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SpringCard Modules with Antenna

Hardware integration guide

www.springcard.com

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1. Introduction

1.1. Abstract

SpringCard OEM product family is a large family of RFID/NFC readers & writers. This family contains OEM modules with USB (H663, H512) or without (K663, K632). To be operated, these modules shall be coupled to a RFID antenna.

SpringCard offers ready-to-use RFID/NFC readers & writers for OEM by installing its OEM modules on top of a **69 x 45 mm antenna**.

This document is the **hardware manual** for these readers & writers.

1.2. Product identification

Friendly name	See doc. #	Description
RS-TTL interface		
K632-TTL	PFL9231	K632 reader & writer with 69 x 45 antenna, RS-TLL interface
K632/RDR-TTL	PFL9345	K632 standalone reader with 69 x 45 antenna, RS-TLL interface
K663-TTL	PFL2251	K663 reader & writer with 69 x 45 antenna, RS-TLL interface
K663/RDR-TTL	*To be written*	K663 standalone reader with 69 x 45 antenna, RS-TLL interface
H663/RDR-TTL	*To be written*	H663 standalone reader with 69 x 45 antenna, RS-TLL interface

Friendly name	See doc. #	Description
RS-232 interface		
K632-232	PFL9230	K632 reader & writer with 69 x 45 antenna, RS-232 interface
K632/RDR-232	PFL9346	K632 standalone reader with 69 x 45 antenna, RS-232 interface
K663-232	PFL2251	K663 reader & writer with 69 x 45 antenna, RS-232 interface
K663/RDR-232	*To be written*	K663 standalone reader with 69 x 45 antenna, RS-232 interface
H663/RDR-232	*To be written*	H663 standalone reader with 69 x 45 antenna, RS-232 interface
USB interface		
H663-USB	PFL2139	H663 PC/SC reader & writer with 69 x 45 antenna, USB interface
H663/RDR-USB	*To be written*	H663 standalone reader with 69 x 45 antenna, USB interface
H512-USB	PFL2226	H512 reader & writer & card emulation with 69 x 45 antenna, USB interface

1.3. Related documents

To be written

1.4. Audience

This manual is designed for use by electronic hardware integrators. It assumes that the reader has expert knowledge of digital and analog electronics.

1.5. Support and updates

Related documentation (e.g. product datasheets, application notes, sample software, HOWTOs and FAQs…) is available at SpringCard's web site:

www.springcard.com

Updated versions of this document and others are posted on this web site as soon as they are available.

For technical support enquiries, please refer to SpringCard support page, on the web at

www.springcard.com/support

1.6. Precautions for installation and use

The products depicted in this document are RFID/NFC couplers. Their antenna generates a magnetic field that creates an inductive coupling to both power and communicate with the card/tag that is present in the field.

Any metallic surface near the reader's antenna distorts the field and is likely to decrease the operating distance and to increase power consumption. It may even prevent any reader operation with all cards/tags or with some of them depending on their characteristics.

Precaution must be taken to keep readers far from any source of perturbation (e.g. other readers, computers…) and far from any metallic housing or shielding, electronics part.

Please refer to document PMI9C2P: Contactless Readers Installation Requirements for details.

2. Module + Antenna with Serial interface at TTL level

2.1. Products in this group

2.1.1. K632-TTL, K632/RDR-TTL

SpringCard K632 is a reader/writer module compliant with ISO/IEC 14443 (Proximity) and ISO/IEC 15693 (Vicinity).

- **SpringCard K632-TTL** is this module mounted on **SpringCard's 69 x 45 unbalanced antenna**, featuring serial communication at TTL level (CMOS compatible).
- **SpringCard K632/RDR-TTL** is the same hardware running a “standalone reader” firmware.

2.1.2. K663-TTL, K663/RDR-TTL

SpringCard K663 is a reader/writer module compliant with ISO/IEC 14443 (Proximity), ISO/IEC 15693 (Vicinity) and ISO/IEC 18092 (NFCIP-1).

- **SpringCard K663-TTL** is this module mounted on **SpringCard's 69 x 45 balanced antenna**, featuring serial communication at TTL level (CMOS compatible).
- **SpringCard K663/RDR-TTL** is the same hardware running a “standalone reader” firmware.

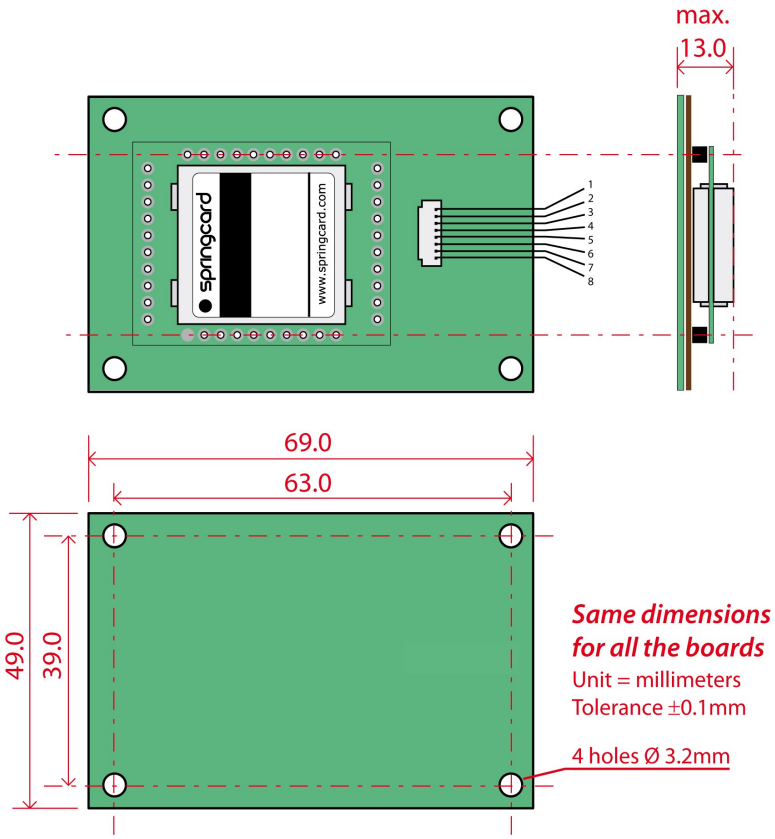
2.1.3. H663/RDR-TLL

SpringCard H663 is a reader/writer module compliant with ISO/IEC 14443 (Proximity), ISO/IEC 15693 (Vicinity) and ISO/IEC 18092 (NFCIP-1).

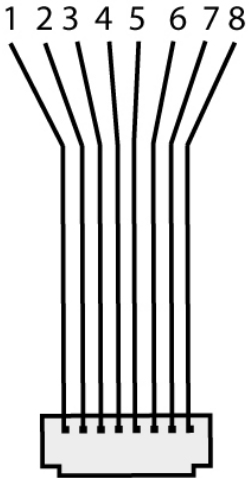
> ***SpringCard H663*** *is primarily designed for USB operation in a PC/SC compliant environment (see § 4.1.1), but when the module runs some particular firmware (for instance, the RDR firmware), it is also possible to use it through a serial interface. The USB connector is present as depicted in §5.2, yet not used in this case.*

- **SpringCard H663-TTL** is this module mounted on **SpringCard's 69 x 45 balanced antenna**, featuring serial communication at TTL level (CMOS compatible).
- **SpringCard H663/RDR-TTL** is the same hardware running a “standalone reader” firmware.

2.2. Mechanical specifications



2.3. Connector and pinout



Reference

JST SHR-08V -S -B

Pinout details

PIN	NAME	Type	Description	Remark
1	RFU		Not used	**Must be left unconnected**
2	/FLASH	IN	Firmware upgrade	Internal pull-up Can be left unconnected
3	GND	Ground	Ground	
4	/RESET	IN	Module reset	Internal pull-up Can be left unconnected
5	VCC	Power	Power supply	
6	RX (TTL)		Serial interface	Host to module
7	TX (TTL)		Serial interface	Module to host
8	GND	Ground	Ground	

2.4. K632-TTL, K632/RDR-TTL – Characteristics

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		3.0	5.0	5.5	V
ICC	Power supply current	Soft power down			6	mA
		RF field OFF		30	35	mA
		RF field ON		150	250	mA

Input pin characteristics

Pins RX, /SUSPEND and /FLASH have TTL input characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{IL}	LOW-level going threshold		0.8	V
V_{IH}	HIGH-level going threshold	2.0		V
I_{LEAK}	Input leakage current		4	µA

Output pin characteristics

Pin TX has TTL output characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{OL}	Output LOW-level		0.4	V
V_{OH}	Output HIGH-level	2.4		V
I_O	Output current source or sink		4	mA

2.5. K663-TTL, K663/RDR-TTL – Characteristics

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		3.0	5.0	5.5	V
ICC	Power supply current	Soft power down			6	mA
		RF field OFF		30	35	mA
		RF field ON		150	250	mA

Input pin characteristics

Pins RX, /SUSPEND and /FLASH have TTL input characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{IL}	LOW-level going threshold		0.8	V
V_{IH}	HIGH-level going threshold	2.0		V
I_{LEAK}	Input leakage current		4	µA

Output pin characteristics

Pin TX has TTL output characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{OL}	Output LOW-level		0.4	V
V_{OH}	Output HIGH-level	2.4		V
I_O	Output current source or sink		4	mA

2.6. H663/RDR-TTL – Characteristics

The H663/RDR-TTL has 2 connectors: the RS-TTL connector documented in this chapter, and the USB connector documented in chapter 4.
Use this product in either RS-232 or USB mode. Plugging the 2 connectors simultaneously is not recommended and not supported.

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		4.5	5.0	5.5	V
ICC	Power supply current	Soft power down			6	mA
		RF field OFF		30	35	mA
		RF field ON		150	250	mA

Input pin characteristics

Pins RX, /SUSPEND and /FLASH have TTL input characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{IL}	LOW-level going threshold		0.8	V
V_{IH}	HIGH-level going threshold	2.0		V
I_{LEAK}	Input leakage current		4	µA

Output pin characteristics

Pin TX has TTL output characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{OL}	Output LOW-level		0.4	V
V_{OH}	Output HIGH-level	2.4		V
I_O	Output current source or sink		4	mA

3. Module + Antenna with Serial interface at RS-232 level

3.1. Products in this group

3.1.1. K632-232, K632/RDR-232

SpringCard K632 is a reader/writer module compliant with ISO/IEC 14443 (Proximity) and ISO/IEC 15693 (Vicinity).

- **SpringCard K632-232** is this module mounted on **SpringCard's 69 x 45 unbalanced** antenna, featuring a serial communication link compliant with the RS-232 specification.
- **SpringCard K632/RDR-232** is the same hardware running a “standalone reader” firmware.

3.1.2. K663-232, K663/RDR-232

SpringCard K663 is a reader/writer module compliant with ISO/IEC 14443 (Proximity), ISO/IEC 15693 (Vicinity) and ISO/IEC 18092 (NFCIP-1).

- **SpringCard K663-232** is this module mounted on **SpringCard's 69 x 45 balanced antenna**, featuring a serial communication link compliant with the RS-232 specification.
- **SpringCard K663/RDR-232** is the same hardware running a “standalone reader” firmware.

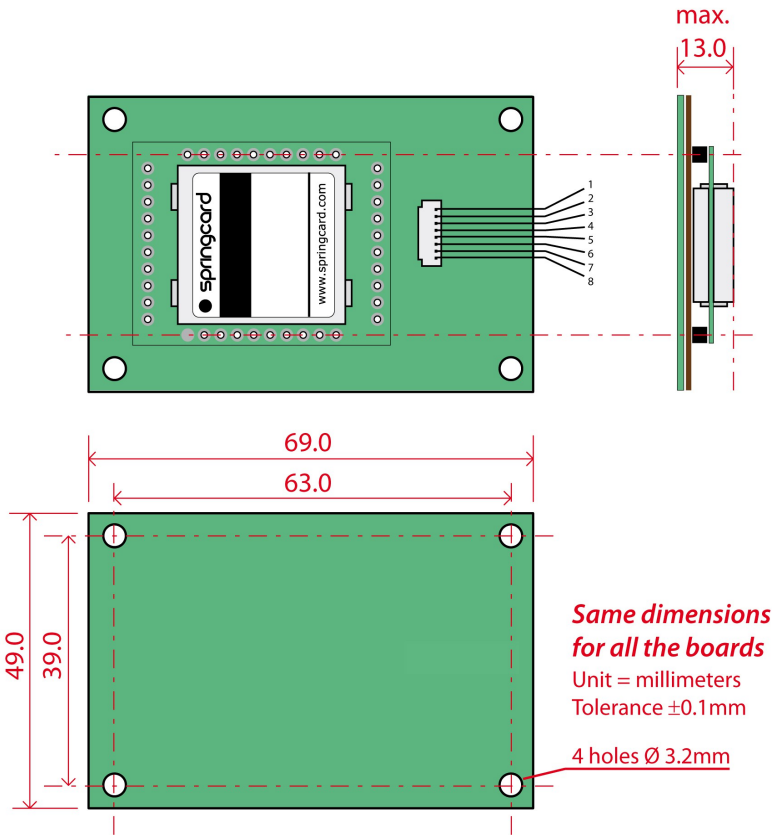
3.1.3. H663-232

SpringCard H663 is a reader/writer module compliant with ISO/IEC 14443 (Proximity), ISO/IEC 15693 (Vicinity) and ISO/IEC 18092 (NFCIP-1).

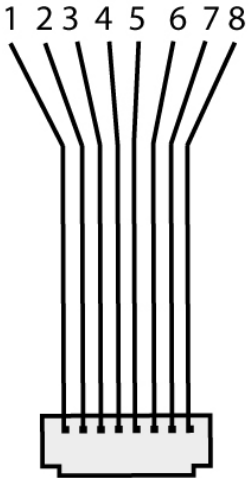
> *SpringCard H663 is primarily designed for USB operation in a PC/SC compliant environment (see § 4.1.1), but when the module runs some particular firmware (for instance the RDR firmware), it is also possible to use it through a serial interface. The USB connector is present as depicted in §5.2, yet not used in this case.*

- **SpringCard H663-232** is this module mounted on **SpringCard's 69 x 45 balanced antenna**, featuring a serial communication link compliant with the RS-232 specification.
- **SpringCard H663/RDR-232** is the same hardware running a “standalone reader” firmware.

3.2. Mechanical specifications



3.3. Connector and pinout



Reference

JST SHR-08V -S -B

Pinout details

PIN	NAME	Type	Description	Remark
1	RFU		Not used	**Must be left unconnected**
2	/FLASH	IN	Firmware upgrade	Internal pull-up Can be left unconnected
3	GND	Ground	Ground	
4	/RESET	IN	Module reset	Internal pull-up Can be left unconnected
5	VCC	Power	Power supply	
6	RX (RS-232)		Serial interface	Host to module
7	TX (RS-232)		Serial interface	Module to host
8	GND	Ground	Ground	

3.4. K632-232, K632/RDR-232 – Characteristics

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		4.5	5.0	5.5	V
ICC	Power supply current	Soft power down			6	mA
		RF field OFF		30	35	mA
		RF field ON		150	250	mA

Input pin characteristics

Pins /SUSPEND and /FLASH have TTL input characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{IL}	LOW-level going threshold		0.8	V
V_{IH}	HIGH-level going threshold	2.0		V
I_{LEAK}	Input leakage current		4	µA

RX pin characteristics

Pin RX is a RS-232 input.

SYMBOL	Parameter	Min	Max	Unit
V_{I0}	Logical "0" valid range	3	25	V
V_{I1}	Logical "1" valid range	-25	-3	V
I_{LEAK}	Input leakage current		4	µA

TX pin characteristics

Pin TX is a RS-232 output

SYMBOL	Parameter	Min	Max	Unit
V_{O0}	Logical “0” output level	6		V
V_{O1}	Logical “1” output level		-6	V
I_O	Output current source or sink		4	mA

3.5. K663-232, K663/RDR-232 – Characteristics

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		3.0	5.0	5.5	V
ICC	Power supply current	Soft power down			6	mA
		RF field OFF		30	35	mA
		RF field ON		150	250	mA

Input pin characteristics

Pins /SUSPEND and /FLASH have TTL input characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{IL}	LOW-level going threshold		0.8	V
V_{IH}	HIGH-level going threshold	2.0		V
I_{LEAK}	Input leakage current		4	µA

RX pin characteristics

Pin RX is a RS-232 input.

SYMBOL	Parameter	Min	Max	Unit
V_{I0}	Logical "0" valid range	3	25	V
V_{I1}	Logical "1" valid range	-25	-3	V
I_{LEAK}	Input leakage current		4	µA

TX pin characteristics

Pin TX is a RS-232 output

SYMBOL	Parameter	Min	Max	Unit
V_{O0}	Logical “0” output level	6		V
V_{O1}	Logical “1” output level		-6	V
I_O	Output current source or sink		4	mA

3.6. H663/RDR-232 – Characteristics

The H663/RDR-232 has 2 connectors: the RS-232 connector documented in this chapter, and the USB connector documented in chapter 4.
Use this product in either RS-232 or USB mode. Plugging the 2 connectors simultaneously is not recommended and not supported.

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		4.5	5.0	5.5	V
ICC	Power supply current	Soft power down			6	mA
		RF field OFF		30	35	mA
		RF field ON		150	250	mA

Input pin characteristics

Pins /SUSPEND and /FLASH have TTL input characteristics.

SYMBOL	Parameter	Min	Max	Unit
V_{IL}	LOW-level going threshold		0.8	V
V_{IH}	HIGH-level going threshold	2.0		V
I_{LEAK}	Input leakage current		4	µA

RX pin characteristics

Pin RX is a RS-232 input.

SYMBOL	Parameter	Min	Max	Unit

V_{I0}	Logical “0” valid range	3	25	V
V_{I1}	Logical “1” valid range	-25	-3	V
I_{LEAK}	Input leakage current		4	µA

TX pin characteristics

Pin TX is a RS-232 output

SYMBOL	Parameter	Min	Max	Unit
V_{O0}	Logical “0” output level	6		V
V_{O1}	Logical “1” output level		-6	V
I_O	Output current source or sink		4	mA

4. Module + Antenna with USB interface

4.1. Products in this group

4.1.1. H663-USB

SpringCard H663 is a reader/writer module compliant with ISO/IEC 14443 (Proximity), ISO/IEC 15693 (Vicinity) and ISO/IEC 18092 (NFCIP-1).

> ***SpringCard H663*** *is primarily designed for USB operation in a PC/SC compliant environment. Please refer to document PMD2271 "H663 Developer's Reference Manual" for details.*
> *When the module runs some particular firmware (for instance H663-RDR), it is also possible to use it as a virtual communication port (USB CDC ACM profile).*

- **SpringCard H663-USB** is this module mounted on SpringCard's balanced antenna.
- **SpringCard H663/RDR-USB** is the same hardware running a "standalone reader" firmware.

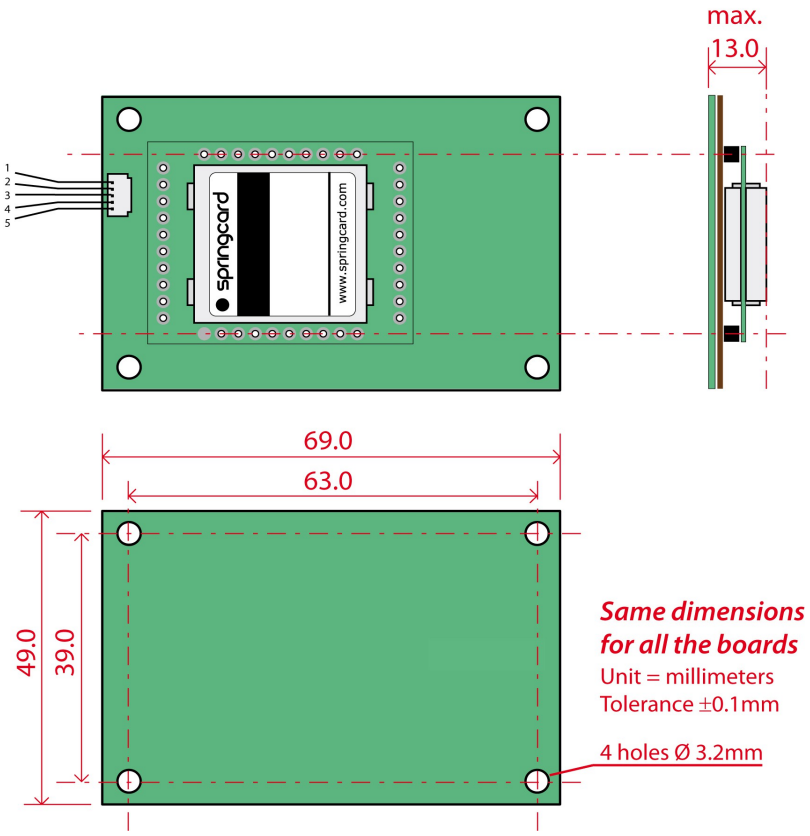
4.1.2. H512-USB

SpringCard H512 is a reader/writer module + NFC target coupler, compliant with ISO/IEC 14443 (Proximity) and ISO/IEC 18092 (NFCIP-1).

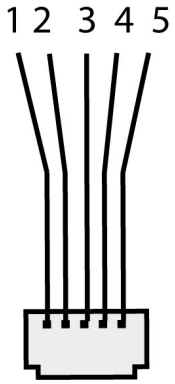
> ***SpringCard H512*** *is designed for USB operation in a PC/SC compliant environment. Please refer to document PMD2271 "H512 Developer's Reference Manual" for details.*

- **SpringCard H512-USB** is this module mounted on SpringCard's mark 1 balanced antenna.

4.2. Mechanical specifications



4.3. Connector and pinout



Reference

JST SHR-05V -S -B

Pinout details

PIN	NAME	Type	Description	Remark
1	VCC	Power	Power supply from bus	
2	USB_DM	IN/OUT	USB D-	
3	USB_DP	IN/OUT	USB D+	
4	GND	Ground	Ground wire	
5	GND	Ground	Ground (shielding)	

4.4. H663-USB, H663/RDR-USB – Characteristics

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		4.5	5.0	5.5	V
ICC	Power supply current			150	250	mA

4.5. H512-USB – Characteristics

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 conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability

SYMBOL	Parameter	Min	Max	Unit
VCC_{ABS}	DC supply voltage with respect to ground	-0.3	6.0	V
$V_{IN,ABS}$	Voltage to any pin with respect to ground	-0.3	VCC+0.3	V
$T_{STORAGE}$	Storage temperature	-20	+70	°C

Operating condition range

SYMBOL	Parameter	Condition	Min	Typ	Max	Unit
$T_{OPERATION}$	Operating temperature		-20	+25	+70	°C
VCC	Supply voltage		4.5	5.0	5.5	V
ICC	Power supply current			150	250	mA

5. Module + Antenna with both Serial and USB interfaces

5.1. Purpose of this chapter

SpringCard H663 is primarily designed for USB operation. More than that, SpringCard H663's firmware could only updated through USB.

For this reason, all products based on H663, even if they provide a serial interface, do have a USB connector.

The next paragraph “mechanical specifications” shows where this USB connector is located on

- **SpringCard H663-TTL**
- **SpringCard H663-232**

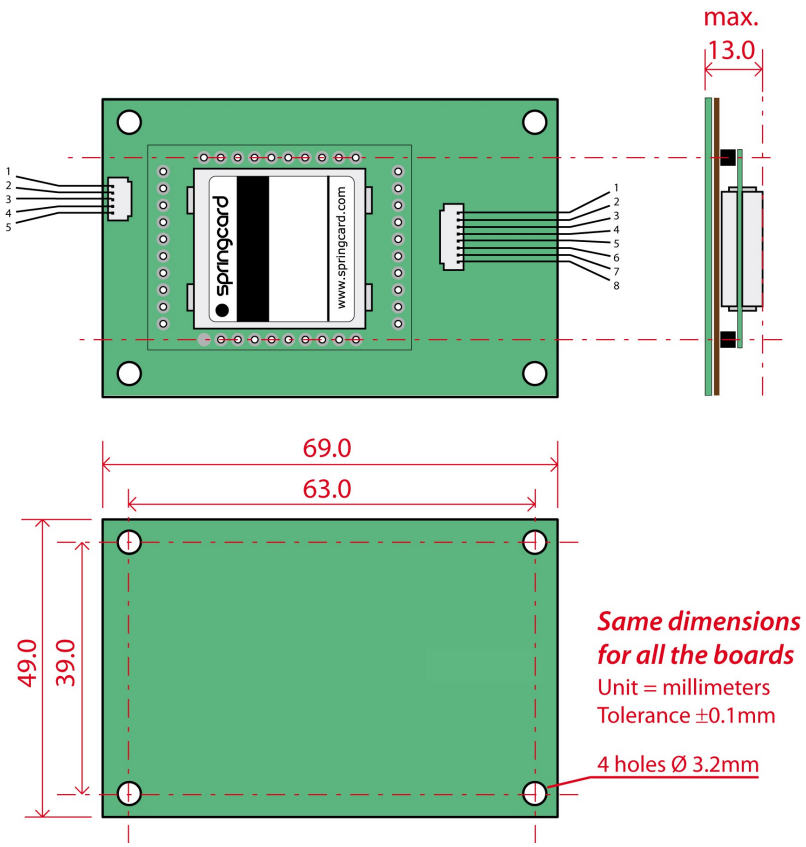
Technical specifications for H663-TTL operated through the Serial link are in chapter 2.

Technical specifications for H663-TTL operated through the Serial link are in chapter 3.

Technical specifications for either H663-TTL or H663-232 operated through USB are in chapter 4.

Trying to operate those devices through both USB and Serial links is not recommended and not supported.

5.2. Mechanical specifications



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