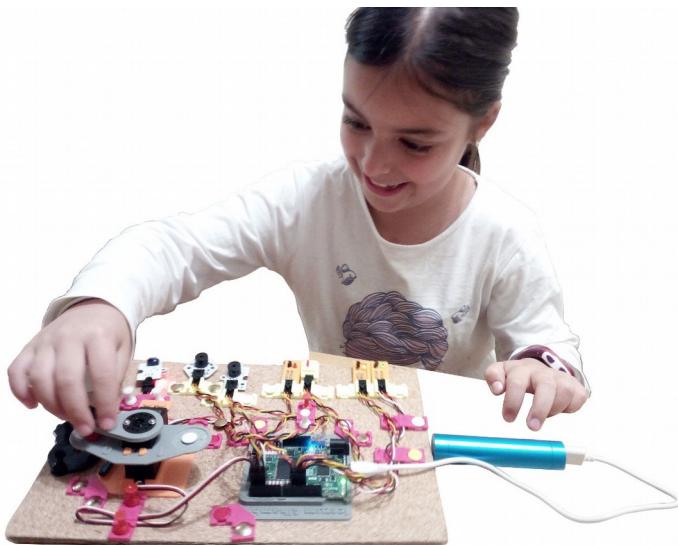


# Electrónica Digital Divertida con FPGAs libres



AYUNTAMIENTO DE  
CAMARGO

**IBEROBOTICS**  
ROBOTS PERSONALES Y DE SERVICIOS



Juan González Gómez  
[@Obijuan\\_cube](https://github.com/Obijuan)  
<https://github.com/Obijuan>



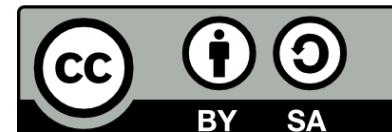
Universidad  
Rey Juan Carlos

**GSyC**



Robótica, Arduino y Hardware Libre  
Centro Municipal de Empresas.  
Pol. Industrial de Trascueto, s/n. Revilla de Camargo

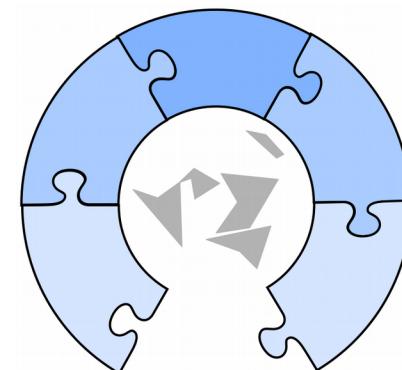
5-Julio-2018



# Electrónica Digital Divertida con FPGAs libres

Esta presentación, y todo el material usado es **Libre**. Tienes permiso para usarlo, estudiarlo, modificarlo o distribuirlo, con cualquier uso

<https://github.com/Obijuan/myslides/tree/master/2018-07-UC-FPGAs-libres>

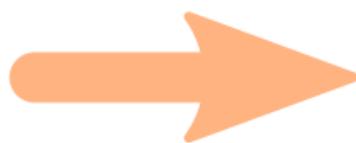


***Patrimonio tecnológico  
de la humanidad***

# Productos electrónicos y circuitos

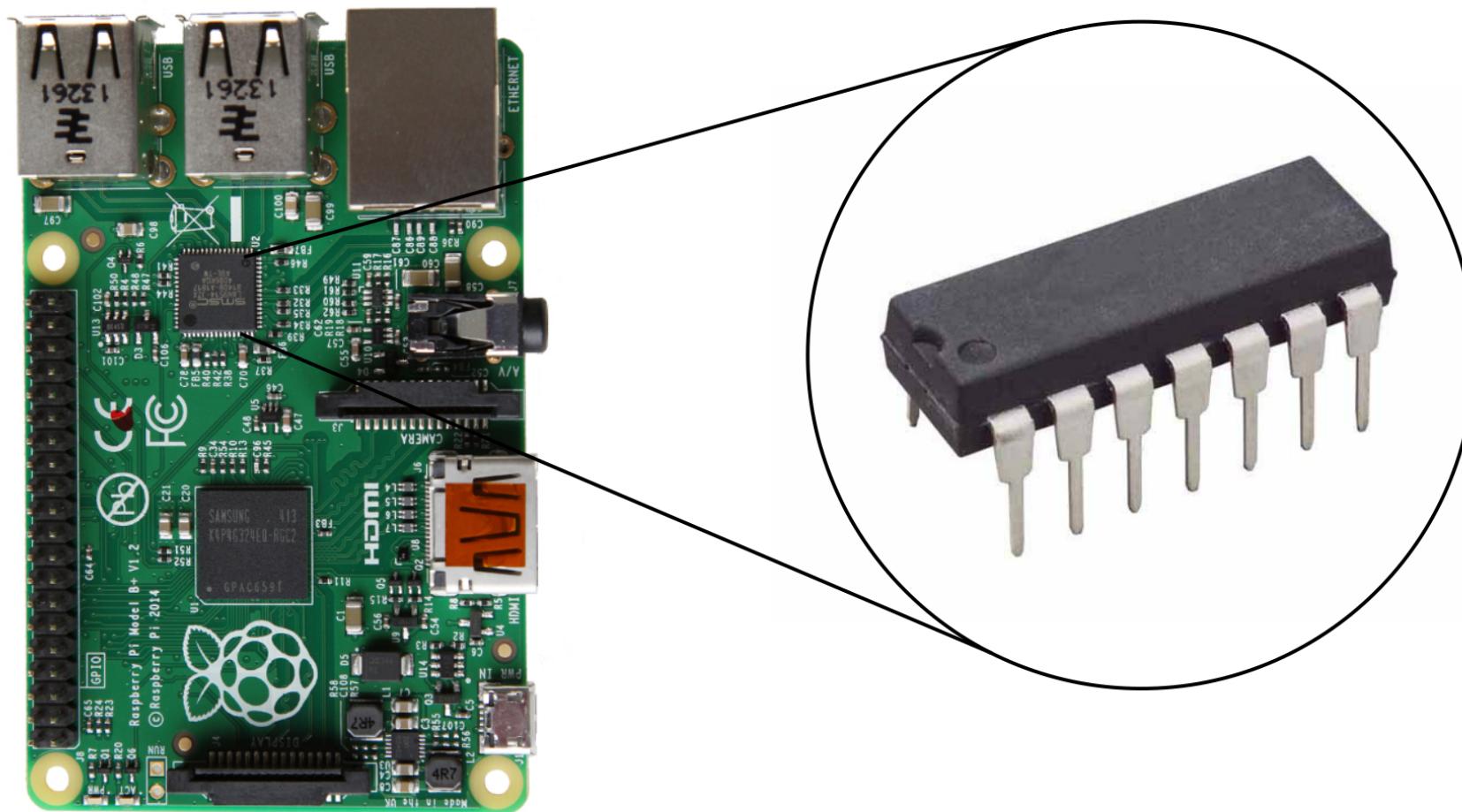


Producto Electrónico

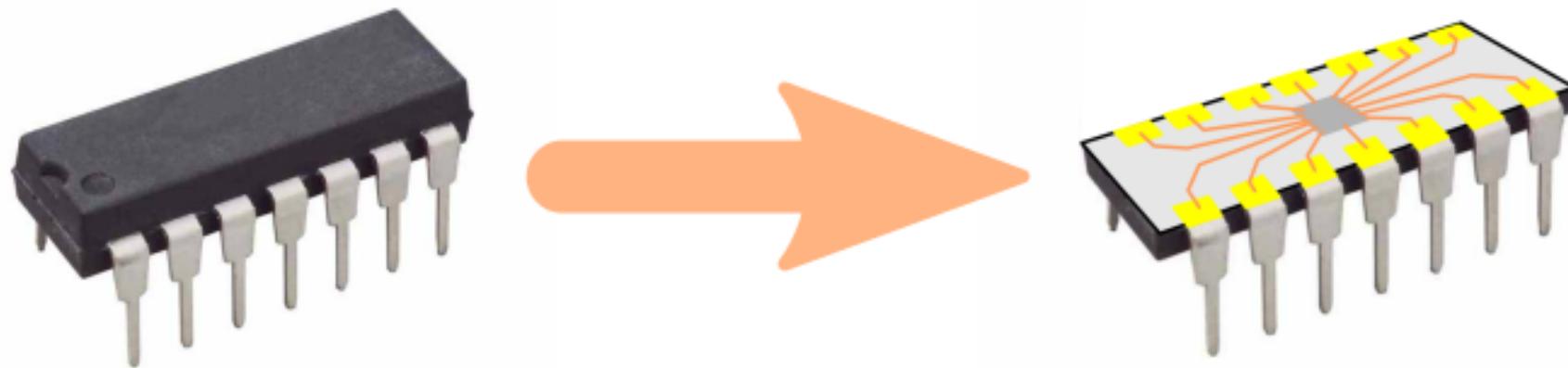


Circuito electrónico

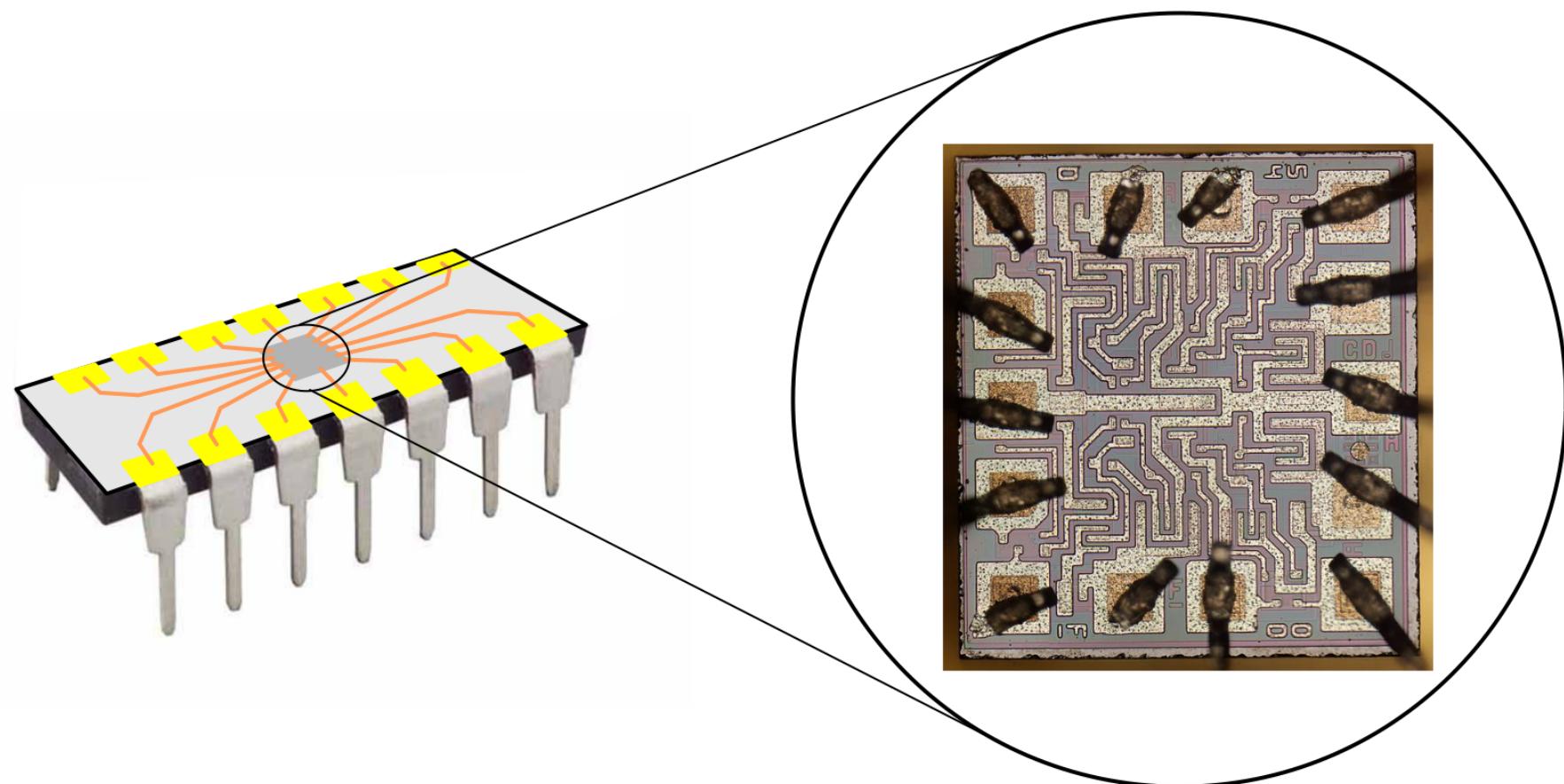
# PCBs y Circuitos integrados



# Encapsulado y dado

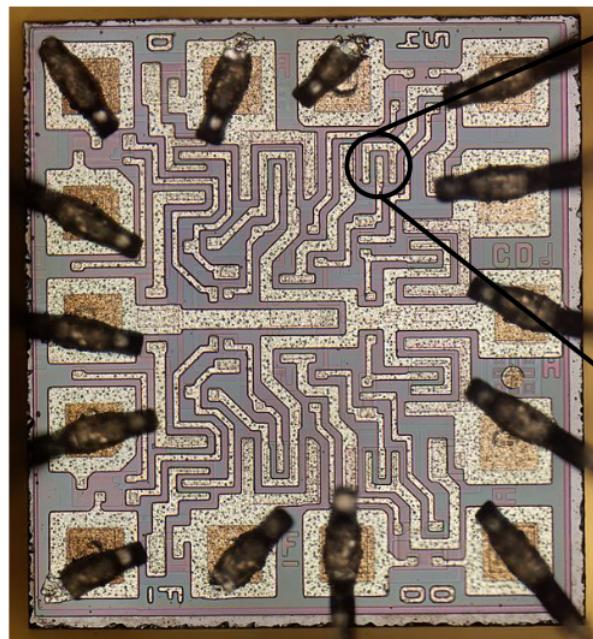


# Dado de silicio

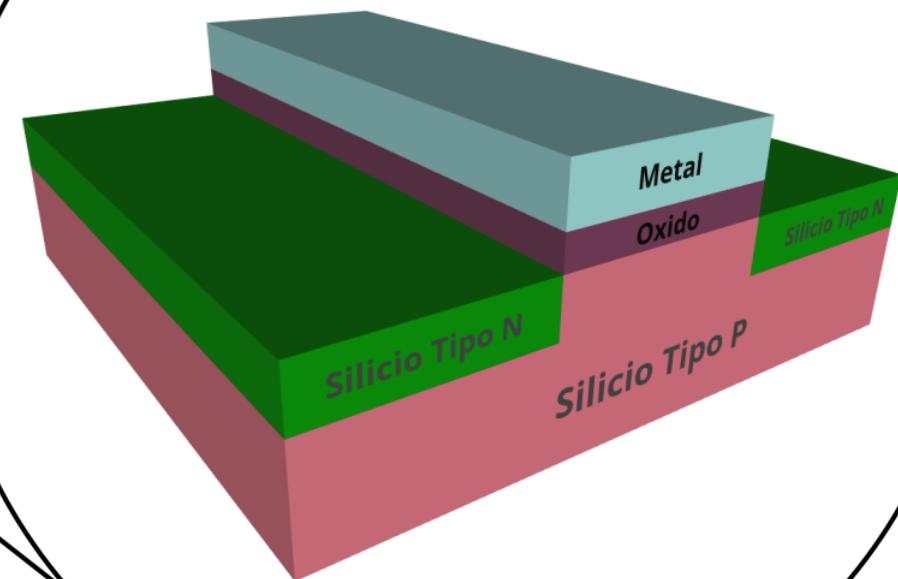


# Semiconductores

Dado

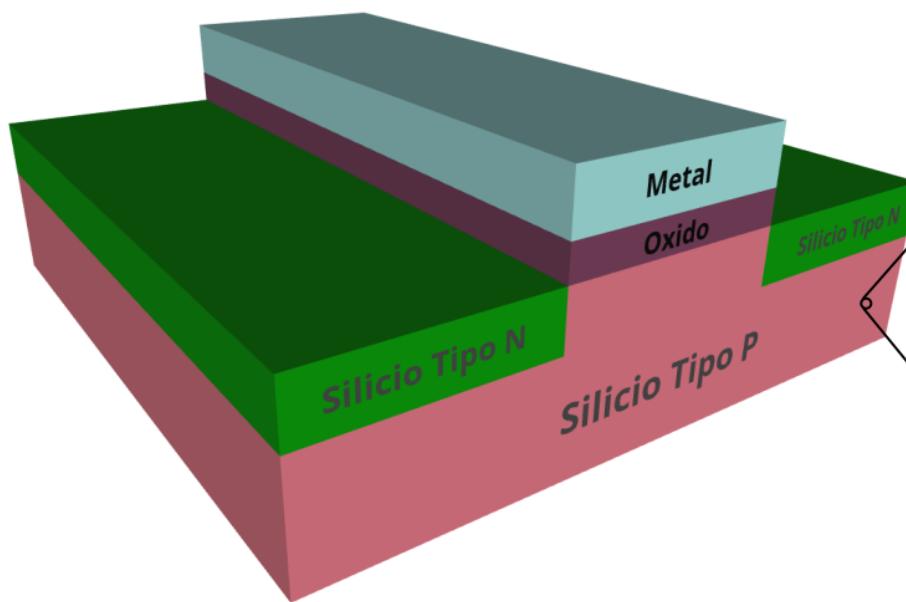


Transistor CMOS

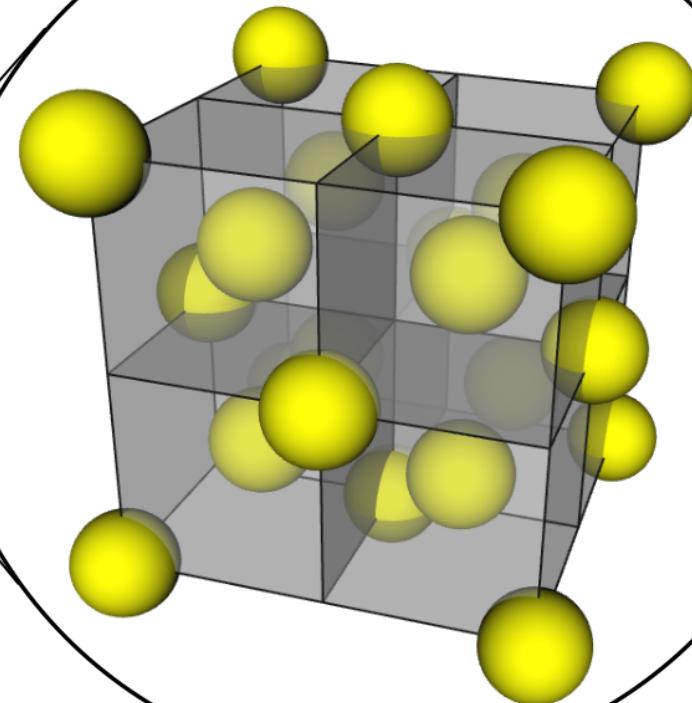


# Cristal de silicio

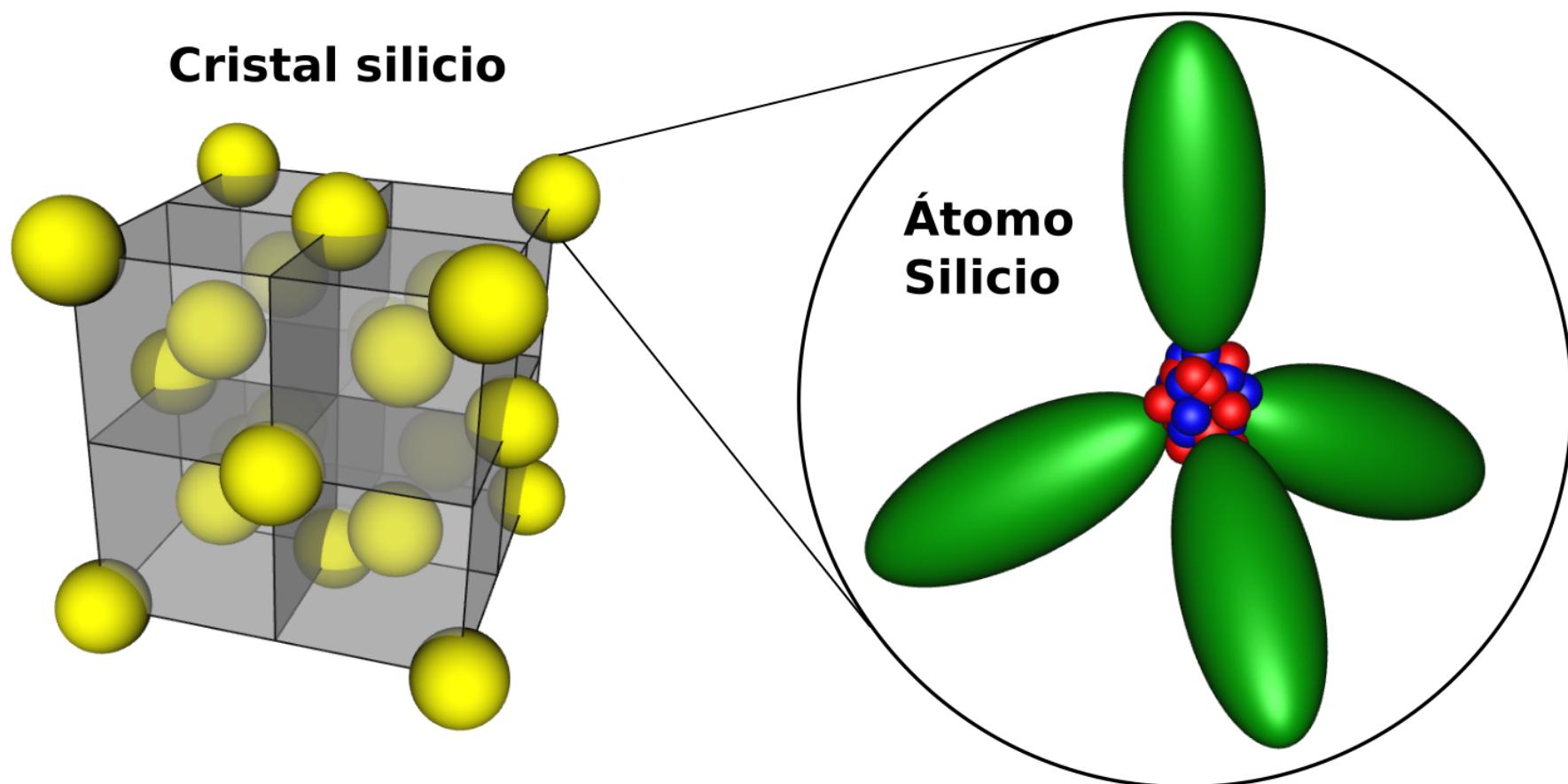
**Transistor CMOS**



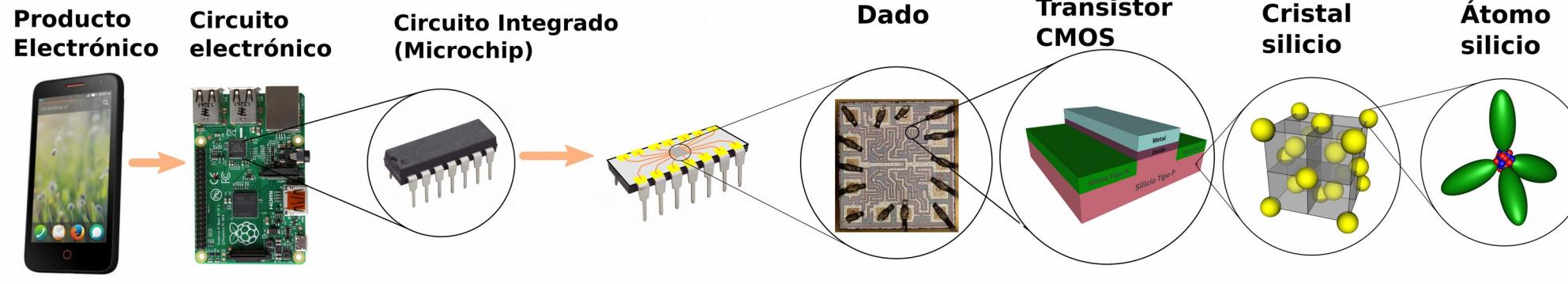
**Cristal silicio**



# Átomos :-)



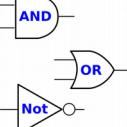
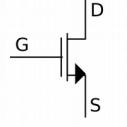
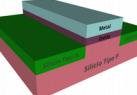
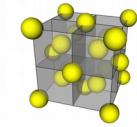
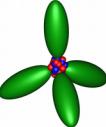
# Del producto al átomo



# Niveles

	<b>Nivel 7:</b> Software
	<b>Nivel 6:</b> Microprocesador
	<b>Nivel 5:</b> Puertas lógicas
	<b>Nivel 4:</b> Transistor
	<b>Nivel 3:</b> Semiconductores
	<b>Nivel 2:</b> Materiales
	<b>Nivel 1:</b> Átomos

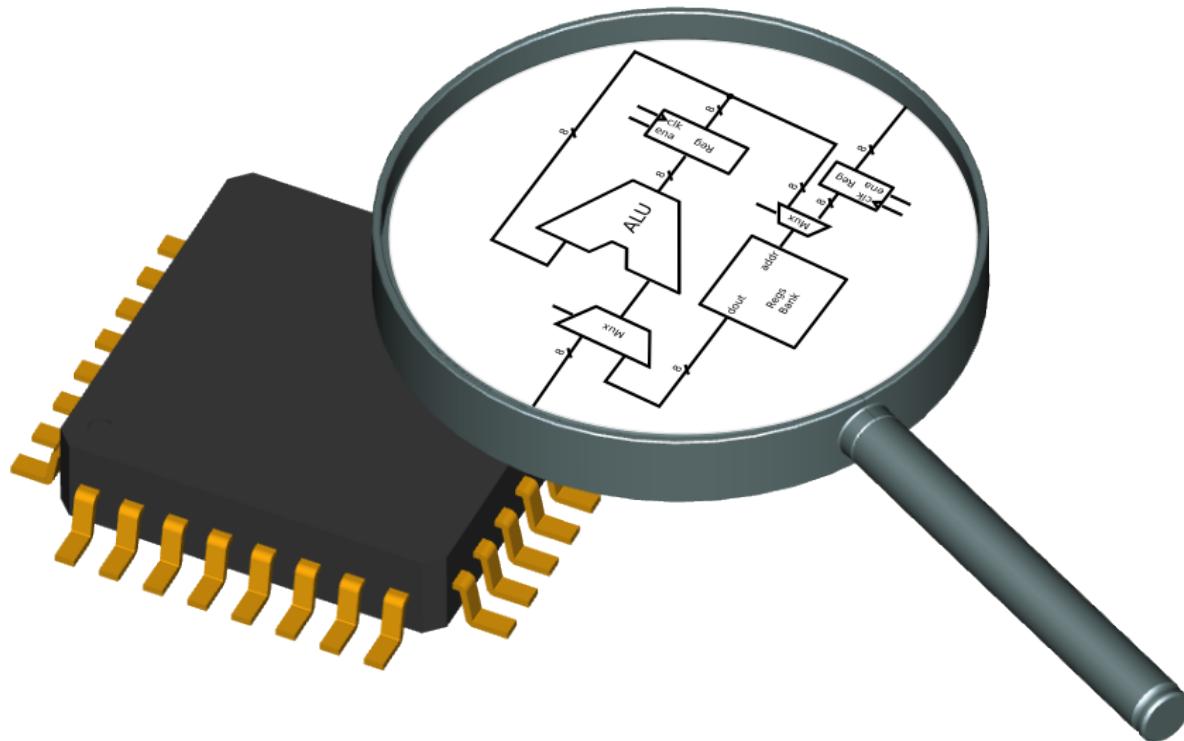
# Niveles

	<b>Nivel 7:</b> Software
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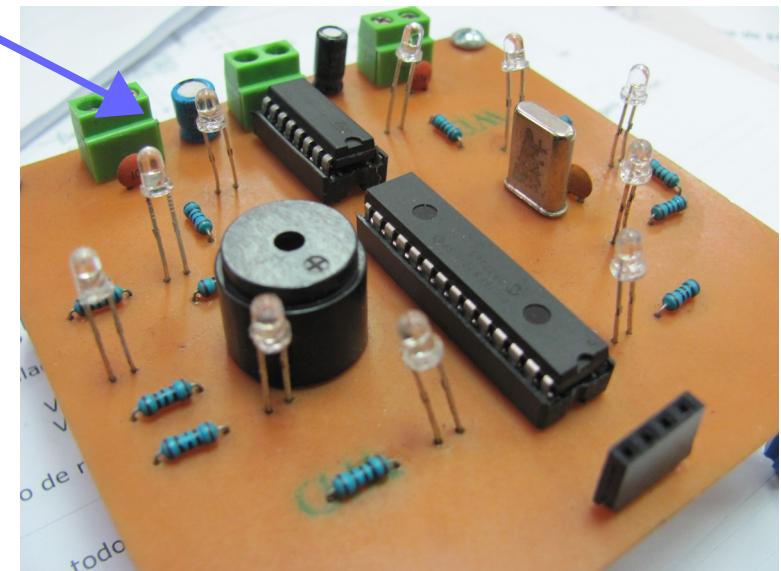
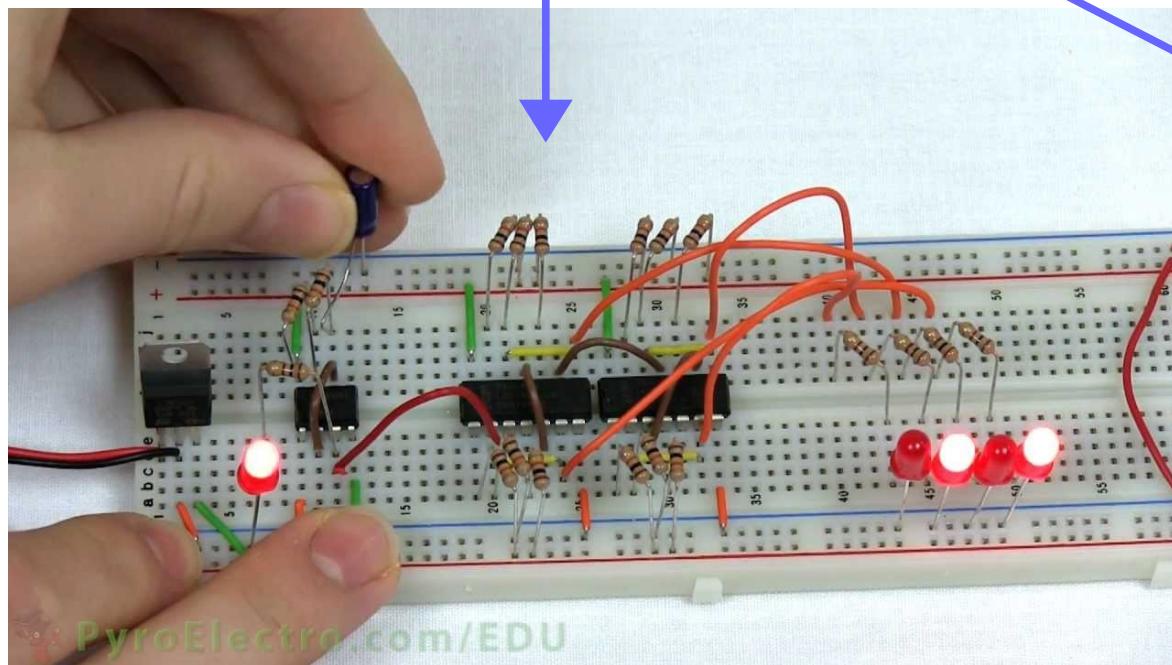
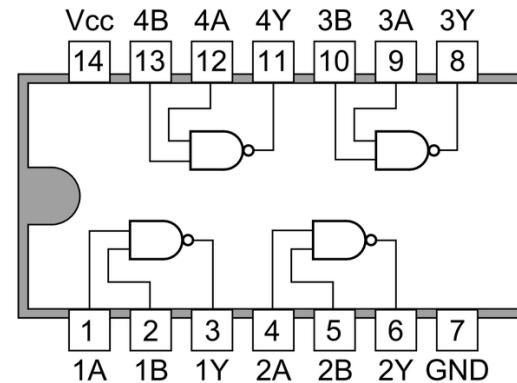
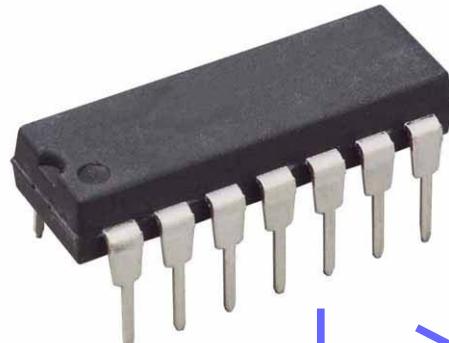
**Electrónica  
digital**

# Electrónica digital

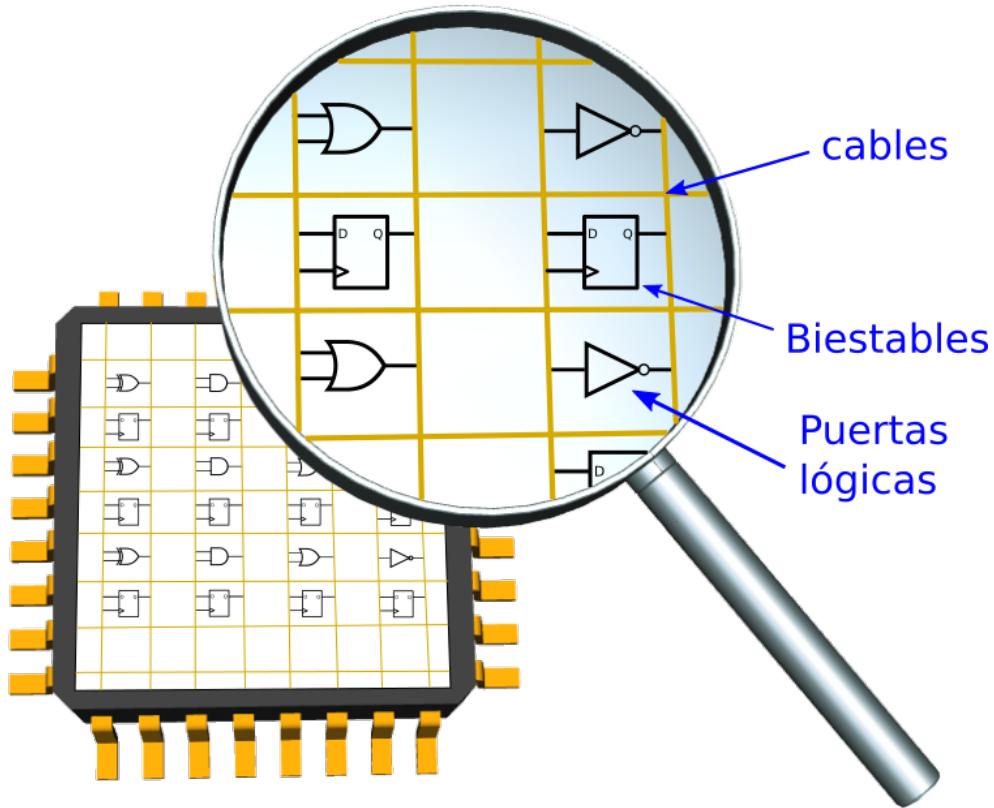


- Nivel de electrónica digital
- Información: Sólo 1s y 0s (Bits)
- Función: **Manipular, almacenar y transportar** bits
- Tres elementos: Cables, biestables y puertas lógicas

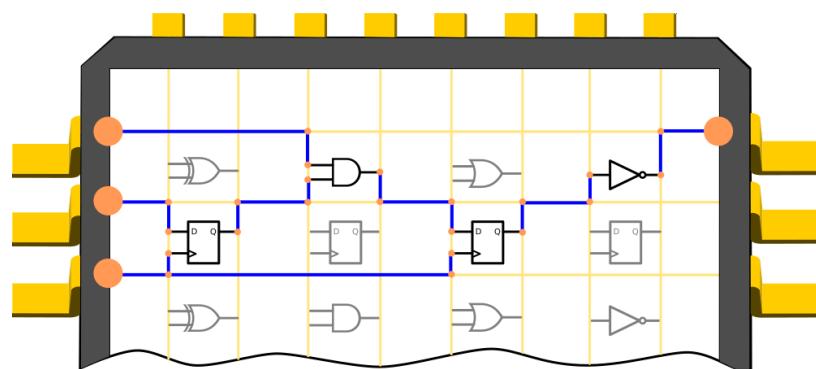
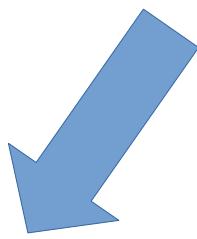
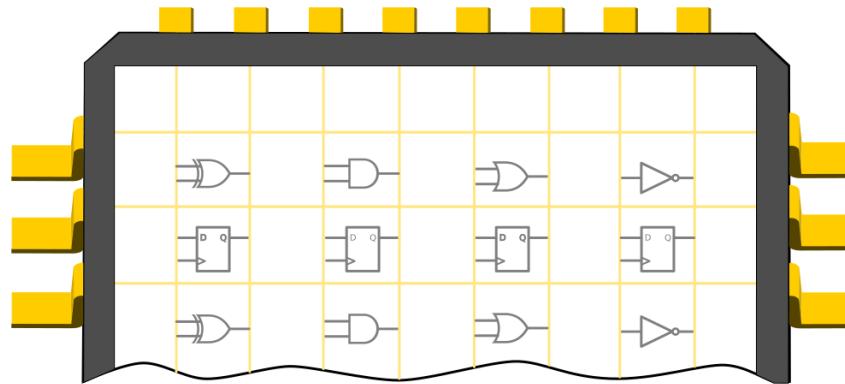
# ¿Cómo se hacen los circuitos digitales?



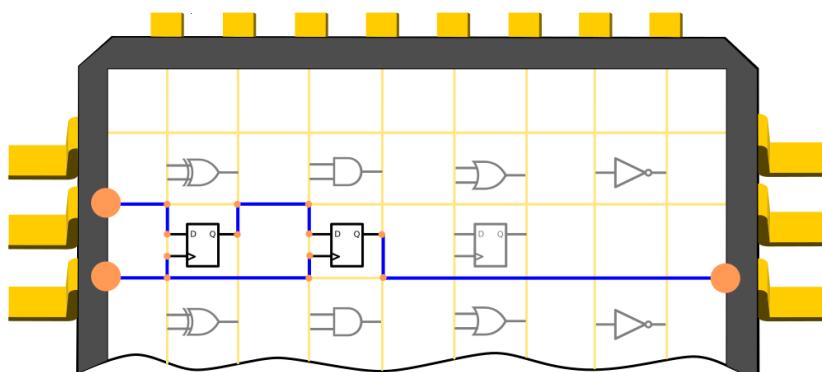
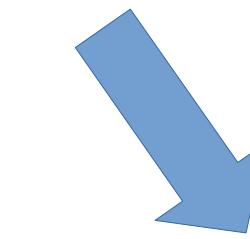
# Tecnología FPGA



**FPGA:** Chip “en blanco” que contiene una matriz con los 3 componentes básicos: puertas lógicas, biestables y cables

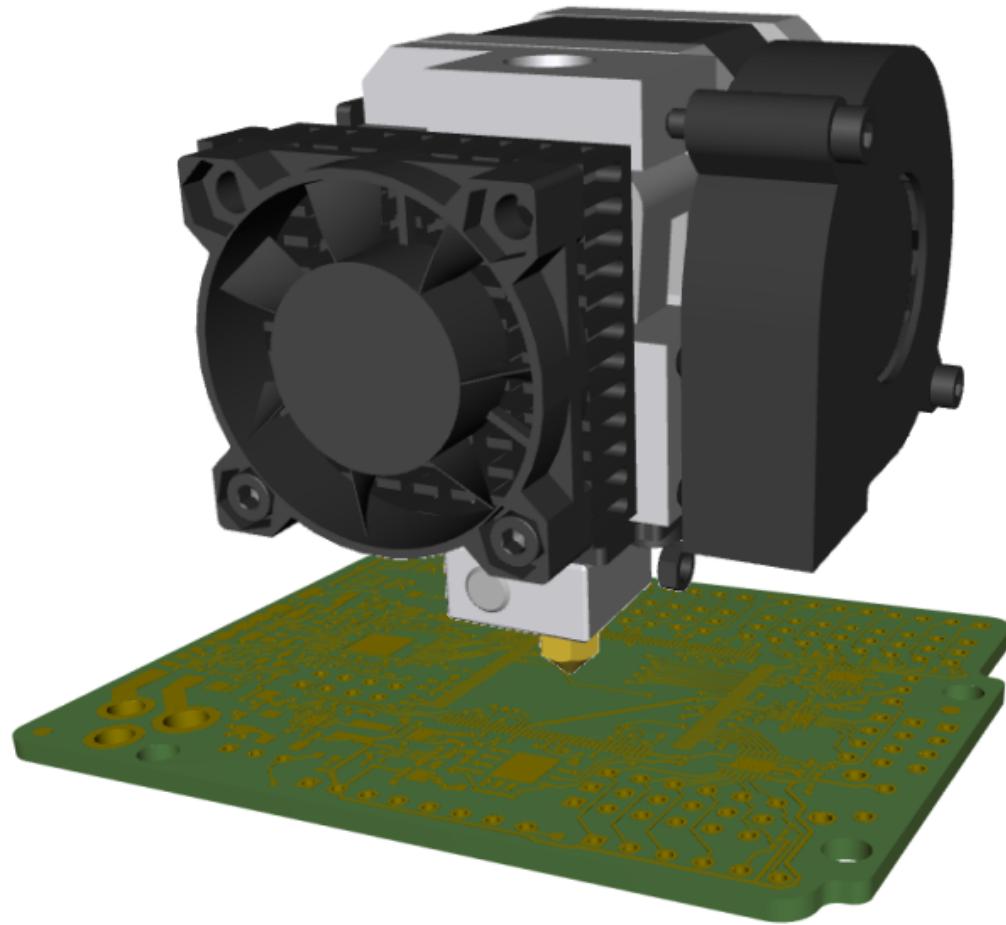


**Circuito 1**

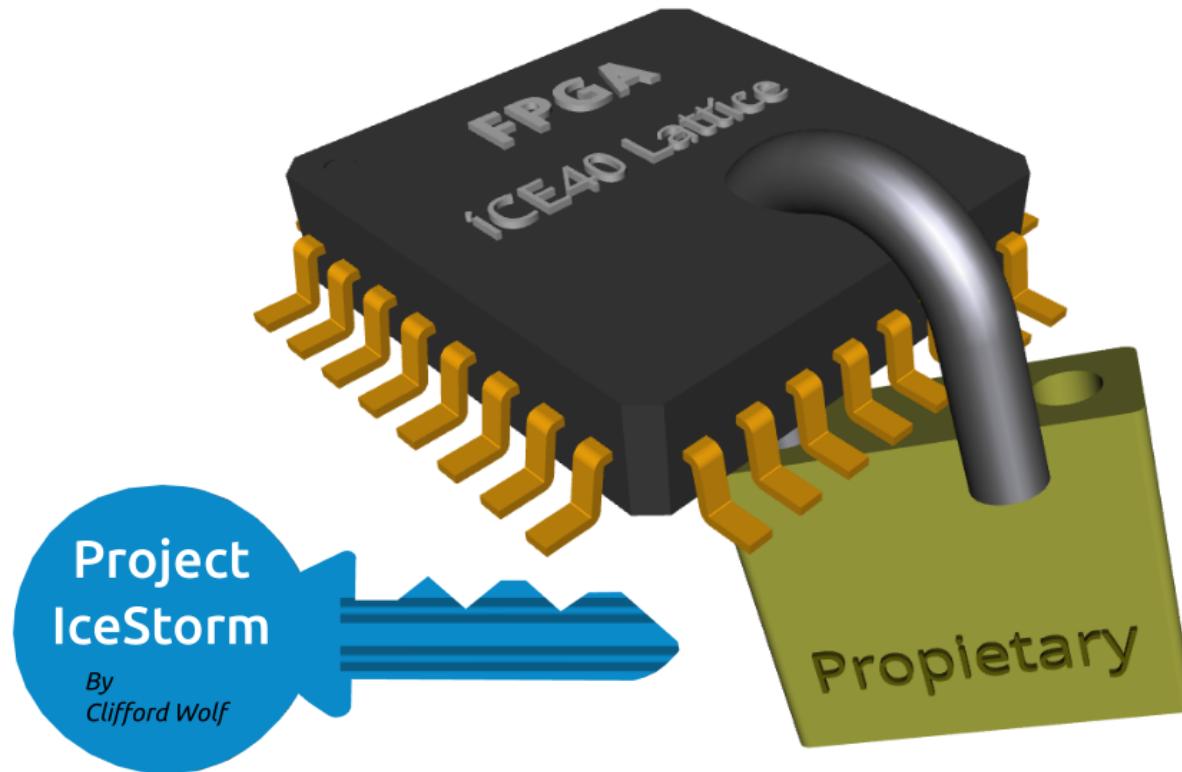


**Circuito 2**

**¡FPGAs = Impresoras 3D de circuitos digitales!**



# FPGAs libres: El renacimiento



- Proyecto Icestorm (Mayo, 2015)
- La primera *toolchain* que permiten pasar de Verilog al bitstream usando sólo Herramientas libres

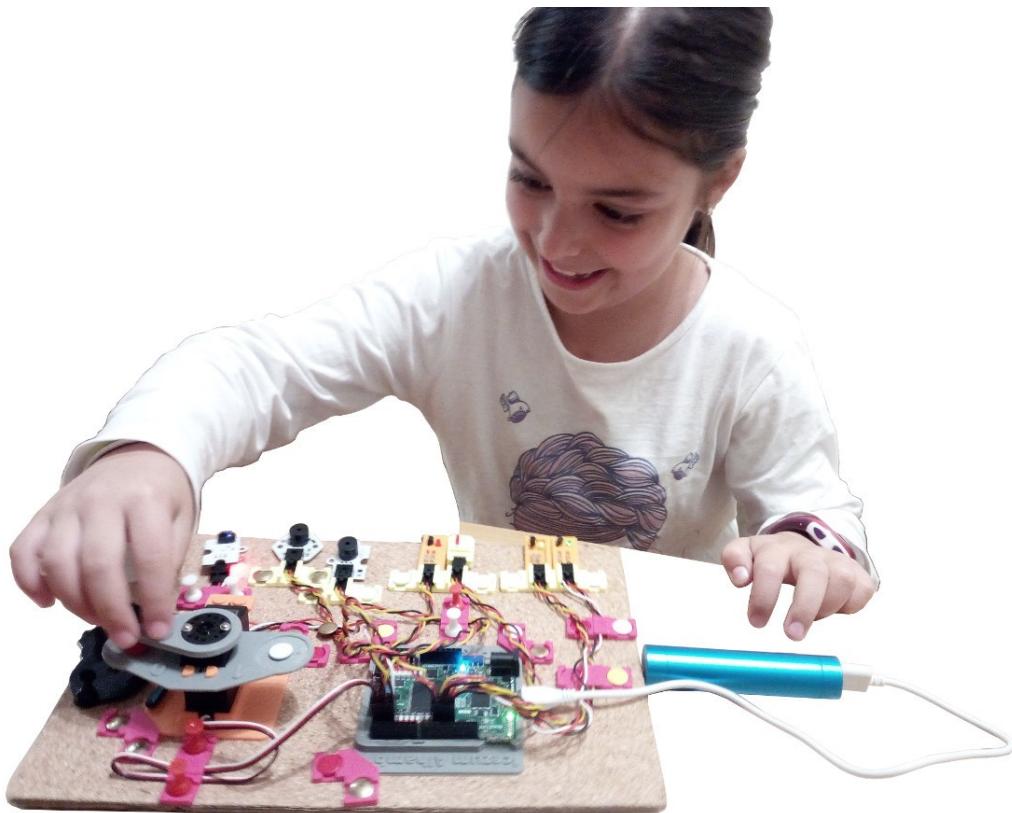
# Comunidad FPGAwars



- Comunidad para **compartir conocimiento** relacionado con **FPGAs libres**
- Es el **clonewars** de las FPGAs, pero en modesto :-)
- Idioma: Castellano
- 605 miembros
- Cualquier pregunta / comentario / sugerencia → Correo a la lista :-)

<http://fpgawars.github.io/>

# Electrónica digital divertida

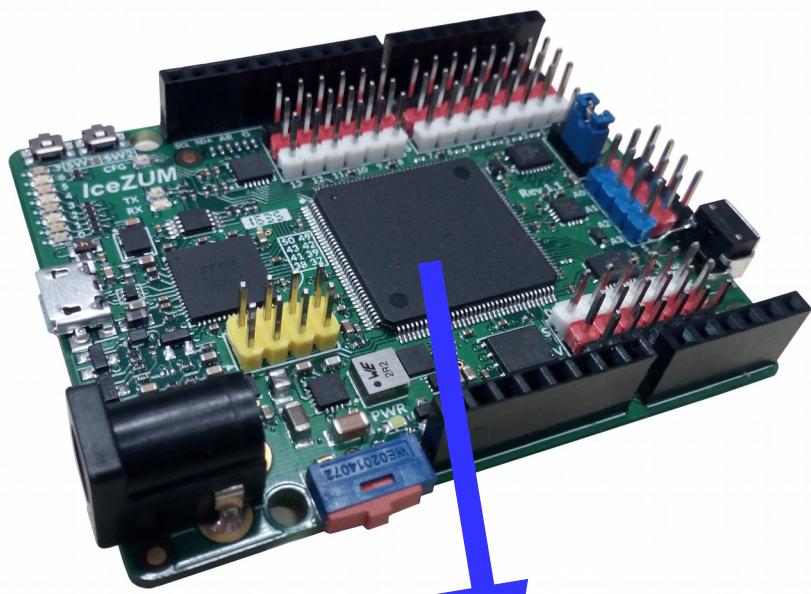


## Motivación

*¿Cómo podrían los niños y los no electrónicos diseñar circuitos digitales?*

# Icezum Alhambra v1.1

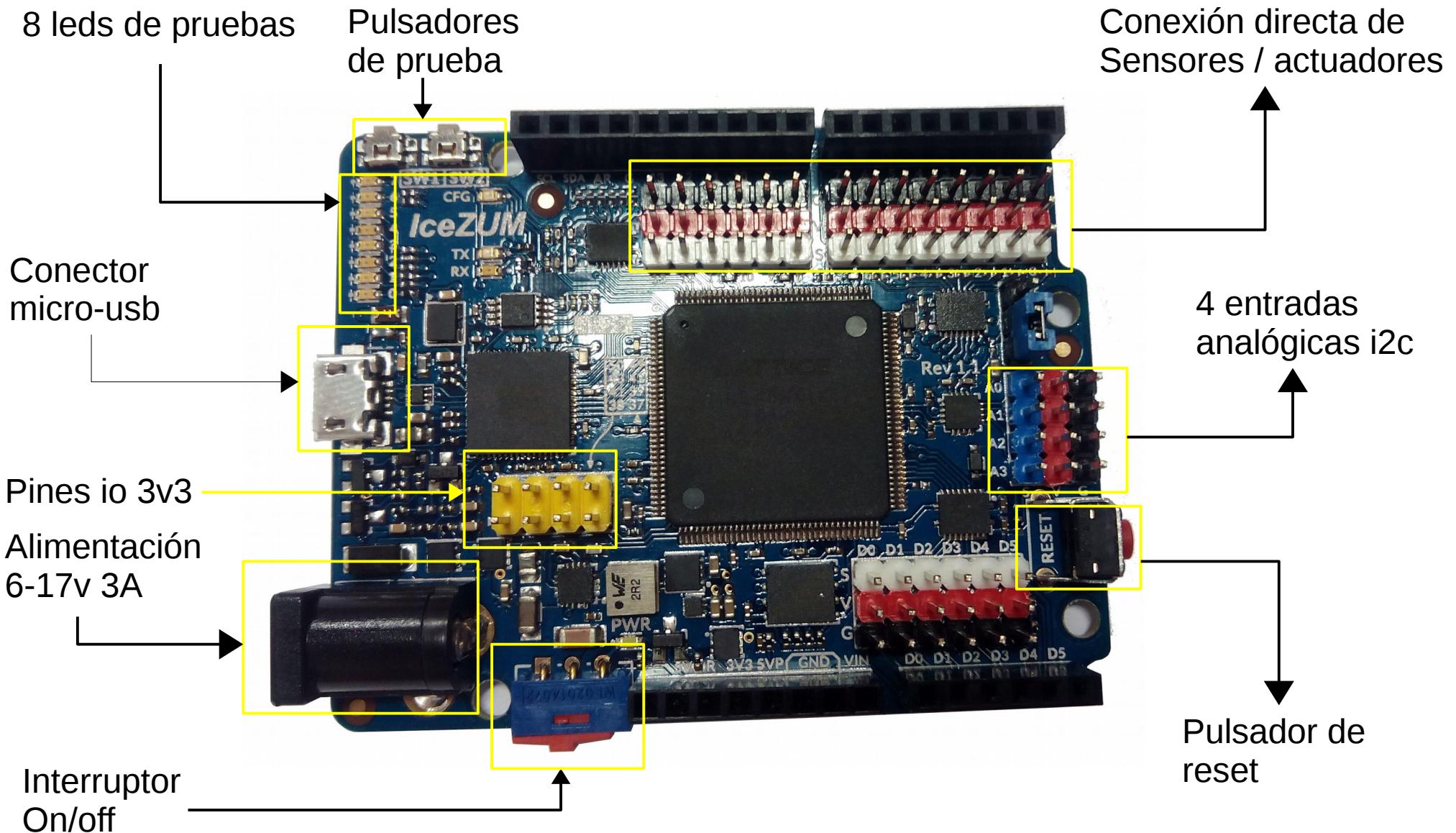
<https://github.com/FPGAwars/icezum/wiki>

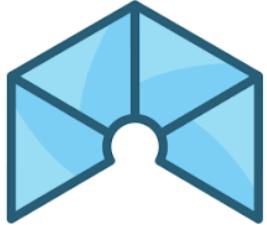


**FPGA Libre**

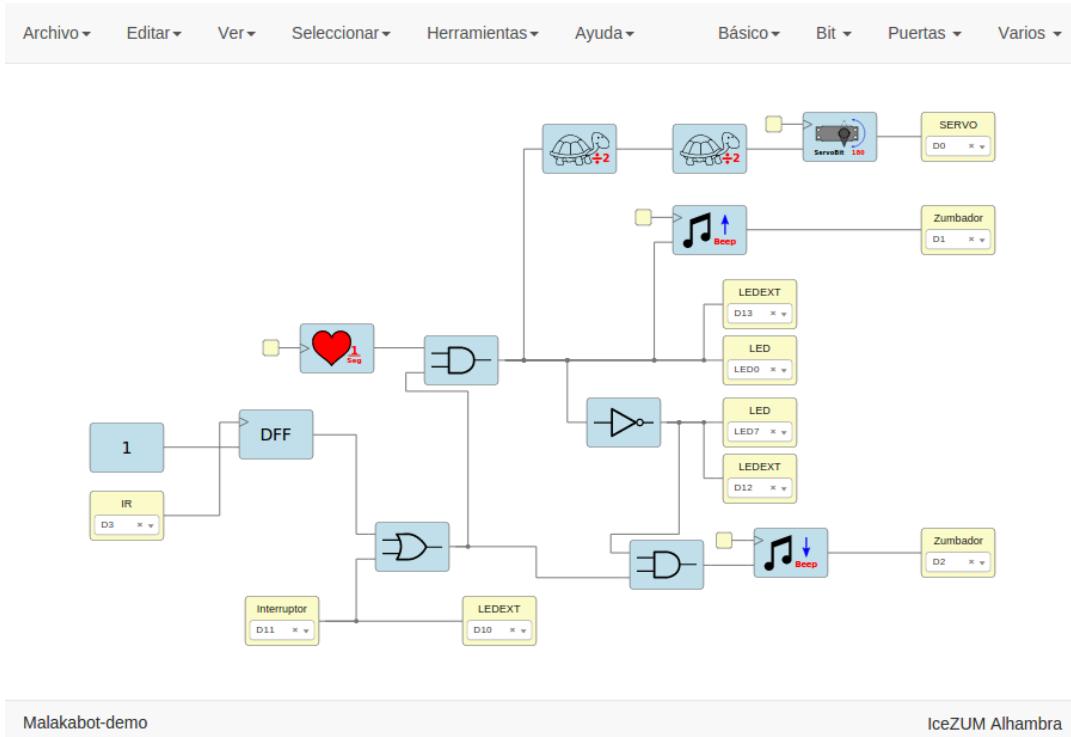
- Autor: **Eladio Delgado**
- Diseñada en Pinos del Valle (Granada)
- Arduino de las **FPGAs**
- Compatible Arduino
- Fácil conexión de circuitos externos/sensores/servos
- Reutilización de los shields de arduino
- 20 entradas/salidas de 5v
- 3A corriente de entrada
- Perfecta para hacer robots

# Icezum Alhambra v1.1





# Icestudio

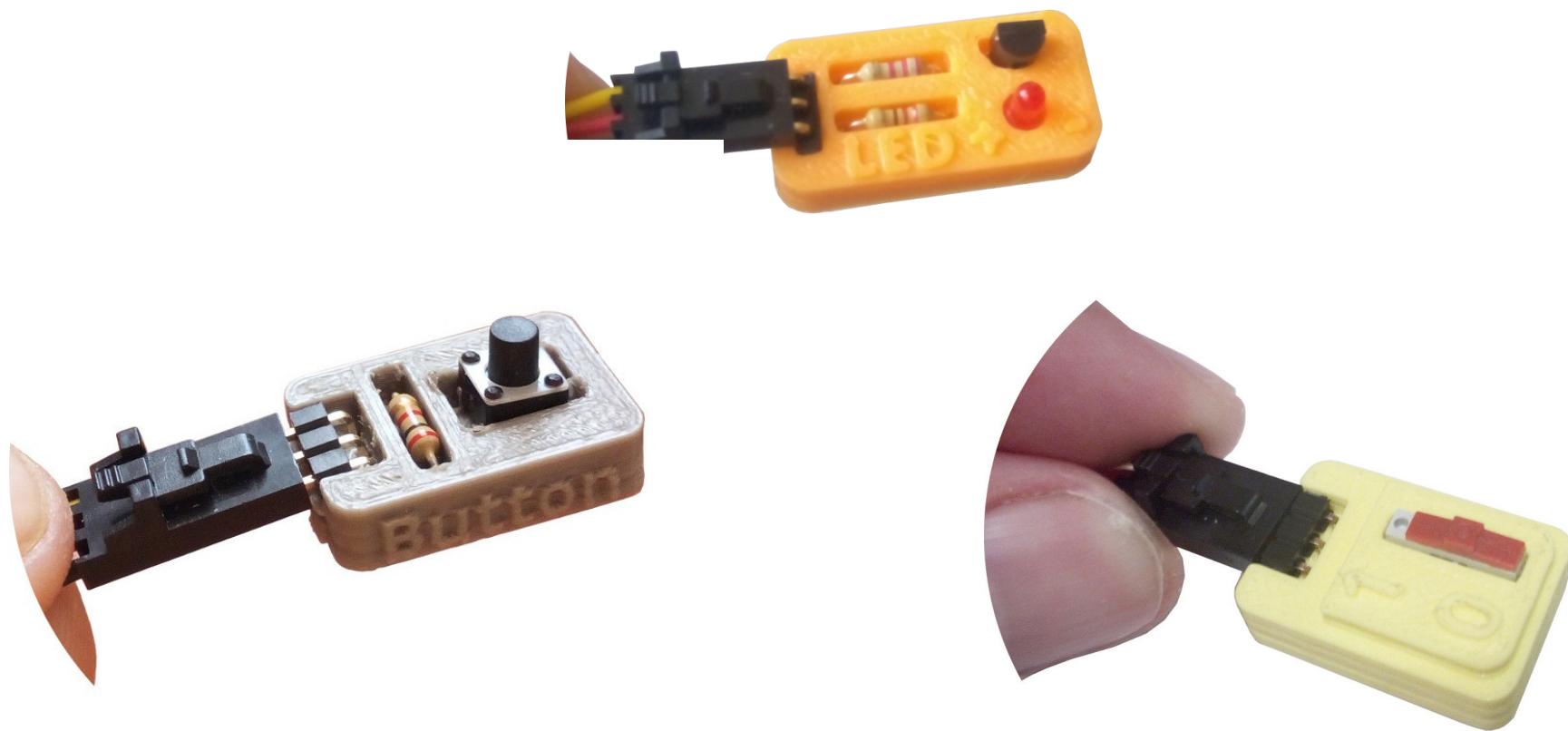


<https://github.com/FPGAwars/icestudio>

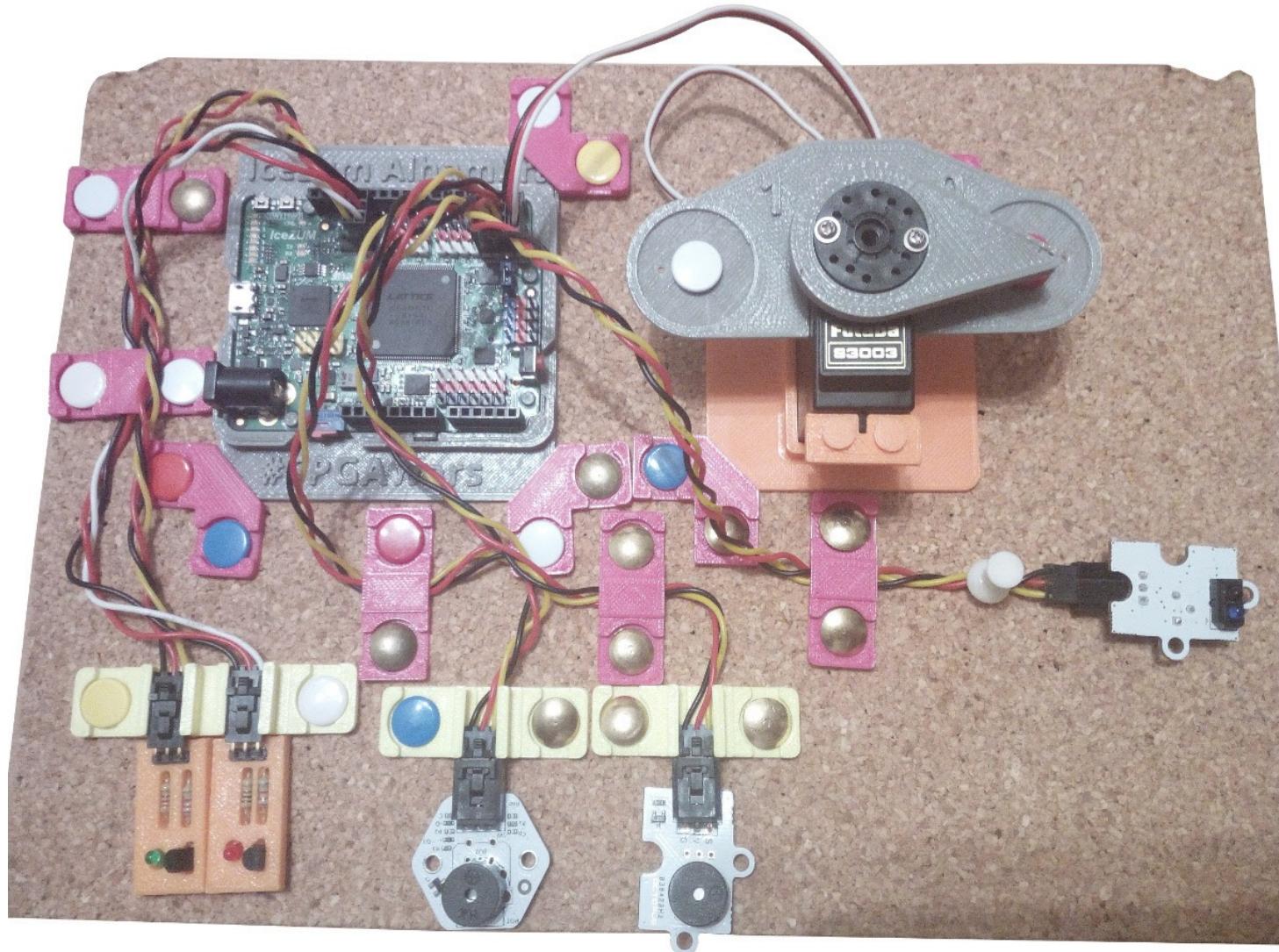
- Autor: **Jesús Arroyo**
- Electrónica digital para todos
- Herramienta visual
- Traduce a verilog

# Periféricos

**PCBprints:** Mini-circuitos impresos en 3D



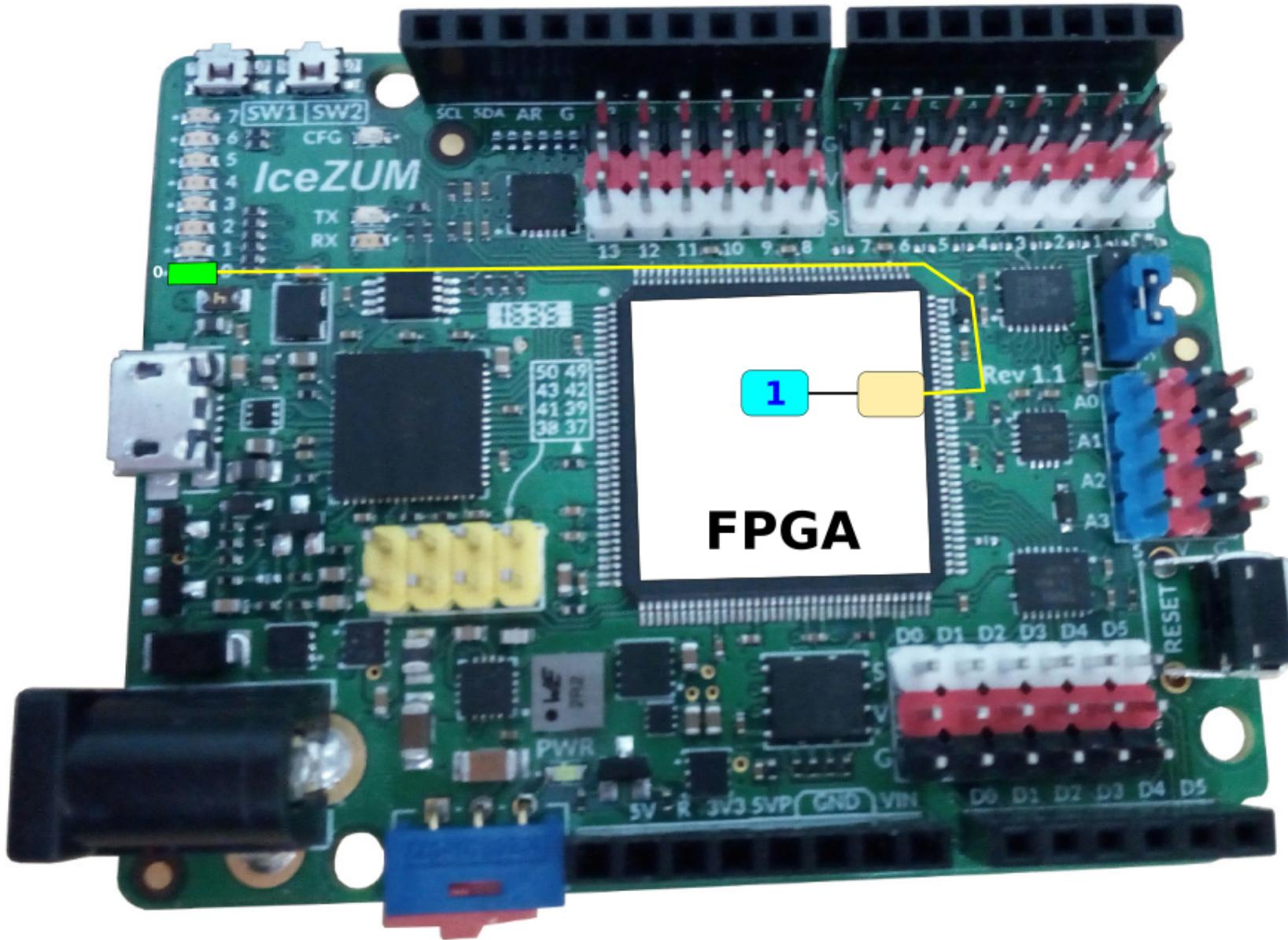
# ¡Empezamos!



# Ejemplo 1: Hola Mundo



# Hola mundo: Implementación física

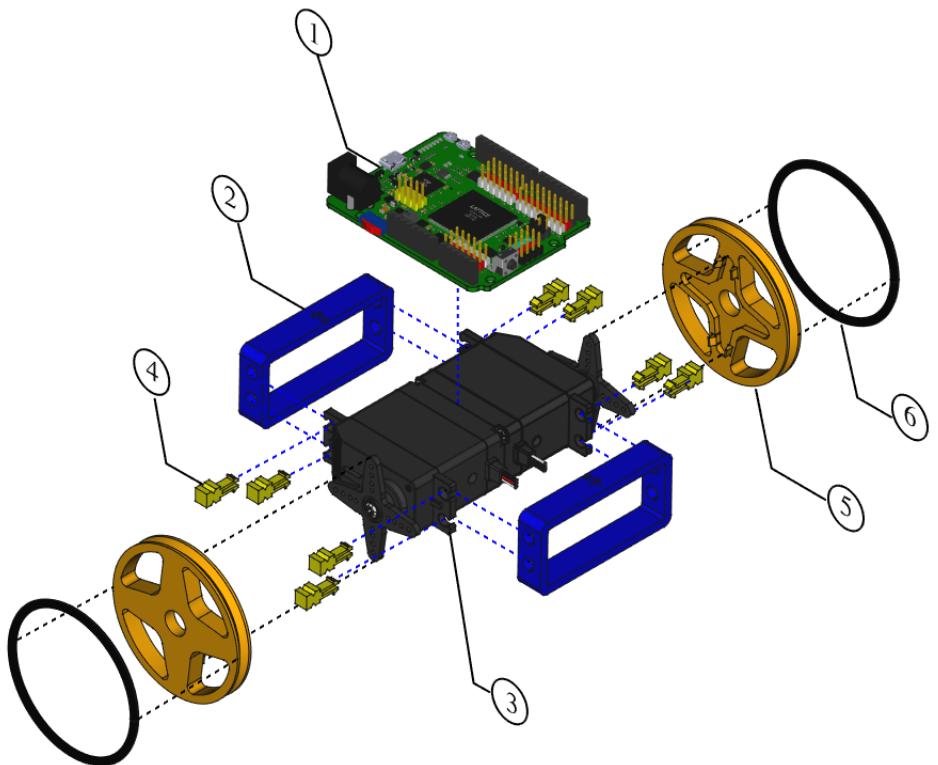
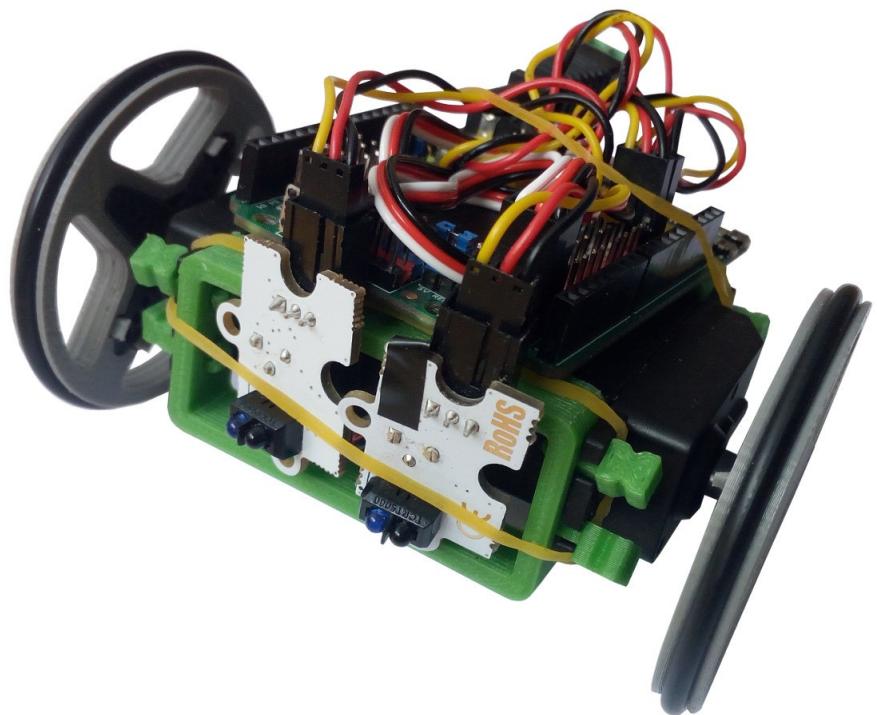


# Larby: Robot modular

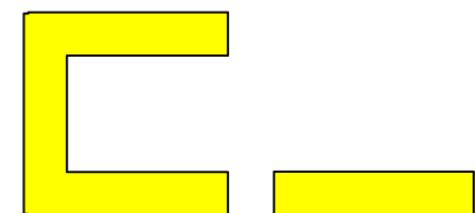
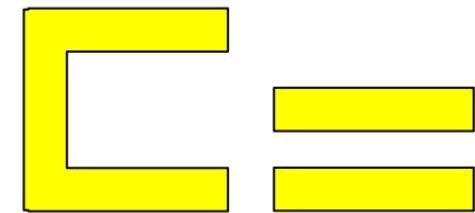
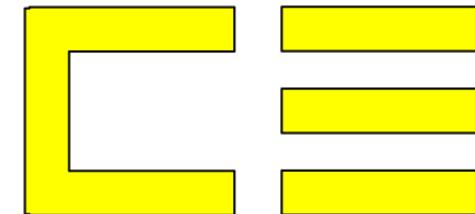


- Servos conectados directamente a Icezum Alhambra
- Configuración mínima pitch-pitch
- Módulo impresos en 3D

# Icebot



# Tutorial de electrónica digital para makers con FPGAs libres

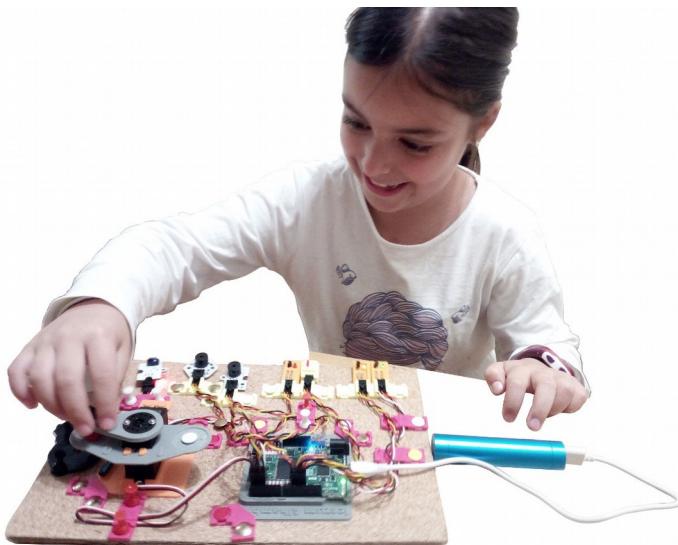


<https://github.com/Obijuan/digital-electronics-with-open-FPGAs-tutorial/wiki>

# ¡Que las FPGAs libres os acompañen!

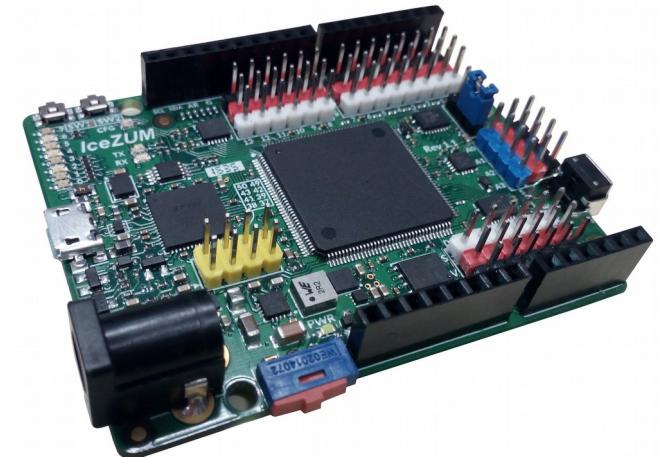


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JdeRobot



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