FSC-BT616

4.1 Single Mode Bluetooth Module Data Sheet

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Release Record

Version Number	Release Date	Comments
Revision 1.0	2016-12-20	First Release

1. INTRODUCTION

FSC-BT616 is a fully integrated Bluetooth module that complies with Bluetooth 4.1 single mode protocols(BLE). It supports GAP, ATT/GATT, SMP, L2CAP profiles. It integrates Baseband controller in a small package（Integrated chip antenna）, so the designers can have better flexibilities for the product shapes.

FSC-BT616 can be communicated by UART port. With Feasycom's Bluetooth stack, Customers can easily transplant to their software. Please refer to Feasycom stack design guide.

1.1 Block Diagram

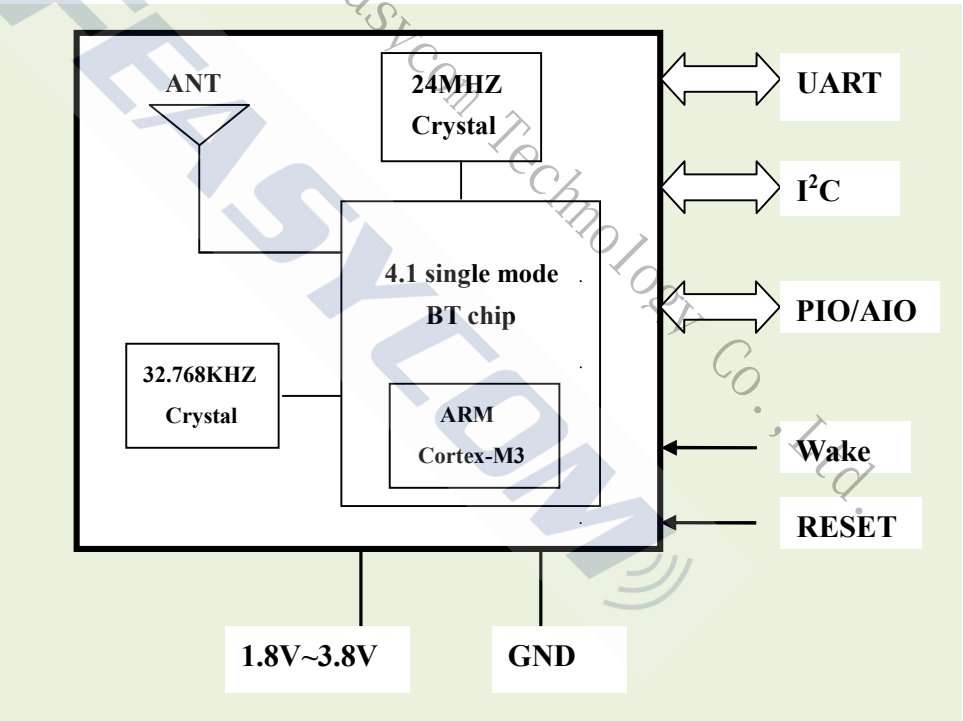


Figure 1

1.2 Feature

- Support the Bluetooth 4.1 core specification
- Integrate MCU to execute Bluetooth protocol stack.
- Postage stamp sized form factor,
- Low power
- Class 1.5 support(high output power)
- The default UART Baud rate is 115.2Kbps and can support from 1200bps up to 921Kbps,.
- UART, I^2C,SPI,12-bit ADC(200ks/S)data connection interfaces.
- Support the OTA upgrade.
- Bluetooth stack profiles support: LE HID, and all BLE protocols.
- PWM
- Support eight capacitance sensor button
- Integrated temperature sensor

1.3 Application

- Smart Watch and Bluetooth Bracelet
- Health & Medical devices
- TV Remote Controller
- LE HID, Beacon,
- Home Automation
- Key fob, wristband, wearable device

2. GENERAL SPECIFICATION

General Specification			
ChipSet	TI CC2640		
Product ID	FSC-BT616		
Dimension	13mm x 26.9mm x 2.4mm		
Bluetooth Specification	Bluetooth V4.1 (Single Mode)		
Power Supply	1.8V~3.8 Volt DC		
Output Power	5 dBm		
Sensitivity	-96dBm@0.1%BER		
Frequency Band	2.402GHz -2.480GHz ISM band		
Modulation	GFSK		
Baseband Crystal OSC	24MHz		
Hopping & channels	1600hops/sec, 2MHz channel space, 40 Channels		
RF Input Impedance	50 ohms		
Antenna	Integrated chip antenna (Optional: External antenna interface)		
Interface	Data: UART, I^2C		
Profile	GATT(BLE Standard) MFI, Airsync, ANCS, iBeacon, OTA		
Temperature	-40ºC to +85 ºC		
Humidity	10%~95% Non-Condensing		
Environmental	RoHS Compliant		
Electrostatic discharge(ESD) performance	Human body model(HBM),per ANSI/ESDA/JEDEC JS001	All pins	±2500V
	Charged device model(CDM),per JESD22-C101	RF pins	±750V
		Non-RF pins	

Table 1

3. PHYSICAL CHARACTERISTIC

- Dimension： 13mm(W) x 26.9mm(L) x 2.4mm(H) Tolerance: ±0.1mm
- Module size: 13mm X 26.9mm Tolerance: ±0.2mm
- Pad size: 1mmX0.8mm Tolerance: ±0.2mm
- Pad pitch: 1.5mm Tolerance: ±0.1mm

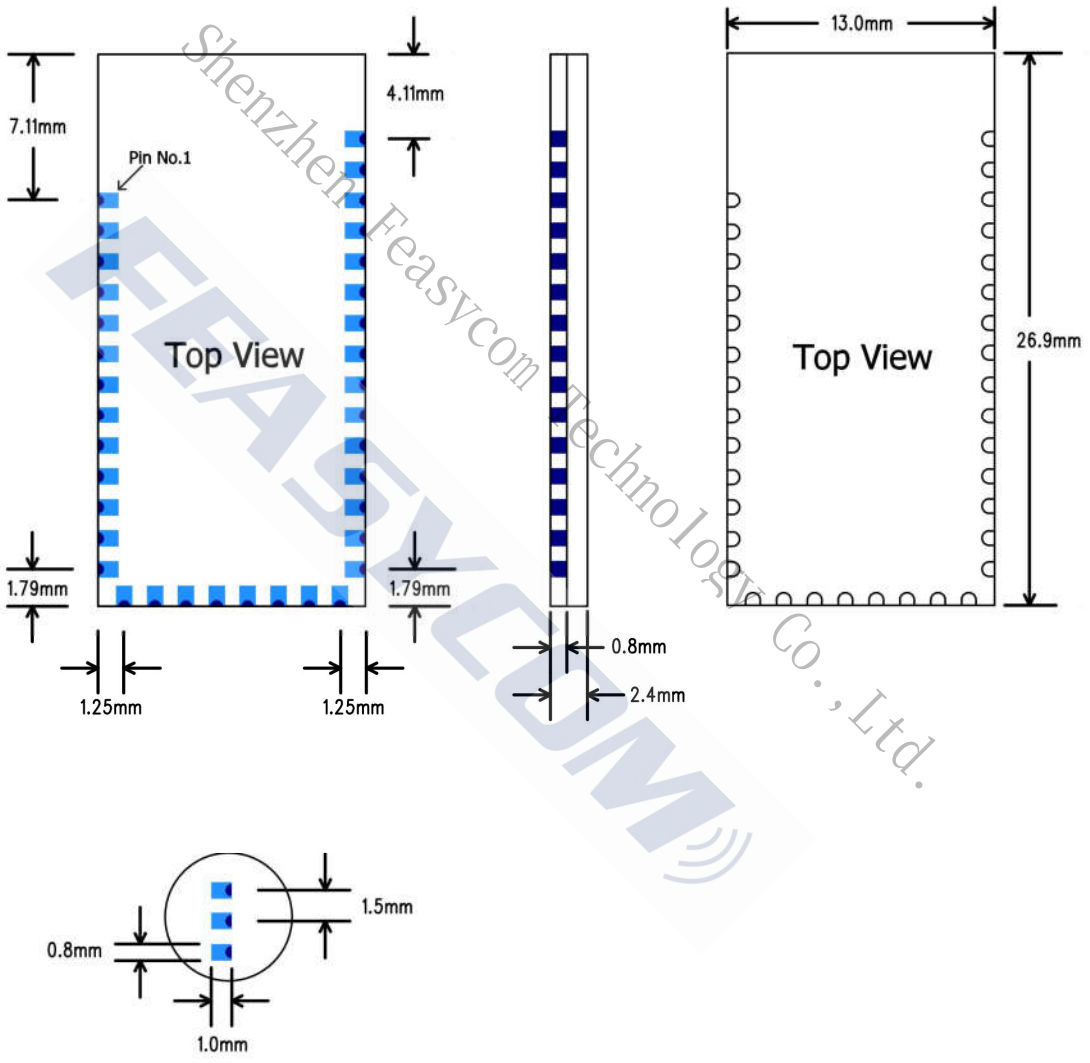


Figure 2 Package Dimensions（TOP VIEW）

4. PIN DEFINITION DESCRIPTIONS

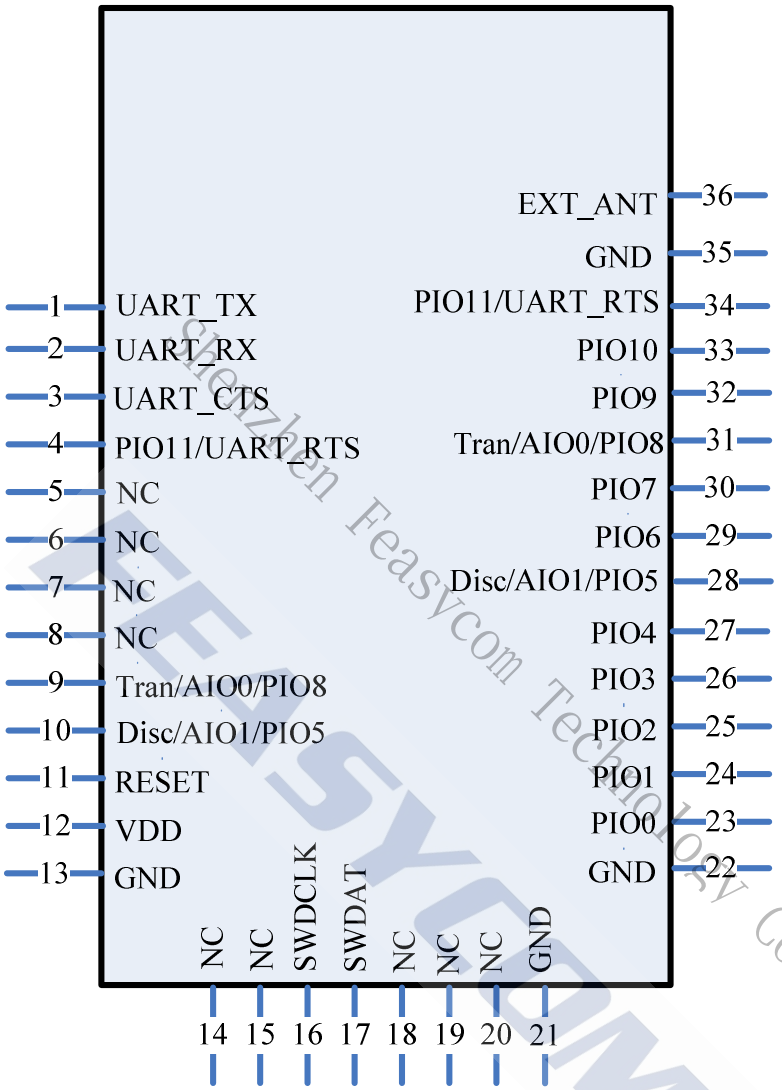


Figure3: FSC-BT616 PIN Diagram

Pin	Pin Name	Pad Type	Description
1	UART-TX	CMOS output	UART data output
2	UART-RX	CMOS input	UART data input
3	UART-CTS	I/O	UART clear to send active low Alternative Function: Programmable input/output line
4	PIO11/UART-RTS	I/O	UART request to send active low Wake Pin (Default) (H= Sleep; L= Wake up) Alternative Function: Programmable input/output line

5	NC	NC	NC
6	NC	NC	NC
7	NC	NC	NC
8	NC	NC	NC
9	PIO8/Disc/AIO 0	I/O	Host MCU disconnect bluetooth. (Default) One low pulse with 80ms duration low signal to trigger bluetooth disconnection.Otherwise it will be set as high always. 1),Alternative Function: Analogue programmable I/O line. 2),Alternative Function: Programmable input/output line
10	PIO5/Tran/AIO 1	I/O	Host MCU change UART transmission mode. (Default) If current UART transmission mode is command mode, one low pulse with 80ms duration low signal will change UART transmission mode to throughput mode, and another low pulse could change UART transmission mode back to command mode. Otherwise it will be set as high always. 1),Alternative Function: Analogue programmable I/O line. 2),Alternative Function: Programmable input/output line
11	RESET	CMOS input	Reset if low. Input debounced so must be low for >5ms to cause a reset.
12	VDD	VDD	Power supply voltage 1.8V ~ 3.8V
13	GND	VSS	Power Ground
14	NC	NC	NC
15	NC	NC	NC
16	SWDCLK	I/O	Update Interface(SWDCLK)
17	SWDAT	I/O	Update Interface(SWDAT)
18	NC	NC	NC
19	NC	NC	NC
20	NC	NC	NC
21	GND	VSS	Power Ground
22	GND	VSS	Power Ground
23	PIO0	I/O	Programmable input/output line
24	PIO1	I/O	Programmable input/output line
25	PIO2	I/O	Programmable input/output line
26	PIO3	I/O	Programmable input/output line
27	PIO4	I/O	Programmable input/output line
28	PIO5/Tran/AIO 1	I/O	Host MCU change UART transmission mode. (Default) If current UART transmission mode is command mode, one low

			pulse with 80ms duration low signal will change UART transmission mode to throughput mode, and another low pulse could change UART transmission mode back to command mode. Otherwise it will be set as high always. 1),Alternative Function: Analogue programmable I/O line. 2),Alternative Function: Programmable input/output line
29	PIO6	Bi-directional	Programmable input/output line Alternative Function: I2C Serial Clock input/output
30	PIO7	Bi-directional	Programmable input/output line Alternative Function:I2C Serial Data input/output
31	PIO8/Disc/AIO 0	I/O	Host MCU disconnect bluetooth. (Default) One low pulse with 80ms duration low signal to trigger bluetooth disconnection.Otherwise it will be set as high always. 1),Alternative Function: Analogue programmable I/O line. 2),Alternative Function: Programmable input/output line
32	PIO9	I/O	Programmable input/output line Alternative Function: LED(Default)
33	PIO10	I/O	Programmable input/output line Alternative Function: BT Status(Default)
34	PIO11/UART-RTS	I/O	UART request to send active low Wake Pin (Default) (H= Sleep; L= Wake up) Alternative Function: Programmable input/output line
35	GND	VSS	Power Ground
36	EXT_ANT	RF signal output	By default, this PIN is an empty feet. This PIN can connect to an external antenna to improve the Bluetooth signal coverage. If you need to use an external antenna, by modifying the module on the 0R resistance to block out the on-board antenna; Or contact Feasycom for modification.

Table 2

5. Electrical Characteristics

5.1 Absolute Maximum Ratings

The module should not continuously run under extreme conditions. The absolute maximum ratings are summarized in Table below. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability and cause permanent damage to the device.

Temperature/Voltage	Min	Max	Unit
Storage temperature	-40	150	°C
Operating temperature	-40	85	°C
Supply voltage	-0.3	3.8	V

Terminal voltages		- 0.3	Vdd + 0.3	V
Voltage on ADC input (Vin)	Voltage scaling enabled	- 0.3	VDD	V
	Voltage scaling disabled, internal reference	- 0.3	1.49	
	Voltage scaling disabled, VDD as reference	- 0.3	VDD / 2.9	
Input RF level		-	5	dBm

Table 3

5.2 Recommended Operating Conditions

The recommended operating conditions are summarized in Table below.

Temperature/Voltage	Min	Typ	Max	Unit
Operating temperature	-40	25	85	°C
Supply voltage	1.8	3.3	3.8	V
Terminal voltages	0		Vdd	V

Table 4

5.3 Terminal Characteristics

FSC-BT616's terminal characteristics are summarized Table below.

Characteristics		Min	Typ	Max	Unit
TA = 25°C, VDD = 1.8 V					
GPIO VOH at 8-mA load	IOCURR = 2, high-drive GPIOs only	1.32	1.54	-	V
GPIO VOL at 8-mA load	IOCURR = 2, high-drive GPIOs only	-	0.26	0.32	V
GPIO VOH at 4-mA load	IOCURR = 1	1.32	1.58	-	V
GPIO VOL at 4-mA load	IOCURR = 1	-	0.21	0.32	V
GPIO pullup current	Input mode, pullup enabled, Vpad = 0 V	-	71.7	-	uA
GPIO pulldown current	Input mode, pulldown enabled, Vpad = VDD	-	21.1	-	uA
GPIO high/low input transition,no hysteresis	IH = 0, transition between reading 0 and reading 1	-	0.88	-	V
GPIO low-to-high input transition,with hysteresis	IH = 1, transition voltage for input read as 0 → 1	-	1.07	-	V
GPIO high-to-low input transition,with	IH = 1, transition voltage for input read as 1 → 0	-	0.74	-	V

hysteresis					
GPIO input hysteresis	IH = 1, difference between 0 → 1 and 1 → 0 points	-	0.33	-	V
TA = 25°C, VDD = 3.0 V					
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
TA = 25°C, VDD = 3.8 V					
GPIO pullup current	Input mode, pullup enabled, Vpad = 0 V	-	277	-	uA
GPIO pulldown current	Input mode, pulldown enabled, Vpad = VDD	-	113	-	uA
GPIO high/low input transition,no hysteresis	IH = 0, transition between reading 0 and reading 1	-	1.67	-	V
GPIO low-to-high input transition,with hysteresis	IH = 1, transition voltage for input read as 0 → 1	-	1.94	-	V
GPIO high-to-low input transition,with hysteresis	IH = 1, transition voltage for input read as 1 → 0	-	1.54	-	V
GPIO input hysteresis	IH = 1, difference between 0 → 1 and 1 → 0 points	-	0.4	-	V
TA = 25°C					
VIH	Lowest GPIO input voltage reliably interpreted as a «High»	-	-	0.8	VDD
VIL	Highest GPIO input voltage reliably interpreted as a «Low»	0.2	-	-	VDD
NRST pin characteristics					
VTH,res threshold voltage		1.65	1.8	VDD	V
RIRES input resistance		-	100	-	kΩ
CIRES input capacitance		-	100	-	nF

Table 5

5.4 Current Consumption

FSC-BT616's current consumption is summarized in Table below.

Operation Mode	Connection Type	Average	Unit
Discoverable	24MHz Off 32.768KHz On Advert interval 500mS Uart Off	42	uA
	24MHz On 32.768KHz On Advert interval 500mS Uart On	1.18	mA
LE Connected	Connection Interval 18mS 24MHz Off 32.768KHz On Uart Off	49	uA
	Connection Interval 18mS 24MHz On 32.768KHz On Uart On	1.47	mA

Table 6

5.5 Radio Characteristics

5.5.1 Transmitter Radio Characteristics

TX output is guaranteed to be unconditionally stable over the guaranteed temperature range. Refer to Table below.

Measurement conditions: T = 25℃, Vdd = 3.0V, F_{RF} = 2440 MHz.

Item		Typical Value	Unit
Maximum output power1,2 (Differential mode, delivered to a single-ended 50-Ω load through a balun)		5	dBm
Output power, lowest setting (Delivered to a single-ended 50-Ω load through a balun)		-21	dBm
Spurious emission conducted measurement(1)	f < 1 GHz, outside restricted bands	-43	dBm
	f < 1 GHz, restricted bands ETSI	-65	dBm
	f < 1 GHz, restricted bands FCC	-76	dBm
	f > 1 GHz, including harmonics	-46	dBm
(1) Suitable for systems targeting compliance with worldwide radio-frequency regulations ETSI EN 300 328 and EN 300 440 Class 2(Europe), FCC CFR47 Part 15 (US), and ARIB STD-T66 (Japan).			

Table 7

5.5.2 Receiver Radio Characteristics

RX input is guaranteed to be unconditionally stable over the guaranteed temperature range. Refer to Table below.

Measurement conditions: T = 25℃, Vdd = 3.0V, F_{RF} = 2440 MHz.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Receiver sensitivity	Differential mode. BER = 10–3	-	-96	-	dBm
Frequency error tolerance	Difference between the incoming carrier frequency and the internally generated carrier frequency	–350	-	350	KHz
Data rate error tolerance	Difference between incoming data rate and the internally generated data rate	–750	-	750	ppm
Co-channel rejection (1)	Wanted signal at –67 dBm, modulated interferer in channel, BER = 10^{-3}	-	-6	-	dB
Selectivity, ±1 MHz (1)	Wanted signal at –67 dBm, modulated interferer at ±1 MHz, BER = 10^{-3}	-	7 / 3(2)	-	dB
Selectivity, ±2 MHz (1)	Wanted signal at –67 dBm, modulated interferer at ±2 MHz, BER = 10^{-3}	-	34 / 25(2)	-	dB
Selectivity, ±3 MHz (1)	Wanted signal at –67 dBm, modulated interferer at ±3 MHz, BER = 10^{-3}	-	38 / 26(2)	-	dB
Selectivity, ±4 MHz (1)	Wanted signal at –67 dBm, modulated interferer at ±4 MHz, BER = 10^{-3}	-	42 / 29(2)	-	dB
Selectivity, ±5 MHz or more(1)	Wanted signal at –67 dBm, modulated interferer at ≥ ±5 MHz, BER = 10^{-3}	-	32	-	dB
Selectivity, Image frequency(1)	Wanted signal at –67 dBm, modulated interferer at image frequency, BER = 10^{-3}	-	25	-	dB
Selectivity, Image frequency ±1 MHz(1)	Wanted signal at –67 dBm, modulated interferer at ±1 MHz from image frequency, BER = 10^{-3}	-	3 / 26(2)	-	dB
Out-of-band blocking (3)	30 MHz to 2000 MHz	-	–20	-	dBm
Out-of-band blocking	2003 MHz to 2399 MHz	-	–5	-	dBm
Out-of-band blocking	2484 MHz to 2997 MHz	-	–8	-	dBm
Out-of-band blocking	3000 MHz to 12.75 GHz	-	–8	-	dBm
Intermodulation	Wanted signal at 2402 MHz, –64 dBm. Two interferers at 2405 and 2408 MHz respectively, at the given power level	-	–34	-	dBm
Spurious emissions, 30 to 1000 MHz	Conducted measurement in a 50-Ω single-ended load. Suitable for systems targeting compliance with EN 300 328,	-	-71	-	dBm

	EN 300 440 class 2, FCC CFR47, Part 15 and ARIB STD-T-66				
Spurious emissions,1 to 12.75 GHz	Conducted measurement in a 50 Ω single-ended load. Suitable for systems targeting compliance with EN 300 328, EN 300 440 class 2, FCC CFR47, Part 15 and ARIB STD-T-66	-	-62	-	dBm
RSSI dynamic range	-	-	70	-	dB
RSSI accuracy	-	-	±4	-	dB
(1) Numbers given as I/C dB. (2) X / Y, where X is +N MHz and Y is –N MHz. (3) Excluding one exception at Fwanted / 2, per Bluetooth Specification.					

Table 8

6. Interface Characteristics

6.1 UART Interface

Four signals are used to implement the UART function. When FSC-BT616 is connected to another digital device, UART_RX and UART_TX transfer data between the two devices. The remaining two signals, UART_CTS and UART_RTS, can be used to implement RS232 hardware flow control where both are active low indicators.

The interface consists of four-line connection as described in below:

Signal name	Driving source	Description
UART-TX	FSC-BT616 module	Data from FSC-BT616 module
UART-RX	Host	Data from Host
UART-RTS	FSC-BT616 module	Request to send output of FSC-BT616 module
UART-CTS	Host	Clear to send input of FSC-BT616 module

Table 9

Default Data Format

Property	Possible Values
Baudrate	115. 2 Kbps
Flow Control	None
Data bit length	8bit
Parity	None
Number of Stop Bits	1

Table 10

6.2 I²C Interface

- Up to two I²C bus interfaces can support both master and slave mode with a frequency up to 400KHZ.
- Provide arbitration function, optional PEC(packet error checking) generation and checking.
- Supports 7 –bit and 10 –bit addressing mode and general call addressing mode.

The I²C interface is an internal circuit allowing communication with an external I²C interface which is an industry standard two line serial interface used for connection to external hardware. These two serial lines are known as a serial data line (SDA) and a serial clock line (SCL). The I²C module provides two data transfer rates: 100 kHz of standard mode or 400kHz of the fast mode. The I²C module also has an arbitration detect function to prevent thesituation where more than one master attempts to transmit data to the I²C bus at the same time. A CRC-8 calculator is also provided in I²C interface to perform packet error checking for I²C data.

6.3 Analog to digital converter (ADC)

Tc = 25°C, VDDS = 3.0 V and voltage scaling enabled, unless otherwise noted.(1)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage range		0		VDD	V
Resolution			12		Bits
Sample rate				200	Ksps
Offset	Internal 4.3-V equivalent reference(2)		2		LSB
Gain error	Internal 4.3-V equivalent reference(2)		2.4		LSB
DNL(3) Differential nonlinearity			>–1		LSB
INL(4) Integral nonlinearity			±3		LSB
ENOB Effective number of bits	Internal 4.3-V equivalent reference(2), 200 ksps, 9.6-kHz input tone		9.8		Bits
	VDDS as reference, 200 ksps, 9.6-kHz input tone		10		
	Internal 1.44-V reference, voltage scaling disabled, 32 samples average, 200 ksps, 300-Hz input tone		11.1		
THD	Internal 4.3-V equivalent reference(2), 200 ksps, 9.6-kHz input tone		-65		dB
	VDDS as reference, 200 ksps, 9.6-kHz		-69		

Total harmonic distortion	input tone				
	Internal 1.44-V reference, voltage scaling disabled, 32 samples average, 200 ksps, 300-Hz input tone		-71		
SINAD, SNDR Signal-to-noise and Distortion ratio	Internal 4.3-V equivalent reference(2), 200 ksps, 9.6-kHz input tone		60		dB
	VDDS as reference, 200 ksps, 9.6-kHz input tone		63		
	Internal 1.44-V reference, voltage scaling disabled, 32 samples average, 200 ksps, 300-Hz input tone		69		
SFDR Spurious-free dynamic range	Internal 4.3-V equivalent reference(2), 200 ksps, 9.6-kHz input tone		67		dB
	VDDS as reference, 200 ksps, 9.6-kHz input tone		72		
	Internal 1.44-V reference, voltage scaling disabled, 32 samples average, 200 ksps, 300-Hz input tone		73		
Conversion time	Serial conversion, time-to-output, 24-MHz clock		50		Clock-cycles
Current consumption	Internal 4.3-V equivalent reference(2)		0.66		mA
Current consumption	VDD as reference		0.75		mA
Reference voltage	Equivalent fixed internal reference (input voltage scaling enabled)		4.3(2) (5)		V
Reference voltage	Fixed internal reference (input voltage scaling disabled)		1.44 ±1%		V
Reference voltage	VDDS as reference (Also known as RELATIVE) (input voltage scaling enabled)		VDD		V
Reference voltage	VDDS as reference (Also known as RELATIVE) (input voltage scaling disabled)		VDD / 2.82(5)		V
Input Impedance	200 ksps, voltage scaling enabled. Capacitive input, Input impedance depends on sampling frequency and sampling time		>1		MΩ

(1) Using IEEE Std 1241™-2010 for terminology and test methods.

(2) Input signal scaled down internally before conversion, as if voltage range was 0 to 4.3 V.

(3) No missing codes. Positive DNL typically varies from +0.3 to +3.5, depending on device (**see Figure 4**).

(4) For a typical example, **see Figure 5**

(5) Applied voltage must be within absolute maximum ratings (Absolute Maximum Ratings) at all times.

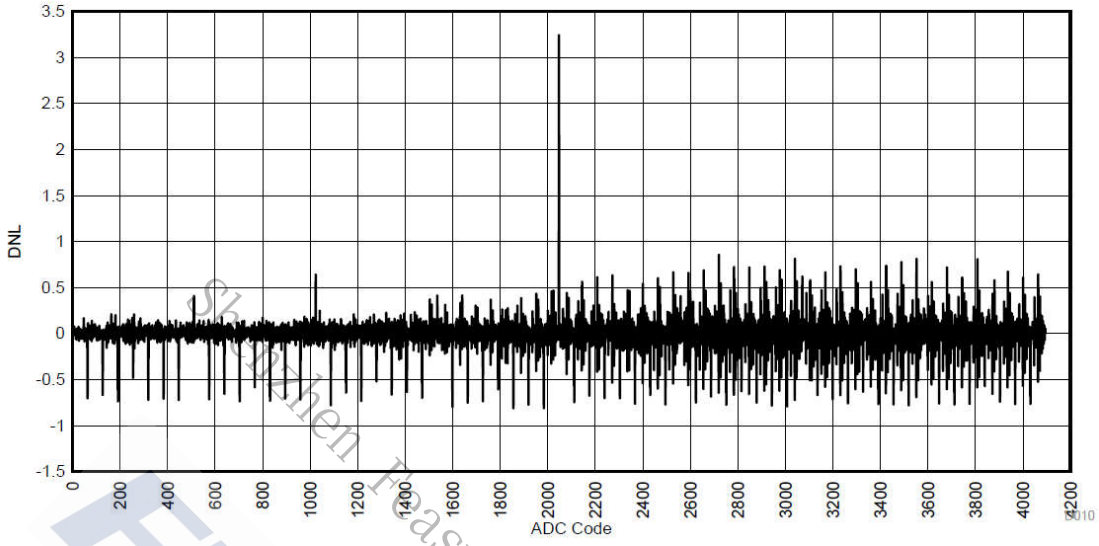


Figure 4: SoC ADC DNL vs ADC Code (Internal Reference, No Scaling)

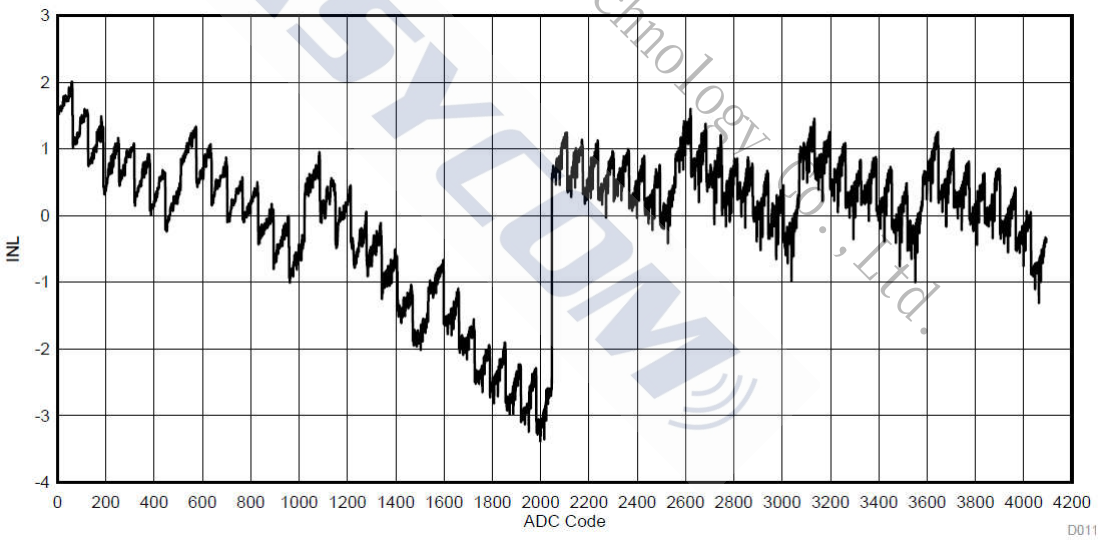


Figure 5: SoC ADC INL vs ADC Code (Internal Reference, No Scaling)

6.4 Wake

Measured on the FSC-BT616 reference design with Tc = 25°C, VDDS = 3.0 V, unless otherwise noted..

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Idle → Active			14		µs

Standby → Active			151		μs
Shutdown → Active			1015		μs

6.5 Temperature Sensor

Measured on the FSC-BT616 reference design with Tc = 25°C, VDDS = 3.0 V, unless otherwise noted

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Resolution			4		°C
Range		-40		85	°C
Accuracy			±5		°C
Supply voltage coefficient(1)			3.2		°C/V
(1) Automatically compensated when using supplied driver libraries.					

6.6 Battery Monitor

Measured on the FSC-BT616 reference design with Tc = 25°C, VDDS = 3.0 V, unless otherwise noted..

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Resolution			50		mV
Range		1.8		3.8	V
Accuracy			13		mV

7. RECOMMENDED TEMPERATURE REFLOW PROFILE

The re-flow profiles are illustrated in Figure 11 and Figure 12 below.

- Follow: IPC/JEDEC J-STD-020 C
- Condition:
  - Average ramp-up rate(217℃ to peak):1~2℃/sec max.
  - Preheat:150~200C,60~180 seconds
  - Temperature maintained above 217℃:60~150 seconds
  - Time within 5℃ of actual peak temperature:20~40 sec.
  - Peak temperature:250+0/-5℃ or 260+0/-5℃
  - Ramp-down rate:3℃/sec.max.
  - Time 25℃ to peak temperature:8 minutes max

- Cycloe interval：5 minus

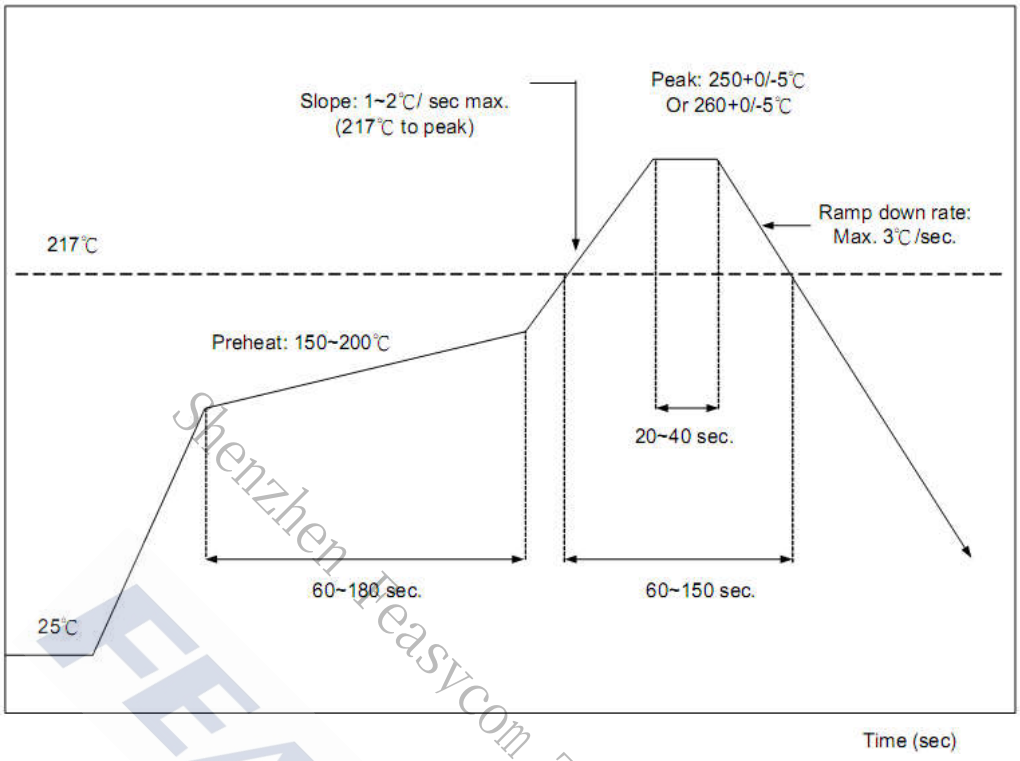


Figure 6: Typical Lead-free Re-flow Solder Profile

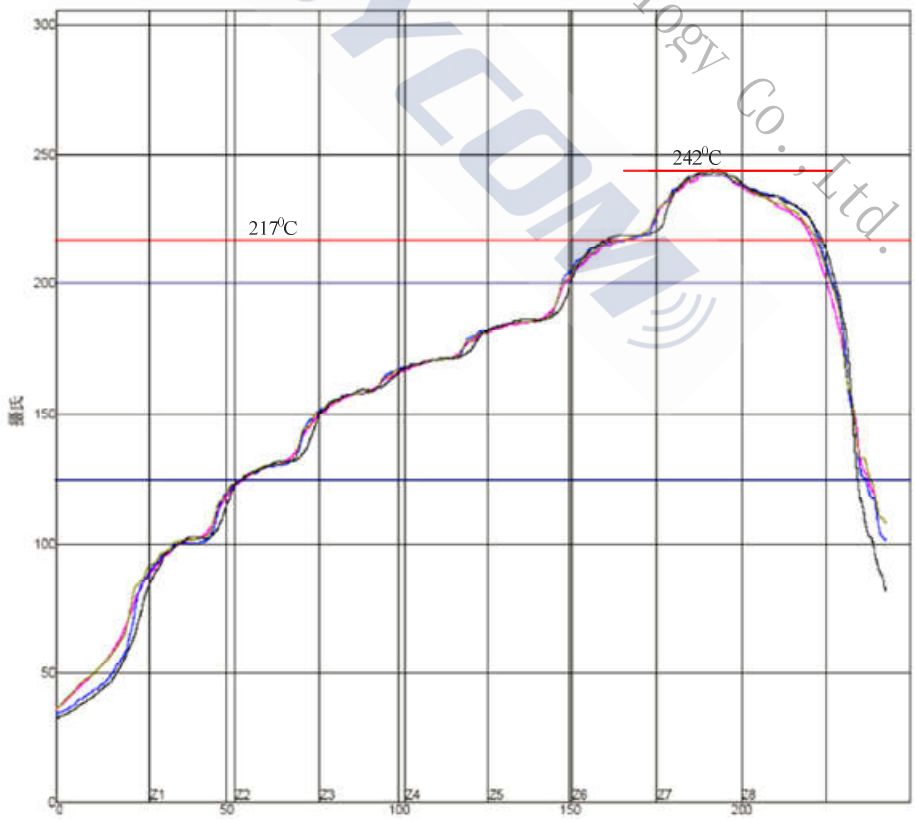


Figure 7: Typical Lead-free Re-flow

The soldering profile depends on various parameters according to the use of different solder and material. The data here is given only for guidance on solder re-flow.

FSC-BT616 will withstand up to two re-flows to a maximum temperature of 245°C.

8. Reliability and Environmental Specification

8.1 Temperature test

Put the module in demo board which uses exit power supply, power on the module and connect to mobile. Then put the demo in the －20℃ space for 1 hour and then move to +70℃ space within 1minute, after 1 hour move back to －20℃ space within1 minute. This is 1 cycle. The cycles are 32 times and the units have to pass the testing.

8.2 Vibration Test

The module is being tested without package. The displacement requests 1.5mm and sample is vibrated in three directions(X,Y,Z).Vibration frequency set as 0.5G , a sweep rate of 0.1 octave/min from 5Hz to 100Hz last for 90 minutes each direction. Vibration frequency set as 1.5G, a sweep rate of 0.25 octave/min from 100Hz to 500Hz last for 20 minutes each direction.

8.3 Desquamation test

Use clamp to fix the module, measure the pull of the component in the module, make sure the module`s soldering is good.

8.4 Drop test

Free fall the module (condition built in a wrapper which can defend ESD) from 150cm height to cement ground, each side twice, total twelve times. The appearance will not be damaged and all functions OK.

7.5 Packaging information

After unpacking, the module should be stored in environment as follows:

- Temperature: 25℃ ± 2℃
- Humidity: <60%
- No acidity, sulfur or chlorine environment

The module must be used in four days after unpacking.

9. Layout and Soldering Considerations

9.1 Soldering Recommendations

FSC-BT616 is compatible with industrial standard reflow profile for Pb-free solders. The reflow profile used is dependent on the thermal mass of the entire populated PCB, heat transfer efficiency of the oven and particular type of solder paste used. Consult the datasheet of particular solder paste for profile configurations.

Feasycom will give following recommendations for soldering the module to ensure reliable solder joint and operation of the module after soldering. Since the profile used is process and layout dependent, the optimum profile should be studied case by case. Thus following recommendation should be taken as a starting point guide.

8.2 Layout Guidelines

It is strongly recommended to use good layout practices to ensure proper operation of the module. Placing copper or any metal near antenna deteriorates its operation by having effect on the matching properties. Metal shield around the antenna will prevent the radiation and thus metal case should not be used with the module. Use grounding vias separated max 3 mm apart at the edge of grounding areas to prevent RF penetrating inside the PCB and causing an unintentional resonator. Use GND vias all around the PCB edges.

The mother board should have no bare conductors or vias in this restricted area, because it is not covered by stop mask print. Also no copper (planes, traces or vias) are allowed in this area, because of mismatching the on-board antenna.

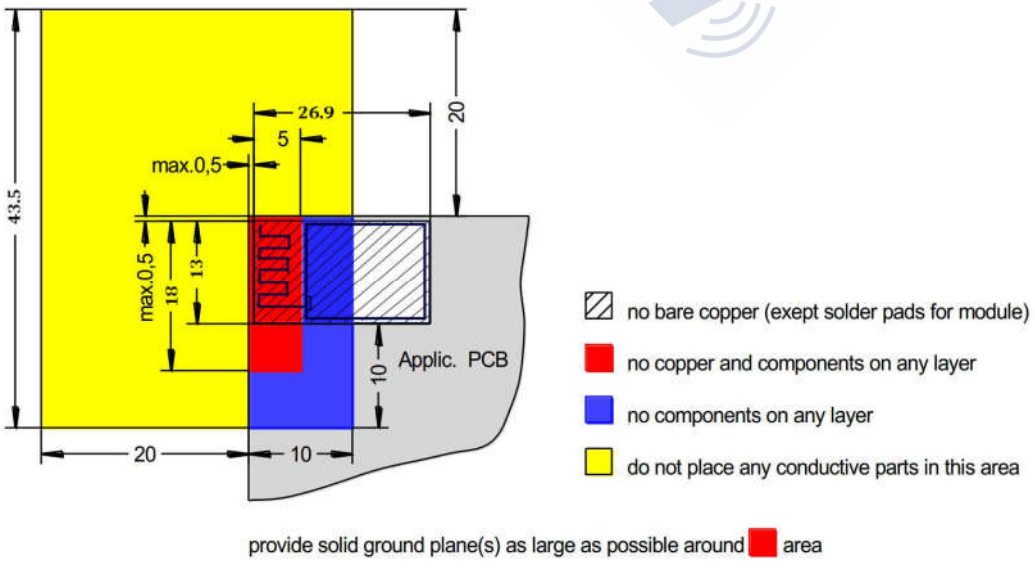


Figure 8: FSC-BT616 Restricted Area

Following recommendations helps to avoid EMC problems arising in the design. Note that each design is unique and the following list do not consider all basic design rules such as avoiding capacitive coupling between signal lines. Following list is aimed to avoid EMC problems caused by RF part of the module. Use good consideration to avoid problems arising from digital signals in the design.

Ensure that signal lines have return paths as short as possible. For example if a signal goes to an inner layer through a via, always use ground vias around it. Locate them tightly and symmetrically around the signal vias. Routing of any sensitive signals should be done in the inner layers of the PCB. Sensitive traces should have a ground area above and under the line. If this is not possible, make sure that the return path is short by other means (for example using a ground line next to the signal line).

10. Product Packaging Information

10.1 Packing

a, Tray vacuum

b, Tray Dimension: 180mm * 195mm

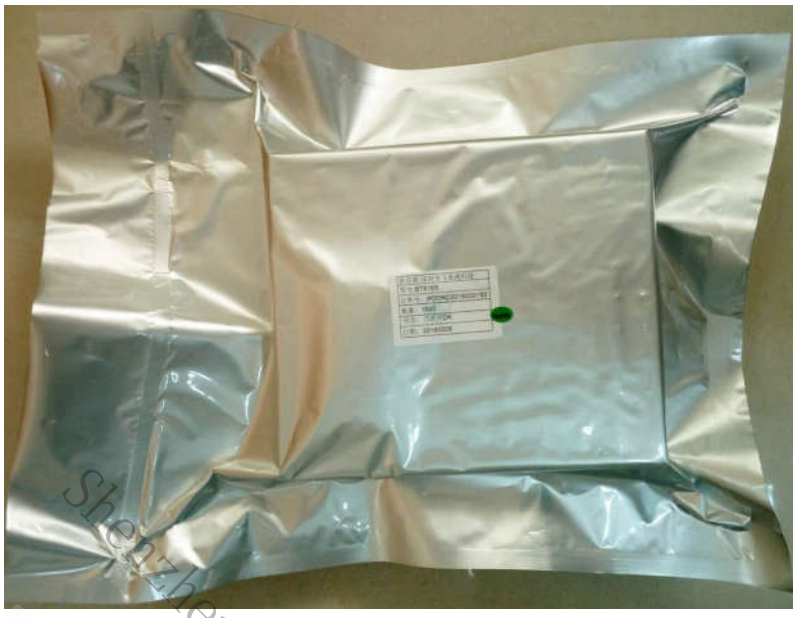
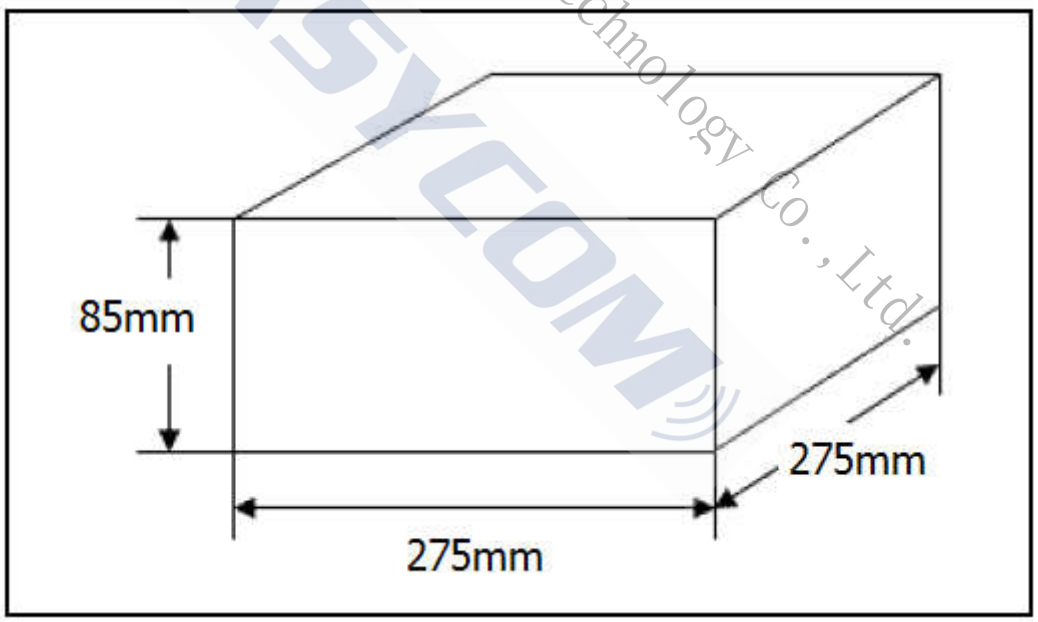


Figure 9,10,11: Product Packaging Information (Tray)

9.2 Packing box(Optional)



* If require any other packing, must be confirmed with customer

Figure 12: Packing Box

11. Application Schematic