GOC-T76253

BLE Module Hardware Specification

深圳顾凯信息技术有限公司

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NOTES:

1.The module must use ladder steel net, and recommend ladder steel net thickness 0.16--0.20mm. The adaptability of the products is adjusted accordingly.
2.Before the use of the module, bake at 60 degrees centigrade and bake for 12 hours.

Release Record

Version Number	Release Date	Comments
V1.0	2019/12/11	Initial draft
V1.1	2020/05/04	Update Pin Description

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1. Introduction

The GOC-T76253 is goodocom Bluetooth LE SoC solution with internal Flash and audio support. It's completely RoHS-compliant.

The GOC-T76253 combines the radio frequency (RF), digital processing, protocols stack software and profiles for Bluetooth Low Energy (up to Bluetooth 5), BLE Mesh and 2.4GHz proprietary standard into a single SoC. The GOC-T76253 also has hardware OTA upgrades support and multiple boot switching, allowing convenient product feature roll outs and upgrades.

The GOC-T76253 is compatible with Bluetooth standard, supports BLE specification up to version 5.0, allows easy connectivity with Bluetooth Smart Ready mobile phones, tablets, laptops, which supports BLE slave and master mode operation, including broadcast, encryption, connection updates, and channel map updates.

The GOC-T76253 integrates hardware acceleration to support the complicated security operations required by Bluetooth, up to and including the 5.0 standard, without the requirement for an external DSP.

The GOC-T76253 supports single or dual analog microphones or digital microphone, and stereo audio output with enhanced voice performance for voice search and other such applications.

The GOC-T76253 also includes a full range of on-chip peripherals for interfacing with external components such as LEDs, sensors, touch controllers, keyboards, and motors. This makes it an ideal single-chip solution for BLE application such as wearable devices, smart lighting, and advanced remote controls.

2. Block Diagram

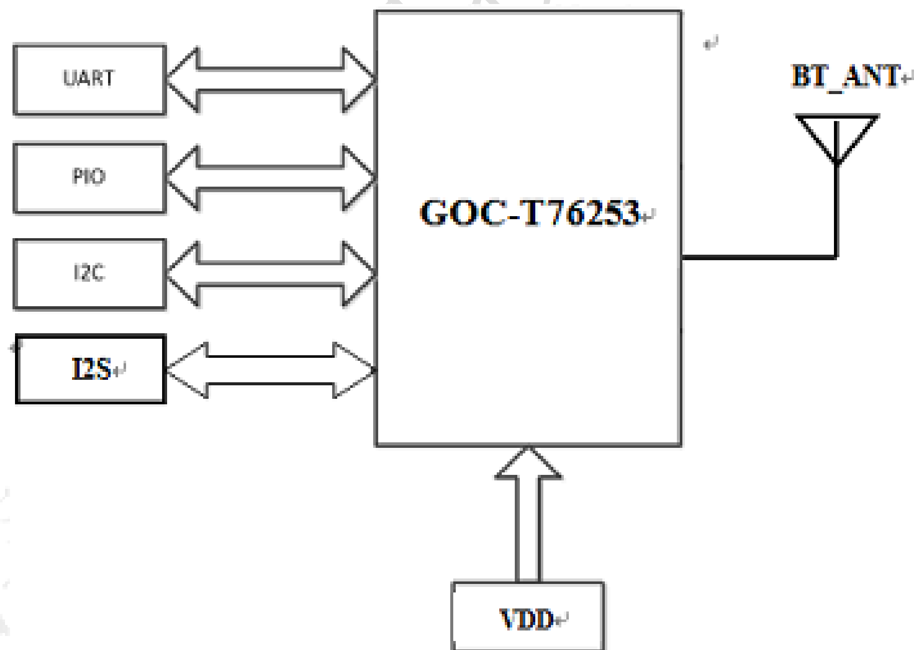

Figure 1: GOC-T76253 System Block Diagram

3. Features

3.1 RF Features

1) BLE/2.4GHz RF transceiver embedded, working in worldwide 2.4GHz ISM band.
2) Bluetooth 5.0 Compliant, 1Mbps and 2Mbps, Long Range 125kbps and 500kbps.
3) 2.4GHz proprietary 1Mbps/2Mbps/250kbps/500kbps mode with Adaptive Frequency Hopping feature support.
4) Rx Sensitivity: -96dBm@BLE 1Mbps, -93dBm @ BLE 2Mbps mode.
5) Tx output power: up to +10dBm.
6) Single-pin antenna interface.
7) RSSI monitoring with +/-1dB resolution.
8) Auto acknowledgement, retransmission and flow control.
9) Support single-antenna AOA/TX BLE location features.

3.2 Features Of Power Management Module

1) Power supply: 1.8V~3.6V.
2) Embedded LDO and DCDC.
3) Battery monitor: Supports low battery detection.
4) Multiple stage power management to minimize power consumption.
5) Low power consumption:
   Whole Module RX mode: 5.3mA
   Whole Module TX mode: 4.8mA @ 0dBm with DCDC
   Deep sleep with external wakeup (without SRAM retention): 0.4uA
   Deep sleep with SRAM retention: 1uA (with 8kB SRAM retention), 1.2uA (with 16kBSRAM retention), 1.4uA (with 32kB SRAM retention)

3.3 BLE features

1) Bluetooth 5 support
2) Bluetooth SIG Mesh support
3) Telink proprietary Mesh support
4) Telink extended profile with audio support for voice command based searches

3.4 BLE Mesh features

1) Compatible with Bluetooth SIG Mesh specification 1.0, with additional features from Telink enhanced design.
2) Support flexible mesh control, e.g. N-to-1 and N-to-M.
3) Supports switch control for over 200 nodes without delay.
4) Supports real time status update for over 200 nodes.
5) Secure and safe control and scalable identification within network.
6) 8/16 groups can be controlled at the same time.
7) 128/256 nodes within mesh network.
8) Configurable to more or fewer hops (e.g. 4 hops) within mesh network, single hop delay less than 15ms.
9) Flexible RF channel usage with both BLE advertising channels and data channels for good anti-interference performance

4. Application

The GOC-T76253 can be applied to Bluetooth Low Energy applications, such as BLE smart devices and BLE mesh devices.

Its typical applications include, but are not limited to the following:

- ✧ Smartphone and tablet accessories
- ✧ RF Remote Control
- ✧ Sports and fitness tracking
- ✧ Wearable devices

5. Main Specification

Production	BLE Module
Type	GOC-T76253
Standard	Bluetooth 5.0
Frequency Range	2.4~2.48GHz
Modulation Method	GFSK
Max speed for transfer	Asynchronous: 723.2kbps/57.6kbps Synchronous: 433.9kbps/433.9kbps
Hop	1600hops/sec, 1MHz channel space
Output impedance	50 ohms
Crystal Frequency	24MHz
Outer interface	UART,GPIO ,I2C,I2S
Range for working distance	10 meters (33 files)
Receiving Sensitivity	-96dBm@BLE 1Mbps, -93dBm @ BLE 2Mbps
Out power	+10dBm
Size	12.0mm*12.0mm*2.20mm (L*W*H)
VDD	3.3V supply voltage
Temperature Range	-40 ℃ to +85 ℃

Table 1: Main Specification

6. Pin Diagram And Description

6.1 Pin Diagram

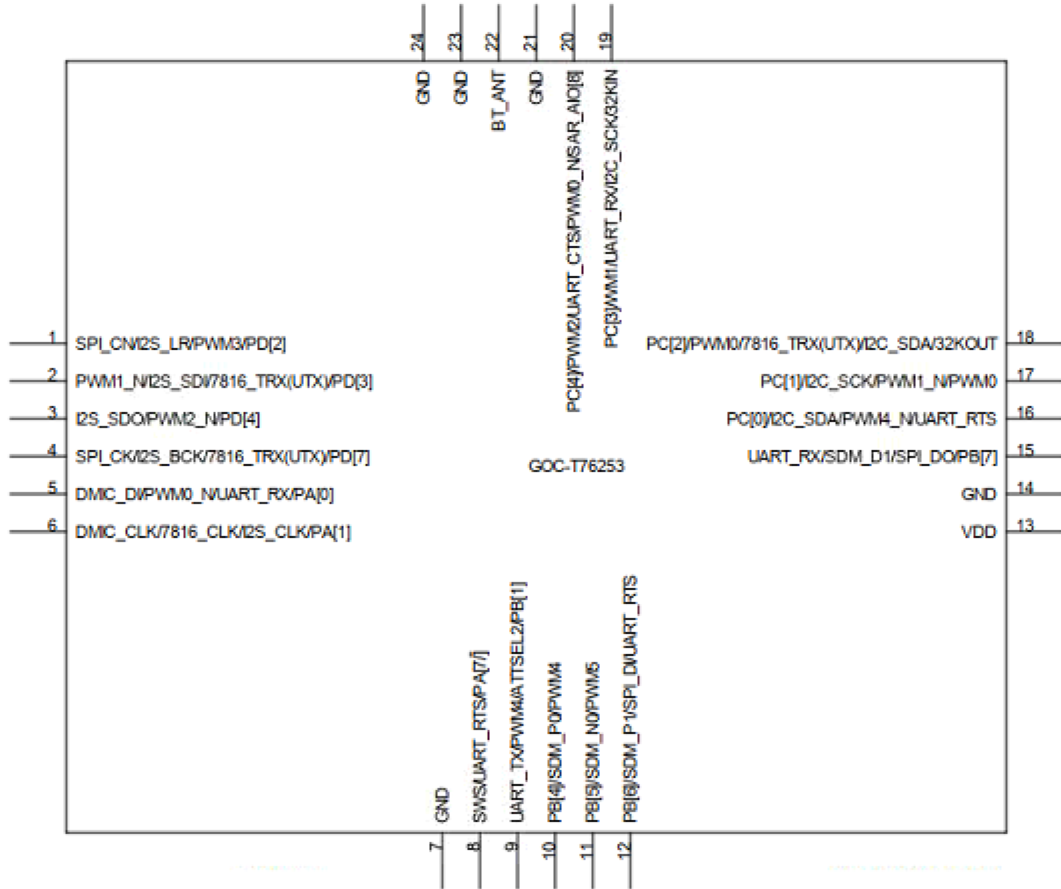

Figure 2: Pin Diagram

6.2 Pin Description

Pin	Name	I/O	Description
1	SPI_CN/I2S_LR/PWM3/PD[2]	Digital I/O	SPI_CN/I2S_LR/PWM3/PD[2]
2	PWM1_N/I2S_SDI/7816_TRX(UTX)/PD[3]	Digital I/O	PWM1_N/I2S_SDI/7816_TRX(UTX)/PD[3]
3	SWM/I2S_SDO/PWM2_N/PD[4]	Digital I/O	SWM/I2S_SDO/PWM2_N/PD[4]
4	SPI_CLK/I2S_BCK/7816_TRX(UTX)/PD[7]/ HOST_WAKEUP_BT	Digital I/O	SPI_CLK/I2S_BCK/7816_TRX(UTX)/PD[7]/ HOST_WAKEUP_BT
5	DMIC_DI/PWM0_N/UART_RX/PA[0]	Digital I/O	DMIC_DI/PWM0_N/UART_RX/PA[0]
6	DMIC_CLK7816_CLK/I2S_CLK/PA[1]	Digital I/O	DMIC_CLK7816_CLK/I2S_CLK/PA[1]
7	GND	GND	Ground
8	SWS/UART_RTS/PA[7]	Digital I/O	SWS/UART_RTS/PA[7]

9	UART_TX/PWM4/ATSEL2/PB [1]	Digital I/O	UART_TX/PWM4/ATSEL2/PB[1]
10	/PB[4/]SDM_P0/PWM4	Digital I/O	/PB[4/]SDM_P0/PWM4
11	PB[5]/SDM_N0/PWM5	Digital I/O	PB[5]/SDM_N0/PWM5
12	PB[6]/SDM_P1/SPI_DI/UART_ RTS	Digital I/O	PB[6]/SDM_P1/SPI_DI/UART_RTS
13	VDD	POWER	3.3V supply voltage
14	GND	GND	Ground
15	UART_RX /SDM_D1_SPI_DO /PB[7]	Digital I/O	UART_RX /SDM_D1_SPI_DO /PB[7]
16	PC[0]/I2C_SDA/PWM4_N/UA RT_RTS	Digital I/O	PC[0]/I2C_SDA/PWM4_N/UART_RTS
17	PC[1]/I2C_SCK/PWM1_N/PW M0	Digital I/O	PC[1]/I2C_SCK/PWM1_N/PWM0
18	PC[2]/PWM0/7816_TRX(UTX) /I2C_SDA/32KOUT	Digital I/O	PC[2]/PWM0/7816_TRX(UTX)/I2C_SDA/32KOUT
19	PC[3]/PWM1/UART_RX/I2C_ SCK/32KIN	Digital I/O	PC[3]/PWM1/UART_RX/I2C_SCK/32KIN
20	PC[4]/PWM2/UART_CTS/PW M0_N/sar_aio[8]	Digital I/O	PC[4]/PWM2/UART_CTS/PWM0_N/sar_aio[8]
21	GND	GND	Ground
22	BT_ANT	RF	Blueteeth antenna
23	GND	GND	Ground
24	GND	GND	Ground

Table 2: Pin Description

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6.3 PCB Layout Footprint

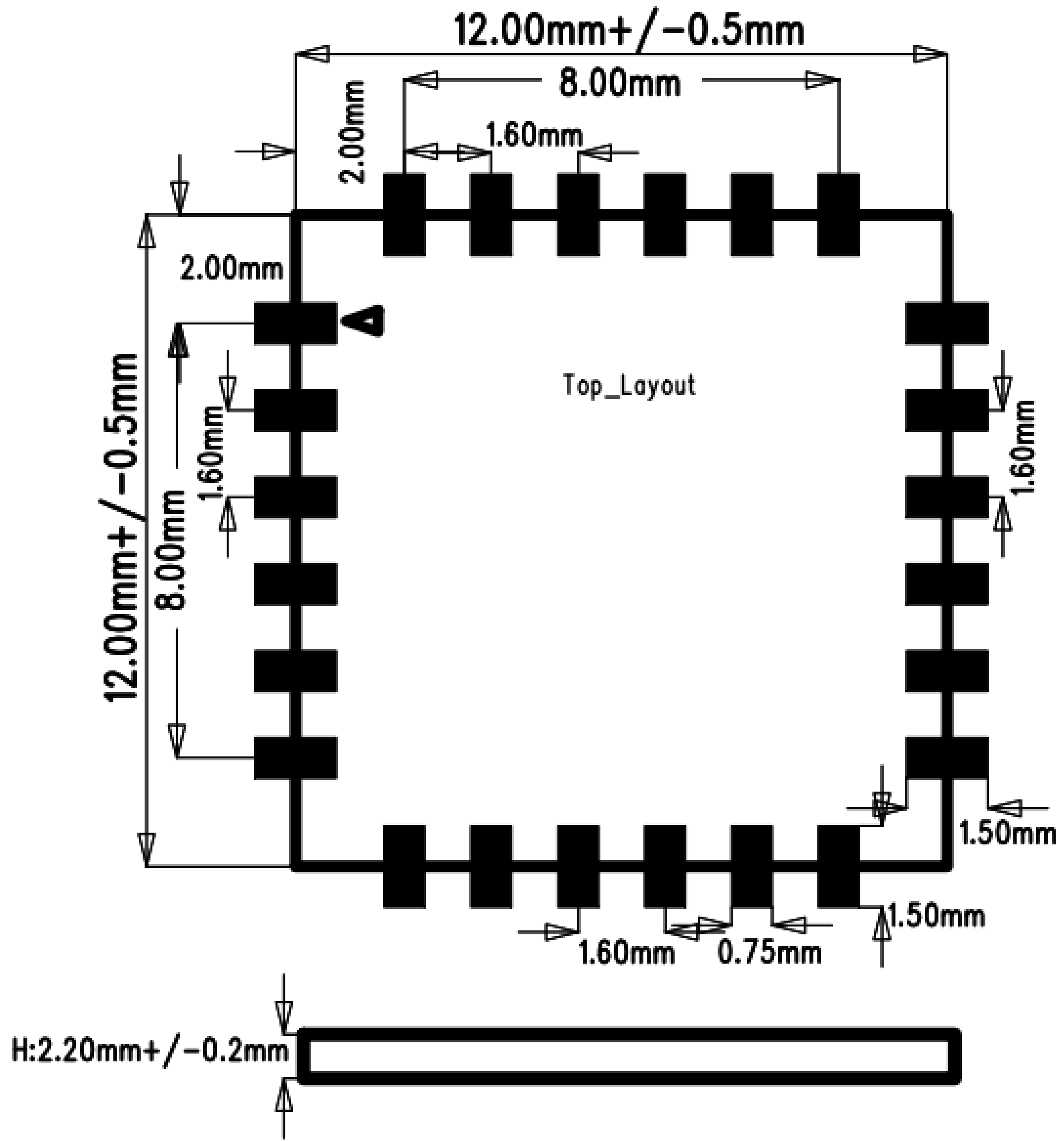

Figure 3: PCB Layout Footprint

7. Power Management

7.1 Power Up

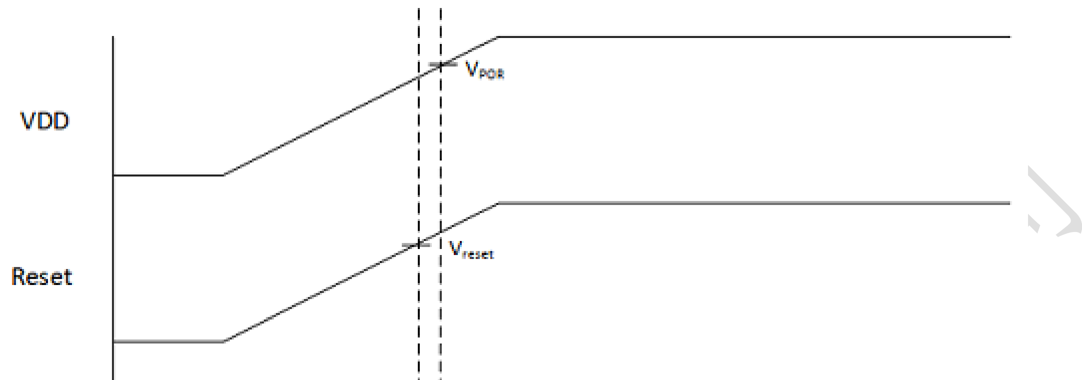

Figure 4: Power-Up Sequen

8. SWM and SWS

The GOC-T76253 supports Single Wire interface. SWM (Single Wire Master) and SWS (Single Wire Slave) represent the master and slave device of the single wire communication system developed by Telink. The maximum data rate can be up to 2Mbps.

9. I2C

The GOC-T76253 embeds I2C hardware module, which could act as Master mode or Slave mode. I2C is a popular inter-IC interface requiring only 2 bus lines, a serial data line (SDA) and a serial clock line (SCL).

10. UART Interface

The GOC-T76253 embeds UART (Universal Asynchronous Receiver/Transmitter) to implement full-duplex transmission and reception via UART TX and RX interface. Both TX and RX interface are 4-layer FIFO (First In First Out) interface.
Hardware flow control is supported via RTS and CTS.
The UART module also supports ISO7816 protocol to enable communication with ISO/IEC 7816 integrated circuit card, especially smart card. In this mode, half-duplex communication (transmission or reception) is supported via the shared 7816_TRX interface.

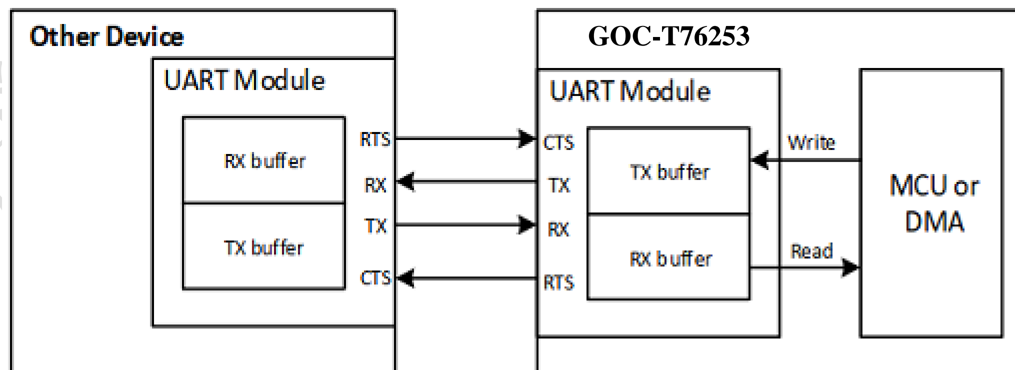

Figure 5: UART Communication

11. PWM

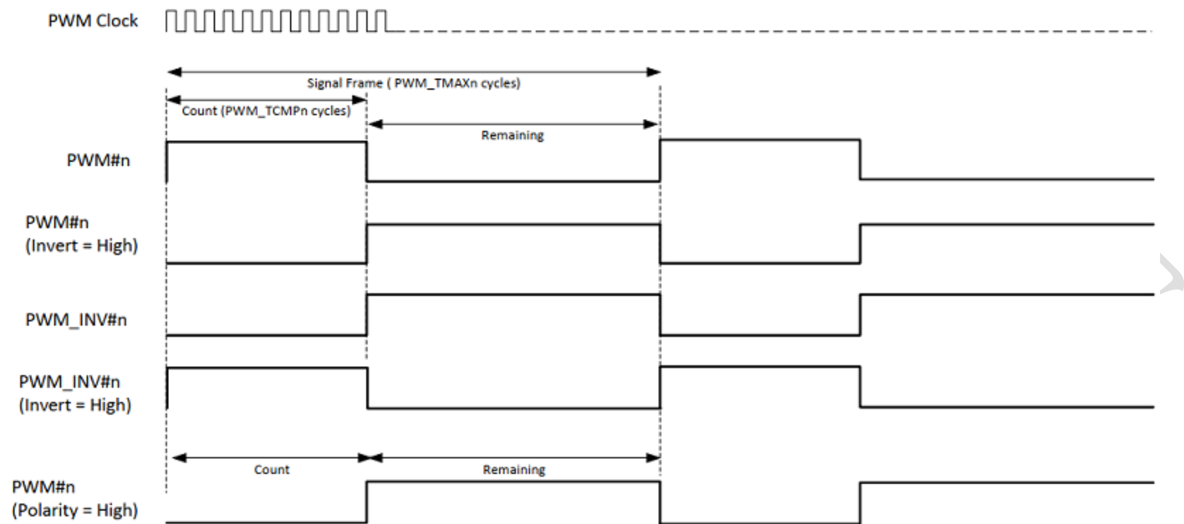

Figure 6: PWM Output Waveform Chart

12. Electrical Characteristics

12.1 Absolute Maximum Ratings

Ratings	Min	Typical	Max
VDD	1.8V	3.3V	3.6V

Table 4: Absolute Maximum Ratings

12.2 Recommended Operating Conditions

Working Conditions	Min	Typical	Max
VDD	3.135V	3.3V	3.465V
Working Temperature	-40 ℃	/	+85 ℃
Storage Temperature	-65 ℃	/	+150 ℃

Table 5: Recommended Operating Conditions

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12.3 DC characteristics

Table 6: DC characteristics (VDD=3.3V, T=25℃)

Item	Sym.	Min	Typ.	Max	Unit	Condition
RX current	I_{Rx}		5.3		mA	Whole Chip
TX current	I_{Tx}		4.8		mA	whole chip @ 0dBm with DCDC
Deep sleep with 8kB SRAM retention	I_{Deep1}		1		uA	
Deep sleep with 16kB SRAM retention			1.2		uA	
Deep sleep with 32kB SRAM retention			1.4		uA	
Deep sleep without SRAM retention	I_{Deep2}		0.4		uA	

12.4 AC characteristics

Item	Sym.	Min	Typ.	Max	Unit	Condition
Digital inputs/outputs						
Input high voltage	VIH	0.7VDD		VDD	V	
Input low voltage	VIL	VSS		0.3VDD	V	
Output high voltage	VOH	0.9VDD		VDD	V	
Output low voltage	VOL	VSS		0.1VDD	V	
RF performance						
Item		**Min**	**Typ**	**Max**	**Unit**	
RF frequency range		2380		2500	MHz	Programmable in 1MHz step
Data rate	BLE/2.4G Proprietary 1Mbps, ±250kHz deviation BLE/2.4G Proprietary 2Mbps, ±500kHz deviation 2.4G Proprietary 500kbps, ±125kHz deviation 2.4G Proprietary 250kbps, ±62.5kHz deviation					
BLE 1Mbps RF_Rx performance (±250kHz deviation)						
Sensitivity	1Mbps		-96		dBm	
Frequency Offset Tolerance		-250		+300	kHz	

Item	Sym.	Min	Typ.	Max	Unit	Condition
Co-channel rejection			-11		dB	Wanted signal at -67dBm
In-band blocking rejection (Equal Modulation Interference)	+1/-1 MHz offset		1/3		dB	Wanted signal at -67dBm
	+2/-2 MHz offset		37/39		dB	
	>=3MHz offset		42		dB	
Image rejection			37		dB	Wanted signal at -67dBm
BLE 1Mbps RF_Tx performance						
Output power, maximum setting			10		dBm	
Output power, minimum setting			-45		dBm	
Programmable output power range			55		dB	
Modulation 20dB bandwidth			2.5		MHz	
BLE 2Mbps RF_Rx performance (±500kHz deviation)						
Sensitivity	2Mbps		-93		dBm	
Frequency Offset Tolerance		-300		+200	kHz	
Co-channel rejection			-10		dB	Wanted signal at -67dBm

Item	Sym.	Min	Typ.	Max	Unit	Condition
In-band blocking rejection	+2/-2 MHz offset		6/6		dB	Wanted signal at -67dBm
	+4/-4 MHz offset		39/38		dB	
	>4MHz offset		42		dB	
Image rejection			25		dB	Wanted signal at -67dBm
BLE 2Mbps RF_Tx performance						
Output power, maximum setting			10		dBm	
Output power, minimum setting			-45		dBm	
Programmable output power range			55		dB	
Modulation 20dB bandwidth			1.4		MHz	
RSSI						
RSSI range		-100		10	dBm	
Resolution			1		dB	
24MHz crystal						
Nominal frequency (parallel resonant)	f_{NOM}		24		MHz	
Frequency tolerance	f_{TOL}	-20		+20	ppm	
Load capacitance	C_L	5	12	18	pF	Programmable on chip load cap
Equivalent series resistance	ESR		50	100	ohm	
32.768kHz crystal (only for TLSR8253F512ET/AT32)						
Nominal frequency (parallel resonant)	f_{NOM}		32.768		kHz	
Frequency tolerance	f_{TOL}	-100		+100	ppm	
Load capacitance	C_L	6	9	12.5	pF	Programmable on chip load cap

Equivalent series resistance	ESR		50	80	kohm	
24MHz RC oscillator						
Nominal frequency	f_{NOM}		24		MHz	
Frequency tolerance	f_{TOL}		1		%	On chip calibration
32kHz RC oscillator						
Nominal frequency	f_{NOM}		32		kHz	
Frequency tolerance	f_{TOL}		0.03		%	On chip calibration
Calibration time			3		ms	
ADC						
Differential nonlinearity	DNL			1	LSB	10bit resolution mode
Integral nonlinearity	INL			2	LSB	10bit resolution mode
Signal-to-noise and distortion ratio	SINAD		70		dB	fin=1kHz, fS=16kHz
Effective Number of Bits	ENOB		10.5		bits	
Item	**Sym.**	**Min**	**Typ.**	**Max**	**Unit**	**Condition**
Sampling frequency	Fs			200	ksps	

13. PCB Layout Recommendation

13.1 HCI UART Lines Layout Guideline

The following HCI line routing must obey the following rule to prevent overshoot/undershoot, as these lines drive 4 ~ 8mA
UART_RX UART_TX
The route length of these signals be less than 15 cm and the line impedance be less than 50Ω.

13.2 Power Trace Lines Layout Guideline

— VDD Trace Width: 20mil

13.3 Ground Lines Layout Guideline

— A Complete Ground in Ground Layer.
— Add Ground Through Holes to GOC-T76253Module Ground Pads
— Decoupling Capacitors close to GOC-T76253 Module Power and Ground Pads

14. Baking Recommendation

-Follow MSL Level 3 to do baking process.
-After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be：
a) Mounted within 168 hours of factory conditions ≤ 30°C/60% RH.
b) Stored at <10% RH.

-Devices require bake, before mounting, if Humidity Indicator Card is >10%, where read at 23 5℃.

If baking is required, Devices shall be baked for 5 hrs at 100 ℃.

15. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : ≦260℃ 10s

Number of Times : 2 times

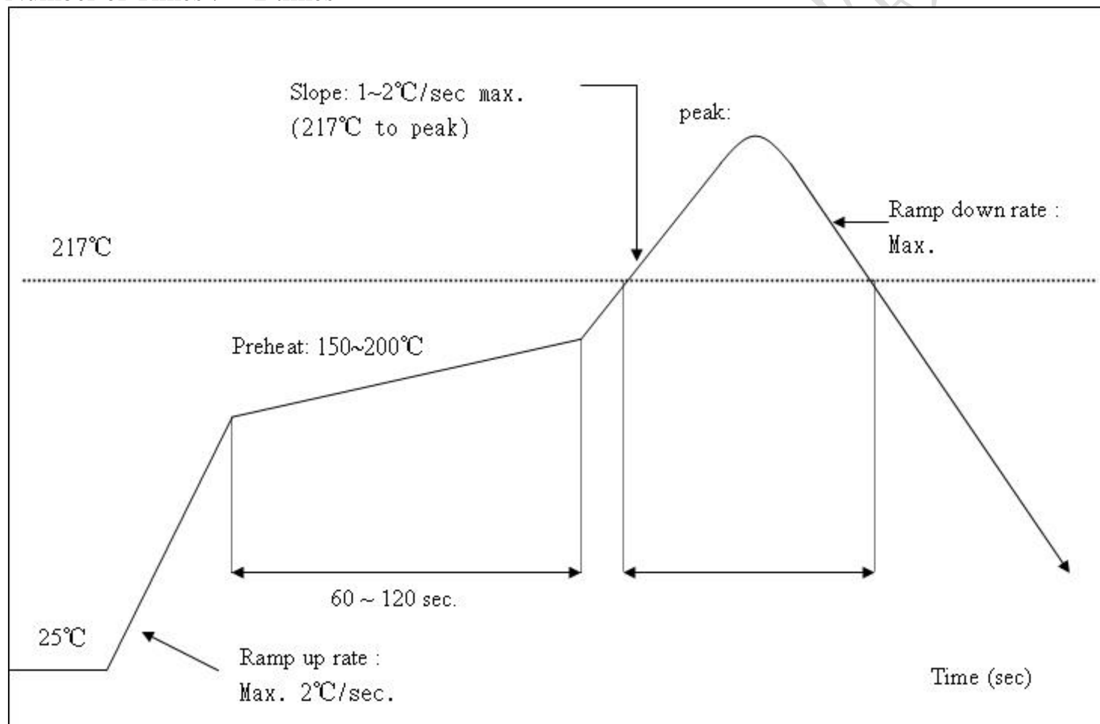

Figure 7: Solder Reflow Profile

16. Module Part Number Description

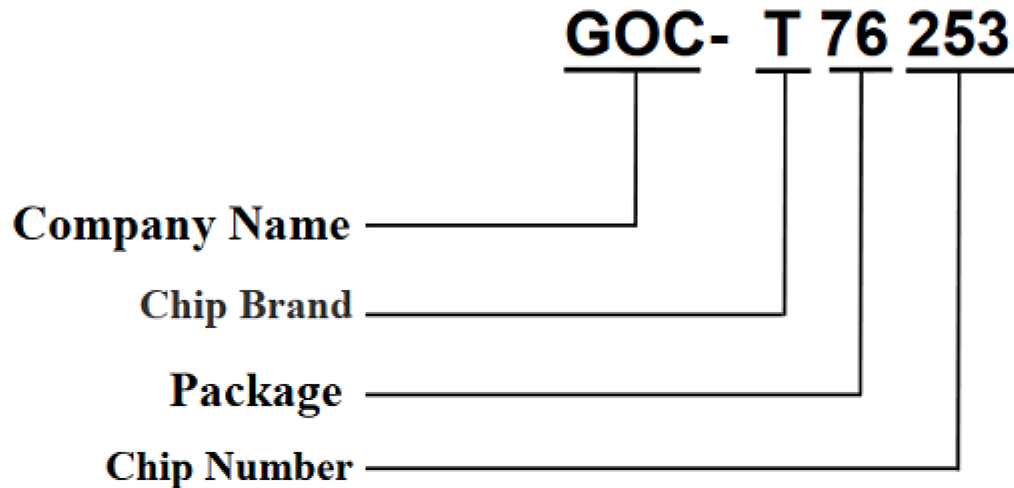

Figure 8: Module Part Number Description

For a list of available options (e.g. package, packing) and orderable part numbers or for further information on any aspect of this device, please go to *www.goodocom.com* or contact the GOODOCOM Sales Office nearest to you.

17. Ordering Information

Part Number	Description	Remark
GOC-T76253 V1.0	BLE Module	

Table 7: Ordering Information

18. Packaging Information

18.1 Net Weight

The module net weight: TBD

18.2 Package

TBD

18.3 Storage Requirements

1）Temperature: 22~28 ℃;
2 ）Humidity: <70%（ RH）;
Vacuum packed and sealed in good condition to ensure 12 months of welding.

18.4 Humidity Sensitive Characteristic

1） MSL: 3 level
2） Once opened, SMT within 168 hours in the condition of temperature: 22~28 ℃ and humidity<60%(RH).
3） Handling, storage, and processing should follow IPC/JEDECJ-STD-033