

# SKW93A Datasheet

## 3x3 MIMO WLAN Module

| Document Information   |                                       |
|------------------------|---------------------------------------|
| Title                  | SKW93A Datasheet 3x3 MIMO WLAN Module |
| Document type          | Datasheet                             |
| Document number        | SL-18060060                           |
| Revision and date      | V2.01 22-June-2021                    |
| Disclosure restriction | Public                                |

## Revision History

| Revision | Description              | Approved  | Date     |
|----------|--------------------------|-----------|----------|
| V1.01    | Initial Release          | George He | 20170928 |
| V1.02    | Update wireless features | George He | 20180605 |
| V2.01    | Update the format        | Wendy     | 20210622 |

SKYLAB reserves all rights to this document and the information contained herein. Products, names, logos and designs described herein may in whole or in part be subject to intellectual property rights. Reproduction, use, modification or disclosure to third parties of this document or any part thereof without the express permission of SKYLAB is strictly prohibited.

The information contained herein is provided “as is” and SKYLAB assumes no liability for the use of the information. No warranty, either express or implied, is given, including but not limited, with respect to the accuracy, correctness, reliability and fitness for a particular purpose of the information. This document may be revised by SKYLAB at any time. For most recent documents, visit [www.skylab.com.cn](http://www.skylab.com.cn).

Copyright © 2017, Skylab M&C Technology Co., Ltd.

SKYLAB® is a registered trademark of Skylab M&C Technology Co., Ltd in China.

## Contents

|                                          |    |
|------------------------------------------|----|
| 1 General Description.....               | 4  |
| 2 Applications.....                      | 4  |
| 3 Features.....                          | 5  |
| 4 Application Block Diagram.....         | 6  |
| 5 Interfaces.....                        | 6  |
| USB.....                                 | 6  |
| I2C.....                                 | 6  |
| SD.....                                  | 7  |
| I2S(192K/24bits).....                    | 7  |
| PCM.....                                 | 9  |
| PWM.....                                 | 9  |
| UARTS lite.....                          | 10 |
| WAN/LAN.....                             | 10 |
| 6 Module Specifications.....             | 10 |
| 7 Module Pinout and Pin Description..... | 12 |
| Module Pinout.....                       | 12 |
| Pin Description.....                     | 12 |
| 8 PCB Footprint and Dimensions.....      | 14 |
| 9 Electrical Characteristics.....        | 15 |
| a) Absolute Maximum Ratings.....         | 15 |
| b) Recommended Operation Ratings.....    | 16 |
| c) Measurement Conditions.....           | 16 |
| 10 Ordering Information.....             | 16 |
| 11 Contact Information.....              | 16 |

## 1 General Description

The SKW93A module compliant to 802.11 a/b/g/n/ac Wi-Fi Solution, It integrates a dual-core MIPS1004Kc (580MHz), 3-port switch, USB2.0, SD-XC, I2S. The module is suitable for 802.11ac, LTE cat4/5, edge, hotspot, VPN, AC (Access Control). For consumer electronic devices, the module requiring only an external 3.3V power supply.

The module integrates a 2.4GHz 2x2 MIMO WLAN chip with internal PA and LNA and integrates a 5GHz 1x1 WLAN chip with internal PA and LNA. It supports 2.4GHz operations up to 144 Mbps for 20 MHz and 300 Mbps for 40 MHz channel respectively, and supports 5GHz operations up to 433 Mbps for 80 MHz channel respectively.

The module supports AP mode and client mode and router mode.



Figure 1: SKW93A Top View

## 2 Applications

- ◆ USB WiFi Camera
- ◆ 802.11ac Router
- ◆ VPN
- ◆ 3G/4G WiFi Router
- ◆ WiFi Audio
- ◆ UART 5GHz WiFi
- ◆ Home Automation
- ◆ Smart Home Gateway
- ◆ Industry Control

### 3 Features

- ◆ Compliant to IEEE 802.11a/b/g/n/ac.
- ◆ 3T3R mode with support for a 733Mbps PHY data rate.
- ◆ DDR2 memory up to 1024Mb.
- ◆ Flash memory up to 256Mb.
- ◆ 2 LAN ports and 1 WAN port.
- ◆ Support USB 2.0 slave device for USB disk and USB 3G/4G dongle and USB camera.
- ◆ Support SD card.
- ◆ Support interface: I2C, SDIO, I2S(192K/24bits), PWM, UART lite, GPIO.
- ◆ Security: WEP64/128, TKIP, AES, WPA, WPA2, WAPI.
- ◆ Support AP/Client/Router mode.
- ◆ RoHS compliance meets environment-friendly requirement.
- ◆ CE/FCC compliance
- ◆ 36.4mm(L) x 30.5mm(W) x 14.8mm(H) dimension.

## 4 Application Block Diagram

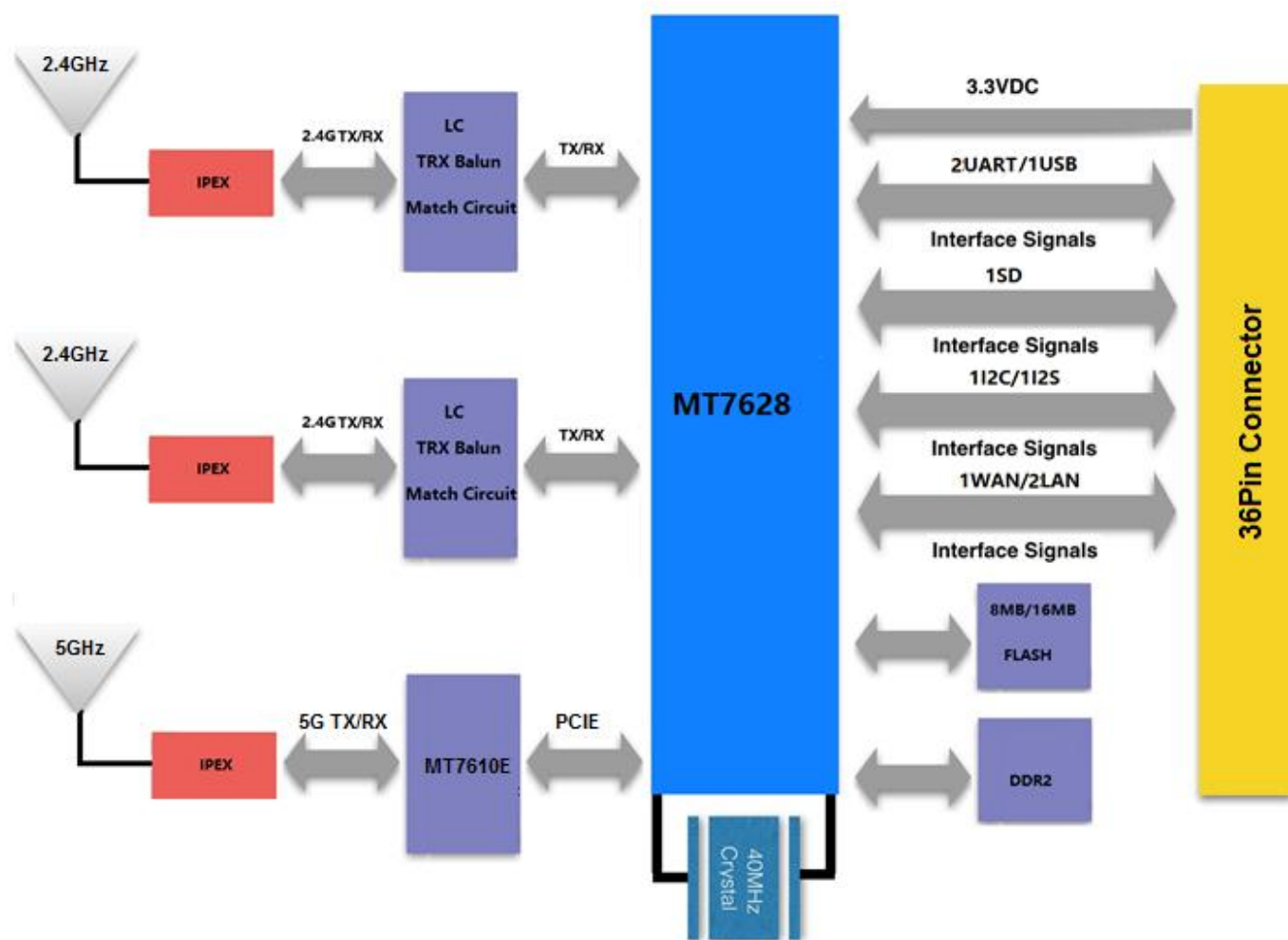


Figure 2: SKW93A Block Diagram

## 5 Interfaces

### USB

The USB interface support USB slave devices for USB disk and USB 3G/4G dongle and USB camera.

### I2C

Table5-1: I2C pin share scheme

| SKW93A Pin Number | Pin Name | GPIO(2'b01) | I2C(2'b00) |
|-------------------|----------|-------------|------------|
| 27                | I2C_SD   | GPIO#05     | I2C_SD     |
| 28                | I2C_CLK  | GPIO#04     | I2C_CLK    |

**Note:** Controlled by I2C\_MODE register

## SD

Table5-2: SD pin share scheme

| SKW93A Pin Number | Pin Name(4'b0000) | GPIO(2'b01) | SD(2'b00) |
|-------------------|-------------------|-------------|-----------|
| 14                | LAN_PORT4_TX-     | GPIO#29     | SD_D2     |
| 13                | LAN_PORT4_TX+     | GPIO#28     | SD_D3     |
| 12                | LAN_PORT4_RX-     | GPIO#27     | SD_CMD    |
| 11                | LAN_PORT4_RX+     | GPIO#26     | SD_CLK    |
| 10                | LAN_PORT3_RX-     | GPIO#25     | SD_D0     |
| 9                 | LAN_PORT3_RX+     | GPIO#24     | SD_D1     |
| 8                 | LAN_PORT3_TX-     | GPIO#23     | SD_CD     |
| 7                 | LAN_PORT3_TX+     | GPIO#22     | SD_WP     |

Note: Controlled by the EPHY\_APGIO\_AIO\_EN[4:1] and SD\_MODE register

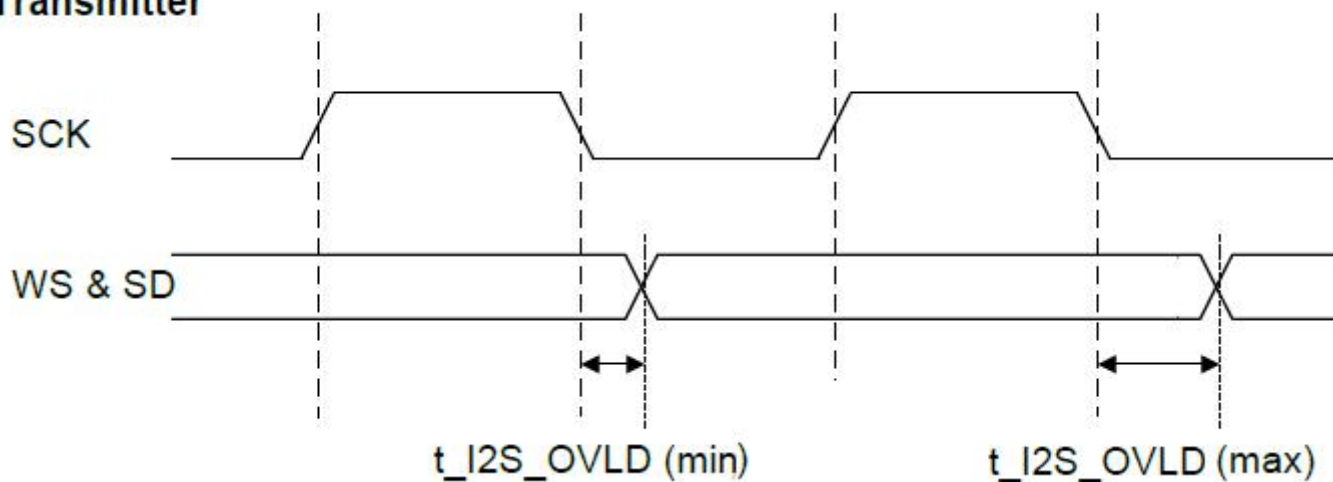
## I2S(192K/24bits)

Table5-3: I2S/PCM pin share scheme

| SKW93A Pin Number | Pin Name | GPIO(2'b01) | I2S(2'b00) | PCM(2'b10) |
|-------------------|----------|-------------|------------|------------|
| 37                | I2S_CLK  | GPIO#03     | I2S_CLK    | PCMFS      |
| 35                | I2S_WS   | GPIO#02     | I2S_WS     | PCMCLK     |
| 36                | I2S_SDO  | GPIO#01     | I2S_SDO    | PCMDTX     |
| 34                | I2S_SDI  | GPIO#0      | I2S_SDI    | PCMDRX     |

**Note:** Controlled by I2S\_MODE register

## Transmitter



## Receiver

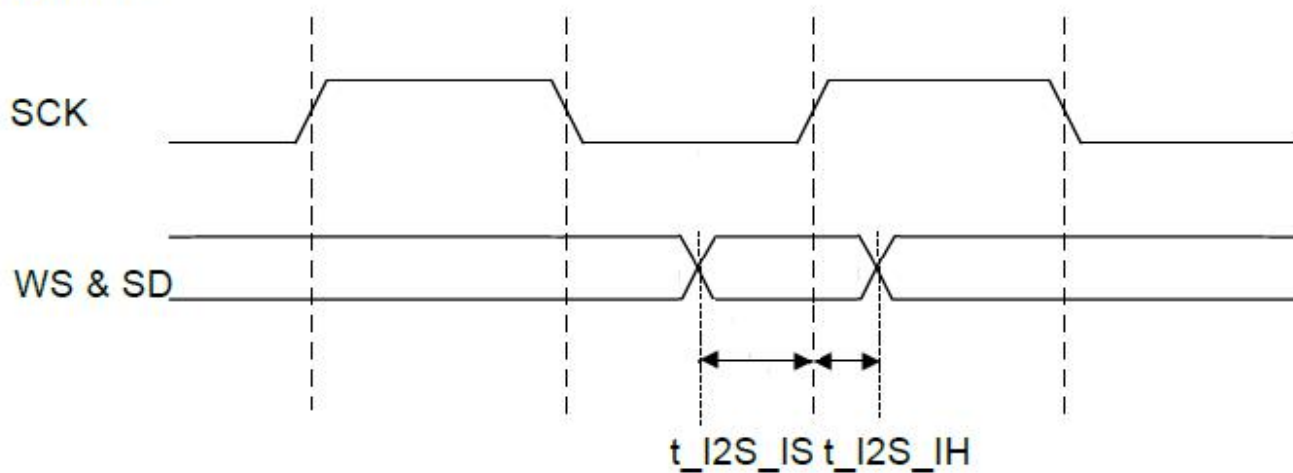
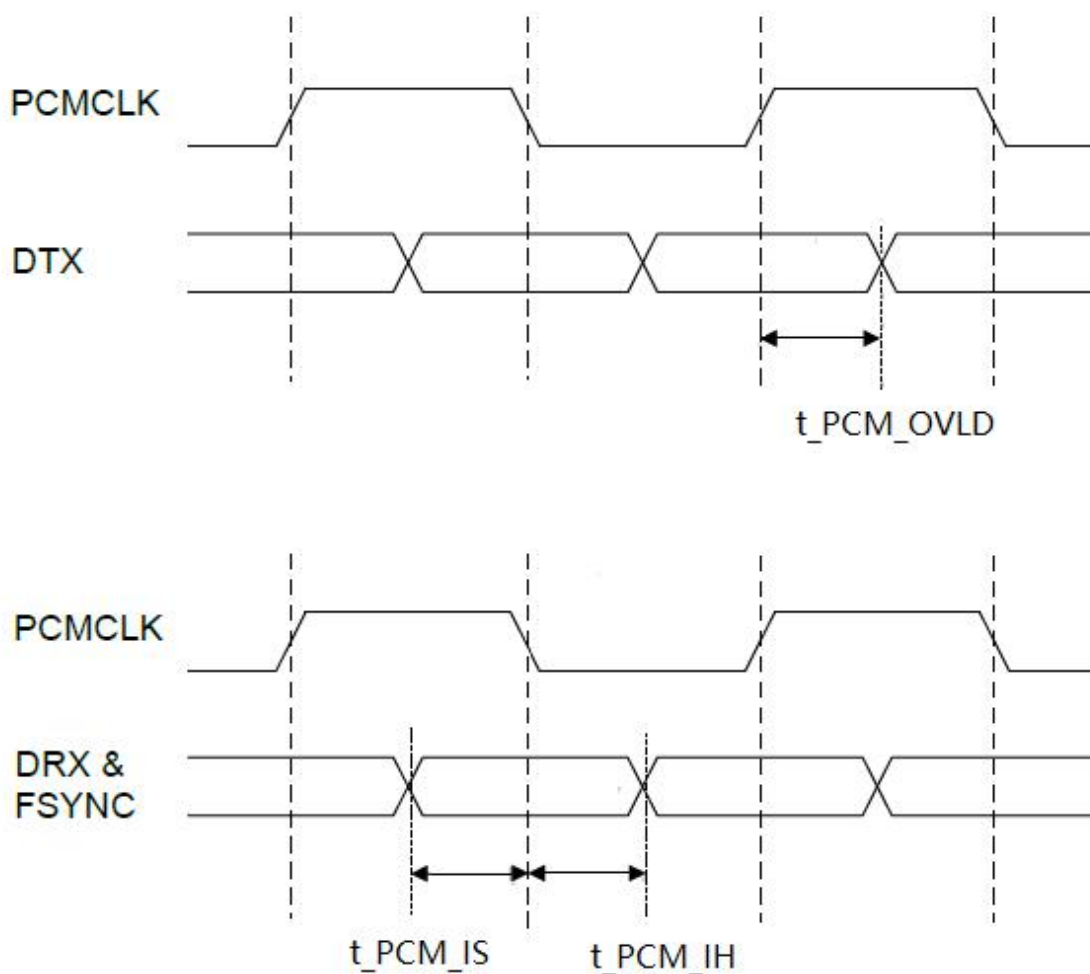


Figure 3: I2S Timing

Table5-3: I2S/PCM pin share scheme

| Symbol          | Description                            | Min | Max | Unit |
|-----------------|----------------------------------------|-----|-----|------|
| $t_{I2S\_IS}$   | Setup Time for I2S input(data & WS)    | 3.5 |     | ns   |
| $t_{I2S\_IH}$   | Hold Time for I2S input(data & WS)     | 0.5 |     | ns   |
| $t_{I2S\_OVLD}$ | I2S_CLK to I2S output(data & WS) valid | 2.5 | 10  | ns   |



**Figure 4: PCM Timing**

## PCM

Table5-5: PCM Interface Diagram Key

| Symbol          | Description                              | Min  | Max  | Unit |
|-----------------|------------------------------------------|------|------|------|
| $t_{PCM\_IS}$   | Setup Time for PCM input to PCM_CLK fall | 3.5  |      | ns   |
| $t_{PCM\_IH}$   | Hold Time for PCM input to PCM_CLK fall  | 1.0  |      | ns   |
| $t_{PCM\_OVLD}$ | PCM_CLK to PCM output valid              | 10.0 | 35.0 | ns   |

## PWM

Table5-6: PWM pin share scheme

| SKW93A Pin Number | Pin Name      | GPIO    | PWM       | Pin Share     |
|-------------------|---------------|---------|-----------|---------------|
| 38                | LAN_PORT2_TX- | GPIO#21 | UART2_RXD | PWM_CH3/SD_D4 |
| 39                | LAN_PORT2_TX+ | GPIO#20 | UART2_TXD | PWM_CH2/SD_D5 |

## UARTS lite

The module support 3UART:

Table5-7: UART pin share scheme

| SKW93A Pin Number | Pin Name      | GPIO    | UART      | Pin Share        |
|-------------------|---------------|---------|-----------|------------------|
| 16                | UART_RXD0     | GPIO#13 | UART0_RXD | UART0(For Debug) |
| 17                | UART_TXD0     | GPIO#12 | UART0_TXD |                  |
| 32                | UART_RXD1     | GPIO#46 | UART1_RXD | PWM_CH1          |
| 31                | UART_TXD1     | GPIO#45 | UART1_TXD | PWM_CH0          |
| 38                | LAN_PORT2_TX- | GPIO#21 | UART2_RXD | PWM_CH3/SD_D4    |
| 39                | LAN_PORT2_TX+ | GPIO#20 | UART2_TXD | PWM_CH2/SD_D5    |

## WAN/LAN

The SKW93A module integrates 3-port 10/100Mbps fast Ethernet switch.

## 6 Module Specifications

| Hardware Features    |                                               |
|----------------------|-----------------------------------------------|
| Model                | SKW93A                                        |
| Antenna Type         | IPEX                                          |
| Chipset solution     |                                               |
| Voltage              | 3.3V±5%                                       |
| Dimension(L×W×H)     | 36.4 x 30.5 x 14.8mm                          |
| Wireless Features    |                                               |
| Wireless Standards   | IEEE 802.11a/b/g/n/ac                         |
| Frequency Range      | 2412---2484MHz & 5180---5825MHz               |
| Data Rates           | IEEE 802.11b : 1,2,5.5,11Mbps                 |
|                      | IEEE 802.11g : 6,9,12,18,24,36,48,54Mbps      |
|                      | IEEE 802.11n : MCS0--MCS7 @ HT20 /2.4GHz band |
|                      | MCS0--MCS7 @ HT40 /2.4GHz band                |
|                      | MCS0--MCS9 @ HT40 /5GHz band                  |
|                      | IEEE 802.11ac : MCS0--MCS9 @ VHT80 /5GHz band |
| Receiver Sensitivity | VHT80 MCS9 : -60dBm@10% PER(MCS9) /5GHz band  |
|                      | HT40 MCS9 : -63dBm@10% PER(MCS9) /5GHz band   |
|                      | HT40 MCS7 : -70dBm@10% PER(MCS7) /2.4GHz band |

|                      |                                                     |
|----------------------|-----------------------------------------------------|
|                      | HT20 MCS7 : -71dBm@10% PER(MCS7) /2.4GHz band       |
|                      | 54M: -76dBm@10% PER                                 |
|                      | 11M: -88dBm@ 8% PER                                 |
| Modulation Technique | DSSS (DBPSK, DQPSK, CCK)                            |
|                      | OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 125-QAM, 256-QAM) |
| Wireless Security    | WPA/WPA2, WEP, TKIP and AES, WPS2.0, WAPI           |
| Transmit Power       | IEEE 802.11ac: 13dBm @HT80 MCS9 /5GHz band          |
|                      | IEEE 802.11ac: 16dBm @HT80 MCS0 /5GHz band          |
|                      | IEEE 802.11n: 14dBm @HT20/40 MCS7 /5GHz band        |
|                      | IEEE 802.11n: 16dBm @HT20/40 MCS0 /5GHz band        |
|                      | IEEE 802.11n: 16dBm @HT20/40 MCS7 /2.4GHz band      |
|                      | IEEE 802.11g: 16dBm @54MHz                          |
|                      | IEEE 802.11b: 18dBm @11MHz                          |
| Work Mode            | Bridge/Gateway/AP Client                            |
| <b>Others</b>        |                                                     |
| Certification        | ROHS                                                |
| Environment          | Operating Temperature: -20℃~55℃                     |
|                      | Storage Temperature: -40℃~125℃                      |
|                      | Operating Humidity: 10%~90% non-condensing          |
|                      | Storage Humidity: 5%~90% non-condensing             |

## 7 Module Pinout and Pin Description

### Module Pinout

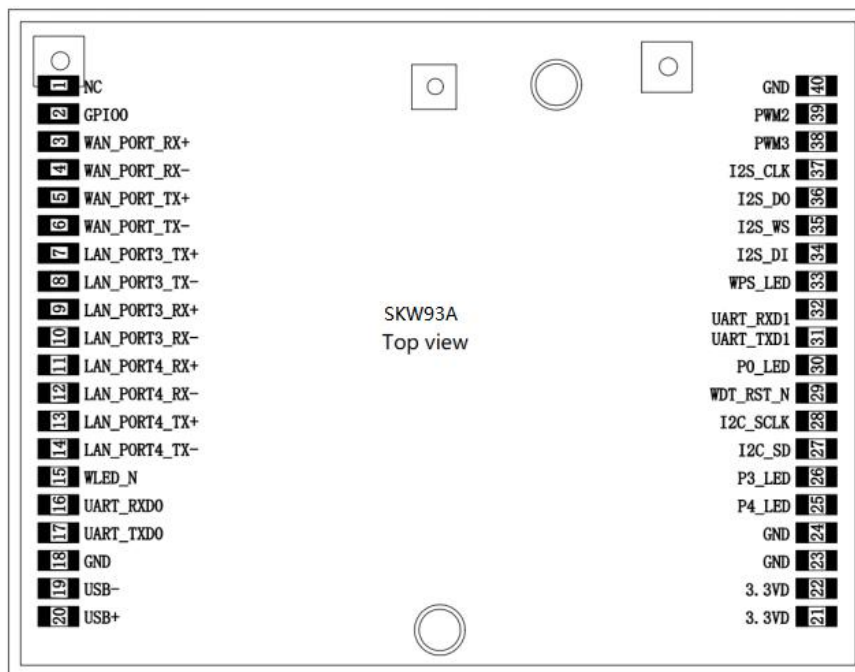


Figure 5: SKW93A Pin Package

### Pin Description

| Pin No. | Pin name      | Description          | Remark                      |
|---------|---------------|----------------------|-----------------------------|
| 1       | NC            | Not Connect          |                             |
| 2       | GPIO0         | General Purpose I/O  | POWER_ON# / GPIO#11/IPD     |
| 3       | WAN_PORT_RX+  | WAN port             | WAN_RX+                     |
| 4       | WAN_PORT_RX-  | WAN port             | WAN_RX-                     |
| 5       | WAN_PORT_TX+  | WAN port             | WAN_TX+                     |
| 6       | WAN_PORT_TX-  | WAN port             | WAN_TX-                     |
| 7       | LAN_PORT3_TX+ | Ethernet port3       | SD_WP / GPIO#22             |
| 8       | LAN_PORT3_TX- | Ethernet port3       | SD_CD / GPIO#23             |
| 9       | LAN_PORT3_RX+ | Ethernet port3       | SD_D1 / GPIO#24             |
| 10      | LAN_PORT3_RX- | Ethernet port3       | SD_D0 / GPIO#25             |
| 11      | LAN_PORT4_RX+ | Ethernet port4       | SD_CLK / GPIO#26            |
| 12      | LAN_PORT4_RX- | Ethernet port4       | SD_CMD/ GPIO#27             |
| 13      | LAN_PORT4_TX+ | Ethernet port4       | SD_D3 / GPIO#28             |
| 14      | LAN_PORT4_TX- | Ethernet port4       | SD_D2 / GPIO#29             |
| 15      | WLED_N        | Wireless LED         | WLED_N / GPIO#44            |
| 16      | UART_RXD0     | UART0 only for debug | UART0_RX / GPIO#13          |
| 17      | UART_TXD0     | UART0 only for debug | UART0_TX / GPIO#12 / O, IPD |

|    |           |                          |                              |
|----|-----------|--------------------------|------------------------------|
| 18 | GND       | Ground                   | GND                          |
| 19 | USB-      | USB data pin Data-       | USB_D-                       |
| 20 | USB+      | USB data pin Data+       | USB_D+                       |
| 21 | 3.3VD     | 3.3V input 1000mA        | +3.3V                        |
| 22 | 3.3VD     | 3.3V input 1000mA        | +3.3V                        |
| 23 | GND       | Ground                   | GND                          |
| 24 | GND       | Ground                   | GND                          |
| 25 | P4_LED    | LAN_PORT4_LED            | P4_LED_N / GPIO#39           |
| 26 | P3_LED    | LAN_PORT3_LED            | P3_LED_N / GPIO#40           |
| 27 | I2C_SD    | I2C Data                 | I2C_SDA(PU 2K2) / GPIO#5     |
| 28 | I2C_SCLK  | I2C clock                | I2C_SCL(PU 2K2) / GPIO#4     |
| 29 | WDT_RST_N | WPS/RST                  | WDT_RST_N / GPIO#38/O, IPU   |
| 30 | P0_LED    | WAN_PORT_LED             | P0_LED_N / GPIO#43           |
| 31 | UART_TXD1 | UART1 Serial Data Output | UART1_TXD / GPIO#45 / O, IPU |
| 32 | UART_RXD1 | UART 1 Serial Data Input | UART1_RXD / GPIO#46          |
| 33 | WPS_LED   | WPS_LED                  | I2S_MCLK/WPS_LED_N / GPIO#37 |
| 34 | I2S_DI    | I2S data input           | I2S_SDI/GPIO#0/PCMDRX        |
| 35 | I2S_WS    | I2S word select          | I2S_WS/GPIO#2/PCMCLK         |
| 36 | I2S_DO    | I2S data output          | I2S_SDO /GPIO#1/PCMDTX/IPD   |
| 37 | I2S_CLK   | I2S clock                | I2S_CLK/GPIO#3/PCMFS         |
| 38 | PWM3      | PWM                      | GPIO#21 / PWM3 / UART2_RXD   |
| 39 | PWM2      | PWM                      | GPIO#20 / PWM2 / UART2_TXD   |
| 40 | GND       | Ground                   | GND                          |

## 8 PCB Footprint and Dimensions

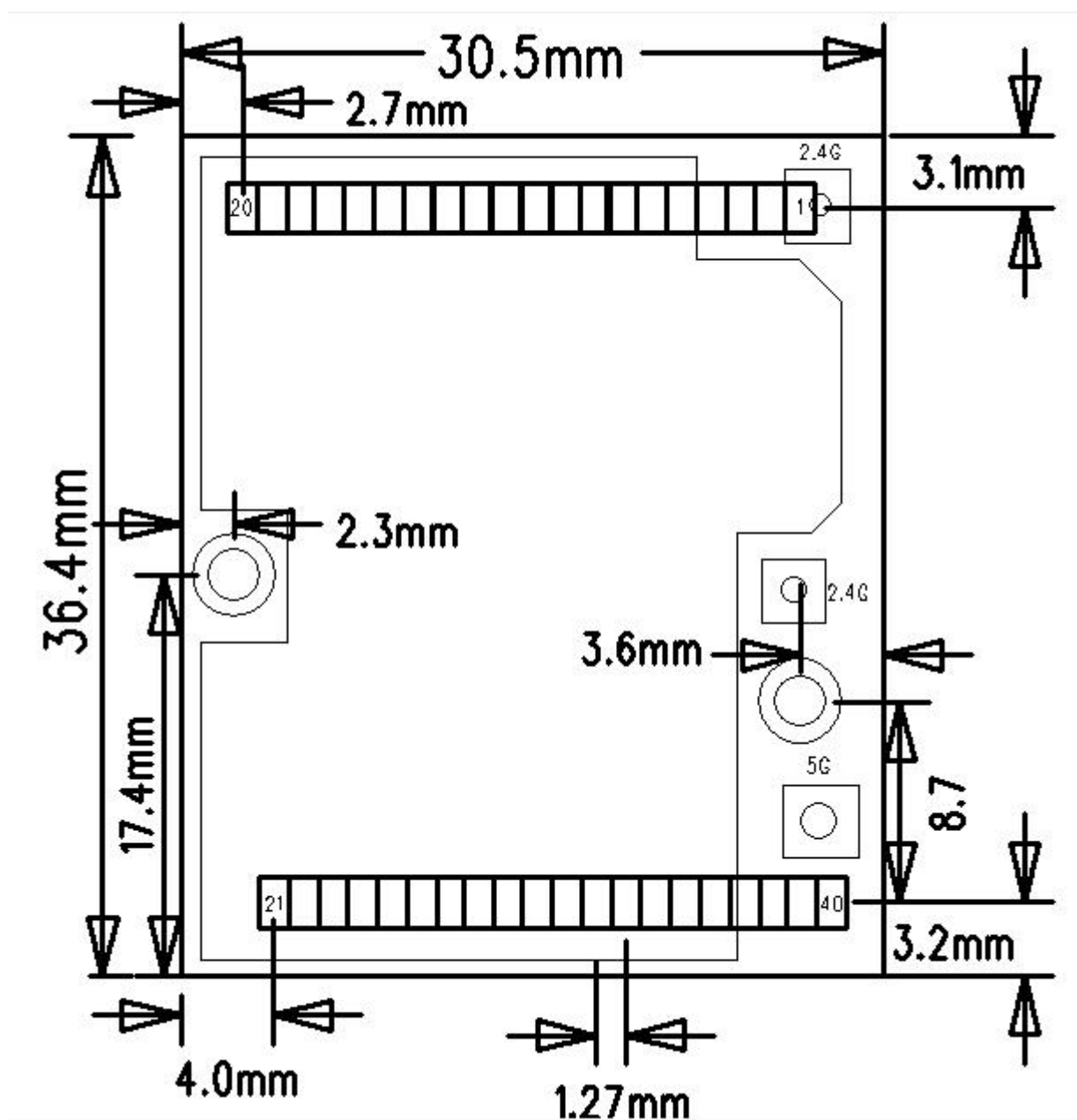


Figure 6: SKW93A Recommend PCB Footprint

## 9 Electrical Characteristics

### a) Absolute Maximum Ratings

Table9-1: Absolute Maximum Ratings

| Parameter                 | Condition | Min  | Typ. | Max. | Unit |
|---------------------------|-----------|------|------|------|------|
| Storage temperature range |           | -40  |      | 125  | °C   |
| ESD Protection            | VESD      | /    |      | 2000 | V    |
| Supply voltage            | VDD_3.3V  | 0    |      | 3.6  | V    |
| Voltage on any I/O pin    |           | -0.3 |      | 3.63 | V    |

**Note:** Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

\*SKW93A series modules are Electrostatic Sensitive Devices and require special precautions while handling.



#### ESD precautions

The SKW93A series modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the SKW93A series modules without proper ESD protection may destroy or damage them permanently.

The SKW93A series modules are electrostatic sensitive devices (ESD) and require special ESD precautions typically applied to ESD sensitive components. Proper ESD handling and packaging procedures must be applied throughout the processing, handling, transportation and operation of any application that incorporates the SKW93A series module. Don't touch the module by hand or solder with non-anti-static soldering iron to avoid damage to the mode.

## b) Recommended Operation Ratings

Table9-2: Operating Conditions

| Parameter            | Symbol   | Minimum | Typical | Maximum | Unit |
|----------------------|----------|---------|---------|---------|------|
| Extended temp. range | TA       | -20     |         | 55      | °C   |
| Power Supply         | VDD_3.3V | 3.14    | 3.3     | 3.46    | V    |
| Input Low Voltage    | VIL      | -0.3    |         | 0.8     | V    |
| Input High Voltage   | VIH      | 2       |         | 3.63    | V    |

## c) Measurement Conditions

Table9-3: Power Consumption in Different States

| System state                               | Current (Typ.)@3.3V |
|--------------------------------------------|---------------------|
| Standby                                    | 280 mA              |
| Transmit (2.4/5g; +13 dBm @ TX HT20 MCS7.) | 590 mA              |
| Transmit (2.4/5g; +16 dBm @ TX HT20 MCS7.) | 850 mA              |

## 10 Ordering Information

| Module No. | DDR2 Flash Size | SPI Flash Size |
|------------|-----------------|----------------|
| SKW93A_8   | 64M Bytes       | 8M Bytes       |
| SKW93A_16  | 64M Bytes       | 16M Bytes      |

## 11 Contact Information

**Skylab M&C Technology Co., Ltd.**

深圳市天工测控技术有限公司

**Address:** 6 Floor, No.9 Building, Lijincheng Scientific & Technical park, Gongye East Road,  
Longhua District, Shenzhen, Guangdong, China

**Phone:** 86-755 8340 8210 (Sales Support)

**Phone:** 86-755 8340 8510 (Technical Support)

**Fax:** 86-755-8340 8560

**E-Mail:** sales1@skylab.com.cn

**Website:** www.skylab.com.cn      www.skylabmodule.com