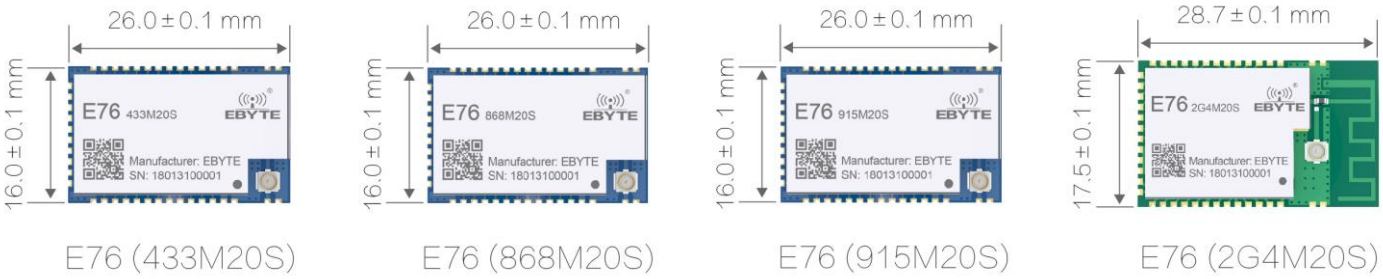
EFR32 Wireless Module

E76 Series

User Manual

Version	Date	Description	Issued by
1.00	2017-11-2	Initial version	huaa
1.10	2018-01-16	E76 (868M20S)/E76 (915M20S) are newly added	huaa
1.20	2018-01-29	E76(2G4M20S) is newly added	huaa

Brief Introduction



E76 series are hardware wireless transceivers designed by Chengdu Ebyte，SMD(pin spacing1.27mm), working as both transmitter and receiver. The antenna type is stamp hole or IPEX. The module is on stable production and suitable for many applications.

E76 series Imported the original EFR32 low power consumption wireless microcontroller from Silicon Labs, which integrated 32bytes ARM MCU and high performance wireless transceiver. All IO port is led out for secondary development. EFR32 has the potential to be the first choice in future smart furniture, IoT revolution and industrial automation.

E76-433M20S integrates EFR32FG1P131F256GM48 and 40MHz crystal oscillator. The related RF parameters can pass FCC, CE, CCC etc. certification, which enables the module to meet export requirements.

E76 series are produced without factory firmware. Users need to conduct secondary development.

Model	Frequency	Transmitting power	Distance	Packing	Antenna
E76 (433M20S)	433M	20dBm	2500m	SMD	IPEX/Stamp hole
E76 (868M20S)	868M	20dBm	2500m	SMD	IPEX/Stamp hole
E76 (915M20S)	915M	20dBm	2500m	SMD	IPEX/Stamp hole
E76 (2G4M20S)	2.4GHz	20dBm	300m/1.5km	SMD	IPEX/PCB

Contents

1. Main Features

Serial No.	Features	Description
1	ARM	The chip integrated 32bit processor based on Cortex-M4.
3	Harmonic stray	The RF hardware design features small harmonic stray, which can through various certification.
4	GPIO	All available IO Port is led out, Users can conduct the secondary development.
5	Dual Antenna	Users can choose IPEX or Stamp hole for external antenna.

2. E76 Series

Model Number	Chip	Frequency	Transmitting Power	Distance	Packing	Antenna
		MHz	dBm	km		
E76 (433M20S)	EFR32FG1P131F256GM48	433M	20	2.5	SMD	IPEX/Stamp hole
E76 (868M20S)	EFR32FG1P131F256GM48	868M	20	2.5	SMD	IPEX/Stamp hole
E76 (915M20S)	EFR32FG1P131F256GM48	915M	20	2.5	SMD	IPEX/Stamp hole
E76 (2G4M20S)	EFR32MG1P	2.4GHz	20	300m/1.5km	SMD	IPEX/PCB
More E76 series are coming soon.						

3. Technical Parameters

3.1 General Parameter

Model Number	Core IC	Size	Net Weight	Working Temperature	Working Humidity	Storage Temperature
E76 (433M20S)	EFR32FG1P131F256GM48	16 * 26mm	1.70±0.1g	-40 ~ 85°C	10% ~ 90%	-40 ~ 125°C
E76 (868M20S)	EFR32FG1P131F256GM48	16 * 26mm	1.70±0.1g	-40 ~ 85°C	10% ~ 90%	-40 ~ 125°C
E76 (915M20S)	EFR32FG1P131F256GM48	16 * 26mm	1.70±0.1g	-40 ~ 85°C	10% ~ 90%	-40 ~ 125°C
E76 (2G4M20S)	EFR32MG1P	17.5* 28.7mm		-40 ~ 85°C	10% ~ 90%	

3.2 Electrical Parameter

3.2.1 Transmitting Current

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	95	100	105	mA	● It' s recommend to keep above 30% capacity when design power supply circuit, which is good for the module working steadily in a long time. ● In transmitting, the required current would be large but because of the short transmission time, the total consumption maybe smaller. ● If users choose the external antenna, the difference of Impedance matching degree in different frequency point between antenna and modules will affect the degree of transmitting current.
E76 (868M20S)	93	98	103	mA	
E76 (915M20S)	105	110	115	mA	
E76 (2G4M20S)	130	135	140	mA	

3.2.2 Receiving Current

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	16	17	18	mA	● At receiving mode, the consumed current is called receiving current. Some RF chip with communication protocol or some developer programmed own firmware on it, which may be lead to large receiving current. ● At receiving mode, the current might be some mA, Users need to use some software to make the receiving current as μA.
E76 (868M20S)	16	17	18	mA	
E76 (915M20S)	16	17	18	mA	
E76 (2G4M20S)	11	11.6	12	mA	

3.2.3 Turn-off Current

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	0.5	1	1.8	μA	● The turn-off current mainly refers to the CPU, RAM, Clock, some register reservation and the consumed current when SoC in ultra-low power consumption. ● The turn-off current usually is less than the consumed current of whole machine in empty load.
E76 (868M20S)	0.5	1	1.8	μA	
E76 (915M20S)	0.5	1	1.8	μA	
E76 (2G4M20S)	13	29.5	45	μA	

3.2.4 Supply Voltage

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	1.85	3.3	3.8	V DC	● If the supply voltage always stays in max value, the modules may be burnt out. ● Power supply pin has certain surge handling capacity, but still users have to handle the pulse higher than max supply voltage.
E76 (868M20S)	1.85	3.3	3.8	V DC	
E76 (915M20S)	1.85	3.3	3.8	V DC	
E76 (2G4M20S)	1.85	3.3	3.8	V DC	

3.2.5 Communication Level

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	1.85	3.3	3.8	V DC	● If the communication level is higher than the max value of module communication level, the modules may be burnt out. ● The module is compatible with some 5.0V MCU. Please refer to our testing result or consult our professional staff. ● The communication level can be converted in many ways, which also largely affect the power consumption of whole machine.
E76 (868M20S)	1.85	3.3	3.8	V DC	
E76 (915M20S)	1.85	3.3	3.8	V DC	
E76 (2G4M20S)	1.85	3.3	3.8	V DC	

3.3 RF Parameters

3.3.1 Transmitting Power

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	19.0	20.0	20.4	dBm	● Because of some error of material, each LRC has the ±0.1% difference. In the whole RF circuit, there’s much LRC components are used, so the cumulative error will cause the difference of transmitting power. ● Lowering the transmitting power can decrease the power consumption, also reduce the efficiency of internal PA. ● The transmitting power will decrease with the decrease of power voltage.
E76 (868M20S)	19.0	20.0	20.4	dBm	
E76 (915M20S)	19.0	20.0	20.4	dBm	
E76 (2G4M20S)	19.0	20.0	20.4	dBm	

3.3.2 Receiving Sensitivity

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	-106	-107	-107.5	dBm	● The testing air data rate is 50kbps. ● Because of some error of material, each LRC has the ± 0.1% difference. In the whole RF circuit, there’s much LRC components are used, so the cumulative error will cause the difference of transmitting power. ● After increasing the air data rate of module, the receiving sensitivity will decrease, which cause the communication distance shorter.
E76 (868M20S)	-106	-107	-107.5	dBm	
E76 (915M20S)	-106	-107	-107.5	dBm	
E76 (2G4M20S)	-100	-101	-102	dBm	

3.3.3 Recommend Working Frequency

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	420	433	450	MHz	● Working in the recommend frequency can ensures the performance of modules. ● It’s recommend to avoid the crowded frequency, such as, 433.0MHz、868.0MHz、915MHz etc.
E76 (868M20S)	863	868	875	MHz	
E76 (915M20S)	902	915	931	MHz	
E76 (2G4M20S)	2400	2440	2480	MHz	

3.3.4 Tested Distance

Model Number	Min	Typ	Max	Unit	Description
E76 (433M20S)	2250	2500	2750	m	● The testing external antenna gain is 5dbi, vertical polarization, antenna height: 2.5m. ● With 30byte in each data packet and 2s spacing interval, we send 100 packet in total and the rate of packet loss less than 5% will be the valid transmission distance. ● To get the accurate testing result, we tested our modules in an open and clear area without any electromagnetic interference. ● The distance will be affected if there’s obstacles or electromagnetic interference.
E76 (868M20S)	2250	2500	2750	m	
E76 (915M20S)	2250	2500	2750	m	
E76 (2G4M20S)	1350	1500	1650	m	

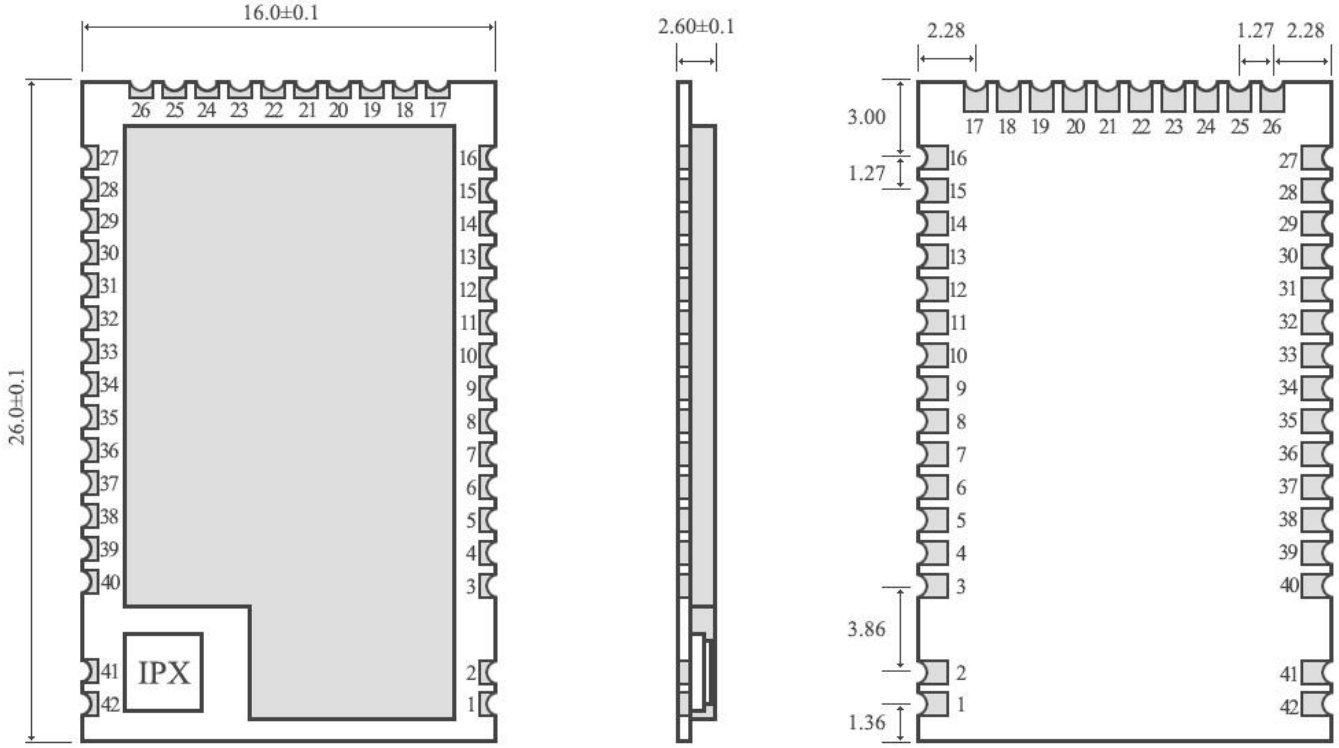
4. Notes

- Static electricity: High Frequency analog device features electrostatic sensitivity. Please avoid to contact with the electrical components.
- Welding: Electric iron need to be grounded well. For mass production, producer need to wear the wired electrostatic Bracelet, which is grounded already.
- Power supply: The quality of power supply has big impact on modules' performance. Please ensure the power supply has few ripple and avoid the power supply jitter frequently. (π type filter is recommended. Ceramic capacitor/tantalum capacitors+inductance)
- Ground electrode: It adopts single point grounding. It's recommend to use 0Ω resistance or 10mH inductance, which is separated from other circuit reference ground.
- Antenna: The installation structure of antenna can affect the modules' performance largely. So please ensure the antenna exposed and vertical upward. When modules is installed in the inside of the shell, users can adopt the high-quality antenna extension line to extend the antenna to the outside of shell. The antenna cannot be installed in the inside of metal shell, which causes transmission distance weakened greatly.
- Interference: If there's any other frequency module working, users need to plan the frequency rationally, adopt screen measures to decrease the impact of harmonic interference and intermodulation interference.
- Crystal oscillator: If there's crystal oscillator near the circuit board, please enlarge the straight distance between modules and crystal oscillator.

5. Pin Definition

5.1 E76 (433M20S)/E76 (868M20S)/E76 (915M20S)

5.1.1 Dimension

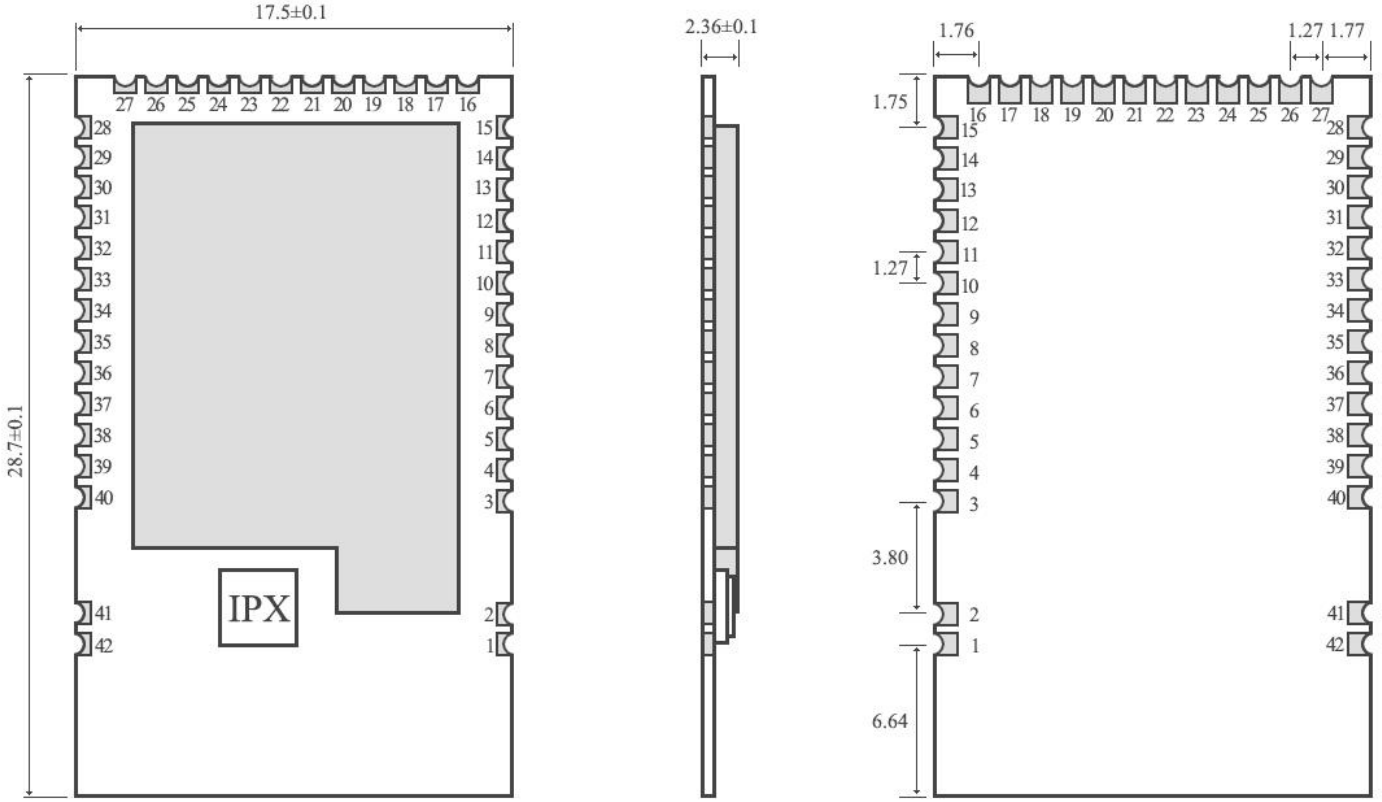


5.1.2 Pin Definition

Pin No.	Name	Direction	Usage
1	GND	Input/Output	Ground electrode, connected to the power reference ground.
2	GND	Input/Output	Ground electrode, connected to the power reference ground.
3	GND	Input/Output	Ground electrode, connected to the power reference ground.
4	RESETN	Input	Reset pin.
5	PD9	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
6	PD10	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
7	PD11	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
8	PD12	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
9	PD13	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
10	PD14	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
11	PD15	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
12	PA0	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
13	PA1	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
14	PA2	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
15	PA3	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
16	GND	Input/Output	Ground electrode, connected to the power reference ground.
17	PA4	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
18	PA5	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
19	PB11	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
20	PB12	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
21	PB13	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
22	PB14	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
23	PB15	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
24	PC6	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
25	PC7	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
26	PC8	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
27	GND	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
28	PC9	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
29	PC10	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
30	PC11	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
31	PF0	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
32	PF1	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
33	PF2	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
34	PF3	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
35	PF4	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
36	PF5	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
37	PF6	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
38	PF7	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
39	VCC	Input/Output	Positive reference power supply, voltage: 1.8V-3.8V
40	GND	Input/Output	Ground electrode, connected to the power reference ground.
41	ANT	Input/Output	Antenna interface. Stamp hole(50Ωcharacteristic impedance)
42	GND	Input/Output	Ground electrode, connected to the power reference ground.

5.2 E76 (2G4M20S)

5.2.1 Dimension



5.2.2 Pin Definition

Pin No.	Name	Direction	Usage
1	GND	Input/Output	Ground electrode, connected to the power reference ground.
2	GND	Input/Output	Ground electrode, connected to the power reference ground.
3	VDD	Input	Positive power reference ground, 1.85V~3.8V
4	GND	Input/Output	Ground electrode, connected to the power reference ground.
5	PD10	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
6	PD11	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
7	PD12	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
8	PD13	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
9	PD14	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
10	PD15	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
11	PA0	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
12	PA1	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
13	PA2	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
14	PA3	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
15	PA4	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
16	PA5	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
17	PB11	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
18	PB12	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
19	PB13	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)

20	GND	Input/Output	Ground electrode, connected to the power reference ground.
21	PB14	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
22	PB15	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
23	GND	Input/Output	Ground electrode, connected to the power reference ground.
24	GND	Input/Output	Ground electrode, connected to the power reference ground.
25	GND	Input/Output	Ground electrode, connected to the power reference ground.
26	PC6	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
27	PC7	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
28	PC8	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
29	PC9	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
30	PC10	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
31	PC11	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
32	SWCLK	Input/Output	DBG_SWCLKTCK, configurable general IO port
33	SWDIO	Input/Output	DBG_SWDIOTMS, configurable general IO port
34	PF2	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
35	PF3	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
36	PF4	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
37	PF5	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
38	PF6	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
39	PF7	Input/Output	Configurable universal IO port(see more details on EFR32 datasheet.)
40	RESTN	Input	Rest pin
41	GND	Input/Output	Ground electrode, connected to the power reference ground.
42	GND	Input/Output	Ground electrode, connected to the power reference ground.

6.Development and Usage

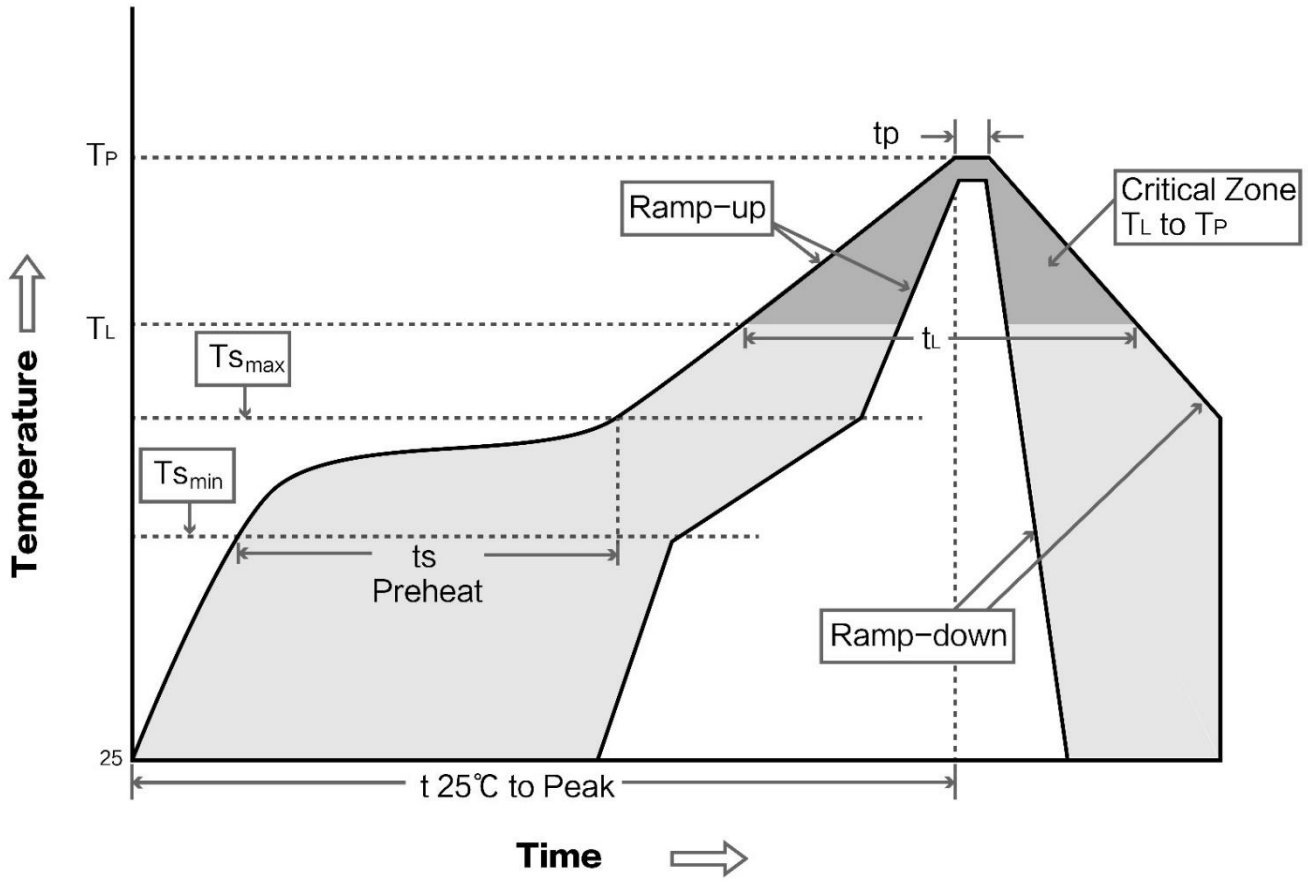
<table>
<tr><th>Serial No.</th><th>Key words</th><th>Notes</th></tr>
<tr><td>1</td><td>Program</td><td>The module is SoC with GPIO port. Only the J-LINK can be used for program downloading.
We provide demo for reference. Users can directly download our compiled HEX files or change the primary code to realized the function needed.
Pin definition of software downloading
<table>
<tr><th>E76 series pin</th><th>J-LINK interface</th></tr>
<tr><td>VCC</td><td>VCC</td></tr>
<tr><td>PF0</td><td>SWCLK</td></tr>
<tr><td>PF1</td><td>SWDIO</td></tr>
<tr><td>GND</td><td>GND</td></tr>
</table></td></tr>
<tr><td>2</td><td>Test board</td><td>We do not provide the matched test board for this module yet.</td></tr>
</table>

7. Production Guidance

7.1 Reflow Temperature

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature（Tp）	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

7.2 Reflow Graph



8. FAQ

8.1 The communication distance is too short

- When there’ s straight Communication barrier, the communication distance will be reduced accordingly.
- Temperature, humidity and same frequency interference will increase the rate of communication packet loss.
- Ground absorption, reflected radio waves, and closing to ground will lead to poor test result.
- Seawater has a strong ability to absorb radio waves, so test near the sea is not recommended .
- If antennas surrounded by metal items or placed in metal shell, the signal will be weakened badly.
- Power register is set wrongly or air data rate too high.(The higher the air data rate, the closer the distance).
- In room temperature, the power voltage will be less than 2.5V. The lower the the power voltage, the smaller the power.
- The antenna is unmatched to the module or the quality of antenna.

8.2 The module is easy to be damaged

- Please check the power supply, which should be 1.8v-3.8v. If the value exceeds that, the module will be damaged.
- Please check the stability of power supply. The voltage cannot be in fluctuations frequently.
- Please ensure all the installation operations are anti-static.
- Please ensure the humidity in the procedure of installation and operation should not be too high because some electrical parts are humidity sensitive device.
- Please do not use it in a too high or too low temperature environment if there’ s no special requirement.

9. Important Statement

- Ebyte reserves the rights of final interpretation and revision for all the involved contents in this manual.
- With the continuous improvement of hardware and software, this manual may subject to change without notice. Please refer to the latest version.
- Users can follow the product news on our official website so as to gain the latest information.

10. About Us

Technical support: support@cdebyte.com

Documents and RF Setting download link: www.cdebyte.com/en/

成都亿佰特电子科技有限公司
Chengdu Ebyte Electronic Technology Co.,Ltd.

Tel：+86-28-61399028 ext. 821

Fax：028-64146160

Web：www.cdebyte.com/en/

Address：Innovation Center D347, 4# XI-XIN Road,Chengdu, Sichuan, China