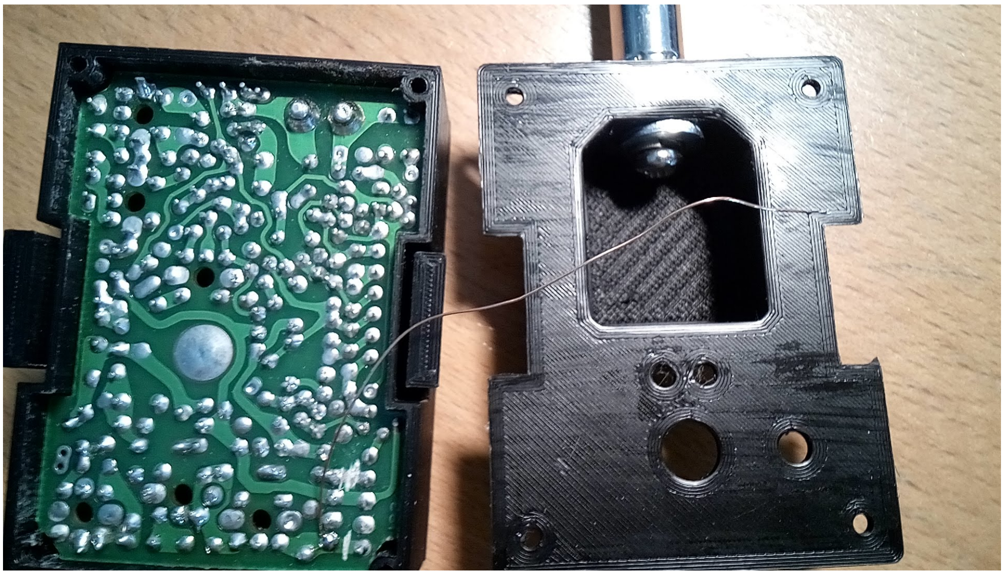


*Figure 27. Housing with boss for mounting the rod antenna.***caution***: the construction is delicate!*

Finally, the conductor track of the antenna signal that has been severed must be extended to the base of the antenna using a piece of enameled copper wire. Then everything can be screwed together.

Figure 28. Extending the antenna signal with some enameled copper wire to the base of the antenna. Ensure good contact at the base of the antenna.

4.6. First commissioning

During the first start-up, the usual *Precautions* are valid. At least the power consumption should be checked first. To do this, you plug in the module *Not* and extends the pins from the transmitter to the module with test leads. You sneak into the supply *multimeter* one and measures the *power consumption*: which should not be more than 120mA. Otherwise, disconnect immediately. and look for unwanted short circuits.

Alternatively, the module can initially be operated via a laboratory power supply *without* Channel!

If everything is ok, a first overall test can be carried out. To do this, the transmitter must of course be on PPM - Signal to be adjusted.

Figure 29. Settings on the transmitter

Then the connection to a receiver should also work.

5. Outlook

6. Material

6.1. soldering iron

short

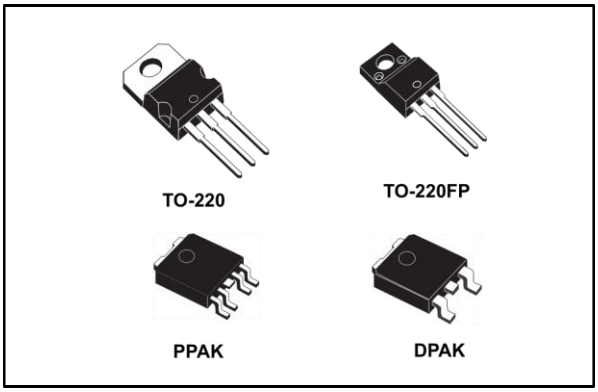
400°C

6.2. voltage regulator

LFXX

Very low drop voltage regulator with inhibit function

Data sheet - production data



features

- Very low-dropout voltage (0.45 V) Very low
- quiescent current (typ. 50 µA in OFF mode, 500 µA in ON mode)
- Output current up to 500 mA Logic-
- controlled electronic shutdown Output
- voltages of 1.5; 1.8; 2.5; 3.3; 4.7; 5; 6; 8th; 8.5; 9; 12v
- Automotive grade product: 1.8V, 2.5V, 3.3V, 5.0V, 8.0V, 8.5VV_{OUT}in DPAK and PPAK packages
- Internal current and thermal limit
- Only 2.2 µF for stability
- Available in ±1% (AB), ±1.5% (AC) or ±2% (C) selection at 25 °C
- Supply voltage rejection: 80 db (typ.)
- Temperature range: from -40 to 125 °C

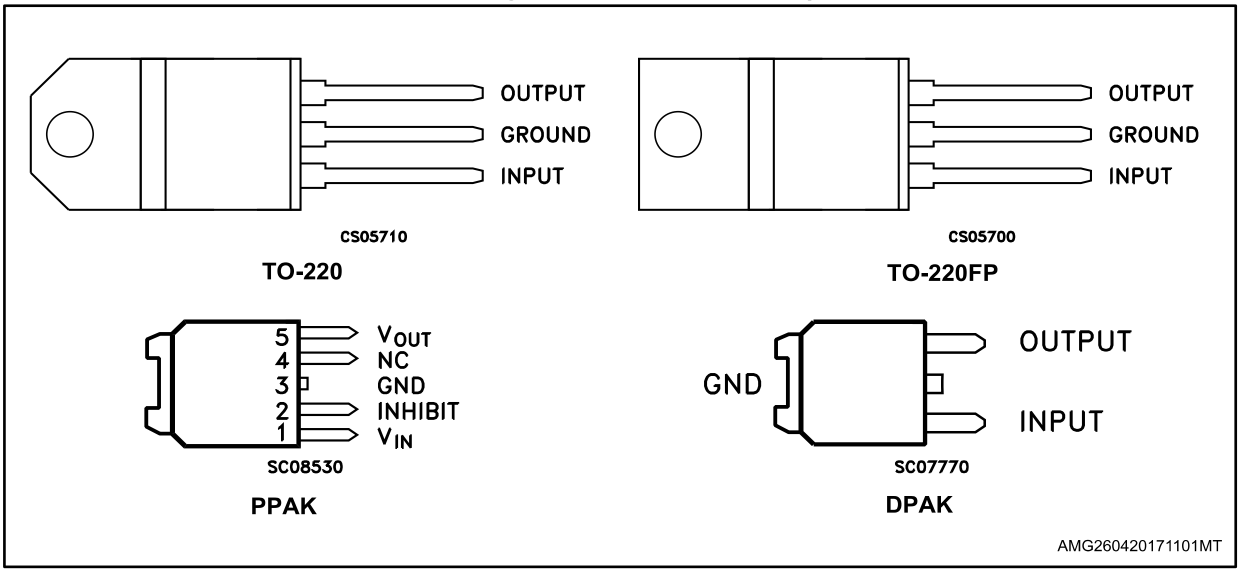
Description

The LFXX is a very low drop regulator available in TO-220, TO-220FP, DPAK and PPAK packages and in a wide range of output voltages. The low drop voltage (0.45 V) and low quiescent current make it particularly suitable for low-noise, low-power applications and especially in battery-powered systems. In the 5 pin configuration (PPAK) a shutdown logic control function is available (pin 2, TTL compatible). This means that when the device is used as a local regulator, a part of the board can be put in standby, decreasing the total power consumption. In the three terminal configuration, the device has the same electrical performance, but it is fixed in ON state. It requires a capacitor of only 2.2 µF for stability, saving board space and costs. The LFXX is available as automotive grade in DPAK and PPAK packages, for the options of output voltages whose commercial part numbers are shown in the order codes. These devices are qualified according to the specification

AEC-Q100 of the automotive market, in the temperature range -40 °C to 125 °C, and the statistical tests PAT, SYL, SBL are performed.

2 pin configuration

Figure 2: Pin connections (top view)



TAB is electrically connected to GND on TO-220, PPAK and DPAK packages.

7. Contact

Requests:wilhelm.wm.meier@googlemail.com