



**This document applicable to the following products :**

| Product name                               | Type number      | Product status  |
|--|------------------|-----------------|
| 802.11b/g/n 2x2 MIMO WiFi AP/Router Module | SKW92A (0919601) | Mass Production |
|  | SKW92A (0919602) |                 |

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## 1 General Description

The SKW92A module includes an 802.11n MAC and baseband, a 2.4GHz radio and FEM, a 580MHz MIPS CPU, a 5-port 10/100 fast Ethernet switch. Solution for low power, low-cost, and highly integrated AP router and consumer electronic devices, the module requires only an external 3.3V power supply. It supports 802.11n operating up to 144 Mbps for 20 MHz and 300 Mbps for 40 MHz channel respectively, and IEEE 802.11b/g data rates.

The module supports bridge mode and AP Client mode and Gateway mode. The high performance Module can process advanced applications effortlessly, such as routing, security and VoIP. It also includes a selection of interface to support a variety of applications, such as a USB port for accessing external storage and 3G/TLE modem. Especially in the IOT, a wide range of applications.

## 2 Applications

- ◆ USB WiFi Camera
- ◆ IOT (internet of things)
- ◆ WiFi AP
- ◆ 3G/4G Wi-Fi Router
- ◆ WiFi Repeater
- ◆ Building Automation
- ◆ Home Automation
- ◆ Smart Home Gateway
- ◆ Industry Control

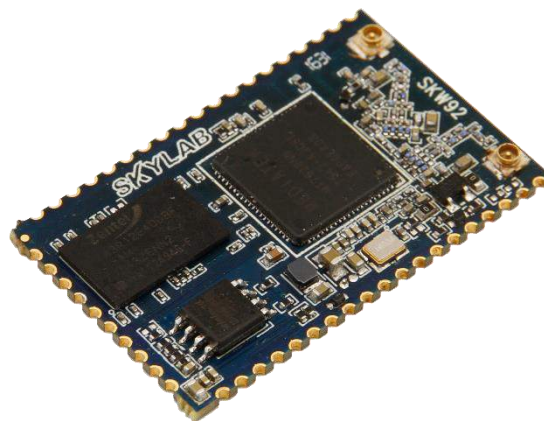


Figure 1: SKW92A Top View

## 3 Features

- ◆ Compliant to IEEE 802.11b/g/n.
- ◆ 2T2R mode with support for a 300Mbps PHY data rate.
- ◆ DDR2 memory up to 1024Mb.
- ◆ Flash memory up to 256Mb.
- ◆ 4 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, PCM, I2S(192K/24bits), PWM, SPI slave, UART lite, GPIO.
- ◆ Security: WEP64/128, TKIP, AES, WPA, WPA2, WAPI.
- ◆ Support AP/Client/Router mode.
- ◆ RoHS compliance meets environment-friendly requirement.
- ◆ Conform to FCC/CE/IC/RoHS certification standards.
- ◆ 40.5mm(L) x 25mm(W) x 3.0mm(H) dimension.

## 4 Application Block Diagram

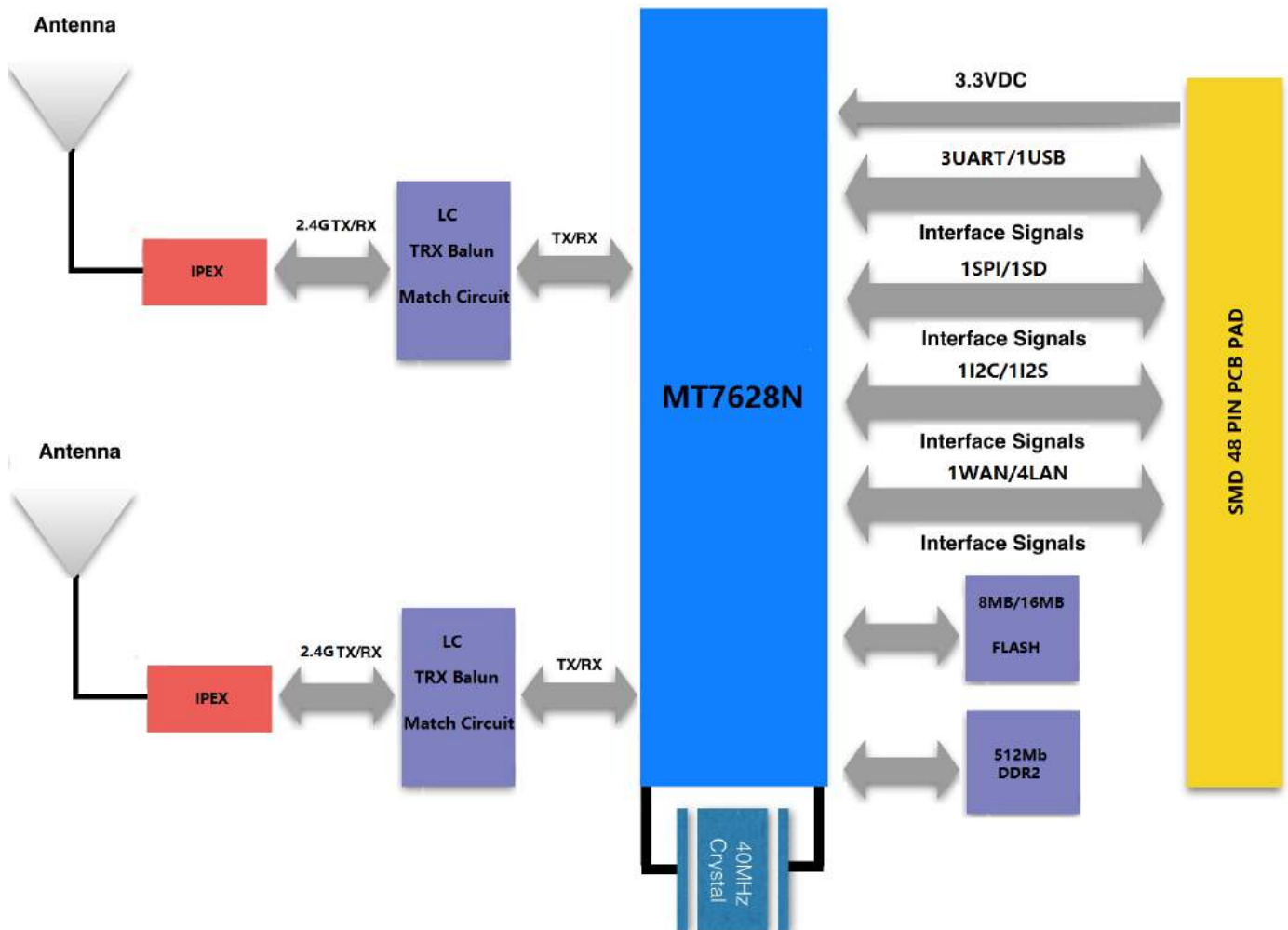


Figure 2: SKW92A Block Diagram

## 5 Interfaces

### USB

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

### I2C

| SKW92A Pin Number | Pin Name | GPIO(2'b01) | I2C(2'b00) |
|-------------------|----------|-------------|------------|
| 46                | I2C_SD   | GPIO#05     | I2C_SD     |
| 47                | I2C_CLK  | GPIO#04     | I2C_CLK    |

Table5-1: I2C pin share scheme

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

## SD

| SKW92A Pin Number | Pin Name(4'b0000) | GPIO(2'b01) | SD(2'b00) |
|-------------------|-------------------|-------------|-----------|
| 24                | LAN_PORT4_TX-     | GPIO#29     | SD_D2     |
| 23                | LAN_PORT4_TX+     | GPIO#28     | SD_D3     |
| 22                | LAN_PORT4_RX-     | GPIO#27     | SD_CMD    |
| 21                | LAN_PORT4_RX+     | GPIO#26     | SD_CLK    |
| 16                | LAN_PORT3_RX-     | GPIO#25     | SD_D0     |
| 15                | LAN_PORT3_RX+     | GPIO#24     | SD_D1     |
| 14                | LAN_PORT3_TX-     | GPIO#23     | SD_CD     |
| 13                | LAN_PORT3_TX+     | GPIO#22     | SD_WP     |

**Table5-2: SD pin share scheme**

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

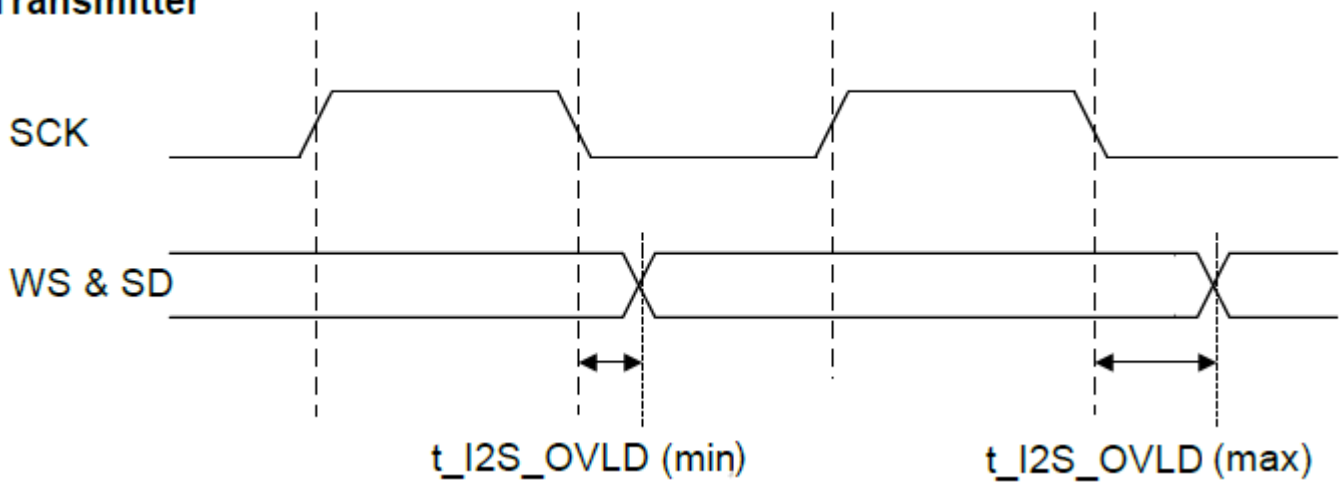
## I2S(192K/24bits)

| SKW92A Pin Number | Pin Name | GPIO(2'b01) | I2S(2'b00) | PCM(2'b10) |
|-------------------|----------|-------------|------------|------------|
| 44                | I2S_CLK  | GPIO#03     | I2S_CLK    | PCMFS      |
| 42                | I2S_WS   | GPIO#02     | I2S_WS     | PCMCLK     |
| 43                | I2S_SDO  | GPIO#01     | I2S_SDO    | PCMDTX     |
| 41                | I2S_SDI  | GPIO#0      | I2S_SDI    | PCMDRX     |

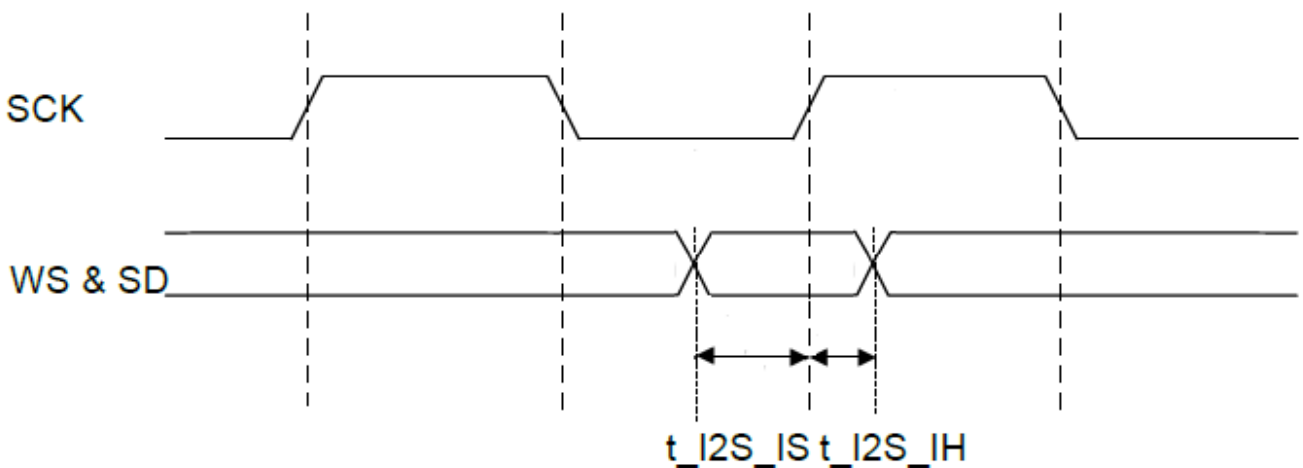
**Table5-3: I2S/PCM pin share scheme**

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

**Transmitter**



**Receiver**



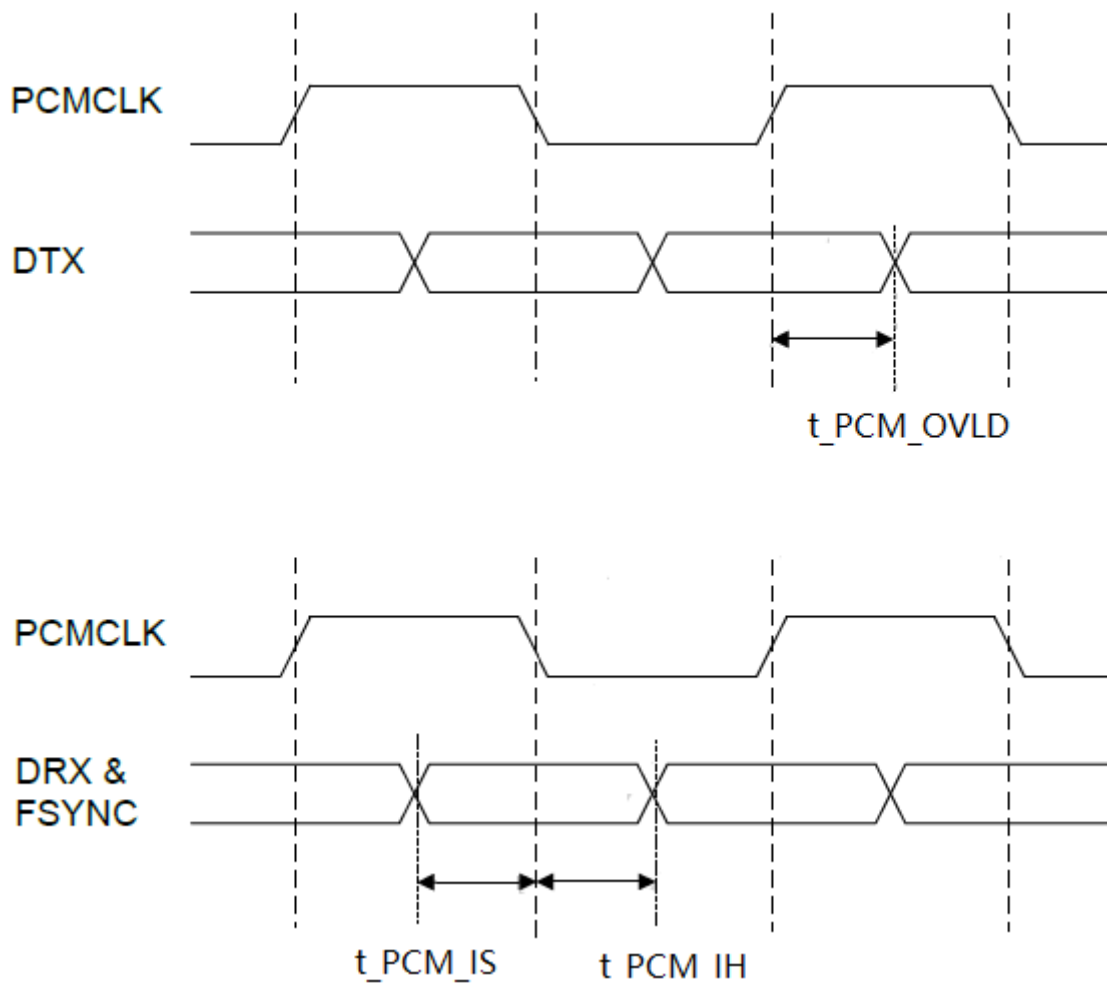
**Figure 3: I2S Timing**

| 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   |

**Table5-4: I2S Interface Diagram Key**



**PCM**



**Figure 4: PCM Timing**

| 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   |

**Table5-5: PCM Interface Diagram Key**

**PWM**

| SKW92A Pin Number | Pin Name      | GPIO    | PWM  | Pin Share |
|-------------------|---------------|---------|------|-----------|
| 10                | LAN_PORT2_RX- | GPIO#19 | PWM1 | SD_D6     |
| 9                 | LAN_PORT2_RX+ | GPIO#18 | PWM0 | SD_D7     |

**Table5-6: PWM pin share scheme**

### SPI slave

| SKW92A Pin Number | Pin Name(4'b0000) | GPIO(2'b01) | SPIS(2'b00) | 2'b11     |
|-------------------|-------------------|-------------|-------------|-----------|
| 8                 | LAN_PORT1_RX-     | GPIO#17     | SPIS_MOSI   | UART_RXD2 |
| 7                 | LAN_PORT1_RX+     | GPIO#16     | SPIS_MISO   | UART_TXD2 |
| 6                 | LAN_PORT1_TX-     | GPIO#15     | SPIS_CLK    | PWM_CH1   |
| 5                 | LAN_PORT1_TX+     | GPIO#14     | SPIS_CS     | PWM_CH0   |

**Table5-7: SPIS pin share scheme**

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

### UARTS lite

The module support 3UART:

| SKW92A Pin Number | Pin Name      | GPIO    | UART      | Pin Share        |
|-------------------|---------------|---------|-----------|------------------|
| 25                | UART_RXD0     | GPIO#13 | UART0_RXD | UART0(For Debug) |
| 26                | UART_TXD0     | GPIO#12 | UART0_TXD |                  |
| 38                | UART_RXD1     | GPIO#46 | UART1_RXD | PWM_CH1          |
| 37                | UART_TXD1     | GPIO#45 | UART1_TXD | PWM_CH0          |
| 12                | LAN_PORT2_TX- | GPIO#21 | UART2_RXD | PWM_CH3/SD_D4    |
| 11                | LAN_PORT2_TX+ | GPIO#20 | UART2_TXD | PWM_CH2/SD_D5    |

**Table5-8: UART pin share scheme**

### GPIO

| SKW92A Pin Number | GPIO    | Description | Share function |
|-------------------|---------|-------------|----------------|
| 38                | GPIO#46 | Uart1_RXD   | UART1          |
| 37                | GPIO#45 | Uart1_TXD   |                |
| 36                | GPIO#44 | WLED_N      | Wireless LED   |
| 35                | GPIO#43 | P0_LED      | Port LED       |
| 34                | GPIO#42 | P1_LED      |                |
| 33                | GPIO#41 | P2_LED      |                |
| 32                | GPIO#40 | P3_LED      |                |
| 31                | GPIO#39 | P4_LED      |                |

|    |         |                |                     |       |
|----|---------|----------------|---------------------|-------|
| 39 | GPIO#38 | WDT_RST_N      | WPS/Factory Setting |       |
| 40 | GPIO#37 | WPS_LED        | WPS LED             |       |
| 24 | GPIO#29 | MDI_TN_P4      | SD-XC               |       |
| 23 | GPIO#28 | MDI_TP_P4      |                     |       |
| 22 | GPIO#27 | MDI_RN_P4      |                     |       |
| 21 | GPIO#26 | MDI_RP_P4      |                     |       |
| 16 | GPIO#25 | MDI_RN_P3      |                     |       |
| 15 | GPIO#24 | MDI_RP_P3      |                     |       |
| 14 | GPIO#23 | MDI_TN_P3      |                     |       |
| 13 | GPIO#22 | MDI_TP_P3      |                     |       |
| 12 | GPIO#21 | MDI_TN_P2      |                     | UART2 |
| 11 | GPIO#20 | MDI_TP_P2      |                     |       |
| 10 | GPIO#19 | MDI_RN_P2      | PWM1                |       |
| 9  | GPIO#18 | MDI_RP_P2      | PWM0                |       |
| 8  | GPIO#17 | MDI_RN_P1      | SPIS                |       |
| 7  | GPIO#16 | MDI_RP_P1      |                     |       |
| 6  | GPIO#15 | MDI_TN_P1      |                     |       |
| 5  | GPIO#14 | MDI_TP_P1      |                     |       |
| 25 | GPIO#13 | UART0_RXD      | Uart0(For Debug)    |       |
| 26 | GPIO#12 | UART0_TXD      |                     |       |
| 48 | GPIO#11 | GPIO0          | GPIO0               |       |
| 46 | GPIO#05 | I2C_SD         | I2C                 |       |
| 47 | GPIO#04 | I2C_CLK        |                     |       |
| 44 | GPIO#03 | I2S_CLK/PCMFS  | I2S/PCM             |       |
| 42 | GPIO#02 | I2S_WS/PCMCLK  |                     |       |
| 43 | GPIO#01 | I2S_SDO/PCMDTX |                     |       |
| 41 | GPIO#0  | I2S_SDI/PCMDRX |                     |       |

**Table5-9: GPIO pin share scheme**

## WAN/LAN

The SKW92A module integrates 5-port 10/100Mbps fast Ethernet switch.

## 6 Module Specifications

| Hardware Features           |  |
|-----------------------------|--|
| <b>Model</b>                | SKW92A                                     |
| <b>Antenna Type</b>         | IPEX                                       |
| <b>Chipset solution</b>     |  |
| <b>Voltage</b>              | 3.3V±5%                                    |
| <b>Dimension(L×W×H)</b>     | 40.5mm*25.0mm*3.0mm                        |
| Wireless Features           |  |
| <b>Wireless Standards</b>   | IEEE 802.11b/g/n                           |
| <b>Frequency Range</b>      | 2.412GHz---2.484 GHz                       |
| <b>Data Rates</b>           | 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           |
|                             | MCS0--MCS7 @ HT40                          |
| <b>Receiver Sensitivity</b> | HT40 MCS7 : -70dBm@10% PER(MCS7)           |
|                             | HT20 MCS7 : -73dBm@10% PER(MCS7)           |
|                             | 54M: -77dBm@10% PER                        |
|                             | 11M: -89dBm@ 8% PER                        |
| <b>Modulation Technique</b> | DSSS (DBPSK, DQPSK, CCK)                   |
|                             | OFDM (BPSK, QPSK, 16-QAM, 64-QAM)          |
| <b>Wireless Security</b>    | WPA/WPA2, WEP, TKIP and AES, WPS2.0, WAPI  |
| <b>Transmit Power</b>       | IEEE 802.11n: 16dBm @HT20/40 MCS7          |
|                             | IEEE 802.11g: 16dBm @54MHz                 |
|                             | IEEE 802.11b: 18dBm @11MHz                 |
| <b>Work Mode</b>            | Bridge/Gateway/AP Client                   |
| Others                      |  |
| <b>Certification</b>        | RoHS                                       |
| <b>Environment</b>          | 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:

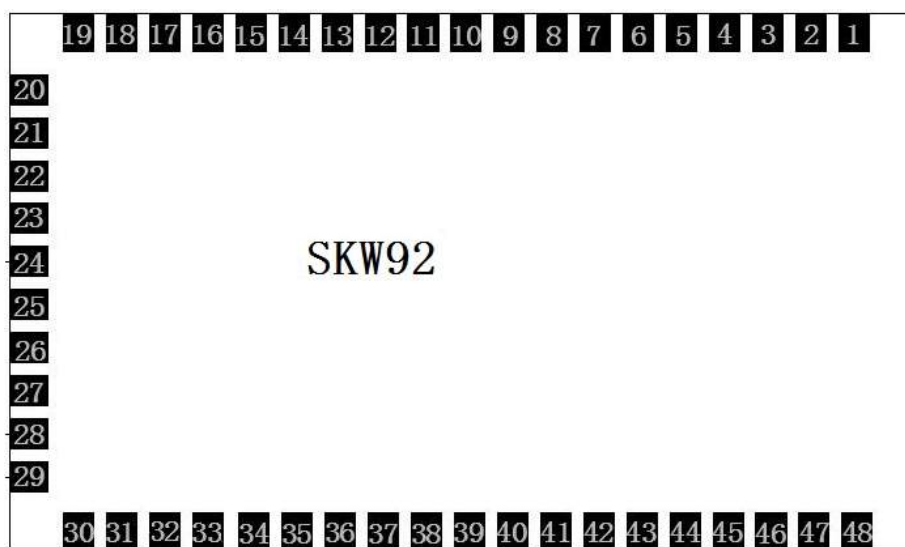


Figure 5: SKW92A Pin Package

### Pin Description:

| Pin No. | Pin name      | Description    | Remark                       |
|---------|---------------|----------------|------------------------------|
| 1       | WAN_PORT_RX+  | WAN port       | WAN_RX+                      |
| 2       | WAN_PORT_RX-  | WAN port       | WAN_RX-                      |
| 3       | WAN_PORT_TX+  | WAN port       | WAN_TX+                      |
| 4       | WAN_PORT_TX-  | WAN port       | WAN_TX-                      |
| 5       | LAN_PORT1_TX+ | Ethernet port1 | SPIS_CS / GPIO#14 / PWM0     |
| 6       | LAN_PORT1_TX- | Ethernet port1 | SPIS_CLK / GPIO#15 / PWM1    |
| 7       | LAN_PORT1_RX+ | Ethernet port1 | SPIS_MISO / GPIO#16 /        |
| 8       | LAN_PORT1_RX- | Ethernet port1 | SPIS_MOSI / GPIO#17 /        |
| 9       | LAN_PORT2_RX+ | Ethernet port2 | GPIO#18 / PWM0 / SD_D7       |
| 10      | LAN_PORT2_RX- | Ethernet port2 | GPIO#19 / PWM1 / SD_D6       |
| 11      | LAN_PORT2_TX+ | Ethernet port2 | GPIO#20 / PWM2 / UART2_TXD / |
| 12      | LAN_PORT2_TX- | Ethernet port2 | GPIO#21 / PWM3 / UART2_RXD / |

|    |               |                          |                              |
|----|---------------|--------------------------|------------------------------|
| 13 | LAN_PORT3_TX+ | Ethernet port3           | SD_WP / GPIO#22              |
| 14 | LAN_PORT3_TX- | Ethernet port3           | SD_CD / GPIO#23              |
| 15 | LAN_PORT3_RX+ | Ethernet port3           | SD_D1 / GPIO#24              |
| 16 | LAN_PORT3_RX- | Ethernet port3           | SD_D0 / GPIO#25              |
| 17 | GND           | Ground                   | GND                          |
| 18 | USB+          | USB data pin Data+       | USB_D+                       |
| 19 | USB-          | USB data pin Data-       | USB_D-                       |
| 20 | GND           | Ground                   | GND                          |
| 21 | LAN_PORT4_RX+ | Ethernet port4           | SD_CLK / GPIO#26             |
| 22 | LAN_PORT4_RX- | Ethernet port4           | SD_CMD/ GPIO#27              |
| 23 | LAN_PORT4_TX+ | Ethernet port4           | SD_D3 / GPIO#28              |
| 24 | LAN_PORT4_TX- | Ethernet port4           | SD_D2 / GPIO#29              |
| 25 | UART_RXD0     | UART0 only for debug     | UART0_RX / GPIO#13           |
| 26 | UART_TXD0     | UART0 only for debug     | UART0_TX / GPIO#12 / O, IPD  |
| 27 | GND           | Ground                   | GND                          |
| 28 | 3.3VD         | 3.3V input 1000mA        | +3.3V                        |
| 29 | 3.3VD         | 3.3V input 1000mA        | +3.3V                        |
| 30 | GND           | Ground                   | GND                          |
| 31 | P4_LED        | LAN_PORT4_LED            | P4_LED_N / GPIO#39           |
| 32 | P3_LED        | LAN_PORT3_LED            | P3_LED_N / GPIO#40           |
| 33 | P2_LED        | LAN_PORT2_LED            | P2_LED_N / GPIO#41           |
| 34 | P1_LED        | LAN_PORT1_LED            | P1_LED_N / GPIO#42           |
| 35 | P0_LED        | WAN_PORT_LED             | P0_LED_N / GPIO#43           |
| 36 | WLED_N        | Wireless LED             | WLED_N / GPIO#44             |
| 37 | UART_TXD1     | UART1 Serial Data Output | UART1_TXD / GPIO#45 / O, IPU |
| 38 | UART_RXD1     | UART 1 Serial Data Input | UART1_RXD / GPIO#46          |
| 39 | WDT_RST_N     | WPS/Factory              | WDT_RST_N / I2S_MCLK /       |
| 40 | WPS_LED       | WPS_LED                  | WPS_LED_N / GPIO#37          |
| 41 | I2S_DI        | I2S data input           | I2S_SDI/GPIO#0/PCMDRX        |
| 42 | I2S_WS        | I2S word select          | I2S_WS/GPIO#2/PCMCLK         |

|    |          |                     |                            |
|----|----------|---------------------|----------------------------|
| 43 | I2S_DO   | I2S data output     | I2S_SDO /GPIO#1/PCMDTX/IPD |
| 44 | I2S_CLK  | I2S clock           | I2S_CLK/GPIO#3/PCMFS       |
| 45 | HW_RESET | Power on reset      | HW_RESET_N#                |
| 46 | I2C_SD   | I2C Data            | I2C_SDA(PU 2K2) / GPIO#5   |
| 47 | I2C_SCLK | I2C clock           | I2C_SCL(PU 2K2) / GPIO#4   |
| 48 | GPIO0    | General Purpose I/O | POWER_ON# / GPIO#11/IPD    |

## 8 PCB Footprint and Dimensions

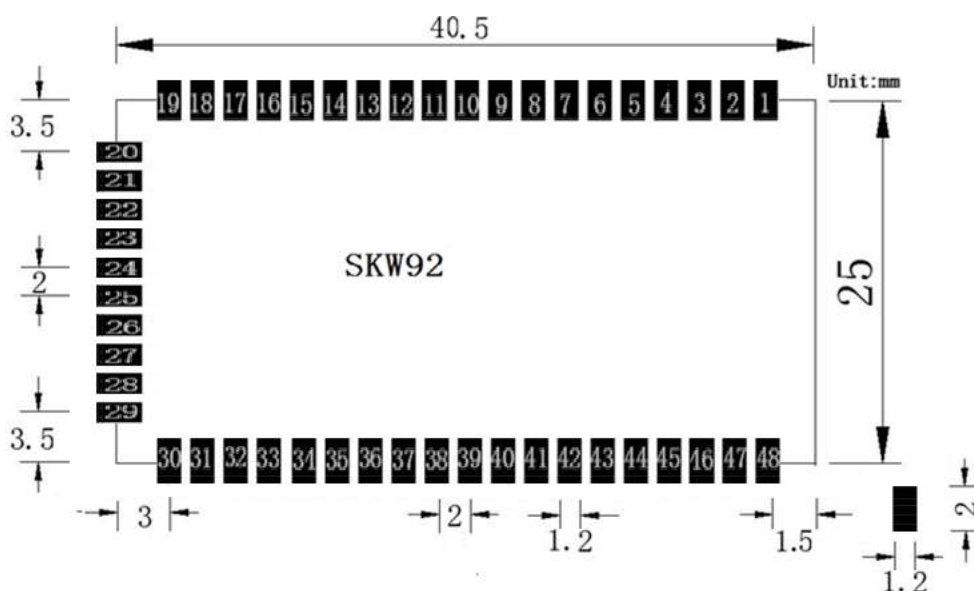


Figure 6: SKW92A Recommend PCB Footprint

## 9 Electrical Characteristics

### a) 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    |

Table9-1: Absolute Maximum Ratings

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.

\*SKW92A series modules are Electrostatic Sensitive Devices and require special precautions while handling.



### ESD precautions

The SKW92A series modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the SKW92A series modules without proper ESD protection may destroy or damage them permanently.

The SKW92A 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 SKW92A 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

| 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    |

Table9-2: Operating Conditions

### c) Measurement Conditions

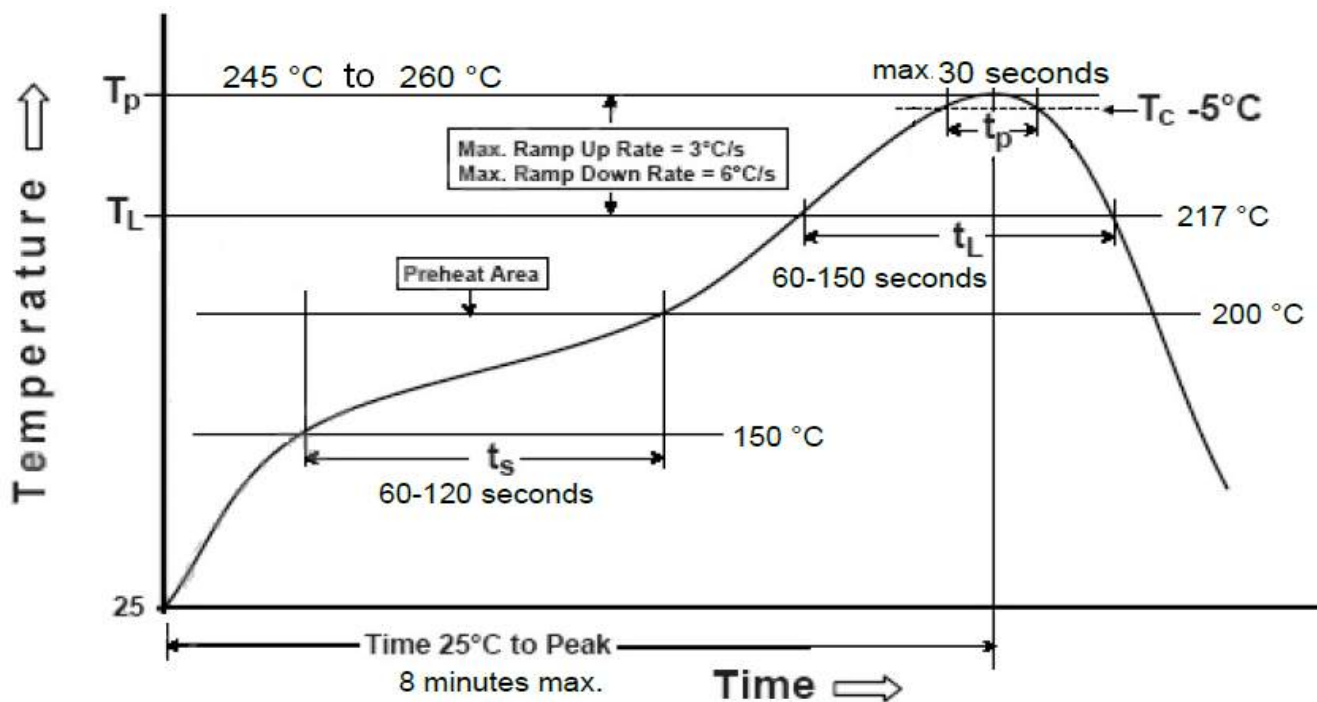
| System state | Current (Typ.)@3.3V | Current (Max.)@3.3V |
|--------------|---------------------|---------------------|
|--------------|---------------------|---------------------|



|  |        |        |
|--|--------|--------|
| Standby                                  | 180 mA | 210 mA |
| Transmit (2.4g; +15 dBm @ TX HT20 MCS7.) | 400 mA |        |
| Transmit (2.4g; +18 dBm @ 11b 11Mbps.)   | 650 mA | 850 mA |

**Table9-3: Power Consumption in Different States**

## 10 Manufacturing Process Recommendations



**Figure 7: SKW92A Typical Lead-free Soldering Profile**

**Note :** The final soldering temperature chosen at the factory depends on additional external factors like choice of soldering paste, size, thickness and properties of the baseboard, etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

## 11 Ordering Information

| Module No.  | SPI Flash Size | DDR2 Size  |
|-------------|----------------|------------|
| SKW92A_E8   | 8M Bytes       | 512M bits  |
| SKW92A_E16  | 16M Bytes      | 512M bits  |
| SKW92A_E325 | 32M Bytes      | 512M bits  |
| SKW92A_E321 | 32M Bytes      | 1024M bits |

## 12 Revision History

| Revision | Description                          | Approved  | Date     |
|----------|--------------------------------------|-----------|----------|
| V1.01    | Initial Release                      | Sunny Pan | 20151228 |
| V1.02    | Update Pin Description               | George He | 20160315 |
| V1.03    | Update Power Consumption             | George He | 20170413 |
| V1.04    | Update Ordering Information          | George He | 20171016 |
| V1.05    | Update Wireless Features Information | George He | 20180605 |

## 13 Contact Information

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