Preliminary Datasheet

Indy® RS500 Reader SiP – IPJ-RS500-GX and IPJ-RS500-EU

Electrical, Mechanical, & Thermal Specification

Indy® RS500 Overview

Air Interface Protocol	**EPCglobal UHF Class 1 Gen 2 / ISO 18000-63 (formerly 18000-6C)** • **Supports dense reader mode (DRM)**
TX Output Power	13 to 23 dBm
Operating Frequencies	IPJ-RS500-GX (902-928MHz) covers all 900MHz bands worldwide. IPJ-RS500-EU (865-868MHz) covers current EU operating band.
Package size	30 mm x 32 mm x 3.8 mm
Package type	22-pin surface mount package (SMT compatible)
Rx sensitivity	-65dBm in DRM mode (1% packet error rate). Actual sensitivity can be better than -65 dBm in most applications. Lower antenna reflection (S11) will result in better Rx sensitivity.
DC supply	3.6 to 5.25 volts
DC consumption	2.5 watts at 23dBm output power and 5.25 volt supply 2 watts at 23dBm output power and 3.6 volt supply
Supported Regions	World wide regional support planned. US, China, Japan and EU initially supported, remaining regions will be supported with subsequent firmware updates.

For technical support, visit the Impinj support portal at: support.impinj.com

TABLE OF CONTENTS

1 INTRODUCTION 3

2 ABOUT THIS DOCUMENT 4

3 SYSTEM BLOCK DIAGRAM 5

4 PIN LISTING/SIGNAL DEFINITIONS 6

5 ELECTRICAL SPECIFICATIONS 8

5.1 ABSOLUTE MAXIMUM RATINGS 8
5.2 OPERATING CONDITIONS 8
5.3 TRANSCEIVER FUNCTIONAL SPECIFICATIONS 8

6 IMPINJ RADIO INTERFACE (IRI) 10

7 PACKAGE INFORMATION 11

NOTICES: 13

TABLES

TABLE 1: PIN LISTING AND SIGNAL DEFINITIONS 6
TABLE 2: ABSOLUTE MAXIMUM RATINGS 8
TABLE 3: OPERATING CONDITIONS 8
TABLE 4: POWER CONSUMPTION SPECIFICATIONS 8
TABLE 5: INDY RS500—RECEIVER SPECIFICATIONS 8
TABLE 6: INDY RS500 —TRANSMITTER SPECIFICATIONS 9
TABLE 7: INDY RS500 READER CHIP SYNTHESIZER 9
TABLE 8: INDY RS500 DIGITAL INTERFACE SPECIFICATION 9

FIGURE 1 - SYSTEM OVERVIEW 3
FIGURE 2 - EXAMPLE RS500 BLOCK DIAGRAM 5
FIGURE 3 - HOST/READER STACK 10
FIGURE 4 - PIN DIMENSIONS 11
FIGURE 5 - ETCHED COPPER FOOTPRINT 12
FIGURE 6 - PASTEMASK FOOTPRINT 12

1 Introduction

The Impinj® Indy®RS500 reader SiP (system in package) is a completely integrated solution for EPC Gen2 / ISO18000-63 (formerly 18000-6C) applications. The SiP was developed to make embedding UHF RFID reader capability easy. The Indy RS500 builds on market-leading Indy reader chip technology and integrates all of the necessary components into a tiny package. The SiP requires no external components, is fully tested and meets regulatory requirements. The Indy RS500 comes in a surface mount package designed to work as a SMT (surface mount technology) component in a standard PCB manufacturing process, which eliminates costly mechanical hardware and RF cables that are typically required with embedded readers on the market today. The Indy RS500 is a turnkey solution that will enable quick and easy embedding of RFID with low development risk and fast time-to-market.

Ideal for moderate read range of small tag populations, the Indy RS500's small form factor enables a diverse range of applications that need a low-cost embedded UHF Gen 2 RFID reader, such as consumables authentication, access control, process control, appliances, medical equipment, printers, and low-cost handheld readers. The RS500 is capable of reading dozens of tags per second at distances up to 1.5meters when using a 3dBi reader antenna and typical far field passive tags.

Here are some key highlights of the Indy RS500:

- The RS500 is a fully tested turnkey solution with regional compliance
- The maximum output power is 23dBm, enables typical embedded reader applications
- The package is shielded to prevent unwanted radiation and immunity in embedded environments
- 30mm x 32mm x 3.8mm small form factor enables a diversity of embedded applications
- Surface mount package is SMT compatible which saves mechanical and assembly costs
- Supports single antenna, mono-static reader operation
- The RS500 is field upgradable via firmware updates (i.e. G2 will be FW upgradable)
- Supports advanced Monza features: FastID, TagFocus and QT

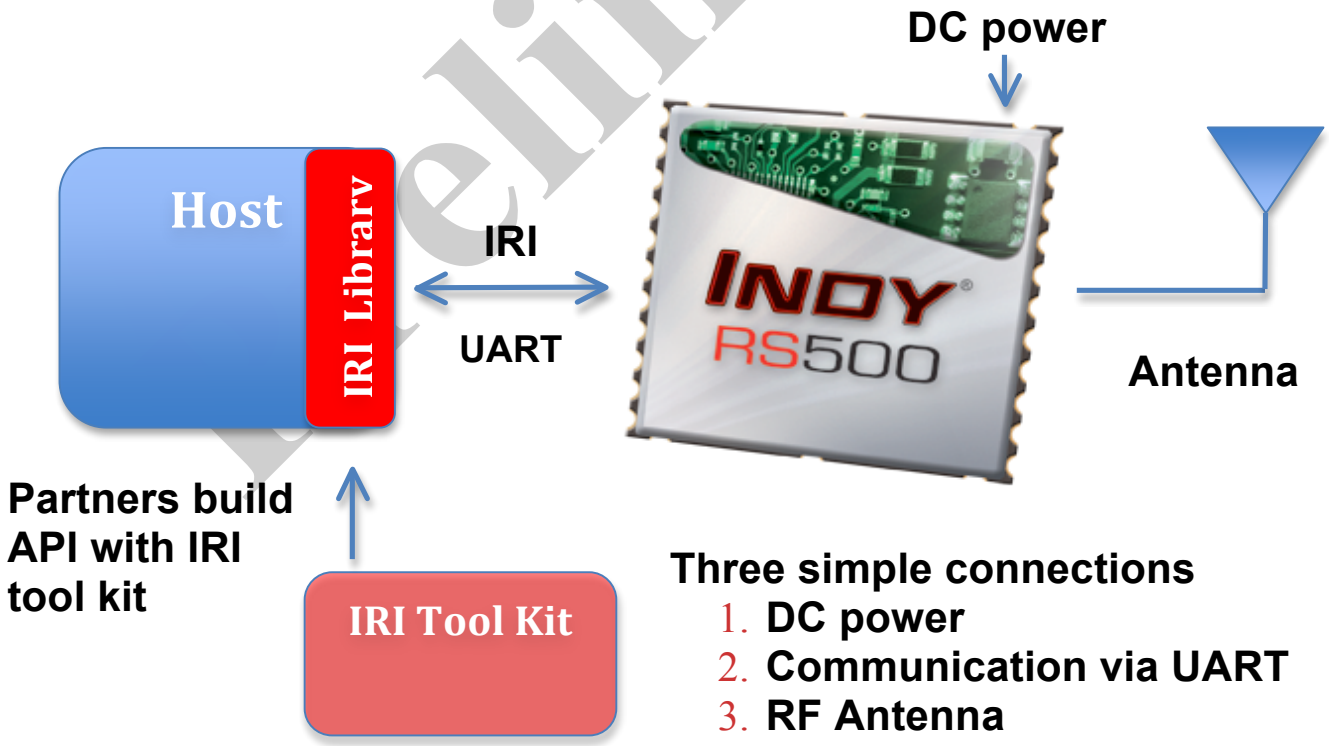

Figure 1 - System overview

2 About This Document

This document constitutes the electrical, mechanical, and thermal specifications for the Indy RS500 reader SiP.

3 System Block Diagram

An example RS500 system-level block diagram for an embedded application is shown in Figure 2. Required connections are illustrated with solid lines. Recommended and optional connections are illustrated with fine and coarse dotted lines, respectively.

Required connections:

- VDC and GND required to power the RS500
- RF required for the connection to the antenna
- UART1 required for host communications
- NRST required to reset the RS500

Recommended connections:

- BOOT0 provides a failsafe backdoor to the built-in Cortex bootloader, If the Impinj bootstrap is corrupted, User must assert BOOT0 at reset to force the Cortex to run its own internal bootloader and allow the Impinj bootstrap and application to be reloaded.
- UART2 provides debug information
- HEALTH indicates successful boot of the RS500. Connection to an LED provides a visual indication of whether or not an error condition exists.
- STATUS provides an indication when the RS500 is inventorying tags. Connection to an LED provides a visual indicator of the tag activity.

Optional connections:

- GPIO allow the user to trigger inventory, generate interrupts based on inventory activity, or provide general-purpose user-controlled digital I/O
- UC_ADC allows the user to ADC convert a user-provided analog signal
- UC_DAC allows the user to generate a digitally-controlled analog signal
- WKUP provides a mechanism to wake up the RS500 from sleep mode. Sleep mode is a low-power mode. Note: WKUP is required to use sleep mode.

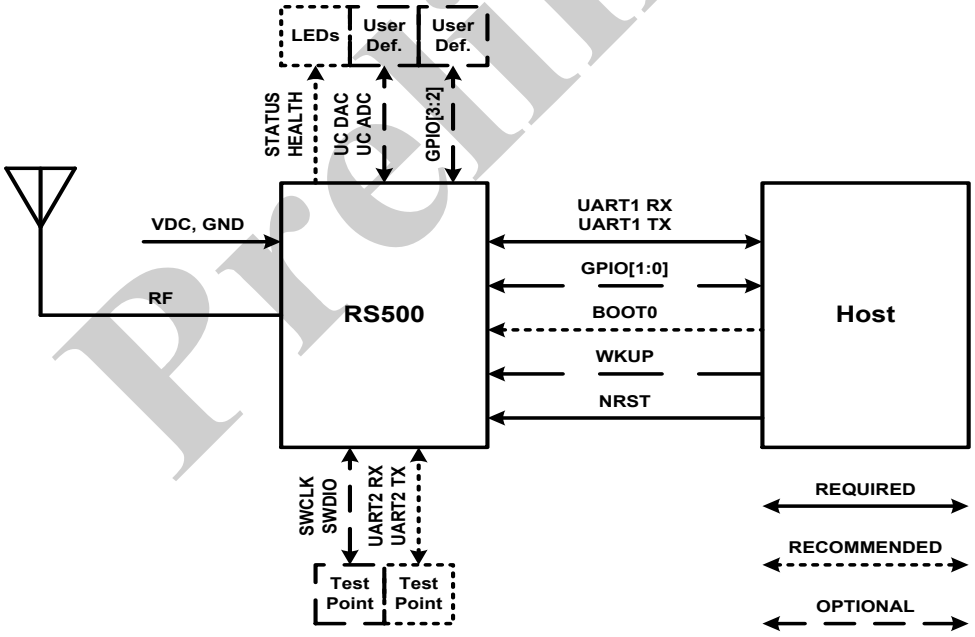

Figure 2 - Example RS500 block diagram

4 Pin Listing/Signal Definitions

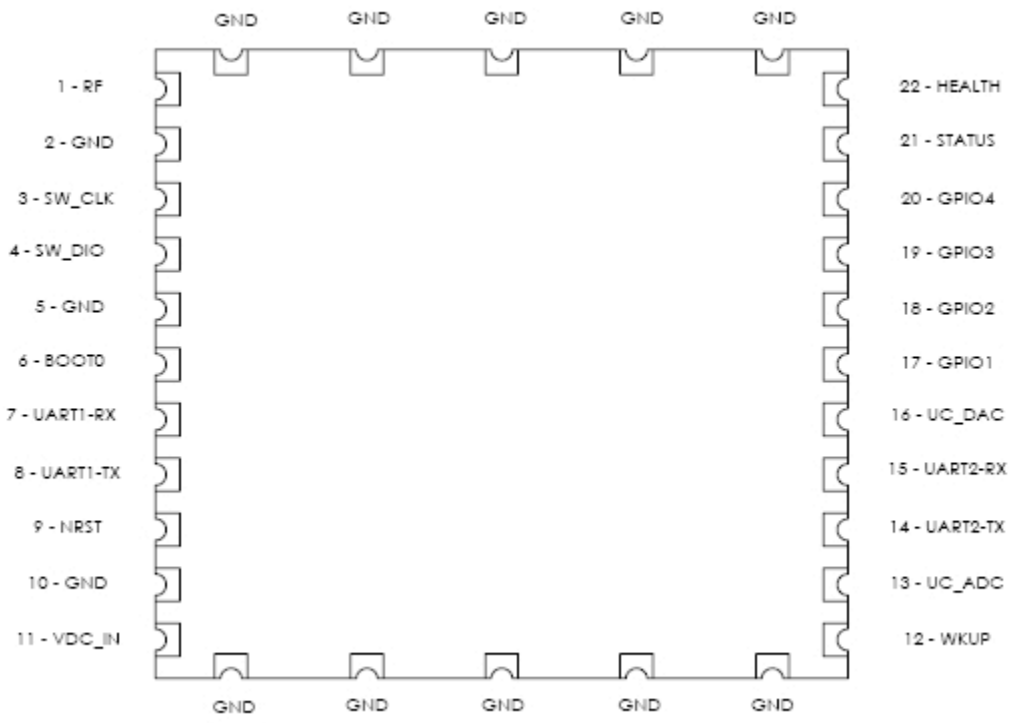

Table 1: Pin Listing and Signal Definitions

Pin #	Pin Name	Type[+]	Description
1	RFIO	RF In/Out	RF transmit and receive pin. Generally connected to antenna
2	GND	Ground	
3	SW_CLK	Digital	System clock
4	SW_DIO	Digital	Digital I/O
5	GND	Ground	
6	BOOT0	Digital	Boot strap pin
7	UART1-RX	Data	UART serial receive pin
8	UART1-TX	Data	UART serial transmit pin
9	nRST	Digital	Reset
10	GND	Ground	

11	VDC_IN	Supply	Input supply voltage
12	WKUP	Digital	Wake up pin
13	ADC	Analog input	Analog to digital converter input
14	UART2-TX	Data	UART serial transmit pin
15	UART2-RX	Data	UART serial receive pin
16	DAC	Analog output	Digital to analog converter input
17	GPIO0	Digital	General purpose I/O
18	GPIO1	Digital	General purpose I/O
19	GPIO2	Digital	General purpose I/O
20	GPIO3	Digital	General purpose I/O
21	Status	Digital	Provides visual indication of status when connected to an LED
22	Health	Digital	Provides visual indication of status when connected to an LED
23-32	GND	Ground	Ground pins on the top and bottom edge of package

5 Electrical Specifications

5.1 Absolute Maximum Ratings

The absolute maximum ratings (see Table 2) define limitations for electrical and thermal stresses. These limits prevent permanent damage to the Indy RS500.

Caution: Operation outside these maximum ratings might result in permanent damage to the device.

Table 2: Absolute Maximum Ratings

Parameter	Conditions	Min.	Max.	Unit
Supply voltage	VDC_IN	3.4	5.5	V
RF input power	Incident to RFIO pin	-	+23	dBm
Storage temperature		-45	+110	°C

5.2 Operating Conditions

This section describes operating voltage, frequency, and temperature specifications for the Indy RS500. Table 3 provides the supported operating conditions:

Table 3: Operating Conditions

Parameter	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	3.6	5		V	VDC_IN
Operating Ambient temperature	-20	-	TBD	C	Case Temperature

5.3 Transceiver Functional Specifications

Table 4: Power Consumption Specifications

Parameter	Min.	Typ.	Max.	Unit	Conditions
Power consumption		2.5		Watts	@ 23dBm and 5.25volts
Power consumption		2		Watts	@ 23dBm and 3.6 volts

Table 5: Indy RS500—Receiver Specifications

Parameter	Min.	Typ.	Max.	Unit	Conditions
Input frequency	860		960	MHz	
Input impedance		50		Ω	
Input match		10		dB	S11
Rx sensitivity		-65		dBm	1% PAR, lower antenna reflection will result in better Rx sensitivity

Table 6: Indy RS500 —Transmitter Specifications

Parameter	Min.	Typ.	Max.	Unit	Notes
Tx output power	13	23	23	dBm	Operating output RF power (20dBm maximum in Japan)
TX output power step size		TBD		dB	

Table 7: Indy RS500 reader chip Synthesizer

SKU	Min.	Typ.	Max.	Unit	Conditions
IPJ-RS500-GX	902		928	MHz	
IPJ-RS500-E	865		868	MHz	

Table 8: Indy RS500 digital interface specification

Parameter	Min.	Typ.	Max.	Unit
NRST				
V_{IL}	-0.3		0.8	V
V_{IH}	2		3.6	V
Hysteresis voltage		200		mV
Internal pull-up resistor	30	40	50	kΩ
BOOT0				
V_{IL}	0		0.6	V
V_{IH}	0.62		5.5	V
Hysteresis voltage		300		mV
Internal pull-up resistor	30	40	50	kΩ
Digital inputs				
V_{IL}	-0.3		1.0	V
V_{IH}	1.8		3.6	V
Hysteresis voltage		200		mV
Digital outputs				
V_{IL}	0		0.4	V
V_{IH}	2.7		3.6	V
Drive current	8			mA
UART				
Baud rate		115.2		kbd
Parity		Even		

6 Impinj Radio Interface (IRI)

IRI and the host API documentation are available in the latest Indy RS500 firmware release package. Please contact your local Impinj representative to access the latest release package. The release package will be available for download on the Impinj support portal after October 2013 (RS500 production date).

Key highlights of the Impinj Radio Interface (IRI)

- Developed to improve ease of use
- Asynchronous message-based interface
- Uses Google protocol buffers
  - Extensible from basic to advanced operation
- IRI tool kit enables easy system integration
  - A portable library of functions in C provided in source
  - Enables partners to easily target multiple host platforms

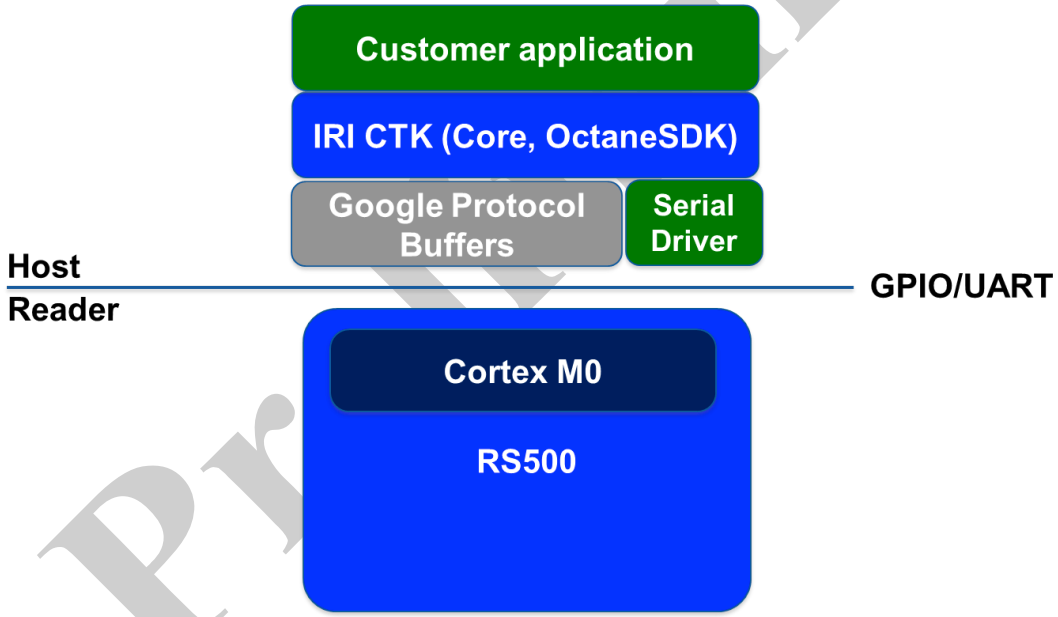

Figure 3 - Host/reader stack

7 Package Information

All dimensions are in millimeters

Tolerances:

Unless otherwise specified:

X = 0.040”

X.X = 0.02”

X.XX = 0.010”

X.XXX = 0.005”

Hole = 0.003”

Angular: MACH 0.5

Bend: 1.0 degree

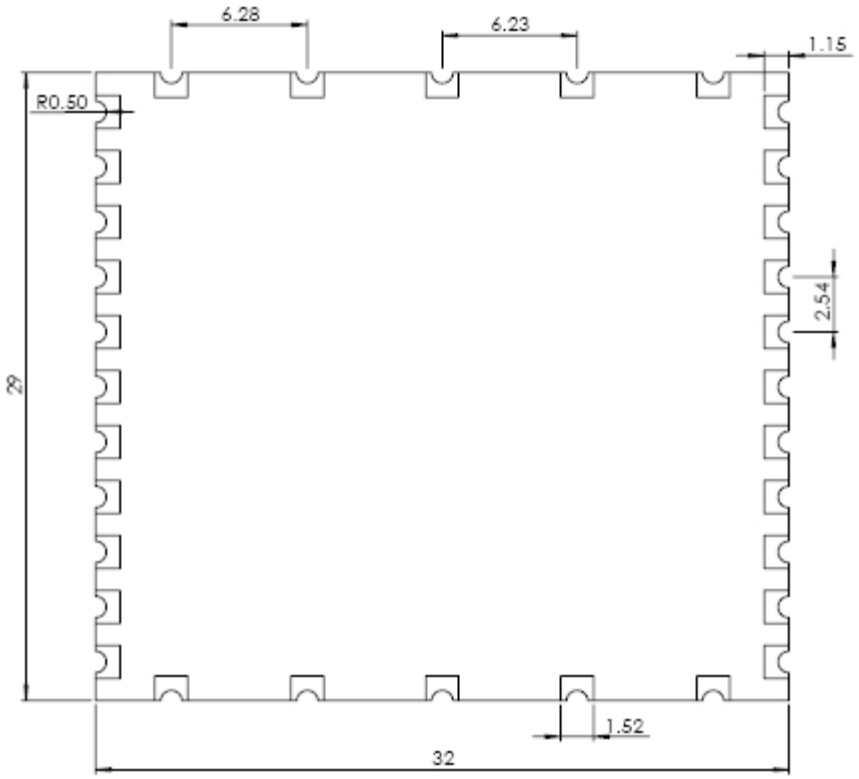

Figure 4 - Pin dimensions

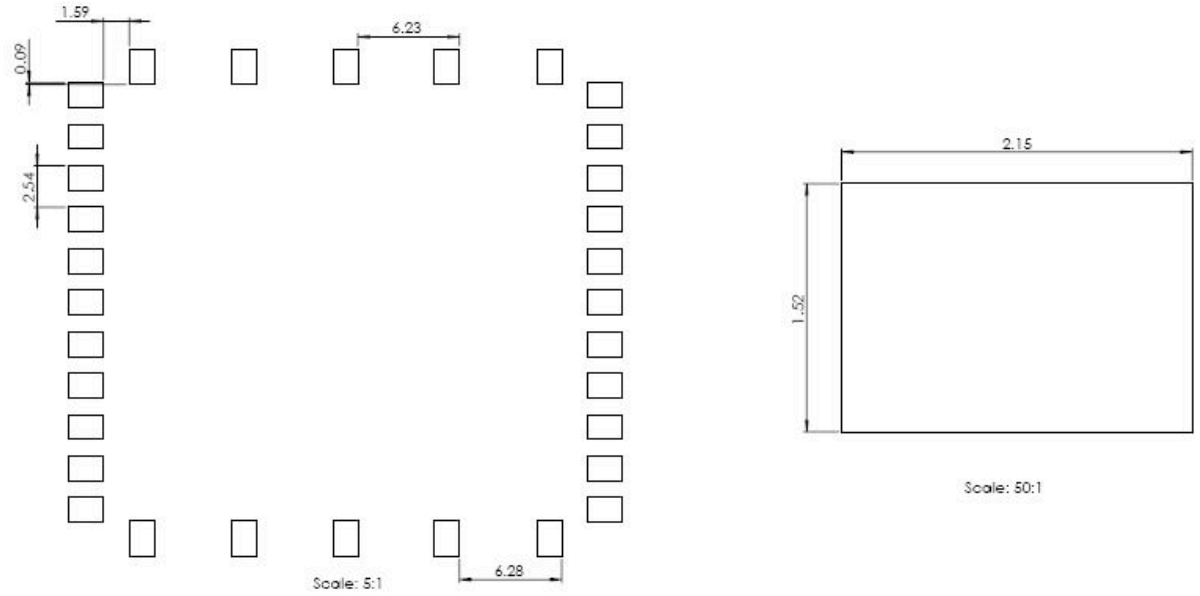

Figure 5 - Etched copper footprint

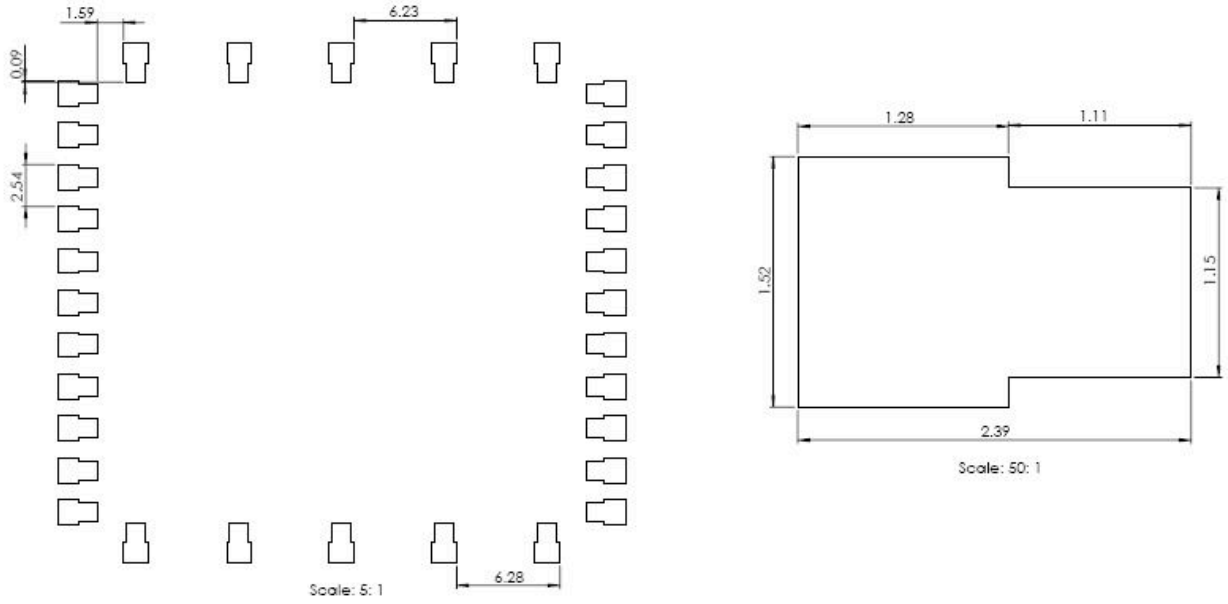

Figure 6 - Pastemask footprint

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