TI Designs

Ethernet Bootloader for Hercules

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Design Resources

TIDM-ETHERNET-BOOTLOADER	Design Folder
TMS570LS3137	Product Folder

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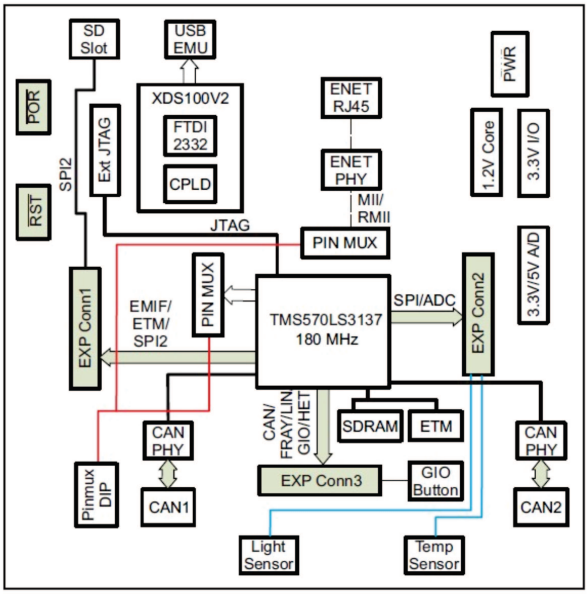
Design Features

- Remote Firmware Upgrades
- Low Memory Cost
- Fast upgrade

Featured Applications

- Devices on internet need firmware upgrade



An IMPORTANT NOTICE at the end of this TI reference design addresses authorized use, intellectual property matters and other important disclaimers and information.

1 System Description

1.1 Hardware Requirements

The hardware required for configuration includes:

- Power supply: 12 V to HDK
- Hercules TMDX570LS31HDK
- PC with Windows for running tftpd32
- Router or connect directly

1.2 Software Requirements

- The bootloader code is implemented in C, ARM® Cortex®-R4F assembly coding is used only when absolutely necessary. The integrated development environment (IDE) is TI Code Composer Studio™ v6.
- The bootloader is compiled in the 32-bit ARM mode.
- The application code needs to change the address with the bootloader setting.

2 Getting Started Firmware

The list of source code files used in the Ethernet bootloader are shown in Table 1.

Table 1. Source Code Files

sys_startup.c	The start-up code used when TI's CCS compiler is being used to build the bootloader.
sys_main.c	The main control loop of the bootloader.
sys_link_boot.cmd	The linker script used when the CCS compiler is being used to build the bootloader.
bl_config.h	Bootloader configuration file. This contains all of the possible configuration values.
bl_flash.c	The functions for erasing, programming the flash, and functions for erase and program check
bl_flash.h	Prototypes for flash operations
bl_tftp.c	Function for define the tftp request and image write and read function
bl_tftp.h	Prototype define the variables and functions
Fapi_UserDefinedFunction.c	Contains all user defined functions that the Fapi functions use
Emac.c	Contains the device abstraction layer APIs for EMAC
Esm.c	Esm driver source file
Mdio.c	Contains the device abstraction layer APIs for MDIO
Pinmux.c	PINMUX driver implementation
tftp.c	Simple LwIP TFTP sever
tftp.h	Public function prototypes and globals related to the LwIP TFTP sever
ustdlib.c	Simple standard library functions
Lwip-1.3.2	Lwip library support TCP/IP stack
Others	Relevant for system

An overview illustrating the Ethernet bootloader firmware flowchart is shown in Figure 1.

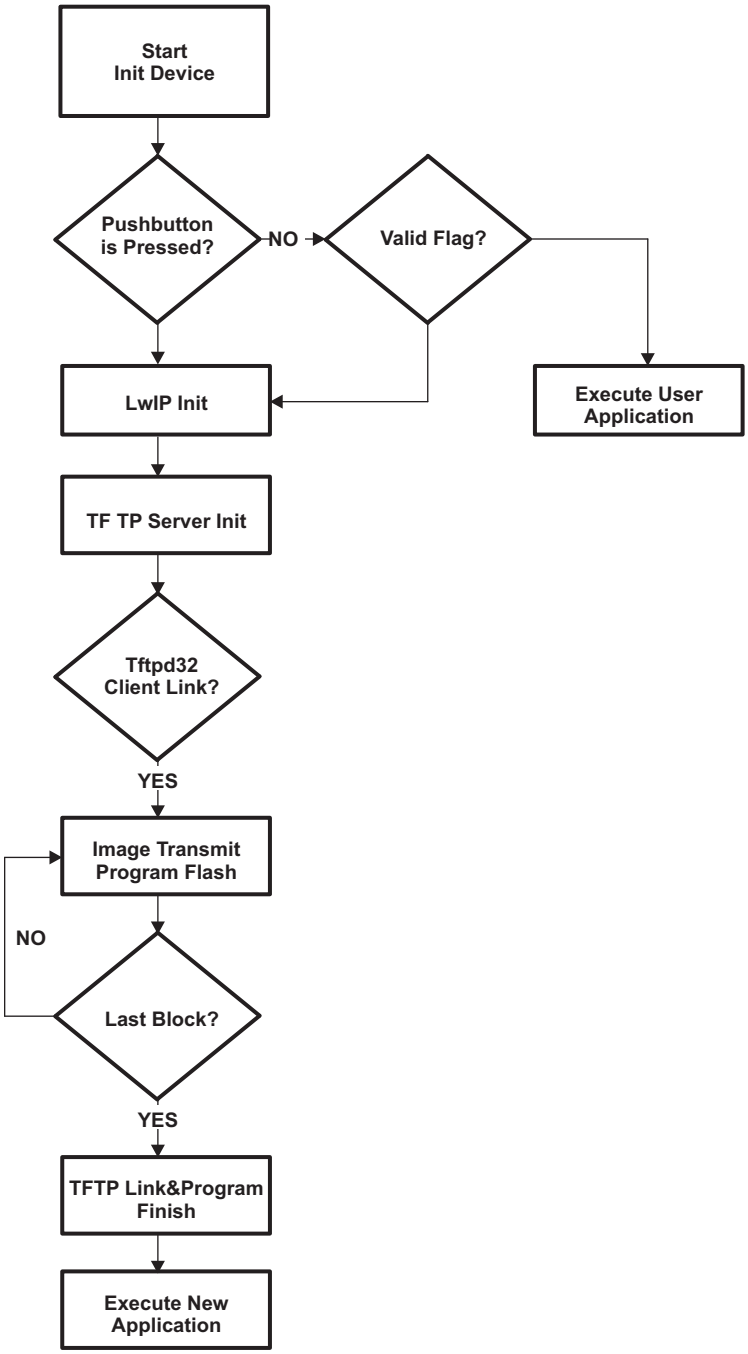


Figure 1. Ethernet Bootloader Flowchart

2.1 Load Application Code

The Ethernet bootloader is built with CCSv6 and loaded through the JTAG port into the lower part of the program memory at 0x00000000.

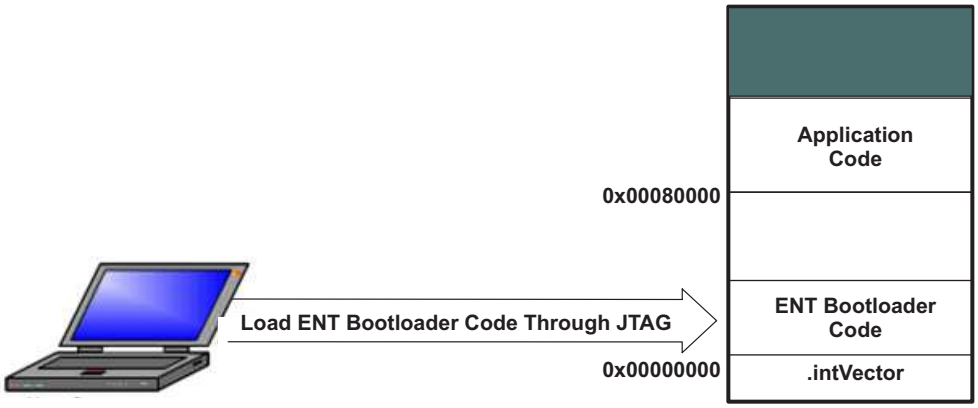


Figure 2. Ethernet Bootloader is Loaded Through the JTAG Port

After HDK reset, the startup code copies the FlashAPI of bootloader from flash to RAM, and executes the bootloader in flash.

It checks to see if the GPIO_A7 key is pushed or not. If the key is not pushed, it executes the application code that already exists in the flash; otherwise, it calls the TFTP update code. The flash is erased waiting for the application image from the PC host.

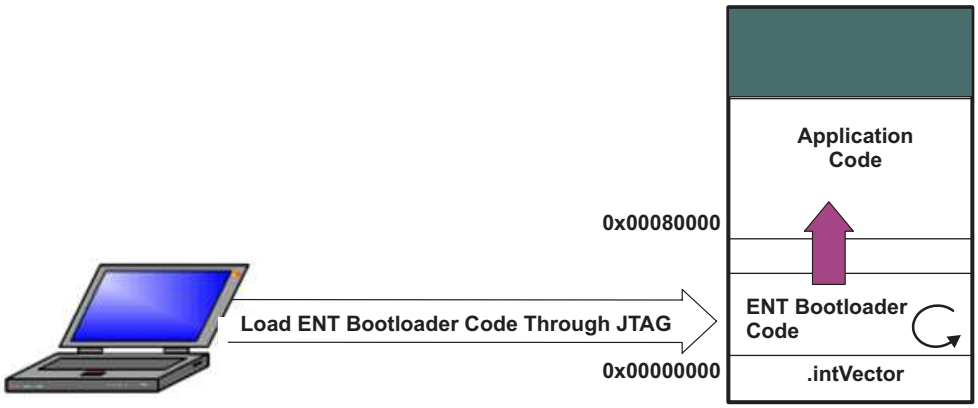


Figure 3. Application Image is Loaded Through the ENT Bootloader

When HDK enters into TFTP update mode, on the PC side, it uses the software named Tftpd32 (that is free) and opens the source. Then, it performs the following steps:

1. Select the tftp client table.
2. Fill the Host with HDK board IP and port NO 69.
3. Choose the local file to the image file location.
4. Set block size as default(512).

Ensure that both the HDK board and the PC are in the same net. Click the Put command button in Figure 5, the image will be transferred into the HDK board.

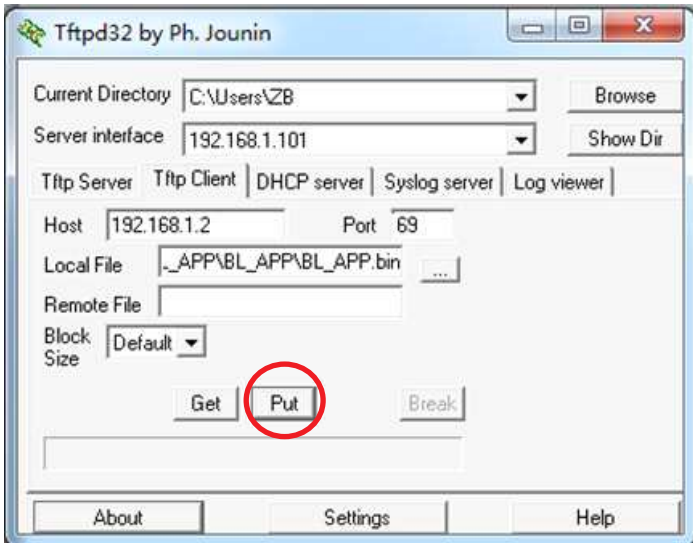


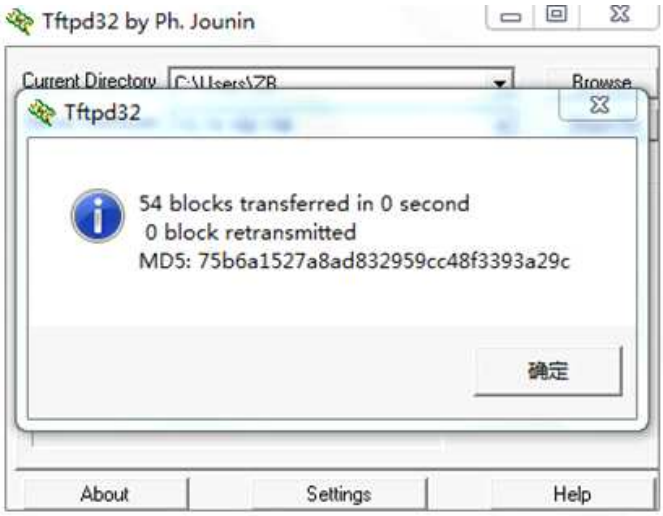
Figure 4. Put Button

3 Test Data

1. Load the Ethernet bootloader to HDK through JTAG and enter it into the Ethernet update mode.
2. Open the tftpd32.exe on the PC host, select the Tftp client tab. Fill the HDK ip and port NO 69. Select the application code BIN file. Then click the Put button.

Figure 5. Tftp Client Tab

3. The BIN file is loaded through Ethernet. All the blocks have been transferred successfully.



4. The application code is run in the HDK board.

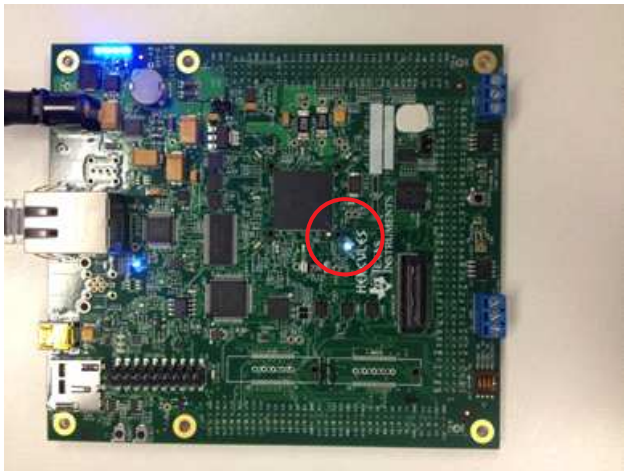


Figure 6. HDK Board

4 Design Files

All the hardware references can be located at: TIDM-ETHERNET-BOOTLOADER.

4.1 Schematics

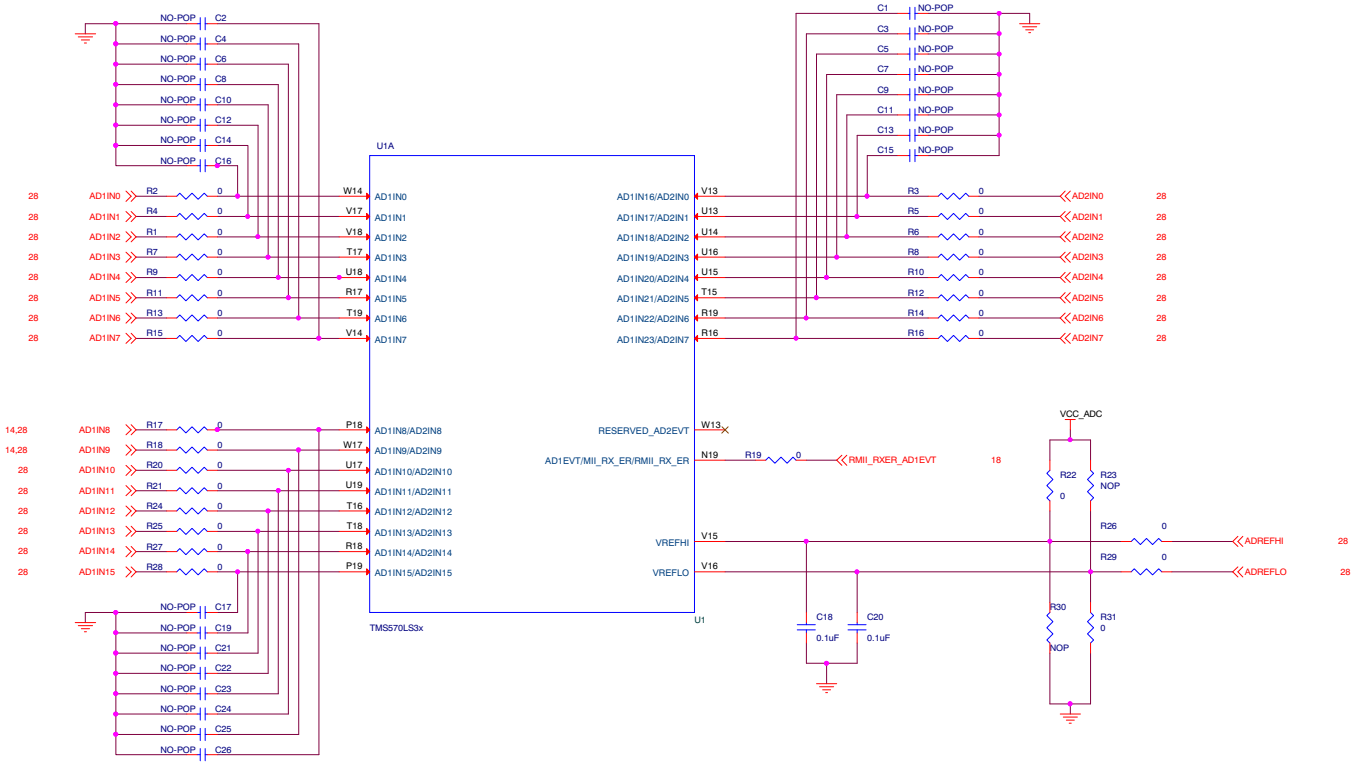


Figure 7. MCU ADC Schematic

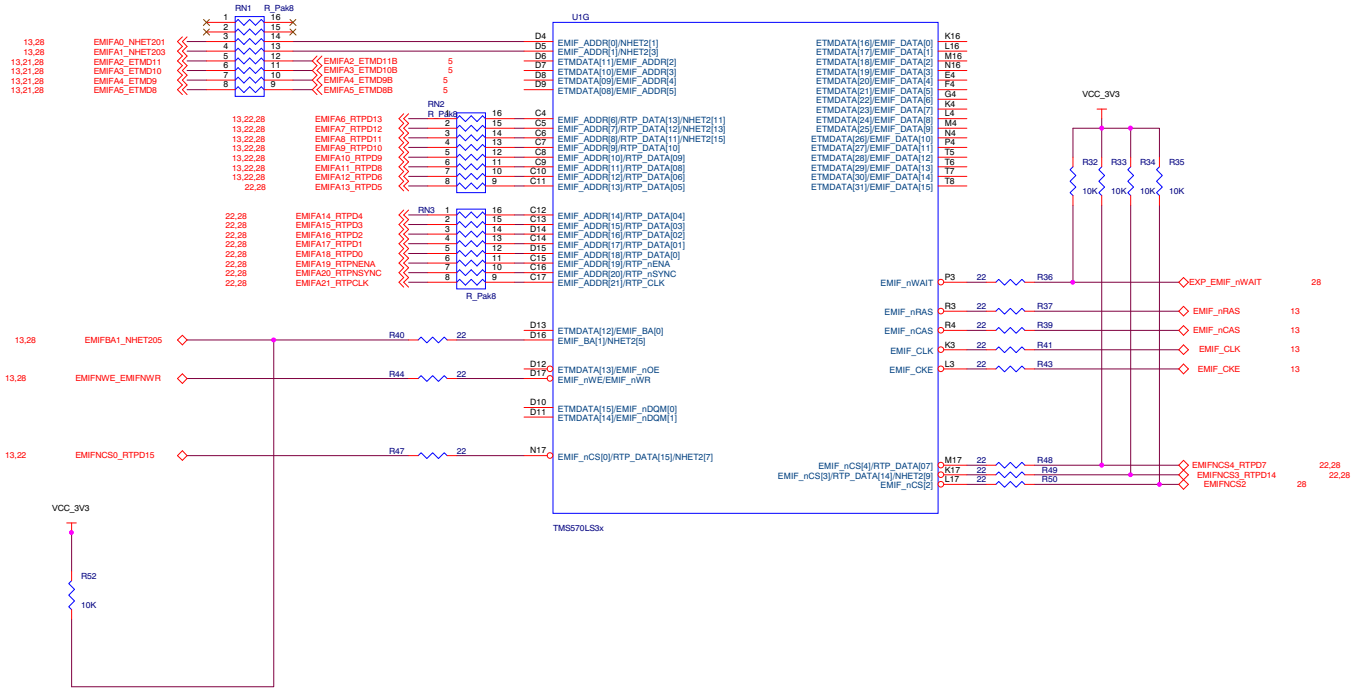


Figure 8. MCU EMIF Schematic

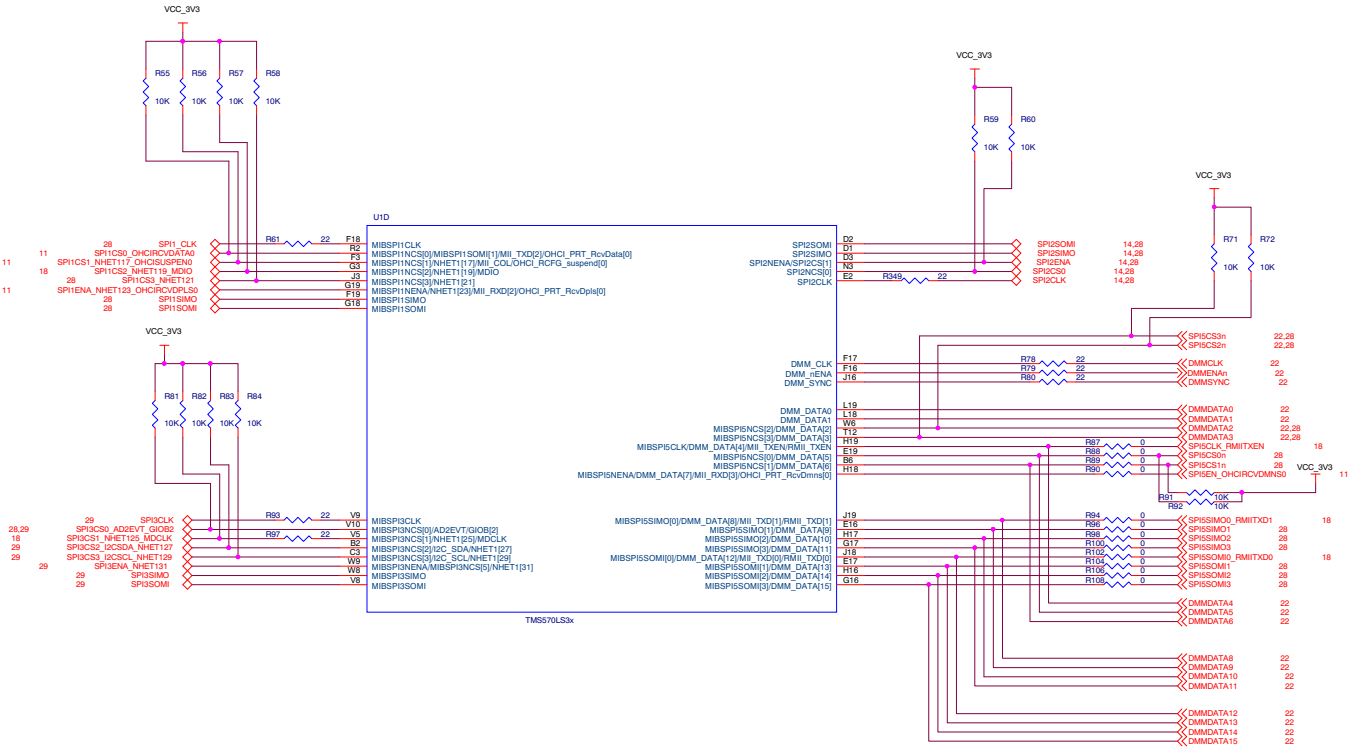


Figure 9. MCU SPI Schematic

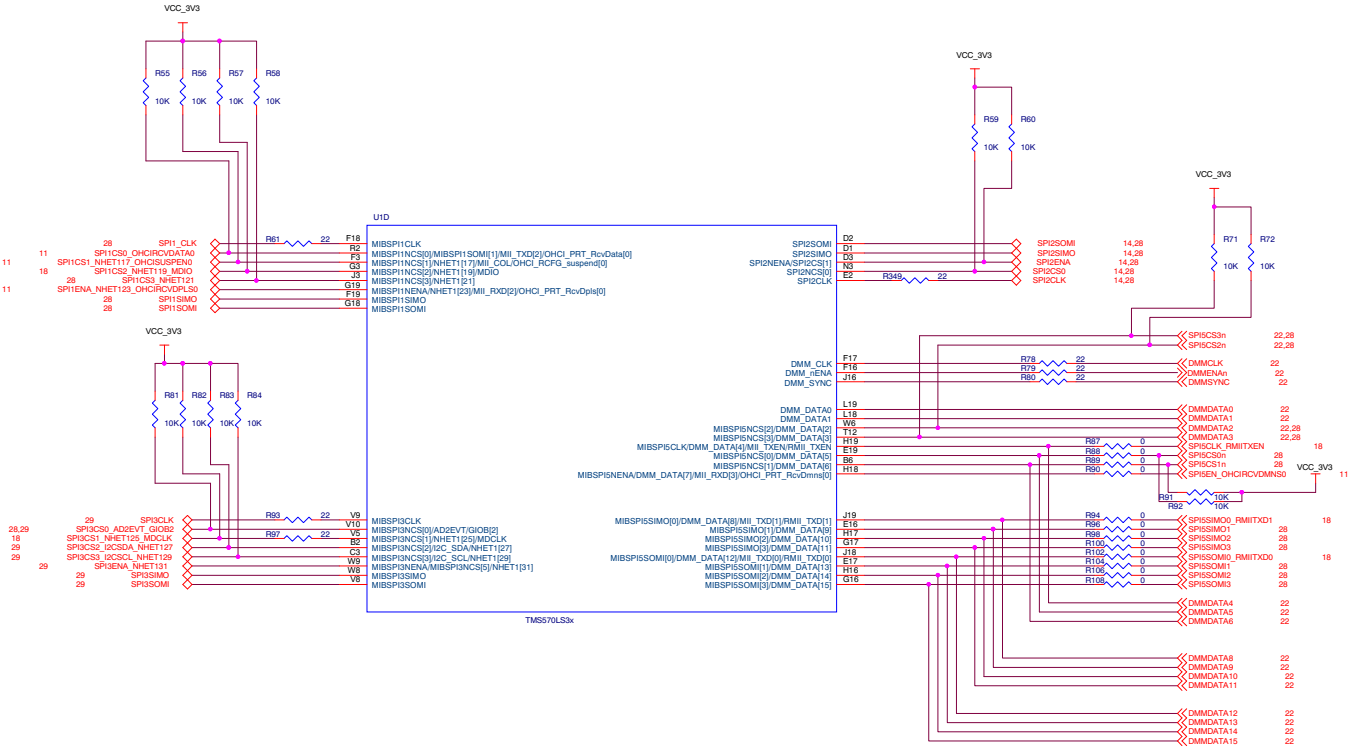


Figure 10. MCU ETM Schematic

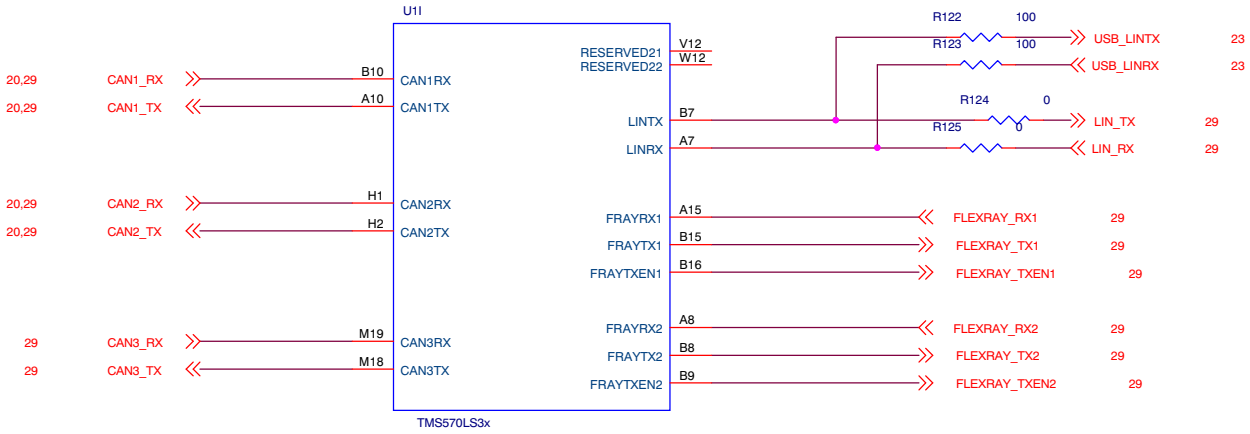


Figure 11. MCU DCAN, FLEXRAY and LIN Schematic

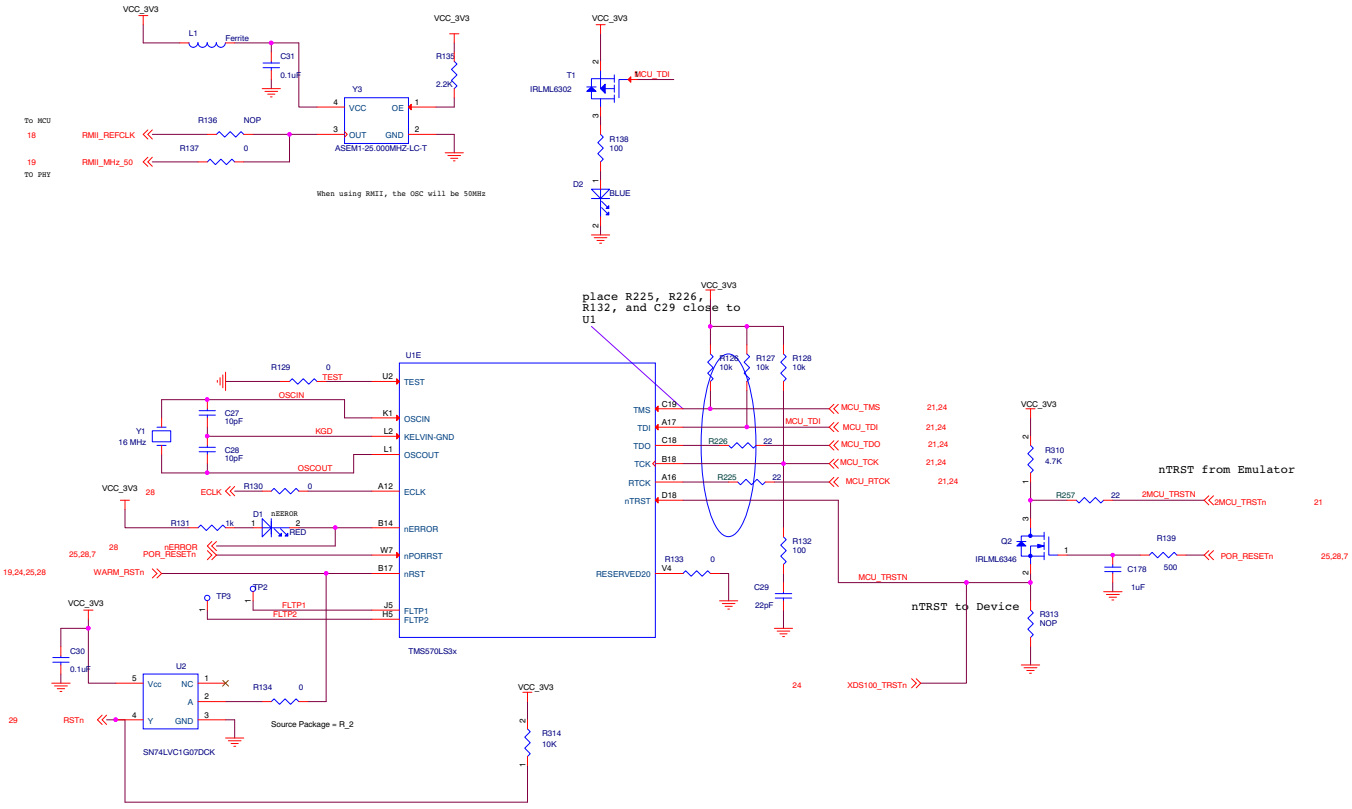


Figure 12. MCU JTAG and OSC Schematic

Figure 13. MCU NHET Schematic

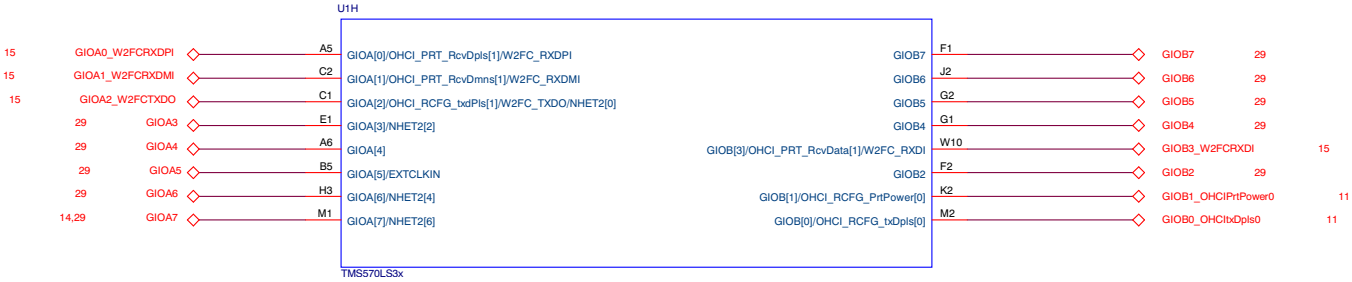


Figure 14. MCU GPIO Schematic

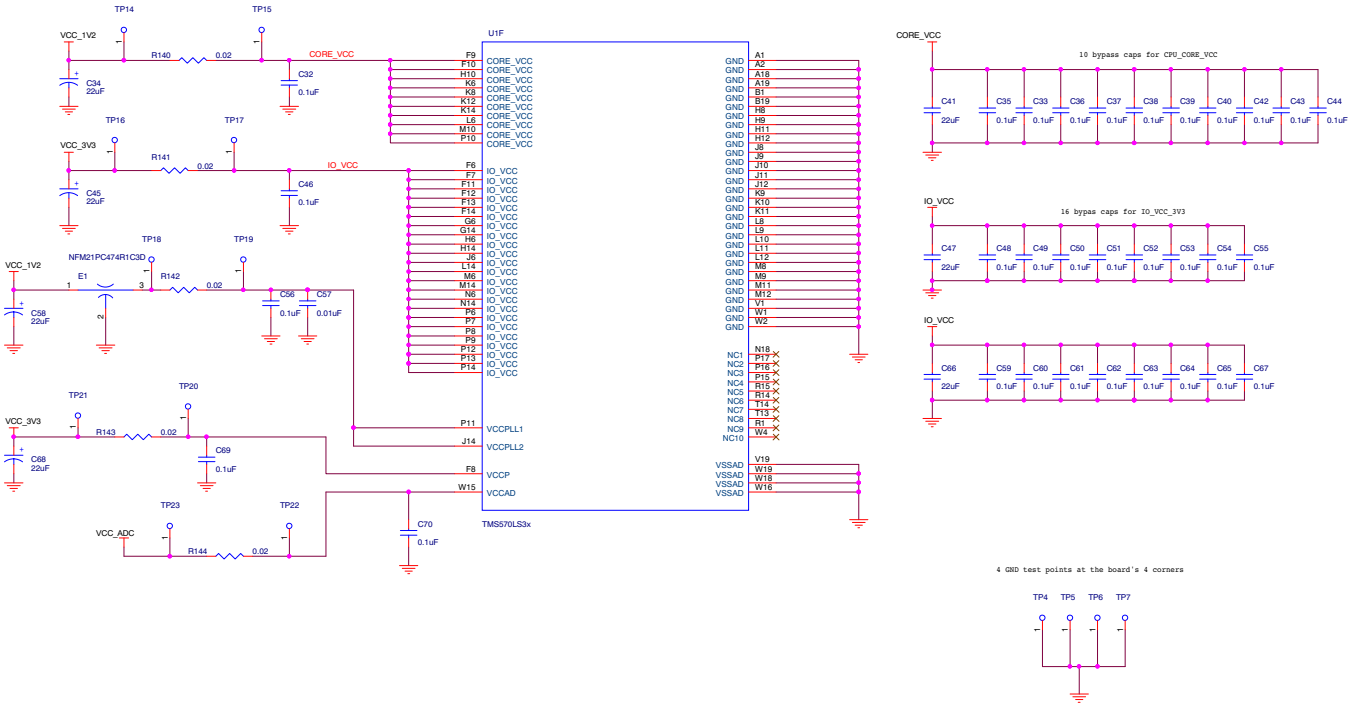
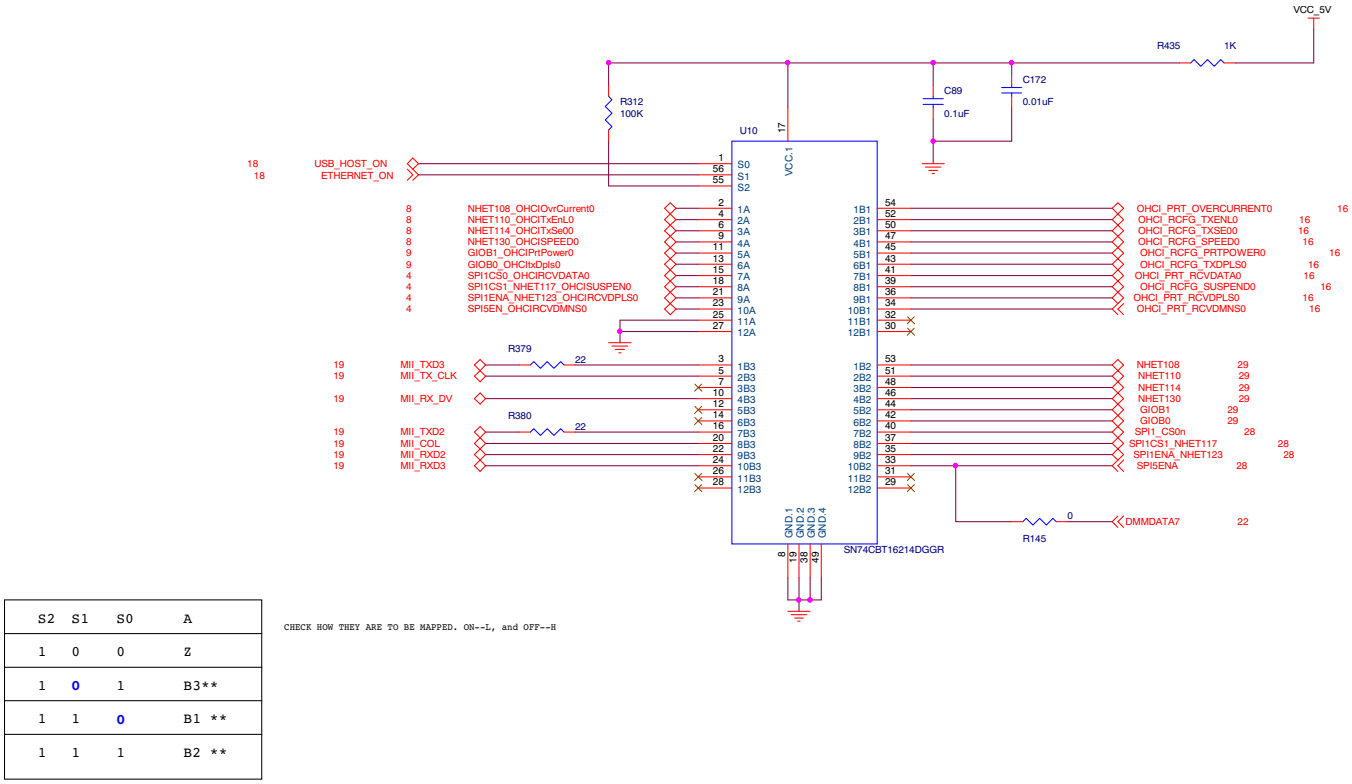


Figure 15. MCU Power and GND Schematic



S2	S1	S0	A
1	0	0	Z
1	0	1	B3**
1	1	0	B1 **
1	1	1	B2 **

CHECK HOW THEY ARE TO BE MAPPED. ON--L, and OFF--H

Figure 16. FET Switches for First USB Schematic

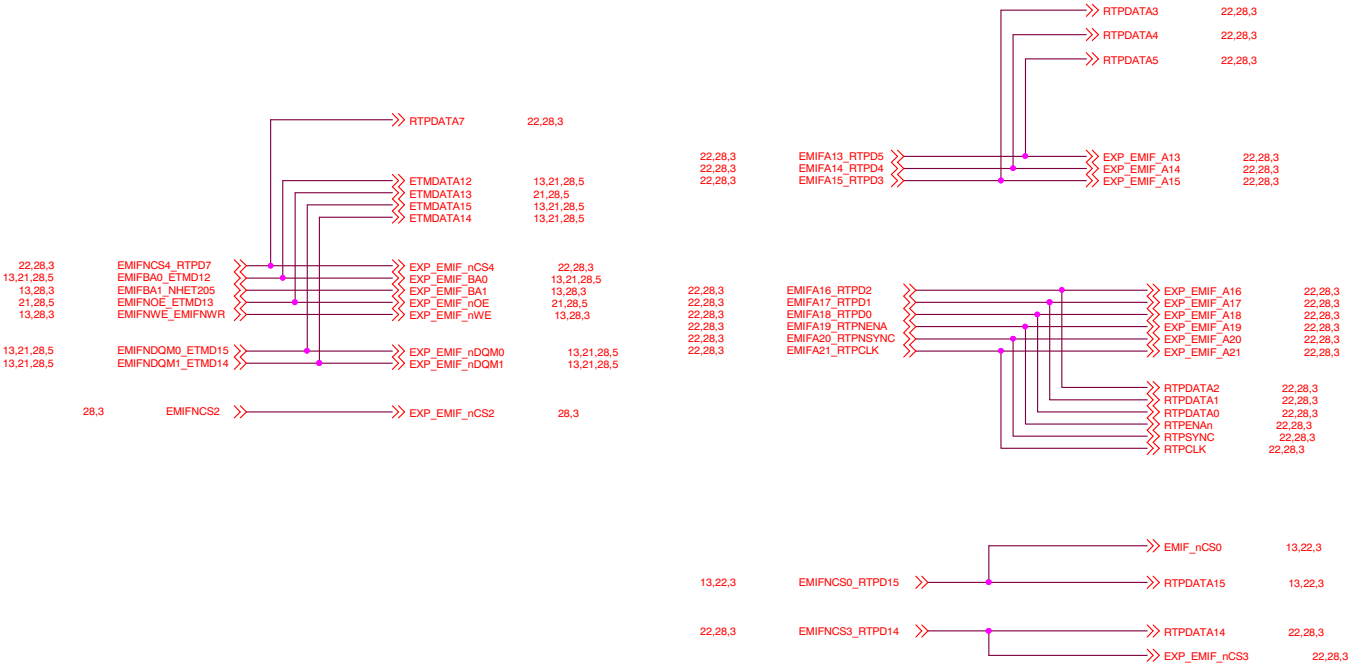


Figure 17. EMIF Addr/ETM/RTP Schematic

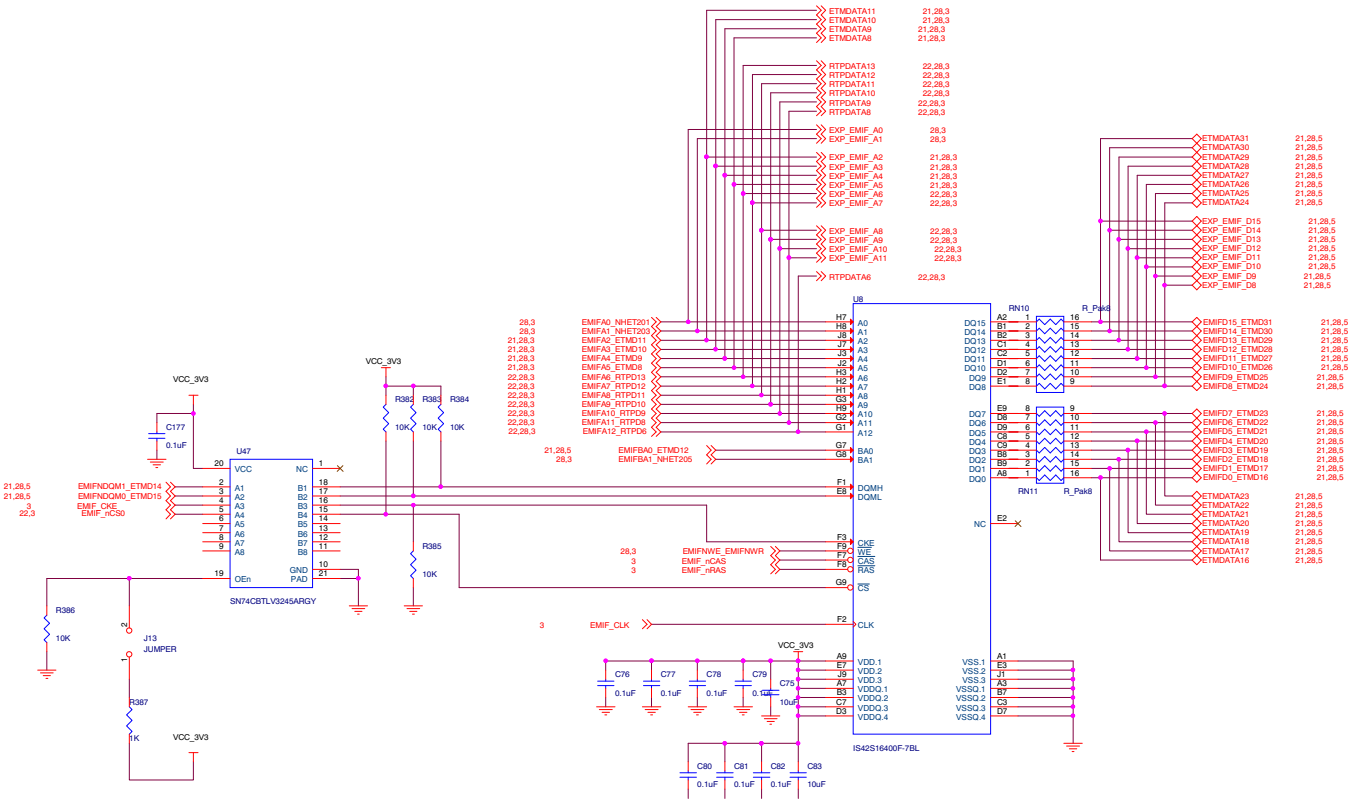


Figure 18. SDRAM Schematic

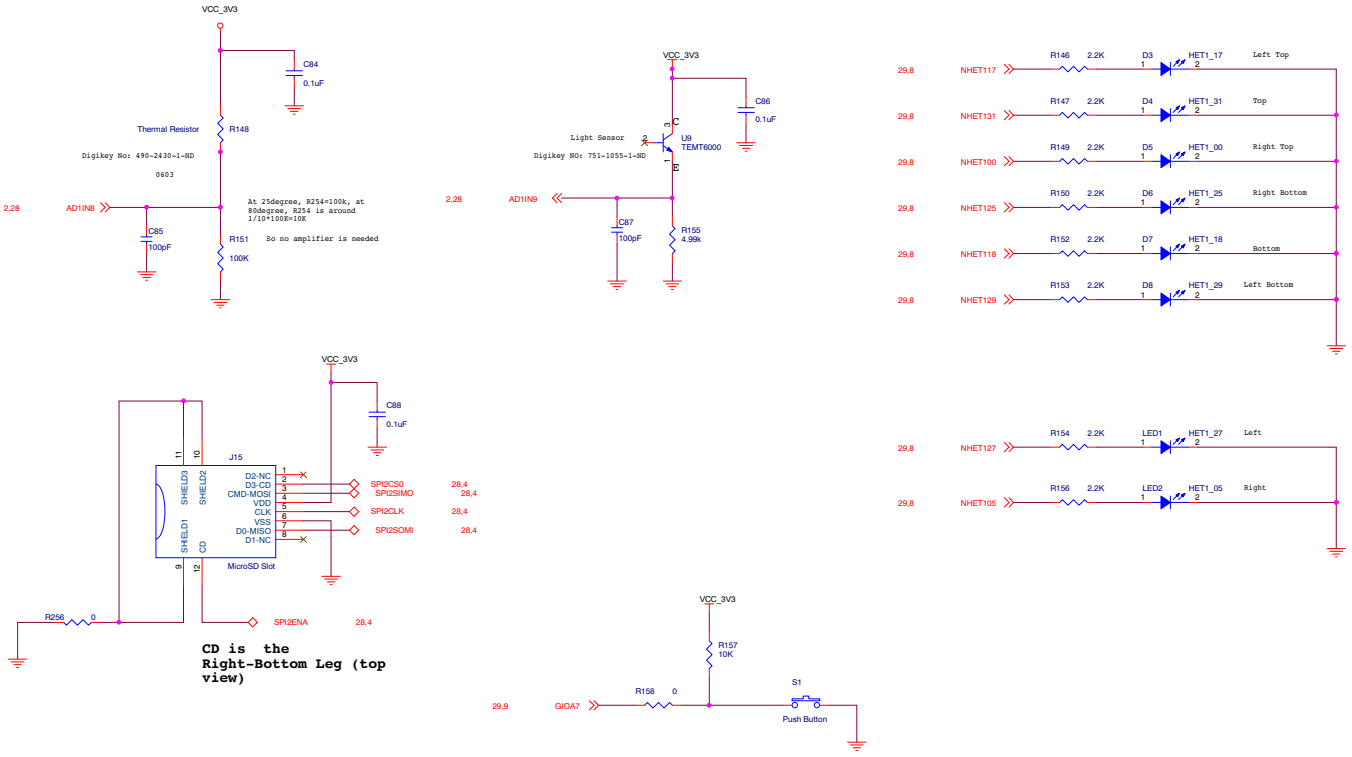


Figure 19. Sensors, LEDs and Pushbutton Schematic

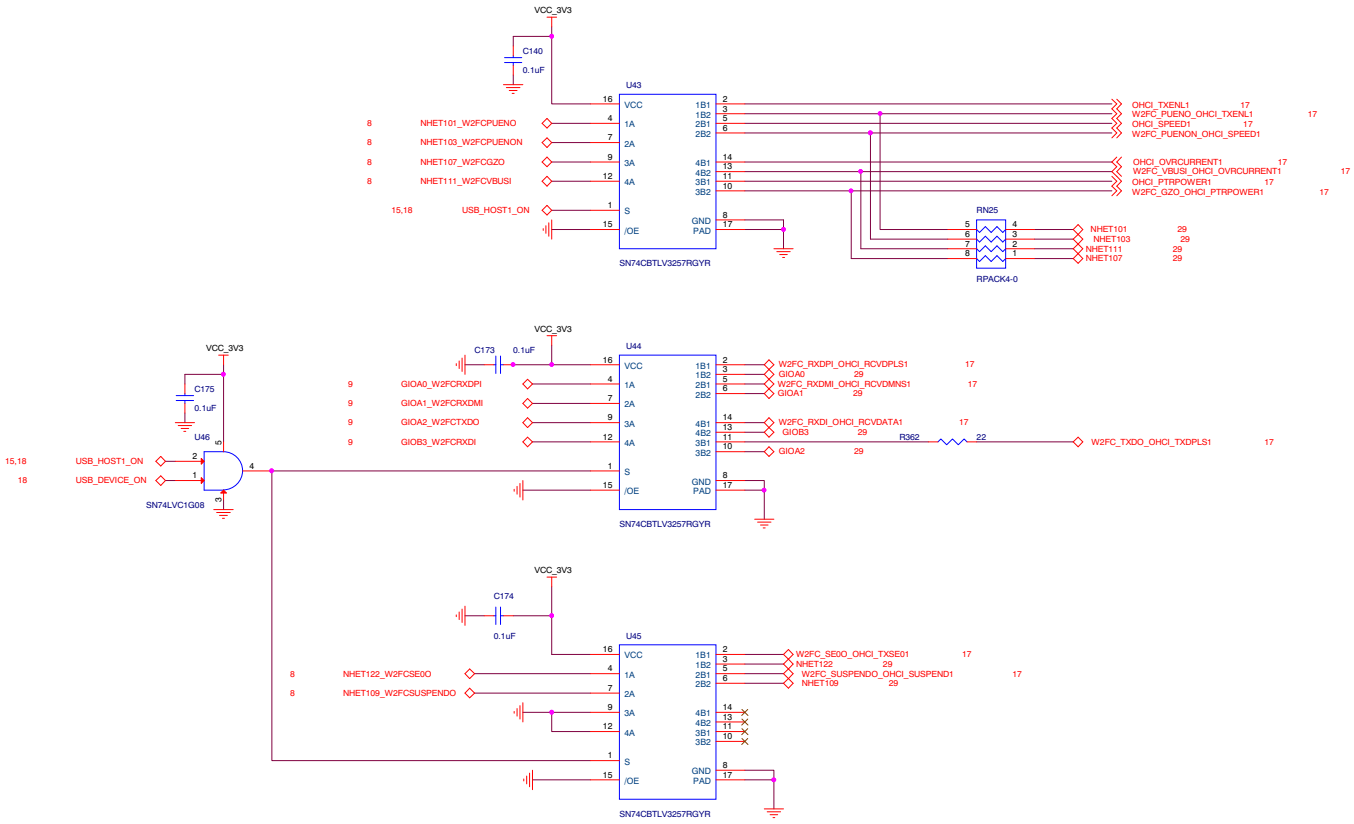


Figure 20. FET Switches for Second USB Schematic

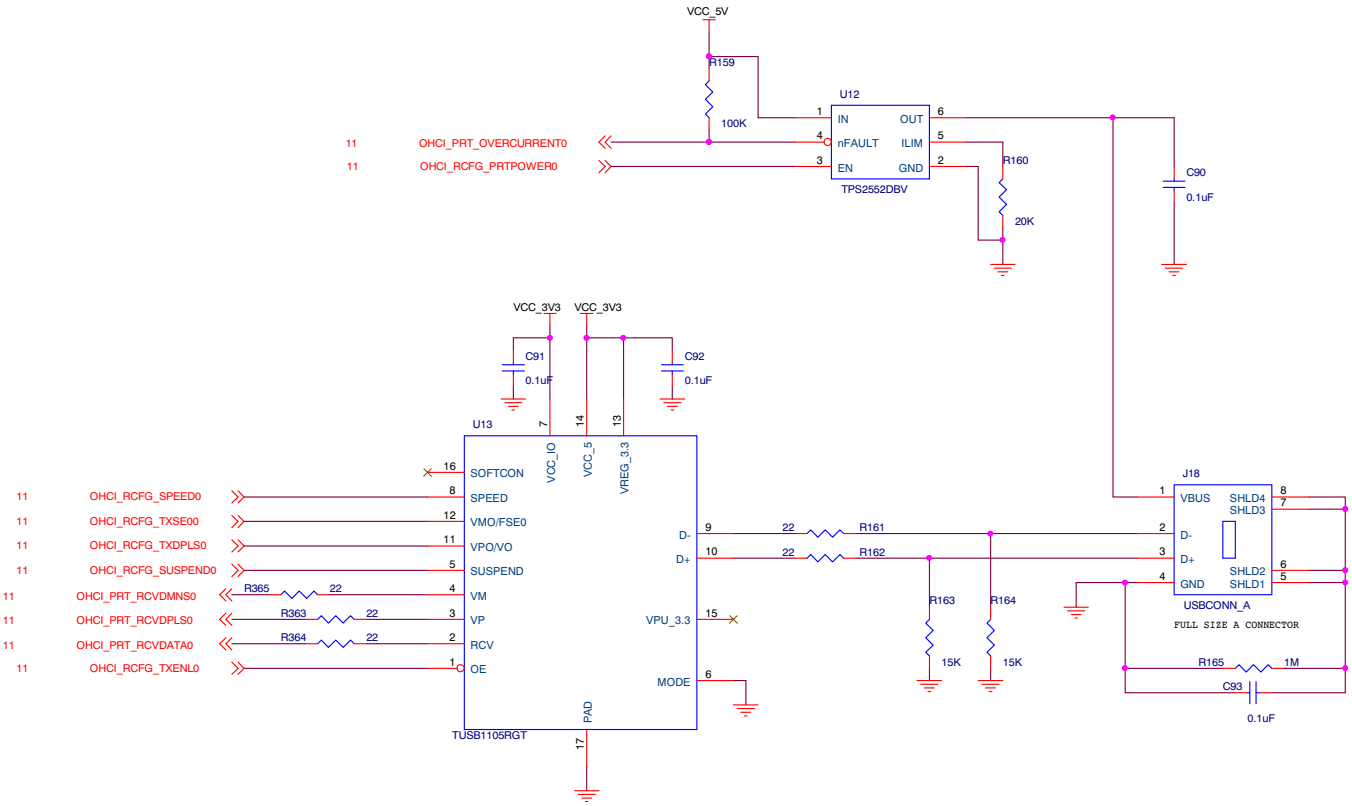


Figure 21. USB First OHCI Host Schematic

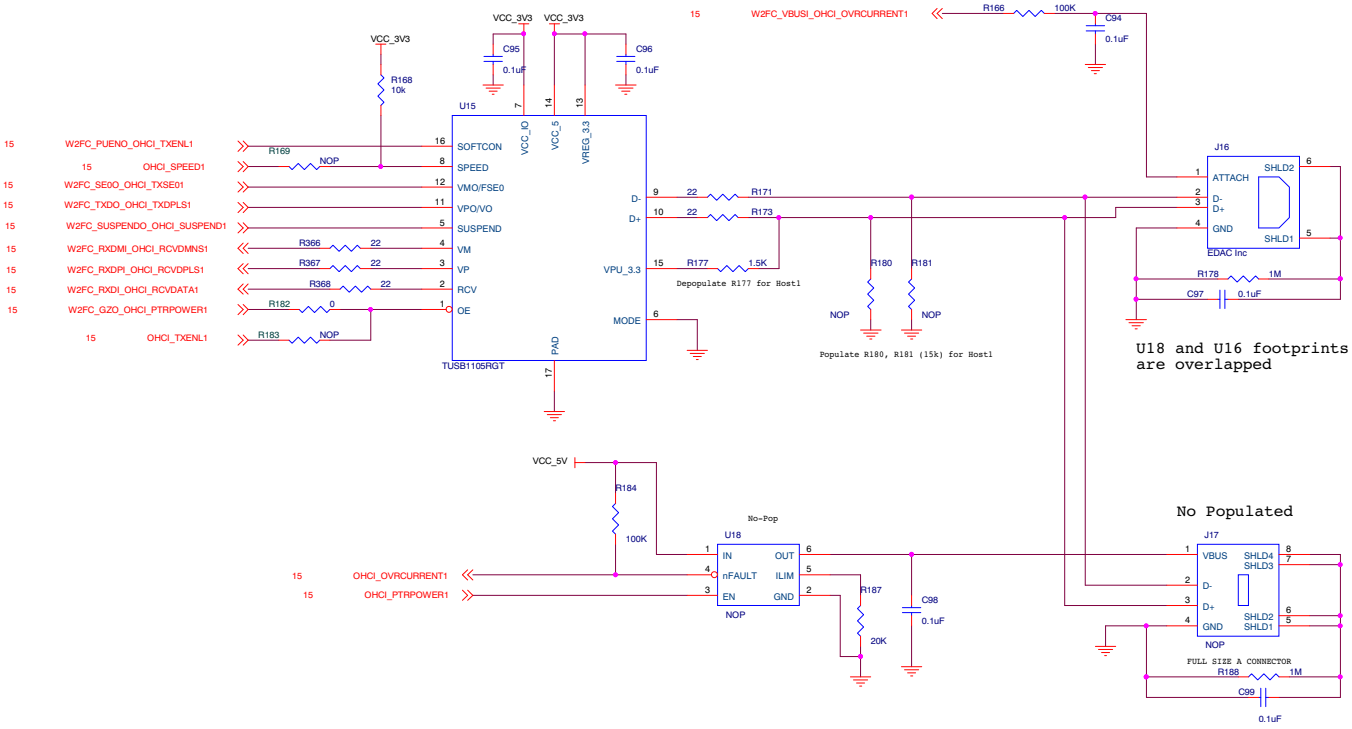


Figure 22. USB Device and Second OHCI Host Schematic

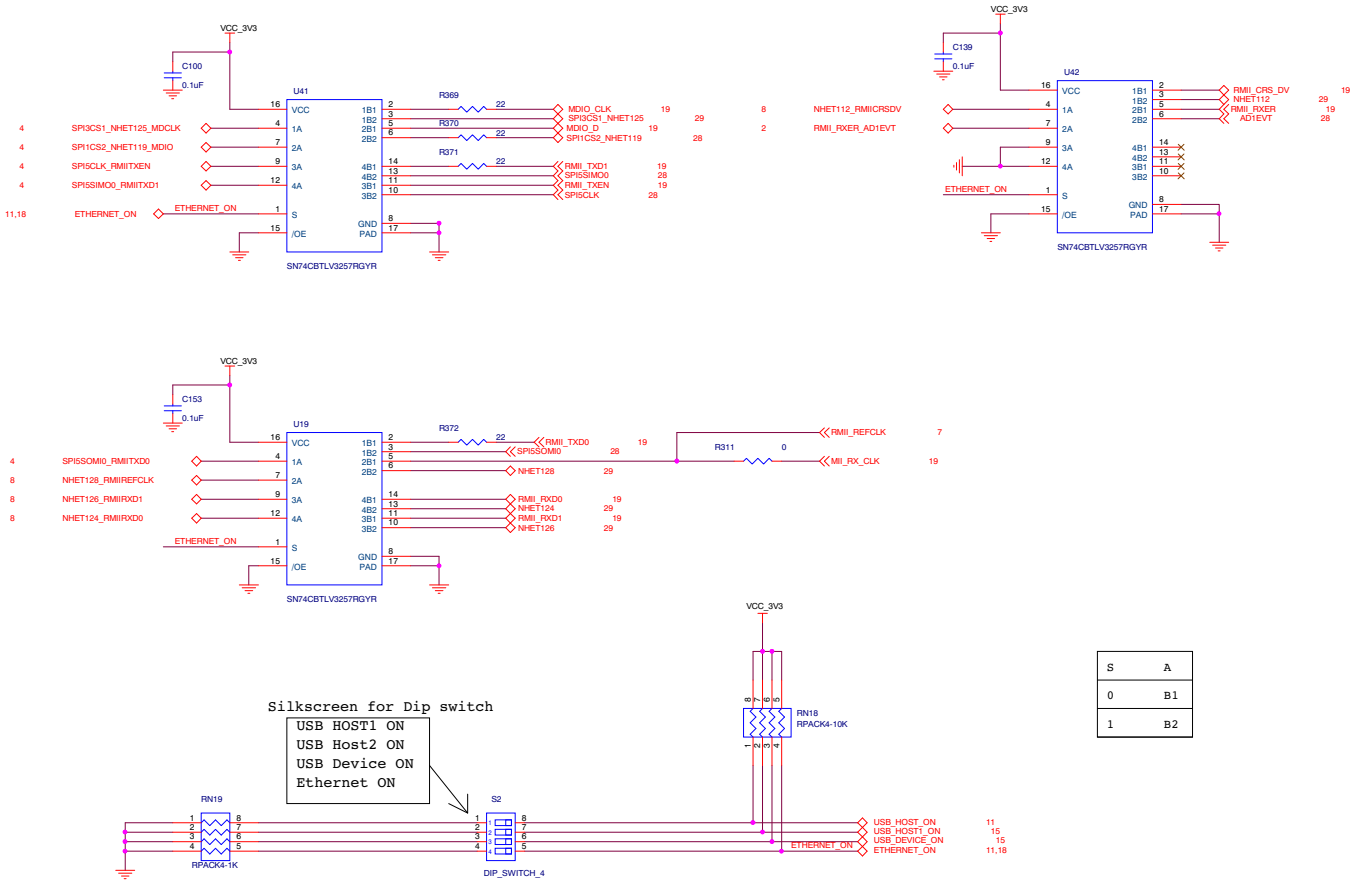


Figure 23. FET Switch for RMII and DIP Switch Schematic

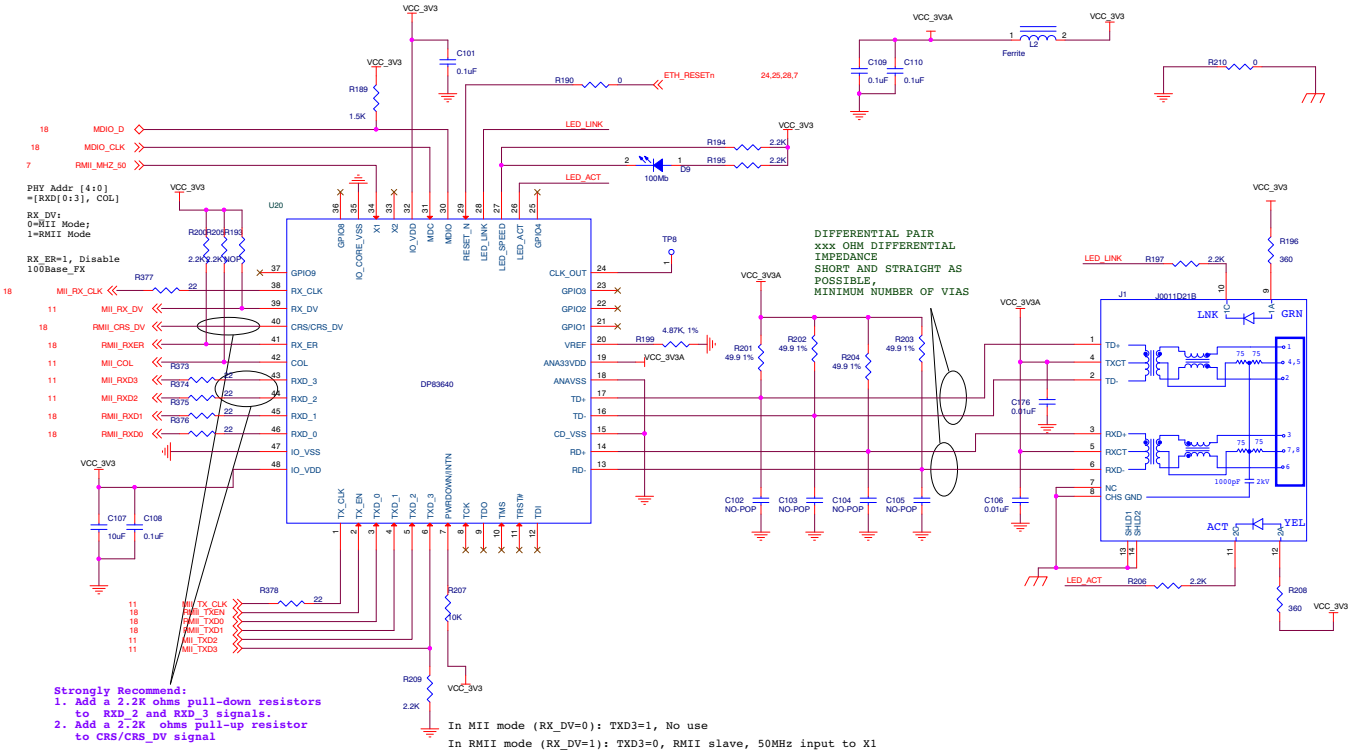


Figure 24. Ethernet PHY and Connector Schematic

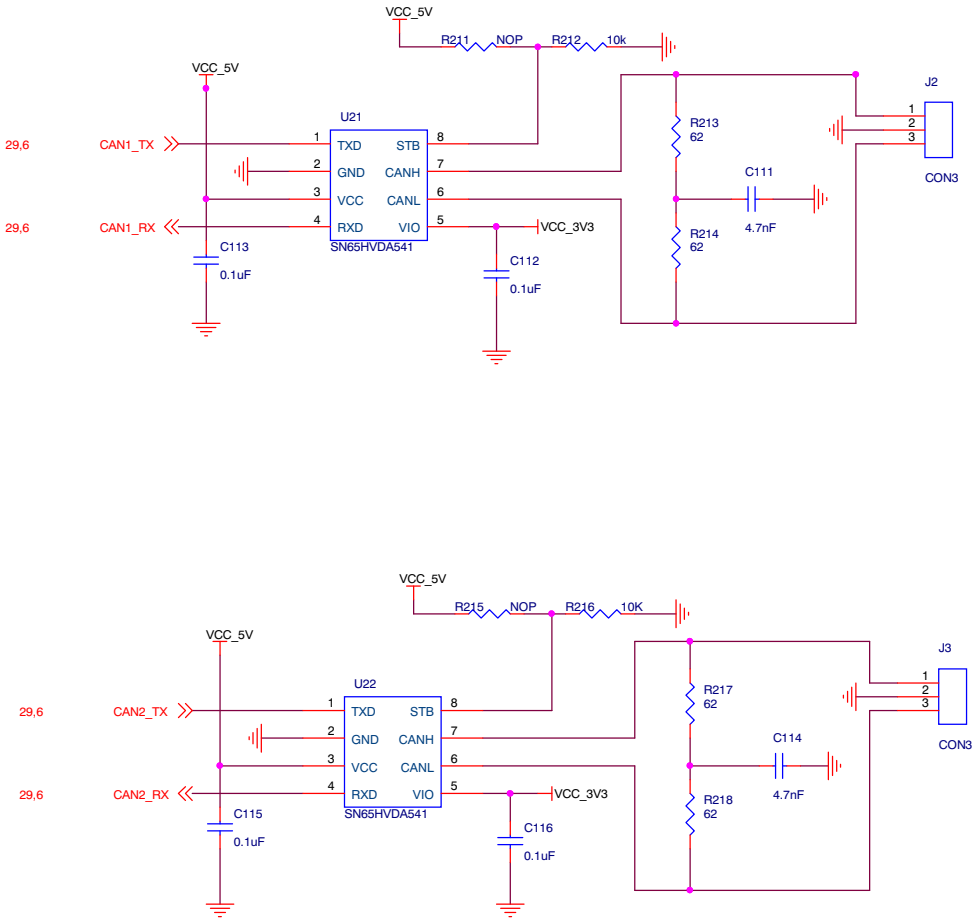
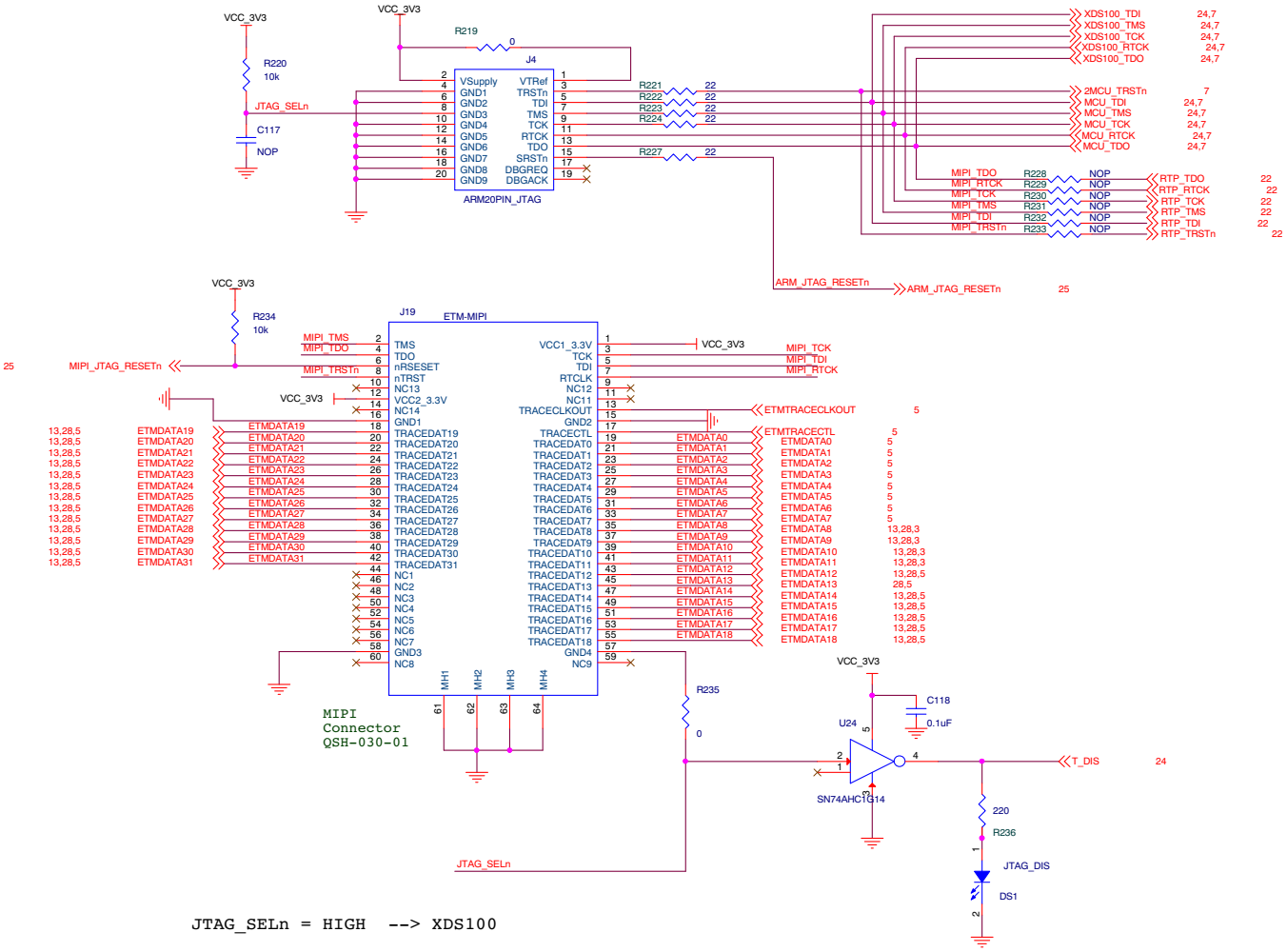


Figure 25. CAN Transceivers Schematic




```
JTAG_SELn = HIGH  --> XDS100

JTAG_SELn = LOW  --> ARM
JTAG and MIPI
```

Figure 26. JTAG and MIPI ETM Connector Schematic

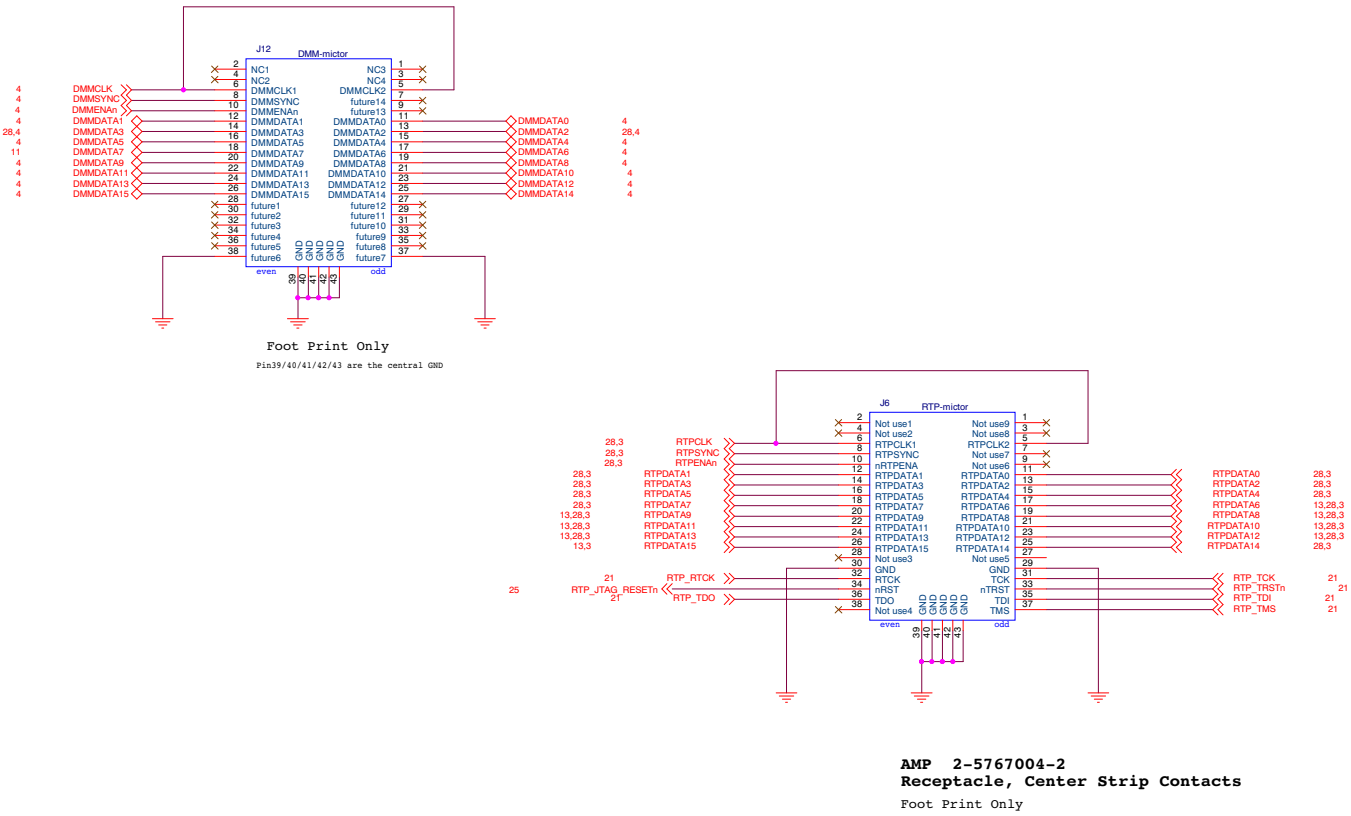


Figure 27. DMM and TRP Mictor Connectors

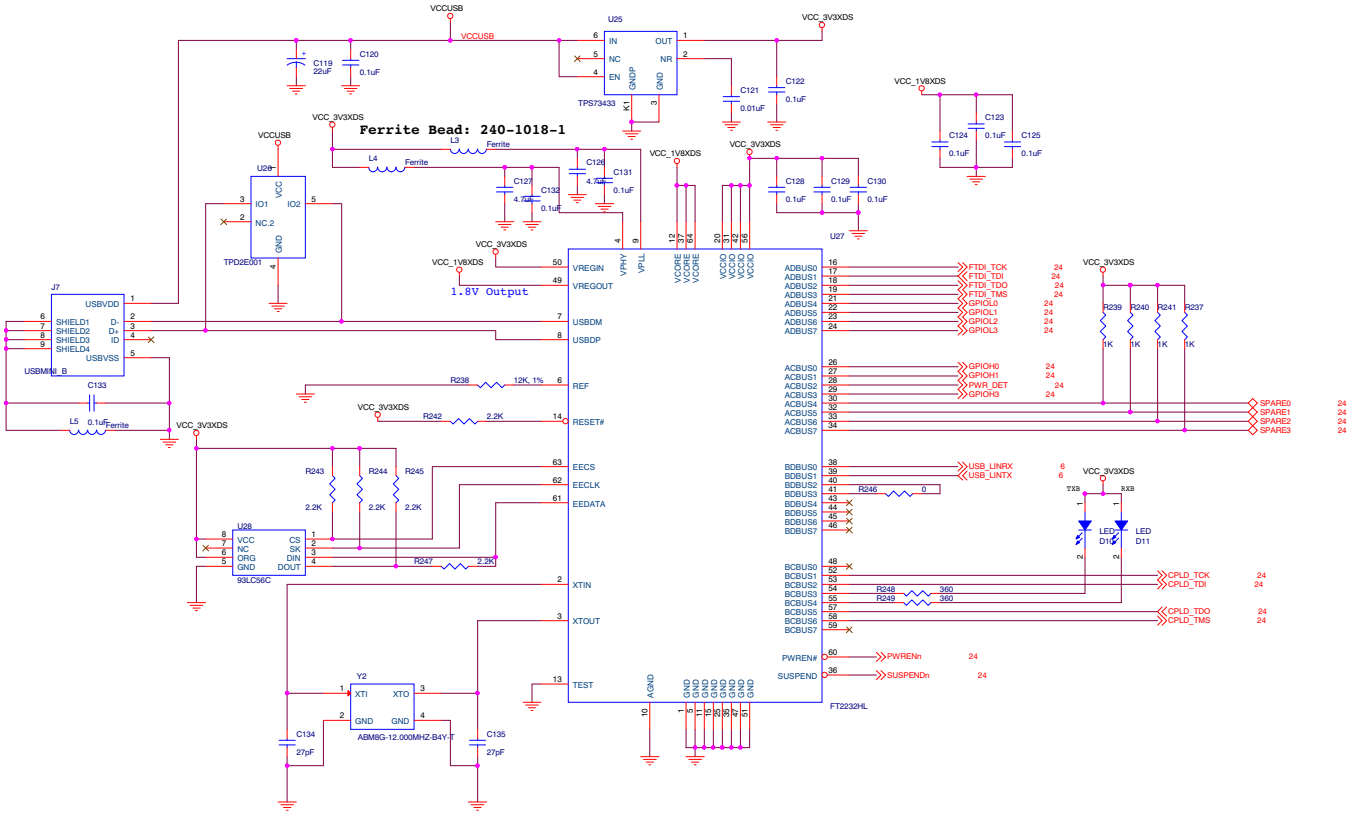


Figure 28. XDS100V2 FTDI2232 Schematic

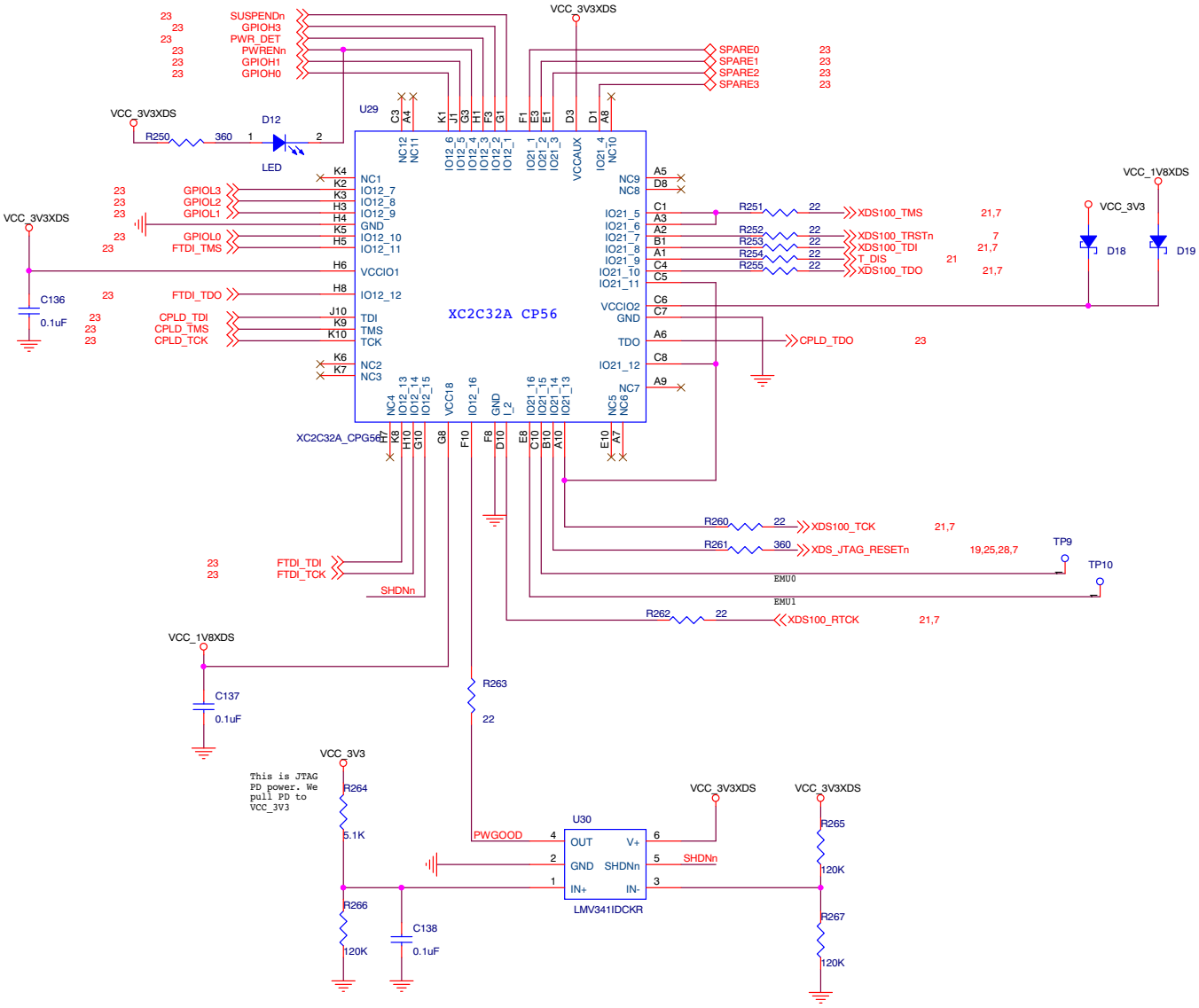


Figure 29. XDS100V2 CPLD Schematic

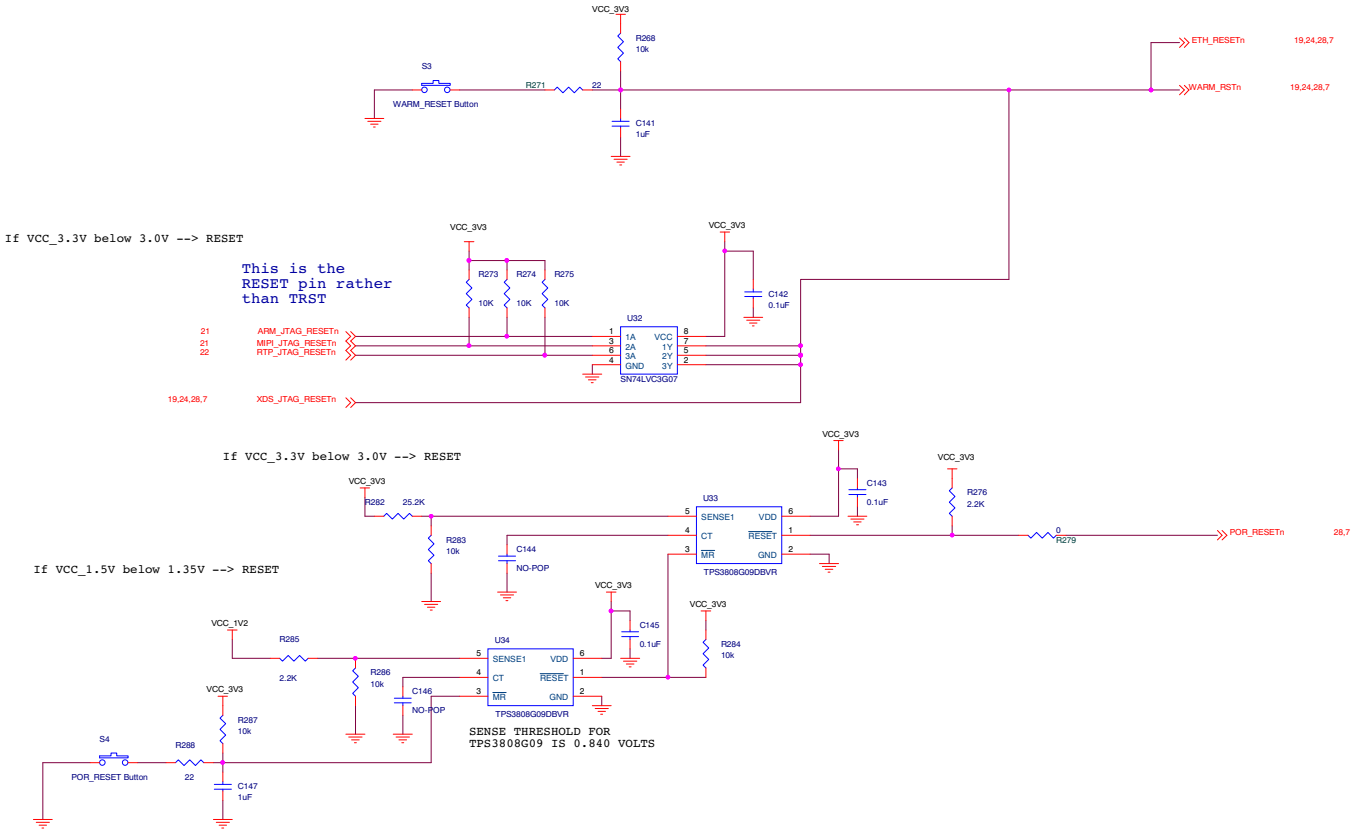


Figure 30. RESET Schematic

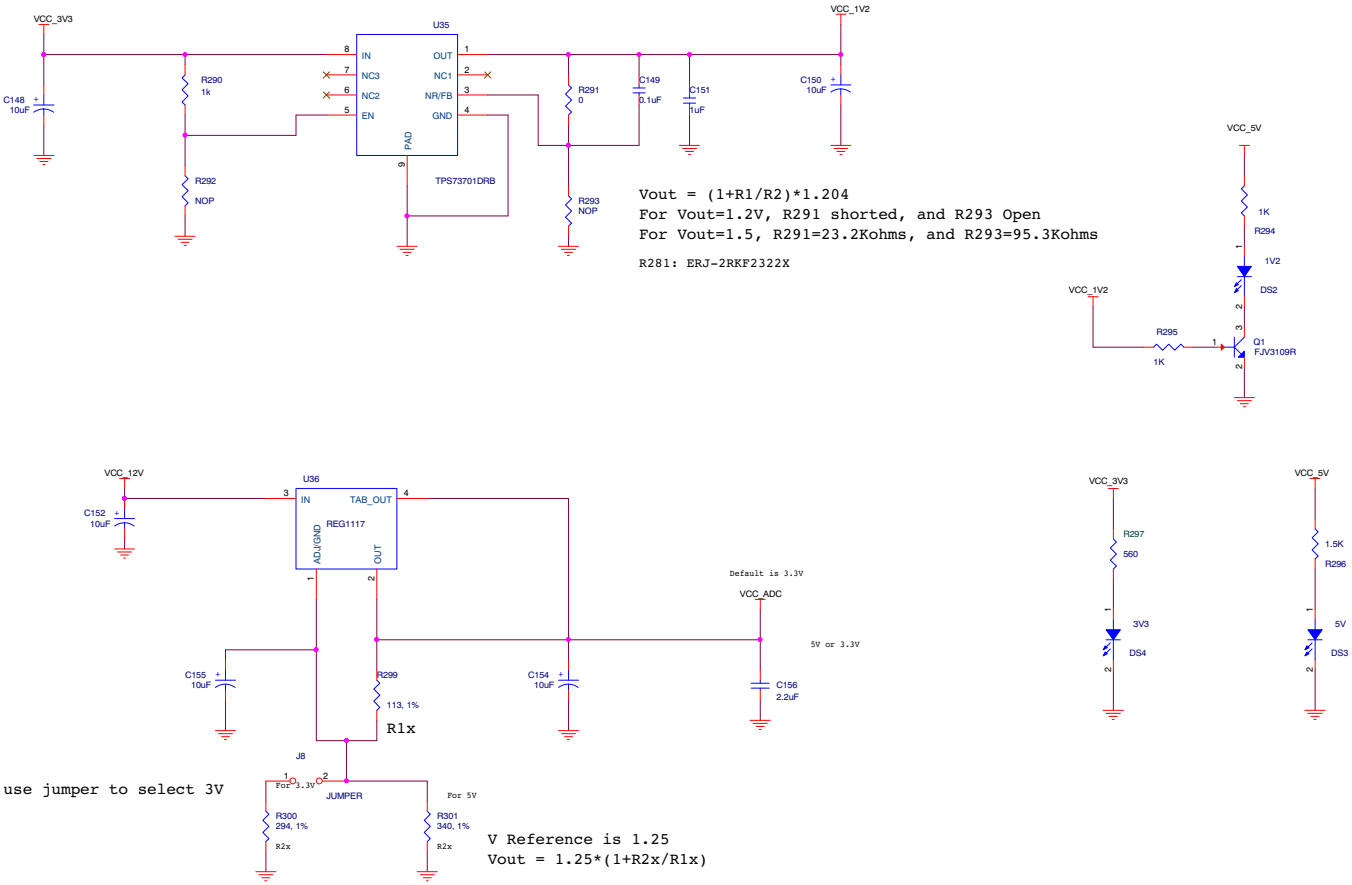


Figure 31. Power Supply Schematic

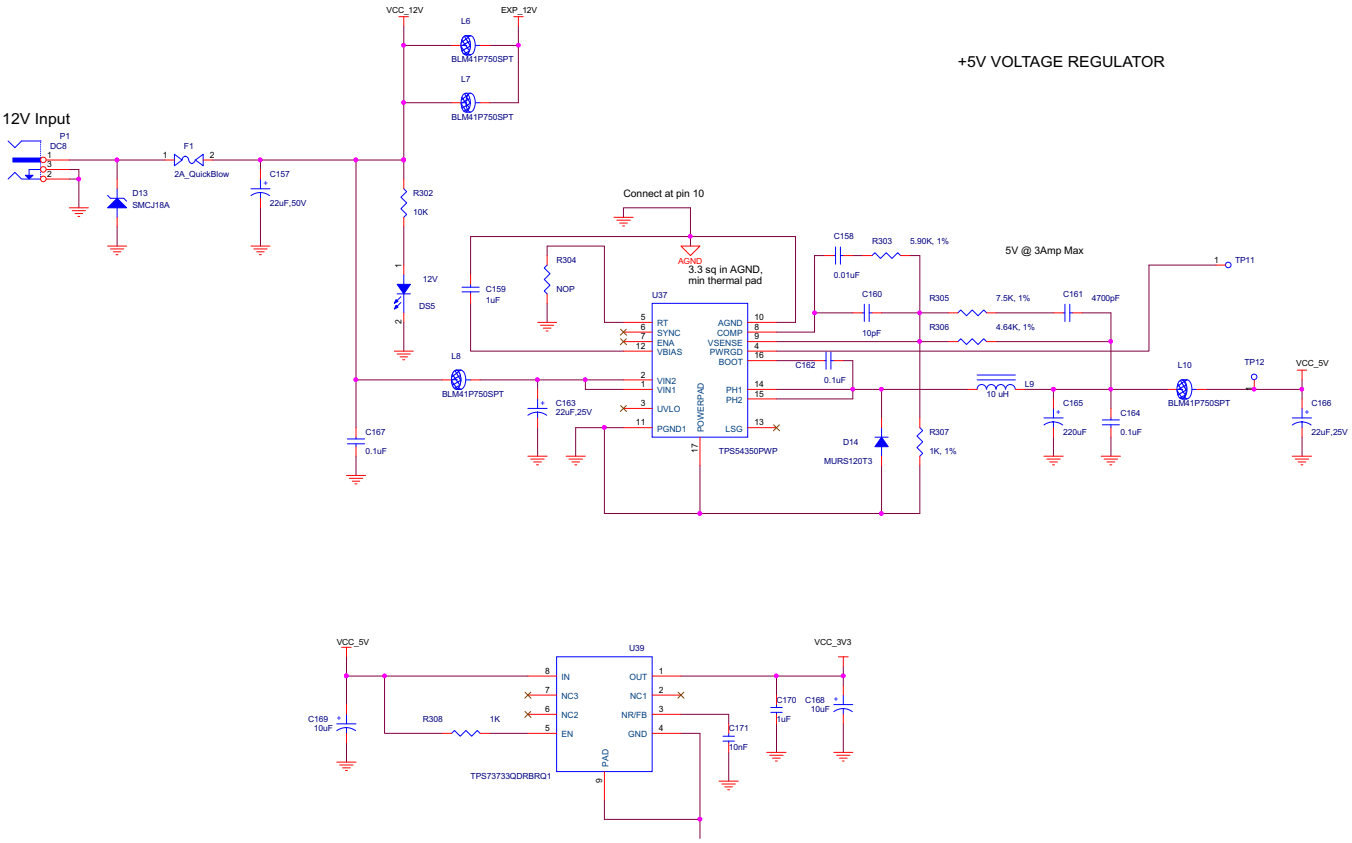


Figure 32. Power Inut Schematic

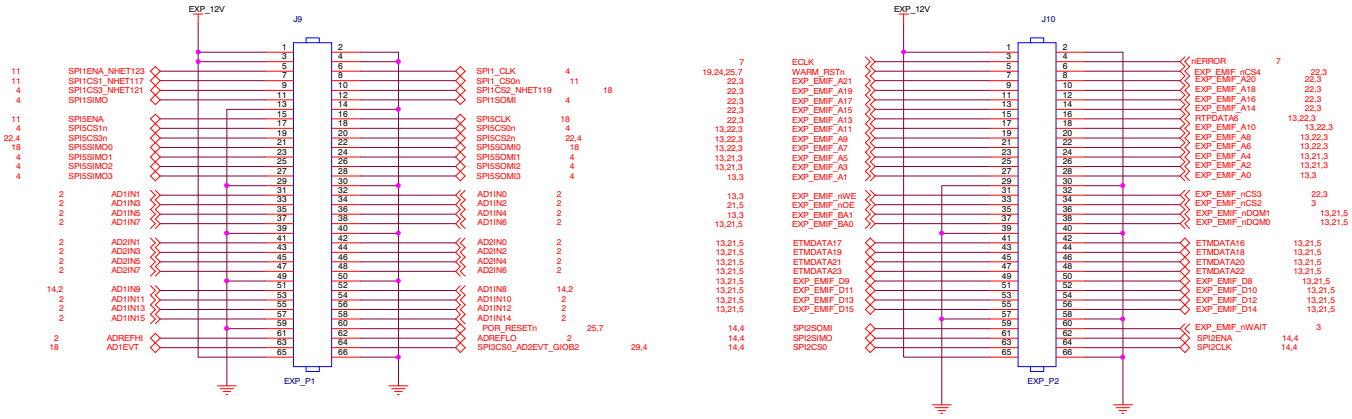


Figure 33. EXP P1 and EXP P2 Schematic

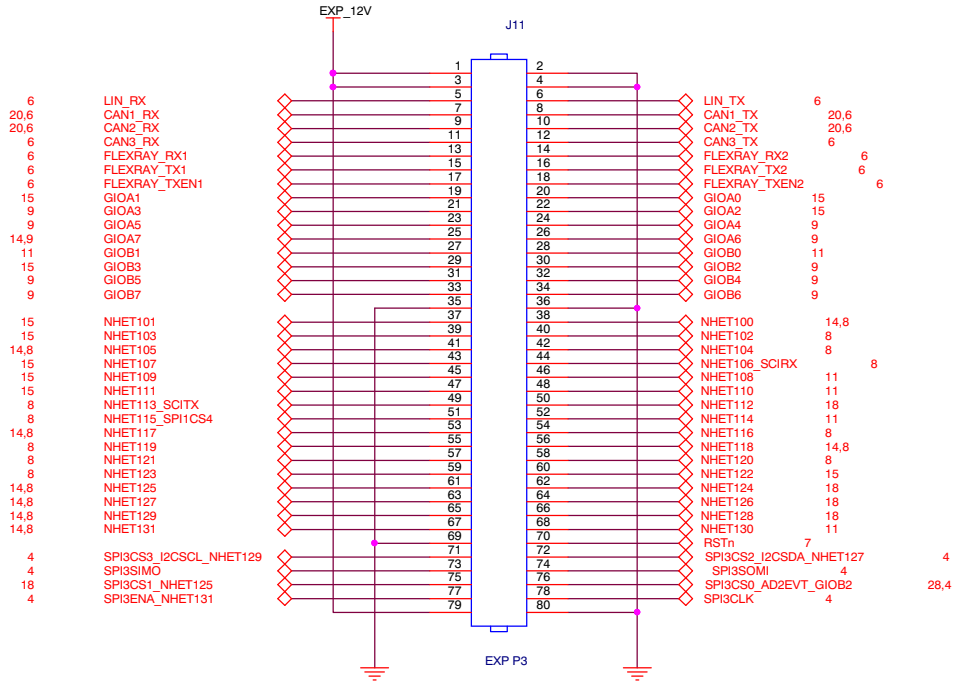


Figure 34. EXP P3 Schematic

4.2 Bill of Materials (BOM)

To download the bill of materials (BOM), see the design files at TIDM-ETHERNET-BOOTLOADER.

Table 2. Bill of Materials (BOM)

Item	Qty	Reference	Value	Part Description	Manufacturer	Manufacturer Part Number	Alternate Part	PCB Footprint
1	28	C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15,C16,C17,C19,C21,C22,C23,C24,C25,C26,C102,C103,C104,C105	NO-POP	CAP ceramic .1 µF 10 V X5R 0402	YAGEO (VA)	CC0402KRX5R6BB104		c0402
2	93	C18,C20,C30,C31,C32,C33,C35,C36,C37,C38,C39,C40,C42,C43,C44,C46,C48,C49,C50,C51,C52,C53,C54,C55,C56,C59,C60,C61,C62,C63,C64,C65,C67,C69,C70,C76,C77,C78,C79,C80,C81,C82,C84,C86,C88,C89,C90,C91,C92,C93,C94,C95,C96,C97,C98,C99,C100,C101,C108,C109,C110,C112,C113,C115,C116,C118,C120,C122,C123,C124,C125,C128,C129,C130,C131,C132,C133,C136,C137,C138,C139,C140,C142,C143,C145,C149,C153,C162,C164,C173,C174,C175,C177	0.1 µF	CAP CER .10 µF 16 V X5R 0402	Taiyo Yuden (VA)	EMK105BJ104KV-F		c0402
3	2	C27,C28	10 pF	CAP CERM 10PF 50 V C0G 0402	Taiyo Yuden (VA)	UMK105CG100DV-F		c0402
4	1	C29	22 pF	CAP CER 22PF 25 V NP0 0603	AVX Corporation (VA)	06033A220JAT2A		c0603
5	5	C34,C45,C58,C68,C119	22 µF	CAP TANTALUM 22 µF 6.3 V 10% SMD	AVX Corporation	TAJB226K006RNJ		c1210_pol
6	3	C41,C47,C66	22 µF	CAP CER 22 µF 6.3 V X5R 0805	Taiyo Yuden (VA)	JMK212BJ226MG-T		c0805
7	6	C57,C106,C121,C158,C172,C176	0.01 µF	CAP 10000PF 16 V ceramic 0402 SMD	Panasonic - ECG (VA)	ECJ-0EB1C103K		c0402
8	3	C75,C83,C107	10 µF	CAP CER 10 µF 6.3 V X5R 0603	Taiyo Yuden (VA)	JMK107BJ106MA-T		c0603
9	2	C85,C87	100 pF	CAP .10 µF 16 V ceramic X7R 0603	YAGEO (VA)	CC0603KRX7R7BB104		c0603
10	2	C111,C114	4.7 nF			VJ0402Y472KXJCW1BC		c0402
11	2	C126,C127	4.7 µF	CAP CER 4.7 µF 6.3 V X5R 0402	Murata Electronics (VA)	GRM155R60J475ME87D		c0402

Table 2. Bill of Materials (BOM) (continued)

Item	Qty	Reference	Value	Part Description	Manufacturer	Manufacturer Part Number	Alternate Part	PCB Footprint
12	2	C134,C135	27 pF	CAP 27PF 50 V ceramic 0402 SMD	Panasonic - ECG (VA)	ECJ-0EC1H270J		c0402
13	3	C141,C147,C159	1 µF	CAP ceramic 1 µF 10 V X5R 0402	Panasonic - ECG (VA)	ECJ-0EB1A105M		c0402
14	2	C144,C146	NO-POP					c0402
15	7	C148,C150,C152,C154,C155,C168,C169	10 µF	CAP TANT 10 µF 20 V 20% SMD	KEMET (VA)	T491A106M020AT		c1206_pol
16	2	C151,C170	1 µF	CAP CERM 1.0 µF 6.3 V X5R 0603	Taiyo Yuden (VA)	JMK107BJ105KK-T		c0603
17	1	C156	2.2 µF	CAP CER 2.2 µF 6.3 V X5R 0402	Taiyo Yuden (VA)	JMK105BJ225MV-F		c0402
18	1	C157	22 µF, 50 V	Capacitor TANT 22 µF 25 V 20% SMD	KEMET	T491D226M025AT		c7343_pol
19	1	C160	10 pF	CAP CER 10PF 50 V C0G 0603	TDK Corporation (VA)	C1608C0G1H100D		c0603
20	1	C161	4700 pF	CAP 4700PF 50 V ceramic X7R 0603	YAGEO (VA)	CC0603KRX7R9BB472		c0603
21	2	C163,C166	22 µF, 25 V	Capacitor TANT 22 µF 25 V 20% SMD	KEMET	T491D226M025AT		c7343_pol
22	1	C165	220 µF	Capacitor TANT 220 µF 10 V 10% SMD	KEMET	T491X227K010AT		c7343_pol
23	1	C167	0.1 µF	CAP .10 µF 50 V ceramic X7R 0805	YAGEO (VA)	CC0805KRX7R9BB104		c0805
24	1	C171	10 nF	CAP CER 10000PF 16 V X7R 0402	TDK Corporation	C1005X7R1C103M		c0402
25	1	DS1	JTAG_DIS	LED blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
26	1	DS2	1V2	LED blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
27	1	DS3	V5.0	LED Blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
28	2	DS4,DS5	3V3	LED blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
29	1	D1	RED	LED red TSS type SMD	Panasonic - SSG (VA)	LNJ212R8ARA		d0603
30	1	D2	BLUE	LED blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
31	1	D3	HET1_17	LED white high brighT USS 0603	Lite-On Inc	LTW-C193TS5		d0603
32	1	D4	HET1_31	LED white high bright USS 0603	Lite-On Inc	LTW-C193TS5		d0603
33	1	D5	HET1_00	LED white high bright USS 0603	Lite-On Inc	LTW-C193TS5		d0603
34	1	D6	HET1_25	LED white high bright USS 0603	Lite-On Inc	LTW-C193TS5		d0603
35	1	D7	HET1_18	LED white high bright USS 0603	Lite-On Inc	LTW-C193TS5		d0603
36	1	D8	HET1_29	LED white high bright USS 0603	Lite-On Inc	LTW-C193TS5		d0603
37	1	D9	100Mb	LED blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
38	2	D10,D11	LED	LED blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
39	1	D12	LED	LED blue high bright USS 0603	Lite-On Inc	LTST-C193TBKT-5A		d0603
40	1	D13	SMCJ18A	Diode TVS 18 V 1500W UNI 5% SMD	BOURNS INC (VA)	SMCJ18A		SMC-DO-214AB
41	1	D14	MURS120T3	Diode ultra fast 1A 200 V SMB	ON Semiconductor (VA)	MURS120T3G		SMB
42	2	D18,D19	DIODE SCHOTTKY	Diode SCHOTTKY 100 MA 30 V 1005	Comchip Technology (VA)	CDBF0130L		d1005_pol
43	1	E1	NFM21PC474R1C3D	Filter LC high freq .47 µF 0805	Murata Electronics (VA)	NFM21PC474R1C3D		NFM21P
44	1	F1	2A_QuickBlow	Fuse 2A 32 V FST 0603 leadfree	Littelfuse INC (VA)	0467002.NR		F0603

Table 2. Bill of Materials (BOM) (continued)

Item	Qty	Reference	Value	Part Description	Manufacturer	Manufacturer Part Number	Alternate Part	PCB Footprint
45	1	J1	J0011D21B	CONN PULSEJACK 1PORT 10/100B-TX	Pulse Electronics Corporation	J0011D21BNL		rj45-pulse_J0
46	2	J2,J3	CON3	Term block 3.5MM VERT 3POS PCB	On Shore Technology Inc	OSTTE030161		11mmx7mm
47	1	J4	ARM20PIN_JTAG	CONN header 20POS .100" SMD TIN	Samtec INC	TSM-110-01-T-DV		10x2
48	1	J6	NO-POP	CONN RECEPT 38POS .025 VERT SMD	Tyco Electronics Amp	2-5767004-2		SMC_MICTOR38
49	1	J7	USBMINI_B	CONN USB RCPT MINI B 5PS R/A SMD	JAE Electronics	DX2R005HN2E700		USB-MiniB
50	2	J8,J13	JUMPER	Jumper plug 2POS single row	Omron Electronics Inc-EMC DIV	XG8S-0231		2_54MMTHROUGHHOLE
51	1	J9	EXP_P1	CONN RCPT 2MM 66POS DL VERT PCB	Samtec Inc (VA)	MMS-133-01-T-DV		MMS_2mmx33
52	1	J10	EXP_P2	CONN RCPT 2MM 66POS DL VERT PCB	Samtec Inc (VA)	MMS-133-01-T-DV		MMS_2mmx33
53	1	J11	EXP P3	CONN RCPT 2MM 80POS DL VERT PCB	Samtec Inc	MMS-140-01-T-DV		MMS_2mmx40
54	1	J12	NO-POP	CONN RECEPT 38POS .025 VERT SMD	Tyco Electronics Amp	2-5767004-2		SMC_MICTOR38
55	1	J15	MicroSD Slot	CONN mini micro-SD 8PIN PCB gold	Amphenol Commercial Products	101-00660-68-6		MicroSD
56	1	J16	NO-POP	CONN USB JACK TYPE B horizon R/A	FCI	61729-1010BLF		USB-B
57	1	J18	NO-POP	CONN RCPT USB type A flag PCB	FCI	73725-0110BLF		USB-A
58	1	J19	ETM-MIPI	CONN RCPT HI-SPD .5MM 60POS DL	Samtec Inc	QSH-030-01-L-D-A		30x2
59	2	LED1,LED2	RGB LED	LED CHIP RGB 2.5X1.0X1.0MM SMD	Lumex Opto/Components Inc	SML-LX0404SIUPGUSB		RGB_LED
60	3	L1,L3,L4	Ferrite	Ferrite 500MA 600 Ω 0805 SMD	Laird-Signal Integrity Products (VA)	HZ0805E601R-10		L0805
61	2	L2,L5	Ferrite	Ferrite chip 220 Ω 2000MA 0805	Murata Electronics (VA)	BLM21PG221SN1D		L0805
62	3	L6,L7,L10	BLM41P750SPT	Ferrite 3A 114 Ωs 1806 SMD	Laird-Signal Integrity Products	HI1806N910R-10		L1806
63	1	L8	BLM41P750SPT	Ferrite 3A 114 Ωs 1806 SMD	Laird-Signal Integrity Products	HI1806N910R-10		L1806
64	1	L9	10 µH	INDUCTOR 10 µH 4.7A 20% SMD	Taiyo Yuden (VA)	NR10050T100M		NR10050
65	1	P1	DC8	CONN power jack 2.1MM	CUI Inc	PJ-002A		100438
66	1	Q1	FJV3109R	TRANS NPN LP 100 MA 30 V SOT23	On Semiconductor (VA)	BC848ALT1G		sot23-28x44
67	5	RN1,RN2,RN3,RN10,RN11	R_Pak8	RES array 22 Ω 5% 8 RES SMD	Panasonic - ECG (VA)	EXB-2HV220JV		EXB-2HVS
68	1	RN18	RPACK4-10K	RES array 10K Ω 5% 4 RES SMD	Panasonic - ECG (VA)	EXB-28V103JX		EXB-28VS
69	1	RN19	RPACK4-1K	RES array 1.0K Ω 5% 4 RES SMD	Panasonic - ECG (VA)	EXB-28V102JX		EXB-28VS
70	1	RN25	RPACK4-0	RES array 22 Ω 5% 4 RES SMD	Panasonic - ECG (VA)	EXB-28V220JX		EXB-28VS

Table 2. Bill of Materials (BOM) (continued)

Item	Qty	Reference	Value	Part Description	Manufacturer	Manufacturer Part Number	Alternate Part	PCB Footprint
71	60	R1,R2,R3,R4,R5,R6,R7,R8,R9,R10,R11,R12,R13,R14,R15,R16,R17,R18,R19,R20,R21,R22,R24,R25,R26,R27,R28,R29,R31,R87,R88,R89,R90,R94,R96,R98,R100,R102,R104,R106,R108,R121,R122,R123,R124,R125,R129,R130,R133,R134,R137,R145,R158,R169,R182,R183,R190,R219,R246,R279	0 Ω	RES 0.0 Ω 1/10W 0402 SMD	Panasonic - ECG	ERJ-2GE0R00X		r0402
72	3	R23,R30,R136	NP	RES 0.0 Ω 1/10W 0402 SMD	Panasonic - ECG	ERJ-2GE0R00X		r0402
73	38	R32,R33,R34,R35,R51,R52,R53,R55,R56,R57,R58,R59,R60,R71,R72,R81,R82,R83,R84,R91,R92,R126,R127,R128,R154,R156,R157,R168,R207,R273,R274,R275,R310,R382,R383,R384,R385,R386	10K Ω	RES 10K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ103X		r0402
74	52	R36,R37,R38,R39,R40,R41,R42,R43,R44,R45,R46,R47,R48,R49,R50,R61,R78,R79,R80,R93,R97,R161,R162,R171,R173,R251,R252,R253,R254,R255,R260,R262,R349,R362,R363,R364,R365,R366,R367,R368,R369,R370,R371,R372,R373,R374,R375,R376,R377,R378,R379,R380	22 Ω	RES 22 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ220X		r0402
75	8	R131,R237,R239,R240,R241,R290,R308,R387	1k Ω	RES 1.0K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ102X		r0402
76	2	R132,R138	100 Ω	RES 100 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ101X		r0402
77	13	R135,R194,R195,R197,R200,R205,R206,R209,R242,R243,R244,R245,R247	2.2K Ω	RES 2.20K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF2201X		r0402

Table 2. Bill of Materials (BOM) (continued)

Item	Qty	Reference	Value	Part Description	Manufacturer	Manufacturer Part Number	Alternate Part	PCB Footprint
78	5	R140,R141,R142,R143,R144	0.02 Ω	RESISTOR .020 Ω 1W 1% 2512	Panasonic - ECG (VA)	ERJ-M1WSF20MU		r2512
79	6	R146,R147,R149,R150,R152,R153	2.2K Ω	RES 680 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF2201X		r0402
80	1	R148	Thermal Resistor	Thermistor 100K Ω NTC 0603 SMD	Murata Electronics (VA)	NCP18WF104J03RB		r0603
81	4	R151,R159,R184,R312	100K Ω	RES 100K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ104X		r0402
82	1	R155	4.99k Ω	RES 4.99K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF4991X		r0402
83	2	R160,R187	20K Ω	RES 20K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ203X		r0402
84	2	R163,R164	15K Ω	RES 15K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ153X		r0402
85	3	R165,R178,R188	1M Ω	RES 1.0M Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ105X		r0402
86	1	R166	100K Ω	RES 100K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ104X		r0402
87	2	R177,R189	1.5K Ω	RES 1.5K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ152X		r0402
88	1	R193	NP	RES 2.20K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF2201X		r0402
89	6	R196,R208,R248,R249,R250,R261	360 Ω	RES 360 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ361X		r0402
90	1	R199	4.87K Ω, 1%	RES 4.87K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF4871X		r0402
91	4	R201,R202,R203,R204	49.9 Ω 1%	RES 49.9 Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF49R9X		r0402
92	4	R210,R235,R256,R311	0	RES 0.0 Ω 1/10W 0402 SMD	Panasonic - ECG (VA)	ERJ-2GE0R00X		r0402
93	1	R211	NO-POP	RES 2.20K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF2201X		r0402
94	9	R212,R216,R220,R234,R268,R283,R284,R286,R287	10k Ω	RES 10K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ103X		r0402
95	4	R213,R214,R217,R218	62 Ω	RES 62 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ620X		r0402
96	1	R215	NO-POP	RES 10K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ103X		r0402
97	10	R221,R222,R223,R224,R225,R226,R227,R263,R271,R288	22 Ω	RES 22 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ220X		r0402
98	7	R228,R229,R230,R231,R232,R233,R292	NO-POP					r0402
99	1	R236	220 Ω	RES 220 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ221X		r0402
100	1	R238	12K Ω, 1%	RES 12.0K Ω 1/10W 1% 0603 SMD	Panasonic - ECG (VA)	ERJ-3EKF1202V		r0603
101	1	R264	5.1K Ω	RES 5.1K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ512X		r0402
102	3	R265,R266,R267	120K Ω	RES 120K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ124X		r0402
103	1	R276	2.2K Ω	RES 2.2K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ222X		r0402
104	1	R282	25.2K Ω	RES 25.5K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2RKF2552X		r0402

Table 2. Bill of Materials (BOM) (continued)

Item	Qty	Reference	Value	Part Description	Manufacturer	Manufacturer Part Number	Alternate Part	PCB Footprint
105	1	R285	2.2K Ω	RES 2.2K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ222X		r0402
106	1	R291	0 Ω	RES 0.0 Ω 1/10W 0402 SMD	Panasonic - ECG (VA)	ERJ-2GE0R00X		r0402
107	1	R293	NO-POP	RES 95.3K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)			r0402
108	2	R295,R435	1K Ω	RES 1.0K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ102X		r0402
109								
110	1	R299	113 Ω, 1%	RES 113 Ω 1/4W 1% 1206 SMD	Panasonic - ECG (VA)	ERJ-8ENF1130V		r1206
111	1	R300	294 Ω, 1%	RES 294 Ω 1/10W 1% 0603 SMD	Panasonic - ECG (VA)	ERJ-3EKF2940V		r0603
112	1	R301	340 Ω, 1%	RES 340 Ω 1/10W 1% 0603 SMD	Panasonic - ECG (VA)	ERJ-3EKF3400V		r0603
113	1	R302	10K Ω	RES 5.6K Ω 1/10W 5% 0603 SMD	Panasonic - ECG (VA)	ERJ-3GEYJ103V		r0603
114	1	R303	5.90K Ω, 1%	RES 5.90K Ω 1/10W 1% 0603 SMD	Panasonic - ECG (VA)	ERJ-3EKF5901V		r0603
115	1	R304	NO-POP	RES 10K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ103X		r0402
116	1	R305	7.5K Ω, 1%	RES 7.50K Ω 1/10W 1% 0603 SMD	Panasonic - ECG (VA)	ERJ-3EKF7501V		r0603
117	1	R306	4.64K Ω, 1%	RES 4.64K Ω 1/10W 1% 0603 SMD	Panasonic - ECG (VA)	ERJ-3EKF4641V		r0603
118	1	R307	1K Ω, 1%	RES 1.00K Ω 1/10W 1% 0603 SMD	Panasonic - ECG (VA)	ERJ-3EKF1001V		r0603
119	1	S1	Push Button			SKRKAHE010		SW-SMT2
120	1	S2	DIP_SWITCH_4	Switch dip 4POS half pitch SMD	C&K Components (VA)	TDA04H0SB1R		DIP_SWITCH_4
121	1	S3	WARM_RESET Button			SKRKAHE010		SW-SMT2
122	1	S4	POR_RESET Button			SKRKAHE010		SW-SMT2
123	18	TP1,TP2,TP3,TP8, TP9,TP10,TP11,TP 12,TP14,TP15,TP1 6,TP17,TP18,TP19 ,TP20,TP21,TP22, TP23	TestPoint1					tp1-6040
124	4	TP4,TP5,TP6,TP7	TestPoint1					tp1-10080
125	1	T1	IRLML6302	MOSFET P-CH 20 V 780MA SOT-23	International Rectifier (VA)	IRLML6302TRPBF		SOT23
126	1	U1	TMS570LS3x			TMS570LS3x		BGA337
127	1	U2	SN74LVC1G07DCK	IC BUFF/DVR non-invert SC705	Texas Instruments (VA)	SN74LVC1G07DCKR		SC70-5
128	1	U8	IS42S16400F-7BL	IC SDRAM 64M-bit 143 MHZ 54 BGA	ISSI	IS42S16400F-7BL		54FBGA
129	1	U9	TEMT6000	Ambient light sensor 1206 SMD	VISHAY/Semiconductors (VA)	TEMT6000X01		4mmL2mmW
130	1	U10	SN74CBT16214DGGR	IC 1-OF-3 FET MUX/DEMUX 56-TSSOP	Texas Instruments (VA)	SN74CBT16214DGGR		TSSOP56
131	2	U12,U18	NO-POP	IC PWR DIST switch ADJ SOT23-6	Texas Instruments	TPS2553DBVT		SOT-23-6
132	2	U13,U15	NO-POP	IC SRL bus TXRX UNVRSL 16-VQFN	Texas Instruments (VA)	TUSB1105RGTR		QFN-RGT
133	3	U19,U41,U42	SN74CBTLV3257RGYR	IC 4-bit 1-4 FET MUX/DEMUX 16VQFN	Texas Instruments (VA)	SN74CBTLV3257RGYR		16QFN
134	1	U20	DP83640	TXRX PHY IEEE 1PORT 1588 48-LQFP	National Semiconductor	DP83640TVV/NOPB		48LQFP
135	2	U21,U22	SN65HVDA541	IC TXRX CAN W/STANDBY 5 V 8SOIC	Texas Instruments (VA)	HVDA541QDRQ1		8SOIC

Table 2. Bill of Materials (BOM) (continued)

Item	Qty	Reference	Value	Part Description	Manufacturer	Manufacturer Part Number	Alternate Part	PCB Footprint
136	1	U24	SN74AHC1G14	IC SGL SCHMT-TRG INV GATE SC70-5	Texas Instruments (VA)	SN74AHC1G14DCKR		SC70-5
137	1	U25	TPS73433	IC LDO REG 3.3 V 250MA 6-SON	Texas Instruments (VA)	TPS73433DRVR		TI_SON6-PWP
138	1	U26	TPD2E001	IC ESD-PROT array 2CH SOT-5	Texas Instruments (VA)	TPD2E001DRLR		SOT5
139	1	U27	FT2232HL	IC USB UART/FIFO dual HS 64LQFP	FTDI (VA)	FT2232HL-REEL		64LQFP
140	1	U28	93LC56C-I/SN	IC EEPROM 1K bit 2 MHZ 8SOIC	Microchip Technology	93LC56C-I/SN		8SOIC
141	1	U29	XC2C32A_CPG56	IC CR-II CPLD 32MCELL 56-CSBGA	XILINX INC	XC2C32A-6CPG56C		CFG56
142	1	U30	LMV341IDCKR	IC OPAMP GP R-R 7MHZ SGL SOT23-6	Texas Instruments (VA)	LMV341IDCKR		DCK_SC70
143	1	U32	SN74LVC3G07	IC BUFF/DVR TRPL N-INV 8VSSOP	Texas Instruments (VA)	SN74LVC3G07DCUR		VSSOP8
144	2	U33,U34	TPS3808G09DBVR	IC volt supervisor 0.9 V SOT23-6	Texas Instruments (VA)	TPS3808G09DBVR		SOT-23-6
145	1	U35	TPS73701DRB	IC REG LDO CAP free 8-SON	Texas Instruments (VA)	TPS73701DRBR		DRB_SON8
146	1	U36	REG1117	IC low dropout ADJ REG SOT223-4	Texas Instruments	REG1117		SOT-223
147	1	U37	TPS54350PWP	IC sync buck PWM CONV 16-HTSSOP	Texas Instruments	TPS54350PWP		PSOP16T
148	1	U39	TPS73733QDRBRQ1	IC LDO REG 1A 3.3 V 8-SON	Texas Instruments (VA)	TPS73733QDRBRQ1		DRB_SON8
149	3	U43,U44,U45	SN74CBTLV3257RGYR	IC 4-bit 1-4 FET MUX/DEMUX 16VQFN	Texas Instruments (VA)	SN74CBTLV3257RGYR		VQFN16
150	1	U46	SN74LVC1G08	IC SNGL 2IN POS-AND gate SOT-5	Texas Instruments (VA)	SN74LVC1G08DRLR		SOT-553
151	1	U47	SN74CBTLV3245ARGY	IC OCTAL FET bus SW LV 20-VQFN	Texas Instruments (VA)	SN74CBTLV3245ARGYR		RGY_QFN20
152	1	Y1	16 MHz	Crystal 16.000 MHZ 18PF SMD	TXC Corporation (VA)	7A-16.000MAAJ-T		SMD2
153	1	Y2	ABM8G-12.000MHZ-B4Y-T	Crystal 12.000 MHZ 10 PF SMD	ABRACON Corporation (VA)	ABM8G-12.000MHZ-B4Y-T		ABM8G-SMT4
154	1	Y3	ASEM1-25.000MHZ-LC-T	OSC MEMS 25.000 MHZ 3.3 V SMD	ABRACON Corporation	ASEM1-25.000MHZ-LC-T		ASEM-SMT4
155	1	R313	NO-POP	RES 2.2K Ω 1/10W 1% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ222X		r0402
156	2	R180,R181	NO-POP	RES 15K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ153X		r0402
157	1	J17	NO-POP	CONN RCPT USB type A FLAG PCB	FCI	73725-0110BLF		USB-A
158	1	c117	NO-POP	CAP CER .10 µF 16 V X5R 0402	Taiyo Yuden (VA)	EMK105BJ104KV-F		c0402
159	1	R294	1K Ω	RES 1.0K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ102X		r0402
160	1	R296	1.5K Ω	RES 1.5K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ152X		r0402
161	1	R297	560 Ω	RES 560 Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ561X		r0402
162	1	Q2	IRLML6346	MOSFET N-CH 30 V 3.4A SOT23	International Rectifier (VA)	IRLML6346TRPBF		SOT23
163	1	R139	1K Ω	RES 1.0K Ω 1/10W 5% 0402 SMD	Panasonic - ECG (VA)	ERJ-2GEJ102X		r0402
164	1	C178	1 µF	CAP ceramic 1 µF 10 V X5R 0402	Panasonic - ECG (VA)	ECJ-0EB1A105M		c0402

5 References

1. TMS570LS3137ZWT 16/32-Bit RISC Flash Microcontroller Data Sheet (SPNS160)
2. *F021 Flash API User's Guide* (SPNU501)

6 About the Author

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