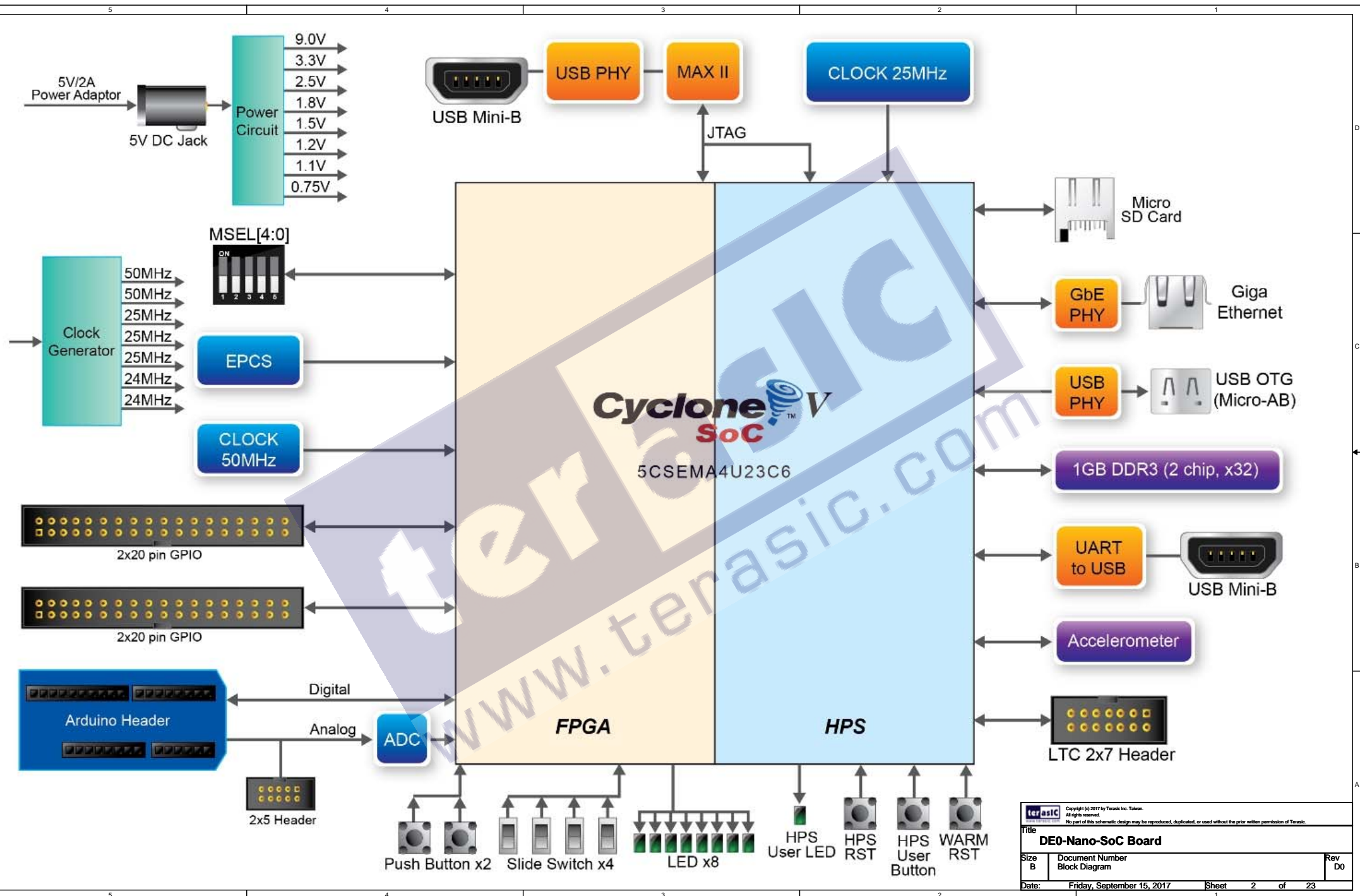


Cyclone V SoC Development & Education Board (DE0-Nano-SoC)

PAGE	CONTENT
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05	FPGA IO Bank 7 (HPS Peripheral Device)
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07	FPGA Configuration and EPCS device
08	FPGA Power
09	FPGA Decoupling
10	USB Blaster II
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13	HPS Peripheral : UART to USB and SD Card Socket
14	HPS Peripheral : USB OTG
15	HPS Peripheral : Gigabit Ethernet
16	HPS Peripheral : Accelerometer & LTC Expansion Header
17	HPS Peripheral : Reset Circuit, Button and LED
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22	Power - 2.5V, 3.3V
23	Power - 1.2V, 1.5V, 1.8V, 9V
24	



U1I CYCLONE V SoC BANK 3

Bank 3A
VCCIO = 3.3V

Y11 IO_3A/PR_ERROR/DIFFIO_RX_B7P
AA11 IO_3A/PR_DONE/DIFFIO_RX_B7N
AD5 IO_3A/DIFFIO_TX_B8P/DQ1B
AE6 IO_3A/PR_READY/DIFFIO_TX_B8N/DQ1B

Bank 3B
VCCIO = 3.3V

GPIO_0_D21 AE4 IO_3B/DIFFIO_TX_B9P/B_WEN/DQ2B
GPIO_0_D18 AF4 IO_3B/DIFFIO_TX_B9N/GND
GPIO_0_D28 AD10 IO_3B/DIFFIO_RX_B10P/B_A_14/DQ2B
GPIO_0_D29 AE9 IO_3B/DIFFIO_RX_B10N/B_A_15/DQ2B
GPIO_0_D23 T11 IO_3B/DIFFIO_RX_B11P/B_CSN_0/DQS2B
GPIO_0_D9 U11 IO_3B/DIFFIO_RX_B11N/B_CSN_1/DQS2B
GPIO_0_D24 AE7 IO_3B/DIFFIO_TX_B12P/B_A_12
GPIO_0_D3 AF8 IO_3B/DIFFIO_TX_B12N/B_A_13/DQ2B
GPIO_0_D27 AE8 IO_3B/DIFFIO_TX_B13P/B_A_10/DQ2B
GPIO_0_D26 AF9 IO_3B/DIFFIO_TX_B13N/B_A_11/DQ2B
GPIO_0_D30 AD11 IO_3B/DIFFIO_RX_B14P/B_A_8/DQ2B
GPIO_0_D33 AE11 IO_3B/DIFFIO_RX_B14N/B_A_9/DQ2B

IO_3B/DIFFIO_TX_B17P/B_BA_0/DQ3B
IO_3B/DIFFIO_TX_B17N/GND
IO_3B/DIFFIO_RX_B18P/B_BA_1/DQ3B
IO_3B/DIFFIO_RX_B18N/B_BA_2/DQ3B
IO_3B/DIFFIO_RX_B19P/B_CK/DQS3B
IO_3B/DIFFIO_RX_B19N/B_CKN/DQS3B
IO_3B/DIFFIO_TX_B20P/B_A_6
IO_3B/DIFFIO_TX_B20N/B_A_7/DQ3B
IO_3B/DIFFIO_RX_B22P/B_A_4/DQ3B
IO_3B/DIFFIO_RX_B22N/B_A_5/DQ3B

GPIO_0_D20 AF5 IO_3B/DIFFIO_TX_B16P/B_CASN/DQ2B
GPIO_0_D25 AF6 IO_3B/DIFFIO_TX_B16N/B_RASN/DQ2B

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U1K CYCLONE V SoC BANK 5

Bank 5A
VCCIO = 3.3V

LED4 AF26 IO_5A/RZQ_1/DIFFIO_TX_R1P/DQ1R
LED5 AE26 IO_5A/PR_REQUEST/DIFFIO_TX_R1N/DQ1R

AD26 IO_5A/CVP_CONFDONE/DIFFIO_TX_R3N/DQ1R
Y17 IO_5A/DIFFIO_RX_R4P/DQ1R
Y18 IO_5A/DIFFIO_RX_R4N/DQ1R

IO_5A/DIFFIO_RX_R6P/DQS1R
IO_5A/DIFFIO_RX_R6N/DQS1R
IO_5A/DIFFIO_TX_R7P/DQ1R
IO_5A/DIFFIO_TX_R7N
IO_5A/DIFFIO_RX_R8P/DQ1R
IO_5A/DIFFIO_RX_R8N/DQ1R

5CSEMA4U23C6N

User Interface (FPGA)

20 KEY[1..0]
20 SW[3..0]
20 LED[7..0]

GPIO

6,7,19 GPIO_0_D[35..0]
6,19 GPIO_1_D[35..0]

Arduino Digital Interface

19 Arduino_IO[15..0]
19 Arduino_Reset_n

AF7 GPIO_0_D1
AG6 GPIO_0_D19
AF11 GPIO_0_D34
AF10 GPIO_0_D31
T13 GPIO_0_D22
T12 GPIO_0_D11
AH3 GPIO_0_D16
AH2 GPIO_0_D17

AE12 GPIO_0_D35
AD12 GPIO_0_D32

AH6 GPIO_0_D13
AH5 GPIO_0_D12

Y16 LED6
W15 LED0
AA24 LED1
AA23 LED7
V16 LED2
V15 LED3

U1J CYCLONE V SoC BANK 4

Bank 4A
VCCIO = 3.3V

Arduino_Reset_n AH7
Arduino_IO6 AG8

Arduino_IO0 AG13
Arduino_IO1 AF13
Arduino_IO4 U14
Arduino_IO5 U13
Arduino_IO3 AG9
Arduino_IO7 AH8
Arduino_IO2 AG10
Arduino_IO14 AH9
Arduino_IO10 AF15
Arduino_IO9 AE15

IO_4A/RZQ_0/DIFFIO_TX_B25N
IO_4A/DIFFIO_TX_B25P/B_DQ_2/DQ4B
IO_4A/DIFFIO_RX_B26P/B_DQ_1/DQ4B
IO_4A/DIFFIO_RX_B26N/B_DQ_0/DQ4B
IO_4A/DIFFIO_RX_B27P/B_DQS_0/DQS4B
IO_4A/DIFFIO_RX_B27N/B_DQSN_0/DQSN4B
IO_4A/DIFFIO_TX_B28P/B_ODT_0
IO_4A/DIFFIO_TX_B28N/B_DQ_3/DQ4B
IO_4A/DIFFIO_TX_B29P/B_DQ_6/DQ4B
IO_4A/DIFFIO_TX_B29N/B_ODT_1/DQ4B
IO_4A/DIFFIO_RX_B30P/B_DQ_5/DQ4B
IO_4A/DIFFIO_RX_B30N/B_DQ_4/DQ4B

Arduino_IO15 AG11
Arduino_IO12 AH11

IO_4A/DIFFIO_TX_B32P/B_DM_0/DQ4B
IO_4A/DIFFIO_TX_B32N/B_DQ_7/DQ4B

Arduino_IO13 AH12

IO_4A/DIFFIO_TX_B33P/B_DQ_10/DQ5B

Arduino_IO8 AF17
Arduino_IO11 AG16
W14
V13
AG14
AH13
AG15
AH14
AD17
AE17

IO_4A/DIFFIO_RX_B34P/B_DQ_9/DQ5B
IO_4A/DIFFIO_RX_B34N/B_DQ_8/DQ5B
IO_4A/DIFFIO_RX_B35P/B_DQS_1/DQ5B
IO_4A/DIFFIO_RX_B35N/B_DQSN_1/DQSN5B
IO_4A/DIFFIO_TX_B36P/B_CKE_1
IO_4A/DIFFIO_TX_B36N/B_DQ_11/DQ5B
IO_4A/DIFFIO_TX_B37P/B_DQ_14/DQ5B
IO_4A/DIFFIO_TX_B37N/B_CKE_0/DQ5B
IO_4A/DIFFIO_RX_B38P/B_DQ_13/DQ5B
IO_4A/DIFFIO_RX_B38N/B_DQ_12/DQ5B

KEY0 AH17
KEY1 AH16

IO_4A/DIFFIO_TX_B40P/B_DM_1/DQ5B
IO_4A/DIFFIO_TX_B40N/B_DQ_15/DQ5B

IO_4A/DIFFIO_TX_B57P/B_DQ_34/DQ8B
IO_4A/DIFFIO_RX_B58P/B_DQ_33/DQ8B
IO_4A/DIFFIO_RX_B58N/B_DQ_32/DQ8B
IO_4A/DIFFIO_RX_B59P/B_DQS_4/DQ8B
IO_4A/DIFFIO_RX_B59N/B_DQSN_4/DQSN8B
IO_4A/DIFFIO_TX_B60N/B_DQ_35/DQ8B
IO_4A/DIFFIO_TX_B61P/B_DQ_38/DQ8B
IO_4A/DIFFIO_TX_B61N/GND/DQ8B
IO_4A/DIFFIO_RX_B62P/B_DQ_37/DQ8B
IO_4A/DIFFIO_RX_B62N/B_DQ_36/DQ8B

IO_4A/DIFFIO_TX_B64P/B_DM_4/DQ8B
IO_4A/DIFFIO_TX_B64N/B_DQ_39/DQ8B

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U1N CYCLONE V SoC BANK 8

Bank 8A
VCCIO = 3.3V

SW0 L10
SW1 L9
SW2 H6
SW3 H5

IO_8A/DIFFIO_RX_T21P
IO_8A/DIFFIO_RX_T21N
IO_8A/DIFFIO_TX_T22P
IO_8A/DIFFIO_TX_T22N

IO_8A/DIFFIO_RX_T23P
IO_8A/DIFFIO_RX_T23N
IO_8A/DIFFIO_TX_T24N

AF18 GPIO_1_D21

AE19 GPIO_1_D20
AD19 GPIO_1_D22
AA19 GPIO_1_D15
AA18 GPIO_1_D34
AG18 GPIO_1_D13
AH18 GPIO_1_D31
AG19 GPIO_1_D10
AH19 GPIO_1_D28
AE20 GPIO_1_D23
AD20 GPIO_1_D25

AF20 GPIO_1_D11
AG20 GPIO_1_D9

AG21 GPIO_1_D30

AF22 GPIO_1_D26
AF21 GPIO_1_D8
AD23 GPIO_1_D32
AE22 GPIO_1_D7

AH21 GPIO_1_D29
AH23 GPIO_1_D18
AH22 GPIO_1_D27
AG23 GPIO_1_D19
AF23 GPIO_1_D6

AG24 GPIO_1_D16
AH24 GPIO_1_D5

AG26 GPIO_1_D4

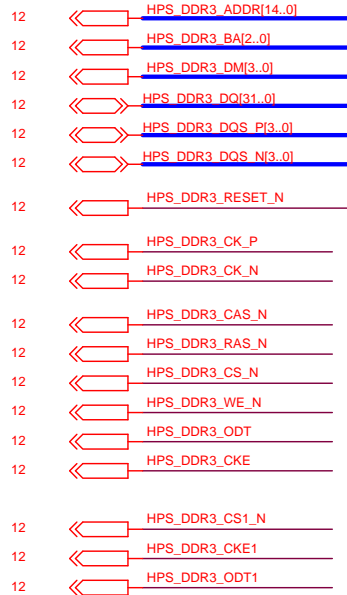
AE24 GPIO_1_D24
AE23 GPIO_1_D33
AC22 GPIO_1_D35
AC23 GPIO_1_D12

AH26 GPIO_1_D14
AG28 GPIO_1_D1
AH27 GPIO_1_D3
AF25 GPIO_1_D17
AG25

AF27
AF28

5CSEMA4U23C6N

DDR3 Interface (HPS)

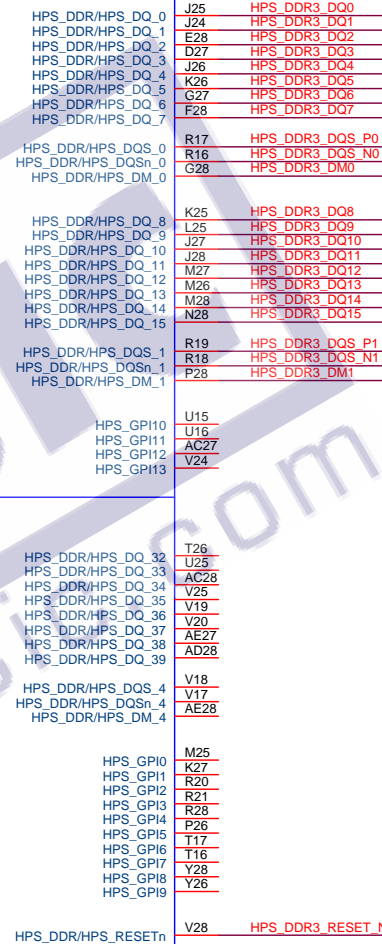
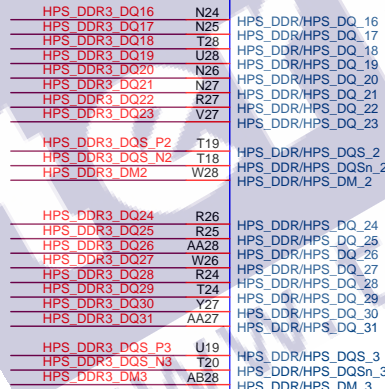


CYCLONE V SoC BANK 6 (HPS)

Bank 6A
VCCIO = 1.5V

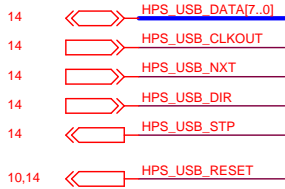


Bank 6B
VCCIO = 1.5V

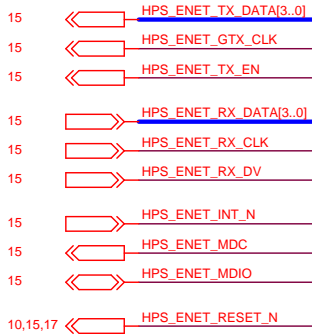


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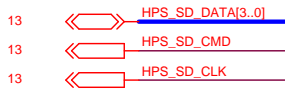
UBS PHY Interface (ULPI)



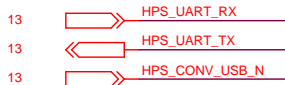
Ethernet PHY Interface (RGMII)



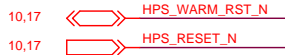
SD Card Interface



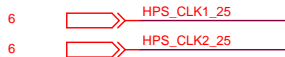
UART Interface



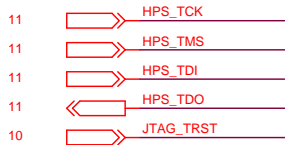
HPS Reset



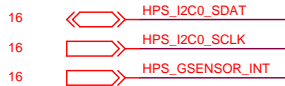
HPS Clock



HPS JTAG INTERFACE



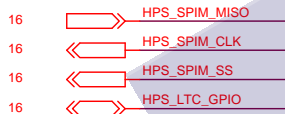
Accelerometer Interface



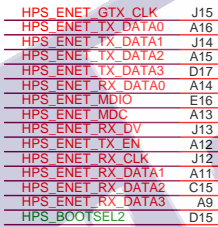
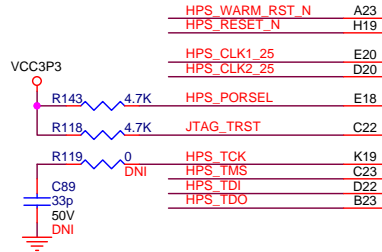
LTC Interface



HPS Key and LED



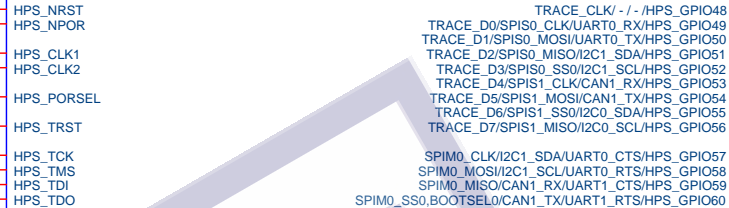
HPS Key and LED



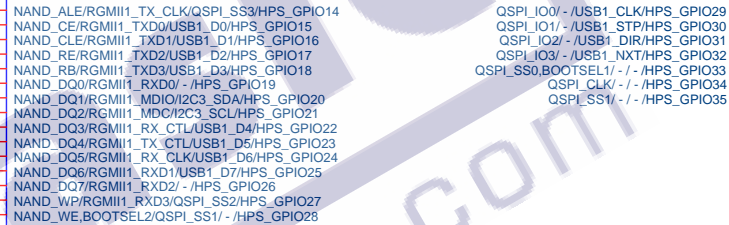
U1M

CYCLONE V SoC BANK 7 (HPS)

Bank 7A
VCCIO = 3.3V



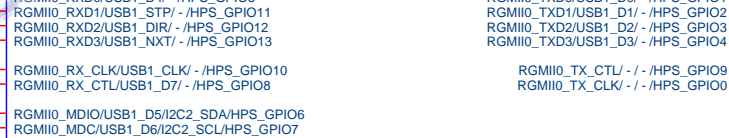
Bank 7B
VCCIO = 3.3V



Bank 7C
VCCIO = 3.3V

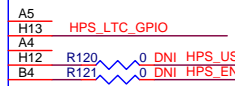
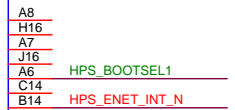
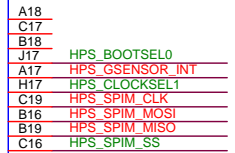
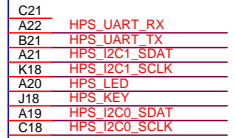
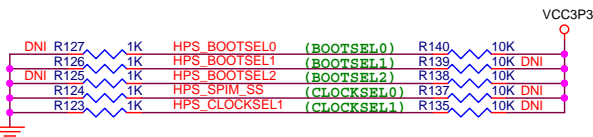


Bank 7D
VCCIO = 3.3V

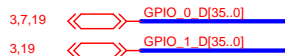


5CSEMA4U23C6N

Default Setting: BOOTSEL[2:0]=101 (Boot from SD CARD)
CLKSEL[1:0] =00



GPIO



Clock from MAX2



U1B

CYCLONE V SoC Clock

Bank 3B

FPGA_CLK1_50 V11
CLK_FPGA_24 W11
GPIO_0_D0 V12
GPIO_0_D2 W12

IO_3B/CLK0P,FPLL_BL_FBP/DIFFIO_RX_B15P
IO_3B/CLK0N,FPLL_BL_FBN/DIFFIO_RX_B15N
IO_3B/CLK1P/DIFFIO_RX_B23P
IO_3B/CLK1N/DIFFIO_RX_B23N

IO_3B/FPLL_BL_CLKOUT0,FPLL_BL_CLKOUTP,FPLL_BL_FB/DIFFIO_TX_B21P/B_A_2/DQ3B
IO_3B/FPLL_BL_CLKOUT1,FPLL_BL_CLKOUTN/DIFFIO_TX_B21N/B_A_3/DQ3B

AG5 GPIO_0_D15
AH4 GPIO_0_D14

Bank 4A

CLK_UB2_24 R158 0

FPGA_CLK2_50 Y13
GPIO_1_D0 AA13
GPIO_1_D2 Y15
GPIO_1_D2 AA15

IO_4A/CLK2P/DIFFIO_RX_B31P
IO_4A/CLK2N/DIFFIO_RX_B31N
IO_4A/CLK3P/DIFFIO_RX_B39P
IO_4A/CLK3N/DIFFIO_RX_B39N

Bank 8A

FPGA_CLK1_50 R159 0 FPGA_CLK3_50 E11
D11
D12
C12

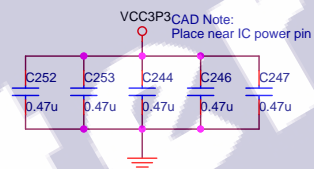
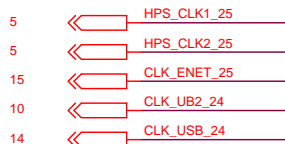
IO_8A/CLK6P,FPLL_TL_FBP/DIFFIO_RX_T9P
IO_8A/CLK6N,FPLL_TL_FBN/DIFFIO_RX_T9N
IO_8A/CLK7P/DIFFIO_RX_T1P
IO_8A/CLK7N/DIFFIO_RX_T1N

IO_8A/FPLL_TL_CLKOUT0,FPLL_TL_CLKOUTP,FPLL_TL_FB/DIFFIO_TX_T4P
IO_8A/FPLL_TL_CLKOUT1,FPLL_TL_CLKOUTN/DIFFIO_TX_T4N

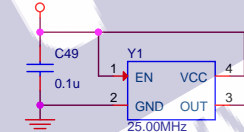
E8
D8

5CSEMA4U23C6N

Clock Generator



VCC3P3



CLKIN

XA

XB

GND_EP

21

Si5350C-B07837-GM

VCC3P3



Default: 24MHz
Default: 24MHz

Default: 25MHz

Default: 25MHz
Default: 25MHz

Default: 50MHz
Default: 50MHz



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Title DE0-Nano-SoC Board		
Size B	Document Number FPGA Clock and Clock Generator	Rev D0
Date: Monday, April 02, 2018	Sheet 6	of 23

FPGA JTAG INTERFACE



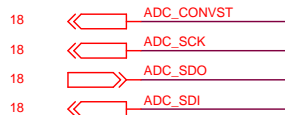
USB Blaster



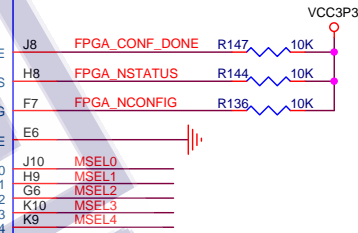
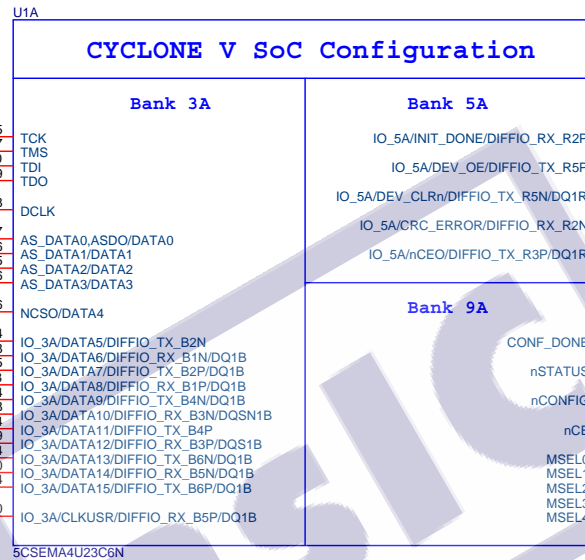
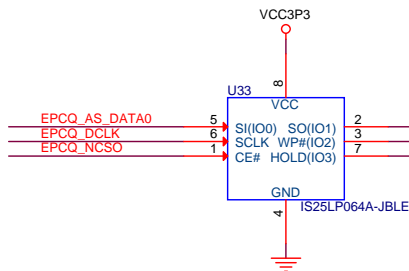
GPIO



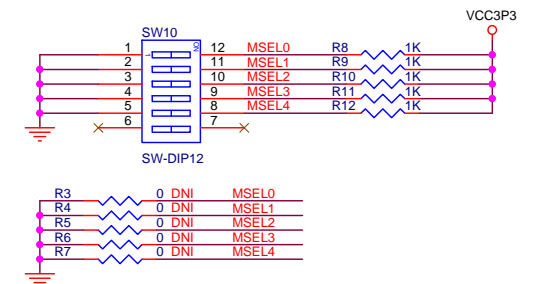
ADC

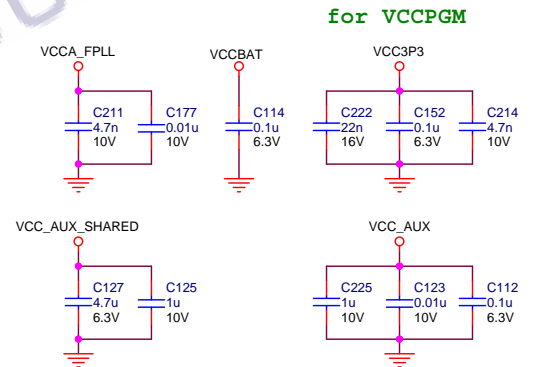
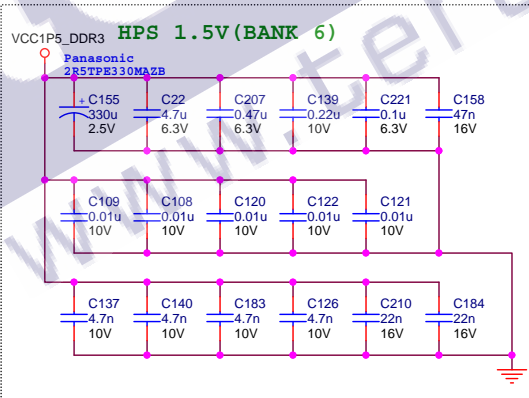
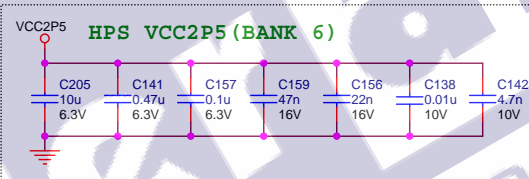
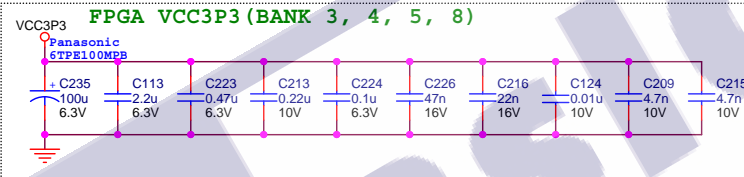
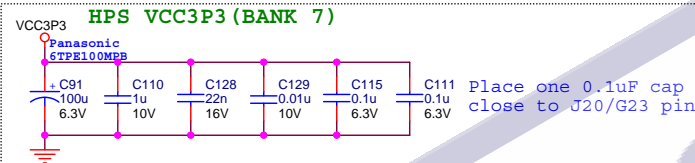
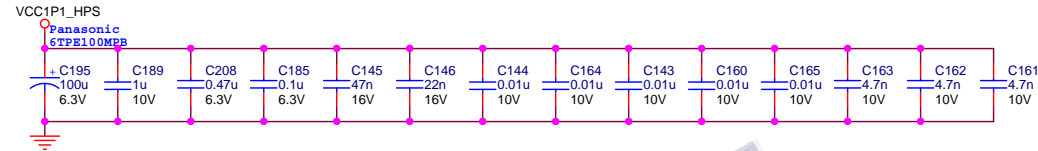
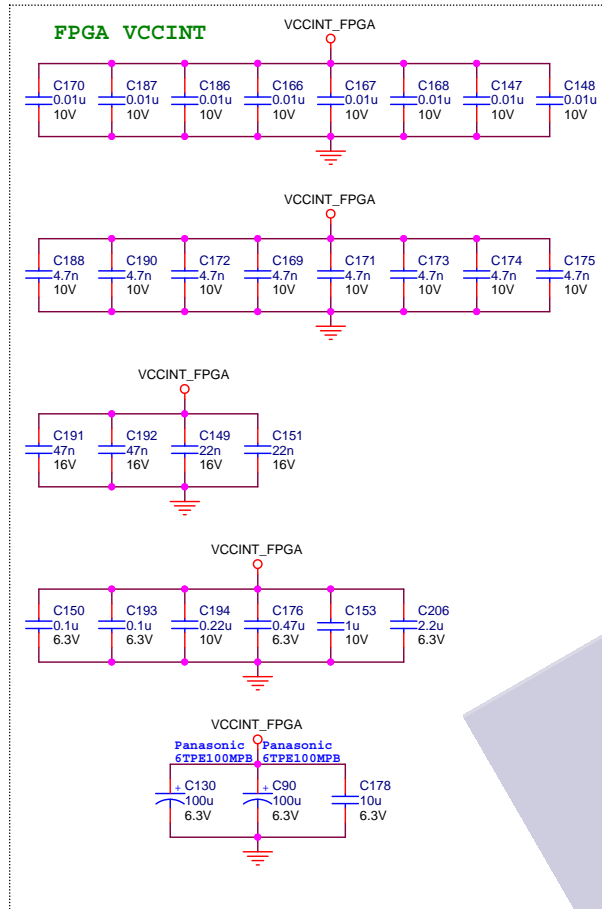


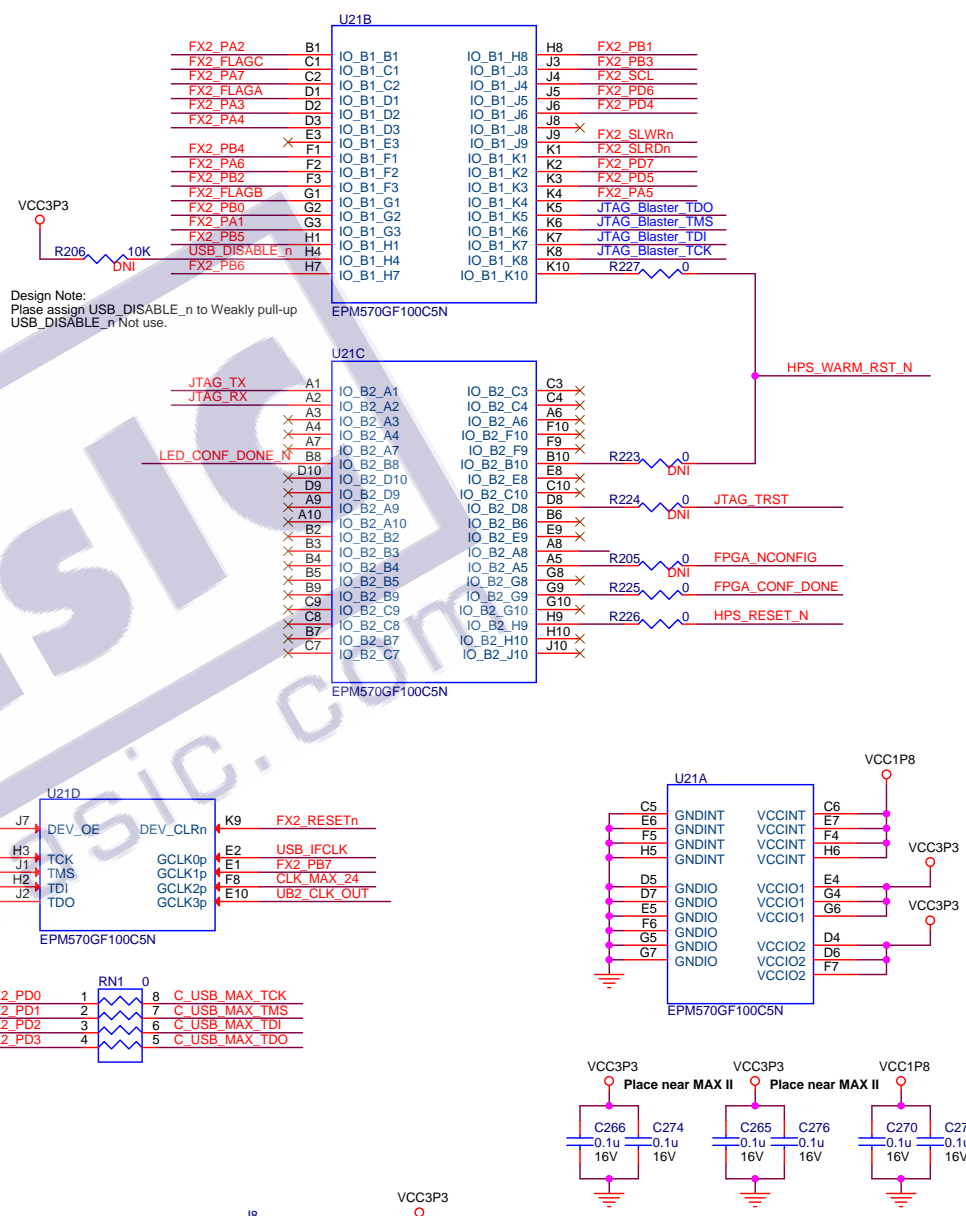
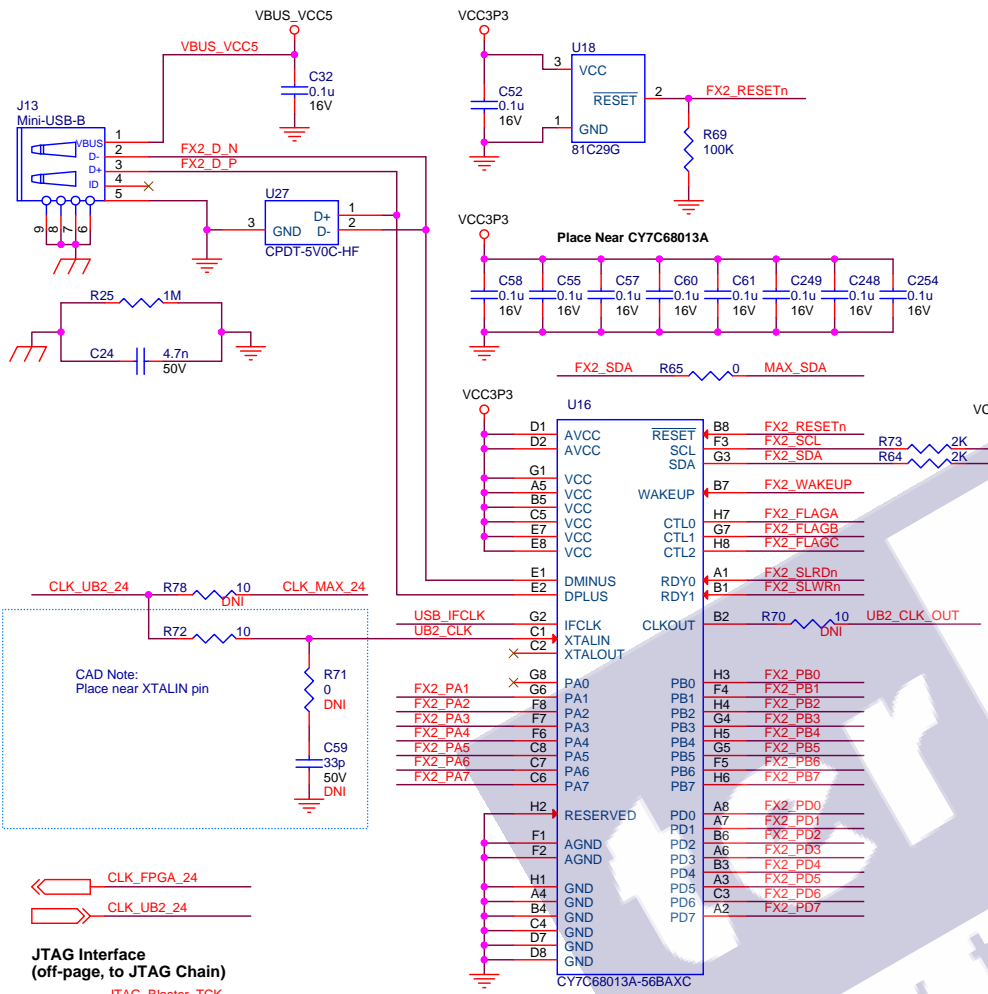
I2C Interface (Clock Generator)



Default Setup MSEL[4:0] = 10010, AS Fast Mode







- 6 CLK_FPGA_24
- 6 CLK_UB2_24
- JTAG Interface**
(off-page, to JTAG Chain)
- 11 JTAG_Blastor_TCK
- 11 JTAG_Blastor_TMS
- 11 JTAG_Blastor_TDO
- 11 JTAG_Blastor_TDI
- 5 JTAG_TRST
- FPGA Configuration**
- 7 FPGA_NCONFIG
- 7 FPGA_CONF_DONE
- HPS Reset**
- 5,17 HPS_WARM_RST_N
- 5,17 HPS_RESET_N
- 5,14 HPS_USB_RESET
- 5,15,17 HPS_ENET_RESET_N
- 17 COLD_RESET_N
- 17 KEY_COLD_RESET_N
- 17 KEY_WARM_RESET_N

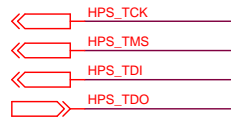
USB Blaster



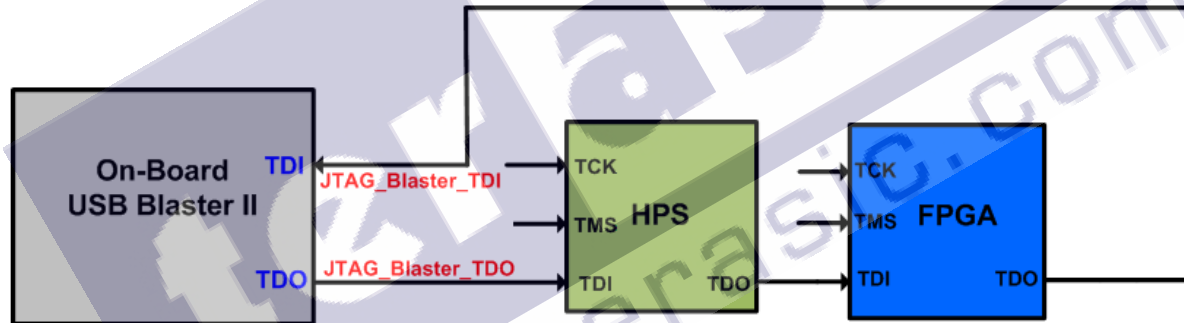
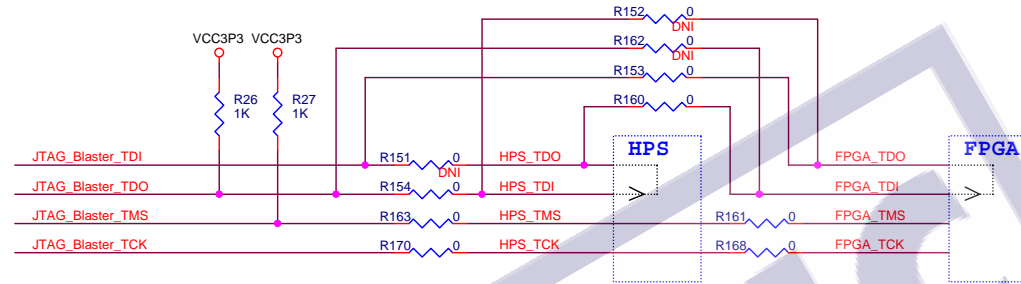
FPGA JTAG INTERFACE



HPS JTAG INTERFACE



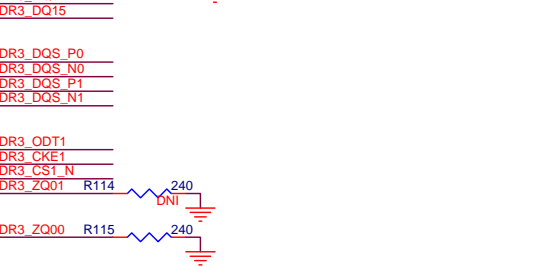
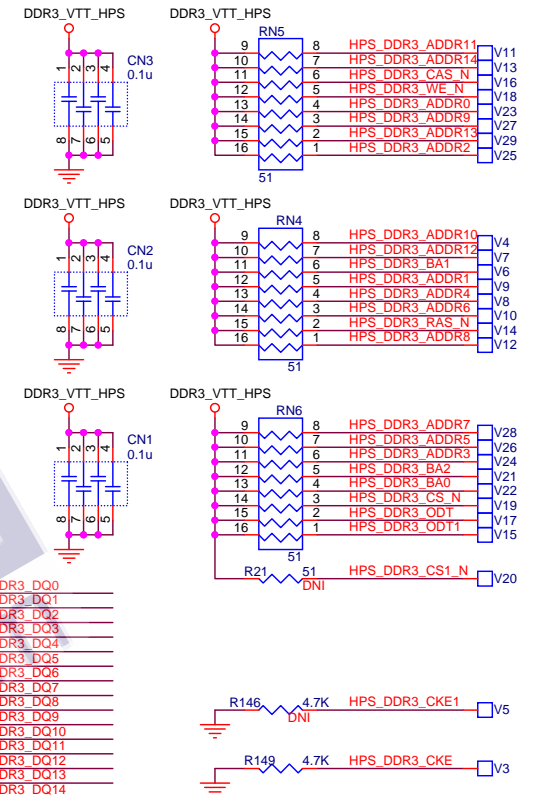
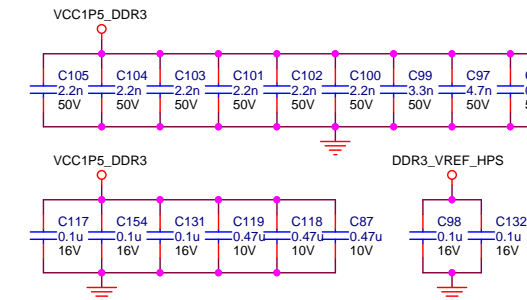
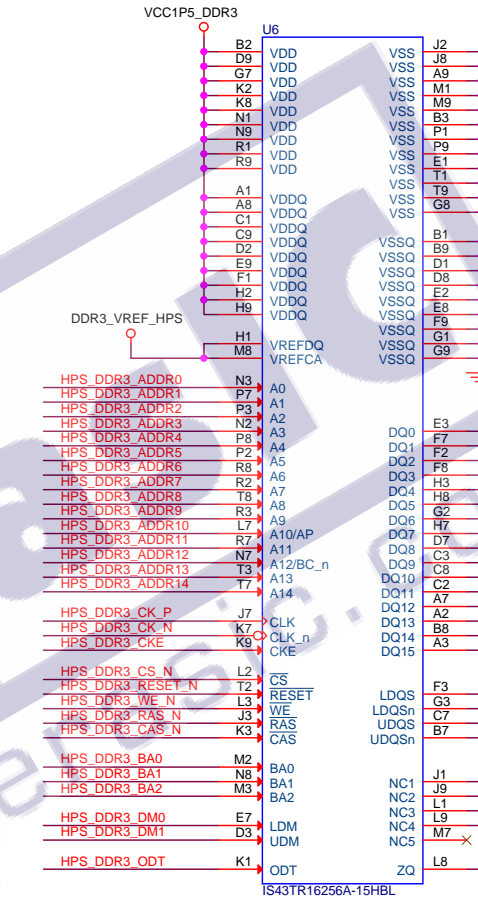
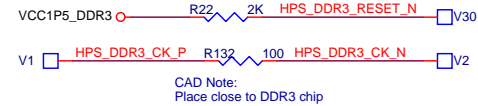
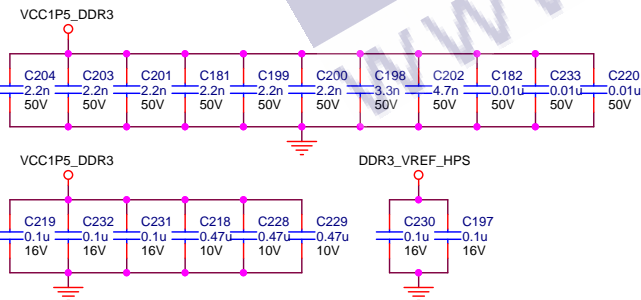
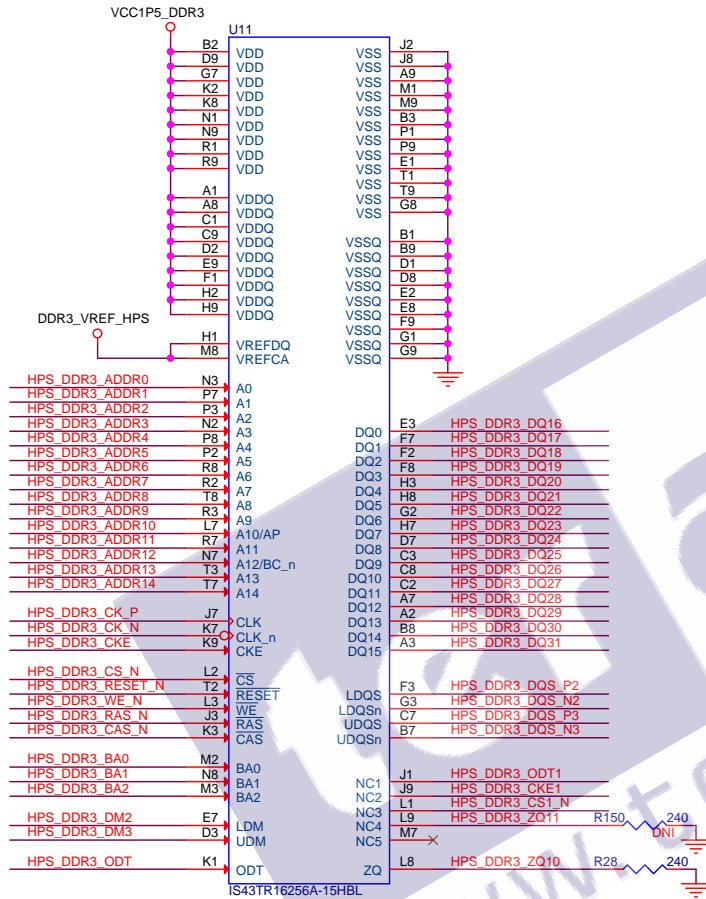
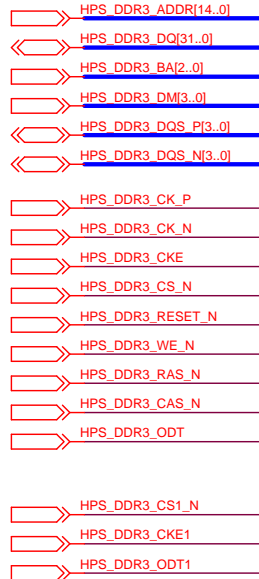
JTAG Chain

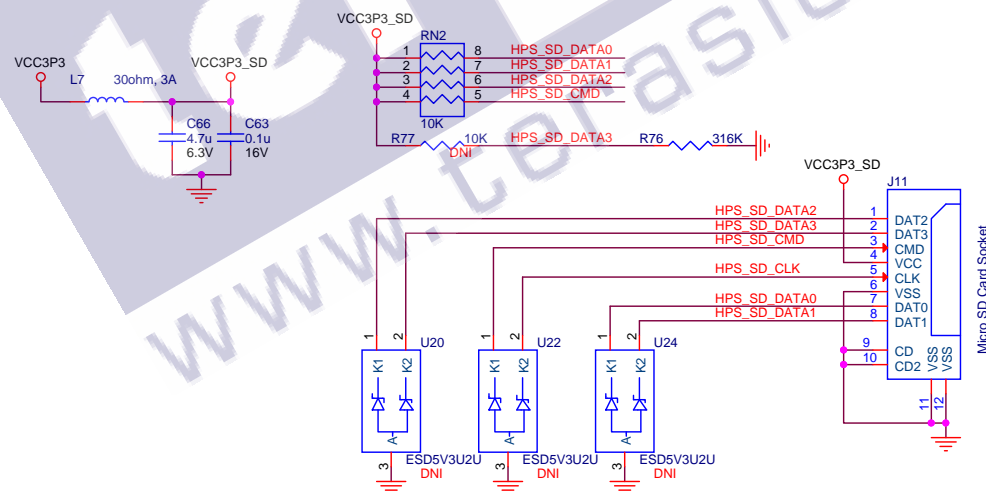
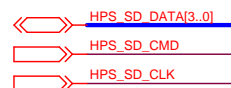
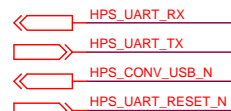


DDR3 Interface (HPS)

Note :
you can only swap the DQ signals
within x8 group (e.g. 0-7,8-15,16-23,24-31)
on the DDR3 chips

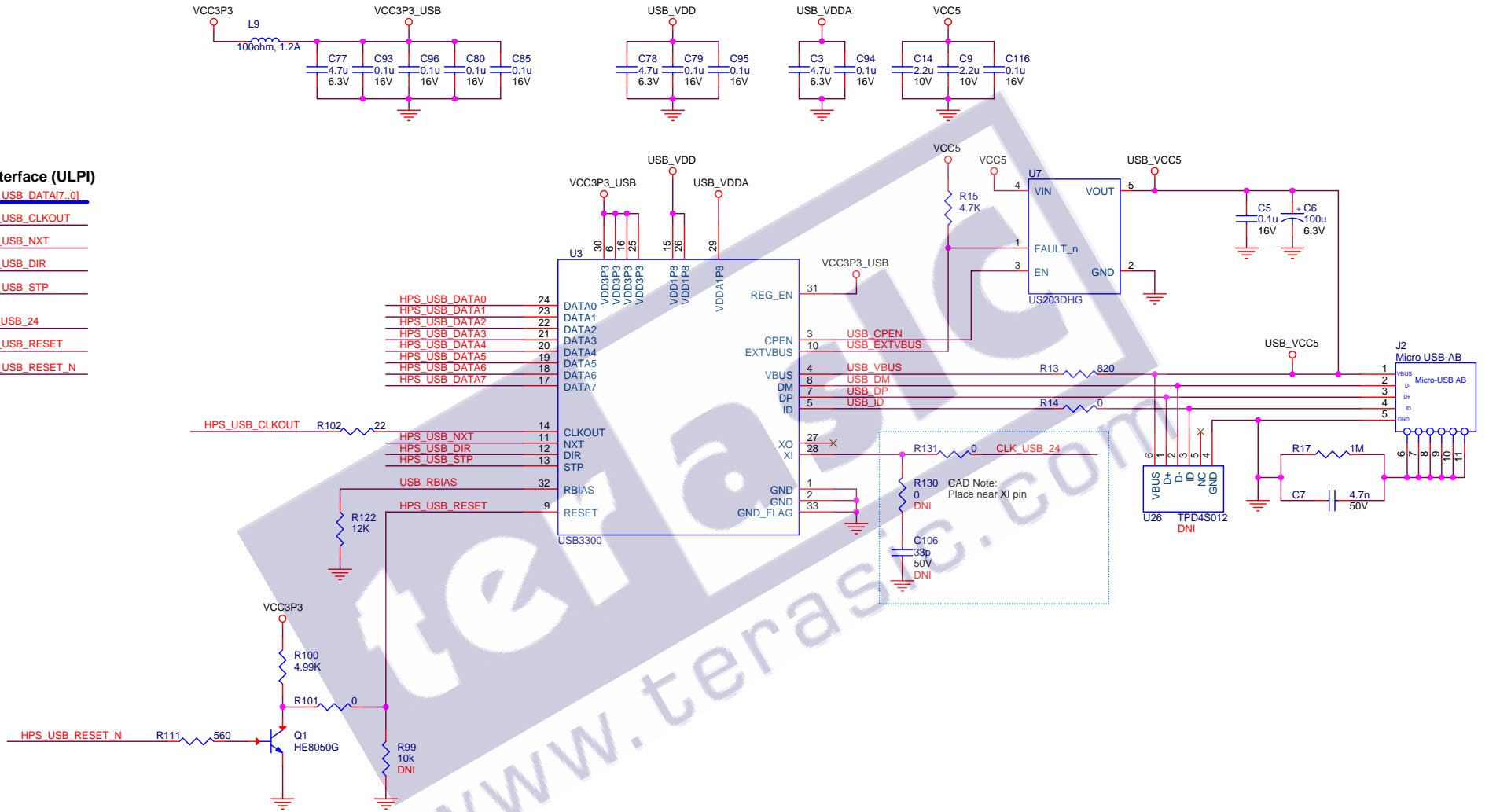
Note : you can swap the signals on the OCT resistor array
(include NC pin)



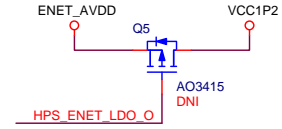
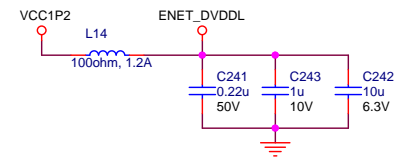
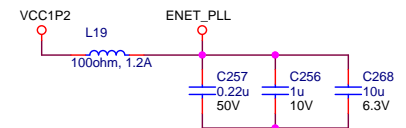
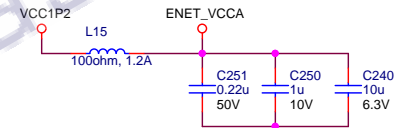
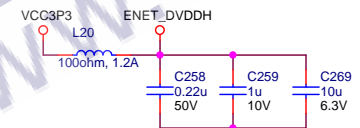
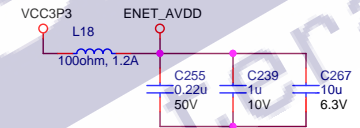
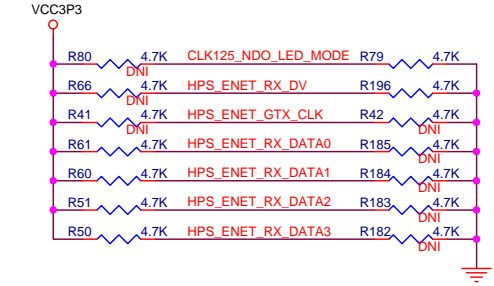
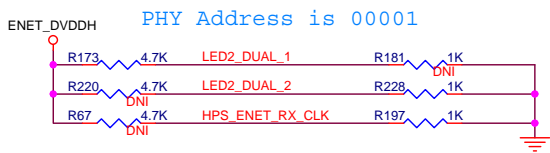
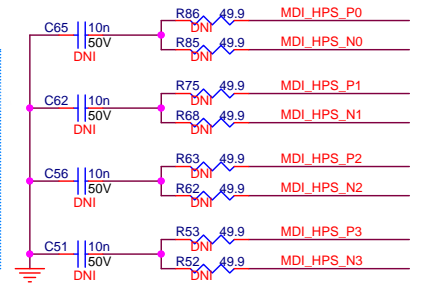
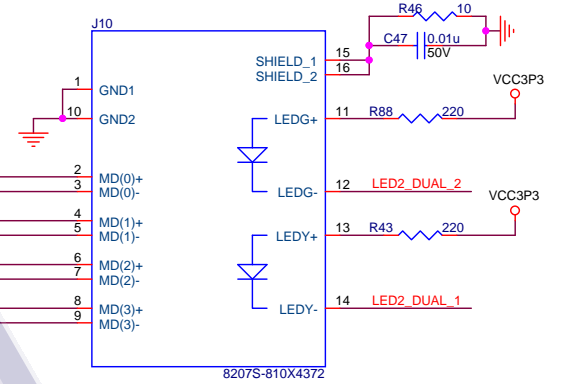
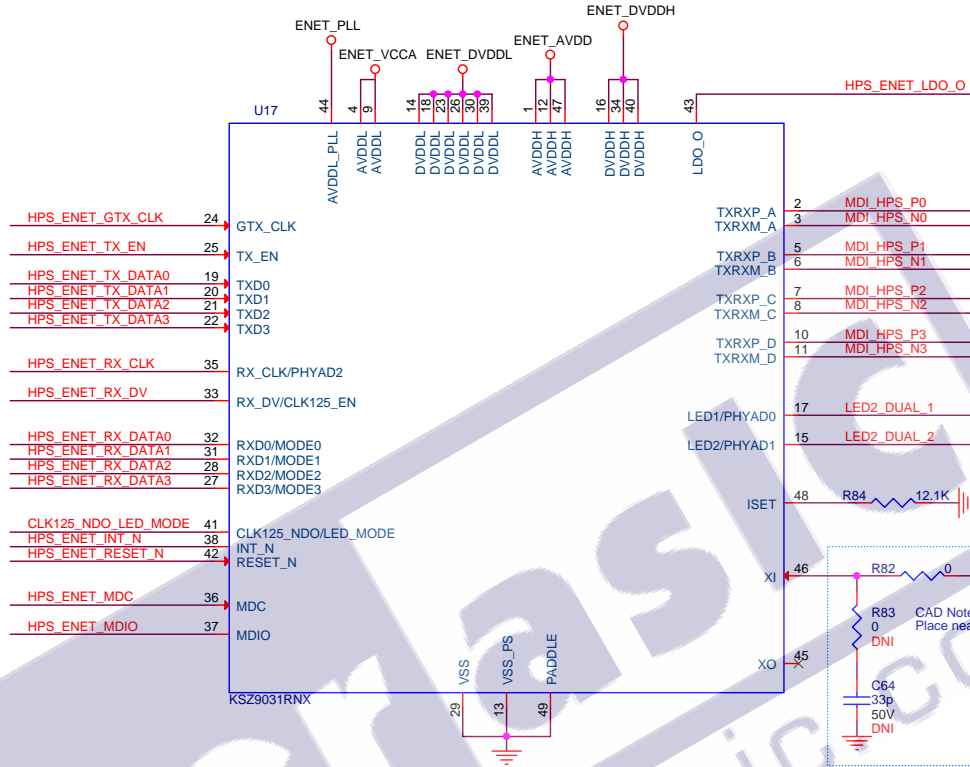
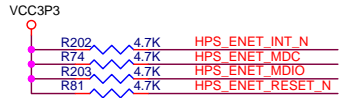
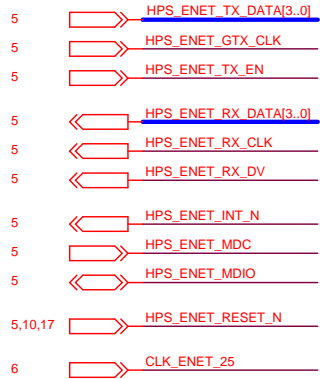


UBS PHY Interface (ULPI)

- 5 HPS_USB_DATA[7..0]
- 5 HPS_USB_CLKOUT
- 5 HPS_USB_NXT
- 5 HPS_USB_DIR
- 5 HPS_USB_STP
- 6 CLK_USB_24
- 5,10 HPS_USB_RESET
- 17 HPS_USB_RESET_N



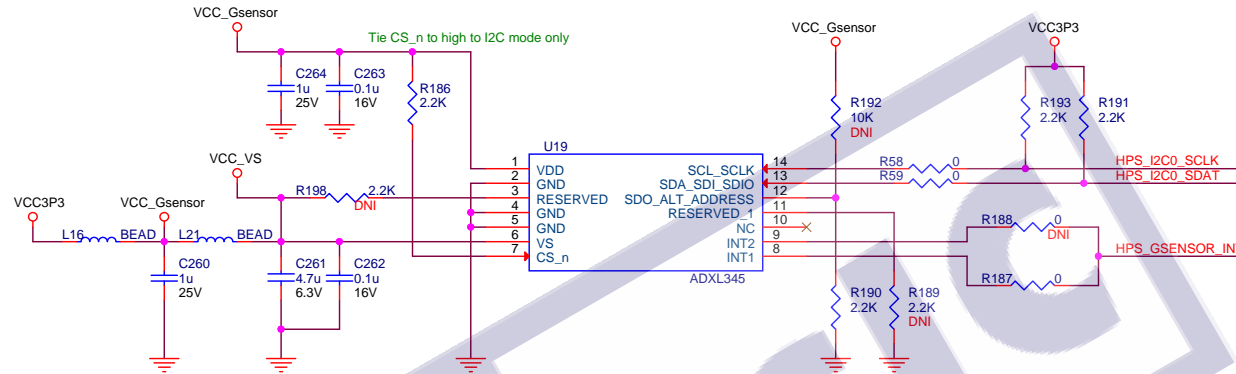
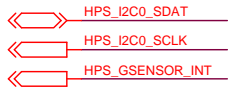
Ethernet PHY Interface (RGMII)



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<div> <div>Title</div> <div>DE0-Nano-SoC Board</div> </div>			
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B	HPS : GigaBit Ethernet	D0	
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Digital Accelerometer

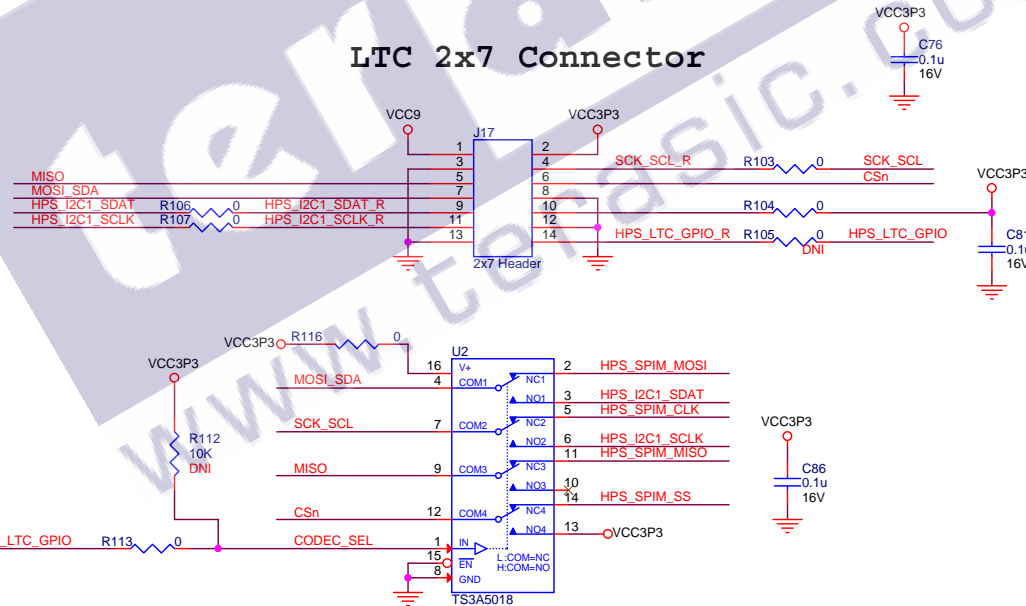
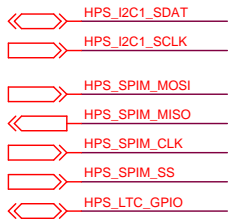
Accelerometer Interface



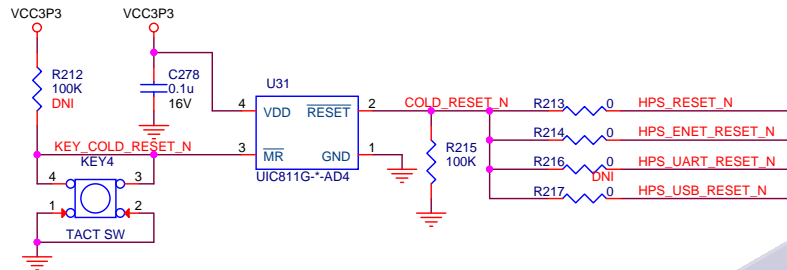
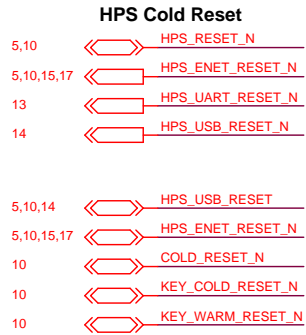
Default : I2C Address 0xA6/0xA7

LTC 2x7 Connector

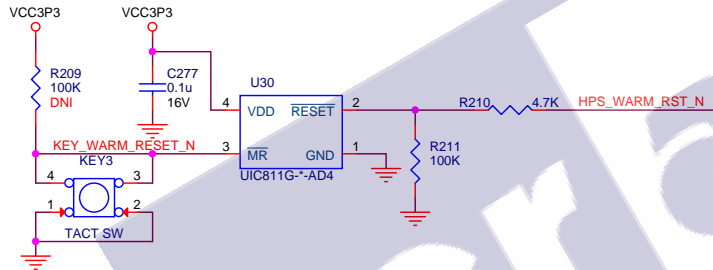
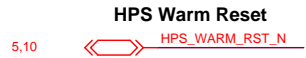
LTC Interface



HPS Cold Reset



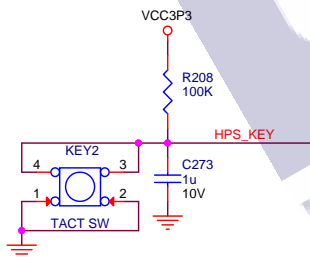
HPS Warm Reset



HPS Key and LED

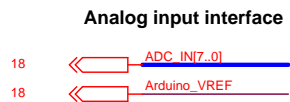
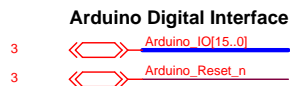
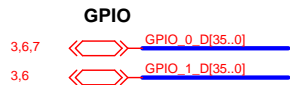


HPS User Button

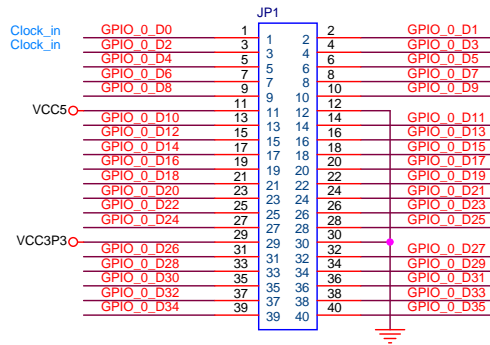


HPS User LED

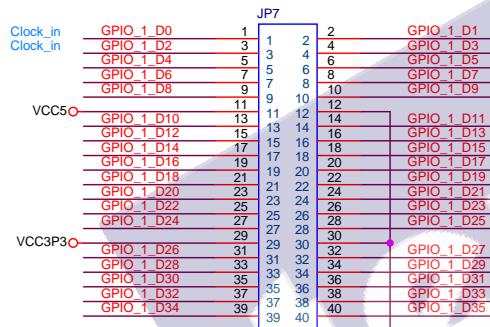




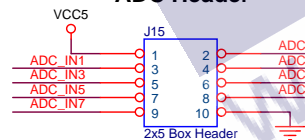
GPIO 0 Header



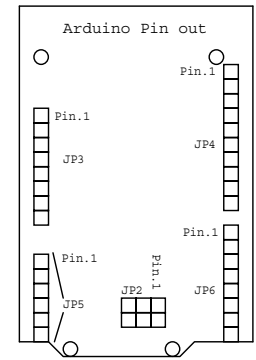
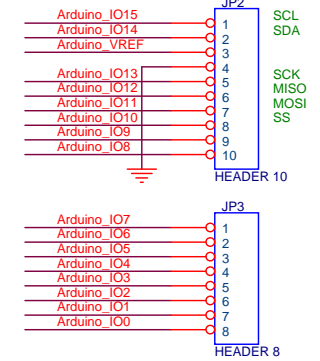
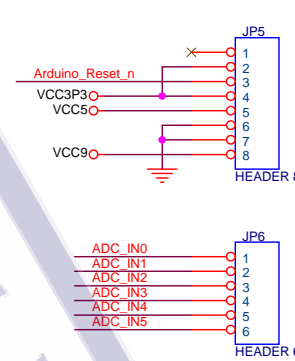
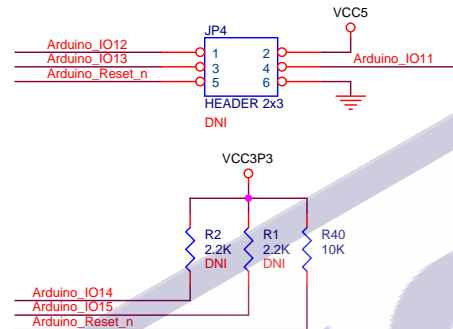
GPIO 1 Header



ADC Header



Arduino UNO Rev3



KEY

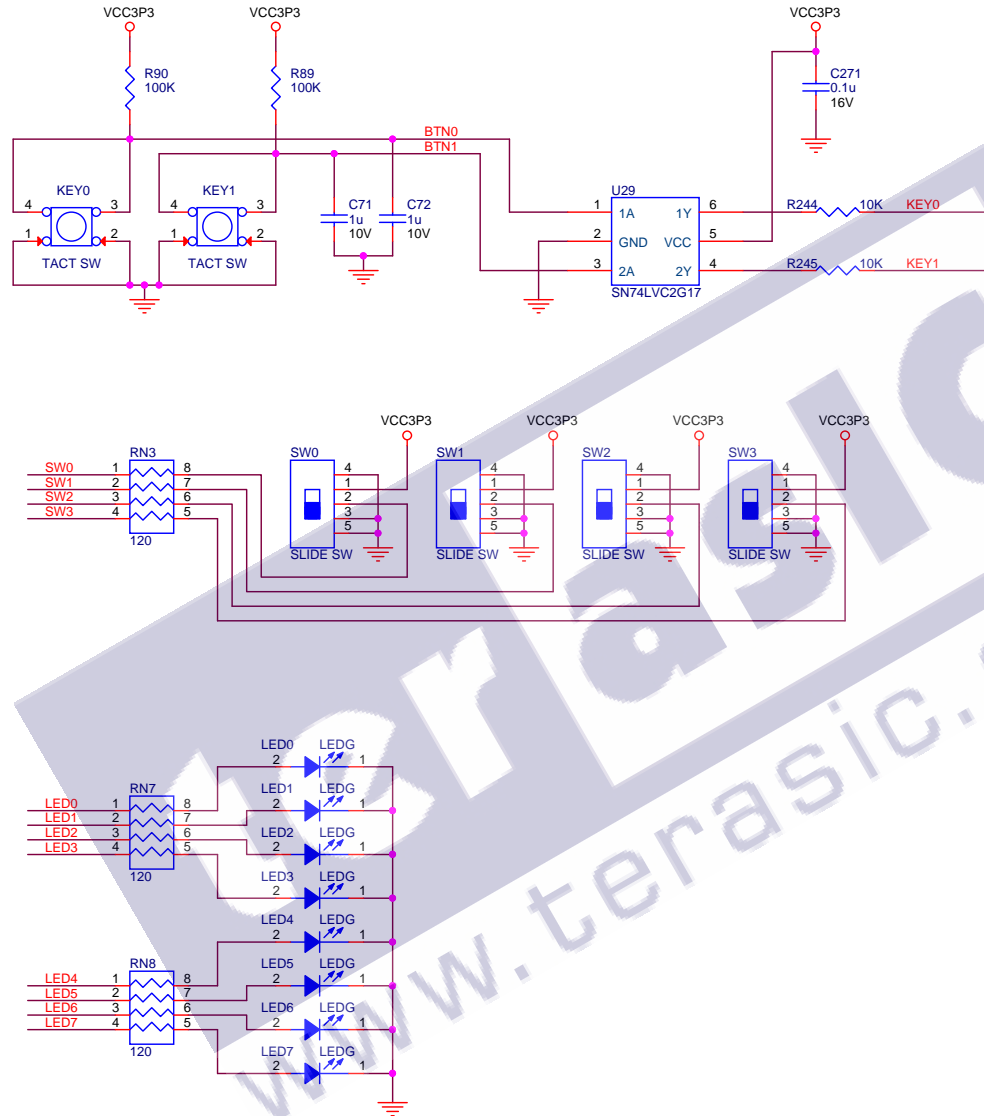
KEY[1..0]

SWITCH

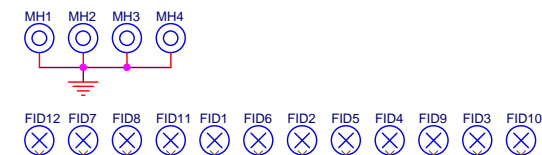
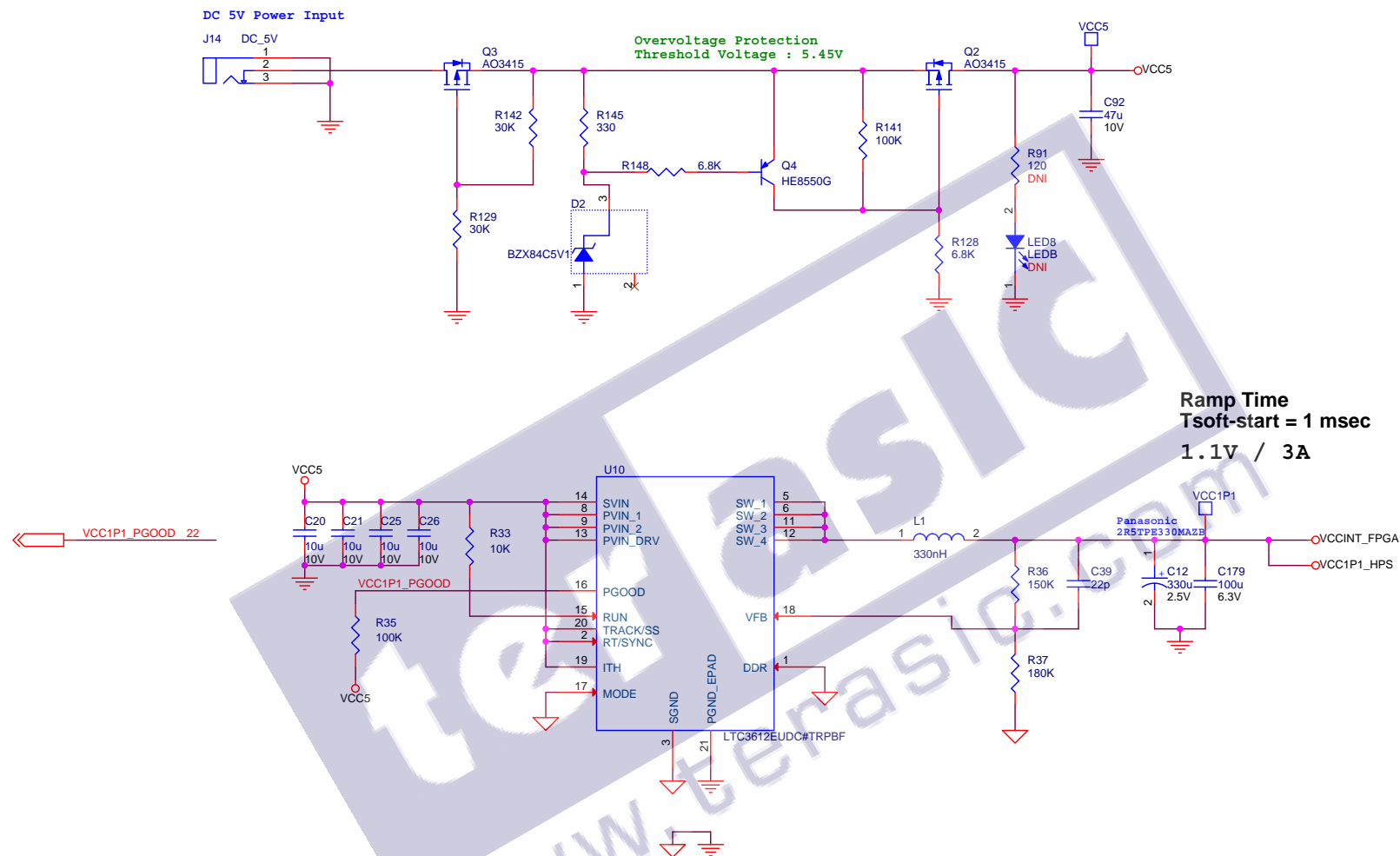
SW[3..0]


LED

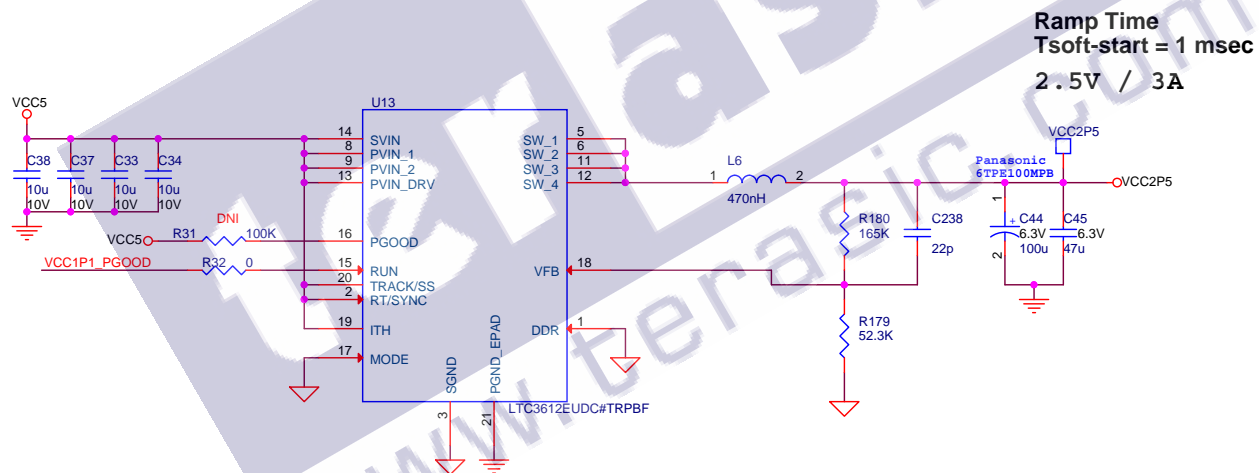
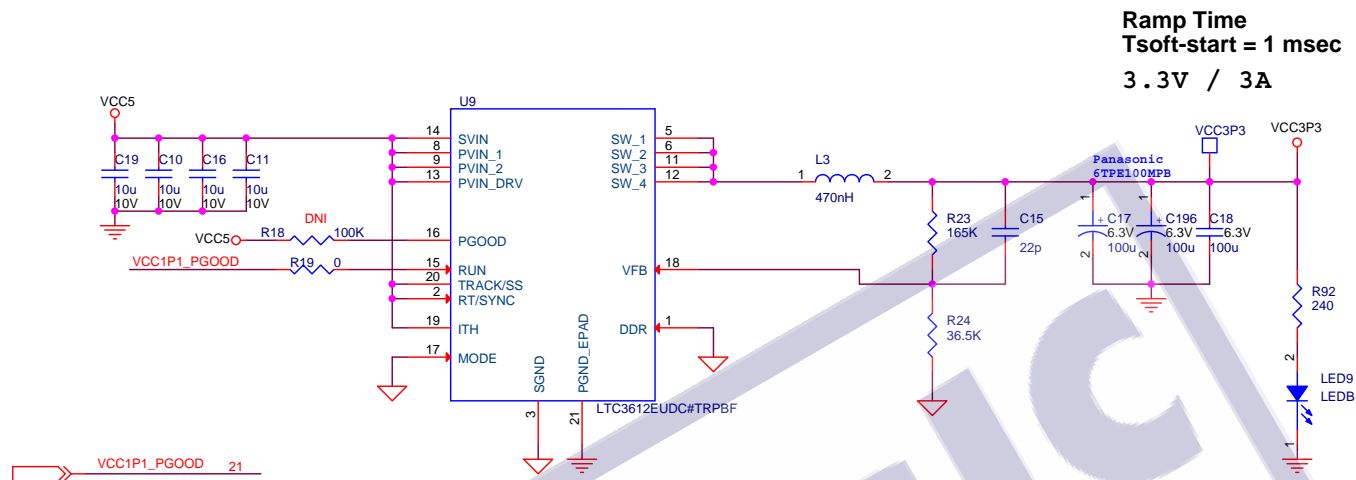
LED[7..0]



PCB
MPB-3250-D0



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Title			
DE0-Nano-SoC Board			
Size	Document Number		Rev
B	Power - 1.1V, 5V		D0
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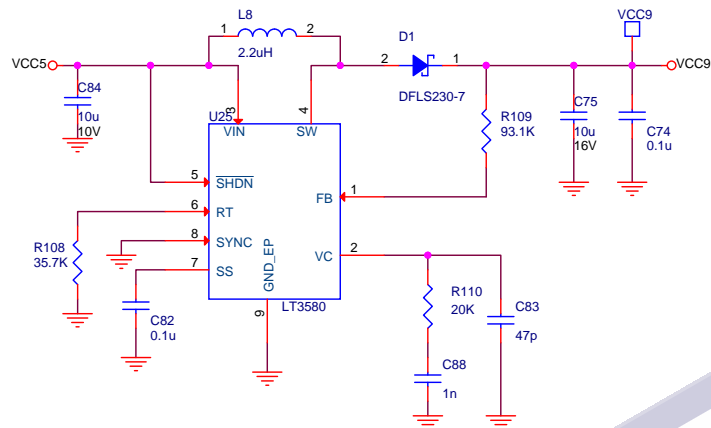
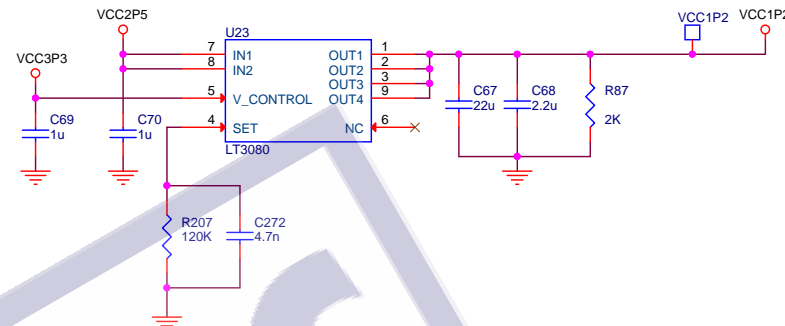
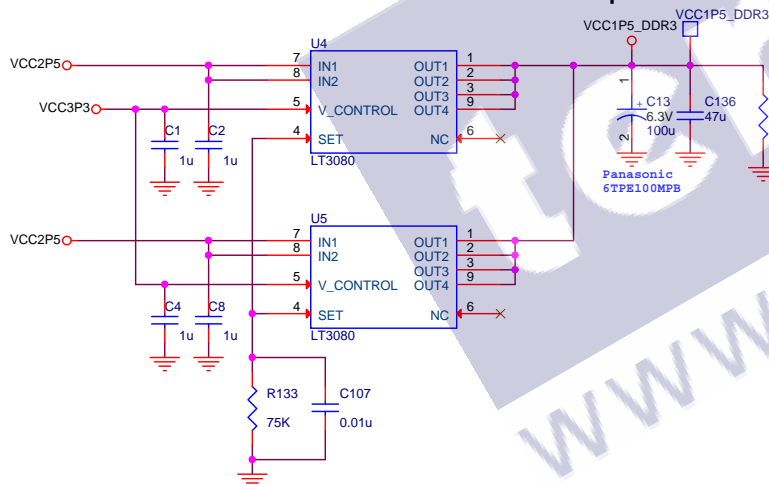
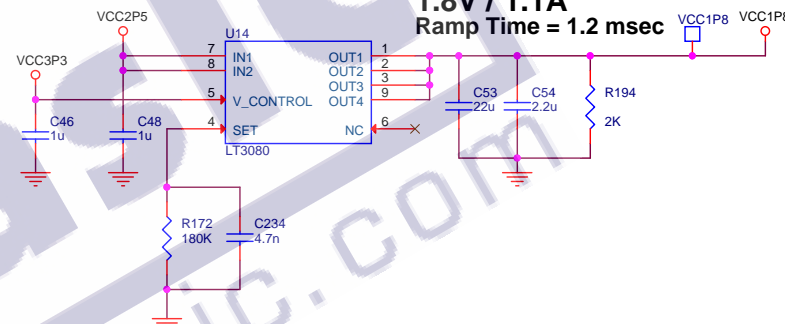
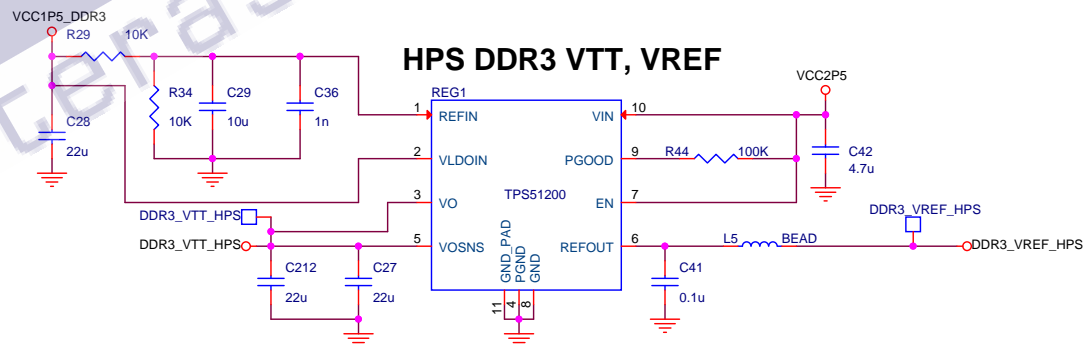
5

4

3

2

1

9V / 1A**1.2V / 1.1A****Ramp Time = 0.8msec****1.5V / 2.2A****Ramp Time = 1.27 msec****1.8V / 1.1A****Ramp Time = 1.2 msec****HPS DDR3 VTT, VREF**

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Title		
DE0-Nano-SoC Board		
Size	Document Number	Rev
B	Power - 1.2V, 1.5V, 1.8V, 9V	D0
Date:	Monday, April 02, 2018	Sheet 23 of 23