PRODUCT SPECIFICATION

PRODUCT: ESP MODULE
PART NO: 830-00021

Prepared By	Checked By	Approved By		
MH			790-00006	
COOLIT SYSTEMS, INC.			REV.	A00

PROPRIETARY NOTE

1. Table of Contents

2. Summary

This document details the specifications of the Coolit Systems, Inc. ESP Wireless Module, P/N: 830-00021.

The ESP Wireless Module is a 2.54GHz, IEEE 802.15.4, transceiver for enabling Coolit Systems Node PCBs (Carrier Boards) to communicate wirelessly across a PAN (Personal Area Network), for monitoring and control of PC cooling devices, including fans, coolant pumps, temperature sensors, and self-contained liquid cooling systems.

3. Block Diagrams

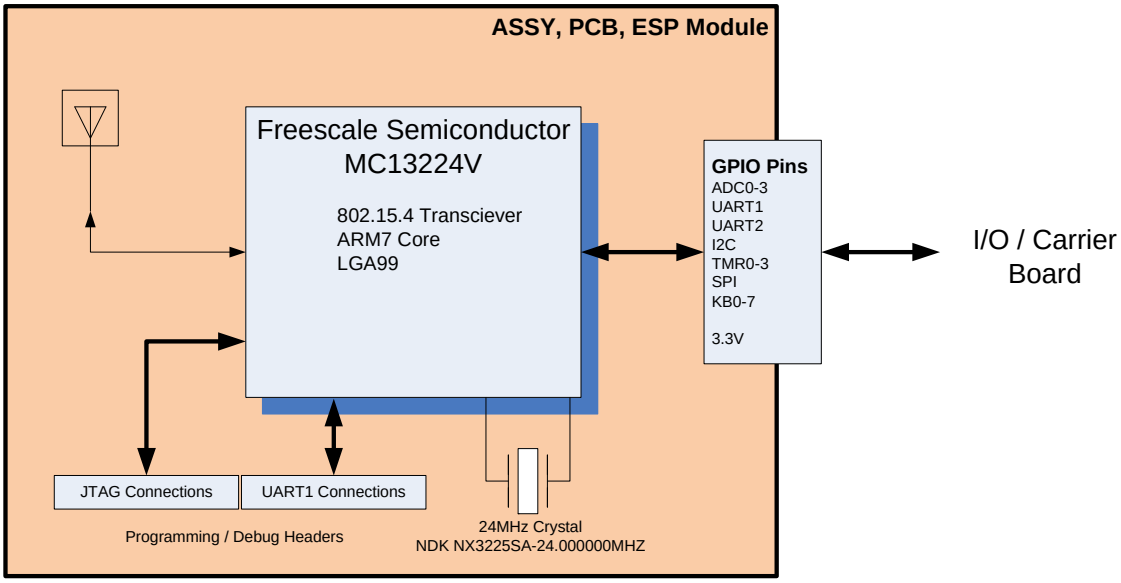


Figure 1 - ESP Module Block Diagram

3.1 Major Components

Microcontroller / Transceiver
- Freescale Semiconductor MC13224V
  - Integrated 802.15.4 Transciever
  - ARM7 Core

Antenna
- Johanson Technology 2450AT18A100
  - On-board chip antenna, 500mW max input power
  - 0.5dBi peak gain (typ.), -0.5dBi avg. gain (typ).

Crystal
- NDK NX3225SA-24.000000MHZ
- 24MHz Crystal, +/-15ppm

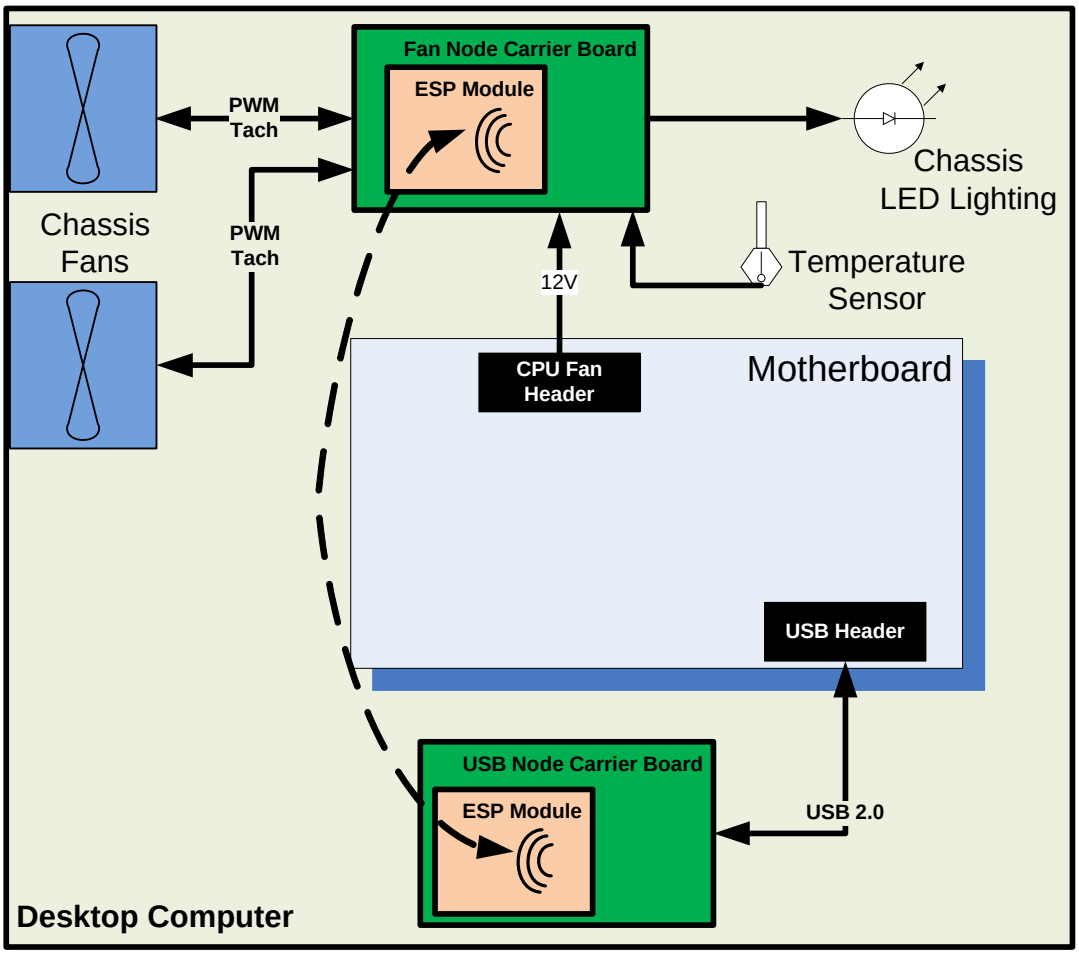


Figure 2 – Typical Usage of the ESP Node

3.2 Typical Usage

The ESP Module enables wireless communications between Carrier Boards within a desktop PC. In Fig.2 above, a typical scenario is shown, where the ESP Module passes wireless communications between a USB I/O Board and a Fan Node I/O Board. The USB Carrier board bridges wired communications between the host operating system (via USB) and the ARM7 controller on the ESP Module. The Fan Node carrier board monitors and controls PC devices such as fans, temperature sensors, and chassis lighting.

4. Mechanical Dimensions

The ESP Module measures 0.945” (24mm) x 0.750” (19.05mm), with a maximum height, including components, of 0.084” (2.14mm).

Figure

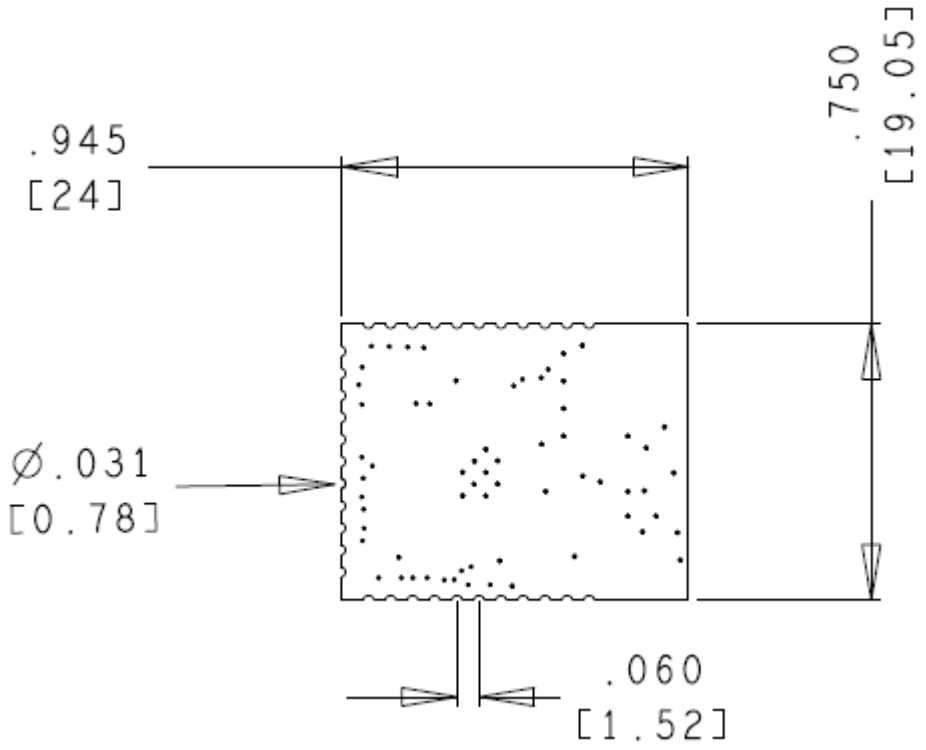


Figure 3 – ESP Module Dimensions

5. Pinouts

The optional JTAG/UART programming pins on the topside of the ESP Module has the following pinout. This connector is not installed for production.

Pin	Net Name	Description
1	+3.3V	3.3V Input for during factory programming
2	UART1_TX	Debug serial port / optional programming port
3	UART1_RX	"
4	UART1_CTS	"
5	UART1_RTS	"
6	RESET#	RESET used during programming operation
7	JTAG_TMS	JTAG / debug port
8	JTAG_TCK	"
9	JTAG_TDI	"
10	JTAG_TDO	"
11	JTAG_RTCK	"
12	GND	Ground conection used during factory prog.

Table 1 - JTAG/UART Pinout for Programming / Debug

The ESP Module itself has 33 solderable connections on the bottom side of the PCB for I/O to various carrier boards. The pinout is as follows:

Pin	Net Name	Description
1	GND	Ground
2	ADC0	Analog input channel 0
3	ADC1	Analog input channel 1
4	ADC2	Analog input channel 2
5	ADC3	Analog input channel 3
6	UART2_RX	UART Port 2
7	UART2_TX	“
8	UART1_RTS	UART Port 1
9	UART1_CTS	“
10	UART1_RX	“
11	UART1_TX	“
12	I2C_SDA	I^2C Interface
13	I2C_SCL	“
14	TMR3	Timer Channel 3
15	TMR2	Timer Channel 2
16	TMR1	Timer Channel 1
17	TMR0	Timer Channel 0
18	SPI_SCK	SPI Port
19	SPI_MOSI	“
20	SPI_MISO	“
21	SPI_SS	“
22	GND	Ground
23	KBI7	GPIO
24	KBI6	GPIO
25	KBI5	GPIO
26	KBI4	GPIO
27	KBI3	GPIO
28	COIL_BK	Unused
29	LREG_BK_FB	+3.3V Input Voltage
30	+3.3V	+3.3V Input Voltage
31	KBI2	GPIO
32	KBI1	GPIO
33	KBI0	GPIO

Table 2 – Carrier Board I/O Connections

6. Electrical Characteristics

Rating	Min	Max	Units
Storage Temperature	-55	125	^{o}C
Reflow Soldering Temperature		260	^{o}C
Power Supply Voltage (Vcc)	2.0	3.6	V
Digital Input Voltage	-0.3	Vcc + 0.2	V
RF Input Power		10	dBm

Table 3 – Absolute Maximum Ratings

Characteristic	Min	Max	Units
Power Supply Voltage (Vcc)	2.0	3.6	V
Operating Temperature Range	-10	70	^{o}C

Table 4 – Recommended Operating Conditions

Component	Voltage (V)	Current (mA)	Power (mW)
MC13224V	3.3	31 (max)[1]	102.3
R4 (Reset Pullup)	3.3	0.33	1.1
TOTAL			**103.4mW**

Table 5 – Power Requirements

Rating	Min	Max	Units
Input Frequency	2.405	2.480	GHz
RF Transmit Power (max.)		4.0	dBm
RF Channels		15	
RF Transmit Power Range		6.5	dB

Table 6 – RF Characteristics

[1] Transmit current, All RAM active, Radio TX on (sending @ 0dBm), CPU clk @ 2MHz

Appendix A Bill of Materials

Item	Part_Number	Qty	Ref	Description	MFG1	MFG_PN1
1	100-00918-00	1	U1	IC, MC13224V, Microcontroller, ARM7 Core, ZigBee Transciever, LGA99	Freescale Semiconductor	MC13224V
2	100-00919-00	1	U2	IC, Chip Antenna, 2.45GHz Antenna	Johanson Technology	2450AT18A100
3	300-00116-00	1	Y1	CRYSTAL, 24MHz, 8pF, SMD 3.2mm x 2.5mm	NDK	NX3225SA-24.000000MHZ
4	450-11401-00	2	C3,C9	CAP, 0.1uF, X7R, +/-20%, 16V, 0402	VENKEL	C0402X7R160-104MNP
5	450-11463-00	1	C2	CAP, 10uF, X5R, +/-20%, 6.3V, 0603	Panasonic	ECJ-1VB0J106M
6	500-02267-00	1	R4	RES, 10.0k ohms, +/-1%, 0.063W, 0402	Rohm	MCR01MZPF1002
7	500-06954-00	1	R3	RES, 0 ohms, +/-5%, 0.063W, 0402	Panasonic	ERJ-2GE0R00X

Table 7 – Bill of Materials

Appendix B Schematics

Page #	Description
1	Title Page and Table of Contents
2	Microcontroller, Power

Date	Revision	Description of Changes
11/26/2009	A00	Released for review

PCB Stackup: 2 Layers, 0.031" Thick

	Layer Name	Trace Width	Impedance
1	Top		
2	Bottom		

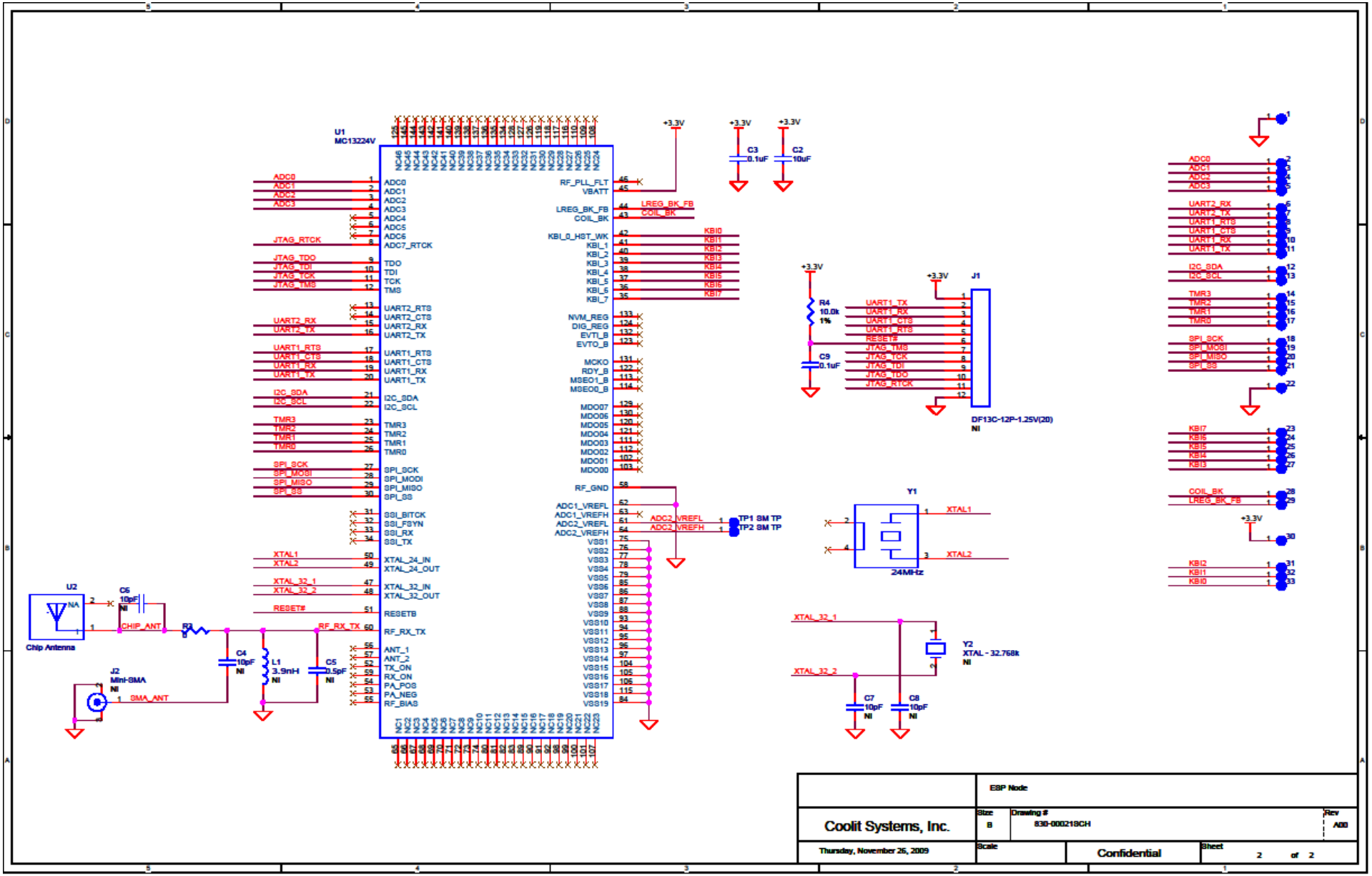
Coolit Systems, Inc.
Thursday, November 26, 2009

Coolit Systems, Inc.
3920 - 29th St. N.E.
Calgary, AB, Canada T1Y 6B6

ESP Node:
Title Page

Size: B | Drawing #: 830-00021SCH | Rev: A00

Scale: | Confidential | Sheet: 1 of 2


U1
MC13224V
ADC0
ADC1
ADC2
ADC3
ADC4
ADC5
ADC6
ADC7_RTCK
JTAG_RTCK
JTAG_TDO
JTAG_TDI
JTAG_TCK
JTAG_TMS
TDO
TDI
TCK
TMS
UART2_RTS
UART2_CTS
UART2_RX
UART2_TX
UART1_RTS
UART1_CTS
UART1_RX
UART1_TX
I2C_SDA
I2C_SCL
TMR3
TMR2
TMR1
TMR0
SPI_SCK
SPI_MOSI
SPI_MISO
SPI_SS
SSI_BITCK
SSI_FSYN
SSI_RX
SSI_TX
XTAL1
XTAL2
XTAL_24_IN
XTAL_24_OUT
XTAL_32_1
XTAL_32_2
XTAL_32_IN
XTAL_32_OUT
RESET#
RESETB
RF_RX_TX
ANT_1
ANT_2
TX_ON
RX_ON
PA_POS
PA_NEG
RF_BIAS
RF_PLL_FLT
VBATT
LREG_BK_FB
COIL_BK
KBI_0_HST_WK
KBI_1
KBI_2
KBI_3
KBI_4
KBI_5
KBI_6
KBI_7
KBI0
KBI1
KBI2
KBI3
KBI4
KBI5
KBI6
KBI7
NVM_REG
DIG_REG
EVTI_B
EVTO_B
MCKO
RDY_B
MSEO1_B
MSEO0_B
MDO07
MDO06
MDO05
MDO04
MDO03
MDO02
MDO01
MDO00
RF_GND
ADC1_VREFL
ADC1_VREFH
ADC2_VREFL
ADC2_VREFH
VSS1
VSS2
VSS3
VSS4
VSS5
VSS6
VSS7
VSS8
VSS9
VSS10
VSS11
VSS12
VSS13
VSS14
VSS15
VSS16
VSS17
VSS18
VSS19
+3.3V
C3
0.1uF
C2
10uF
R4
10.0k
1%
C9
0.1uF
J1
DF13C-12P-1.25V(20)
NI
Y1
24MHz
XTAL1
XTAL2
Y2
XTAL - 32.768k
C7
10pF
C8
10pF
U2
Chip Antenna
C6
10pF
CHIP_ANT
R2
C4
10pF
L1
3.9nH
C5
0.5pF
J2
Mini-SMA
SMA_ANT
TP1 SM TP
TP2 SM TP
Coolit Systems, Inc.
ESP Node
Drawing #
830-000218CH
Rev
A00
Size
B
Scale
Sheet
2 of 2
Confidential
Thursday, November 26, 2009

Appendix C Layout

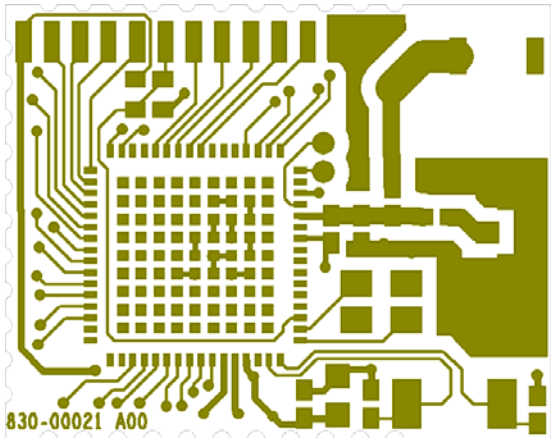


Figure 4 - Top Signal

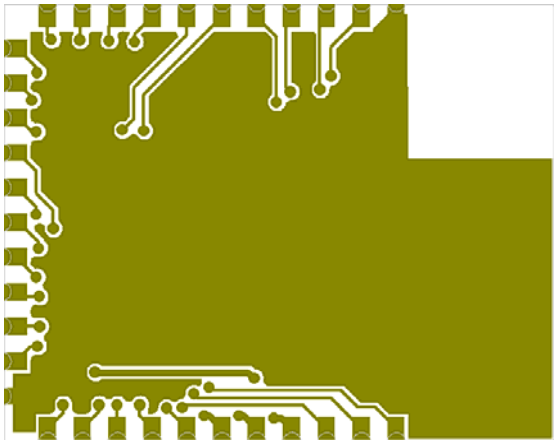


Figure 5 - Bottom Signal

Figure 6 – Top Silkscreen

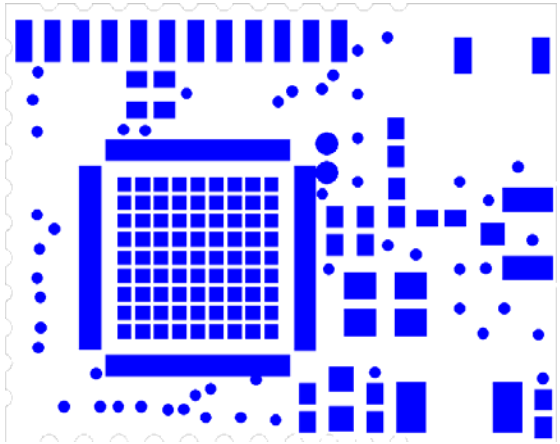


Figure 7 – Top Solder Mask

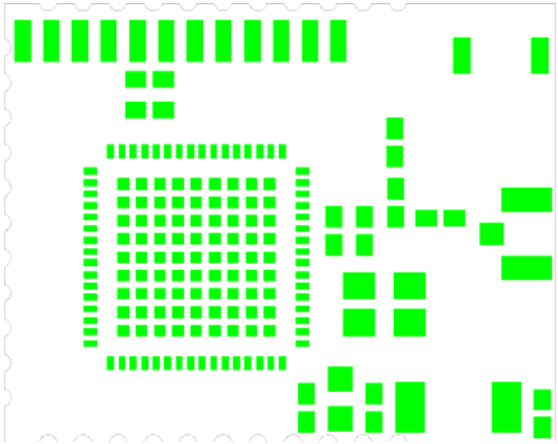


Figure 8 – Top Paste Mask

Figure 9 – Bottom Solder Mask

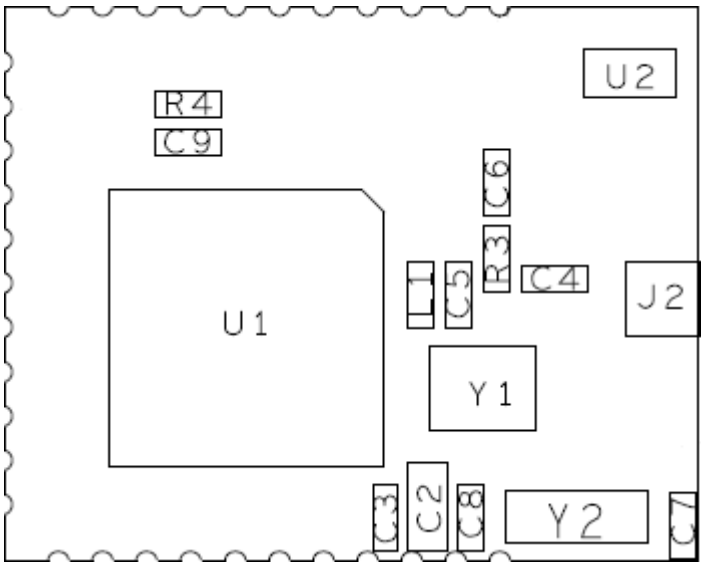


Figure 10 – Component Placement

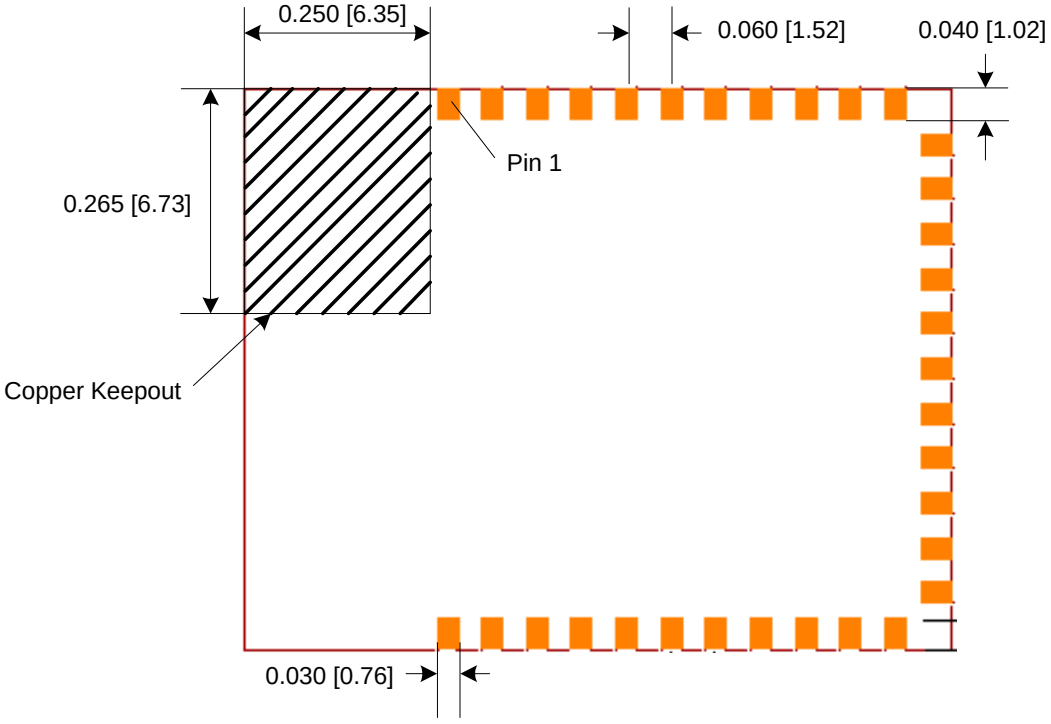


Figure 11 – Bottom Side Pad Layout