規 格 承 認 書

Approval Sheet

DATE: 2019 / 10 / 01

Customer:	飛捷科技股份有限公司
Brand:	Sunion
Product:	**6CR530002010** HF RFID MINI USB EXTERMAL ANTENNA MD-551L+ANT4424 (13.56MHz)(70 x 30 x 5 (mm) 聯暘
Part NO.:	MD-551L+_V2A5Pcable_FY (A01514)
	ANT-4424-FY-IPX70V1.00B (A01882-7)

Customer Approved: 客戶承認章

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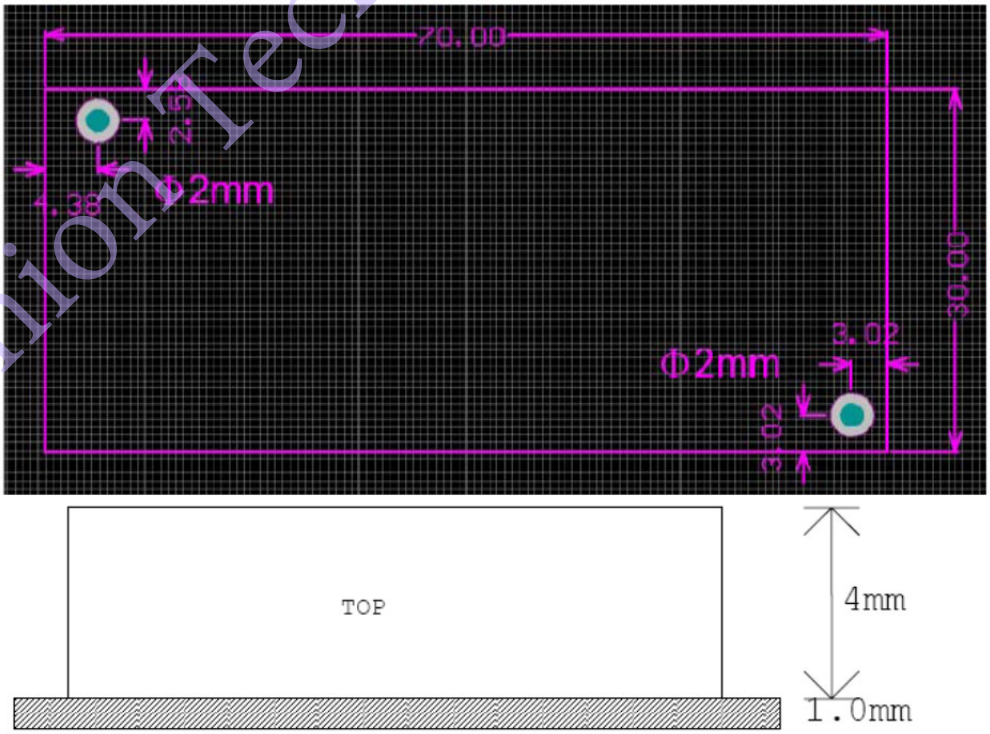
1. MD-551L+ V2A5Pcable FY Specification

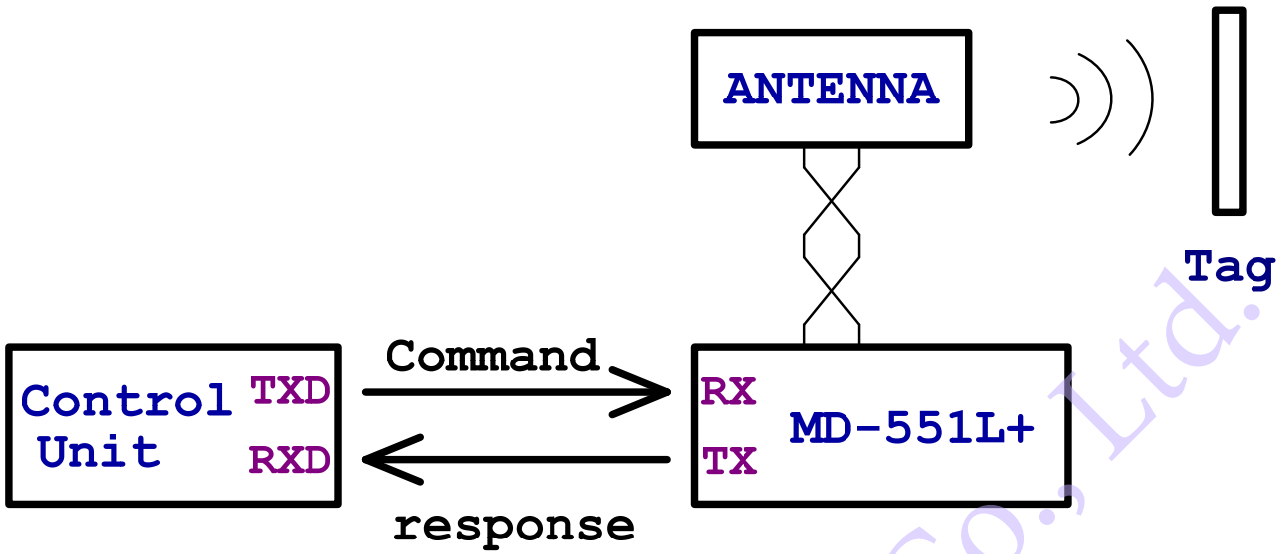
1-1 Specifications

Part Number	MD-551L+ V2A5Pcable FY
RF Transmit Frequency	13.56MHz
Supported Transponder	ISO 15693(R/W) ISO 18092(R/W) ISO 14443-A(R/W) ISO 14443-B(Read UID) ** Appendix1**
Antenna impedance	Loop Antenna, 50 ohm
Operating Temperature	-20℃to + 85℃
Storage Temperature	-20℃to + 85℃
Storage Humidity	5 ~ 97% non-condensing
Power Supply	DC 5V
Power Consumption(MAX)	Operating: 100mA Standby: 20mA
Dimensions (Unit : mm±0.5mm)	70 x 30 x 5 (L x W x H)
Weight	6g (around)
Communication Protocol	UART Simulation



L:70mm x W:30mm x H:5mm
Unit: mm±0.5mm

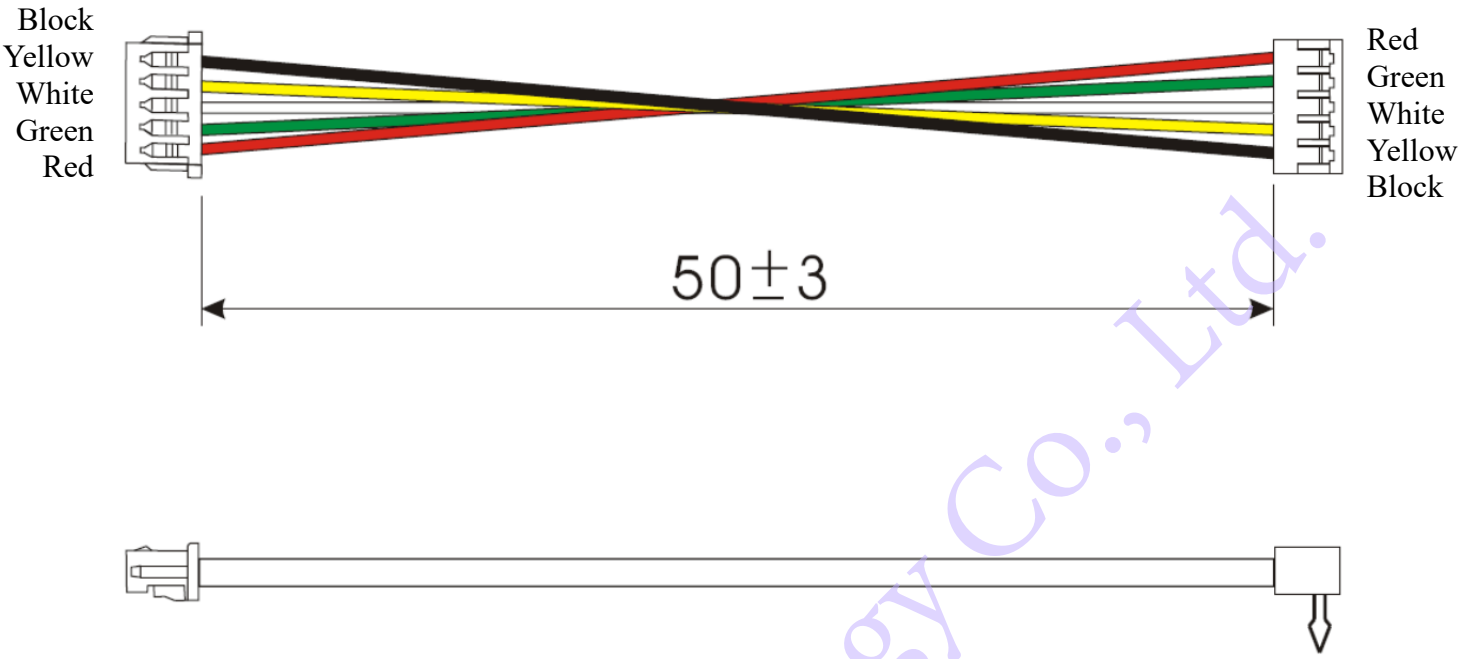
1-2 MD-551L+ and MCU circuit examples



1-3 Pin Assignment

Pin		Name	Function
CON1	1	VDD	Supply voltage
	2	USB	D-
	3	USB	D+
	4 5	GND	Ground reference
CN2		ANT MHF	MHF CONNECTOR

1-4 Cable Specifications



Unit：mm

No.	MATERIAL	DESCRIPTION	COLOR	Q'TY
5	Terminal	Molex 500588000 or Compatible		5
4	Housing	Molex 51021-0500 or Compatible		1
3	Terminal	TYU TB1561TPR-AE or Compatible		5
2	Housing	TYU TB1561HNR-05 or Compatible		1
1	Wire	瑞樂 UL1571-30AWG or Compatible		5

PVC 電子線 UL 1571

UL Subject 758 UL FILE NO:E108485

Hook-up Wire 80℃ 30V

說 明

- 導體使用單條或絞線最小到 50AWG 裸銅或鍍錫銅。
- 使用環保半硬質 PVC 絕緣。
- 額定溫度：80℃,額定電壓：30Volts
- 使用標準厚度，易剝，截斷容易。
- 可通過 UL VW-1 及 CSA FT1，垂直型耐燃試驗。

Product Description

- Tinned, bared, stranded or Solid copper Conductor, MIN, 50AWG.
- Lead Free SR-PVC Insulation.
- Rated temperature:80℃;Rated voltage:30Volts.
- Uniform thickness of wire to ensure easy stripping And cutting.
- Passed UL VW-1& CSA FT1vertical flame test.

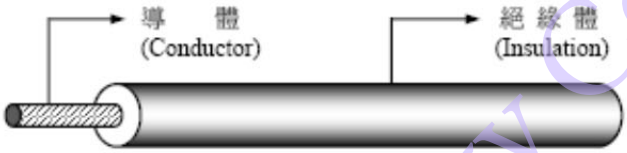
應 用

- 電子設備二次回路中內部連接用線..

Applications

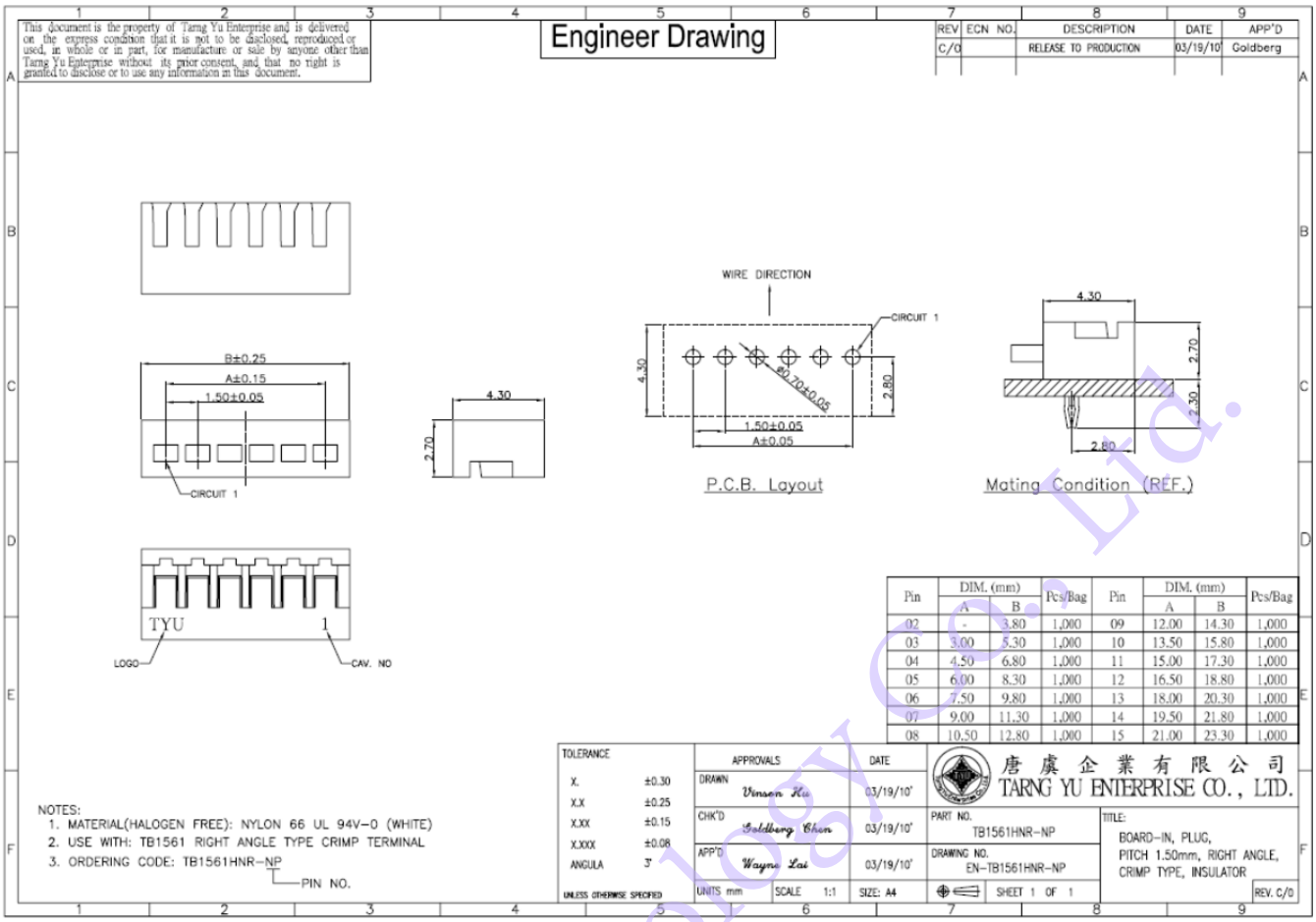
- Internal wiring of class 2 circuits in electronic equipments.

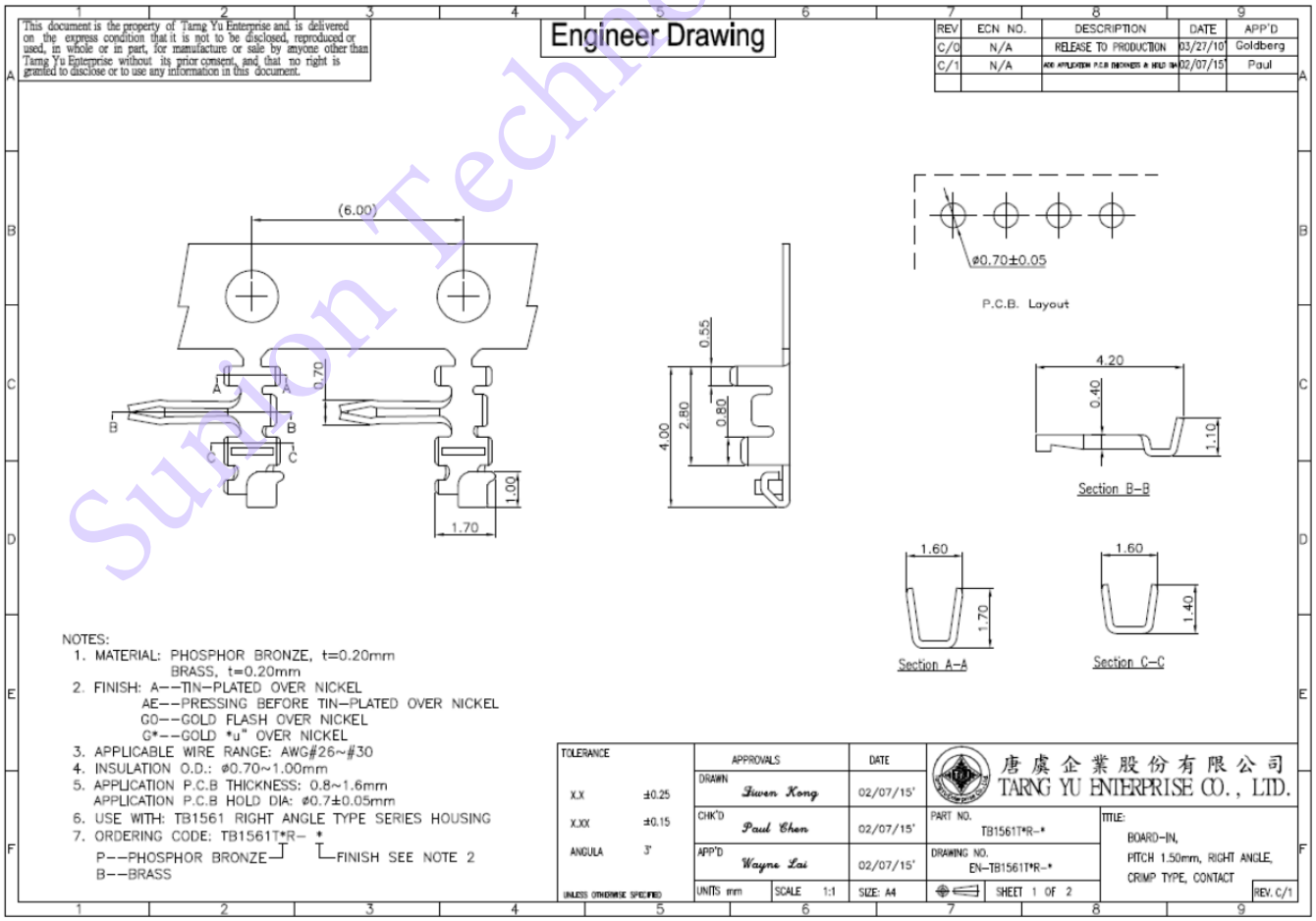
構造及電氣性能(Structure & electrical properties)



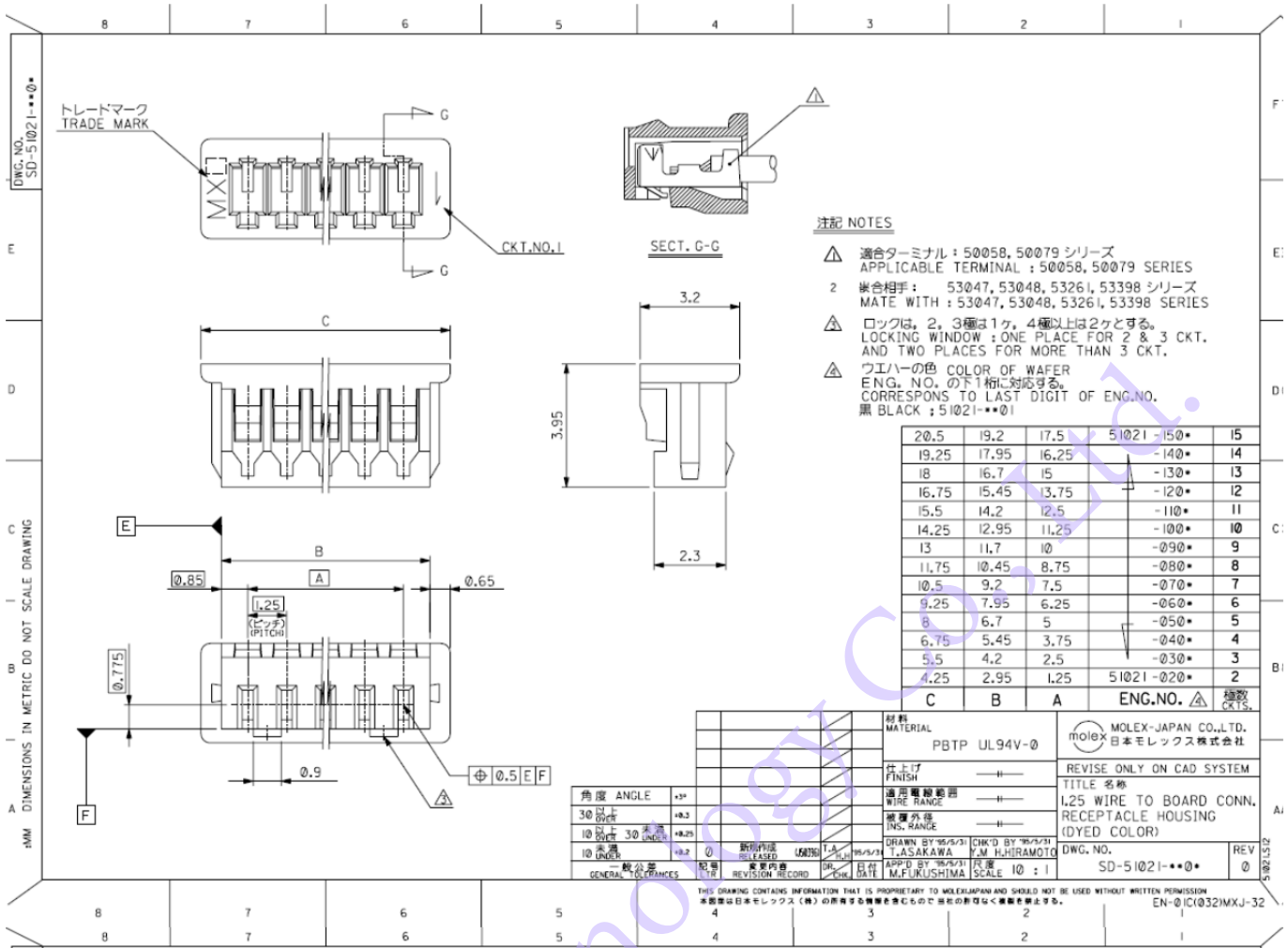
UL 1571	額定 Range		導體 Conductor		絕緣體 Insulation		公差值 Tolerance mm	最大導體阻抗 Maximum Conductor Resistance Ω/km	絕緣耐電壓 (VAC/min) Insulation Potential Strength
	溫度 Temp ℃	電壓 Voltage V	線號 AWG	構成 NO./mm	厚度 Thickness mm	外徑 O.D mm			
多絞線 Stranded	80℃	30V	34	7/0.060	0.20	0.60	±0.05	728.5	500
			32	7/0.080	0.20	0.65	±0.05	703.0	
			30	7/0.100	0.20	0.70	±0.05	397.0	
			28	7/0.127	0.20	0.80	±0.05	248.0	
			26	7/0.160	0.20	0.90	±0.05	152.0	
			24	11/0.160	0.20	1.05	±0.05	88.60	
先絞後鍍 Top-Coated (ATC)	80℃	30V	34	7/0.060	0.20	0.60	±0.05	728.5	
			32	7/0.080	0.20	0.65	±0.05	703.0	
			30	7/0.100	0.20	0.70	±0.05	397.0	
			28	7/0.127	0.20	0.80	±0.05	248.0	
			26	7/0.160	0.20	0.90	±0.05	152.0	
			24	7/0.200	0.20	1.05	±0.05	88.60	
單芯線 Solid(TA)	80℃	30V	32	1/0.203	0.20	0.60	±0.05	575.0	
			30	1/0.254	0.20	0.65	±0.05	377.0	
			28	1/0.320	0.20	0.75	±0.05	232.1	
			26	1/0.404	0.20	0.85	±0.05	155.0	
			24	1/0.511	0.20	0.95	±0.05	92.40	

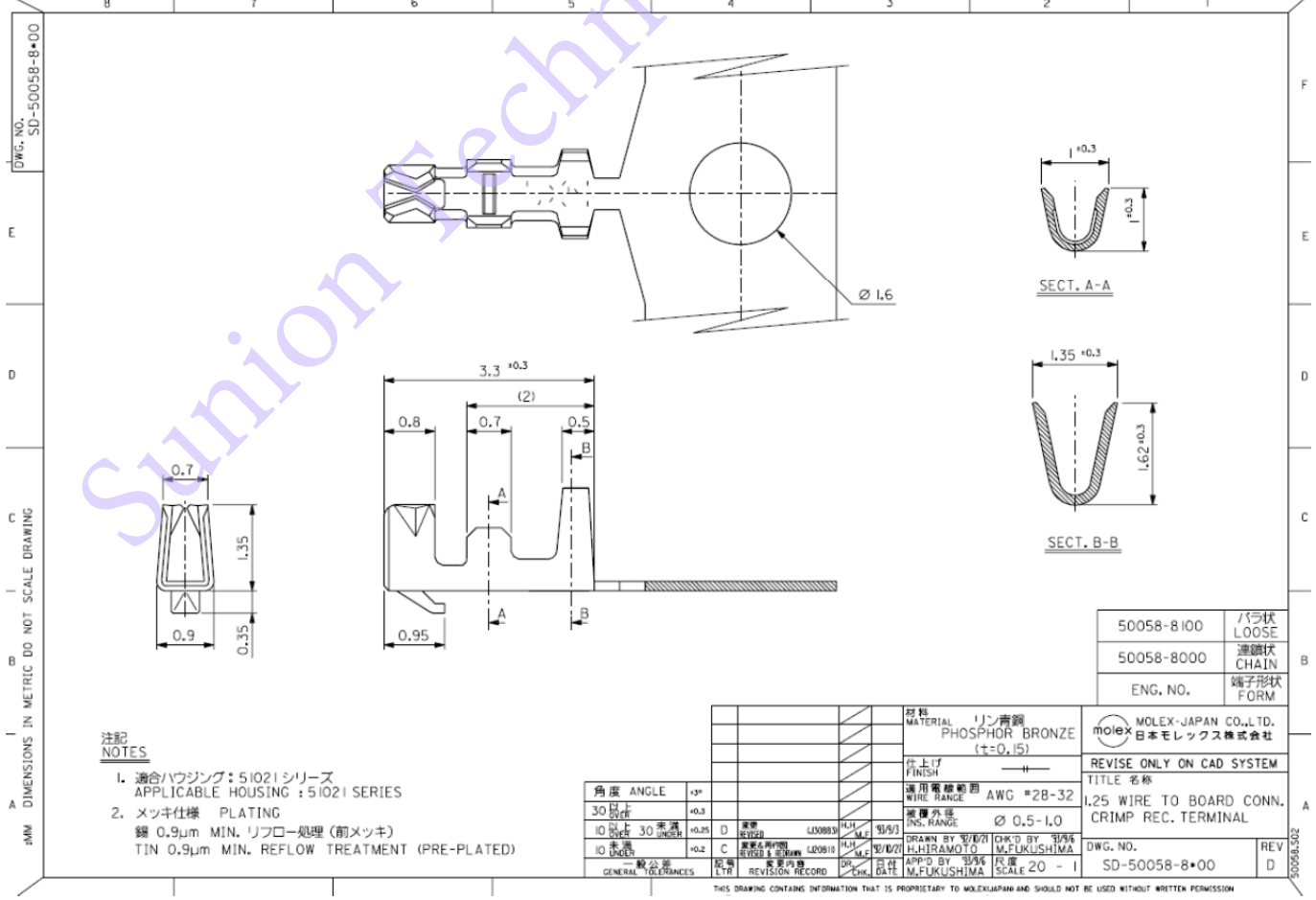
TB1561HNR-05 / TB1561TPR-AE





51021-0500 / 500588000





1-5 Communication protocol

MD-551L+ is using the international Standard **UART** communication format, and with communication parameters set to **9600.N.8.1.**

DATA format are as follows:

HEADER						DATA			CHECK
SOH	PT	ID1	ID2	FC1	FC2	STX	DATA	ETX	BCC
01	Identify	01		Function Code		02	Data	03	Check sum

Description:

1. SOH, STX and ETX are all contained with one byte and used for control byte, the definition is:

   SOH=01H, STX=02H, ETX=03H
   Note: The "SOH" is the start byte for current command set
   The "STX" is the start byte for "Data"
   The "ETX" is the end byte for "Data"
   You will need these to judge the data length you transmitted or received; the data length will vary in depend on different command you given.

2. PT (Packet Type) is used to identify where is the message comes from; "S" means it comes from PC and "s" means from the MD-551L+.

3. ID1, ID2 are the ID codes of reader, the value is always "01".

4. FC1 and FC2 are function codes, and related to the DATA, the relative data please refers to the next page.

5. BCC is checksum，from SOH to ETX one byte do "xor"，then do "or" 20H.

6. After each one Command is sent, Time Out should set 100ms

7. Returned data is first sent by the Low Byte

Ex. MD-551L+ responds:

SOH	"S"	"01"	"A1"	STX	"010"	ETX	BCC

BCC = ***01H*** xor 53H xor 30H xor 31H xor 41H xor 31H xor ***02H***
Xor 30H xor 31H xor 30H xor ***03H*** or 20H =33H

1-6 Command list

No.	Code	Description	Page
1	“A0”	Tag ID will auto return.	11
2	“A1”	Get Tag ID by command.	12
3	“A9”	Read card and get card ID and type of card.	13
4	“E1”	Get the firmware version	14
5	“K0”	Read a block.	15
6	“K1”	Write a block.	18
7	“K4”	Setting the A key (sector 1-16) or B key(sector 17-32) for temporarily.	19
8	“K5”	Add value to the specify block.	21
9	“K6”	Subtract value to the specify block.	22
10	“K7”	Backup the value from X block to the Y block.	23
11	“K8”	Mifare Plus Functions	24
12	“K9”	ISO15693 RFID Functions (Read UID, Read Single Block Write Single Block, Lock Block, Write AFI, Write Locked Block, Kill)	26
13	“KA”	ISO18092 RFID Functions (Read/Write Block, Enable/Disable NDEF)	40

Note 1: “K0”~”K8”Command sets have to be applied to ISO14443AMifare series only.
Note 2: “K9”Command set has to be applied to ISO15693 card only.
Note 3: “KA” Command set has to be applied to ISO18092 Felica card only.

1-7 Command description

1. “A0”: Tag ID will auto return

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“A”**	**“0”**	STX	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“A”**	**“0”**	STX	**data**	ETX	BCC

Data description:

1. The format of “data” is the Card type (1 byte) + UID (16 byte).
2. The digits of card number include “0”～ “9”, “A” ～ “F” (Hex).For example, “00000000003EA88F”.

Function description:

1. If reader could not get the card UID, it will be no response.
2. The data which include card UID will be returned while reader got the card UID.
3. Reader will respond “Y” before the reading is started.

Example：

The command is sent by host:

SOH + “S01A0” + STX + ETX + BCC

The message is responded by reader:

Success:

SOH + “s01A0” + STX + “M0000000000123456” + ETX + BCC

Failure:

SOH + “s01A0” + STX + ETX + BCC

2. “A1”: Get Tag ID by command

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“A”**	**“1”**	STX	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“A”**	**“1”**	STX	**data**	ETX	BCC

Data description:

1. The format of “data” is the Card type (1 byte) + UID (16 byte).
2. The digits of card number include “0”～ “9”, “A” ～ “F” (Hex). For example, “00000000003EA88F”.

Function description:

1. Use this function to obtain card UID.
2. The “data” will be “N” if reader couldn’t get card UID. Such as: STX + “N” + ETX.
3. Reader clear data after responding.

Example：

The command is sent by host:

SOH + “S01A1” + STX + ETX + BCC

The message is responded by reader:

Success:

SOH + “s01A1” + STX + “M0000000000123456” + ETX + BCC

Failure:

SOH + “s01A1” + STX + “N” + ETX + BCC

3. “A9”: Read card and get card ID and type of card.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“A”**	**“9”**	STX	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“A”**	**“9”**	STX	**data**	ETX	BCC

Data description:

1. The format of “data” is the Card type (1 byte) + UID (16 byte).
2. The digits of card number include “0”～ “9”, “A” ～ “F” (Hex). For example, “00000000003EA88F”.

The list of card chip as follows:

0151: SONY Felica Lite	0152: SONY Felica Lite s
0201: ST Srix 4K	
0401: NXP Mifare_UltraLight	0403: NXP Mifare_One(S50_4byte)
0404: NXP Mifare_One(S50_7byte)	0405: NXP Mifare_One(S70_4byte)
0411: NXP Mifare DESFire_EV1 4K	0415:NXP Mifare Plus_s 2K
0416: NXP Mifare Plus_s 4K	0417: NXP Mifare Plus_x 2K
0418: NXP Mifare Plus_x 4K	0431: NXP I-CODE SLI
0731: TI HF-I Plus	0732: TI HF-I Pro

Function description:

1. Use this function to obtain UID and the chip model of card.
2. The “data” will be “N” if reader couldn’t get card UID. Such as: STX + “N” + ETX.

Example：

The command is sent by host:

SOH + "S01A9" + STX + ETX + BCC

The message is responded by reader:

Success:

SOH + "s01A9" + STX + "M00000000001234560401" + ETX + BCC

Failure:

SOH + "s01A9" + STX + " N" + ETX + BCC

Description:

1. Card UID: "0000000000123456".
2. "0401" indicates the card chip which is NXP UltraLight.

4. “E1”: Get the firmware Version.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“E”**	**“1”**	STX	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“E”**	**“1”**	STX	**date**	ETX	BCC

Data description：

The string of data” includes model number and current firmware version.

Function description：

Use this function to get model number and firmware version of reader.

Example：

The command is sent by host:

SOH + "S01E1" + STX + ETX + BCC

The message is responded by reader:

SOH + "s01E1" + STX + "V1.00 MD-551L+" + ETX + BCC

Description：

1. The model number is MD-551L+ and the firmware version is V1.00.
2. Sunion Electronics Corp. reserves the right to update firmware at any time without notice.

5. “K0”: Read a block.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“0”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“0”**	STX	**data**	ETX	BCC

Data description：

1. “DATA”: DATA must be Card type (“M”, 1 bytes) + specified Block number (2 bytes).

2. “data”:reader would be responded Card type (“M”, 1 bytes) + Card LOCK/UNLOCK status(1 bytes) + Block number (2 bytes) + value which is stored in the Block (32 bytes).

3. If you need to read the value which is stored in specified Block of Mifare Series Card the length of block number is fixed, 2 bytes. The range of Block number arebetween“00”～ “3F”(HEX)，64 Blocks (Block 0 is store the card number and settings, it’s also locked by factory).

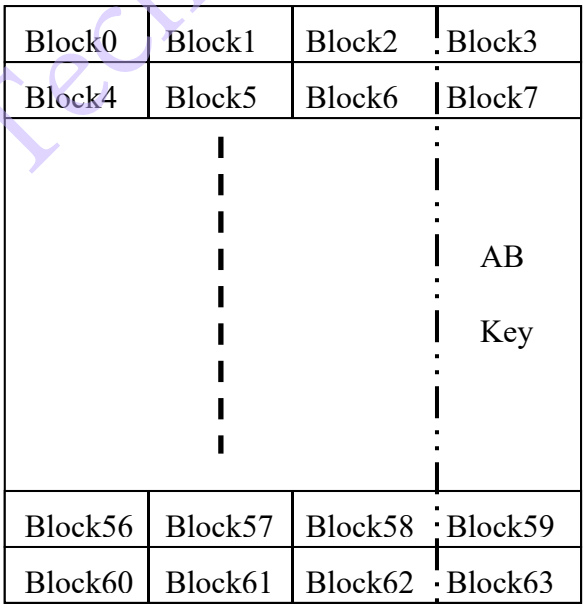


Figure 3: Mifare Card’s Block diagram

Function description:

1. Use this function to Read the specified Mifare Card Block DATA.

2. The Mifare Card is organized in 16 Sectors with 4 Blocks of 16 bytes each, the 4th Block of each sector is stored Keys (Key A and Key B) and settings, it could not store the user's data.

3. Due to protect the keys and data in Blocks, the Key A of each sector is always shown "0", not truth.

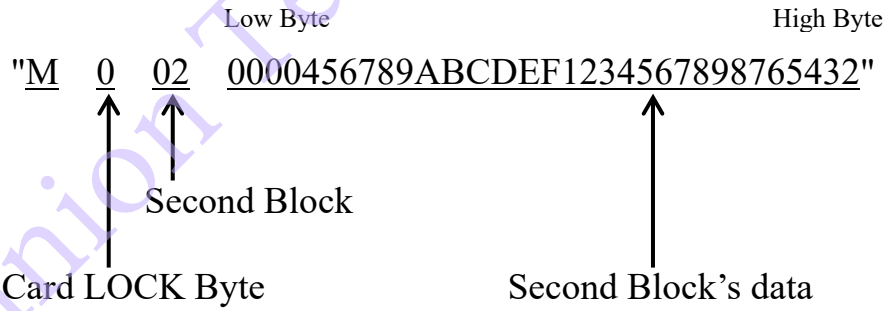
4. Mifare Card doesn't support LOCK function, Card LOCK byte is always returned "0".

Example 1：

The command is sent by host:
SOH + "S01K0" + STX + "M02" + ETX + BCC

The message is responded by reader:
SOH + "s01K0" + STX + "M0020000456789ABCDEF1234567898765432" + ETX + BCC

Description:
The message is responded by reader:



Example 2:

The command is sent by host:
SOH + "S01K0" + STX + "M03" + ETX + BCC

The message is responded by reader:
SOH + "s01K0" + STX + "M00300000000000698007FFFFFFFFFFFF" + ETX + BCC

Description：
The message is responded by reader:

Low Byte High Byte

"M 0 03 00000000000698007FFFFFFFFFFFF "

A key B key

Third Block's data

Example 3：

If the chip of card is Ultralight, readercould read 16bytes (4 Blocks)at once time. (Due to every Block of Ultralight is 4 bytes.)

The command is sent by host:
SOH + "S01K0" + STX + "M04" + ETX + BCC

The message is responded by reader:
SOH + "s01K0" + STX + "M00400000000001075501777 72E636F6DFE00" + ETX + BCC

Description：
The message is responded by reader:
Success:
M00400000000001075501777 72E636F6DFE00

Failure:
SOH + "s01K0" + STX + " **N**" + ETX + BCC

6. “K1”: Write a block.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“1”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“1”**	STX	**data**	ETX	BCC

Data description：

1. DATA must be Card type (1 bytes)+ specified Block number (2 bytes) + the user data which is modified by user.
2. Mifare Card type must be set to “M ” + specified Block number. The range of Block number is between “01”～ “3F”(HEX)，63 Blocks.
3. reader will return “data” string as following:
   a. It is written successful for “Y”.
   b. If it is written failed, the string will be returned “N”.
4. Attention: When you write new Key A and Key B into the 4th Block of any Sector, the Keys would be changed immediately. The Keys could NOT be read from the Block.

Function description:

1. Use this function to write user’s data into specified Block of Mifare Card.
2. Use this function to write Key A and/or Key B into specified Trailer Block (the 4th Block) of any Sector.

Example 1：

The command is sent by host:

SOH + "S01K1" + STX +"M071111111111111698007FFFFFFFFFFFFF"+ ETX + BCC

The message is responded by reader:

SOH + "s01K1" + STX + "**Y**" + ETX + BCC

(“Y” means the data is written into specified Block successfully.)

Example 2：Ultralight can be written 4byte only at once time:

The command is sent by host:

SOH + "S01K1" + STX +"M07000000000107550177772E636F6DFE00" + ETX + BCC

Write data: 000000000

The message is responded by reader:

Successful: SOH + "s01K1" + STX + "**Y**" + ETX + BCC

Failed: SOH + "s01K1" + STX + " **N**" + ETX + BCC

7. “K4”: Setting the A key (sector 1-16) or B key (sector 17-32) for temporarily.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“4”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“4”**	STX	**data**	ETX	BCC

The message is responded by reader:

1. DATA consists of card type, Key Sector and the key that you want to input as follow: **Card type (“M”, 1 byte) + 〔Key Sector(2 bytes)〕+ Key (12 bytes)**
2. Responded “data” string as below:
   If “data” is **“Y”** means Block is successfully locked.
   If “data” is **“N”** means failed.

Function description：

1. Use this function to set a key (Key A or Key B) which keep in the memory of reader, but it would be volatile immediately while power-off. You have to set the key again while reader is restarted next time if you need.
2. If you want to perform the function “K0” or “K1” and the card had be locked by keys, you have to perform “K4” function to set a key (Key A or Key B) correctly first. Due to you can keep only one key (Key A or Key B) in the memory of reader temporarily, reader will set the key to Key A when Key Sector is set to “01”~”10” (A Key). Similarly, reader will set the key to Key B when Key Sector is set to “11”~”20” (B Key).
3. It is not necessary to perform “K2” if “K4” had be performed.
4. Please perform this function again if you want to change thekey.
5. Mifare Ultralight could be read or written directly without the any key.
6. It needs 6 bytes key authentication to read or write Mifare Plus S/X data while security level is up graded to Level1.
7. It needs 16 bytes key authentication to read or write Mifare Plus S/X data while security level is upgraded to Level 3. The default setting is 0xff.

Example：

The command is sent by host:
SOH + "S01K4" + STX + "M01123456789ABC" + ETX + BCC

The message is responded by reader:
SOH + "s01K4" + STX + "Y" + ETX + BCC

● Block frame in the adding and subtracting value function

1. First, before adding or subtracting the value, you have to write 3 values to specified Block, one of these values must be reversed. Then, you have to fill the 4 addresses into the same Block, similarly, two of addresses must be reversed. See the table as below.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value				Value				Value				Address	$\overline{\text{Address}}$	Address	$\overline{\text{Address}}$

Example：

00000000FFFFFFFF00000000FF00FF00

2. Attention: Don't write the data into the 4th Block of each Sector. The key and settings would be changed and the card may not be read or written again.

8. “K5”: Add value to the specify block.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“5”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“5”**	STX	**data**	ETX	BCC

Data description：

1. DATA must be Card type(1 bytes)+ specified Block(2 bytes) + the value (4 bytes).
2. The representations of responded “data” string are as follow:
   If “data” is **“Y”** means the Block is added value successfully.
   If “data” is **“N”** means it’s failed.

Function description：

1. Use this function to add value and store the value in specified Block.
2. The default value of Block must be written into the specified Block before adding value (See Page 20) to allow this operation.

Example：

The command is sent by host:

SOH + "S01K5" + STX + "M0100000001" + ETX + BCC

The message is responded by reader:

SOH + "s01K5" + STX + "Y" + ETX + BCC

9. “K6” :Subtract value to the specify block.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“6”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“6”**	STX	**data**	ETX	BCC

Data description：

1. DATA must be **Card type (“M”, 1 byte) + specified Block (2 bytes)+value (4 bytes)**
2. The representations of responded “data” string are as follow:
   If “data” is **“Y”** means the value stored in specified Block is subtracted successfully.
   If “data” is **“N”** means it’s failed.

Function description：

1. Use this function to subtract value and store the value in specified Block.
2. The default value of Block must be written into the specified Block before adding value (See Page 20) to allow this operation.

Example：

The command is sent by host:
SOH + "S01K6" + STX + "M0100000001" + ETX + BCC

The message is responded by reader:
SOH + "s01K6" + STX + "Y" + ETX + BCC

10. “K7” : Backup the value from X block to the Y block.

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“7”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“7”**	STX	**data**	ETX	BCC

Data description：

1. DATA must be **Card type (“M”, 1 byte) + Source Block Number (2 bytes)+ Destination Block Number (2 bytes)**
2. The representation of responded “data” string are as follow:
   If “data” is **“Y”** means backup is successfully.
   If “data” is **“N”** means it’s failed.

Function description：

1. Use this function to backup Block A data to Block B, but both Block A and Block B must be in the same sector.
2. The default value of Block must be written into the specified Block before adding value (See Page 20) to allow this operation.

Example：

The command is sent by host:
SOH + "S01K7" + STX + "M0102" + ETX + BCC

The message is responded by reader:
SOH + "s01K7" + STX + "Y" + ETX + BCC

11. “K8” :Mifare Plus Security Level Function

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“8”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“8”**	STX	**data**	ETX	BCC

11-1 Data description

1. The format of “DATA” is as below:

Command 1	Command 2	Parameter

1. The lengths of Command 1 & Command 2 are both 2 bytes, respectively.
2. The length of DATA is 2 bytes with ASCII, but it is 1byte with Hex.
3. Parameter: The definition and length of DATA depend on C1 and C2.

Command1(C1)：

7	6	5	4	3	2	1	0
Command				0000			

Table1: Command1 list

Command	Description
0001	Mifare Plus upgrade

Command2(C2)：

7	6	5	4	3	2	1	0
Tag type				0000			

Table2: Tag type list

Command	Description
0001	Mifare Plus S/X upgrade Level1
0010	Mifare Plus S/X upgrade Level2
0011	Mifare Plus S/X upgrade Level3

C1, C2 ：

C1	C2	C1+C2
Upgrade	Mifare Plus S/X upgrade Level1	1010
	Mifare Plus S/X upgrade Level2	1020
	Mifare Plus S/X upgrade Level3	1030

11-2 Function description

Mifare Plus upgrade (Command = 0001)

DATA:

C1	C2	Parameter
00010000	00000000	Null
2 byte	2 byte	0 byte

The representations of “data” string are as follow:
2. “Y” means it is successfully.
3. “N” means it is failed.

Example 1

The command is sent by host:
SOH + “S01K8” + STX+ “1010” + ETX + BCC

The message is responded by reader:

Success:
SOH + “s01K8” + STX + “Y” + ETX + BCC

Failure:
SOH + “s01K8” + STX + “N” + ETX + BCC

12. “K9” :ISO15693 RFID Functions

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“9”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“9”**	STX	**data**	ETX	BCC

12-1 Data description

1. The format of “DATA” is as below:

Command 1	Command 2	Parameter

1. The lengths of Command 1 & Command 2 are both 2 bytes.
2. The length of DATA is 2 bytes with ASCII, but it is 1 byte with Hex.
3. Parameter: The definition and length depend on C1 and C2.

Command1(C1)：

7	6	5	4	3	2	1	0
Command				0000			

Table1: Command1 list

Command	Description
0000	Read UID
0001	Read Single Block
0010	Write Single Block
0011	Lock Block
0100	R.F.U
0101	R.F.U
0110	Write AFI
0111	Lock AFI
1000	R.F.U
1001	R.F.U
1010	Write Locked Block
1011	Kill
1100	R.F.U
1101	R.F.U
1110	R.F.U
1111	R.F.U

Command2(C2)：

7	6	5	4	3	2	1	0
Tag type				0000			

Table2: Tag type list

Tag type	Description
0000	ALL TYPES
0001	R.F.U
0010	Tag-it HF-I Plus
0011	Tag-it HF-I Pro
0100	R.F.U
0101	R.F.U
0110	ICODE2
0111	R.F.U
1000	R.F.U
1001	R.F.U
1010	R.F.U
1011	R.F.U
1100	R.F.U
1101	R.F.U
1110	R.F.U
1111	R.F.U

*1: R.F.U = Reserve for Use

2. DATA format:
   The definition and length of DATA depend on C1 and C2.

Table 3 :Tag type & Supported Command table(K9)

Command		Tag type						
		R.F.U	R.F.U	Tag-it HF-I Plus	Tag-it HF-I Pro	R.F.U	R.F.U	ICODE2
		0000	0001	0010	0011	0100	0101	0110
0000	Read UID	V						
0001	Read Single Block			V	V			V
0010	Write Single Block			V	V			V
0011	Lock Block			V	V			V
0100	R.F.U							
0101	R.F.U							
0110	Write AFI			V	V			V
0111	Lock AFI			V	V			V
1000	R.F.U							
1001	R.F.U							
1010	Write Locked Block				V			
1011	Kill				V			
1100	R.F.U							
1101	R.F.U							
1110	R.F.U							
1111	R.F.U							

*1: R.F.U = Reserve for Use

*2: V= Supported

*3: The different tag type is corresponding to different command set, if the host send a command which is not supported by the tag, reader willreturn “N” which represents failure.

Table 4 :C1, C2 Combinations for all supporting tags and command sets:

Table4 Combinations

C1	C2	C1+C2
Read UID	All types	“0000”
Read Single Block	TI HF-I Plus	“1020”
	TI HF-I Pro	“1030”
	R.F.U	“1040”
	R.F.U	“1050”
	I-CODE2	“1060”
Write Single Block	TI HF-I Plus	“2020”
	TI HF-I Pro	“2030”
	R.F.U	“2040”
	R.F.U	“2050”
	I-CODE2	“2060”
Lock Block	TI HF-I Plus	“3020”
	TI HF-I Pro	‘3030”
	R.F.U	“3040”
	R.F.U	“3050”
	I-CODE2	“3060”
Write AFI	TI HF-I Plus	“6020”
	TI HF-I Pro	“6030”
	R.F.U	“6040”
	I-CODE2	“6060”
Lock AFI	TI HF-I Plus	“7020”
	TI HF-I Pro	“7030”
	R.F.U	“7040”
	I-CODE2	“7060”
Write Locked Block	TI HF-I Pro	“A030”
Kill	TI HF-I Pro	“B030”

12-2 Function description

12-2.1 Read UID (Command = 0000)

DATA:

C1	C2	Parameter
00000000	00000000	None
2 byte	2 byte	0 byte

data:

<Successful>

'M'	UID
1 byte	16 byte

<Unsuccessful>
Return 'N'

Example1
The command is sent by host:
SOH + "S01K9" + STX+ "0000" + ETX + BCC

The message is responded by reader:
SOH + "s01K9" + STX +"MCD0712345678ABE0" + ETX + BCC

Description：
"0000" means "to read the serial number of All Type cards".
"M" - Multi Page
UID: "CD0712345678ABE0"

12-2.2 Read Single Block (Command = 0001)

DATA:

C1	C2	Parameter
00010000 or 00010001	xxxx0000	Block Address
2 byte	2 byte	2 byte

1.xxxx represents specified card type in tag type list
2. Block Address range:
   TI HF-I Plus: 00H – 3FH
   TI HF-I Pro: 00H – 0BH
   I-CODE SLI: 00H – 1BH

data:

<Successfully>

'M'	Status	Block Address	Block Data
1 byte	1 byte	2 byte	4 bytes or 8 bytes

1. Reader will return "N" if it is failure.
2. Status: "0" - not locked; "2" – locked.
3. Block Data:4 bytes or 8 bytes Tag data.

Example1
The command is sent by host:
   SOH + "S01K9" + STX+ "102005" + ETX + BCC

The message is responded by reader:
   SOH + "s01K9" + STX + "M00512345678" + ETX + BCC

Description：
The command is sent by host:
"1020": Read Single Block, TI HF-I Plus.
"05": Block 05H.

The message is responded by reader:
"M": Multi page.
"0": Unlocked.
"05": Block 05H
"12345678": Block data.

Example2

The command is sent by host:
SOH + “S01K9” + STX+ “102005” + ETX + BCC

The message is responded by reader：
SOH + “s01K9” + STX + “M20512345678” + ETX + BCC

Description:
The command is sent by host:
”1020” :Read Single Block, TI HF-I Plus
“05” :Block 05H

The message is responded by reader：
“M”: Multi page.
“2”: Locked.
“05”: Block 05H
“12345678”: Block data.

Example3

The command is sent by host:
SOH + “S01K9” + STX+ “118005” + ETX + BCC

The message is responded by reader:
SOH + “s01K9” + STX + “M005012345678ABCDEF” + ETX + BCC

Description：
The command is sent by host:
”1180”: Read Single Block, MB89R118.
“05”: Block 05H.

The message is responded by reader:
“M”:Multi page.
“0”:Unlocked.
“05”:Block 05H
“012345678ABCDEF”:Block data.

12-2.3 Write Single Block (Command = 0010)

DATA:

C1	C2	Parameter	
00100000 or 00100001	xxxx0000	Block Address	Block Data
2 byte	2 byte	2 byte	8 byte or 16 byte

data:
<Successful>
Reader will return “Y”.

<No card or Unsuccessful>
Reader will return “N”.

Example1
The command is sent by host:
SOH + “S01K9” + STX+ “20200112345678” + ETX + BCC
The message is responded by reader
SOH + “s01K9” + STX + “Y” + ETX + BCC

Description：
”2020” :Write Single Block, TI HF-I Plus
“01” :Block 01H
“12345678”: Block data.
Reader responds “Y” means data is written successfully.

Example2
The command is sent by host:
SOH + “S01K9” + STX+ “20600912345678”+ ETX + BCC
The message is responded by reader:
SOH + “s01K9” + STX + “N” + ETX + BCC

Description：
The command is sent by host:
”2060” :Write Single Block, I-Code2
“09” :Block 09H
“12345678”isBlock Data which user desire to write into Block 09H.

The message is responded by reader:
Readerreturn "N", it can not write data into Block 09H or no Tag.

12-2.4 Lock Block (Command = 0011)

DATA:

C1	C2	Parameter
00110000	xxxx0000	Block Address
2 byte	2 byte	2 byte

data:
<Successful>
Reader will return “Y”.

<Unsuccessful>
Reader will return “N”.

◎The data in the locked Block can not be changed, and the locked Block can not be unlocked. Just only Tag-it HF-I Pro could be written the data into locked Block using “Write Locked Block”.
◎The Block 0BH of Tag-it HF-I Pro is used to set the Password, but it can not be read while the Block 0BH is locked.

Example1
The command is sent by host:
SOH + “S01K9” + STX+ “30200A” + ETX + BCC
The message is responded by reader:
SOH + “s01K9” + STX + “Y” + ETX + BCC

Description：
”3020” :Lock Block, TI HF-I Plus
“0A” :Block 0AH
Reader responds “Y” means Block 0AH is lockedsuccessfully.

Example2
The command is sent by host:
SOH + “S01K9” + STX+ “303005” + ETX + BCC
The message is responded by reader:
SOH + “s01K9” + STX + “N” + ETX + BCC

Description：
”3030” :Lock Block, TI HF-I Pro
“05” :Block 05H
Reader responds “N” means Block 05H is locked failure.

12-2.5 Write AFI (Command = 0110)

DATA:

C1	C2	Parameter
01100000	xxxx0000	AFI value
2 byte	2 byte	2 byte

data:
<Successful>
Reader will return “Y”.

<Unsuccessful>
Reader will return “N”.

Example1
The command is sent by host:
SOH + “S01K9” + STX+ “602080”+ ETX + BCC

The message is responded by reader:
SOH + “s01K9” + STX + “Y” + ETX + BCC

Description：
”6020” :Write AFI, TI HF-I Plus
“80” :AFI Value
Reader responds “Y” means AFI value is writtensuccessfully.

Example2
The command is sent by host:
SOH + “S01K9” + STX+ “603090” + ETX + BCC

The message is responded by reader:
SOH + “s01K9” + STX + “N” + ETX + BCC

Description：
”6030” :Write AFI, TI HF-I Pro
“90” :AFI Value
Reader responds “N” means AFI value is written failure.

12-2.6 Lock AFI (Command = 0111)

DATA:

C1	C2	Parameter
01110000	Xxxx0000	None
2 byte	2 byte	0 byte

data:
<Successful>
Reader will return “Y”.

<Unsuccessfully>
Reader will return “N”.

Example1
The command is sent by:
SOH + “S01K9” + STX+ “7020” + ETX + BCC

The message is responded by reader:
SOH + “s01K9” + STX + “Y” + ETX + BCC

Description：
”7020” :Lock AFI, TI HF-I Plus
Reader responds “Y” means AFI is lockedsuccessfully.

Example2
The command is sent by host:
SOH + “S01K9” + STX+ “7030”+ ETX + BCC

The message is responded by reader
SOH + “s01K9” + STX + “N” + ETX + BCC

Description：
”7030” :Lock AFI, TI HF-I Pro
Reader responds “N” means AFI is locked failure.

12-2.7 Write Locked Block (Command = 1010)

◎This function is only Tag-it HF-I Pro card available.
◎This function is used to write the data into a locked Block using Password and UID.
◎This function is allowed to performwhile the Password is enabled.
◎The content of Block 0BH is the Password and it is enabled whileBlock 0BH is locked.
◎Password can be read or written while it isenabled.

DATA:

C1	C2	Parameter			
10100000	00110000	Tag UID	Pwd	Block Address	Block Data
2 byte	2 byte	16 byte	8 byte	2 byte	8 byte

data:
<Successfully>
Reader will return “Y”.

<no Tag>
Reader will return “N”.

Example1
The command is sent by host:
SOH + “S01K9” + STX+
“A03062 07C4A509C215E0AAAAAAAA**07**12345678” + ETX + BCC
(Write Locked Block、TI HF-I Pro、Tag UID =E007C4A509C21562、Pwd = AAAAAAAA、Block Address = 07、Block Data = 12345678)

The message is responded by reader:
SOH + “s01K9” + STX + “Y” + ETX + BCC

12-2.8 Kill(Command = 1011)

◎This function is only Tag-it HF-I Pro card available.
◎Use this function to kill aTag-it HF-I Pro card.
◎A killed tag can not be read any data and responded.
◎This function is allowed to perform while the Password is enabled.
◎The content of Block 0BH is the Password and it is enabled while Block 0BH is locked.

DATA:

C1	C2	Parameter	
10110000	00110000	Tag UID	Pwd
2 byte	2 byte	16 byte	8 byte

data:
<Successful>
Reader will return “Y”.

<Unsuccessful>
Reader will return “N”.

Example1
The command is sent by host:
SOH + “S01K9” + STX+ “B0306207C4A509C215E0AAAAAAAA” + ETX + BCC
(Kill、TI HF-I Pro、Tag UID = E007C4A509C21562、Pwd = AAAAAAAA)

The message is responded by reader:
SOH + “s01K9” + STX + “Y” + ETX + BCC (Kill successfully)

The command is sent by host:
SOH + “S01K9” + STX+ “B0306207C4A509C215E0AAAAAAAA” + ETX + BCC

The message is responded by reader:
SOH + “s01K9” + STX + “N” + ETX + BCC (KillFailure)

12-2.9 Read System

This function is only TI HF-I Plus and I Code 2 available.

DATA:

C1	C2	Parameter
11100000	xxxx0000	Null
2 byte	2 byte	0 byte

data:

Reader will return successful data as below:

Info flags	UID	DSFID	AFI	Other fields
8 bit	64 bit	8 bit	8 bit	24 bit

Example

The command is sent by host:

SOH + "S01K9" + STX+ "E020" + ETX + BCC

The message is responded by reader:

SOH + "s01K9" + STX + "0F83284406822007E000993F038B"+ ETX + BCC(Read System successfully)

(0F=Info flags, 83284406822007E0=uid,00= DSFID, 99=AFI, Other fields=3F038B)

13. “KA” :ISO18092 RFID Functions

The command is sent by host:

SOH	**“S”**	ID1	ID2	**“K”**	**“A”**	STX	**DATA**	ETX	BCC

The message is responded by reader:

SOH	**“s”**	ID1	ID2	**“K”**	**“A”**	STX	**data**	ETX	BCC

13-1 Data description

1. The format of “DATA” is as below:

Command 1	Command 2	Parameter

1. The lengths of Command 1 & Command 2 are both 2 bytes.
2. The length of DATA is 2 bytes with ASCII, but it is 1 byte with Hex.
3. Parameter: The definition and length depend on C1 and C2.

Command1(C1)：

7	6	5	4	3	2	1	0
Command				0000			

Command	Description
0001	Read Single Block
0010	Write Single Block
1100	Enable NDEF
1101	Disable NDEF

Command2(C2)：

7	6	5	4	3	2	1	0
Tag type				0000			

Tag type	Description
00010000	Sony Felica

2. DATA format:
   The definition and length of DATA depend on C1 and C2.

13-2 Function description

13-2.1 Read Single Block (Command = 0001)

DATA:

C1	C2	Parameter
00010000	xxxx0000	Block Address
2 byte	2 byte	2 byte

data:

'M'	Status	Block Address	Block Data
1 byte	1 byte	2 byte	32 byte

1. Reader will return "N" while the specified Block is read failure.
2. Status: "0" - Unlocked; "2" – Locked.
3. The Lock status is always "0", due to the Lock function is unavailable for Feliaca.
4. Block Address range:
   Felica lite:00h~88h
   Felica lite S:00h~A0h
5. Block Data: The length of data is 32 byte

Example 1

The command is sent by host:
SOH + "S01KA" + STX+ "101005" + ETX + BCC

The message is responded by reader:
SOH + "s01KA" + STX + "M0051234567812345678" + ETX + BCC

Description :
The command is sent by host:
"1010" means "Read Single Block, Sony Felica".
"05"means Block 05H.

The message is responded by reader
"M" – Multi-Page
"0" –Unlocked
"05" – Block 05H
"1234567812345678" – Block data

13-2.2 Write Single Block (Command = 0010)

DATA:

C1	C2	Parameter	
00100000	xxxx0000	Block Address	Block Data
2 byte	2 byte	2 byte	32 byte

data:

1. Reader will return “Y” while the data is written successfully.
2. Reader will return “N” while the data is written unsuccessfully.
3. Block Address range:
   Felica lit:00h~88h
   Felica lite S:00h~A0h

Example1

The command is sent by host:

SOH + “S01KA” + STX+ “2010012345678123456781234567812345678” + ETX + BCC

The message is responded by reader:

SOH + “s01KA” + STX + “Y” + ETX + BCC

Description:

“2010” means「Write Single Block,Felica」

“01” Block 01H

“12345678123456781234567812345678” representsBlock Data

Reader responds “Y”means the data is written successfully.

Example2

The command is sent by host:

SOH + “S01K9” + STX+ “2010091234567812345678123456781234567 8” + ETX + BCC

The message is responded by reader:

SOH + “s01K9” + STX + “N” + ETX + BCC

Description:

“2010” means「Write Single Block, Sony Felica」

“09”Block 09H

“12345678123456781234567812345678” represents Block Data

Reader responds “N” while it can not write the data into Tag or no Tag.

13-2.3 Enable NDEF (Command = 11000000)

DATA:

C1	C2
11000000	xxxx0000
2 byte	2 byte

Use this function to enable NDEF for NFC data access.

data
1. It is “Y” for success.
2. It is “N” for failure.

Example 1

The command is sent by host:
SOH + “S01KA” + STX+ “C010” + ETX + BCC

The message is responded by reader
Success: SOH + “s01KA” + STX + “Y” + ETX + BCC
Failure: SOH + “s01KA” + STX + “N” + ETX + BCC

Description:
“C010”represents”Enable NDEF, Sony Felica”
Reader responds "Y" while Block Data is written successfully.
Reader responds "N" while Block Data is written failure.

13-2.4 Disable NDEF (Command = 11010000)

DATA:

C1	C2
11010000	xxxx0000
2 byte	2 byte

Use this function to disable NDEF for NFC data access.

data
1. It is “Y” for success.
2. It is “N” for failure.

Example 1

The command is sent by host:
SOH + “S01KA” + STX+ “D010”+ ETX + BCC

The message is responded by reader:

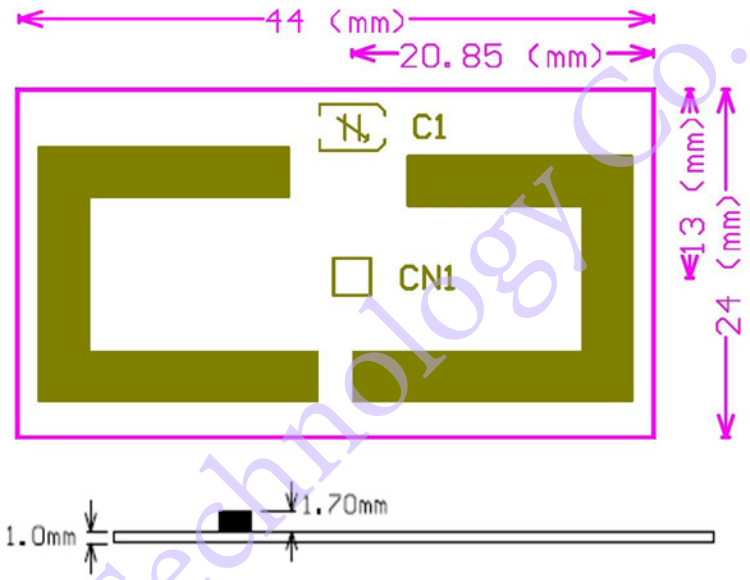
Successful:
SOH + “s01KA” + STX + “Y” + ETX + BCC

Failure:
SOH + “s01KA” + STX + “N” + ETX + BCC

Description:
“D010” represents Disable NDEF, Sony Felica.
Reader responds "Y" while Block Data is written successfully.
Reader responds "N" while Block Data is written failure.

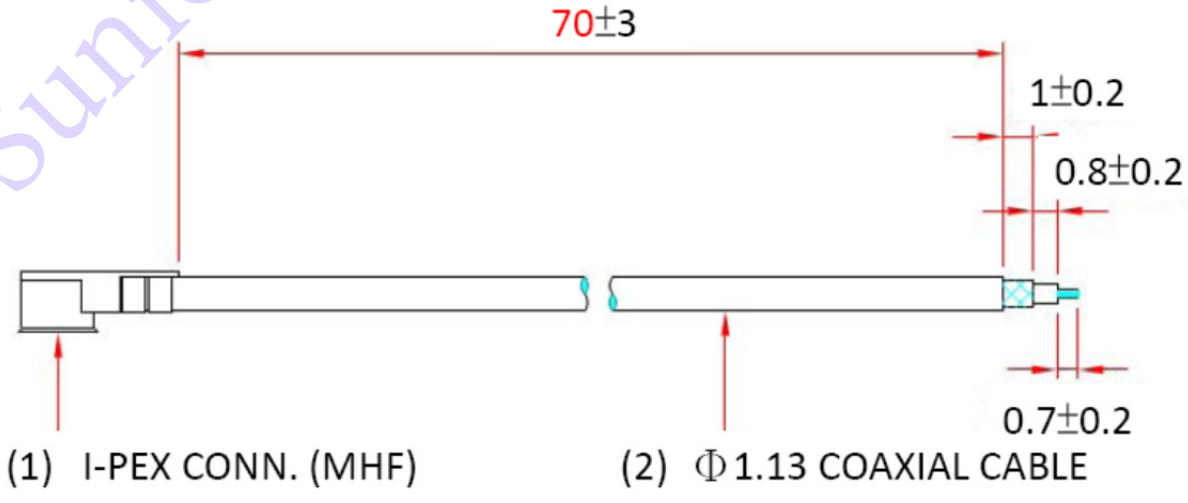
2. Specification

Part Number	ANT-4424-FY-IPX70
Operation Frequency	13.56MHz
Operation Temperature	-20℃ to + 85℃
Storage Temperature	-20℃ to + 85℃
PCB Dimensions (Unit : mm±0.5 mm)	44 x 24x 1.0 (L x W x H)

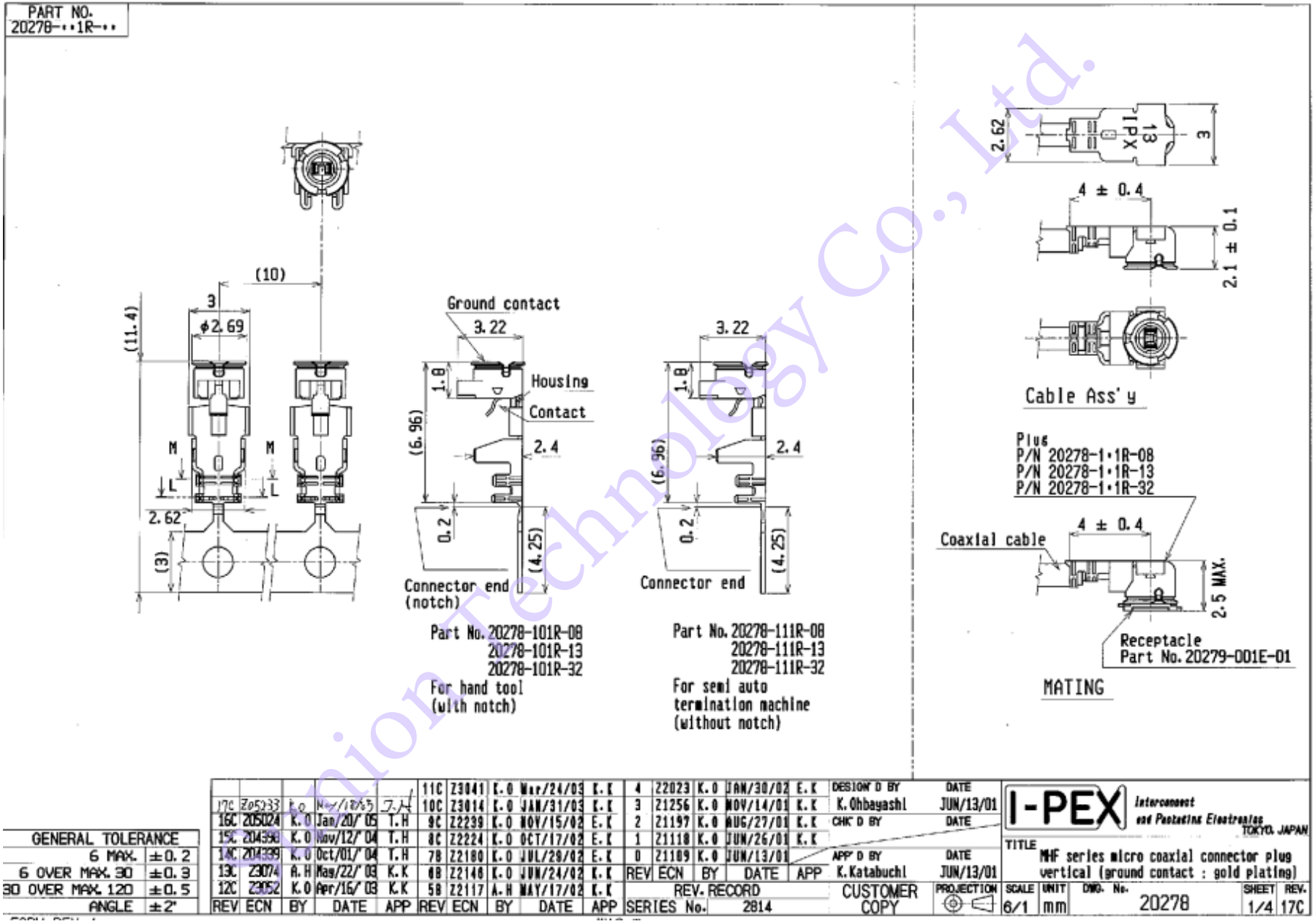


Unit : mm±0.5 mm

CN1 Connector Cable	MHF Connector MINI 1.13 Coaxial Cable 70mm

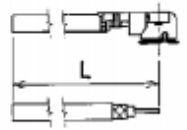


(1) MHF Connector 20278-111R-13

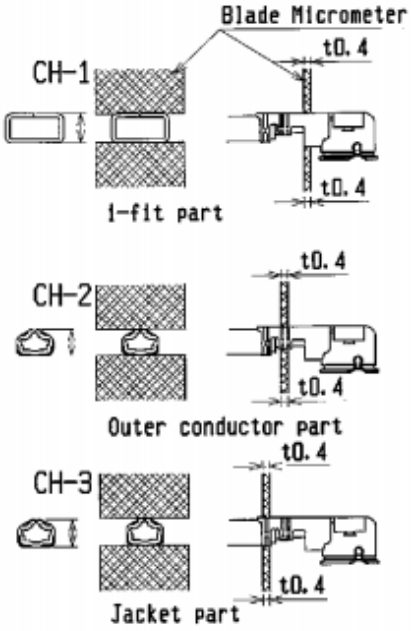


Part No.	20278-101R-08 / 20278-111R-08	20278-101R-13 / 20278-111R-13	20278-101R-32 / 20278-111R-32	20278-101R-18 / 20278-111R-18
Housing color	White	Black	Black	White
Applicable cable nominal dimension	2.09±0.1 / 1.25±0.1 / 1.16±0.1 / φ0.81 Nominal / (φ0.65) / φ0.4 Nominal / AWG36(7/0.05) / ※ NOTE-1	2.09±0.1 / 1.25±0.1 / 1.16±0.1 / φ1.13 Nominal / (φ0.93) / φ0.68 Nominal / AWG32(7/0.08) / ※ NOTE-1	2.09±0.1 / 1.25±0.1 / 1.16±0.1 / φ1.32 Nominal / (φ1.12) / φ0.66 Nominal / AWG32(7/0.08) / ※ NOTE-1	2.09±0.1 / RG178 B/U / 1.25±0.1 / 1.16±0.1 / φ1.8 Nominal / (φ1.35) / φ0.84 Nominal / AWG30(7/0.102) / ※ NOTE-1
Braided shield of Outer conductor 外部導体の編組	Single / 1重編組	Single / 1重編組	Double / 2重編組	Single / 1重編組
P/N of hand Tool / P/N of semi auto termination machine	90187-008C / 90213-008C	90187-013C / 90213-013C	90187-032C / 90213-032C	90233-018 / 90232-018
Sect. M-M	1.68 / 1.12	2.24 / 1.48	2.29 / 1.56	2.71 / 1.9
Sect. L-L	1.72 / 1.19	2.28 / 1.55	2.37 / 1.71	3.1 / 2.26
Crimp Height CH-1	1.34~1.40	1.34~1.40	1.34~1.40	1.34~1.40
Crimp Height CH-2	0.76~0.84	1.06~1.14	1.20~1.30	1.41~1.49
Crimp Height CH-3	0.85~0.97	1.15~1.35	1.26~1.46	1.70~1.80

Cable cut length



Crimp Height



NOTE-1
中心導体，外部導体への半田コーティングは不可
Must not use solder coated
inner conductor and outer conductor.

GENERAL TOLERANCE	
6 MAX.	±0.2
6 OVER MAX. 30	±0.3
30 OVER MAX. 120	±0.5
ANGLE	±2°

REV	ECN	BY	DATE	APP
REV. RECORD				
SERIES No.	2814			

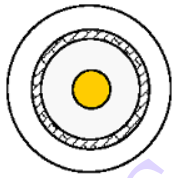
DESIGN'D BY DATE
CHK'D BY DATE
APP'D BY DATE
CUSTOMER COPY
PROJECTION

I-PEX Interconnect and Packaging Electronics TOKYO JAPAN

TITLE: MHF series micro coaxial connector plug vertical (ground contact : gold plating)

SCALE	UNIT	DWG. No.	SHEET	REV.
-/-	mm	20278	3/4	17C

(2) MINI 1.13 Coaxial Cable

STYLE	105℃ 30V UL 1979	DOCUMENT NO : A3132TS001	
SIZE	32AWG	ESTABLISHED DATE: 2005/05/11	
STANDARD :			
Conductor	Size	AWG	32
	Material	----	Silver Cover Copper
	Conductors No.	----	7
	Conductors Size	mm	0.080
	O.D.	mm	0.240
Insulation	Average Thickness	mm	0.22
	Diameter	mm	0.68 ± 0.02
	Material	----	FEP
	Color	----	Clear
Braid	Material	----	Tinned Copper
	Construction	mm	16 / 4 / 0.050
	Coverage	%	90
Jacket	Average Thickness	mm	0.13
	Diameter	mm	1.13 ± 0.05
	Material	----	FEP
	Color	----	According to custom
Marking	Non		
Drawing			

Electrical & Physical Properties						
Item			32AWG			
Rating Temp Voltage			105℃ 30V			
Conductor Resistance			545 OHM/KM/20℃ MAX.			
Insulation Resistance			1000 MEGA OHM/KM MIN.			
Dielectric Strength			AC 500 V/Minute			
Spark Test			2.5 KV			
Insulation	Unaged	Tensile Strength	2500 PSI MIN.(1.76 Kg / mm²)			
		Elongation	200% MIN.			
	Aged	Tensile Strength	UNAGED MIN. 75%(168HRS×232℃)			
		Elongation	UNAGED MIN. 75%(168HRS×232℃)			
Jacket	Unaged	Tensile Strength	2500 PSI MIN.(1.76 Kg / mm²)			
		Elongation	200% MIN.			
	Aged	Tensile Strength	UNAGED MIN.75%(168HRS×232℃)			
		Elongation	UNAGED MIN.75%(168HRS×232℃)			
Nom. Impedance			50 ± 3 Ohms			
Nom. Capacitance			96 ± 3 pF/m			
Nom. Vel. of Prop.			69%			
VSWR Test (0 – 6 GHZ)			Less 1.3			
Flame Test			VW-1 OK			
Attenuation (dB/1m)	2.0GHZ		2.4GHZ	2.5GHZ	5.0GHZ	6.0 GHZ
	2.80		3.10	3.15	4.85	5.20

** Appendix 1 **

Software support format, actual use depends on the antenna, mechanism and card production quality.

Supporting Cards Type description:

ISO 15693(R/W):
1. TI HF-I Plus
2. TI HF-I Pro
3. NXP I-Code SLI

ISO 14443-A(R/W):
1. NXP Mifare_One(S50_4Byte)
2. NXP Mifare_One(S50_7Byte)
3. NXP Mifare_One(S70_4Byte)
4. NXP Mifare_UltraLight
5. NXP Mifare_UltraLight C
6. NXPMifare Plus S _2K/4K
7. NXPMifare Plus X _2K/4K
8. NXPNTAG213

ISO 18092(R/W):
1. SONY Felica Lite S
2. SONY Felica Lite

ISO 14443-A(Only Read UID) :
1. NXP Mifare DESFire_EV1 4K

ISO 14443-B(Only Read UID) :
1. STSRIX 4K

Date	Revise contents
2019/10/1	First edition