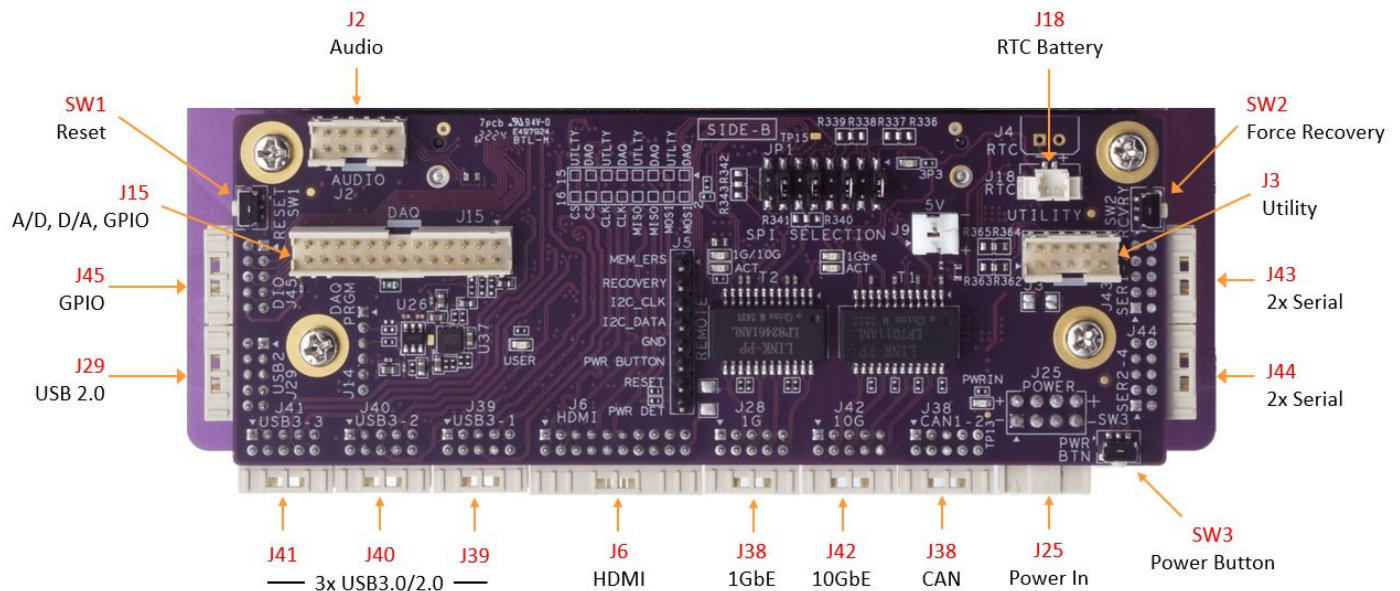


# Product Hardware Specification

## Osbourne Embedded IO Board

DSC Document no. 7542670 Revision 1.3



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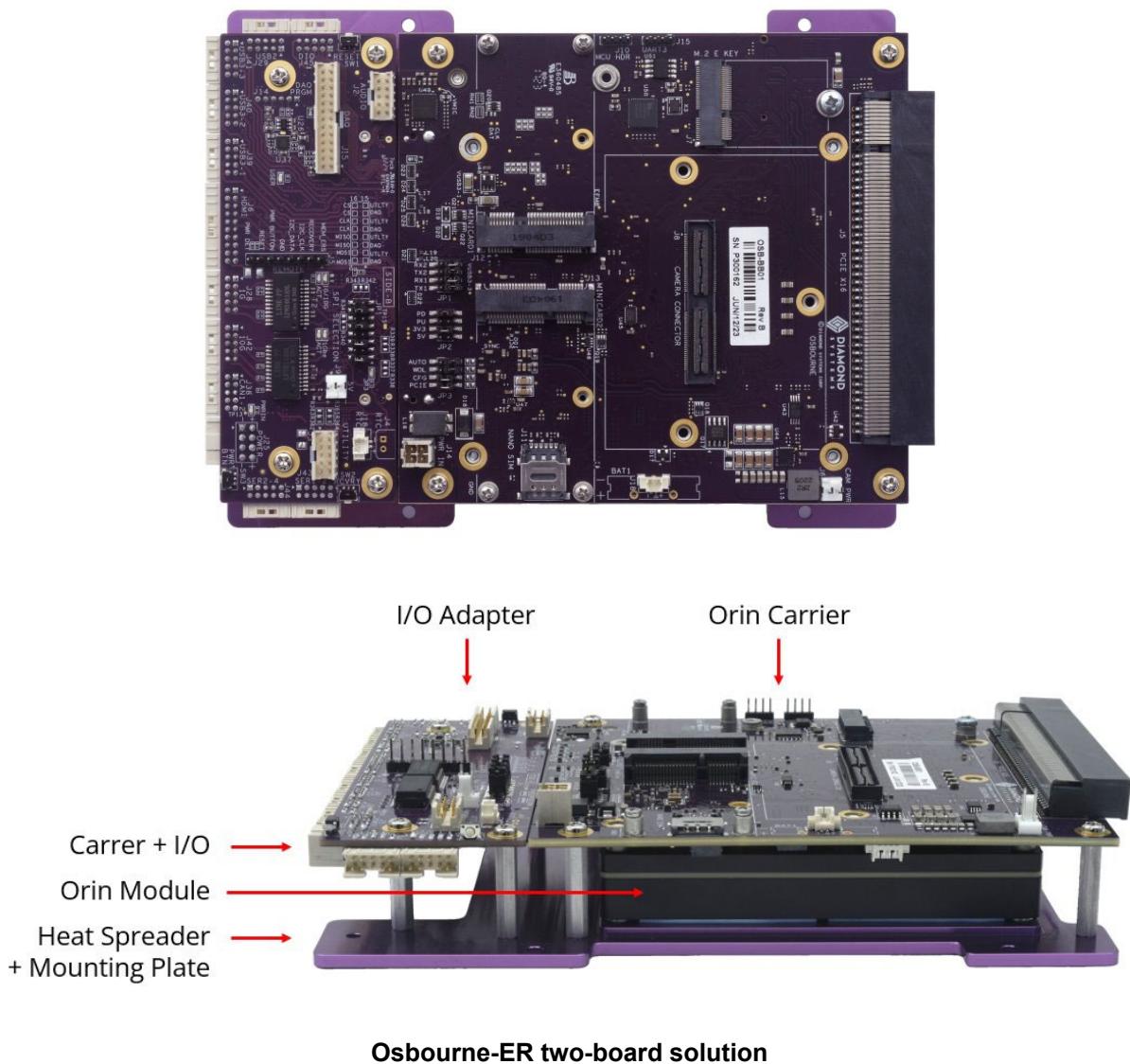
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# 1. DESCRIPTION

This product is an IO breakout board for the Osbourne carrier board, incorporating standard right angled latching connectors on a PCB mounted in-line with the Osbourne carrier board. The two-board assembly is intended to sit atop a heat spreader to provide a thermally efficient, rugged, compact solution for embedded Jetson AGX Orin applications.

The board can be powered from a wide input voltage range of +7V to +20V. It offers 1G and 10G Ethernet port, one HDMI 2.0a/b video output option, audio, 2xR232, 2xRS232/422/485, 2xUSB2.0, 3xUSB3.2,CAN,DIO. Some of the additional interfaces like power button, force recovery, reset, I2C, and SPI are available on a utility header. All I/O features available on the Osbourne main I/O connector are made available on pin headers for user access.

Additionally, the SAM-based Data Acquisition circuit used on other Jetson carriers such as Jethro, Elton, and Stevie is added to this I/O board to provide even greater utility.



## 1.1 I/O Features and Connector Locations

Feature	Description	Connector Type
Power	7- 20V wide input supply	2x4 latching Samtec IPL connector
DAQ	A/D, D/A, and DIO	2x13 2mm Latching FCI connector
1G Ethernet	10/100/1000Mbps MDI	2x5 2mm Latching FCI connector
10G Ethernet	10G MGBE	2x5 2mm Latching FCI connector
Audio	Audio I/O signals include stereo line out and mono mic in	2x5 2mm Latching FCI connector
DAQ Programming header	CLK, DATA, RESET, 3V3, GND	1x6 pin header (factory use only)
Remote control	Reset, recovery, power on, I2C, MEM_ERS	1x8 connector
Utility	I2C, SPI, System reset, System power On, MEM_ERS, Force recovery	2x5 2mm Latching FCI connector
USB 2.0	Standard USB 2.0	2x5 2mm Latching FCI connector
USB 3.1	3 ports USB 3.x with USB 2.0 fallback	3x 2x5 2mm Latching FCI connectors
RTC	RTC Battery connector	1x2 Latching connector
CAN	CAN-1 and CAN-2	2x5 2mm Latching FCI connector
DIO Port	Digital IO Port0-7	2x5 2mm Latching FCI connector
Serial Ports	4 ports with RS-232/422/485 capability	2x 2x5 2mm Latching FCI connectors
HDMI	HDMI 2.0 capability	2x10 2mm Latching FCI connector

## 1.2 Operating System Support

- ◆ Supported by standard Nvidia Jetson BSP for Osbourne

## 1.3 Mechanical, Electrical, Environmental

- ◆ Form factor 120mmx45mm (I/O adapter)  
165 L x 137 W x 36mm H / 6.5 x 5.4 x 1.4" (fully assembled with heat spreader)
- ◆ Cooling Conduction cooling (complete system)
- ◆ Power input 7 – 20VDC
- ◆ Operating Temp -40°C to +80°C ambient (to support all models of AGX Orin)

## 2. KEY SUBSYSTEMS

### 1.4 System overview

The embedded IO board interfaces with Osbourne base board and provides I/O connectors for all the major features such as HDMI, USB3, USB2, ethernet, audio, utility, power supply and additional I/O capability.

### 1.5 Power Supply

The board can be powered from a wide input voltage range of +7V to +20VDC. All required supply voltages for the board are derived from the main supply voltage fed into the Osbourne board and then back to the I/O board via the main I/O connector.

### 1.6 Ethernet

The board offers one 10/100/1000Mbps Ethernet port and one MGBE ethernet port capable of supporting 1, 2.5, 5, and 10Gbps data rates.

10G Ethernet port is terminated onto a 2x5 latching connector. Onboard magnetics is provided. LED signals are provided for Link, Activity, and Speed Indication.

1G Ethernet port is terminated onto a 2x5 latching connector with onboard magnetics and LED signals.

### 1.7 Display

The board offers one HDMI2.0 a/b video output option. The HDMI signals are available on the I/O connector and is terminated on a latching 2x5 connector

The HDMI hot plug detector and I2C circuitry are incorporated on the board. The 5V output required on the HDMI is controlled through a switch.

### 1.8 Audio

Audio I/O signals include stereo line out and mono mic in. The audio signals are made available on the I/O connector and are terminated onto a 2x5 latching connector.

### 1.9 Serial Ports, DIO, CAN

Serial port 1 and serial port 2 is made available on a latching 2x5 connector. Also 8 DIO's can be made available on a 2x5 connector and CAN1-2 is made separately available with a 2x5 connector.

For more information see [Jumper Configuration](#)

Serial port 3 and 4(RS232) are separately available on a 2x5 latching connector.

### 1.10 USB

The board provides access 2x USB2.0 via USB 2.0 hub routed to the Osbourne main I/O connector. Three USB3.2 and three USB2.0 ports are also routed to the I/O connector.

The 3x USB 3.1 is terminated on 2x5 latching connectors separately and marked as USB3-1, USB3-2, USB3-3

One number of USB2.0 is terminated on 2x5 latching and marked as USB2

### 1.11 Utility

Some of the additional interfaces like Power button, Reset, I2C, SPI, MER\_ERS and Force recovery signals are available through a 2x5 utility latching connector.

## 1.12 Jumper Configuration

Jumpers are provided as an ORing option between SPI signals to DAQ or Utility header.

The configuration is as given below:

SPI Selection header JP1

<b>Position</b>	<b>Function</b>	<b>IN</b>	<b>OUT</b>
1	DAQ SPI MOSI	<b>SPI MOSI CB*</b>	DAQ
3	UTIL SPI MOSI	<b>SPI MOSI CB</b>	UTILITY
5	DAQ SPI MISO	<b>SPI MISO CB*</b>	DAQ
7	UTIL SPI MISO	<b>SPI MISO CB</b>	UTILITY
9	DAQ SPI SCK	<b>SPI SCK CB*</b>	DAQ
11	UTIL SPI SCK	<b>SPI SCK CB</b>	UTILITY
13	DAQ SPI CS	<b>SPI CS CB*</b>	DAQ
15	UTIL SPI CS	<b>SPI CS CB</b>	UTILITY
<b>*Default Mode</b>			

### 3. BLOCK DIAGRAM

Figure 1 provides an overview of the key functional blocks of the Osbourne Embedded I/O Board.

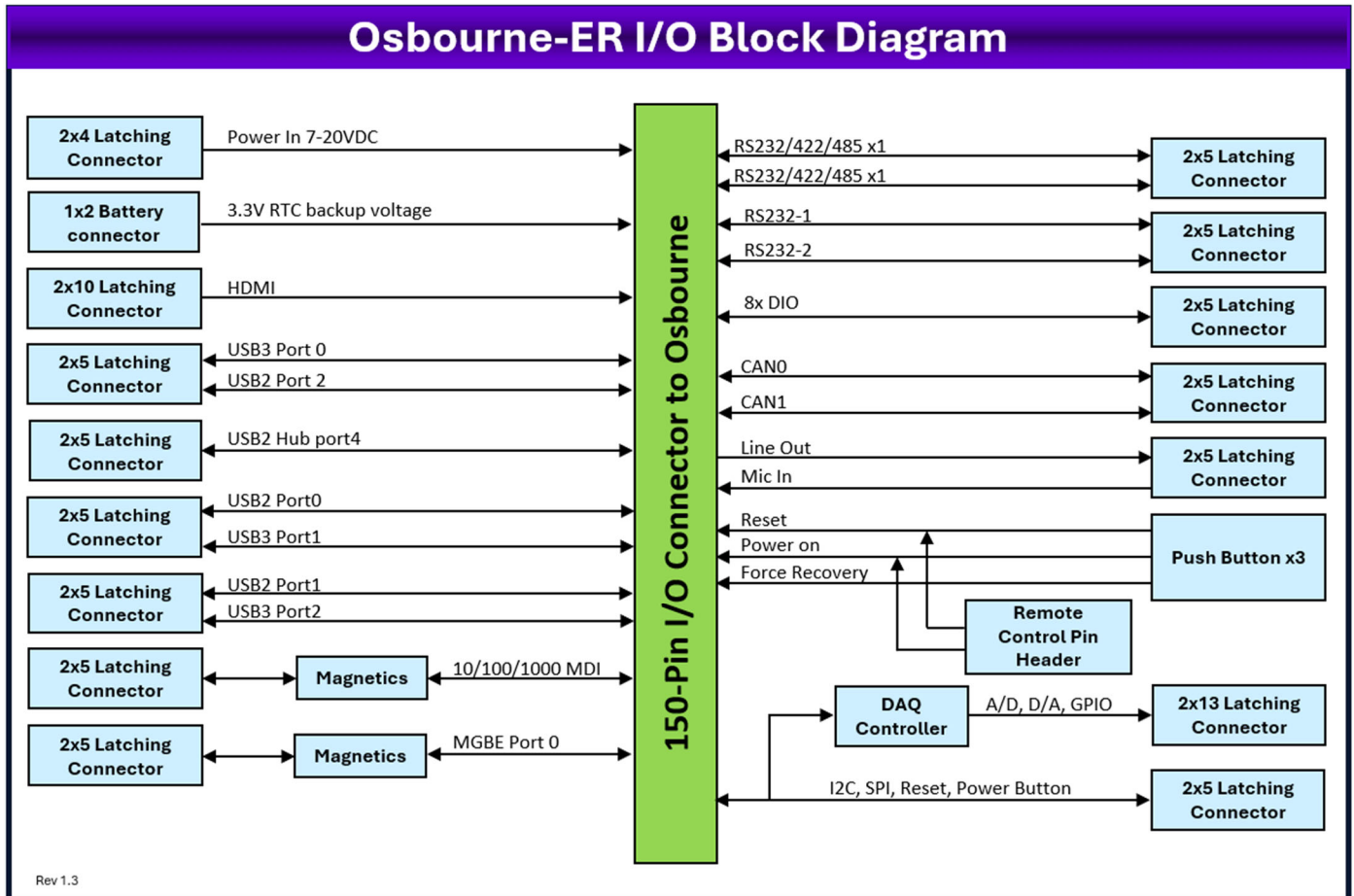


Figure 1: Block Diagram of Osbourne Embedded IO Board

## 4. MECHANICAL DRAWING

Figure 2: Mechanical outline, top view



## 5. I/O CONNECTORS

### 1.13 Power In

The pinouts for power input are as shown below:

GND	1	5	VIN
GND	2	6	VIN
GND	3	7	VIN
GND	4	8	VIN

+VIN = +7V to +20V

**Connector PN:** ASP-194529-01

**Mating Cable PN:** 6980512 DSC cable assembly

### 1.14 Main I/O Connector

Most I/O connections are routed to a high density, high-speed I/O connector.

The pinouts are as shown below.

AUDIO_MIC_L	1	2	GND_AUD
AUDIO_MIC_R	3	4	AUDIO_PRSENT_L
AUDIO_HPOR_HDA	5	6	AUDIO_JD1
AUDIO_HPOL_HDA	7	8	AUDIO_JD2
GND_DIG	9	10	GND_DIG
V_BAT	11	12	USB3_UPHY_RX0_P
GPIO20_DP/HDMI_EN_1P8	13	14	USB3_UPHY_RX0_N
V_5P0	15	16	GND_DIG
GND_DIG	17	18	USB3_UPHY_TX0_P
HDMI_CEC_CON	19	20	USB3_UPHY_TX0_N
DP2/HDMI_HPD	21	22	GND_DIG
DP2_AUX_CH_P	23	24	USB2_D0_CH_N
DP2_AUX_CH_N	25	26	USB2_D0_CH_P
V_DIO	27	28	GND_DIG
DIO_PA7	29	30	USB3_UPHY_RX1_P
DIO_PA6	31	32	USB3_UPHY_RX1_N
DIO_PA5	33	34	GND_DIG
DIO_PA4	35	36	USB3_UPHY_TX1_P
DIO_PA3	37	38	USB3_UPHY_TX1_N
DIO_PA2	39	40	GND_DIG
DIO_PA1	41	42	USB2_D2_CH_N
DIO_PA0	43	44	USB2_D2_CH_P
GND_DIG	45	46	GND_DIG
V_USB2_VBUS	47	48	HDMI_DP2_TX0_CON_P
V_USB2_VBUS	49	50	HDMI_DP2_TX0_CON_N
V_USB3_3	51	52	GND_DIG
V_USB3_3	53	54	HDMI_DP2_TX3_CON_N
GND_DIG	55	56	HDMI_DP2_TX3_CON_P
UART5_CTS_RS232	57	58	GND_DIG
UART5_RX_RS232	59	60	HDMI_DP2_TX2_CON_N
UART5_RTS_RS232	61	62	HDMI_DP2_TX2_CON_P
UART5_TX_RS232	63	64	GND_DIG
V_USB3_1	65	66	HDMI_DP2_TX1_CON_N
V_USB3_1	67	68	HDMI_DP2_TX1_CON_P
UART3_9_RX_RS232	69	70	GND_DIG

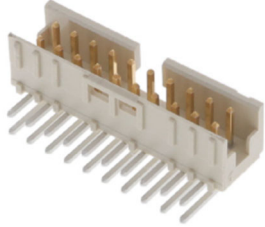
UART3_9_TX_RS232	71	72	USB2_D1_CH_N
CAN1_L	73	74	USB2_D1_CH_P
CAN1_H	75	76	GND_DIG
V_5P0_A	77	78	USB3_UPHY_RX2_P
V_USB3_2	79	80	USB3_UPHY_RX2_N
V_USB3_2	81	82	GND_DIG
CAN0_L	83	84	USB3_UPHY_TX2_P
CAN0_H	85	86	USB3_UPHY_TX2_N
GND_DIG	87	88	GND_DIG
CTS2/RX2_N	89	90	USB2_HUB_D4_CH_N
RX2/RX2_P	91	92	USB2_HUB_D4_CH_P
RTS2/TX2_N/RX2_N	93	94	GND_DIG
TX2/TX2_P/RX2_P	95	96	GBE_MDI0_P
GND_DIG	97	98	GBE_MDI0_N
CTS1/RX1_N	99	100	GND_DIG
RX1/RX1_P	101	102	GBE_MDI1_P
RTS1/TX1_N/RX1_N	103	104	GBE_MDI1_N
TX1/TX1_P/RX1_P	105	106	GND_DIG
GND_DIG	107	108	GBE_MDI2_P
I2C_GP8_DAT_3P3	109	110	GBE_MDI2_N
I2C_GP8_CLK_3P3	111	112	GND_DIG
GND_DIG	113	114	GBE_MDI3_P
SPI1_SCK	115	116	GBE_MDI3_N
SPI1_MISO	117	118	GND_DIG
SPI1_MOSI	119	120	MGBE_PHY_A_N
SPI1_CS0	121	122	MGBE_PHY_A_P
BUTTON_POWER_ON_N	123	124	GND_DIG
SYS_RST_IN_N	125	126	MGBE_PHY_B_N
FORCE_RECOVERY#	127	128	MGBE_PHY_B_P
GND_DIG	129	130	GND_DIG
V_3P3	131	132	MGBE_PHY_C_N
MGBE_LED2	133	134	MGBE_PHY_C_P
MGBE_LED1	135	136	GND_DIG
MGBE_LED0	137	138	MGBE_PHY_D_P
KSZ_LED2	139	140	MGBE_PHY_D_N
KSZ_LED1	141	142	GND_DIG
GND_DIG	143	144	V_VIN
V_VIN	145	146	V_VIN
V_VIN	147	148	V_VIN
V_VIN	149	150	V_VIN

Connector used is ERF8-075-01-L-D-RA-TR

### 1.15 HDMI Latching connector

HDMI interface is available on the IO card with 2x10 latching connector.

GND	2	1	HDMI_DP2_TX2_CON_P
HDMI_DP2_TX1_CON_P	4	3	HDMI_DP2_TX2_CON_N
HDMI_DP2_TX1_CON_N	6	5	GND
GND	8	7	HDMI_DP2_TX0_CON_P
HDMI_DP2_TX3_CON_P	10	9	HDMI_DP2_TX0_CON_P
HDMI_DP2_TX3_CON_N	12	11	GND
RSVD	14	13	HDMI_CEC_CON
HDMI_SDA_CON	16	15	HDMI_SCL_CON
V_5P0_HDMI	18	17	GND
GND_CH	20	19	HDMI_HPD_CON



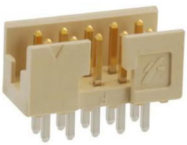
**Connector PN:** 98464-G61-20ULF

**Mating cable PN:** 6980605 DSC cable assembly

### 1.1 Audio

This connector provides the audio signals. The pinouts are as shown below:

AUDIO_HPOL_HDA	1	2	AUDIO_HPOR_HDA
GND_AUD	3	4	GND_AUD
NC	5	6	NC
GND_AUD	7	8	GND_AUD
AUDIO_MIC_L	9	10	AUDIO_MIC_R



**Connector type:** 2x5 2mm latching connector

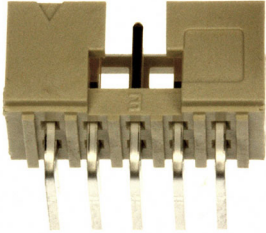
**Connector PN:** 98414-G06-10LF

**Mating Cable PN:** 6980608

## 1.2 1G Ethernet

1G ethernet interface is available in 2x5 Latching connector as shown below:

GND_CHASSIS	<b>1</b>	<b>2</b>	NC
GBE_MAG_MDI0_P	<b>3</b>	<b>4</b>	GBE_MAG_MDI0_N
GBE_MAG_MDI1_P	<b>5</b>	<b>6</b>	GBE_MAG_MDI1_N
GBE_MAG_MDI2_P	<b>7</b>	<b>8</b>	GBE_MAG_MDI2_N
GBE_MAG_MDI3_P	<b>9</b>	<b>10</b>	GBE_MAG_MDI3_N



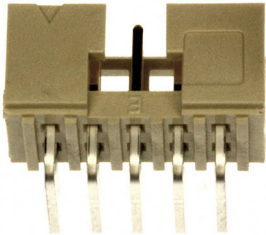
**Connector PN:** 98464-G61-10ULF

**Mating Cable PN:** 6980604 DSC cable assembly

## 1.3 10G Ethernet

10G ethernet interface is available in 2x5 Latching connector as shown below:

GND_CHASSIS	<b>1</b>	<b>2</b>	NC
MGBE0_MAG_A_HDR_P	<b>3</b>	<b>4</b>	MGBE0_MAG_A_HDR_N
MGBE0_MAG_B_HDR_P	<b>5</b>	<b>6</b>	MGBE0_MAG_B_HDR_N
MGBE0_MAG_C_HDR_P	<b>7</b>	<b>8</b>	MGBE0_MAG_C_HDR_N
MGBE0_MAG_D_HDR_P	<b>9</b>	<b>10</b>	MGBE0_MAG_D_HDR_N



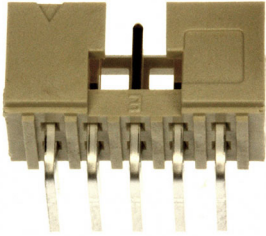
**Connector PN:** 98464-G61-10ULF

**Mating Cable PN:** 6980604 DSC cable assembly

## 1.4 Serial Ports1-2

There are 2 serial ports mapped to one 2x5 connector

TX2/TX2_P/RX2_P	1	2	RTS2/TX2_N/RX2_N
RX2/RX2_P	3	4	CTS2/RX2_N
GND	5	6	GND
TX1/TX1_P/RX1_P	7	8	RTS1/TX1_N/RX1_N
RX1/RX1_P	9	10	CTS1/RX1_N



**Connector type: 2x5 2mm latching connector**

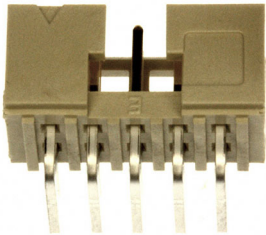
**Connector PN: 98464-G61-10ULF**

**Mating Cable PN: 6980601**

## 1.5 Serial Ports3-4

There are 2 serial ports mapped to one 2x5 connector

UART5_TX_RS232	1	2	UART5_RTS_RS232
UART5_RX_RS232	3	4	UART5_CTS_RS232
GND	5	6	GND
UART3_9_TX_RS232	7	8	NC
UART3_9_RX_RS232	9	10	NC



**Connector type: 2x5 2mm latching connector**

**Connector PN: 98464-G61-10ULF**

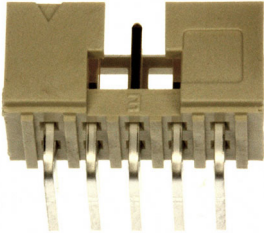
**Mating Cable PN: 6980601**

## 1.6 CAN1-2

There are 2 CAN interface available in the unit.

The pinouts are as shown below:

CAN0_L	1	2	GND
CAN0_H	3	4	GND
GND	5	6	GND
CAN1_L	7	8	GND
CAN1_H	9	10	GND



**Connector PN:** 98464-G61-10ULF

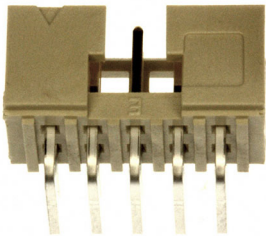
**Mating Cable PN:** 6980601

## 1.7 Utility

The utility connector provides access to SPI and I2C. Power button, MEM\_ERS, FORCE\_RCVY.

The pinouts are as shown below

V_3P3	1	2	I2C-CLK_MER-ERS
BUTTON_POWER_ON_N	3	4	I2C-DAT_FORCE-RCVY
DIO_GND	5	6	SPI_CLK
SYS_RST_IN_N	7	8	SPI_MISO
SPI_CS0	9	10	SPI_MOSI



**Connector Type:** 2x5 2mm latching header

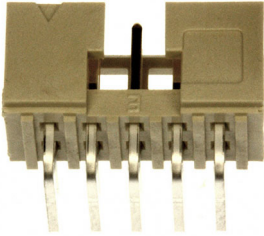
**Connector PN:** 98464-G61-10ULF

**Mating Cable PN:** NA

## 1.8 Digital IO Port

There are 8 DIO ports available on a 2x5 latching connector.

DIO_PA0	1	2	DIO_PA1
DIO_PA2	3	4	DIO_PA3
DIO_PA4	5	6	DIO_PA5
DIO_PA6	7	8	DIO_PA7
GND	9	10	V_DIO



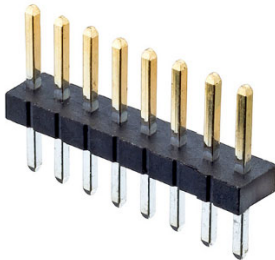
**Connector PN:** 98464-G61-10ULF

**Mating Cable PN:** NA

## 1.9 Remote control

The connector provides access to recovery, reset and power on signals for use by a 3<sup>rd</sup> party remote control circuit board.

MEM_ERS_GPIO	1
FORCE_RECOVERY#	2
I2C_GP8_CLK_3P3	3
I2C_GP8_DAT_3P3	4
GND	5
BUTTON_POWER_ON_N	6
SYS_RST_IN_N	7
PWR_DETECT	8



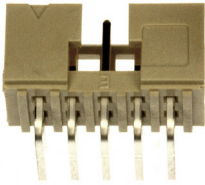
**Connector PN:** S1011EC-40-ND

**Connector Type:** 1x8 2mm Header

**Cable PN:** Standard cable assembly from remote module

### 1.10 USB3.1 Port 0

USB3/PCIE_UPHY_RX0_N	1	2	GND_CH_USB
USB3/PCIE_UPHY_RX0_P	3	4	GND
GND	5	6	USB2/PCIE_CLK_CH_P
USB3/PCIE_UPHY_TX0_N	7	8	USB2/PCIE_CLK_CH_N
USB3/PCIE_UPHY_TX0_P	9	10	V_USB3_1



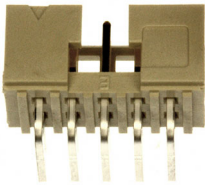
**Connector Type:** 2x5 2mm latching header

**Connector PN:** 98464-G61-10ULF

**Cable PN:** 6980603

### 1.11 USB3.1 Port 1

USB3/PCIE_UPHY_RX1_N	1	2	GND_CH_USB
USB3/PCIE_UPHY_RX1_P	3	4	GND
GND	5	6	USB2_D0_CH_P
USB3/PCIE_UPHY_TX1_N	7	8	USB2_D0_CH_N
USB3/PCIE_UPHY_TX1_P	9	10	V_USB3_2



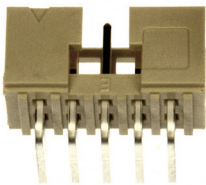
**Connector Type:** 2x5 2mm latching header

**Connector PN:** 98464-G61-10ULF

**Cable PN:** 6980603

### 1.12 USB3.1 Port 2

USB3/PCIE_UPHY_RX20_N	1	2	GND_CH_USB
USB3/PCIE_UPHY_RX20_P	3	4	GND
GND	5	6	USB2_D1_CH_P
USB3/PCIE_UPHY_TX20_N	7	8	USB2_D1_CH_N
USB3/PCIE_UPHY_TX20_P	9	10	V_USB3_3



**Connector Type:** 2x5 2mm latching header

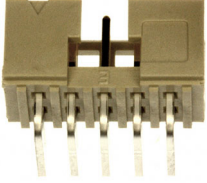
**Connector PN:** 98464-G61-10ULF

**Cable PN:** 6980603



### 1.13 USB2.0 Port 0

NC	1	2	GND_CH_USB
NC	3	4	GND
GND	5	6	USB2_HUB_D4_CH_P
NC	7	8	USB2_HUB_D4_CH_N
NC	9	10	V_USB2_VBUS



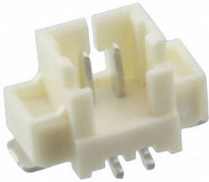
**Connector Type:** 2x5 2mm latching header

**Connector PN:** 98464-G61-10ULF

**Cable PN:** 6980603

### 1.1 RTC Cable Connector

V_3P0_RTC_CON	1	2	GND
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**Connector PN:** 0533980271

**Cable PN:** 4713001

## 6. CONNECTOR INFORMATION

### 1.2 Connector Table

The following table provides a summary of all I/O connectors on the board.

Function	Manufacturer	Part no.	Description	DSC Mating Cable
Power in	CUI Inc.	PJ-202BH	CONN PWR JACK 2.5X5.5MM SOLDER	6980512
Main I/O Connector	Samtec	ERF8-075-01-L-D-RA-TR	2x75 0.8mm pitch R/A SMD	Standard
HDMI	Foxconn	UEA11191-DFH1-4F	HDMI type A with 2x10mm latching connector	6980605
1G Ethernet/USB	Würth	7497110616	CONN JACK 1PORT 1000 BASE-T WITH DUAL USB	6980604
10G Ethernet	Pulse	JT4-1108HL	1 Port RJ45 Magjack Connector Through Hole 10G Base-T, AutoMDIX	6980604
<b>Audio</b>	<b>Amphenol</b>	<b>98414-G06-10LF</b>	<b>Connector Header Through Hole 10 position 2.00mm</b>	<b>6980608</b>
Serial Ports/GPIO	Assmann	ASUB-277-09TP23	9, 9 Position D-Sub - Stacked Plug, Male Pins Connector	6980601
CAN/Serial Ports	Link-PP	LPJE212XDNL	2x1 RJ11 6p4c connector without integrated magnetics	Standard
Utility	Amphenol	0877581016	Connector Header Through Hole 10 position 2.00mm	Standard
Remote control	Amphenol	98414-G06-10LF	Connector Header Through Hole 10 position 2.00mm	Standard
USB 3.0	Foxconn	1BT018-10240-004-7F	Side-push SMT type Tact switch	NA

## 7. BACKUP INFORMATION

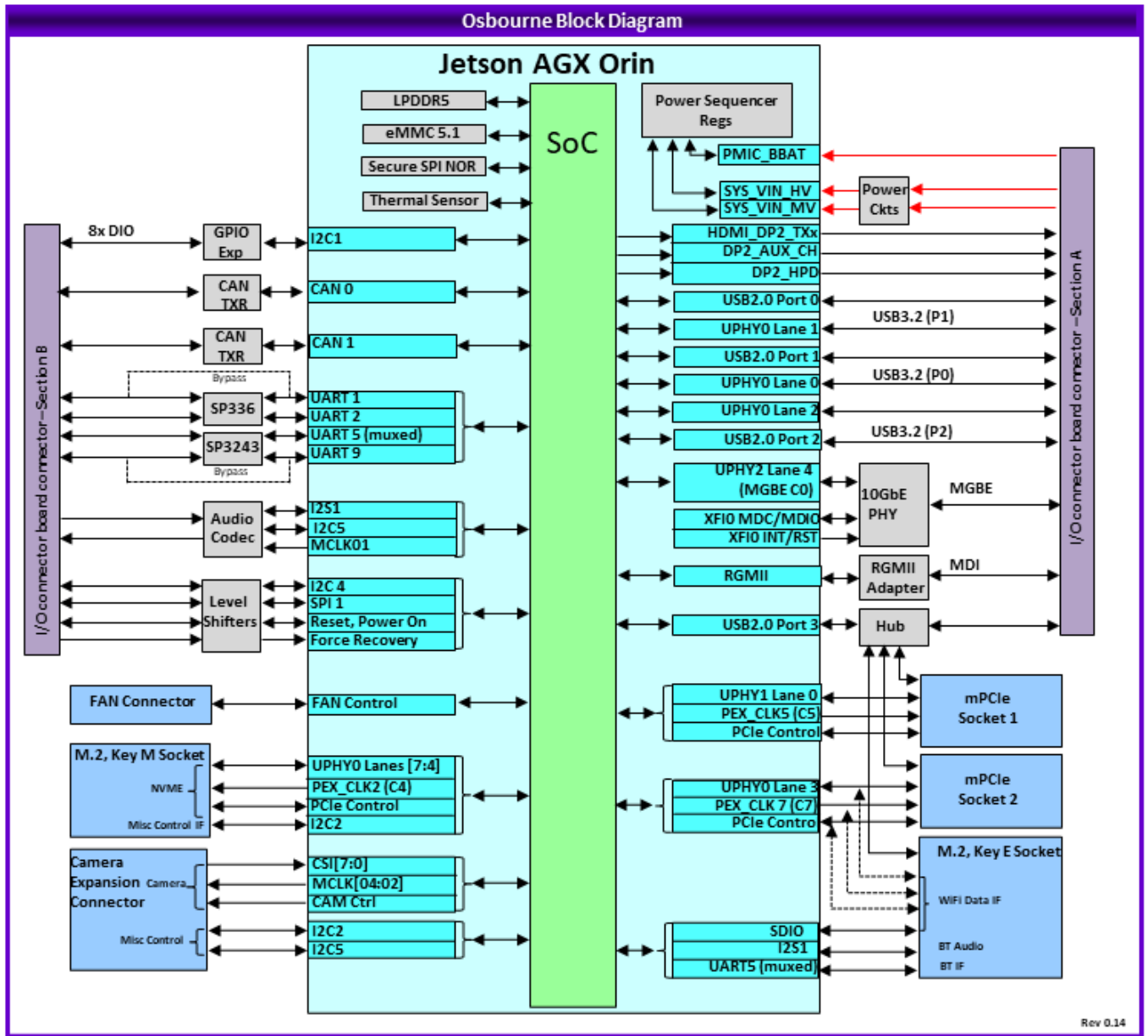


Figure 3: Osbourne Block diagram