

# Popoto Modem

## PMM6081 OEM Board Interface Control Document

delResearch LLC

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**Document Versions**

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# 1 PMM6081 OEM Interface Description

## 1.1 Popoto Digital Interface

### 1.1.1 Overview

The Popoto Digital Interface (PDI) is a single connector which provides access to the most commonly used interfaces in the Popoto Modem system. These interfaces include RS-232, RS-422, 10/100 Ethernet, Board On/Off control, and PPS input signal.

### 1.1.2 PDI Hardware Components

PDI is connected to using a Molex Microfit 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 MicroFit series, the best pins for use with Popoto Modems 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 20-24Ga 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](#).

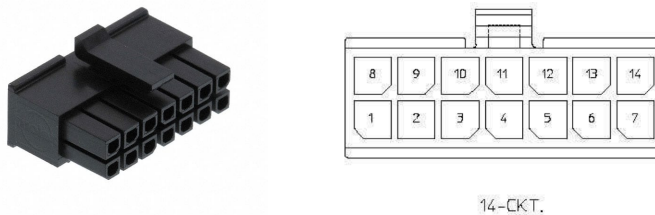


Figure 1.1: PDI User-Side Molex Connector. Interfacing to the PDI is accomplished with a Molex Microfit shell P/N 0430251400 and either Pre-pinned jumper wires, or Molex socket crimps.

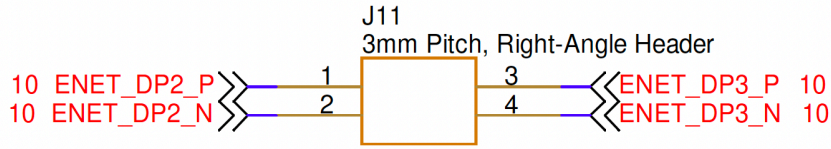


Figure 1.2: Additional PDI Connection to enable Gigabit Ethernet.

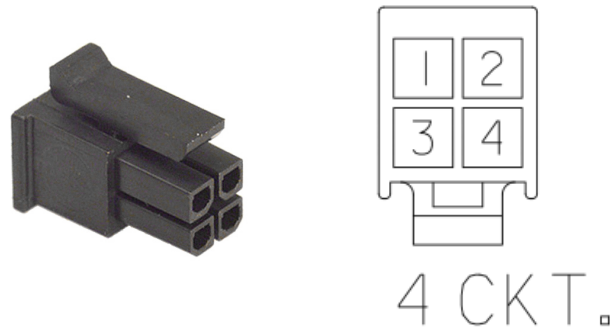


Figure 1.3: PDI Extended Gigabit User-Side Molex Connector. By Adding the 2 additional differential pairs, the Extended Gigabit connector enables gigabit ethernet to the PMM6081.

### 1.1.2.1 PDI Expanded Gigabit Ethernet

In addition to the standard Ethernet capabilities, the PMM6081 boasts an advanced feature for enhanced network performance. A separate 4-pin port (see Figure ?? and Figure ??) is included on the device, specifically designed to enable Gigabit Ethernet. This port, when used in conjunction with the 14-pin connector’s four Ethernet pins, unlocks the full potential of Gigabit Ethernet speeds. This feature is particularly beneficial for applications that require high-speed data transfer, such as large file transfers, multichannel audio streaming, or rapid upgrades. .

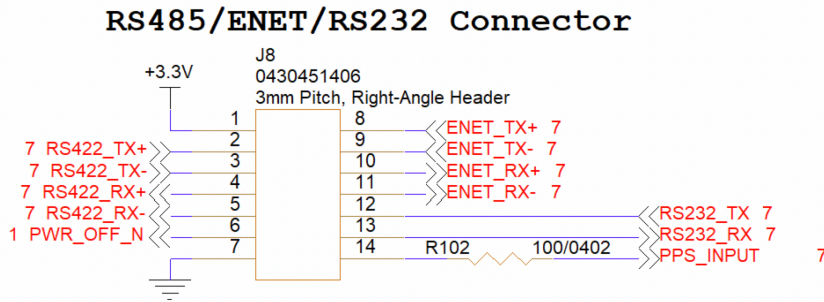


Figure 1.4: PDI Schematic connections.

### 1.1.3 Electrical Connections

Figure 1.4 shows the electrical connections for the the PDI interface. Pins labeled RS-422 are UART signals that comply with EIA-RS-422 interface standards. Default UART signaling parameters are 115200N81. Pins labeled with RS-232 are UART signals that comply with EIA-RS-232 electrical interface standards. UART signaling parameters for the RS-232 port default to 115200N81. PowerOFFN allows the unit to be powered off by connecting this signal to ground. ENET Signals are 10 100 Ethernet signals. As the Popoto board has on-board magnetics, these signals are standard 10 100 BaseT Ethernet signals. PpsInput is a 3.3V logic level input signal that is used for PPS input for clock discipline.

Table 1.1: PDI Components and Part Numbers

Part Number	Manufacturer	Description
0430251400	Molex	Microfit 14 position connector Receptacle 3.0MM
0430250400	Molex	Microfit 4 position connector Receptacle 3.0MM for Gigabit Extended PDI
0462355001	Molex	Microfit 20-24Ga gold plated, lubricated sockets
0638190000	Molex	Microfit Hand Crimp tool
0797580010	Molex/Digikey	Precrimped Microfit leads

Table 1.2: PDI Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	O	3.3V	3.3V out when unit is powered up
2	O	RS 422 Tx +	Connect to Rx+ on Host
3	O	RS 422 Tx -	Connect to Rx- On Host
4	I	RS 422 Rx+	Connect Tx+ on Host
5	I	RS 422 Rx-	Connect to Tx- on Host
6	I	PowerSwitch	Short to ground to power down unit
7	-	Gnd	Digital Ground
8	O	Ethernet Tx+	T568A Green White T568B Orange White
9	O	Ethernet Tx-	T568A Green T568B Orange
10	I	Ethernet Rx+	T568A Orange & White T568B Green & White
11	I	Ethernet Rx-	T568A Orange T568B Green
12	O	RS-232 TX	Connect RX on Host
13	I	RS-232 RX	Connect to Tx On Host
14	I	PPS Interrupt	PPS interrupt for optional time Sync Max Voltage 3.3V for PMM3511 5V for PMM5021

The PMM6081 provides an additional Connector (J11) to enable gigabit ethernet. To use the gigabit ethernet, wire the PDI port per table 1.2 and add the additional 2 differential pairs for the ethernet as shown below.

Table 1.3: Extended Gigabit PDI Electrical Pinout

Pin Number	I/O	Pin Name	Notes
1	O	Ethernet Diff Pair 2P	
2	O	Ethernet Diff Pair 2N	
3	I	Ethernet Diff Pair 3P	
4	I	Ethernet Diff Pair 3N	

## 1.1.4 Digital Interfaces

Popoto Modems have 3 additional digital interfaces beyond the PDI port. These interfaces are used to connect to external devices, or to provide alternate digital connection schemes for a host controller.

### 1.1.4.1 TTL Uart

The TTL UART port is used for connecting Popoto to a local controller over a short distance. The TTL UART port is a 5 pin Molex picoblade connector. Figure 1.5 shows the schematic connections on the TTL-UART port. In order



### UART (3.3V) Port Connector

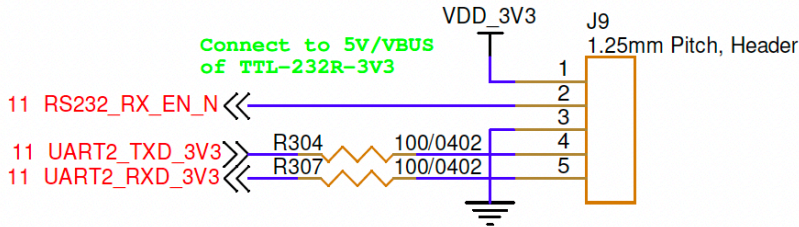


Figure 1.5: Popoto TTL Uart Plug. This port allows 3.3V Logic level uart connections

to enable the 3.3V uart port, pins one and 2 of J6 must be shorted together. Doing this disables the RS-232 level translator, and thereby disables the RS232 port on the PDI connector.

Table 1.4: Popoto TTL UART Parts

Part Number	Manufacturer	Description
0510210500	Molex	Picoblade 5 position connector Receptacle
0500798000	Molex	Picoblade 26-28Ga sockets
2002181900	Molex	HAND TOOL FOR PICO-BLADE 26-32AW
2149202214	Molex	Precrimped Picoblade 150mm 26Ga

Table 1.5: Popoto 3.3V Uart Port

Pin Number	I/O	Pin Name	Notes
1	P	V+	+3.3V
2	I	V+	RS232_EN_N Tie this pin high (short to pin 1) to enable the 3.3V UART port
3	G	GND	Ground
4	O	UART0_TXD	Popoto UART Output
5	I	UART0_RXD	Popoto UART Input

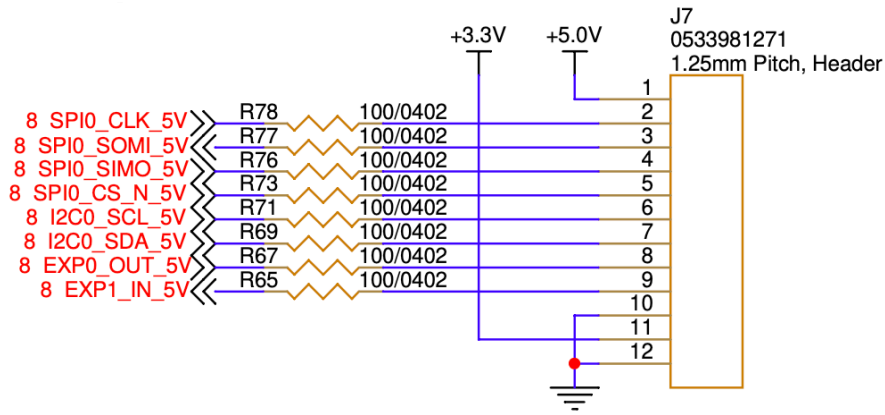


Figure 1.6: Popoto Expansion Header. This connector allows access to I2C, SPI and General purpose I/O from the Popoto Modem.

### 1.1.4.2 Expansion Header

Figure 1.6 shows the schematic diagram of the expansion header. This header is used to access peripherals from the Popoto Modem when running applications locally on the SOC. It supports a General Purpose input and General Purpose output pin, as well as SPI and I2C interfaces. Signals from this connector are used for PTT and volume control in SSB mode(PMM5021). This connector is a 12 Pin Picoblade connector, and the parts required for its use are listed in Table 1.6

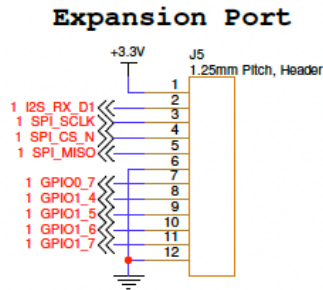


Figure 1.7: Popoto 0056 Board Expansion Header. This connector allows access to I2C, and General purpose I/O from the Popoto Modem.

Table 1.6: Popoto Expansion Header Parts

Part Number	Manufacturer	Description
0510211200	Molex	Picoblade 12 position connector Receptacle
0500798000	Molex	Picoblade 26-28Ga sockets
2002181900	Molex	HAND TOOL FOR PICO-BLADE 26-32AW
2149202214	Molex	Precrimped Picoblade 150mm 26Ga

### 1.1.4.3 0056 Analog Board GPIO Expansion Header

On the PMM6081 and PMM5021 boards shipped with the 068-0056-xx version analog boards, a GPIO header is provided for additional interface possibilities. The connector is found at J5 along the edge of the board and is a Molex 12 pin Picoblade connector. Refer to 1.7 for part numbers for this part, and refer to 1.7 for the schematic diagram. This pins are accessible from the Linux GPIO subsystem.

Table 1.7: 0056 Analog Board GPIO Expansion Header

Part Number	Manufacturer	Description
0510211200	Molex	Picoblade 12 position connector Receptacle
0500798000	Molex	Picoblade 26-28Ga sockets
2002181900	Molex	HAND TOOL FOR PICO-BLADE 26-32AW
2149202214	Molex	Precrimped Picoblade 150mm 26Ga

### 1.1.4.4 MCU Expansion Header

The MCU Expansion header allows interface to the Popoto wake up processor. The Popoto wakeup processor is a mixed signal device. This device has Ana-

log inputs, as well as digital I/O at 1.8V. This port is especially useful for monitoring signals while the main processor is in Deep sleep mode. Use of this port requires special firmware support from Popoto Modem. If you require access to these signals for your application, please reach out to [info@popotomodem.com](mailto:info@popotomodem.com).

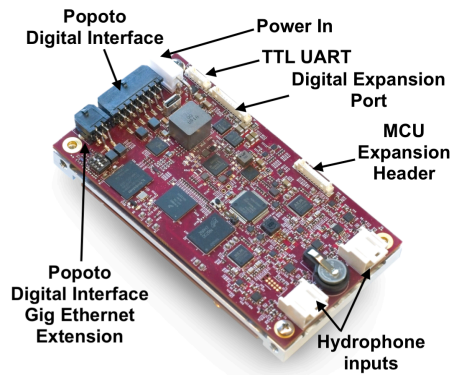


Figure 1.8: PMM6081 Digital Board Connector Locations

### 1.1.4.5 Micro USB Port

The Micro USB port is a standard USB OTG port as configured by the Popoto Modem Linux Operating system. This port is extremely flexible, allowing both host and peripheral connections. If you have need for the Micro USB port, please contact Popoto Modem at [info@popotomodem.com](mailto:info@popotomodem.com).

## 1.2 PMM6081 Specific Interfaces

### 1.2.1 Power

Power is provided to the PMM6081 OEM Boardset via connector J1 on the Digital Board. This connector is a 2 pin Molex MiniFit Jr connector, and has provisions for V+ pin and Ground pin. Acceptable input voltages are between 8.5 and 36 Volts. Table 1.9 and Figure 1.9 show the connections required for powering the PMM6081. Table 1.8 shows the parts required for attaching to the power connector on the PMM6081. Two options are given: Using sockets and a crimp tool for larger production runs, or ordering precrimped wires from Digikey for smaller prototype/production runs.

Table 1.8: PMM6081 Power Plug Components

Part Number	Manufacturer	Description
0039013022	Molex	MiniFit Jr 2 position connector Receptacle
0039000182	Molex	MiniFit Jr 18-24Ga gold plated, sockets
0638190901	Molex	Minifit Hand Crimp tool
0039000038-12-R9	Molex/Digikey	Precrimped MiniFit 12in 18Ga Red
0039000038-12-K9	Molex/Digikey	Precrimped MiniFit 12in 18Ga Black

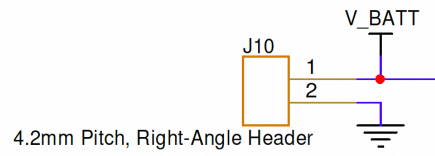


Figure 1.9: PMM6081 Power Schematic.

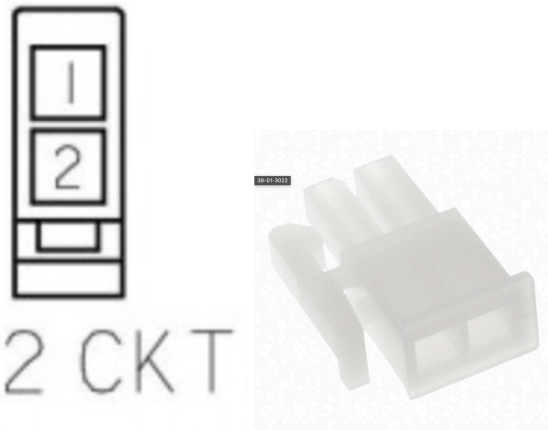


Figure 1.10: PMM6081 Power Connectors and pinout.

Table 1.9: PMM6081 Power Connector Pinout

Pin Number	I/O	Pin Name	Notes
1	P	V+	8.5-36 Volts 150 Watts
2	G	GND	Ground

## 1.2.2 Analog Interfaces

### 1.2.2.1 Hydrophone Interfaces for PMM6081 Digital Board

The PMM6081 Digital Board features two 10 Pin Molex iGrid connectors for hydrophone interfaces. These connectors are designated as J1 and J2, each providing different levels of gain for hydrophone channels.

### 1.2.2.2 J1: High Gain Hydrophone Connector

The J1 connector provides a High Gain 43dB amplification suitable for hydrophone channels. The pinout configuration for the J1 connector is as follows:

Pin	Function	Description
1	AIN4P	Analog input 4 Positive
2	AIN4N	Analog input 4 Negative
3	AIN3P	Analog input 3 Positive
4	AIN3N	Analog input 3 Negative
5	AIN2P	Analog input 2 Positive
6	AIN2N	Analog input 2 Negative
7	AIN1P	Analog input 1 Positive
8	AIN1N	Analog input 1 Negative
9	VSYS5V	5V output
10	GND	Ground

Table 1.10: J1 High Gain Hydrophone Connector Pinout, AINxP and AINxN are the positive and negative inputs for a given hydrophone channel.

### 1.2.2.3 J2: Low Gain Hydrophone Connector

The J2 connector provides a Low Gain (12dB) for hydrophone connections. The pinout configuration for the J2 connector is as follows:

Pin	Function	Description
1	AIN8P	Analog input 8 Positive
2	AIN8N	Analog input 8 Negative
3	AIN7P	Analog input 7 Positive
4	AIN7N	Analog input 7 Negative
5	AIN6P	Analog input 6 Positive
6	AIN6N	Analog input 6 Negative
7	AIN5P	Analog input 5 Positive
8	AIN5N	Analog input 5 Negative
9	VSYS5V	5V output
10	GND	Ground

Table 1.11: J2 Low Gain Hydrophone Connector Pinout, AINxP and AINxN are the positive and negative inputs for a given hydrophone channel.

### 1.2.2.4 Hydrophone Connectors Part Number Table

#### 1.2.3 Analog Board

The remaining analog interfaces to the PMM6081 can be found on the analog board. This board has the large round pot-core inductor, and can be seen in

Component	Manufacturer Part Number
Crimps	Molex 5016471000
Housing	Molex 5016461000

Table 1.12: Manufacturer Part Number for iGrid Pins and Shells

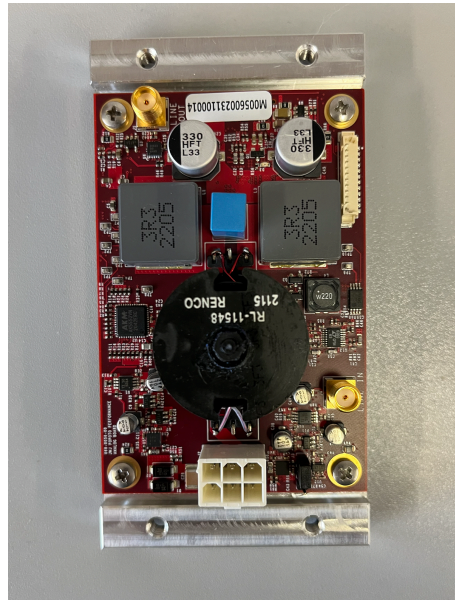


Figure 1.11: The PMM6081 Analog board

Figure 1.11

### 1.2.3.1 Transducer

The Transducer is connected to the Popoto Modem by a 6 pin Molex MiniFit Jr connection, labelled J9. This connector provides access to the TPA output and provides positions for series and parallel matching networks. In its default configuration with the Popoto 25-30Khz transducer, no additional matching networks are required. See Figures 1.12 and 1.13 for the pinout for this connector.



**Place Series Matching network from Pin 1 to 2.  
 Short with a shorting loop if no match needed  
 Place parallel Matching network from 6 to 5.  
 Connect transducer to pins 6 (inner ring) and 4 (Outer Ring)**

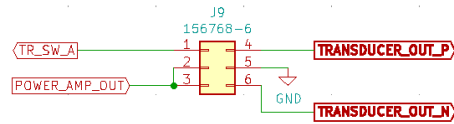


Figure 1.12: The PMM6081 Transducer connector schematic.

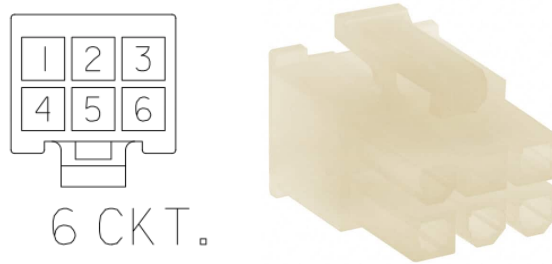


Figure 1.13: PMM6081 Transducer connector and pinout.

Table 1.13: PMM6081 Transducer Connector Pinout

Pin Number	I/O	Pin Name	Notes
1	I	TR_SW_A	Input to the TR Switch. Connect to Pin 2 with series matching network
2	O	POWER_AMP_OUT	Connect to Pin 1 with series Matching network
3	O	POWER_AMP_OUT	Same signal as Pin 2
4	O	TRANSDUCER_OUT_P	Positive transducer connection. Connect to Pin 5 with parallel matching network if needed
5	G	GND	Ground
6	O	TRANSDUCER_OUT_N	Negative transducer connection.

Table 1.14: PMM6081 Transducer Plug Parts

Part Number	Manufacturer	Description
0039012060	Molex	MiniFit Jr 6 position connector Receptacle
0039000182	Molex	MiniFit Jr 18-24Ga gold plated, sockets
0638190901	Molex	Minifit Hand Crimp tool
0039000038-12-R9	Molex/Digikey	Precrimped MiniFit 12in 18Ga Red
0039000038-12-K9	Molex/Digikey	Precrimped MiniFit 12in 18Ga Black

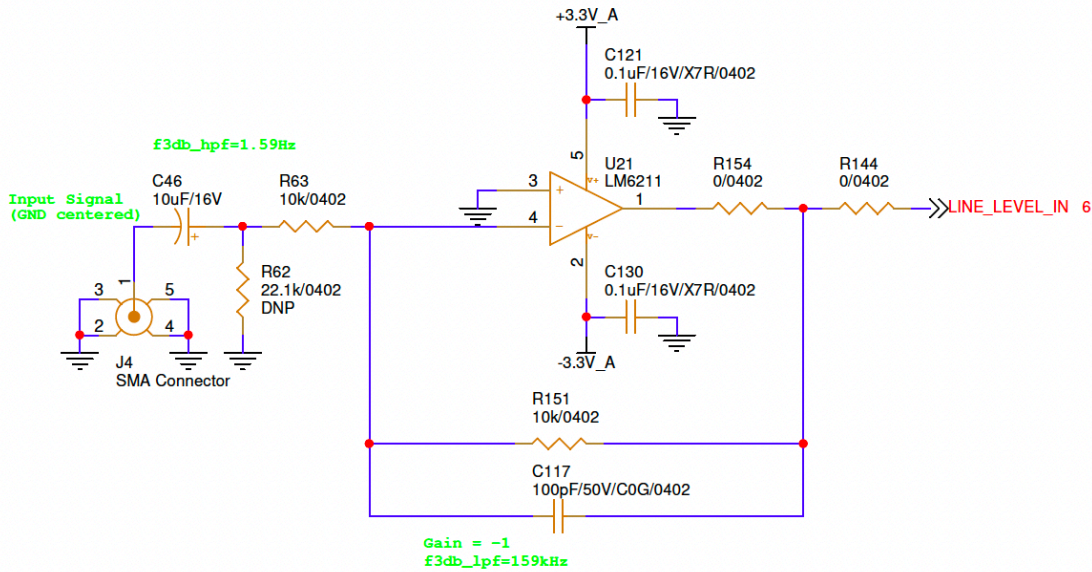


Figure 1.14: PMM6081 Analog input schematic excerpt. This circuit conditions the input signal and is used for SSB voice input or for applications providing line level analog input.

### 1.2.3.2 Analog In

The PMM6081 Analog board has provisions for analog input via an SMA connector mounted on the analog board. This connector is used for SSB voice input, as well as for applications that have line level outputs of transducer signals. The Analog input port drives an adjustable gain amplifier to allow for level matching between different equipment. An excerpt of the schematic, showing the input amplifier topology is shown in Figure 1.14. Note that for the analog input to operate, the J5 and J1 jumpers must be installed and J2 should be installed in the 2-3 position to connect the input to SMA. The input impedance of the SMA connection is 22.1 K. The input gain is adjustable by R13 yield a gain spanning from 1/2 to 25. The A/D input spans +/- 2.5 volts.

### 1.2.3.3 Analog Out

The PMM6081 Analog board has provisions for analog output via an SMA connector mounted on the analog board. This connector is used for SSB voice output, as well as for applications that utilize offboard power amplifiers. The Analog output port drives a fixed gain amplifier to provide buffering and level setting of the output. An excerpt of the schematic, showing the input amplifier topology is shown in Figure 1.15. The full scale output voltage on the SMA

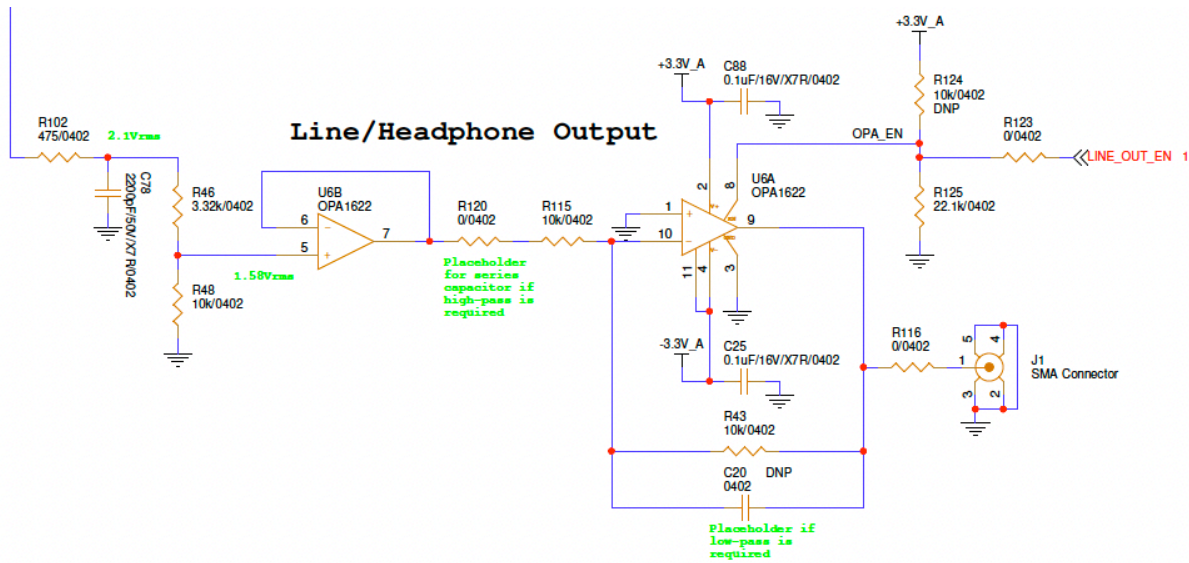


Figure 1.15: PMM6081 Analog output schematic excerpt. This circuit provides a +/- 3.3V signal to the SMA output port. This signal is used for the headphones output during SMA voice mode, or for a diagnostic port or to drive an external power amplifier if needed.

is +/- 3.3 Vpp. The maximum output current is 145mA and is ground centered. The 3dB cut off point of the output low-pass filter is 152KHz.