BT Qualification
QDID: 52727

ACI8107M0-BLE-MD40-V10 **module specification**

With 256KBytes In-system programmable flash memory

Version :V2.0

Revision History

Date	Revision Content	Revised By	Version
2016/11/12	Initial released	Jonathan Lin	V1.0
2017/06/27	Revise module parts number to ACI8107M0-BLE-MD40-V10	David Liao	V2.0

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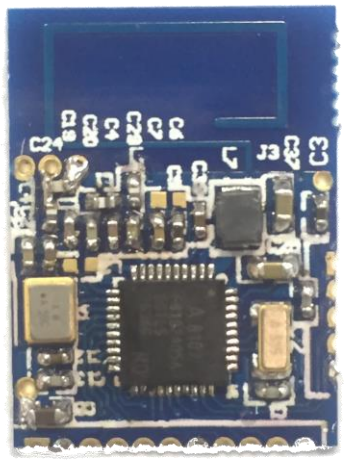
General Description

A8107M0 is a high performance and low cost 2.4GHz FSK/GFSK system-on-chip (SOC) wireless transceiver. With on chip fraction-N synthesizer, it can support the application of data rate from 5Kbps to 2Mbps and frequency hopping system and it is designed for Bluetooth Low Energy (Bluetooth 4.0 Single MODE). It is a Bluetooth smart device. This device integrates high ARM-M0 MCU, 256K Bytes In-system programmable flash memory, 32KB SRAM, various powerful functions and excellent performance of a leading 2.4GHz FSK/GFSK RF transceiver. It can be operated with wide voltage from 2.0V ~ 3.6V. A8107M0 has various operating MODEs, making it highly suited for systems where ultra-low power consumption is required. A8107M0 has 256K bytes flash that supports AES128 engine and CCM. For low current consumption, A8107M0 is integrated with both LDO and DC-DC (buck) so that this device can be operated more efficient when VDD voltage range from 2.7V to 3.6V. User can configure one of them (LDO or DC-DC) as a powered source for device operations. The device has 2 package sizes: QFN5X5 40 pin package and QFN6x6 48pin package

Application



- 2400 ~ 2483.5 MHz ISM frequency hopping system
- Helicopter and airplane radio controller
- Bluetooth smart device
- Wireless toy and gaming
- Smart remote controller
- Home and building automation
- Wireless keyboard and mouse

Features

- Package size (QFN5X5, 40 pins/ QFN6X6 48 pins).
- High performance ARM-M0 MCU
- Operation clock: 1, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64 of crystal oscillator.
- 256KB Flash memory with copy protection, 32KB SARM
- UART, I^2C, SPI serial communication
- Two 32-bit timers and one 32-bit dual MODE timer.
- Four Channel PWM
- Watchdog timer
- Two 16-bit Sleep timer
- In-Circuit Debugger
- In-System programming/ In-Application programming
- 23/31 GPIO for QFN40/48
- RX current consumption with MCU stop and DC-DC turn on: 6.2mA @REGI= 3.3V
- TX current consumption with MCU stop and DC-DC turn on: 9.3mA @ 5dBm, REGI=3.3V.
- Power saving MODE without sleep timer, no SRAM retention (1.3 uA)
- Power saving MODE with sleep timer, 16K SRAM retentio (2.1uA)
- Frequency band: 2400 – 2483MHz.
- FSK and GFSK modulation
- High sensitivity:
  - -97dBm at 500Kbps data rate
  - -94dm at 1Mbps data rate
  - -91dBm at 2Mbps data rate
- Programmable data rate 5K ~ 2Mbps.
- Fast settling time synthesizer for frequency hopping system.
- Built-in thermal sensor for monitoring relative temperature.
- Built-in one channel 8-bits ADC for external analog voltage. (0V ~ 0.9V).
- Built-in eight channels 12-bits ADC for general purpose analog input (0V ~ 1.8 V).
- Built-in Low Battery Detector.
- Support 16MHz crystal
- Easy to use.
  - Change frequency channel by one register setting.
  - 8-bits Digital RSSI for clear channel indication.
  - Auto RSSI measurement.
  - Auto WOR (wake up when receive RX packet).
  - Auto WOT (wake up to transmit TX packet).
  - Auto Calibrations.
  - Auto IF function.
  - Auto Frequency Compensation.
  - Auto CRC Check.
  - Separated 256 bytes RX and TX FIFO.

Electrical Specification

Item	Specification	Remark
Standard Bluetooth	BTLE V4.2	
Data Encryption	AES128 engine and CCM	
Antenna Type	Integrated Print circuit board antenna	
Supply voltage	2.0V~3.6V	
Current consumption (MCU in stop mode) With DC-DC	3.3uA @Sleep mode (PM1 with sleep timer) 0.7mA @Stand-by mode 4.2mA @PLL mode 6.6mA @Rx mode (AGC On) 9.8mA @Tx mode (2.5 dBm output) 11.3mA @Tx mode (5 dBm output)	typical
Frequency	2402 – 2480 MHz	ISM band
Transmit output power	2.5 dBm @ room temperature 5 dBm @ room temperature	Typical ***Annotation1***
Rx sensitivity	-93 dBm (typical) @ 1Mbps mode	BER≦1E-3
Modulation	GFSK	
Interface	16 pin 1.27mm header	
Dimension ACI8107M0-BLE-MD-V1.0	21mm(L) x 15.5mm(W) mm2 with Print circuit board Antenna	
Operating temperature	-40 ~ 85 ℃	

Absolute Maximum Ratings

Parameter	With respect to	Rating	Unit
Supply voltage range (VDD)	GND	-0.3 ~ 3.6	V
Digital IO pins range	GND	-0.3 ~ VDD+0.3	V
Voltage on the analog pins range	GND	-0.3 ~ 2.1	V
Input RF level		14	dB
Storage Temperature range		-55 ~ 125	°
ESD Rating	HBM	± 2K	V
	MM	± 100	V

*Stresses above those listed under “Absolute Maximum Rating” may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

*Device is ESD sensitive. Use appropriate ESD precautions. HBM (Human Body MODE) is tested under MIL-STD-883F Method 3015.7. MM (Machine MODE) is tested under JEDEC EIA/JESD22-A115-A.

*Device is Moisture Sensitivity Level III (MSL 3).

Electrical Specification in detail

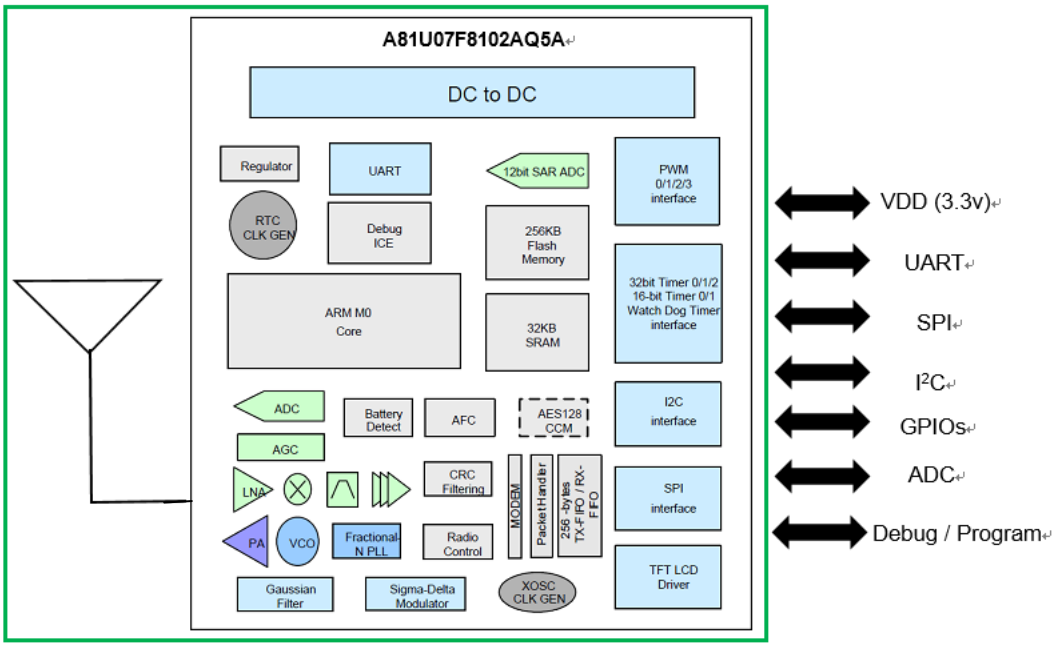
(Ta=25℃, **REGI = 3.3V,** unless otherwise noted)

Parameter	Description	Min.	Typ.	Max.	Unit
General					
Operating Temperature		-40		85	°C
Supply Voltage (REGI)	Regulator supply input	2.0		3.6	V
Current Consumption (MCU in stop MODE, and RF in sleep MODE)	PM1 with sleep timer		3.3		uA
	PM2 with sleep timer		3.3		uA
	PM3 with sleep timer, 16K SRAM retention		2.1		uA
	PM3 without sleep timer, 16K SRAM off		1.3		uA
Current Consumption (MCU in normal MODE) Without DC-DC MCU Clock @8MHz	Sleep MODE		3		mA
	Standby MODE		3.5		mA
	PLL MODE		9.5		mA
	RX MODE (AGC Off)		15		mA
	RX MODE (AGC On)		15.5		mA
	TX MODE (@5dBm output)		20		mA
Current Consumption (MCU in STOP MODE) Without DC-DC	Standby MODE		1.2		mA
	PLL MODE		5.8		mA
	RX MODE (AGC Off)		11.5		mA
	RX MODE (AGC On)		12.0		mA
	TX MODE (@5dBm output)		18.5		mA
Current Consumption (MCU in STOP MODE) With DC-DC	Standby MODE		0.7		mA
	PLL MODE		4.2		mA
	RX MODE (AGC Off)		6.2		mA
	RX MODE (AGC On)		6.6		mA
	TX MODE (@5dBm output)		9.3		mA
Synthesizer block					
Crystal settling time	Idle to standby (XTAL SMD2016)		0.6		ms
Crystal frequency			16		MHz
Crystal tolerance			±20		ppm
Crystal Load Capacitance			9		pF
Crystal ESR				80	ohm
PLL settling time	Standby to PLL		75		uS
Transmitter					
Carrier Frequency		2400		2483.5	MHz
Maximum Output Power			4		dBm
RF Power Control Range			20		dB
Out Band Spurious Emission[1]	30MHz~1GHz			-36	dBm
	1GHz~12.75GHz			-30	dBm
	1.8GHz~ 1.9GHz			-47	dBm
	5.15GHz~ 5.3GHz			-47	dBm
Frequency deviation	500Kbps		186K		Hz
	1M		250K		Hz
	2M		500K		Hz

Data rate		5K		2M	Bps
TX settling time	Standby to TX		120		µS
Receiver					
Receiver sensitivity @ BER = 0.1%	Data rate 2M (F_{IF} = 2MHz)		-91		dBm
	Data rate 1M (F_{IF} = 1MHz)		-94		dBm
	Data rate 500K (F_{IF} = 1MHz)		-97		dBm
IF frequency bandwidth			1200/2400		KHz
IF center frequency			1000/2000		KHz
Interference	Co-Channel (C/I_0)		11		dB
	1st Adjacent Channel (C/I_1)		2		dB
	2nd Adjacent Channel (C/I^2)		-18		dB
	3rd Adjacent Channel (C/I_3)		-28		dB
	Image (C/IIM)		-12		dB
Maximum Operating Input Power	@RF input (BER=0.1%)			0	dBm
RX Spurious Emission	30MHz~1GHz			-52	dBm
	1GHz~12.75GHz			-47	dBm
RSSI Range with AGC turn on	@RF input	-100		-10	dBm
RX settling time	Standby to RX		130		µS
12Bit SAR ADC					
Input voltage range		0		1.8	V
External reference voltage			1.8		V
Input capacitor			25		pF
Bandwidth			200		KHz
EOB, effective number of bits			10		bit
INL			+/- 2		LSB
DNL			+/-1		LSB
Conversion time		128		8	uS
Current consumption			0.4		mA
Regulator					
Regulator settling time			200		µS
Band-gap reference voltage			1.21		V
Regulator output voltage			1.21		V
Digital IO DC characteristics					
High Level Input Voltage (V_{IH})		0.8*VDD		VDD	V
Low Level Input Voltage (V_{IL})		0		0.2*VDD	V
High Level Output Voltage (V_{OH})	@I_{OH}= -0.5mA	VDD-0.4		VDD	V
Low Level Output Voltage (V_{OL})	@I_{OL}= 0.5mA	0		0.4	V
DC-DC Buck converter					
Input voltage range		2.0		3.6	V
Output voltage		1.5	1.6	1.8	V
Efficiency (with 100 ohm load @ 3.0V input.)	PWM MODE		89		%
Efficiency (with 100 ohm load @ 3.6V input.)	PWM MODE		86		%
Maximum load current				50	mA

M0 Module Block Diagram

ACI8107M0-BLE-MD-V1.0



Interface Descriptions

J1 :

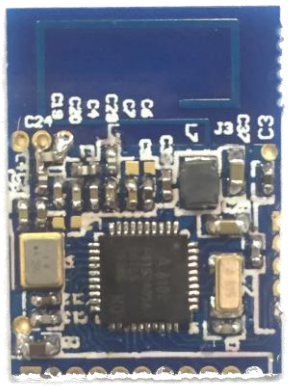
Pin No.	Symbol	Function Description	Remark
1	RESETN	RESETN input	
2	P0.20	UART2_RX / PWM0 / LCD_nWR/ s_LCD_SCL	
3	P0.17	UART0_TX / LCD_A0	
4	P0.16	UART0_RX / LCD_nCS	
5	P0.7	SWCLKTCK	

J2 :

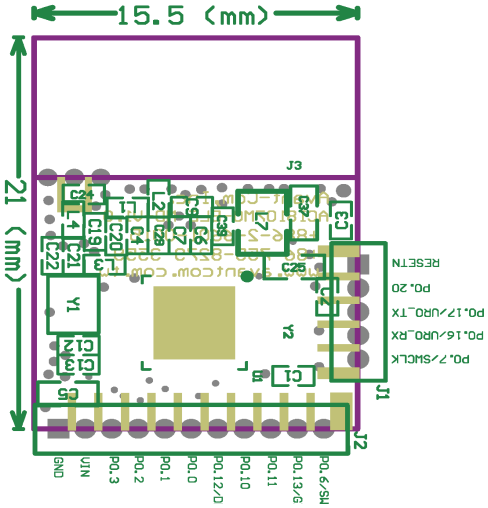
Pin No.	Symbol	Function Description	Remark
1	GND	GND	
2	VIN	Voltage IN	2.0 ~ 3.6V
3	P0.3	SPI_SCK	
4	P0.2	SPI_MOSI	
5	P0.1	SPI_MISO	
6	P0.0	SPI_CS	
7	P0.12	ADC4 / ICE_MODE / LCD_nRD	
8	P0.10	PWM2 / I2C_SCL	
9	P0.11	PWM3 / I2C_SDA / LCD_TE	
10	P0.13	ADC5 / BB_GIO1 / LCD_Data[2]	
11	P0.6	SWDIOTMS	

Outline TOP View

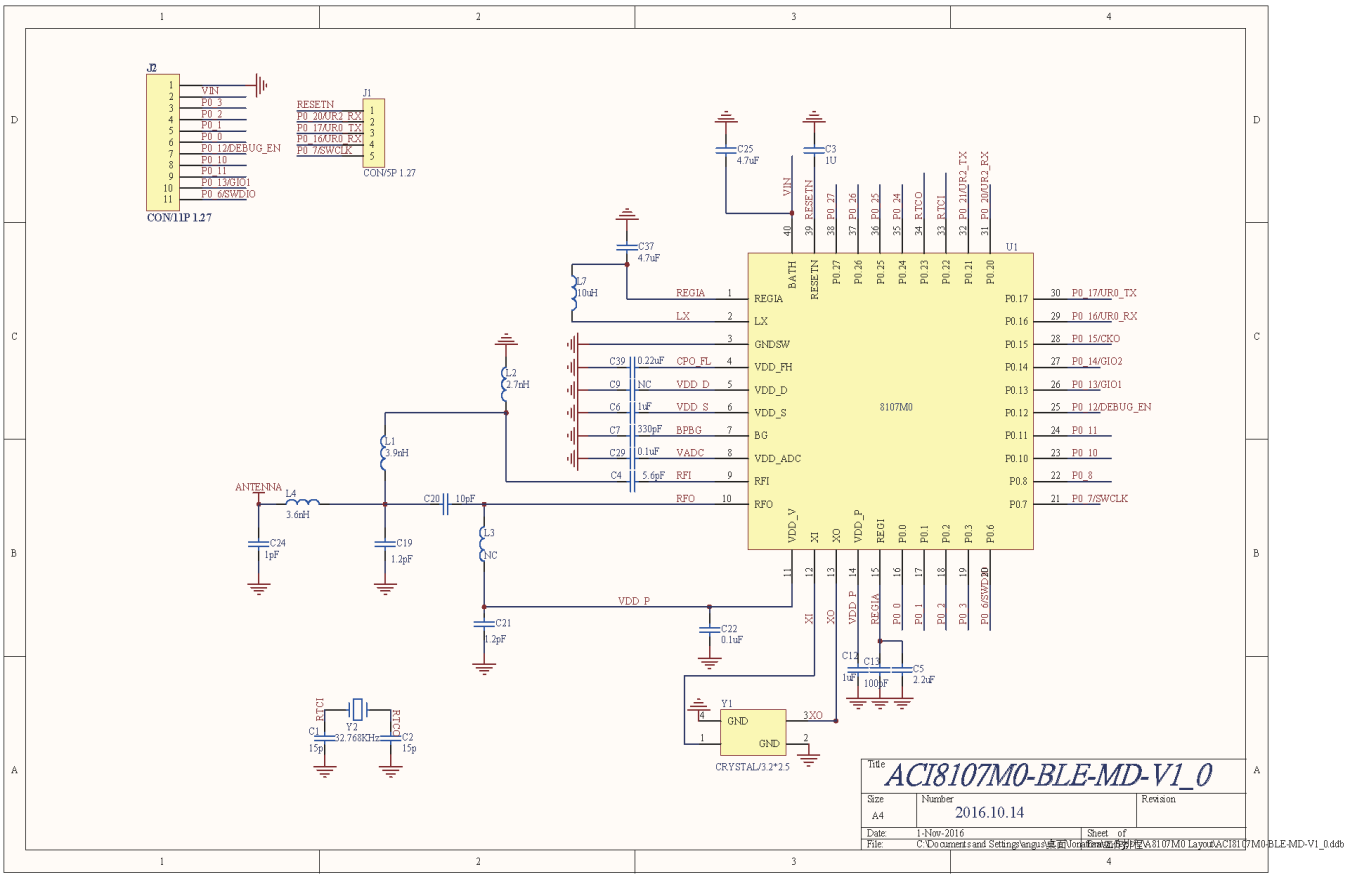
ACI8107M0-BLE-MD-V1.0



Dimension information



Schematic



Bill of Material

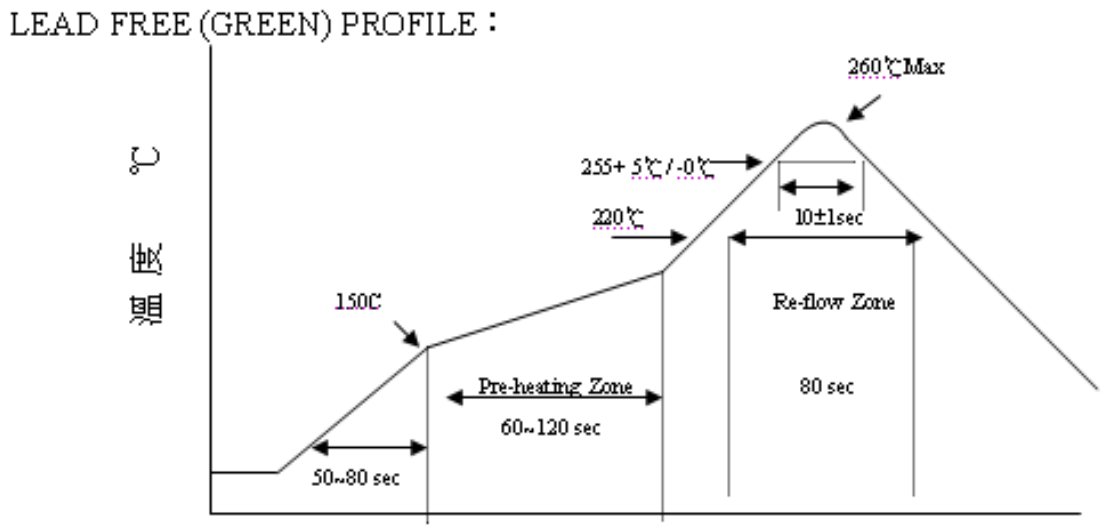
Item	Component	Description	Size	Value	Tol.	Manufacturer	Manufacturer
1	C1, C2	C0G ceramic	0402	15pF	±5%	Murata	GRM1555C1H150J
2	C3, C6, C12	X5R ceramic	0402	1uF	±10%	Murata	GRM155R61A105K
3	C4	C0G ceramic	0402	5.6pF	± 0.25pF	Murata	GRM1555C1H5R6C
4	C5	Y5V ceramic	0603	2.2uF	±20%		
5	C7	C0G ceramic	0402	330pF	±5%	Murata	GRM1555C1H331J
6	C9, L3		0402	NC			
7	C13	C0G ceramic	0402	100pF	±5%	Murata	GRM1555C1H101J
8	C19, C21	C0G ceramic	0402	1.2pF	± 0.25pF	Murata	GRM1555C1H1R2C
9	C20	C0G ceramic	0402	10pF	±5%	Murata	GRM1555C1H100J
10	C22,C29	X7R ceramic	0402	0.1uF	±10%	Murata	GRM155R71C104K
11	C24	C0G ceramic	0402	1pF	± 0.25pF	Murata	GRM1555C1H1R0C
12	C25,C37	Y5V ceramic	0603	4.7uF	±20%		
13	C39	X7R ceramic	0402	0.22uF	±10%		
14	L1	Chip inductor	0402	3.9nH	±0.3nH	Murata	LQG15HS3N9S
15	L2	Chip inductor	0402	2.7nH	±0.3nH	Murata	LQG15HS2N7S
16	L4	Chip inductor	0402	3.6nH	±0.3nH	Murata	LQG15HS3N6S
17	L7	Chip inductor	0806	10uH	±20%	GOTREND(高創)	LQH2HPN100MGR
18	U1		QFN 40	A8107M0		Amiccom	
19	Y1	Crystal	2.0 x1.6mm	16MHz,	±10ppm	台灣嘉碩(TST)	Annotation1
20	Y3	Crystal	3.2 x1.5mm	32.768KHz	±20ppm		

Annotation1:

1. A8107M0 has built-in crystal loading. User can set VCOSC[5:0] to meet crystal loading requirement.

2. Recommend VCOSC = 10, if crystal load = 9pF

Reflow Profile



BTLE QDID Profile Certification Numbers

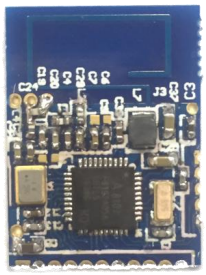
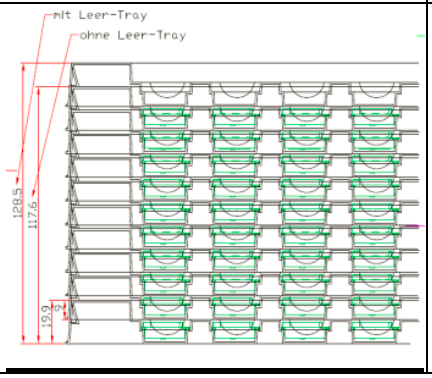
Bluetooth(R) SIG Qualifications			
QDID	Product Type	Design Name	Design Description
52727	Controller Subsystem	A8105 controller subsystem-4.0	A8105 / A8107 (RF compatible w. A8105) is a high speed 51 family SOC w. single mode Bluetooth low energy (BLE) RF transceiver
45008	Host Subsystem	AMC_BLE Host	A host subsystem for Bluetooth 4.0 LE
49896	Profile Subsystem	AMC_BLE Profile SPL01	A profile subsystem for Bluetooth 4.0 LE
51582	Profile Subsystem	AMC_BLE Profile SPL02	A profile subsystem for Bluetooth 4.0 LE (expansion)
62785	Profile Subsystem	AMC_BLE Profile SPL03	A profile subsystem for Bluetooth 4.1 LE

Note: Profile subsystem QDID is needed only if SIG standard profile is used.

All subsystem by AMICCOM

Order & Shipping Packing information

Item	Module Part No.	dimension	N.W	MOQ	Tray	Vacuum Bag	Carton	Remark
1	ACI8107M0-BLE-MD-V1.0	15.5 x 21 mm	mg	1000PCS	100 pcs	1000pcs/10Tray	5000pcs/5 Bag	Integrated PCB Antenna

Module	**Tray**	**Stacked trays(**Vacuum Bag)	**Packing carton**
15.5 x 21 mm(PCB Antenna)	300 x 230 x 11(H)mm	300 x 230 x 50(H)mm	380 x 270 x 270(H)mm
			

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