BC7211

NEC Format IR Remote Decoder

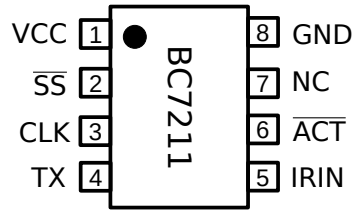
BC7211 is a low-cost NEC format decoder chip for infrared remote control, the NEC code format refers to the output format of NEC's μPD6121, which is widely used for remote control of home appliances and other devices and is adopted by many infrared remote control chips, The output and data format of the BC7211 are compatible with the BC7210A (not pin compatible), so if the RC5 format decoding function of the BC7210A is not requested, the BC7211 can be used as a low-cost replacement for the BC7210A.

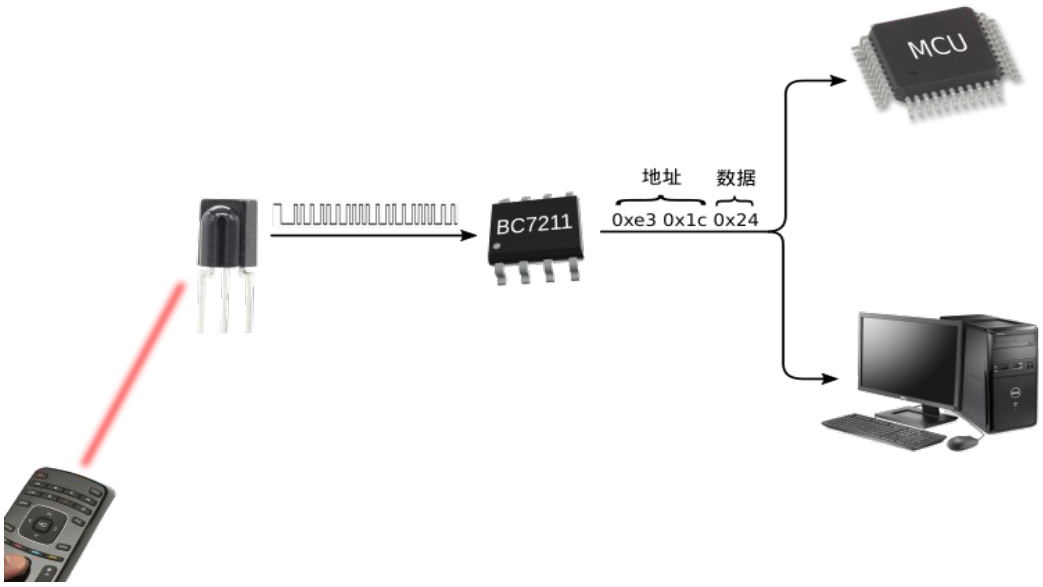
With the BC7211, product development can be done will reduced time and effort, CPU load and peripheral requirements are also reduced, resulting in overall cost reduction.

Features

- Support all IR remote control encoders in NEC format
- High tolerance, anti-interference, error free output
- Standby current 5uA @ 3V
- Output compatible with both UART/SPI
- Interface and format compatible with BC7210A
- Wide temperature range

Pin Diagram





Pin Descriptions

Pin Number	Name	Descriptions
1	VCC	Power supply, 2.2-5.5V
2	$\overline{SS}$	Slave Select for SPI, connected to Chip Select on SPI slave
3	CLK	SPI clock, output a positive pulse when data bit on Tx is ready
4	TX	Data output, Open Drain, need a pull-up resistor, as DATA for SPI or TX for UART, baud rate 9600
5	IRIN	IR signal input, connected to the output of IR receiver
6	$\overline{ACT}$	Data Active indicator, active low, can be used for indicator or checking for long-press on remote
7	NC	No connect, keep float
8	GND	ground

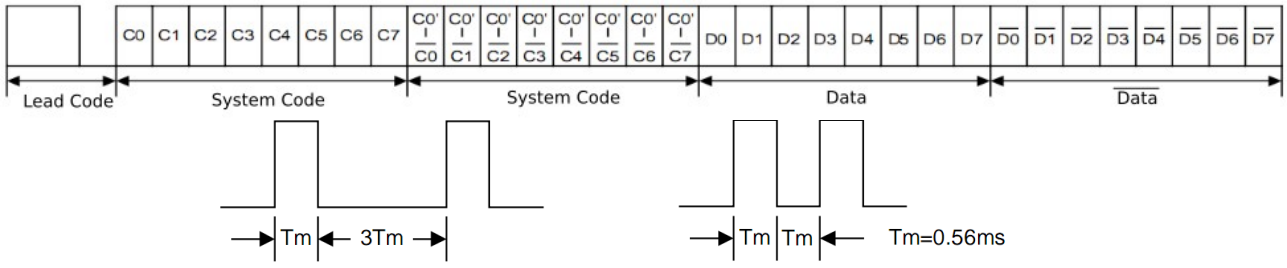
NEC Format

NEC format is one of the most widely used infrared remote control coding scheme. This coding scheme uses pulse position modulation to distinguish "0" and "1" with different the time interval between pulses.

Each data frame includes 32 bits of data, including 16 bits of system code (address code), 8 bits of keypad data code and 8 bits of reversed keypad data code. The system code can be up to 16 bits, but in practice it is usually 8 bits, and the high 8-bit system code is often set as the one’s complement of the low 8-bit user code. Because the 1’s complement can be used for verification, so this coding scheme has a strong anti-interference ability.

Theoretically, NEC coding can support 256 keys, the actual encoding chip can generally support 64 keys. μPD1621 and other chips support key combinations, that is, some key codes will only be generated in the case of a specific 2 keys pressed at the same time, this function is very useful for such as VCR "record keys" and other occasions need to prevent misuse.

When a key is pressed on the remote control, it sends out a data frame, which includes the leading signal and the data code. If the key is kept pressed and not released, the remote with NEC format will keep sending out a hold frame, which only includes the leading signal, excluding any data.



logic 1 logic 0

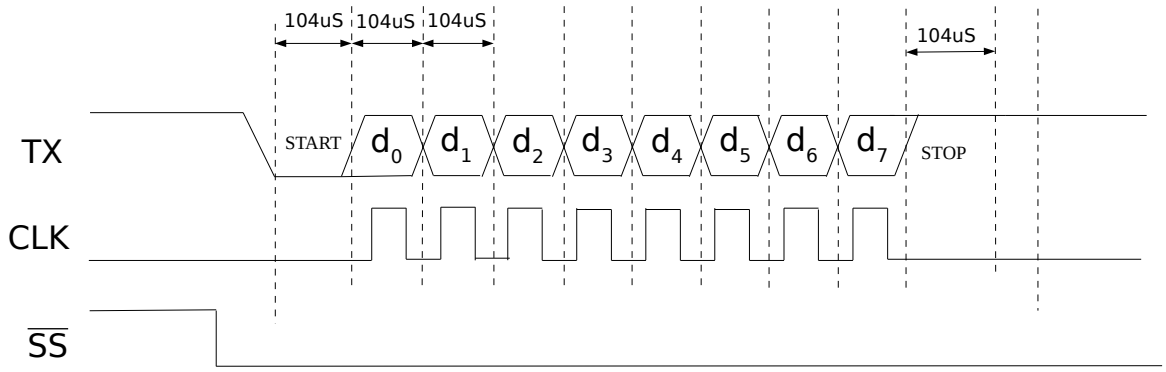
Data frame holding frame

Output Format

BC7211 has serial output. The port pins are SS (Slave Select), CLK (clock signal) and TX (serial data output). The pin TX is used as the data line of both SPI and UART, the baud rate of UART is 9600, and the parameter is set to 8 data bits, 1 start bit, 1 stop bit, no parity. TX is open drain, a pull-up resistor must be connected. TX can be directly connected to the UART input pin of MCU or connected to a USB port through USB-UART bridging chip.

BC7211 outputs 3 bytes at a time, including 2 bytes of system code (address code) and 1 byte of data code. When the BC7211 receives a complete data frame, it outputs the data of that data frame through the serial port, and the $\overline{ACT}$ pin goes low. If a hold frame is followed, the $\overline{ACT}$ signal will stay low. If no new hold frame is input at the IRIN pin for more than 128ms, or if a signal is received that is neither a data frame nor a hold frame, the $\overline{ACT}$ will return to high level. Users can use $\overline{ACT}$ signal to determine whether the remote control button is in long press state. (Please note that some remote control transmitter chips are not fully compatible with μPD6121, these chips only send data frame, not the hold frame, so when using these remote control encoders, you can't get the long-press information from the remote. This situation is especially common in some universal remotes)

The $\overline{SS}$ signal jumps to low at the beginning of each group of 3 bytes and returns to high after the last byte of the group is sent.



Output contents:

1st byte							
b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8

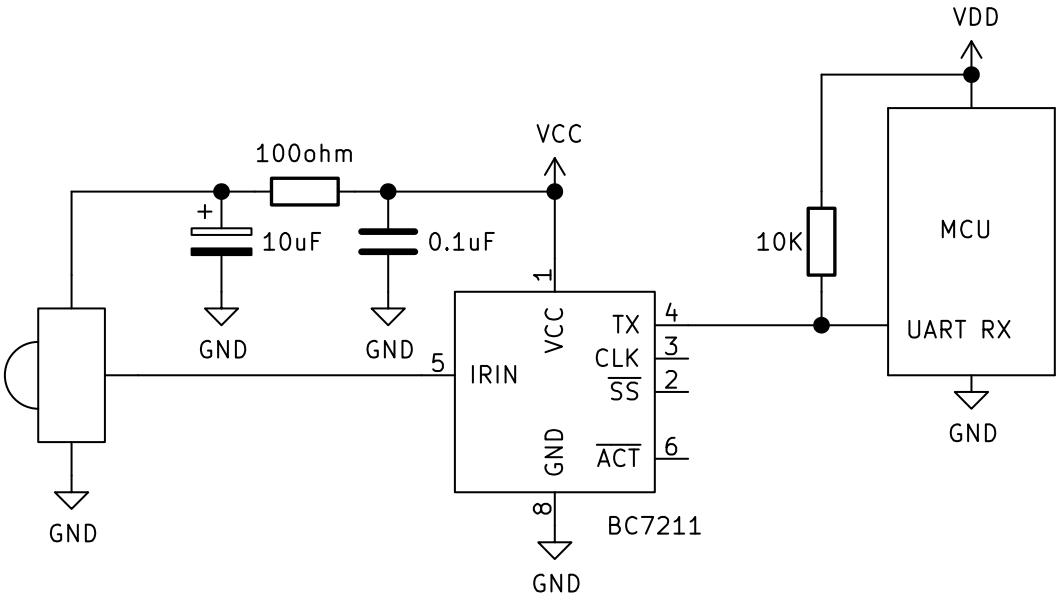
2nd byte							
b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0

3rd byte							
b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0

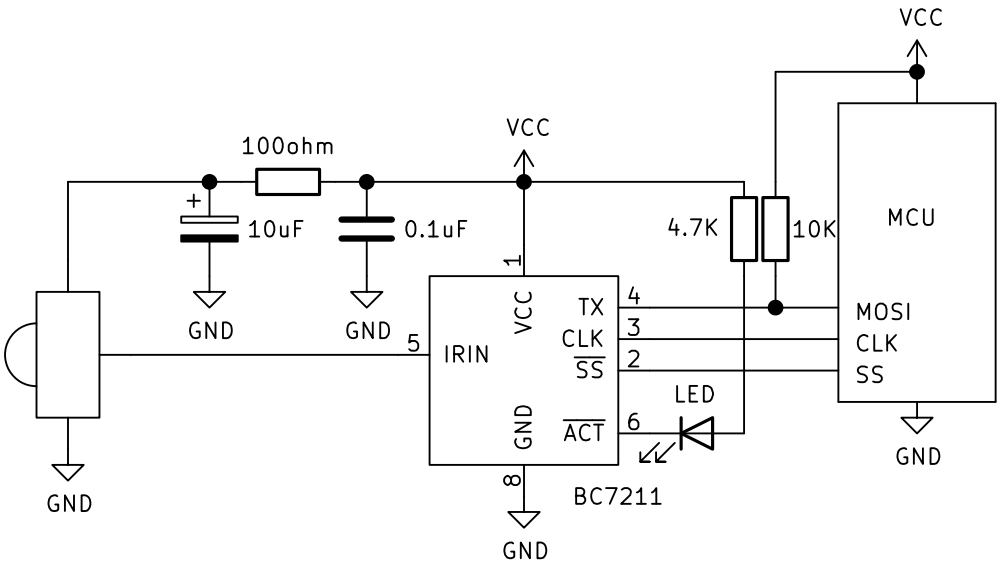
Where A_0-A_{15} is the system code (address code) and D_0-D_7 is the data code (key code). Note that the data transmission is compatible with the UART format as the low bit comes first, i.e., on the TX line, the order of appearance of the data bits is

$A_8 \rightarrow A_9 \rightarrow A_{10} \rightarrow A_{11} \rightarrow A_{12} \rightarrow A_{13} \rightarrow A_{14} \rightarrow A_{15} \rightarrow A_0 \rightarrow A_1 \rightarrow A_2 \rightarrow A_3 \rightarrow A_4 \rightarrow A_5 \rightarrow A_6 \rightarrow A_7 \rightarrow D_0 \rightarrow D_1 \rightarrow D_2 \rightarrow D_3 \rightarrow D_4 \rightarrow D_5 \rightarrow D_6 \rightarrow D_7$

Typical Applications



App 1: Using UART



App2: Using SPI and $\overline{\text{ACT}}$ as indicator

Because the TX pin is an open drain output, when using the UART port, different voltages can be used on the BC7211 side and the MCU side, i.e. VCC and VDD can be the same or different in application 1.

When there is no new signal input from IRIN for more than 128ms, the BC7211 will enter low-power standby mode and automatically exit the standby and enter the working mode when a new signal arrives. Please note that regardless of whether the received signal is valid or not, as long as the level on IRIN changes, it will make the BC7211 enter operating mode. In addition, users who need low-power design also need to take into account that although the BC7211 is at low power consumption in the standby mode, the IR receiver itself must be kept in the working mode to receive IR signals, and the IR receiver will generally have several hundred uA to several mA of operating current, please refer to the data sheet of the selected IR receiver to get the actual power consumption.

Absolute Parameters

Parameters	Symble	Range
Storage Temperature	Ts	-55 - +125˚C
Working Temperature	Ta	-40 - +85˚C
Power Supply Voltage	Vcc	-0.3 - 5.5V
Voltage On Any Pin	Vpg	-0.3 - Vcc+0.3

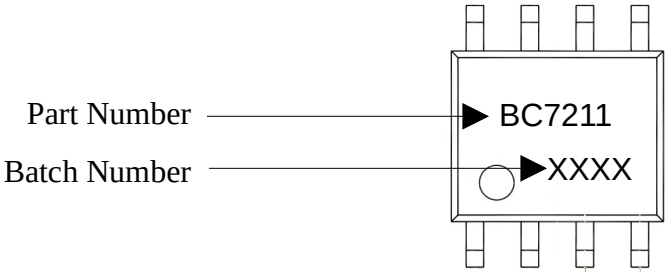
Electrical Characteristics

Note: Ta=25˚C

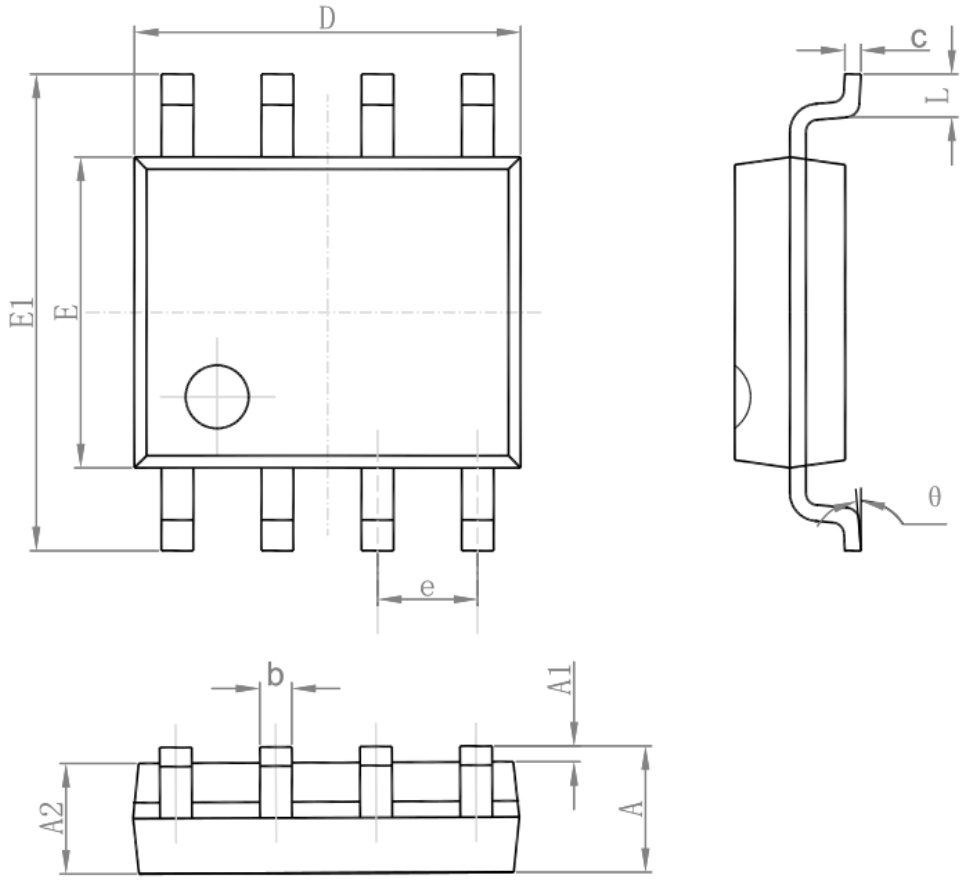
Parameters	Symble	Min	Typical	Max	Unit	Comments
Supply Voltage	Vcc	2.2		5.5	V	
Working Current	Icc		600		uA	Vcc=3V
			1.2		mA	Vcc=5V
Standby Current	I_{IDL}		5		uA	Vcc=3V
			23		uA	Vcc=5V
Input Low Level	V_{IL}			0.2Vcc	V	
Input High Level	V_{IH}	0.5Vcc			V	
Sink Current on Output Pins	I_{OL}			20	mA	ACT, TX, CLK, SS
Source Current on Output Pins	I_{OH}			20	mA	ACT, CLK, SS

Packaging Information

Chip Marking



Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Ordering Information

Ordering Number	Packaging	Qty in each package
BC7211-T	Tube	10000
BC7211-RS	Tape & Reel	1800