**Technical & Functional analysis**

**Breakout game with accelerometer controller using Thread/Matter**

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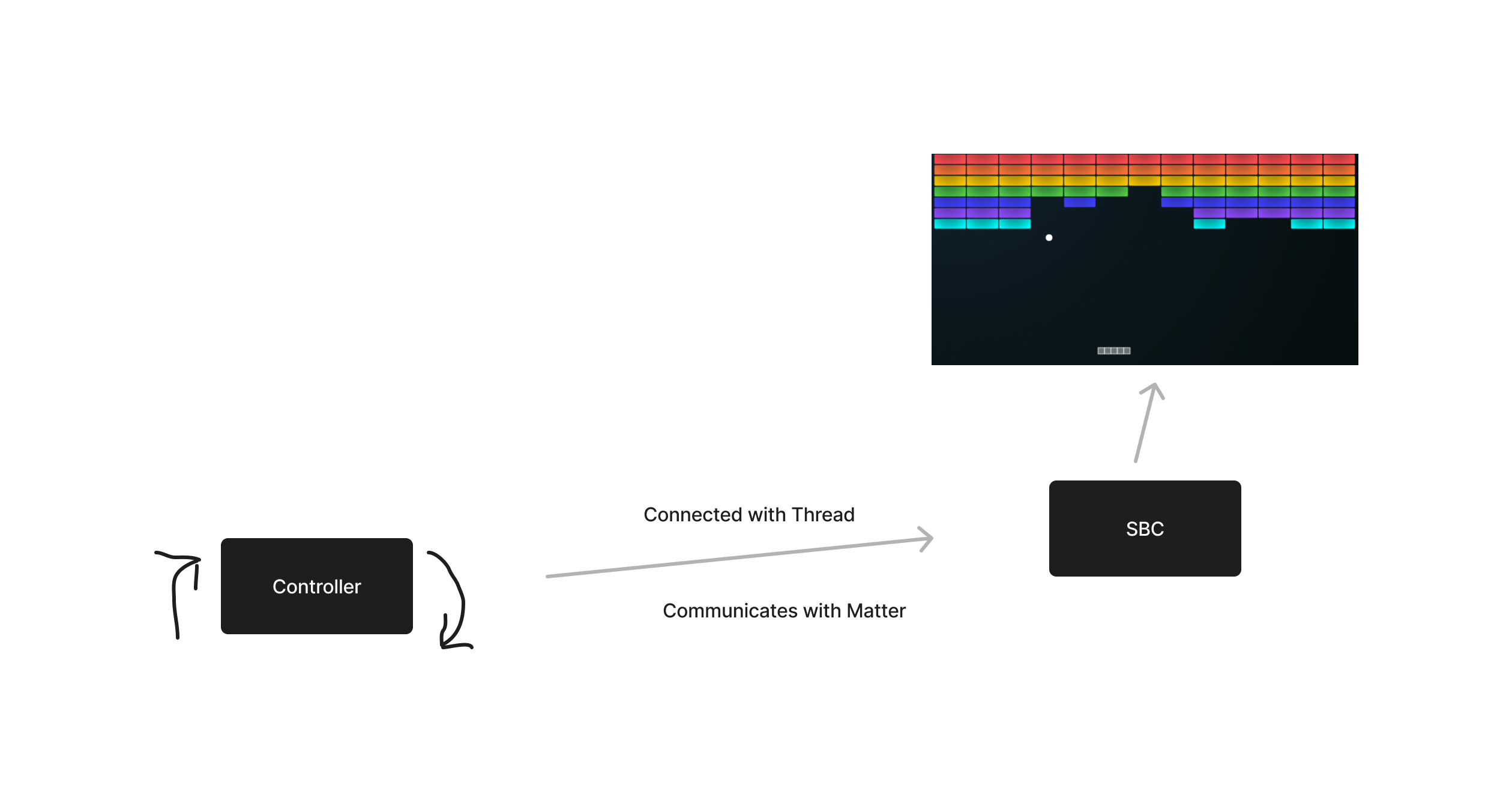
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# Project overview

This project is an interactive breakout game controlled by motion with a wireless controller. The controller is connected to a Thread network and communicates with the Matter protocol. The breakout game is displayed on a tv using a Single Board Computer that is also connected to a Thread network.



# Matter protocol

Matter, formerly known as “Project CHIP” (Connected Home over IP) is an open-source, royalty-free connectivity standard designed to make it easier for various smart devices to communicate with each other. It aims to create a unified standard for the Internet of Things devices. A Matter device can connect to a network with Thread, WIFI and Ethernet.

# Thread network protocol

Thread is an low-power mesh networking protocol that is based on IPv6. Thread is a open standard and is built for IoT applications. It uses 6LoWPAN which uses IEEE 802.15.4 (2.4Ghz) wireless protocol with mesh communication.

# Game controller

The wireless controller must be equipped with:

* 2.4Ghz wireless controller used for the Thread connection
* Accelerometer used for interact with the game (moving the bar)
* Button used for interact with the game (pause, start, etc)
* A battery to provide power to the controller

# ICM-20689

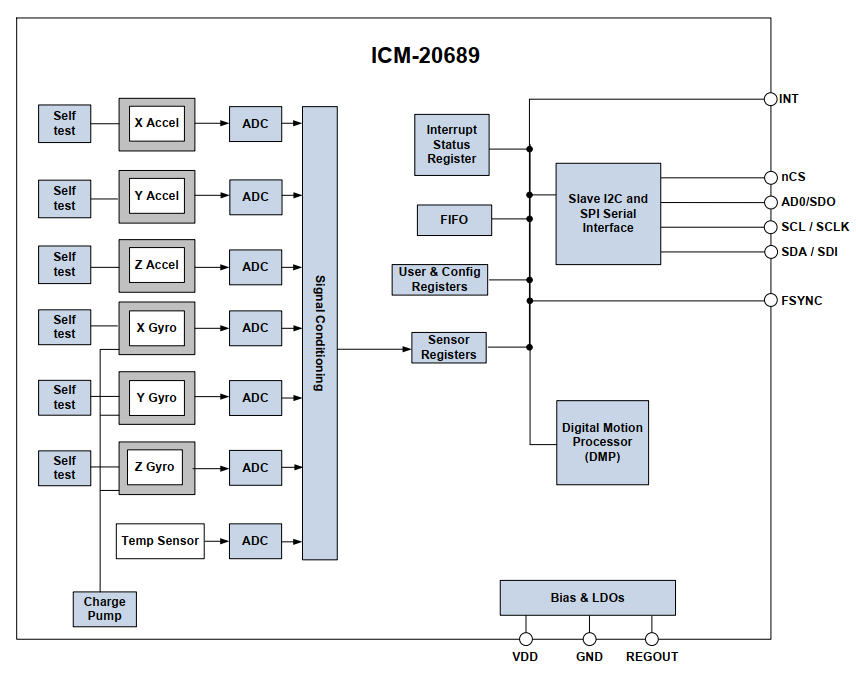
## Product Overview

The ICM-20689 is a 6-axis MotionTracking device that combines a 3 axis gyroscope, 3 axis accelerometer, and a Digital Motion Processor™ (DMP) in a small 4x4x0.9 mm (24pin QFN) package. ICM-20689 includes on-chip 16bit ADCs, programmable digital filters, an embedded temperature sensor, and programmable interrupts. Communication ports include I2C and high speed SPI..

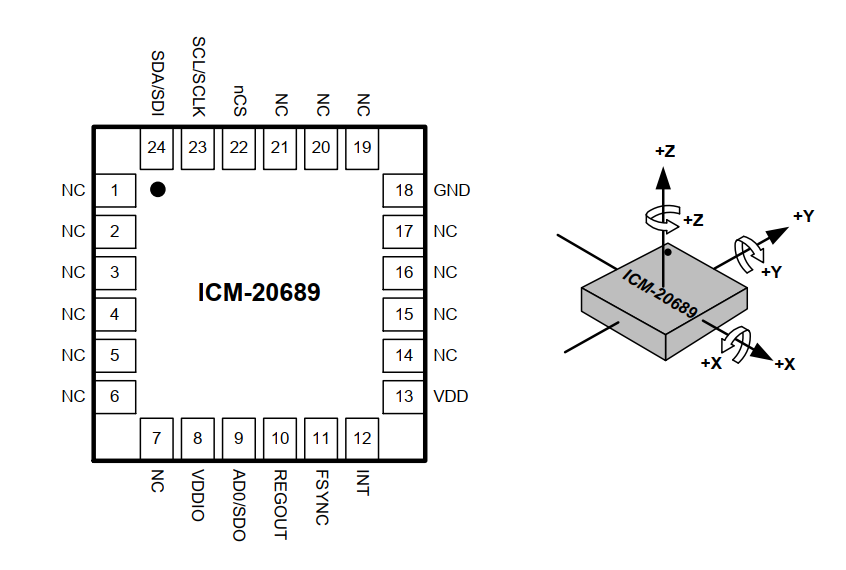
* User-programmable interrupts
* Wake-on-motion interrupt for low power operation of applications processor
* 4K-byte FIFO buffer enables the applications processor to read the data in bursts
* On-Chip 16bit ADCs and Programmable Filters
* Host interface: 8 MHz SPI or 400kHz Fast Mode I2C
* Digital-output temperature sensor
* VDD operating range of 1.71V to 3.45V
* MEMS structure hermetically sealed and bonded at wafer level

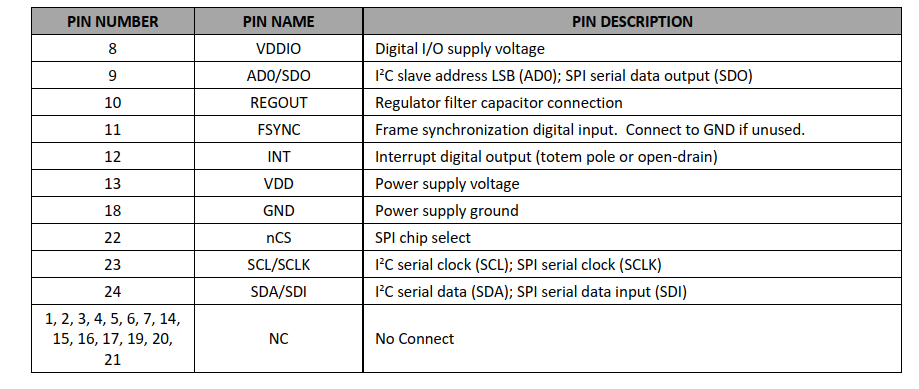
The gyroscope has a programmable full-scale range of ±250, ±500, ±1000, and ±2000 degrees/sec. The accelerometer has a user programmable accelerometer full-scale range of ±2g, ±4g, ±8g and ±16g. Factory-calibrated initial sensitivity of both sensors reduces production-line calibration requirements.

Other industry-leading features include on-chip 16-bit ADCs, programmable digital filters, an embedded temperature sensor, and programmable interrupts. The device features I2C and SPI serial interfaces, a VDD operating range of 1.71 V to 3.45 V, and a separate digital IO supply, VDDIO from 1.71 V to 3.45 V. Communication with all registers of the device is performed using either I2C at 400kHz or SPI at 8 MHz.



## Technical specifications





**Note:** VDD, VDDIO, SCL/SCLK and nCS pins must be correctly managed at power-up to guarantee proper device start-up. When applying VDD, the power voltage ramp is detected and a power-on-reset sequence is triggered inside the component. During this phase the device starts operating and internal logic levels are defined. For proper component initialization the power-up should be performed with both nCS and SCL/SCLK low, ensuring that nCS and SCL pins are not in an undetermined state during the VDD ramp. If starting in I2C mode (CS at logic high), power-up should be performed with SCL/SCLK low. Power-up with SCL/SCLK high is not a supported case and must be avoided.

