UM10075

ISP1508 Hi-Speed ULPI T&MT eval board

Rev. 01 — 22 January 2008 **User manual**

Document information

Info	Content
Keywords	isp1508; isp1508a; isp1508b; usb; ulpi; universal serial bus; transceiver; utmi+ low-pin interface; host; peripheral; otg; usb 2.0; phy
Abstract	This document explains the usage of the ISP1508 evaluation kit.

Revision history

Rev	Date	Description
01	20080122	First release.

Contact information

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1. Introduction

The ISP1508 evaluation (eval) kit allows system designers to evaluate the functions and features of the ISP1508. The eval kit interfaces to a link platform through the Transceiver and Macro Tester (T&MT) interface. The eval kit can be powered through a 5 V DC power adaptor or through the T&MT connector. A mini-AB USB connector is mounted on the eval board to be evaluated as a host, peripheral or OTG transceiver.

2. Board outlook

Fig 1 and Fig 2 show the top and bottom views of the ISP1508 eval board, respectively.

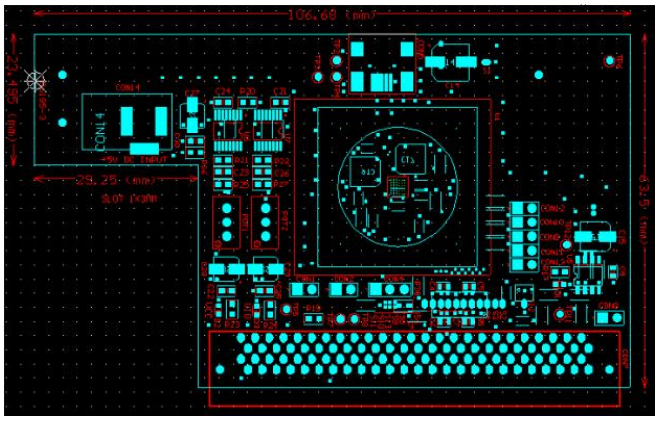

Fig 1. Top view of the eval board

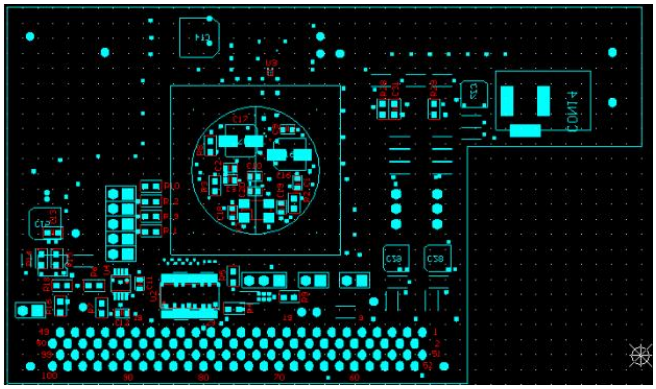

Fig 2. Bottom view of the eval board

3. Block diagram

Fig 3 depicts the functional block diagram of the ISP1508 eval kit. With an external V_{BUS} power switch designed on the eval board, the ISP1508 can also be evaluated as a host or OTG transceiver.

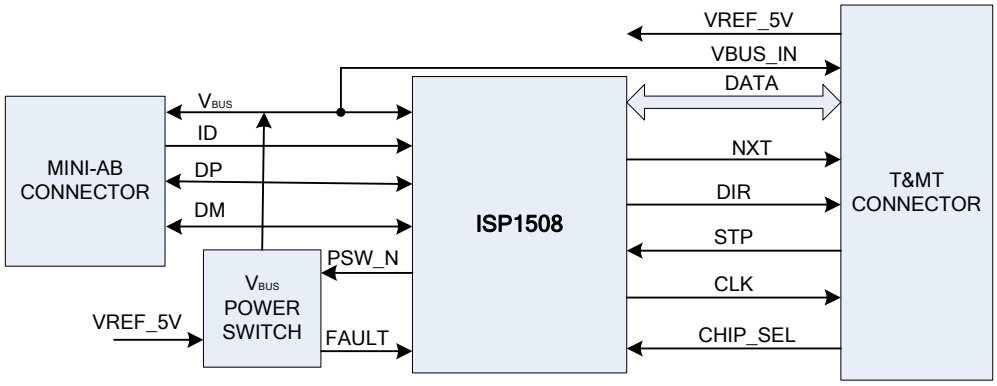

Fig 3. Functional block diagram

4. Configuration and settings

4.1 Powering the eval board

The eval board can be powered by the 5 V DC power supply through the CON14 DC jack. Two linear regulators U6 and U7 will step down 5 V input to supply V_{CC} and $V_{CC(I/O)}$ of the ISP1508. Both regulators have adjustable outputs, which provide system designer the flexibility to evaluate the ISP1508 with desired operating conditions. Adjusting POT1 will vary V_{CC} supply voltages while adjusting POT2 will vary $V_{CC(I/O)}$ supply voltages. Alternatively, the eval board can be powered through the T&MT connector interface. The link system can supply power to V_{CC} of the ISP1508 through pins 8, 16, 57 and 69 of T&MT connector CON7. Similarly, $V_{CC(I/O)}$ can be supplied by the link through pins 38, 81 and 87 of CON7.

Note that pin 100 of the T&MT connector controls the output from regulators U6 and U7. When power is supplied through the DC jack, pin 100 of the T&MT connector must be left open at the link side. When power is supplied through the T&MT connector, pin 100 must be driven to ground at the link side.

Jumpers CON1 and CON2 must be always closed so that power is routed to the V_{CC} and $V_{CC(I/O)}$ pins. If power consumption of the ISP1508 needs to be measured, a current meter can be inserted.

4.2 Supplying V_{BUS}

The ISP1508 cannot supply power to V_{BUS}. An external V_{BUS} power switch or external charge pump must be incorporated into the design to supply V_{BUS}. On the eval board, a dual-port V_{BUS} power switch from Micrel is implemented. The link must provide 5 V at pin 28 of the T&MT connector, which is routed to the input of the V_{BUS} switch. The V_{BUS} switch can in turn be controlled by the ISP1508 through the PSW_N pin. When the V_{BUS} switch is on, green LED D1 will light up. The ISP1508 can detect the overcurrent fault condition reported by the Micrel V_{BUS} switch using the FAULT input.

If the ISP1508 is evaluated as a host transceiver, solder bridge S1 must be closed to attach large value capacitance to V_{BUS}.

4.3 V_{BUS} detection

When the ISP1508 is evaluated as a peripheral transceiver, the link might not be capable of decoding RXCMDs for the V_{BUS} status. In such a case, a jumper must be installed on CON8. In doing so, the V_{BUS} pin of the mini-AB connector is routed to pin 47 of the T&MT connector so that the link or the system controller can detect the presence of V_{BUS} through I/O pins.

4.4 Crystal frequency selection

The ISP1508 supports four crystal frequencies: 13 MHz, 19.2 MHz, 24 MHz and 26 MHz. The frequency selection is done through the CFG1 and CFG2 pins. On the eval board, jumpers CON10 and CON11 can be installed or un-installed to select crystal frequency.

Table 1. Frequency selection

CFG[2:1]	Frequency selected	Jumper CON10	Jumper CON11
00	19.2 MHz	Installed	Installed
01	24 MHz	Installed	Not installed
10	26 MHz	Not installed	Installed
11	13 MHz	Not installed	Not installed

4.5 Clock source

The ISP1508 supports only output clock mode. A jumper can be installed on pin 2 and pin 3 of CON4 so that the crystal mounted is attached to the XTAL1 and XTAL2 pins of the ISP1508. Alternatively, an external clock source can be connected to pin 2 of CON4 to drive a clock signal into XTAL1, with XTAL2 left floating. The internal crystal oscillator will generate clock signal and feed it to the internal PLL block, which outputs 60 MHz clock to the CLOCK pin.

4.6 ULPI data bus width selection

The ISP1508 also supports Double Data Rate (DDR) ULPI data interfaces. The logic level on the CFG0 pin decides the data bus width. On the eval board, jumper CON12 can be installed or un-installed to select the data bus width.

Table 2. Data bus width selection

CFG0	Data bus width selected	Jumper CON12
0	Single Data Rate (SDR)	Installed
1	Double Data Rate (DDR)	Not installed

4.7 CHIP_SEL input

CHIP_SEL is an active-HIGH input for the ISP1508A. When CHIP_SEL is driven LOW, the ISP1508A is put into power-down mode and the power consumed by the ISP1508A is negligible (in terms of micro-amperes). In power-down mode, all the internal circuits are not powered and the ULPI interface on-chip pads are configured as high-impedance input. It is strongly recommended that you terminate ULPI interface pins with weak pull-down resistors to avoid floating inputs in this mode. The pins that are not powered must

be either left floating or driven LOW. Driving HIGH on these pins might turn on parasitic diode path and increases power consumption.

CHIP_SEL is an active-LOW input for the ISP1508B.

4.8 TEST input

The test pin must be connected to HIGH for normal operations. Therefore, jumper CON9 must not be installed.

5. Troubleshooting

The following steps can be followed to troubleshoot the ISP1508 eval kit if you encounter any problems.

1. Remove the eval board from the system and power it through DC jack CON14.
2. Check regulator output voltages at the V_{CC} and $V_{CC(I/O)}$ pins. The voltage at V_{CC} must be within the range of 3.0 V to 4.5 V. The voltage at $V_{CC(I/O)}$ must be within the range of 1.4 V to 1.95 V. If not, tune POT1 or POT2 to set the voltage to the correct value.
3. Check to ensure that the voltage at the CHIP_SEL pin is the same as the $V_{CC(I/O)}$ voltage for the ISP1508A and at the ground level for the ISP1508B. If not, check jumper CON13 and any other damage to the eval board.
4. Check voltage at the RREF, REG1V8 and REG3V3 pins. The voltage must be around 1.2 V, 1.8 V and 3.3 V, respectively. If not, then ISP1508 may be damaged.
5. Check jumper setting at CON4. Jumper must be installed on pin 2 and pin 3 of CON4.
6. Check the frequency of the crystal mounted on the eval board, and configure jumpers CON10 and CON11, accordingly. Now a 60 MHz clock must be observed on the CLOCK pin of the ISP1508.

With the preceding steps, the eval board must be verified working. If problem persists, contact NXP support.

6. Connector pin information

Table 3 gives the T&MT connector pin out.

Table 3. T&MT connector pin out

Pin no	Pin name	Pin no	Pin name	Pin no	Pin name	Pin no	Pin name
1	n.c.	2	GND	51	GND	52	n.c.
3	n.c.	4	GND	53	GND	54	GND
5	n.c.	6	n.c.	55	n.c.	56	n.c.
7	n.c.	8	V_{CC}	57	V_{CC}	58	n.c.
9	GND	10	n.c.	59	n.c.	60	n.c.
11	n.c.	12	n.c.	61	n.c.	62	GND
13	GND	14	n.c.	63	n.c.	64	n.c.
15	TP7	16	V_{CC}	65	GND	66	n.c.

Pin no	Pin name	Pin no	Pin name	Pin no	Pin name	Pin no	Pin name
17	TP8	18	CHIP_SEL	67	n.c.	68	GND
19	n.c.	20	n.c.	69	V_{CC}	70	ULPI_DIR
21	GND	22	n.c.	71	ULPI_NXT	72	n.c.
23	n.c.	24	GND	73	GND	74	n.c.
25	n.c.	26	n.c.	75	n.c.	76	GND
27	GND	28	VREF_5V	77	n.c.	78	n.c.
29	n.c.	30	n.c.	79	n.c.	80	GND
31	ULPI_D7	32	GND	81	$V_{CC(I/O)}$	82	ULPI_D6
33	ULPI_D5	34	ULPI_D3	83	ULPI_D4	84	GND
35	GND	36	ULPI_D1	85	ULPI_D2	86	ULPI_D0
37	n.c.	38	$V_{CC(I/O)}$	87	$V_{CC(I/O)}$	88	n.c.
39	GND	40	n.c.	89	n.c.	90	ULPI_CLK
41	n.c.	42	n.c.	91	n.c.	92	GND
43	GND	44	n.c.	93	n.c.	94	n.c.
45	TP11	46	GND	95	GND	96	ULPI_STP
47	V_{BUS}	48	n.c.	97	n.c.	98	n.c.
49	DC_PSNT_N	50	n.c.	99	n.c.	100	PUSH_SHD_N

7. Schematics

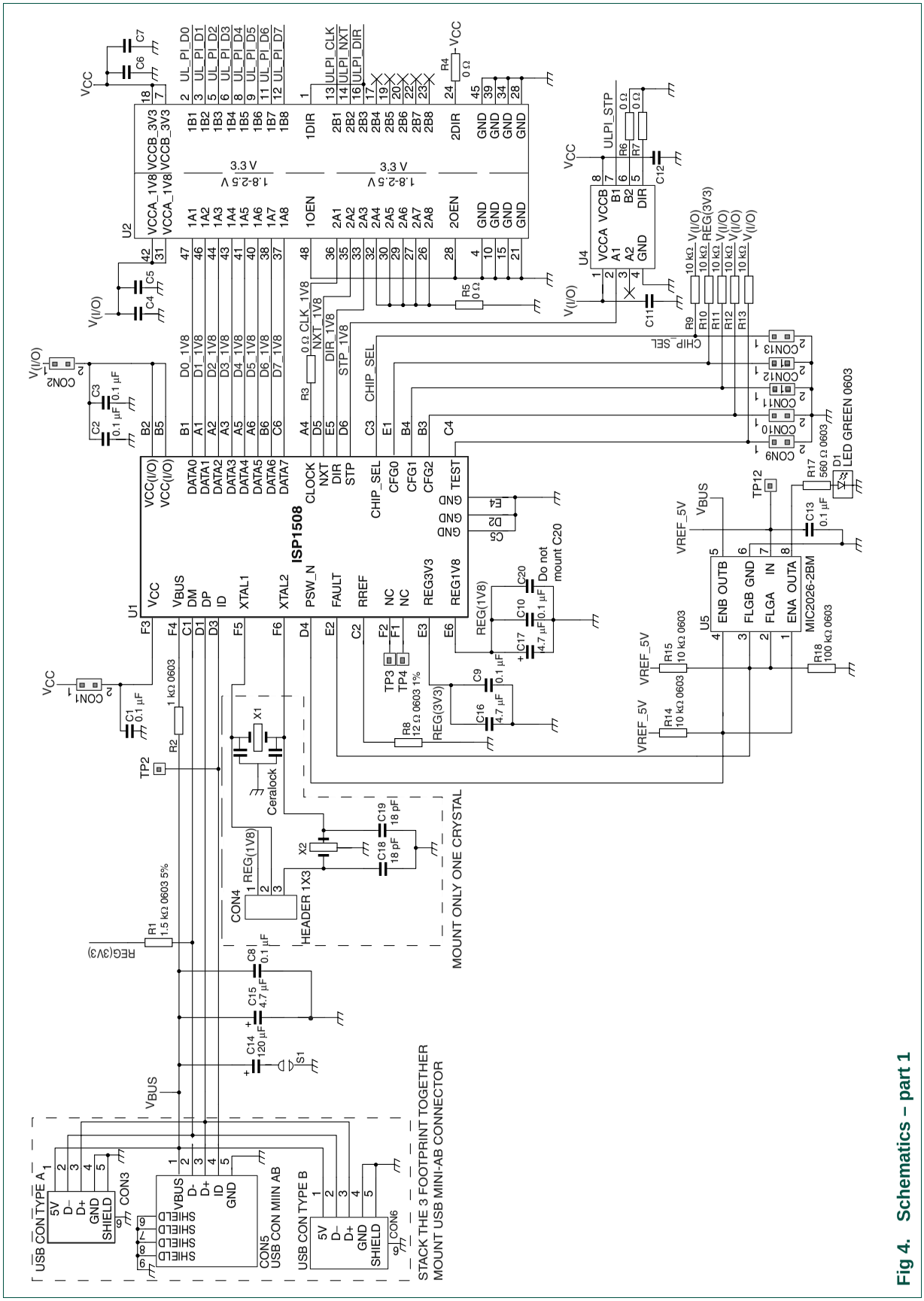

Fig 4. Schematics – part 1

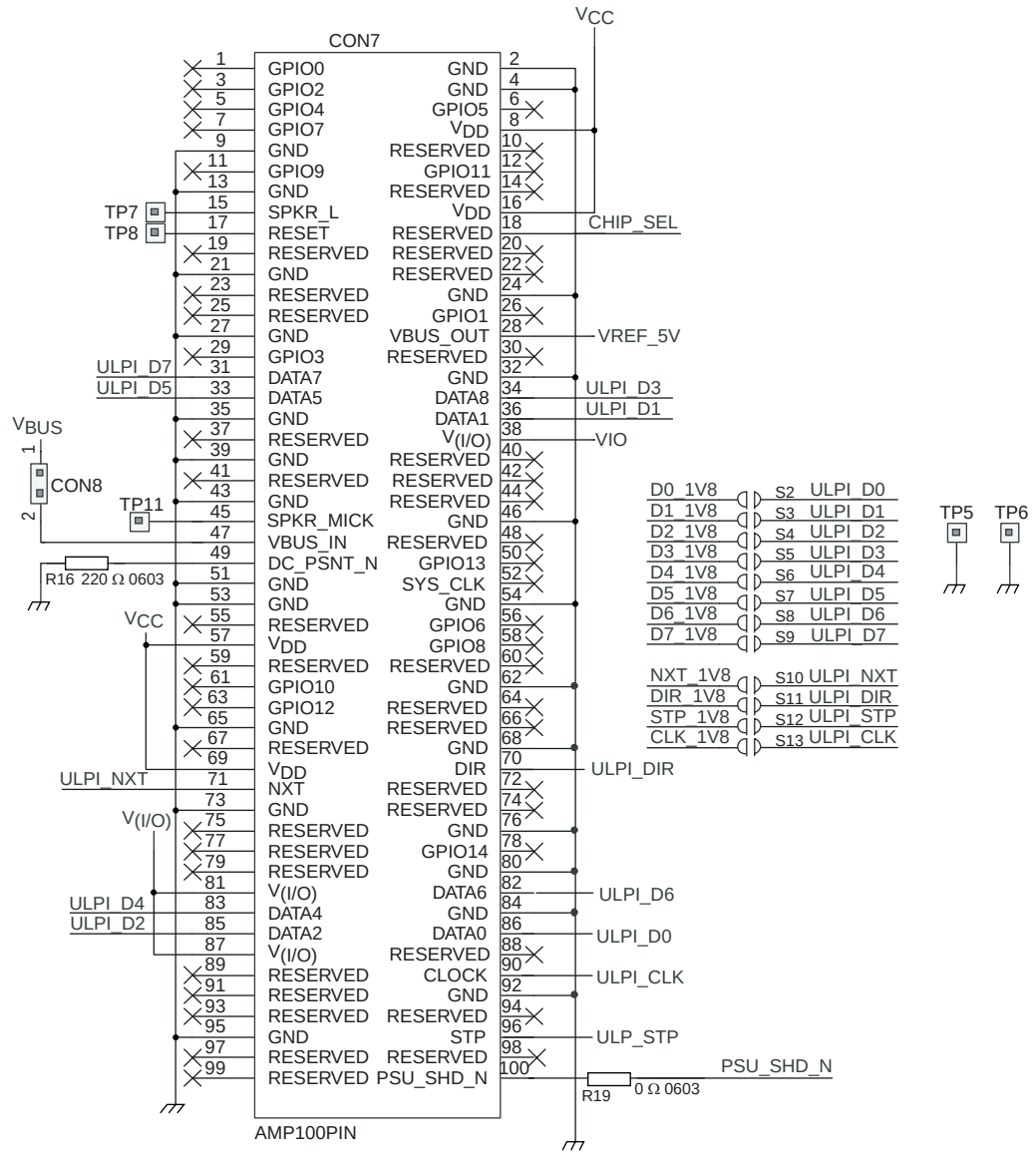

Fig 5. Schematics – part 2

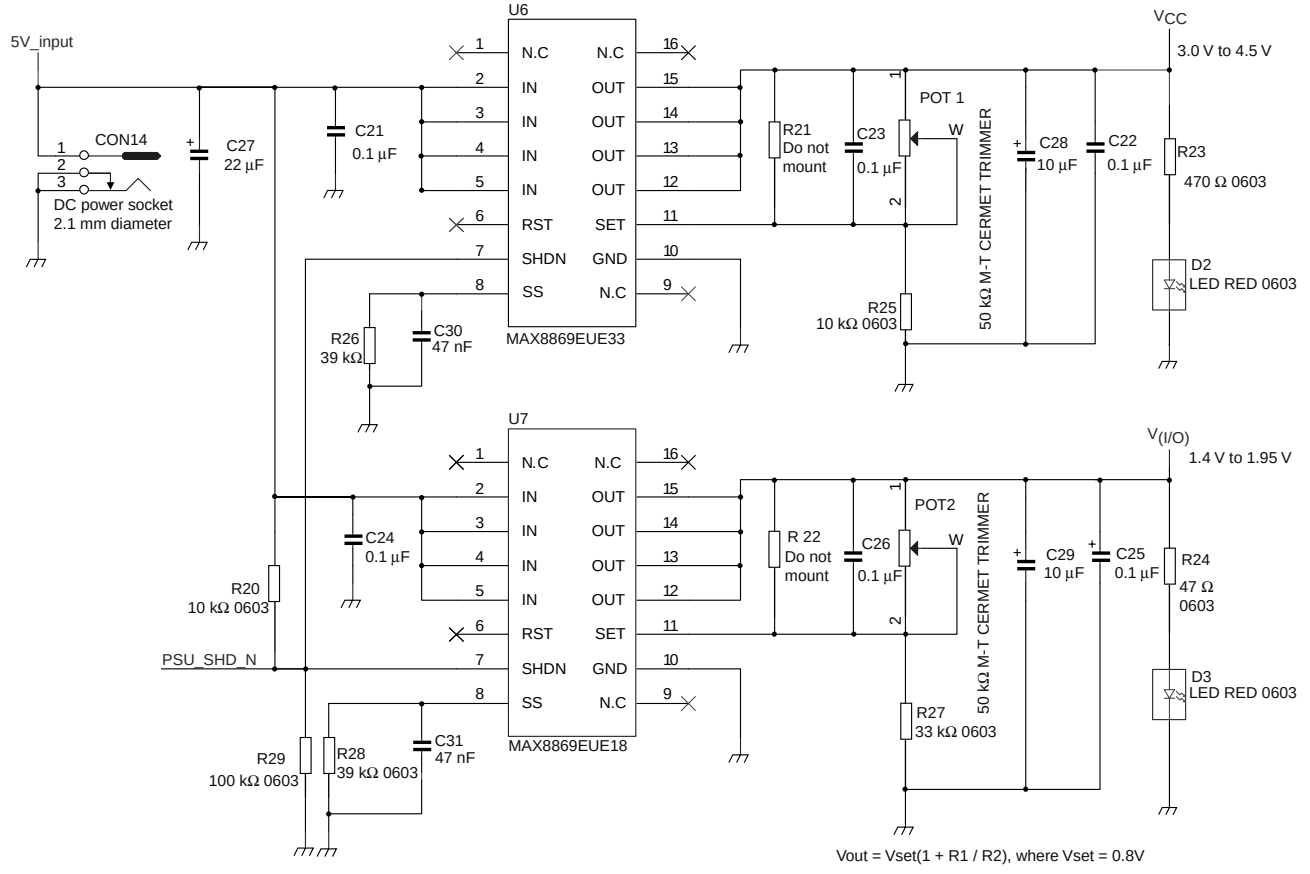

Fig 6. Schematics – part 3

8. Bill of materials

Table 4. Bill of materials

Description	Designator	Footprint
0 Ω, 0603, 1/16 W, 5 %	R3, R4, R5, R6, R7, R19	R0603-W
0603, 10 nF, 25 V, 10 %, X7R	C20 (do not mount)	C0603
0603, 100 nF, 16 V, 10 %, X7R	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C21, C22, C23, C24, C25, C26	C0603
0603, 18 pF, 50 V, 5 %, NP0	C18, C19	C0603
0603, 47 nF, 16 V, 10 %, X7R	C30, C31	C0603-W
1 kΩ, 0603, 1/16 W, 1 %	R2	R0603-W
10 kΩ, 0603, 1/16 W, 5 %	R9, R10, R11, R12, R13, R14, R15, R20, R25	R0603-W
100 kΩ, 0603, 1/16 W, 5 %	R18, R29, R21, R22	R0603-W

Description	Designator	Footprint
100PIN_T&MT connector	CON7	2-557101-5
12 kΩ, 0603, 1/16 W, 1 %	R8	R0603-W
19.2 MHz SMD crystal, 10 ppm, 7.0 pF, 50 Ω	X2	CS5032H_19.2 MHZ
220 Ω, 0603, 1/16 W, 5 %	R16	R0603-W
39 kΩ, 0603, 1/16 W, 5 %	R26, R27, R28	R0603-W
47 Ω, 0603, 1/16 W, 5 %	R24	R0603-W
470 Ω, 0603, 1/16 W, 5 %	R23	R0603-W
560 Ω, 0603, 1/16 W, 5 %	R17	R0603-W
Capacitor electrolytic SMD-B 10 μF / 16 V 20 %	C27, C28, C29	Electrolytic SMD-B
Capacitor electrolytic SMD-C 4.7 μF / 35 V 20 %	C15, C16, C17	Electrolytic SMD-C
Capacitor electrolytic SMD-D 100 μF / 16 V 20 %	C14	Electrolytic SMD-D
Chip LED, red, SMD, 0603 package, 0.8 x 1.6 x 0.8 mm	D1, D2, D3	LED0603
DC power socket, pin diameter 2.1 mm	CON14	DC power socket
Header, 0.1" pitch, 1 x 2 way, gold	CON1, CON2, CON8, CON9, CON10, CON11, CON12, CON13	SIP2-S
Header, 0.1" pitch, 1 x 3 way, gold	CON4	Header 1 x 3
ISP1508 TFBGA	U1	None available
MAX8869	U6, U7	TSSO5X6-G16
MIC2026-2BM	U5	SOIC-8-M_4.93 x 3.94 mm
Mini AB USB connector	CON5	USB_AB
PCB solder bridge	S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13	Shorting point 1.0 mm
Resistor trim M-T 100 kΩ 3296W-1-104	POT1, POT2	BOURNS 3296W

9. References

- ISP1508 ULPI Hi-Speed Universal Serial Bus transceiver data sheet
- UTMI+ Low Pin Interface (ULPI) Specification Rev. 1.1
- USB 2.0 Transceiver and Macrocell Interface (UTMI) Specification Ver. 1.05

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