

MAX30003WING Expansion Board

Evaluates: MAX30003
Biopotential AFE

General Description

The MAX30003WING is an expansion board designed to help engineers and students alike to rapidly prototype ECG applications for wearables using the MAX30003 biopotential analog front end. The form factor is a small 0.9in by 2.0in dual-row header footprint that is compatible with breadboards and featherboards from Maxim and Adafruit®, as well as additional expansion boards called wings. Two grove connectors and a 6-pin Pmod™ connector are also included for additional connectivity to popular development boards offered by Seeed Studio® and Digilent®.

Ordering Information appears at end of data sheet.

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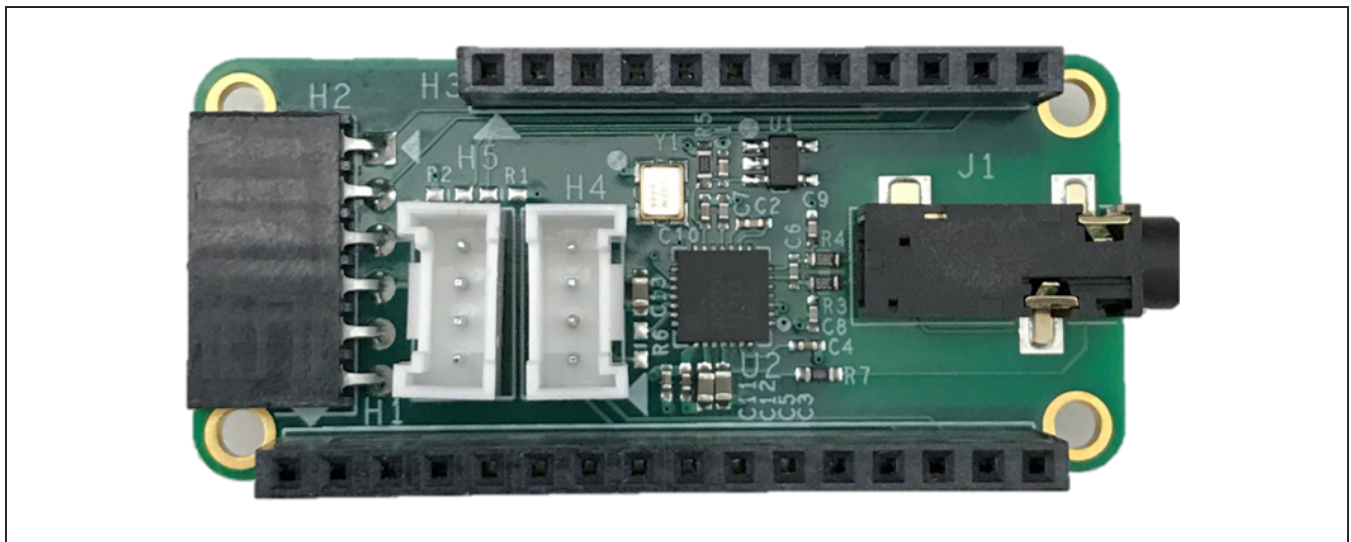
Digilent is a registered trademark and Pmod is a trademark of Digilent Inc.

Seeed Studio is a registered trademark Seeed Technology Co., Ltd.

Features

- Expansion Board
 - 0.9in x 2.0in DIP Form Factor
 - Breadboard Compatible
 - Feather Compatible
 - 6-Pin PMOD Compatible Socket
 - I²C
 - Two Optional GPIO
 - Two Grove Connectors
 - I²C
 - UART
 - 3.5mm Jack for ECG Leads
- MAX30003 Biopotential AFE
 - Clinical-Grade ECG AFE with High-Resolution Data Converter
 - 15.5 Bits Effective Resolution with 5μV_{p-p} Noise
 - Longer Battery Life Compared to Competing Solutions
 - 85μW at 1.1V Supply Voltage
 - Built-In Heart Rate Detection with Interrupt Feature
 - Eliminates the Need to Run HR Algorithm on the Microcontroller
 - Robust R-R Detection in High-Motion Environment at Extremely Low Power
 - 32-Word FIFO Allows You to Wake Up Microcontroller Every 256ms with Full ECG Acquisition

MAX30003WING Expansion Board Photo



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Detailed Description

The MAX30003WING expansion board is designed to provide a compact rapid development platform for the MAX30003 biopotential AFE. A 3.5mm jack has been provided for prototyping with ECG leads that support this interface. Two 4-pin grove connectors allow for integration of additional I²C and UART sensors from the Seeed Studio Grove ecosystem. The dual inline pinout and form-factor for this board are based on the Adafruit featherboard series, and it is intended to be compatible with many of their boards, but it is not guaranteed to work with all of them.

Firmware Development

The simplest way to develop firmware for the MAX3003WING is through the Mbed™ development site. At the Mbed site, import examples into the online IDE, then edit, compile, and load them into the Mbed-compatible featherboard without installing any software. Go to <https://os.mbed.com/platforms/MAX32630FTHR/> to get started programming with the MAX32630FTHR now. To support software development with the MAX30003, an example library has been developed and can be found at the following link: <https://os.mbed.com/teams/MaximIntegrated/code/MAX30003/>.

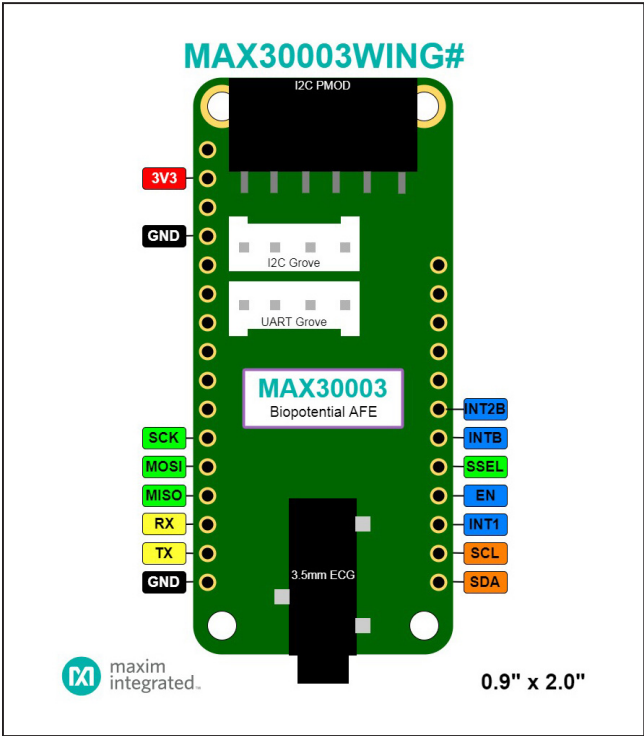


Figure 1. DIP Pinout

Additionally, the two demo programs have been developed to expedite prototyping. The MAX30003WING_Demo_Debug program notifies the user that there has been an interrupt, calculates heart rate, displays the status register, FIFO data, and ETAG result. The MAX30003WING_Demo_Debug program can be found at the following link: https://os.mbed.com/teams/MaximIntegrated/code/MAX30003WING_Demo_Debug/. The MAX30003WING_Demo_QRS program serially streams FIFO data to be plotted by a serial plotter of the user's choosing. The MAX30003WING_Demo_QRS program reproduces the recorded QRS complex and can be found at the following link: https://os.mbed.com/teams/MaximIntegrated/code/MAX30003WING_Demo_QRS/. For information on how to start using the MAX30003WING, refer to the Application Note 6556: *How to Interface the MAX30003WING ECG AFE with the MAX32630FTHR* located in the Design Resource tab of the product page.

Table 1. DIP Header H1 Pins

PIN	PORT	DESCRIPTION
1, 3, 5–10	N.C.	No Connection
2	3V3	3.3V supply voltage
4, 16	GND	Ground
11	SCK	MAX30003 SCLK
12	MOSI	MAX30003 SDI
13	MISO	MAX30003 SDO
14	Rx	UART Receive (with respect to MCU)
15	Tx	UART Transmit (with respect to MCU)

Table 2. DIP Header H3 Pins

PIN	PORT	DESCRIPTION
1–5	N.C.	No Connection
6	INT2B	Default No Connection. Install 0Ω resistor R6 for INT2B.
7	INTB	MAX30003 Interrupt
8	SSEL	MAX30003 CSB
9	EN	PMOD Enable
10	INT1	PMOD Interrupt
11	SCL	PMOD/Grove I ² C SCL
12	SDA	PMOD/Grove I ² C SDA

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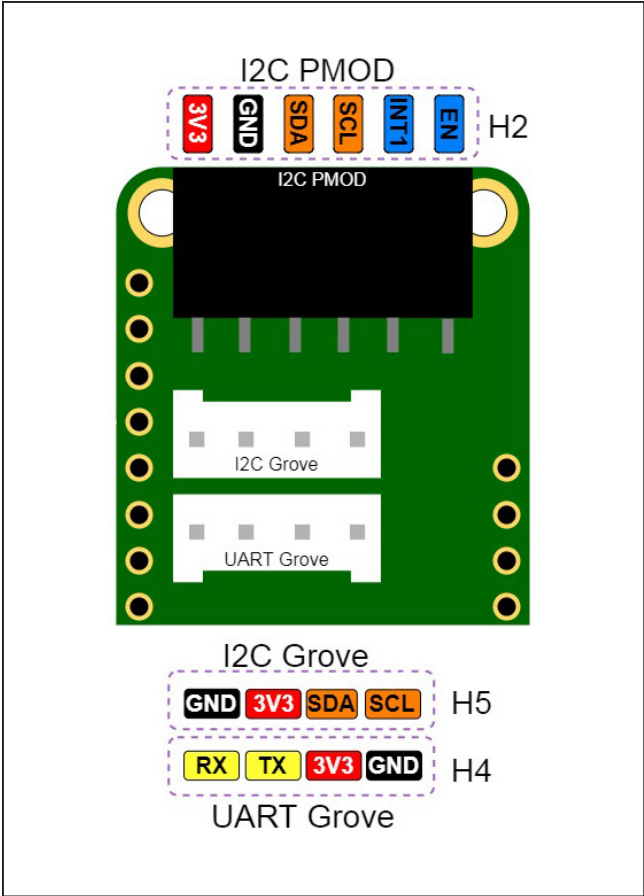


Figure 2. PMOD/Grove Connectors

Table 3. PMOD Socket H2 Pins

PIN	PORT	DESCRIPTION
1	EN	Optional Enable (GPIO)
2	INT1	Optional Interrupt (GPIO)
3	SCL	I ² C Serial Clock
4	SDA	I ² C Serial Data
5	GND	Ground
6	3V3	3.3V Supply (Output)

Table 4. Grove Socket H4 Pins

PIN	PORT	DESCRIPTION
1	Rx	UART Receive (with Respect to MCU)
2	Tx	UART Transmit (with Respect to MCU)
3	3V3	3.3V Supply (Output)
4	GND	Ground

Table 5. Grove Socket H5 Pins

PIN	PORT	DESCRIPTION
1	SCL	I ² C Serial Clock
2	SDA	I ² C Serial Data
3	3V3	3.3V Supply (output)
4	GND	Ground

Ordering Information

PART	TYPE
MAX30003WING#	Expansion Board

#Denotes RoHS compliance.

MAX30003WING EV Kit Bill of Materials

QTY	REF_DES	MFG	PART NUMBER	DESCRIPTION
5	C1, C2, C4, C10, C11	SAMSUNG	CL05B105KQ5NQNC	CAPACITOR; SMT (0402); CERAMIC CHIP; 1UF; 6.3V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R
3	C3, C5, C13	MURATA	GRM188R61A106KE69	CAPACITOR; SMT (0603); CERAMIC CHIP; 10UF; 10V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R
2	C6, C7	MURATA	GRM1555C1H102JA01	CAPACITOR; SMT (0402); CERAMIC CHIP; 1000PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC
2	C8, C9	KEMET	C0402C100D5GAC	CAPACITOR; SMT (0402); CERAMIC CHIP; 10PF; 50V; TOL=0.5PF; TG=-55 DEGC TO +125 DEGC; TC=C0G
1	C12	MURATA	GRM155R71A104JA01	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 10V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=X7R
1	H2	SAMTEC	SSQ-106-02-T-S-RA	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; RIGHT ANGLE; 6PINS
1	J1	SWITCHCRAFT	35RASMT2BHNTRX	CONNECTOR; FEMALE; SMT; 3.5MM PHONE JACK; RIGHT ANGLE; 3PINS
2	R3, R4	YAGEO	RC0603FR-0749K9L	RESISTOR; 0603; 49.9K OHM; 1%; 100PPM; 0.10W; THICK FILM
1	R5	SAMSUNG ELECTRONICS	RC1608J000CS	RESISTOR; 0603; 0 OHM; 5%; JUMPER; 0.10W; THICK FILM
1	R7	VISHAY DALE	CRCW0603499KFK	RESISTOR; 0603; 499K OHM; 1%; 100PPM; 0.1W; THICK FILM
1	U1	MAXIM	MAX1726EUK18+	IC; REG; 12V; ULTRA-LOW IQ; LOW-DROPOUT LINEAR REGULATOR; SOT23-5
1	U2	MAXIM	MAX30003CTI+	IC; AFEC; ULTRA-LOW POWER; SINGLE-CHANNEL INTEGRATED BIOPOTENTIAL (ECG R TO R DETECTION) AFE; TQFN28-EP
1	Y1	SARONIX	KX3211A0032.768000	CRYSTAL; SMT 3.2X2.5; 15PF; 32.768KHZ; +/-20PPM; +/-50PPM

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The schematic diagram illustrates the hardware design for the MAX30033WING# project. The components and their connections are as follows:

- Power Supply:** A +3V3 source (V3) is connected to the circuit. The power is regulated by a voltage divider (R1, R2) and decoupled by capacitors (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13).
- ICs:**
 - U1:** MAX1728ELR18+ (Analog-to-Digital Converter)
 - U2:** MAX30033CT+ (Digital-to-Analog Converter)
- Connectors:**
 - H1:** TSW-116-07-G-S (Header)
 - H2:** SSO-106-02-T-S-RA (Header)
 - H3:** TSW-112-07-G-S (Header)
 - H4:** 3470130P1 (Header)
 - H5:** 3470130P1 (Header)
 - J1:** 30RA0MT2BH1NTRX (Header)
- Resistors:** R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100.
- Capacitors:** C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13.
- Other Components:** L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L42, L43, L44, L45, L46, L47, L48, L49, L50, L51, L52, L53, L54, L55, L56, L57, L58, L59, L60, L61, L62, L63, L64, L65, L66, L67, L68, L69, L70, L71, L72, L73, L74, L75, L76, L77, L78, L79, L80, L81, L82, L83, L84, L85, L86, L87, L88, L89, L90, L91, L92, L93, L94, L95, L96, L97, L98, L99, L100.

Table of Components:

Part	Value	Quantity	Notes
U1	MAX1728ELR18+	1	
U2	MAX30033CT+	1	
U3	MAX30033CT+	1	
U4	MAX30033CT+	1	
U5	MAX30033CT+	1	
U6	MAX30033CT+	1	
U7	MAX30033CT+	1	
U8	MAX30033CT+	1	
U9	MAX30033CT+	1	
U10	MAX30033CT+	1	
U11	MAX30033CT+	1	
U12	MAX30033CT+	1	
U13	MAX30033CT+	1	
U14	MAX30033CT+	1	
U15	MAX30033CT+	1	
U16	MAX30033CT+	1	
U17	MAX30033CT+	1	
U18	MAX30033CT+	1	
U19	MAX30033CT+	1	
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U21	MAX30033CT+	1	
U22	MAX30033CT+	1	
U23	MAX30033CT+	1	
U24	MAX30033CT+	1	
U25	MAX30033CT+	1	
U26	MAX30033CT+	1	
U27	MAX30033CT+	1	
U28	MAX30033CT+	1	
U29	MAX30033CT+	1	
U30	MAX30033CT+	1	
U31	MAX30033CT+	1	
U32	MAX30033CT+	1	
U33	MAX30033CT+	1	
U34	MAX30033CT+	1	
U35	MAX30033CT+	1	
U36	MAX30033CT+	1	
U37	MAX30033CT+	1	
U38	MAX30033CT+	1	
U39	MAX30033CT+	1	
U40	MAX30033CT+	1	
U41	MAX30033CT+	1	
U42	MAX30033CT+	1	
U43	MAX30033CT+	1	
U44	MAX30033CT+	1	
U45	MAX30033CT+	1	
U46	MAX30033CT+	1	
U47	MAX30033CT+	1	
U48	MAX30033CT+	1	
U49	MAX30033CT+	1	
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U51	MAX30033CT+	1	
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U55	MAX30033CT+	1	
U56	MAX30033CT+	1	
U57	MAX30033CT+	1	
U58	MAX30033CT+	1	
U59	MAX30033CT+	1	
U60	MAX30033CT+	1	
U61	MAX30033CT+	1	
U62	MAX30033CT+	1	
U63	MAX30033CT+	1</	

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/18	Initial release	—

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