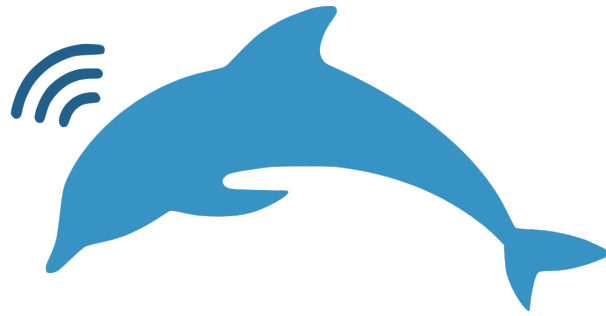




PopotoModem

PMM5544 OEM Modem Interface Control Document

delResearch LLC

Document Versions

Version	Purpose	Date
1.00	Initial draft	4/20/2021
1.01	Fixed Ducer Connector	6/18/2021
1.02	Updates for Latest Hardware	7/6/2026

Contents

1	Digital Board Interfaces	4
1.1	Power Input Interface	5
1.1.1	Overview	5
1.1.2	Electrical Connections	5
1.1.3	Hardware Components	5
1.1.4	Mating Cable Notes	6
1.2	Popoto Digital Interface	6
1.2.1	Overview	6
1.2.2	Electrical Connections	6
1.2.3	Hardware Components	7
1.2.4	Mating Cable Notes	8
1.3	Gigabit Ethernet Expansion Interface	8
1.3.1	Overview	8
1.3.2	Electrical Connections	9
1.3.3	Hardware Components	9
1.3.4	Mating Cable Notes	10
1.4	TTL UART Interface	10
1.4.1	Overview	10
1.4.2	Electrical Connections	10
1.4.3	Hardware Components	11
1.4.4	Mating Cable Notes	12
1.5	USB Interface	12
1.5.1	Overview	12
1.6	MPU Expansion Interface	12
1.6.1	Overview	12
1.6.2	Electrical Connections	12
1.6.3	Hardware Components	13
1.6.4	Mating Cable Notes	14
1.7	Wakeup MCU Expansion Interface	14
1.7.1	Overview	14
1.8	RTC Coin Cell Interface	14
1.8.1	Overview	14
1.8.2	Electrical Connections	15
1.8.3	Hardware Components	15
1.9	CODEC Input/Output Interface	16
1.9.1	Overview	16
1.9.2	Electrical Connections	16

1.9.3	Hardware Components	17
1.9.4	Mating Cable Notes	18
2	Analog Board Interfaces	19
2.1	Transducer Interface	20
2.1.1	Overview	20
2.1.2	3-Pin (mid-2025 and later) Electrical Connections	20
2.1.3	3-Pin (mid-2025 and later) Hardware Components	21
2.1.4	6-Pin (mid-2025 and earlier) Electrical Connections	22
2.1.5	6-Pin (mid-2025 and earlier) Hardware Components	22
2.1.6	Mating Cable Notes	23
2.2	Analog Line Input Interface	23
2.2.1	Overview	23
2.2.2	Electrical Connections	24
2.2.3	Hardware Components	25
2.3	Analog Line Output Interface	25
2.3.1	Overview	25
2.3.2	Electrical Connections	25
2.3.3	Hardware Components	26
2.4	Analog Board Expansion Interface	26
2.4.1	Overview	26
2.4.2	Electrical Connections	26
2.4.3	Hardware Components	27
2.4.4	Mating Cable Notes	28

1 Digital Board Interfaces

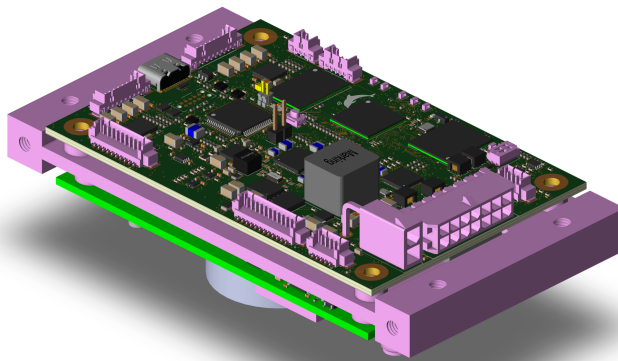


Figure 1.1: PMM5544-00 OEM Modem - Digital Board

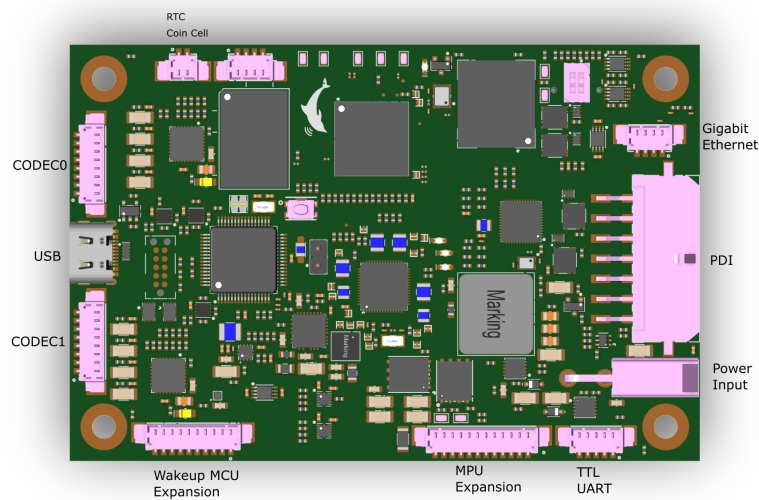


Figure 1.2: Digital Board Connector Locations

1.1 Power Input Interface

1.1.1 Overview

The Power Input Interface is a single connector available to provide power to the board.

1.1.2 Electrical Connections

Figure 1.3 shows the electrical connections for the the Power Input Interface.

Pins labeled V_BATT (pin 1) and GND (pin 2) provide power to the OEM board. Allowable voltage range is 12-38 V, with nominal expected voltage of 24 V.

Please refer to Figure 1.2 for the physical location of the interface connector on the OEM Modem.

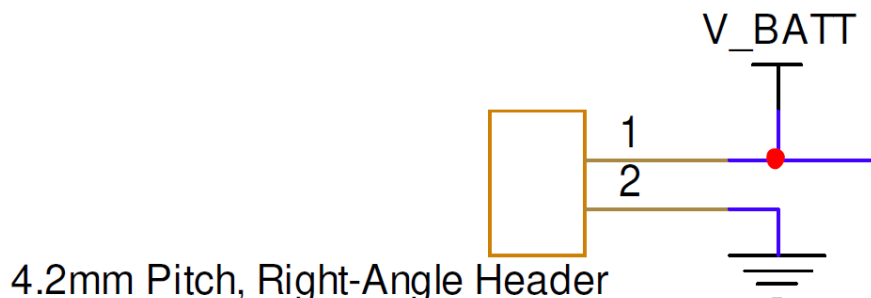


Figure 1.3: Power Input Interface Schematic connections

Table 1.1: Power Input Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	P	V_BATT	Board Power Input (12-38 V, nominal 24 V)
2	P	GND	Board Ground

1.1.3 Hardware Components

The Power Input Interface is connected to using a Molex Mini-Fit Jr. connector (P/N 0039013022) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces many different pins for use with the Mini-Fit Jr. series, the best pins for use with the Power Input Interface are Molex part number 0039000074. They are suitable for use with 18-24 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 0638190901. Alternatively, pre-crimped wire leads can be used.

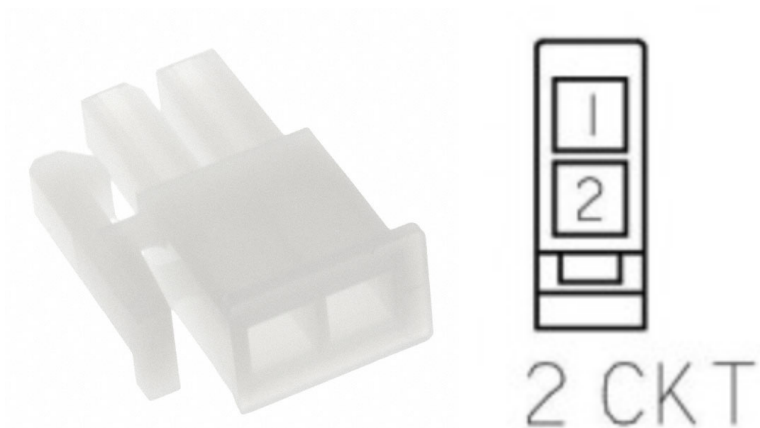


Figure 1.4: Power Input Interface User-Side Molex Connector

Table 1.2: Power Input Interface Components and Part Numbers

Part Number	Manufacturer	Description
0039013022	Molex	Mini-Fit Jr. 2 position connector receptacle, 4.2 mm pitch
0039000074	Molex	Mini-Fit Jr. 18-24 AWG gold plated sockets
0638190901	Molex	Mini-Fit Jr. Hand Crimp tool
2153431215	Molex	Pre-crimped Mini-Fit Jr. lead - 450mm length

1.1.4 Mating Cable Notes

- 18 AWG wire gauge is preferred to reduce power losses during modem operation.
- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.

1.2 Popoto Digital Interface

1.2.1 Overview

The Popoto Digital Interface (PDI) is a single connector available to provide power, communicate via Ethernet (10/100 Mbps), RS-232, and/or RS-422 (full-duplex), and provide a 1PPS time sync input to the modem.

1.2.2 Electrical Connections

Figure 1.5 shows the electrical connections for the the PDI. All signal directions are relative to the OEM Modem.

Please refer to Figure 1.2 for the physical location of the interface connector on the OEM Modem.

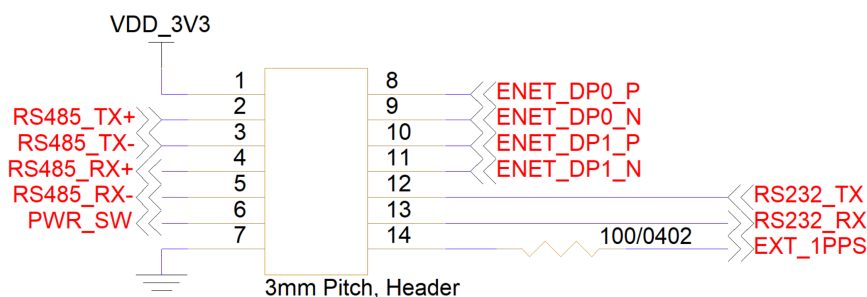


Figure 1.5: PDI Schematic connections

Table 1.3: PDI Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	P	VDD_3V3	+3.3V out when unit is powered up
2	O	RS-422 TX+	RS-422 Transmit Positive
3	O	RS-422 TX-	RS-422 Transmit Negative
4	I	RS-422 RX+	RS-422 Receive Positive
5	I	RS-422 RX-	RS-422 Receive Negative
6	I	Power Switch	Short to GND to power down unit. Leave open for normal operation.
7	P	GND	Board GND
8	O	ENET_DP0_P	T568A: Green & White T568B: Orange & White
9	O	ENET_DP0_N	T568A: Green T568B: Orange
10	I	ENET_DP1_P	T568A: Orange & White T568B: Green & White
11	I	ENET_DP1_N	T568A: Orange T568B: Green
12	O	RS-232 TX	RS-232 Transmit
13	I	RS-232 RX	RS-232 Receive
14	I	1PPS Input	Used for 1PPS or general purpose digital input. +1.8V to +5V logic-level.

1.2.3 Hardware Components

The PDI is connected to using a Molex Micro-Fit 3.0 connector (P/N 0430251400) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces many different pins for use with the Micro-Fit 3.0 series, the best pins for use with the PDI are Molex part number 0462355001. These pins are gold plated, rated for 250 mating cycles, and have a low insertion force. They are suitable for use with 20-24 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 0638190000. Alternately, if

the expense of the crimp tool is cost-prohibitive for small prototype or limited production runs, pre-crimped wires are available from suppliers such as [Digikey](#).

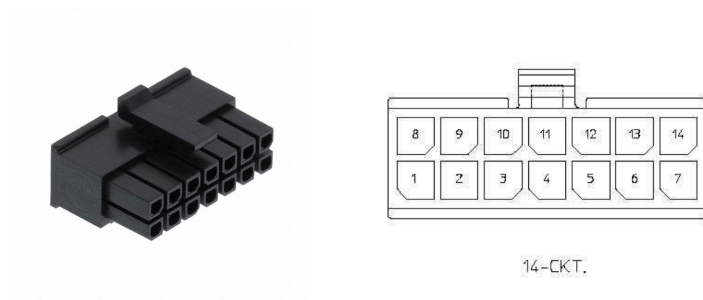


Figure 1.6: PDI User-Side Molex Connector

Table 1.4: PDI Components and Part Numbers

Part Number	Manufacturer	Description
0430251400	Molex	Micro-Fit 3.0 14 position connector receptacle, 3.0 mm pitch
0462355001	Molex	Micro-Fit 3.0 20-24 AWG gold plated, lubricated sockets
0638190000	Molex	Micro-Fit 3.0 Hand Crimp tool
2147611215	Molex	Pre-crimped Micro-Fit 3.0 lead - 450mm length

1.2.4 Mating Cable Notes

- **NOTE:** If using RS-422 interface, it is important that any mating cables utilize twisted-pair wiring for pins 2/3 and 4/5.
- **NOTE:** If using Ethernet interface, it is important that any mating cables utilize twisted-pair wiring (100 ohm differential impedance ideally) for pins 8/9 and 10/11.
- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.

1.3 Gigabit Ethernet Expansion Interface

1.3.1 Overview

The Gigabit Ethernet Interface is a single connector available to provide the third and fourth differential pairs required to enable Gigabit Ethernet on the OEM modem.

1.3.2 Electrical Connections

Figure 1.7 shows the electrical connections for the the Gigabit Ethernet Interface. All signal directions are relative to the OEM Modem.

Please refer to Figure 1.2 for the physical location of the interface connector on the OEM Modem.

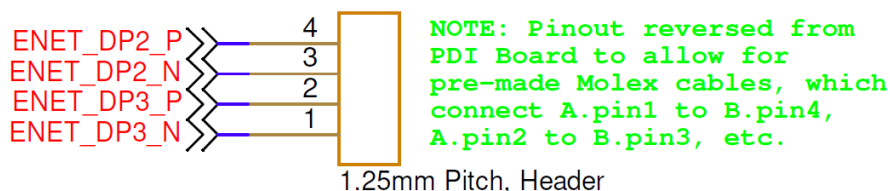


Figure 1.7: Gigabit Ethernet Schematic connections

Table 1.5: Gigabit Ethernet Electrical Pinout

Pin Number	I/O	Pin Name	Notes
4	IO	ENET_DP2_P	T568A: Blue T568B: Blue
3	IO	ENET_DP2_N	T568A: Blue & White T568B: Blue & White
2	IO	ENET_DP3_P	T568A: Brown & White T568B: Brown & White
1	IO	ENET_DP3_N	T568A: Brown T568B: Brown

1.3.3 Hardware Components

The Gigabit Ethernet Interface is connected to using a Molex PicoBlade connector (P/N 0510210400) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces several different pins for use with the PicoBlade series, the best pins for use with the Gigabit Ethernet Interface are Molex part number 0500798000. They are suitable for use with 26-28 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 2002181900. Alternately, if the expense of the crimp tool is cost-prohibitive for small prototype or limited production runs, pre-crimped wires are available from suppliers such as [Digikey](#).

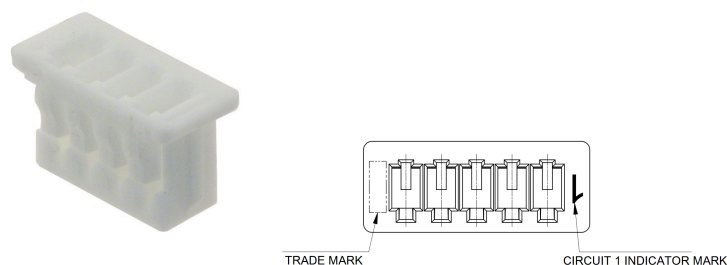


Figure 1.8: Gigabit Ethernet Interface User-Side Molex Connector

Table 1.6: Gigabit Ethernet Interface Components and Part Numbers

Part Number	Manufacturer	Description
0510210400	Molex	PicoBlade 4 position connector receptacle, 1.25 mm pitch
0500798000	Molex	PicoBlade 26-28 AWG sockets
2002181900	Molex	PicoBlade Hand Crimp tool
2149202211	Molex	Pre-crimped PicoBlade lead - 75mm length

1.3.4 Mating Cable Notes

- **NOTE:** Pinout reversed from PDI Board to allow for pre-made Molex cables, which connect A.pin1 to B.pin4, A.pin2 to B.pin3, etc.
- **NOTE:** If using Gigabit Ethernet interface, it is important that any mating cables utilize twisted-pair wiring (100 ohm differential impedance ideally) for pins 4/3 and 2/1.
- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.

1.4 TTL UART Interface

1.4.1 Overview

The TTL UART Interface is a single connector available to communicate with the modem MPU via +3.3V logic-level UART. This interface runs by default with UART parameters of 115200 8N1.

1.4.2 Electrical Connections

Figure 1.9 shows the electrical connections for the the TTL UART Interface. All signal directions are relative to the OEM Modem.

Please refer to Figure 1.2 for the physical location of the interface connector on the OEM Modem.

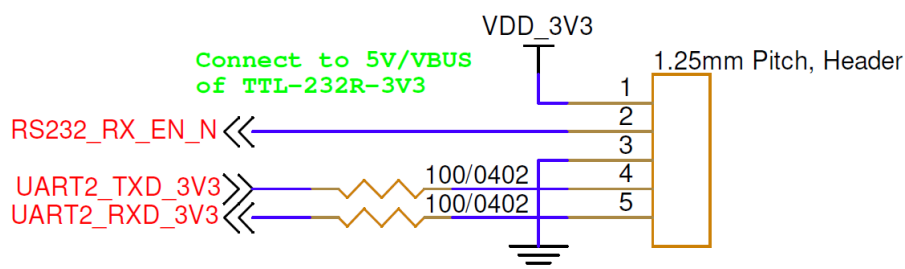


Figure 1.9: TTL UART Schematic connections

Table 1.7: TTL UART Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	P	VDD_3V3	+3.3V out when unit is powered up
2	I	RS232_RX_EN_N	Connect either to pin 1 or 3.3-5V to disable RS-232 transceiver, which shares the same UART
3	P	GND	Board GND
4	O	UART2_TXD_3V3	UART Transmit (+3.3V logic-level)
5	I	UART2_RXD_3V3	UART Receive (+3.3V logic-level)

1.4.3 Hardware Components

The TTL UART Interface is connected to using a Molex PicoBlade connector (P/N 0510210500) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces several different pins for use with the PicoBlade series, the best pins for use with the TTL UART Interface are Molex part number 0500798000. They are suitable for use with 26-28 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 2002181900. Alternately, if the expense of the crimp tool is cost-prohibitive for small prototype or limited production runs, pre-crimped wires are available from suppliers such as [Digikey](#).

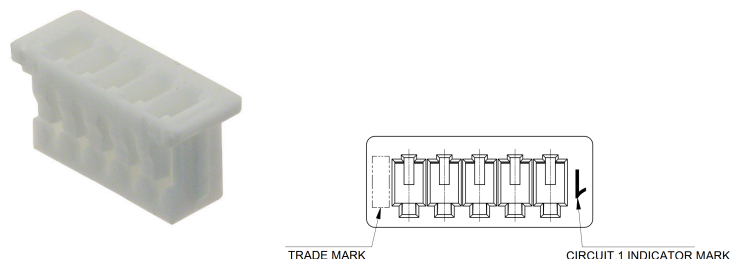


Figure 1.10: TTL UART Interface User-Side Molex Connector

Table 1.8: TTL UART Interface Components and Part Numbers

Part Number	Manufacturer	Description
0510210500	Molex	PicoBlade 5 position connector receptacle, 1.25 mm pitch
0500798000	Molex	PicoBlade 26-28 AWG sockets
2002181900	Molex	PicoBlade Hand Crimp tool
2149202211	Molex	Pre-crimped PicoBlade lead - 75mm length

1.4.4 Mating Cable Notes

- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.

1.5 USB Interface

1.5.1 Overview

The USB port is a standard dual-role USB port, configured by the Popoto Modem Linux operating system. This port is flexible, allowing both host and peripheral connections. If you have need to use the USB port, please contact Popoto Modem at info@popotomodem.com.

NOTE: On OEM Modem units prior to mid-2026, the USB port is a Micro-USB connector. Around mid-2026, OEM Modems were revised to use a USB-C connector.

1.6 MPU Expansion Interface

1.6.1 Overview

The MPU Expansion Interface is a single connector available to communicate with the modem MPU via +5V logic-level digital peripherals, including SPI, I2C, and GPIO. All pins of this expansion header are level translated from internal logic voltage level to +5V for robustness.

1.6.2 Electrical Connections

Figure 1.11 shows the electrical connections for the the MPU Expansion Interface. All signal directions are relative to the OEM Modem.

Please refer to Figure 1.2 for the physical location of the interface connector on the OEM Modem.

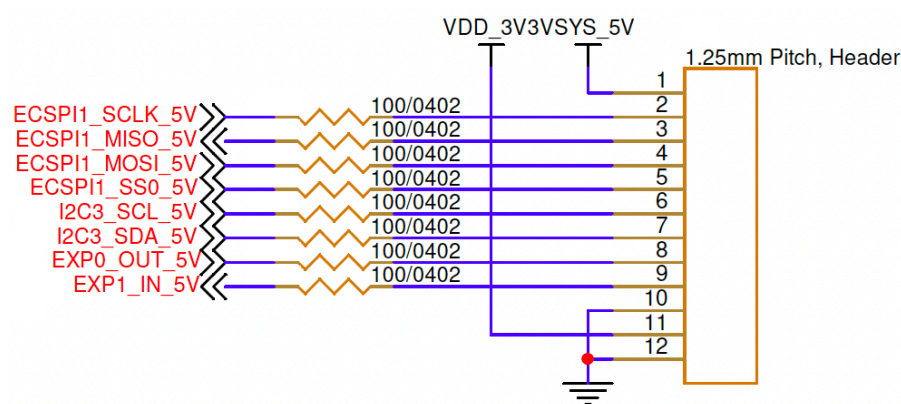


Figure 1.11: MPU Expansion Interface Schematic connections

Table 1.9: MPU Expansion Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	P	VSYS_5V	+5V out when unit is powered up
2	O	ECSPi1_SCLK_5V	SPI serial clock
3	I	ECSPi1_MISO_5V	SPI Master In Slave Out
4	O	ECSPi1_MOSI_5V	SPI Master Out Slave In
5	O	ECSPi1_SS0_5V	SPI Slave Select
6	O	I2C3_SCL_5V	I2C clock - maximum 400 kHz
7	IO	I2C3_SDA_5V	I2C data
8	O	EXP0_OUT_5V	General-purpose Digital Output
9	I	EXP1_IN_5V	General-purpose Digital Input
10	P	GND	Board GND
11	P	VDD_3V3	+3.3V out when unit is powered up
12	P	GND	Board GND

NOTE: Due to the internal 5V level translators, all signals above are fixed direction signals and cannot be modified.

1.6.3 Hardware Components

The MPU Expansion Interface is connected to using a Molex PicoBlade connector (P/N 0510211200) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces several different pins for use with the PicoBlade series, the best pins for use with the MPU Expansion Interface are Molex part number 0500798000. They are suitable for use with 26-28 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 2002181900. Alternately, if the expense of the crimp tool is cost-prohibitive for small prototype or limited production runs, pre-crimped wires are available from suppliers such as [Digikey](#).

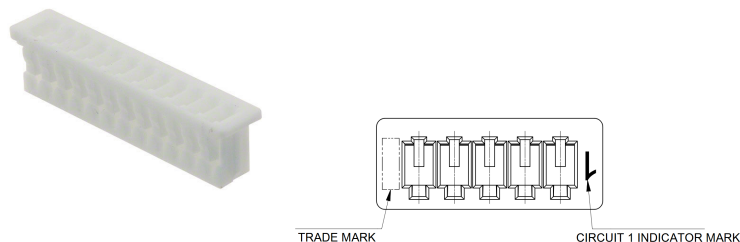


Figure 1.12: MPU Expansion Interface User-Side Molex Connector

Table 1.10: MPU Expansion Interface Components and Part Numbers

Part Number	Manufacturer	Description
0510211200	Molex	PicoBlade 12 position connector receptacle, 1.25 mm pitch
0500798000	Molex	PicoBlade 26-28 AWG sockets
2002181900	Molex	PicoBlade Hand Crimp tool
2149202211	Molex	Pre-crimped PicoBlade lead - 75mm length

1.6.4 Mating Cable Notes

- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.

1.7 Wakeup MCU Expansion Interface

1.7.1 Overview

The Wakeup MCU Expansion Interface is a single connector available to communicate with the wakeup MCU via +1.8V logic-level analog & digital peripherals.

NOTE: The physical connector of this interface is the same as described in Section 1.6, however the pinout is not the same. If you have need to use the Wakeup MCU Expansion Interface, please contact Popoto Modem at info@popotomodem.com.

1.8 RTC Coin Cell Interface

1.8.1 Overview

The RTC Coin Cell Interface is a single connector available to provide coin cell backup power to the real-time clock (RTC) on the OEM Modem. This allows the OEM Modem's calendar time to be retained across power cycles of the main battery.

1.8.2 Electrical Connections

Figure 1.13 shows the electrical connections for the the RTC Coin Cell Interface. All signal directions are relative to the OEM Modem.

Please refer to Figure 1.2 for the physical location of the interface connector on the OEM Modem.

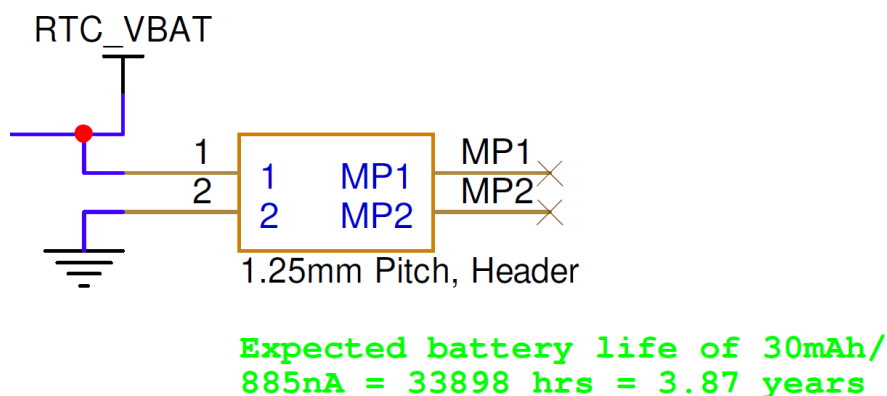


Figure 1.13: RTC Coin Cell Interface Schematic connections

Table 1.11: RTC Coin Cell Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	P	RTC_VBAT	RTC battery backup voltage supply (1.0-5.0 V, nominal 3.0 V)
2	P	GND	Board GND

1.8.3 Hardware Components

The RTC Coin Cell Interface is connected to using a Molex PicoBlade connector (P/N 0510210200) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces several different pins for use with the PicoBlade series, the best pins for use with the RTC Coin Cell Interface are Molex part number 0500798000. They are suitable for use with 26-28 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 2002181900. Alternately, if the expense of the crimp tool is cost-prohibitive for small prototype or limited production runs, pre-crimped wires are available from suppliers such as [Digikey](#).

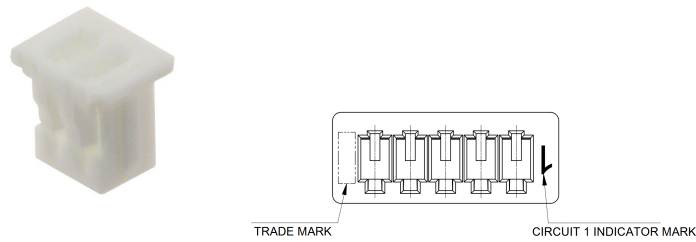


Figure 1.14: RTC Coin Cell Interface User-Side Molex Connector

Table 1.12: RTC Coin Cell Interface Components and Part Numbers

Part Number	Manufacturer	Description
0510211200	Molex	PicoBlade 12 position connector receptacle, 1.25 mm pitch
0500798000	Molex	PicoBlade 26-28 AWG sockets
2002181900	Molex	PicoBlade Hand Crimp tool
2149202211	Molex	Pre-crimped PicoBlade lead - 75mm length

1.9 CODEC Input/Output Interface

1.9.1 Overview

The CODEC Input/Output Interface are dual connectors available to provide up to four analog inputs and four analog outputs. These analog inputs & outputs are in addition to the standard acoustic communication transducer interface.

1.9.2 Electrical Connections

Figure 1.15 shows the electrical connections for the the CODEC Input/Output Interface. All signal directions are relative to the OEM Modem.

Each headphone line output is single-ended and AC-coupled on the output via a 47uF/10V/X5R capacitor. Thus, there is a high-pass filter formed by the AC-coupling capacitor and the load impedance, with a cutoff frequency as follows:

$$f_{3dB,HPF} = \frac{1}{2\pi \cdot 47 \times 10^{-6} \cdot R_{LOAD}}$$

The full-scale output voltage of each headphone line output is 0.5 V_{RMS} .

By default, the CODEC inputs are configured in single-ended mode. Thus, only CODECn_LIN1 and CODECn_RIN1 connections are used; CODECn_LIN2 and CODECn_RIN2 are unused. The full-scale input voltage of each analog line input is 0.5 V_{RMS} . Each CODEC input pin is AC-coupled via a 0.1uF/50V/COG

capacitor. The high-pass filter cutoff frequency depends on CODEC input impedance software setting, and can be 159.2 Hz, 79.6 Hz, or 39.8 Hz.

If differential input option is required (increasing full-scale input voltage to $1 V_{RMS}$, please contact Popoto Modem at info@popotomodem.com.

The maximum sampling rate of CODEC outputs and inputs is 192 ksps, and thus the maximum frequency handled by the CODEC outputs and inputs is 96 kHz.

Please refer to Figure 1.2 for the physical locations of the interface connectors on the OEM Modem.

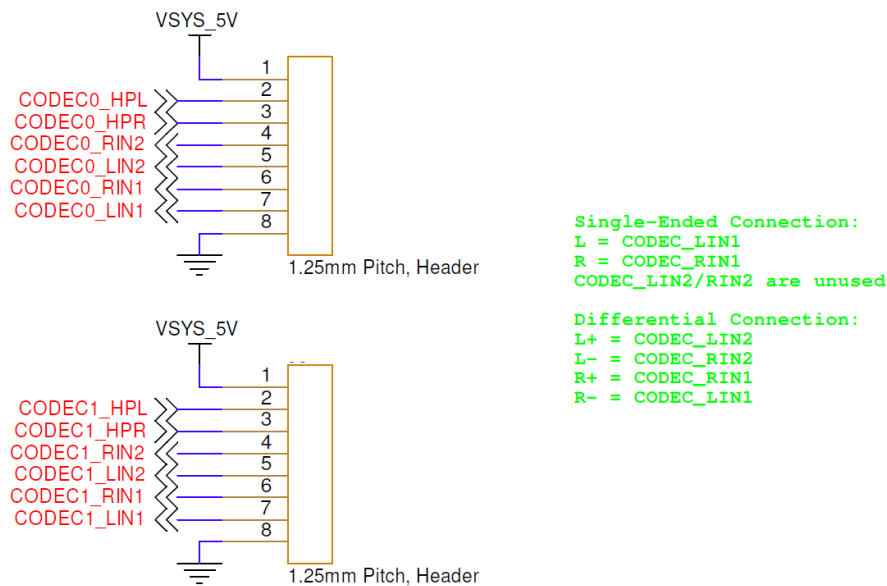


Figure 1.15: CODEC Input/Output Interface Schematic connections

Table 1.13: CODEC Input/Output Interface Connector Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	P	VSYS_5V	+5V out when unit is powered up
2	O	CODEC _x _HPL	headphone line output - Left Channel
3	O	CODEC _x _HPR	headphone line output - Right Channel
4	I	CODEC _x _RIN2	Analog line input 2 - Right Channel
5	I	CODEC _x _LIN2	Analog line input 2 - Left Channel
6	I	CODEC _x _RIN1	Analog line input 1 - Right Channel
7	I	CODEC _x _LIN1	Analog line input 1 - Left Channel
8	P	GND	Board GND

1.9.3 Hardware Components

The CODEC Input/Output Interface is connected to using a Molex PicoBlade connector (P/N 0510210800) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces several different pins for use with

the PicoBlade series, the best pins for use with the CODEC Input/Output Interface are Molex part number 0500798000. They are suitable for use with 26-28 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 2002181900. Alternately, if the expense of the crimp tool is cost-prohibitive for small prototype or limited production runs, pre-crimped wires are available from suppliers such as [Digikey](#).

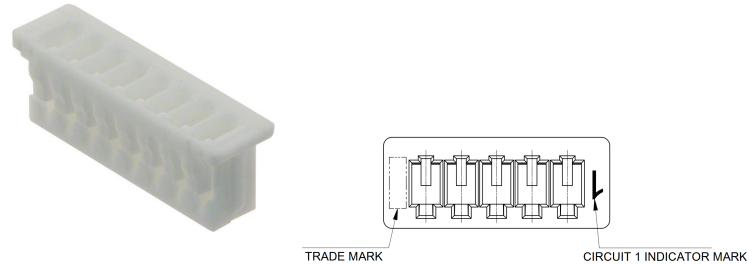


Figure 1.16: CODEC Input/Output Interface User-Side Molex Connector

Table 1.14: CODEC Input/Output Interface Components and Part Numbers

Part Number	Manufacturer	Description
0510210800	Molex	PicoBlade 8 position connector receptacle, 1.25 mm pitch
0500798000	Molex	PicoBlade 26-28 AWG sockets
2002181900	Molex	PicoBlade Hand Crimp tool
2149202211	Molex	Pre-crimped PicoBlade lead - 75mm length

1.9.4 Mating Cable Notes

- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.

2 Analog Board Interfaces

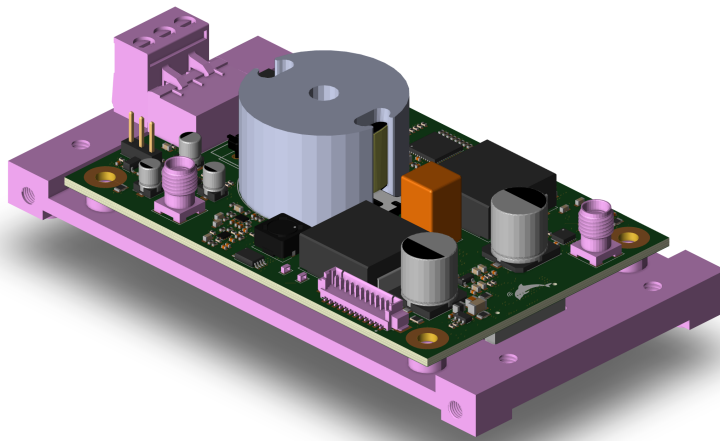


Figure 2.1: PMM5544-00 OEM Modem - Analog Board

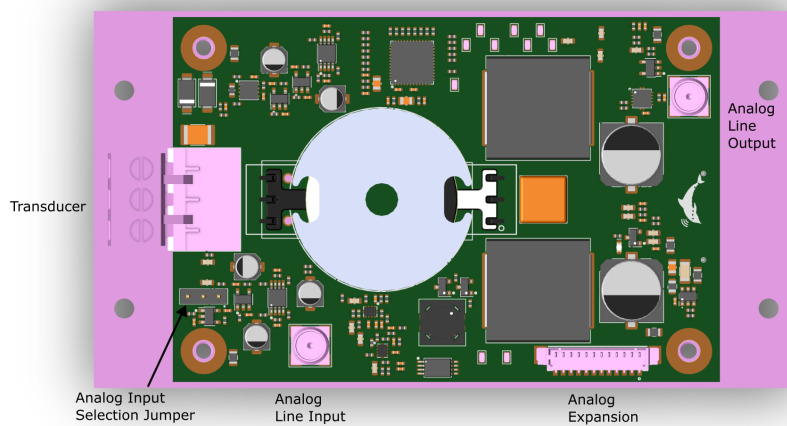


Figure 2.2: Analog Board Connector Locations

2.1 Transducer Interface

2.1.1 Overview

The Transducer Interface is a single connector to attach the transducer for acoustic communications.

NOTE: OEM Modems built prior to mid-2025 have a 6-pin connector, while newer OEM Modems have a 3-pin terminal block connector. Both are described below for convenience. Figure 2.2 shows the newer 3-pin terminal block interface version.

Please refer to Figure 2.2 for the physical locations of the interface connectors on the OEM Modem.

2.1.2 3-Pin (mid-2025 and later) Electrical Connections

Figure 2.3 shows the electrical connections for the 3-pin Transducer Interface. All signal directions are relative to the OEM Modem.

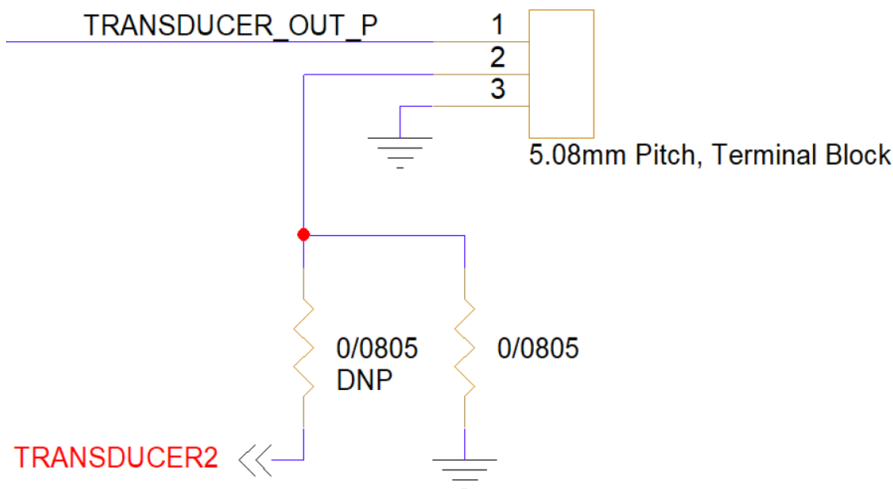


Figure 2.3: 3-Pin Transducer Interface Schematic connections

Table 2.1: 3-Pin Transducer Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	O	TRANSDUCER_OUT_P	Transducer Output
2	P/I	GND/TRANSDUCER2	Board GND / 2nd Transducer input
3	P	GND	Board GND

- **NOTE:** The transducer is connected between pins 1 & 3 with shield (if any) connected to pin 2.

- **NOTE:** If second transducer for receive-only operation is required, please contact Popoto Modem at info@popotomodem.com. By default, pin 2 is identical to pin 3 and connected to board GND.

2.1.3 3-Pin (mid-2025 and later) Hardware Components

The 3-pin Transducer Interface is connected to using a Same Sky terminal block plug connector (P/N TBP01P1-508-03BE) or equivalent. This connector has built-in screw cage clamps, thus the transducer wires can be screwed directly in with a small flat-head screwdriver.

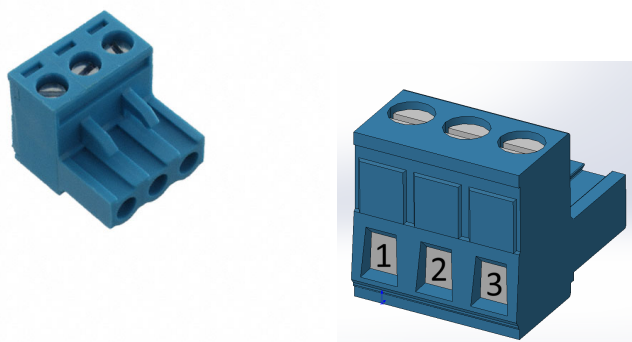


Figure 2.4: 3-Pin Transducer Interface User-Side Connector

Table 2.2: 3-Pin Transducer Interface Components and Part Numbers

Part Number	Manufacturer	Description
TBP01P1-508-03BE	Same Sky	3 position terminal block plug, 5.08 mm pitch

2.1.4 6-Pin (mid-2025 and earlier) Electrical Connections

Table 2.3: 6-Pin Transducer Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	O	TR_OUT	TR node
2	O	TRANSDUCER_OUT_P	Transducer Output
3	O	AMP_OUT	Internal Amplifier Node
4	P/I	GND/TRANSDUCER2	Board GND / 2nd Transducer input
5	O	AMP_OUT	Internal Amplifier Node
6	P	GND	Board GND

- **NOTE:** The transducer is connected between pins 2 & 6.
- **NOTE:** Pins 1 & 3 are normally shorted together with a jumper wire. Alternatively, a series match element can be inserted between pins 1 & 3. If the series match element is required, please contact Popoto Modem at info@popotomodem.com for further details.
- **NOTE:** A parallel match element can be inserted between pins 5 & 4. If the parallel match element is required, please contact Popoto Modem at info@popotomodem.com for further details.
- **NOTE:** If second transducer for receive-only operation is required, please contact Popoto Modem at info@popotomodem.com. By default, pin 4 is identical to pin 6 and connected to board GND.

2.1.5 6-Pin (mid-2025 and earlier) Hardware Components

The 6-pin Transducer Interface is connected to using a Molex Mini-Fit Jr. connector (P/N 0039013065) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces many different pins for use with the Mini-Fit Jr. series, the best pins for use with the 6-pin Transducer Interface are Molex part number 0039000074. They are suitable for use with 18-24 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 0638190901. Alternatively, pre-crimped wire leads can be used.

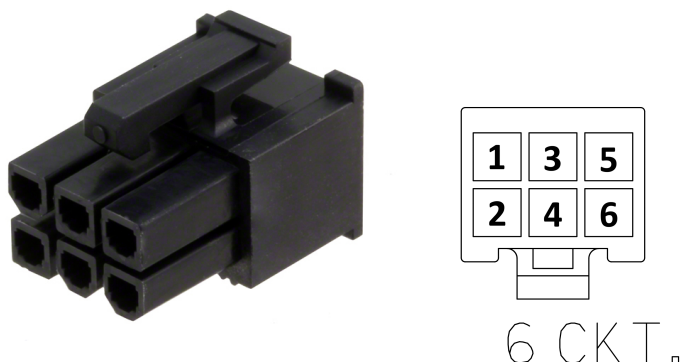


Figure 2.5: 6-Pin Transducer Interface User-Side Molex Connector

NOTE: The pinout used above does not match Molex's drawing for 0039013065, but does match the analog board pinout.

Table 2.4: 6-Pin Transducer Interface Components and Part Numbers

Part Number	Manufacturer	Description
0039013065	Molex	Mini-Fit Jr. 6 position connector receptacle, 4.2 mm pitch
0039000074	Molex	Mini-Fit Jr. 18-24 AWG gold plated sockets
0638190901	Molex	Mini-Fit Jr. Hand Crimp tool
2153431215	Molex	Pre-crimped Mini-Fit Jr. lead - 450mm length

2.1.6 Mating Cable Notes

- **SAFETY NOTE:** The Transducer Interface is a high-voltage connection during modem transmissions. Voltages in the range of hundreds of volts peak-to-peak can be present. Ensure proper clearances around any exposed metal on the Transducer Interface to any other metal.
- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.

2.2 Analog Line Input Interface

2.2.1 Overview

The Analog Line Input Interface is a single connector to allow input of an analog signal into the receiver pathway.

The transducer receiver pathway normally is digitized at two separate gains (43 dB & 12 dB). Using the analog line input will remove the connection between the transducer at the 12 dB gain pathway.

If using the Analog Line Input Interface, it is necessary to move the jumper on the Analog Input Selection Jumper from pins 1 & 2 to pins 2 & 3.

2.2.2 Electrical Connections

Figure 2.6 shows the electrical connections for the Analog Line Input Interface. All signal directions are relative to the OEM Modem.

The Analog Line Input Interface is single-ended. The input is AC-coupled with 10 uF capacitor 10 kOhm input resistor, yielding $f_{3dB-HPF} = 1.59$ Hz with pass-band input impedance of 10 kOhm.

The gain of the Analog Line Input Interface is set to -1 V/V, and there is an intentional $f_{3dB-LPF} = 123$ kHz roll-off.

The full-scale ADC input voltage is 5.32 Vpp. Thus, the input voltage at the hydrophone inputs that produces full-scale ADC input voltage is 5.32 Vpp.

Please refer to Figure 2.2 for the physical location of the interface connector on the OEM Modem.

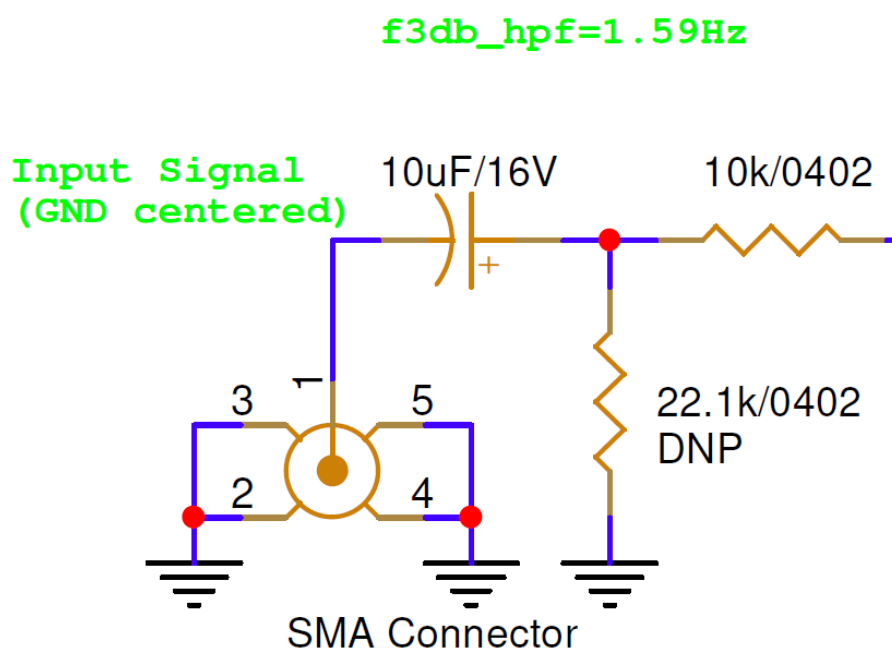


Figure 2.6: Analog Line Input Interface Schematic connections

Table 2.5: Analog Line Input Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1 SMA center	I	LINE_IN	Analog Line Input
2-5 SMA shell	P	GND	Board GND

2.2.3 Hardware Components

The Analog Line Input Interface is connected to using any standard SMA cable. An example of such a cable is TE Connectivity CSE-SGAM-305-SGAM.

2.3 Analog Line Output Interface

2.3.1 Overview

The Analog Line Output Interface is a single connector to allow output of an analog signal from the transmitter pathway.

2.3.2 Electrical Connections

Figure 2.7 shows the electrical connections for the Analog Line Input Interface. All signal directions are relative to the OEM Modem.

The transmitter pathway has a 2-channel stereo DAC internally. The left channel is used for the Transducer Interface, and the right channel is used for the Analog Line Output Interface. the transducer at the 12 dB gain pathway.

The Analog Line Output Interface is single-ended. The output is DC-coupled with a maximum load impedance of 32 ohms. The full-scale output voltage is 1.58 Vrms.

Please refer to Figure 2.2 for the physical location of the interface connector on the OEM Modem.

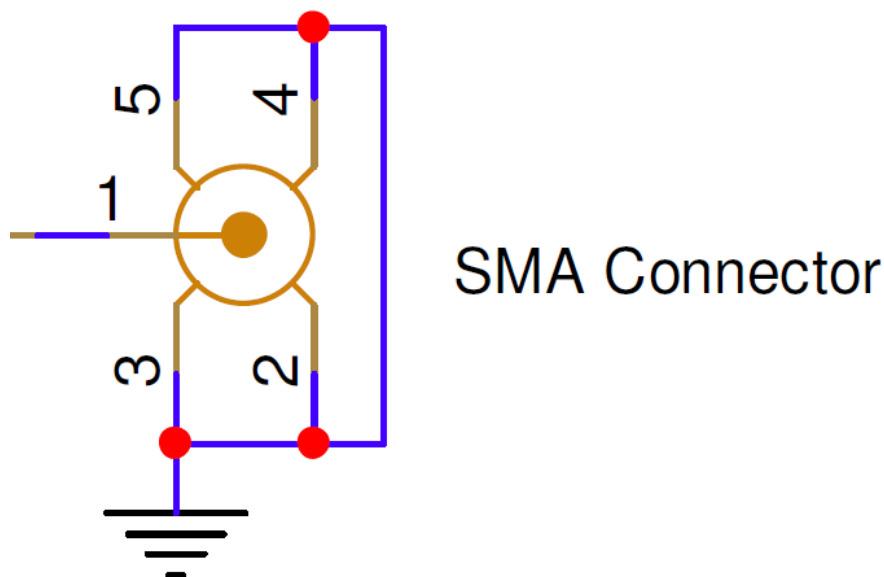


Figure 2.7: Analog Line Output Interface Schematic connections

Table 2.6: Analog Line Output Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1 SMA center	I	LINE_OUT	Analog Line Output
2-5 SMA shell	P	GND	Board GND

2.3.3 Hardware Components

The Analog Line Output Interface is connected to using any standard SMA cable. An example of such a cable is TE Connectivity CSE-SGAM-305-SGAM.

2.4 Analog Board Expansion Interface

2.4.1 Overview

The Analog Board Expansion Interface is a single connector available to communicate with the modem MPU via +3.3V logic-level digital peripherals. All pins of this expansion header are level translated from internal logic voltage level to +3.3V for robustness.

2.4.2 Electrical Connections

Figure 2.8 shows the electrical connections for the the Analog Board Expansion Interface. All signal directions are relative to the OEM Modem.

Please refer to Figure 1.2 for the physical location of the interface connector on the OEM Modem.

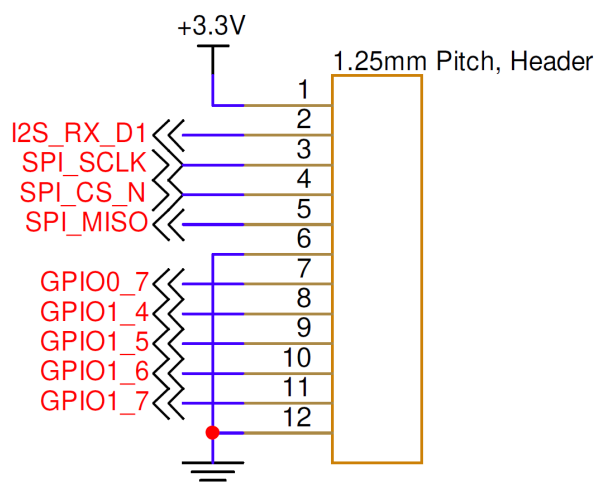


Figure 2.8: Analog Board Expansion Interface Schematic connections

Table 2.7: Analog Board Expansion Interface Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	P	+3.3V	+3.3V out when unit is powered up
2	I	I2S_RX_D1	I2S receive data pin
3	O	SPI_SCLK	SPI serial clock
4	O	SPI_CS_N	SPI slave select
5	I	SPI_MISO	SPI master in slave out
6	P	GND	Board GND
7	IO	GPIO0_7	General-purpose IO
8	IO	GPIO1_4	General-purpose IO
9	IO	GPIO1_5	General-purpose IO
10	IO	GPIO1_6	General-purpose IO
11	IO	GPIO1_7	General-purpose IO
12	P	GND	Board GND

NOTE: Please contact Popoto Modem at info@popotomodem.com if the Analog Board Expansion Interface needs to be used.

2.4.3 Hardware Components

The Analog Board Expansion Interface is connected to using a Molex PicoBlade connector (P/N 0510211200) or equivalent. This connector is sold as a shell plus discrete pins. While Molex produces several different pins for use with the PicoBlade series, the best pins for use with the Analog Board Expansion Interface are Molex part number 0500798000. They are suitable for use with 26-28 AWG wire. These pins can be crimped using one of Molex hand crimp tools such as the 2002181900. Alternately, if the expense of the crimp tool is cost-prohibitive for small prototype or limited production runs, pre-crimped wires are available from suppliers such as [Digikey](https://www.digikey.com).

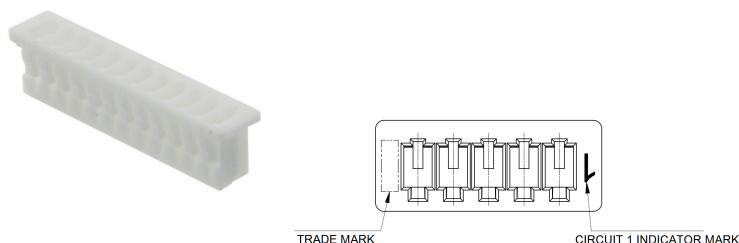


Figure 2.9: Analog Board Expansion Interface User-Side Molex Connector

Table 2.8: Analog Board Expansion Interface Components and Part Numbers

Part Number	Manufacturer	Description
0510211200	Molex	PicoBlade 12 position connector receptacle, 1.25 mm pitch
0500798000	Molex	PicoBlade 26-28 AWG sockets
2002181900	Molex	PicoBlade Hand Crimp tool
2149202211	Molex	Pre-crimped PicoBlade lead - 75mm length

2.4.4 Mating Cable Notes

- Interface should only be attached / detached while power is disconnected from the OEM Modem to avoid electrical damage.