

LoRa Concentrator Card

GL5512 Datasheet

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1. Description

1.1 Overview

GL5512 is a LoRa concentrator card with industrial standard mini PCI express form factor based on SX1301 chipset and 2*SX1255 RF end-front . This mPCIe module can be used in any embedded platform offering a free mPCIe slot with USB/SPI connectivity and capable of providing enough power for the module, enables low-power wide area communication capabilities to your new gateway design or existing industrial routers/computer.

Each module support eight(8) programmable Lora parallel demodulation channels, allowing it to receive up to eight LoRa® modulated packets simultaneously. -142.5dBm high sensitivity combine with +27dBm power amplifier yields industry leading link budget making it optimal for applications requiring extended range and robustness.

Typical applications

- ✓ Automated Meter Reading
- ✓ Home and Building Automation
- ✓ Wireless Alarm and Security Systems
- ✓ Industrial Monitoring and Control
- ✓ Machine to Machine (M2M)
- ✓ Internet of Things (IoT)



GL5512 LoRa concentrator cards are available in four product variants

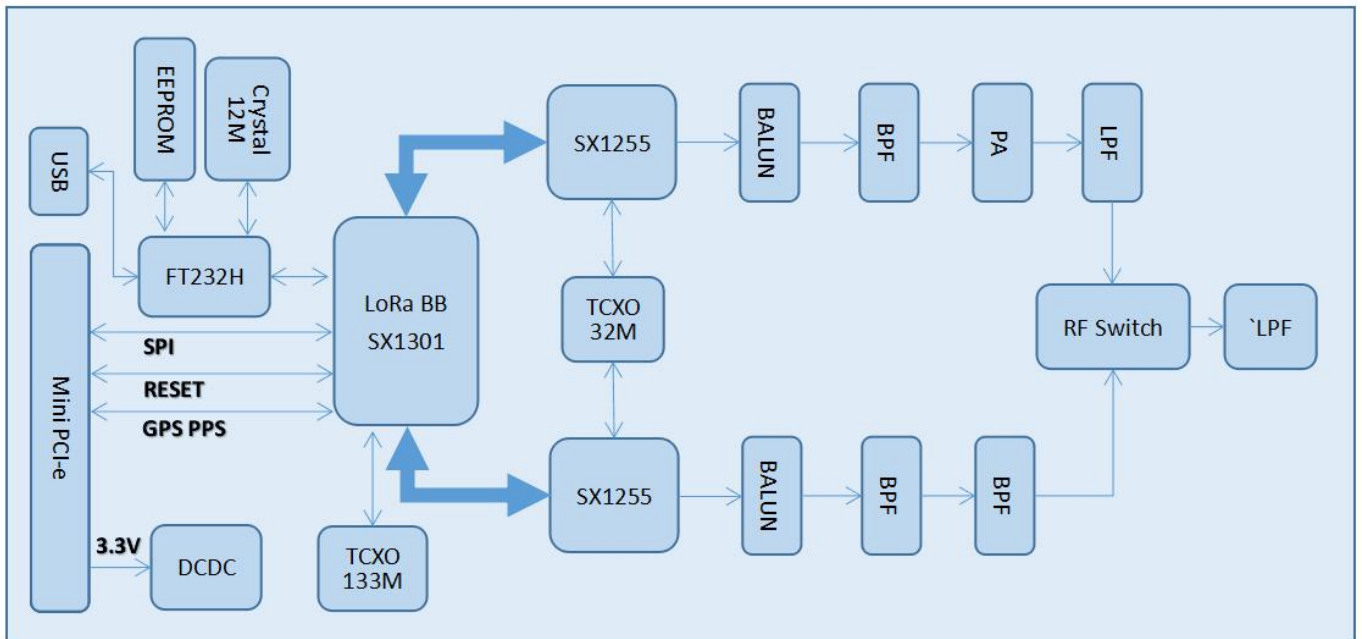
| NO. | Model | Description | Remark |
|-----|-----------|---|--------|
| 1 | GL5512-WX | 433MH, IPEX antenna connector, Suitable for China &Europe | |
| 2 | GL5512-CX | 470~510MHz, IPEX antenna connector, Suitable for China | |
| 3 | GL5512-WA | 433MH, SMA antenna connector, Suitable for China &Europe | |
| 4 | GL5512-CA | 470~510MHz, SMA antenna connector, Suitable for China | |

Table1.1 Product variants

1.2 Product features

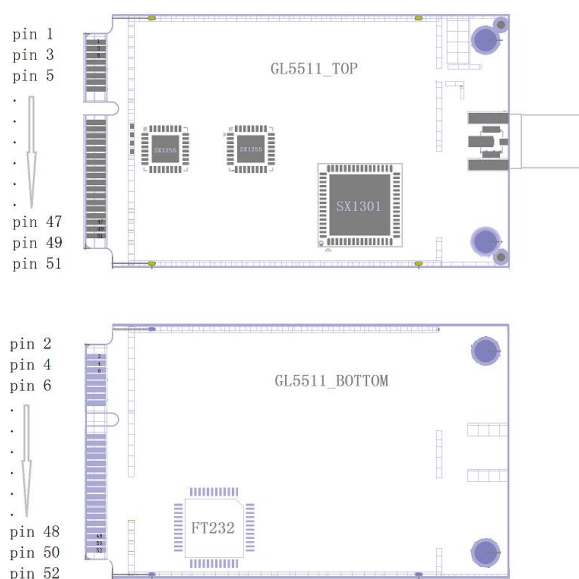
- ✓ **Multichannel:** Eight(8) programmable Lora parallel demodulation channels.
- ✓ **SPI Interface:**The SPI interface gives access to the configuration register of SX1301 via a synchronous full-duplex protocol.
- ✓ **USB2.0 Interface:** Build in FT232H chip convert SPI interface of SX1301 to USB2.0 .
- ✓ Compact mini PCI express form factor TYP. 50.8*30.3*4.7mm (W*L*H)
- ✓ Standard mini PCI express supply voltage +3.3V
- ✓ Firmware upgradeable
- ✓ Environmentally friendly RoHS compliant

1.3 Function block diagram



2. Pin Definition

2.1 Pin assignment



2.2 Pin description

| No. | Symbol | Type | Description |
|-----|--------|--------------|-------------------------------------|
| 1 | NC | N/A | Not connected (Default) |
| 2 | +3.3V | Supply input | Supply voltage to the engine board. |
| 3 | NC | N/A | Not connected (Default) |
| 4 | GND | GND | Ground |
| 5 | NC | N/A | Not connected (Default) |
| 6 | NC | N/A | Not connected (Default) |
| 7 | NC | N/A | Not connected (Default) |
| 8 | NC | N/A | Not connected (Default) |
| 9 | GND | GND | Ground |
| 10 | NC | N/A | Not connected (Default) |
| 11 | NC | N/A | Not connected (Default) |
| 12 | NC | N/A | Not connected (Default) |
| 13 | NC | N/A | Not connected (Default) |
| 14 | NC | N/A | Not connected (Default) |
| 15 | GND | GND | Ground |
| 16 | NC | N/A | Not connected (Default) |
| 17 | NC | N/A | Not connected (Default) |
| 18 | GND | GND | Ground |

| | | | |
|----|--------|--------------------|---|
| 19 | NC | N/A | Not connected (Default) |
| 20 | NC | N/A | Not connected (Default) |
| 21 | GND | GND | Ground |
| 22 | /Reset | Reset input | Reset Module, Active-low device Reset input |
| 23 | NC | N/A | Not connected (Default) |
| 24 | +3.3V | Supply input | Main power supply to the engine board. |
| 25 | NC | N/A | Not connected (Default) |
| 26 | GND | GND | Ground |
| 27 | GND | GND | Ground |
| 28 | NC | N/A | Not connected (Default) |
| 29 | GND | GND | Ground |
| 30 | NC | N/A | Not connected (Default) |
| 31 | NC | N/A | Not connected (Default) |
| 32 | NC | N/A | Not connected (Default) |
| 33 | NC | N/A | Not connected (Default) |
| 34 | GND | GND | Ground |
| 35 | GND | GND | Ground |
| 36 | USB_DM | USB Data Line D- | USB Data Signal Minus |
| 37 | GND | GND | Ground |
| 38 | USB_DP | USB Data Line D+ | USB Data Signal Plus |
| 39 | +3.3V | Supply input | Main power supply to the engine board. |
| 40 | GND | GND | Ground |
| 41 | +3.3V | Supply input | Main power supply to the engine board. |
| 42 | NC | N/A | Not connected (Default) |
| 43 | GND | GND | Ground |
| 44 | NC | N/A | Not connected (Default) |
| 45 | SCK | Host SPI interface | SPI interface |
| 46 | GPS_IN | GPS_IN | GPS pps in |
| 47 | MISO | Host SPI interface | SPI interface |
| 48 | NC | N/A | Not connected |
| 49 | MOSI | Host SPI interface | SPI interface |
| 50 | GND | N/A | Ground |
| 51 | CSN | Host SPI interface | SPI interface |
| 52 | +3.3V | Supply input | Main power supply to the engine board. |

Table 2.1 Pin definition

3. Specifications

3.1 General specifications

| Parameters | Description |
|------------------------|---|
| Modulation type | ISM Band LoRa [®] |
| LoRa chipset | SX1301 |
| Multi-channel | Eight (8) uplink , one (1) down link |
| Package | Mini PCI express |
| Host interface | USB/SPI |
| Frequency | 433MHZ, 470~510MHZ(Opt.) |
| Receiving sensitivity | -142.5dBm |
| Tx power | +27dBm typ30dBm(Opt.) |
| Communication range | 3~5KM in urban area , >15KM line-of-sight |
| Supply voltage | +3.3V |
| Power consumption | Tx(Max)<700mA Rx <200mA |
| Operating temperature | -40~+85℃ (industrial grade) |
| Operating humidity | 10%~90%, no-condensing |
| Dimensions | TYP. 50.8*30.3*4.5mm (W*L*H) |
| ESD (Human Body Model) | JEDEC JS-001 Standard ±1kV, Class 2 |

Table3.1 General specification

3.2 Electric specifications

ESD Notice: GL5512 is a high performance radio frequency device. It satisfies:

- ✓ Class 2 of the JEDEC standard JESD22-A114 (Human Body Model) on all pins.
- ✓ Class III of the JEDEC standard JESD22-C101 (Charged Device Model) on all pins

It should thus be handled with all the necessary ESD precautions to avoid any permanent damage.



The limiting values given are in accordance with the Absolute Maximum Rating System . Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only, and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to these limits for extended periods may affect device reliability.

3.3 Absolute maximum rating

| Symbol | Description | Condition | Min | Max. | Unit |
|----------|-----------------------|--|------|------|------|
| 3.3Vaux | Module supply voltage | Input DC voltage at 3.3Vaux pins | −0.3 | 3.6 | V |
| USB | USB D+/D- pins | Input DC voltage at USB interface pins | | 3.6 | V |
| SPDT_SEL | Port select | Input DC voltage at SPDT_SEL input pins | −0.3 | 3.6 | V |
| RESET | MPCI reset input | Input DC voltage at RESET input pin | −0.3 | 3.6 | V |
| SPI | SPI interface | Input DC voltage at SPI interface pin | −0.3 | 3.6 | V |
| GPS_PPS | GPS 1 pps input | Input DC voltage at GPS_PPS input pin | −0.3 | 3.6 | V |
| Rho_ANT | Antenna ruggedness | Output RF load mismatch ruggedness at ANT1 | | 10:1 | VSWR |
| Tstg | Storage Temperature | | −40 | 85 | °C |

Table3.2 absolute maximum rating



Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. The product is not protected against over-voltage or reversed voltages. If necessary, voltage spikes exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection diodes.

3.4 Operating conditions



All specifications are at an ambient temperature of 25 ° C. Extreme operating temperatures can significantly impact specification values. Applications operating near the temperature limits should be tested to ensure the specification.

| Parameter | Min. | Typ | Max. | Unit | Remarks |
|--------------------------------|------|-----|------|------|--|
| Normal operating temperature | −20 | +25 | +65 | °C | fully functional and meet 3GPP specifications |
| Extended operating temperature | −40 | | +85 | °C | RF performance may be affected by outside normal operating range |
| Storage Temperature | −40 | | +125 | °C | |

Table3.3 operating temperature range



Operating beyond the specified operating conditions can affect device reliability.

| Symbol | Parameter | Min. | Typical | Max. | Unit |
|---------|--------------------------|------|---------|------|------|
| 3.3Vaux | operating supply voltage | 3.00 | 3.30 | 3.60 | V |

Table3.4 Operating power supply range



Operating beyond the specified operating conditions can affect device reliability.

| Item | Parameter | SPEC | | | Unit | Condition |
|------|-----------------------|------|--------|-----|------|--------------------|
| | | MIN | TYP | MAX | | |
| TX | Transmit Frequency | 863 | | 870 | MHz | ISM Band(GL5512-E) |
| | Transmit Frequency | 902 | | 928 | MHz | ISM Band(GL5512-U) |
| | Transmit Power | | +27 | +30 | dBm | Including ANT Gain |
| | Frequency Deviation | | 12.5 | | KHz | 25 °C |
| RX | Receiving Sensitivity | | -142.5 | | dBm | |

Table3.5 RF receiver characteristics



GL5512 series LoRa RF characteristics are specified in the SX1255series Data Sheet .

| Mode | Condition | Min | Typ | Max | Unit |
|------------------|---|-----|-----|-----|-----------|
| RF Idle | All of the chip on the board enter idle mode or shutdown. | | 70 | | uA |
| Rx active | TX disabled and shutdown PA. | | 120 | 185 | mA |
| Tx active | The power of TX channel is 27dBm and 3.3V supply. | | 520 | 700 | mA |

Table3.6 Current consumption

4.3 Interfaces

Reference circuit design shows the typical hardware connections for the module. Interfacing to the module requires connecting to the signals provided on the GL5512 mPCIe connector as listed in pin description. Specific interface connections are discussed in this chapter.

4.3.1 Interface to host MCU

✓ SPI interface

A SPI interface is provided on the PCIe_SCK, PCIe_MISO, PCIe_MOSI, PCIe_CSN pins of the system connector. The SPI interface gives access to the configuration register of SX1301 via a synchronous full-duplex protocol. Only the slave side is implemented.

✓ USB interface

GL5512 series modules support high speed USB interface with a built in TF232H chip convert SPI to USB, can be connected to any USB host equipment with compatible drivers. The module can use the USB signals through the mPCIe interface.

4.3.2 Power pins

GL5512 series modules has multiple power and ground pins available on the mPCIe connector. It is recommended that all power and ground pins be used when connecting to the module.

4.3.3 RF connection

GL5512 series modules have a U.FL connector for interfacing with an external antenna. For proper operation, antenna selection must consider frequency band and impedance.

4.3.4 RESET pin

GL5512 series modules have an active-low reset input. Pulling this signal low during normal operation will cause the module to execute a reset cycle.

4.3.5 GPS_PPS

GL5512 series modules include a GPS_PPS input used to receive time-stamped packets.

4.3.6 RF enable

GL5512 series modules have an input signal used to enable the RF radio on the module. A low level on the RF_ENABLE pin will disable all RF transmission and reception.

5. Reliability Test and Approves

Tests for product family qualifications are according to ISO 16750 "Road vehicles – Environmental conditions and testing for electrical and electronic equipment", and appropriate standards.



Products marked with this lead-free symbol on the product label comply with the "Directive 2002/95/EC and Directive 2011/65/EU of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS). All Maxiot GL5512 modules are RoHS compliant.

6. Package

| Module | Package | | | Article number |
|--------|---------|-------------|-------------|----------------|
| | Form | QTY | Size | |
| GL5512 | Trays | As required | As required | Undetermined |

Table6.1 package

7. Contact Us

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