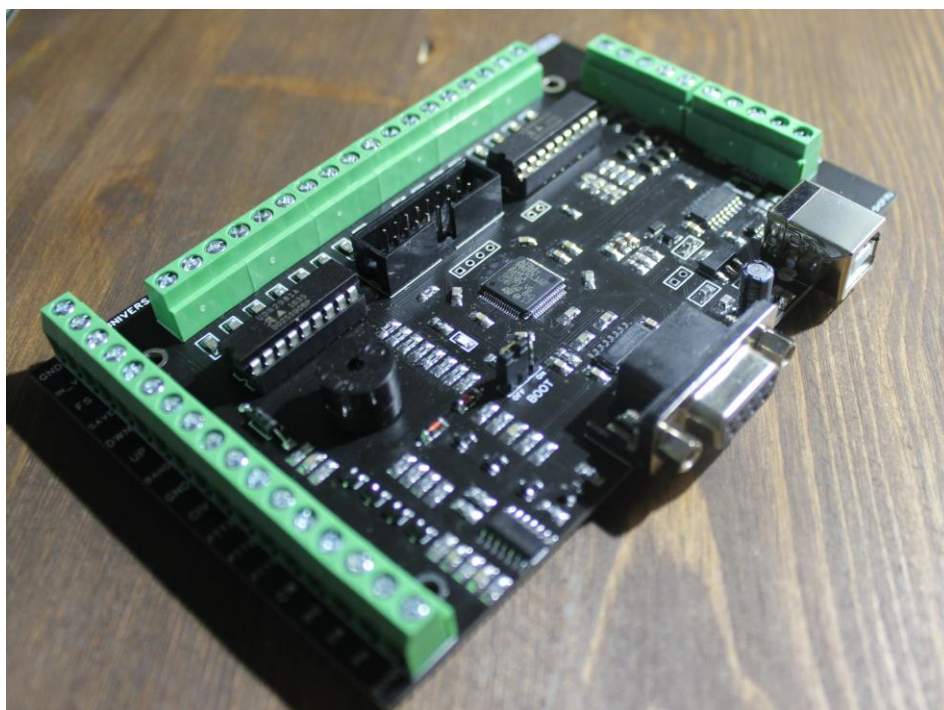# Universal automatic band decoder (USB interface, CW, PTT)

Manual

Irkutsk, Siberia
2022

CONTENTS:

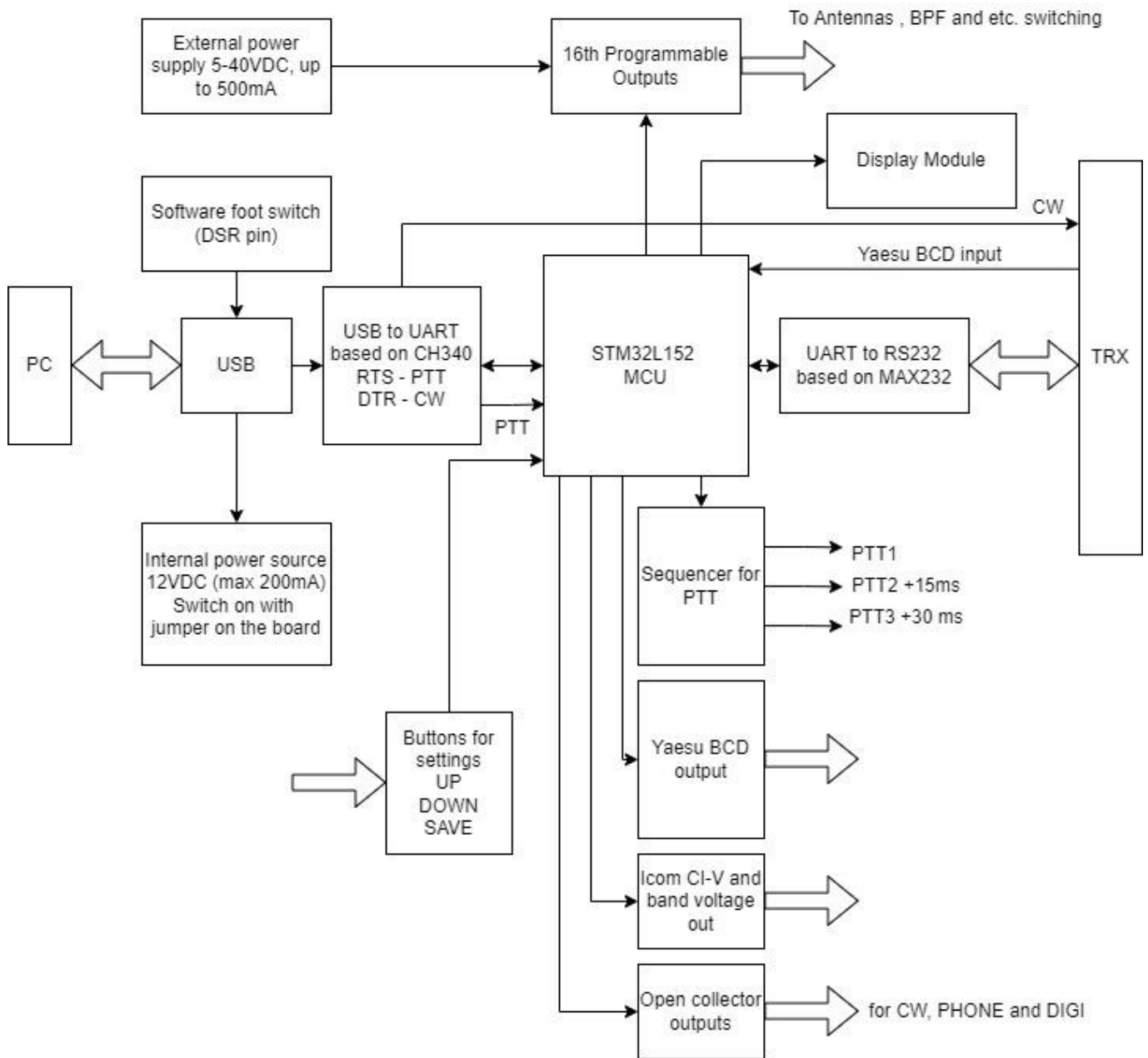# 1. General description of the device and its functionality.

Рис. 1 Diagram of the device

The device connects to the computer with a single USB cable. The microcontroller on the board performs the functions of transmitting data between the transceiver and the PC and thereby receives data on the state of the transceiver, frequencies and modulation type. Further, the device generates all the necessary signals at its outputs, while the data exchange between the programs running on the PC and the transceiver does not stop.

The device consists of two boards - the main board and the display module board. The boards are connected by a cable and a 16-pin connector.

2. Description of input and output signals

Top to bottom sequence.

INPUTS:

- **GND** – common ground
- **IN_V** – the input for connecting an external power source for switching external circuits. This voltage will appear on outputs A1-A16. Range from 5 to 40V (maximum current up to 500 mA)
- **FS** – Foot Switch input. Active state is GND.
- **SAVE** – Push Button input. Active state is GND. See below.
- **DWN** - Push Button input. Active state is GND. See below.
- **UP** - Push Button input. Active state is GND. See below.
- **BAND** –Band voltage input (ICOM)

OUTPUTS:

- **GND** – common ground
- **CIV** – output ICOM CI-V
- **PTT3** – Sequencer output PTT3 (delay 30ms)
- **PTT2** – Sequencer output PTT2 (delay 15ms)
- **PTT1** – Sequencer output PTT1 (without delay)
- **CW** – output for CW manipulation
- **DIG** – open drain output which turn on in DIGI mode
- **CW** - open drain output which turn on in CW mode
- **PH** - open drain output which turn on in Phone modes (SSB, FM, AM)
- **BAND** – Band voltage output (ICOM)

Band voltage ICOM:

Band	160m	80m	40m	30m	20m	17m	15m	12m	10m	6m	None
Frequency	1.8	3.5	7	10	14	18	21	24	28	50	NA
Icom Voltage	7.0v to 8.0v	6.0v to 6.5v	5.0v to 5.5v	0.1v to 1.2v	4.0v to 4.5v	3.0v to 3.5v	3.0v to 3.5v	2.0v to 2.5v	2.0v to 2.5v	1.2v to 2.0v	0v
Band A	H	L	H	L	H	L	H	L	H	L	L
Band B	L	H	H	L	L	H	H	L	L	H	L
Band C	L	L	L	H	H	H	H	L	L	L	L
Band D	L	L	L	L	L	L	L	H	H	H	L

Outputs for external circuits:
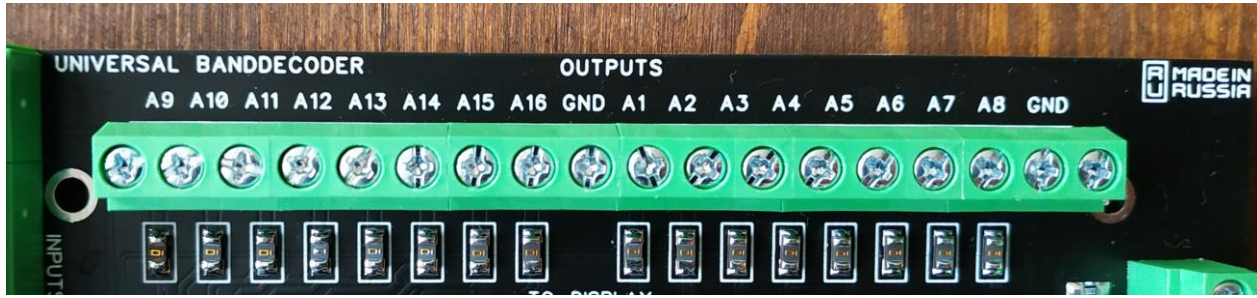
Input and output of Yaesu BCD band data. Signals are generated at the output regardless of whether or not the BCD input signal is enabled. The output is generated based on the data received by the device during data exchange between the PC and the transceiver.
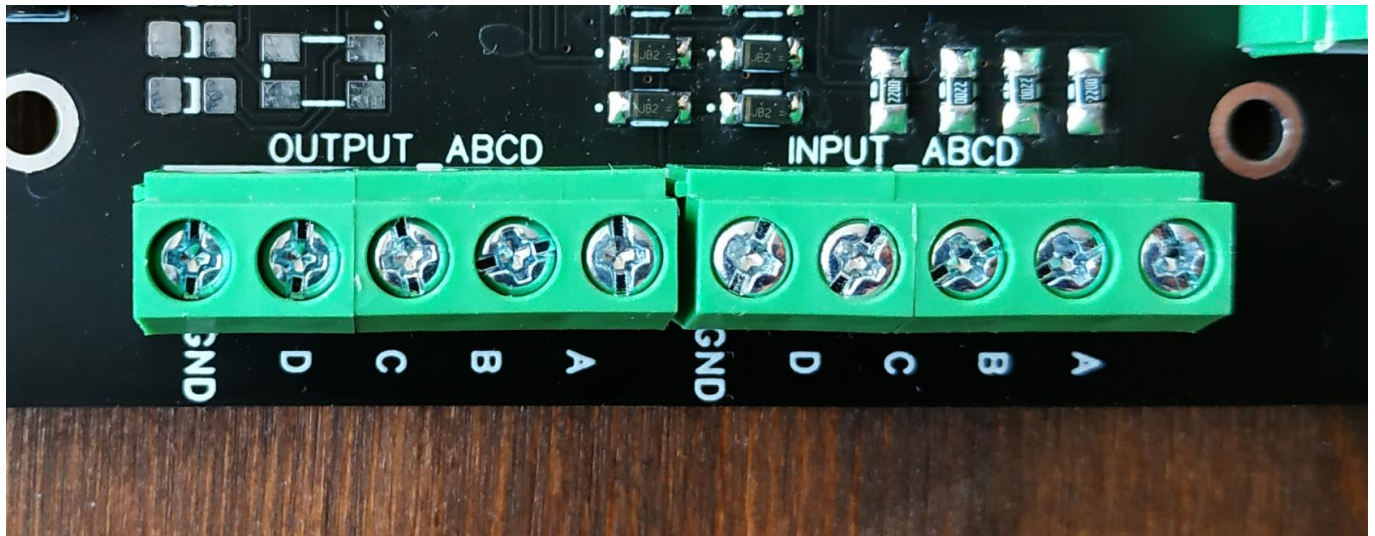
3. Connection between PC and TRX

The device is connected to the computer with a single USB cable (USB type B connector). A new COM port will be detected in the system, which must be used in the settings of programs for working with the transceiver. The speed is 9600 kb/s, the same speed must be set in the transceiver settings.

The device is connected to the transceiver via the DB9F (RS232) connector. The device only supports Kenwood's CAT protocol. If you have a transceiver with a different communication protocol, or you do not want to use this interface, you can use the Yaesu BCD data or ICOM band voltage data inputs. In these cases, the device will not be able to obtain information about the exact frequency and type of modulation. It is not necessary to use all inputs at the same time.

4. External devices connection

To save the settings of the outputs A1-A16 by bandes, it is necessary to connect 3 buttons without fixation to the device board - UP, DOWN and SAVE (the active state is closed to a common wire). The settings are saved independently for the receive and transmit modes. Thus, it is possible to configure

different outputs to be switched on independently in receive mode and in transmit mode. For example, when operating on 80 meters, you want to transmit to the antenna on port A1, and while receiving, listen to another antenna on port A2. This switch will take place automatically.

The setup procedure is as follows. When changing bandes in the transceiver, the device determines the current active band, the desired output A1-A16 is selected with the UP or DOWN buttons (they switch in a loop). After the desired output is selected, you must press the SAVE button, after which the selected output will be saved for the current range (a sound signal will inform you about the successful saving of the settings). For the transmission mode, everything is the same, but the selection of the antenna and the saving of parameters must be done with the pedal depressed (the FS input is closed to a common wire).

If you plan to use the outputs A1-A16 for switching loads with a voltage of 12V and a current of not more than 200 mA, it is possible to use an internal voltage source. To do this, you need to install a jumper on the board.
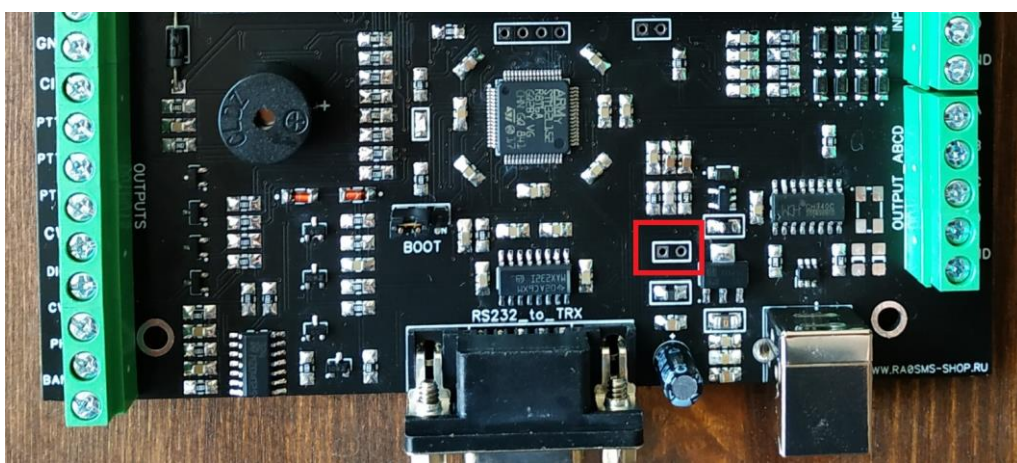
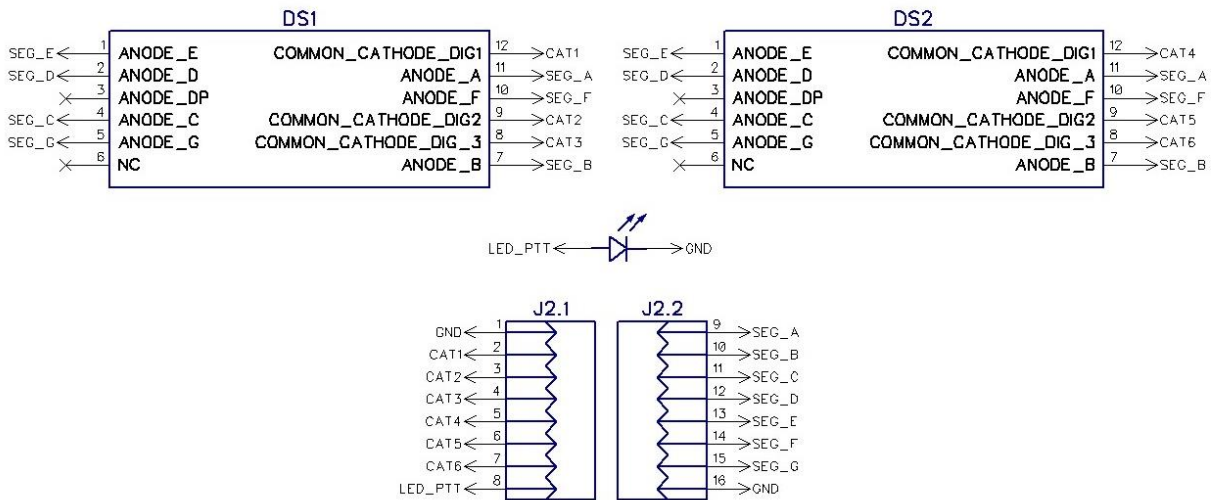To connect a software-defined footswitch (DSR input), use the input marked in the figure:
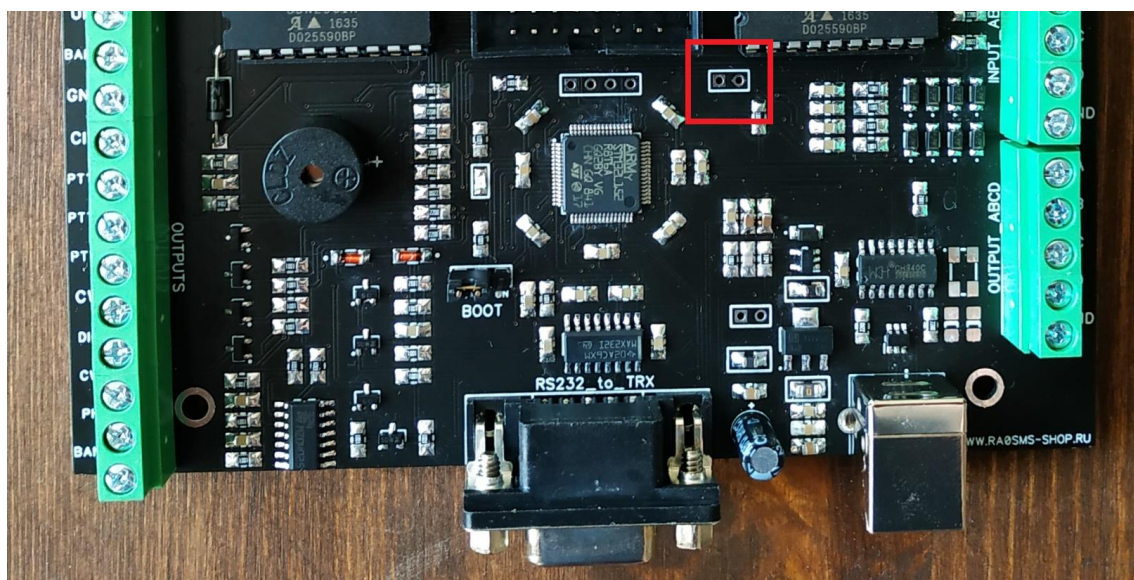
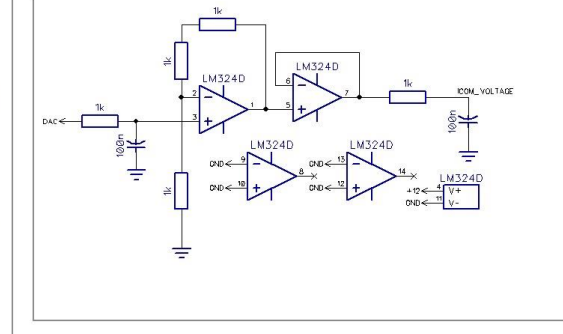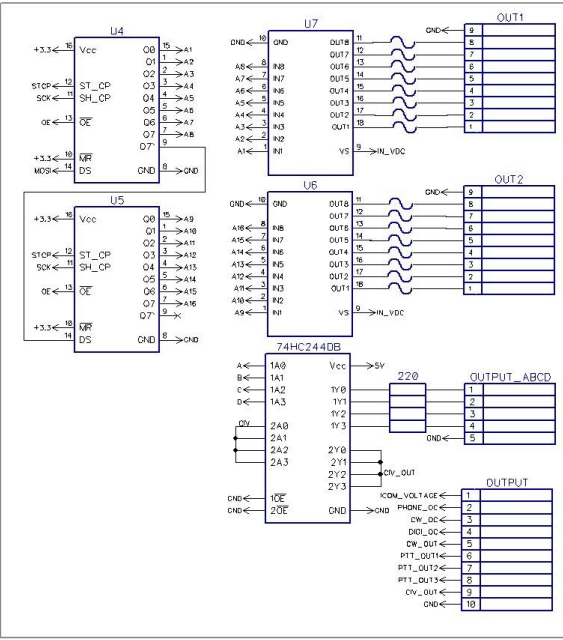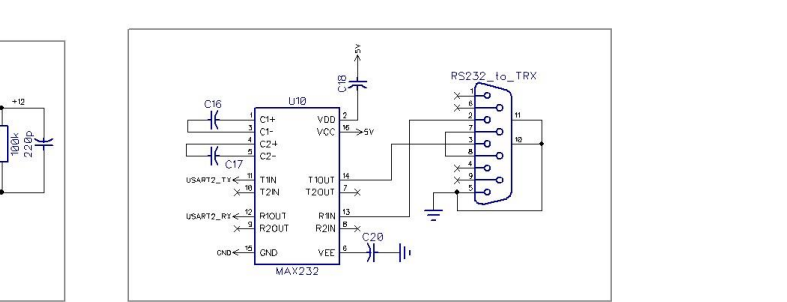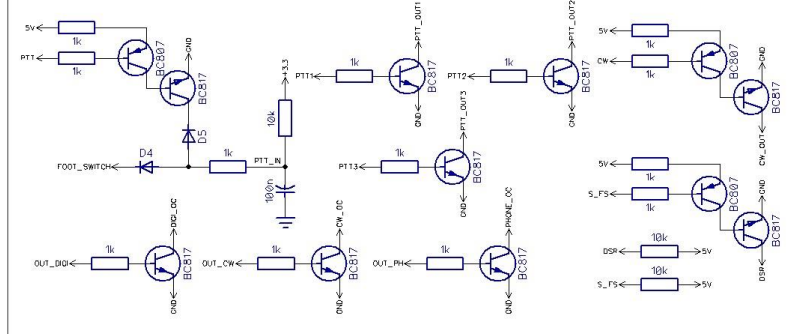# 5. Schematic diagram and dimensions

Main PCB – **130*85 мм**

Display module PCB – **90*40 мм**

Display (6 digits) – **75*20мм**

Schematic diagram of the display module and its appearance
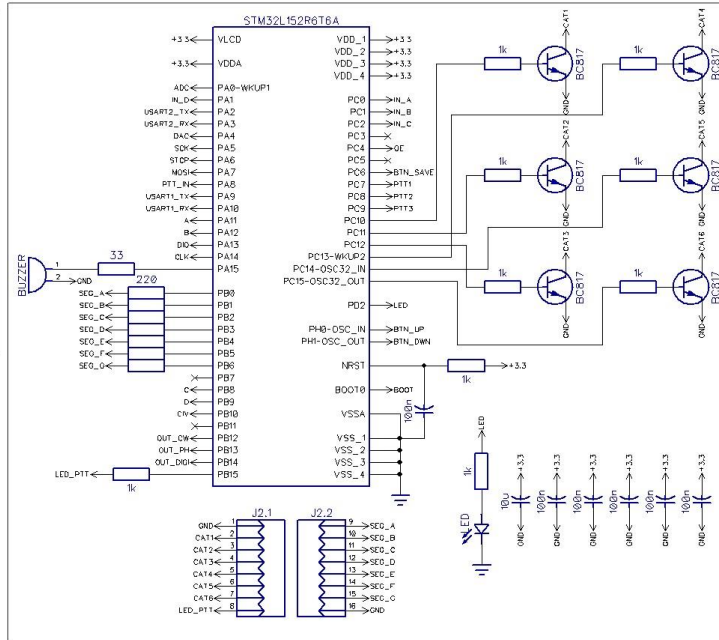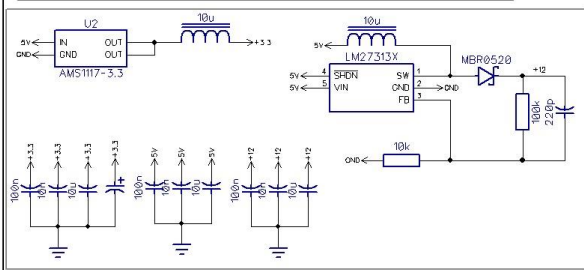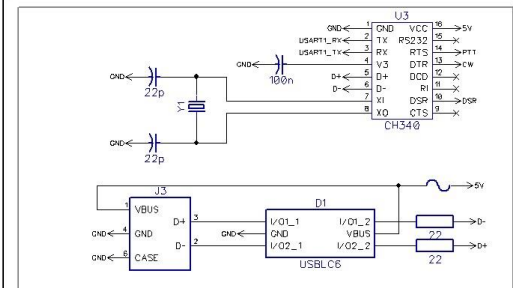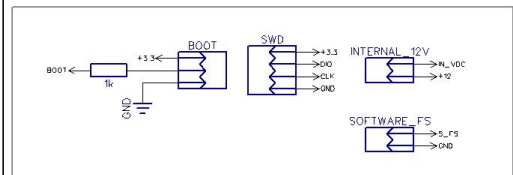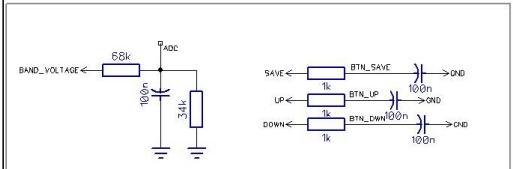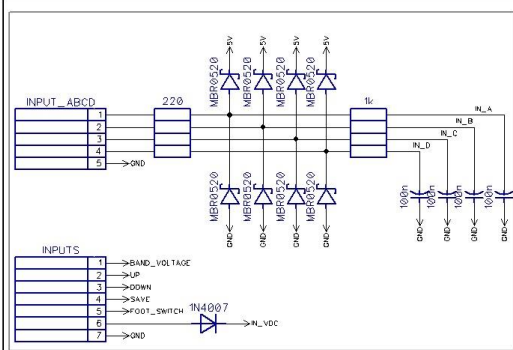
Universal Band Decoder

INPUT_ABCD
MBR0520
220
1k
IN_A
IN_B
IN_C
IN_D
GND

INPUTS
BAND_VOLTAGE
UP
DOWN
SAVE
FOOT_SWITCH
GND
1N4007
IN_VDC

68k
ADC
100n
34k
BAND_VOLTAGE

SAVE 1k BTN_SAVE 100n GND
UP   1k BTN_UP   100n GND
DOWN 1k BTN_DWN   100n GND

BOOT
SWD
+3.3
DIO
CLK
GND
INTERNAL_12V
IN_VDC
+12
1k
GND
SOFTWARE_FS
S_FS
GND

U3 CH340
GND VCC 5V
TX   RS232
RX   RTS PTT
V3   DTR CW
D+   DCD
D-   RI
XI   DSR DSR
XO   CTS
USART1_RX
USART1_TX
100n
GND
22p Y1 22p

J3
VBUS
GND
D-
CASE
D1 USBLC6
I/O1_1 I/O1_2
GND   VBUS
I/O2_1 I/O2_2
22
22
D-
D+
5V

U2 AMS1117-3.3
IN   OUT
GND OUT
10u
+3.3
5V
GND

LM27313X
SHDN SW
VIN   GND
      FB
10u
MBR0520
+12
100k
220p
10k
GND

100n +3.3 100n +5V 100n +12V

STM32L152R6T6A
+3.3 VLCD
+3.3 VDDA
ADC   PA0-WKUP1
IN_D PA1
USART2_TX PA2
USART2_RX PA3
DAC   PA4
SCK   PA5
MISO PA6
MOSI PA7
PTT_IN PA8
USART11_TX PA9
USART11_RX PA10
A PA11
B PA12
DIO PA13
CLK PA14
PA15
BUZZER
33
220
SEG_A PB0
SEG_B PB1
SEG_C PB2
SEG_D PB3
SEG_E PB4
SEG_F PB5
SEG_G PB6
PB7
C PB8
D PB9
CW PB10
PB11
OUT_CW PB12
OUT_PH PB13
OUT_DIGI PB14
PB15
LED_PTT
1k

VDD_1 +3.3
VDD_2 +3.3
VDD_3 +3.3
VDD_4 +3.3
PC0 IN_A
PC1 IN_B
PC2 IN_C
PC3 X
PC4 OE
PC5 X
PC6 BTN_SAVE
PC7 PTT1
PC8 PTT2
PC9 PTT3
PC10
PC11
PC12
PC13-WKUP2
PC14-OSC32_IN
PC15-OSC32_OUT
PD2 LED
PH0-OSC_IN BTN_UP
PH1-OSC_OUT BTN_DWN
NRST
BOOT0 BOOT
VSSA
VSS_1
VSS_2
VSS_3
VSS_4
1k +3.3
100n
LED
1k
LED
10u 100n 100n 100n 100n +3.3

BC817 CAT1
BC817 CAT4
BC817 CAT2
BC817 CAT5
BC817 CAT3
BC817 CAT6
1k

J2.1
GND
CAT1
CAT2
CAT3
CAT4
CAT5
CAT6
LED_PTT
J2.2
SEG_A
SEG_B
SEG_C
SEG_D
SEG_E
SEG_F
SEG_G

U4 74HC244DB
Vcc
Q0 A1
Q1 A2
ST_CP Q2 A3
SCK SH_CP Q3 A4
OE Q4 A5
Q5 A6
Q6 A7
MOSI DS Q7 A8
GND

U5
Vcc
Q0 A9
Q1 A10
ST_CP Q2 A11
SCK Q3 A12
OE Q4 A13
Q5 A14
Q6 A15
DS Q7 A16

U7
GND
OUT1
IN8
IN7
IN6
IN5
IN4
IN3
IN2
IN1
VS IN_VDC

U6
GND
OUT2
IN8
IN7
IN6
IN5
IN4
IN3
IN2
IN1
VS IN_VDC

74HC244DB
A 1A0
B 1A1
C 1A2
D 1A3
TY0
1Y1
1Y2
1Y3
2A0
2A1
2A2
2A3
2Y0
2Y1
2Y2
2Y3
Vcc 5V
220
OUTPUT_ABCD
GND
CIV_OUT
1OE
2OE
GND

OUTPUT
ICOM_VOLTAGE
PHONE_OC
CW_OC
DIGI_OC
CW_OUT
PTT_OUT1
PTT_OUT2
PTT_OUT3
CIV_OUT
GND

5V 1k PTT BC807 BC817
PTT_OUT1
10k
+3.3
PTT1
1k
BC817
PTT_OUT2
1k
BC817
PTT2 CW 1k BC807 BC817
CW_OUT
D5
FOOT_SWITCH D4 1k PTT_IN 100n
PTT3 1k BC817 PHONE_OC
5V 1k S_FS BC807 BC817
OUT_DIGI 1k BC817 DIGI_OC
OUT_CW 1k BC817 CW_OC
OUT_PH 1k BC817
DSR 10k 5V
S_FS 10k 5V

1k LM324D LM324D 1k ICOM_VOLTAGE
DAC 1k 100n
1k
LM324D
LM324D
GND
LM324D
V+ +12
V- GND
100n

U10 MAX232
C16 C1+ VDD
C1- VCC 5V
C2+
C17 C2-
USART2_TX T1IN T1OUT
T2IN T2OUT
USART2_RX R1OUT R1IN
R2OUT R2IN
GND VEE
C18
C20
RS232_to_TRX

Universal Band Decader
Size A3
Rev 0.1
20 Aug 2021
RA0SMS
1