# PowerLine Module--LX200V20

Version：V1.2
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# Content

# 1. Introduction

LX200V20 is the newest power line communication products which can support IEEE 1901 and Homeplug AV standard. It provides the standard MII interface for communication. The small-foot-print is ideal for embedded design application. You can easily plug into mother boards through the connector. It is the best choice to shorten the design cycle and accelerate the time to market.

# 2. Features

## 1) Support multiple existing cables for transmission

- Telephone Lines          The range is up to 600 meters for IP access
- Two wired line           The range is up to 2000 meters for IP access
- Power Lines              The range is up to 300 meters for IP access

## 2) Data Transmission

- Maximum physical layer data rate is 200Mbps；
- Support the streaming transmission like IPTV,HDTV etc.

## 3) Reliability

- 128-bit data encryption
- The working frequency is 2-30MHz. No influence on current CATV signals at home.
- The module can be interoperable with any devices based on homeplug AV specification and IEEE1901 standard. One Master Module can connect to four salve modules.

## 4) Simple

- No need for configuration by end users.   It can work when plugging into the lines
- Cost-optimized design and also can provide the customized design after signing the NRE agreement in place
- Ideal modules for small-footprint embedded devices

# 3. Application

The LX200V20 can be widely used in industrial and home automation system by combining with Ethernet and WIFI. This can achieve the seamless networking coverage in specific scenario. At present, The Powerline module has good application in the Internet of

Thing like smart home, survellience, Medical

Table 1  LX200V20 Target Market

| | |
|---|---|
| ✓ Smart Meter | ✓ Home Automation |
| ✓ Smart Energy | ✓ Medical |
| ✓ Automotive | ✓ Industry |

# 4. LX200V20 Top View

The LX200V20 module is shown in Figure 1. The Module is ideal for embedded system since the form factor of module is 40x21mm. Customers only need to provide one 3.3V power supply to the module and use the pin connector to the mother board. The module shortens the customer design cycle and enhances the flexibility on system design
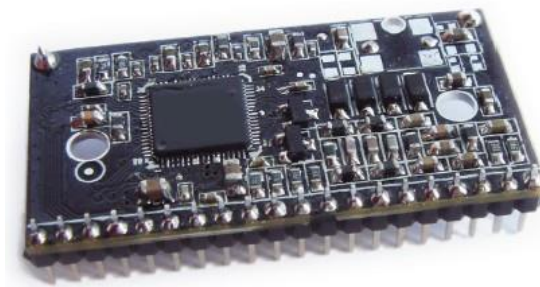


Figure1  LX200V20 Module Top View

# 5. LX200V20 Design Reference

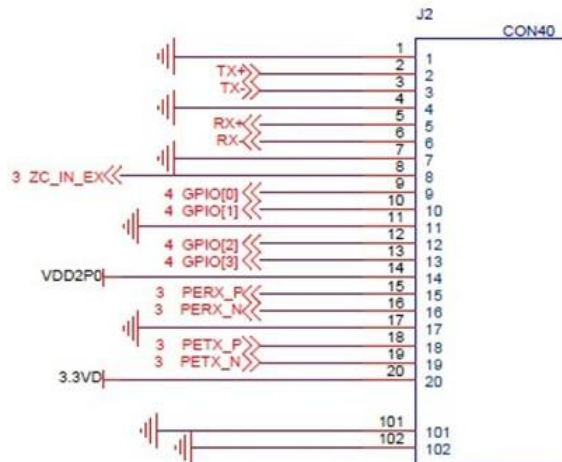The Pin definition of LX200V20 in schematic is shown in Figure2



Figure 2  Pin Definition in LX200V20 Schematics

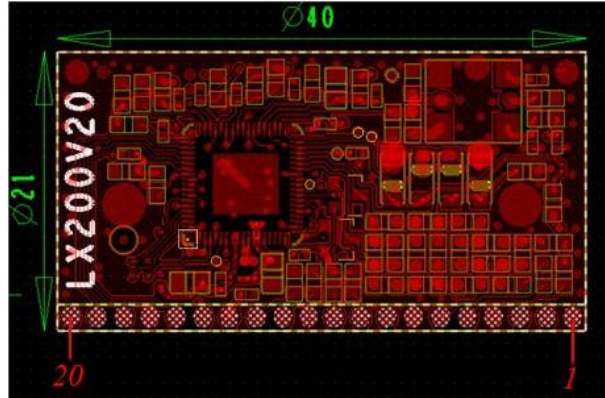In PCB Layout of LX200V20, the right side is the Pin"1", and the left side is the Pin"20",which is shown in figure 3.



Figure 3  PCB LAYOUT Size Of LX200V20

# 6. Pin Function Description

Table 2  LX200V20 Pin Description

| Pin # | Definition | Description |
|---|---|---|
| 1 | GND | Ground |
| 2 | TX+ | Powerline Tx signal |
| 3 | TX- | Powerline Tx signal |
| 4 | GND | Ground |
| 5 | RX+ | Power line Rx signal |
| 6 | RX- | Power line Rx signal |
| 7 | GND | Ground |

| | | |
|---|---|---|
| 8 | ZC_IN_EX | Zero Cross Input.<br><br>Minimun:100mVpp,AC coupled and Maximum:3.3Vpp,AC coupled |
| 9 | GPIO[0] | RED_LED, System Link |
| 10 | GPIO[1] | GRE_LED(Green)，System Self check |
| 11 | GND | Ground |
| 12 | GPIO[2] | Ethernet ACT LED: Shining when data in transmission |
| 13 | GPIO[3] | Factory Default |
| 14 | VDD2P0 | Ethernet Ethernet 2.0V |
| 15 | PERX_P | Differential In. Positive Differential Input from Bandpass filter |
| 16 | PERX_N | Differential In. Negative differential Input from Bandpass filter |
| 17 | GND | Ground |
| 18 | PETX_P | Differential Out. Positive Differential output of the TX PGA |
| 19 | PETX_N | Differential Out. Negative Differential output of the TX PGA |
| 20 | 3.3V | +3.3V Working voltage |

# 7. Installation

LX200V20 has pin connector to main board. This is the common dual row 2.0mm pin pitch connectors for Ethernet and other signals interface. The right side is Pin"1" and the left side is Pin"20".

# 8. Electrical Characteristics

Table 3 LX200V20 Electrical Specification

| | Min. | Typical | Max. | |
|---|---|---|---|---|

| 3.3v Working voltage | 3.15 | 3.3 | 3.45 | V |
|---|---|---|---|---|
| 3.3v working current | \ | 700 | \ | mA |

## 9. Top View For LX-PB

LX-PB is the evaluation board for LX200V20. It has all the interfaces that design needs. The interface contains RJ-45 Ethernet Port, +12V～+15V DC-DC,3.3V BUCK,Connector of DC power supply, transformer etc. This board is just for customer to quickly evaluate the performance of PLC module. Customers don't need to care for the size of evaluation board because you can make you own board based on our reference design. The LX-PB board was shown like Figure 6:
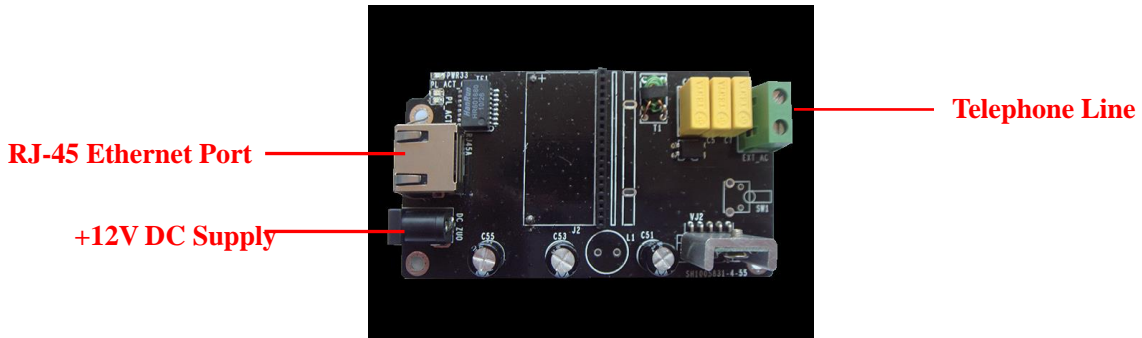


Figure 4 LX-PB

## 10. The Schematics Of LX-PB

The Schematics of LX-PB contains four parts：

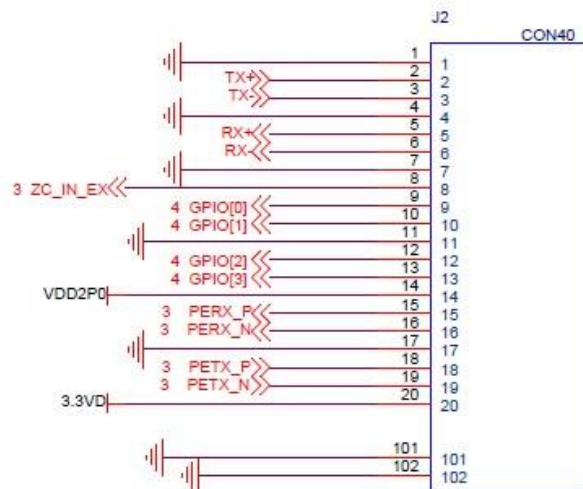1) The connector between mother board and LX200V20 module，like Figure 7 as below：



Figure 5 The Pin Map of LX-PB
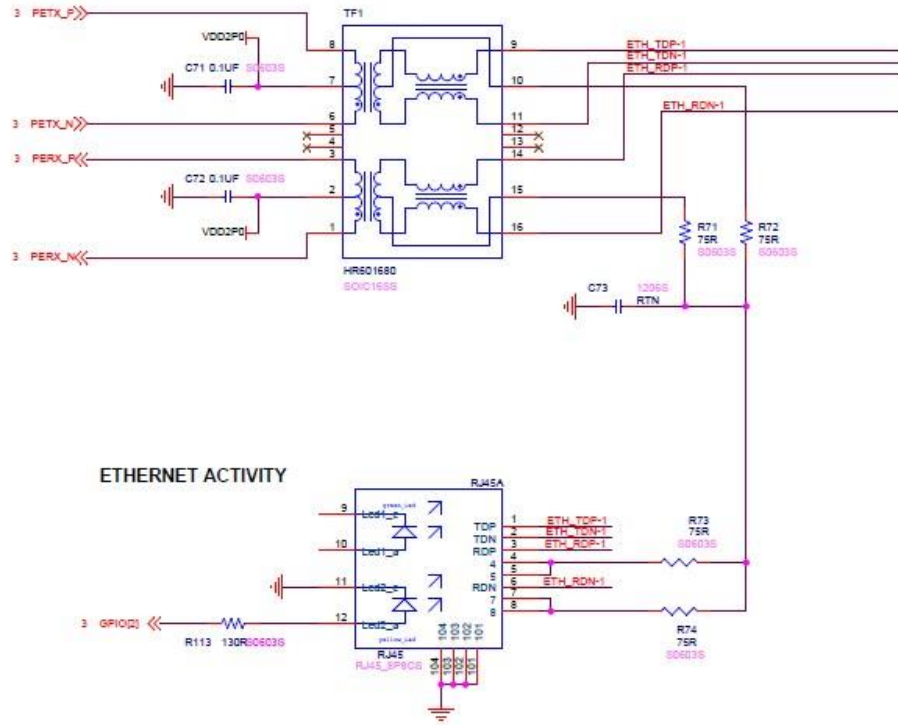
2) Ethernet Port circuit，Like Figure 6 as below：



Figure 6 Ethernet Port Circuit

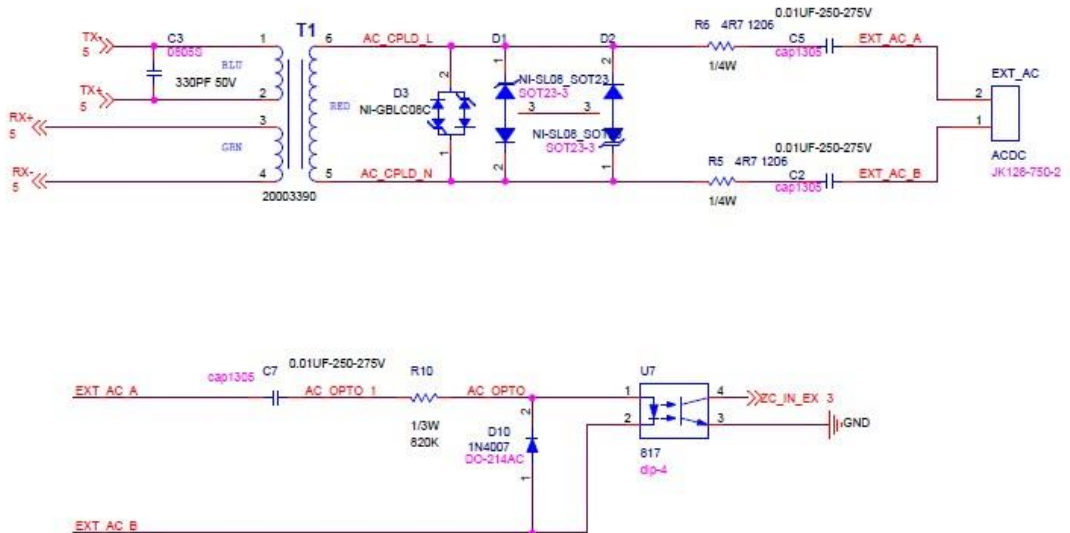3) Signal Tx and Rx circuit，like Figure 7 as below：



Figure 7 Signal Tx and Rx

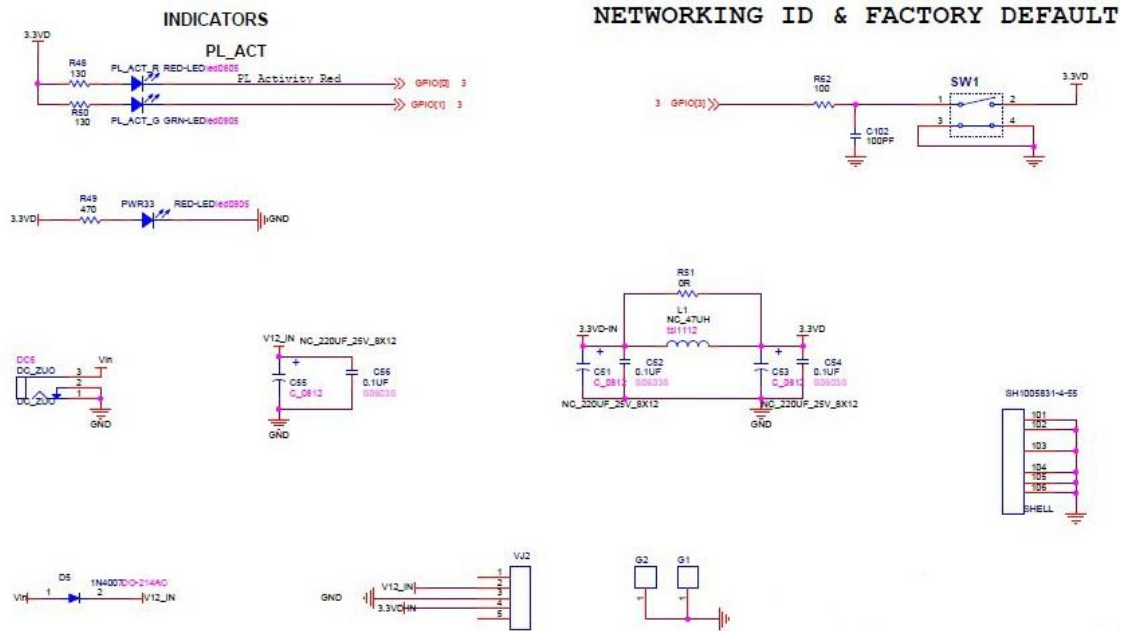4) The Figure 9 introduce the detail of LED, Reset circuit and filter circuit



Figure 9 Signal LED、Reset circuit and Filter circuit etc.

## 11. Layout of LX-PB

There are three interfaces on the mother board, RJ-45 Ethernet Port, +12V～+15V DC-DC interface and coexist port. The size of mother board is 100mm x 58mm, as shown in figure 10.
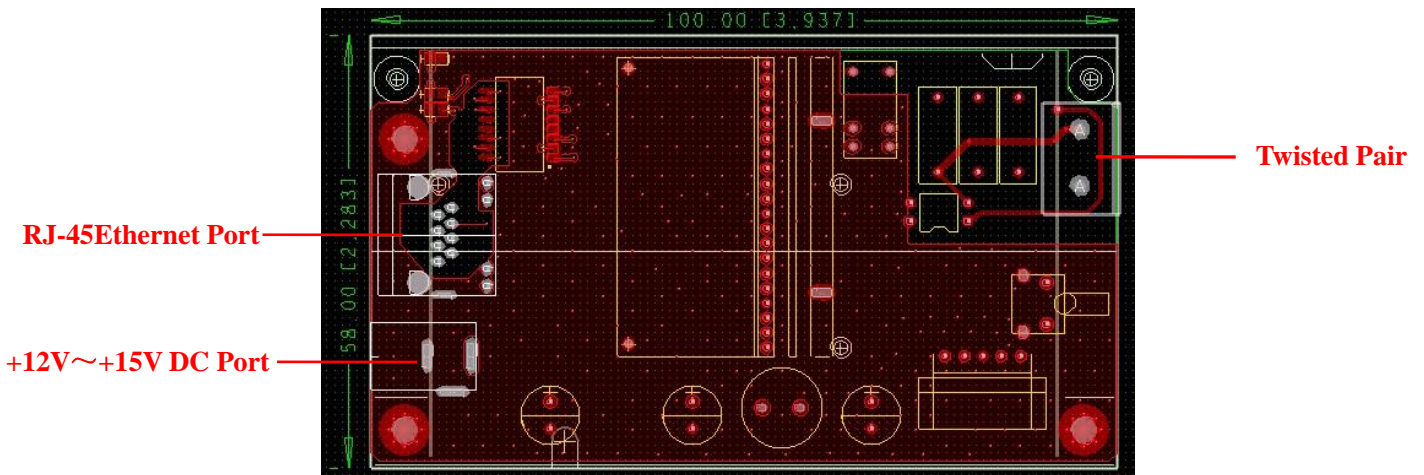


Figure 10  PCB layout of LX-PB

## 12.Key Notes for the PCB Layout

1)  RX+ and RX-,TX+ and Tx-,PERX_P and PERX_N,PETX_P and PETX_N are all the differential signals. We need to follow the differential signal rules when we design the hardware

2)  The width of RX+ and RX-、TX+ and TX- are not less than 20mil.The length of lines are not more than 15mil.

## 13.  Instruction of Transformer winding

Winding method of Transformer TX/RX/PL,shown on figure 11：

### 1. TX WINDING

Prepare 30mm #24 TX wire. Tin 5mm each end as shown. Bend in a tight "U" shape and insert in core as shown. Bend leads at right angle as shown. A drop of adhesive can be applied where indicated if needed. (core appears gray for clarity)

Apply adhesive (optional)

### 2. PL WINDING

Prepare 75mm #32 PL wire. Tin 5mm each end as shown. Starting at the opposite end of the TX leads, wind PL wire through both holes in core 3 times. Pull turns snug against the core.

### 3. RX WINDING

Prepare 100mm #32 RX wire. Tin 5mm each end as shown. Starting at the same end of the TX leads, wind RX wire through both holes in core 4 times. Pull turns gently against the other windings and the core.
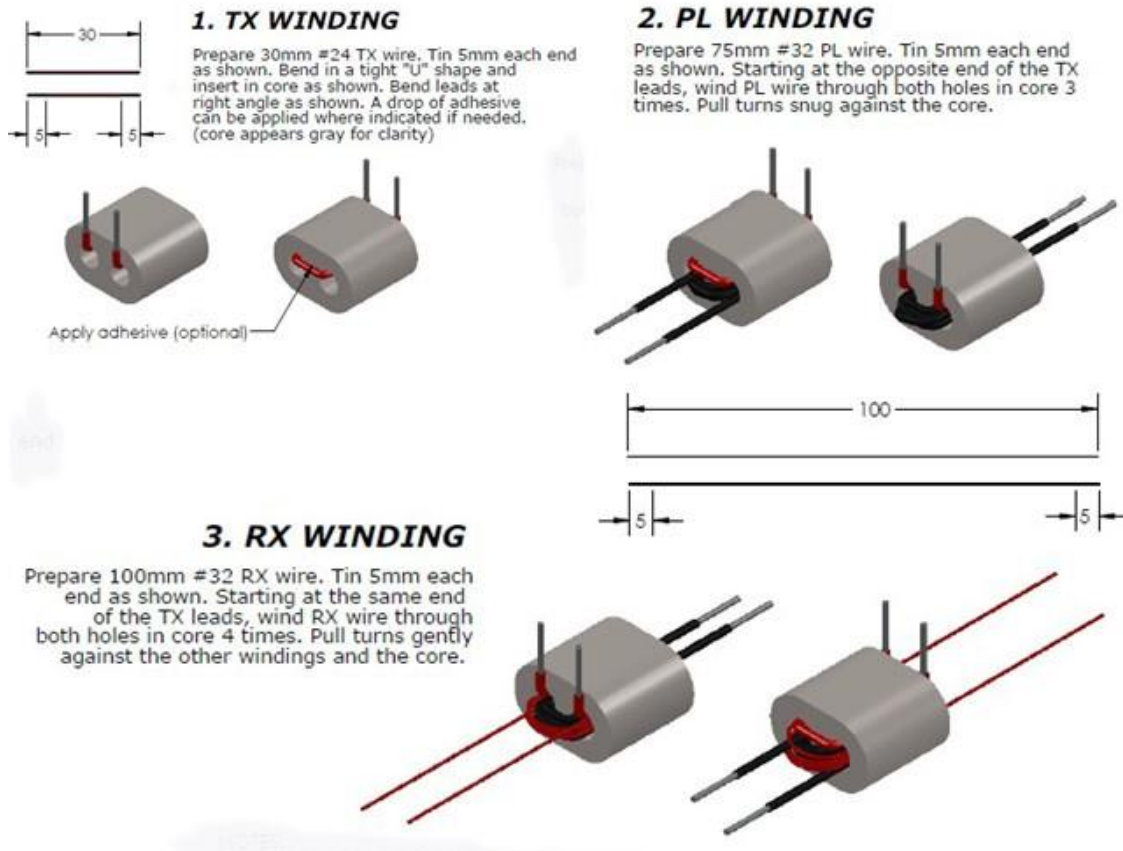
Figure 11 Winding method of Transformer TX/RX/PL

The detail Instruction，shown on figure 12：

NOTES:
1.  DIMENSIONS ARE IN mm.
2.  SEE BILL OF MATERIAL 10005345 FOR PARTS AND MATERIAL DETAILS.
3.  **SPECIFICATIONS:**
    - Frequency Range: 2 to 30 MHz.
    - Turns Ratio: (TX:RX:PL): 1:4:3.
    - TX Winding Inductance: 1.4 uH @ 2 MHz.
    - RX Winding Inductance: 23 uH @ 2 MHz.
    - PL Inductance: 11.7 uH @ 2 MHz.
    - TX Leakage Inductance: 15 nH @ 2 MHz (PL winding shorted).

4.  **MATERIALS:**
    - Core: Fair-Rite Products Corp. Part #: 2843002402.
    - TX Winding: 30mm #24 insulated magnet wire (1 turn). Belden Part # 8052 "Beldsol" dual insulated, polyurethane plus a nylon overcoat.
    - PL Winding: 75mm #32 Tefzel triple insulated UL safety wire (3 turns) Rabudue Wire Co. Part #: T32A01T090-2 (do not substitute).
    - RX Winding: 100mm #32 insulated magnet wire (4 turns). Belden Part # 8056 "Beldsol" dual insulated, polyurethane plus a nylon overcoat.

5.  Finish and length of leads to be adjusted according to installation parameters. Transformer may be mounted on a header if required.

Figure 12 Winding instruction of transformer