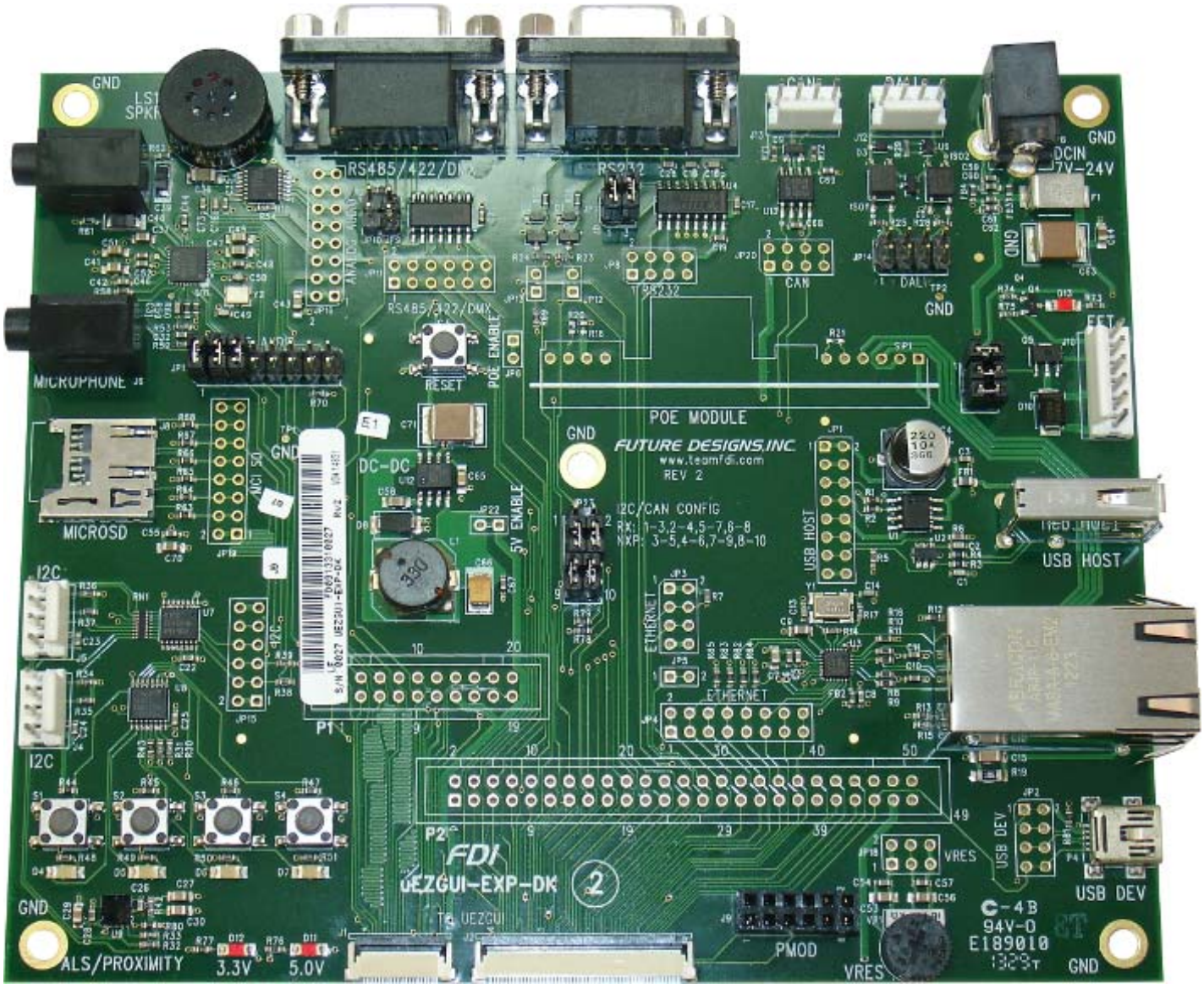
uEZGUI-EXP-DK

User's Manual



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NOTE: The inclusion of vendor software products in this kit does not imply an endorsement of the product by Future Designs, Inc.

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1. Introduction

The uEZGUI-EXP-DK is a quick and easy solution for rapid prototyping additional hardware with the uEZGUI family of products. The uEZGUI-EXP-DK offers the hardware necessary for many different features.

2. Kit Contents

- uEZGUI-EXP-DK development expansion board
- 50 pin Flat Flexible Cable (FFC)
- 20 pin Flat Flexible Cable (FFC)

3. Functional Description

- RS232/RS485 Serial communication
- USB Host and Device
- 10/100 Ethernet
- Optional Power over Ethernet
- FET driver
- Potentiometer
- Optional DALI
- CAN
- I2S/DAC Audio (not supported on Renesas uEZGUIs)
- Built-in Speaker
- High –Speed 4 bit microSD card(not supported on Renesas uEZGUIs)
- I2C bus expander
- I2C GPIO with pushbuttons and LEDs
- I2C ALS/Proximity Sensor
- 70 Pin GPIO Expansion
- Ability to disconnect unused features

4. Requirements

The uEZGUI-EXP-DK comes with the necessary flex cables to begin development right away with the purchase of a compatible uEZGUI kit. A 7V-24V power supply with a minimum of 1A current will be required to power the uEZGUI-EXP-DK and connected uEZGUI. At this time, the uEZGUI-EXP-DK's expansion pin configuration is compatible with uEZGUIs based on the following microcontrollers:

- NXP LPC1788 (part numbers starting with uEZGUI-1788)
- NXP LPC2478 (part numbers starting with uEZGUI-2478)
- Renesas RX62N (part numbers starting with uEZGUI-RX62N)

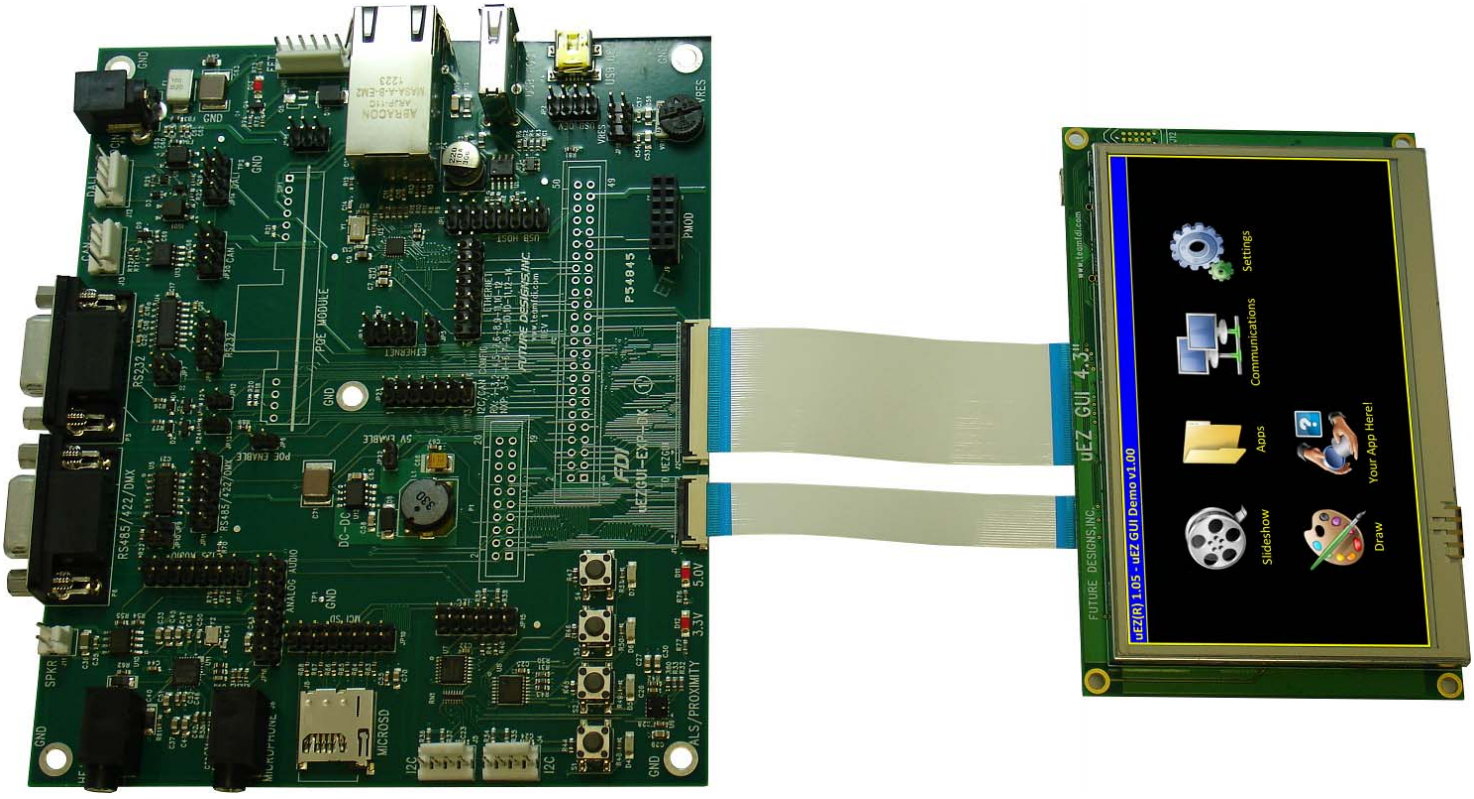
With the 70 pin break-out and the ability to cut PCB traces, the uEZGUI-EXP-DK could be re-configured to support future uEZGUIs, or to swap for the desired pins on existing uEZGUIs. Note that some features of the uEZGUI-EXP-DK will only work with certain microcontrollers, such as the 4-bit microSD card slot and I2S audio.

5. ESD Warning

The uEZGUI-EXP-DK is shipped in a protective anti-static package. The device must not be subjected to high electrostatic potentials. Damage may occur to the board that will not be covered under warranty. General practice for working with static sensitive devices should be followed when working with the uEZGUI-EXP-DK.

6. Startup Procedure

To get started with the uEZGUI-EXP-DK, please connect the 50 pin and 20 pin FFCs to the uEZGUI as shown. The uEZGUI-RX62N-35QT does not support the 20 pin expansion. Take care not to damage the FFCs as they are very fragile.



uEZGUI-1788-43WQR with uEZGUI-EXP-DK (revision 1 is shown in this picture)

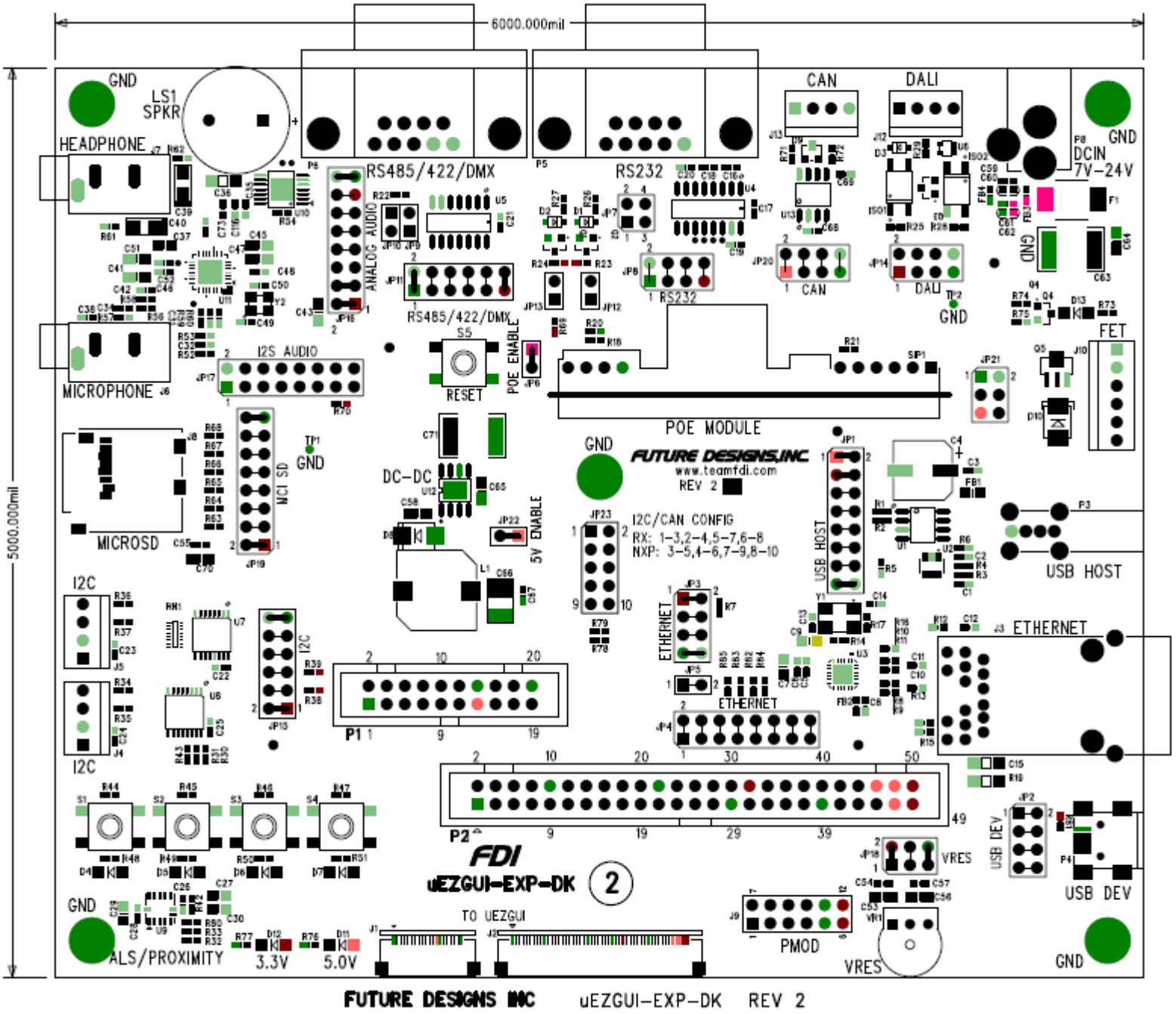
After connecting the cables, connect a 7V-24V DC power supply (minimum of 1A) to the 2.1mm barrel plug P8 on the EXP-DK to power on the unit. With uEZ 2.05 or later, the EXP-DK will be auto-detected and the USB ports, Ethernet, RS232, Audio, and high-speed microSD SD card will be automatically enabled. At this time the high speed microSD card is only support on LPC1788 uEZGUI units. The out of the box demo does not include the video player. This will need to be enabled inside of the project's Config_Build.h file.

7. Mechanical Details

The uEZGUI-EXP-DK has 5 screw mounts that accept #6 size screws. The total board dimensions are 5" x 6".
Each of the 4 corner screw mounts is centered 0.2" away from each side of the board.

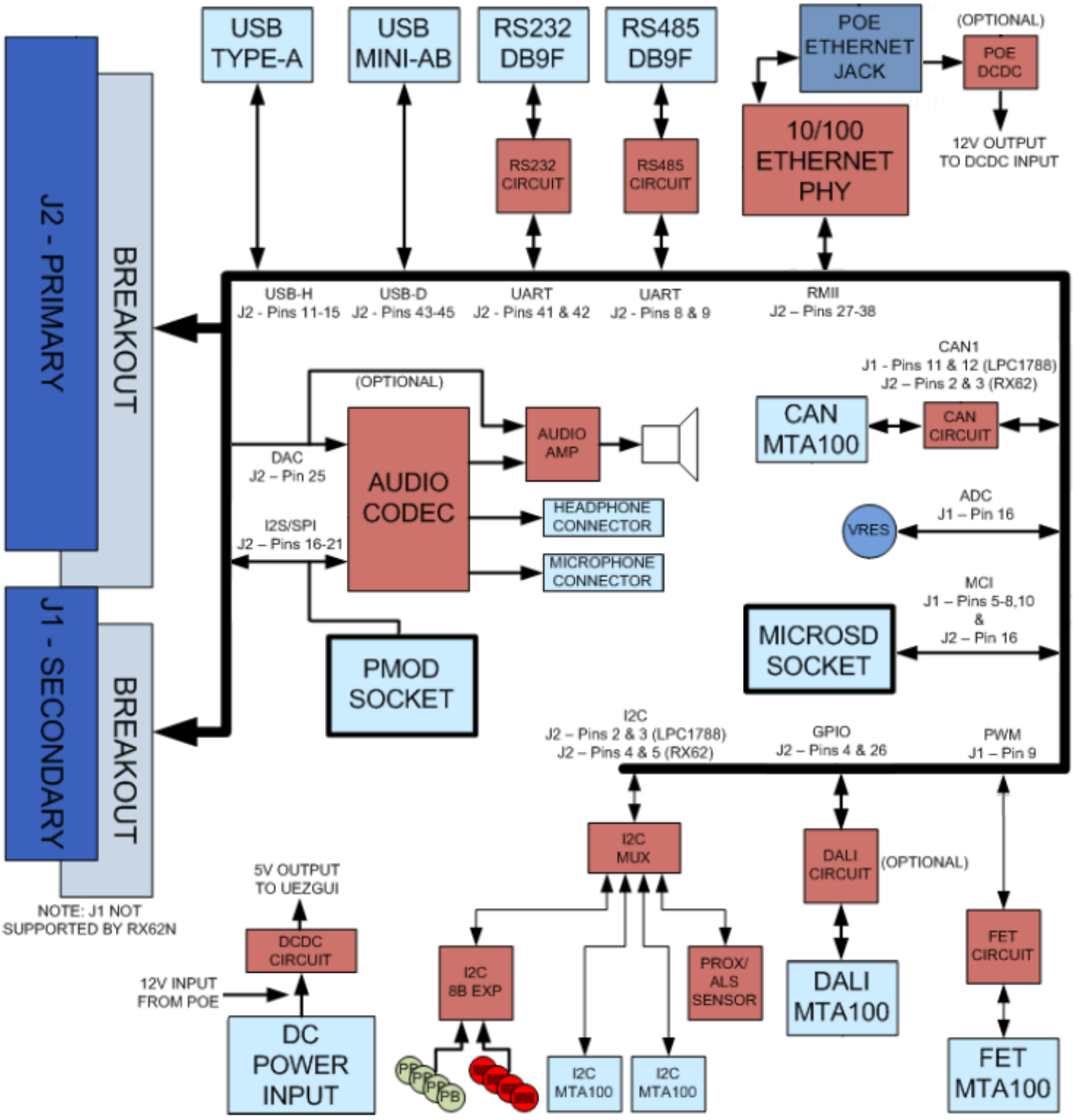
8. Expansion Board Top Level Mechanical Diagram / Board Layout

Below is the top level mechanical drawing of the uEZGUI-EXP-DK Rev 2 showing all of the part positions and silkscreen:



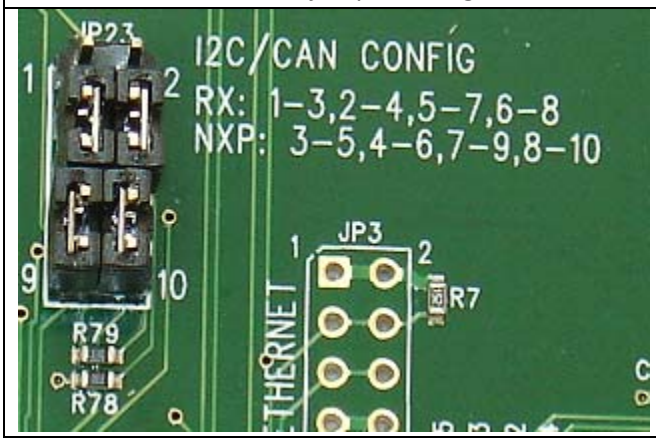
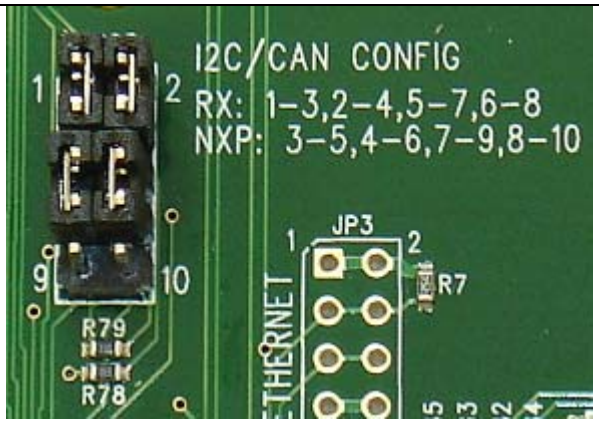
9. Expansion Board Functional Block Diagram

The uEZGUI-EXP-DK includes the following features on the specified expansion pins:



10. JP23 Setting for LPC based uEZGUIs or RX based uEZGUIs.

The jumpers on JP23 are designed to switch the CAN and I2C pins since these are different on the Renesas RX and NXP LPC uEZGUIs. In positions (3-5, 4-6, 7-9, 8-10) the unit is in NXP mode. In positions (1-3, 2-4, 5-7, 6-8) the unit is in RX mode.

NXP mode jumper configuration	RX mode jumper configuration
	

11. Expansion Connector pin usage

The uEZGUI-EXP-DK includes 50 pin and 20 pin FFC Expansion Connectors that connect to the host uEZGUI. The table below details which pins are used on the EXP-DK and what they are used for by default on the EXP-DK. All of these pins are brought out to the standard 1/8" header breakout on the EXP-DK for ease of connecting additional hardware.

J1/P1 connectors

Pin	Pin Name	Function used on EXP-DK
1	Ground (GND)	Ground
2	USBID	GPIO input to uEZGUI to detect a USB OTG host adapter cable on P41
3	Unused	Expansion pin not used by EXP-DK
4	DALITXD	DALI transmit output from uEZGUI host unit
5	MCIDAT3	High Speed SD card DAT3
6	MCIDAT2	High Speed SD card DAT2
7	MCIDAT1	High Speed SD card DAT1
8	MCIDAT0	High Speed SD card DAT0
9	FETPWM	PWM or GPIO output from host uEZGUI for FET driver
10	MCICMD	High Speed SD card CMD
11	NXPCANTD	CAN Transmit output from host uEZGUI using LPC1788/LPC2478
12	NXPCANRD	CAN Receive input to host uEZGUI using LPC1788/LPC2478
13	5V	5V power supply to host uEZGUI unit (generated on EXP-DK)
14	Ground (GND)	Ground
15	Unused	Expansion pin not used by EXP-DK
16	Unused	Expansion pin not used by EXP-DK
17	ADC	Used for reading potentiometer into uEZGUI's ADC
18	Unused	Expansion pin not used by EXP-DK (ADC touch input on resistive touch
19	Unused	Expansion pin not used by EXP-DK (ADC touch input on resistive touch
20	Ground (GND)	Ground

J2/P2 connectors

Pin	Pin Name	Function used on EXP-DK
1	Ground (GND)	Ground
2	RX62CRX_SCL	I2C SCL on NXP uEZGUIs, CAN RX on uEZGUI-RX62N-35QT
3	RX62CTX_SDA	I2C SDA on NXP uEZGUIs, CAN TX on uEZGUI-RX62N-35QT
4	RX62SCL_DALIRXD	DALI Receive input, I2C SCL on uEZGUI-RX62N-35QT
5	RX62SDA_MCICLK	High Speed SD card CLK, I2C SDA on uEZGUI-RX62N-35QT
6	485DE	RS485 Data enable input, active high; pin not available on uEZGUI-RX62N-
7	485RE	RS485 Receive enable input, active low; pin not available on uEZGUI-RX62N-
8	485RXD	RS485 RX input to uEZGUI; pin not available on uEZGUI-RX62N-35QT
9	485TXD	RS485 TX output from uEZGUI; pin not available on uEZGUI-RX62N-35QT
10	Ground (GND)	Ground
11	USBHDM	USH Host Port Data Negative
12	USBHDP	USH Host Port Data Positive
13	USBHPWRD	USH Host Port 5V Power, Power output from MIC2025-2YM
14	USBHOVC	USH Host Port Fault Flag input to microcontroller
15	USBHPPWR	USH Host Port Power Enable GPIO input to MIC2025-2YM
16	I2STXSDA_MOSI	DACDAT input to I2S audio / SPI MOSI connection on PMOD
17	I2STXWS_MISO	DACLRC input to I2S audio / SPI MISO connection on PMOD
18	I2STXCLK_SCK	BCLK input to I2S audio / SPI Clock connection on PMOD
19	I2SRXSDA_SSEL	ADCDAT input to I2S audio / SPI Select connection on PMOD
20	I2SRXWS	ADCLRC input to I2S audio
21	I2CIRQ	Interrupt input to micro-controller from ALS / Proximity Sensor
22	Ground (GND)	Ground
23	RESETIN	Reset switch and ISP reset input into host uEZGUI micro-controller
24	RESETOUT	Reset output from micro-controller to Ethernet, PMOD, I2C Mux, and I2C
25	AOUT	DAC Output from micro-controller to I2S Audio or (optional) directly to AMP
26	Unused	Expansion pin not used by EXP-DK
27	ENETMDIO	Ethernet PHY MDIO
28	ENETMDC	Ethernet PHY MDC
29	Ground (GND)	Ground
30	ENETREFCLK	Ethernet PHY REFCLK0 (50MHz reference clock from PHY to uEZGUI)
31	ENETRXER	Ethernet PHY RXER / PHYADR0 (address LSB set on PHY reset)
32	3.3V	3.3V power from uEZGUI host unit's own step down converter
33	ENETRXD1	Ethernet PHY RXD1 / MODE1 (MODE1 input on PHY reset)
34	ENETRXD0	Ethernet PHY RXD0 / MODE0 (MODE0 input on PHY reset)
35	ENETCRSDV	Ethernet PHY CRS_DV / MODE2 (MODE2 input on PHY reset)
36	ENETTXEN	Ethernet PHY TXEN
37	ENETTXD1	Ethernet PHY TXD1
38	ENETTXD0	Ethernet PHY TXDO
39	Ground (GND)	Ground
40	IRQ_ISPENTRY	Used for optional ISP_Entry to NXP based uEZGUIs, used for IRQ on PMOD
41	RS232RXD	RS232 Port RX
42	RS232TXD	RS232 Port TX
43	USBDDP	USB device port Data Positive
44	USBDDM	USB device port Data Negative
45	USBDVBUS	USB device port 5V power input. Switchable on select uEZGUIs to host power
46	5V	5V power supply to host uEZGUI unit (generated on EXP-DK)
47	5V	5V power supply to host uEZGUI unit (generated on EXP-DK)
48	5V	5V power supply to host uEZGUI unit (generated on EXP-DK)
49	3.3V	3.3V power from uEZGUI host unit's own step down converter
50	3.3V	3.3V power from uEZGUI host unit's own step down converter

12. Expansion Connector Cable Details

The maximum length for the expansion connector cables is as follows:
General Purpose IO, TTL, Serial, etc = 6” recommended maximum, 8” absolute maximum
Ethernet, high-speed IO, etc = 3” recommended maximum, 4” absolute maximum

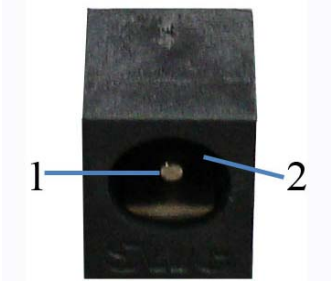
The following table provides example part numbers for the expansion cables: Molex Inc, Parlex Corp, and Wurth Electronics, Inc provide compatible cables.

Description	Mfg	Mfg PN	Digi-Key Pn
3.00” 50-pin 0.5mm	Molex	21020-7650	WM10231-ND
3.00” 20-pin 0.5mm	Molex	21020-0209	WM10226-ND
1.18” 50-pin 0.5mm	Molex	21020-3050	WM14323-ND
1.18” 20-pin 0.5mm	Molex	21020-0205	WM14317-ND

Note: These lengths are only recommendations. The actual lengths utilized will be dependent on the expansion board circuitry, layouts and general environment of the application. It is up to the customer to test and validate the functional operation and use of the expansion connectors.

13. DC Power Input – P8

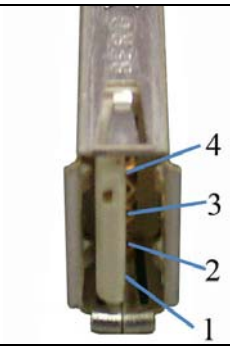
The uEZGUI-EXP-DK supports a 7VDC-24VDC 1A (min) Power Supply. The connector is 2.1mm with center positive.



P8 Pin Number	Description
1	7VDC to 24VDC, +/- 10%, 1.0A (min)
2	Power Supply Ground

14. USB Host – P3

The uEZGUI-EXP-DK Board includes one USB Host Port allowing the unit to interface to various USB peripherals such as a USB Flash Drive (Thumb Drive). The operational mode of this port is dependent on the software utilized (i.e. driver support)



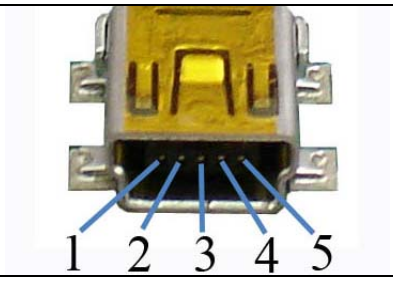
P3 Pin Number	Description
1	USB VBus
2	D –
3	D +
4	Signal Ground

15. USB Device – P4

The UEZGUI-EXP-DK Board includes one USB Device Interface allowing the unit to be connected to a USB Host, such as a PC. Through this connection, the uEZGUI represents a peripheral to the USB Host. The operational mode of the port is dependent on the software utilized (i.e. Mass Storage or Human-Interface).

The UEZGUI-EXP-DK Board may also be powered via the USB Device connector. Care must be taken to not overload the USB Host since 500mA is the maximum current allowable via USB. This port can also be used with a USB OTG adapter to function as a USB Host port on select uEZGUI units such as the uEZGUI-1788-43WQR.

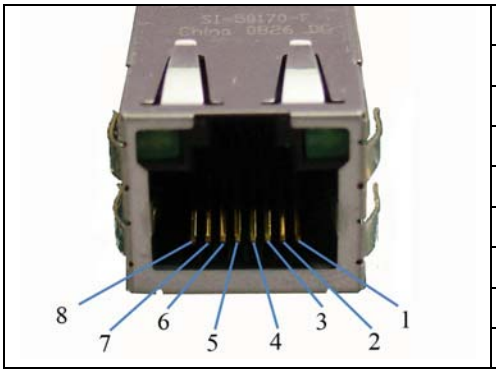
Note: The USB Device connector of the Expansion Board is connected in parallel to the USB Device connector of the uEZGUI Main board. **To avoid damage or improper operation, do not connect both of these at the same time**.



P4 Pin Number	Description
1	USB 5V
2	D-
3	D+
4	USB ID Pin (Host Mode Detect Active Low)
5	Signal Ground

16. Ethernet – J3

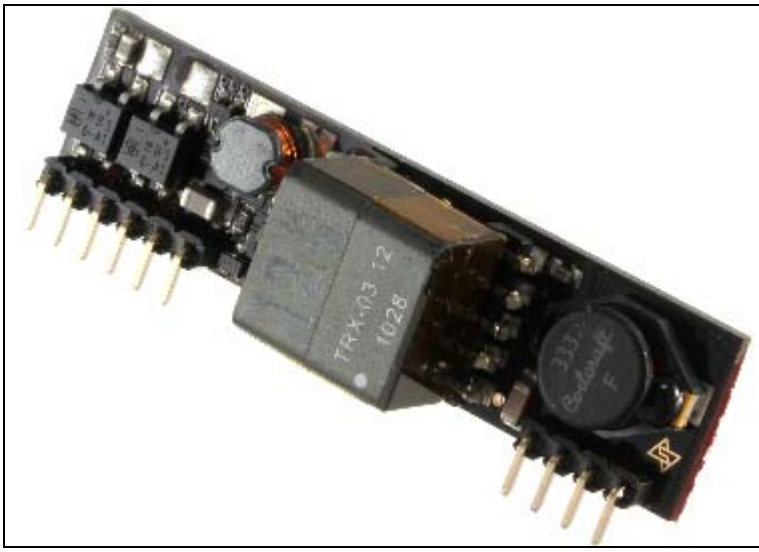
The UEZGUI-EXP-DK Board includes one 10/100 Ethernet Port to interface to a local area network via CAT5 cable. Please refer to the specific details of the processor being utilized for support of the Ethernet function. Note that the low cost ABRACON ARJP11C-MASA-A-B-EMU2 connector was specifically selected for use with PoE and 10/100 Base-T.



J3 Pin Number	Description
1	Tx +
2	Tx –
3	Rx +
4	75 ohm terminated
5	75 ohm terminated
6	Rx –
7	75 ohm terminated
8	75 ohm terminated

17. Power over Ethernet – SIP1 (optional)

The UEZGUI-EXP-DK Board includes a mounting point for an AG9120-S PoE module. If this module is installed and soldered down, the uEZGUI-EXP-DK and attached uEZGUI can be powered over Ethernet. (IEEE 802.3af-2003 compliant) **P8 must be unplugged when PoE is used!**



SIP1 Pin Number	Description
1	VA1 +
2	VA2 –
3	VB1 +
4	VB2 –
5	CP1 (class detect)
6	CP2 (class detect)
7	Ground
8	12V Power output to EXP-DK
9	Output voltage adjust +
10	No Connect

R21 controls the PoE class that is seen by the power source. By default this is set to class 0, the most flexible option in the original PoE spec. R18 and R20 can be loaded to adjust the 12V output. See the AG9120-S datasheet for details. Note that most uEZGUIs average around 1W-3W power draw, so class 1 or class 2 would be suitable for most uEZGUI final hardware implementations (such as an access control box) without additional power loads.

R21 Value	PoE Class	Power available
No load (default)	Class 0	0.44W – 12.29W
698 ± 1 %	Class 1	0.44W – 3.84W
383 ± 1 %	Class 2	3.84W – 6.49W
249 ± 1 %	Class 3	6.49W – 12.94W

18. PMOD – J9

The UEZGUI-EXP-DK Board includes one SPI PMOD type 2A connector. Make sure that the following jumpers on JP17 are removed: 7 – 8, 9 – 10, 11 – 12, 13 – 14, and 15 – 16.

J9 Pin Number	Description	J9 Pin Number	Description
1	SPI Select	7	Interrupt output
2	SPI MOSI	8	Reset Input
3	SPI MISO	9	No Connect
4	SPI Clock	10	No Connect
5	Ground	11	Ground
6	3.3V	12	3.3V

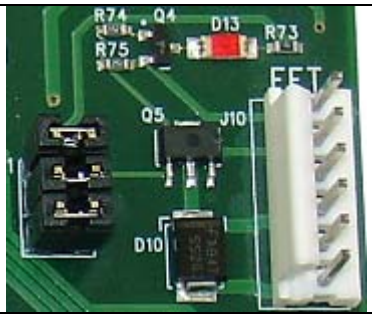
19. Potentiometer – VRES

The UEZGUI-EXP-DK Board includes one Potentiometer connected to the host uEZGUI's ADC input.

JP18 Pin Number	Description
1-2	3.3V
3-4	Output to ADC
5-6	Ground

20. FET Driver – J10

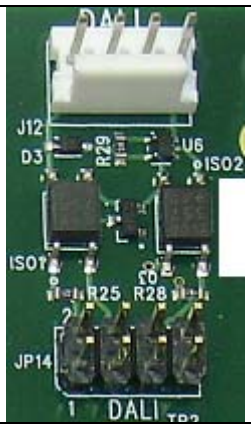
The UEZGUI-EXP-DK Board includes one FET driver port that is controlled by a GPIO. The 3 jumpers must be loaded in the configuration shown below for the FET driver to be enabled.



J10 Pin Number	Description
1	Ground (FET Source gate)
2	Ground (FET Source gate)
3	FET Drain gate
4	FET Drain gate
5	FET Drain gate (through diode D10)
6	FET Drain gate (through diode D10)

21. DALI – J12 (not loaded by default)

The UEZGUI-EXP-DK board includes one DALI interface. Nine parts must be manually loaded to enable DALI support. Look at the schematic for details on loading DALI.
The 4 jumpers must be loaded on JP14 pins 1 – 2, 3 – 4, 5 – 6, and 7 – 8 for the DALI port to be enabled.



J12 Pin Number	Description
1	DALI DP
2	No Connect
3	No Connect
4	DALI MP

22. RS232 – P5

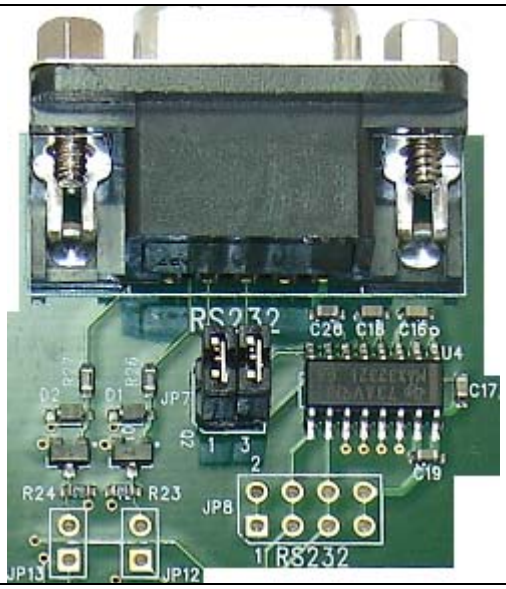
The uEZGUI-EXP-DK Board includes one female DB9 Serial Port Connector for RS232.

The jumpers on JP7 select null modem cable mode of the serial port;

Jumper 1-2 and 3-4 for straight through mode

Jumper 1-3 and 2-4 for NULL Modem cable mode (swap TX and RX)

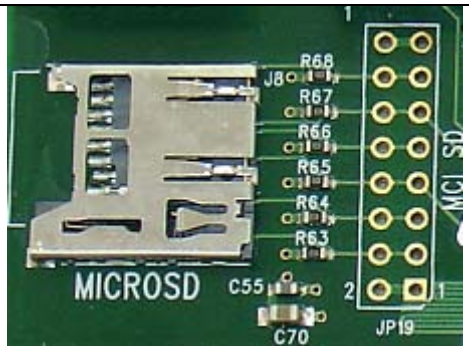
The serial port may also be optionally configured to support ISP programming of the LPC1788 using FlashMagic Software. To enable ISP programming, jumper JP12 & JP13 must be loaded. Note that with these jumpers loaded, operation of the LPC1788 may be affected by the RS232 interface signals. Refer to the FlashMagic user manual for details. The ISP programming mode only applies to NXP LPC based uEZGUI units.



P5 Pin Number	Description
1	No Connect
2	TXD (Output)
3	RXD (Input)
4	Optional RESET input
5	Signal Ground
6	No Connect
7	Optional ISP Entry
8	No Connect
9	No Connect

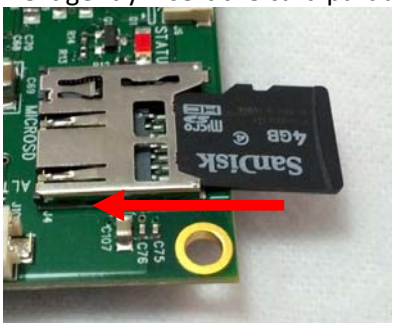
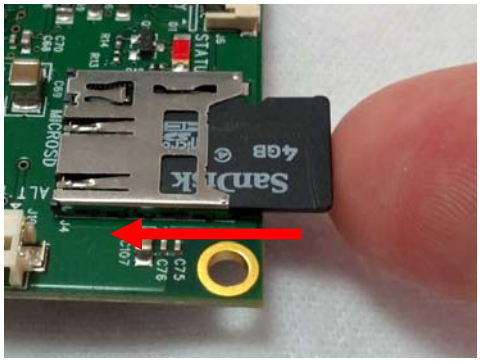
23. MicroSD – J8

The UEZGUI-EXP-DK Board includes one 4 bit high speed microSDHC card.

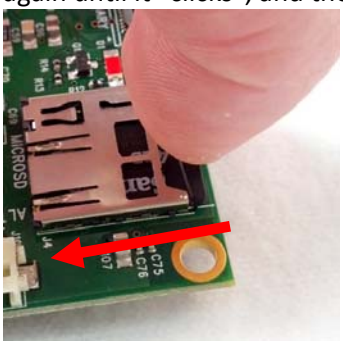
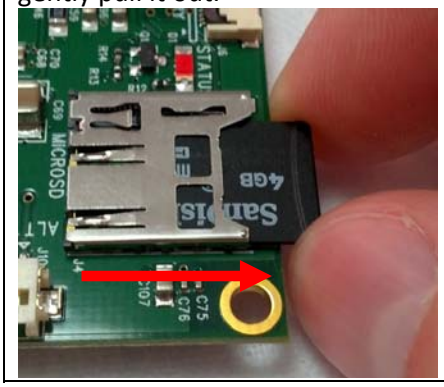
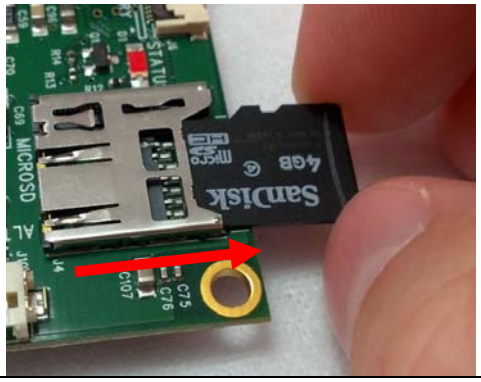


JP19 Pin Number	Description
1 – 2	3.3V
3 – 4	MCI DAT 2
5 – 6	MCI DAT 3
7 – 8	MCI CMD
9 – 10	MCI Clock
11 – 12	MCI DAT 0
13 – 14	MCI DAT 1
15 – 16	Ground

WARNING: The microSD card must only be removed using the spring loaded "push-pull" mechanism on the microSD socket. Improper forceful removal of the microSD card will result in permanent damage to the socket that is <u>not covered under warranty</u>. To insert the card, just push it into the socket until a "click" sound is heard.

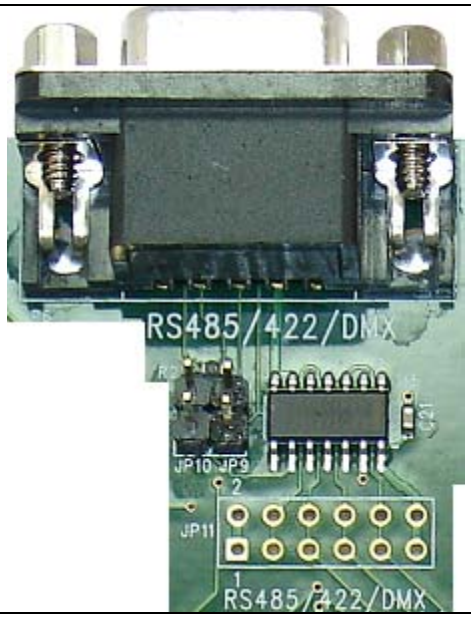
Start with the microSD card in this position relative to the microSD slot with the text and "lip" facing up. 	Next gently insert the card partially into the socket. 
Use your figure to gently push the card into the socket until it clicks. 	At this point the microSD card is fully inserted. It should not fall out, even if the unit is shaken vigorously. 

To remove the microSD card, press the card back into the socket until another "click" sound is heard, then release pressure on the card. At this point, the card should be partially ejected from the socket. Finally grab the card and gently pull to remove it. See the following pictures for proper micro-SD removal:

To remove the microSD card, gently push it into the socket again until it "clicks", and then release your figure. 	At this point, the microSD card should partially stick out of the socket. 
Carefully grab the edges or sides of the microSD card and gently pull it out. 	At this point the microSD card is fully removed from the socket. 

24. RS485 – P6

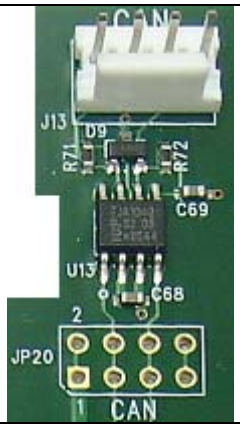
The UEZGUI-EXP-DK Board includes one female DB9 RS485 port. Jumpers can be loaded onto JP9 and JP10 for half duplex mode.



P6 Pin Number	Description
1	No Connect
2	485_RDB –
3	485_TDA +
4	Signal Ground
5	Signal Ground
6	No Connect
7	485_RDA +
8	485_TDB –
9	No Connect

25. CAN – J13

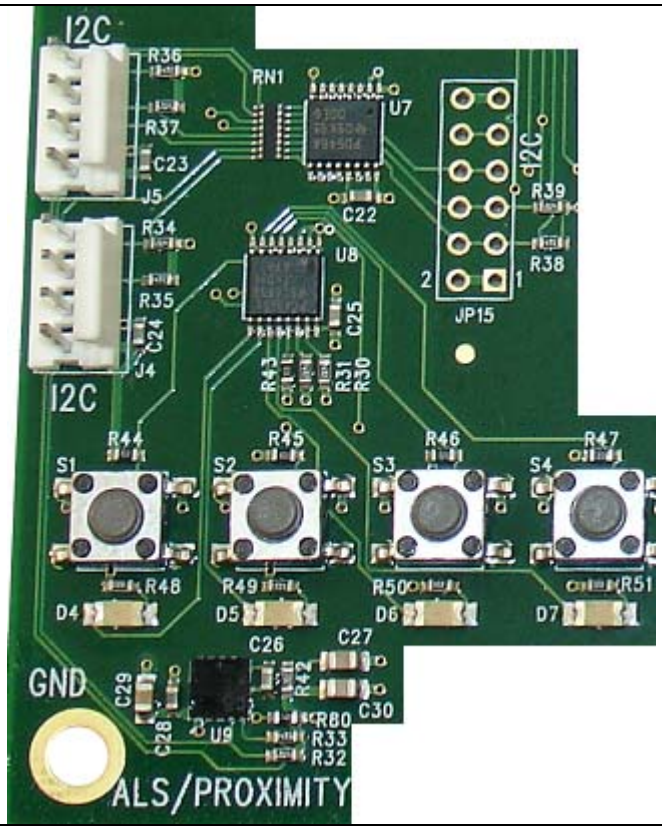
The UEZGUI-EXP-DK Board includes one CAN interface



J13 Pin Number	Description
1	Ground
2	CAN H
3	CAN L
4	Ground

26. I2C System – JP13

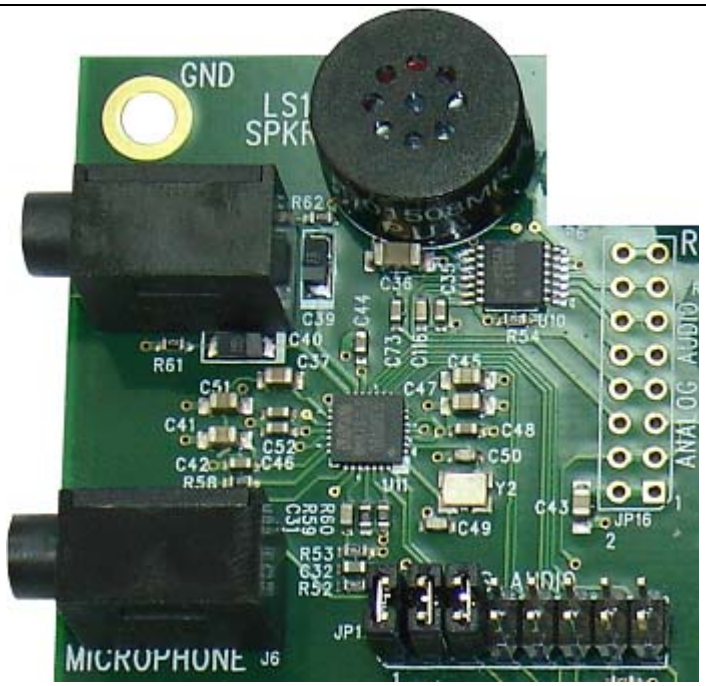
The UEZGUI-EXP-DK Board includes one I2C mux with two expansion ports. The I2C 'A' bus is connected to the I2C GPIO (4 buttons and 4 LEDs) shown below. The I2C 'B' bus is connected to the I2C ALS / Proximity sensor shown below. The I2C 'C' and 'D' busses are connected to the two expansion ports J4 and J5. Each expansion port has the following pinout.



JP15 Pin Number	Description
1 – 2	3.3V
3 – 4	I2C SDA
5 – 6	I2C SCL
7 – 8	I2C Reset from µC
9 – 10	I2C IRQ to µC
11 – 12	Ground
J4 Pin Number	**Description**
1	3.3V
2	Ground
3	I2C Bus C SCL
4	I2C Bus C SDA
J5 Pin Number	**Description**
1	3.3V
2	Ground
3	I2C Bus D SCL
4	I2C Bus D SDA

27. Audio System – JP 16 and JP17

The UEZGUI-EXP-DK Board includes a Wolfson I2S audio system and an I2C controlled audio amplifier, connected to an onboard speaker. By default on JP17 only jumpers on 1-2, 3-4, and 5-6 are loaded. The rest of the jumpers on JP17 must be loaded to use I2S audio. Only certain micro-controllers have support for I2S audio. DAC audio must be used otherwise. DAC audio can be fed through the Wolfson codec to be used with headphones or external speakers using I2C control commands.



Pin Number	Description
JP16 – 1 – 2	3.3V to I2S Codec
JP16 – 3 – 4	DAC from µC to I2S Codec
JP16 – 5 – 6	DAC from µC to I2C Amp
JP16 – 7 – 8	I2S Codec to I2C Amp
JP16 – 9 – 10	I2C SCL to I2C Amp
JP16 – 11 – 12	I2C SDA to I2C Amp
JP16 – 13 – 14	3.3V to I2C Amp
JP16 – 15 – 16	Ground to I2C Amp
JP17 – 1 – 2	I2S RX WS to I2S Codec
JP17 – 4 – 4	I2S RX SDA to I2S Codec
JP17 – 5 – 6	I2S TX WS to I2S Codec
JP17 – 7 – 8	I2S TX SDA to I2S Codec
JP17 – 9 – 10	I2S TX CLK to I2S Codec
JP17 – 11 – 12	I2C SCL to I2S Codec
JP17 – 13 – 14	I2C SDA to I2S Codec
JP17 – 15 – 16	Ground to I2S Codec

28. Additional Documentation, Schematics, and Software Updates

Complete Users Manuals, Schematics, Software updates, and documentation are available from the following websites (please refer to the websites for the latest updates):

- http://www.uEZGUI.com/uEZGUI-EXP-DK
- http://sourceforge.net/projects/uez/