BCM-DC100-AS

Specification

Revision 1.0 2021/06/02

BnCOM Co.,Ltd.

List of Contents

1. General

1.1 Overview

This specification covers Bluetooth module which complies with Bluetooth specification version 5.0 and integrates RF & Baseband controller in small package. This Module has deployed Cypress 20706 chipset.

All detailed specification including pin outs and electrical specification may be changed without notice.

1.2 Features

■ Bluetooth® v5.0 (Dual mode) specification compliant

■ Radio includes integrated balun and typical RF performance of 9dBm transmit power and -90 dBm receive sensitivity

■ Intergrated ARM Cortex-M3 32-bit processor

■ Embedded 4Mbit Flash

■ Serial interfaces: UART and I²C

■ PCM / I2S Audio Interface.

■ 8 GPIO Support include alternative 7 AIO

■ Competitive Size: 11mm x 16mm x 2.5mm : 30Pin

■ Operating temperature range (MAX -30℃ ~ 85℃)

1.3 Application

■ Game Controller

■ Mobile Payment

■ Smart Home

■ Remote Sensor

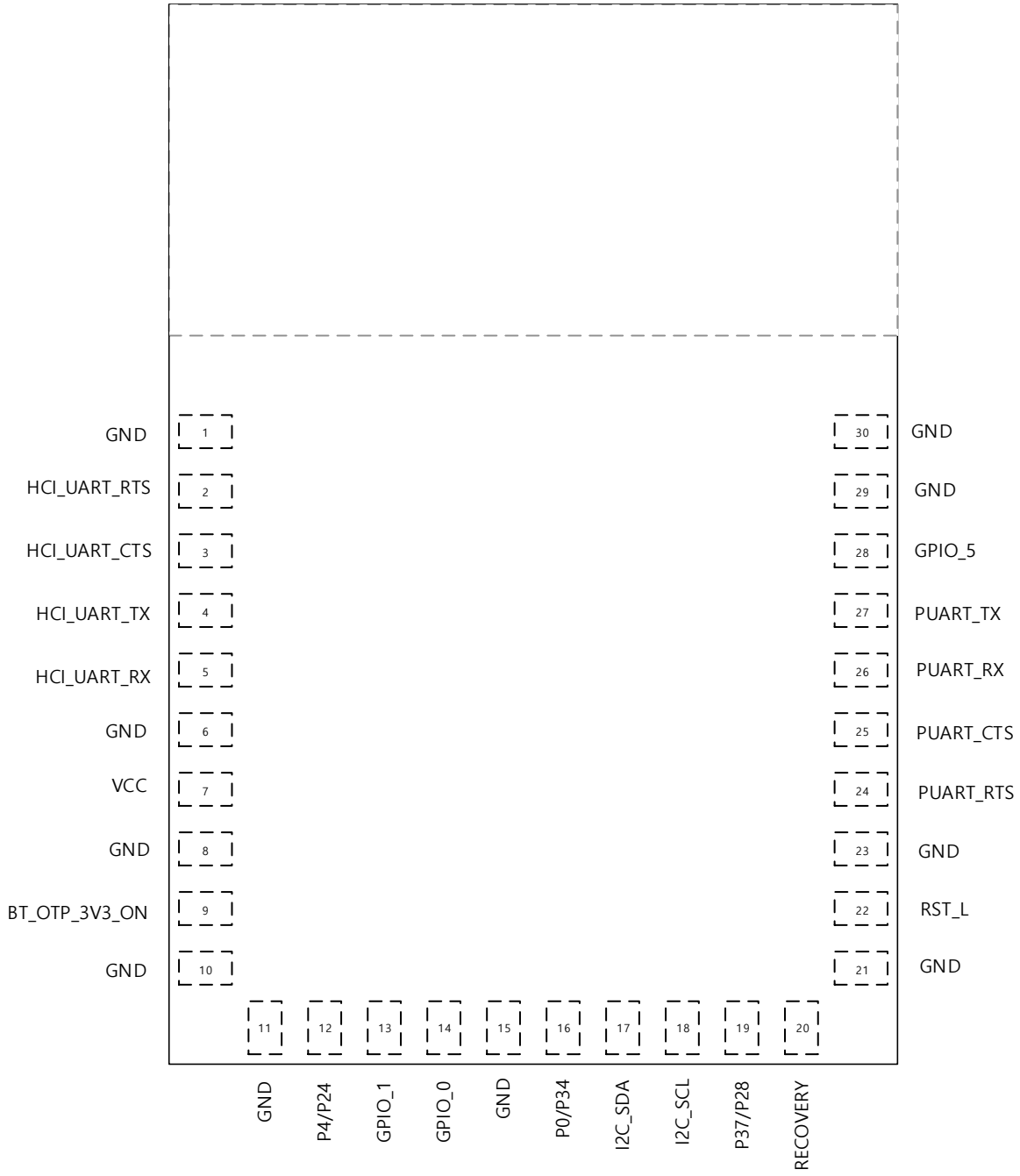
1.4 Certificate information

■ KC : (To be acquired in the near future)

■ TELEC : (To be acquired in the near future)

■ FCC: (To be acquired in the near future)

1.5 Pin Configuration



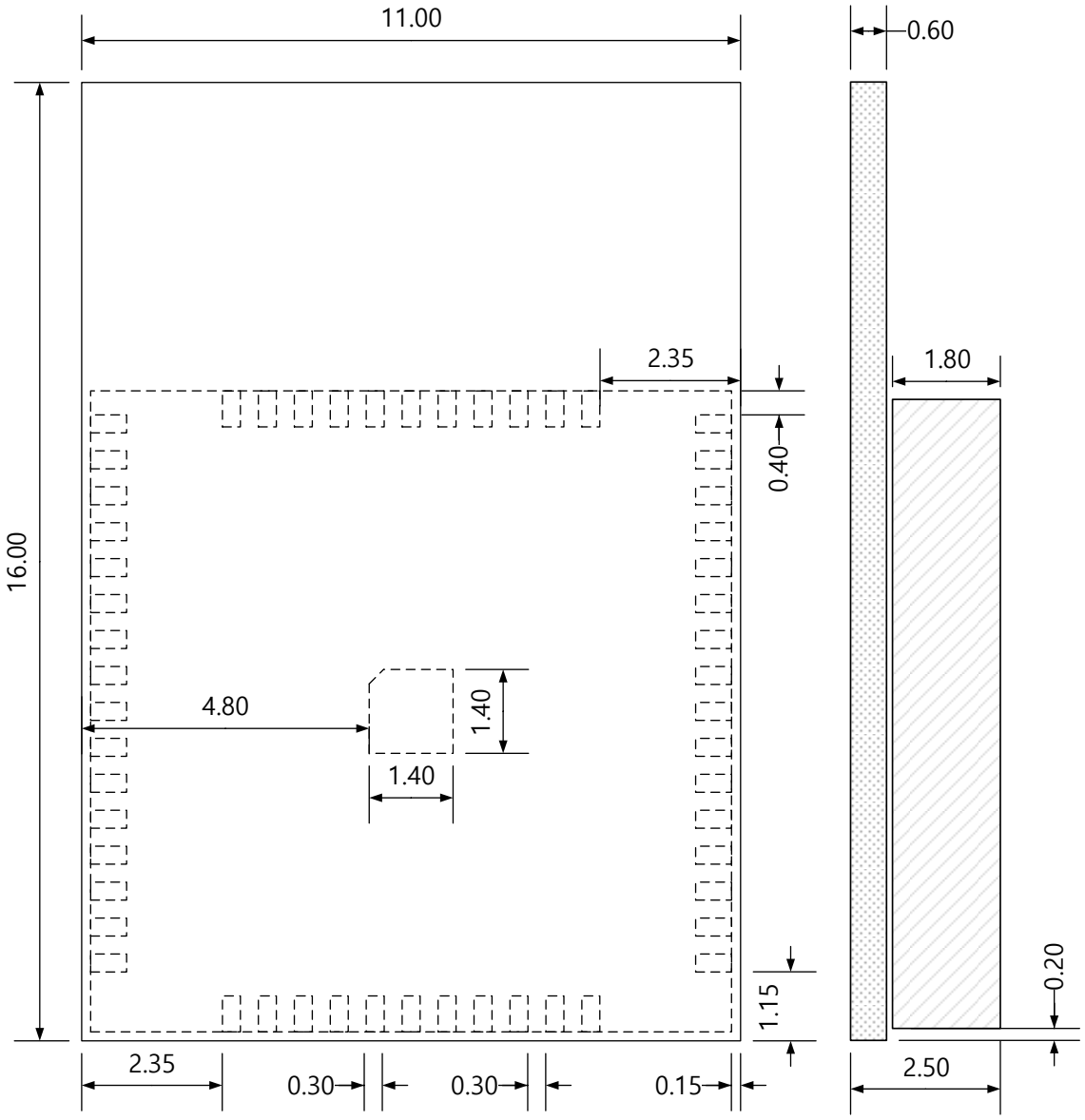
Pin Configuration (TOP VIEW)

1.6 Device Terminal Functions

Pin No	Function	Iinput / Output	Power Domain	Description
1	GND	-	N/A	Ground
2	HCI_UART_RTS	O	VDDO	UART request to send ouput
3	HCI_UART_CTS	I	VDDO	UART clear to send input
4	HCI_UART_TXD	O	VDDO	UART transmit data
5	HCI_UART_RXD	I	VDDO	UART receive data
6	GND	-	N/A	Ground
7	VCC	I	N/A	VBAT input pin. This must be less than or equal to VDDO.
8	GND	-	N/A	Ground
9	BT_OTP_3P3V_ON	I	N/A	3.3V OTP supply voltage
10	GND	-	N/A	Ground
11	GND	-	N/A	Ground
12	GPIO_P4	I/O	VDDO	GPIO_P4
	GPIO_P24	I/O		GPIO: P24
13	**GPIO_1**	O	VDDO	BT_GPIO_1/BT_HOST_WAKE A signal from the CYW20706 device to the host indicating that the Bluetooth device requires attention.
	P25	I/O	VDDO	GPIO: P25
	P32 ADC_7	I/O	VDDO	GPIO: P32 A/D converter input 7
14	**GPIO_0**	I	VDDO	BT_GPIO_0/BT_DEV_WAKE A signal from the host to the CYW20706 that the host requires attention.
	P36 ADC_3	I/O	VDDO	GPIO: P36 A/D converter input 3 Auxiliary Clock Output: ACLK0
	P38 ADC_1	I/O	VDDO	GPIO: P38 A/D converter input 1
15	GND	-	N/A	Ground
16	I2S_WS	I/O	VDDO	PCM sync/I2S word select
	P0 ADC_29	I/O	VDDO	GPIO: P0 A/D converter input 29
	P34 ADC_05	I/O	VDDO	GPIO: P34 A/D converter input 5
17	12S_DI **I2C_SDA**	I/O	VDDO	PCM/I2S data input. I2C_SDA
18	GPIO_12 ADC_23	I/O	VDDO	GPIO: P12 A/D converter input 23
	I2S_DO **I2C_SCL**	I/O	VDDO	PCM/I2S data output. I2C_SCL
	P3	I/O	VDDO	GPIO: P3
	P29 ADC_10 LED_2	I/O	VDDO	GPIO: P29 A/D converter input 10, LED2 Current: 16 mA sink
	P35 ADC_4	I/O	VDDO	GPIO: P35 A/D converter input 4
19	I2S_CLK	I/O	VDDO	PCM/I2S clock Fp1
	P2	I/O	VDDO	GPIO: P2
	P28 ADC_11 LED_1	I/O	VDDO	GPIO: P28 A/D converter input 11, LED1 Current: 16 mA sink
	P37 ADC_02	I/O	VDDO	GPIO: P37 A/D converter input 2
20	RECOVERY	I/O	VDDO	Recovery pin
21	GND	-	N/A	Ground
22	RST_L	I	VDDO	Active-low reset input
23	GND	-	N/A	Ground
24	PUART_RTS	I/O	VDDO	Peripheral UART: puart_rts
25	PUART_CTS	I/O	VDDO	Peripheral UART: puart_cts
26	PUART_RX	I/O	VDDO	Peripheral UART: puart_rx
27	PUART_TX	I/O	VDDO	Peripheral UART: puart_tx
28	GPIO_5	I/O	VDDO	General-purpose I/O
	P15 ADC_20	I/O	VDDO	GPIO: P15 A/D converter input 20
29	GND	-	N/A	Ground
30	GND	-	N/A	Ground

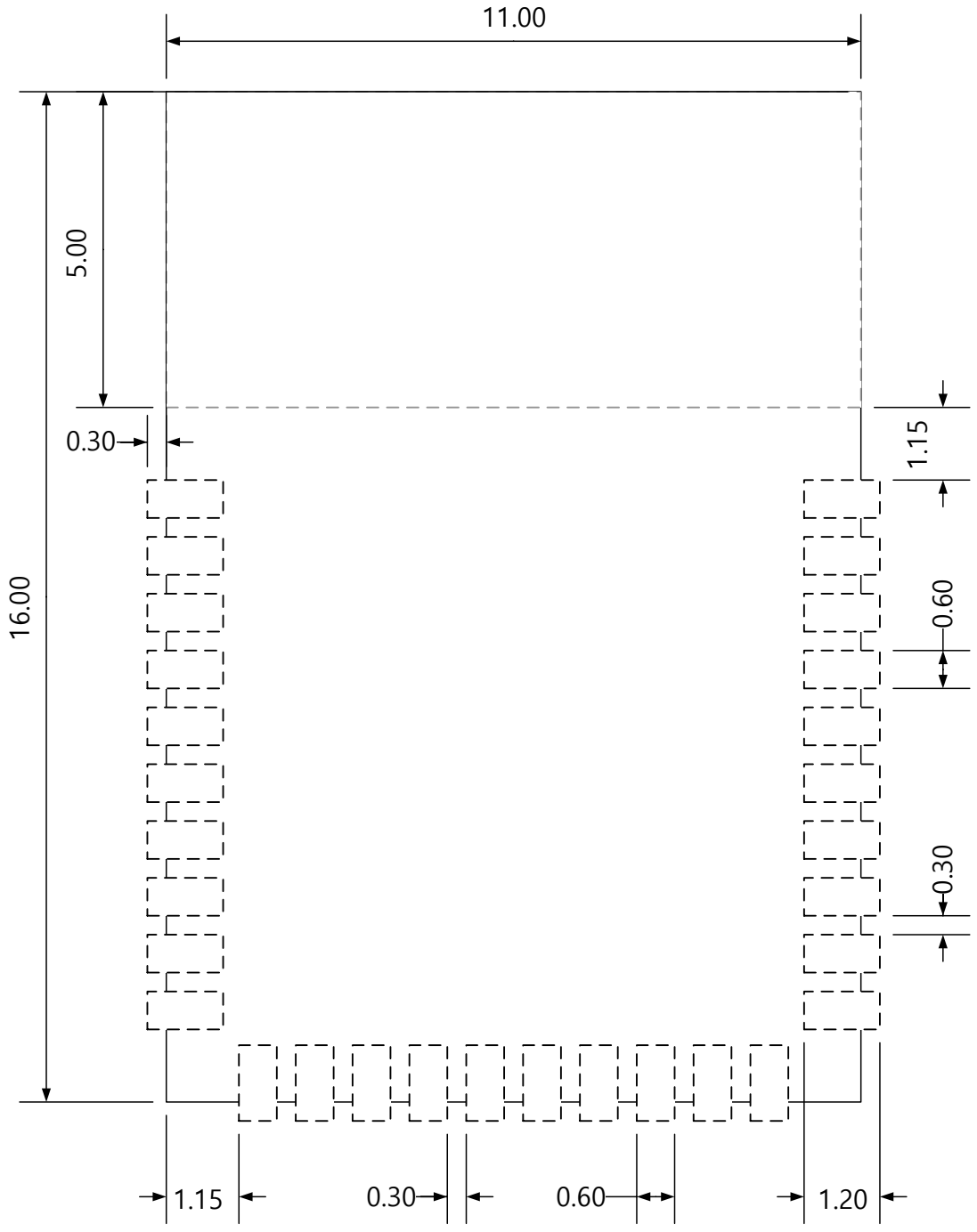
1.7 Package Dimensions & Land Pattern

- **unit = mm**
- **General Tolerances = ±0.2mm**



BCM-DC100-AS Package Dimensions

● **unit = mm**



< Land Pattern >

2. Characteristics

2.1 Electrical Characteristics

■ Absolute Maximum Ratings

ITEM	Min	Max	Unit
Storage Temperature range	-40	85	℃
VBAT	-0.5	3.795	V
BT_OTP_VDD3P3V	-0.5	3.795	V

■ Recommended Operating Conditions

ITEM	Min	TYP	Max	Unit
Operating Temperature range	-30	20	85	℃
VBAT	2.7	3.3	3.6	V
BT_OTP_VDD3P3V	3.0	3.3	3.6	V

■ Digital Terminals

ITEM	Min	TYP	Max	Unit
Input Voltage Levels				
Input logic level low (V_{IL})	-	-	0.8	V
Input logic level high (V_{IH})	2.0	-	-	V
Output Voltage Levels				
output logic level low (V_{OL})	-	-	0.4	V
output logic level high (V_{OH})	VBAT-0.4V	-	-	V
Input Currents				
Input Current level Low(I_{IL})	-	-	1.0	uA
Input Current level High(I_{IH})	-	-	1.0	uA
Output Currents				
Output Current level Low(I_{OL}), V_{OL} = 0.4V	-	-	2.0	mA
Output Current level High, V_{OH} = 2.9V	-	-	4.0	mA
Input Capacitiance (C_{IN}),	-	-	0.4	pF

2.2 RF Characteristics

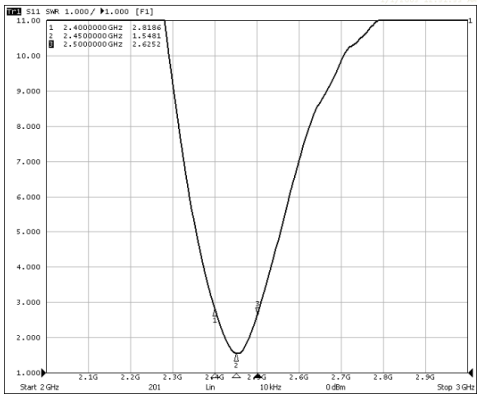
- Frequency Range : 2402 Mhz ~ 2480 Mhz
- Channels :
  Classic : 79CH
  BLE : 40CH
- Modulation :
  Classic : GFSK, π/4 DQPSK, 8DPSK
  BLE : GFSK
- Output Power :
  Classic : 8dBm, +/- 1.5dBm
  BLE : 8dBm, +/- 1.5dBm

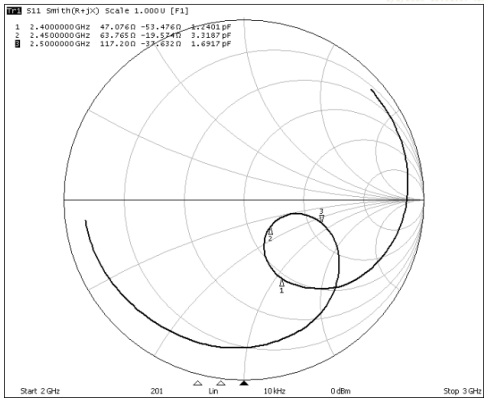
RF	Specification	Condition	Min	Typ	Max	Unit
Transmitter	Output transmit power	CH0	-	7.68	-	dBm
		CH39	-	6.51	-	dBm
		CH78	-	5.78	-	dBm
	Transmit power density		-	-1.13	-	dBm
	Transmit power control (power step)	CH0	2.92	-	4.04	dB
		CH39	2.34	-	4.06	dB
		CH78	2.45	-	4.19	dB
	Frequency Range f_l > 2400 , f_h < 2483.50	-	2401.417	-	2483.50	Mhz
	-20dB bandwidth for modulation (f_h – f_l <= 1Mhz)	CH0	-	0.914	-	Mhz
		CH39	-	0.914	-	Mhz
		CH78	-	0.906	-	Mhz
	Adjacent channel transmit power	+/- 2Mhz	-	-45.61	-	dBm
		+/- 3Mhz	-	-55.12	-	dBm
		+/- 4Mhz	-	-48.83	-	dBm
	Modulation characteristics 140Khz <= df1_avg, df2 pass rate >99.9% df2/df1 =>= 0.8	-	Δf1avg	Δf2 pass rate	Δf1avg/Δf2 avg	-
		CH0	154.1 Khz	100%	1.08	-
		CH39	153.1 Khz	100%	1.06	-
		CH78	151.9 Khz	100%	1.07	-
	Initial carrier frequency tolerance -75Khz <= df0_min df0_max = > 75Khz	CH0-	-13.9		-10.1	kHz
		CH39	-8.8		-3.3	kHz
		CH78	-7.8		-0.7	kHz
	Carrier frequency drift	DH1	-	-	4.5	kHz
		DH3	-	-	4.5	kHz
		DH5	-	-	4.5	kHz
Receiver	Sensitivity at 0.1% BER for all Basic rate packet type	CH0		-86		dBm
		CH39		-87		dBm
		CH78		-86		dBm

2.3 Antenna Characteristics

The antenna is Gradiant type of PCB antenna. The antenna impedance matching is optimized for 1 mm ~ 2 mm mother board PCB thickness. The radiation pattern is impacted by the layout of the mother board. Typically the highest gain is towards GND plane and weakest gain away from the GND plane.

S-Parameter





Radiation Gain

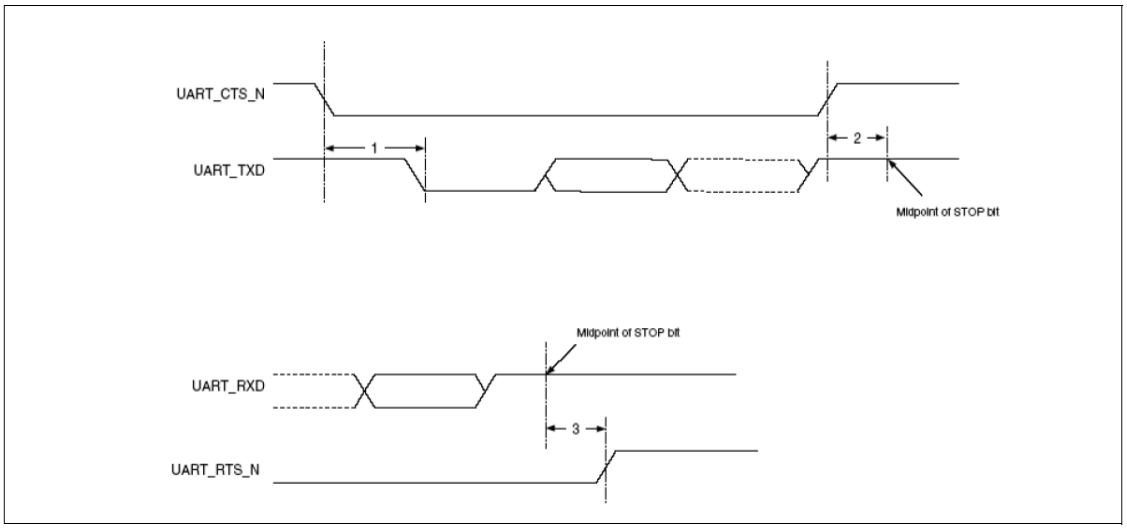
Average Efficiency	-3.68dBi	42.89%
Peak Gain	1.33dBi	

3. Terminal Description

3.1 UART Interface

3.1.1 UART Timing Specifications

Reference	Characteristics	Min	Max	Unit
1	Delay time, UART_CTS_N low to UART_TXD valid		24	Baud out cycles
2	Setup time, UART_CTS_N high before midpoint of stop bit		10	ns
3	Delay time, midpoint of stop bit to UART_RTS_N high		2	Baud out cycles



UART Timing

3.2 **PCM Interface**

The BCM-DC100-AS includes a PCM interface that shares pins with the I2S interface. The PCM Interface on the BCM-DC100-AS can connect
to linear PCM codec devices in master or slave mode. In master mode, the BCM-DC100-AS generates the PCM_CLK and PCM_SYNC
signals. In slave mode, these signals are provided by another master on the PCM interface and are inputs to the BCM-DC100-AS.

3.2.1 Slot Mapping

The BCM-DC100-AS supports up to three simultaneous full-duplex SCO or eSCO channels through the PCM interface. These three
channels are time-multiplexed onto the single PCM interface by using a time-slotting scheme where the 8 kHz or 16 kHz audio sample
interval is divided into as many as 16 slots. The number of slots is dependent on the selected interface rate (128 kHz, 512 kHz, or
1024 kHz). The corresponding number of slots for these interface rate is 1, 2, 4, 8, and 16, respectively. Transmit and receive PCM
data from an SCO channel is always mapped to the same slot. The PCM data output driver tristates its output on unused slots to allow
other devices to share the same PCM interface signals. The data output driver tristates its output after the falling edge of the PCM
clock during the last bit of the slot.

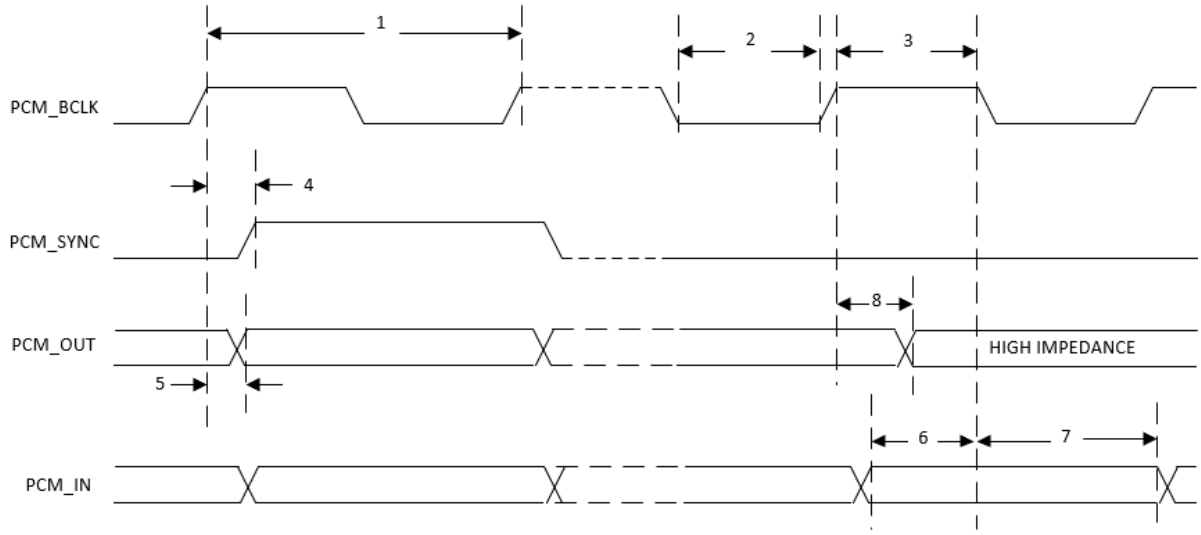
3.2.2 Frame Synchronization

The BCM-DC100-AS supports both short- and long-frame synchronization in both master and slave modes. In short-frame synchronization
mode, the frame synchronization signal is an active-high pulse at the audio frame rate that is a single-bit period in width and is
synchronized to the rising edge of the bit clock. The PCM slave looks for a high on the falling edge of the bit clock and expects the
first bit of the first slot to start at the next rising edge of the clock. In long-frame synchronization mode, the frame synchronization
signal is again an active-high pulse at the audio frame rate; however, the duration is three-bit periods and the pulse starts coincident with the first bit of the first slot.

3.2.3 Data Formatting

The BCM-DC100-AS may be configured to generate and accept several different data formats. For conventional narrowband speech mode,
the BCM-DC100-AS uses 13 of the 16 bits in each PCM frame. The location and order of these 13 bits can be configured to support various
data formats on the PCM interface. The remaining three bits are ignored on the input and may be filled with 0s, 1s, a sign bit, or a
programmed value on the output. The default format is 13-bit 2's complement data, left justified, and clocked MSB first.

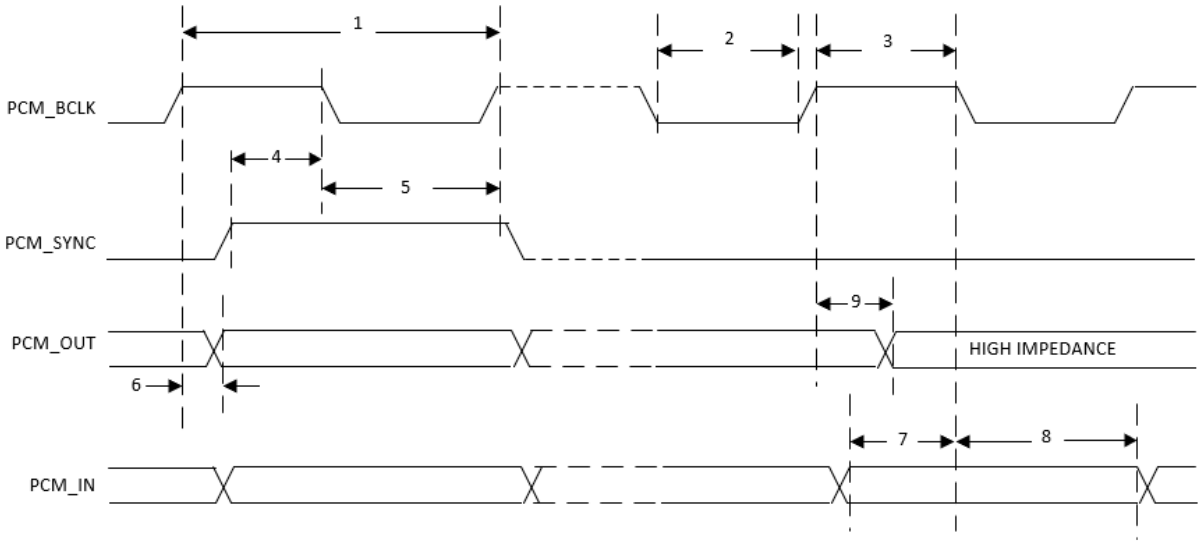
3.2.4 PCM Interface Timing



PCM Timing Diagram(Short Frame Sync, Master mode)

Reference	Characteristics	Min	Typ	Max	Unit
1	PCM bit clock frequency	-	-	12	MHz
2	PCM bit clock LOW	41	-	-	ns
3	PCM bit clock HIGH	41	-	-	ns
4	PCM_SYNC delay	0	-	25	ns
5	PCM_OUT delay	0	-	25	ns
6	PCM_IN setup	8	-	-	ns
7	PCM_IN hold	8	-	-	ns
8	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	-	25	ns

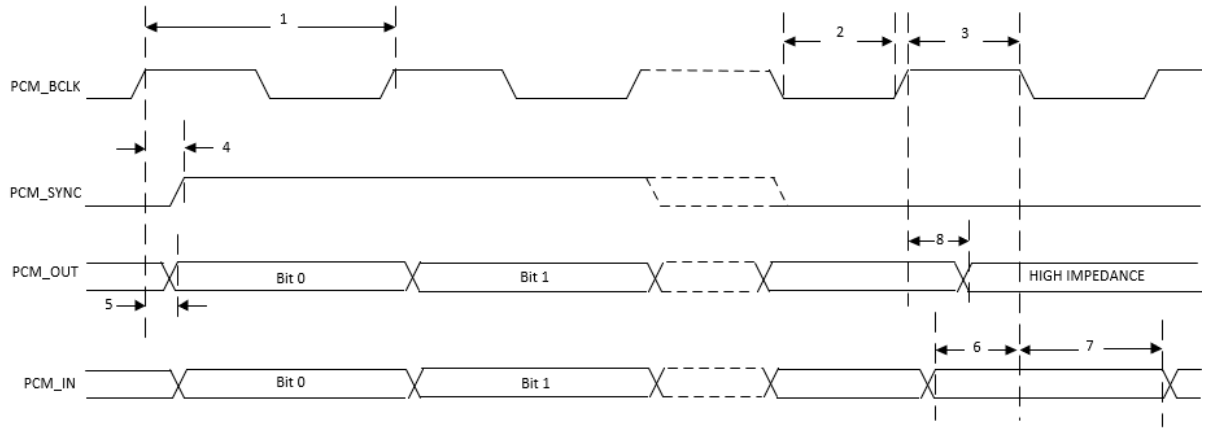
PCM Interface Timing Specifications(Short Frame Sync, Master Mode)



PCM Timing Diagram(Short Frame Sync, Slave mode)

Reference	Characteristics	Min	Typ	Max	Unit
1	PCM bit clock frequency	-	-	12	MHz
2	PCM bit clock LOW	41	-	-	ns
3	PCM bit clock HIGH	41	-	-	ns
4	PCM_SYNC setup	8	-	-	ns
5	PCM_SYNC hold	8	-	-	ns
6	PCM_OUT delay	0	-	25	ns
7	PCM_IN setup	8	-	-	ns
8	PCM_IN hold	8		-	
9	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	-	25	ns

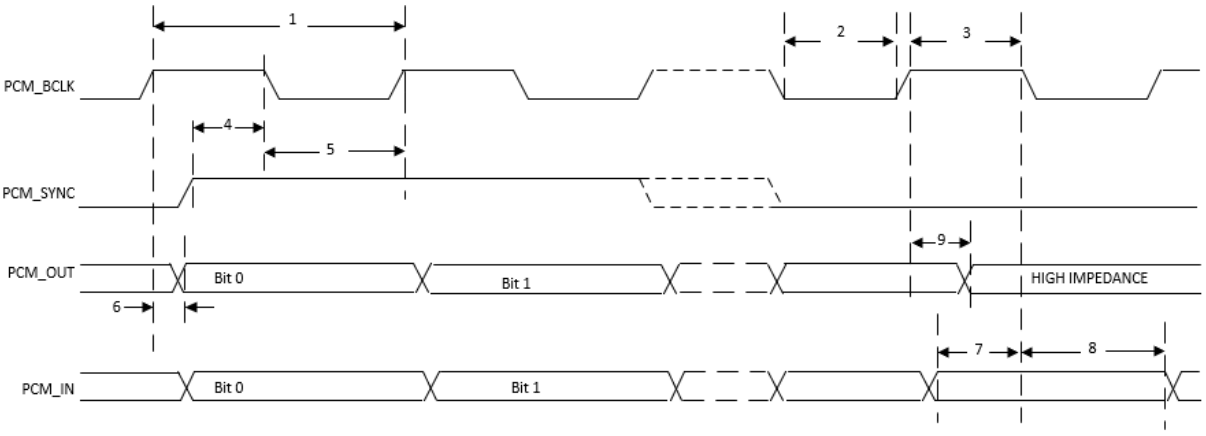
PCM Interface Timing Specifications(Short Frame Sync, Slave Mode)



PCM Timing Diagram(Long Frame Sync, Master mode)

Reference	Characteristics	Min	Typ	Max	Unit
1	PCM bit clock frequency	-	-	12	MHz
2	PCM bit clock LOW	41	-	-	ns
3	PCM bit clock HIGH	41	-	-	ns
4	PCM_SYNC delay	0	-	25	ns
5	PCM_OUT delay	0	-	25	ns
6	PCM_IN setup	8	-	-	ns
7	PCM_IN hold	8	-	-	ns
8	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	-	25	ns

PCM Interface Timing Specifications(Long Frame Sync, Master Mode)



PCM Timing Diagram(Long Frame Sync, Slave mode)

Reference	Characteristics	Min	Typ	Max	Unit
1	PCM bit clock frequency	-	-	12	MHz
2	PCM bit clock LOW	41	-	-	ns
3	PCM bit clock HIGH	41	-	-	ns
4	PCM_SYNC setup	8	-	-	ns
5	PCM_SYNC hold	8	-	-	ns
6	PCM_OUT delay	0	-	25	ns
7	PCM_IN setup	8	-	-	ns
8	PCM_IN hold	8		-	
9	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	-	25	ns

PCM Timing Diagram(Long Frame Sync, Slave mode)

3.3 I2S Interface

3.3.1 I2S Interface Timing

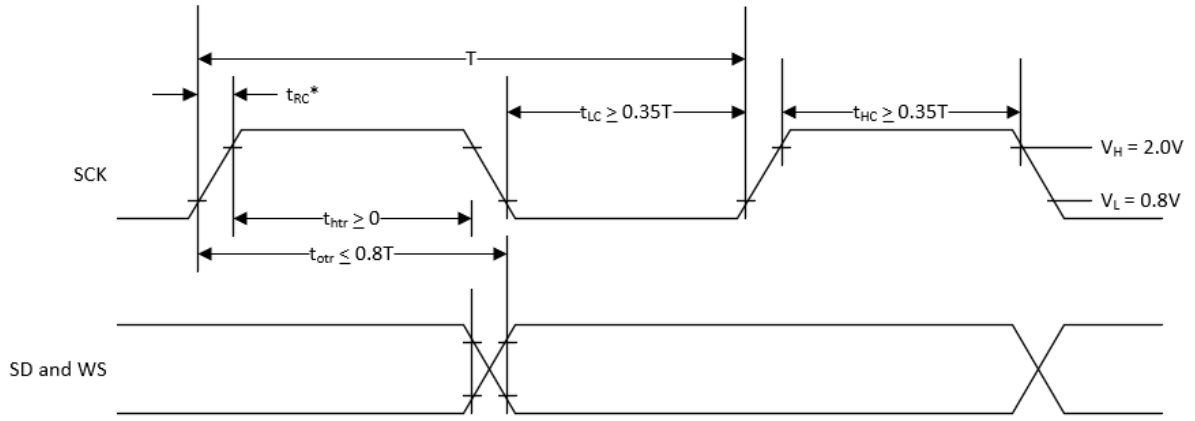
The I2S interface supports both master and slave modes. The I2S signals are:
■ I2S clock: I2S SCK
■ I2S Word Select: I2S WS
■ I2S Data Out: I2S SDO
■ I2S Data In: I2S SDI
I2S SCK and I2S WS become outputs in master mode and inputs in slave mode, while I2S SDO always stays as an output. The channel
word length is 16 bits and the data is justified so that the MSB of the left-channel data is aligned with the MSB of the I2S bus, per the
I2S specification. The MSB of each data word is transmitted one bit clock cycle after the I2S WS transition, synchronous with the falling
edge of bit clock. Left-channel data is transmitted when I2S WS is low, and right-channel data is transmitted when I2S WS is high.
Data bits sent by the BCM-DC100-AS are synchronized with the falling edge of I2S_SCK and should be sampled by the receiver on
the rising edge of I2S_SSCK.
The clock rate in master mode is either of the following:
■ 48 kHz x 32 bits per frame = 1.536 MHz
■ 48 kHz x 50 bits per frame = 2.400 MHz

The master clock is generated from the input reference clock using a N/M clock divider. In the slave mode, any clock rate is supported
to a maximum of 3.072 MHz. Timing values specified in Table 25 are relative to high and low threshold levels.

	Transmitter				Receiver			
	Lower LImit		Upper Limit		Lower Limit		Upper Limit	
	Min	Max	Min	Max	Min	Max	Min	Max
Clock Period T	Ttr				Tr			Note 22
Master Mode: Clock generated by transmitter or receiver								
HIGH tHC	0.35Ttr				0.35Ttr			Note 23
LOWtLC	0.35Ttr				0.35Ttr			Note 23
Slave Mode: Clock accepted by transmitter or receiver								
HIGH tHC		0.35Ttr				0.35Ttr		Note 24
LOW tLC		0.35Ttr				0.35Ttr		Note 24
Rise time tRC			0.15Ttr					Note 25
Transmitter								
Delay tdtr				0.8T				Note 26
Hold time thtr	0							Note 26
Receiver								
Setup time tsr						0.2Tr		Note 27
Hold time thr						0		Note 27

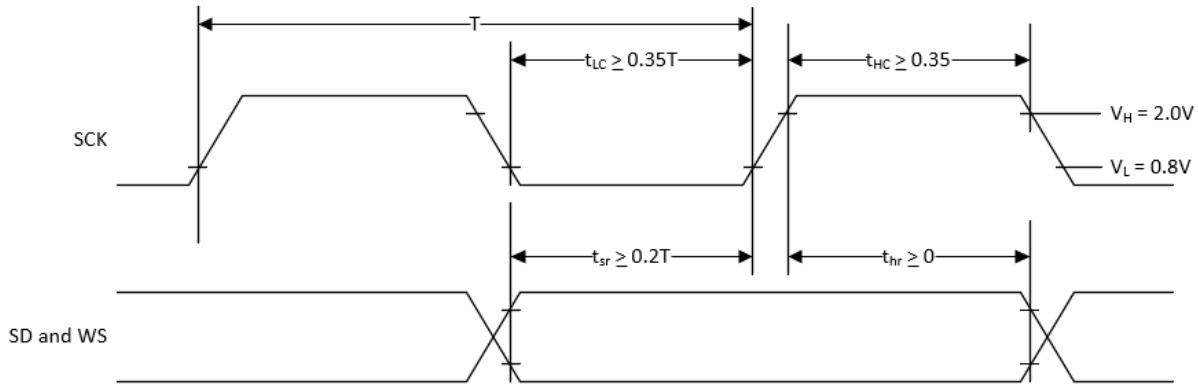
Note: The time periods specified in Figure 21 and Figure 22 are defined by the transmitter speed. The receiver specifications must match transmitter performance.

Notes
22. The system clock period T must be greater than Ttr and Tr because both the transmitter and receiver have to be able to handle the data transfer rate.
23. At all data rates in master mode, the transmitter or receiver generates a clock signal with a fixed mark/space ratio. For this reason, tHC and tLC are specified with
respect to T.
24. In slave mode, the transmitter and receiver need a clock signal with minimum HIGH and LOW periods so that they can detect the signal. So long as the minimum
periods are greater than 0.35Tr, any clock that meets the requirements can be used.
25. Because the delay (tdtr) and the maximum transmitter speed (defined by Ttr) are related, a fast transmitter driven by a slow clock edge can result in tdtr not exceeding
tRC which means thtr becomes zero or negative. Therefore, the transmitter has to guarantee that thtr is greater than or equal to zero, so long as the clock rise-time
tRC is not more than tRCmax, where tRCmax is not less than 0.15Ttr.
26. To allow data to be clocked out on a falling edge, the delay is specified with respect to the rising edge of the clock signal and T, always giving the receiver sufficient
setup time.
27. The data setup and hold time must not be less than the specified receiver setup and hold time.



T = Clock period
T_{tr} = Minimum allowed clock period for transmitter
$T = T_{tr}$
* t_{RC} is only relevant for transmitters in slave mode.

I2S Transmitter Timing



T = Clock period
T_r = Minimum allowed clock period for transmitter
$T > T_r$

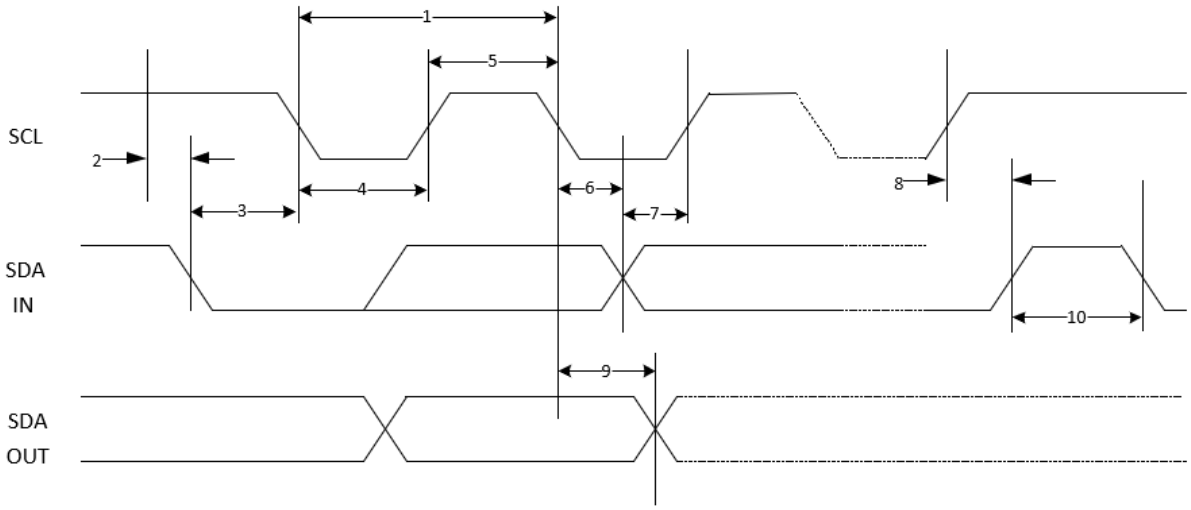
I2S Receiver Timing

3.4 I2C Interface

The BCM-DC100-AS provides a 2-pin master I2C interface, which can be used to retrieve configuration information from an external
EEPROM or to communicate with peripherals such as trackball or touch-pad modules, and motion tracking ICs used in mouse devices.
The BSC interface is compatible with I2C slave devices. I2C does not support multimaster capability or flexible wait-state insertion by
either master or slave devices.
The following transfer clock rates are supported by I2C:
■ 100 kHz
■ 400 kHz
■ 800 kHz (Not a standard I2C-compatible speed.)
■ 1 MHz (Compatibility with high-speed I2C-compatible devices is not guaranteed.)
The following transfer types are supported by I2C:
■ Read (Up to 127 bytes can be read.)
■ Write (Up to 127 bytes can be written.)
■ Read-then-Write (Up to 127 bytes can be read and up to 127 bytes can be written.)
■ Write-then-Read (Up to 127 bytes can be written and up to 127 bytes can be read.)
Hardware controls the transfers, requiring minimal firmware setup and supervision.
The clock pin (SCL) and data pin (SDA) are both open-drain I/O pins. Pull-up resistors external to the BCM-DC100-AS are required on
both the SCL and SDA pins for proper operation.

Reference	Characteristics	Min	Max	Unit
1	Clock frequency	-	100 400 800 1000	kHz
2	START condition setup time	650	-	ns
3	START condition hold time	280	-	ns
4	Clock low time	650	-	ns
5	Clock high time	280	-	ns
6	Data input hold time[20]	0	-	ns
7	Data input setup time	100	-	ns
8	STOP condition setup time	280	-	ns
9	Output valid from clock	-	400	ns
10	Bus free time[21]	650		ns

I2C Interface Timing Specifications



I2C Interface Timing Diagram

Notes

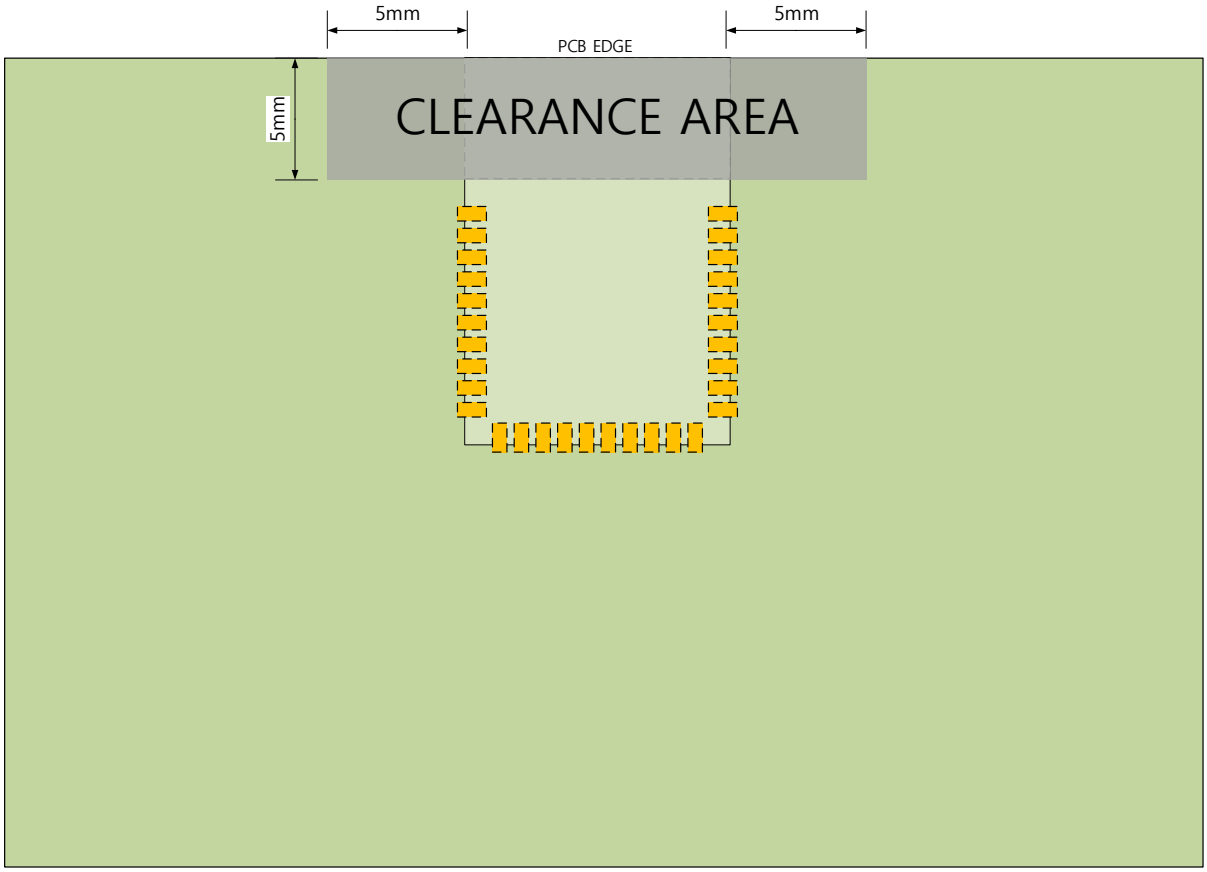
20. As a transmitter, 125 ns of delay is provided to bridge the undefined region of the falling edge of SCL to avoid unintended generation of START or STOP conditions.

21. Time that the cbus must be free before a new transaction can start.

4. Layout Guide

4.1 Layout Guide

For optimal performance of the antenna place the module at the outside of the PCB
Do not place any metal (traces, components, battery etc.) within the clearance area of the antenna. Connect all the GND pins directly to a solid GND plane. Place the GND vias as close to the GND pins as possible. Use good layout practices to avoid any excessive noise coupling to signal lines or supply voltage lines. Avoid placing plastic or any other dielectric material closer than 5 mm from the antenna. Any dielectric closer than 5 mm from the antenna will detune the antenna to lower frequencies.



5. Reflow Temperature Profile

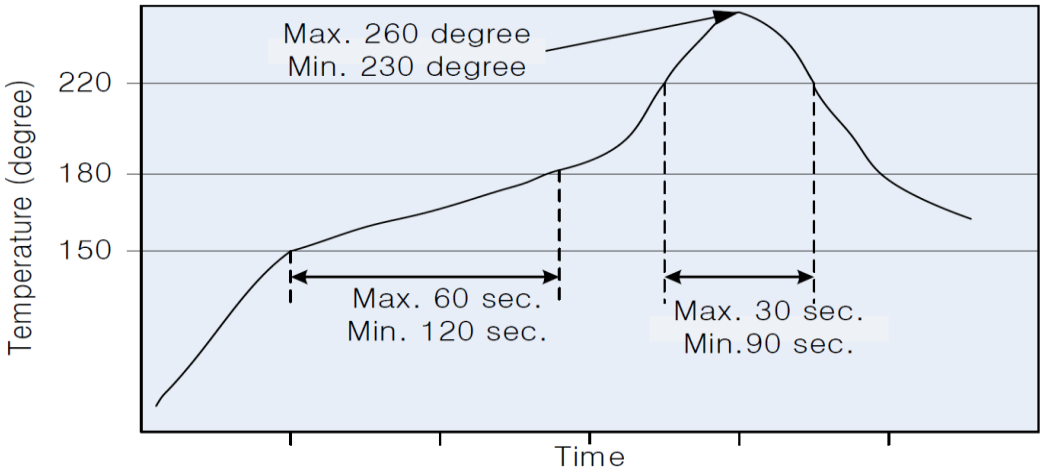
Recommended solder reflow profile are shown in below and follow the lead-free profile I accordance with JEDEC Std 20C.

Table lists the critical reflow temperatures.

Flux residue remaining from board assembly can contribute to electrochemical migration over time.

This depends on number of factors, including flux type, amount of flux residue remaining after reflow, and stress conditions during product use, such as temperature, humidity, and potential difference between pins.

Care should be taken in selecting production board/module assembly processes and materials, taking into account these factors.



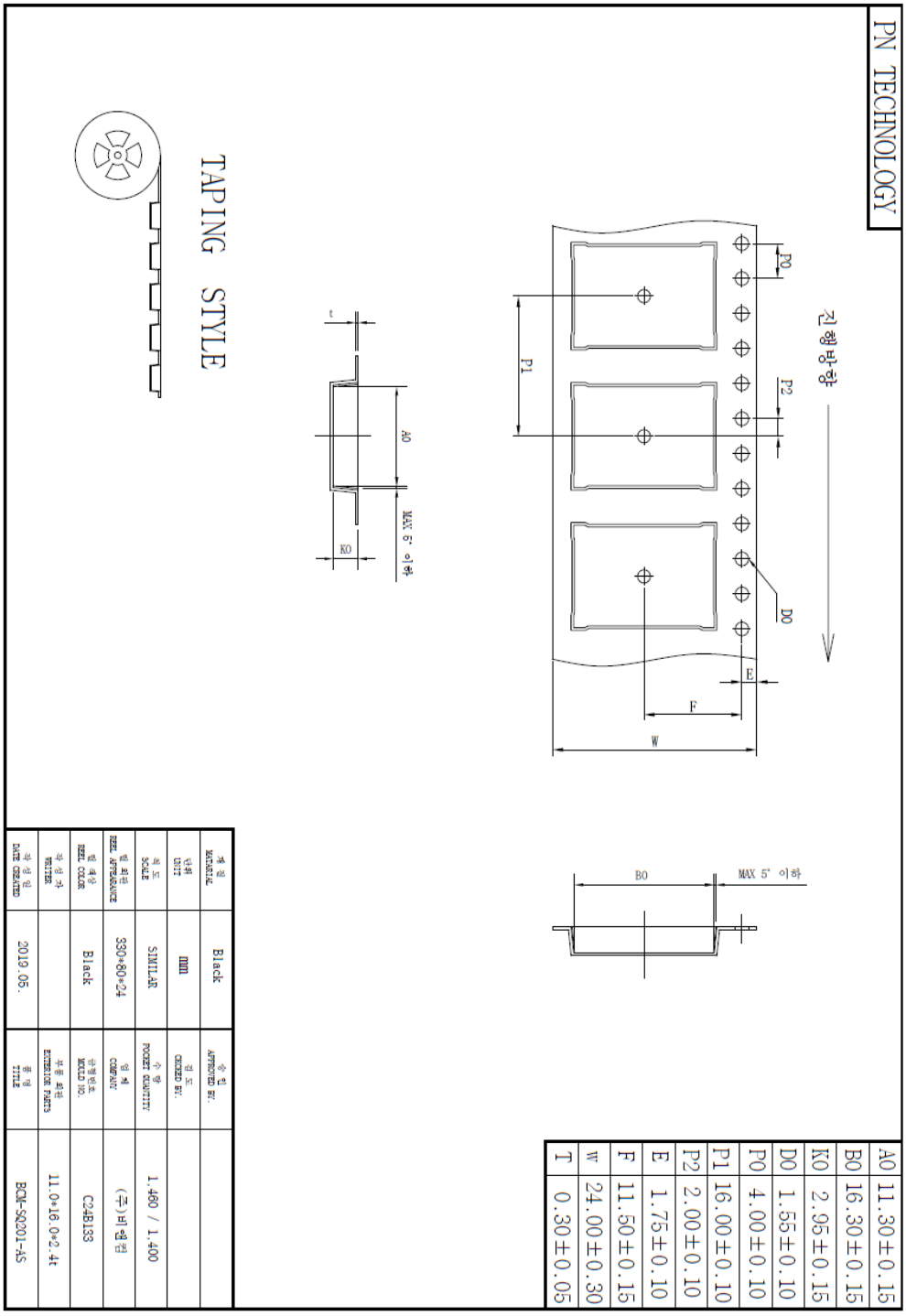
Process Step	Lead-Free Solder
Ramp rate	3°C/sec
Preheat	Max. 150°C to 180°C, 60 to 180 sec
Time above liquidus	+220°C 30 to 90 sec
Peak temperature	+255°C ±5°C
Time within 5°C of peak temperature	10 to 20 sec
Ramp-down rate	6°C/sec max

WARNING : For BCM-DC100-AS.

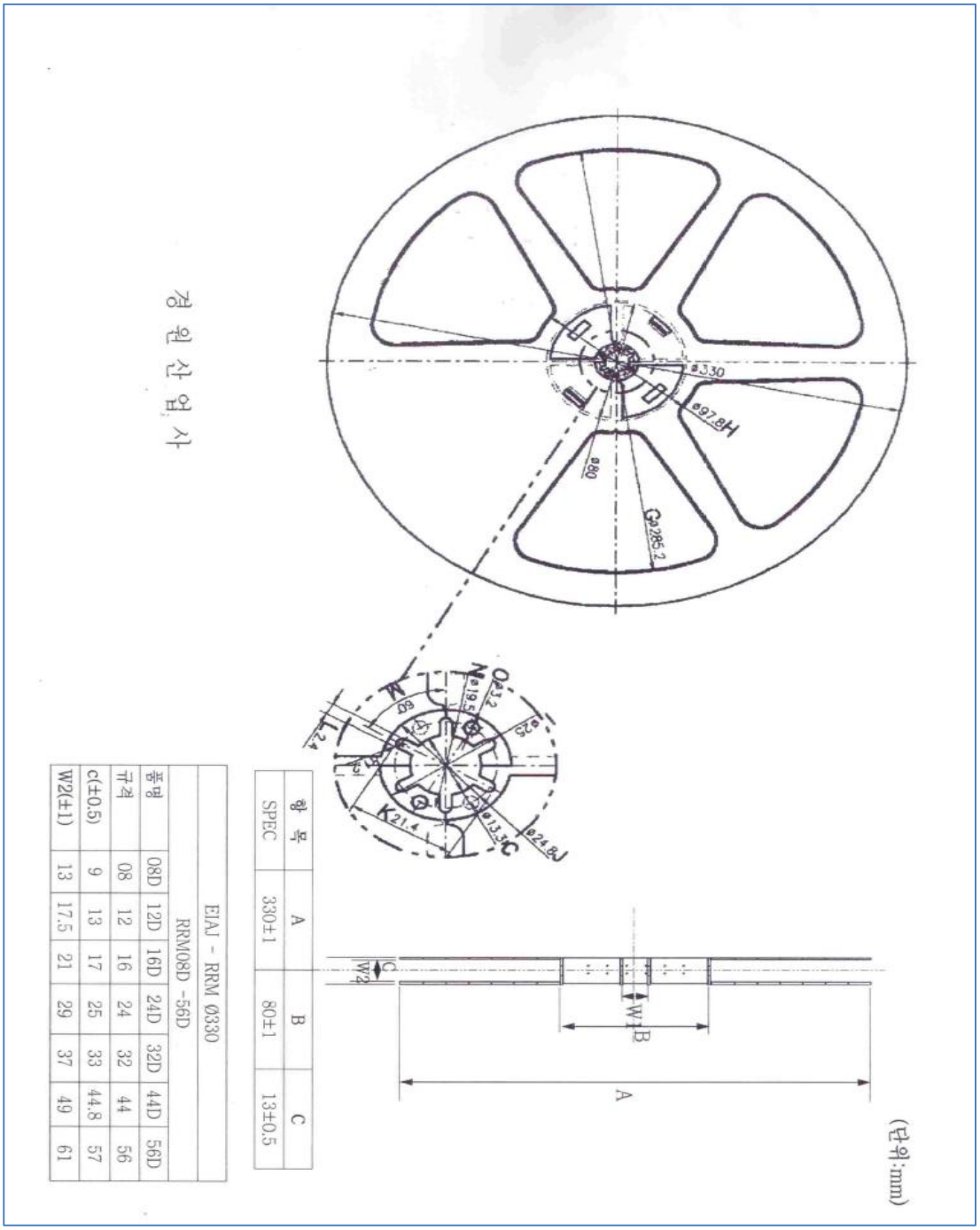
If you have reflow process multiple times in your product, you must be proceed this module in the final reflow process. If not the Shield can will drop out.

6. Package Information

6.1 Reel Pocket Information



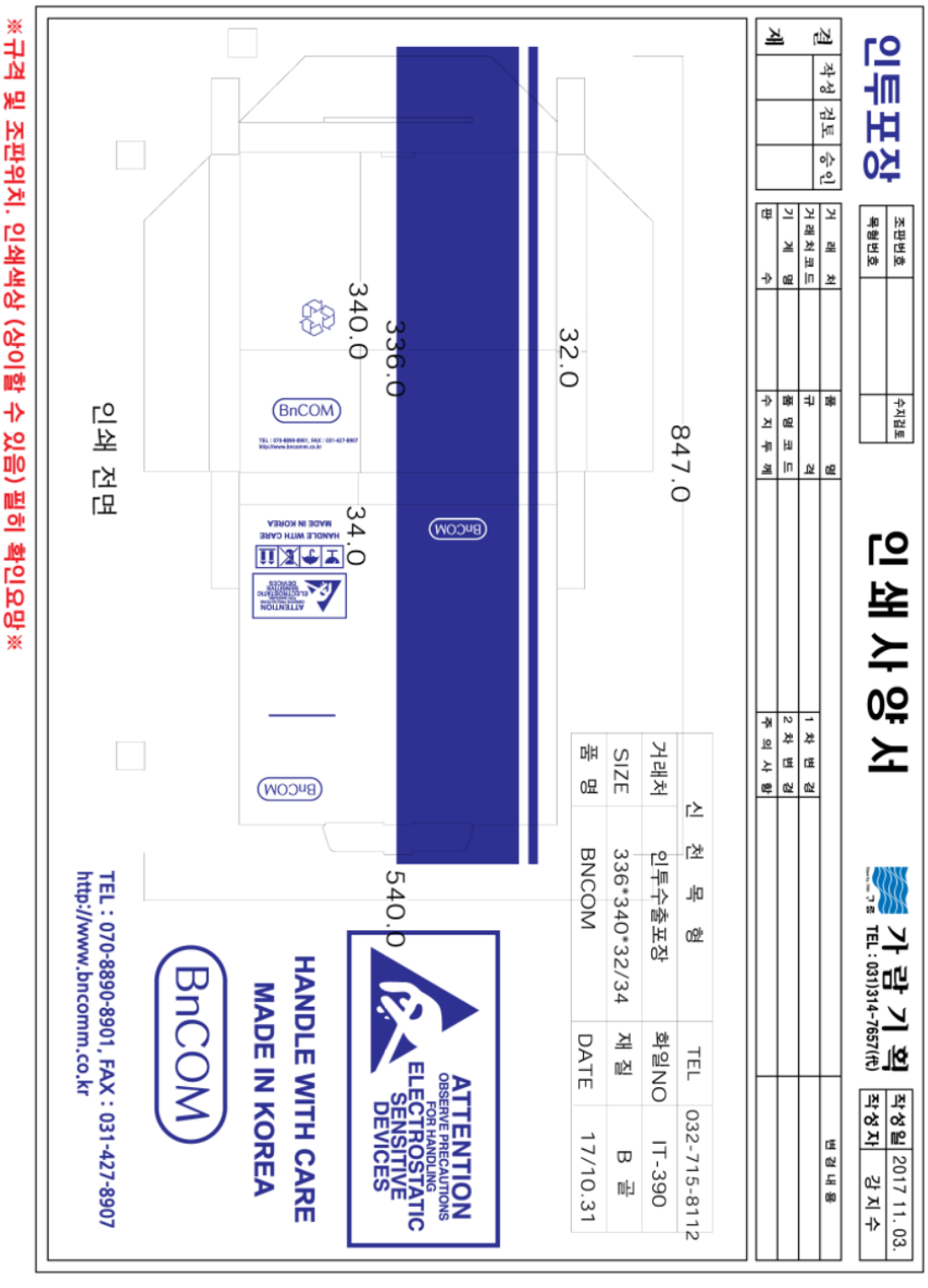
6.2 Reel Information



항 목	A	B	C
SPEC	330±1	80±1	13±0.5

EIAJ - RRM Ø330								
RRM08D -56D								
품명	08D	12D	16D	24D	32D	44D	56D
규격	08	12	16	24	32	44	56
c(±0.5)	9	13	17	25	33	44.8	57
W2(±1)	13	17.5	21	29	37	49	61

6.3 Out Box Information



6.4 Certification Label Information

End Product Labeling

These modules are designed to comply with the FCC single modular FCC grant, BCM-DC100-AS.

The host system using this module must display a visible label indicating the following text:

Contains FCC ID: 2APDI-BCM-DC100-AS

BnCOM Module Protocol

AT communication protocol
For SPP module(BCM-DC100-AS)

BnCOM Co.,Ltd

■ HISTORY

Version	Distribution Date	Content
0.0.1	2021.03.12	Created the document draft
0.0.2	2021.03.15	BT GPIO description modification
0.0.3	2021.03.26	Modified the description of the entire operation function, added OTA Guide
0.0.4	2021.05.06	Modify and add full action feature settings

■ Contents

1. Introduction

This document defines the communication protocol through UART (Seral port) between the "BnCOM Module" (hereinafter "BT")and the client's MCU (hereinafter "HOST") connected by UART interface.

Protocol Basic Rule

Data transmission/reception between HOST and BT is made based on UART (serial port) interface.

- Baud rate : 230400 bps
- Data bit : 8
- Parity bit : none
- Stop bit : 1
- Flow control : RTS/CTS Enable

  The above are default setting values. In case you want to change them, please make a request for modification when writing BT firmware or modify them using the corresponding AT command (AT+BTUART=B,P,S).

Communication Direction

- REQUEST (HOST→BT) : Generated from HOST and transmitted to BT.
- NOTIFY(BT → HOST) : A message that occurs in BT and is delivered to HOST. It informs the basic status of BT.
- RESPONSE(BT → HOST) : A message that occurs in BT and is delivered to HOST. It informs the basic status of BT.

Communication Rule

All protocols consist of a combination of ASCII values, the protocol command informs the end of the instructions over a Carriage Return (0x0D).

Ex) REQUEST – Recent Device Connections : AT+CONNECT↵

Command	AT+CONNECT										
Command set	A	T	+	C	O	N	N	E	C	T	₩r
Ascii set	0x41	0x54	0x2B	0x43	0x4F	0x4E	0x4E	0x45	0x43	0x54	0x0D

Ex) NOTIFY – First message to HOST when power is applied: READY↵

Command	READY					
command set	R	E	A	D	Y	₩r
ascii set	0x52	0x45	0x41	0x44	0x59	0x0D

Ex) RESPONSE – Request failed (BAD_HOST_COMMAND) : ERROR↵

Command	ERROR					
Command set	E	R	R	O	R	₩r
ascii set	0x45	0x52	0x52	0x4F	0x52	0x0D

Basic protocol operation

BT transmits the corresponding RESPONSE after receiving a request from HOST. HOST may basically expect a RESPONSE of “OK↵” or “ERROR↵”, and may receive a specific RESPONSE corresponding to the request.

Description of BT GPIO

Separate GPIO is allocated to notify BT status information or control specific BT functions in HOST.

GPIO	Name	Direction	I/O	Description
GPIO 15	Power State LED	Output	Low	BT Power Off
			High	BT Power On
GPIO 36	Connected State LED	Output	Low	BT Device Disconnected
			High	BT Device Connected
GPIO 24	BT Command Port	Input	Low	AT Command Mode
			High	Bypass Mode
GPIO 34	BT Command State LED	Output	Low	Bypass Mode State
			High	AT Command Mode State

- BT switches to Bypass Mode when it is connected (AT Command mode can be switched to GPIO24)
- BT switches to AT Command Mode when disconnected (Bypass mode cannot be switched to GPIO24)
- To change from Bypass to AT Command in connected state, change GPIO24 from HIGH to LOW.
- To change from AT Command to Bypass in connected state, change GPIO24 from LOW to HIGH.

Service UUID Classification

BT provides Data Service for data communication. Each UUID is shown in the table below. Smartphones or other devices can access each service through the following UUID.

.

Class	UUID	Property
Data Service (Primary)	0xA2980000DA8D4B0FA94D74F07D000000	N/A
Notification (Characteristic)	0xA2980001DA8D4B0FA94D74F07D000000	Notification
Write No Response (Characteristic)	0xA2980002DA8D4B0FA94D74F07D000000	Write without Response

BLE ADVERTISING DATA

ADVERTISING DATA transmitted through BLE is as follows.

Total 31Byte	AD Structure 1	Length	0x02	Length of this data
		Type	0x01	Advertising type flag
		AD Data	0x06	LE Flag
	AD Structure 2	Length	0x18	Length of this data
		Type	0x09	Complete Local Name
		AD Data Name	0x42	B
			0x6E	n
			0x43	C
			0x4F	O
			0x4D	M
			0x20	' '
			0x44	D
			0x75	u
			0x61	a
			0x6C	l
			0x20	' '
			0x4D	M
			0x6F	o
			0x64	d
			0x75	u
			0x6C	l
			0x65	e
	AD Structure 3	Length	0x18	Length of this data
		Type	0xFF	Manufacturer Specific Data
		AD Data	0x74	BT MAC Address(6Bytes)
			0xF0	
			0x7D	
			0x00	
			0x00	
			0x00	
			NULL	

REQUEST (HOST→BT) Protocol Summary

Command	Function	Factory Default (Initialization) Setting Value

SYSTEM Command		
AT	BT의 UART Tx/Rx Path Test	
ATZ	BT Soft Reset	
AT&F	BT Factory Reset	
AT+BTUART=B,P,S	UART Setting	230400,N,1
AT+BTUART?	UART information	
AT+BTNAME=xxx	BT Local Name Setting	BnCOM Dual Module
AT+BTNAME?	BT Local Name information	
AT+BTADDR?	BT Mac Address information	
AT+VERSION?	F/W Version information	
AT+DISCONNECT	Disconnect device (In case of AT Command mode)	
AT+REMOTEMAC?	Connected device Mac Address information	
AT+SCANMODE=n	BT Searchable Setting	1
AT+SCANMODE?	BT Searchable information	
Classic Command(SPP)		
AT+PAIRCLEAR	Initialize Paring Device Storage	
AT+BTAUTOCON=e,n,s	Settings related to repeated connection attempts in BT	0,10,20
AT+BTAUTOCON?	Check the settings related to repeated connection attempts in BT	
AT+CONNECT	BT SPP connection, last connected device	
AT+CONNECTMAC=n,xxxx	Connect with BT-designated Mac Address device	
AT+CONNECTMAC?	All Mac Address information registered in BT	
AT+BTINQUIRY=E,T,N	SSP device discovery	
AT+BTPINCODE=xxxx	PIN Code Setting	0000
AT+BTPINCODE?	PIN Code information	
AT+BTSSP=n	Simple Secure Pairing mode setting	1(SSP Mode)
AT+BTSSP?	Simple Secure Pairing mode information	
AT+BTSSPMODE=n	SSP Security Authentication setting	0(Just_Work)
AT+BTSSPMODE?	SSP Security Authentication information	
AT+BTNUMACC	Numeric Comparison Mode certification	
AT+BTPASSKEY	Passkey Entry Mode certification	
iAP Command		
AT+IAPMODEL=xxxx	IAP Model Name setting	BCM-DC100-AS
AT+IAPMODE?	IAP Model Name information	
AT+IAPACCESSORY=xxxx	IAP Accessory Name setting	BCM-DC100-AS
AT+IAPACCESSORY?	IAP Accessory Name information	
AT+IAPPROSTR=xxxx	IAP protocol String setting	com.bncom.protocol

AT+IAPPROSTR?	IAP protocol String information	
AT+IAPSERIAL=xxxx	IAP Serial Number setting	123456789
AT+IAPSERIAL?	IAP Serial Number information	
AT+IAPMANUF=xxxx	IAP Manufacture setting	BnCOM Co., Ltd.
AT+IAPMANUF?	IAP Manufacture information	
BLE Command		
AT+LEADVINTERVAL=x	Advertising Interval setting	256(160ms)
AT+LEADVINTERVAL?	Advertising Interval information	
AT+LECONINTERVAL=Min,Max	Connection Interval setting	8,24(10ms,30ms)
AT+LECONINTERVAL?	Connection Interval information	

NOTIFY (BT→HOST) Protocol Summary

Command	Description	Remark
READY	Initialization completed with power applied.	
OK	Bypass mode -> AT Command mode	
CONNFAIL	Device connection failed	
CONNECTED:1	Classic SPP Device connection	
CONNECTED:2	IAP SSP Device connection	
CONNECTED:3	BLE Device connection	
DISCONNECTED	Disconnect Device	

General RESPONSE (BT→HOST) Protocol Summary

Command	Description	Remark
OK	Response to command reception	
ERROR	Response to the case that it does not work normally	

REQUEST Protocol Detail

AT

Description	BT UART Tx/Rx Path Test
Examples	(HOST→BT) : AT (BT→HOST) : OK

ATZ

Description	BT Soft Reset
Examples	(HOST→BT) : ATZ (BT→HOST) : OK --- Reboot --- (BT→HOST) : READY

AT&F

Description	BT Factory Reset (Reset Required) - Page 8, REQUEST Protocol Summary, Note the factory default value
Examples	(HOST→BT) : AT&F (BT→HOST) : OK (HOST→BT) : ATZ (BT→HOST) : OK --- Reboot --- (BT→HOST) : READY

AT+BTUART=B,P,S

Description	BT UART Setting	
Info	B = BaudRate	'9600' ~ '921600' Other value: Error
	P = Parity bit	'N' or 'E' or 'O' Other value: Error
	S = Stop bit	'0' or '1' Other value: Error

Examples	(HOST→BT) : AT+BTUART=230400,N,1↵ (BT→HOST) : OK

AT+BTUART?

Description	BT UART information
Examples	(HOST→BT) : AT+BTUART? (BT→HOST) : +BTUART:230400,N,1 (BT→HOST) : OK

AT+BTNAME=String

Description	BT Local Name Setting	
Info	String	English and numbers 1~30 character For BLE Name, up to 17 digits
Examples	(HOST→BT) : AT+BTNAME=BnCOM Dual Module (BT→HOST) : OK	

1.1. AT+BTNAME?

Description	BT Local Name information
Examples	(HOST→BT) : AT+BTNAME? (BT→HOST) : +BTNAME:BnCOM Dual Module (BT→HOST) : OK

AT+BTADDR?

Description	BT MAC Address information
Examples	(HOST→BT) : AT+BTADDR? (BT→HOST) : +BTADDR:74f07d000000 (BT→HOST) : OK

AT+VERSION?

Description	F/W Version information
Examples	(HOST→BT) : AT+VERSION? (BT→HOST) : +VERSION:0.2.0 (BT→HOST) : OK

AT+SCANMODE=mode

Description	BT Searchable Setting	
Info	Mode	'0' = BT Search Disable '1' = BT Search Enable
Examples	(HOST→BT) : AT+SCANMODE=1 (BT→HOST) : OK	

AT+SCANMODE?

Description	BT Searchable information
Examples	(HOST→BT) : AT+SCANMODE? (BT→HOST) : +SCANMODE:1 (BT→HOST) : OK

AT+REMOTEMAC?

Description	Connected device Mac Address information - Use after switching AT Command mode while connected	
Info	Response Type	Mac Address,OS OS : 1(SPP), 2(IAP), 3(BLE)
Examples	(HOST→BT) : AT+REMOTEMAC? (BT→HOST) : +REMOTEMAC:5883257d4c70,3 (BT→HOST) : OK	

AT+PAIRCLEAR

Description	Initialize Paring Device Storage
Examples	(HOST→BT) : AT+PAIRCLEAR (BT→HOST) : OK

AT+DISCONNECT

Description	Disconnect device (In case of AT Command mode)
Examples	(HOST→BT) : AT+DISCONNECT (BT→HOST) : OK

AT+BTAUTOCON=E,N,T

Description	Related settings for attempting to connect to a device that was connected using "AT+CONNECT" Command 1) BT Device Link Loss Disconnected 2) Repeat connection setting when "AT+CONNECT" fails	
Info	E = Enable	'0' or '1' Other Value = Error
	N = Retry Number	'1' ~ '50' Other Value = Error
	T = Retry Time	'1' ~ '180' (Unit per 1sec) Other Value = Error
Examples	(HOST→BT) : AT+BTAUTOCON=0,10,20 (BT→HOST) : OK	

AT+BTAUTOCON?

Description	BT Auto Connection Setting values information
Examples	(HOST→BT) : AT+BTAUTOCON? (BT→HOST) : +BTAUTOCON:0,10,20 (BT→HOST) : OK

AT+CONNECT

Description	BT attempts to connect with the last connected device (SPP Only) - When BTAUTOCON is enabled, retry as much as set
Examples	(HOST→BT) : AT+CONNECT (BT→HOST) : OK (BT→HOST) : CONNECTED:1

AT+CONNECTMAC=OS,ADDRESS

Description	BT attempts to connect to the designated Mac Address device (SPP Only)	
Info	OS	'0' (SPP) '1' (IAP) Other Value = Error
	ADDRESS	Mac Address
Examples	(HOST→BT) : AT+CONNECTMAC=0,74F07D000000 (BT→HOST) : OK (BT→HOST) : CONNECTED:1 ---------- (HOST→BT) : AT+CONNECTMAC=1,C0E8622F6151 (BT→HOST) : OK (BT→HOST) : CONNECTED:2	

AT+CONNECTMAC?

Description	All Mac Address information registered in BT (SPP Only)
Examples	(HOST→BT) : AT+BTCONNECTMAC? (BT→HOST) : +BTCONNECTMAC:a82bb9e0cb61 (BT→HOST) : OK

AT+BTINQUIRY=E,T,N

Description	BT attempts to discover SPP devices (SPP Only)	
Info	E = Enable	0 = Inquiry Disable 1 = Inquiry Enable Other Value = Error
	T = Inquiry Time	'1' ~ '25' (Unit per 1.28s) = (1.28s ~ 32s) Other Value = Error
	N = Inquiry Number	'1' ~ '10' Other Value = Error
	Inquiry Response Type	Device Name,Mac Address,COD,RSSI
Examples	(HOST→BT) : AT+INQUIRY=1,10,5 (BT→HOST) : OK --- If you have a scanning device --- (BT→HOST) : G5,5c70a3da6d14,0x5a020c,-34 (BT→HOST) : Galaxy Note9,A82BB97F6BD5,0x00020C,-31 **(Scan N(5) device in T(10*1.28) second)**	

AT+BTPINCODE=xxxx

Description	BT Security PIN Code Setting (Set Pincode value for BTSSP=0 Operation)	
Info	xxxx	PIN code (4~16 byte)
Examples	(HOST→BT) : AT+BTPINCODE=1234 (BT→HOST) : OK	

AT+BTPINCODE?

Description	BT Security PIN Code information
Examples	(HOST→BT) : AT+BTPINCODE? (BT→HOST) : +BTPINCODE:1234 (BT→HOST) : OK

AT+BTSSP=N

Description	Secure Simple Pairing(SSP) mode Setting. (Reset Required)	
Info	N	0 – Pincode Mode 1 – SSP Mode Other Value - Error
Examples	(HOST→BT) : AT+BTSSP=1 (BT→HOST) : OK	

AT+BTSSP?

Description	BTSSP Setting information
Examples	(HOST→BT) : AT+BTSSP? (BT→HOST) : +BTSSP:1 (BT→HOST) : OK

AT+BTSSPMODE=N

Description	SSP Security Authentication Setting (Required for "AT+BTSSP=1" operation)	
Info	N	0 Just Works Mode
		1 Numeric Comparison Mode
		2 Passkey Entry Mode
Examples	(HOST→BT) : AT+SSPMODE=1 (BT→HOST) : OK	

AT+BTSSPMODE?

Description	SSPMODE information
Examples	(HOST→BT) : AT+BTSSPMODE? (BT→HOST) : +BTSSPMODE=1 (BT→HOST) : OK

AT+BTNUMACC=N

Description	Numeric Comparison Mode certification When AT+BTSSP=1 and AT+SSPMODE=1, it is used when connecting	
Info	N	0 (Reject, "No") 1 (Accept, "Yes")
Examples	(BT→HOST) : [NUMACC] 874134 (HOST→BT) : AT+BTNUMACC=1 (BT→HOST) : OK	

AT+BTPASSKEY=String

Description	Passkey Entry Mode certification (When AT+BTSSP=1 and AT+SSPMODE=2, use when connecting)	
Info	String	6 digit number
Examples	(HOST→BT) : AT+BTPASSKEY=123456 (BT→HOST) : [PASSKEY] 123456 (BT→HOST) : OK	

AT+IAPMODEL=String

Description	IAP Model Name Setting	
Info	String	Value corresponding to Model Name (1~30character)
Examples	(HOST→BT) : AT+IAPMODEL=BCM-DC100-AS (BT→HOST) : OK	

AT+IAPMODEL?

Description	IAP Model Name information
Examples	(HOST→BT) : AT+BTSSPMODE? (BT→HOST) : +IAPMODEL:BCM-DC100-AS (BT→HOST) : OK

AT+IAPACCESSORY=String

Description	IAP Accessory Name Setting	
Info	String	Value corresponding to Accessory Name (1~30character)
Examples	(HOST→BT) : AT+IAPACCESSORY=BCM-DC100-AS (BT→HOST) : OK	

AT+IAPACCESSORY?

Description	IAP Accessory Name information
Examples	(HOST→BT) : AT+IAPACCESSORY? (BT→HOST) : +IAPACCESSORY:BCM-DC100-AS (BT→HOST) : OK

AT+IAPPROSTR=String

Description	IAP Protocol String Setting	
Info	String	Value corresponding to Protocol String (1~30character)
Examples	(HOST→BT) : AT+IAPPROSTR=com.bncom.protocol (BT→HOST) : OK	

AT+IAPPROSTR?

Description	IAP Protocol String information
Examples	(HOST→BT) : AT+IAPPROSTR? (BT→HOST) : +IAPPROSTR:com.bncom.protocol (BT→HOST) : OK

AT+IAPSERIAL=xxxx

Description	IAP Serial Number Setting	
Info	xxxx	Value corresponding to Serial Numer (1~30character)
Examples	(HOST→BT) : AT+IAPSERIAL=123456789 (BT→HOST) : OK	

AT+IAPSERIAL?

Description	IAP Serial Number information
Examples	(HOST→BT) : AT+IAPSERIAL? (BT→HOST) : +IAPSERIAL:123456789 (BT→HOST) : OK

AT+IAPMANUF=String

Description	IAP Manufacturer Setting	
Info	String	Value corresponding to Manufacturer (1~30character)
Examples	(HOST→BT) : AT+IAPMANUF=BnCOM Co., Ltd. (BT→HOST) : OK	

AT+IAPMANUF?

Description	IAP Manufacturer information
Examples	(HOST→BT) : AT+IAPMANUF? (BT→HOST) : +IAPMANUF:BnCOM Co., Ltd. (BT→HOST) : OK

AT+LEADVINTERVAL=X

Description	BLE Advertising Interval Setting value	
Info	X	32 ~ 16384 (Unit per 0.625ms) = (20ms ~ 10240ms) Other Value = Error
	Value Example	X = 256 -> 256 * 0.625 = 160ms X = 16384 -> 16384 * 0.625 = 10240ms
Examples	(HOST→BT) : AT+LEADVINTERVAL=256 (BT→HOST) : OK	

AT+LEADVINTERVAL?

Description	BLE Advertising Interval information
Examples	(HOST→BT) : AT+LEADVINTERVAL? (BT→HOST) : +LEADVINTERVAL:256 (BT→HOST) : OK

AT+LECONINTERVAL=MIN,MAX

Description	BLE Connection Interval Setting value	
Info	MIN	6 ~ 3200 (Unit per 1.25ms) = (7.5ms ~ 4000ms) Other Value = Error
	MAX	6 ~ 3200 (Unit per 1.25ms) = (7.5ms ~ 4000ms) Other Value = Error
	Value Example	MIN,MAX = 16,32 -> 16 * 1.25 = 20ms, -> 32 * 1.25 = 40ms
Examples	(HOST→BT) : AT+LECONINTERVAL=16,32 (BT→HOST) : OK	

AT+ LECONINTERVAL?

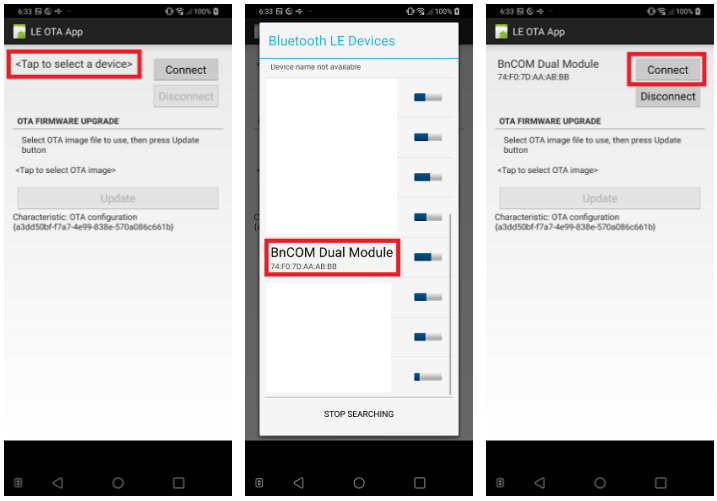
Description	BLE Connection Interval information
Examples	(HOST→BT) : AT+LECONINTERVAL? (BT→HOST) : +LECONINTERVAL:8,24 (BT→HOST) : OK

Over The Air Firmware Upgrade Guide

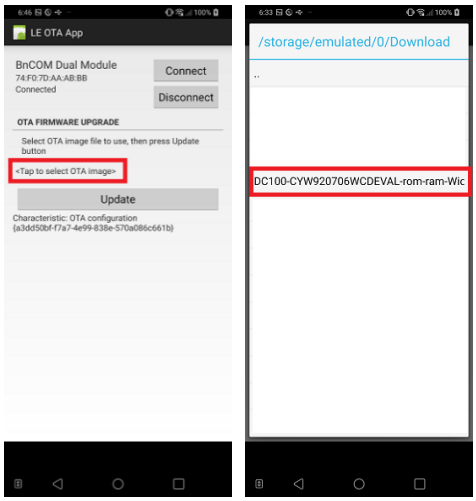
Cypress Application “LE OTA App” User Guide

Run LE OTA App

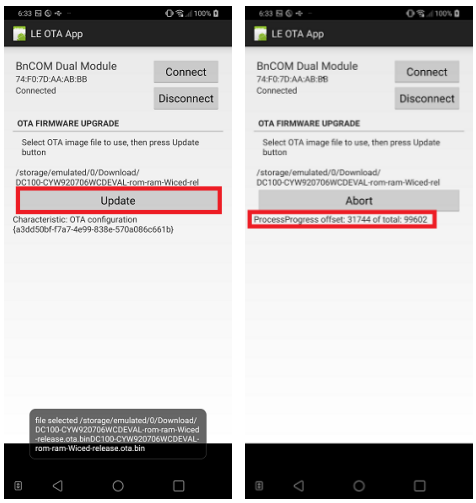
Device Select & Connect



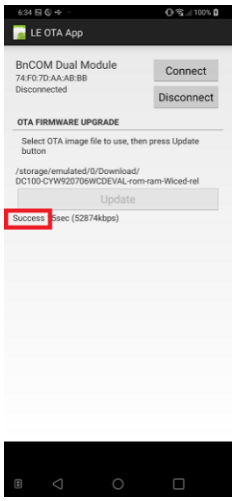
Upgrade File Select



Firmware Updating



Upgrade Complete



FCC Certification and Statement

The BCM-DC100-AS modules from BNCOM are certified for the FCC as a single-modular transmitter. The
modules are FCC-certified radio modules that carries a modular grant. Users are cautioned that changes
or modifications not expressively approved by the party responsible for compliance could void the
authority of the user to operate the equipment.
This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
• This device may not cause harmful interference.
• This device must accept any interference received, including interference that may cause undesired operation of the device.

FCC Information to User

Caution
THE GRANTEE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.
Exposure to Radio Frequency Radiation.
To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.
Any Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

IMPORTANT NOTE : FCC RF Radiation Exposure Statement
This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
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.

OEM/integrators Installation Manual

the modules limited to OEM installation only

the OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Instructions to the OEM/integrator

The OEM integrator must include the instructions or statements required by part 15.19 and 15.21 in the user manual.

the OEM integrator must include a separate section in the host user's manual concerning the operating conditions to satisfy RF exposure compliance.

there is requirement that the grantee provide

Traceability requirements information

Model Name : BCM-DC100-AS

Manufacturer : BNCOM.CO.LTD

Manufacturer Logo :

Address : #1106, M-Techno Center, 46, Gongdan-ro 140 Beon-gil,

Gunpo-si, Gyeonggi-do, 15847, Korea.

Information on test modes and additional testing requirements

A separate test firmware is provided for the RF test and Proceeds as follows:

Provides input voltage according to spec to module.
Connect the serial port of the module to the PC using the external UART interface board.

A dedicated tool for RF test is provided separately.
The test guide can be found at the link below , and detailed guides are provided separately

BDR/EDR : https://www.cypress.com/file/298376/download
BLE : https://www.cypress.com/file/298381/download