JP1
54602-908LF

Brn — 8 — HOST_TX_STATUS
— 7 — HOST_RX_STATUS
Grn — 6 — HOST_UART_RX
Blu — 5 — HOST_GPS_STATUS
— 4 — HOST_UART_TX
W/Grn — 3 — HOST_TX_OFF
Org — 2 — V_IN
— 1

HOST_GPS_STATUS — R14 100R — U14G$1 DMN63D8LDW-7 — GPS_STATUS/2.5B

HOST_RX_STATUS — R15 100R — U14G$2 DMN63D8LDW-7 — RX_STATUS/2.2B

HOST_TX_STATUS — R17 0R — U17G$1 DMN63D8LDW-7 — TX_STATUS/2.5A

MCU_TX_OFF/2.4B
HOST_TX_OFF — U17G$2 DMN63D8LDW-7
R18 10k

U9
D3V3X8U9LP3810
HOST_UART_TX — C8
HOST_UART_RX — C7
HOST_RX_STATUS — C6
HOST_TX_STATUS — C5
GND
C4
C3
HOST_GPS_STATUS — C2
HOST_TX_OFF — C1

HOST_UART_TX — R2 1k1 — D1 BZT52C3V6T-7 — MCU_UART_RX/2.4B

HOST_UART_RX — R13 1k1 — D2 BZT52C3V6T-7 — MCU_UART_TX/2.5B

V_IN
Q1 DMP3099L-7
V_IN
D3 SMBJ16CA-13-F
V_PROT
C4 .1uF
L2 4.7uH
C43 .1uF
C1 10uF

U1 AP3211KTR-G1
IN   BS
SW
EN GND FB

C2 22nF
L12 4.7uH
D4 BAT41ZFILM
R21 51k
R24 16k
GND1 GND2

3V3
C6 22uF
3.3V

U3 LDFPVR
VIN   PG
VOUT
EN GND ADJ
C47 2.2uF

V_PA
R5 10k
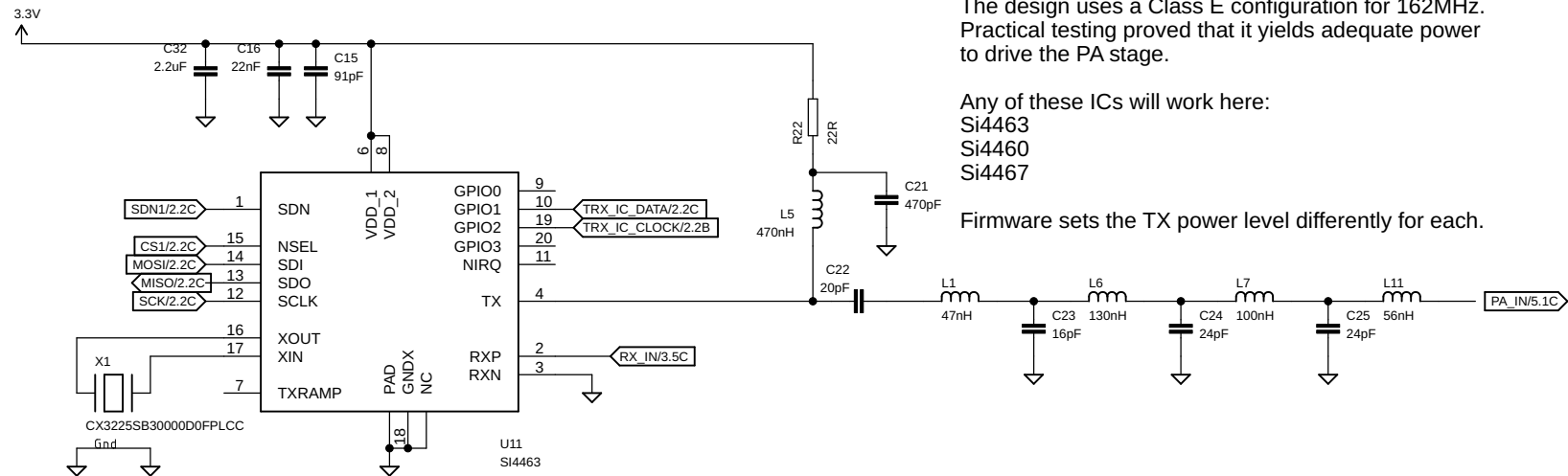R4 1k1
C49 2.2uF
V_PA
V_PA is set to 8V

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Connections & Power
transponder-10.5.0
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The STM32L412K8U6 is a reasonably priced M4 MCU
with 64K of flash. Given recent supply constraints,
it can be substituted with a 128K variant or the
more expensive L432.

In either case, firmware fits well within 60K, so
configuration is persisted at flash address 0x0800F800
and there is no need for an external EEPROM or I2C
bus anymore.

This connector will accommodate either SEGGER or
STLINK adapters that need a reference voltage.

U13

STM32L412K8U6

JLINK

S1
KMR221NGLFS

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MCU & EEPROM

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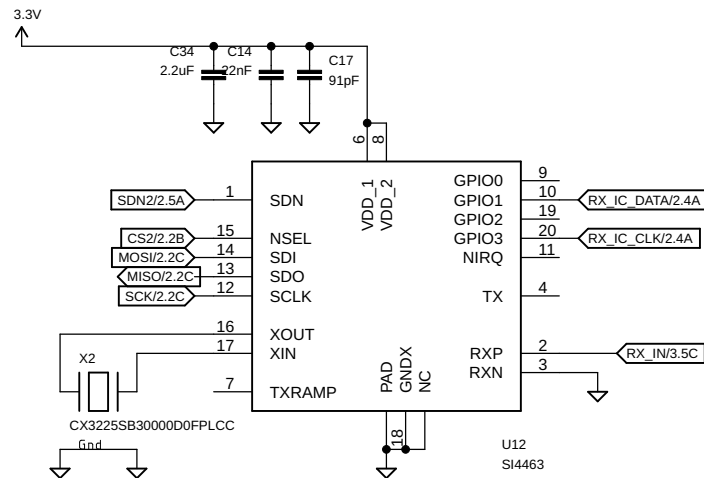This 3-pole Chebyshev has a measured insertion loss of only 2.6dB in the passband.
It is sharp enough to bring FM radio and aviation aids (~200MHz)
near or below the AIS band, but not selective enough to decimate VHF television
between 174 and 180MHz.
If this becomes an issue a notch filter will need to be inserted after the amplifier.

V_LNA

RX_EN/2.5A

R10
100R

C13
22nF

L8
270nH

C9
3.3pF

C10
3.3pF

L13
270nH

RF_IN/7.2B

L14
10nH

C8
91pF

C12
2.2nF

6 IN   VCC   OUT 3

GND

2*3

U5
BGA2818,115

C18
2.2nF

RX_IN/4.3B

The design uses a Class E configuration for 162MHz.
Practical testing proved that it yields adequate power
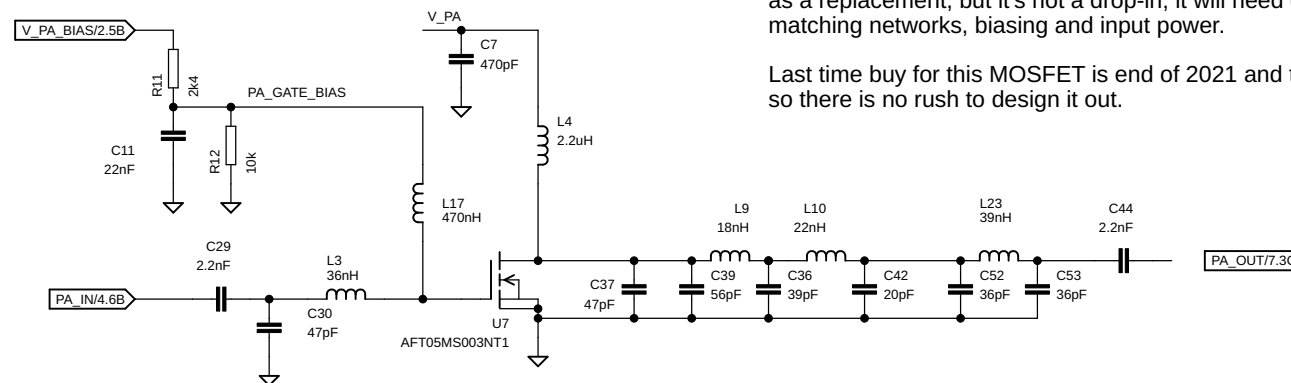to drive the PA stage.

Any of these ICs will work here:
Si4463
Si4460
Si4467

Firmware sets the TX power level differently for each.

For RX, both IC inputs are configured as single-ended with no matching network.
Practical field testing suggests there is no need for one.

Any of these ICs can work here: Si4460, Si4467, Si4362, Si4463.

3.3V

C32 2.2uF   C16 22nF   C15 91pF

R22 22R

L5 470nH
C21 470pF

C22 20pF

L1 47nH   L6 130nH   L7 100nH   L11 56nH
C23 16pF   C24 24pF   C25 24pF

PA_IN/5.1C

SDN1/2.2C   1   SDN
CS1/2.2C   15   NSEL
MOSI/2.2C   14   SDI
MISO/2.2C   13   SDO
SCK/2.2C   12   SCLK
16   XOUT
17   XIN
7   TXRAMP
VDD_1   6
VDD_2   8
GPIO0   9
GPIO1   10
GPIO2   19
GPIO3   20
NIRQ   11
TX   4
RXP   2
RXN   3
PAD GNDX NC   18

TRX_IC_DATA/2.2C
TRX_IC_CLOCK/2.2B

RX_IN/3.5C

X1
CX3225SB30000D0FPLCC
Gnd

U11
SI4463

3.3V

C34 2.2uF   C14 22nF   C17 91pF

SDN2/2.5A   1   SDN
CS2/2.2B   15   NSEL
MOSI/2.2C   14   SDI
MISO/2.2C   13   SDO
SCK/2.2C   12   SCLK
16   XOUT
17   XIN
7   TXRAMP
VDD_1   6
VDD_2   8
GPIO0   9
GPIO1   10
GPIO2   19
GPIO3   20
NIRQ   11
TX   4
RXP   2
RXN   3
PAD GNDX NC   18

RX_IC_DATA/2.4A
RX_IC_CLK/2.4A

RX_IN/3.5C

X2
CX3225SB30000D0FPLCC
Gnd

U12
SI4463

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RF Backend
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This power amplifier adds almost 20dB of gain for a total
conducted output power of +33dBm.

It is based on the reference designs in the datasheet, but
includes a narrowband input matching network to reduce BOM
and a very steep Chebyshev low pass filter to deal with a
pesky 2nd harmonic that falls in the restricted aviation band (324MHz).

The MOSFET drain is always powered, but the gate bias voltage
is turned on via R11, R12, C11 and L17. The RC delay is essential for suppressing
spurious emissions during ramp up and ramp down.

This MOSFET is at End Of Life. NXP recommends the AFT05MS004N
as a replacement, but it's not a drop-in; it will need different
matching networks, biasing and input power.

Last time buy for this MOSFET is end of 2021 and there is ample supply,
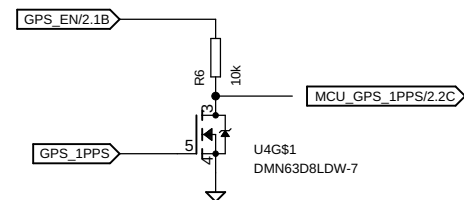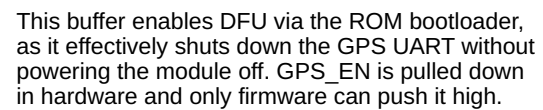so there is no rush to design it out.

V_PA_BIAS/2.5B

R11
2k4

PA_GATE_BIAS

V_PA

C7
470pF

C11
22nF

R12
10k

L4
2.2uH

L17
470nH

L9
18nH

L10
22nH

L23
39nH

C44
2.2nF

C29
2.2nF

L3
36nH

PA_IN/4.6B

C30
47pF

U7
AFT05MS003NT1

C37
47pF

C39
56pF

C36
39pF

C42
20pF

C52
36pF

C53
36pF

PA_OUT/7.3C

RF Power Amplifier

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3.3V

C3
2.2uF

C5
22nF

U10
1575AT43A0040E

RF

Z1
12pF

Z2

Z3

VCC

VBAT

RFIN

1PPS

TX

RX

GND

GPS_1PPS

GPS_UART_TX

U2
L76-M33

This buffer enables DFU via the ROM bootloader,
as it effectively shuts down the GPS UART without
powering the module off. GPS_EN is pulled down
in hardware and only firmware can push it high.

GPS_EN/2.1B

3.3V

GPS_EN/2.1B

R3
10k

R16
10k

R6
10k

GPS_UART_TX

MCU_GPS_UART_RX/2.2C

MCU_GPS_1PPS/2.2C

GPS_1PPS

U4G$2
DMN63D8LDW-7

U4G$1
DMN63D8LDW-7

GPS

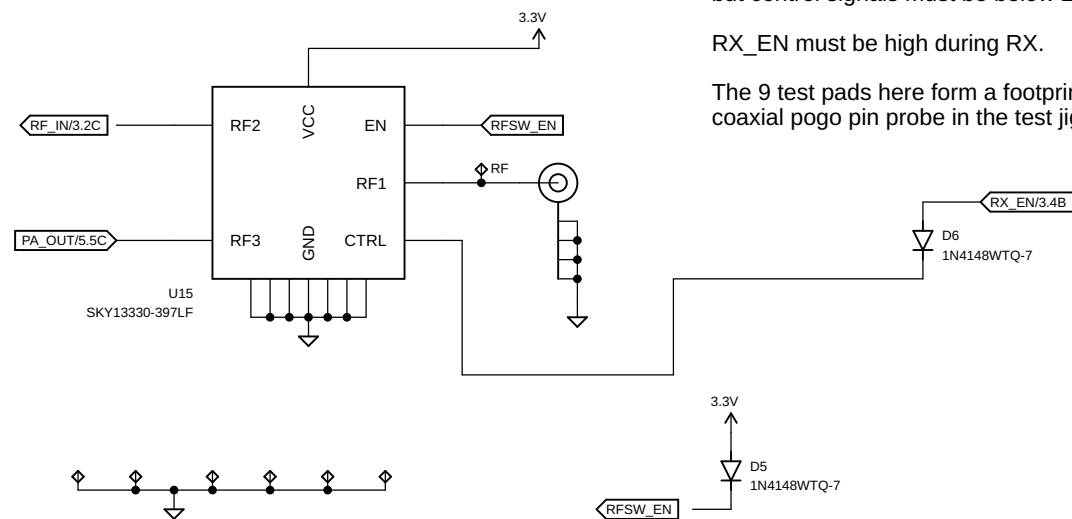MAIANA™ AIS Transponder
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transponder-10.5.0

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This switch does not need DC blocking caps, but control signals must be below 2.7V.

RX_EN must be high during RX.

The 9 test pads here form a footprint for a coaxial pogo pin probe in the test jig.

3.3V

RF_IN/3.2C

RF2
VCC
EN

RFSW_EN

RF1

RF

PA_OUT/5.5C

RF3
GND
CTRL

U15
SKY13330-397LF

RX_EN/3.4B

D6
1N4148WTQ-7

3.3V

D5
1N4148WTQ-7

RFSW_EN

Antenna Switch

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