

# ARM Cortex A7 Series

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## **Automotive Box-PC 100 / 120, iMX6UL, 500MHz**

PKBA2000 / -1

PKBA2001 / -1

PKBA2002 / -1

PKBA2003 / -1

Version: 04.05.2017

# Reference User Manual

## Release Notes

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Version	Release Date	Notes	By
1.0	October , 2016	The 1 <sup>st</sup> Release to Customer	

## Disclaimer

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# 1 Precautions

## 1.1 Safety Precautions

In order to use this product safely, please take special note of the following precautions.

- Read all product manuals and related documentation before using this product. Use this product correctly and safely. Follow all warnings.
- If operating or extending this product in a manner not described in this manual, please do so at your own risk. Be sure to fully read this manual and other technical information on our website and proceed safely and responsibly.
- Do not install this product in a place with a lot of water, moisture, dust or soot. This could cause product failure, fire, or an electric shock.
- Some parts of this product generate heat and can reach high temperatures. This may cause burns if it is improperly handled. Do not touch the electronic components or surrounding area while powered on or immediately after being turned off.
- Carry out any design and development only after you have thoroughly read and understood this manual and any other related technical materials on the website or in the data sheets. Test your product thoroughly for reliability and safety.
- This product is not intended for applications that require extremely high reliability, safety, functionality and accuracy: including but not limited to medical equipment, traffic control systems, combustion control systems, and safety equipment. This company is not liable for death or injury if used in such systems.
- This product uses semiconductor components designed for generic electronics equipment such as office automation, communications, measurement equipment and machine tools. Foreign noise or a power surge may cause this product to malfunction or fail.
- To ensure there is no risk of bodily harm or property damage, be sure to take all electrical safety precautions such as protection circuits, limit switches, fuse breakers, or redundant systems. Only use the device after sufficient reliability and safety measures are in place.

## 1.2 Write Prohibited Regions

Data stored by the EEPROM, i.MX6 electrical fuse (e-Fuse) is used by the software contained in this product. Do not write to these regions as this may cause the product stop working correctly. Purposely writing to these regions voids the product warranty.

## 1.3 Warranty

As described in the Product Warranty Policy provided with this product, the main board is covered by a one year replacement warranty starting from the time of purchase. Please note that the other included goods and software are not covered under this warranty. Some knowledge used by DELTA COMPONENTS is provided by third parties, and DELTA COMPONENTS makes no representation or warranty as to the accuracy of such information.

## 2 Product Features

### 2.1 Overview

The Automotive Box-PC 100/120 is a communication gateway designed for in-vehicle applications or IOT (Internet of Things) applications. The Automotive Box-PC 100/120 offers some unique features, including the latest NXP iMX6UL (ARM Cortex-A7) quad or dual cores application processor, an LTE modem socket with dual-sim card holder, a ublox GPS receiver, G-sensors, and software controlled power on/off.

With the latest Android/Linux kernel and tools, the Automotive Box-PC 100/120 allows users to design and deploy custom software for various applications, such as vehicle tracking, fleet management and IOT communication gateway.

The Automotive Box-PC 100 series of products include the following models:

#### PKBA2000/-1

Automotive Box-PC 100, ARM Cortex A7 iMX6UL, 500MHz QuadCore  
256MB DDR3, 512MB NAND, LAN, 3G Q69, GPS, Yocto, CAN, (Overvoltage Prot.)

#### PKBA2001/-1

Automotive Box-PC 100, ARM Cortex A7 iMX6UL, 500MHz QuadCore  
256MB DDR3, 512MB NAND, LAN, 3G Q69, GPS, Yocto, CAN, WiFi/BT, (Overvoltage Prot.)

#### PKBA2002/-1

Automotive Box-PC 120, ARM Cortex A7 iMX6UL, 500MHz QuadCore  
256MB DDR3, 512MB NAND, LAN, 3G Q69, GPS, Yocto, CAN, w/ Battery Kit, (Overvoltage Prot.)

#### PKBA2003/ -1

Automotive Box-PC 120, ARM Cortex A7 iMX6UL, 500MHz QuadCore  
256MB DDR3, 512MB NAND, LAN, 3G Q69, GPS, Yocto, CAN, WiFi/BT, w/ Battery Kit,  
(Overvoltage Prot.)

## 2.2 Features and Specifications

### Features

- ARM Cortex processor with Linux enables quick software development and deployment
- 9-36V wide input voltage range for vehicle application
- Photo-coupled GPIO for vehicle sensor monitoring
- Sample OpenGTS server software for remote server demonstration
- ([optional](#)) Bluetooth interface to support BT-based ([optional](#)) OBD2 module

### Hardware Specifications

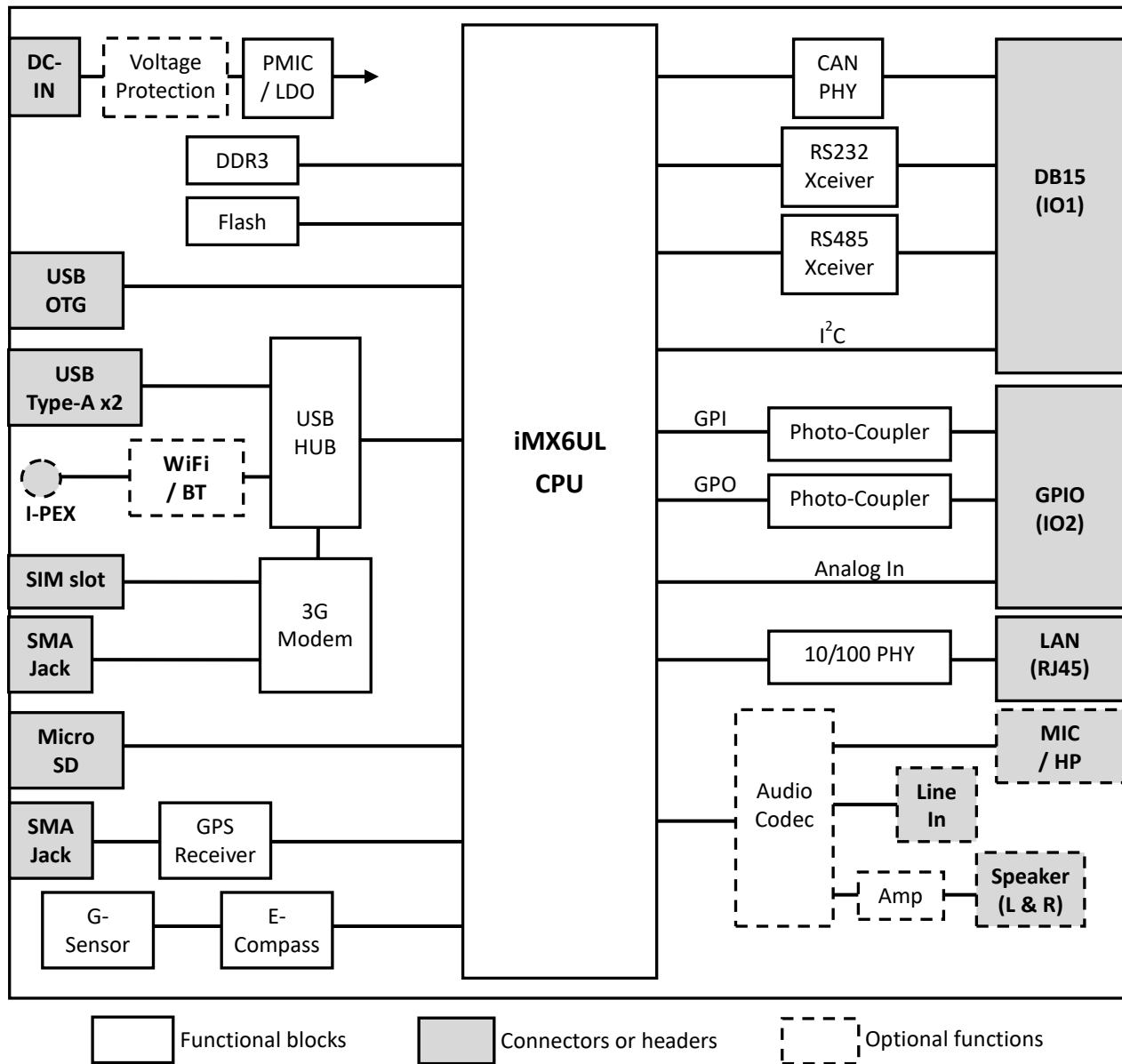
- NXP iMX6UL ARM Cortex™-A7 core @ 500MHz
- 256MB DDR3 + 512MB Flash
- 9V-36V DC power input
- ([optional](#)) DC power input with over-voltage protection
- USB 2.0 host port x2 + USB 2.0 OTG port x1
- Micro SD card socket x1
- GPS receiver x1
- 3G (WCDMA) x1
- 3-Axis G-sensor x1 + E-compass x1
- RS485 port x1 + RS232 port x1
- CAN bus x 1
- I<sup>2</sup>C port x1
- Photo coupler GP Input x 10 + Photo coupler GP Output x 2
- Analog input x 2
- 10/100 Mbps Ethernet (RJ-45) x1
- 3.7V/2350mAh Battery Kit x1 (**Automotive Box-PC 120 only**)
- Audio (MIC and Headphone) ([optional](#))
- 802.11b/g/n Wifi and Bluetooth 4.0 ([optional](#))
- Dimension: 125mm x 147mm x 41mm (L x W x H)

### Software Specifications

- Yocto 1.8 (Linux kernel 3.14)

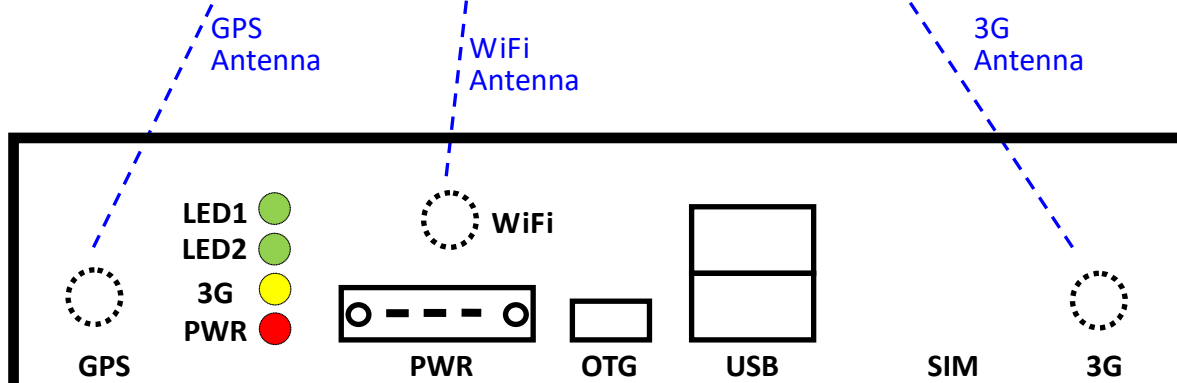


## 2.3 Block Diagram

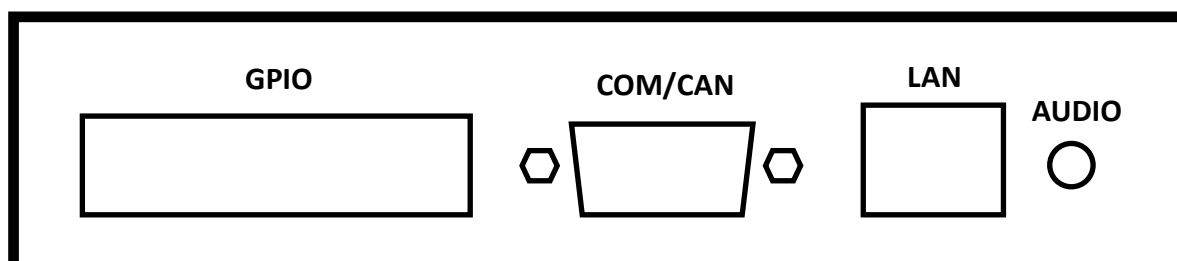


# 3 Functional Descriptions

The following photos and diagrams show connector positions on the Automotive Box-PC 100/120 series of products. The functional details of the connectors are described in subsequent sections.



Front Panel

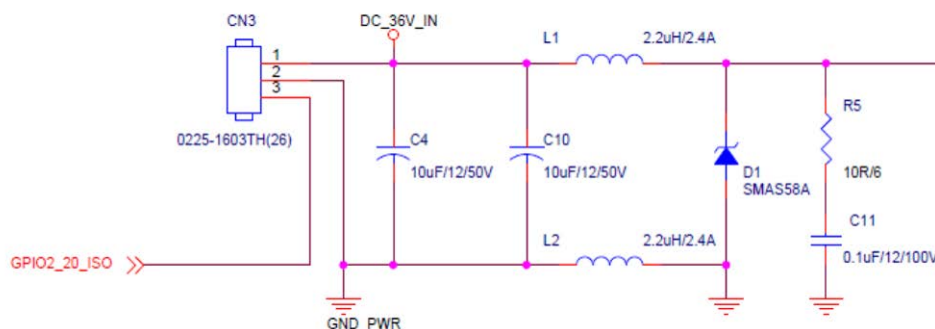


Rear Panel

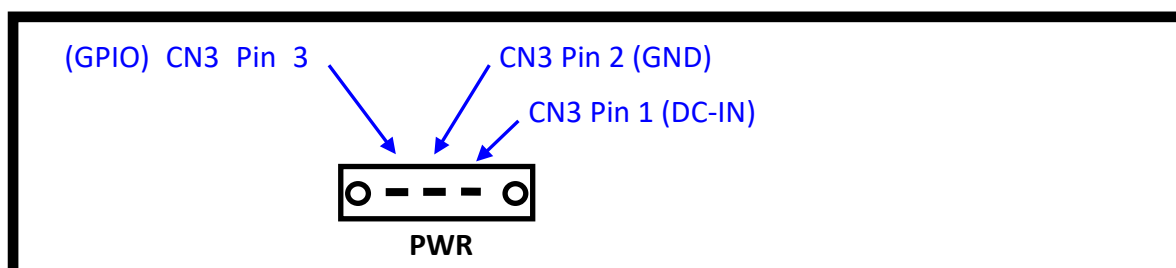
### 3.1 Power Supply (DC-IN connector)

The Automotive Box-PC 100/120 power input should be applied to the 3-pin DC-IN connector (CN3). Refer to Appendix C for DC-IN **mating** connector specification.

Refer to Appendix D for DC-IN connector specification.

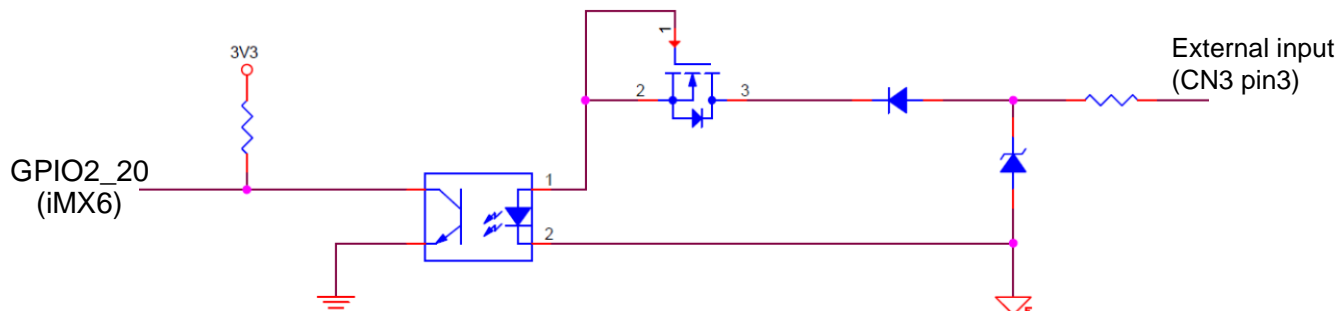


The input voltage can be in the range of DC 9V-36V. An Over-Voltage-Protection circuit is implemented to protect Automotive Box-PC 100/120 from over voltage damage.



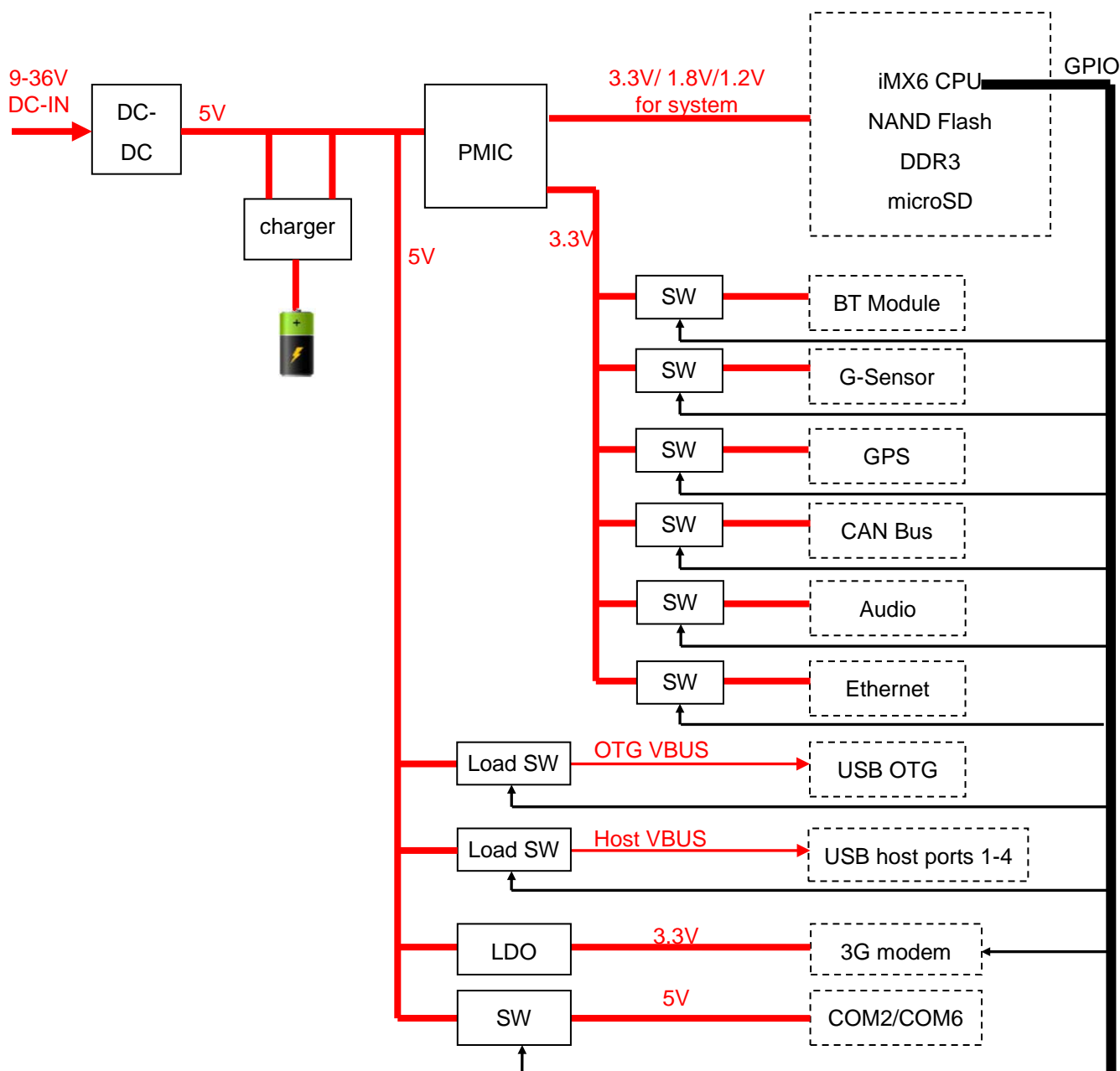
The pin 3 of DC-IN connector is a photo-coupled input for general purpose digital input (e.g, vehicle power ignition signal, etc). The input is directly connected to iMX6UL CPU GPIO2\_20 (pad name: SD1\_DATA2).

The photo-coupled digital input schematic is shown below. The external digital input is 5~36V for logic high and 0V for logic low. Refer to Appendix A for brief specification of the photo-coupler.



## 3.2 System Power Management

The following diagram shows Automotive Box-PC 100/120 peripherals power tree. The power supply of each peripheral module is with an on/off switch controlled by a GPIO from i.MX6UL CPU. The GPIO is used to turn on/off power switch for power saving.



iMX6UL Pad Name	Functions
SNVS_TAMPER0	GPS module power on/off
SNVS_TAMPER1	WiFi/Bluetooth power on/off
SNVS_TAMPER2	G-Sensor/e-Compass power on/off
SNVS_TAMPER3	COM port (RS232/RS485) power on/off
SNVS_TAMPER4	CAN bus power on/off
SNVS_TAMPER5	LAN power on/off
SNVS_TAMPER6	Audio codec & Amp power on/off
GPIO1_IO02	Power on/off : +5V host power & USB Hub & USB host ports 1~4 (2x USB type A, 3G; WiFi)
GPIO1_IO04	USB OTG power on/off
GPIO1_IO08	3G modem wake up
GPIO1_IO09	3G module power on/off

There is limitation on using GPIO to turn on/off peripherals power supply. Incorrect use of GPIO could result to malfunction of peripherals or unstable system.  
Please contact us for information on the GPIOs.

### **CPU Sleep Mode**

iMX6UL can enter sleep mode by using the following command in Linux:

```
// Linux command to let CPU enters sleep mode
echo mem > /sys/power/state      // sleep mode
```

### **Wake Up CPU**

To wakeup CPU after a period of time, use the following command (before sleep mode):

```
// Linux command to wake up CPU in 60 seconds
echo +60 > /sys/class/rtc/rtc0/wakealarm      // wake up CPU in 60 seconds
```

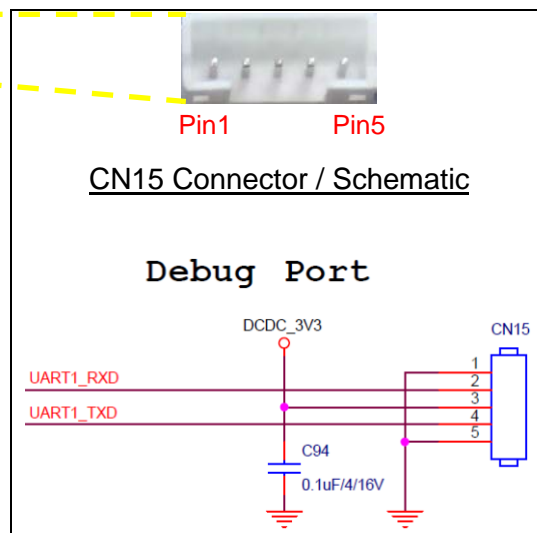
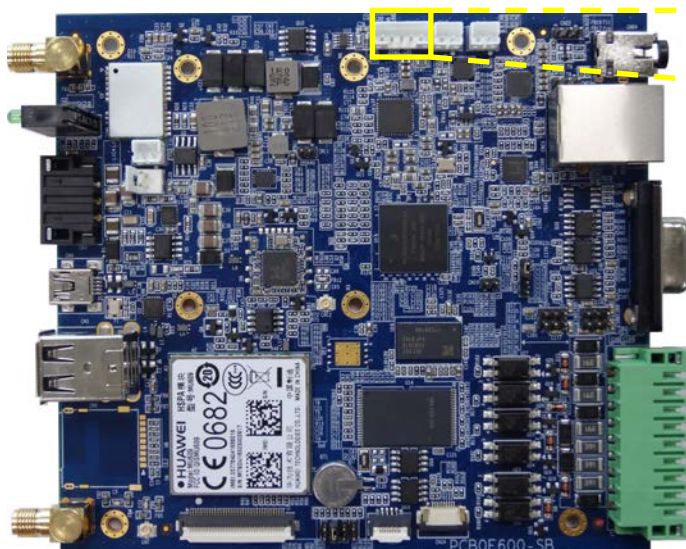
To wakeup CPU by hardware signal, please refer to Section 3.5 GPIO connector: ONOFF pin.

### 3.3 Console and Debug Port

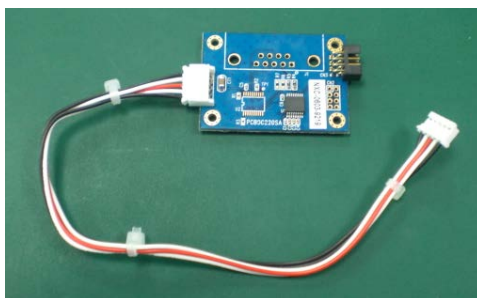
The console port (or debug port) is located inside Automotive Box-PC 100/120 box (CN15 of Automotive Box-PC 100/120 PCBA).

Follow steps below to setup console port:

- Find CN15 console port connector on Automotive Box-PC 100/120 PCB.



- Make sure you have C220 debug board and cable. Note that C220 board is not part of the Automotive Box-PC 100/120 product. It has to be purchased separately.
- Connect C220 debug board cable to Automotive Box-PC 100/120 PCB CN15.

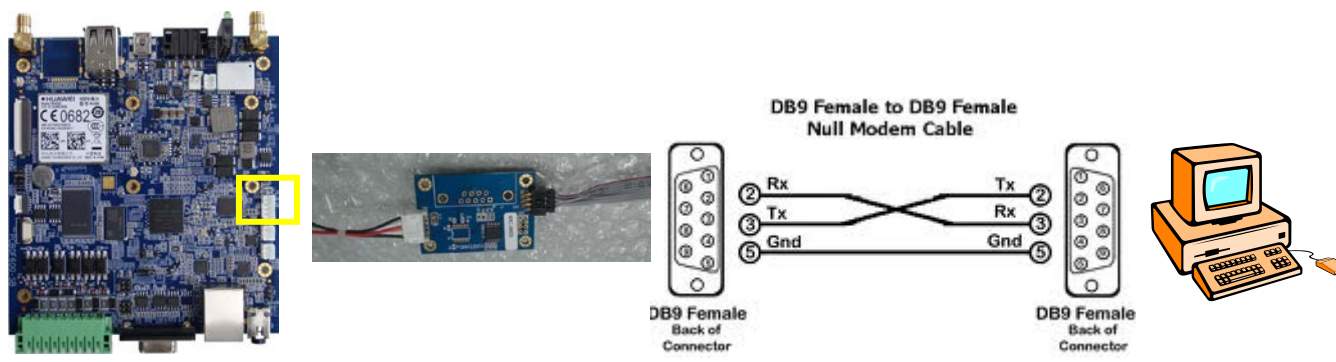
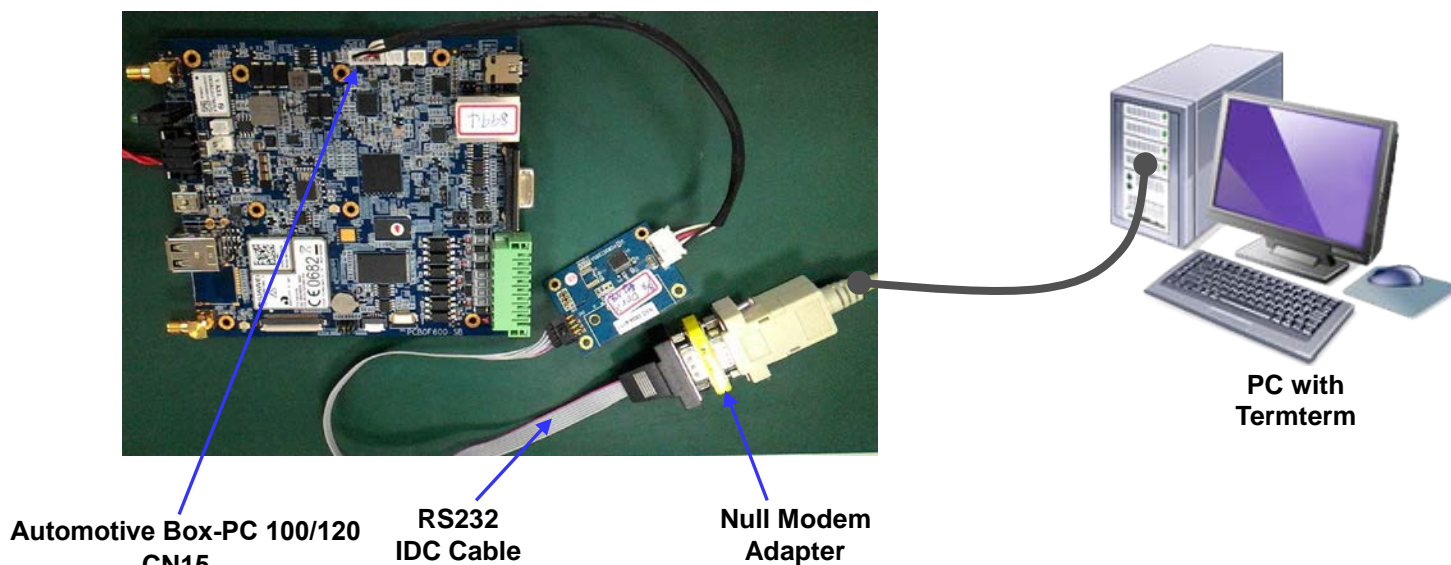


- Connect the RS232 IDC cable to C220 debug board 2x4 box header (black connector):





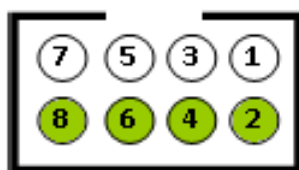
- A DB9 **null modem cable** (or adapter) is required when you want to connect console port to a PC with terminal emulation software such as TeraTerm.
- Turn on PC, run the terminal emulation program (e.g. **TeraTerm**), and open TeraTerm COM port.



- Set COM port at **Baud Rate 115200, 8 data bits, no parity, 1 stop bit and no flow control.**
- After the above connection/setting, you will see Linux console prompt "\$" in the PC TeraTerm.

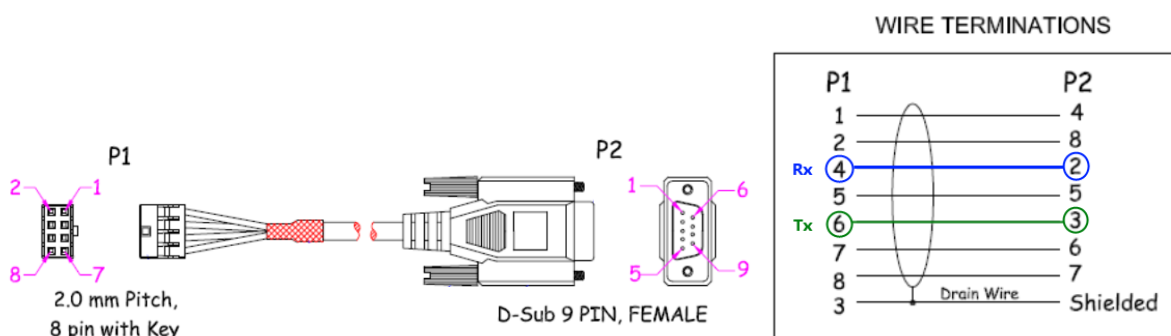
### **Pin Assignment: RS232 IDC Cable and Null Modem Adapter**

- ☐ Console box header (CN3 on C220 board) pin assignment

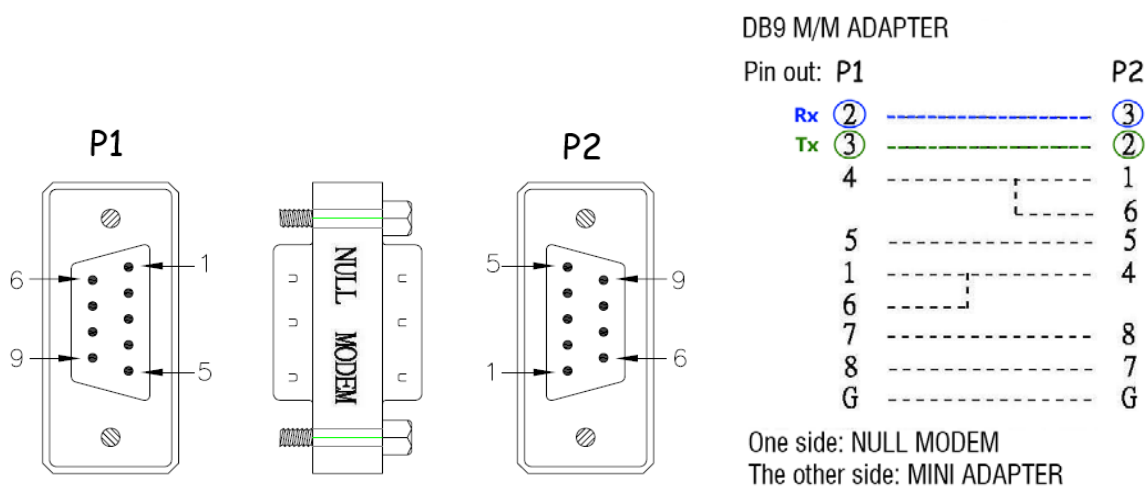


2 : CTS    6 : Tx  
 4 : Rx    8 : RTS

■ RS232 IDC cable: pin header for DB9



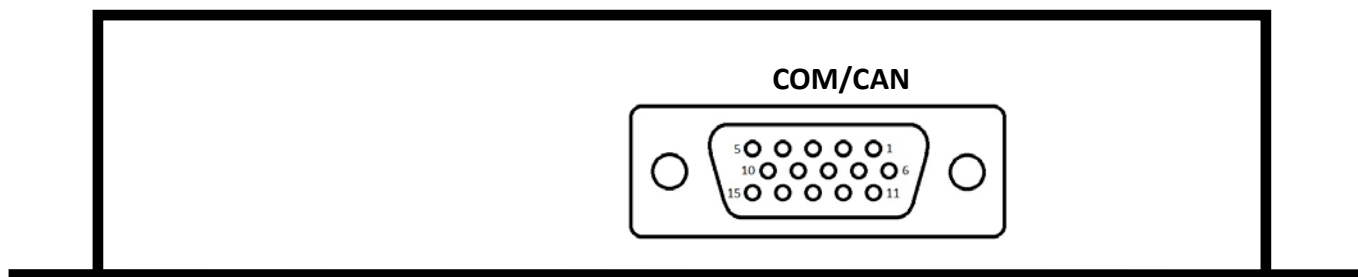
■ Null modem adapter: male-to-male for DB9



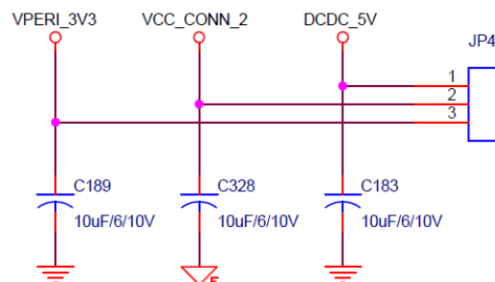
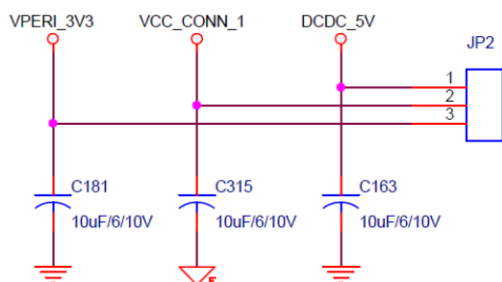
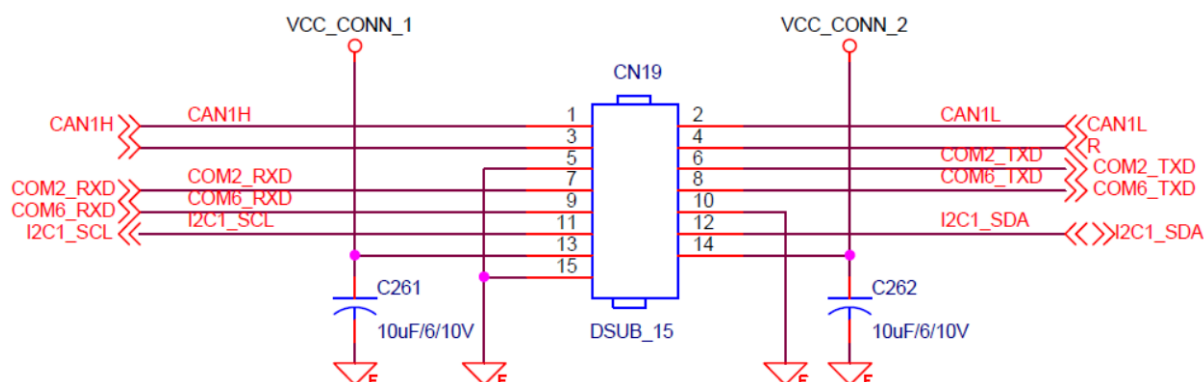


### 3.4 IO1 (COM/CAN) Connector

The IO1 connector is a DB15 female connector at the rear side of Automotive Box-PC 100/120.



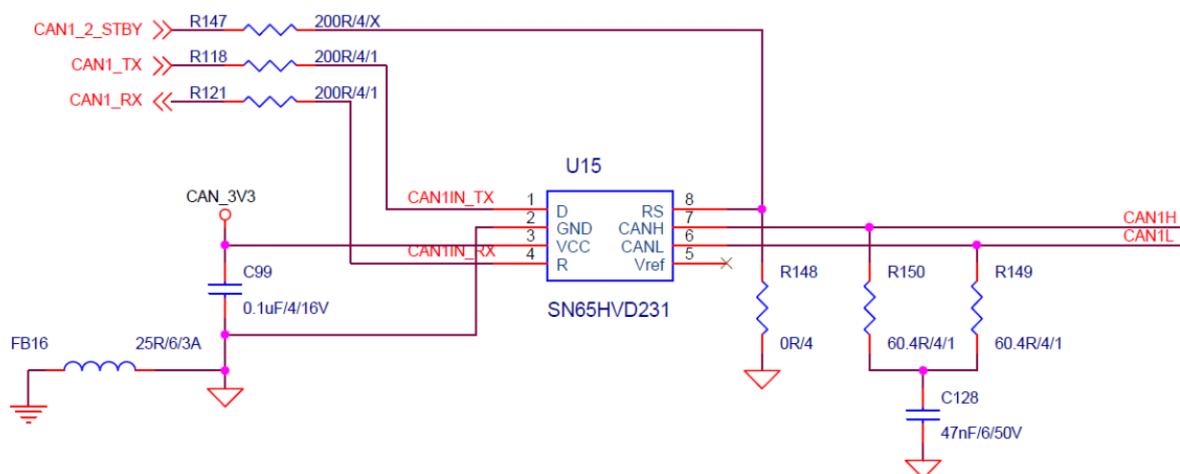
The schematic IO1 connector:



1x CAN2.0B bus interfaces, 2x COM port (RS232/ RS485), I<sup>2</sup>C bus and power pins are available on the IO1 connector. On the standard Automotive Box-PC 100/120 hardware, COM2 is configured as RS232 and COM6 is configured as RS485 port. Both COM2 and COM6 can be configured as either RS232 or RS485 port (on ordering Automotive Box-PC 100/120 products).

I/O functions	Pin Number	Available Signals	Notes
CAN1	1 2	CANH, CANL	CAN 2.0B protocol
Reserved	3 4	Reserved	<b><u>Do not connect</u></b>
COM2 (RS232)	6 7	TXD, RXD	COM2_TXD = 485- COM2_RXD = 485+
COM6 (RS485)	8 9	485- 485+	COM6_RXD = 485- COM6_TXD = 485+
I <sup>2</sup> C Bus	11 12	SCL SDA	--
PWR	13 14	3.3V/5V	3.3V/5V configured by JP2 and JP4 (default +5V)

## Schematic of CAN1 bus



### Reserved Pins:

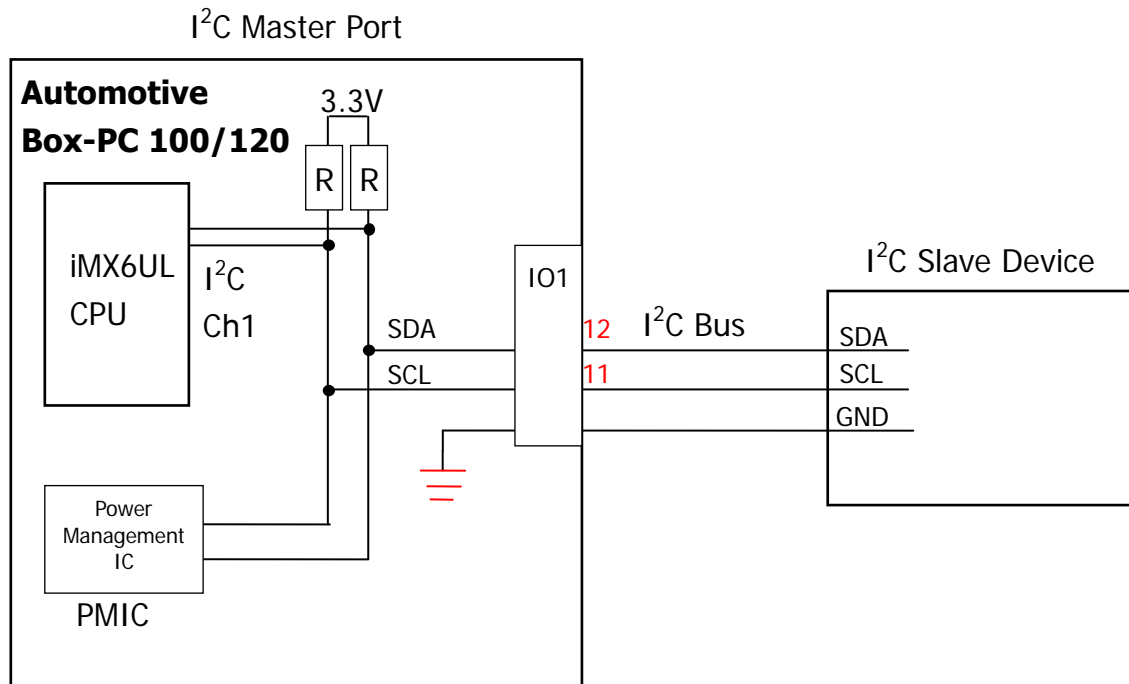
I/O functions	Pin Number	Available Signals	Notes
Reserved	3 4	Reserved	<b><u>Do not connect</u></b>

Pin3 and Pin4 are reserved for expansion of one additional CAN bus (CAN2) or one additional COM port (RS232 or RS485). Contact us for details of the expansion.

## I<sup>2</sup>C Bus

The I<sup>2</sup>C works as a master port by default: The master port is pulled high to +3.3V with 2 resistors internally. The slave devices have to be connected directly without additional power supply on I<sup>2</sup>C bus.

The I<sup>2</sup>C interface is connected to iMX6UL I<sup>2</sup>C channel 1 and shared the same bus with on-board power management IC.



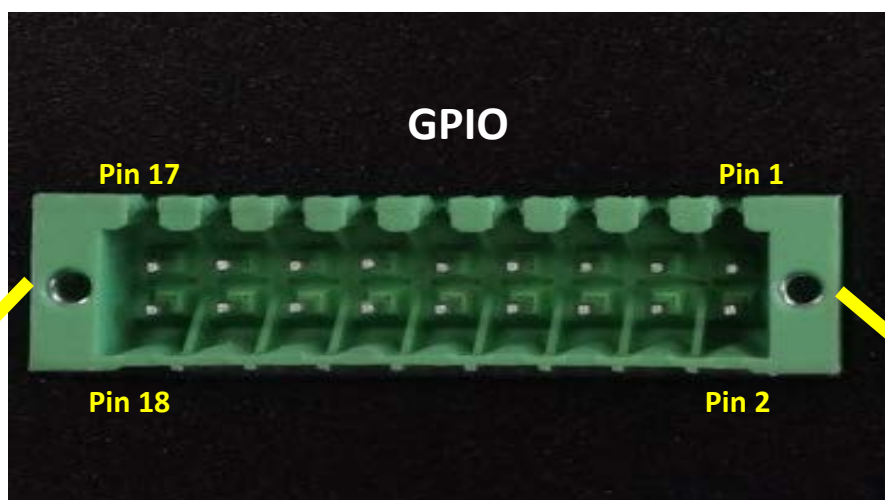
### 3.5 IO2 (GPIO) Connector

The IO2 is an 18-pin connector mainly for GPIO.

Refer to Appendix E for IO2 (GPIO) **mating** connector specification.

Refer to Appendix F for IO2 (GPIO) connector specification.

The connector pin assignment and pin functions are in the following table and diagrams:



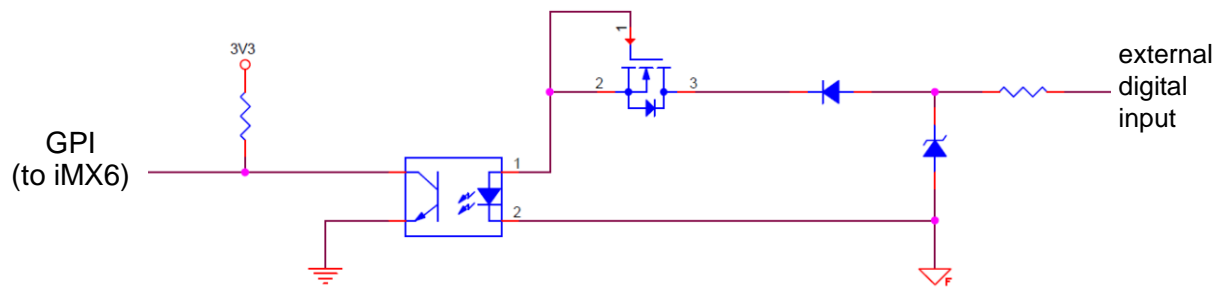
Pin 17	15	13	11	9	7	5	3	Pin 1
<b>GND</b>	<b>PWR (+5V)</b>	GPO (GPIO2_15)	Ain (ADC1_IN7)	<b>ONOFF</b>	Ain (ADC1_IN6)	GPO (GPIO2_10)	<b>PWR (+5V)</b>	<b>GND</b>
Pin 18	16	14	12	10	8	6	4	Pin 2
GPI (GPIO2_21)	GPI (GPIO4_28)	GPI (GPIO4_27)	GPI (GPIO4_26)	GPI (GPIO4_25)	GPI (GPIO4_24)	GPI (GPIO4_23)	GPI (GPIO4_22)	GPI (GPIO4_21)

GPIO Name	iMX6 Pad Name
GPIO4_21	CSI_DATA00
GPIO4_22	CSI_DATA01
GPIO4_23	CSI_DATA02
GPIO4_24	CSI_DATA03
GPIO4_25	CSI_DATA04
GPIO4_26	CSI_DATA05

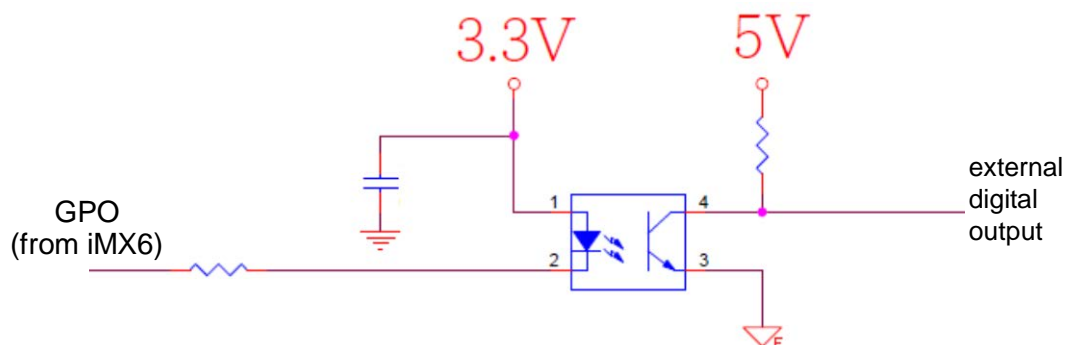
GPIO Name	iMX6 Pad Name
GPIO4_28	CSI_DATA07
GPIO2_21	SD1_DATA3
GPIO2_10	ENET2_TX_EN
ADC1_IN6	GPIO1_IO06
ADC1_IN7	GPIO1_IO07
GPIO2_15	ENET2_RX_ER

GPIO4_27	CSI_DATA06		
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Each GPI is a photo-coupled (5K V rms) digital input with schematic shown below. The external digital input is clamped to 36V by a voltage suppressor. Refer to Appendix A for brief specification of the photo-coupler.



Each GPO is a photo-coupled digital output with schematic shown below. The GPO is directly from iMX6 CPU and output level is pulled-up to 5V.



**Note: When iMX6UL enters sleep mode, all GPO will become “low” state. There is no latch function in the GPO to keep output state.**

The Ain pins (ADC1\_IN6 and ADC1\_IN7) are connected directly to iMX6UL ADC converter (pad name: GPIO1\_IO06 and GPIO1\_IO07). For more information on ADC, refer to iMX6UL manual for “Analog-to-Digital Converter”.

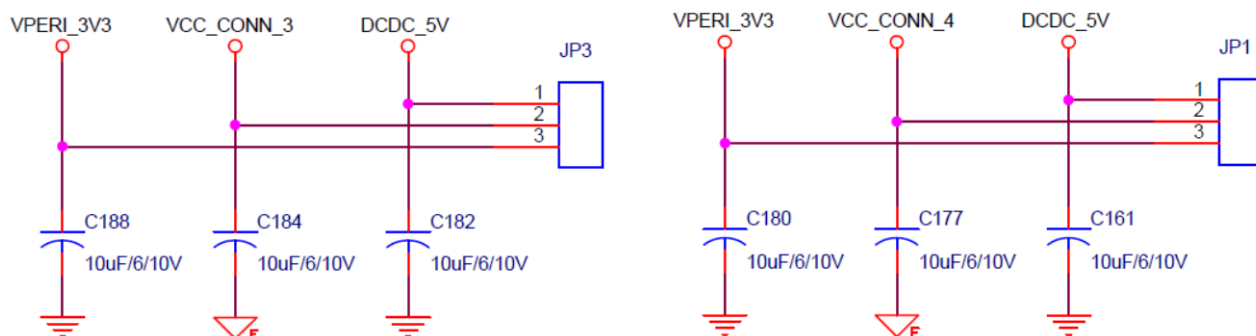
**Table 13-1. ADC External Signals (continued)**

Signal	Description	Pad	Mode	Direction
ADC1_IN4	Analog channel 1 input 4	GPIO1_IO04	No Muxing	I
ADC1_IN5	Analog channel 1 input 5	GPIO1_IO05	No Muxing	I
ADC1_IN6	Analog channel 1 input 6	GPIO1_IO06	No Muxing	I
ADC1_IN7	Analog channel 1 input 7	GPIO1_IO07	No Muxing	I
ADC1_IN8	Analog channel 1 input 8	GPIO1_IO08	No Muxing	I
ADC1_IN9	Analog channel 1 input 9	GPIO1_IO09	No Muxing	I

### **PWR pin**

Connector pins 3 and 15 are power supply pins. The voltage level can be selected from JP3 or JP5. Default voltage is +5V.

Use JP3 to select pin 3 voltage level, and use JP1 to select pin 15



### **ONOFF pin**

The ONOFF pin is used to wake up CPU (if CPU is in sleep mode) or to reset CPU.

The ONOFF pin in “low” logic (short to ground) in between 750ms and 5 seconds will wake up iMX6UL CPU from sleep mode.

The ONOFF pin in “low” logic (short to ground) greater than 5 seconds will result in hardware reset to iMX6UL CPU.

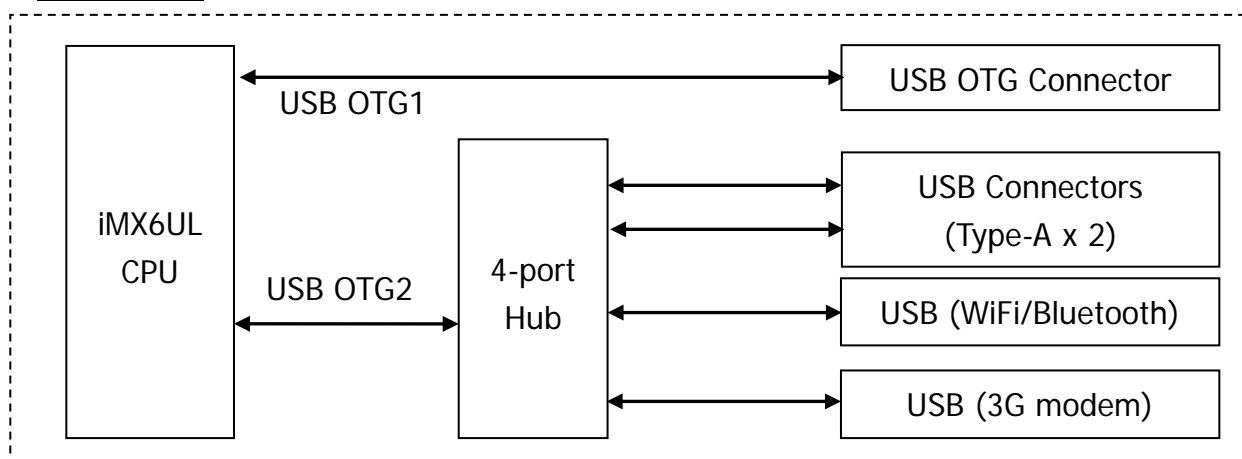
Please refer to Section 3.1 about how to let iMX6UL enters sleep mode.

## 3.6 USB Connectors

The USB interfaces on Automotive Box-PC 100/120 include a USB OTG port and two USB host ports. All USB ports support 480Mbps high speed.

The iMX6UL USB OTG2 is configured as a host interface and connected to a hub controller to extend host ports. Two of the USB hub ports are available in standard Type A connectors for external connection. The other two USB ports are used by Bluetooth and 3G modem.

### USB Port:



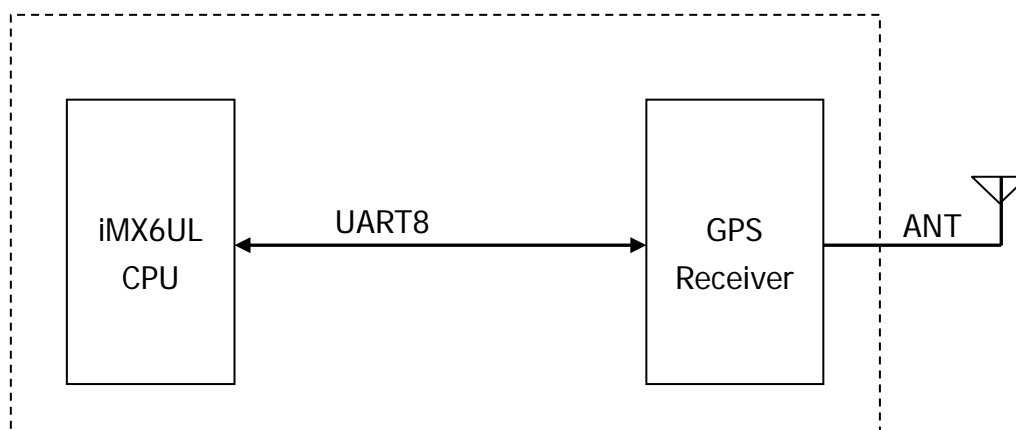
**NOTE:** The USB 2.0 OTG can be used in host mode or device mode. If you would like to use it in host mode, a separate OTG-to-host cable is required.

The USB host connector is a standard USB type A connector that can be connected to +5V USB storage device. This port is mainly used to connect to USB flash drive.

2x GPIO are used to turn on/off USB OTG1 and USB OTG2 for power saving. Refer to Section 3.1 for more information on USB power GPIO.

## 3.7 GPS Receiver

The GPS receiver function is implemented by a u-blox 7 GNSS chip (UBX-G7020-KT). It is connected to iMX6UL via UART8 serial interface.



The brief characteristic of the receiver is in the table below:

Receiver type	56 channel (GPS, GLONASS)
Navigation update rate	Up to 10Hz
Protocol	NEMA 0183 v2.3
Accuracy	Position : 2.5m (GPS), 4m (GLONASS); SBAS: 2.0m
Acquisition	Cold Start: 29 seconds; Hot Start: 1 seconds
Sensitivity	Tracking: -162dBm Cold Starts: -148dBm Reacquisition: -160dBm
Supply Voltage	1.4V to 3.6V
Power Consumption	41mW @ 1.4V (Continuous) 9mW @ 1.4V Power Save mode
Operating temp	-40°C to 85°C

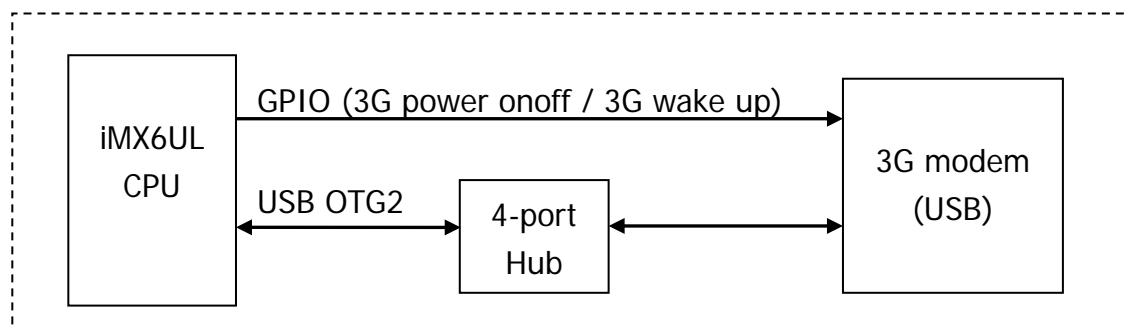
For more information about UBX-G7020-KT chip, please check it on u-blox web site.



### 3.8 3G (WCDMA) modem

The Automotive Box-PC 100/120 3G (WCDMA) modem is connected to iMX6 CPU through USB port. Two GPIO pins are used to control 3G modem for power saving:

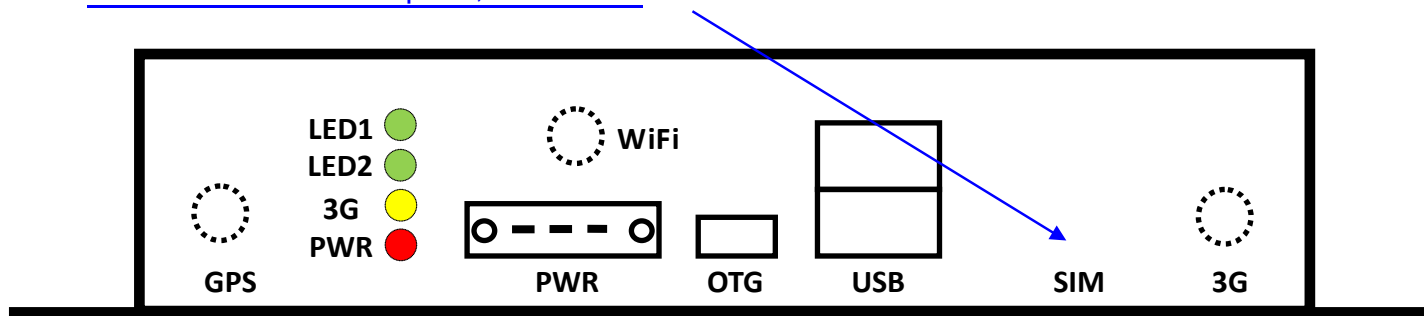
iMX6UL Pad Name	Functions	Affected Devices
GPIO1_IO08	3G Wake up	3G modem
GPIO1_IO09	3G module power on/off	3G modem



The 3G modem are available in 3 options as in the table below:

Order Code	3G Bands	2G Bands	3G Speed	Suggested Area
-D72	UMTS/HSPA Dual Band 900/2100Mhz	GSM/GPRS 850/900/ 1800/1900Mhz	UL: 5.76Mbps DL: 14.4Mbps	European , China
-D76	UMTS/HSPA Triple Band 850/1900/2100Mhz	GSM/GPRS 850/900/ 1800/1900Mhz	UL: 5.76Mbps DL: 14.4Mbps	Asia, Latin America
-Q69	UMTS/HSPA Quad Band 850/900/1900/2100Mhz	GSM/GPRS 850/900/ 1800/1900Mhz	UL: 5.76Mbps DL: 14.4Mbps	North America, Worldwide

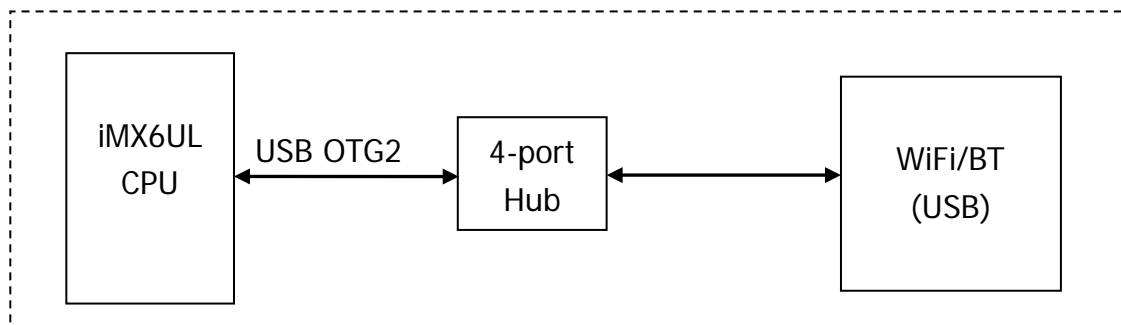
To insert SIM card to Automotive Box-PC 100/120, you have to unscrew and open Automotive Box-PC 100/120 front plate, locate SIM slot at the area marked with "SIM":



Front Panel

### 3.9 WiFi and Bluetooth (optional)

The Automotive Box-PC 100/120 WiFi and Bluetooth module is connected to iMX6 CPU through USB port. The WiFi and Bluetooth is based on an RTL8723 wifi/bt combo chip.

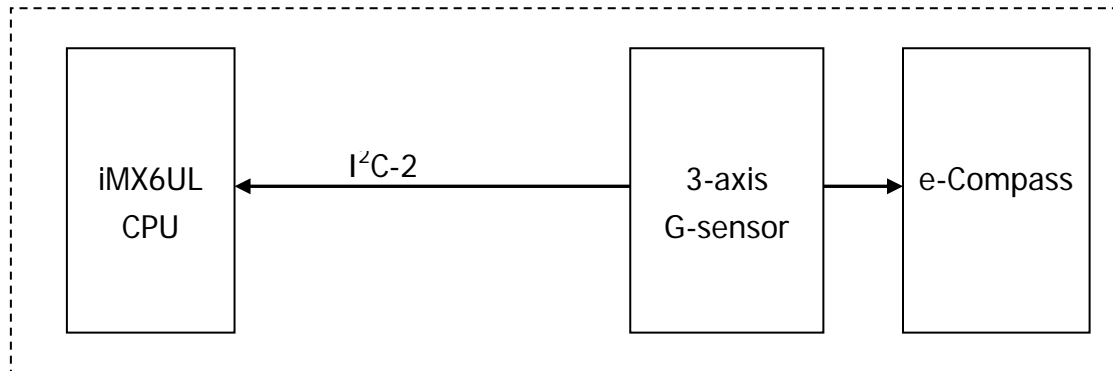


Function	Features
WiFi	<ul style="list-style-type: none"> <li>● 802.11b/g/n (2.4GHz)</li> <li>● Software AP mode</li> <li>● WPA security</li> </ul>
Bluetooth	<ul style="list-style-type: none"> <li>● BT v2.1, EDR/BT v3.0, HS/BT 4.0, BLE 4.0 (2.4GHz)</li> <li>● Pico Net, Scatter Net</li> <li>● Simple pairing security</li> </ul>

### 3.10 G-Sensor & e-Compass

The Automotive Box-PC 100/120 has built-in 3-axis G-sensor and e-compass functions. The 3-axis G-sensor function is based on NXP MMA8451QT chip and e-compass function is based on NXP MAG3110 chip.

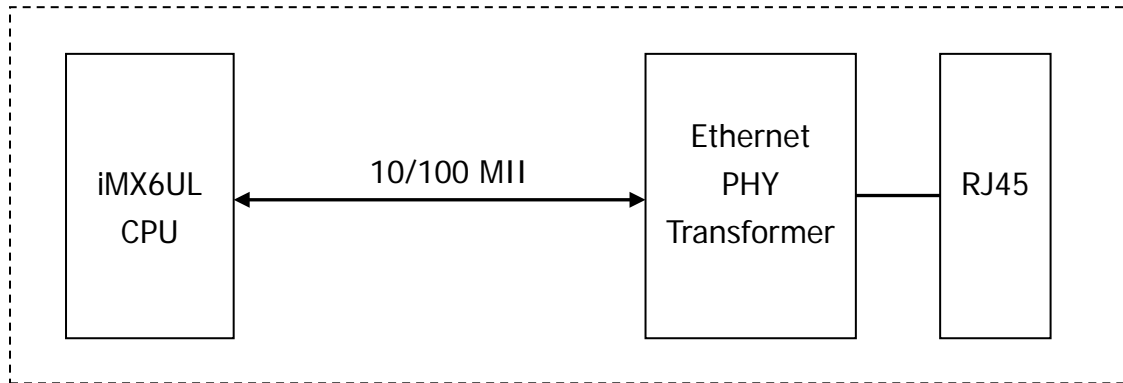
Both chips are connected to iMX6UL cpu via I<sup>2</sup>C bus channel 2.



For more information about G-sensor and e-Compass, refer to NXP product data sheet.

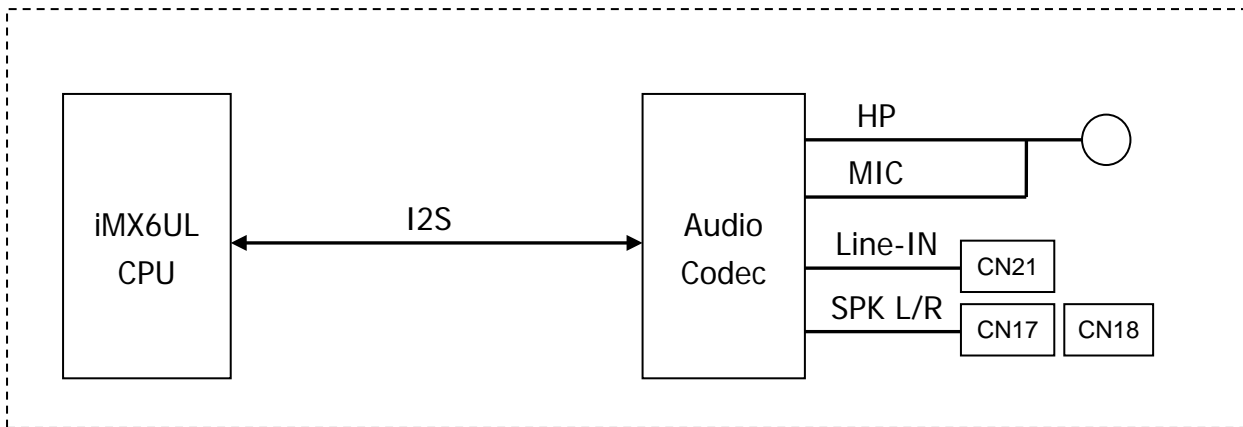
### 3.11 Ethernet

The Automotive Box-PC 100/120 is with a 10/100Mbps Ethernet interface on the industrial standard RJ45 connector.

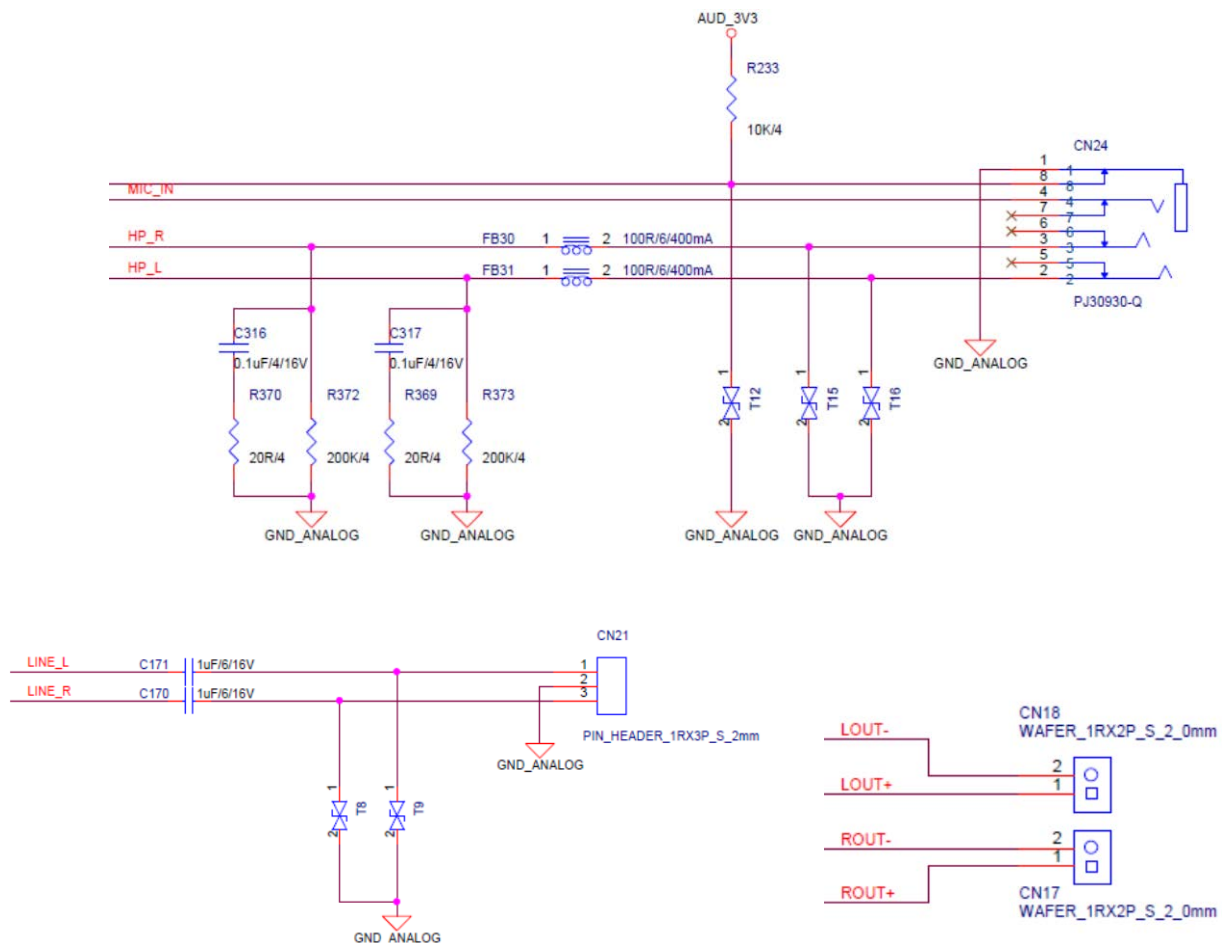


## 3.12 Audio (optional)

The Automotive Box-PC 100/120 audio interface is with 1x audio jack available for external headphone and microphone.



The line-in and speaker interfaces are at CN21, CN17 and CN18 connectors on Automotive Box-PC 100/120 PCB. The schematics are here:



### 3.13 Unique Board ID

Each Automotive Box-PC 100/120 product is with a “Guaranteed Unique 72-bit Serial Number”. The unique serial number allows software developer to protect their software by the unique number.

Please contact us for more information about how to read serial number from software.

## 3.14 LED

There are 4x LEDs at the Automotive Box-PC 100/120 front panel:



- When DC power is applied, PWR LED is on
- LED2 is connected to GPIO2\_19, and can be turned on/off by software.
- LED1 is connected to GPIO2\_18, and can be turned on/off by software.
- 3G LED mode is in below table:

Mode	Operating Status	LED ON/OFF
1	No service/Restricted service	ON(0.1s) - OFF(0.1s) - ON(0.1s) - OFF(1.7s) 2-second cycle
2	Register to the network	ON(0.1s) - OFF (1.9s) 2-second cycle
3	Dial-up successfully	ON

When Automotive Box-PC 100/120 is connected to 3G network, the LED is ON.  
In searching 3G network, the LED keeps blinking.

// Linux commands to turn on/off LED1 or LED2:

```
echo 1 > /sys/class/leds/led1/brightness // led1 off
echo 0 > /sys/class/leds/led1/brightness // led1 on
```

```
echo 1 > /sys/class/leds/led2/brightness // led2 off
echo 0 > /sys/class/leds/led2/brightness // led2 on
```

### 3.15 MicroSD Connector

The microSD host connector is an industrial standard connector and has the following specification:

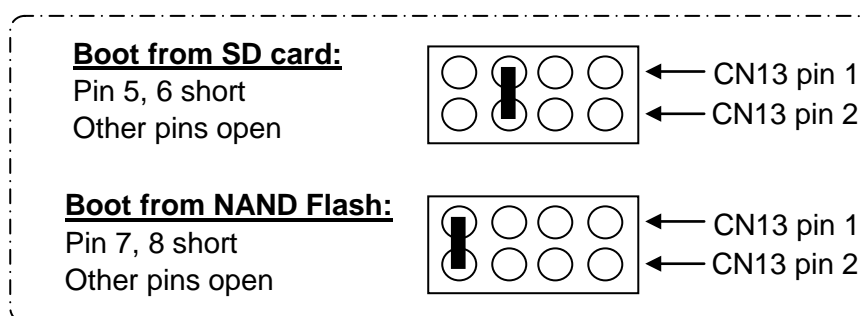
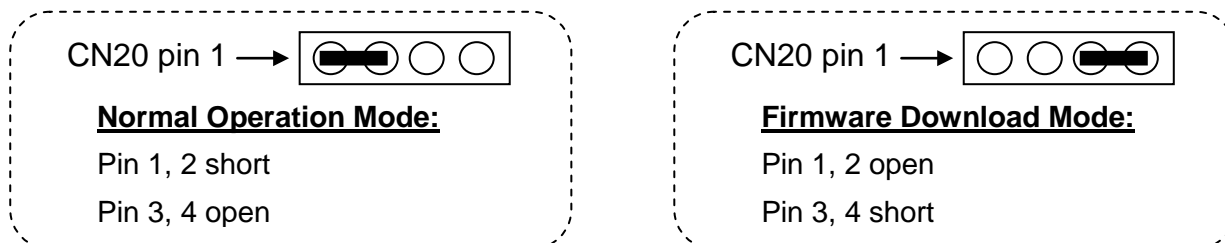
- SD Host Controller Standard Specification version 3.0
- MMC System Specification version 4.2/4.3/4.4
- SD Memory Card Specification version 3.0 and supports the Extended Capacity SD Memory Card
- SDIO Card Specification version 3.0

The microSD connector is located inside the Automotive Box-PC 100/120, and can be configured as a boot device or a normal storage device.



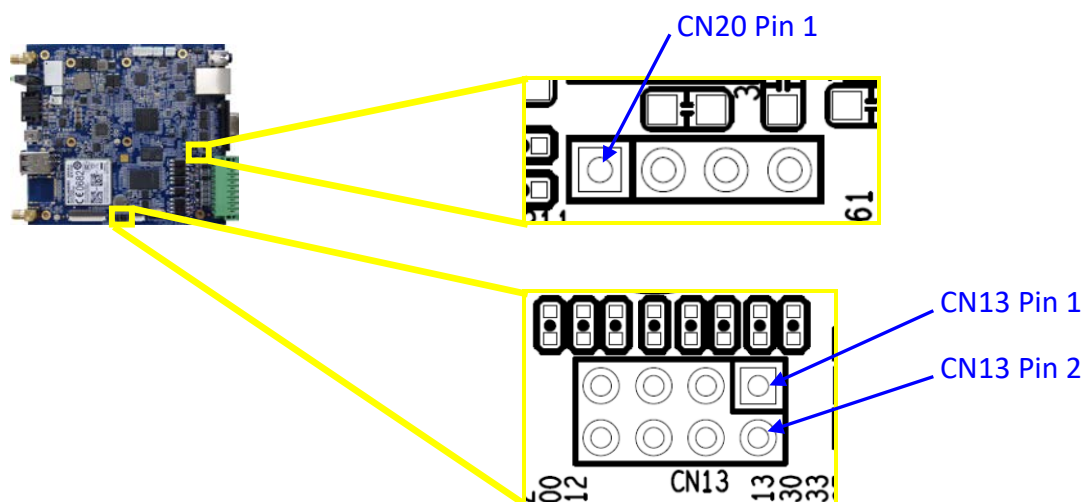
### 3.16 BM Connectors (Boot Device & Firmware Update)

The CN20 pin header is used to select the Automotive Box-PC 100/120 operation mode: Normal Operation mode or Firmware Download mode.



The CN13 pin header is to select boot device. Set CN13 to boot Automotive Box-PC 100/120 from either NAND flash or microSD card.

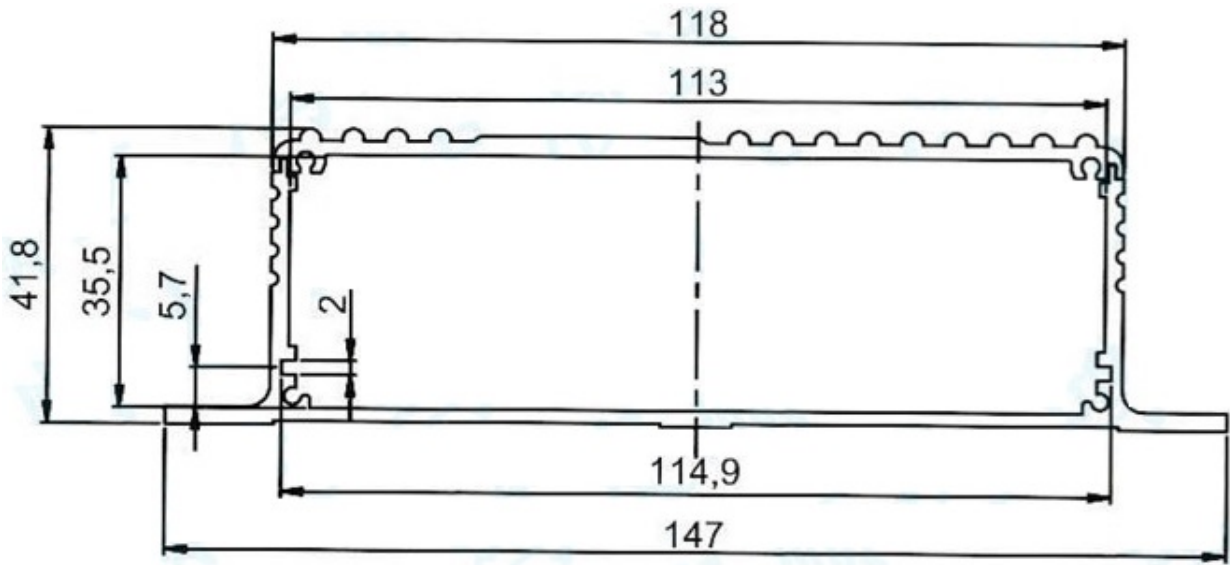
For more information about Firmware download, please refer to Automotive Box-PC 100/120 software development Guide.



## 4 Outline Drawing

Automotive Box-PC 100/120 aluminum enclosure outline drawing (cross section):

unit: mm



# 5 Electrical Specifications

## Absolute Maximum Ratings

	Min	Max	Unit	Note
Main Power Supply (DC-IN)	8.55	37.8	V	
Operating Temperature	-20	+70	°C	A. Box-PC 100
Operating Temperature	0	+50	°C	A. Box-PC 120

## Operating Range:

	Min	Max	Unit	Note
Main Power Supply (DC-IN)	9	36	V	

VSS = 0V. VDD = +3.3V

## Power Consumption:

The power consumption of a device is highly dependent on application. The following Automotive Box-PC 100/120 active mode and low power mode consumption tests are for reference only:

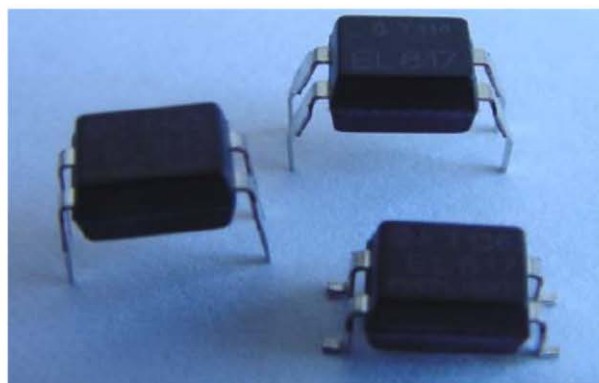
Operating Mode	Test Conditions	Power Consumption
Active Mode -1	<ul style="list-style-type: none"> <li>● CPU keeps running at 528Mhz</li> <li>● GPS keeps receiving satellite data</li> <li>● <b>3G module in not activated.</b></li> <li>● Bluetooth keeps receiving data from OBD2 module</li> <li>● Lighttpd web server keeps running and updating GPS, OBD2, GPIO data</li> </ul>	about 525mA @ 3.3V
Active Mode -2	<ul style="list-style-type: none"> <li>● CPU keeps running at 528Mhz</li> <li>● GPS keeps receiving satellite data</li> <li>● <b>3G module keeps reporting data to remote server &amp; running in router mode</b></li> <li>● Bluetooth keeps receiving data from OBD2 module</li> <li>● Lighttpd web server keeps running and updating GPS, OBD2, GPIO data</li> </ul>	about 750mA @ 3.3V
Active Mode -3	<ul style="list-style-type: none"> <li>● CPU keeps running at 528Mhz</li> <li>● GPS keeps receiving satellite data</li> <li>● <b>3G module keeps reporting data to remote server &amp; running in router mode</b></li> <li>● Bluetooth keeps receiving data from OBD2 module</li> <li>● Lighttpd web server keeps running and updating GPS, OBD2, GPIO data</li> <li>● <b>A PC connects to Automotive Box-PC 100/120 via LAN and keeps running web browser with a HD MTV on youtube</b></li> <li>● <b>A mobile phone connects to Automotive Box-PC 100/120 via WiFi and keeps running network radio function</b></li> </ul>	about 970mA @ 3.3V
Low	<ul style="list-style-type: none"> <li>● CPU enters sleep mode</li> </ul>	about

Power Mode	<ul style="list-style-type: none"> <li>● Turn off power supplies of these functions:               <ul style="list-style-type: none"> <li>■ USB HUB</li> <li>■ 3G modem; WiFi/BT; GPS</li> <li>■ All COM ports; All CAN ports</li> <li>■ G-sensor; e-Compass</li> </ul> </li> </ul>	27mA @ 3.3V
------------	---	----------------

# Appendix A: Photo-Coupler Brief Spec

## Features:

- Current transfer ratio  
(CTR:MIN.50% at  $I_F = 5\text{mA}$ ,  $V_{CE} = 5\text{V}$ )
- High isolation voltage between input and output ( $V_{iso} = 5000\text{ V rms}$ )
- Compact dual-in-line package  
EL817\*:1-channel type
- Pb free
- UL approved (No. E214129)
- VDE approved (No. 132249)
- SEMKO approved (No. 0143133/01-03)
- NEMKO approved (No. P00102385)
- DEMKO approved (No. 310352-04)
- FIMKO approved (No. FI 16763A2)
- CSA approved (No. 1143601)
- BSI approved (No. 8592 / 8593)



## Absolute Maximum Ratings

(  $T_a = 25^\circ\text{C}$  )

Parameter		Symbol	Rating	Unit
Input	Forward Current	$I_F$	50	mA
	Reverse Voltage	$V_R$	6	V
	Power Dissipation	P	70	mW
Output	Collector Power Dissipation	$P_C$	150	mW
	Collector Current	$I_C$	50	mA
	Collector-Emitter Voltage	$V_{CEO}$	35	V
	Emitter-Collector Voltage	$V_{ECO}$	6	V
Total Power Dissipation		$P_{tot}$	200	mW
*1 Isolation Voltage		$V_{iso}$	5000	V rms
Operating Temperature		$T_{opr}$	-55~+110	$^\circ\text{C}$
Storage Temperature		$T_{stg}$	-55~+125	$^\circ\text{C}$
*2 Soldering Temperature		$T_{sol}$	260	$^\circ\text{C}$

\*1 AC for 1 minute, R.H= 40~ 60%RH

-Isolation voltage shall be measured using the following method.

- (1) Short between anode and cathode on the primary side and between collector, emitter and base on the secondary side.
- (2) The isolation voltage tester with zero-cross circuit shall be used.
- (3) The waveform of applied voltage shall be a sine wave

\*2 For 10 seconds

### Electro-Optical Characteristics

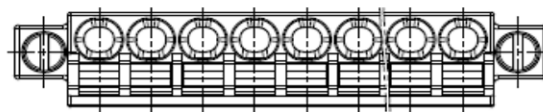
(Ta=25°C)

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Input	Forward	$V_F$	-	1.2	1.4	V	$I_F=20\text{mA}$
	Reverse Current	$I_R$	-	-	10	$\mu\text{A}$	$V_R=4\text{V}$
	Terminal	$C_t$	-	30	250	pF	$V=0, f=1\text{kHz}$
Output	Collector Dark current	$I_{CEO}$	-	-	100	nA	$V_{CE}=20\text{V}$
	Collector-Emitter breakdown voltage	$BV_{CEO}$	35	-	-	V	$I_C=0.1\text{mA}$
Transfer Characteristics	Current Transfer ratio	CTR	50	-	600	%	$I_F=5\text{mA}, V_{CE}=5\text{V}$
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	-	0.1	0.2	V	$I_F=20\text{mA}, I_C=1\text{mA}$
	Isolation resistance	$R_{ISO}$	$5 \times 10^{10}$	$10^{11}$	-	$\Omega$	DC500V, 40~60%R.H
	Floating capacitance	$C_f$	-	0.6	1.0	pF	$V=0, f=1\text{MHz}$
	Cut-off frequency	$f_c$	-	80	-	kHz	$V_{CE}=5\text{V}, I_C=2\text{mA}$ $R_L=100\Omega, -3\text{dB}$
	Rise time	$t_r$	-	4	18	$\mu\text{s}$	$V_{CE}=2\text{V}$ $I_C=2\text{mA}, R_L=100\Omega$
	Fall time	$t_f$	-	3	18	$\mu\text{s}$	

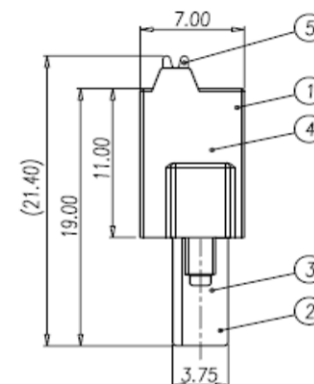
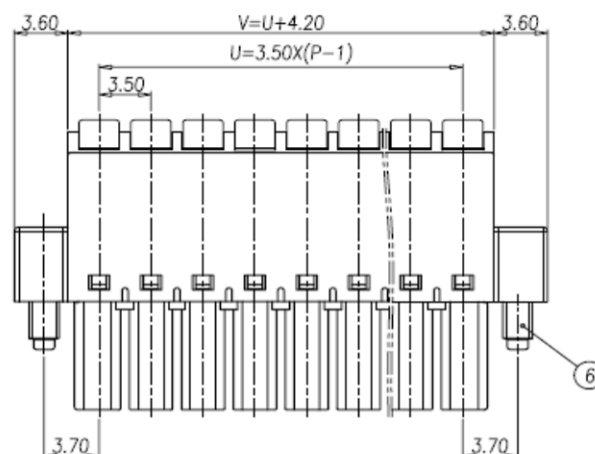
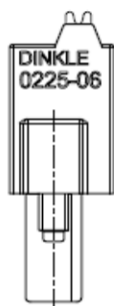


## Appendix B: DC-IN Mating Connector Specifications

FILE 0225\0225-06XX



P	2	3	4	5	6	7	8	9	10	11	12	13
U	3.5	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5	35.0	38.5	42.0
V	7.7	11.2	14.7	17.2	21.7	25.2	28.7	32.2	35.7	39.2	42.7	46.2
P	14	15	16	17	18	19	20	21	22	23	24	
U	45.5	49.0	52.5	56.0	59.5	63.0	66.5	70.0	73.5	77.0	80.5	
V	49.7	53.2	56.7	60.2	63.7	67.2	70.7	74.2	77.7	81.2	84.7	



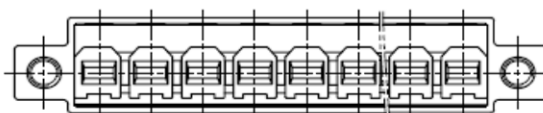
NOTES 1:

UL Standard :

1. Rating: 300V 8A  
PITCH: 3.50mm
2. Insulation Withstands Voltage:  
AC 2000V at 1 minute
3. Using Temperature Range:  
-40°C~+115°C
4. Suitable Electric Wire:  
AWG 28 ~ 16

IEC Standard :

1. Rating: 630V 15A
2. Rate Impulse Voltage: 5000V
3. Insulation Resistance:  
500MΩ or more at DC500V
4. Material Group : I
5. Pollution Degree : 2
6. Overvoltage Category: II
7. Using Temperature Range:  
-40℃~+120℃





Normal Geometric Tolerancing			
— //		≡ ⊥	
0 to 100	0.2	0 to 10	0.2
over 100 to 150	0.3	over 10	0.3
over 150	0.5		
Total Pitch Tolerances		Normal dimension Tolerances	
0<U<=30	±0.20	0~30	±0.25
30<U<=53	±0.25	over 30~53	±0.30
53<U<=70	±0.30	over 53~70	±0.35
70<U<=90	±0.35	over 70~90	±0.44
90<U<=115	±0.44	over 90~115	±0.55
115<U<=150	±0.55	over 115~150	±0.70

NOTES 2:

1. RoHS compliance
2. Strip length: 8~9mm

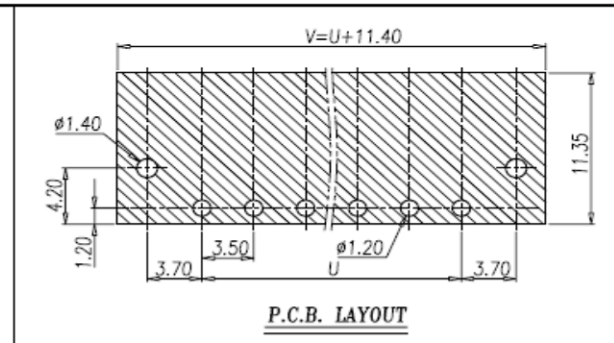
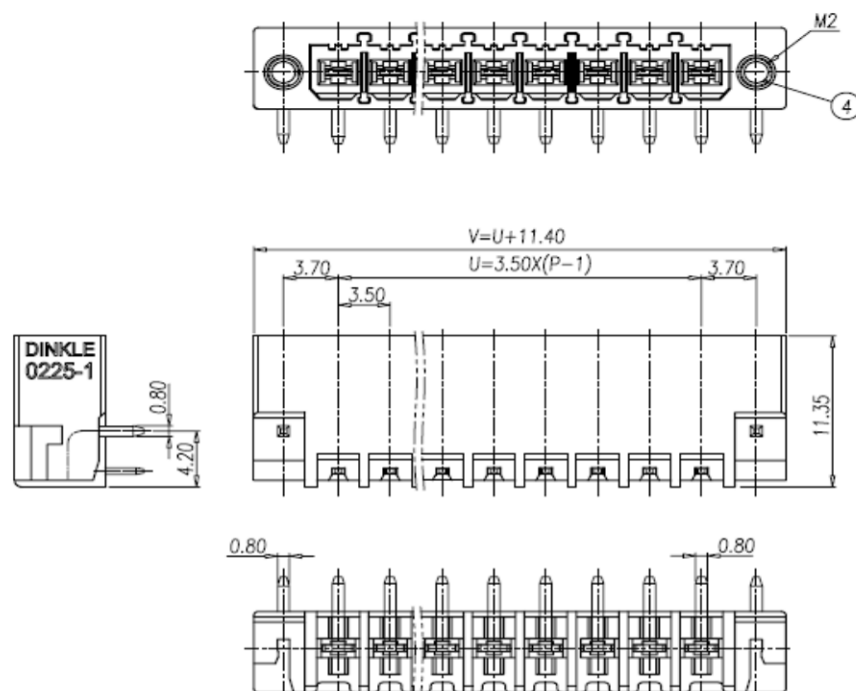
6	SCREW	STEEL	M2/Zn Plated
5	LEVER	POM	ORANGE
4	S-CAGE	STAINLESS STEEL	
3	CLAMP	COPPER ALLOY	Tin Plated
2	COVER	PA66	UL94-V0 BLACK
1	HOUSING	PA66	UL94-V0 BLACK

DWG.	LWF	DATE	14.05.29	UNITS	MM	SHEET/OF	1/1
CHK.		DATE		SCALE	3:1 ( : )		
APP.		DATE					
 <b>DINKLE</b> ENTERPRISE CO.,LTD				NAME	0225-06XX		
				DWG NO.	SP-03-02250600		



## Appendix C: DC-IN Connector Specification

FILE 0225\0225-16XXTH



P	2	3	4	5	6	7	8	9
U	3.5	7.0	10.5	14.0	17.5	21.0	24.5	28.0
V	14.9	18.4	21.9	25.4	28.9	32.4	35.9	39.4
P	10	11	12	13	14	15	16	17
U	31.5	35.0	38.5	42.0	45.5	49.0	52.5	56.0
V	42.9	46.4	49.9	53.4	56.9	60.4	63.9	67.4
P	18	19	20	21	22	23	24	
U	59.5	63.0	66.5	70.0	73.5	77.0	80.5	
V	70.9	74.4	77.9	81.4	84.9	88.4	91.9	

### NOTES 1:

UL Standard :

1. Rating: 300V 8A  
PITCH: 3.50mm
2. Insulation Withstands Voltage:  
AC 2000V at 1 minute
3. Using Temperature Range:  
-40°C~+110°C

IEC Standard :

1. Rating: 630V 15A
2. Rate Impulse Voltage: 4000V
3. Insulation Resistance:  
500MΩ or more at DC500V

4. Material Group : I

5. Pollution Degree : 2

6. Overvoltage Category: II

7. Using Temperature Range:  
-40°C~+110°C

### NOTES 2:

1. RoHS compliance
2. Through hole reflow soldering  
Temperature: 245°C

Normal Geometric Tolerancing			
—	//	≡	⊥
0 to 100	0.2	0 to 10	0.2
over 100 to 150	0.3	over 10	0.3
over 150	0.5		
Total Pitch Tolerances			
Normal dimension Tolerances			
0<U<=30	±0.20	0~30	±0.25
30<U<=53	±0.25	over 30~53	±0.30
53<U<=70	±0.30	over 53~70	±0.35
70<U<=90	±0.35	over 70~90	±0.44
90<U<=115	±0.44	over 90~115	±0.55
115<U<=150	±0.55	over 115~150	±0.70

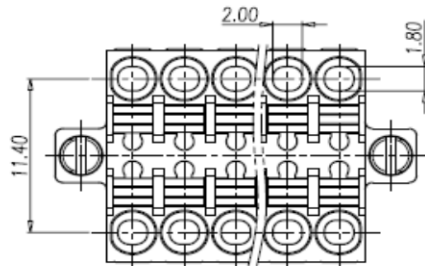
4	NUT	STEEL	M2/Zn Plated
3	SOLDER PIN 2	COPPER ALLOY	Tin Plated
2	SOLDER PIN 1	COPPER ALLOY	Tin Plated
1	HOUSING	PA+GF	UL94-V0 BLACK
ITEM	NAME OF PART	MATERIAL	NOTES

DWG.	LWF	DATE	14.05.29	UNITS	MM	SHEET/OF	1/1
CHK.		DATE		SCALE	3:1		
APP.		DATE					
				NAME	0225-16XXTH/26		
				DWG NO.	SP-03-02251626		

**DINKLE**  
DINKLE ENTERPRISE CO., LTD

## Appendix D: IO2 (GPIO) Mating Connector Specification

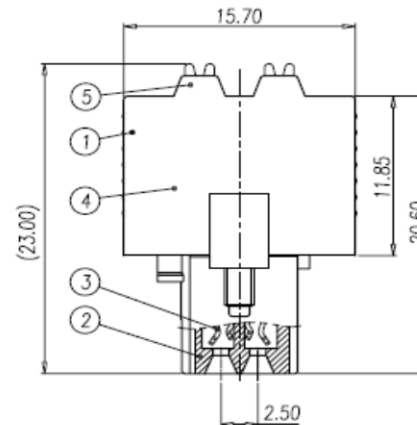
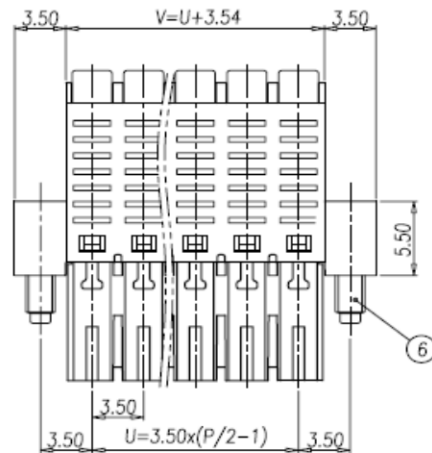
FILE 0156\0156-2AXX



P	6	8	10	12	14	16	18	20	22
U	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5	35.0
V	10.54	14.04	17.54	21.04	24.54	28.04	31.54	35.04	38.54
P	24	26	28	30	32	34	36	38	40
U	38.5	42.0	45.5	49.0	52.5	56.0	59.5	63.0	66.5
V	42.04	45.54	49.04	52.54	56.04	59.54	63.04	66.54	70.04

### NOTES:

1. Rating: 150V 8A (UL)  
320V 10A (VDE)  
PITCH: 3.50mm
2. Insulation Withstands Voltage:  
AC 2000V at 1 minute
3. Insulation Resistance:  
500MΩ or more at DC500V
4. Using Temperature Range:  
-40°C ~ +105°C
5. Suitable Electric Wire:  
UL: 28 ~ 16 AWG  
VDE: Rigid: 0.2~1.0mm<sup>2</sup>  
Flexibly: 0.2~1.5mm<sup>2</sup>  
Strip length: 7~8mm
6. RoHS compliance



Normal Geometric Tolerancing			
—	//	≡	⊥
0 to 100	0.2	0 to 10	0.2
over 100 to 150	0.3	over 10	0.3
over 150	0.5		
Total Pitch Tolerances		Normal dimension Tolerances	
0<U<=30	±0.20	0~30	±0.25
30<U<=53	±0.25	over 30~53	±0.30
53<U<=70	±0.30	over 53~70	±0.35
70<U<=90	±0.35	over 70~90	±0.44
90<U<=115	±0.44	over 90~115	±0.55
115<U<=150	±0.55	over 115~150	±0.70

ITEM	NAME OF PART	MATERIAL	NOTES
6	SCREW	STEEL	M2/Zn Plated
5	LEVER	POM	ORANGE
4	WIRE CAGE	STEEL	
3	CLAMP	COPPER ALLOY	Tin Plated
2	COVER	PA66	UL94-V0 GREEN
1	HOUSING	PA66	UL94-V0 GREEN

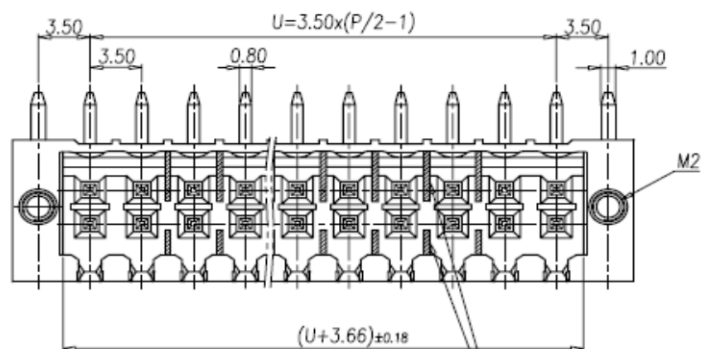
DWG.	LWF	DATE	13.05.02	UNITS	MM	SHEET/OF	1/1
CHK.		DATE		SCALE	3:1		
APP.		DATE					
		NAME	0156-2AXX				
		DWG NO.	SP-03-01562AXX				

REV.	CONTENT	CHK.	DATE

DINKLE		DINKLE ENTERPRISE CO.,LTD	
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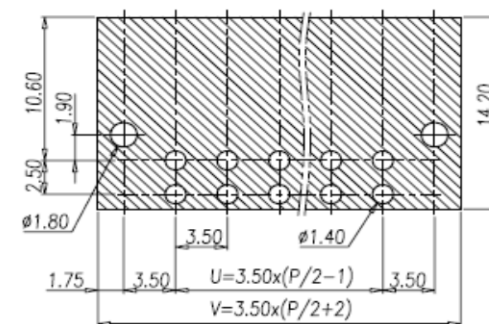
## Appendix E: IO2 (GPIO) Connector Specification

FILE 0156\0156-28XX



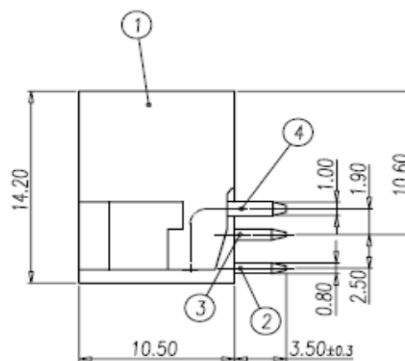
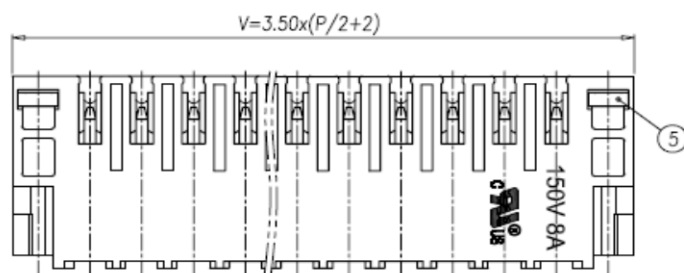
NOTES:

1. Rating: 150V 8A (UL)  
320V 10A (VDE)  
PITCH: 3.50mm
2. Insulation Withstands Voltage:  
AC 2000V at 1 minute
3. Insulation Resistance:  
500M $\Omega$  or more at DC500V
4. Using Temperature Range:  
-40°C ~ +105°C
5. RoHS compliance



### P.C.B. LAYOUT



P	6	8	10	12	14	16	18	20	22
肋数量	6-18P之间都有肋							7	8
P	24	26	28	30	32	34	36	38	40
肋数量	7	8	7	8	7	8	9	10	11



P	6	8	10	12	14	16	18	20	22
U	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5	35.0
V	17.5	21.0	24.5	28.0	31.5	35.0	38.5	42.0	45.5
P	24	26	28	30	32	34	36	38	40
U	38.5	42.0	45.5	49.0	52.5	56.0	59.5	63.0	66.5
V	49.0	52.5	56.0	59.5	63.0	66.5	70.0	73.5	77.0

Normal Geometric Tolerancing				
— //		$\equiv$	$\perp$	
0 to 100	0.2	0.3	0 to 10	0.2
over 100 to 150	0.3		over 10	0.3
over 150	0.5			
Total Pitch Tolerances		Normal dimension Tolerances		
0<U<=30	±0.20	0~30	±0.25	
30<U<=53	±0.25	over 30~53	±0.30	
53<U<=70	±0.30	over 53~70	±0.35	
70<U<=90	±0.35	over 70~90	±0.44	
90<U<=115	±0.44	over 90~115	±0.55	
115<U<=150	±0.55	over 115~150	±0.70	

5	NUT	STEEL	M2/Zn Plated
4	SOLDER PIN 3	COPPER ALLOY	Tin Plated
3	SOLDER PIN 2	COPPER ALLOY	Tin Plated
2	SOLDER PIN 1	COPPER ALLOY	Tin Plated
1	HOUSING	PA66(G30)	UL94-V0 GREEN
ITEM	NAME OF PART	MATERIAL	NOTES

DWG.	LWF	DATE	13.10.16	UNITS	MM	SHEET/OF	1 /
CHK.		DATE		SCALE	3:1 ( : )		
APP.		DATE		NAME	0156-28XX		
 DINKLE ENTERPRISE CO.,LTD			DWG NO.				