



CC2340 Bluetooth Module

Excellent Performance  Bluetooth



TI CC2340



Secondary Development



AT Command



Ultra-low Power Consumption



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BLE 5.3

Bluetooth Low Energy

Classic Bluetooth Module (BT)

These classic Bluetooth before BT 4.0 was mainly used for multimedia transmission
Features: high-power consumption, high-speed, but short communication range

Bluetooth Low Energy (BLE) Module

Only BT 4.0 or higher version Bluetooth is BLE (Bluetooth Low Energy)

Features: Long communication range, low power consumption, and small data transmission volume

Introduction

DL-CC2340-A and DL-CC2340-B BLE modules are both designed base on TI wireless series CC2340R5 Bluetooth®LowEnergy Chip, which uses a 48-MHz Cortex-M0+ kernel, integrates up to 512 KB of flash memory, 36 KB of SRAM, and has up to 26 universal I/O interfaces. Moreover, these Bluetooth Low Energy modules are equipped with a built-in 48MHz 10PPM external high-speed clock, and 32.768Khz external low-speed clock.

The DL-CC2340-A BLE module can use a variety of universal peripherals for all I/O ports of the CC2340R5 chip, which includes UART, SPI, I2C, timer, temperature sensor, battery voltage detection, built-in analog comparator, and 12-bit ADC analog-to-digital converter. In addition, to meet the security requirements of Bluetooth, this BLE module also take security issues into consideration, it also has AES-128 encryption and RNG functions. Customers can use the SDK for secondary development, and embed its complete applications. The DL-CC2340-B BLE module has a smaller size, but features AT command, which makes it suitable for use as a UART BLE module. The external MCU can be connected to the BLE module through the UART interface to achieve BLE data transmission. In AT command mode, UART can be used to send commands to modify scan intervals, scan timeouts, connection intervals, broadcast intervals, broadcast custom data, baud rates, etc. The MCU can also send switching commands to the BLE Peripherals through UART, which has broadcast and connection status, and can be connected by the BLE Central, serving as a bridge between the BLE Central and MCU for data transmission.

In terms of RF performance, these CC2340 BLE modules integrate RF balun internally, with simplified RF design, and reduced power consumption. The typical sensitivity can reach as high as -96.5 dBm @ 1 Mbps, and they can also achieve an output power up to +8 dBm. In order to meet the limit standards for RF power in various countries, the power of the BLE modules can be adjusted (ranging from -21 dBm to+8 dBm).

Characteristics

Working Temperature

Rang: -40~85°C,
suitable for various
applications, even harsh
environments

Transmitting Power

Adjustable range of
-21~+8 dBm,
in compliant with limit
standards for RF power
in various countries

Low Power Consumption

It has a low RX current
of 5.3mA, and a standby
current of less than 800nA,
which can greatly increase
the lifespan of the battery.

Excellent Performance

-102dBm sensitivity(Bluetooth
®Low Energy 125 kbps)
-96.5dBm sensitivity (Bluetooth
® Low Energy 1 Mbps)



Technical Parameter

Hardware Parameters

Model No.	DL-CC2340-A / DL-CC2340-B
Dimension	26.5x18 mm / 18x12 mm
Chip Model	TI CC2340R5
Development Method	Secondary Development / AT Command
Module Pin QTY.	40 PIN (25 GPIO) / 20 PIN (15 GPIO)
Antenna	PCB antenna + IPEX / PCB antenna + external PAD
Working Voltage (DC)	1.75~3.8V
Working Temperature	-40 °C ~ +85 °C
Storage Temperature	-40 °C ~ +85 °C

Wireless Characteristics

Bluetooth Version	supports Bluetooth 5.3
Frequency Range	2402-2480 MHz (2.4G ISM radio band)
Modulation Mode	GFSK
Transmission Power	-21 dBm ~ +8 dBm (can be programmed via software)
Receiving Sensitivity	-96 dBm (typical value @ 1 Mbps)
Transparent Mode	Central / Peripheral
Communication Range	70 meters (open area)

Power Consumption Parameters

Active-Mode RX	5.3 mA
Active-mode TX	5mA @ 0dBm 12mA @ +8dBm
Sleep State	sleep state 0.7- μ A avg (RTC running and RAM/CPU holding)
Running	2.6mA active mode
Data Transmission	to be updated

Software Parameters

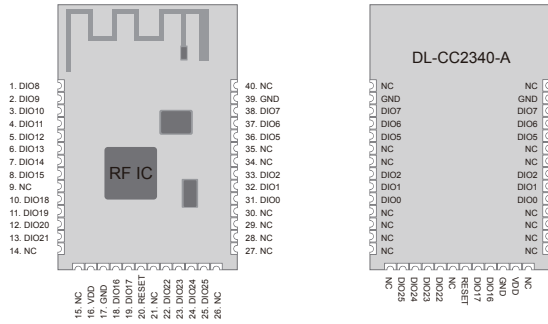
Supported Protocols	<ul style="list-style-type: none">• Bluetooth® 5.3 Low Energy• Zigbee® 1• SimpleLink™ TI 15.4-stack 1
OTA	available
Peripheral & Central	both available



Pin Definition & Dimensions

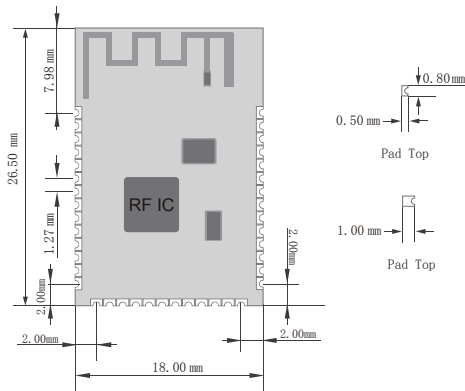
DL-CC2340-A

Pin Definition



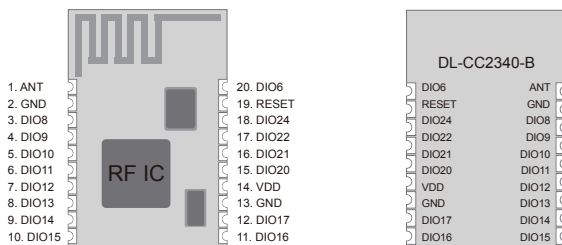
Pin	Type	Function Description
1.DIO8	Digital	GPIO
2.DIO9	Digital	GPIO
3.DIO10	Digital	GPIO
4.DIO11	Digital	GPIO
5.DIO12	Digital	GPIO
6.DIO13	Digital	GPIO
7.DIO14	Digital	GPIO
8.DIO15	Digital	GPIO
10.DIO18	Digital	GPIO
11.DIO19	Digital	GPIO
12.DIO20	Digital or Analog	GPIO, analog capability
13.DIO21	Digital or Analog	GPIO, analog capability
16.VDD	Power	1.8-V to 3.8-V DIO supply
17.GND	Power	Ground
18. DIO16	Digital	GPIO, SWD interface: mode select or SWDIO, high-drive capability
19.DIO17	Digital	GPIO, SWD interface:SWDCK clock, high-drive capability
20.RESET	Digital	Reset, active low. No internal pullup resistor
22.DIO22	Digital or Analog	GPIO, analog capability
23.DIO23	Digital or Analog	GPIO, analog capability
24.DIO24	Digital or Analog	GPIO, analog capability
25.DIO25	Digital or Analog	GPIO, analog capability
31.DIO0	Digital or Analog	GPIO, analog capability
32.DIO1	Digital or Analog	GPIO, analog capability
33.DIO2	Digital or Analog	GPIO, analog capability
36.DIO5	Digital or Analog	GPIO, analog capability
37.DIO6	Digital or Analog	GPIO, analog capability
38.DIO7	Digital or Analog	GPIO, analog capability
39.GND	Power	GPIO, analog capability
9.NC	14.NC	NC
15.NC	21.NC	
26.NC	27.NC	
8.NC	29.NC	
30.NC	34.NC	
35.NC	40.NC	NC

Size

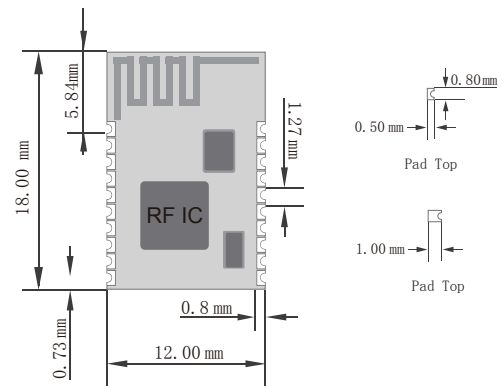


DL-CC2340-B

Pin Definition

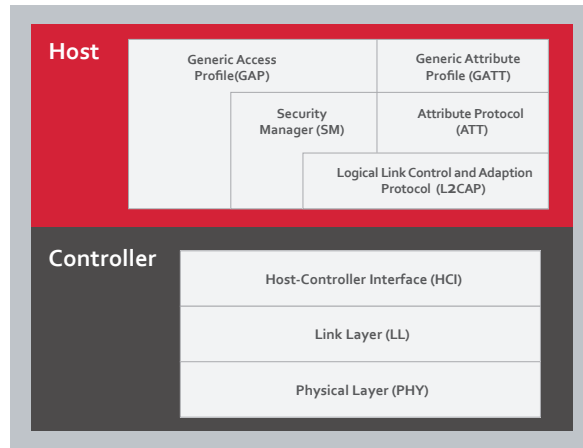


Size

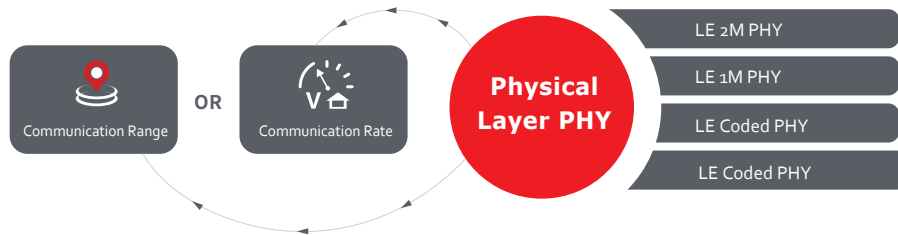




Framework Diagram

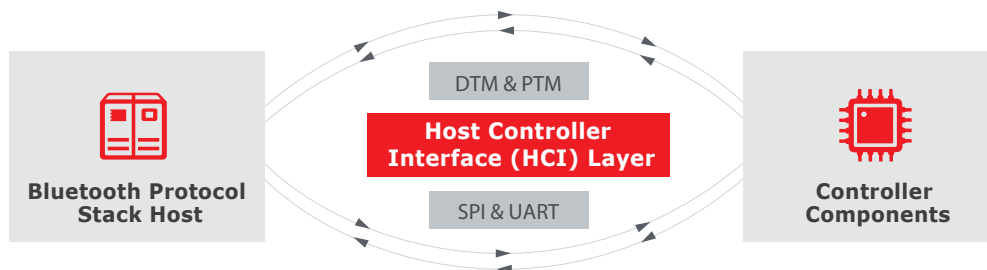


■ CC2340R5 Physical Layer PHY



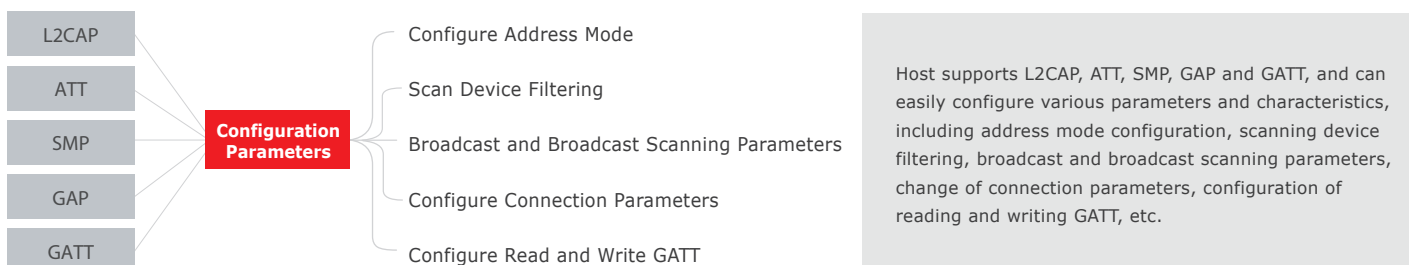
CC2340R5 physical layer (PHY) supports LE 2M PHY, LE 1M PHY, and LE Coded PHY (S2 and S8), allowing users to make a better choice between Communication Range and Communication Rate.

■ Host Controller Interface (HCI) Layer



HCI transmits commands and events between the host and controller components of the Bluetooth protocol stack. CC2340 HCI also supports DTM (Direct Test Mode) and PTM (Production Test Mode). You can even take CC2340 as a Bluetooth protocol stack controller (by using the SDK's host_test routine) to achieve data exchange with external MCU, through SPI or UART interfaces, and customize the Bluetooth protocol stack.

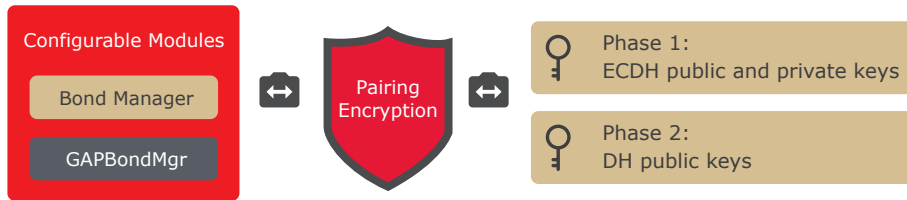
■ Host





Features

■ Bond Manager, GAPBond Manager

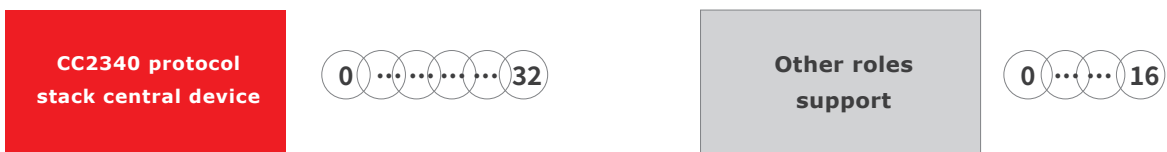


- It offloads most of the pairing and bonding security mechanisms associated with the Security Manager (SM) protocol from the application.
- Pairing encryption is supported, enabling secure connections will activate ECDH public and private keys during the pairing process.
- As part of the first phase of LESC pairing, each device will generate its own ECDH public-private key pair.
- As part of the second phase of LESC pairing, each device will calculate a Diffie-Hellman (DH) key based on the public keys exchanged.

■ Both Peripheral & Central Available: Peripheral+Central

Broadcaster	Unconnectable broadcast device.
Observer	The device scans for advertisements, but cannot initiate a connection.
Peripheral	This device is a connectable broadcast device that operates as a peripheral on single or multiple link layer connections.
Central	This device scans broadcasts and can initiate connections, and operates as a Central within a single or multiple link layer connection.
Central +Broadcaster	This device scans broadcasts and initiates connections, operating as a Central within a single or multiple link layer connection. Additionally, this device is a non-connectable broadcast device.
Peripheral +Observer	This device is a connectable broadcast device that operates as a peripheral on single or multiple link layer connections. Additionally, the device scans for broadcasts but cannot initiate connections.
Peripheral +Central	This device is a connectable broadcast device that operates as a peripheral on single or multiple link layer connections. Also, this device scans broadcasts and initiates connections and operates as a Central in single or multiple link layer connections

■ Multi-connection: CC2340 protocol stack central device supports 0 to 32 connections; other roles support: 0 to 16 connections



More connections take more RAM, and may require increasing HEAP

■ More Features (SDK is being improved)



BLE5.3

LE Periodic Advertising



BLE5.3

Randomized Advertising Channel Indexing



LE Advertising Extensions

LE Advertising Extensions



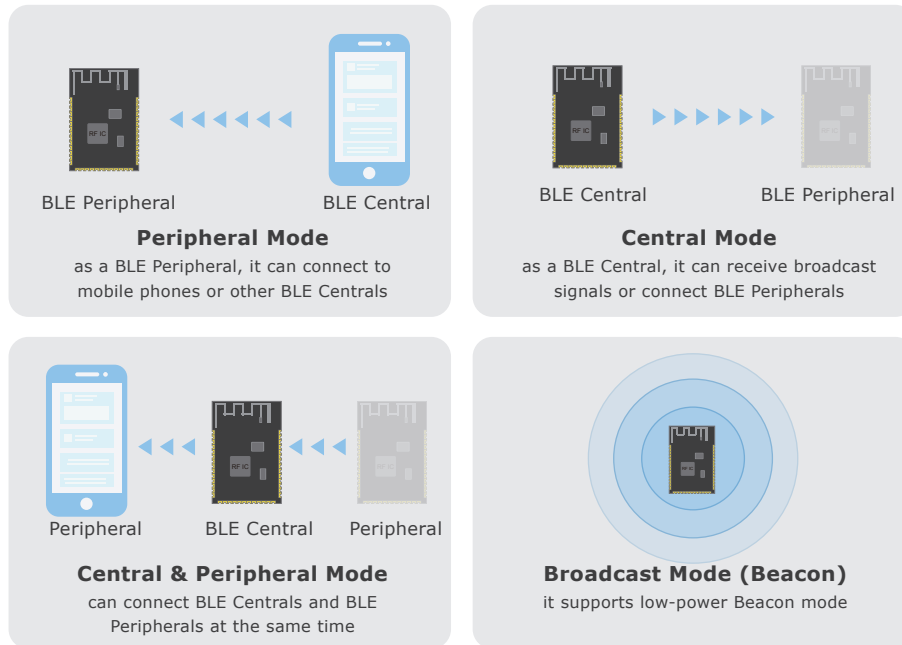
AoA

AoA

BLE5.1



Common Working Modes: Central Mode, Peripheral Mode, Central & Peripheral Mode, Broadcast Mode

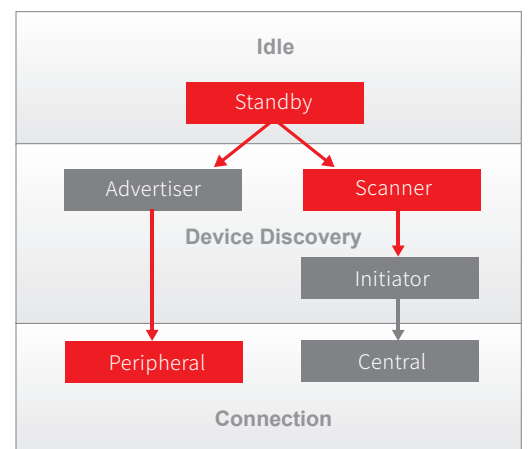


In Beacon Broadcast Mode, it is generally set to a non-connectable state. Beacon will broadcast a data packet to the surroundings at certain intervals. As an independent BLE Central, when performing scanning actions, it will receive data package from Beacon broadcasts at intervals, which is commonly used for Indoor Positioning application, Store Information Push.

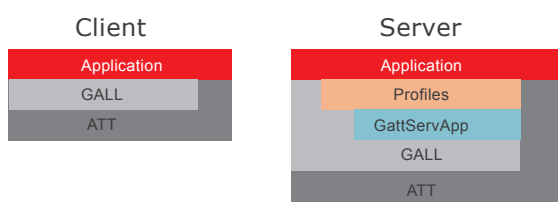
The BLE module in Peripheral Mode is also in the broadcast state, waiting to be scanned. Different from Broadcast Mode, when the Bluetooth module in Peripheral Mode is connected to the BLE Central, there is no broadcast and it can scan for surrounding broadcasting devices.

Bluetooth Status

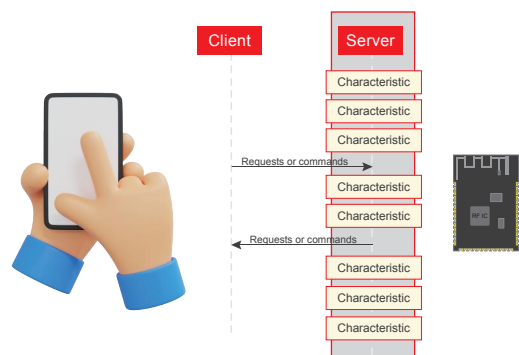
- Standby: no device is connected, and no data is transmitted or sent.
- Broadcasting (Advertiser/advertising): periodic broadcast status.
- Scanning (Scanner/scanning): actively search for devices that are broadcasting.
- Initiating Connection (Initiator/initiating): actively initiating a connection.
- Connected: has been connected.



Data Transmission



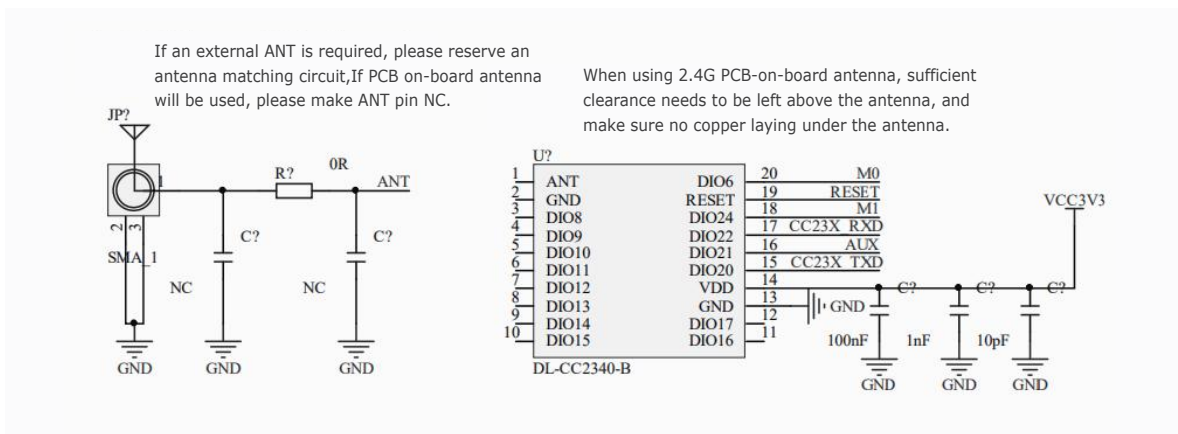
Server and Client Frameworks



Interaction Flow Chart

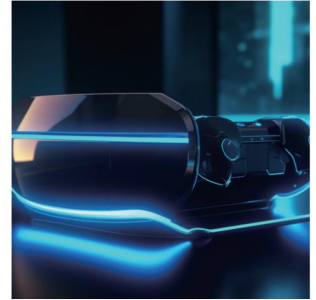


■ Recommended Circuit for DL-CC2340-B AT command



■ AT command

Command	Description
AT+UART	Set/Query Serial Port
AT+HELP	Acquire Command List
AT+RST	Restart Module
AT+SHUTD	Close Module
AT+DEFAULT	Restore Factory Settings
AT+BINIT	Bluetooth Initialization
AT+ADDR	Set/query Bluetooth Address
AT+MTULEN	MTU Set/Query MTU Length
AT+CONNP	Query/Update Connection Parameters
AT+CONN	Establish Connection
AT+DISC	Disconnect
AT+ADVP	Set/Read Broadcast Parameters
AT+ADVST	Start Broadcast
AT+SCANP	Set/Read Scanning Parameters
AT+SCANST	Start Scanning
SSRVCRE	Create Service Characteristics
SSRVSTA	Enable/Disable Services
SSRVDISC	Discover Service Characteristics
CHARWRITE	Write Service Characteristics
CHARREAD	Read Service Characteristics
AT+STA	Read/Set Instruction Status Bit
	Transparent Transmission Monitoring
	Exit Transparent Transmission



Sports & Health

Activity Tracker, Pedometers, Sports Measurement (running, cycling, golf), etc.

Smart Home

Socket Improvement, Remote Control Switch, Smart Lighting, Smart Locks, Smart Curtains, Thermometer and Hygrometer, Smart Scale, Environmental Monitoring, Smart Detector, Pet Supervision, etc.

Health and Medical

Medical Detection/Tracking (heart rate, blood pressure, blood oxygen, pulse, body temperature), Blood Glucose Monitoring, Insulin Pump, Medical Sensor Patch

Infant Care

Real-time Temperature Detection, Smart Crib, Anti-lost

Toys

Interactive Remote-control Toys, Robots, Aircraft, Toy cars, Anti-lost devices

Vehicle Electronics

Tire Pressure Detection, Automatic Car Lock, Parking Record, Electric Vehicle Anti-theft Device, Data Collection and Monitoring

Automation

Beacons, Electronic Labels, Asset Management, Cold Chain Logistics, Industrial Control, Electronic Shelf Label, Electronic Sales Terminals

Smart Building

Building Security, HVAC, Lighting

Personal Care

Electric Toothbrush, Electric Shaver, Facial Cleanser

Games, Remote Control

Game Controllers, Voice Remote Control, Toys

Electronic Product

Keyboard/Mouse (non-USB type), Printer, Storage