

COM.

An intercom device for the SONOS system.

Overview

COM. is an intercom device that connects and controls all SONOS speakers within the same network. It allows the user to do the following:

- Talk to any of the speakers.
- Control music on any of the speakers.

COM. is an important step towards building a complete home network of SONOS products.



Music Mode

In music mode, play, pause, and skip tracks for any room in your home.



Intuitive Control

COM. includes 4 capacitive touch areas and an easy to read LCD screen.

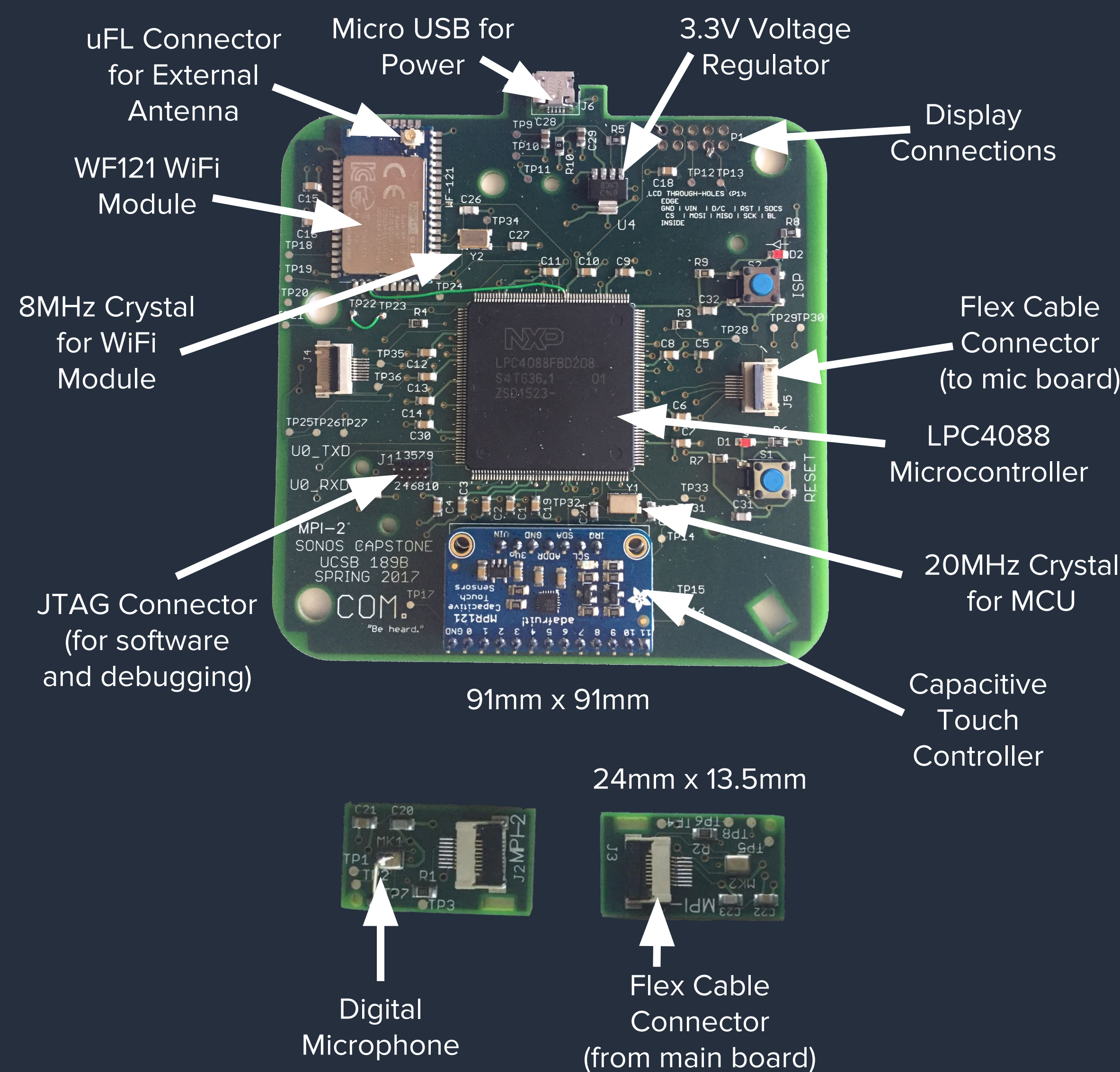


Intercom Mode

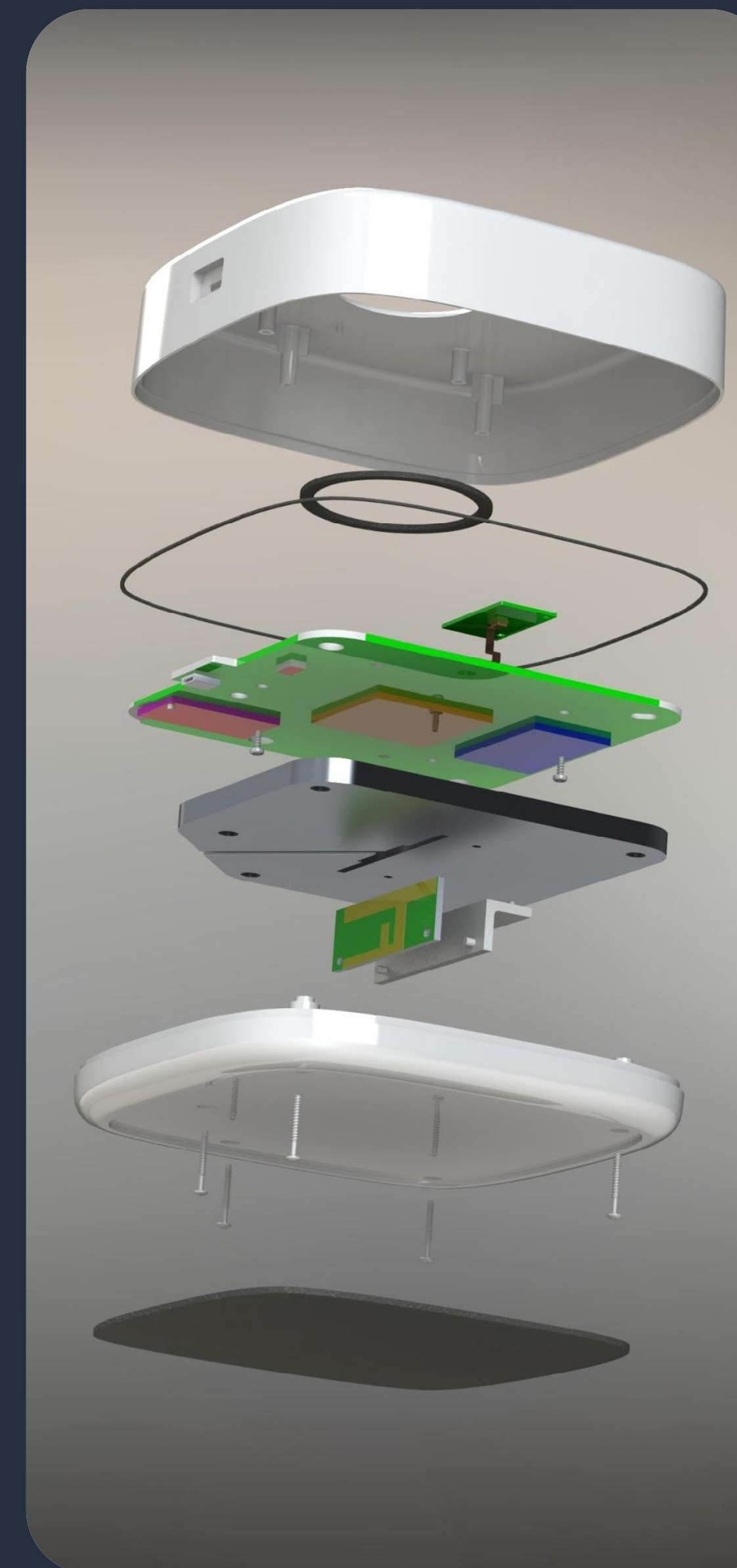
In intercom mode, choose any room, speak to it, and be heard.



Hardware Design



Physical Design



Important Components:

- Shell is made of PC plastic, with a high resistance to drops and ultraviolet light.
- Gaskets of silicon rubber to achieve splash resistance.
- PCB board with an LCD screen, WiFi module, micro-USB power source and microphones.
- Aluminum heatsink attached to the bottom of the PCB.
- Antenna partially inserted into the heatsink, attached via a carrier.
- Bottom shell that allows easy assembly with screws.
- Bottom silicon rubber padding attached to the shell with PSA.

Capstone Team

Mechanical Engineering: Kuan Sung, Kenny Wang, Yang Xue, Yubin Liu, and Shuangyu Li.
Electrical Engineering: Luke Bucklew, Yiqin Wang, and Jiangyang Lu.
Computer Engineering: Marcellis Carr-Barfield, Subhdeep Choudhury, Brian Sandler, Richard Wei, Brenden Fujishige, and Mohammad Cazi.

UCSB: Tyler Susko, Carl Meinhart, Ted Bennett, Steve Laguette, Trevor Marks, John Johnson, Yogananda Isukapalli, Ilan Ben-Yaacov, Ekta Prashnani, Sean Mackenzie, Caio Motta, and Celeste Bean.
SONOS: Camille Zaba, Nathan Pike, Connor Buckland, Farhad Mirbod, Daniel Huhsing, Vicki Chen, and Gregorio Teller.
Laritech: Bill Larrick, Veronica Ellias, Lillian Ware, and Kristin Bradley.

Original Criteria	Accomplished?
<ul style="list-style-type: none"> • Must operate with reasonable internal temperatures. • Surface temp must be comfortable to touch. 	✓
<ul style="list-style-type: none"> • Capacitive touch needs to be operational with wet fingers. 	✓
<ul style="list-style-type: none"> • Must have functional mics, that are able to deliver audible sound. 	✓
<ul style="list-style-type: none"> • Must be able to survive a 1 m drop. (Simulation only) 	✓
<ul style="list-style-type: none"> • Needs to control music playing through Sonos network. • Must be able to function as an intercom. 	✓

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Durable and Stylish

Drops and discoloring? Forget about it.

The COM. enclosure uses a high quality polycarbonate plastic.

Splash Resistant

Gaskets of silicon rubber make sure that your COM. can withstand any home environment.

Cool as a Cucumber

Not only is this device cool to the touch due to a custom aluminum heatsink, it is also just cool in general.

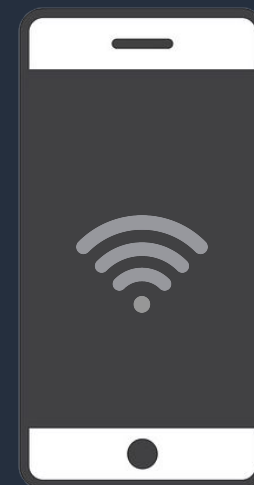
Tap away.

The silicon rubber padding on the base of the unit will let you tap until your heart's content while preventing the device from slipping and sliding around.

Simple Setup



1. Plug it in.



2. Connect to the "SONOS COM." WiFi network.



3. Use the app to send your SSID and password.

Specifications

Wireless Network Connectivity

WiFi b/g/n supported.
Customized SONOS antenna to optimize signal quality.

Dual Microphone Setup

Two digital microphones create unlimited potential for high quality recording.

LCD Display

An 18-bit color TFT LCD display maximizes the user experience.

Capacitive Touch Controller

Allows for an intuitive user experience.

Compact

A custom made schematic, layout, and 4 layer PCB that enables us to fit everything into a small form factor.

Software and Behavioral Design

The functionality of the COM. is split into two modes: music control and intercom. The software performs different actions depending on what inputs the device registers and what mode it is in. After the initial startup sequence, the COM. will be in one of those two modes using a state machine.

Music Mode



Intercom Mode



Specification and Testing Results

Specifications	Desired Value	Final Results
Mass	185 g	248.5 g
Surface Temperature	<48°C <118.4°F	26°C 78.8 °F
Highest Operating Temperature (CPU)	<125°C <257°F	43°C 109.4°F
Water Resistance Level	IP 62	IP 62
Microphone	THD _F 10%	THD _F 32.6%

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