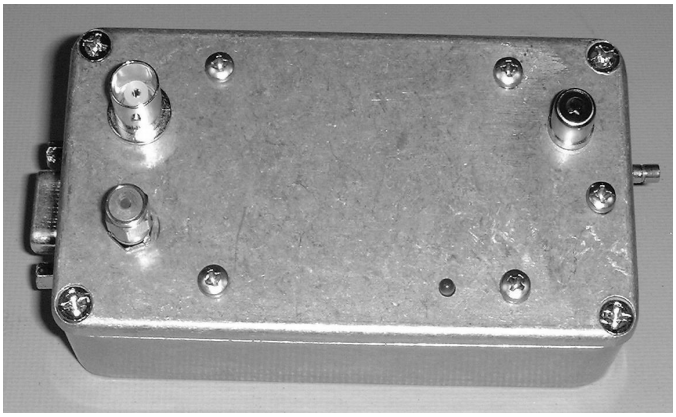
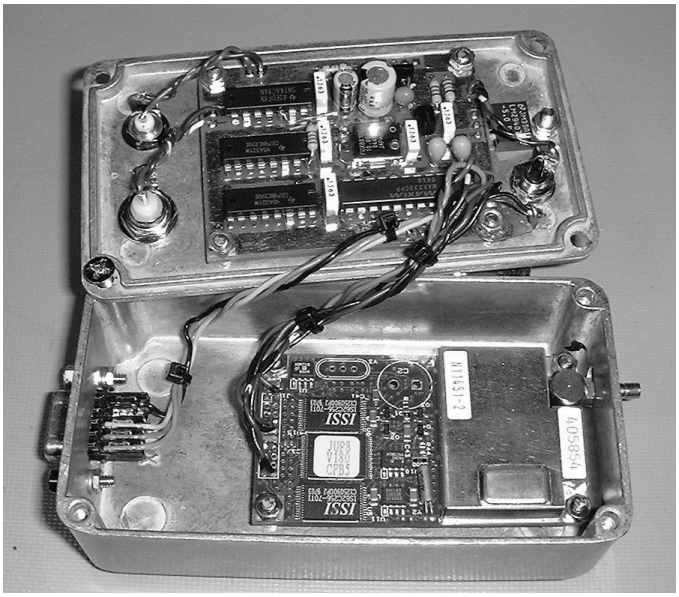
A *Simple* GPS Stabilized Oscillator

Based on the orginal design by James Miller, G3RUH
Mike Seguin, N1JEZ

There are many ways to assemble this project. Presented here, is just one idea. Below are 2 pictures of the way I packaged my system. Please feel free to package the Interface Board and GPS engine any way that might better suit your needs.





There are 4 ways that the Interface board can be configured:

1.) 5 volt GPS - 5 volt DIL-14 VCXO
2.) 5 volt GPS - 3 volt SMD VCXO
3.) 3.3 volt GPS - 5 volt DIL-14 VCXO
4.) 3.3 volt GPS - 3 volt SMD VCXO

The following pages will detail the parts required and their placement on the Interface Board. Not all parts are used for each version. The last page of this document has the pinouts for the Jupiter 11 GPS engine. The basic configuration is for NMEA 4800 baud 8,N,1 serial output.

If you use a 3.3 volt GPS engine, you will need to supply 5 volts to pin 1 if you intend to use a powered antenna. There is an extra hole on the Interface Board between U5 and U7 specifically for this purpose. Simply run a wire from there to pin 1 on the GPS engine.

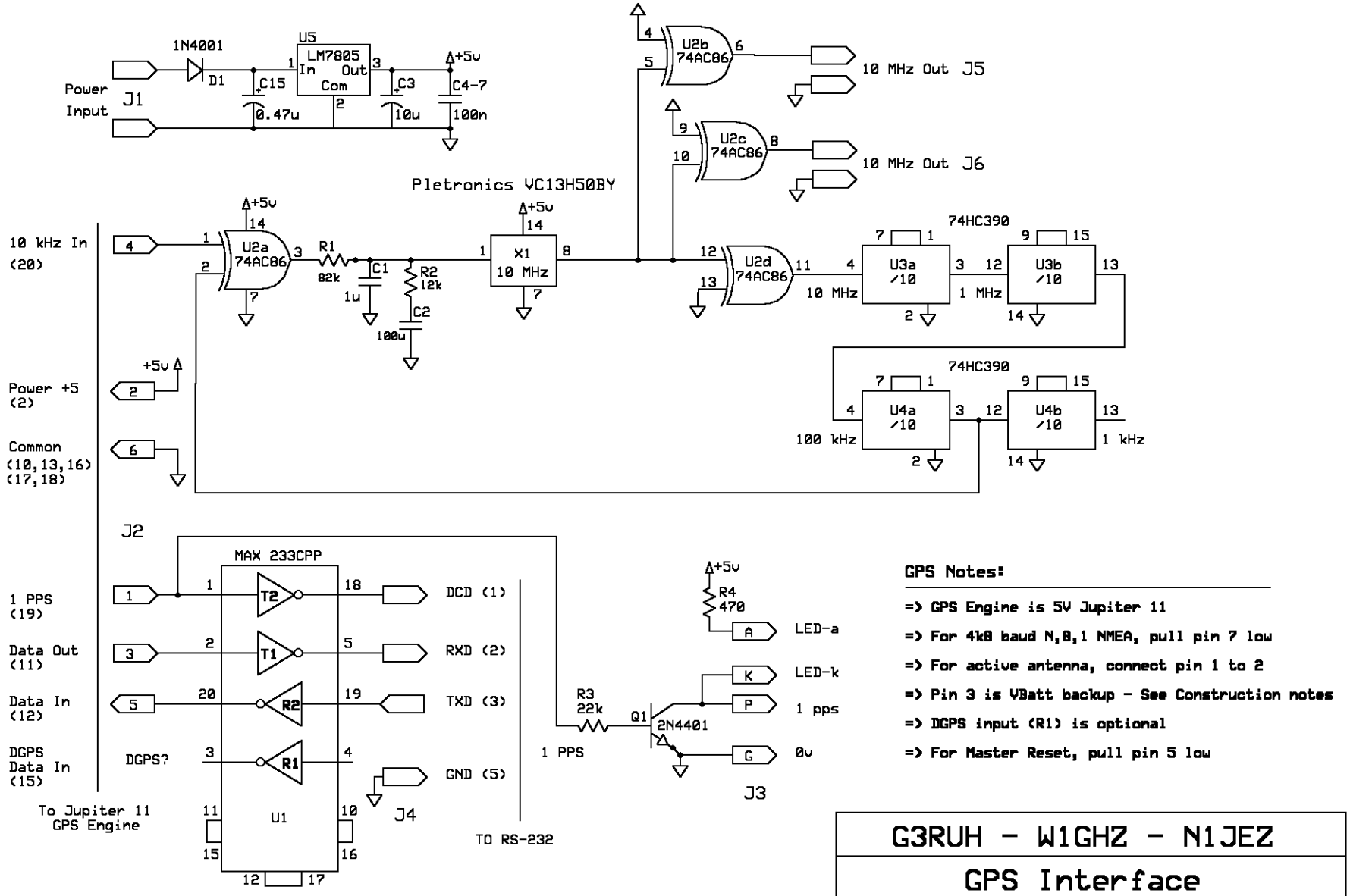
The loop filter parts that are listed are for a FOX801BE and Pletronic VC13H50BY. These are average values and could possibly be fine tuned. A Basic program to calculate loop filter components is included on this CD. It is in the folder “GW Basic_PLL”.

In some cases, the output will require attenuation and a band pass filter to drive a synthesizer or counter.

5V GPS 5V VCXO

Devices	
U1	MAX233CPP
U2	74AC86
U3-4	74HC390
U5	LM7805

Power	+5v	0v
U1	7	6,9
U2	14	7
U3-4	16	8



GPS Notes:

=> GPS Engine is 5V Jupiter 11

=> For 4k8 baud N,8,1 NMEA, pull pin 7 low

=> For active antenna, connect pin 1 to 2

=> Pin 3 is VBatt backup - See Construction notes

=> DGPS input (R1) is optional

=> For Master Reset, pull pin 5 low

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GPS Interface		
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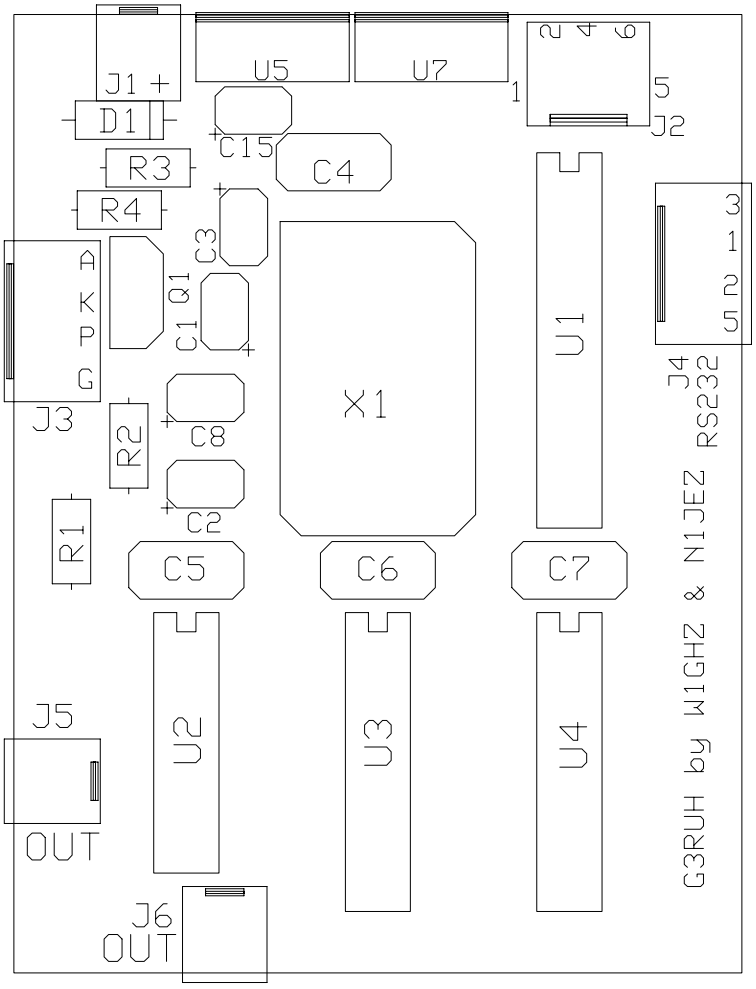
5 Volt GPS - 5 Volt DIL-14 VCXO

C1	**1 uf 35v**	**Tantalum**
C2	**100 uf 6.3v**	**Tantalum-Loop Filter**
C3	**10 uf 25v**	**Tantalum**
C4	**100 nf**	**Polyester**
C5	**100 nf**	**Polyester**
C6	**100 nf**	**Polyester**
C7	**100 nf**	**Polyester**
C8	**Select**	**Tantalum-Loop Filter**
C15	**0.47 uf 35v**	**Tantalum**
D1	**1N4001**	**Protection Diode**
Q1	**2N4401**	**General Purpose NPN**
R1	**82k**	**1/8 watt Loop Filter**
R2	**12k**	**1/8 watt Loop Filter**
R3	**22K**	**1/8 watt**
R4	**470**	**1/8 watt**
U1	**MAX233CP**	**RS-232**
U2	**74AC86**	**Gate**
U3	**74HC390**	**Divider**
U4	**74HC390**	**Divider**
U5	**LM7805**	**TO-220**
X1	**10 MHz VCXO**	**Pletronic**
LED	**Red**	**1 PPS**
Box	**Enclosure**	**Hammond 1590B**
DB-9	**DB-9 F**	**RS-232**
BNC	**2 - 10 MHz Outs**	**10 MHz Outputs**
RCA	**Power Input**	**Your Choice**



Notes:

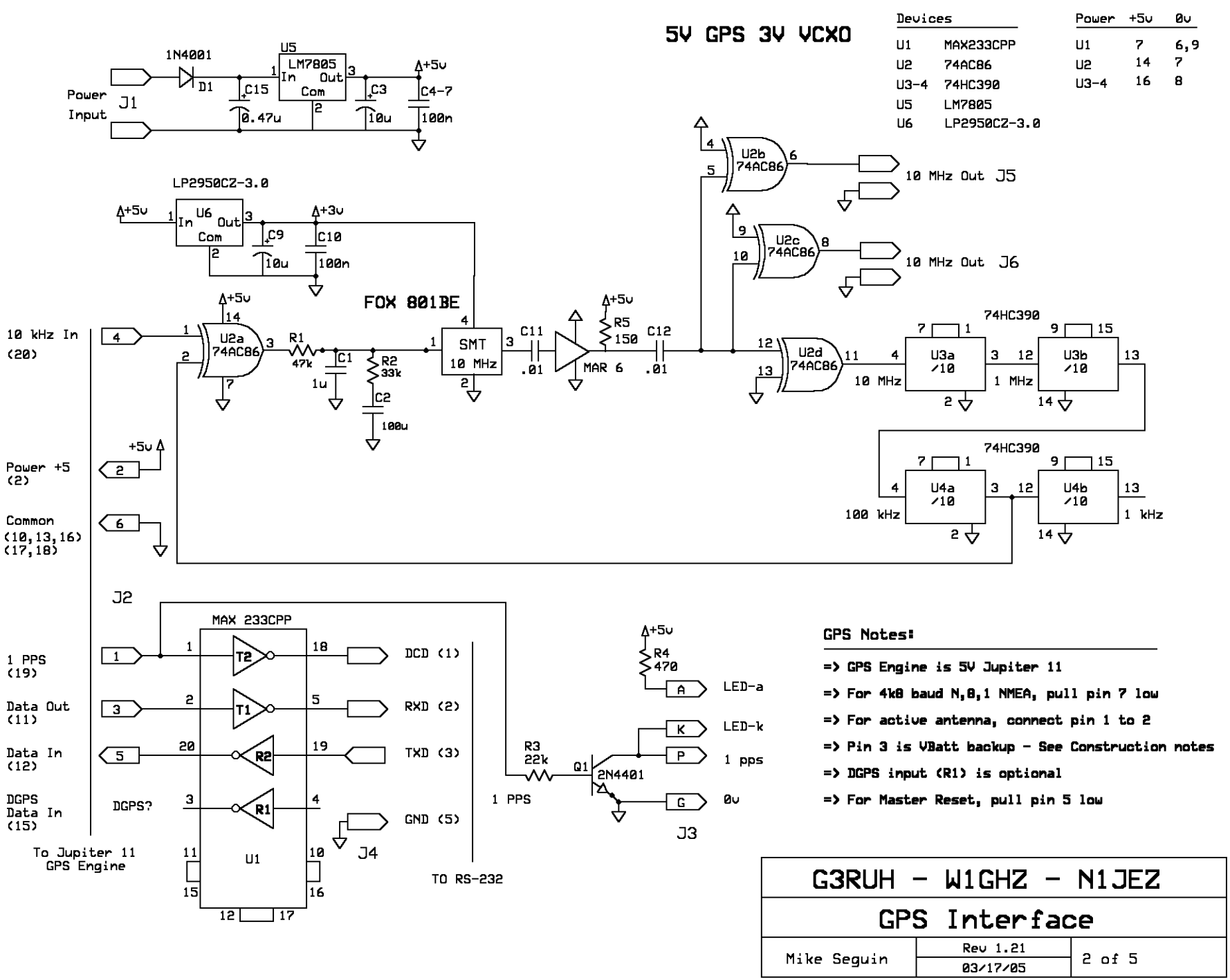
U7 is not installed and shown for reference only.

For 5 volt GPS engine, jump pins 1 to 3 on U7.

Buffer amp for X1 is **not** used. See page 10 for details.

J4 is actual DB-9 pin numbers.

C8 is optional. Used for different loop filters.


5V GPS 3V VCXO
Devices
U1 MAX233CPP
U2 74AC86
U3-4 74HC390
U5 LM7805
U6 LP2950CZ-3.0
Power +5v 0v
U1 7 6,9
U2 14 7
U3-4 16 8
1N4001
D1
U5
LM7805
In Out Com
C15 0.47u
C3 10u
C4-7 100n
+5v
Power Input J1
LP2950CZ-3.0
U6
C9 10u
C10 100n
+3v
FOX 801BE
10 kHz In (20)
U2a 74AC86
R1 47k
C1 1u
R2 33k
C2 100u
SMT 10 MHz
C11 .01
MAR 6
R5 150
C12 .01
U2b 74AC86
10 MHz Out J5
U2c 74AC86
10 MHz Out J6
U2d 74AC86
74HC390
U3a /10
U3b /10
10 MHz
1 MHz
U4a /10
U4b /10
100 kHz
1 kHz
Power +5 (2)
Common (10,13,16) (17,18)
J2
MAX 233CPP
1 PPS (19)
Data Out (11)
Data In (12)
DGPS Data In (15)
DGPS?
T2
T1
R2
R1
DCD (1)
RXD (2)
TXD (3)
GND (5)
J4
To Jupiter 11 GPS Engine
U1
TO RS-232
R3 22k
Q1 2N4401
R4 470
LED-a
LED-k
1 pps
0v
J3
GPS Notes:
=> GPS Engine is 5V Jupiter 11
=> For 4k8 baud N,8,1 NMEA, pull pin 7 low
=> For active antenna, connect pin 1 to 2
=> Pin 3 is VBatt backup - See Construction notes
=> DGPS input (R1) is optional
=> For Master Reset, pull pin 5 low
G3RUH - W1GHZ - N1JEZ
GPS Interface
Mike Seguin
Rev 1.21
03/17/05
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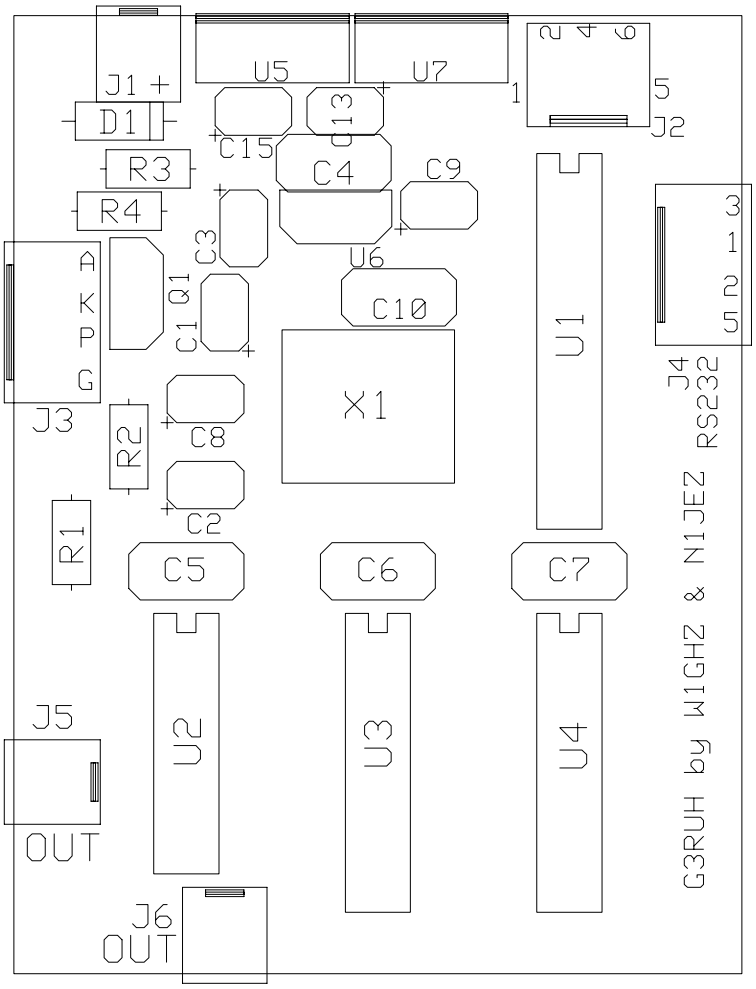
5 Volt GPS - 3 Volt SMD VCXO

C1	**1 uf 35v**	**Tantalum**
C2	**100 uf 6.3v**	**Tantalum-Loop Filter**
C3	**10 uf 25v**	**Tantalum**
C4	**100 nf**	**Polyester**
C5	**100 nf**	**Polyester**
C6	**100 nf**	**Polyester**
C7	**100 nf**	**Polyester**
C8	**Select**	**Tantalum-Loop Filter**
C9	**10 uf 25v**	**Tantalum**
C10	**100 nf**	**Polyester**
C11	**0.01**	**0805 Chip (underside)**
C12	**0.01**	**0805 Chip (underside)**
C15	**0.47 uf 35v**	**Tantalum**
D1	**1N4001**	**protection diode**
Q1	**2N4401**	**General Purpose NPN**
R1	**47k**	**1/8 watt Loop Filter**
R2	**33k**	**1/8 watt Loop Filter**
R3	**22K**	**1/8 watt**
R4	**470**	**1/8 watt**
R5	**150**	**1206 Chip (underside)**
U1	**MAX233CP**	**RS-232**
U2	**74AC86**	**Gate**
U3	**74HC390**	**Divider**
U4	**74HC390**	**Divider**
U5	**LM7805**	**TO-220**
U6	**3V LDO Reg**	**TO-92**
X1	**10 MHz VCXO**	**FOX**
LED	**Red**	**1 pps**
MAR 6	**MMIC**	**Buffer (underside)**
Box	**Enclosure**	**Hammond 1590B**
DB-9	**DB-9 F**	**RS-232**
BNC	**2 - 10 MHz Outs**	**10 MHz Outputs**
RCA	**Power Input**	**Your choice**



Notes:

U7 is not installed and shown for reference only.

For 5 volt GPS engine, jump pins 1 to 3 on U7.

Buffer amp for X1 **is** used. See page 10 for details.

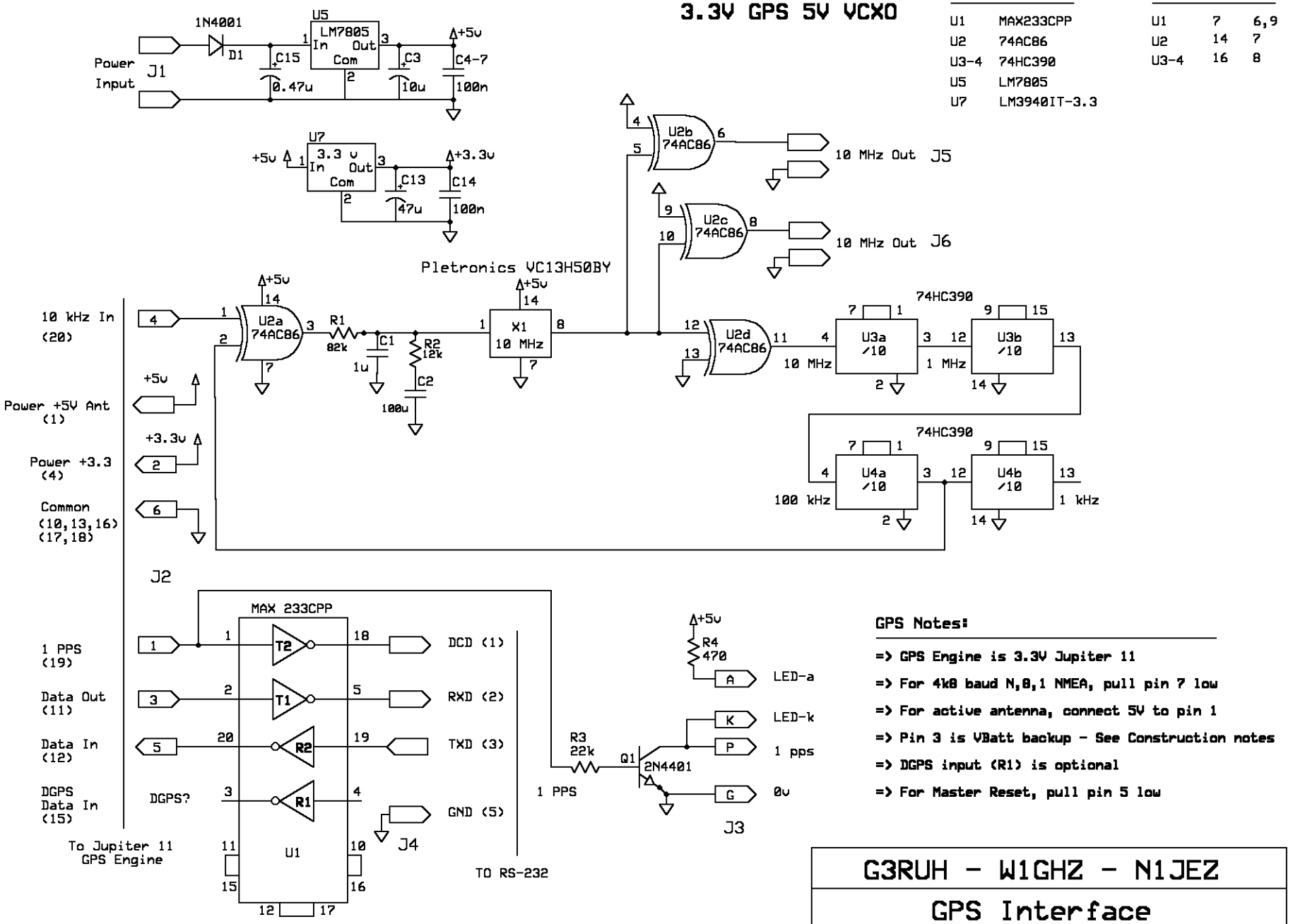
J4 is actual DB-9 pin numbers.

C8 is optional. Used for different loop filters.

3.3V GPS 5V VCXO

Devices	
U1	MAX233CPP
U2	74AC86
U3-4	74HC390
U5	LM7805
U7	LM3940IT-3.3

Power	+5v	0v
U1	7	6,9
U2	14	7
U3-4	16	8



GPS Notes:

- => GPS Engine is 3.3V Jupiter 11
- => For 4k8 baud N,8,1 NMEA, pull pin 7 low
- => For active antenna, connect 5V to pin 1
- => Pin 3 is VBatt backup - See Construction notes
- => DGPS input (R1) is optional
- => For Master Reset, pull pin 5 low

G3RUH - W1GHZ - N1JEZ		
GPS Interface		
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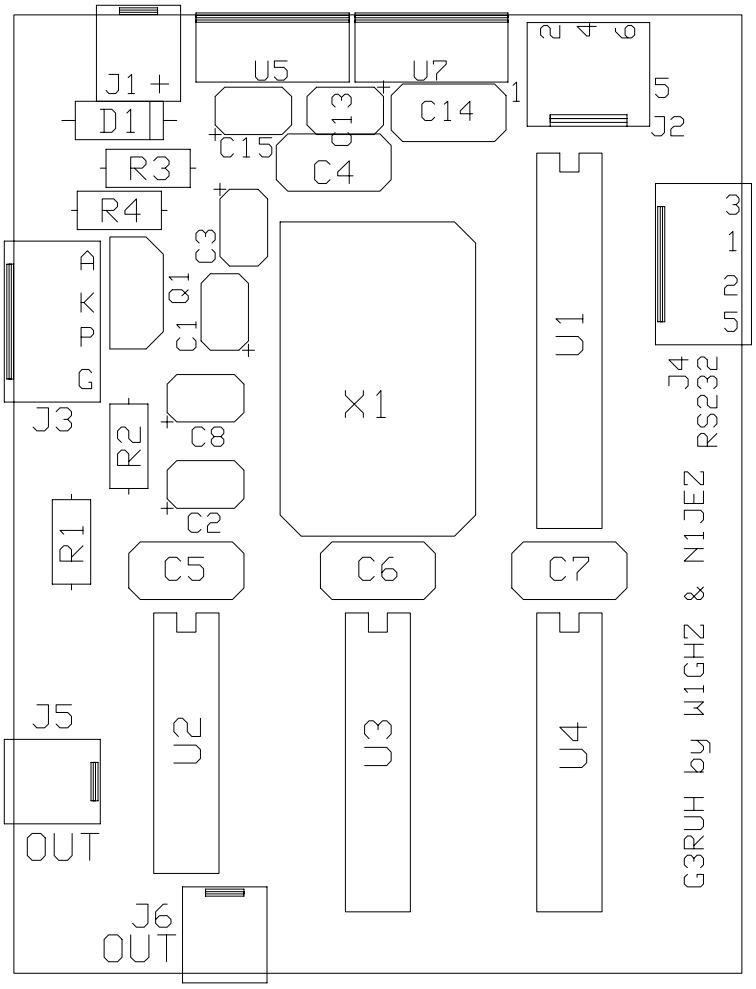
3.3 Volt GPS - 5 Volt DIL-14 VCXO

C1	**1 uf 35v**	**Tantalum**
C2	**100 uf 6.3v**	**Tantalum-Loop Filter**
C3	**10 uf 25v**	**Tantalum**
C4	**100 nf**	**Polyester**
C5	**100 nf**	**Polyester**
C6	**100 nf**	**Polyester**
C7	**100 nf**	**Polyester**
C8	**Select**	**Tantalum-Loop Filter**
C13	**47 uf 6.3v**	**Tantalum**
C14	**100 nf**	**Polyester**
C15	**0.47 uf 35v**	**Tantalum**
D1	**1N4001**	**protection diode**
Q1	**2N4401**	**General Purpose NPN**
R1	**82k**	**1/8 watt Loop Filter**
R2	**12k**	**1/8 watt Loop Filter**
R3	**22K**	**1/8 watt**
R4	**470**	**1/8 watt**
U1	**MAX233CP**	**RS-232**
U2	**74AC86**	**Gate**
U3	**74HC390**	**Divider**
U4	**74HC390**	**Divider**
U5	**LM7805**	**TO-220**
U7	**3.3V LDO Reg**	**TO-220**
X1	**10 MHz VCXO**	**Pletronics**
LED	**Red**	**1 pps**
Box	**Enclosure**	**Hammond 1590B**
DB-9	**DB-9 F**	**RS-232**
BNC	**2 - 10 MHz Outs**	**10 MHz Outputs**
RCA	**Power Input**	**Your choice**

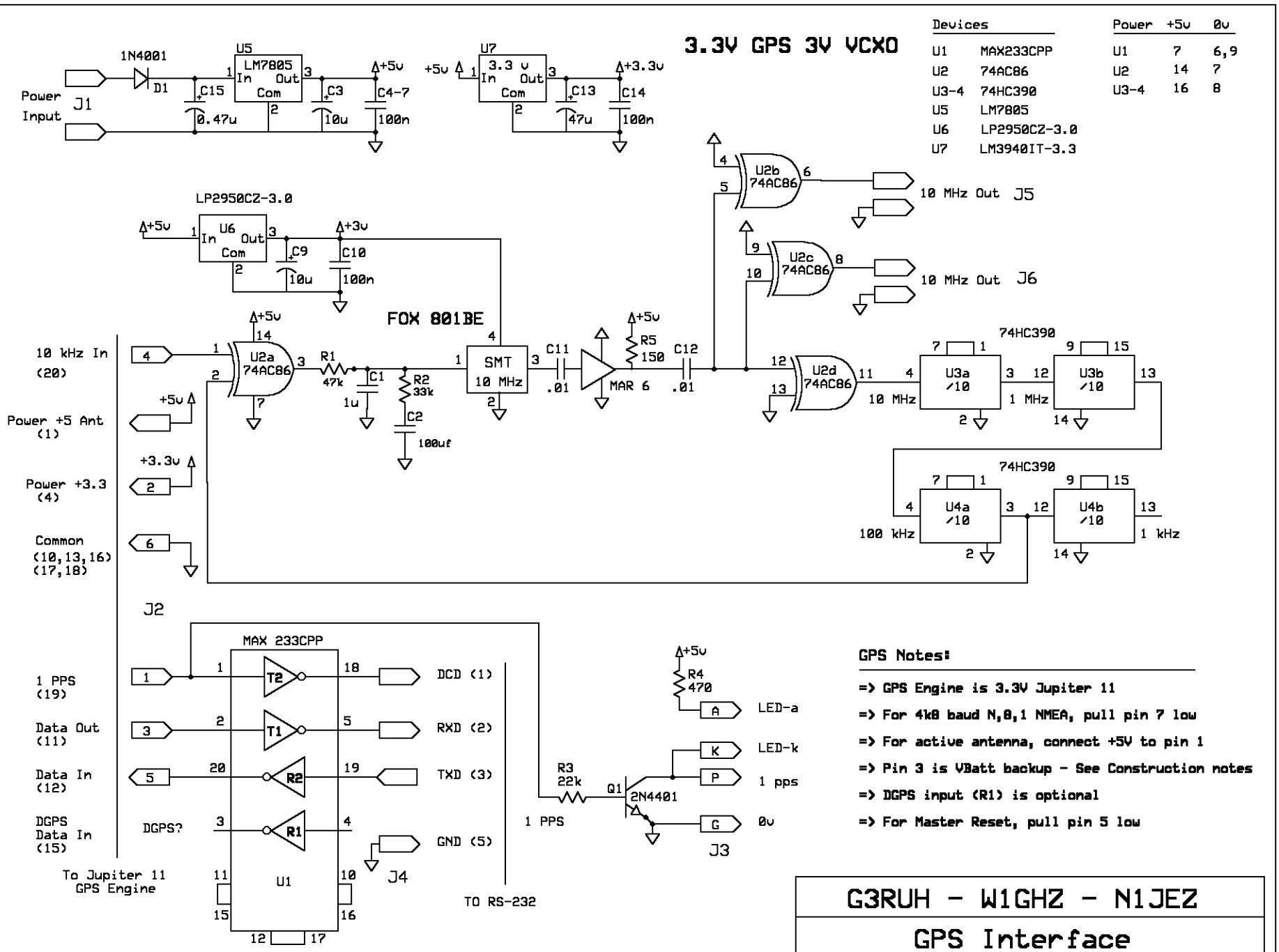


Notes:

Buffer amp for X1 is **not** used. See page 10 for details.

J4 is actual DB-9 pin numbers.

C8 is optional. Used for different loop filters.


3.3V GPS 3V VCXO
Devices
U1 MAX233CPP
U2 74AC86
U3-4 74HC390
U5 LM7805
U6 LP2950CZ-3.0
U7 LM3940IT-3.3
Power +5v 0v
U1 7 6,9
U2 14 7
U3-4 16 8
1N4001
D1
Power Input
J1
U5
LM7805
C15
0.47u
C3
10u
C4-7
100n
+5v
+3.3v
U7
3.3 v
C13
47u
C14
LP2950CZ-3.0
U6
C9
10u
C10
100n
FOX 801BE
SMT
10 MHz
R1
47k
C1
1u
R2
33k
C2
100uf
C11
.01
R5
150
C12
.01
MAR 6
U2a
74AC86
U2b
74AC86
U2c
74AC86
U2d
74AC86
10 MHz Out J5
10 MHz Out J6
74HC390
U3a
/10
U3b
/10
1 MHz
U4a
/10
U4b
/10
100 kHz
1 kHz
10 kHz In (20)
Power +5 Ant (1)
Power +3.3 (4)
Common (10,13,16) (17,18)
J2
MAX 233CPP
T2
T1
R2
R1
U1
1 PPS (19)
Data Out (11)
Data In (12)
DGPS Data In (15)
DGPS?
To Jupiter 11 GPS Engine
DCD (1)
RXD (2)
TXD (3)
GND (5)
J4
TO RS-232
R4
470
LED-a
LED-k
1 pps
0v
R3
22k
Q1
2N4401
1 PPS
J3
GPS Notes:
=> GPS Engine is 3.3V Jupiter 11
=> For 4k8 baud N,8,1 NMEA, pull pin 7 low
=> For active antenna, connect +5V to pin 1
=> Pin 3 is VBatt backup - See Construction notes
=> DGPS input (R1) is optional
=> For Master Reset, pull pin 5 low
G3RUH - W1GHZ - N1JEZ
GPS Interface
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3.3 Volt GPS - 3 Volt SMD VCXO

C1	**1 uf 35v**	**Tantalum**
C2	**100 uf 6.3v**	**Tantalum-Loop Filter**
C3	**10 uf 25v**	**Tantalum**
C4	**100 nf**	**Polyester**
C5	**100 nf**	**Polyester**
C6	**100 nf**	**Polyester**
C7	**100 nf**	**Polyester**
C8	**Select**	**Tantalum-Loop Filter**
C9	**10 uf 25v**	**Tantalum**
C10	**100 nf**	**Polyester**
C11	**0.01**	**0805 Chip (underside)**
C12	**0.01**	**0805 Chip (underside)**
C13	**47 uf 6.3v**	**Tantalum**
C14	**100 nf**	**Polyester**
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D1	**1N4001**	**protection diode**
Q1	**2N4401**	**General Purpose NPN**
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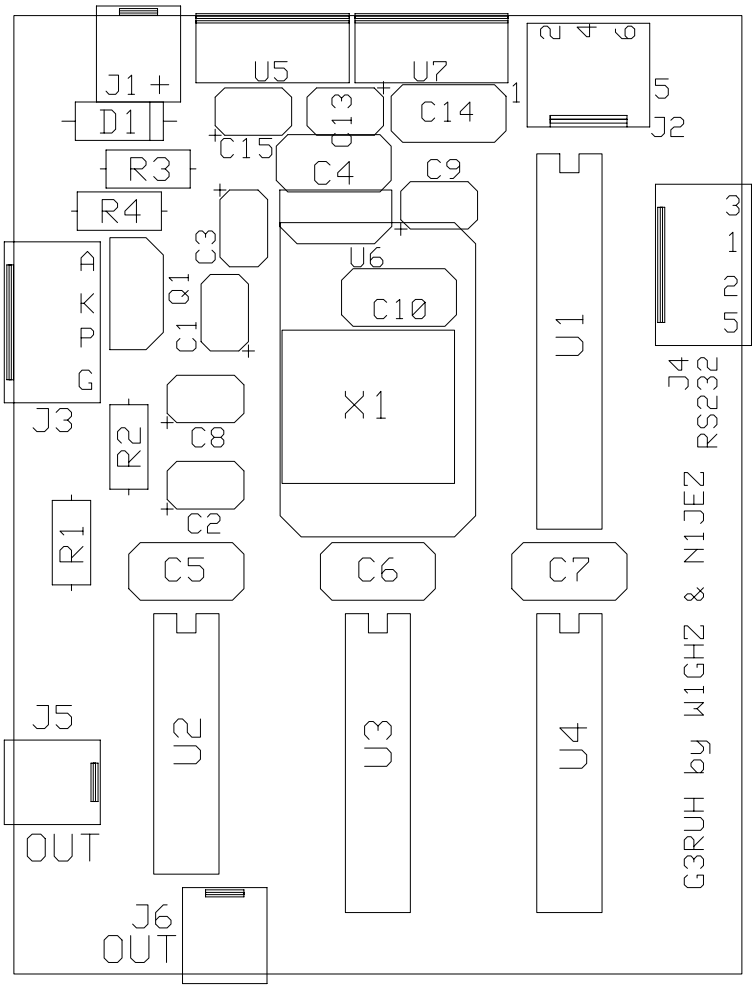
R5	**150**	**1206 Chip (underside)**
U1	**MAX233CP**	**RS-232**
U2	**74AC86**	**Gate**
U3	**74HC390**	**Divider**
U4	**74HC390**	**Divider**
U5	**LM7805**	**TO-220**
U6	**3V LDO Reg**	**TO-92**
U7	**3.3V LDO Reg**	**TO-220**
X1	**10 MHz VCXO**	**FOX**
LED	**Red**	**1 pps**
MAR 6	**MMIC**	**Buffer (underside)**
Box	**Enclosure**	**Hammond 1590B**
DB-9	**DB-9 F**	**RS-232**
BNC	**2 - 10 MHz Outs**	**10 MHz Outputs**
RCA	**Power Input**	**Your choice**



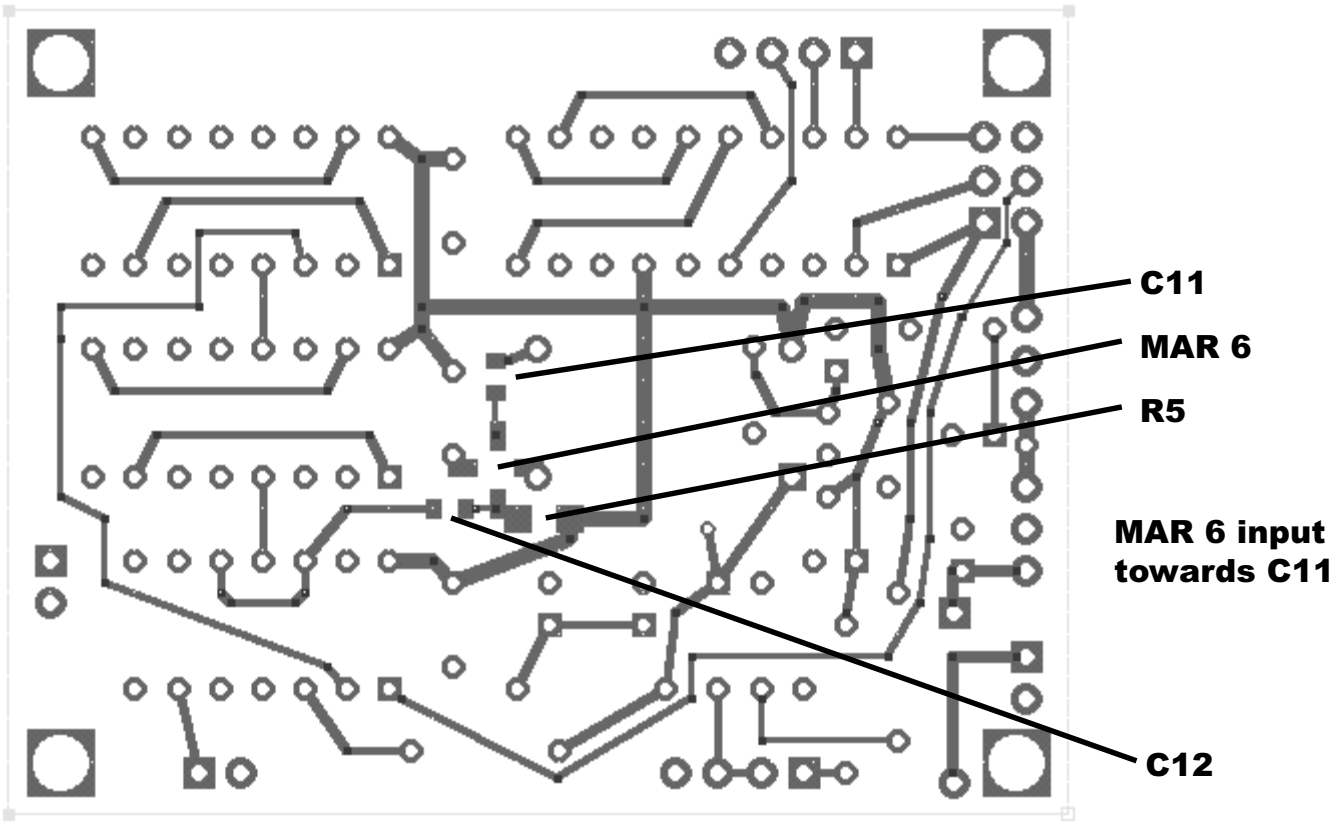
Notes:

Buffer amp for X1 **is** used. See page 10 for details.

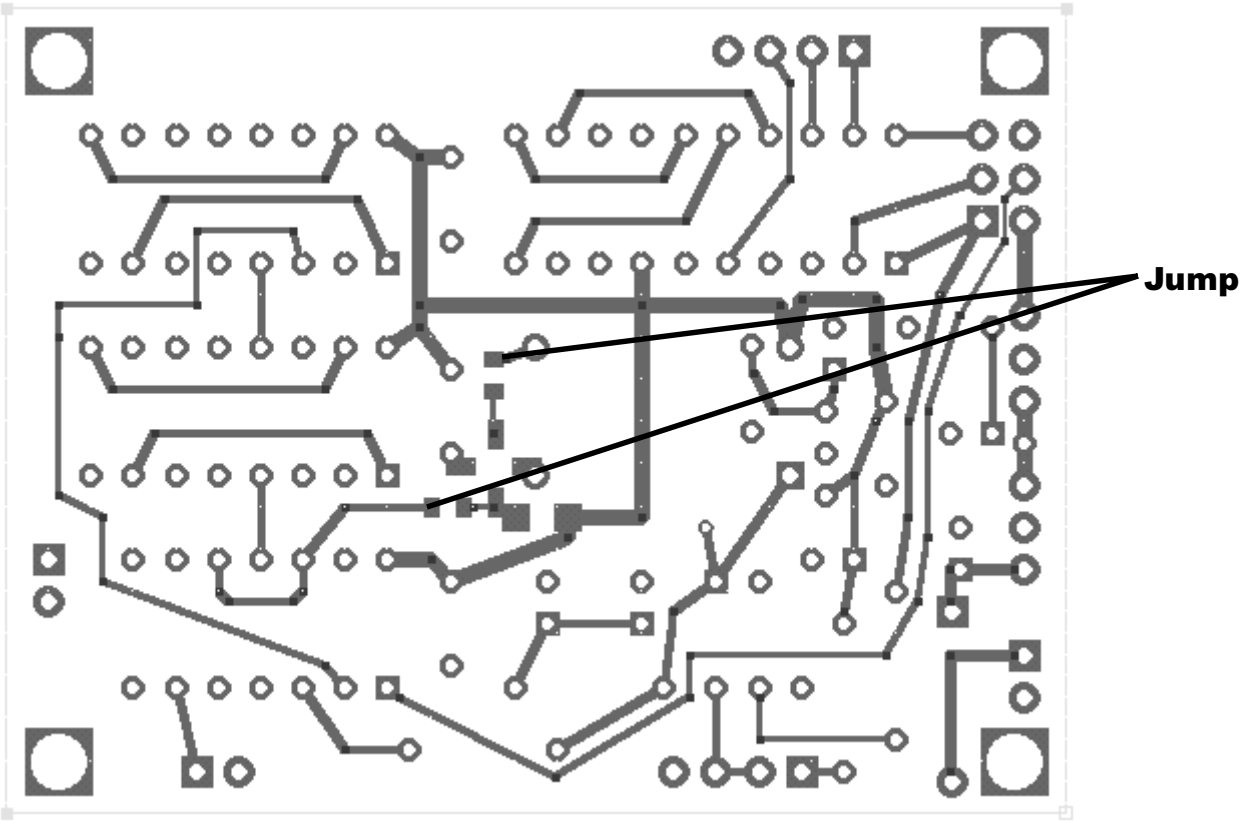
J4 is actual DB-9 pin numbers.

C8 is optional. Used for different loop filters.

MAR 6 Buffer



MAR 6 Not Used



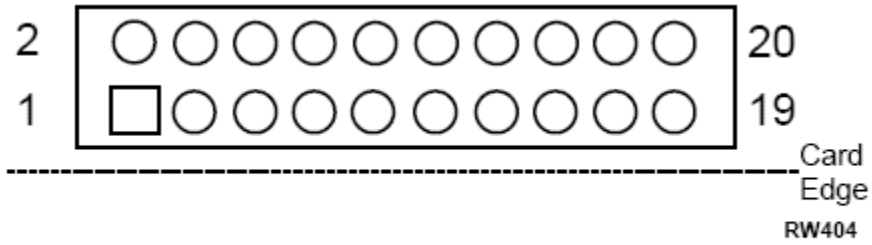


Figure 6. 2x10 Pin Field Connector (J1) Pin 1 Reference Location (Top View)

Table 4. "Jupiter" Receiver Standard 2x10 Pin Field OEM Interface Connector Pinout

PIN	NAME	DESCRIPTION	PIN	NAME	DESCRIPTION
1	PREAMP	Preamp power input	11	SDO1	Serial data output port #1
2	PWRIN_5	Primary +5 VDC power input	12	SDI1	Serial data input port #1
3	VBATT	Battery backup voltage input	13	GND	Ground
4	N/C	Reserved (no connect)	14	N/C	Reserved (no connect)
5	M_RST	Master reset input (active low)	15	SDI2	Serial data input port #2
6	N/C	Reserved (no connect)	16	GND	Ground
7	GPIO2	NMEA protocol select	17	GND	Ground
8	GPIO3	ROM default select	18	GND	Ground
9	GPIO4	Reserved (no connect)	19	TMARK	1PPS time mark output
10	GND	Ground	20	10KHZ	10 KHz clock output

NOTES:

Pin 1 5 volts Antenna LNA power.
Pin 2 To J2 Pin 2 on Interface Board. Pin 2 on Jupiter may be missing. See Pin 4.
Pin 3 Backup Battery.
Pin 4 If 3.3 volt GPS Engine, to Pin 2 J2 on Interface Board.
Pin 5 Master Reset - Pull high through 47k. For Reset, pull low momentarily.
Pin 7 NMEA select - Pull low.
Pin 10 To J2 Pin 6 on Interface Board.
Pin 11 To J2 Pin 3 on Interface Board.
Pin 12 To J2 Pin 5 on Interface Board.
Pin 13 To J2 Pin 6 on Interface Board.
Pin 19 To J2 Pin 1 on Interface Board.
Pin 20 To J2 Pin 4 on Interface Board.