Smart GPS Antenna A1035-D

A description of Tyco Electronics’ GPS antenna module A1035-D

User’s Manual - PRELIMINARY

Version 1.0
Hardware Revision 01
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## Revision History

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>07-22-05</td>
<td>Initial Draft – preliminary information</td>
</tr>
</tbody>
</table>

mm-dd-yy
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1 Introduction

Tyco Electronics’ smart GPS antenna A1035-D is the combination of a highly integrated GPS receiver module and a ceramic GPS patch antenna. The antenna is connected to the module via an LNA. The module is capable of receiving signals from up to 20 GPS satellites and transferring them into position and timing information that can be read over a serial port. Small size and high-end GPS functionality are combined at low power consumption:

- Operable at 3.3V / 41mA (typ.) @ 1fix per second
- UART interface at CMOS level
- Small form factor of 35.6 x 35.6 mm (1.4” x 1.4”)
- Standard power and I/O connector
- Mountable without solder process
- Field replaceable

The smart antenna module is available as an off-the-shelf component, 100% tested and shipped in trays.

NOTE: The module can be offered for OEM applications with adaptation in form and connection. Additionally, the antennas can be tuned to their final environment.

1.1 Label

The A1035-D’s labels hold the following information:

![Figure 1: A1035-D labels]

- Product code (A1035-D) with hardware version (01)
- Firmware version (102-02), factory and date code (week and year: 31 07)
1.2 Characteristics
The antenna modules are characterized by the following parameters.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channels</td>
<td>20, parallel tracking</td>
</tr>
<tr>
<td>Correlators</td>
<td>200.000 plus</td>
</tr>
<tr>
<td>Frequency</td>
<td>L1 (= 1575 MHz)</td>
</tr>
<tr>
<td>Tracking Sensitivity</td>
<td>-159dBm</td>
</tr>
<tr>
<td>Position Accuracy</td>
<td>Stand alone</td>
</tr>
<tr>
<td></td>
<td>&lt; 10m CEP (SA off)</td>
</tr>
<tr>
<td>Time To First Fix – TTFF</td>
<td>Obscuration recovery (1)</td>
</tr>
<tr>
<td></td>
<td>0.1s</td>
</tr>
<tr>
<td>(theoretical minimum values;</td>
<td>Hot start (2)</td>
</tr>
<tr>
<td>values in real world may differ)</td>
<td>&lt; 1s</td>
</tr>
<tr>
<td></td>
<td>Warm (3)</td>
</tr>
<tr>
<td></td>
<td>&lt; 32s</td>
</tr>
<tr>
<td></td>
<td>Cold (4)</td>
</tr>
<tr>
<td></td>
<td>&lt; 35s</td>
</tr>
</tbody>
</table>

Table 1: A1035-D characteristics

(1) The calibrated clock of the receiver has not stopped, thus it knows precise time (to the µs level).
(2) The receiver has estimates of time/date/position and valid almanac and ephemeris data.
(3) The receiver has estimates of time/date/position and recent almanac.
(4) The receiver has no estimate of time/date/position, and no recent almanac.

1.3 Mechanical Characteristics

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>35.56mm, 1.4”</td>
</tr>
<tr>
<td>Width</td>
<td>35.56mm, 1.4”</td>
</tr>
<tr>
<td>Height</td>
<td>8.0mm, 0.315”</td>
</tr>
<tr>
<td>Weight</td>
<td>12g, 0.5oz (may vary)</td>
</tr>
</tbody>
</table>

Table 2: A1035-D dimensions and weight

1.4 Handling Precautions
The smart GPS antenna A1035-D is a module that is sensitive to electrostatic discharge (ESD). Please handle with appropriate care.
2 Ordering Information

2.1 GPS Receiver A1035-D
The order numbers are built as follows:

- V23993A1035Dxxx

V23993 stands for Tyco Electronics wireless and communication products, A1035-D for the A1035-D module. The "xxx" stands for the according firmware version. Where

2.2 Packing
The A1035-D comes in trays, with 18 modules per tray.
2.3 Additional Equipment

<table>
<thead>
<tr>
<th>V23993DKS1035</th>
<th>Demonstration Kit (including one module V23993A1035D)</th>
</tr>
</thead>
</table>

Table 3: Additional equipment

Detailed descriptions of the additional kits can be found in the according manuals.
3 Quick Start

In order to allow an easy and quick start with the modules A1035-D, this chapter provides a short overview on the most important steps to receive NMEA messages with position information on a serial port. For details please refer to the according chapters.

3.1 Minimum Configuration

The following picture shows a recommended minimum configuration for NMEA output and commands received and sent via an RS232 interface based on the A1035-D.

![Recommended minimum configuration A1035-D](image)

**Figure 3: Recommended minimum configuration A1035-D**

Remarks:

- Place C1 to C5 close to MAX3232. For capacity values see datasheet of actual component used.
- Use 3.3V level shifter (MAX3232 or equivalent).
- A battery back-up circuit for the RTC (Real Time Clock) should be considered (see below)!

3.2 Serial Port Settings

The default configuration within the standard GPS firmware is:

- Serial 0 (NMEA) 4800 baud, 8 data bits, no parity, 1 stop bit, no flow control
3.3 Improved TTFF

In order to improve the TTFF (Time To First Fix), it is recommended to support the RTC with a back-up power when no system power is available.

If the system or the GPS receiver alone should not be backed-up it is possible to support the restart procedure by providing position and date/time information to the module. This is described in the firmware manual. Please refer there to chapter “Start-up Support” in the document T.E. GPS Firmware A1080.
4 Mechanical Outline
4.1 Overview A1035-D

All dimensions in [mm]

Figure 4: Mechanical outline overview A1035-D (bottom)
All dimensions in [mm]

Figure 5: Mechanical outline overview A1035-D (top)
All dimensions in [mm]

Figure 6: Mechanical outline overview A1035-D (side A)

Figure 7: Mechanical outline overview A1035-D (side B)

Attention: The height of the module and the antenna dimensions and position might change for series production!
4.2 Connector A1035-D

The power and I/O connector used on the A1035-D is a 1.27mm (0.05”) low profile, double row socket with a height of 2.21mm (.087”) and a total of 22 contacts. Potential counterparts on the motherboard are e.g. Samtec 1.27mm (0.05”) micro strips of the FTS series (e.g. FTS-122-02-L-D).
5 Pin-out Information

5.1 Layout A1035-D

Figure 8: Pin out information A1035-D (bottom and top view)

Bottom view is showing the side of the module that will face the carrier board.
5.2 Description A1035-D Signals
This table describes the functionality of the pins and their associated symbols.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 PPS</td>
<td>1PPS (pulse per second) output</td>
</tr>
<tr>
<td>3</td>
<td>TX0</td>
<td>Serial output 0, NMEA out</td>
</tr>
<tr>
<td>5</td>
<td>RX0</td>
<td>Serial input 0, NMEA in</td>
</tr>
<tr>
<td>7</td>
<td>Vcc</td>
<td>+3.3V (power supply option)</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>Ground (power supply)</td>
</tr>
<tr>
<td>11</td>
<td>Vbak</td>
<td>Back-up pin of module for “supercap” or battery (Please see chapter 9.2 Battery Back up)</td>
</tr>
<tr>
<td>13</td>
<td>Rx1</td>
<td>Serial input 1 – reserved for binary in (leave open)</td>
</tr>
<tr>
<td>15</td>
<td>Tx1</td>
<td>Serial output 1 – reserved for binary out (leave open)</td>
</tr>
<tr>
<td>17</td>
<td>Boot</td>
<td>Special boot mode – leave open for normal operation</td>
</tr>
<tr>
<td>19</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>21</td>
<td>nc</td>
<td>Not connected</td>
</tr>
</tbody>
</table>

Table 4: Pin description A1035-D (part 1)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>nRST</td>
<td>Reset input (negative)</td>
</tr>
<tr>
<td>4</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>6</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>8</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>10</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>12</td>
<td>Vbak</td>
<td>Back-up pin of module for “supercap” or battery (Please see chapter 9.2 Battery Back up)</td>
</tr>
<tr>
<td>14</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>16</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>18</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>20</td>
<td>nc</td>
<td>Not connected</td>
</tr>
<tr>
<td>22</td>
<td>nc</td>
<td>Not connected</td>
</tr>
</tbody>
</table>

Table 5: Pin description A1035-D (part 2)

5.3 General Comments
The following comments should be considered for a design with and use of the module:

- Standard configuration of serial port:
  Serial 0 (NMEA) 4800 baud, 8 data bits, no parity, 1 stop bit, no flow control
6 Electrical Characteristics

6.1 Operating Conditions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Vcc</td>
<td>3.0V</td>
<td>3.3V</td>
<td>3.6V</td>
</tr>
<tr>
<td></td>
<td>Peak Acquisition Current</td>
<td></td>
<td>57mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average Acquisition Current</td>
<td></td>
<td>41mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tracking Current</td>
<td></td>
<td>36mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standby Current</td>
<td></td>
<td>20µA</td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Operating Conditions

6.2 Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Vcc</td>
<td>-0.3V</td>
<td>Vcc+0.3V max. 3.6V</td>
</tr>
<tr>
<td></td>
<td>Applied voltage to all input pins excluding Vcc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Absolute maximum ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

7 Mounting

The A1035-D offers a power and I/O connector with a 1.27mm (0.05") low profile, double row socket with a total of 22 contacts. Potential counterparts on the motherboard are Samtec 1.27mm (0.05") micro strips of the FTS series. For fixing the A1035-D on a motherboard appropriate screws and bolts or clips (see also chapter 4 Mechanical Outline) are recommended.
8 Quality and Reliability

8.1 Environmental Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-30°C to +85°C</td>
</tr>
<tr>
<td>Operating humidity</td>
<td>Max. 85% r.H., non-condensing, at 85°C</td>
</tr>
<tr>
<td>MSL JEDEC (Moisture Sensitivity Level)</td>
<td>3</td>
</tr>
<tr>
<td>Storage</td>
<td>6 months in original package.</td>
</tr>
</tbody>
</table>

Table 8: Environmental conditions

8.2 Product Qualification
Prior to product qualification the GPS receiver is preconditioned according to EIA/JEDEC standard JESD22-A113-B / Level 3.

Basic qualification tests:

- MSL Classification according to J-STD-020C (MSL3 @ 245°C)
- MSL Rework Compatibility according to J-STD-020C
- Temperature Cycling −30°C to +85°C
- Temperature Humidity Bias 70°C / 85% RH
- High / Low Temperature Operating −30° / +85°C
- High Temperature Operating Life +85°C
- Vibration Variable Frequency
- Mechanical Shock

Please contact Tyco Electronics for detailed information.

8.3 Production Test
Each module is electrically tested prior to packing and shipping to ensure state of the art GPS receiver performance and accuracy.
9 Applications and Hints

9.1 Minimum Configuration
Please refer to chapter 3.1 Minimum Configuration for details. In addition, for optimized start-up behavior it is strongly recommended to add a battery back-up circuit (see chapter 3.3)!

9.2 Battery Back-up
This application note describes on how to back-up the RTC and the SRAM of the GPS receiver module. The basic of the first examples is to provide a back-up by a separate battery or a “supercap”.

While the “supercap” is charged thru the module during normal operation, the battery (primary cell) is decoupled thru a diode!

![Diagrams of backup supply options](image)

Backup Supply Options
(A) Supercap, charged through GPS module
(B) Primary cell, decoupled with diode

Figure 9: Application note: Module back-up

An alternative to this solution is to switch the supply voltage from the Vcc pin to the Vbuk pin. Care needs to be taken that the there is no voltage outage during the switch-over phase!
9.3 1PPS pin (1 pulse per second pin)
The 1PPS pin is an output pin.

In addition to precise positioning, GPS also allows for accurate timing due to the synchronized atomic clocks in the GPS satellites. While the current date and time is transmitted in NMEA sentences, an exact and accurate timing signal is provided via the 1PPS pin of the A1080 modules.

9.4 Reset Signal
The nRST pin is an input pin.

The nRST pin can be used to generate a reset on the A1080-A module. Resetting the module will result in a restart of the complete firmware. All information stored in SRAM will still be valid.

10 Demonstration Kits
10.1 Demonstration Kit A1035
For demonstration and easy evaluation of GPS performance Tyco Electronics offers a Demonstration Kit (including one smart GPS antenna A1035-D). It shows two serial interfaces, but only one is being used (NMEA). The Demonstration Kit can be powered by an external 5 to 12V source. Accompanied by a serial cable it offers a ready-to-go set. For further information please contact Tyco Electronics.
11 Related Information

11.1 Contact

This manual was created with due diligence. We hope that it will be helpful to the user to get the most out of the GPS module.

Anyway, inputs about errors or mistakable verbalizations and comments or proposals to TYCO Electronics, Power Systems in Munich, Germany, for further improvements are highly appreciated.

Hans Wiedemann
Product Marketing Manager
Positioning Products
Tel.: +49 89 6089 838
Fax: +49 89 6089 835

Tyco Electronics Corporation
Power Systems
Finsinger Feld 1
85521 Ottobrunn, Germany

Email to gps@tycoelectronics.com.

Please visit our website at www.tycoelectronics.com/gps.

12 Related Documents

- Manual: T.E. GPS DemoKit DKS1035 (TYCO)
- Manual: T.E. GPS Receiver A1080 V2.3.doc (TYCO)
- Application note: GPS AN A1080-A – EDLC as Backup Supply V1.0 (TYCO)
- Application note: GPS AN A1080-A – Backup V1.0 (TYCO)
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