HY-40R201 Bluetooth BLE 5.0 Module Specifications

(40 pin)

12 Jun. 2019

Version：V2.3

Version History

Version	Revision Date	Reviser	Reviewer	Revised Contents
V1.0	2019/01/07	GKL	LYC	1st issue
V2.0	17/10/2017	WF/ZLL	LYC	1. Added English address map. 2. Added ceramic antenna model and changed Model No. 3. Added application note 4. Added FCC ID No. 5. Changed document format.
V2.1	25/10/2017	WF	LYC	1.Added RF Regurations pre-certified description; And Canada IC No.
V2.2	11/11/2017	WF	LYC	1.Correct: 5. Pinout and GPIO function Description UART RX/TX GIO Port pin.
V2.3	2019/06/12	FJ	LYC	Added frequency drift specification & RF TX / RX test point characteristics & 4-1a:Soldering iron front end to ground impedance , and leakage voltage and Static voltage shall be within 0±100V.& Changed Storage Temperature :+125℃

CONTENTS

1. Description

HY-40R201 Bluetooth low energy single mode module is a single mode device targeted for low power sensors and accessories.

HY-40R201 offers all Bluetooth low energy features: radio, stack, profiles and application space for customer applications. The module also provides flexible hardware interfaces to connect sensors.

HY-40R201 can be powered directly with a standard 3V coin cell batteries or pair of AAA batteries. in lowest power shutdown mode it consumes only 0.15uA and will wake up in few microseconds.

HY-40R201 transmission distance of 100 meter or more. (At face to face, free space, 1.2 Meter high from Ground for testing).

Bluetooth IC：TTC2640R2 6*6*0.9mm 48pin IC,Used TI CC2640R2 die chip

1-1.APPLICATIONS:

Heart rate sensors

Pedometers

Watches

Blood pressure and glucose meters

Weight scales

Key fobs

Households sensors and collector devices

Security tags

Wireless keys (keyless go)

Proximity sensors

HID keyboards and mice

Indoor GPS broadcasting devices

1-2.KEY FEATURES:

- Bluetooth v.5.0 single mode compliant
- Supports master,slaveand master/slave modes
- Integrated Bluetooth low energy stack
- GAP, GATT, L2CAP, SMP Bluetooth low energy profiles
- Pre-certified RF regurations for BQB BLE 5.0, CE ETSI RED, FCC, IC(Canada), (FCC and IC certified only for HY-40R201PC PCB antenna with shield case model);
  Another can Compliance for worldwide RF Regulations.
- Ultra low current consumption :Shutdown. No clocks running, no retention: 150 nA(Typical)
- Programmable ARM Cortex-M3 processor for embedding full applications

2. Product model Number:　Hardware Model Description

2-1. (4 kinds Antenna type for choice) ,(Option: with shield case or no shield case)

	Product Mode Item	PCB NO.	Description
1	WMD40R201SR6P0	HY-40R201P	PCB Helix Antenna
2	WMD40R201SR6I0	HY-40R201I	IPEX Connector for External Antenna
3	WMD40R201SR6W0	HY-40R201W	Metal Wire Antenna(λ/4 Half wave dipole)
4	WMD40R201SR6C0	HY-40R201C	Ceramic Antenna
6	WMD40R201SR6PC	HY-40R201PC	PCB Helix Antenna with shield case
5	WMD40R201SR6IC	HY-40R201IC	IPEX Connector for External Antenna with shield case
7	WMD40R201SR6WC	HY-40R201WC	Metal Wire Antenna with shield case
8	WMD40R201SR6CC	HY-40R201CC	CeramicAntenna with shield case

2-2: FCC ID &(IC ID/ wait defind) Print Format on the Shield Case :(HY-40R201PC model only)

Model:HY-40R201PC
FCC ID:2ADXE-HY-40R201PC
IC :　23267-HY40R201PC

18.4mm

13.0mm

Shield Case Size:
13.0*18.4*1.5mm

Shield Case Size:
13.0*18.4*1.5mm

Word Type: Calibri

Direction: Horizon

3. PCBA dimension size and picture

3-1: HY-40R201P / WMD40R201SR6P0(PCB IFAAntenna)

&HY-40R201PC / WMD40R201SR6PC (PCB IFA Antenna, with shield case);

　(PCBA dimension size : (25.16*15.22*2.0/2.6 mm).

3-2:HY-40R201I / WMD40R201SR6I0(IPEX RF connector terminal)

&HY-40R201IC / WMD40R201SR6IC (IPEX RF connector with shield case)

(PCBA dimension size : 25.16*15.22*2.0/2.6 mm).
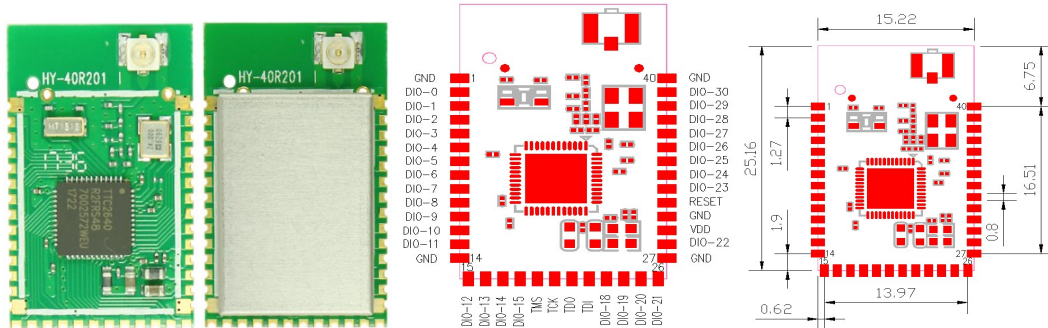
3-3: HY-40R201W / WMD40R201SR6W0(Metal WireAntenna)(1/4λ half wave dipole)_

&HY-40R201WC / WMD40R201SR6WC (Metal Wire Antenna, with shield case)；
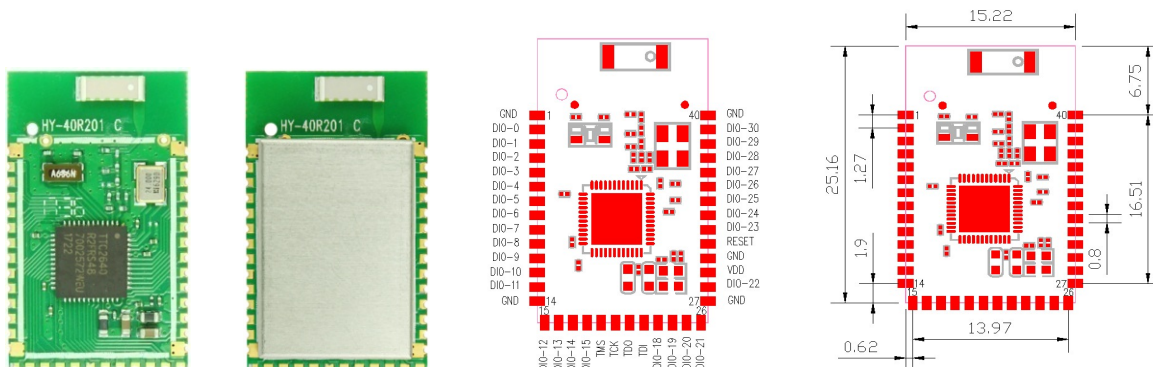
(PCBA dimension size : 23.2*15.22*2.0/2.6 mm).
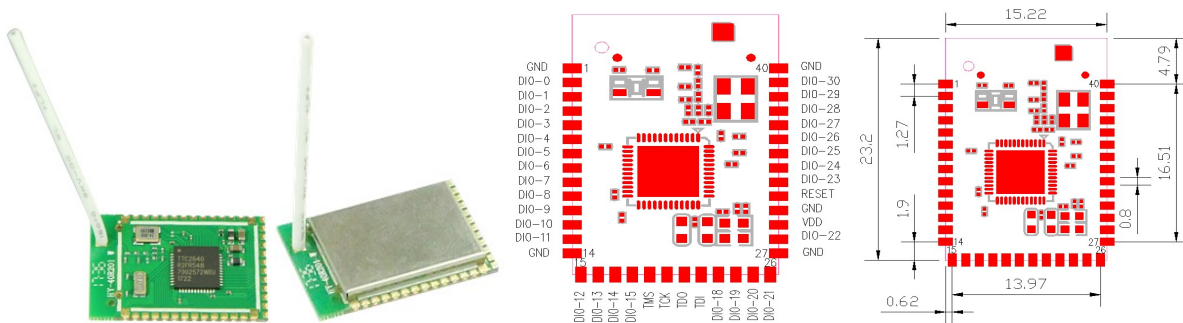
3-4: HY-40R201C / WMD40R201SR6C0(CeramicAntenna)

&HY-40R201CC / WMD40R201SR6CC (Ceramic Antenna, with shield case)；

(PCBA dimension size : 25.16 * 15.22 * 2.0/2.6 mm).

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4.Application Note:

4-1. Attention to the electrostatic protection, prevent the soldering iron and the equipment grounding bad; And the workbench, working environment, packaging materials and from the human body Touch with static electricity, etc., destroy IC and software to be flied; Manual welding module solder iron temperature, should pay attention to avoid the PCB copper stripping off;Soldering iron strictly Grounding requirements, eliminating solder iron leak voltage and avoid supply power Vcc switch instant turn on/ turn off state ,generate high voltage,May be let the module to damaged;

4-1a. Soldering iron front end to ground resistance under the 10 Ω,, and leakage voltage < 0.1 V; The environment and Personnel static voltage shall be within 0±100V. Anti-static labeling shall be show in the operation area.

4-2.Attention to avoid the overall motherboard power supply circuit of bad welding connected to short circuit or open circuit, causing the Bluetooth chip, abnormal voltage,Thesoftwarewill fly and problems of IC was damaged.

4-3.When programming firm ware , the VDDS supply voltage must in DC 2.4~3.3V, To avoid programming has not completely, and abnormal status occur.

4-4. Avoid supply voltage in (BOD Brown - Out Dectect) fall within the scope of electrical detection threshold (1.76 V ~ 1.78 V) occurred many times, (diagram below off electric Lock - up area) firmware may be locked.

Cause the Boot Code startup Code suspended, unable to connect to the JTAG protocol,;In case of this state is available use Reset pin action under 1.0 V, to remove this phenomenon; The rechargeable batteries at charge-discharg status; In the application at the same time, to ensure the voltage setting of the protection system; And pay attention to the supply of power caused by the internal resistance and line impedance voltage drop; And make sure that

The equipment operating voltage from 2.0 V to 3.6 V, and ensure that the voltage slope faster than 0.5 V/ms (through BOD threshold).
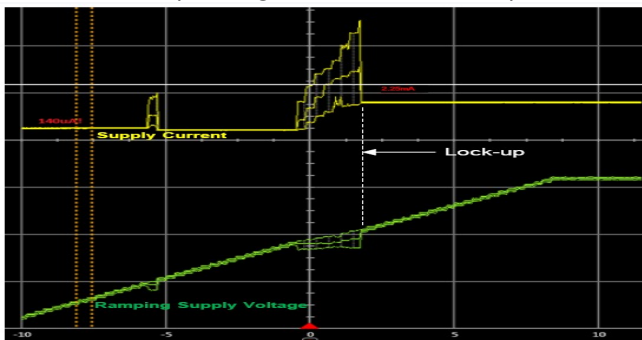
4-5. Use the module in the production and the transport process, please insure module's component protection, prevent the precision parts on the moduleDamaged (welding furnace exit and assembly, testing, delivery process, suggest using collision buffer material, not collide with each other)

4-6. The module is humidity sensitive components (MSD level 3), if used in SMT reflow soldering operations, please strictly follow the IPC/JEDECJ - STD – 020 regulation, completes the drying dehumidifying , and for this module has second processing work after placed in the functional test environment, the humidity of the chip is no guarantee that in a certain ratio, the honored guest please understand;(The attention note show in below Fig.)

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4-7. The diagram (show in below Fig.) of the module application on external filter parts, whenneed, please design in the mainboard, the parts parameter can depend on the actual need to changes. And pay attention to the increase and decrease ramping of supply voltage fast than 0.5v/ms;
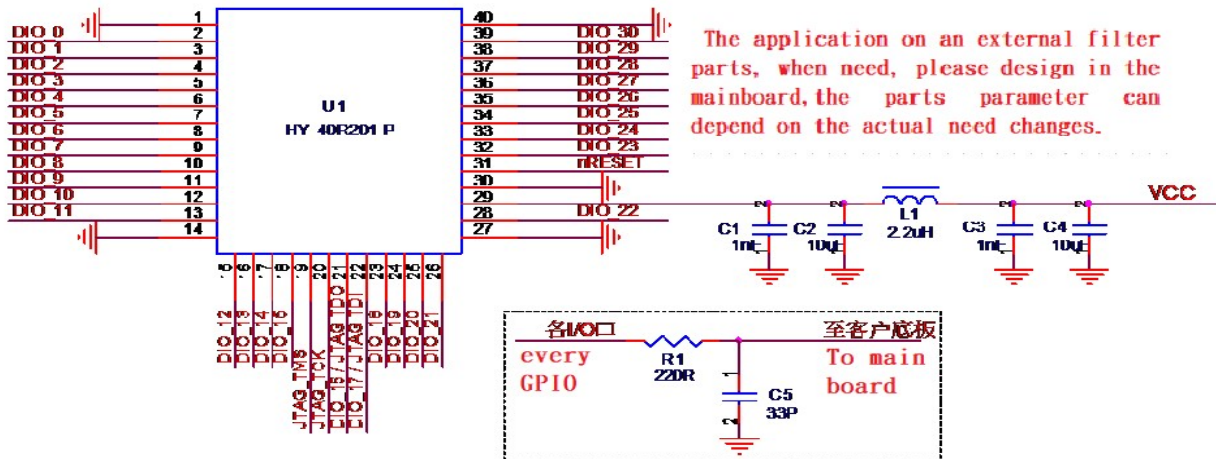
4-8.Assembly recommendation 1:Underneath the module antenna and RF circuit on themain board PCB copper need to clearance, and place close to the main board edge, as show in below Fig. The antenna can't be near around metal parts and prevent material existence of electromagnetic radiation , Can affect the manipulation of the distance.

4-9. Assembly recommendation (2): Signal trace and power supply trace, don't cross layout, as show in below Fig.To avoid crosstalk, affect the receiving sensitivity.Assembly recommendation 1:Underneath the module antenna and RF circuit on themain board PCB copper need to clearance, and place close to the main board edge, as show in below Fig.

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5. Pinout and GPIO function Description

Pin	Name	Type	Function Description
1	GND	Power GND	Ground
2	DIO_0	Digital I/O	GPIO, Sensor Controller (I:4mA max)
3	DIO_1	Digital I/O	GPIO, Sensor Controller (I:4mA max)
4	DIO_2	Digital I/O	UART RX; GPIO, Sensor Controller (I:4mA max)
5	DIO_3	Digital I/O	UART TX; GPIO, Sensor Controller (I:4mA max)
6	DIO_4	Digital I/O	WAKE UP; Don't floating GPIO, Sensor Controller (I:4mA max)
7	DIO_5	Digital I/O	GPIO, Sensor Controller, high-drive capability (8mA max).
8	DIO_6	Digital I/O	GPIO, Sensor Controller, high-drive capability (8mA max).
9	DIO_7	Digital I/O	GPIO, Sensor Controller, high-drive capability (8mA max).
10	DIO_8	Digital I/O	GPIO (I: 4mA max)
11	DIO_9	Digital I/O	GPIO (I: 4mA max)
12	DIO_10	Digital I/O	GPIO (I: 4mA max)
13	DIO_11	Digital I/O	GPIO (I: 4mA max)
14	GND	Power GND	Ground
15	DIO_12	Digital I/O	GPIO (I: 4mA max)
16	DIO_13	Digital I/O	GPIO (I: 4mA max)
17	DIO_14	Digital I/O	GPIO (I: 4mA max)
18	DIO_15	Digital I/O	GPIO (I: 4mA max)
19	JTAG TMSC	Digital I/O	JTAG TMSC; high-drive capability
20	JTAG TCKC	Digital I/O	JTAG TCKC
21	DIO_16 TDO	Digital I/O	GPIO,JTAG_TDO; high-drive capability(8mA max).
22	DIO_17 TDI	Digital I/O	GPIO,JTAG_TDI; high-drive capability(8mA max).
23	DIO_18	Digital I/O	GPIO (I: 4mA max)
24	DIO_19	Digital I/O	GPIO (I: 4mA max)
25	DIO_20	Digital I/O	GPIO (I: 4mA max)
26	DIO_21	Digital I/O	GPIO (I: 4mA max)
27	GND	Power GND	Ground
28	DIO_22	Digital I/O	GPIO (I: 4mA max)

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29	VDD	Power Supply	+2.0V to +3.6V (Recommended 2.7~3.3V)
30	GND	Power GND	Ground
31	RESET	Digital input	Reset, active-low. Module have pull up.
32	DIO_23	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
33	DIO_24	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
34	DIO_25	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
35	DIO_26	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
36	DIO_27	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
37	DIO_28	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
38	DIO_29	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
39	DIO_30	Digital I/O	GPIO, Sensor Controller, Analog(I: 4mA max)
40	GND	Power GND	Ground

6. Electrical Characteristics

(Test condition: With Ta = 25 ℃, VDD =3.0V with internal DC-DC converter, standardmeasure:1Mbps GFSKmodulation ,FRF = 2440MHz Bluetooth Low energy mode.)

6-1.Radio performance & current consumption

(Test condition:With Ta = 25 ℃, VDD =3.0V, with internal DC-DC converter, standardmeasure:1Mbps GFSKmodulation ,FRF = 2440MHz Bluetooth Low energy mode.)

- ➤ Modulation Mode: GFSK
- ➤ Frequency range: 2402~2480MHZ (2.4GHz ISM band)
- ➤ Transmit power setting Range: -21 ~ +5 dBm typical (IC differential mode point characteristics; programmable by software) .
- ➤ The antenna feed point transmit power : +2 dBm typ. (TX set Max.output characteristics)
- ➤ Receiver sensitivity: -97dBm typical(IC differential mode point characteristics)
- ➤ The antenna feed point receiver sensitivity : -93 dBm typical. (PER <30.8%)
- ➤ Frequency drift specification :RF ± 60ppm , MCU clock 32.768KHz ± 350ppm.(Use X-Tal)
- ➤ Pre-certified RF regurations for BQB BLE 4.2/5.0, CE ETSI RED, FCC, IC(Canada), (FCC and IC only for HY-40R201PC PCB antenna with shield case model); Another can Compliance for worldwide RF Regulations.
- ● Ultra low current consumption
  - ➤ Transmit : 6.1mA(typical) (O/P Power setting :0dBm)
  - ➤ Transmit : 9.1mA(typical) (O/P Power setting :5dBm)
  - ➤ Receive(high gain setting): 6.1 mA(typical)
  - ➤ Idle. Supply Systems and RAM powered:550uA(Typical)
  - ➤ Standby. With Cache, RTC, CPU, RAM and partial register retention. XOSC_LF: 3.0 uA(Typical)
  - ➤ Shutdown. No clocks running, no retention: 150 nA(Typical)

6-2. Absolute Maximum Ratings

Note: These are absolute maximum ratings beyond which the module can be permanently damaged, these are not Maximum operating conditions, the maximum recommended operating conditions are in the table 6.

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Rating	Min	Max	Unit
VDDS	-0.3	3.9	V
Other Terminal Voltages	VSS-0.3	VDDS+0.3	V
Storage Temperature	-40	+125	°C

6-3. ESD Ratings

			Value	Unit
V_{ESD}Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDECJS001	All pins	±2500	V
	Charged device model (CDM), per JESD22-C101	RF pins	±750	
		Non-RFpins	±750	

6-4. Recommended Operating Conditions

Supply voltage noise should be less than 10mVpp. Excessive noise at the supply voltage will reduce the RF performance.

Rating	Min	Max	Unit
VDD (when BlueTooth Active)	2.0	3.6	V
VDD(when flash programming)	2.4	3.3	V
Operating Temperature Range	-40	+85	°C

Note: (1).VDD power supply recommended voltage : 2.7~3.3V

(2).When programming firm ware , the VDD supply voltage must in DC 2.4~3.3V,

To avoid programming has not completely, or abnormal status occur..

(3).For smaller coin cell batteries, with high worst-case end-of-life equivalent source resistance, a 22-µF VDDS input capacitor must be used to ensure compliance with this slew rate(6-6 timing req.).

6-5.GPIODC Characteristics

Parameter	Test Condition	Typical	Unit
GPIO VOH at 8-mA load	IOCURR = 2, high-drive GPIOs only	2.68	V
GPIO VOL at 8-mA load	IOCURR = 2, high-drive GPIOs only	0.33	V
GPIO VOH at 4-mA load	IOCURR = 1	2.72	V
GPIO VOL at 4-mA load	IOCURR = 1	0.28	V

6-6. Timing Requirements

RESET_N low duration		1			uS

(1) For smaller coin cell batteries, with high worst-case end-of-life equivalent source resistance, a 22-µF VDDS input capacitor must be used to ensure compliance with this slew rate.
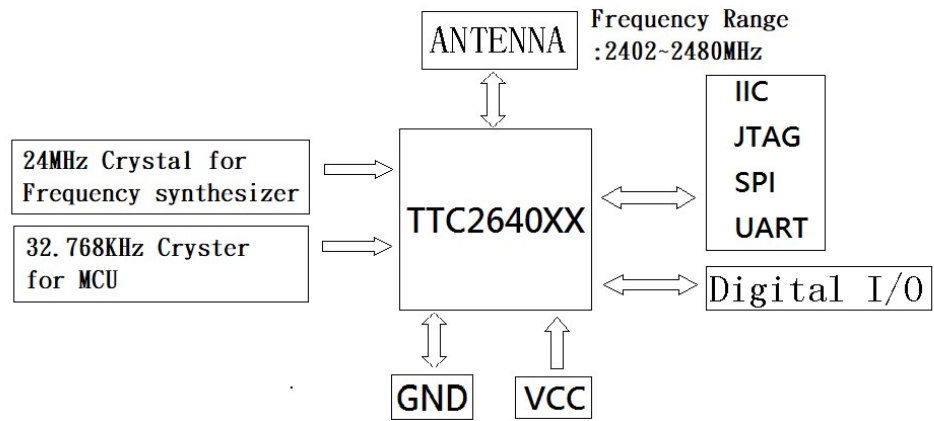
(2) Applications using RCOSC_LF as sleep timer must also consider the drift in frequency caused by a change in temperature .
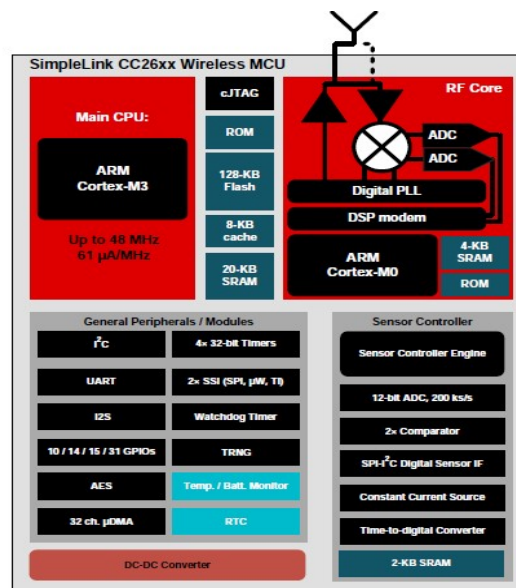
6-7. Switching Characteristics

Measured with Tc = 25°C, VDDS = 3.0 V, unless otherwise noted.

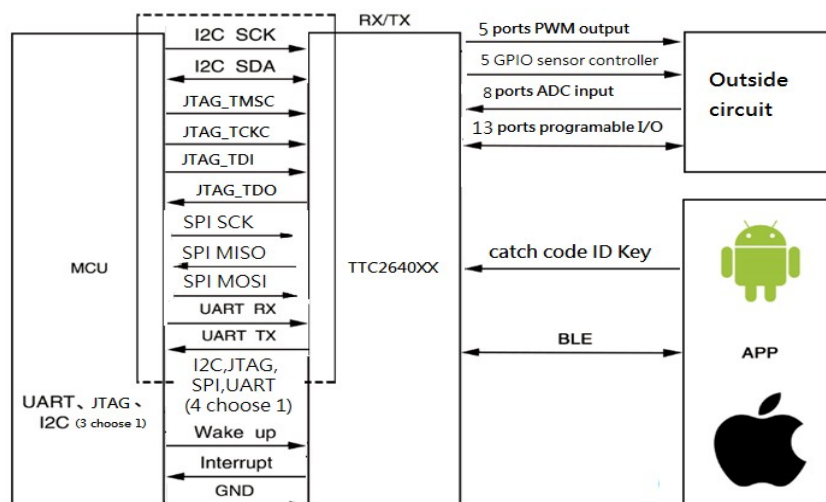| Parameter	Test Condition	Min	Typical	Max	Unit
Wakeup and Timing					
Idle →Active			14		µs
Standby →Active			151		µs
Shutdown →Active			1015		µs

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7. Block Diagram

8. Functional Block Diagram

9. Working mode schematic

10. Recommend Reflow Profile(Leadless solder cream: Sn 96.5%, Ag 3%, Cu 0.5%)

Profile Feature	Pb-Free Assembly	
	Large Body	Small Body
Average ramp-up rate(T_L to T_P)	3°C/second max	
Preheat-Temperature Min (Ts_{min}) -Temperature Max (Ts_{max}) -Time (min to max)(ts)	150°C 200°C 60-180 seconds	
$Ts_{max}$to T_L-Ramp-up Rate	3°C/second max	
Time maintained above-Temperature (T_L) -Time (t_L)	217°C 60-150 seconds	
Peak Temperature (T_P)	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actualPeakTemperature (t_p)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max	
Time 25°C to PeakTemperature	8 minutes max	

Reflow Curve Classification

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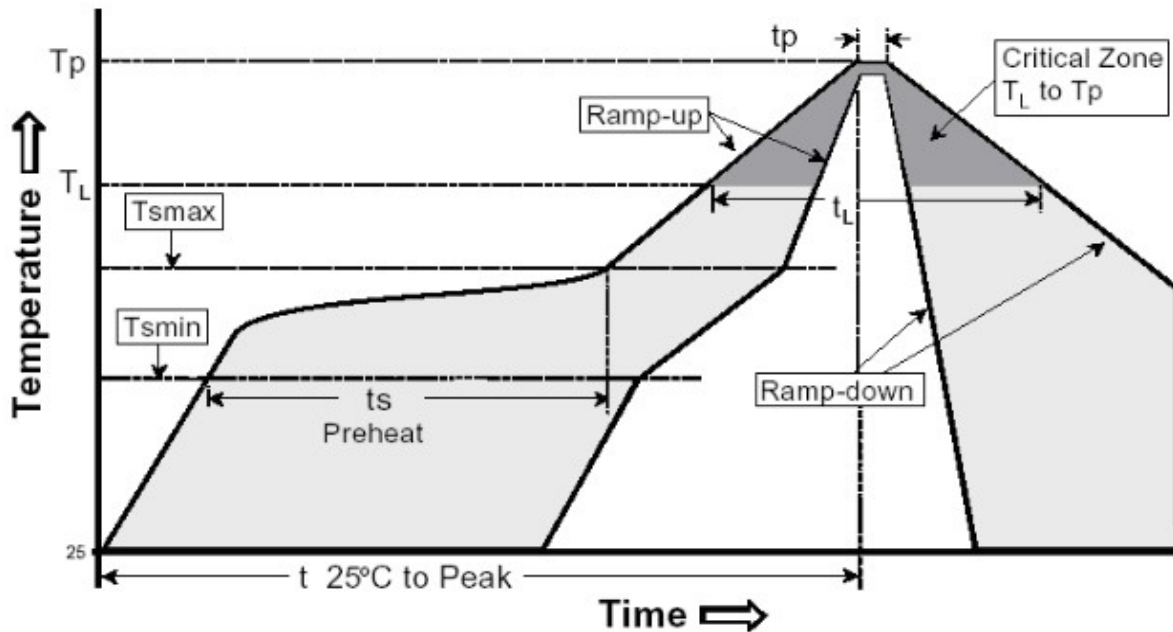
11.HY-40R201PC/WMD40R201SR6PC Module　FCC / Industry Canada Statement

(to be placed on End Products)Federal Communications Commission (FCC) Statement

FCC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2ADXE-HY-40R201PC

"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."

"Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

the Integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device.

Module statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

1) The radio elements have the radio frequency circuitry shielded.

2) The module has buffered modulation/data inputs to ensure that the device will complywith Part 15

requirements with any type of input signal.

3) The module contains power supply regulation on the module.

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4) The module contains a permanently attached antenna.

5) The module demonstrates compliance in a stand-alone configuration.

6) The module is labeled with its permanently affixed FCC ID label.

7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.

8) The module complies with RF exposure requirements.

NOTE: 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

Industry Canada (IC) Statement

This device complies with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the followingtwo 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.

Canada, avisd'Industry Canada (IC)

Le présentappareilestconforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitationestautorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareildoit accepter tout brouillageradioélectriquesubi, mêmesi lebrouillageest susceptible d'en comp

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