# veriCLASS

VP3500 Reader Board
P-Series Payment and Ticketing
Embedded Reader Platform

Hardware Specification

PLT-02091, Rev. A.3

September 2014
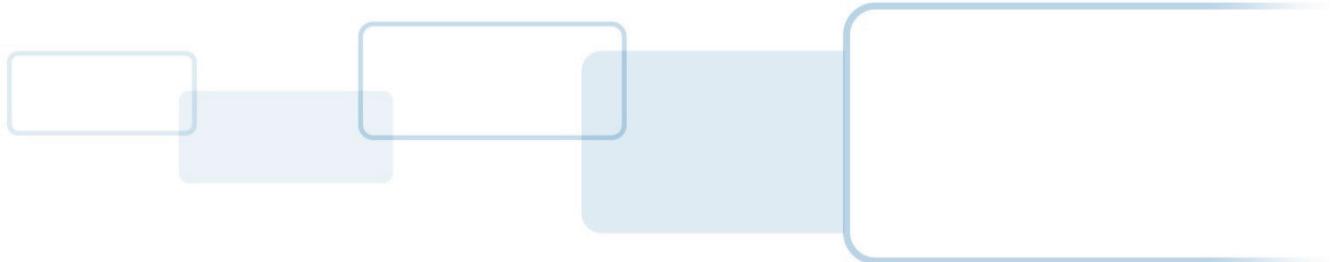
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Revision History

Date	Author	Description	Version
8/21/14	RC	Updated UL statement	A.3
3/30/11	HP	Corrected Storage Temperature in Table 1: Feature Overview & Table 13: Absolute Maximum Ratings	A.2
3/7/11	HP	Added FCC, IC and CE statements	A.1
2/17/11	HP	Initial version	A.0

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HID Global Customer Support: support.hidglobal.com

Contents

List of Figures

List of Tables

Regulatory

FCC / Canada Radio Certification

CAUTION: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

The final product, containing the modular transmitter must be labeled with its own FCC ID and IC ID. If the FCC and IC ID is not visible, when the module is installed inside another device, then the final assembly label must contain the FCC and IC ID numbers with a statement such as follows: "Contains Transmitter Module with FCC ID WTM-RFID-DUAL-IVG".

Class B Statement:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

The OEM integrator is still responsible for the FCC compliance of the end product, which integrates this module.

Appropriate measurements (e.g. 15 B compliance) and if applicable additional equipment authorizations (e.g. Verification, Doc) of the host device to be addressed by the integrator/manufacturer.

CE Marking

HID Global hereby declares that these proximity readers are in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Por el presente, HID Global declara que estos lectores de proximidad cumplen con los requisitos esenciales y otras disposiciones relevantes de la Directiva 1999/5/EC.

HID Global déclare par la présente que ces lecteurs à proximité sont conformes aux exigences essentielles et aux autres stipulations pertinentes de la Directive 1999/5/CE.

A HID Global, por meio deste, declara que estes leitores de proximidade estão em conformidade com as exigências essenciais e outras condições da diretiva 1999/5/EC.

HID Global bestätigt hiermit, dass die Leser die wesentlichen Anforderungen und anderen relevanten Bestimmungen der Richtlinie 1999/5/EG erfüllen.

HID Global dichiara che i lettori di prossimità sono conformi ai requisiti essenziali e ad altre misure rilevanti come previsto dalla Direttiva europea 1999/5/EC.

Download copies of the R&TTE Declaration of Conformity (DoC) at http://certifications.hidglobal.com.

Reference Documents

3300-901	veriCLASS Quick Start Guide
3300-911	veriCLASS DTK Application Note
3300-905	veriCLASS Antenna Design Guide (*)
3300-906	veriCLASS Hardware Specification
3300-910	veriCLASS Software Developers Guide
EMV 2000	Integrated Circuit Card Specification for Payment Systems Version 4.2
EMV Contactless	Contactless Specification for Payment Systems Version 2
FCC 47 CFR Part 15	Radio Frequency Devices
ISO/IEC 10373-6:2011	Identification Cards – Test Methods. – Part6: Proximity Cards
ISO/IEC 14443-1:2008	Proximity Cards: Physical Characteristics
ISO/IEC 14443-2:2001	Proximity Cards: Radio Frequency Power and Signal Interface
ISO/IEC 14443-2:2001/Amd1:2005	Bit rates of fc64, fc/32 and fc/16
ISO/IEC 14443-2:2001/Amd1:2005/Cor1:2007	
ISO/IEC 14443-3:2001	Proximity Cards: Initialization and Anti-collision
ISO/IEC 14443-3:2001/Amd1:2005	Bit rates of fc/64, fc/32 and fc/16
ISO/IEC 14443-3:2001/Amd1:2005/Cor1:2006	
ISO/IEC 14443-3:2001/Amd3:2006	Handling of reserved field values
ISO/IEC 14443-4:2008	Proximity Cards: Transmission protocol
ISO/IEC 15693-1:2000	Vicinity Cards: Physical Characteristics
ISO/IEC 15693-2:2006	Vicinity Cards: Air Interface and Initialization
ISO/IEC 15693-3:2009	Vicinity Cards: Anti-collision and Transmission protocol
ISO/IEC 7813:2006	Financial transaction cards
ISO/IEC 7816-3:2006	Integrated circuit(s) cards: Electrical Interface and Transmission Protocols
USB	Universal Serial Bus Specification Revision 2.0

(*) Contact HID Global Technical Support for further information.

1   Introduction

1.1   Product Description

The veriCLASS® P-Series platform is a fully certified and easy-to-integrate reader product line that provides simultaneous support for multiple card technologies as well as open and closed loop payment schemes within one system. veriCLASS is tailored to meet the needs of Payment and Ticketing manufacturers, such as automated fare collection systems, handheld terminals, ATMs, vending, kiosk or retail applications. The platform offers ultimate integration flexibility for secure contactless cashless payment and AFC solutions.

In addition, the veriCLASS platform allows developers without RF design expertise to utilize the advantages of HID's support. Provided are integration tools and product pre-certification based on industry recognized standards to develop market-ready products faster.

1.2   Key Features

- Single platform supporting
    - Multiple contactless card technologies (for example, MIFARE, iCLASS, FeliCa)
    - Multiple contactless payment protocols (for example, Calypso, EMVCo)
    - Multiple payment schemes (both open and closed)
- A complete flexible product line of reader modules, antennas and accessories.
- Developer tools and support. veriCLASS provides a fully featured Development Tool Kit (DTK) providing web / desktop based tools and documentation.
- Development support from HID Global Support Services.
- Product pre-certification for industry standard bodies such as modular-FCC, CE and EMVCo.
- Field-upgradeability giving the installer the flexibility to implement new features in the field.

1.3   veriCLASS Platform Products

VP3300 Reader Core

- 2 RF interfaces for external 50 ohm antennas
- 4 ISO/IEC 7816 Smart Card Interfaces
- USB / UART Connection
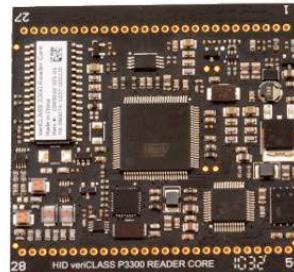
Development Tool Kit

- Development Board (includes VP3300 Reader Core)
- 2 development board antennas (50 ohm)
- Sample Credentials.
- Memory Stick containing development tools and documentation

VP3500 Reader Board

- Integrated Antenna
- 2 ISO/IEC 7816 Smart Card Sockets (ID000)
- USB / UART Connection
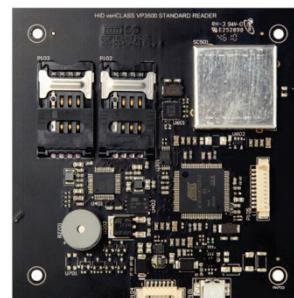
VP3700 Enhanced Reader Board

- Integrated Antenna
- 1 External Antenna plus option for a total of 4 external antennas
- 4 ISO/IEC 7816 Smart Card Sockets (ID000)
- 2 External ISO/IEC 7816 Smart Card Sockets (ID000/1)
- USB / UART Connection
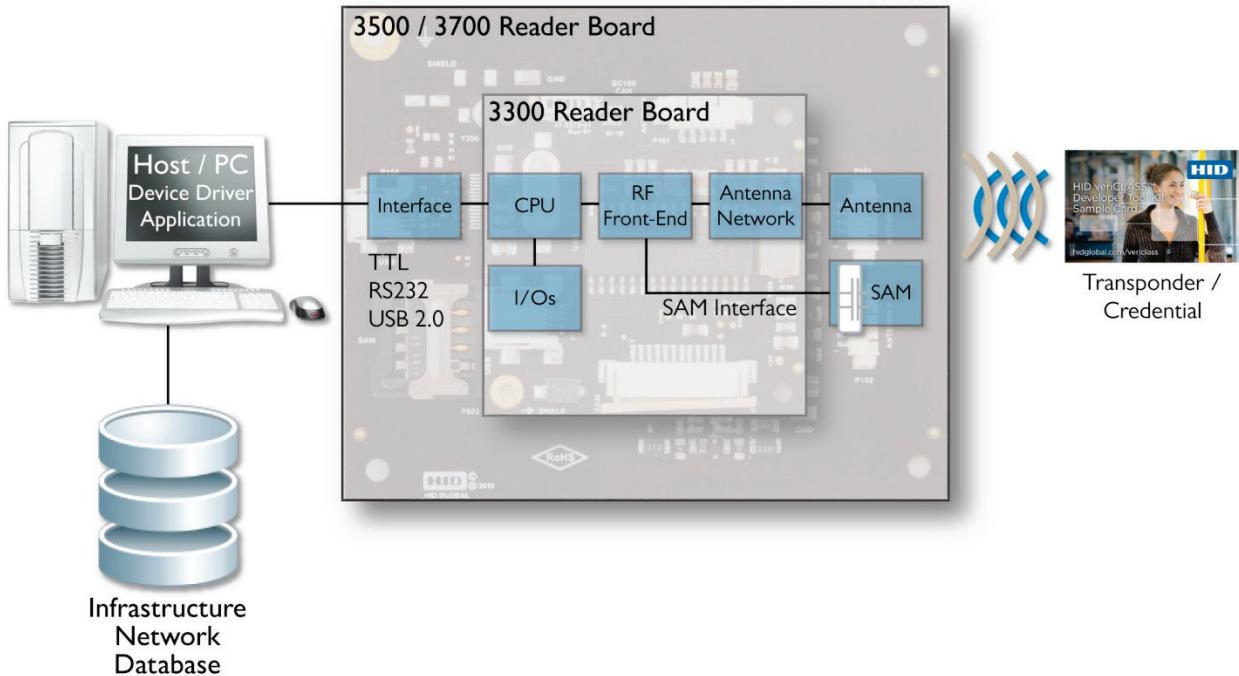
Figure 1: veriCLASS P Series Product Schematic

1.4   Product Guide

Description	Part Number
Readers	
HID veriCLASS P3300 Reader Core	VP3300A00
HID veriCLASS P3500 Standard Reader Board	VP3500A00
HID veriCLASS P3700 Enhanced Reader Board	VP3700A00 *
Antenna	
HID veriCLASS Antenna	4090A05 *
Antenna Cable	
HID veriCLASS Antenna Cable	4091A01 *
DTK	
HID veriCLASS Developer Toolkit	3134ANJ0000

* Available soon.

For further sales information contact AFC@hidglobal.com.

1.5 Scope/Purpose

This document describes the hardware features of the veriCLASS P-series reader board VP3500A00.

1.6 Terms and Abbreviations

Abbreviation	Description
ANT	Antenna
ARM	Advanced RISC Machine
DNC	Do Not Connect
EMC	Electro Magnetic Compatibility
LED	Light Emitting Diode
FeliCa	Felicity Card
H	Magnetic Field Strength
I/O	Input / Output
m	Modulation index
PCD	Proximity Coupling Device
PICC	Proximity IC Card
RF	Radio Frequency
Ta	Ambient Temperature
tf	Fall time
TTL	Transistor – Transistor Logic
tr	Rise time
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

2 Overview

2.1 Features

Table 1: Feature Overview

Type	Feature	Comment
RF Interface	ISO/IEC 14443 Type A	Up to 848kbps
	ISO/IEC 14443 Type B	Up to 848kbps
	ISO/IEC 15693	
	HID iCLASS	Both ISO/IEC 14443 and ISO/IEC 15693 mode are supported
	Sony FeliCa	
	One integrated antenna	EMV Contactless compliant
Contact Interfaces	Two ISO/IEC 7816 contact card interfaces	ID-000 contact card holders
Host Interfaces	USB	Compliant with USB 2.0 Specification
	UART	TTL Levels
Digital I/Os	4 LED controls	EMV Contactless indication mode supported
	Buzzer Control	
Environmental Properties	Storage Temperature -40 to 80°C	
	Operating Temperature -25 to 85°C	
	Humidity 0 – 90%	Non condensing

2.2   Assembly Drawing
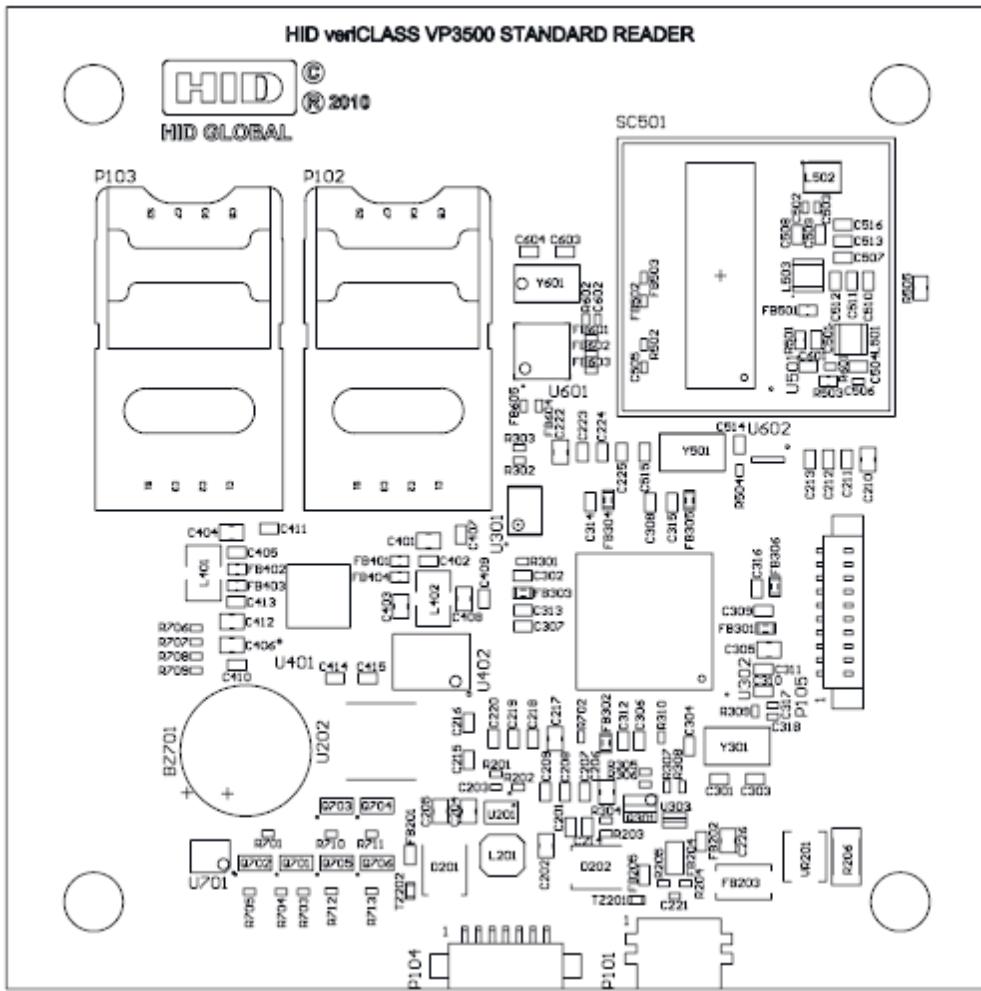
Figure 2: VP3500A00 Reader Board Assembly Drawing

3 Power Considerations

A single voltage through the USB or serial interface connector supplies the VP3500A00. Supported is a voltage range from 3VDC to 5VDC (only through serial interface).

Note: Use only one of these two options at a time. If using USB as the host interface, use VUSB to supply the board to ensure correct enumeration.

The VP3500A00 power consumption depends on the power consumption of the antenna. Metal or ferrite material within the proximity of the board affects the power consumption.

Table 2: Power Consumptions for different Operation Modes

Operation Mode	Vin	Typ	Unit
Reader polling for cards; no contact card inserted	3V	450	mA
	5V	220	
Constant carrier on; no contact card inserted	3V	750	mA
	5V	370	
Carrier off; no contact card inserted	3V	240	mA
	5V	125	
RF Interface turned off; no contact card inserted	3V	165	mA
	5V	100	
RF interface and contact card interface turned off	3V	125	mA
	5V	75	

4 Host Interfaces

4.1 USB Interface P101

Used is a standard USB Mini-B connector (meeting the USB 2.0 Standard requirements).

Table 3: USB Interface

UART Interface		
Function	**Signal Pin**	**Description**
VUSB	1	5VDC Bus Voltage
DM	2	Data Minus Line
DP	3	Data Plus Line
ID	4	Not Connected for Type B
GND	5	GND
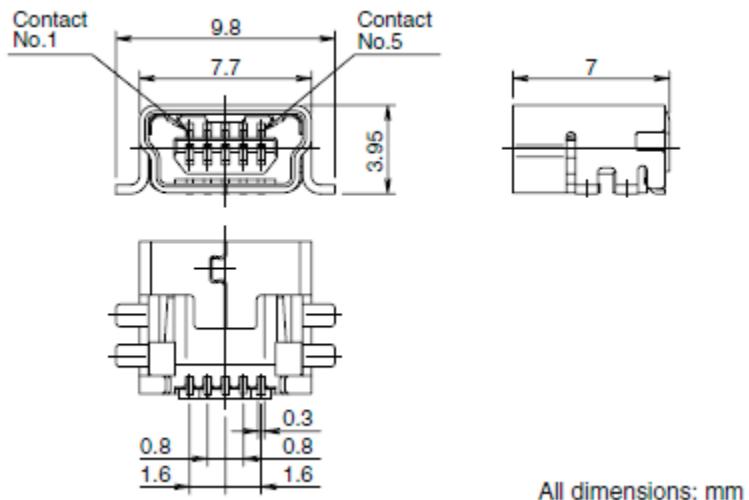
Figure 3: Mechanical Drawing USB Connector

4.2 UART Interface P104

Table 4: UART Interface

UART interface		
Function	**Signal Pin**	**Description**
Vin Supply Voltage	1	Reader supply 2.5 VDC – 5.5 VDC
RX Receive Signal	2	Receive signal of the VP3500A00 (Input)
TX Transmit Signal	3	Transmit signal of the VP3500A00 (Output)
RTS Ready to Send	4	Signal line that indicates when the VP3300A00 is ready to receive (output)
CTS Clear to Send	5	Signal line that indicates when the host is ready to receive (input)
nRST – Reset Line	6	Signal line resets the reader (low active)
GND	7	GND

Supported are baud rates between 9600 and 460080 Baud.

As connector a 7 way Molex PicoBlade® is used:

Table 5: UART Connector

UART interface	
Manufacturer	Molex
Series	PicoBlade
Part Number	53261 0771
Maximum Current	1A
	Image is for example only.
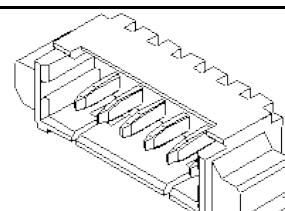
5 RF Interface

The VP3500A00 reader board offers one integrated antenna compliant with the EMV Contactless requirements. The tuning is optimized for operation with ISO/IEC14443 Type A & B credentials.

5.1 Operating Field Strength

The magnetic field strength was measured in accordance to ISO/IEC10373-6 (16.5MHz resonance frequency of reference PICC).

The measurements were taken for a concentric arrangement between reference PICC and test PCD in four different distances.

The field strength may vary slightly between different reader boards due to production tolerances.

Note: Metal or ferrite material in proximity of the antenna will lead to detuning effects, which may cause major changes in the RF properties.

Table 6: Field Strength

Distance [mm]	2	7.5	12	20
H [A/m]	6.27	5.83	5.38	4.29
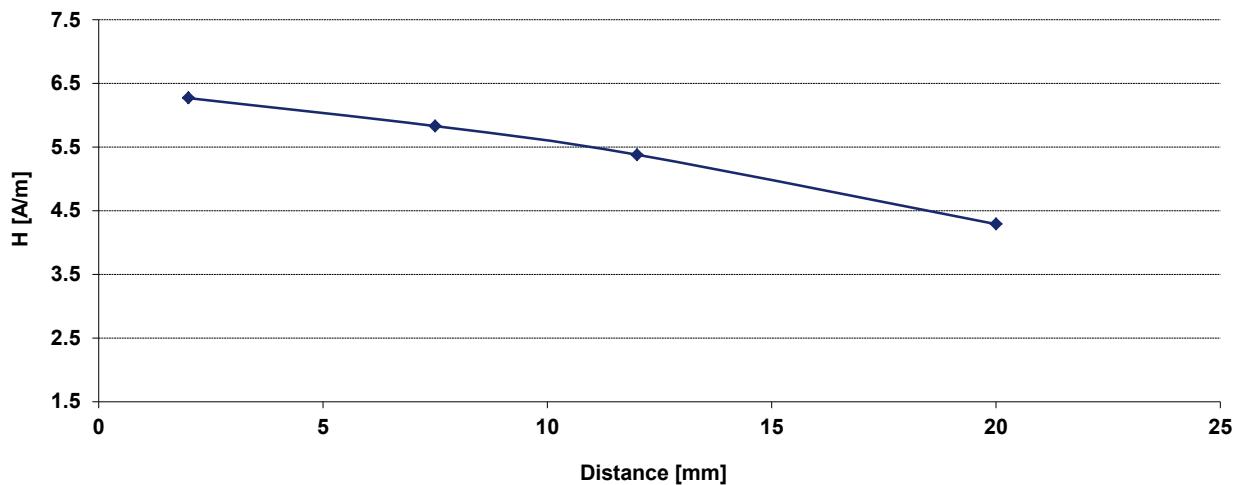
Figure 4: Operating Field Strength

5.2 Modulation Waveforms

The measurements were taken for a concentric arrangement between reference PICC and test PCD in four different distances.

The results may vary slightly between different reader boards due to production tolerances.

Note: Metal or ferrite material in proximity of the antenna will lead to detuning effects, which may cause major changes in the RF properties.

5.2.1 ISO/IEC 14443 Type A Waveforms

The waveforms were measured in accordance to ISO/IEC10373-6 (16.5MHz resonance frequency of reference PICC).

Table 7: ISO/IEC 14443 Type A Waveforms
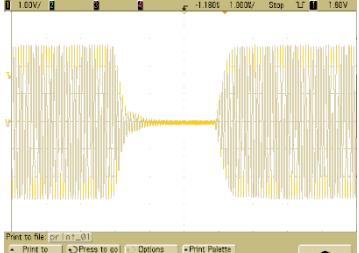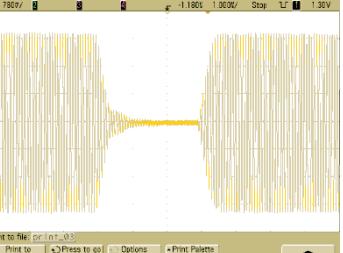
Distance 0mm @ 106kbps		Distance 7.5mm @ 106kbps	
t1 [ns]	2914	t1 [ns]	2913
t2 [ns]	2070	t2 [ns]	2057
t3 [ns]	438	t3 [ns]	436
t4 [ns]	236	t4 [ns]	239
Os [%]	0.35	Os [%]	0.48
Distance 12mm @ 106kbps		Distance 20mm @ 106kbps	
t1 [ns]	2912	t1 [ns]	2915
t2 [ns]	2018	t2 [ns]	1977
t3 [ns]	442	t3 [ns]	459
t4 [ns]	244	t4 [ns]	248
Os [%]	0.36	Os [%]	0.64
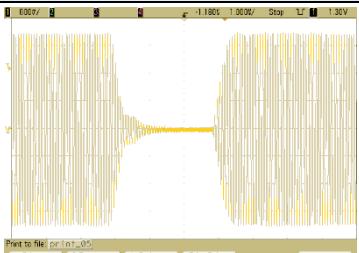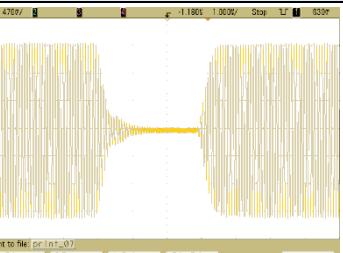
5.2.2 ISO/IEC 14443 Type B Waveforms

The waveforms were measured in accordance to ISO/IEC10373-6 (16.5MHz resonance frequency of reference PICC).

Table 8: ISO/IEC 14443 Type B Waveforms

Distance 0mm @ 106kbps		Distance 7.5mm @ 106kbps	
m [%]	11.01	m [%]	10.68
tr [ns]	389	tr [ns]	379
tf [ns]	384	tf [ns]	392
Os [%]	3.28	Os [%]	4.34
Us [%]	3.14	Us [%]	4.18
Distance 12mm @ 106kbps		Distance 20mm @ 106kbps	
m [%]	10.55	m [%]	9.70
tr [ns]	395	tr [ns]	386
tf [ns]	427	tf [ns]	423
Os [%]	4.32	Os [%]	4.11
Us [%]	4.11	Us [%]	4.05

Note: Measured with modulation conductance setting of 33Hex (ISO/IEC 14443 Type B register #2).

5.2.3 ISO/IEC 15693 Waveforms

The waveforms were measured in accordance to ISO/IEC10373-6 (16.5MHz resonance frequency of reference PICC).

Reader configured for 100% modulation.

Table 9: ISO/IEC 15693 Waveforms
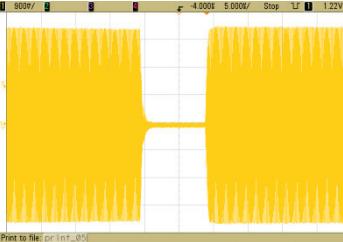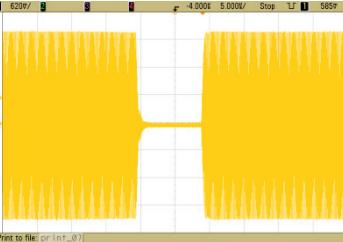
Distance 0mm		Distance 7.5mm	
tr [ns]	411	tr [ns]	408
tf [ns]	717	tf [ns]	718
Os [%]	1.06	Os [%]	0.28
Distance 12mm		Distance 20mm	
tr [ns]	391	tr [ns]	411
tf [ns]	746	tf [ns]	781
Os [%]	3.68	Os [%]	1.42
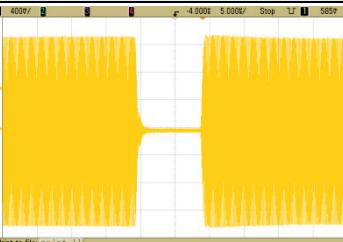
5.2.4 FeliCa Waveforms

Table 10: FeliCa Waveforms

| Distance 0mm		Distance 7.5mm	
m [%]	17.01	m [%]	16.81
tr [ns]	422	tr [ns]	431
tf [ns]	398	tf [ns]	408
Os [%]	0.00	Os [%]	0.00
Us [%]	0.05	Us [%]	0.25
Distance 12mm		Distance 20mm	
m [%]	16.31	m [%]	15.34
tr [ns]	413	tr [ns]	411
tf [ns]	424	tf [ns]	436
Os [%]	0.00	Os [%]	0.00
Us [%]	0.70	Us [%]	0.70

Note: Measured with modulation conductance setting of 99Hex (FeliCa register #2).

6   Contact Interfaces

The reader board provides four ISO/IEC7816 contact interfaces. Both interfaces offer ID-000 cardholders (P102 and P103).

6.1   Assembly Drawing
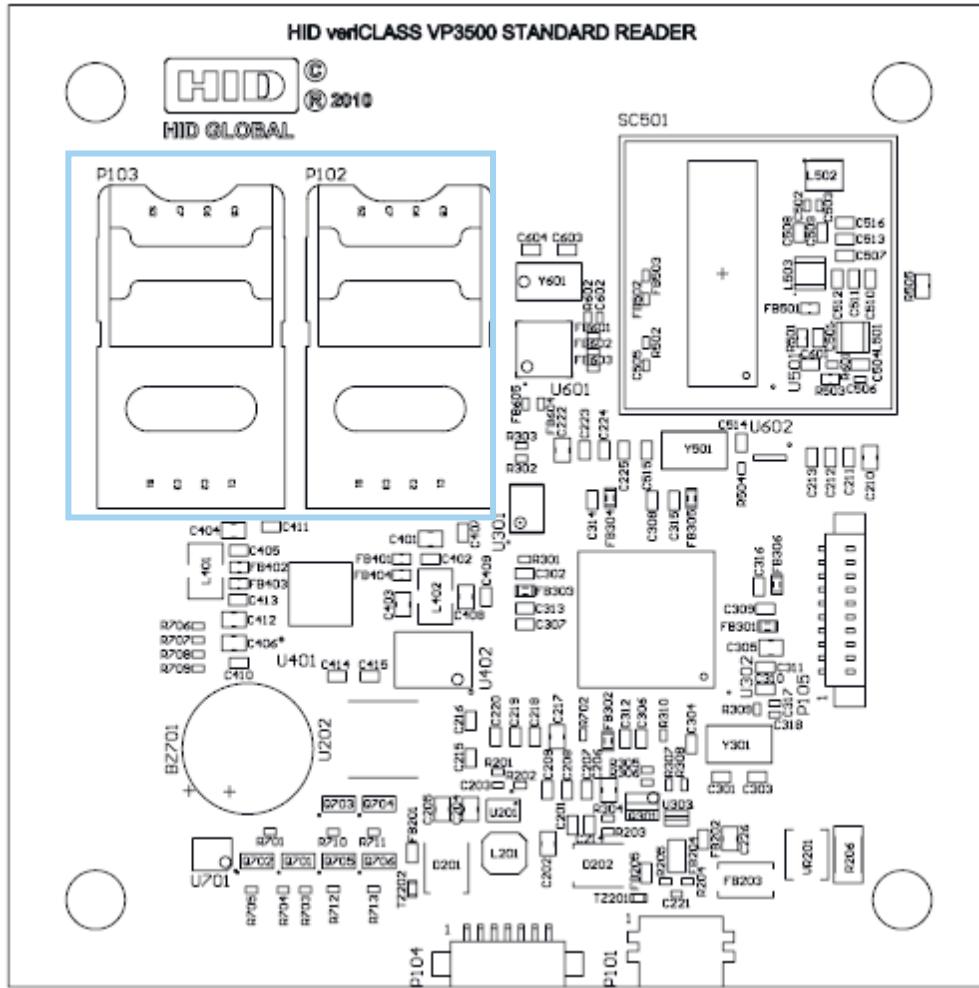

Figure 5: VP3500A00 Reader Contact Interfaces

7 Visual /Audio Interface

The veriCLASS reader board offers four LEDs and one buzzer to fulfill the requirements of the EMV Contactless specification on visual and audio interface. Both LEDs and buzzer are fully configurable through software (for example, veriCLASS web server).
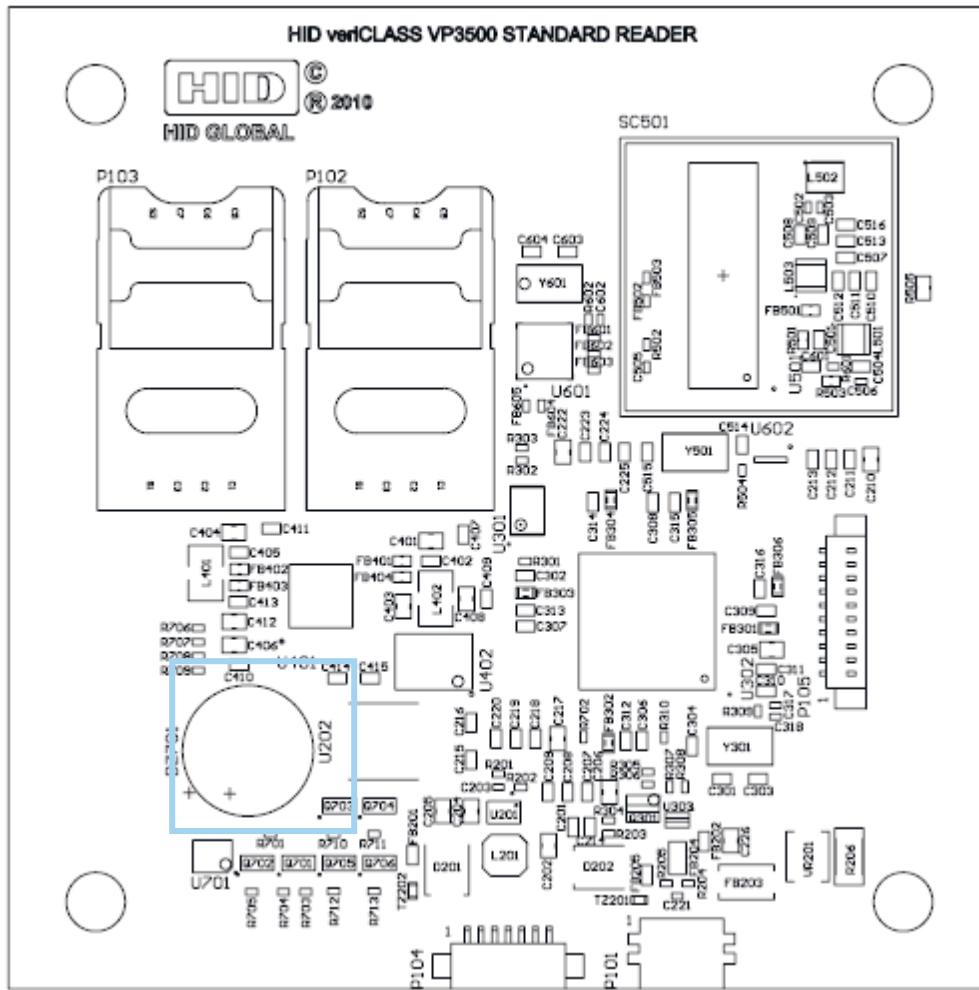
Figure 6: veriCLASS Buzzer
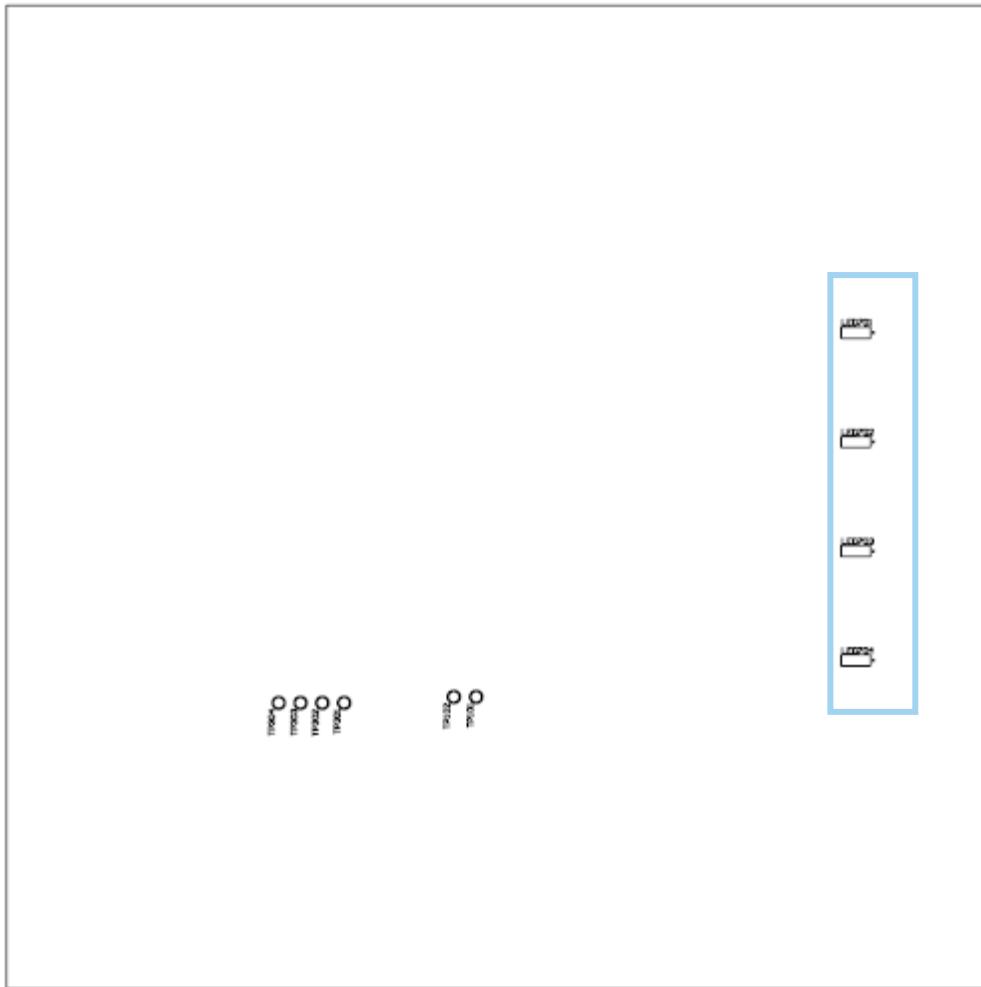
Figure 7: veriCLASS LEDs (Bottom)

8 I/O

The veriCLASS reader board offers four dedicated LED controls and one dedicated buzzer control line (open collector). The board itself already has all LED's and the buzzer populated but the control lines are still available in through connector P105 in case the visual/audio interface needs to be placed off the board.

Note: The onboard LEDs and buzzer are using the same signal lines provided by the connector.

Table 11: UART Interface

UART Interface		
Function	**Signal Pin**	**Description**
+5V	1	Regulated 5VDC from the reader board
LED1	2	Control line LED1
LED2	3	Control line LED2
LED3	4	Control line LED3
LED4	5	Control line LED4
Buzzer	6	Control line for Buzzer (open collector)
RFU	7	Reserved for future use
RFU	8	Reserved for future use
RFU	9	Reserved for future use
GND	10	GND

Table 12: I/O Connector

UART Interface	
Manufacturer	Molex
Series	PicoBlade®
Part Number	053398 1071
Maximum Current	1A
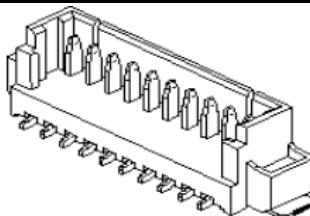
Example Picture only

9 VP3500A00 Electrical Characteristics

9.1 Absolute Maximum Ratings

Stresses beyond those listed under **Absolute Maximum Ratings** may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or other conditions beyond those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 13: Absolute Maximum Ratings

Operating Temperature	-25 to 85°C
Storage Temperature	-40 to 80°C
Voltage on Input Pins in respect to Ground	-0.3V to 5.5V
Maximum Operating Voltage	5.5V

9.2 Power Supply

Table 14: Electrical Characteristics Power Supply

Signal	Parameter	Min	Typ	Max	Unit
Vin (P104)	Input Voltage	2.7		5.5	V
	Current Consumption at 5VDC				mA
VUSB (P101)	Input Voltage	4.3		5.5	V

Note: The power consumption depends on the operation mode and the supply voltage. For more details reference 0

Power Considerations.

9.3 Host Interfaces

9.3.1 USB Interface (P101)

Table 15: Electrical Characteristics USB Interface

Signal	Parameter	Min	Typ	Max	Unit
VUSB	Input High-level Voltage	4.2		5.5	V
	Input Low-level Voltage	-0.3		0.8	V
DP, DM	Input High-level Voltage	2		5.5	V
	Input Low-level Voltage	-0.3		0.8	V
	Output High-level Voltage	2.9		3.3	V
	Output Low-level Voltage			0.2	V

9.3.2 UART Interface (P104)

Table 16: P104 - Electrical Characteristics UART Interface

Signal	Parameter	Min	Typ	Max	Unit
RX, CTS	Input High-level Voltage	2		5.5	V
	Input Low-level Voltage	-0.3		0.8	V
	Input Leakage Current Typ: Ta=25˚C Max: Ta=85˚C		40	400	nA
TX, RTS	Output High-level Voltage	2.9		3.3	V
	Output Low-level Voltage			0.2	V
nRST	Input Low-level Voltage	-0.15		0.15*CVCC	V
	Input High-level Voltage	0.7CVCC		CVCC+0.5	V
	Input Low-level Current			600	uA
	Input Low-level Current	-40		40	uA

9.4 Contact Interfaces (P102, P103)

Table 17: P102 - Contact Interface 1 Class A, 5V

Signal	Parameter	Min	Typ	Max	Unit
CVCC (P102)	Contact Card Voltage Load = 60mA	4.6	5	5.4	V
	Maximum Load Current			75	mA

Table 18: P102 - Contact Interface 1 Class B, 3V

Signal	Parameter	Min	Typ	Max	Unit
CVCC (P102)	Contact Card Voltage Load = 60mA	2.76	3	3.24	V
	Maximum Load Current			60	mA

Table 19: P102 - Contact Interface 1 Class B, 1.8V

Signal	Parameter	Min	Typ	Max	Unit
CVCC (P102)	Contact Card Voltage Load = 35mA	1.656	1.8	1.944	V
	Maximum Load Current			75	mA

Table 20: P103- Contact Interface 2 Class A, 5V

Signal	Parameter	Min	Typ	Max	Unit
CVCC (P103)	Contact Card Voltage Load = 30mA	4.6	5	5.4	V
	Maximum Load Current			70	mA

Table 21: P103 - Contact Interface 2 Class B, 3V

Signal	Parameter	Min	Typ	Max	Unit
CVCC (P103)	Contact Card Voltage Load = 30mA	2.76	3	3.24	V
	Maximum Load Current			70	mA

Table 22: P103 - Contact Interface 2 Class C, 1.8V

Signal	Parameter	Min	Typ	Max	Unit
CVCC (P103)	Contact Card Voltage Load = 30mA	1.656	1.8	1.944	V
	Maximum Load Current			70	mA

Table 23: Contact Interface 1, 2 Clock

Signal	Parameter	Min	Typ	Max	Unit
CCLK1 (P102, P103)	Output Low-level Voltage			0.3	V
	Output High-level Voltage	0.8*CVCC			V
	Rise Time Cl=30pF			16	ns
	Fall Time Cl=30pF			16	Ns

Table 24: Contact Interface I/Os

Signal	Parameter	Min	Typ	Max	Unit
CIO (P102, P103) CRST (P102, P103)	Output Low-level Voltage			0.3	V
	Output High-level Voltage	0.8*CVCC			V
	Input Low-level Voltage	-0.15		0.15*CVCC	V
	Input High-level Voltage	0.7CVCC		CVCC+0.5	V
	Input Low-level Current			600	uA
	Input Low-level Current	-40		40	uA
	Rise Time Cl=30pF			100	ns
	Fall Time Cl=30pF			100	Ns

9.5 Electrical I/O (P105)

Table 25: P105 - Electrical Characteristics I/Os

Signal	Parameter	Min	Typ	Max	Unit
LED1-4	Output High-level Voltage	2.9		3.3	V
	Output Low-level Voltage			0.2	V
	Current Draw			8	mA
Buzzer	Current Draw (Open Collector)			60	mA

# 10 VP3500 Mechanical Characteristics

10.1 Mechanical Drawings
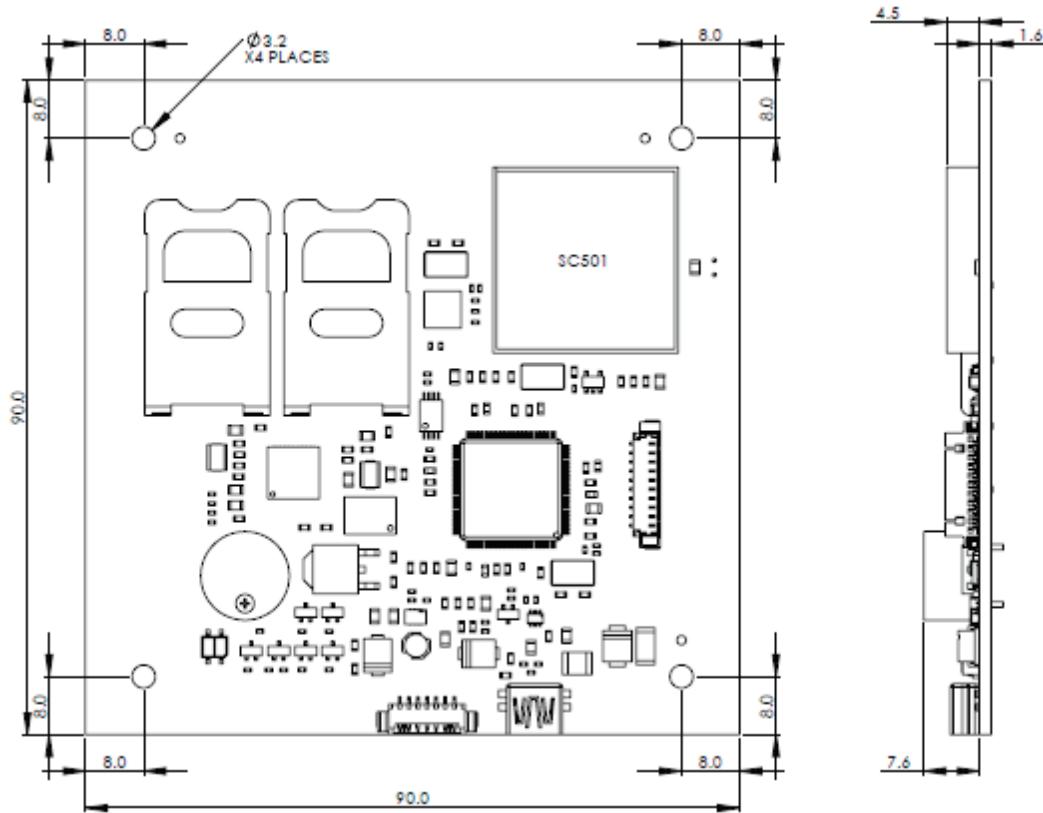
Figure 8: Mechanical Drawing (Dimensions = mm)

Weight: 38Gramm