

# SKW78 4x4 MIMO WLAN

## Module Datasheet

Name: 802.11b/g/n/ac 4x4 MIMO WiFi AP/Router Module

Model No.: SKW78

Revision: V1.02

### Revision History

Revision	Description	Approved	Date
V1.01	Initial Release	George He	20160222
V1.02	Update certification information	George He	20170831

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## 1. General Description

The SKW78 module compliant to 802.11 a/b/g/n/ac Wi-Fi Solution, It integrates a dual-core MIPS1004Kc (880MHz), 3-port GbE switch, USB2.0, SD-XC. The module is suitable for 802.11ac, LTE cat4/5, edge, hotspot, VPN, AC (Access Control). For consumer electronic devices, the module requires 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 2x2 MIMO 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 866 Mbps for 80 MHz channel respectively.

The module support Bridge mode and AP/Client mode and Gateway mode.

## 2. Applications

- ◆ AP WiFi
- ◆ 802.11ac Router
- ◆ VPN
- ◆ 3G/4G Wi-Fi Router
- ◆ WiFi AP Client
- ◆ Hotspot
- ◆ Home Security Gateway
- ◆ Internet Service Router



Figure 1: SKW78 Top View

## 3. Features

- ◆ IEEE 802.11 a/b/g/n and 802.11ac draft compliant.
- ◆ Dual-band 4T4R mode with data rate up to 1167Mbps.
- ◆ 2.4G band 2T2R Mode with support for a 300Mbps TX/RX PHY rate.
- ◆ 5G band 2T2R Mode with support for a 867Mbps TX/RX PHY rate.
- ◆ DDR3 memory up to 1024Mb.
- ◆ Flash memory up to 128Mb.
- ◆ 2 LAN ports and 1 WAN port with 1000Mbps PHY.
- ◆ Firmware: Linux 2.6 SDK, OpenWRT
- ◆ Support WAN/LAN/USB/I2C/I2S/SD interfaces.
- ◆ Support 20MHz, 40MHz, 80MHz bandwidth.
- ◆ Security: WEP64/128, TKIP, AES, WPA, WPA2, WAPI.
- ◆ Support AP/Client/Router mode.
- ◆ RoHS compliance meets environment-friendly requirement.
- ◆ FCC,CE compliance.
- ◆ 71-pin header.
- ◆ 75.0mm(L) x 52.3mm(W) x 9.0mm(H) dimension.

## 4. Application Block Diagram

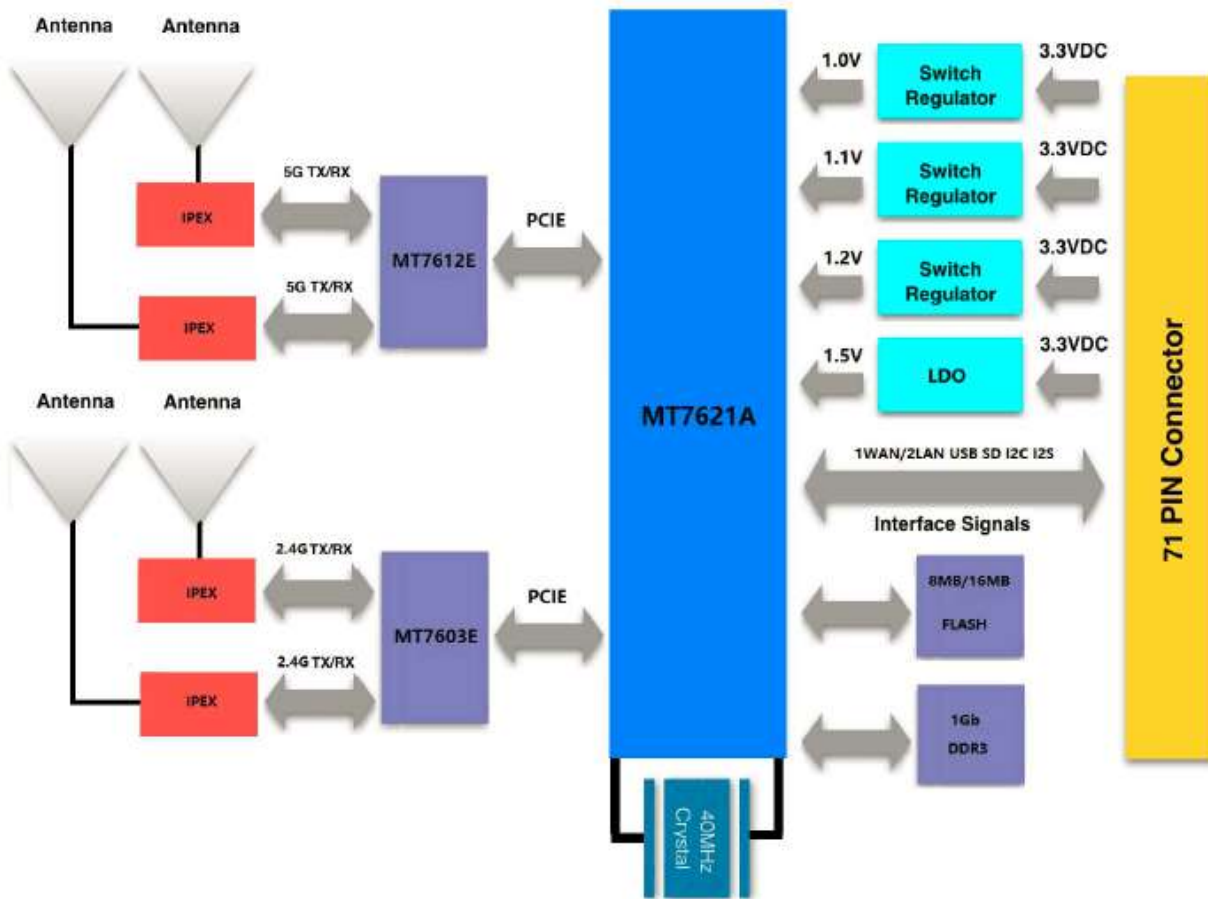


Figure 2: SKW78 Block Diagram

## 5. Interfaces

### USB2.0 Host

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

## I2C Interface

Below is the I2C interface timing.

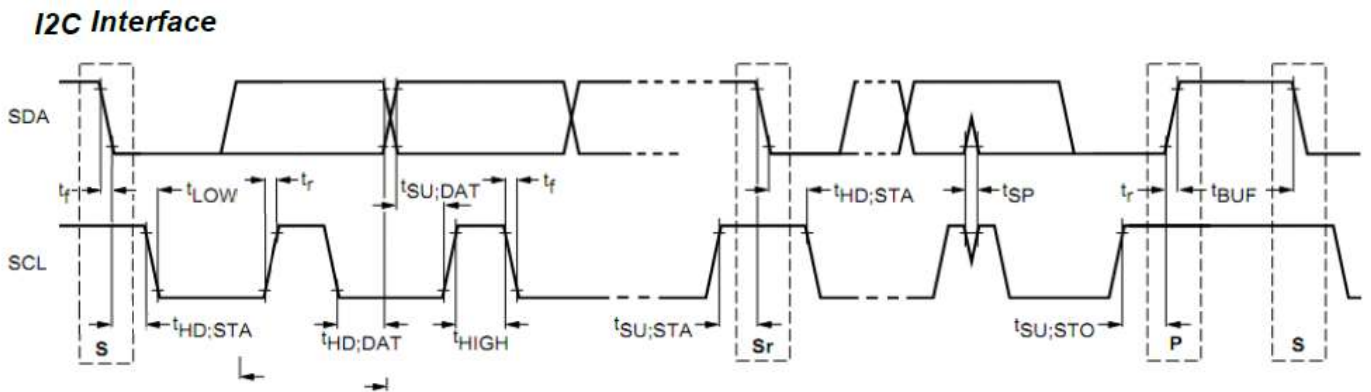


Figure 3: I2C Timing

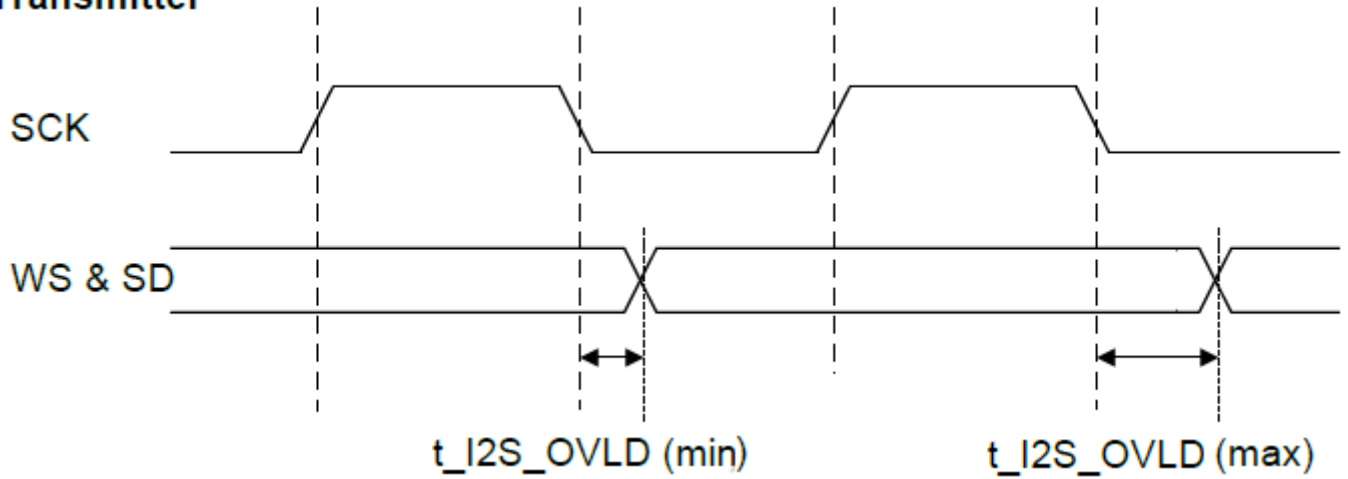
## I2S Interface

SKW78 Pin Number	SKW78 Pin Name	GPIO	I2S	UART3
50	I2S CLK	GPIO#6	I2S CLK	CTS3
51	I2S WS	GPIO#7	I2S WS	TXD3
52	I2S SDI	GPIO#8	I2S SDI	RXD3
53	I2S SDO	GPIO#5	I2S SDO	RTS3

Table5-1: I2S/UART3 pin share scheme

Note: Controlled by the UART3\_MODE register.

**Transmitter**



**Receiver**

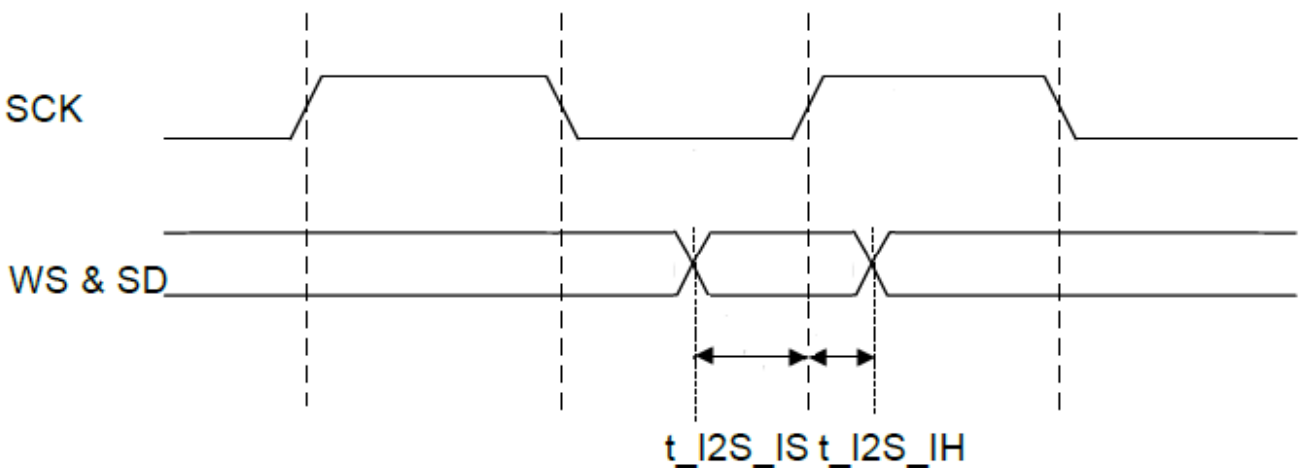


Figure 4: I2S Timing

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

Table5-2: I2S Interface Diagram Key

## SDXC

The SDXC interface support NAND flash(SLC) up to 8Gbits

SKW78 Pin Number	SKW78 Pin Name	GPIO	NAND	SDXC
42	ND D3	GPIO#48	ND D3	SD DATA3
43	ND D2	GPIO#47	ND D2	SD DATA2
44	ND D1	GPIO#46	ND D1	SD DATA1
45	ND D0	GPIO#45	ND D0	SD DATA0
46	ND RB N	GPIO#42	ND RB N	SD CLK
47	ND WP	GPIO#41	ND WP	SD WP
48	ND ALE	GPIO#44	ND ALE	SD CMD
49	ND CLE	GPIO#43	ND CLE	SD CD

Table5-3: NAND/SDXC pin share scheme

Note: Controlled by the SDXC\_MODE register.

## UART lite for debug

The UART interface only for debug.

SKW78 Pin Number	SKW78 Pin Name	GPIO	UART
36	UART RX	GPIO#1	RXD1
37	UART TX	GPIO#2	TXD1

Table5-4: UART1 pin share scheme

Note: Controlled by the UART1\_MODE register.

**GPIO**

SKW78 Pin Number	SKW78 Pin Name	GPIO		
42	ND D3	GPIO#48	ND D3	SD DATA3
43	ND D2	GPIO#47	ND D2	SD DATA2
44	ND D1	GPIO#46	ND D1	SD DATA1
45	ND D0	GPIO#45	ND D0	SD DATA0
46	ND RB N	GPIO#42	ND RB N	SD CLK
47	ND WP	GPIO#41	ND WP	SD WP
48	ND ALE	GPIO#44	ND ALE	SD CMD
49	ND CLE	GPIO#43	ND CLE	SD CD
36	UART RX	GPIO#1	RXD1	
37	UART TX	GPIO#2	TXD1	
50	I2S CLK	GPIO#6	I2S CLK	CTS3
51	I2S WS	GPIO#7	I2S WS	TXD3
52	I2S SDI	GPIO#8	I2S SDI	RXD3
53	I2S SDO	GPIO#5	I2S SDO	RTS3
35	WPS CONFIG	GPIO#18		
39	GPIO#0	GPIO#0		
40	I2C SCLK	GPIO#4		
41	I2C SD	GPIO#3		

**Table5-5: GPIO pin share scheme**



## WAN/LAN

The SKW78 module integrates 3-port GbE switch with full-line rate, 10/100/1000Mbps MDI transceivers.

## 6. Module Specifications

Hardware Features	
Model	SKW78
Antenna Type	IPEX
Chipset solution	
Voltage	3.3V±5%
Dimension(L×W×H)	75.0 x 52.3 x 9.0mm
Wireless Features	
Wireless Standards	IEEE 802.11a/b/g/n/ac
Frequency Range	2.412GHz-2.484GHz & 5.180GHz-5.825GHz
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 @ HT80 /5GHz band
Receiver Sensitivity	HT80 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 : -73dBm@10% PER(MCS7) /2.4GHz band
	54M: -76dBm@10% PER
	11M: -88dBm@ 8% PER
Modulation	DSSS (DBPSK, DQPSK, CCK)

<b>Technique</b>	OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 125-QAM,
<b>Wireless Security</b>	WPA/WPA2, WEP, TKIP and AES, WPS2.0, WAPI
<b>Transmit Power</b>	IEEE 802.11ac: 13dBm @HT80 MCS9 /5GHz band
	IEEE 802.11ac: 17dBm @HT80 MCS0 /5GHz band
	IEEE 802.11n: 15dBm @HT20/40 MCS7 /5GHz band
	IEEE 802.11n: 17dBm @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
<b>Work Mode</b>	Bridge/Gateway/AP Client
<b>Others</b>	
<b>Certification</b>	RoHS
<b>Environment</b>	Operating Temperature: -20°C~55°C
	Storage Temperature: -40°C~125°C
	Operating Humidity: 10%~90% non-condensing
	Storage Humidity: 5%~90% non-condensing

**Table6-1: Specifications**

## 7. Module Pinout and Pin Description

### Module Pinout:

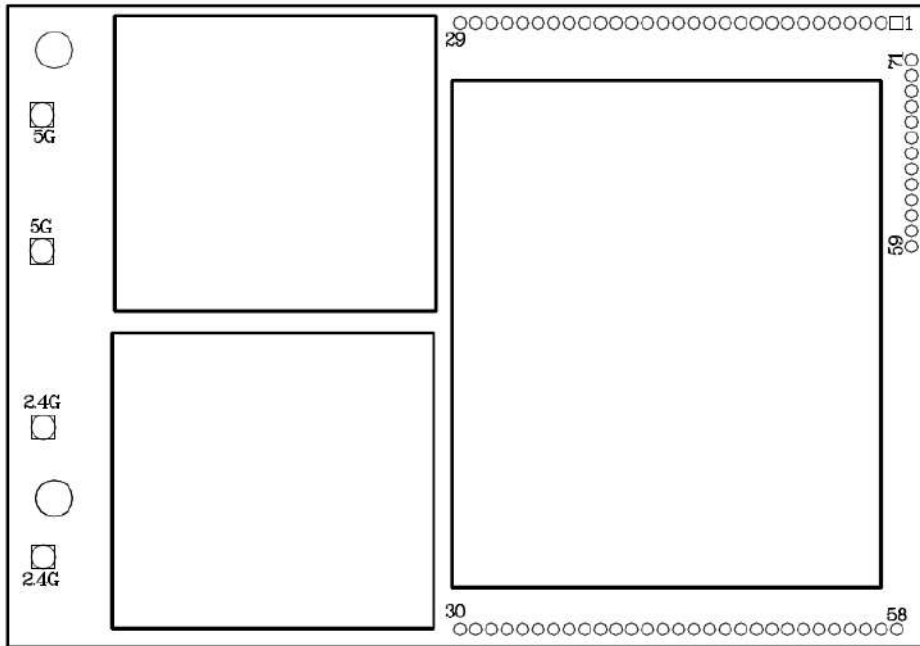


Figure 5: SKW78 Pin Package

### Pin Description:

1	GND	GROUND
2	LAN_P2_TXVP_A	1000M PHY LAN port #2 TXVP_A
3	LAN_P2_TXVN_A	1000M PHY LAN port #2 TXVN_A
4	GND	GROUND
5	LAN_P2_TXVP_B	1000M PHY LAN port #2 TXVP_B
6	LAN_P2_TXVN_B	1000M PHY LAN port #2 TXVN_B
7	GND	GROUND
8	LAN_P2_TXVP_C	1000M PHY LAN port #2 TXVP_C
9	LAN_P2_TXVN_C	1000M PHY LAN port #2 TXVN_C
10	GND	GROUND

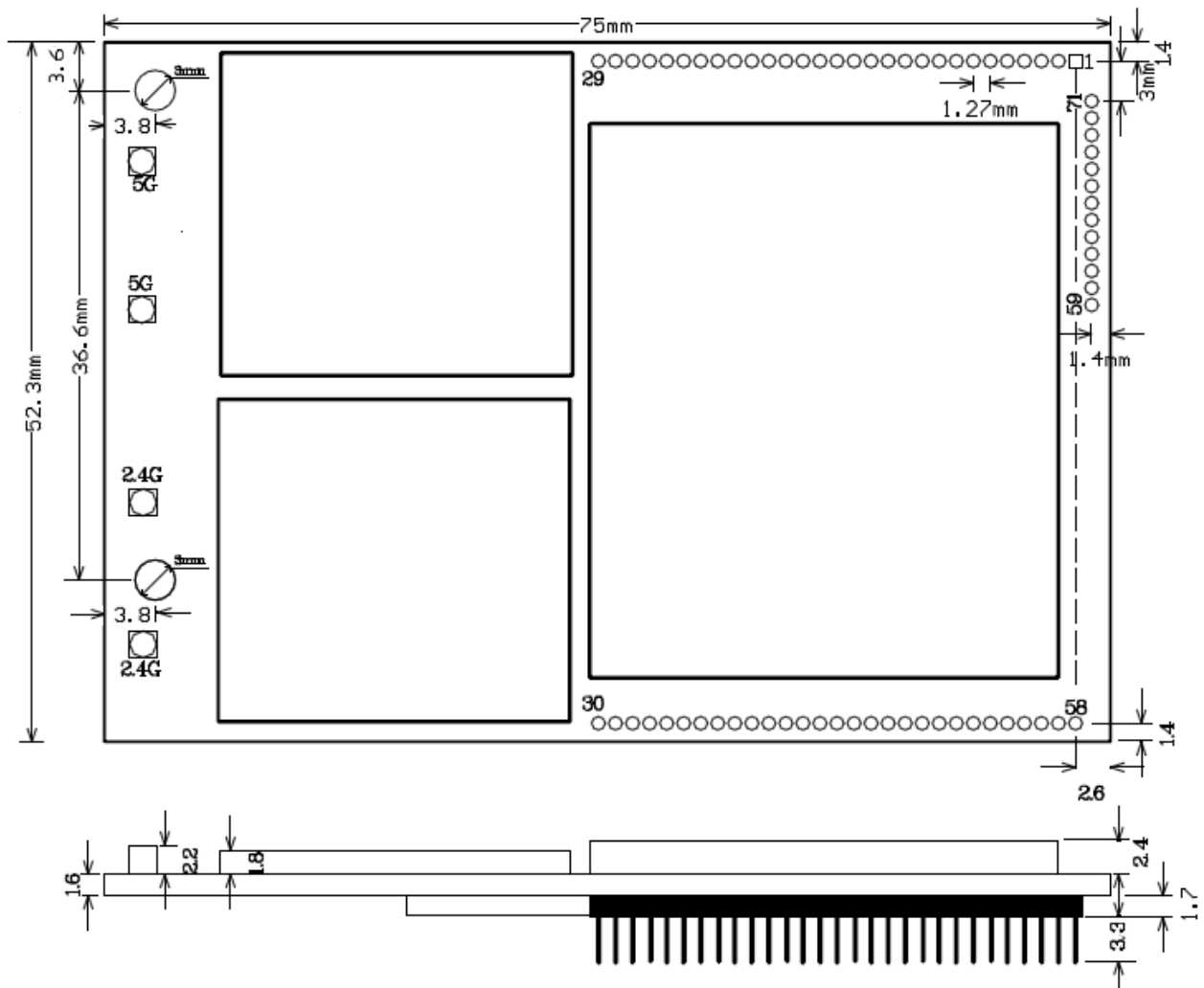
11	LAN P2 TXVP D	1000M PHY LAN port #2 TXVP D
12	LAN P2 TXVN D	1000M PHY LAN port #2 TXVN D
13	GND	GROUND
14	GND	GROUND
15	WAN P4 TXVP A	1000M PHY WAN port #4 TXVP A
16	WAN P4 TXVN A	1000M PHY WAN port #4 TXVN A
17	GND	GROUND
18	WAN P4 TXVP B	1000M PHY WAN port #4 TXVP B
19	WAN P4 TXVN B	1000M PHY WAN port #4 TXVN B
20	GND	GROUND
21	WAN P4 TXVP C	1000M PHY WAN port #4 TXVP C
22	WAN P4 TXVN C	1000M PHY WAN port #4 TXVN C
23	GND	GROUND
24	WAN P4 TXVP D	1000M PHY WAN port #4 TXVP D
25	WAN P4 TXVN D	1000M PHY WAN port #4 TXVN D
26	GND	GROUND
27	WAN P4 LED	WAN PORT4 PHY LED.
28	LAN P2 LED	LAN PORT2 PHY LED
29	LAN P1 LED	LAN PORT1 PHY LED
30	VDD 3.3V	3.3V input 1000mA, recommended voltage 3.3V±5%.
31	VDD 3.3V	3.3V input 1000mA, recommended voltage 3.3V±5%.
32	GND	GROUND
33	GND	GROUND
34	LED 2.4G	Wireless LED for 2.4G
35	WPS CONFIG	Module WPS Input(Active Low Status), IPU, GPIO#18
36	UART RX	UART Serial Data Input, GPIO#2
37	UART TX	UART Serial Data Output, GPIO#1

38	RESET CONFIG	Module Reset Input(Active Low Status)
39	GPIO0	GPIO#0
40	I2C SCLK	I2C clock. GPIO#4
41	I2C SD	I2C Data. GPIO#3
42	ND D3	NAND Flash data3. GPIO#48
43	ND D2	NAND Flash data2. GPIO#47
44	ND D1	NAND Flash data1. GPIO#46
45	ND D0	NAND Flash data0. GPIO#45
46	ND RB N	NAND Flash Ready/Busy. GPIO#42
47	ND WP	NAND Flash Write Protect. GPIO#41
48	ND ALE	NAND Flash ALE Latch Enable. GPIO#44
49	ND CLE	NAND Flash Command Latch Enable. GPIO#43
50	I2S CLK	IIS clock. In master mode the pin data direction is set
51	I2S WS	IIS Channel Selection. In master mode the pin data
52	I2S SDI	IIS Data Input. GPIO#8
53	I2S SDO	IIS Data Output. GPIO#5.
54	GND	GROUND
55	USB +	USB signal, carries USB data to and from the USB 2.0
56	USB -	USB signal, carries USB data to and from the USB 2.0
57	GND	GROUND
58	VDD 3.3V	3.3V input 1000mA, recommended voltage 3.3V±5%.
59	GND	GROUND
60	LAN P1 TXVP A	1000M PHY LAN port #1 TXVP A
61	LAN P1 TXVN A	1000M PHY LAN port #1 TXVN A
62	GND	GROUND
63	LAN P1 TXVP B	1000M PHY LAN port #1 TXVP B
64	LAN P1 TXVN B	1000M PHY LAN port #1 TXVN B

65	GND	GROUND
66	LAN P1 TXVP C	1000M PHY LAN port #1 TXVP C
67	LAN P1 TXVN C	1000M PHY LAN port #1 TXVN C
68	GND	GROUND
69	LAN P1 TXVP D	1000M PHY LAN port #1 TXVP D
70	LAN P1 TXVN D	1000M PHY LAN port #1 TXVN D
71	GND	GROUND

Table7-1: GPIO description

## 8. PCB Footprint and Dimensions



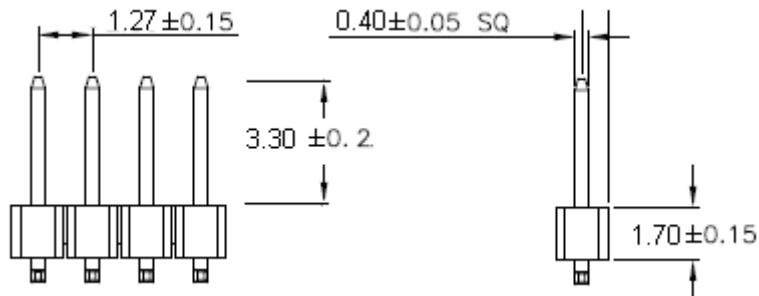


Figure 6: SKW78 Recommend PCB Footprint

## 9. Electrical Characteristics

### a) Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max.	Unit
Storage temperature		-40		125	°C
ESD Protection	VESD	/		2000	V
Supply voltage	VDD 3.3V	0		3.6	V
Voltage on any I/O		-0.3		3.63	V

Table9-1: Absolute Maximum Ratings

### b) Recommended Operation Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Extended temp.	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
Standby	360 mA
Transmit (2.4g; +15 dBm @ TX HT20 MCS7.)	560 mA
Transmit (5g; +14 dBm @ TX HT20 MCS7.)	650 mA
Transmit (5g; +14 dBm @ TX HT20 MCS7.+ 2.4g;	900 mA

Table9-3: Power Consumption in Different States

## 10. Ordering Information

Module No.	Antenna Connector Type	SPI Flash Size
SKW78_8	IPEX Connector	8M Bytes
SKW78_16	IPEX Connector	16M Bytes

## 11. Contact Information

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