GPS2058 Module Evaluation Kit

User Manual
April, 2008
Rev 1.3

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Introduction

The GPS2058EVK evaluation kit provides a complete hardware and software platform to test and evaluate the DeLorme GPS2058 GPS receiver module for integration into custom applications. This kit contains all the components of a complete GPS receiver system and may also be used as a reference design. All of the necessary components to evaluate the GPS2058 module, including development board, antenna, and cables are included. A copy of DeLorme Street Atlas® USA 2008 is also provided to demonstrate how seamlessly the evaluation kit can interface with software mapping products for use as a GPS navigation system.

This user guide describes the hardware items supplied with the evaluation kit and provides guidelines on the set-up and operation of the kit. We recommend that you familiarize yourself with the features before applying power and operating the unit.

Technical information and performance characteristics relating to the GPS2058 module can be found in the GPS2058 technical specification on our website: http://www.delorme.com/gpsmodules

This guide is intended to provide you with detailed information on how to use this kit with the DeLorme GPS2058 module, however, this kit has also been designed to support future generations of DeLorme modules. Throughout this document the convention used to identify features that are not used with the GPS2058 module will be identified as "future" features to simplify the documentation. When new modules are released, additional documentation will be made available to describe these features.

Kit Contents

Your GPS2058EVK kit contains the following:

1. GPS2058 evaluation board with module, in plastic case
2. Active antenna
3. USB cable
4. 120/220V wall adapter
5. 12V auto adapter
6. Street Atlas USA® 2008 DVD

Getting Started – Quick Guide

1) Verify all kit contents are present.
2) Install Evaluation kit demonstration software (downloaded with this document)
3) Plug the antenna into the antenna connector. Ensure you have a sky view with the antenna for proper signal reception.
4) Connect the USB cable between the evaluation kit and the PC.
5) Turn on the evaluation kit power. The right LED shows green.
6) The left LED should be flashing red once per second while acquiring a signal.
7) An initial fix should be achieved in approximately 1 minute or less. It may take longer if the antenna view of the sky is blocked. If no fix is achieved, refer to the troubleshooting section. A fix is achieved when the Status LED alternates between green and yellow once per second.

Description of Contents

- GPS2058EVK evaluation board with module
  The development board with GPS module is housed in a plastic case. You can open the lid to access the module and internal connectors, batteries, and switches. The following resources are available on the unit:
    - Dual RS232 level serial data I/O ports
    - USB port
    - Backup battery power source for standby mode demonstration
    - Regulated DC power supply to the GPS2058
    - GPS and Power Status indicator LEDs on the front panel
    - User connectors

- GPS antenna
  The antenna is an active type with powered pre-amp, magnetic base, and RF cable (RG-316) already terminated with the required SMA connector for the unit. The supplied active antenna is biased at +3.0 VDC, though the GPS2058 is designed to work with a broad range of active antenna supply voltages – up to 5.0V.

- USB cable
  A USB cable is provided to interface between the development unit and your PC. This cable is terminated at both ends with connectors to match the PC USB I/O and the type B connector on the evaluation kit.

- 120/240V power adapter
  DC power for the development unit can be provided by the AC converter. The AC converter operates from a nominal 120/240 VAC input and provides a 6 VDC at 500mA output.

- 12V DC power adapter
  A car power adapter (12 V) suitable for use with a cigarette lighter socket is provided for road testing.

Minimum System Requirements

To Install the Street Atlas® USA software or the evaluation kit demo software the following system requirements must be met:

Operating System:
- Microsoft® Windows® Vista™ Home Basic/Home Premium/Ultimate/Business with 512 MB RAM
- Microsoft Windows XP (Service Pack 1 and later) with 128 MB RAM (256 MB recommended)
- Microsoft Windows 2000 (Service Pack 3 and higher) with 64 MB RAM (256 MB recommended)

Laptop or PC Hardware:
- Intel® Pentium 300 MHz or higher processor (600 MHZ recommended)
- 700MB of available hard-disk space required (only if Street Atlas USA® is installed)
- DVD-ROM Drive
- Minimum of one serial port (if your PC only has USB, a USB serial adapter can be used)

For additional details about the Street Atlas USA® software, refer to the program help.

Layout and Component Location
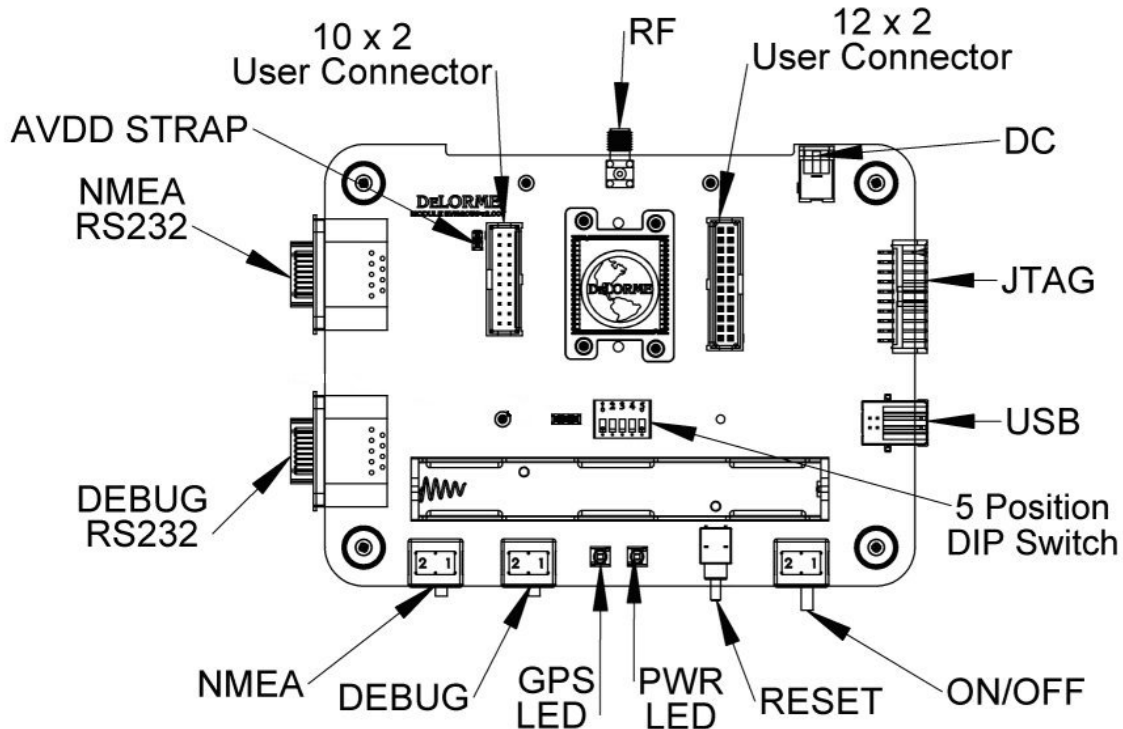
Features/Functional Descriptions

The evaluation kit is self-contained and portable with a minimum number of external connections. You can operate the kit using a USB cable to the host computer and an active RF antenna (supplied) in a minimum configuration. Other kit features:

- DC Options: The kit may be powered from the 12V Car adapter, 120/240V DC adapter, USB power, or two AA Batteries. **Note that only one power source is necessary for the kit to function**.

- Power Switch
    - When on without batteries, the entire unit is powered from DC or USB.
    - When off without batteries, the entire unit is off.
    - When on with batteries only, the entire unit is powered from the batteries.
    - When off with batteries only, the module is placed in standby mode.

- USB: Low-speed USB 2.0, standard Type B connector. The primary interface to a PC and kit may be powered from the USB port.

- RS232: Two ports; one for standard NMEA GPS messaging and one for debug messages. Baud rates are selectable using the inside DIP switch. RS232 ports may be switched between DCE & DTE connections through the front panel switches.

- JTAG Interface: For factory updates

- Standard RF connector, SMA type: Although one is supplied, it fits many available active RF antennas. Limited to 150mA.

- Power Indicator (right-side Bi-color LED)
  - DC On, Battery Good = Green
  - DC On, Battery Weak = Yellow-Orange
  - DC Off or not present, Battery Weak = Red
  - Other conditions = No indication

- Reset Switch: Available from the front panel. Signals a reset directly to the module; observable on the User Connectors (Refer to schematic).

- Battery Holder: 2 AA in coin-type holder (end-to-end), accessible under the lid.

- User Connector: Accessible under the lid for probing and or custom development. One connector is 20 pins and one is 24 pins; both are shrouded headers The headers expose 24 user I/O pins (with some restrictions), 7 DC voltages, multiple ground connections, and five special functions. Refer to the schematic for detailed description of each pin function.

- 3-Pin Header: Used to select module type (affects positions 2 and 3 of the DIP Switch).

- DIP Switch functions (0 = Open, 1 = Closed, X = Don't Care) [default configuration = all open]
  - Switch 1,2,3,4,5 = For future features.

- GPS Signal Indicator (left Bi-color LED), signaled from the module
  - PPS available (acquiring) = Flashing Red
  - Track Lock = Green
  - Track and PPS = Yellow-Orange
  - A normal sequence will be flashing red during acquisition followed by green alternating with yellow-orange every second once a fix is achieved.

Procedure for establishing RS-232 serial connections

NMEA Port
1) Disconnect the USB connection (the NMEA and USB share UART0 and may conflict with each other).
2) Connect External AC Adapter as power source.
3) Connect the antenna.
4) Power on the kit.
5) Connect the RS-232 serial cable to the NMEA port (at the back of the EVK).
6) Ensure the NMEA DTC/DTE switch on the left is in the correct position for the cable. Left position for straight-thru cable, right position for a switch-cable.
7) Ensure all 5 dip switches on SW5 are OFF.
8) Ensure no jumpers are in place on J11 or J12.
9) Open 'HyperTerminal' on your PC or Laptop.
    a. Enter a new connection name, e.g.; "GPS2058_NMEA".
    b. In the "Connect To" dialog box, open the drop-down for "connect using:" and select the appropriate COM port for your connection.
    c. Set the port settings to 4800-8-N-1, no flow control, click OK
10) You should now see streaming NMEA messages!
11) You may also open the DeLorme GPS Module Eval Kit Software:
    a. Click on "Initialize GPS" button, (3rd down on the right, looks like earth with 4 satellites around it)
    b. Choose "generic NMEA" device
    c. Select the appropriate COM port
    d. Settings 4800,8,N,1
    e. Click Finish
12) You should now also see streaming NMEA Messages in the "Receiving Data" window, and be able to view other tabs such as the satellite status.

DeBug Port
1) The USB connection may be left intact (the Debug port uses UART1 and will not conflict with USB)
2) Connect External AC Adapter as power source, or use USB power.
3) Connect the antenna
4) Power on the kit
5) Connect the RS-232 serial cable to the Debug port (towards the front of the EVK)
6) Ensure the Debug DTC/DTE switch on the right is in the correct position for the cable. Left position for straight-thru cable, right position for a switch-cable.
7) Ensure all 5 dip switches on SW5 are OFF
8) Ensure no jumpers are in place on J11 or J12
9) Open 'HyperTerminal' on your PC or Laptop
    a. Enter a new connection name, e.g.; "GPS2058_Debug"
    b. In the "Connect To" dialog box, open the drop-down for "connect using:" and select the appropriate COM port for your connection.
    c. Set the port settings to 38400-8-N-1, no flow control, click OK
10) You should now see streaming debug messages!

Serial Connections - Sending NMEA commands with Hyperterminal
The best way to send NMEA commands with HyperTerminal is to create a text file with the NMEA commands on separate lines (be sure to hit <return> at the end of each line, which is equivalent to <cr><lf>). Once the test file is created open HyperTerminal and establish the connection, to send the command choose 'Transfer – Send Text File…' and browse to find the command file.

FAQ

Q: Why don't the LEDs light up when I apply power?
A: If you're using either USB or external DC, the power LED (on the right) should be illuminated. If the batteries are inserted, this won't be illuminated unless the batteries are low. If power is OK, then the GPS LED (on the left) should be pulsing about once per second. If this LED is not pulsing, check the module alignment– see "How are modules aligned" below.

Q: Why can't I get a fix?
A: Check the LEDs first! (See question immediately above.) The color of the GPS LED is important: red-to-off means the module is hunting, orange-to-green means a fix is achieved. After three minutes, if no fix is achieved (and the GPS LED is pulsing), then check the antenna. The connection should be tight and the position of the antenna should have a relatively unobstructed sky view. In general, reductions in signal strength still permit a fix though it takes a little longer to achieve TTFF (time to first fix). However once a fix is achieved, the link should remain relatively stable. Using the provided evaluation kit demo software you can also check the signal-to-noise levels of the individual satellite signals – they need to be greater than 25dB in order to obtain an initial fix. Good SNR values are in the range of 30-45dB or higher. If you are still unable to obtain a fix the best thing to do is to go outside with an unobstructed sky view and test it there initially to eliminate other variables.

Q: How does weather and environment affect GPS signal reception?
A: In general, a GPS fix can be achieved in a variety of circumstances; however, certain atmospheric disturbances can create scattering which reduces the quality of the signal. Moisture can play a role– rain, for example, is not always a problem, though dense clouds can be. Other factors, such as solar flares, can cause difficulties. It is important to note the environmental conditions when evaluating any GPS solution.

Q: Where do I place the antenna?
A: Examples are on the roof of a car or the dashboard, if the sky view is clear. Indoors, it's best to place the antenna near a window. A window view, however, will limit the geometry of the GPS constellation and give poor accuracy, or a 3-D fix may not be obtainable if 4 satellites are not visible. For both automotive and indoor usage, the type of glass, particularly metalized glass, may affect the performance. Setting the antenna on a windowsill may not be enough of a sky view to obtain a fix, and even if a fix is obtained the accuracy may not be that good since most of the sky view will be blocked. Remember – the position fix is triangulated from the satellite signals, so the wider the constellation view, the better the accuracy.

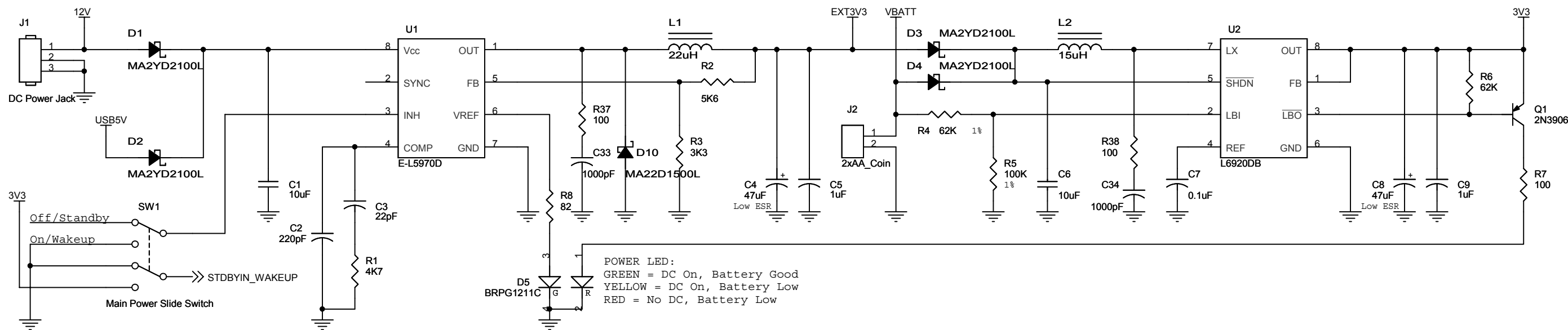**Q: How are modules aligned and how do I change modules?**
A: The GPS2058 module comes pre-installed onto an adapter board that fits into the evaluation kit. Alignment between the adapter card and the spring loaded contacts in the evaluation kit is very good, but occasionally the adapter can be slightly misaligned. You can loosen the screws for the adapter card and shift the adapter slightly and re-snug the screws to adjust alignment.

Q: Why can't I establish a USB connection: "USB Device Not Recognized"
A: Early versions of the evaluation kit may be sensitive to low/reduced USB voltages, and if your laptop or PC USB voltage levels are about 4.75v or less the kit may not be recognized as an Earthmate GPS device. The short term fix is to use the supplied wall power adapter even when USB is connected. For the long term fix, please contact us at gps.modules@delorme.com for a replacement or the instructions on how to change one component to overcome this problem.
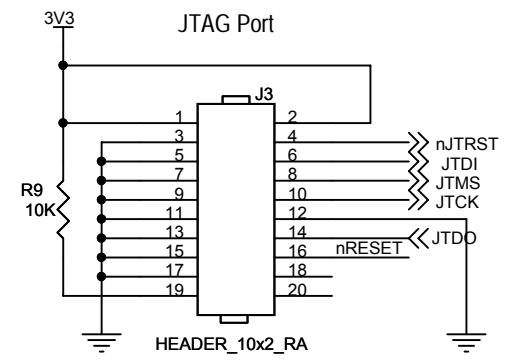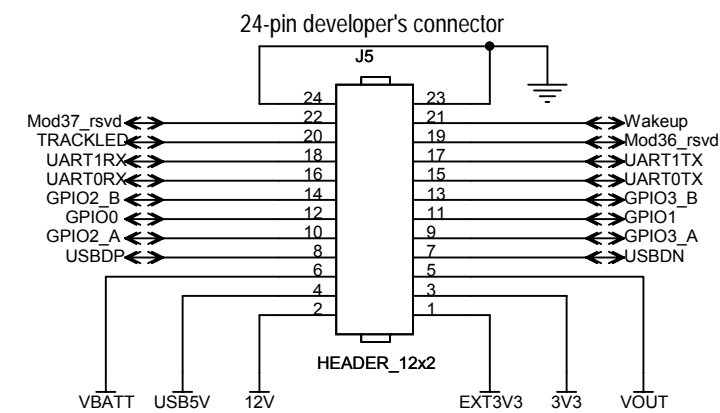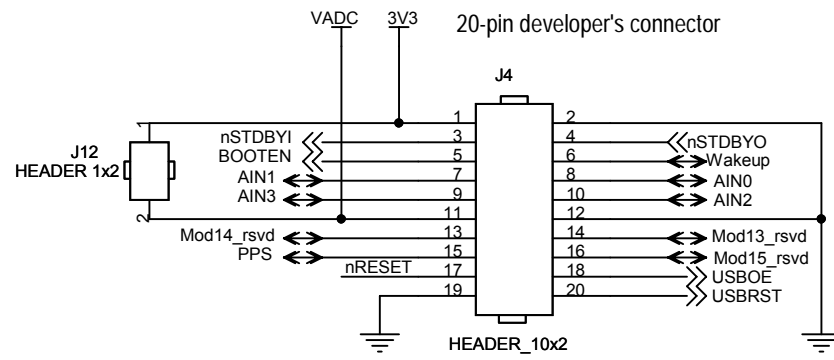
Q: Why won't the module respond to commands sent across the serial connection?
A: Some kits are more sensitive to this than others and the problem stems from a component that has a normal variation in input leakage that robs current from the signal path. If you are experiencing this issue please contact us at gps.modules@delorme.com for the instructions on correcting this problem.
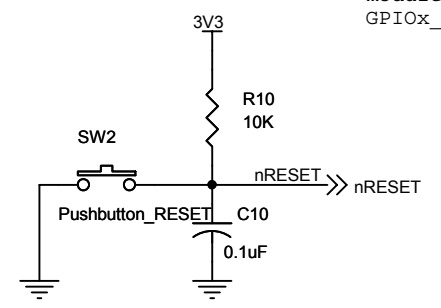
DeLorme GPS Module Evaluation Kit — Main Power and Connectors page

J1 — DC Power Jack — 12V
D1 MA2YD2100L
USB5V
D2 MA2YD2100L

U1 — E-L5970D
8 Vcc — OUT
2 SYNC — FB 5
3 INH — VREF 6
4 COMP — GND 7

C1 10uF
C2 220pF
C3 22pF
R1 4K7

R37 100
C33 1000pF
R3 3K3
D10 MA22D1500L
R8 82

L1 22uH
R2 5K6

EXT3V3   VBATT
D3 MA2YD2100L
D4 MA2YD2100L
J2 2xAA_Coin
R4 62K 1%
R5 100K 1%
C6 10uF
C34 1000pF

L2 15uH

U2 — L6920DB
7 LX — OUT 8
5 SHDN — FB 1
2 LBI — LBO 3
4 REF — GND 6
R38 100
C7 0.1uF

3V3
R6 62K
Q1 2N3906
R7 100
C8 47uF Low ESR
C9 1uF

C4 47uF Low ESR
C5 1uF

SW1 — Off/Standby — On/Wakeup — STDBYIN_WAKEUP
Main Power Slide Switch
3V3

When batteries are present, the main switch operates as Wakeup-Standby. Without batteries, it acts as On-Off.

D5 BRPG1211C
POWER LED:
GREEN = DC On, Battery Good
YELLOW = DC On, Battery Low
RED = No DC, Battery Low

J12 provides an easy way to access the VADC and 3V3 supplies but should not be jumpered.

J12 HEADER 1x2

20-pin developer's connector
VADC 3V3
J4 — HEADER_10x2
nSTDBYI | 3 | 4 | nSTDBYO
BOOTEN | 5 | 6 | Wakeup
AIN1 | 7 | 8 | AIN0
AIN3 | 9 | 10 | AIN2
| 11 | 12 |
Mod14_rsvd | 13 | 14 | Mod13_rsvd
PPS | 15 | 16 | Mod15_rsvd
nRESET | 17 | 18 | USBOE
| 19 | 20 | USBRST

24-pin developer's connector
J5 — HEADER_12x2
Mod37_rsvd | 22 | 21 | Wakeup
TRACKLED | 20 | 19 | Mod36_rsvd
UART1RX | 18 | 17 | UART1TX
UART0RX | 16 | 15 | UART0TX
GPIO2_B | 14 | 13 | GPIO3_B
GPIO0 | 12 | 11 | GPIO1
GPIO2_A | 10 | 9 | GPIO3_A
USBDP | 8 | 7 | USBDN
VBATT USB5V 12V   EXT3V3 3V3 VOUT

JTAG Port
3V3
J3 — HEADER_10x2_RA
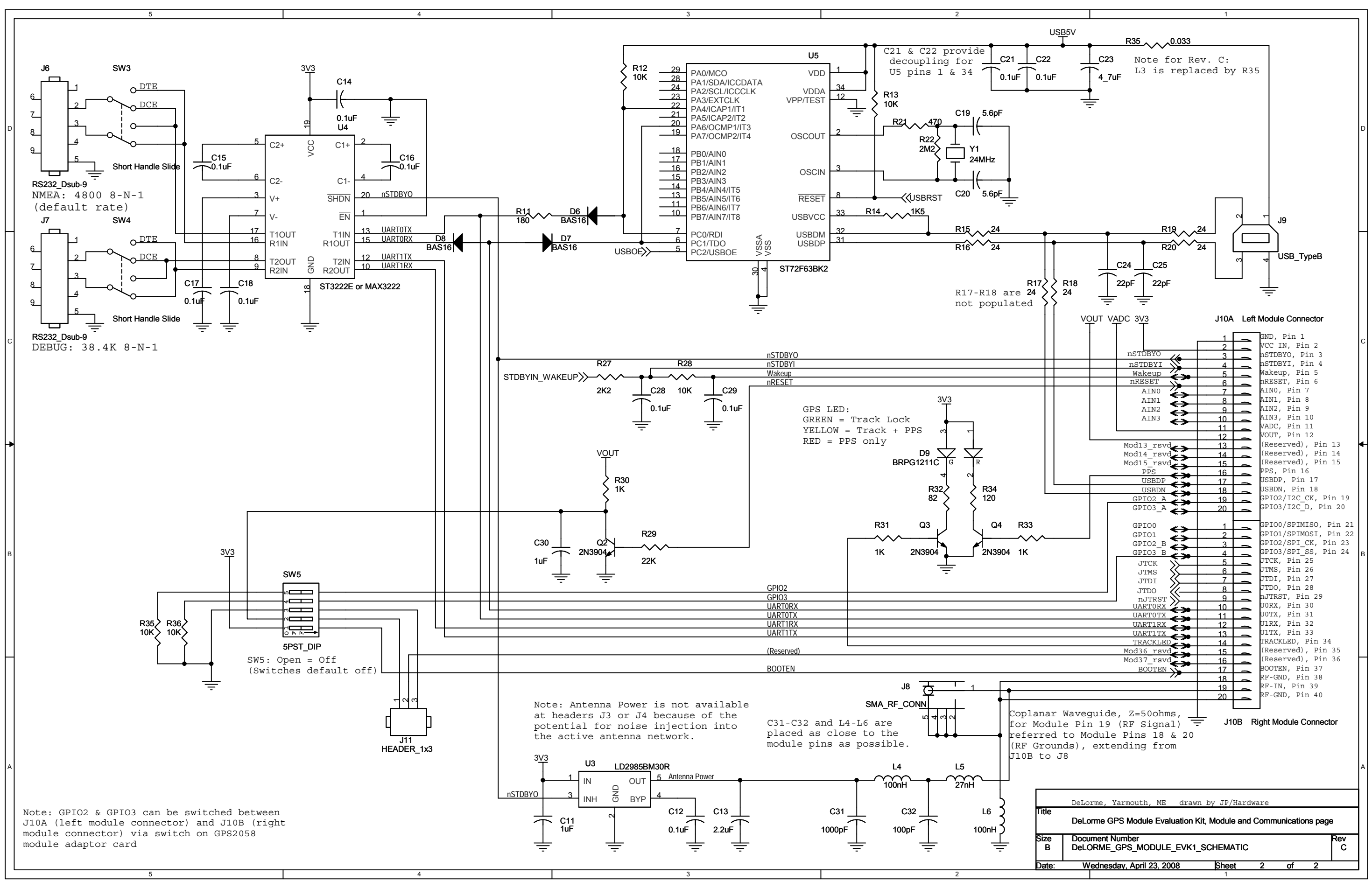R9 10K
nJTRST
JTDI
JTMS
JTCK
nRESET
JTDO

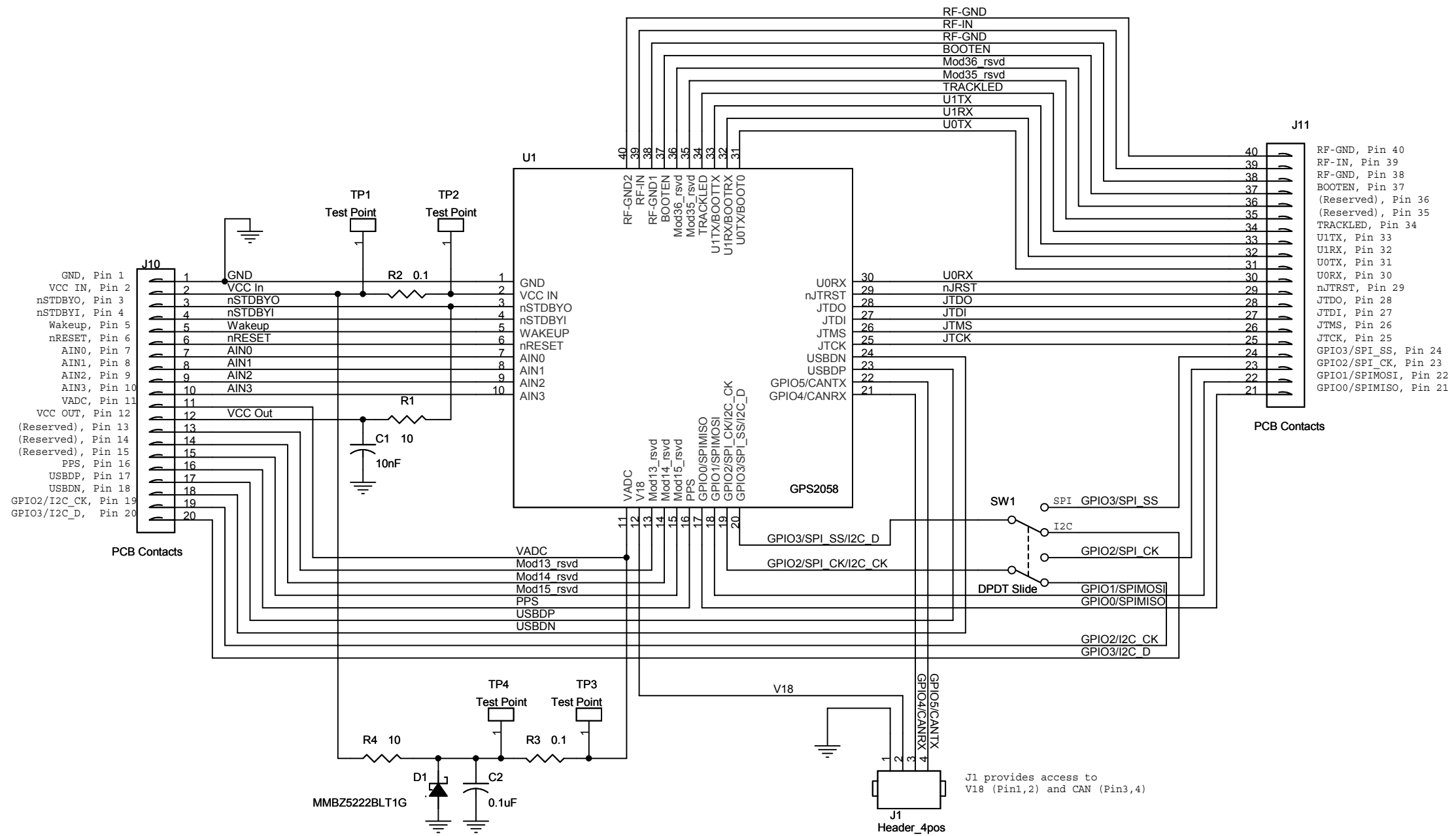Connectors J4, J5 and J6 are shown as oriented in the evaluation kit.

Note: GPIO2_A/B & GPIO3_A/B are selected from J10A (left module connector) and J10B (right module connector) via switch on GPS2058 module adaptor card; switch-down selects GPIOx_A and switch-up selects GPIOx_B

3V3
R10 10K
SW2 — Pushbutton_RESET
nRESET
C10 0.1uF

GPS2058 Module Adapter PCB

Title: GPS2058 Module Adapter PCB
Size: B
Document Number: DeLORME_GPS2058_EVK_Adapter
Rev: C
Date: Wednesday, April 23, 2008
Sheet 1 of 1
MC/JP