UM1705
User manual

Discovery kit for the M24SR series Dynamic NFC/RFID tag Premium and Standard Editions

Introduction

The M24SR-DISCOVERY is a demonstration kit to evaluate the features and capabilities of the M24SR series and is based on the M24SR64 device. Two versions of this kit are available: the Standard Edition and the Premium Edition.
The Premium Edition includes all of the Standard edition features, plus a headset and a Bluetooth module to demonstrate the convenience to pair it with a smartphone via NFC.
The M24SR64 device is a dynamic NFC/RFID tag IC with a dual interface. It embeds a 64 Kbits EEPROM memory. It can be operated from an I2C interface or by a 13.56 MHz RFID reader or an NFC phone.
The I2C interface uses a two-wire serial interface, consisting of a bidirectional data line and a clock line. It behaves as a slave with respect to the I2C protocol.
The RF protocol is compatible with ISO/IEC 14443 Type A and NFC Forum Type 4 Tag.
The board is powered through the USB bus. It also includes a microcontroller STM32F103 to drive the EEPROM via I2C and the LCD screen via SPI bus.
The M24SR-DISCOVERY (MB1138) schematics, BOM, gerber files, drivers and firmware can be downloaded from *www.st.com*.

Figure 1. M24SR-Discovery Board

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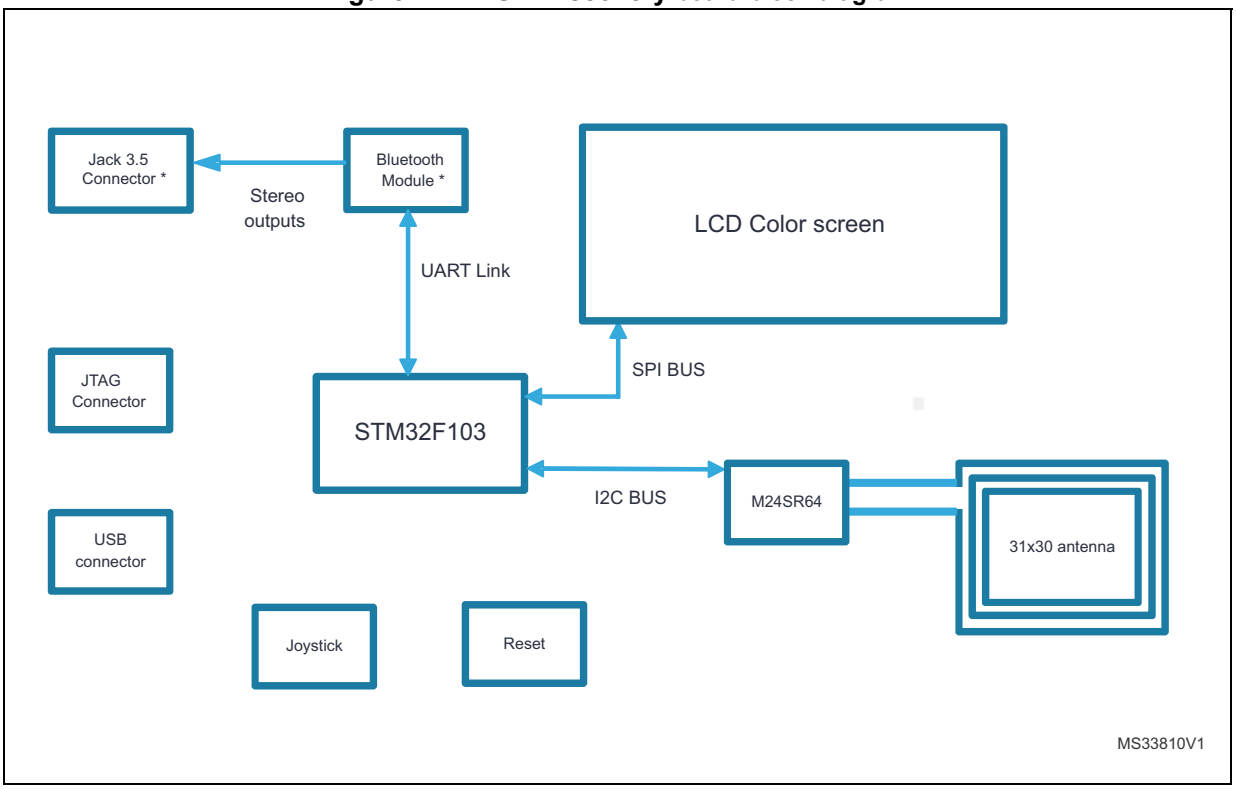
1 Description

Standard and premium editions of M24SRXX-Y family's discovery kit (M24SR-DISCOVERY) are discovery kits meant to evaluate the features and capabilities of the M24SRxx-Y products.
They come with application notes, I2C drivers for M24SR, BOM board schematics, gerber files, firmware schematics which help reduce design effort and can be downloaded at *www.st.com*.
The features of Standard Edition are the M24SR64 IC (64-Kbit), a 30x31mm NFC antenna, a 2.4"QVGA LCD display, a Micro USB connector, the STM32F103 MCU, a JTAG connector for possible firmware upgrades, a Joystick and a reset button.
The board is powered through the USB bus. It also includes a microcontroller STM32F103 to drive the EEPROM via I2C and the LCD screen via SPI bus.
The Premium Edition includes all of the features of the standard edition plus a headset and a Bluetooth module which demonstrates the ease of pairing a smartphone to the kit over NFC. The Bluetooth module is driven by the STM32F103 microcontroller via UART link.
The *Figure 2* shows the M24SR-Discovery board block diagram.

Figure 2. M24SR-Discovery board block diagram



**Available only on premium edition.*

2 Features

Ready-to-use printed circuit board (PCB) including

- M24SR64-Y Dynamic NFC/RFID tag.
- 31 mm x 30 mm 13.56 MHz double layer inductive antenna etched on the PCB (ANT14)
- STM32F103RGT6 64LQFP 32-bit microcontroller, with 1Mbytes of Flash memory
- LCD Color Screen (320*200 pixels)
- Different color LEDs
- USB micro-B connector for board powering
- JTAG connector for microcontroller firmware upgrade and debug
- Joystick for menu selection
- Bluetooth module with audio outputs connected to Jack 3.5(a)
- Headset(a)

Table 1. Device Summary

Reference	Order Code
M24SR-DISCOVERY	M24SR-DISCO-STD M24SR-DISCO-PREM

a. Available with the Premium edition only: M24SRDISCO-PREM

3 Hardware and layout description

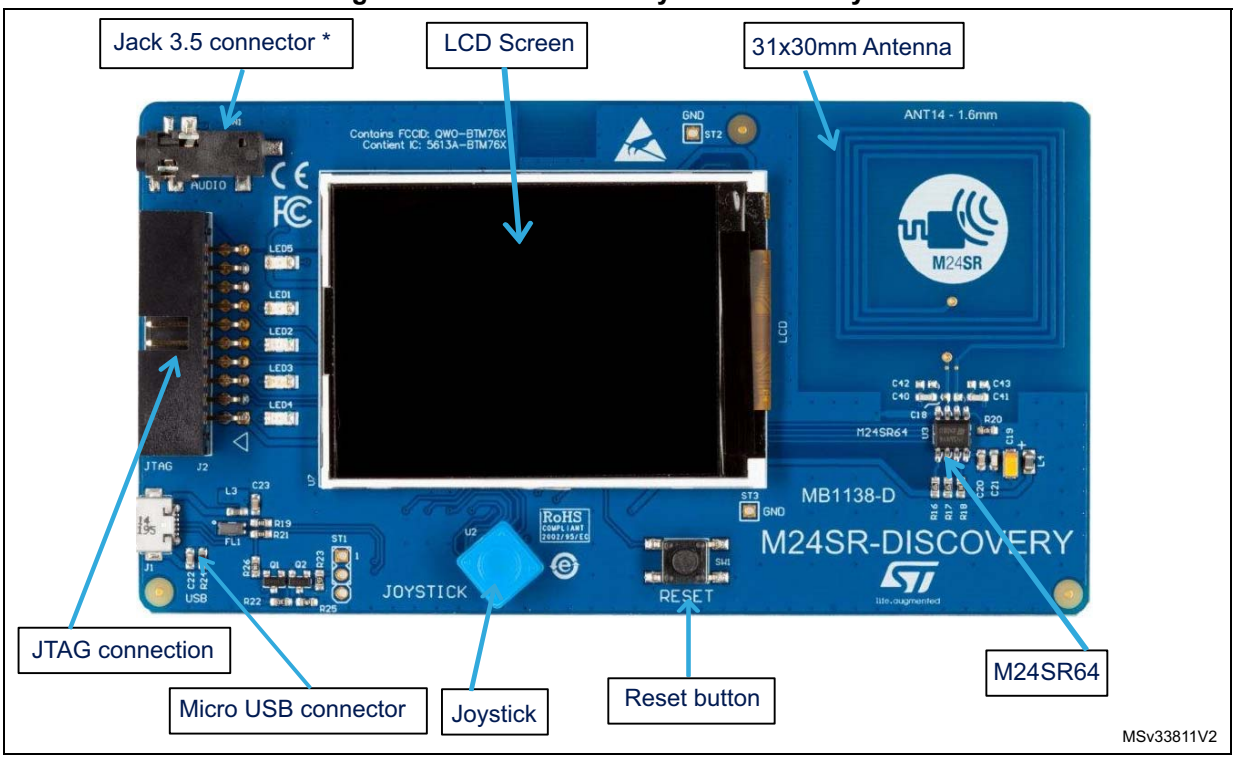
The M24SR-DISCO board contains the M24SR64-Y chip. It is a dynamic NFC/RFID tag IC. It features a 64 Kbits of EEPROM memory, preformatted for NFC transactions, and which can be protected by a unique and flexible 128-bit password scheme. The memory bank can be accessed by any of its to interfaces, either from an I2C interface or by a 13.56 MHz passive NFC interface. The I2C interface uses a two-wire serial interface, consisting of a bidirectional data line and a clock line. It behaves as a slave in the I2C protocol. The NFC interface is based on the ISO/IEC 14443 Type A and NFC Forum Type 4 Tag specifications. Because it is a passive RF interface, it operates when the board is powered but also when the board is unpowered. Two control pins are also available from the M24SR64-Y chip, allowing flexible management of the NFC interface.

3.1 M24SR-Discovery board description

The following figures show:

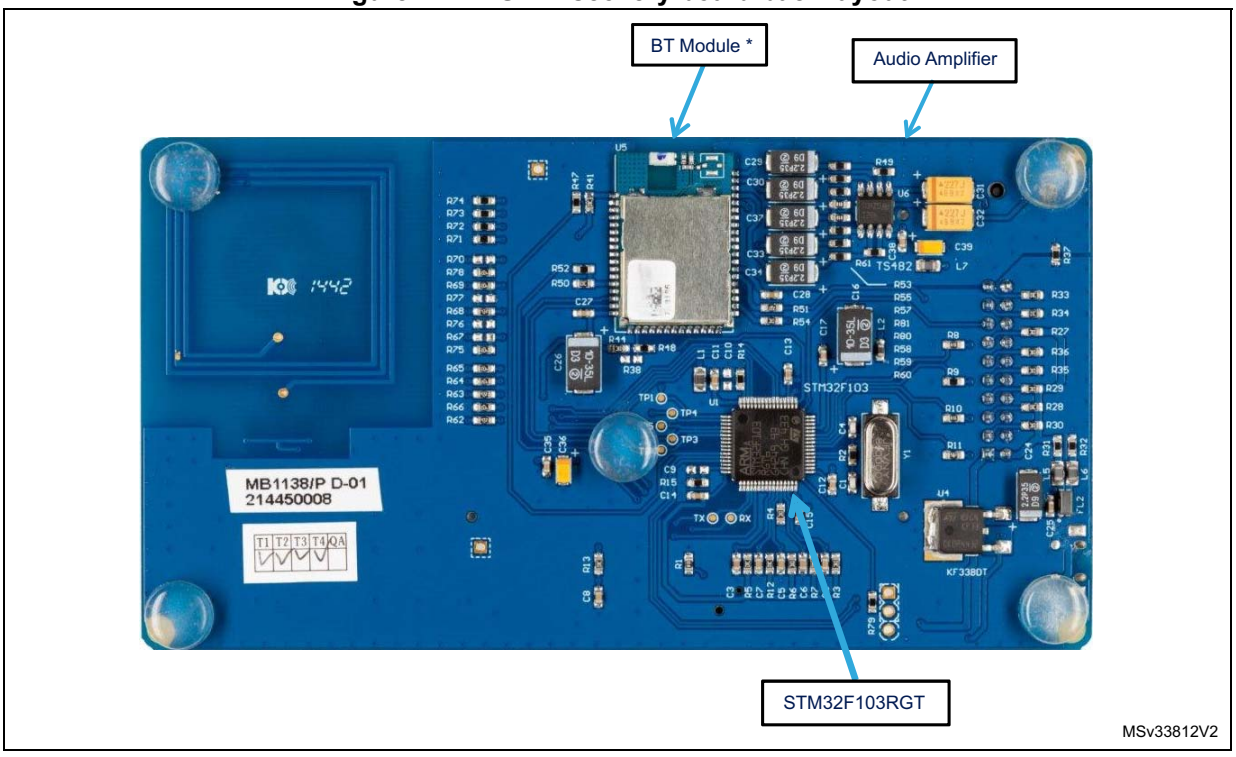
- M24SR-Discovery board front layout
- M24SR-Discovery board back layout

Figure 3. M24SR-Discovery board front layout



Available only on premium edition.

Figure 4. M24SR-Discovery board back layout



Available only on premium edition.

3.2 M24SR-Discovery board powering and startup

The M24SR-Discovery board is powered by the USB bus via a Type A / micro B USB cable connected to a PC.

When powered up, the microcontroller starts the firmware already downloaded in the Flash memory. This is a demonstration of the different capability of the M24SR64 (RF on/off, change Vcard message, etc). There is no modification or configuration to be done on the board to run the demo. Please refer to the firmware user manual available on ST web site *www.st.com* to get more detail.

3.3 Program and debug the M24SR-Discovery board

In order to flash or debug an STM32 microcontroller application on the M24SR-Discovery board, simply connect the 20-pin JTAG/SWD flat ribbon of the STLINK/V2 in-circuit debugger and programmer to the discovery kit board JTAG connector (J2).

Launch STLink Utility PC software. STM32F103RGT6 is part of the STM32F10x XL-density family.

(It can be downloaded from ST web site: *www.st.com*)

For more information or documentation on the STLINK/V2 in-circuit debugger and programmer, please visit *www.st.com*.

3.4 Hardware implementation

The *Figure 5*, *Figure 6* and *Figure 7* show the M24SR-Discovery Schematics (board reference MB1138).

The *Figure 8* shows the Premium Bill of Material (MB1138_B01_BOM_PREMIUM).

Figure 5. Discovery Kit M24SR (MCU & M24SR)

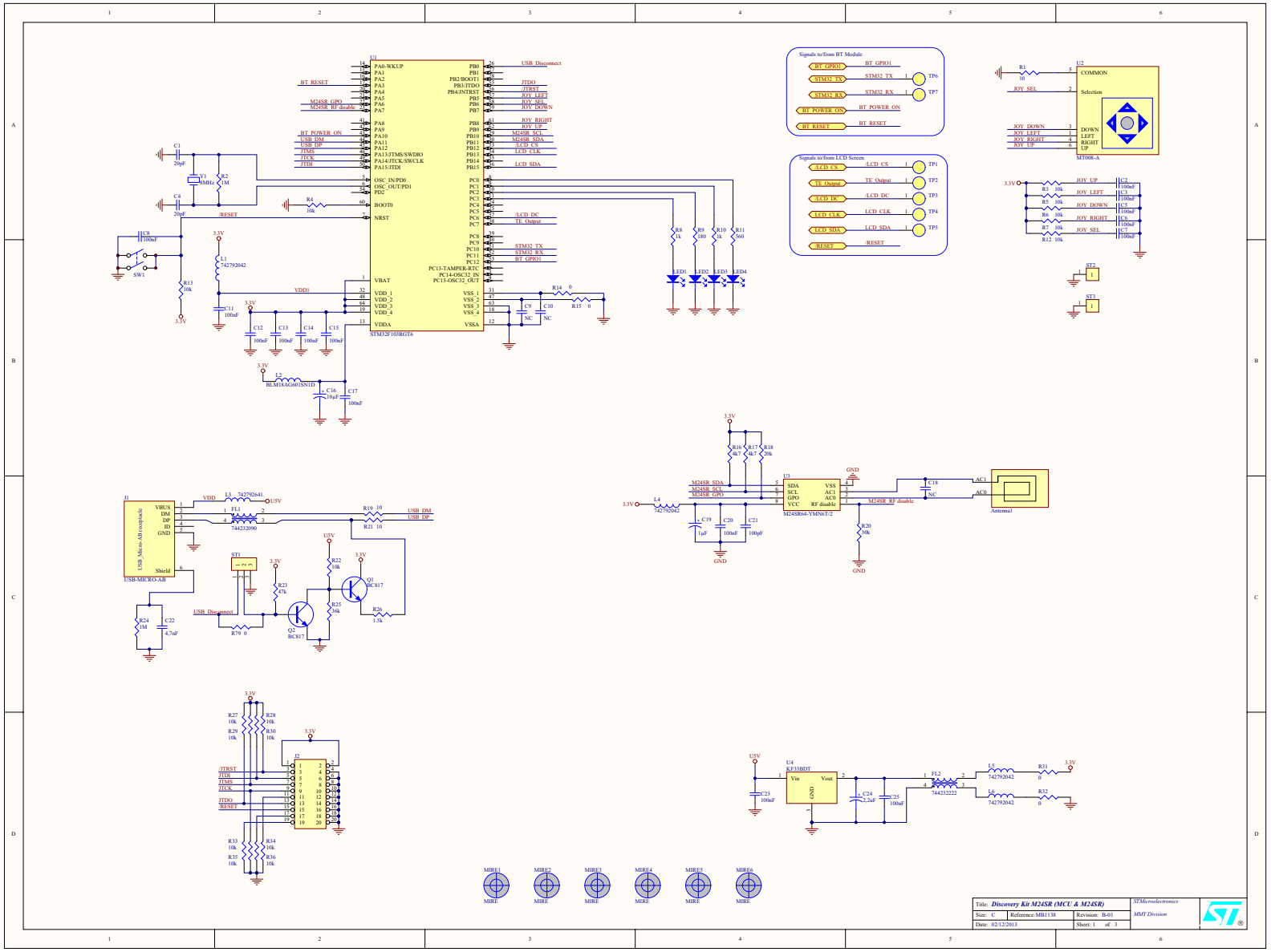


Figure 6. Discovery Kit M24SR(LCD Screen)

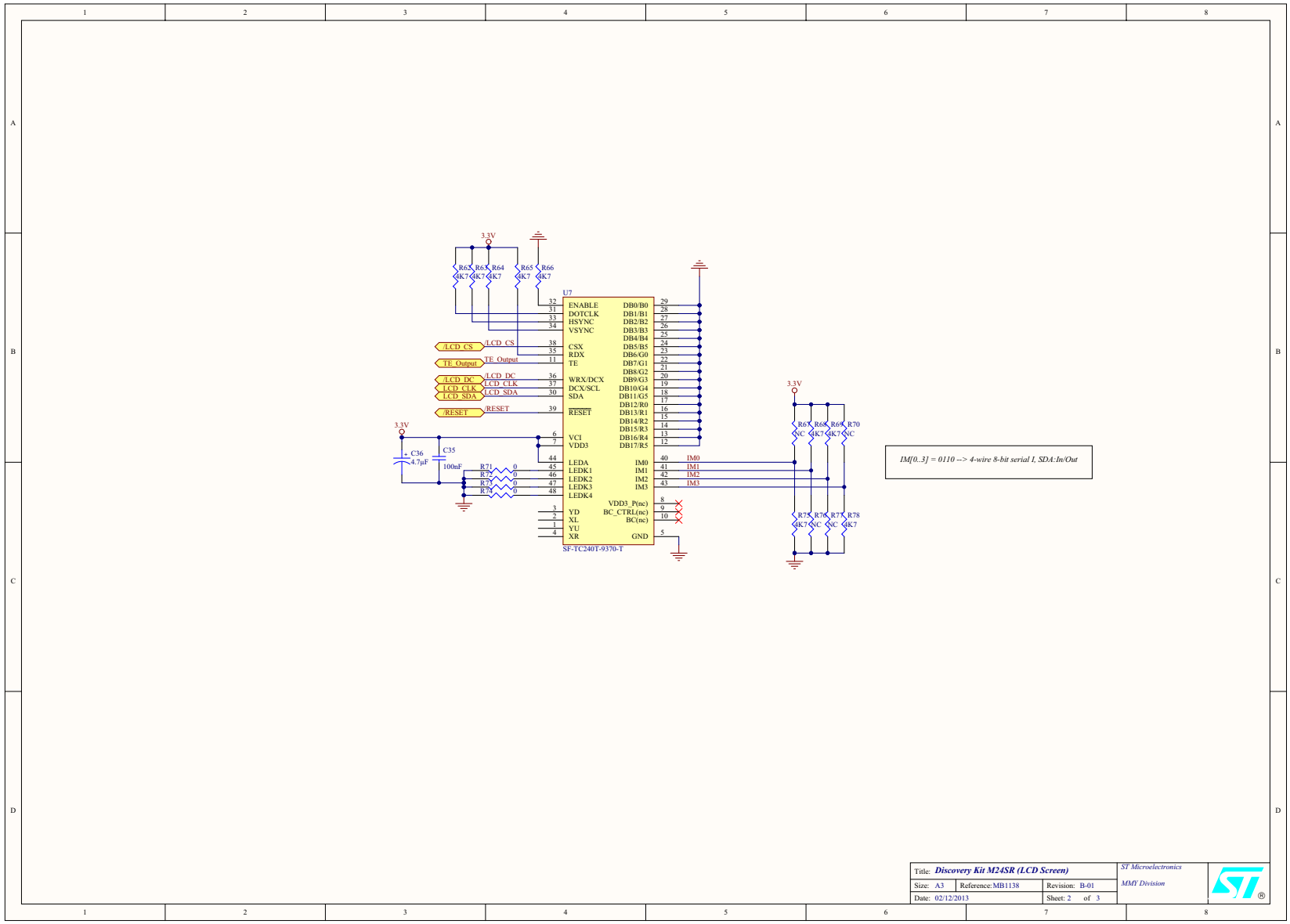


Figure 7. Discovery Kit M24SR (BT Module)

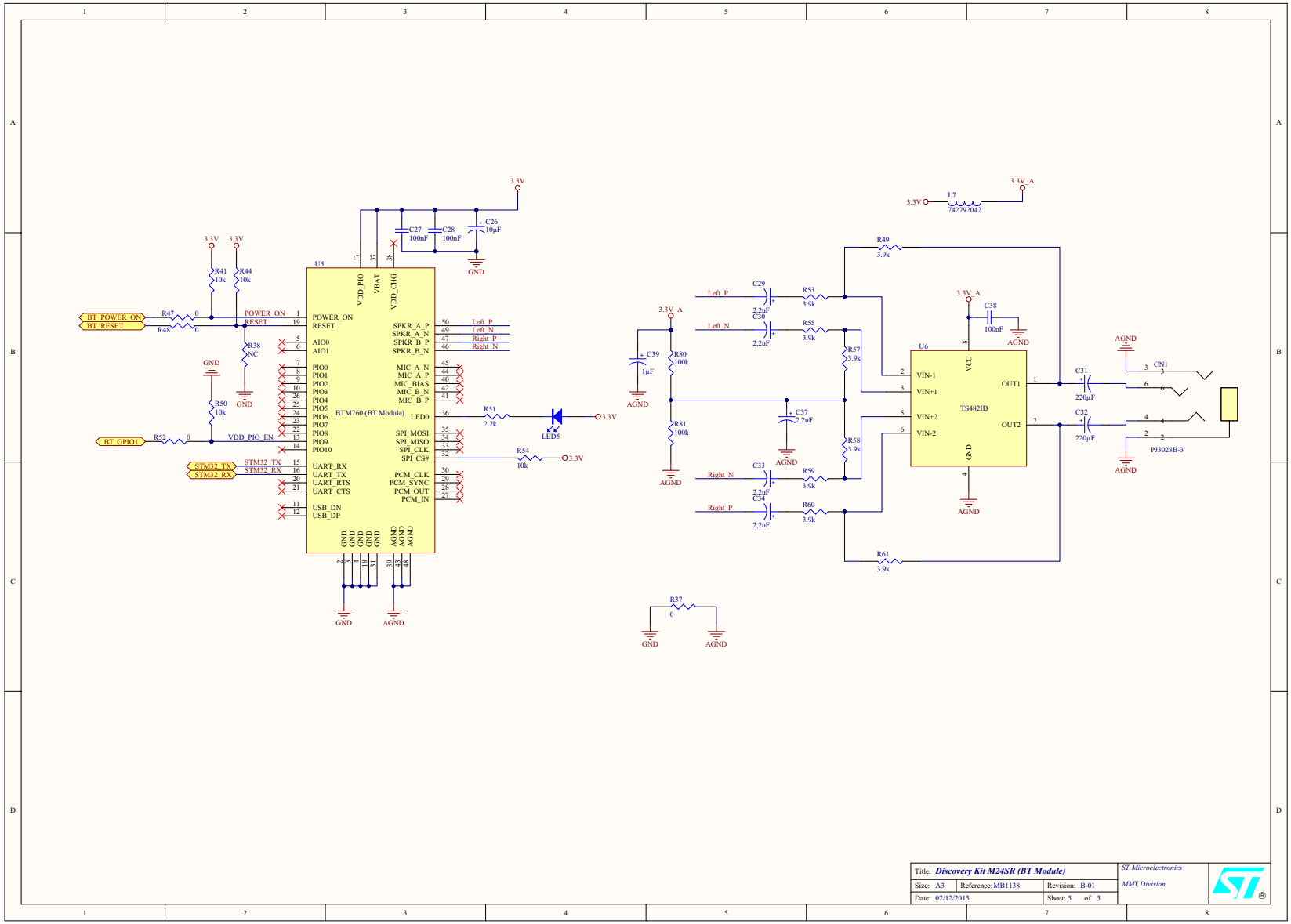


Figure 8. BOM (Bill Of Material)

Quantity	Description	Reference	Version	Package	Manufacturer 1	Part#1	Manufacturer 2	Part#2	Distributor	Order code	Fitted or not fitted	Supplied by	ROHS Compliant	Comments
1	MCU 32 BITS 1MB FLASH 64LQFP STM32F103RGT6	U1		LQFP64_10x10	STMicroelectronics	STM32F103RGT6						ST		
1	Joystick 4 directions 1 select Wealth Metal Factory MT008-A	U2		JOYSTICK_MT-008A	Wealth Metal Factory	MT008-A								
1	I2C/NFC EEPROM M24SR64-YMN6T/2	U3		M24SR64-YMN6T/2	STMicroelectronics	M24SR64-YMN6T/2						ST		
1	3.3V Voltage regulator KF33BDT	U4		DPAK	STMicroelectronics	KF33BDT						ST		
1	BlueTooth Module BTM760	U5		BTM760	Rayson Technology	BTM760								
1	Audio Amplifier TS482IDT	U6		SO8N	STMicroelectronics	TS482IDT						ST		
1	LCD Screen SF-TC240T-9370A-T	U7		SF-TC240T-48P-07	Saef Technology	SF-TC240T-9370A-T								
1	CONDENSATEUR MLCC 0603 NP0 50V 1% NC	C18		0603							N			no double source allowed
2	CONDENSATEUR MLCC 0603 NP0 50V 5% NC	C9, C10		0603							N			
2	CONDENSATEUR MLCC 0603 NP0 50V 5% 20pF	C1, C4		0603					Farnell	1844172				
1	CONDENSATEUR MLCC 0603 NP0 50V 5% 100pF	C21		0603					Farnell	499122				
1	CONDENSATEUR MLCC 0603 NP0 50V 5% 4,7nF	C22		0603					Farnell	1833869				
19	CONDENSATEUR MLCC 0603 NP0 50V 5% 100nF	C2, C3, C5, C6, C7, C8, C11, C12, C13, C14, C15, C17, C20, C23, C25, C27, C28, C35, C38		0603					Farnell	1740621				
2	293D TANTAL SMD POL CAP 1uF 16V 10% Boitier A 1µF	C19, C39		293D-A					Farnell	1754174				
6	293D TANTAL SMD POL CAP 2,2uF 35V 10% Boitier C 2,2uF	C24, C29, C30, C33, C34, C37		293D-C					Farnell	1754228				
1	293D TANTAL SMD POL CAP 4,7uF 16V 10% Boitier A 4,7µF	C36		293D-A					Farnell	1754174				
2	293D TANTAL SMD POL CAP 10uF 35V 10% boitier D 10µF	C16, C26		293D-D					Farnell	2112949				
2	293D TANTAL SMD POL CAP 220uF 6.3V 10% Boitier C 220µF	C31, C32		293D-C					Farnell	2353060				
13	Resistance CMS 0603 0,1W 5% 0	R14, R15, R31, R32, R37, R47, R48, R52, R71, R72, R73, R74, R79		0603										
3	Resistance CMS 0603 0,1W 5% 10	R1, R19, R21		0603										
1	Resistance CMS 0603 0,1W 5% 180	R9		0603										
1	Resistance CMS 0603 0,1W 5% 560	R11		0603										
2	Resistance CMS 0603 0,1W 5% 1k	R8, R10		0603										
1	Resistance CMS 0603 0,1W 5% 1.5k	R26		0603										
1	Resistance CMS 0603 0,1W 5% 2.2k	R51		0603										
8	Resistance CMS 0603 0,1W 5% 3.9k	R49, R53, R55, R57, R58, R59, R60, R61		0603										
11	Resistance CMS 0603 0,1W 5% 4K7	R16, R17,R62, R63, R64, R65, R66, R68, R69, R75, R78		0603										
20	Resistance CMS 0603 0,1W 5% 10k	R3, R4, R5, R6, R7, R12, R13, R22, R27, R28, R29, R30, R33, R34, R35, R36, R41, R44, R50, R54		0603										
1	Resistance CMS 0603 0,1W 5% 20k	R18		0603										
1	Resistance CMS 0603 0,1W 5% 30k	R20		0603										
1	Resistance CMS 0603 0,1W 5% 36k	R25		0603										
1	Resistance CMS 0603 0,1W 5% 47k	R23		0603										
2	Resistance CMS 0603 0,1W 5% 100k	R80, R81		0603										
2	Resistance CMS 0603 0,1W 5% 1M	R2, R24		0603										
5	Resistance CMS 0603 0,1W 5% NC	R38, R67, R70, R76, R77		0603							N			
1	FERRITE BEAD, 0.38OHM, 500MA, 0603 BLM18AG601SN1D	L2		0603	MURATA	BLM18AG601SN1D			Farnell	1515679				no double source allowed
1	FERRITE CMS 300OHM. 0603 742792641	L3		0603	WURTH ELEKTRONIK	742792641			Farnell	1635705				no double source allowed
5	FERRITE CMS 600OHM. 0805 742792042	L1, L4, L5, L6, L7		0805	WURTH ELEKTRONIK	742792042			Farnell	1635716				no double source allowed
1	NOISE SUPPRESSOR CMS 2.2KOHM. 0.4A 744232222	FL2		74423zxxx	WURTH ELEKTRONIK	744232222			Farnell	1636481				no double source allowed
1	NOISE SUPPRESSOR CMS 90OHM. 370MA 744232090	FL1		74423zxxx	WURTH ELEKTRONIK	744232090			Farnell	1636474				no double source allowed
2	BC817-16 - TRANSISTOR NPN 0.5A 45V SOT23 BC817	Q1, Q2		SOT23	MULTICOMP	BC817-16			Farnell	1798077				
1	LED, 1206, BLUE Blue Led	LED3		LED-1206	DIALIGHT	5988291107F			Farnell	2113953				
1	LED, 1206, GREEN Green Led	LED2		LED-1206	DIALIGHT	5988270107F			Farnell	1466000				
2	LED, 1206, RED Red Led	LED1, LED5		LED-1206	DIALIGHT	5988210107F			Farnell	1465997				
1	LED, 1206, YELLOW Yellow Led	LED4		LED-1206	DIALIGHT	5988240107F			Farnell	1465998				
1	SMD CRYSTAL OSCILLATOR,8M,20PF,20ppm 8MHz	Y1		HC49SD	FOX ELECTRONICS	FOXSDLF/080-20			Farnell	2063972				
2	Connector 1PT	ST2, ST3		CON_1PTS	FCI	77311-401-36LF			Farnell	1097954	N			
1	Connector 3PTS	ST1		CON_3PTS_P2.54	FCI	77311-401-36LF			Farnell	1097954	N			
1	HEADER, RIGHT ANGLE, 20WAY	J2		HE10_20PTS_M_COUDE	MULTICOMP	MC9A22-2034			Farnell	1099248				
1	Micro USB Type AB Connector	J1		USB-MICRO-AB	MOLEX	47590-0001								
1	Push Button SW_BP_ST	SW1		FSM4JSMA	ALCOSWITCH	FSM4JSMA	Qiaodi	TC-03XG-6.0	Farnell	3801305				
1	Jack 3.5 PJ3028B-3	CN1		PJ-3028B	Qiaod	PJ3028B-3								
1	PCB 130mm x 60mm x1.6mm (dual side, components on both sides, Blue Color)													
5	Bumpon protective product				HAMMOND	1421TSCL			Farnell	1876520				must be higher than SMD Crystal Y1
1	Blue Joystick button hat for U2													
1	Test production													
1	Headset													
1	Blister (Premium Edition)													
1	Insert Card (Premium Edition)													
1	Final assembly (board+insert Card+Headset+Blister)													

4 Federal Communications Commission (FCC) and Industry Canada (IC) Compliance Statements

4.1 FCC Compliance Statement

4.1.1 Part 2.1077

STMicroelectronics Part No. M24SR-Discovery

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.

For purposes of FCC Rule 2.909, the Responsible Party is STMicroelectronics Inc., located at 750 Canyon Drive, Suite 300, Coppell, TX 75019, USA, with telephone number (972) 466-6000.

4.1.2 Part 15.105

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's by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the 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.

4.1.3 Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user’s authority to operate this equipment.

4.2 IC Compliance Statement

4.2.1 Compliance Statement

This device complies with Industry Canada licence-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.

4.2.2 Déclaration de conformité

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

5 Revision history

Table 2. Document revision history

Date	Revision	Changes
04-Feb-2014	1	Initial Release
07-May-2015	2	Added *Section 4: Federal Communications Commission (FCC) and Industry Canada (IC) Compliance Statements* Updated *Figure 2: M24SR-Discovery board block diagram*, *Figure 3: M24SR-Discovery board front layout* and *Figure 4: M24SR-Discovery board back layout*