

General Description

The BC7701 is a fully-integrated, single-chip Bluetooth Low Energy (BLE) controller with 2Mbps data rate supported. The BC7701 integrates a switch DC-DC regulator and designs to act as BLE slave according to the Bluetooth specification 5.2.

Moreover, during the intervals with no active BLE RF connection, the BC7701 works in Deep Sleep mode which can further reduce the power consumption.

The device is suitable for use in a wide range of BLE products such as health care products, home appliances, smart device information beacons, human interface device service products etc.

Features

Core

- MCU integrated
- 16MHz operating frequency
- The BC7701 implements on-chip DC-DC for a wide range of power and only one power supply is needed

On-chip Memory

- 160KB on-chip Flash memory
- 20KB on-chip SRAM

Bluetooth Low Energy Controller

- 2.4GHz RF transceiver compatible with Bluetooth Low Energy (BLE) 5.2 specification
- 16MHz external crystal reference clock
- GFSK modulation, Frequency-Hopping Spread Spectrum (FHSS)
- Support LE 1Mbps and 2Mbps
- Receiver supports programmable gain of over 70dB
- Excellent receiver sensitivity of -94dbm @1Mbps
- Programmable transmitter output power up to +3.5dBm
- Three operating modes: Normal, Deep-Sleep and Power-Down

I/O Ports – GPIO

- 16 GPIO pins

There are up to 20 General Purpose I/O pins for the implementation of logic input/output functions.

Watchdog Timer – WDT

- Reset event for the system

The system will reset after the watchdog timer is expired.

Real Time Clock – RTC

- 32-bit RTC timer
- Wake-up MCU event

Universal Asynchronous Receiver Transmitter – UART

- Full duplex communication
- Fully programmable serial communication characteristics including:
 - ♦ Word length: 5, 6, 7 or 8-bit character
 - ♦ Parity: Even, odd or no-parity bit generation and detection
 - ♦ Stop bit: 1 or 2 stop bit generation
- Error detection: Parity, overrun and frame error
- Auto hardware flow control mode – RTS, CTS
- FIFO Depth: 8-level for both receiver and transmitter

The UART baud rate can be up to 3.2MHz.

Package and Operation Temperature

- 32-pin QFN package
- Operation temperature range: -40°C to 85°C

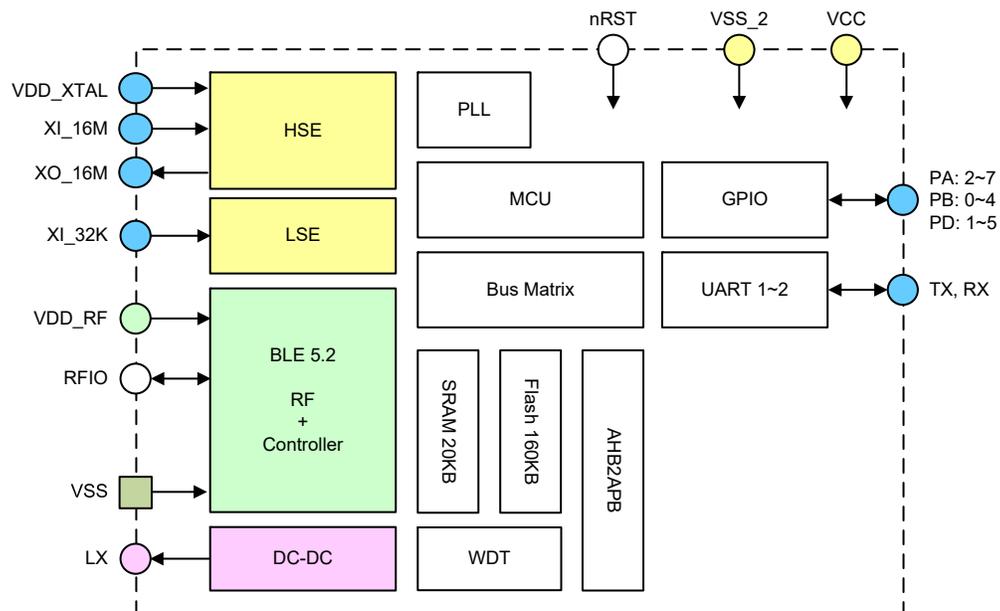
Overview

Device Information

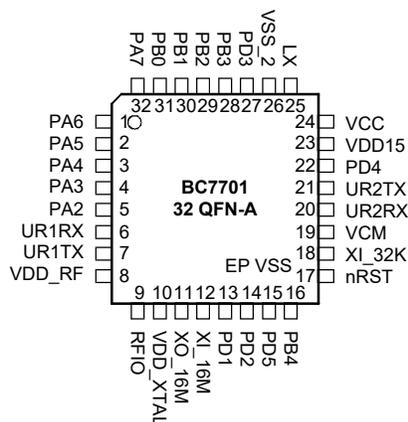
Peripherals		BC7701
Main Flash (KB)		160
SRAM (KB)		20
Timers	WDT	1
	RTC	1
	UART	2
GPIO		16
CPU frequency		16MHz
Operating voltage		2.0V~3.6V
Operating temperature		-40°C~85°C
Package		32-pin QFN

Features and Peripheral List

Block Diagram



Pin Assignment



Pin Description

Pin Name	Pin No.	Type ^(Note)	Description
PA6	1	I/O	General purpose I/O
PA5	2	I/O	General purpose I/O
PA4	3	I/O	General purpose I/O
PA3	4	I/O	General purpose I/O
PA2	5	I/O	General purpose I/O
UR1RX	6	I/O	UART1 receive pin
UR1TX	7	I/O	UART1 transmit pin
VDD_RF	8	P	RF power
RFIO	9	AI/O	RF input or output
VDD_XTAL	10	P	Crystal oscillator power
XO_16M	11	AO	16MHz Crystal oscillator output
XI_16M	12	AI	16MHz Crystal oscillator input
PD1	13	I/O	General purpose I/O
PD2	14	I/O	General purpose I/O
PD5	15	I/O	General purpose I/O
PB4	16	I/O	General purpose I/O
nRST	17	I	Hardware reset
XI_32K	18	AI	32.768kHz Crystal oscillator input
VCM	19	AO	Voltage for ADC reference. Use this pin only when ADC is enabled V_{CM} =Common mode voltage
UR2RX	20	I/O	UART2 receive pin
UR2TX	21	I/O	UART2 transmit pin
PD4	22	I/O	General purpose I/O
VDD15	23	P	Internal power
VCC	24	P	Digital power supply
LX	25	AO	Switching output. Connect this pin to the switching end of the inductor
VSS_2	26	P	Ground reference for digital I/O
PD3	27	I/O	General purpose I/O
PB3	28	I/O	General purpose I/O
PB2	29	I/O	General purpose I/O
PB1	30	I/O	General purpose I/O

Pin Name	Pin No.	Type ^(Note)	Description
PB0	31	I/O	General purpose I/O
PA7	32	I/O	General purpose I/O
VSS	EP	P	Exposed Pad on the bottom of the package. Internally connected to RF Grounding. Solder this exposed pad to a PCB pad that uses multiple ground vias to provide heat transfer out of the device into the PCB ground planes. These multiple ground vias are also required to achieve the noted RF performance.

Note: I = Input; O = Output; A = Analog port; P = Power supply; EP = Exposed pad.

Electrical Characteristics

Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the device. These are stress ratings only. Stresses beyond absolute maximum ratings may cause permanent damage to the device. Note that the device is not guaranteed to operate properly at the maximum ratings. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Min.	Max.	Unit
V _{CC}	External Main Supply Voltage	2.0	3.6	V
V _{IN}	Input Voltage on I/O	V _{CC} -0.3	V _{CC} +0.3	V
T _A	Ambient Operating Temperature Range	-40	+85	°C
T _{STG}	Storage Temperature Range	-55	+150	°C

Recommended DC Operating Conditions

T_A=25°C

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{CC}	Operating Voltage	—	2.0	3.0	3.6	V

A.C. Characteristics

T_A=25°C

Symbol	Parameter	Min.	Typ.	Max.	Unit
Crystal Oscillator 16MHz					
f _{HSE}	Frequency	—	16	—	MHz
ACC _{HSE}	Frequency Accuracy Requirement	-30	—	30	ppm
ESR	Equivalent Series Resistance	—	—	80	Ω
C ₀	Crystal Shunt Capacitance	—	—	3	pF
CL	Crystal Load Capacitance	—	7	—	pF
Crystal Oscillator 32.768kHz					
f _{LSE}	Frequency	—	32.768	—	kHz
ACC _{LSE}	Frequency Accuracy Requirement	-20	—	20	ppm
ESR	Equivalent Series Resistance	—	—	70k	Ω
C ₀	Crystal Shunt Capacitance	—	—	2	pF
CL	Crystal Load Capacitance	—	12.5	—	pF
RX Characteristic					

Symbol	Parameter	Min.	Typ.	Max.	Unit	
CI0	Co-channel Interference	—	7	—	dB	
CI1	In-band Blocking	Interfere at $f_{\text{OFFS}}=\pm 1\text{MHz}$	-9	—	-6	dB
CI2		Interfere at $f_{\text{OFFS}}=\pm 2\text{MHz}$	—	-44	—	dB
CI3		Interfere at $f_{\text{OFFS}}=\pm 3\text{MHz}$	—	-50	—	dB
CI4		Interfere at f_{IMAGE}	—	-25	—	dB
CI5		Interfere at $f_{\text{IMAGE}}=\pm 1\text{MHz}$	—	-35	—	dB
Intermodulation		Pin=-64dBm; Punwant=50dBm; $f_0=2f_1-f_2$, $f_2-f_1=3/4/5\text{MHz}$	-25	—	-22	dBm
PSENS	Sensitivity @ 1Mbps	—	-94	—	dBm	
	Sensitivity @ 2Mbps	—	-91	—	dBm	
PTX	Output Power	—	3.5	—	dBm	
TX Characteristic						
P_{TX}	Output Power	—	3.5	—	dBm	
P_{BW}	Modulation 20dB Bandwidth	—	—	1	MHz	
PRF1	Out of Band Emission 2MHz	—	-20	—	dB	
PRF2	Out of Band Emission 3MHz	—	-58	—	dB	
Dev	Transmit FM Deviation	115	250	300	kHz	
Drift	Transmit Drift in any Position	—	—	400	Hz/ μs	

BLE Power Consumption Characteristics

 $V_{\text{CC}}=3\text{V}$, $T_{\text{A}}=25^{\circ}\text{C}$

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RX}	Supply Current (RX Mode)	—	—	8	—	mA
I_{TX}	Supply Current (TX Mode, 0dBm Output Power)	—	—	5.83	—	mA
I_{SLEEP}	Supply Current (IDLE Mode when MCU Deep Sleep)	—	—	1.6	—	μA
I_{ACT}	Supply Current (IDLE Mode when MCU Active)	—	—	1.38	—	mA
I_{PDN}	Supply Current (Power Down)	—	—	1	—	μA

I/O Port Characteristics

 $T_{\text{A}}=25^{\circ}\text{C}$

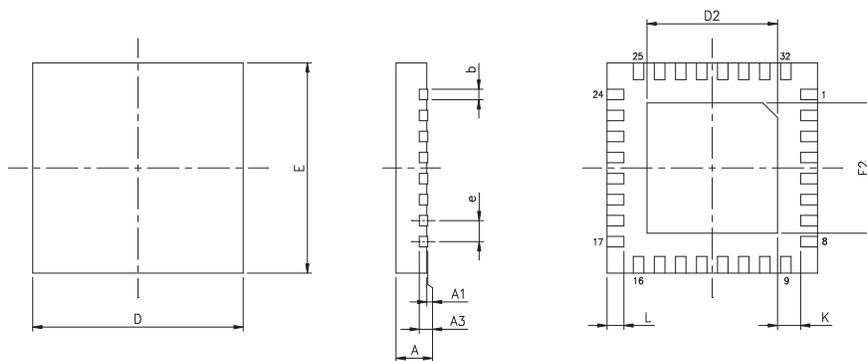
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IL}	Low Level Input Voltage	3V I/O	0	—	0.3	V
V_{IH}	High Level Input Voltage	3V I/O	2.7	—	3.3	V
V_{OL}	Low Level Output Voltage	3V, $I_{\text{OH}}=0.25\text{mA}$	—	—	0.3	V
V_{OH}	High Level Output Voltage	3V, $I_{\text{OH}}=-0.25\text{mA}$	$V_{\text{CC}}-0.3$	—	V_{CC}	V

Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the [Holtek website](#) for the latest version of the [Package Information](#).

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- [Package Information \(include Outline Dimensions, Product Tape and Reel Specifications\)](#)
- [Packing Materials Information](#)
- [Carton information](#)

SAW Type 32-pin QFN (4mm×4mm×0.55mm) Outline Dimensions


Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	0.020	0.022	0.024
A1	0.000	0.001	0.002
A3	0.006 REF		
b	0.006	0.008	0.010
D	0.157 BSC		
E	0.157 BSC		
e	0.016 BSC		
D2	0.100	—	0.108
E2	0.100	—	0.108
L	0.010	0.012	0.014
K	0.008	—	—

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3	0.150 REF		
b	0.15	0.20	0.25
D	4.00 BSC		
E	4.00 BSC		
e	0.40 BSC		
D2	2.55	—	2.75
E2	2.55	—	2.75
L	0.25	0.30	0.35
K	0.20	—	—

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