Next Gen SAO9000 Badge Module

Features

- Top-notch engineering
- Latest and greatest add on support
  - SAO 9000 protocol
- 3.3V pin voltage
  - Do **NOT** use 5V logic on pins
- CPU
  - 150MHz 32-bit MCU
- Memory
  - 520kB SRAM
  - 4MB QSPI flash
- Serial communication interfaces
  - UART
  - I^2C
  - Shift register controller
- Input interrupts
  - Every GPIO is an interrupt
- Digital to analog converter
  - x3 12-bit inputs
- Drives all the LEDs
  - Dedicated WS2812B drive
- State-of-the-art encryption module
  - Xorshift random number generator
- IO and Packaging
  - 13 Programmable IO
  - 16 pin package

Applications

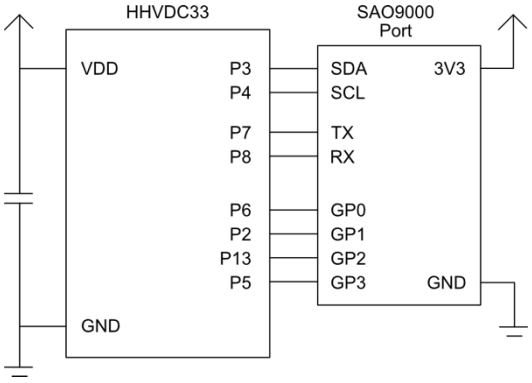
- Conference badges
- Local meetup event badges
- School ID badges
- Pet rock badges
- BADGES!

Description

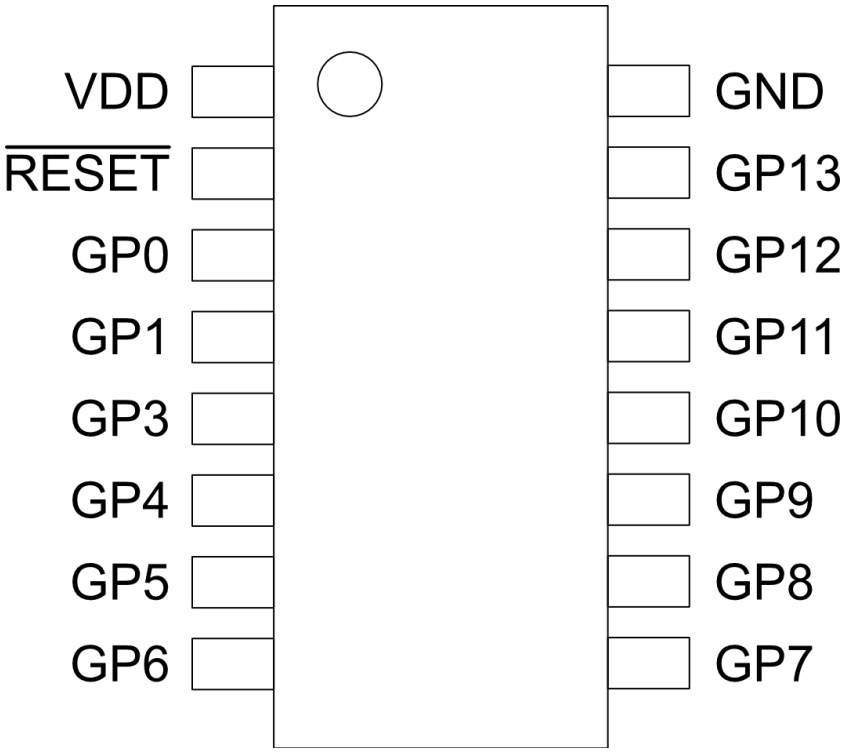
The HHVDC33 represents the pinnacle of our badge-driving expertise, an all-new, state-of-the-art microcontroller module purpose-built to power the next generation of electronic conference badges. Designed with obsessive attention to LED performance, it pushes more light, more colors, and more control than any badge driver before it. In fact, we're confident there's nothing out there that can rival it.

Debuting alongside the HHVDC33 is our bold new addon standard: SAO9000. This expanded interface redefines what's possible for badge accessories, supporting a full spectrum of modern protocols and outputs—including ADC, DAC, I²S, WS2812B, multiple UART channels, and I²C. With SAO9000, badge creators and addon developers alike can effortlessly integrate advanced lighting effects, audio capabilities, sensors, and interactive features, all through a single, streamlined port. Our goal is simple: to make badge expansion faster, easier, and more robust.

Application Circuit



Pin Configuration and Functionality



PIN		I/O	Description	ADC	DAC	I2C	UART	I2S	Extra Feature
No.	Name								
1	VDD	I	Input voltage						
2	Reset	I	Reset device						
3	P1	IO	General purpose IO						WS2812B Driver
4	P2	IO	General purpose IO						
5	P3	IO	General purpose IO			SDA			
6	P4	IO	General purpose IO			SCL			
7	P5	IO	General purpose IO	ADC1					
8	P6	IO	General purpose IO	ADC0					

9	P7	IO	General purpose IO				TX0	BCK	
10	P8	IO	General purpose IO				RX0	LRCK	
11	P9	IO	General purpose IO					SDO	
12	P10	IO	General purpose IO				RX1		
13	P11	IO	General purpose IO				TX1		
14	P12	IO	General purpose IO		DAC1				
15	P13	IO	General purpose IO		DAC0				
16	GND	—	Ground						

Recommended Voltages

		Min	Typical	Max	Unit
V_{IN}	Input voltage	2.3	3.3	3.6	V
V_{SAO}	SAO output voltage	-	3.3	-	V

DC Characteristics

		Min	Typical	Max	Unit
C_{IN}	Pin capacitance	-	2	-	pF
V_{IH}	High-level input voltage	$0.75 \times V_{DD}$	3.3	$V_{DD} + 0.3$	V
V_{IL}	Low-level input voltage	-0.3	V_{IN}	$0.25 \times V_{DD}$	V
I_{IH}	High-level input current	-	-	50	nA
I_{IL}	Low-level input current	-	-	50	nA
V_{OH}	High-level output voltage	$0.8 \times V_{DD}$	-	-	V
V_{OL}	Low-level output voltage	-	-	$0.1 \times V_{DD}$	V
I_{OH}	High-level HHV{source_current}	-	20	-	mA
I_{OL}	Low-level sink current	-	28	-	mA
V_{SPCH}	SAO power control high output voltage	$0.8 \times V_{DD}$	-	-	V
V_{SPCL}	SAO power control low output voltage	-	-	$0.1 \times V_{DD}$	V
R_{PU}	Resistance of internal pull-up resistor		45		kΩ
R_{PD}	Resistance of internal pull-down resistor		45		kΩ

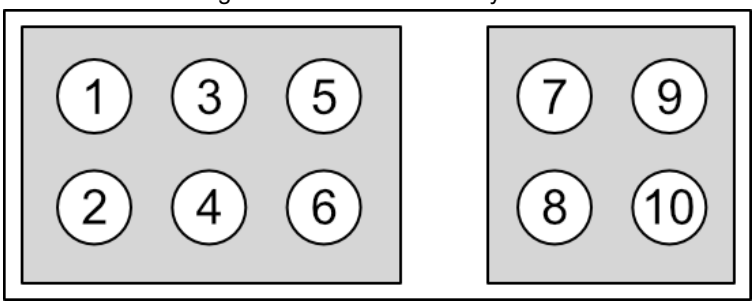
SAO9000 Overview

The SAO9000 is a comprehensive, no-compromise modernization of the classic SAO standard, purpose-built to address the escalating technical demands of contemporary conference badges. By introducing four additional pins, the SAO9000 increases addon communication capability by an order of magnitude, while simultaneously ensuring foolproof orientation—because no one should suffer the indignity of a misaligned addon during critical badge operations.

These new connections are not frivolous. Each has been carefully chosen to expand the creative and functional potential of the badge ecosystem. The SAO9000 adds four additional general purpose IO pin which can be used for a second UART for parallel communications, an I²S interface enabling direct audio streaming from addons, analog inputs for advanced sensing applications. GP3 can also be used as an addon detection pin, to detect when an addon is plugged in to prevent constant guessing of the SAO port connection status.

With the SAO9000, the addon port is no longer a mere accessory connector, it is a serious, future-proofed expansion interface engineered for the next decade of badge innovation.

SAO9000 Pin Configuration and Functionality



Pin		Primary Functionality	Secondary Functionality
No.	Name		
1	3V3	3.3V output to power addon	
2	GND	Ground return for addon	
3	SDA	I2C signal data line	
4	SCL	I2C signal data clock	
5	UART TX	UART Transmit	
6	UART RX	UART Receive	
7	GP0	General purpose IO	
8	GP1	General purpose IO	
9	GP2	General purpose IO	
10	GP3	General purpose IO	Addon detect (active high)

Packaging Information

Device Part Number	Status	Package Type	Pins	Op Temp (° C)	Device Marking
HHVDC33	PRE	SOP	16	-10 to 125	HHVDC33 YYMM

Ordering Information

This module is currently in pre-production. Find the HHV Technologies booth at your local conferences to play with our pre-production demo unit.

Revision History

Date	Version	Release notes
2025.08	V1.0	• Initial release