THIS IS A FLAT SCHEMATIC, NOT A HIERARCHICAL ONE. NETS USE "OFFPAGE CONNECTOR" SYMBOLS TO GO FROM PAGE TO PAGE.

THE SCHEMATIC IS DIVIDED INTO SECTIONS OF RELATED FUNCTIONALITY.
THE SECTIONS ARE:
1: NOTES AND BLOCK DIAGRAMS
2: GLOBAL SIGNALS
3: POWER SOURCES AND CONTROLS
4: I2C CONTROLS
5: KU15P POWER AND SIGNAL (NON-MGT)
6: VU7P POWER AND SIGNAL (NON-MGT)
7: KU15P MGT TRANSCEIVERS
8: VU7P MGT TRANSCEIVERS

TO DO:

CHECK "bc" AND "ac" PREFIXES ON AC-COUPLED SIGNALS

ON VU7P QUAD "S', CHANGE "...133" TO "...S" IN PIN NAMES

ON VU7P QUAD "A-J', CHANGE "...GTH" TO "...GTY" IN PIN NAMES

ASSIGN AND LABEL I2C ADDRESSES

SOLDERPASTE PATTERNS FOR UEC5_UCCE FOOTPRINT

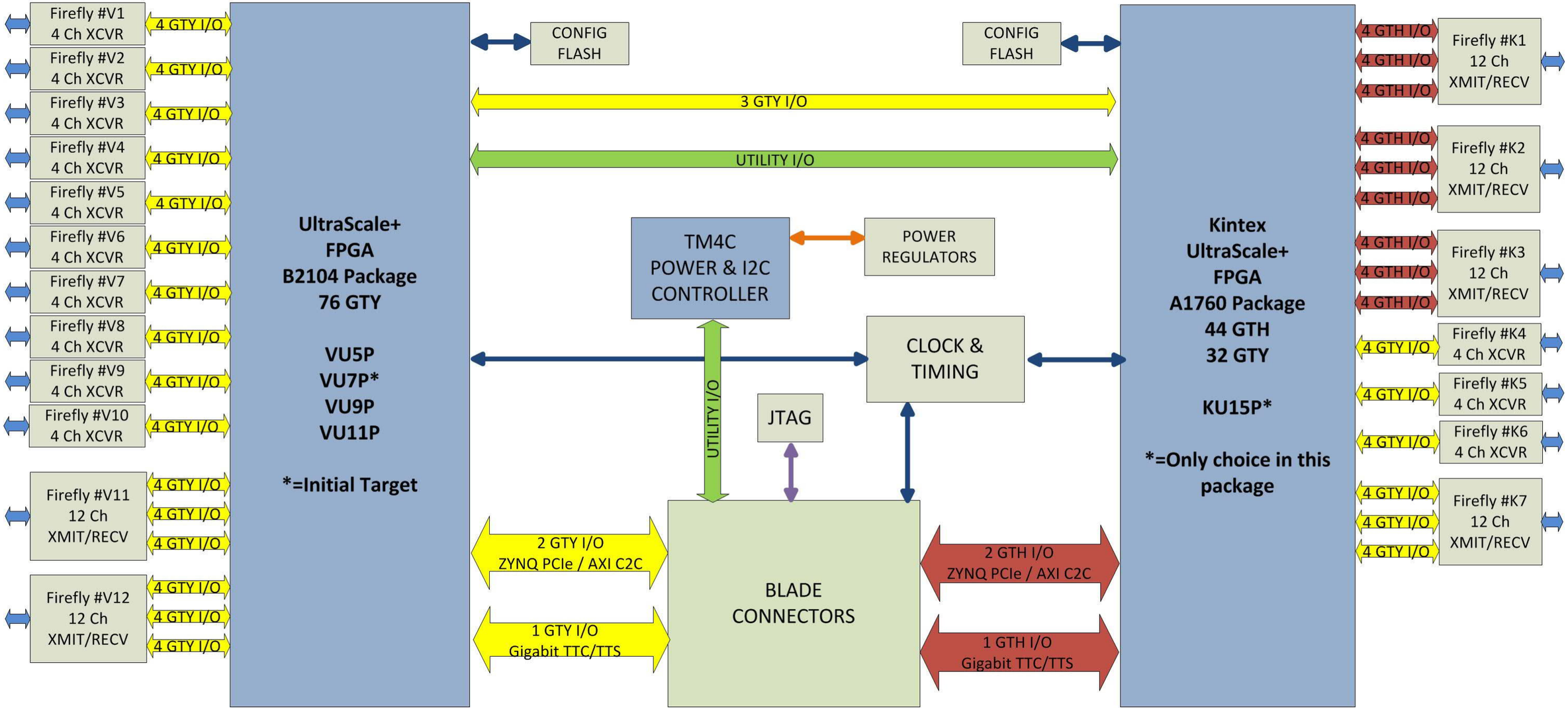
NETS TO STUDY / DOCUMENT

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 1.01: NOTES

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 1 of 74



ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 1.02: BLOCK DIAGRAM		
Size	Document Number: 6089-103	Rev: A
Date: Wednesday, March 06, 2019	Sheet 2 of 74	

KU15P TRANSCEIVER ASSIGNMENTS AND CLOCKED QUADS

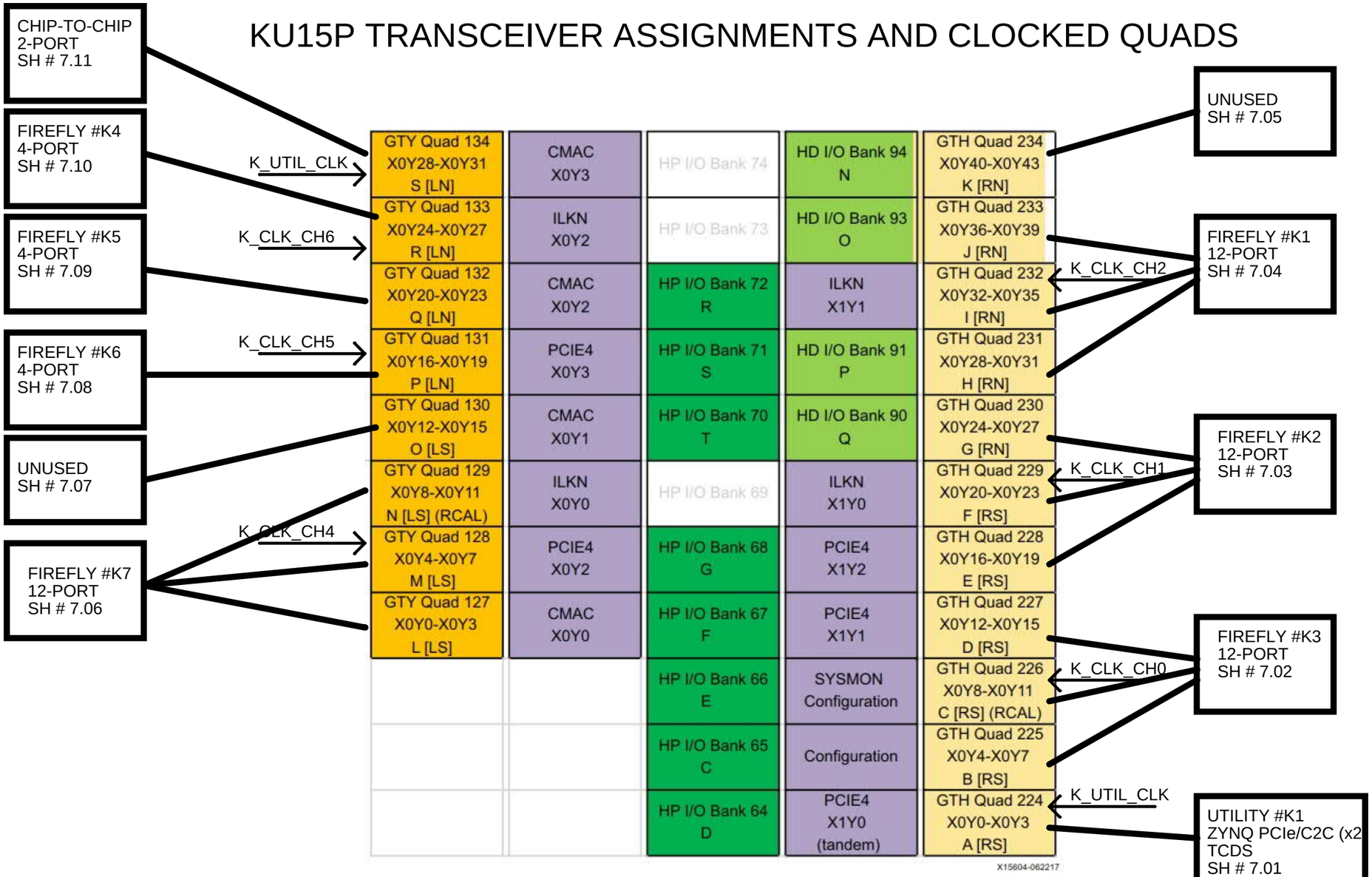


Figure 1-86: **XCKU15P Banks in FFVA1760 Package**

EACK "K_CLK_CHn" CONSISTS OF TWO CLOCKS.
ONE IS FROM A FIXED OSCILLATOR AND THE OTHER IS DERIVED FROM AN 'LHC" CLOCK.

THERE ARE 2 FIXED OSCILLATORS. ONE FEEDS THE QUADS ON THE LEFT SIDE OF THE CHIP AND THE OTHER FEEDS THE QUADS ON THE RIGHT SIDE OF THE CHIP.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 1.03: KU15P TRANSCEIVERS		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 3 of 74	

VU7P TRANSCEIVER ASSIGNMENTS AND CLOCKED QUADS

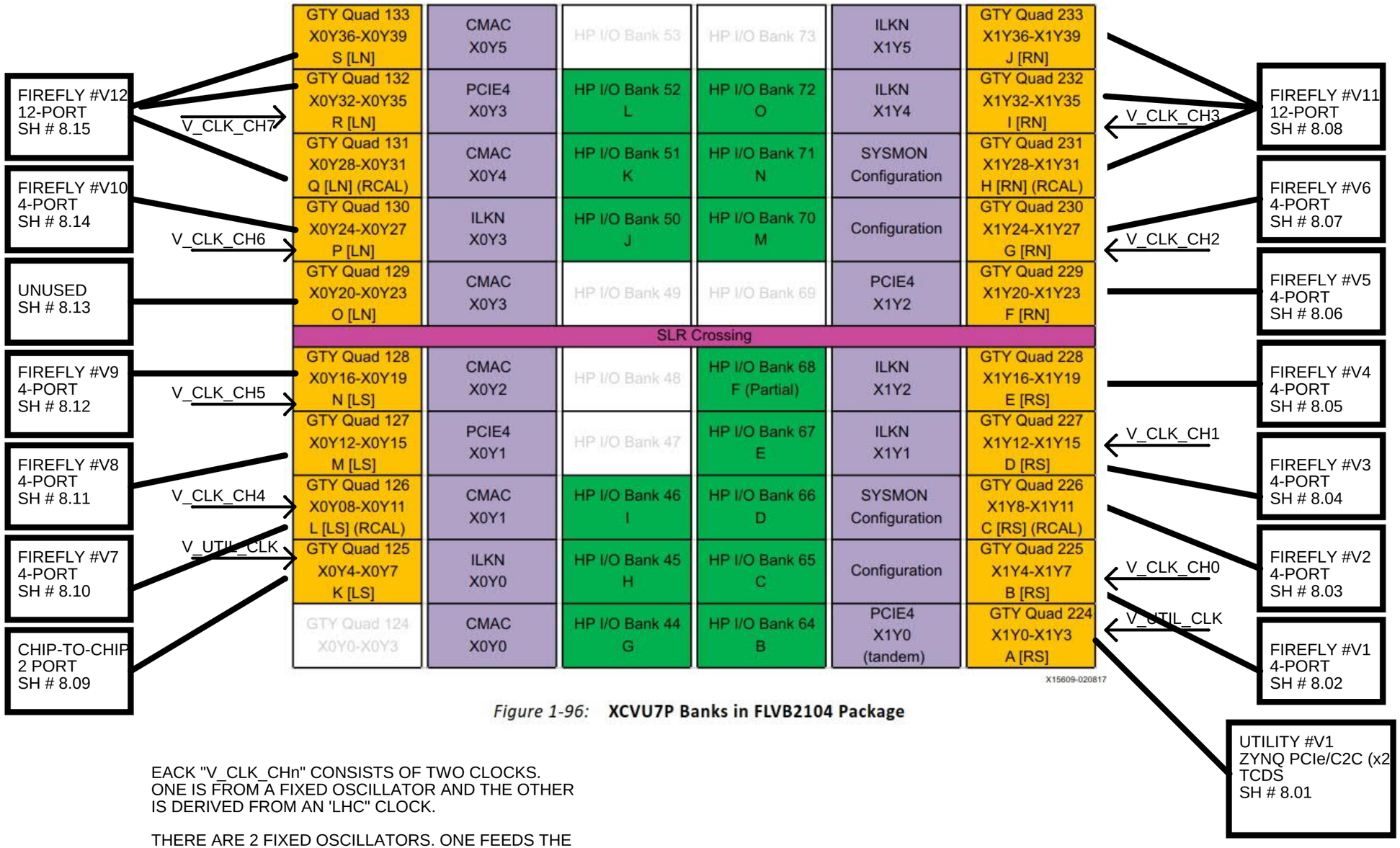


Figure 1-96: **XCVU7P Banks in FLVB2104 Package**

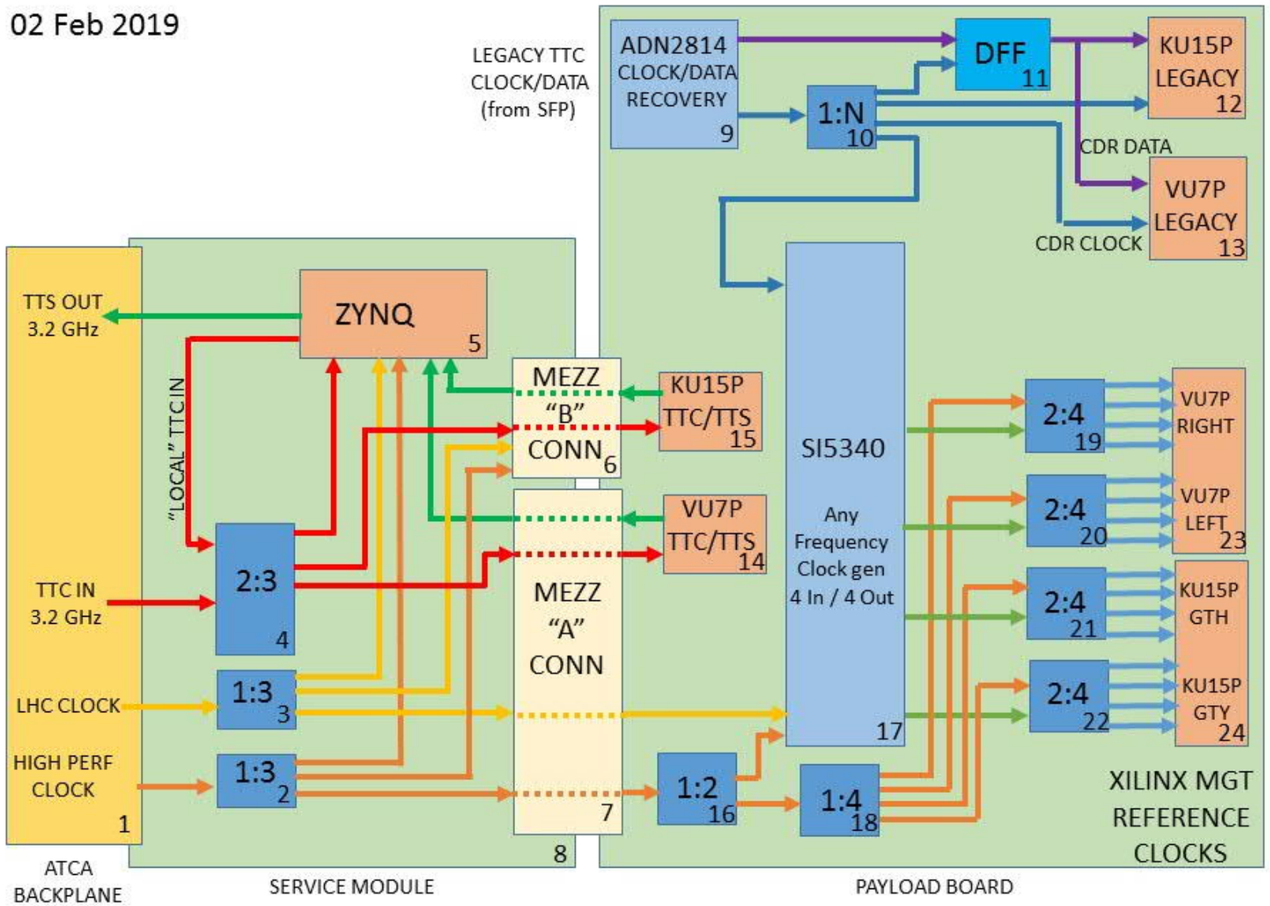
EACK "V_CLK_CHn" CONSISTS OF TWO CLOCKS. ONE IS FROM A FIXED OSCILLATOR AND THE OTHER IS DERIVED FROM AN 'LHC" CLOCK.

THERE ARE 2 FIXED OSCILLATORS. ONE FEEDS THE QUADS ON THE LEFT SIDE OF THE CHIP AND THE OTHER FEEDS THE QUADS ON THE RIGHT SIDE OF THE CHIP.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 1.04: VU7P TRANSCEIVERS		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 4 of 74	

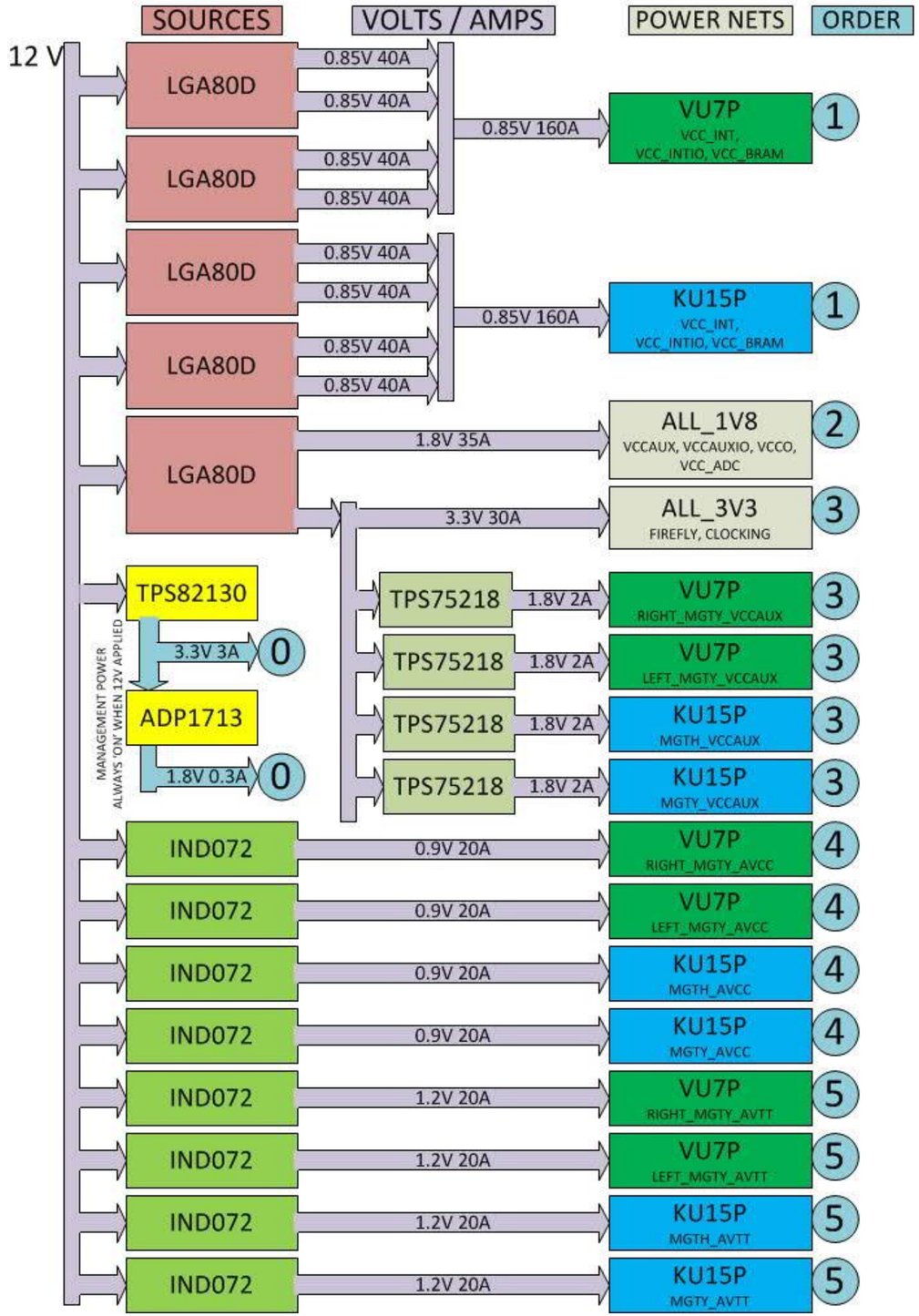
BU/CU Apollo ATCA Backplane Signal Distribution

02 Feb 2019



Charlie Strohman crs5@cornell.edu

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 1.05: LHC SIGNAL DISTRIBUTION		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 5 of 74	

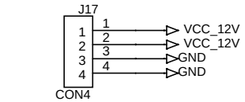


ATCA FPGA BOARD, KU15P AND VU7P, MK1

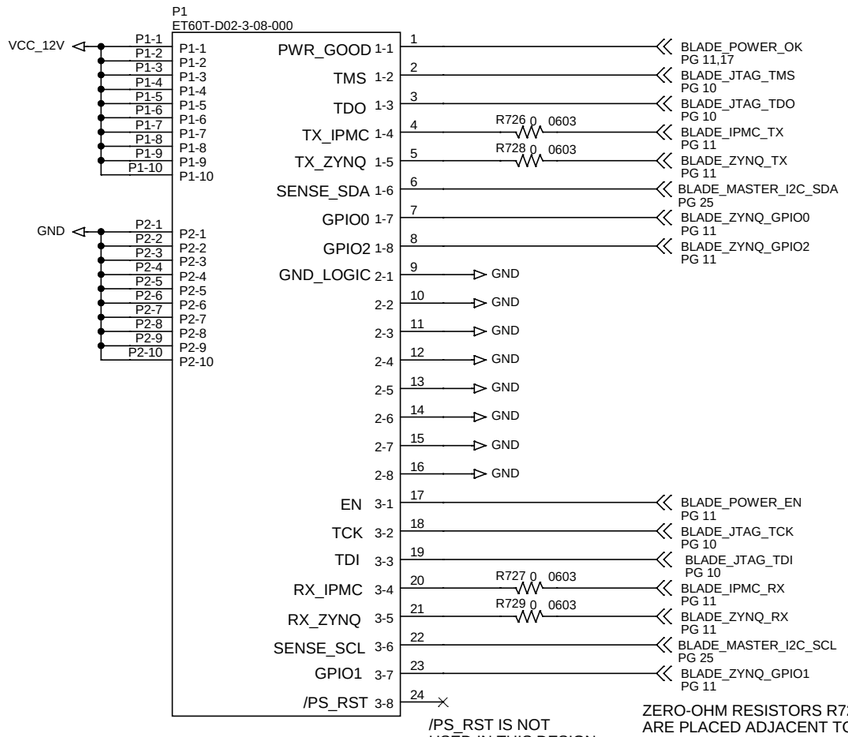
Title: 1.06: POWER DISTRIBUTION

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 6 of 74

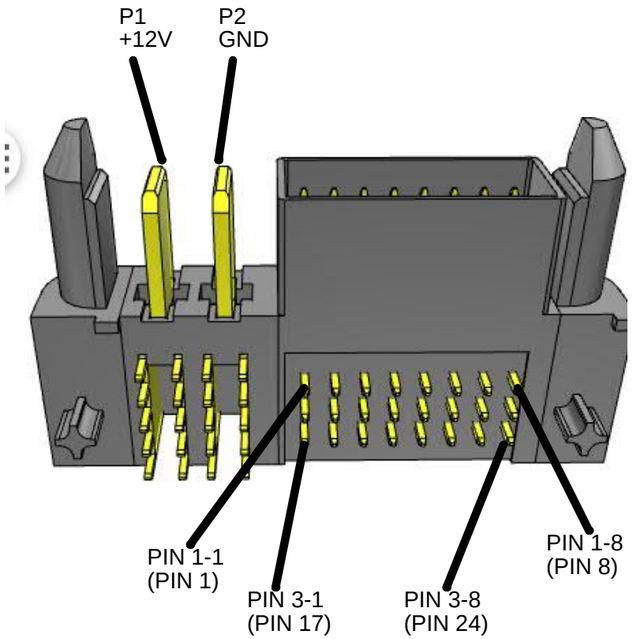


Bench Top Power Inlet



/PS_RST IS NOT USED IN THIS DESIGN

ZERO-OHM RESISTORS R726 AND R727 ARE PLACED ADJACENT TO EACH OTHER. IF "TX" AND "RX" NEED TO BE SWAPPED, REMOVE AND ROTATE THE JUMPERS BY 90 DEGREES. THE SAME IS TRUE FOR R728 AND R729.



ET60T-D02-3-08-000

THESE SHAPES DEFINE HOLES AND KEEPOUT AREAS FOR THE SPLICE PLATES.

SP2 DNI SP1 DNI

THESE HOLES ARE FOR MOUNTING THE FIREFLY HEATSINKS

H13 H12 H11 H8 H7 H6 — DNI

THESE HOLES ARE FOR MOUNTING THE TOP COVER

H5 H18 H4 H17 H3 H16 — DNI

THESE HOLES ARE FOR MOUNTING THE BOTTOM COVER

H1 H14 H9 H15 H10 H2 — DNI

THESE SHAPES DEFINE MECHANICAL OBJECTS THAT SHOULD BE IN THE BILL OF MATERIALS.

BR1 BR2 BR3 — BRACKET

BRACKETS FOR SUPPORTING A SUB-FRONT PANEL

M1 KU15P HEATSINK
M23 HEATSINK PLATE
M3 M3 STANDOFF
M4 M3 STANDOFF
M5 M3 STANDOFF
M6 M3 STANDOFF
M7 M3 STANDOFF
M8 M3 STANDOFF
M2 VU7P HEATSINK
M24 HEATSINK PLATE
M9 M3 STANDOFF
M10 M3 STANDOFF
M11 M3 STANDOFF
M12 M3 STANDOFF
M13 M3 STANDOFF
M14 M3 STANDOFF
M15 FIREFLY HEATSINK (LEFT SIDE)
M16 M2.5 STANDOFF
M17 M2.5 STANDOFF
M18 M2.5 STANDOFF
M19 FIREFLY HEATSINK (RIGHT SIDE)
M20 M2.5 STANDOFF
M21 M2.5 STANDOFF
M22 M2.5 STANDOFF

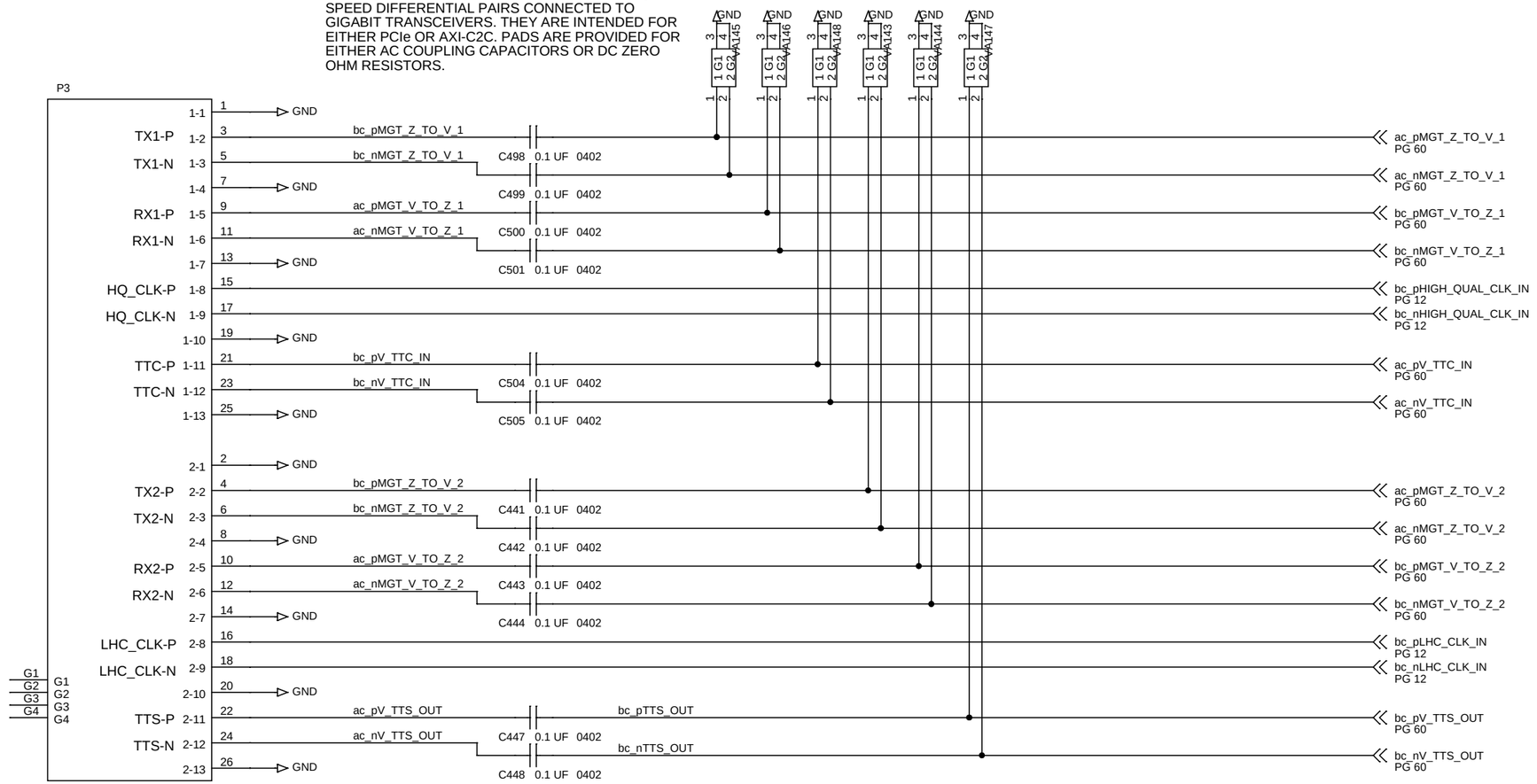
ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 2.01: BLADE POWER CONNECTOR

Size	Document Number	Rev
	6089-103	A

Date: Thursday, February 28, 2019 Sheet 7 of 74

THE SIGNALS THAT START WITH "MGT" ARE HIGH SPEED DIFFERENTIAL PAIRS CONNECTED TO GIGABIT TRANSCEIVERS. THEY ARE INTENDED FOR EITHER PCIe OR AXI-C2C. PADS ARE PROVIDED FOR EITHER AC COUPLING CAPACITORS OR DC ZERO OHM RESISTORS.



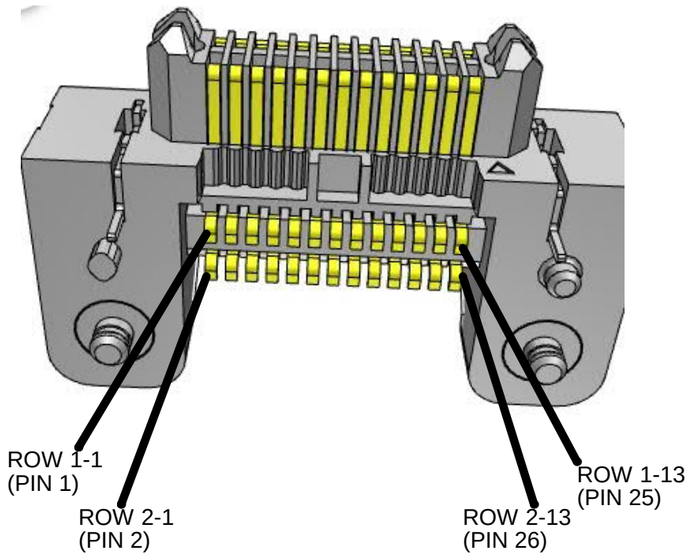
AC COUPLED SIGNALS

bc = BEFORE CAPACITOR

ac = AFTER CAPACITOR

REPLACE THE DC BLOCKING CAPACITORS WITH ZERO-OHM RESISTORS IF THE SERVICE BLADE ALREADY PROVIDES CAPACITORS.

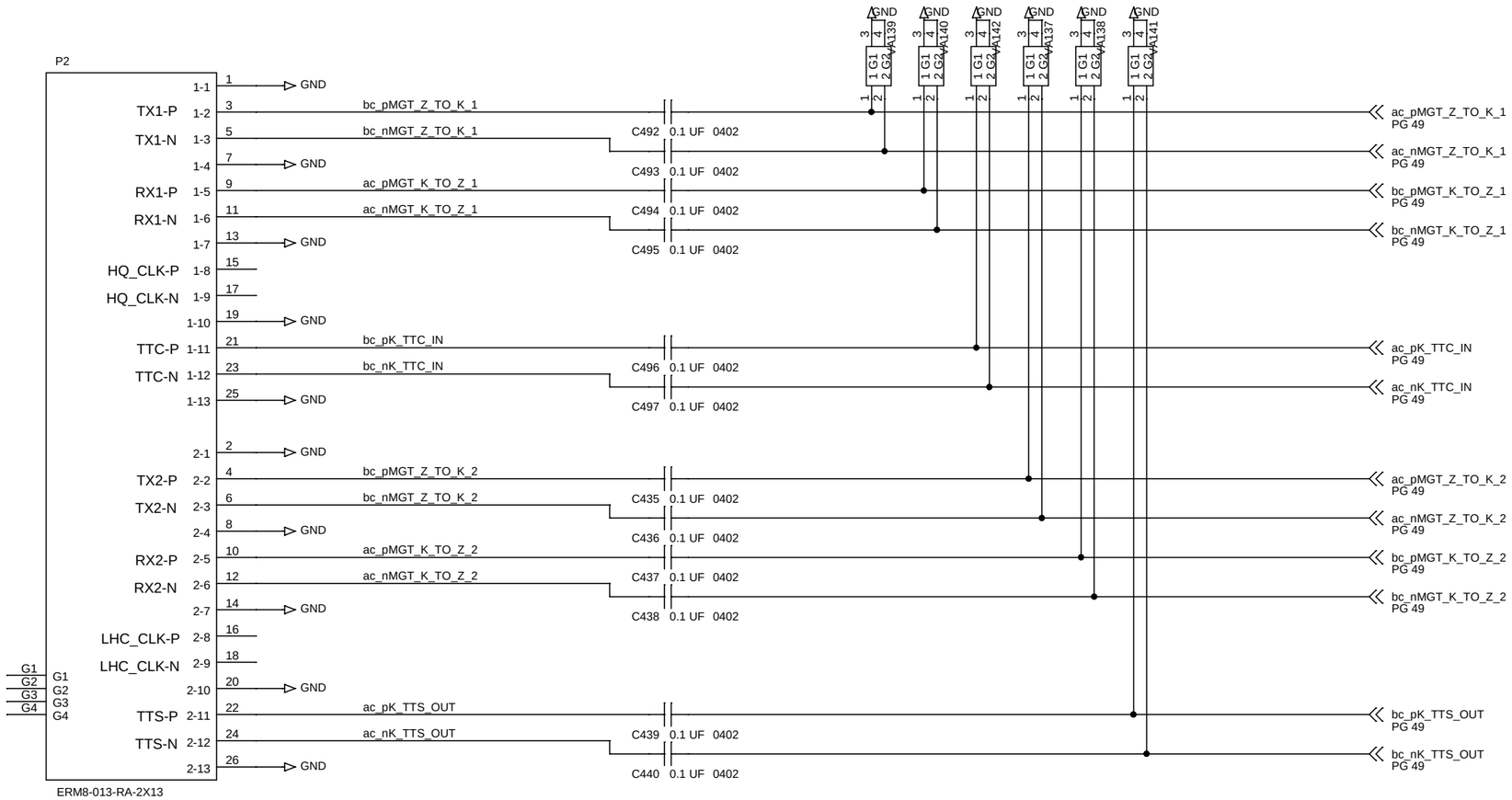
VU7P AND BACKPLANE CLOCK SIGNALS ONLY



ERM8-013-01-L-D-RA-DS

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 2.02: BLADE HS CONNECTOR #1		
Size	Document Number: 6089-103	Rev: A
Date: Thursday, February 28, 2019	Sheet 8 of 74	

THE SIGNALS THAT START WITH "MGT" ARE HIGH SPEED DIFFERENTIAL PAIRS CONNECTED TO GIGABIT TRANSCEIVERS. THEY ARE INTENDED FOR EITHER PCIe OR AXI-C2C. PADS ARE PROVIDED FOR EITHER AC COUPLING CAPACITORS OR DC ZERO OHM RESISTORS.



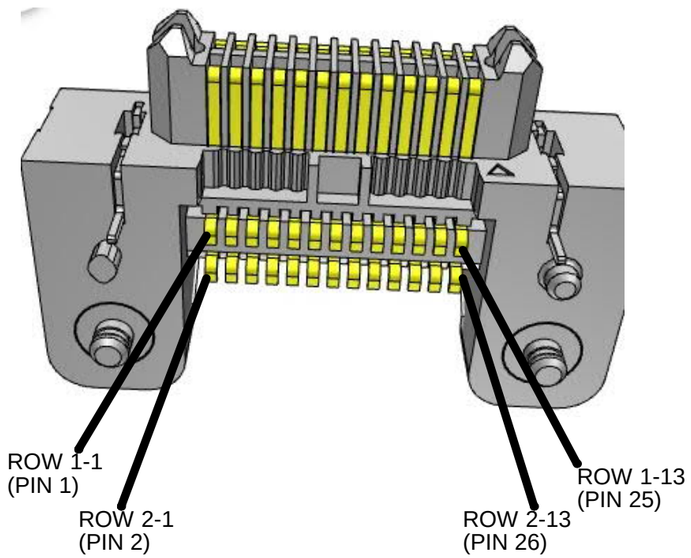
AC COUPLED SIGNALS

bc = BEFORE CAPACITOR

ac = AFTER CAPACITOR

REPLACE THE DC BLOCKING CAPACITORS WITH ZERO-OHM RESISTORS IF THE SERVICE BLADE ALREADY PROVIDES CAPACITORS.

KU15P SIGNALS ONLY



ERM8-013-01-L-D-RA-DS

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 2.03: BLADE HS CONNECTOR #2

Size | Document Number: 6089-103 | Rev: A

Date: Thursday, February 28, 2019 | Sheet 9 of 74

TO BYPASS A DEVICE, CONNECT A JUMPER FROM 1 TO 3.
TO INCLUDE A DEVICE IN THE CHAIN, CONNECT A JUMPER FROM 1 TO 2 AND FROM 3 TO 4.
AS ILLUSTRATED, THE CONTROLLER AND THE VU7P ARE PART OF THE CHAIN, AND THE KU15P IS BYPASSED.

BLADE JTAG

BLADE_JTAG_TMS PG 7

VCC_M3V3 — R108 10K 0603

A VOLTAGE TRANSLATOR CAN BE INSERTED HERE IF THE MAIN BLADE HASOTHER THAN 3.3 VOLT LOGIC LEVELS ON THE JTAG SIGNALS. THE PULLUP RESISTOR CONNECTS TO THE LOGIC VOLTAGE.

U49 74LVC1G126 — R92 33 0603 — V_TMS_1V8
U53 74LVC1G126 — R98 33 0603 — K_TMS_1V8
U57 74LVC1G126 — R107 33 0603 — C_TMS_3V3
U50 74LVC1G125 — R95 33 0603
U55 74LVC1G125 — R101 33 0603
U60 74LVC1G125 — R109 33 0603
U62 74LVC1G126 — R113 33 0603 — V_TCK_1V8
U77 74LVC1G126 — R123 33 0603 — K_TCK_1V8
U84 74LVC1G126 — R133 33 0603 — C_TCK_3V3
U67 74LVC1G125 — R116 33 0603
U78 74LVC1G125 — R130 33 0603
U86 74LVC1G125 — R136 33 0603

VCC_M3V3 — R94 10K 0603

VCC_M1V8 GND VCC_M3V3

BLADE JTAG

BLADE_JTAG_TCK PG 7

VCC_M3V3 — R134 10K 0603

A VOLTAGE TRANSLATOR CAN BE INSERTED HERE IF THE MAIN BLADE HASOTHER THAN 3.3 VOLT LOGIC LEVELS ON THE JTAG SIGNALS. THE PULLUP RESISTOR CONNECTS TO THE LOGIC VOLTAGE.

VCC_M3V3 — R115 10K 0603

FORCE JTAG CABLE

IF EITHER THE JUMPER IS IN PLACE, OR THE PROGRAMMING CABLE IS PLUGGED IN, THE OUTPUT OF THIS BUFFER WILL BE LOW. THIS WILL ENABLE ALL OF THE DRIVERS RELATED TO THE CABLE SIGNALS, AND DISABLE ALL OF THE DRIVERS RELATED TO THE MAIN BLADE.

VCC_M3V3 — R70 10K 0603 — U37 74LVC1G125 — VCC_M3V3

J12 JUMPER — GND

THE JTAG REFERENCE IS 3.3 VOLTS.

VCC_M3V3 — J1

CONN_JTAG_TMS
CONN_JTAG_TCK
CONN_JTAG_TDO
CONN_JTAG_TDI

GND — CON_2X7_RA

USE THE JUMPER IF PIN 13 IS NOT AUTOMATICALLY PULLED LOW WHEN THE CABLE IS PLUGGED IN.

PIN 13 SHOULD BE PULLED LOW WHEN THE CABLE IS PLUGGED IN.

FRONT PANEL JTAG

BLADE JTAG

BLADE_JTAG_TDI PG 7

VCC_M3V3 — R86 10K 0603

A VOLTAGE TRANSLATOR CAN BE INSERTED HERE IF THE MAIN BLADE HASOTHER THAN 3.3 VOLT LOGIC LEVELS ON THE JTAG SIGNALS. THE PULLUP RESISTOR CONNECTS TO THE LOGIC VOLTAGE.

VCC_M3V3 — R82 10K 0603

TDI_3V3

U42 74LVC1G126 — R85 33 0603 — VCC_M3V3 GND
U41 74LVC1G125 — R83 33 0603 — VCC_M3V3 GND

THESE VOLTAGE TRANSLATORS CONVERT THE 1.8 VOLT LOGIC LEVEL FROM THE LAST FPGA TO THE 3.3 VOLT LOGIC LEVEL USED ON THE MAIN BLADE OR THE EXTERNAL PROGRAMMER.

U38 74AUP1T34 — R72 33 0603 — VCC_M1V8 VCC_M3V3 GND
U40 74AUP1T34 — R81 33 0603 — BLADE_JTAG_TDO PG 7 — VCC_M1V8 VCC_M3V3 GND

BLADE JTAG

JUMPER_2X2 J13 — BYPASS JUMPER

V_TDO AC13
V_TDI AE15
V_TMS_1V8 AG15
V_TCK_1V8 AE13

U66-43 FPGA_VU7P_B2104 — JTAG — TDO_0 TDI_0 TMS_0 TCK_0

VU7P

U7 74LVC1G125 — R11 33 0603 — VCC_M1V8 GND

VCC_M3V3 — C771 C766 C752 C747 C825 0.1 UF 0402 — GND
VCC_M3V3 — C812 C809 C803 C826 0.1 UF 0402 — GND

JUMPER_2X2 J14 — BYPASS JUMPER

K_TDO AK16
K_TDI AJ15
K_TMS_1V8 AJ17
K_TCK_1V8 AK15

U65-11 FPGA_KU15P_A1760 — JTAG — TDO_0 TDI_0 TMS_0 TCK_0

KU15P

VCC_M1V8 — C794 C786 C781 C778 C762 0.1 UF 0402 — GND
VCC_M1V8 — C761 C758 C755 C969 C971 0.1 UF 0402 — GND

TDI_1V8

U9 74LVC1G125 — R25 33 0603 — VCC_M1V8 GND

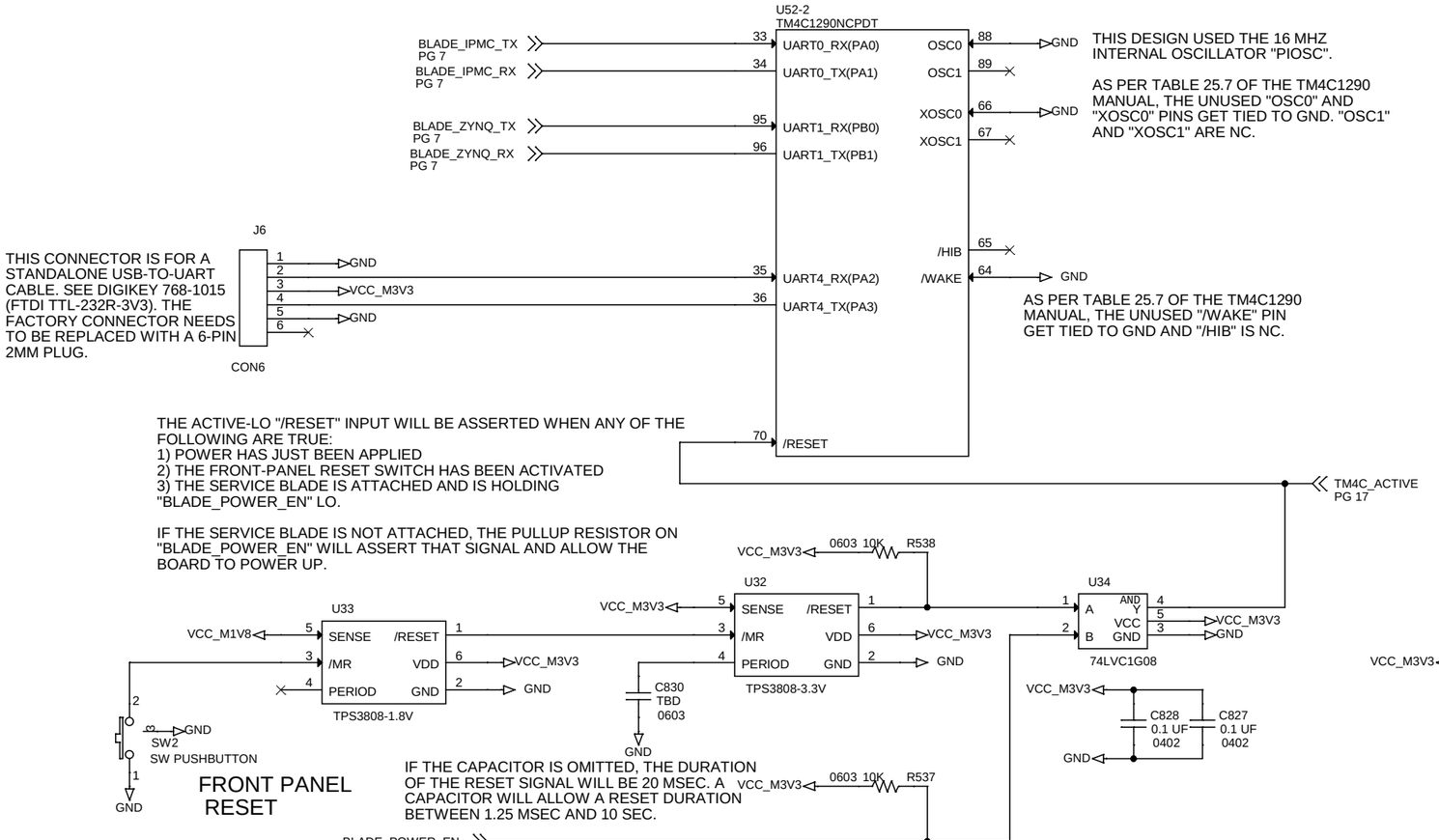
JUMPER_2X2 J15 — BYPASS JUMPER

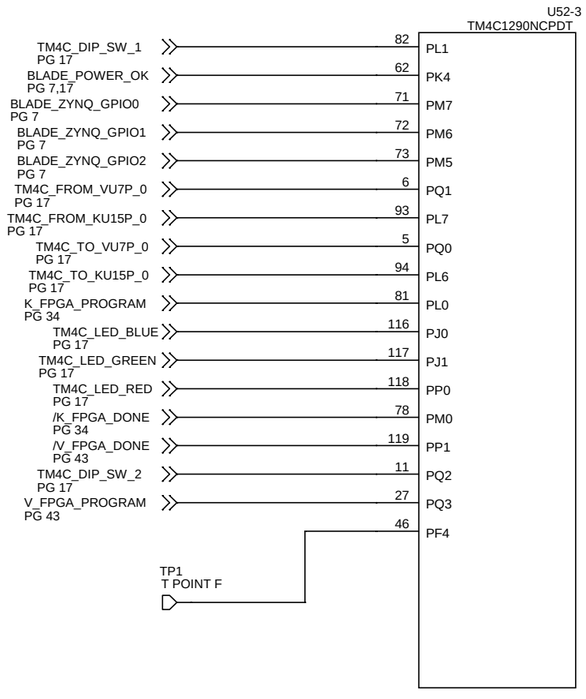
C_TDO 97
C_TDI 98
C_TMS_3V3 99
C_TCK_3V3 100

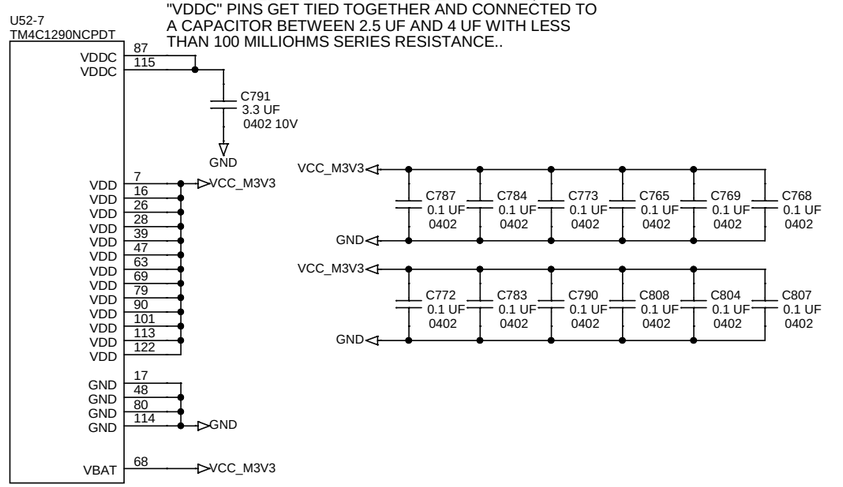
U52-1 TM4C1290NCPDT — JTAG_TDO JTAG_TDI JTAG_TMS JTAG_TCK

CONTROLLER

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 2.04: JTAG CHAIN		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 10 of 74	







ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 2.05 CONTROLLER		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 11 of 74	

DO WE NEED TO ADD A BUFFER TO GET AN LHC-BASED CLOCK INTO THE FPGA LOGIC SECTION? WILL USING THE "TXOUTCLK" FROM A GTH/GTY BLOCK BE ADEQUATE?

bc_pLEGACY_CLK PG 14 — C1 0.1 UF 0402 — ac_pLEGACY_CLK
bc_nLEGACY_CLK PG 14 — C2 0.1 UF 0402 — ac_nLEGACY_CLK
R129 49.9 0402, R131 49.9 0402, C216 0.1 UF 0402 GND
bc_pLHC_CLK_IN PG 8 — C445 0.1 UF 0402 — ac_pLHC_CLK_IN
bc_nLHC_CLK_IN PG 8 — C446 0.1 UF 0402 — ac_nLHC_CLK_IN
R120 49.9 0402, R119 49.9 0402, C205 0.1 UF 0402 GND
bc_pHIGH_QUAL_CLK_IN PG 8 — C502 0.1 UF 0402 — ac_pHIGH_PERF_CLK_IN
bc_nHIGH_QUAL_CLK_IN PG 8 — C503 0.1 UF 0402 — ac_nHIGH_PERF_CLK_IN
R138 49.9 0402, R139 49.9 0402, C250 0.1 UF 0402 GND

U81-1 SI5340
pXTAL, X1, 48 MHz, nXTAL
XA, X1_SHIELD, X2_SHIELD, XB
FB_IN /FB_IN
OUT_0 /OUT_0 — pSYNTH_CLK0 / nSYNTH_CLK0
OUT_1 /OUT_1 — pSYNTH_CLK1 / nSYNTH_CLK1
OUT_2 /OUT_2 — pSYNTH_CLK2 / nSYNTH_CLK2
OUT_3 /OUT_3 — pSYNTH_CLK3 / nSYNTH_CLK3
IN_0 /IN_0, IN_1 /IN_1, IN_2 /IN_2

THESE CLOCKS DRIVE THE 4 BUFFERS AT THE BOTTOM OF THIS PAGE.

WE DO NOT HAVE AN UNUSED OUTPUT, SO WE CAN NOT USE FEEDBACK. ZERO-DELAY BUFFERING IS NOT A REQUIREMENT, NOR IS FIXED PHASE BETWEEN OUTPUTS.

U80 SI53340 1:2
CLK0 /CLK0, CLK1 /CLK1, NC8, CLK_SEL
Q0 /Q0 — pHIGH_PERF_CLK_BUF1 / nHIGH_PERF_CLK_BUF1
Q1 /Q1 — pHIGH_PERF_CLK_BUF0 / nHIGH_PERF_CLK_BUF0
Q2 /Q2, Q3 /QE, VDD, GND PAD
R126 4.7K 0603 GND
R121 100 0402, R110 100 0402
DC COUPLED LVDS
<Implementation>
C751 1 UF 0402 10v

THE SPLIT TERMINATOR WITH A CAPACITOR TO GND IS USED FOR CLOCKS COMING FROM OFF THE BOARD. CLOCKS THAT ARE STRICTLY WITHIN THE BOARD USE SIMPLE 100 OHM TERMINATORS.

U61 SI53340 1:4
CLK0 /CLK0, CLK1 /CLK1, NC8, CLK_SEL
Q0 /Q0 — pHIGH_PERF_CLK0 / nHIGH_PERF_CLK0
Q1 /Q1 — pHIGH_PERF_CLK1 / nHIGH_PERF_CLK1
Q2 /Q2 — pHIGH_PERF_CLK2 / nHIGH_PERF_CLK2
Q3 /QE — pHIGH_PERF_CLK3 / nHIGH_PERF_CLK3
R105 4.7K 0603 GND
<Implementation>
C767 1 UF 0402 10v

THESE CLOCKS DRIVE THE 4 BUFFERS AT THE BOTTOM OF THIS PAGE.

AC COUPLED LVDS

U83 SI53340 2:4
pHIGH_PERF_CLK0, nHIGH_PERF_CLK0 — R127 100 0402, R132 100 0402
pSYNTH_CLK0, nSYNTH_CLK0
DC COUPLED LVDS
R135 4.7K 0603 GND
V_GTY1_SEL_SYNTH PG 27
<Implementation>
C754 1 UF 0402 10v
Q0 /Q0 — bc_pV_CLK1_CHAN0 / bc_nV_CLK1_CHAN0 — C228 0.1 UF 0402 — ac_pV_CLK1_CHAN0 PG 61 / ac_nV_CLK1_CHAN0 PG 61 — QUAD B
Q1 /Q1 — bc_pV_CLK1_CHAN1 / bc_nV_CLK1_CHAN1 — C232 0.1 UF 0402, C241 0.1 UF 0402 — ac_pV_CLK1_CHAN1 PG 63 / ac_nV_CLK1_CHAN1 PG 63 — QUAD D
Q2 /Q2 — bc_pV_CLK1_CHAN2 / bc_nV_CLK1_CHAN2 — C244 0.1 UF 0402, C251 0.1 UF 0402 — ac_pV_CLK1_CHAN2 PG 66 / ac_nV_CLK1_CHAN2 PG 66 — QUAD G
Q3 /QE — bc_pV_CLK1_CHAN3 / bc_nV_CLK1_CHAN3 — C257 0.1 UF 0402, C269 0.1 UF 0402 — ac_pV_CLK1_CHAN3 PG 67 / ac_nV_CLK1_CHAN3 PG 67 — QUAD I

THESE CLOCKS DRIVE THE FIREFLY "GTY1" TRANSCEIVERS ON THE RIGHT SIDE OF THE VU7P.

U56 SI53340 2:4
pHIGH_PERF_CLK1, nHIGH_PERF_CLK1 — R97 100 0402, R100 100 0402
pSYNTH_CLK1, nSYNTH_CLK1
DC COUPLED LVDS
R106 4.7K 0603 GND
V_GTY2_SEL_SYNTH PG 27
<Implementation>
C780 1 UF 0402 10v
Q0 /Q0 — bc_pV_CLK1_CHAN4 / bc_nV_CLK1_CHAN4 — C149 0.1 UF 0402 — ac_pV_CLK1_CHAN4 PG 69 / ac_nV_CLK1_CHAN4 PG 69 — QUAD L
Q1 /Q1 — bc_pV_CLK1_CHAN5 / bc_nV_CLK1_CHAN5 — C151 0.1 UF 0402, C158 0.1 UF 0402 — ac_pV_CLK1_CHAN5 PG 71 / ac_nV_CLK1_CHAN5 PG 71 — QUAD N
Q2 /Q2 — bc_pV_CLK1_CHAN6 / bc_nV_CLK1_CHAN6 — C160 0.1 UF 0402, C162 0.1 UF 0402 — ac_pV_CLK1_CHAN6 PG 73 / ac_nV_CLK1_CHAN6 PG 73 — QUAD P
Q3 /QE — bc_pV_CLK1_CHAN7 / bc_nV_CLK1_CHAN7 — C166 0.1 UF 0402, C172 0.1 UF 0402 — ac_pV_CLK1_CHAN7 PG 74 / ac_nV_CLK1_CHAN7 PG 74 — QUAD R

THESE CLOCKS DRIVE THE FIREFLY "GTY2" TRANSCEIVERS ON THE LEFT SIDE OF THE VU7P.

AC COUPLED LVDS

U87 SI53340 2:4
pHIGH_PERF_CLK2, nHIGH_PERF_CLK2 — R147 100 0402, R143 100 0402
pSYNTH_CLK2, nSYNTH_CLK2
DC COUPLED LVDS
R140 4.7K 0603 GND
K_GTH_SEL_SYNTH PG 27
SPARE
<Implementation>
C736 1 UF 0402 10v
Q0 /Q0 — bc_pK_CLK1_CHAN0 / bc_nK_CLK1_CHAN0 — C286 0.1 UF 0402 — ac_pK_CLK1_CHAN0 PG 50 / ac_nK_CLK1_CHAN0 PG 50 — QUAD C
Q1 /Q1 — bc_pK_CLK1_CHAN1 / bc_nK_CLK1_CHAN1 — C281 0.1 UF 0402, C270 0.1 UF 0402 — ac_pK_CLK1_CHAN1 PG 51 / ac_nK_CLK1_CHAN1 PG 51 — QUAD F
Q2 /Q2 — bc_pK_CLK1_CHAN2 / bc_nK_CLK1_CHAN2 — C264 0.1 UF 0402, C252 0.1 UF 0402 — ac_pK_CLK1_CHAN2 PG 52 / ac_nK_CLK1_CHAN2 PG 52 — QUAD I
Q3 /QE — C249 0.1 UF 0402

THESE CLOCKS DRIVE THE FIREFLY "GTH" TRANSCEIVERS ON THE KU15P.

U68 SI53340 2:4
pHIGH_PERF_CLK3, nHIGH_PERF_CLK3 — R125 100 0402, R117 100 0402
pSYNTH_CLK3, nSYNTH_CLK3
DC COUPLED LVDS
R114 4.7K 0603 GND
K_GTY_SEL_SYNTH PG 27
<Implementation>
C759 1 UF 0402 10v
Q0 /Q0 — bc_pK_CLK1_CHAN4 / bc_nK_CLK1_CHAN4 — C211 0.1 UF 0402 — ac_pK_CLK1_CHAN4 PG 54 / ac_nK_CLK1_CHAN4 PG 54 — QUAD M
Q1 /Q1 — bc_pK_CLK1_CHAN5 / bc_nK_CLK1_CHAN5 — C204 0.1 UF 0402 — ac_pK_CLK1_CHAN5 PG 56 / ac_nK_CLK1_CHAN5 PG 56 — QUAD P
Q2 /Q2 — bc_pK_CLK1_CHAN6 / bc_nK_CLK1_CHAN6 — C200 0.1 UF 0402 — ac_pK_CLK1_CHAN6 PG 58 / ac_nK_CLK1_CHAN6 PG 58 — QUAD R
Q3 /QE — C191 0.1 UF 0402, C189 0.1 UF 0402, C181 0.1 UF 0402

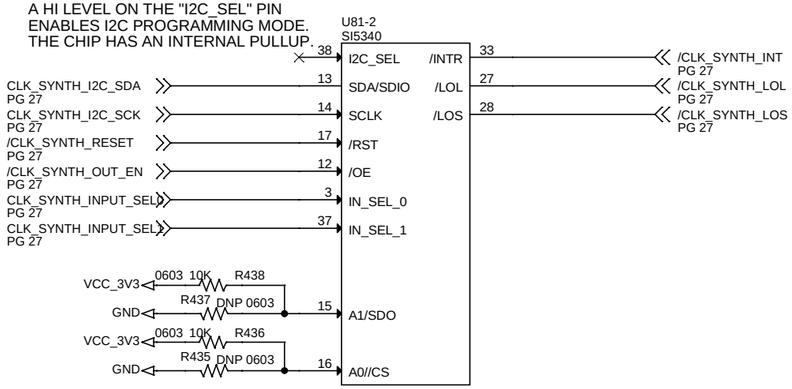
THESE CLOCKS DRIVE THE FIREFLY "GTY" TRANSCEIVERS ON THE KU15P.

AC COUPLED LVDS
bc = BEFORE CAPACITOR
ac = AFTER CAPACITOR

THE CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

ATCA FPGA BOARD, KU15P AND VU7P, MK1
Title: 2.06: LHC CLOCKING
Size | Document Number: 6089-103 | Rev: A
Date: Tuesday, February 26, 2019 | Sheet 12 of 74

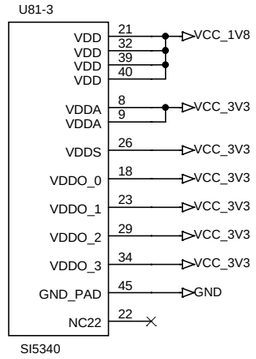
A HI LEVEL ON THE "I2C_SEL" PIN
ENABLES I2C PROGRAMMING MODE.
THE CHIP HAS AN INTERNAL PULLUP.

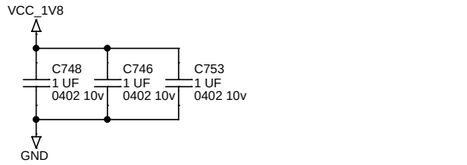


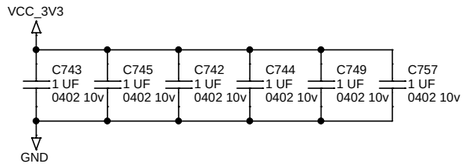
SI5340 I2C ADDRESS:
READ OR WRITE
1 1 1 0 1 A1 A0
RANGE: 0X74 TO 0X77

INSTALL A ZERO-OHM JUMPER
TO SET AN ADDRESS BIT TO '0'.

OMIT THE ZERO-OHM JUMPER
TO SET AN ADDRESS BIT TO '1'.







ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 2.07: LHC CLOCKING SUPPORT		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 13 of 74	

THIS CIRCUIT ON THIS PAGE IS FOR USE IN THE PROTOTYPE ONLY. IT ALLOWS US TO FEED LEGACY TTC SIGNALS INTO THE SYSTEM.

U13-2
SFP_CONN_WITH_CAGE

U13-1
SFP_CONN_WITH_CAGE

THE SFP I2C SIGNALS AND CONTROL LINES ARE WIRED TO THE CHIPS THAT SUPPORT ACCESS TO THE KU15P OPTICS. THEY CAN BE CONNECTED ELSEWHERE IF DESIRED.

SFP+ CONNECTOR TO RECEIVE ENCODED TTC CLOCK/DATA STREAM.

THIS JUMPER ALLOWS DIRECT CONNECTION OF "TTS_OUT" TO EITHER THE KU15P OR THE VU7P. IF BOTH FPGAS WILL GENERATE THIS DATA, USE A UTILITY CONNECTION BETWEEN THEM TO ROUTE FROM ONE TO THE OTHER.

J11 JUMPER_DIFF

THESE RESISTORS MUST BE NEAR THE 65LVDS100 INPUT PINS.

U12 NB7V52M

U8 65LVDS100

DC COUPLED LVDS

THESE NETS NEED 100 OHM INTERNAL TERMINATION AT THE FPGA.

J10 JUMPER_DIFF

THIS BUFFER CONVERTS 2.5V CML SIGNALS TO LVDS LEVELS THAT ARE COMPATABLE WITH ULTRASCALE "HP" BANK INPUTS.

THIS JUMPER ALLOWS DIRECT CONNECTION OF "CDR_DATA" TO EITHER THE KU15P OR THE VU7P. IF BOTH FPGAS NEED THIS DATA, USE A UTILITY CONNECTION BETWEEN THEM TO ROUTE FROM ONE TO THE OTHER.

U14 ADN2814

THE CLOCK POLARITY IS INVERTED.

U11 SY89832U

THIS DIVIDER NETWORK PROVIDES A DIFFERENTIAL VOLTAGE OF 0.83 VOLTS. IT HOLDS THE RESET INPUT AT A "FALSE" VALUE.

U10 SY89872

S1=0, S0=1 -> B=INPUT/4

AC COUPLED LVDS

THESE NETS NEED 100 OHM INTERNAL TERMINATION AT THE FPGA.

J9 JUMPER_DIFF

THIS JUMPER ALLOWS DIRECT CONNECTION OF "TTC_CLK40" TO EITHER THE KU15P OR THE VU7P. IF BOTH FPGAS NEED THIS CLOCK, USE A UTILITY CONNECTION BETWEEN THEM TO ROUTE FROM ONE TO THE OTHER.

THE THRESHOLD ADJUST SET BY R27=33 IS NOT MUCH DIFFERENT THAN R27=10 OHMS. MAYBE CHECK WITH ERIC HAZEN TO VALIDATE THIS VALUE.

PLACE ONE OF EACH VALUE NEAR PINS 2, 12, 18, 24, AND 31.

THIS DESIGN ONLY USES 2,5 VOLTS FOR LEGACY TTC SUPPORT. IT DOES NOT NEED A DC-DC CONVERTER SUPPLY.

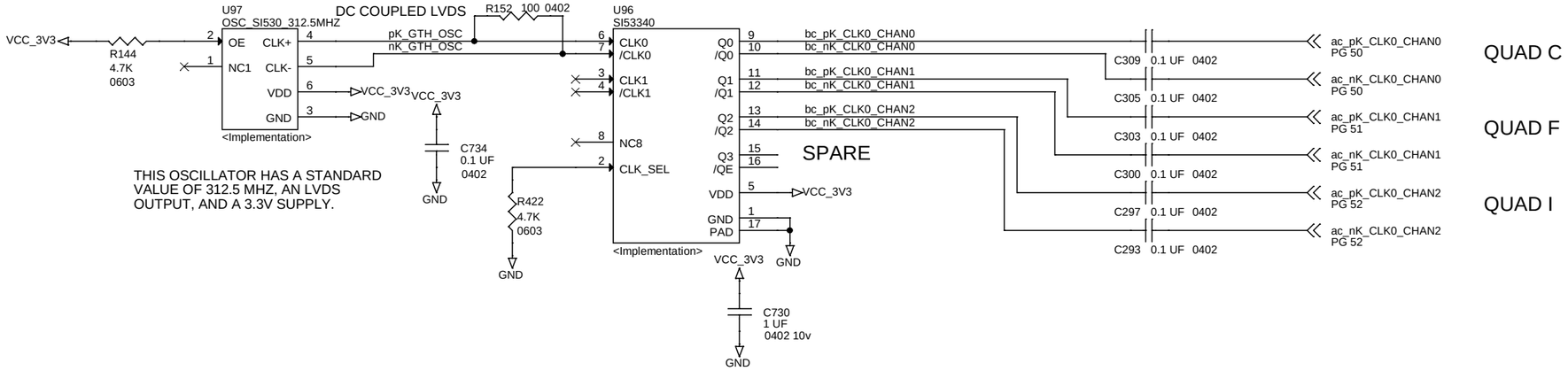
U19 LT1963A

Title	ATCA FPGA BOARD, KU15P AND VU7P, MK1
	2.08: LEGACY TTC
Size	Document Number: 6089-103
Rev	A
Date:	Wednesday, March 06, 2019
Sheet	14 of 74

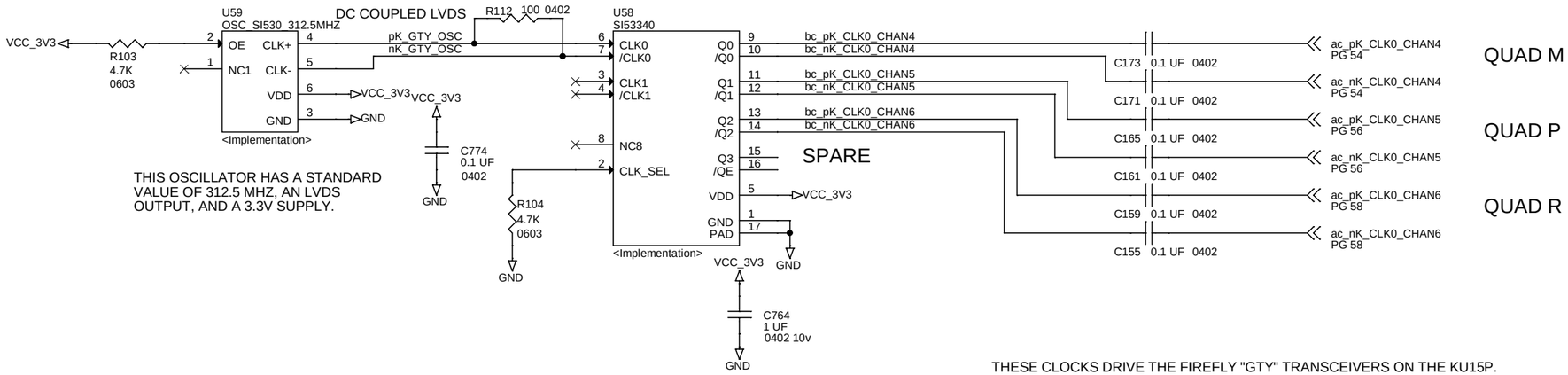
AC COUPLED LVDS

bc = BEFORE CAPACITOR

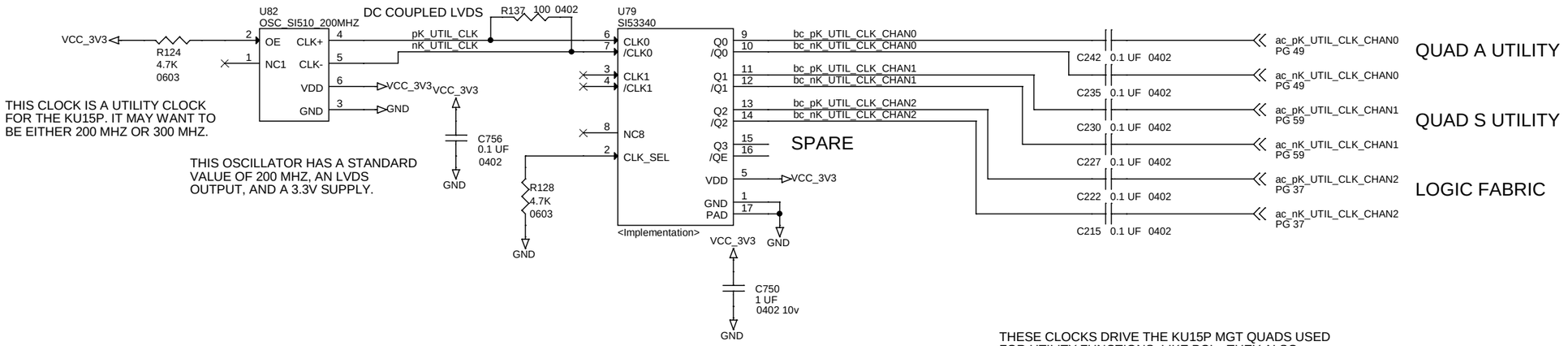
THE CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.



THESE CLOCKS DRIVE THE FIREFLY "GTH" TRANSCEIVERS ON THE KU15P.



THESE CLOCKS DRIVE THE FIREFLY "GTY" TRANSCEIVERS ON THE KU15P.



THESE CLOCKS DRIVE THE KU15P MGT QUADS USED FOR UTILITY FUNCTIONS, LIKE PCIe. THEY ALSO PROVIDE A CLOCK TO THE LOGIC FABRIC.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title

2.09: KU15P OSCILLATOR CLOCKING

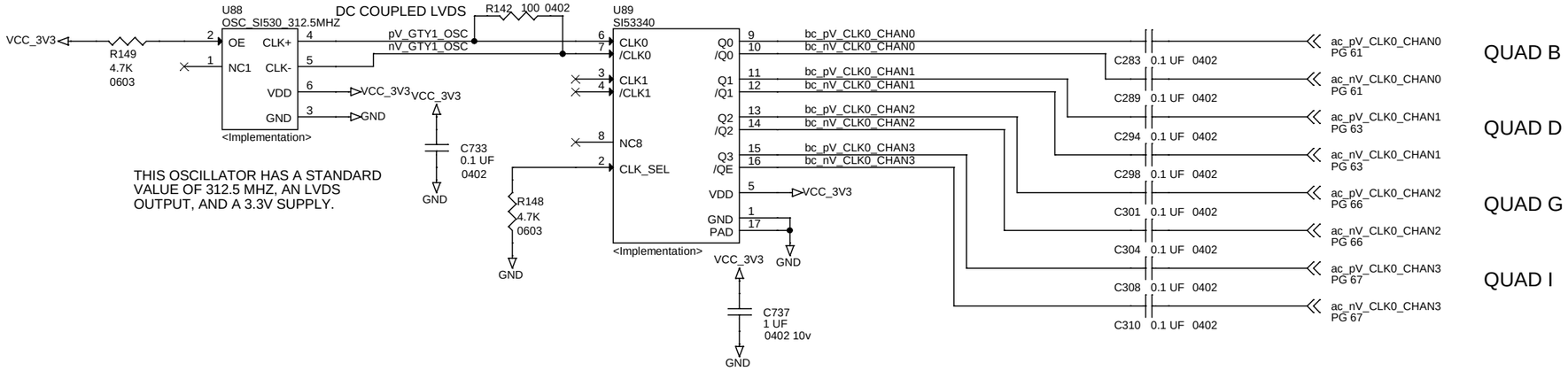
Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 15 of 74

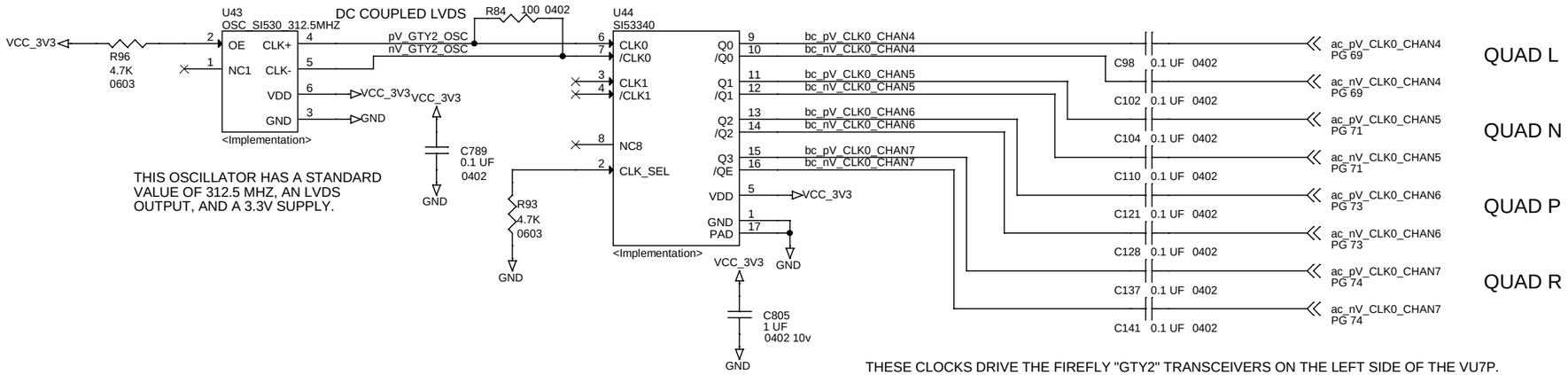
AC COUPLED LVDS

bc = BEFORE CAPACITOR

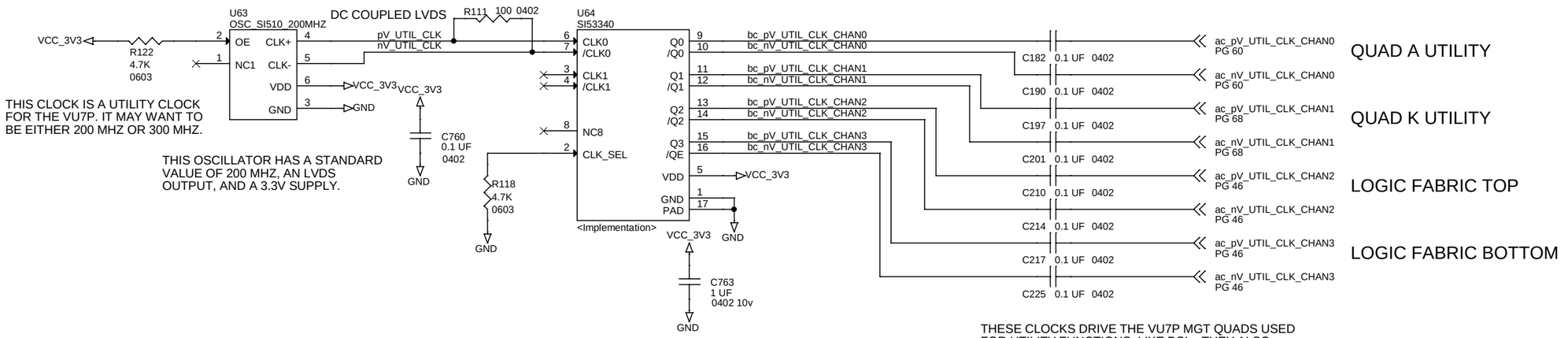
THE CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.



THESE CLOCKS DRIVE THE FIREFLY "GTY1" TRANSCEIVERS ON THE RIGHT SIDE OF THE VU7P.



THESE CLOCKS DRIVE THE FIREFLY "GTY2" TRANSCEIVERS ON THE LEFT SIDE OF THE VU7P.



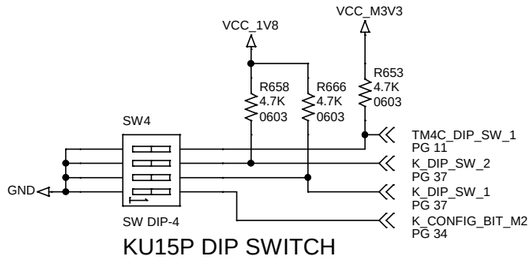
THESE CLOCKS DRIVE THE VU7P MGT QUADS USED FOR UTILITY FUNCTIONS, LIKE PCIe. THEY ALSO PROVIDE A CLOCK TO THE LOGIC FABRIC.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

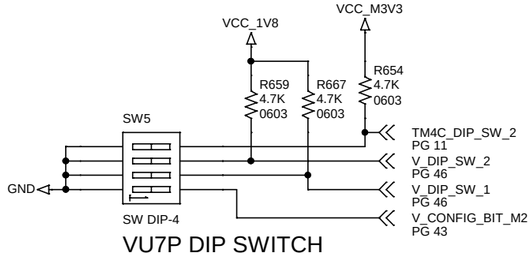
Title: 2.10: VU7P OSCILLATOR CLOCKING

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 16 of 74



KU15P DIP SWITCH

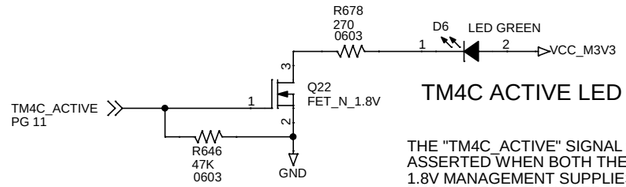


VU7P DIP SWITCH

SWITCH POSITION 4 IS USED TO TELL THE TM4C WHETHER OR NOT THE ASSOCIATED FPGA SHOULD BE POWERED. A HI LEVEL (SWITCH OPEN) MEANS "TURN ON FPGA POWER".

SWITCH POSITION 1 IS USED TO TELL THE FPGA WHETHER THE BOOT MODE IS "MASTER SPI (WITH JTAG OPTION)", OR "JTAG ONLY (MASTER SPI DISABLED)". A HI LEVEL (SWITCH OPEN) MEANS "JTAG ONLY (MASTER SPI DISABLED)"

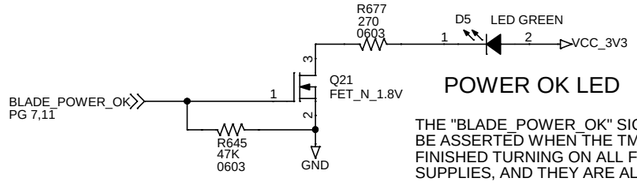
THE FUNCTION OF SWITCH POSITIONS 2 AND 3 ARE UNDEFINED AT THIS TIME.



TM4C ACTIVE LED

THE "TM4C_ACTIVE" SIGNAL WILL BE ASSERTED WHEN BOTH THE 3.3V AND 1.8V MANAGEMENT SUPPLIES ARE GOOD, THE "ENABLE" SIGNAL FROM THE SERVICE BLADE IS HIGH, AND THE "RESET" SWITCH IS NOT ACTIVATED.

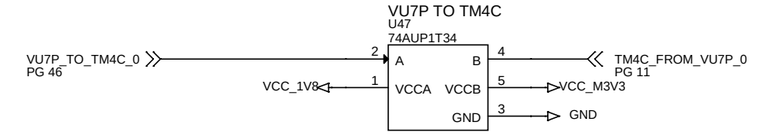
FOR LED CURRENT OF 5 MA, THE FORWARD VOLTAGE DROP IS 1.95V. USE 270 OHM RESISTOR.

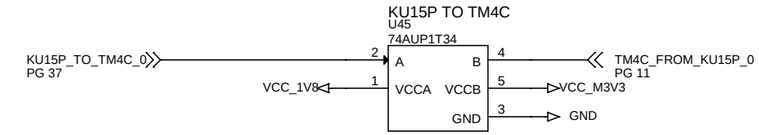


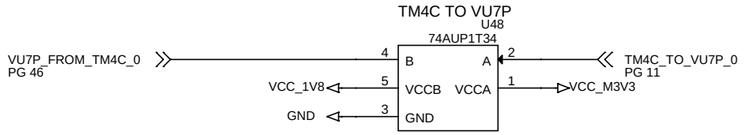
POWER OK LED

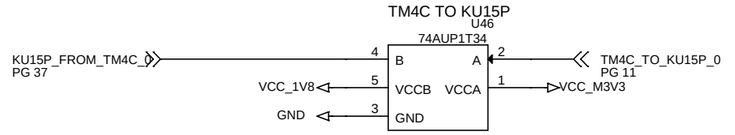
THE "BLADE_POWER_OK" SIGNAL WILL BE ASSERTED WHEN THE TM4C HAS FINISHED TURNING ON ALL FPGA POWER SUPPLIES, AND THEY ARE ALL GOOD.

FOR LED CURRENT OF 5 MA, THE FORWARD VOLTAGE DROP IS 1.95V. USE 270 OHM RESISTOR.

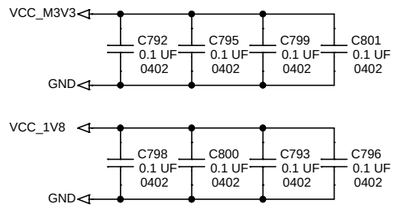






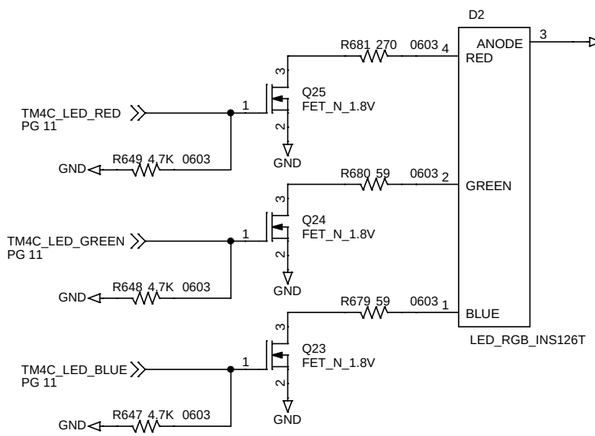


UTILITY CONNECTIONS BETWEEN THE TM4C CONTROLLER AND THE FPGAS. THE LEVEL TRANSLATORS ARE UNI-DIRECTIONAL.

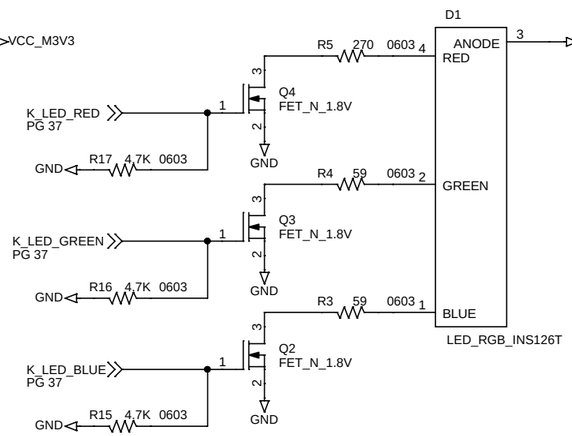


FOR LED CURRENT OF 5 MA, THE FORWARD VOLTAGE DROPS ARE:
RED 2.0V. USE 270 OHM RESISTOR
BLUE 3.0V. USE 59 OHM RESISTOR
GREEN 3.0V. USE 59 OHM RESISTOR

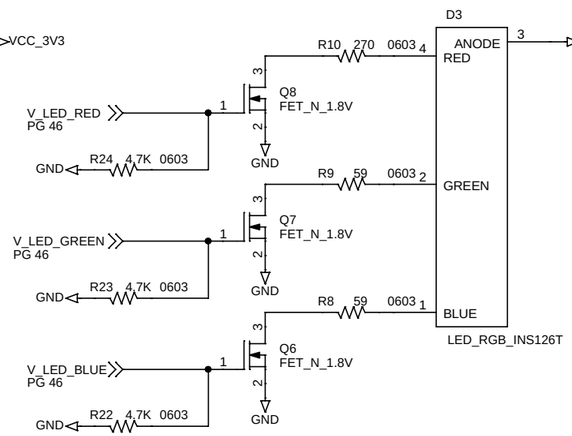
TM4C CONTROLLER LED



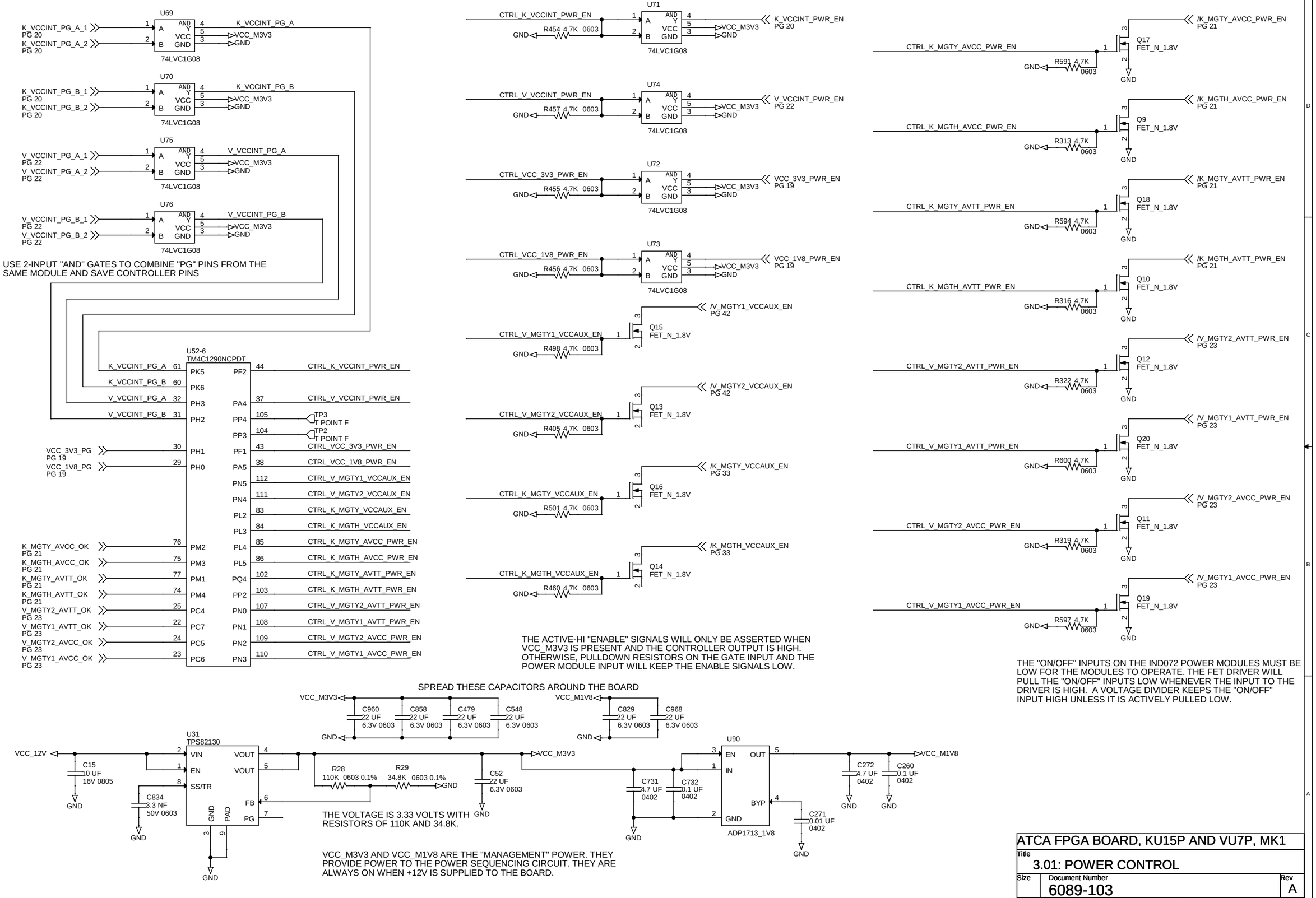
KU15P LED



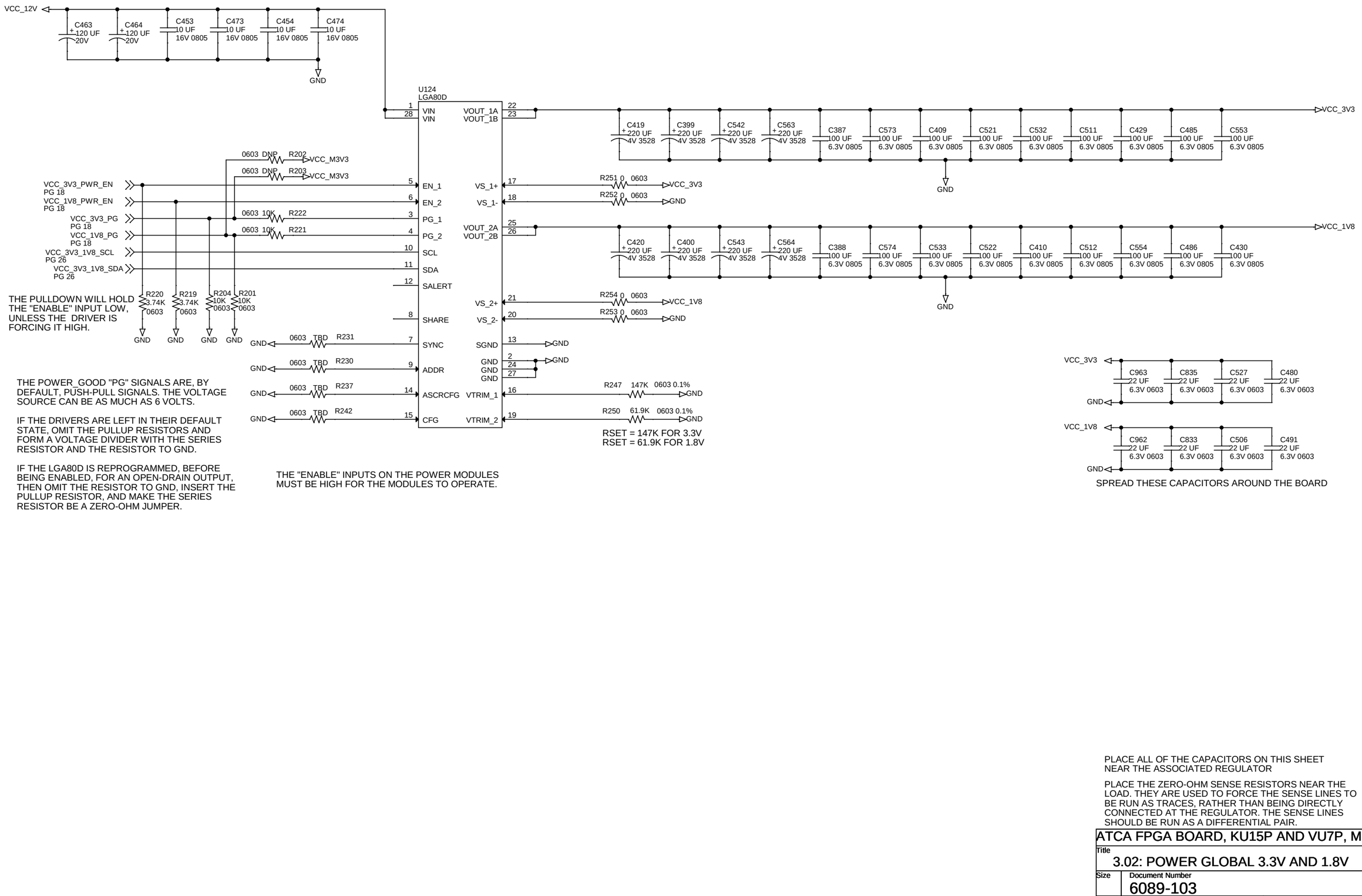
VU7P LED



ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 2.11: LEDS, SWITCHES, LEVEL SHIFTERS		
Size	Document Number: 6089-103	Rev: A
Date: Thursday, March 07, 2019	Sheet 17 of 74	



ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 3.01: POWER CONTROL		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 18 of 74	



THE PULLDOWN WILL HOLD THE "ENABLE" INPUT LOW, UNLESS THE DRIVER IS FORCING IT HIGH.

THE POWER_GOOD "PG" SIGNALS ARE, BY DEFAULT, PUSH-PULL SIGNALS. THE VOLTAGE SOURCE CAN BE AS MUCH AS 6 VOLTS.

IF THE DRIVERS ARE LEFT IN THEIR DEFAULT STATE, OMIT THE PULLUP RESISTORS AND FORM A VOLTAGE DIVIDER WITH THE SERIES RESISTOR AND THE RESISTOR TO GND.

IF THE LGA80D IS REPROGRAMMED, BEFORE BEING ENABLED, FOR AN OPEN-DRAIN OUTPUT, THEN OMIT THE RESISTOR TO GND, INSERT THE PULLUP RESISTOR, AND MAKE THE SERIES RESISTOR BE A ZERO-OHM JUMPER.

THE "ENABLE" INPUTS ON THE POWER MODULES MUST BE HIGH FOR THE MODULES TO OPERATE.

RSET = 147K FOR 3.3V
RSET = 61.9K FOR 1.8V

SPREAD THESE CAPACITORS AROUND THE BOARD

PLACE ALL OF THE CAPACITORS ON THIS SHEET NEAR THE ASSOCIATED REGULATOR

PLACE THE ZERO-OHM SENSE RESISTORS NEAR THE LOAD. THEY ARE USED TO FORCE THE SENSE LINES TO BE RUN AS TRACES, RATHER THAN BEING DIRECTLY CONNECTED AT THE REGULATOR. THE SENSE LINES SHOULD BE RUN AS A DIFFERENTIAL PAIR.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 3.02: POWER GLOBAL 3.3V AND 1.8V		
Size	Document Number: 6089-103	Rev: A
Date: Wednesday, March 06, 2019	Sheet 19 of 74	

KU15P VCCINT MUST BE 0.85V.

U122
LGA80D

VCC_12V

C459 120 UF 20V
C460 120 UF 20V
C449 10 UF 16V 0805
C469 10 UF 16V 0805
C450 10 UF 16V 0805
C470 10 UF 16V 0805
GND

C415 330 UF 2.5V 3528
C393 330 UF 2.5V 3528
C538 330 UF 2.5V 3528
C559 330 UF 2.5V 3528
C425 100 UF 4V 0805
C405 100 UF 4V 0805
C528 100 UF 4V 0805
C550 100 UF 4V 0805
C383 100 UF 4V 0805
C569 100 UF 4V 0805
C481 100 UF 4V 0805
C507 100 UF 4V 0805
C517 100 UF 4V 0805
GND

K_VCCINT

A

1 VIN
28 VIN
22 VOUT_1A
23 VOUT_1B

0603 DNP R194 VCC_M3V3
0603 DNP R195 VCC_M3V3
0603 10K R216
0603 10K R215

5 EN_1
6 EN_2
3 PG_1
4 PG_2
10 SCL
11 SDA
12 SALERT
8 SHARE
7 SYNC
9 ADDR
14 ASCRCFG
15 CFG

17 VS_1+
18 VS_1-
25 VOUT_2A
26 VOUT_2B
21 VS_2+
20 VS_2-
13 SGND
2 GND
24 GND
27 GND
16 VTRIM_1
19 VTRIM_2

R191 0 0603 K_VCCINT
R192 0 0603 GND

C416 330 UF 2.5V 3528
C394 330 UF 2.5V 3528
C539 330 UF 2.5V 3528
C560 330 UF 2.5V 3528
C426 100 UF 4V 0805
C406 100 UF 4V 0805
C529 100 UF 4V 0805
C551 100 UF 4V 0805
C384 100 UF 4V 0805
C570 100 UF 4V 0805
C482 100 UF 4V 0805
C508 100 UF 4V 0805
C518 100 UF 4V 0805
GND

K_VCCINT_PG_A_1 PG 18
K_VCCINT_PG_A_2 PG 18
K_VCCINT_A_SCL PG 26
K_VCCINT_A_SDA PG 26

R196 10K 0603
R193 10K 0603
GND GND

K_VCCINT_PWR_EN PG 18

R213 3.74K 0603
GND

THE PULLDOWN WILL HOLD THE "ENABLE" INPUT LOW, UNLESS THE DRIVER IS FORCING IT HIGH.

0603 TBD R227
0603 TBD R235
0603 TBD R240
GND

R245 16.2K 0603 0.1% GND

RSET = 16.2K FOR 0.85V

U123
LGA80D

C461 120 UF 20V
C462 120 UF 20V
C451 10 UF 16V 0805
C471 10 UF 16V 0805
C452 10 UF 16V 0805
C472 10 UF 16V 0805
GND

C417 330 UF 2.5V 3528
C396 330 UF 2.5V 3528
C540 330 UF 2.5V 3528
C561 330 UF 2.5V 3528
C427 100 UF 4V 0805
C407 100 UF 4V 0805
C530 100 UF 4V 0805
C552 100 UF 4V 0805
C385 100 UF 4V 0805
C571 100 UF 4V 0805
C519 100 UF 4V 0805
C509 100 UF 4V 0805
C483 100 UF 4V 0805
GND

B

1 VIN
28 VIN
22 VOUT_1A
23 VOUT_1B

0603 DNP R198 VCC_M3V3
0603 DNP R199 VCC_M3V3
0603 10K R218
0603 10K R217

5 EN_1
6 EN_2
3 PG_1
4 PG_2
10 SCL
11 SDA
12 SALERT
8 SHARE
7 SYNC
9 ADDR
14 ASCRCFG
15 CFG

17 VS_1+
18 VS_1-
25 VOUT_2A
26 VOUT_2B
21 VS_2+
20 VS_2-
13 SGND
2 GND
24 GND
27 GND
16 VTRIM_1
19 VTRIM_2

C418 330 UF 2.5V 3528
C397 330 UF 2.5V 3528
C541 330 UF 2.5V 3528
C562 330 UF 2.5V 3528
C428 100 UF 4V 0805
C408 100 UF 4V 0805
C531 100 UF 4V 0805
C549 100 UF 4V 0805
C386 100 UF 4V 0805
C572 100 UF 4V 0805
C520 100 UF 4V 0805
C510 100 UF 4V 0805
C484 100 UF 4V 0805
GND

K_VCCINT_PG_B_1 PG 18
K_VCCINT_PG_B_2 PG 18
K_VCCINT_B_SCL PG 26
K_VCCINT_B_SDA PG 26

R200 10K 0603
R197 10K 0603
GND GND

0603 TBD R229
0603 TBD R228
0603 TBD R236
0603 TBD R241
GND

R246 16.2K 0603 0.1% GND

RSET = 16.2K FOR 0.85V

THE POWER_GOOD "PG" SIGNALS ARE, BY DEFAULT, PUSH-PULL SIGNALS. THE VOLTAGE SOURCE CAN BE AS MUCH AS 6 VOLTS.

IF THE DRIVERS ARE LEFT IN THEIR DEFAULT STATE, OMIT THE PULLUP RESISTORS AND FORM A VOLTAGE DIVIDER WITH THE SERIES RESISTOR AND THE RESISTOR TO GND.

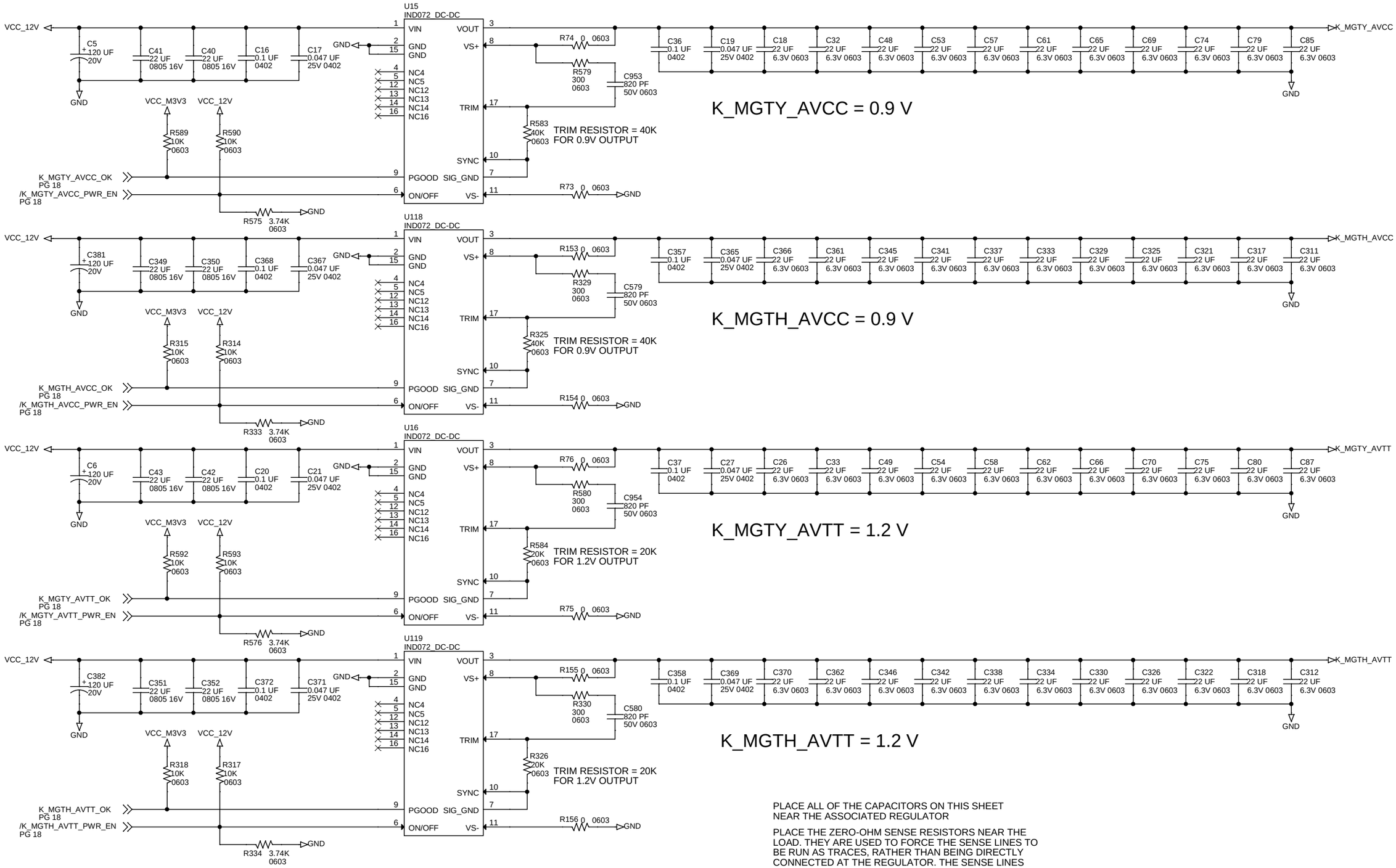
IF THE LGA80D IS REPROGRAMMED, BEFORE BEING ENABLED, FOR AN OPEN-DRAIN OUTPUT, THEN OMIT THE RESISTOR TO GND, INSERT THE PULLUP RESISTOR, AND MAKE THE SERIES RESISTOR BE A ZERO-OHM JUMPER.

THE "ENABLE" INPUTS ON THE POWER MODULES MUST BE HIGH FOR THE MODULES TO OPERATE.

PLACE ALL OF THE CAPACITORS ON THIS SHEET NEAR THE ASSOCIATED REGULATOR

PLACE THE ZERO-OHM SENSE RESISTORS NEAR THE LOAD. THEY ARE USED TO FORCE THE SENSE LINES TO BE RUN AS TRACES, RATHER THAN BEING DIRECTLY CONNECTED AT THE REGULATOR. THE SENSE LINES SHOULD BE RUN AS A DIFFERENTIAL PAIR.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 3.03: POWER SOURCE KU15P INTERNAL		
Size	Document Number: 6089-103	Rev: A
Date: Wednesday, March 06, 2019	Sheet 20 of 74	



THE "ON/OFF" INPUTS ON THE IND072 POWER MODULES MUST BE LOW FOR THE MODULES TO OPERATE. THE FET DRIVER WILL PULL THE "ON/OFF" INPUTS LOW WHENEVER THE INPUT TO THE DRIVER IS HIGH. THE VOLTAGE DIVIDER KEEPS THE "ON/OFF" INPUT HIGH UNLESS IT IS ACTIVELY PULLED LOW.

PLACE ALL OF THE CAPACITORS ON THIS SHEET NEAR THE ASSOCIATED REGULATOR

PLACE THE ZERO-OHM SENSE RESISTORS NEAR THE LOAD. THEY ARE USED TO FORCE THE SENSE LINES TO BE RUN AS TRACES, RATHER THAN BEING DIRECTLY CONNECTED AT THE REGULATOR. THE SENSE LINES SHOULD BE RUN AS A DIFFERENTIAL PAIR.

THE IND072 REGULATORS HAVE A TUNABLE LOOP THAT SHOULD BE ADJUSTED FOR THE AMOUNT OF CAPACITANCE THAT IS ON THE OUTPUT. REFER TO THE APP NOTE FOR SUGGESTED VALUES.

THE ON/OFF PIN NEEDS TO BE HELD AT A LOW LOGIC LEVEL TO TURN THE MODULE ON.

THE "PGOOD" SIGNAL WILL BE PULLED LOW IF THE OUTPUT VOLTAGE IS OUTSIDE OF 10% OF THE SETPOINT VALUE.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 3.04: POWER SOURCE KU15P MGT XCVR

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 21 of 74

VU7P VCCINT MUST BE 0.85V.

U125
LGA80D

VCC_12V

C465 120 UF 20V
C466 120 UF 20V
C455 10 UF 16V 0805
C475 10 UF 16V 0805
C456 10 UF 16V 0805
C476 10 UF 16V 0805
GND

1 VIN
28 VIN
22 VOUT_1A
23 VOUT_1B

A

5 EN_1
6 EN_2
3 PG_1
4 PG_2
10 SCL
11 SDA
12 SALERT
8 SHARE
7 SYNC
9 ADDR
14 ASCRCFG
15 CFG

17 VS_1+
18 VS_1-
25 VOUT_2A
26 VOUT_2B
21 VS_2+
20 VS_2-
13 SGND
2 GND
24 GND
27 GND
16 VTRIM_1
19 VTRIM_2

0603 DNP R206 VCC_M3V3
0603 DNP R207 VCC_M3V3
0603 10K R224
0603 10K R223

V_VCCINT_PG_A_1 PG 18
V_VCCINT_PG_A_2 PG 18
V_VCCINT_A_SCL PG 26
V_VCCINT_A_SDA PG 26

R208 10K 0603
R205 10K 0603
GND GND

V_VCCINT_PWR_EN PG 18
R214 3.74K 0603
GND

THE PULLDOWN WILL HOLD THE "ENABLE" INPUT LOW, UNLESS THE DRIVER IS FORCING IT HIGH.

0603 TBD R232
0603 TBD R238
0603 TBD R243
GND

R256 0 0603 V_VCCINT
R255 0 0603 GND

R248 16.2K 0603 0.1% GND

RSET = 16.2K FOR 0.85V

C421 330 UF 2.5V 3528
C401 330 UF 2.5V 3528
C544 330 UF 2.5V 3528
C565 330 UF 2.5V 3528
C431 100 UF 6.3V 0805
C411 100 UF 6.3V 0805
C534 100 UF 6.3V 0805
C555 100 UF 6.3V 0805
C389 100 UF 6.3V 0805
C575 100 UF 6.3V 0805
C523 100 UF 6.3V 0805
C513 100 UF 6.3V 0805
C487 100 UF 6.3V 0805
GND

V_VCCINT

C402 330 UF 2.5V 3528
C422 330 UF 2.5V 3528
C566 330 UF 2.5V 3528
C545 330 UF 2.5V 3528
C432 100 UF 6.3V 0805
C412 100 UF 6.3V 0805
C535 100 UF 6.3V 0805
C556 100 UF 6.3V 0805
C390 100 UF 6.3V 0805
C576 100 UF 6.3V 0805
C524 100 UF 6.3V 0805
C514 100 UF 6.3V 0805
C488 100 UF 6.3V 0805
GND

U126
LGA80D

C467 120 UF 20V
C468 120 UF 20V
C457 10 UF 16V 0805
C477 10 UF 16V 0805
C458 10 UF 16V 0805
C478 10 UF 16V 0805
GND

1 VIN
28 VIN
22 VOUT_1A
23 VOUT_1B

B

5 EN_1
6 EN_2
3 PG_1
4 PG_2
10 SCL
11 SDA
12 SALERT
8 SHARE
7 SYNC
9 ADDR
14 ASCRCFG
15 CFG

17 VS_1+
18 VS_1-
25 VOUT_2A
26 VOUT_2B
21 VS_2+
20 VS_2-
13 SGND
2 GND
24 GND
27 GND
16 VTRIM_1
19 VTRIM_2

0603 DNP R210 VCC_M3V3
0603 DNP R211 VCC_M3V3
0603 10K R226
0603 10K R225

V_VCCINT_PG_B_1 PG 18
V_VCCINT_PG_B_2 PG 18
V_VCCINT_B_SCL PG 26
V_VCCINT_B_SDA PG 26

R212 10K 0603
R209 10K 0603
GND GND

0603 TBD R234
0603 TBD R233
0603 TBD R239
0603 TBD R244
GND

R249 16.2K 0603 0.1% GND

RSET = 16.2K FOR 0.85V

C423 330 UF 2.5V 3528
C403 330 UF 2.5V 3528
C546 330 UF 2.5V 3528
C567 330 UF 2.5V 3528
C433 100 UF 6.3V 0805
C413 100 UF 6.3V 0805
C536 100 UF 6.3V 0805
C557 100 UF 6.3V 0805
C391 100 UF 6.3V 0805
C577 100 UF 6.3V 0805
C525 100 UF 6.3V 0805
C515 100 UF 6.3V 0805
C489 100 UF 6.3V 0805
GND

C424 330 UF 2.5V 3528
C404 330 UF 2.5V 3528
C568 330 UF 2.5V 3528
C547 330 UF 2.5V 3528
C434 100 UF 6.3V 0805
C414 100 UF 6.3V 0805
C537 100 UF 6.3V 0805
C558 100 UF 6.3V 0805
C392 100 UF 6.3V 0805
C578 100 UF 6.3V 0805
C490 100 UF 6.3V 0805
C516 100 UF 6.3V 0805
C526 100 UF 6.3V 0805
GND

THE POWER_GOOD "PG" SIGNALS ARE, BY DEFAULT, PUSH-PULL SIGNALS. THE VOLTAGE SOURCE CAN BE AS MUCH AS 6 VOLTS.

IF THE DRIVERS ARE LEFT IN THEIR DEFAULT STATE, OMIT THE PULLUP RESISTORS AND FORM A VOLTAGE DIVIDER WITH THE SERIES RESISTOR AND THE RESISTOR TO GND.

IF THE LGA80D IS REPROGRAMMED, BEFORE BEING ENABLED, FOR AN OPEN-DRAIN OUTPUT, THEN OMIT THE RESISTOR TO GND, INSERT THE PULLUP RESISTOR, AND MAKE THE SERIES RESISTOR BE A ZERO-OHM JUMPER.

THE "ENABLE" INPUTS ON THE POWER MODULES MUST BE HIGH FOR THE MODULES TO OPERATE.

PLACE ALL OF THE CAPACITORS ON THIS SHEET NEAR THE ASSOCIATED REGULATOR

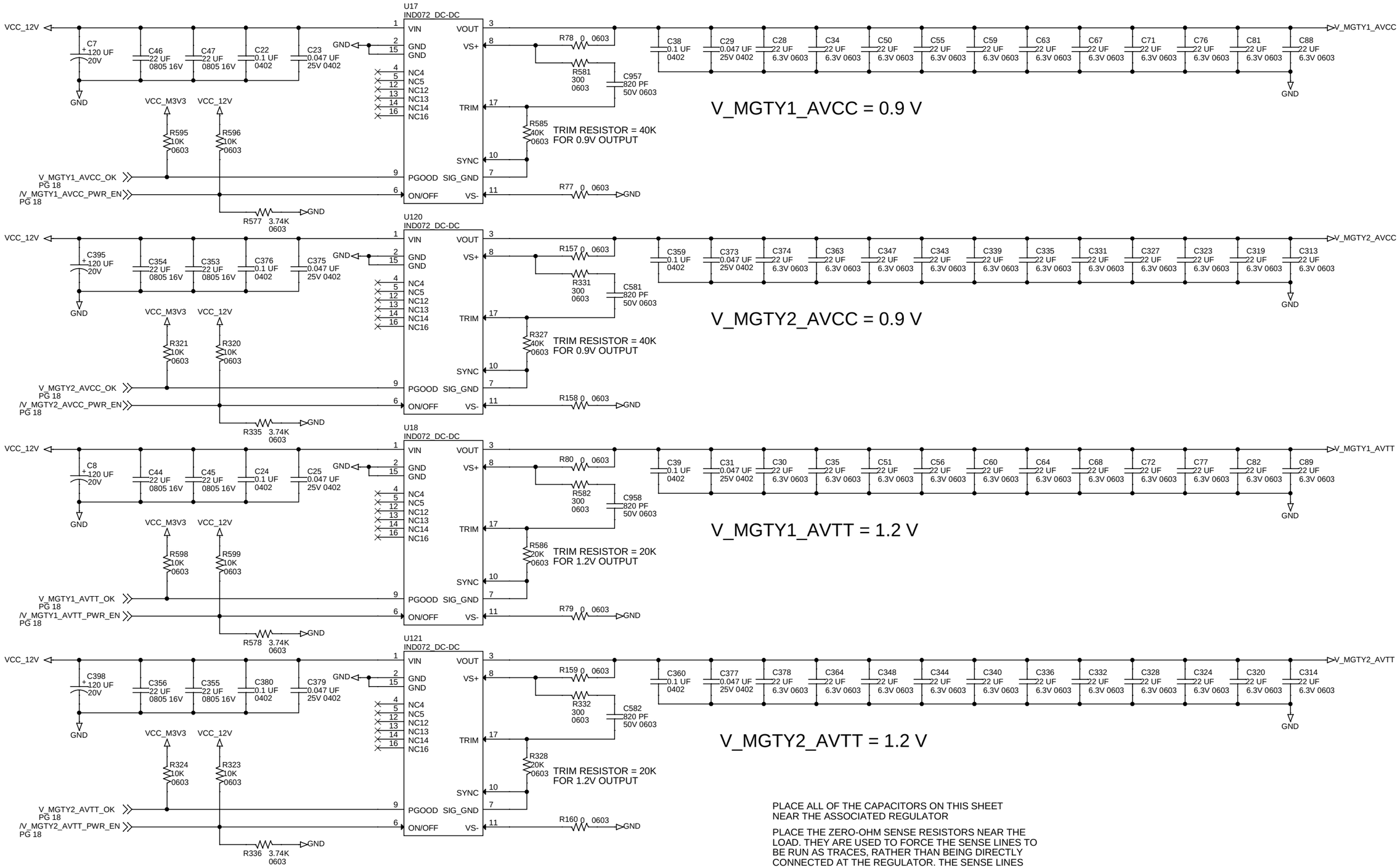
PLACE THE ZERO-OHM SENSE RESISTORS NEAR THE LOAD. THEY ARE USED TO FORCE THE SENSE LINES TO BE RUN AS TRACES, RATHER THAN BEING DIRECTLY CONNECTED AT THE REGULATOR. THE SENSE LINES SHOULD BE RUN AS A DIFFERENTIAL PAIR.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 3.05: POWER SOURCE VU7P INTERNAL

Size	Document Number	Rev
	6089-103	A

Date: Wednesday, March 06, 2019 Sheet 22 of 74



THE "ON/OFF" INPUTS ON THE IND072 POWER MODULES MUST BE LOW FOR THE MODULES TO OPERATE. THE FET DRIVER WILL PULL THE "ON/OFF" INPUTS LOW WHENEVER THE INPUT TO THE DRIVER IS HIGH. THE VOLTAGE DIVIDER KEEPS THE "ON/OFF" INPUT HIGH UNLESS IT IS ACTIVELY PULLED LOW.

PLACE ALL OF THE CAPACITORS ON THIS SHEET NEAR THE ASSOCIATED REGULATOR

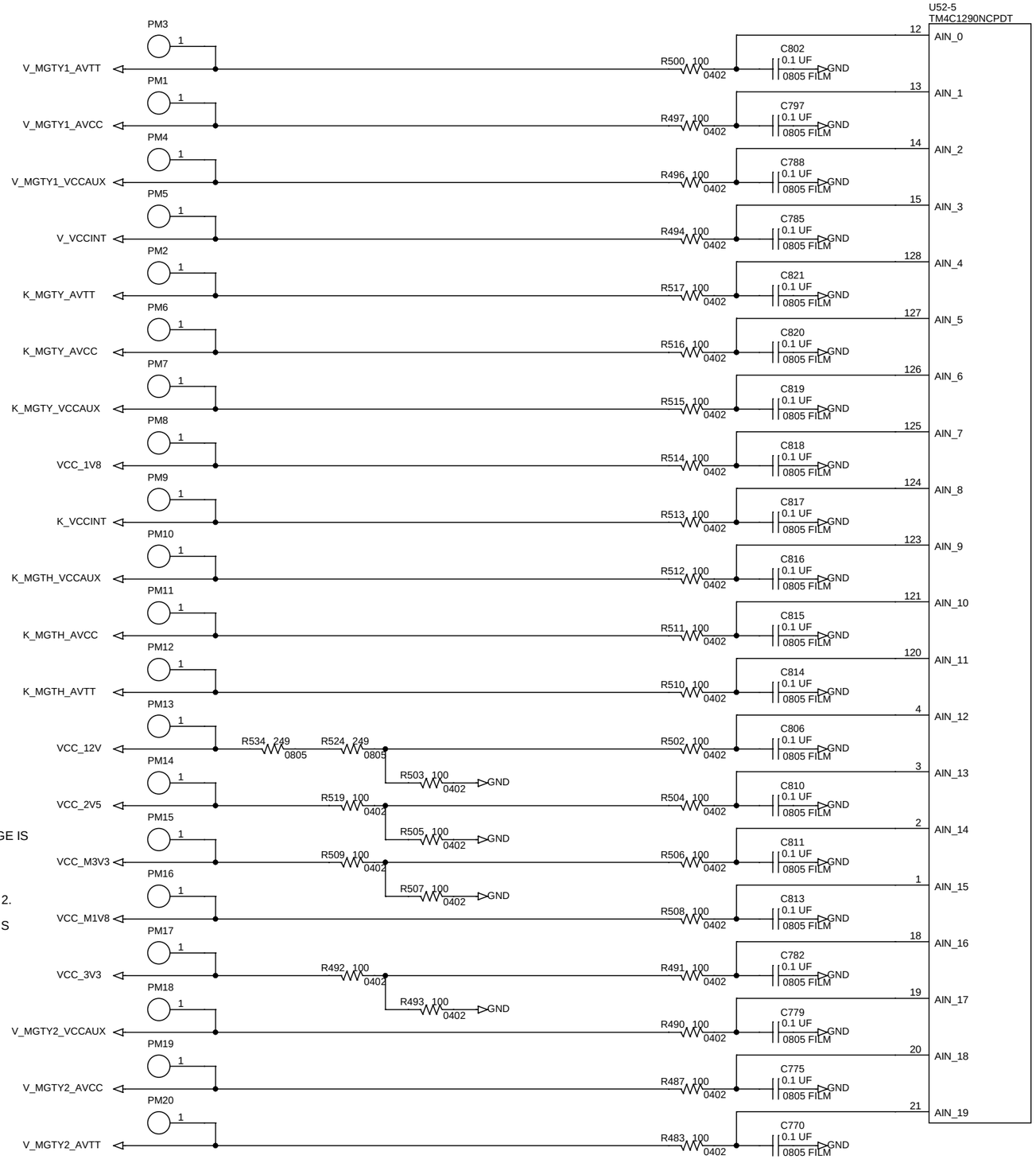
PLACE THE ZERO-OHM SENSE RESISTORS NEAR THE LOAD. THEY ARE USED TO FORCE THE SENSE LINES TO BE RUN AS TRACES, RATHER THAN BEING DIRECTLY CONNECTED AT THE REGULATOR. THE SENSE LINES SHOULD BE RUN AS A DIFFERENTIAL PAIR.

THE IND072 REGULATORS HAVE A TUNABLE LOOP THAT SHOULD BE ADJUSTED FOR THE AMOUNT OF CAPACITANCE THAT IS ON THE OUTPUT. REFER TO THE APP NOTE FOR SUGGESTED VALUES.

THE ON/OFF PIN NEEDS TO BE HELD AT A LOW LOGIC LEVEL TO TURN THE MODULE ON.

THE "PGOOD" SIGNAL WILL BE PULLED LOW IF THE OUTPUT VOLTAGE IS OUTSIDE OF 10% OF THE SETPOINT VALUE.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 3.06: POWER SOURCE VU7P MGT XCVR		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 23 of 74	



THE FULL SCALE ADC VOLTAGE IS 2.5 VOLTS, AS SET BY THE VOLTAGE REFERENCE.

THE 2.5 VOLT AND 3.3 VOLT SUPPLY LEVEL IS DIVIDED BY 2.

THE 12 VOLT SUPPLY LEVEL IS DIVIDED BY 6.

TEST POINTS TO MEASURE VOLTAGES

PM21 GND
PM22 GND
PM23 GND
PM24 GND
PM25 GND
PM26 GND

THE ANTI-ALIASING CUTOFF FREQUENCY IS 15.9 KHZ

A 16 MHZ ADC CLOCK PROVIDES A SAMPLING RATE OF 1 MEGA-SAMPLES PER SECOND. IF ALL 20 ADC CHANNELS ARE USED, THE SAMPLE RATE PER CHANNEL IS 50 KILO-SAMPLES PER SECOND, AND THE NYQUIST FREQUENCY IS 25 KHZ.

THE MAXIMUM SOURCE IMPEDANCE FEEDING THE ADC INPUTS IS 500 OHMS.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 3.07: POWER MEASUREMENT

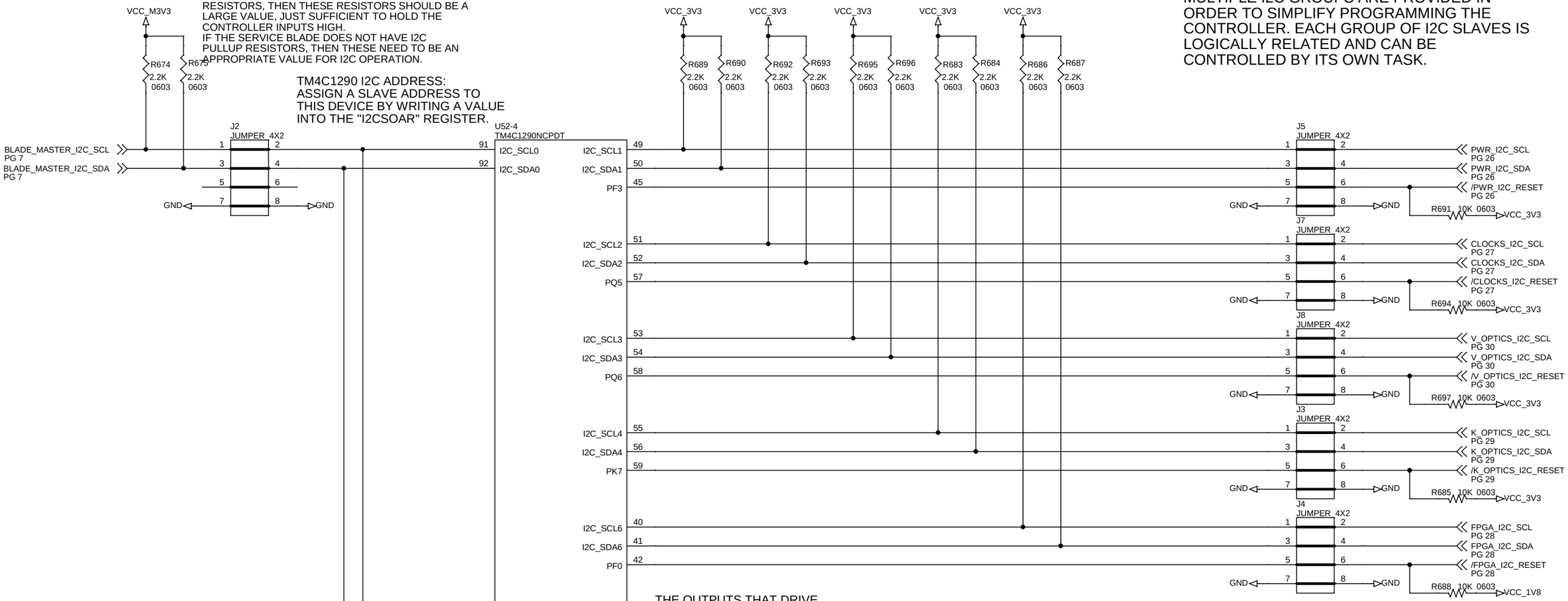
Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 24 of 74

IF THE SERVICE BLADE HAS I2C PULLUP RESISTORS, THEN THESE RESISTORS SHOULD BE A LARGE VALUE, JUST SUFFICIENT TO HOLD THE CONTROLLER INPUTS HIGH.
IF THE SERVICE BLADE DOES NOT HAVE I2C PULLUP RESISTORS, THEN THESE NEED TO BE AN APPROPRIATE VALUE FOR I2C OPERATION.

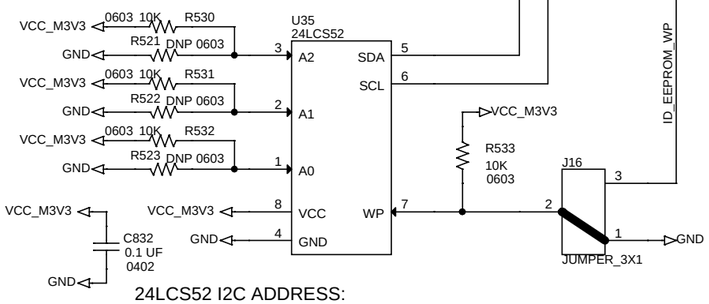
TM4C1290 I2C ADDRESS:
ASSIGN A SLAVE ADDRESS TO THIS DEVICE BY WRITING A VALUE INTO THE "I2CSOAR" REGISTER.

MULTIPLE I2C GROUPS ARE PROVIDED IN ORDER TO SIMPLIFY PROGRAMMING THE CONTROLLER. EACH GROUP OF I2C SLAVES IS LOGICALLY RELATED AND CAN BE CONTROLLED BY ITS OWN TASK.



THE OUTPUTS THAT DRIVE THE "RESET" SIGNALS NEED TO BE OPEN-DRAIN.

THIS EEPROM IS FOR STORING UNCHANGING INFORMATION, LIKE SERIAL NUMBERS OR OTHER BOARD IDENTIFIERS.



24LCS52 I2C ADDRESS:
READ OR WRITE
1 0 1 0 A2 A1 A0
RANGE: 0X50 TO 0X57
WRITE-PROTECT REGISTER
0 1 1 0 A2 A1 A0

INSTALL A ZERO-OHM JUMPER TO SET AN ADDRESS BIT TO '0'.

OMIT THE ZERO-OHM JUMPER TO SET AN ADDRESS BIT TO '1'.
RANGE: 0X30 TO 0X37

THIS JUMPER CONFIGURES THE HARDWARE WRITE-PROTECT PIN.

IF NO JUMPER IS IN PLACE, THE HARDWARE WRITE PROTECTION IS ALWAYS ENABLED.

IF THE JUMPER CONNECTS PINS 1 AND 2, THE HARDWARE WRITE PROTECTION IS ALWAYS DISABLED.

IF THE JUMPER CONNECTS PINS 2 AND 3, THE HARDWARE PROTECTION IS CONTROLLED BY A GPIO PIN ON THE CONTROLLER.

REFER TO THE DATA SHEET FOR DETAILS ABOUT CONNECTING AN EXTERNAL HIGH VOLTAGE TO RESET THE SOFTWARE WRITE PROTECT FUSE.

HEADERS ARE PROVIDED TO SUPPORT DRIVING ANY I2C BUS WITH A STAND-ALONE USB-TO-I2C CONTROLLER.

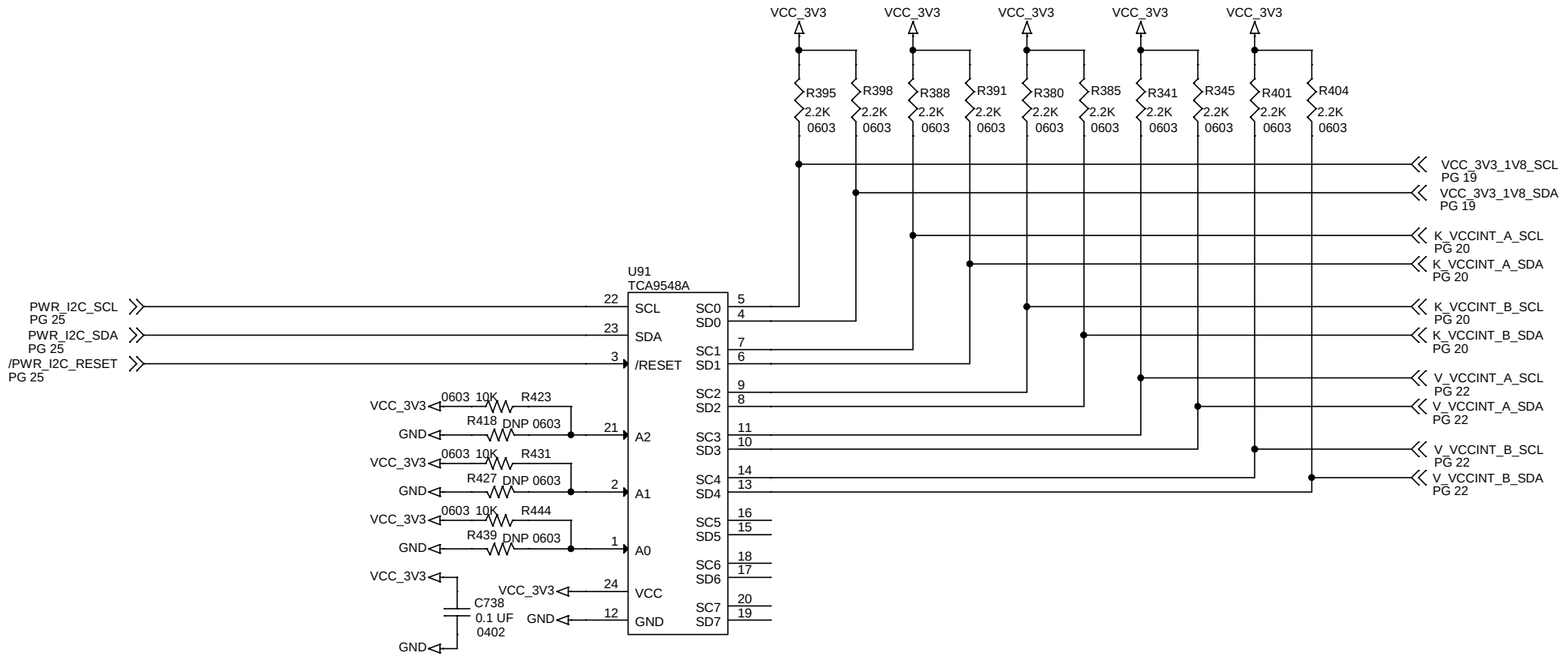
NORMALLY, JUMPERS WILL CONNECT THE ON-BOARD "SCL", "SDA", AND "/RESET" SIGNALS STRAIGHT THROUGH THE HEADERS.

TO CONNECT THE STAND-ALONE CONTROLLER, PULL THE JUMPERS FROM THE HEADER AND CONNECT THE CONTROLLER'S SIGNALS TO PINS 2, 4, AND 6, AND CONNECT GND TO PIN 8.

CONFIGURE THE "SPI MISO" PIN ON THE AARDVARK CONTROLLER AS A "GPIO OUTPUT" TO CONTROL THE "RESET" SIGNAL.

THIS LAYOUT ASSUMES THAT THE STAND-ALONE CONTROLLER PROVIDES PULL-UP RESISTORS ON THE I2C SIGNALS.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 4.01: I2C CONTROLLER		
Size	Document Number: 6089-103	Rev: A
Date: Thursday, February 28, 2019	Sheet 25 of 74	



TCA9548A I2C ADDRESS:
READ OR WRITE
1 1 1 0 A2 A1 A0
RANGE: 0X70 TO 0X77

INSTALL A ZERO-OHM JUMPER
TO SET AN ADDRESS BIT TO '0'.

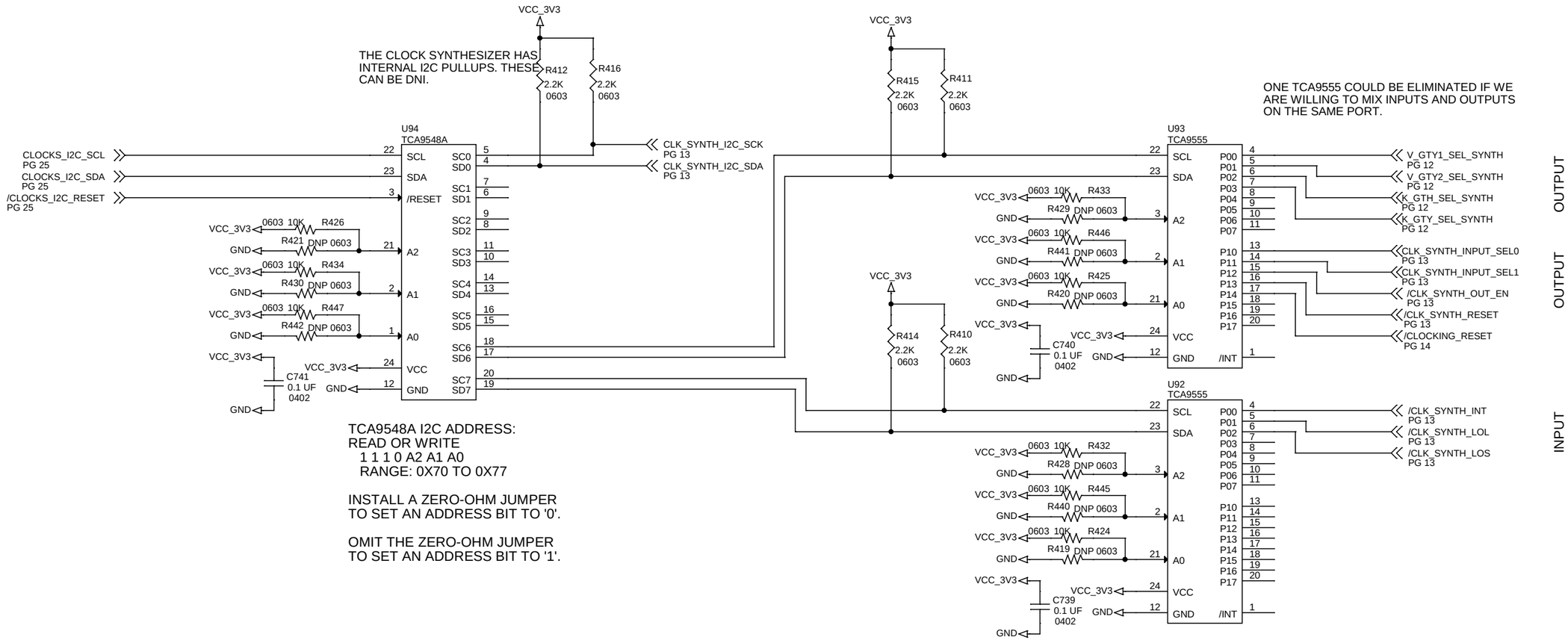
OMIT THE ZERO-OHM JUMPER
TO SET AN ADDRESS BIT TO '1'.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 4.02: I2C POWER CONTROL

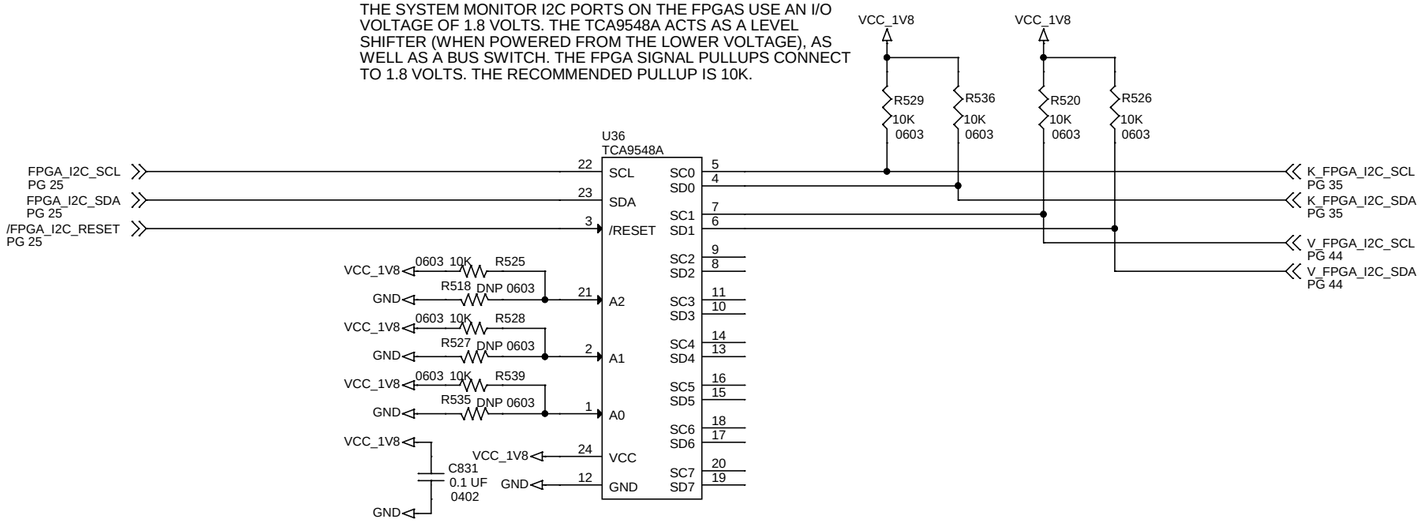
Size | Document Number: 6089-103 | Rev: A

Date: Thursday, February 28, 2019 Sheet 26 of 74



ATCA FPGA BOARD, KU15P AND VU7P, MK1			
Title: 4.03: I2C CLOCK SOURCE CONTROL			
Size	Document Number: 6089-103		Rev: A
Date: Thursday, February 28, 2019	Sheet 27 of 74		

THE SYSTEM MONITOR I2C PORTS ON THE FPGAS USE AN I/O VOLTAGE OF 1.8 VOLTS. THE TCA9548A ACTS AS A LEVEL SHIFTER (WHEN POWERED FROM THE LOWER VOLTAGE), AS WELL AS A BUS SWITCH. THE FPGA SIGNAL PULLUPS CONNECT TO 1.8 VOLTS. THE RECOMMENDED PULLUP IS 10K.



TCA9548A I2C ADDRESS:
READ OR WRITE
1 1 1 0 A2 A1 A0
RANGE: 0X70 TO 0X77

INSTALL A ZERO-OHM JUMPER
TO SET AN ADDRESS BIT TO '0'.

OMIT THE ZERO-OHM JUMPER
TO SET AN ADDRESS BIT TO '1'.

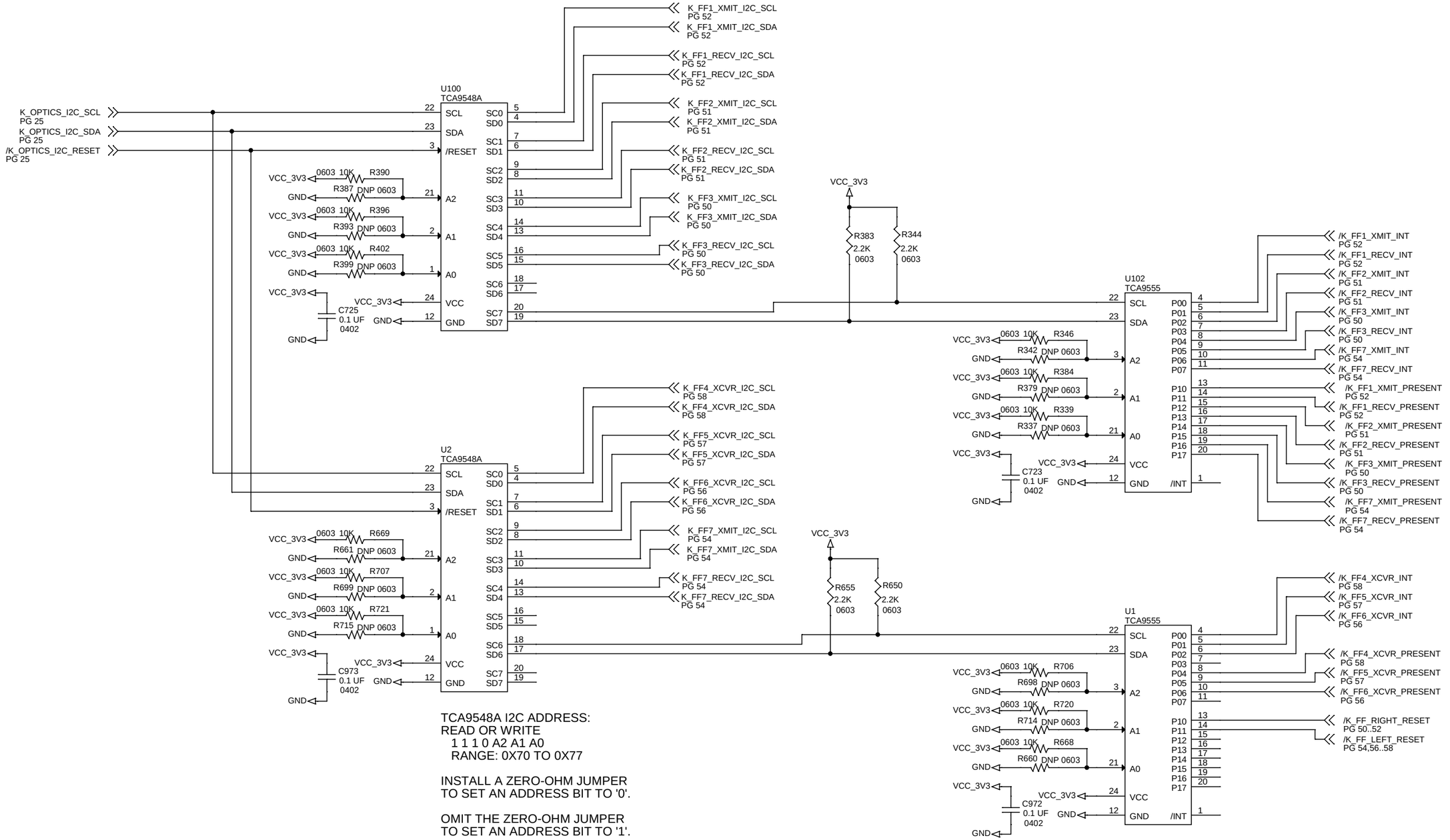
A2	A1	A0	I2C BUS SLAVE ADDRESS
L	L	L	112 (decimal), 70 (hexadecimal)
L	L	H	113 (decimal), 71 (hexadecimal)
L	H	L	114 (decimal), 72 (hexadecimal)
L	H	H	115 (decimal), 73 (hexadecimal)
H	L	L	116 (decimal), 74 (hexadecimal)
H	L	H	117 (decimal), 75 (hexadecimal)
H	H	L	118 (decimal), 76 (hexadecimal)
H	H	H	119 (decimal), 77 (hexadecimal)

ATCA FPGA BOARD, KU15P AND VU7P, MK1

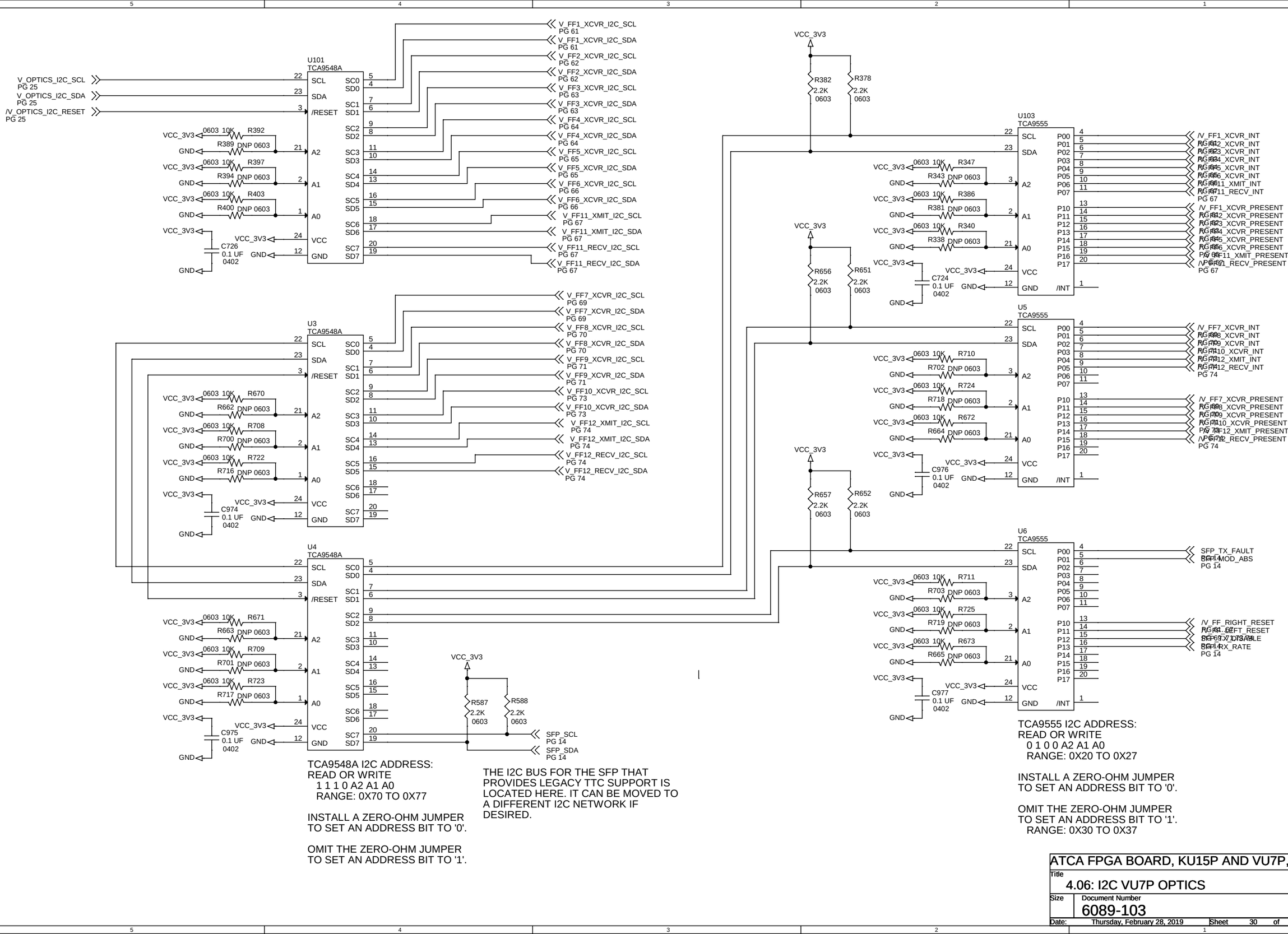
Title: 4.04: I2C FPGA SYSMON

Size | Document Number: 6089-103 | Rev: A

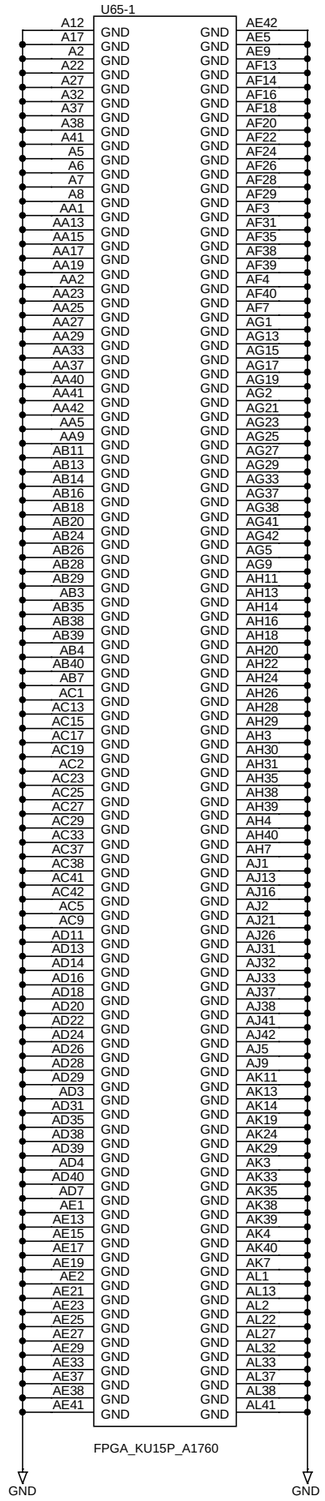
Date: Thursday, February 28, 2019 | Sheet 28 of 74

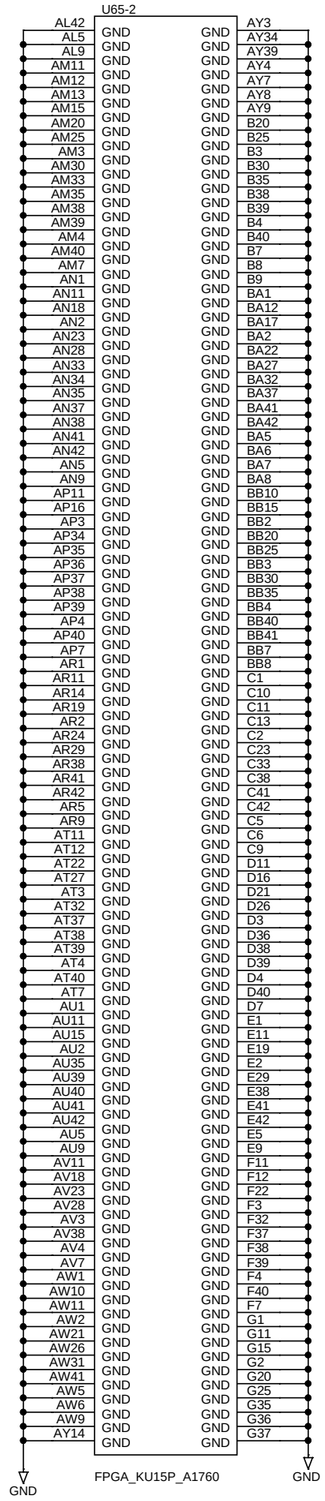


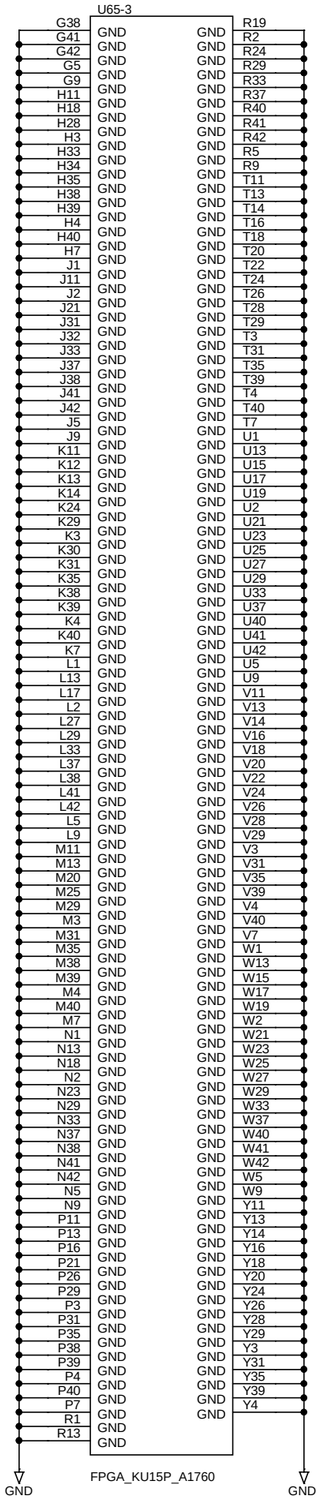
ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 4.05: I2C KU15P OPTICS		
Size	Document Number: 6089-103	Rev: A
Date: Thursday, February 28, 2019	Sheet 29 of 74	

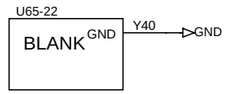


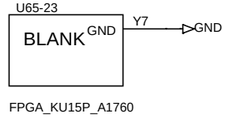
ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 4.06: I2C VU7P OPTICS		
Size	Document Number: 6089-103	Rev: A
Date: Thursday, February 28, 2019	Sheet 30 of 74	



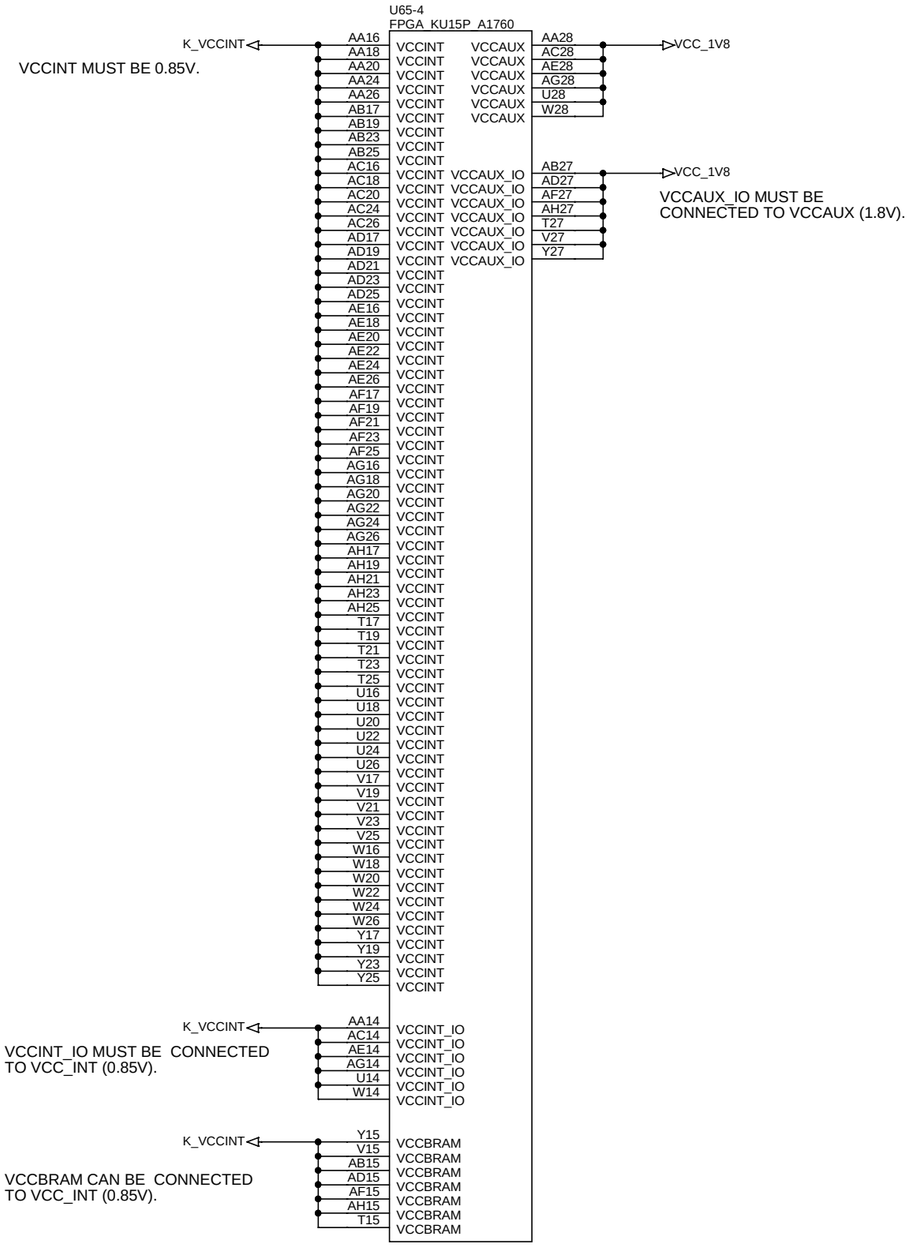


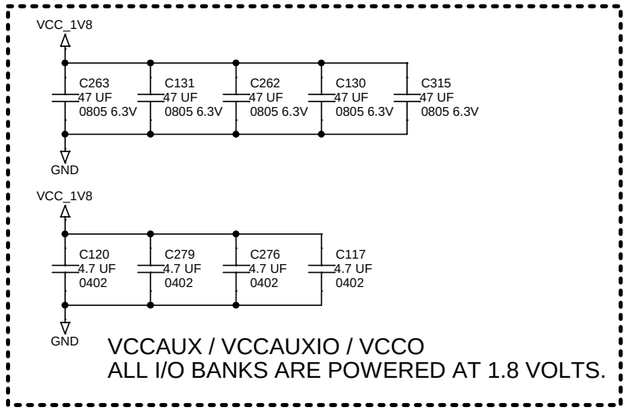


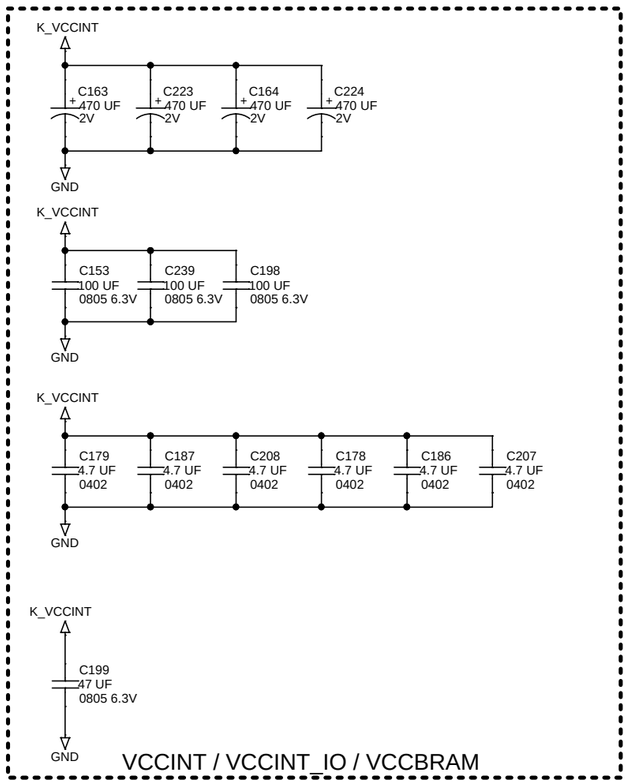




ATCA FPGA BOARD, KU15P AND VU7P, MK1			
Title: 5.01: KU15P FPGA GND			
Size	Document Number: 6089-103		Rev: A
Date: Tuesday, February 26, 2019	Sheet 31 of 74		

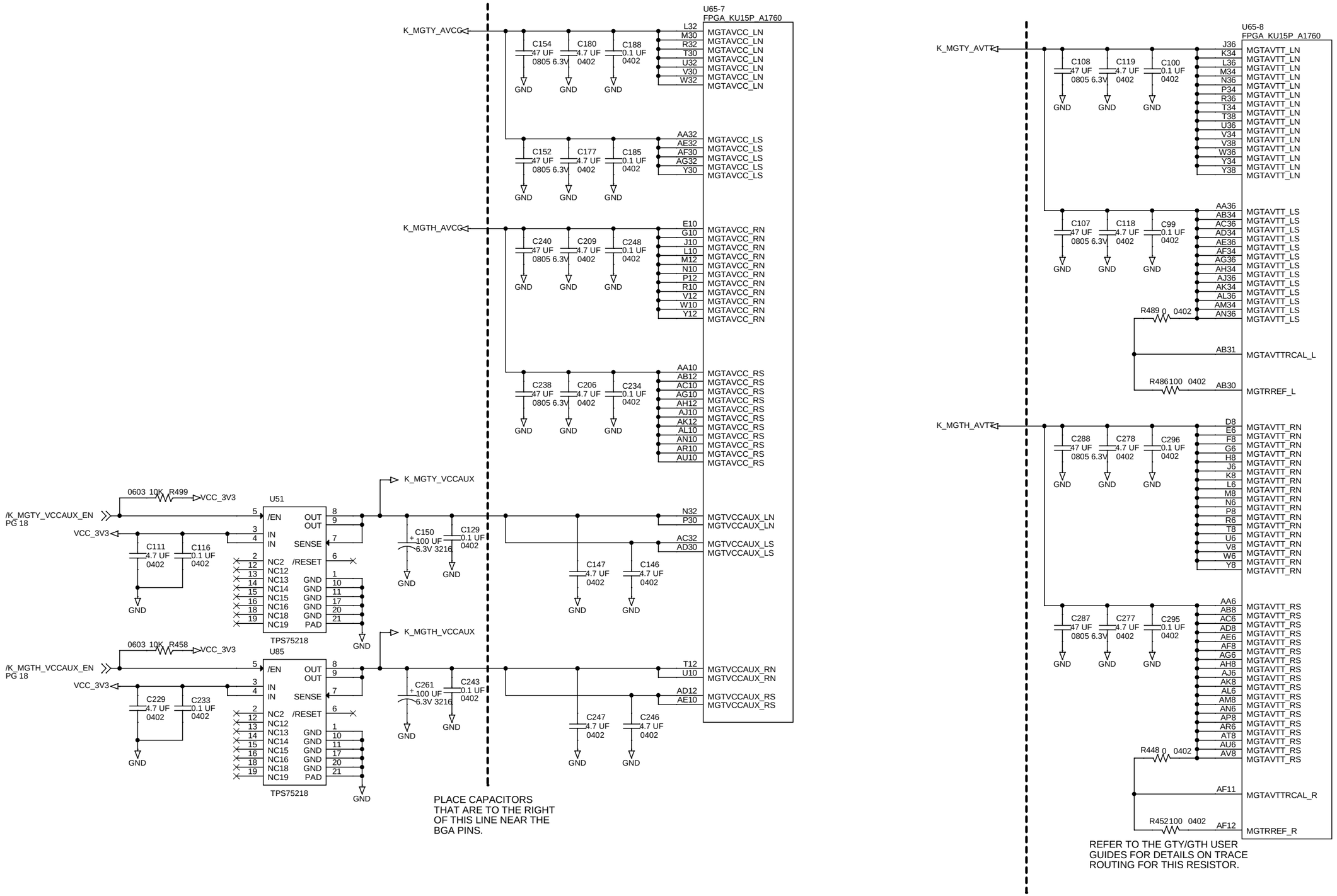






BYPASS CAPACITOR VALUES AND QUANTITIES FROM
"xtp427-ultrascale-plus-schematic-review-checklist.xls"

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 5.02: KU15P FPGA INTERNAL POWER		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 32 of 74	



ON MIXED TRANSCEIVER DEVICES, REGIONS "LN" AND "LS" ARE GTY TRANSCEIVERS. REGIONS "RN" AND "RS" ARE GTH TRANSCEIVERS.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 5.03: KU15P GTH/GTY TRANSCEIVER POWER

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 33 of 74

QUAD SPI CONFIG FLASH

CONFIGURATION BITSTREAM LENGTHS
KU15P 290,744,896
VU7P 427,519,232
VU9P 641,272,864

MUST BE TIED TO "VCCINT" OR "GND".
DO NOT CONNECT TO "VCCO_0".
CONNECT TO "GND" FOR STANDARD
POR DELAY.

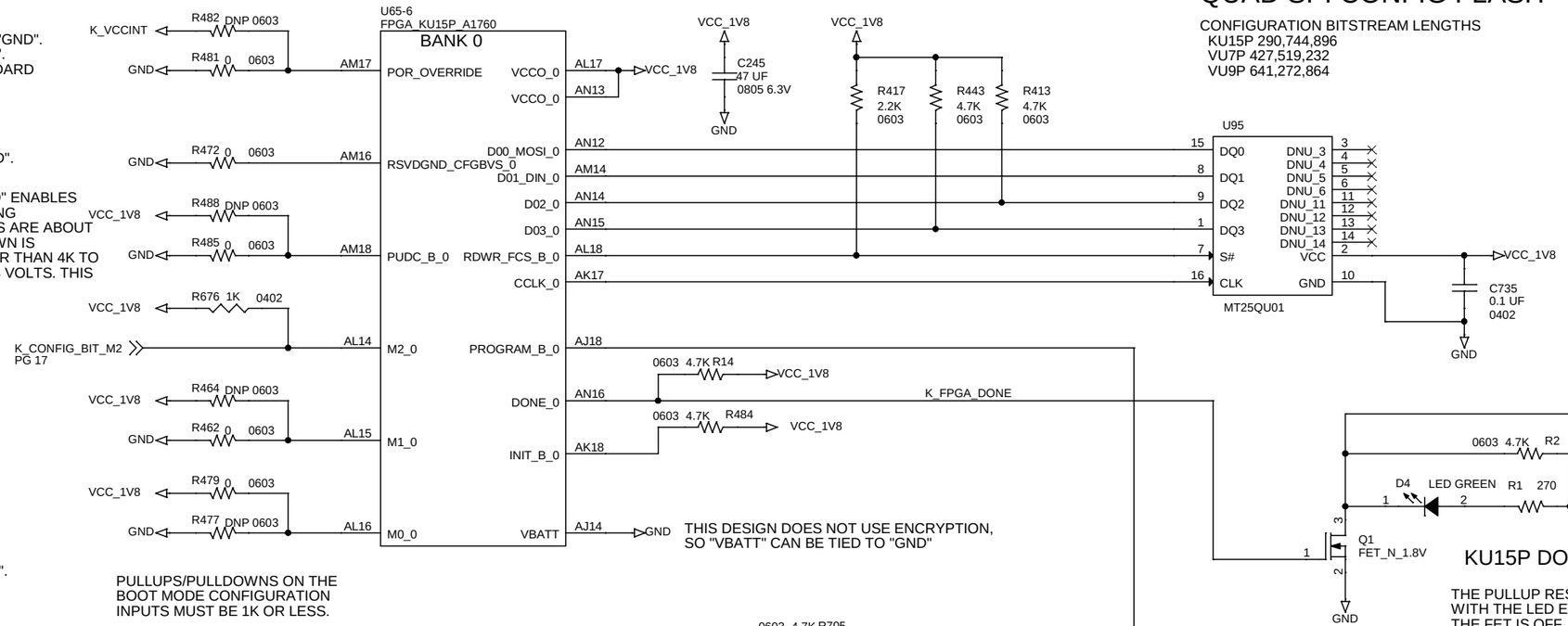
THIS PIN MUST BE TIED TO "GND".

CONNECTING THIS PIN TO "GND" ENABLES PULLUPS ON ALL I/O PINS DURING CONFIGURATION. THE PULLUPS ARE ABOUT 15K AT 1.8 VOLTS. IF A PULLDOWN IS REQUIRED, IT MUST BE SMALLER THAN 4K TO DROP THE VOLTAGE BELOW 0.4 VOLTS. THIS PIN MUST NOT FLOAT.

M[2:0] MODE
000 Master serial
001 Master SPI
010 Master BPI
100 Master SelectMAP
101 JTAG only
110 Slave SelectMAP
111 Slave Serial

THIS SWITCH ON BIT "M2"
ALLOW A CHOICE OF EITHER
"MASTER SPI" OR "JTAG ONLY".

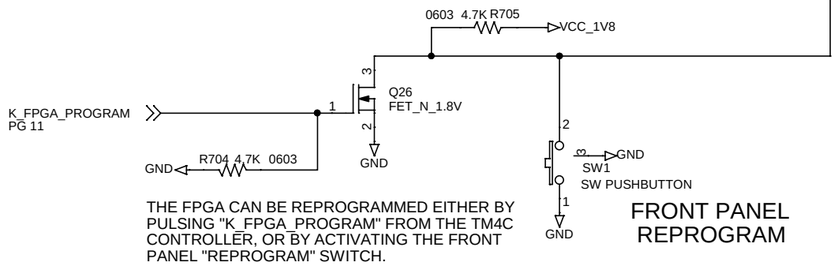
PULLUPS/PULLDOWNS ON THE
BOOT MODE CONFIGURATION
INPUTS MUST BE 1K OR LESS.



KU15P DONE LED

THE PULLUP RESISTOR IN PARALLEL WITH THE LED ENSURES THAT, WHEN THE FET IS OFF, THE "/K_FPGA_DONE" SIGNAL IS AT A HIGH LEVEL FOR FEEDING THE TM4C CONTROLLER.

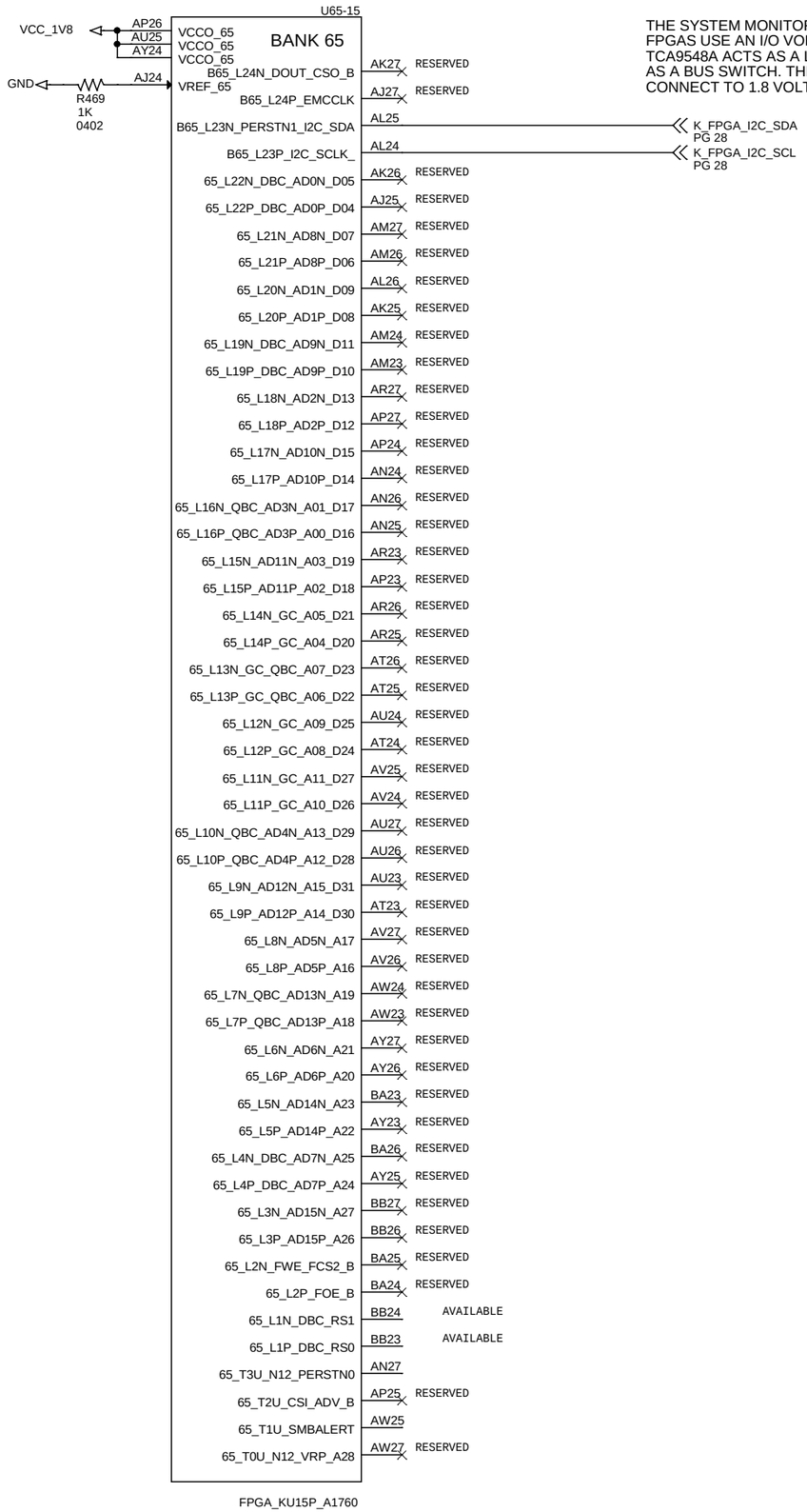
FOR LED CURRENT OF 5 MA, THE FORWARD VOLTAGE DROP IS 1.95V. USE 270 OHM RESISTOR.



THE FPGA CAN BE REPROGRAMMED EITHER BY PULSING "K_FPGA_PROGRAM" FROM THE TM4C CONTROLLER, OR BY ACTIVATING THE FRONT PANEL "REPROGRAM" SWITCH.

FRONT PANEL REPROGRAM

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 5.04: KU15P FPGA CONFIGURATION		
Size	Document Number: 6089-103	Rev: A
Date: Wednesday, March 06, 2019	Sheet 34 of 74	



THE SYSTEM MONITOR I2C PORTS ON THE FPGAS USE AN I/O VOLTAGE OF 1.8 VOLTS. THE TCA9548A ACTS AS A LEVEL SHIFTER AS WELL AS A BUS SWITCH. THE FPGA SIGNAL PULLUPS CONNECT TO 1.8 VOLTS.

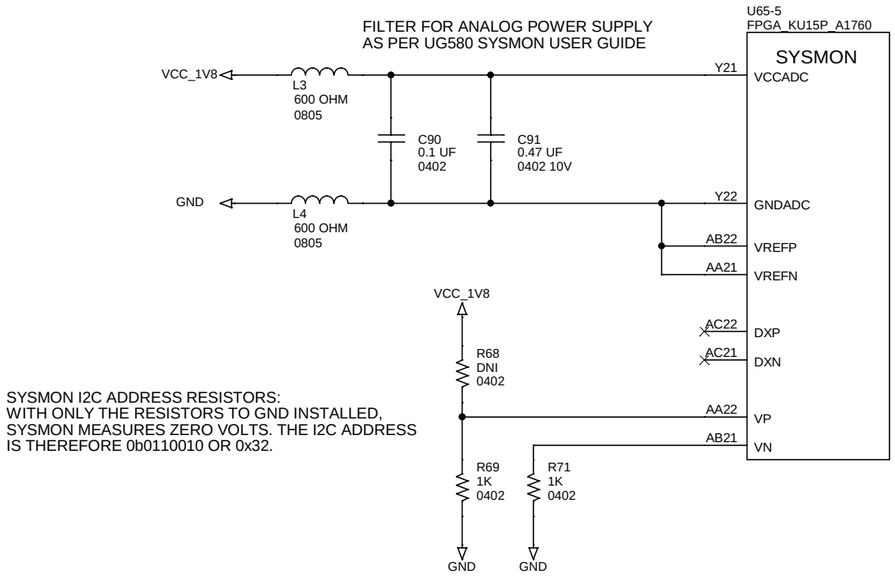
BANK 65 CONTAINS MANY DUAL-FUNCTION PINS THAT CAN BE USED DURING CONFIGURATION. THOSE PINS WILL BE MARKED AS "NO CONNECT" AND SHOULD NOT BE USED FOR NORMAL LOGIC.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 5.05: KU15P BANK 65

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 35 of 74



ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 5.06: KU15P SYSTEM MONITOR

Size	Document Number	Rev
	6089-103	A

Date: Wednesday, February 27, 2019 Sheet 36 of 74

THE UTILITY CLOCK MUST CONNECT TO CLOCK-CAPABLE PINS.

THE "KV_SPARE" SIGNALS ARE INTENDED FOR DEBUGGING OR FOR UNFORSEEN I/O NEEDS BETWEEN THE TWO FPGAS. EACH PAIR IS ROUTED AS A 100 OHM DIFFERENTIAL PAIR.

THE "KV_SPARE6" SIGNAL IS CONNECTED TO CLOCK INPUT PINS ON THE KU15P.

U65-21

BANK 72

nKV_SPARE0 PG 46	nKV_SPARE0	B22	72_L24N_T3U_N11
pKV_SPARE0 PG 46	pKV_SPARE0	B23	72_L24P_T3U_N10
nKV_SPARE1 PG 46	nKV_SPARE1	A23	72_L23N_T3U_N9
pKV_SPARE1 PG 46	pKV_SPARE1	A24	72_L23P_T3U_N8
		A21	72_L22N_T3U_N7_DBC_AD0N
		B21	72_L22P_T3U_N6_DBC_AD0P
nKV_SPARE2 PG 46	nKV_SPARE2	B24	72_L21N_T3L_N5_AD8N
pKV_SPARE2 PG 46	pKV_SPARE2	C24	72_L21P_T3L_N4_AD8P
nKV_SPARE3 PG 46	nKV_SPARE3	C21	72_L20N_T3L_N3_AD1N
pKV_SPARE3 PG 46	pKV_SPARE3	C22	72_L20P_T3L_N2_AD1P
nKV_SPARE4 PG 46	nKV_SPARE4	D23	72_L19N_T3L_N1_DBC_AD9N
pKV_SPARE4 PG 46	pKV_SPARE4	D24	72_L19P_T3L_N0_DBC_AD9P
nKV_SPARE5 PG 46	nKV_SPARE5	E21	72_L18N_T2U_N11_AD2N
pKV_SPARE5 PG 46	pKV_SPARE5	E22	72_L18P_T2U_N10_AD2P
nK_CDR_DATA PG 14		G24	72_L17N_T2U_N9_AD10N
pK_CDR_DATA PG 14		H24	72_L17P_T2U_N8_AD10P
nKV_SPARE7 PG 46	nKV_SPARE7	F20	72_L16N_T2U_N7_QBC_AD3N
pKV_SPARE7 PG 46	pKV_SPARE7	F21	72_L16P_T2U_N6_QBC_AD3P
nKV_SPARE8 PG 46	nKV_SPARE8	E23	72_L15N_T2L_N5_AD11N
pKV_SPARE8 PG 46	pKV_SPARE8	F24	72_L15P_T2L_N4_AD11P
ac_nK_UTIL_CLK_CHAN2 PG 15		G21	72_L14N_T2L_N3_GC
ac_pK_UTIL_CLK_CHAN2 PG 15		G22	72_L14P_T2L_N2_GC
nK_TTS_OUT PG 14		F23	72_L13N_T2L_N1_GC_QBC
pK_TTS_OUT PG 14		G23	72_L13P_T2L_N0_GC_QBC
nKV_SPARE6 PG 46	nKV_SPARE6	J22	72_L12N_T1U_N11_GC
pKV_SPARE6 PG 46	pKV_SPARE6	K22	72_L12P_T1U_N10_GC
ac_nK_TTC_CLK40 PG 14		J23	72_L11N_T1U_N9_GC
ac_pK_TTC_CLK40 PG 14		K23	72_L11P_T1U_N8_GC
nKV_SPARE9 PG 46	nKV_SPARE9	H20	72_L10N_T1U_N7_QBC_AD4N
pKV_SPARE9 PG 46	pKV_SPARE9	H21	72_L10P_T1U_N6_QBC_AD4P
nKV_SPARE10 PG 46	nKV_SPARE10	L23	72_L9N_T1L_N5_AD12N
pKV_SPARE10 PG 46	pKV_SPARE10	L24	72_L9P_T1L_N4_AD12P
nKV_SPARE11 PG 46	nKV_SPARE11	J20	72_L8N_T1L_N3_AD5N
pKV_SPARE11 PG 46	pKV_SPARE11	K20	72_L8P_T1L_N2_AD5P
nKV_SPARE12 PG 46	nKV_SPARE12	K21	72_L7N_T1L_N1_QBC_AD13N
pKV_SPARE12 PG 46	pKV_SPARE12	L21	72_L7P_T1L_N0_QBC_AD13P
		M22	72_L6N_T0U_N11_AD6N
		N22	72_L6P_T0U_N10_AD6P
		P23	72_L5N_T0U_N9_AD14N
		R23	72_L5P_T0U_N8_AD14P
		N20	72_L4N_T0U_N7_DBC_AD7N
		N21	72_L4P_T0U_N6_DBC_AD7P
		P22	72_L3N_T0L_N5_AD15N
		R22	72_L3P_T0L_N4_AD15P
		L20	72_L2N_T0L_N3
		M21	72_L2P_T0L_N2
		P20	72_L1N_T0L_N1_DBC
		R21	72_L1P_T0L_N0_DBC
KU15P_FROM_TM4C_0 PG 17		D22	72_T3U_N12
KU15P_TO_TM4C_0 PG 17		H22	72_T2U_N12
		J24	72_T1U_N12
		M23	72_T0U_N12_VRP

VCCO_72: E24, H23, L22 → VCC_1V8

VREF_72: R20 R470 1K 0402 → GND

GND: R465 240 0402

FPGA_KU15P_A1760

U65-17

BANK 67

		AJ30	67_L24N_T3U_N11
		AJ29	67_L24P_T3U_N10
		AM32	67_L23N_T3U_N9
		AM31	67_L23P_T3U_N8
		AK32	67_L22N_T3U_N7_DBC_AD0N
		AK31	67_L22P_T3U_N6_DBC_AD0P
		AL30	67_L21N_T3L_N5_AD8N
		AL29	67_L21P_T3L_N4_AD8P
		AL31	67_L20N_T3L_N3_AD1N
		AK30	67_L20P_T3L_N2_AD1P
		AM29	67_L19N_T3L_N1_DBC_AD9N
		AL28	67_L19P_T3L_N0_DBC_AD9P
		AR32	67_L18N_T2U_N11_AD2N
		AP32	67_L18P_T2U_N10_AD2P
		AN32	67_L17N_T2U_N9_AD10N
		AN31	67_L17P_T2U_N8_AD10P
		AR28	67_L16N_T2U_N7_QBC_AD3N
		AP28	67_L16P_T2U_N6_QBC_AD3P
		AN30	67_L15N_T2L_N5_AD11N
		AN29	67_L15P_T2L_N4_AD11P
		AR31	67_L14N_T2L_N3_GC
		AR30	67_L14P_T2L_N2_GC
		AP30	67_L13N_T2L_N1_GC_QBC
		AP29	67_L13P_T2L_N0_GC_QBC
		AT30	67_L12N_T1U_N11_GC
		AT29	67_L12P_T1U_N10_GC
		AU31	67_L11N_T1U_N9_GC
		AT31	67_L11P_T1U_N8_GC
		AV29	67_L10N_T1U_N7_QBC_AD4N
		AU29	67_L10P_T1U_N6_QBC_AD4P
K_DIP_SW_1 PG 17		AV32	67_L9N_T1L_N5_AD12N
K_DIP_SW_2 PG 17		AU32	67_L9P_T1L_N4_AD12P
		AU28	67_L8N_T1L_N3_AD5N
		AT28	67_L8P_T1L_N2_AD5P
		AV31	67_L7N_T1L_N1_QBC_AD13N
		AV30	67_L7P_T1L_N0_QBC_AD13P
		AY31	67_L6N_T0U_N11_AD6N
		AY30	67_L6P_T0U_N10_AD6P
		BB31	67_L5N_T0U_N9_AD14N
		BA31	67_L5P_T0U_N8_AD14P
		AW29	67_L4N_T0U_N7_DBC_AD7N
K_LED_RED PG 17		AW28	67_L4P_T0U_N6_DBC_AD7P
		BA30	67_L3N_T0L_N5_AD15N
K_LED_BLUE PG 17		BA29	67_L3P_T0L_N4_AD15P
		BA28	67_L2N_T0L_N3
K_LED_GREEN PG 17		AY28	67_L2P_T0L_N2
		BB29	67_L1N_T0L_N1_DBC
		BB28	67_L1P_T0L_N0_DBC
		AK28	67_T3U_N12
		AM28	67_T2U_N12
		AW30	67_T1U_N12
		BB32	67_T0U_N12_VRP

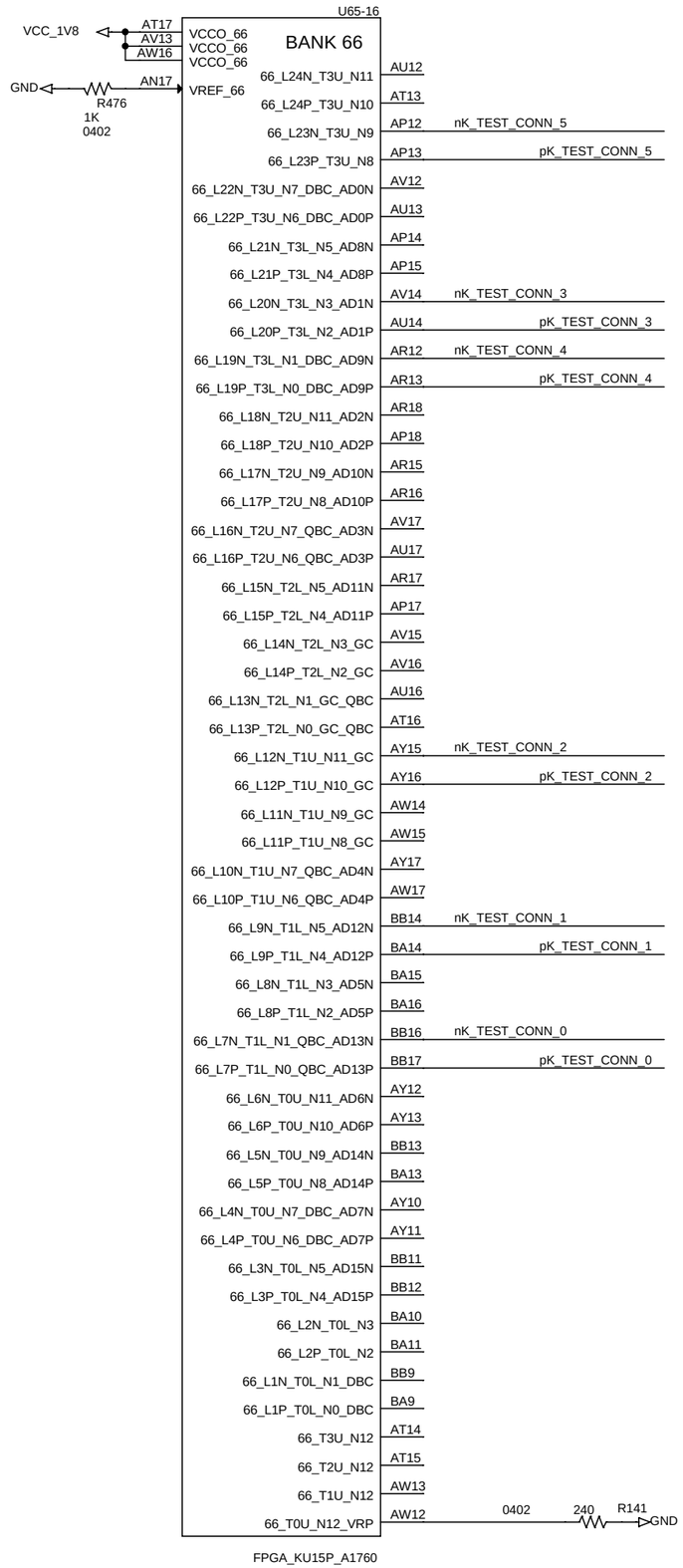
VCCO_67: AP31, AU30, AY29 → VCC_1V8

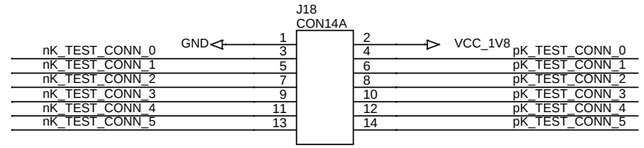
VREF_67: AJ28 R102 1K 0402 → GND

GND: R99 240 0402

FPGA_KU15P_A1760

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 5.07: KU15P UTILITY BANKS		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 37 of 74	





THIS CONNECTOR IS LOCATED ON THE BOTTOM OF THE BOARD. IF THE SITE IS POPULATED, THE CONNECTOR HEIGHT WILL EXCEED THE ATCA DIMENSIONS.

THE CONNECTOR SITE IS INTENDED FOR DEBUGGING OR FOR UNFORSEEN I/O NEEDS. EACH PAIR IS ROUTED AS A 100 OHM DIFFERENTIAL PAIR.

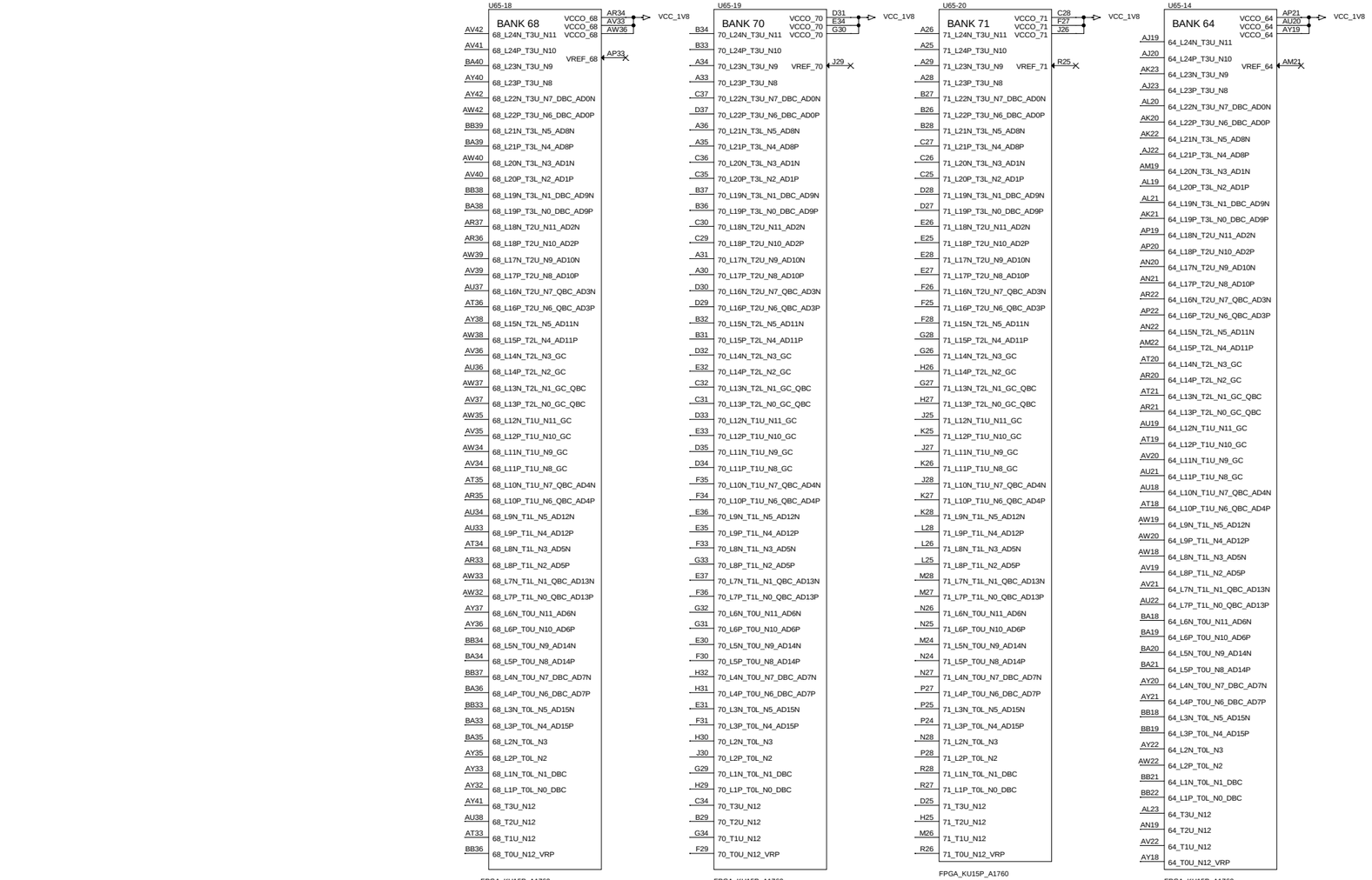
THE "K_TEST_CONN_2" SIGNAL IS CONNECTED TO GLOBAL CLOCK RESOURCES.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 5.08 KU15P TEST CONNECTOR

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 38 of 74



KU15P UNUSED BLOCKS

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 5.99: KU15P UNUSED BLOCKS

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 39 of 74

U66-1
FPGA_VU7P_B2104

A10	GND	GND	AF28
A12	GND	GND	AF3
A21	GND	GND	AF35
A3	GND	GND	AF36
A31	GND	GND	AF4
A41	GND	GND	AF40
A44	GND	GND	AF42
A6	GND	GND	AF45
AA1	GND	GND	AF46
AA10	GND	GND	AF5
AA13	GND	GND	AF8
AA15	GND	GND	AG1
AA17	GND	GND	AG11
AA19	GND	GND	AG17
AA2	GND	GND	AG2
AA21	GND	GND	AG21
AA23	GND	GND	AG23
AA25	GND	GND	AG25
AA27	GND	GND	AG27
AA29	GND	GND	AG33
AA31	GND	GND	AG35
AA35	GND	GND	AG39
AA38	GND	GND	AG42
AA42	GND	GND	AG43
AA43	GND	GND	AG44
AA44	GND	GND	AG5
AA5	GND	GND	AG7
AA6	GND	GND	AH14
AA7	GND	GND	AH16
AB12	GND	GND	AH20
AB14	GND	GND	AH22
AB16	GND	GND	AH24
AB18	GND	GND	AH26
AB20	GND	GND	AH3
AB22	GND	GND	AH30
AB24	GND	GND	AH35
AB26	GND	GND	AH37
AB28	GND	GND	AH4
AB3	GND	GND	AH41
AB30	GND	GND	AH42
AB35	GND	GND	AH45
AB37	GND	GND	AH46
AB4	GND	GND	AH5
AB40	GND	GND	AH9
AB42	GND	GND	AJ1
AB45	GND	GND	AJ10
AB46	GND	GND	AJ13
AB5	GND	GND	AJ15
AB8	GND	GND	AJ17
AC1	GND	GND	AJ2
AC10	GND	GND	AJ21
AC15	GND	GND	AJ23
AC17	GND	GND	AJ25
AC19	GND	GND	AJ35
AC2	GND	GND	AJ38
AC21	GND	GND	AJ42
AC23	GND	GND	AJ43
AC25	GND	GND	AJ44
AC27	GND	GND	AJ5
AC29	GND	GND	AJ6
AC35	GND	GND	AK14
AC39	GND	GND	AK16
AC42	GND	GND	AK18
AC43	GND	GND	AK20
AC44	GND	GND	AK22
AC5	GND	GND	AK24
AC7	GND	GND	AK3
AD14	GND	GND	AK34
AD16	GND	GND	AK35
AD18	GND	GND	AK37
AD20	GND	GND	AK4
AD22	GND	GND	AK40
AD24	GND	GND	AK42
AD26	GND	GND	AK45
AD28	GND	GND	AK46
AD3	GND	GND	AK5
AD32	GND	GND	AK8
AD35	GND	GND	AL1
AD37	GND	GND	AL11
AD4	GND	GND	AL2
AD41	GND	GND	AL31
AD42	GND	GND	AL35
AD45	GND	GND	AL39
AD46	GND	GND	AL42
AD5	GND	GND	AL43
AD9	GND	GND	AL44
AE1	GND	GND	AL5
AE10	GND	GND	AL7
AE17	GND	GND	AM18
AE19	GND	GND	AM28
AE2	GND	GND	AM3
AE21	GND	GND	AM35
AE23	GND	GND	AM37
AE25	GND	GND	AM4
AE27	GND	GND	AM41
AE29	GND	GND	AM42
AE35	GND	GND	AM45
AE38	GND	GND	AM46
AE42	GND	GND	AM5
AE43	GND	GND	AM9
AE44	GND	GND	AN1
AE5	GND	GND	AN10
AE6	GND	GND	AN12
AF12	GND	GND	AN15
AF14	GND	GND	AN2
AF16	GND	GND	AN25
AF20	GND	GND	AN35
AF22	GND	GND	AN38
AF24	GND	GND	AN42
AF26	GND	GND	AN43

GND GND

U66-2
FPGA_VU7P_B2104

AN44	GND	GND	B44
AN5	GND	GND	B45
AN6	GND	GND	B5
AP12	GND	GND	B6
AP22	GND	GND	B7
AP3	GND	GND	B8
AP32	GND	GND	BA11
AP35	GND	GND	BA21
AP36	GND	GND	BA3
AP4	GND	GND	BA31
AP40	GND	GND	BA37
AP42	GND	GND	BA38
AP45	GND	GND	BA39
AP46	GND	GND	BA44
AP5	GND	GND	BA6
AP8	GND	GND	BB1
AR1	GND	GND	BB18
AR11	GND	GND	BB2
AR12	GND	GND	BB28
AR19	GND	GND	BB3
AR2	GND	GND	BB39
AR29	GND	GND	BB40
AR35	GND	GND	BB41
AR39	GND	GND	BB44
AR42	GND	GND	BB45
AR43	GND	GND	BB46
AR44	GND	GND	BB6
AR5	GND	GND	BB8
AR7	GND	GND	BC15
AT12	GND	GND	BC25
AT16	GND	GND	BC3
AT26	GND	GND	BC35
AT3	GND	GND	BC4
AT35	GND	GND	BC41
AT37	GND	GND	BC42
AT4	GND	GND	BC44
AT41	GND	GND	BC6
AT42	GND	GND	BD1
AT45	GND	GND	BD12
AT46	GND	GND	BD22
AT5	GND	GND	BD3
AT9	GND	GND	BD32
AU1	GND	GND	BD41
AU10	GND	GND	BD44
AU12	GND	GND	BD46
AU2	GND	GND	BD6
AU23	GND	GND	BE19
AU33	GND	GND	BE2
AU35	GND	GND	BE29
AU38	GND	GND	BE3
AU42	GND	GND	BE39
AU43	GND	GND	BE41
AU44	GND	GND	BE45
AU5	GND	GND	BE5
AU6	GND	GND	BE6
AV12	GND	GND	BE9
AV20	GND	GND	BF16
AV3	GND	GND	BF26
AV30	GND	GND	BF3
AV35	GND	GND	BF36
AV36	GND	GND	BF41
AV37	GND	GND	BF44
AV4	GND	GND	BF6
AV40	GND	GND	C1
AV42	GND	GND	C11
AV45	GND	GND	C12
AV46	GND	GND	C15
AV5	GND	GND	C2
AV8	GND	GND	C25
AW1	GND	GND	C35
AW10	GND	GND	C41
AW11	GND	GND	C44
AW12	GND	GND	C46
AW17	GND	GND	C5
AW2	GND	GND	D12
AW27	GND	GND	D22
AW37	GND	GND	D3
AW39	GND	GND	D32
AW42	GND	GND	D4
AW43	GND	GND	D41
AW44	GND	GND	D42
AW5	GND	GND	D44
AW6	GND	GND	D5
AY1	GND	GND	D9
AY10	GND	GND	E1
AY14	GND	GND	E10
AY2	GND	GND	E12
AY24	GND	GND	E19
AY3	GND	GND	E2
AY34	GND	GND	E29
AY37	GND	GND	E41
AY4	GND	GND	E44
AY41	GND	GND	E45
AY42	GND	GND	E46
AY43	GND	GND	E5
AY44	GND	GND	E6
AY45	GND	GND	F12
AY46	GND	GND	F16
AY5	GND	GND	F26
AY6	GND	GND	F3
AY7	GND	GND	F36
AY8	GND	GND	F39
AY9	GND	GND	F4
B12	GND	GND	F40
B18	GND	GND	F41
B2	GND	GND	F44
B28	GND	GND	F5
B38	GND	GND	F8
B4	GND	GND	G1
B41	GND	GND	G11

GND GND

U66-3
FPGA_VU7P_B2104

G12	GND	GND	R35
G13	GND	GND	R39
G2	GND	GND	R42
G23	GND	GND	R43
G33	GND	GND	R44
G39	GND	GND	R5
G42	GND	GND	R7
G43	GND	GND	T12
G44	GND	GND	T14
G45	GND	GND	T16
G46	GND	GND	T18
G5	GND	GND	T20
G7	GND	GND	T22
H12	GND	GND	T24
H20	GND	GND	T3
H3	GND	GND	T35
H30	GND	GND	T37
H39	GND	GND	T4
H4	GND	GND	T41
H41	GND	GND	T42
H42	GND	GND	T45
H45	GND	GND	T46
H46	GND	GND	T5
H5	GND	GND	T9
H9	GND	GND	U1
J1	GND	GND	U10
J10	GND	GND	U13
J12	GND	GND	U15
J17	GND	GND	U17
J2	GND	GND	U19
J27	GND	GND	U2
J37	GND	GND	U21
J38	GND	GND	U23
J39	GND	GND	U25
J42	GND	GND	U27
J43	GND	GND	U33
J44	GND	GND	U35
J5	GND	GND	U38
J6	GND	GND	U42
K12	GND	GND	U43
K14	GND	GND	U44
K24	GND	GND	U5
K3	GND	GND	U6
K35	GND	GND	V14
K36	GND	GND	V16
K37	GND	GND	V18
K4	GND	GND	V20
K40	GND	GND	V22
K42	GND	GND	V24
K45	GND	GND	V26
K46	GND	GND	V28
K5	GND	GND	V3
K8	GND	GND	V30
L1	GND	GND	V35
L11	GND	GND	V36
L12	GND	GND	V4
L2	GND	GND	V40
L21	GND	GND	V42
L31	GND	GND	V45
L35	GND	GND	V46
L39	GND	GND	V5
L42	GND	GND	V8
L43	GND	GND	W1
L44	GND	GND	W11
L5	GND	GND	W13
L7	GND	GND	W15
M12	GND	GND	W17
M18	GND	GND	W19
M28	GND	GND	W2
M3	GND	GND	W21
M35	GND	GND	W23
M37	GND	GND	W25
M4	GND	GND	W27
M41	GND	GND	W29
M42	GND	GND	W35
M45	GND	GND	W39
M46	GND	GND	W42
M5	GND	GND	W43
M9	GND	GND	W44
N1	GND	GND	W5
N10	GND	GND	W7
N12	GND	GND	Y14
N15	GND	GND	Y16
N2	GND	GND	Y18
N25	GND	GND	Y20
N35	GND	GND	Y22
N38	GND	GND	Y24
N42	GND	GND	Y26
N43	GND	GND	Y28
N44	GND	GND	Y3
N5	GND	GND	Y34
N6	GND	GND	Y35
P12	GND	GND	Y37
P22	GND	GND	Y4
P3	GND	GND	Y41
P32	GND	GND	Y42
P35	GND	GND	Y45
P36	GND	GND	Y46
P4	GND	GND	Y5
P40	GND	GND	Y9
P42	GND		
P45	GND		
P46	GND		
P5	GND		
P8	GND		
R1	GND		
R10	GND		
R19	GND		
R2	GND		
R29	GND		

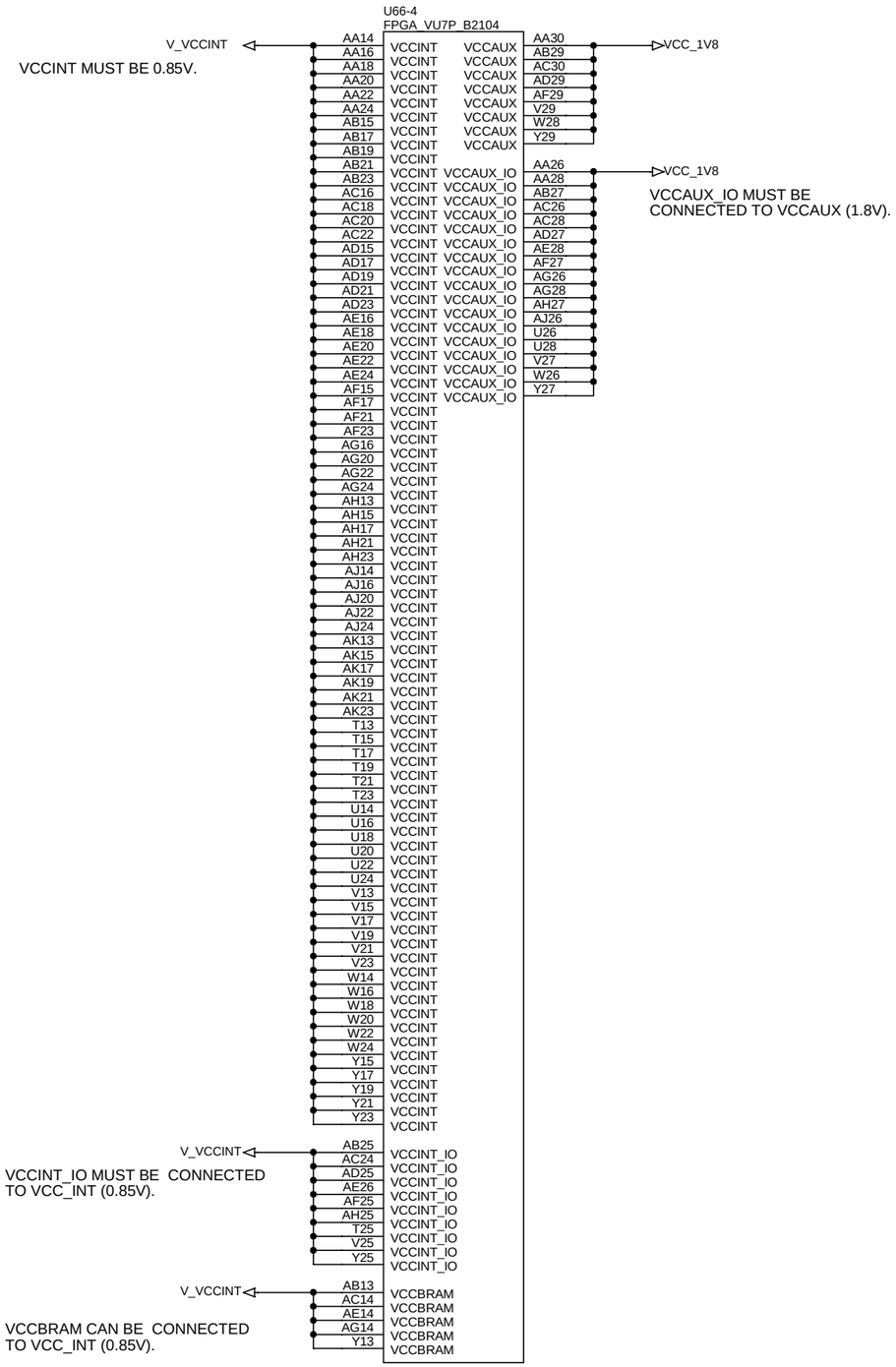
GND GND

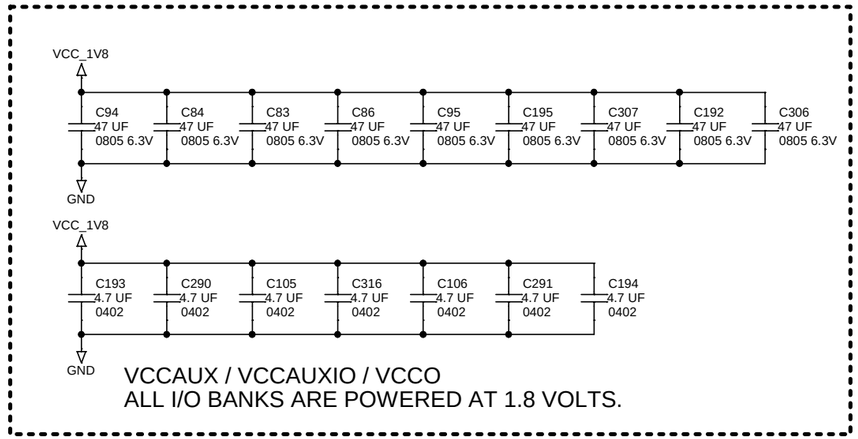
ATCA FPGA BOARD, KU15P AND VU7P, MK1

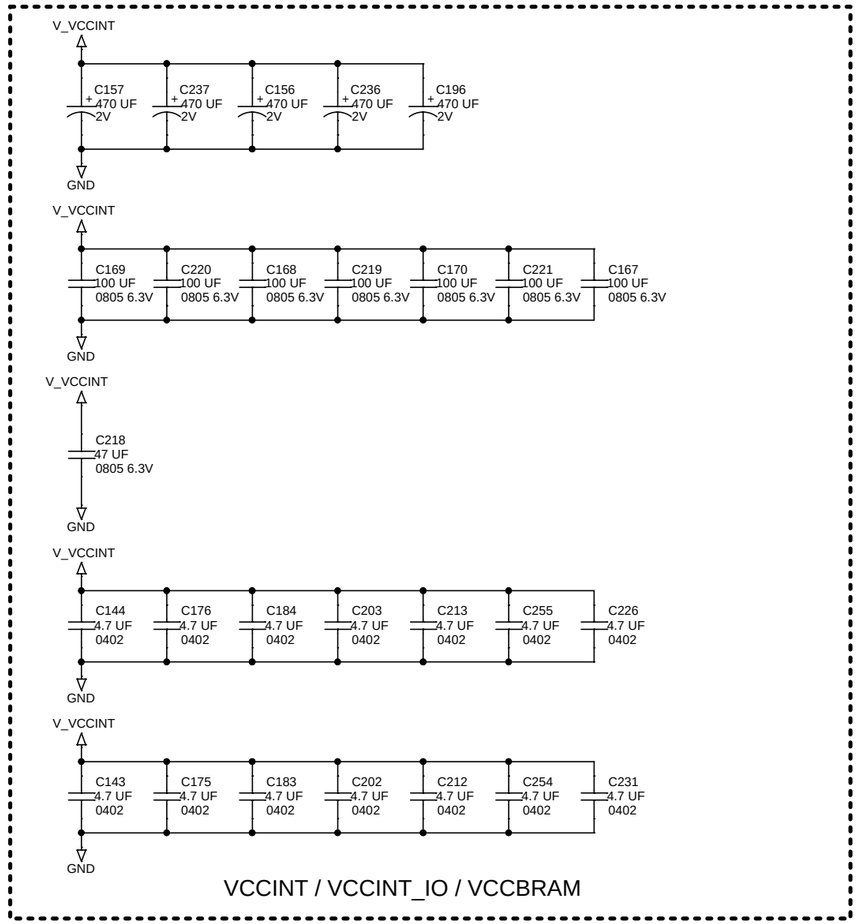
Title
6.01: VU7P FPGA GND

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 40 of 74







BYPASS CAPACITOR VALUES AND QUANTITIES FROM
"xtp427-ultrascale-plus-schematic-review-checklist.xls"

QUANTITIES BASE ON POSSIBLE UPGRADE TO VU9P

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 6.02: VU7P FPGA INTERNAL POWER		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 41 of 74	

U66-7
FPGA_VU7P_B2104

V_MGTY1_AVCC
C139 47 UF 0805 6.3V
C145 4.7 UF 0402
C136 0.1 UF 0402
AD36 MGTAVCC_LN
AF37 MGTAVCC_LN
L38 MGTAVCC_LN
M36 MGTAVCC_LN
N39 MGTAVCC_LN
P37 MGTAVCC_LN
R38 MGTAVCC_LN
T36 MGTAVCC_LN
U39 MGTAVCC_LN
V37 MGTAVCC_LN

C138 47 UF 0805 6.3V
C142 4.7 UF 0402
C133 0.1 UF 0402
AG38 MGTAVCC_LS
AL38 MGTAVCC_LS
AM36 MGTAVCC_LS
AP37 MGTAVCC_LS
AR38 MGTAVCC_LS
AT36 MGTAVCC_LS
AW38 MGTAVCC_LS
AY40 MGTAVCC_LS

V_MGTY2_AVCC
C259 47 UF 0805 6.3V
C256 4.7 UF 0402
C268 0.1 UF 0402
A11 MGTAVCC_RN
A7 MGTAVCC_RN
B9 MGTAVCC_RN
C10 MGTAVCC_RN
E11 MGTAVCC_RN
G10 MGTAVCC_RN
J11 MGTAVCC_RN
L10 MGTAVCC_RN
N11 MGTAVCC_RN
W10 MGTAVCC_RN

C258 47 UF 0805 6.3V
C253 4.7 UF 0402
C265 0.1 UF 0402
AA11 MGTAVCC_RS
AG10 MGTAVCC_RS
AJ11 MGTAVCC_RS
AL10 MGTAVCC_RS
AN11 MGTAVCC_RS
AP9 MGTAVCC_RS
AR10 MGTAVCC_RS
AU11 MGTAVCC_RS
AV9 MGTAVCC_RS
AW7 MGTAVCC_RS

0603 10K R495
VCC_3V3
/V_MGTY1_VCCAUX_EN
PG 18
U54
/EN
IN
IN
NC2
NC12
NC13
NC14
NC15
NC16
NC18
NC19
OUT
OUT
SENSE
/RESET
GND
PAD
TPS75218
V_MGTY1_VCCAUX
C776 4.7 UF 0402
C777 0.1 UF 0402
C114 100 UF 6.3V 3216
C126 0.1 UF 0402
AB36 MGTVCCAUX_LN
Y36 MGTVCCAUX_LN
AH36 MGTVCCAUX_LS
AK36 MGTVCCAUX_LS
C135 4.7 UF 0402
C134 4.7 UF 0402

0603 10K R408
VCC_3V3
/V_MGTY2_VCCAUX_EN
PG 18
U99
TPS75218
V_MGTY2_VCCAUX
C727 4.7 UF 0402
C728 0.1 UF 0402
C299 100 UF 6.3V 3216
C302 0.1 UF 0402
R11 MGTVCCAUX_RN
U11 MGTVCCAUX_RN
AC11 MGTVCCAUX_RS
AE11 MGTVCCAUX_RS
C267 4.7 UF 0402
C266 4.7 UF 0402

PLACE CAPACITORS
THAT ARE TO THE RIGHT
OF THIS LINE NEAR THE
BGA PINS.

U66-8
FPGA_VU7P_B2104

V_MGTY1_AVTT
C123 47 UF 0805 6.3V
C125 4.7 UF 0402
C113 0.1 UF 0402
AA39 MGTAVTT_LN
AB41 MGTAVTT_LN
AC38 MGTAVTT_LN
AD40 MGTAVTT_LN
AE39 MGTAVTT_LN
AF41 MGTAVTT_LN
C45 MGTAVTT_LN
D43 MGTAVTT_LN
F42 MGTAVTT_LN
F43 MGTAVTT_LN
H40 MGTAVTT_LN
K41 MGTAVTT_LN
M40 MGTAVTT_LN
P41 MGTAVTT_LN
T40 MGTAVTT_LN
V41 MGTAVTT_LN
W38 MGTAVTT_LN
Y40 MGTAVTT_LN
R91 0 0402
B42 MGTAVTTRCAL_LN
R88 100 0402
B43 MGTRREF_LN

C122 47 UF 0805 6.3V
C112 4.7 UF 0402
C124 0.1 UF 0402
AH40 MGTAVTT_LS
AJ39 MGTAVTT_LS
AK41 MGTAVTT_LS
AM40 MGTAVTT_LS
AN39 MGTAVTT_LS
AP41 MGTAVTT_LS
AT40 MGTAVTT_LS
AU39 MGTAVTT_LS
AV41 MGTAVTT_LS
BA42 MGTAVTT_LS
BA43 MGTAVTT_LS
BC43 MGTAVTT_LS
BD45 MGTAVTT_LS
BE44 MGTAVTT_LS
R90 0 0402
BE42 MGTAVTTRCAL_LS
R87 100 0402
BE43 MGTRREF_LS

V_MGTY2_AVTT
C280 47 UF 0805 6.3V
C275 4.7 UF 0402
C285 0.1 UF 0402
B3 MGTAVTT_RN
D8 MGTAVTT_RN
E7 MGTAVTT_RN
F9 MGTAVTT_RN
G6 MGTAVTT_RN
H8 MGTAVTT_RN
J7 MGTAVTT_RN
K9 MGTAVTT_RN
L6 MGTAVTT_RN
M8 MGTAVTT_RN
N7 MGTAVTT_RN
P9 MGTAVTT_RN
R6 MGTAVTT_RN
T8 MGTAVTT_RN
U7 MGTAVTT_RN
V9 MGTAVTT_RN
W6 MGTAVTT_RN
Y8 MGTAVTT_RN
R146 0 0402
C7 MGTAVTTRCAL_RN
R151 100 0402
C6 MGTRREF_RN

C282 47 UF 0805 6.3V
C274 4.7 UF 0402
C284 0.1 UF 0402
AB9 MGTAVTT_RS
AC6 MGTAVTT_RS
AD8 MGTAVTT_RS
AE7 MGTAVTT_RS
AF9 MGTAVTT_RS
AG6 MGTAVTT_RS
AH8 MGTAVTT_RS
AJ7 MGTAVTT_RS
AK9 MGTAVTT_RS
AL6 MGTAVTT_RS
AM8 MGTAVTT_RS
AN7 MGTAVTT_RS
AR6 MGTAVTT_RS
AT8 MGTAVTT_RS
AU7 MGTAVTT_RS
BC5 MGTAVTT_RS
BD2 MGTAVTT_RS
BE4 MGTAVTT_RS
R145 0 0402
BA5 MGTAVTTRCAL_RS
R150 100 0402
BA4 MGTRREF_RS

REFER TO THE GTY/GTH USER
GUIDES FOR DETAILS ON TRACE
ROUTING FOR THIS RESISTOR.

PLACE CAPACITORS AND RESISTORS
THAT ARE TO THE RIGHT OF THIS LINE
NEAR THE BGA PINS.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 6.03: VU7P GTY TRANSCEIVER POWER		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 42 of 74	

MUST BE TIED TO "VCCINT" OR "GND".
DO NOT CONNECT TO "VCCO_0".
CONNECT TO "GND" FOR STANDARD
POR DELAY.

THIS PIN MUST BE TIED TO "GND".

CONNECTING THIS PIN TO "GND" ENABLES PULLUPS ON ALL I/O PINS DURING CONFIGURATION. THE PULLUPS ARE ABOUT 15K AT 1.8 VOLTS. IF A PULLDOWN IS REQUIRED, IT MUST BE SMALLER THAN 4K TO DROP THE VOLTAGE BELOW 0.4 VOLTS. THIS PIN MUST NOT FLOAT.

V_CONFIG_BIT_M2
PG 17

M[2:0] MODE
000 Master serial
001 Master SPI
010 Master BPI
100 Master SelectMAP
101 JTAG only
110 Slave SelectMAP
111 Slave Serial

THIS SWITCH ON BIT "M2"
ALLOW A CHOICE OF EITHER
"MASTER SPI" OR "JTAG ONLY".

U66-6
FPGA_VU7P_B2104
BANK 0

V_VCCINT, GND, R478 DNP 0603, R480 0 0603 → AD12 POR_OVERRIDE
GND, R449 0 0603 → W12 RSVDGND
VCC_1V8, R463 DNP 0603; GND, R474 0 0603 → AA12 PUDC_B_0
VCC_1V8, R682 1K 0402 → R12 M2_0
VCC_1V8, R459 DNP 0603; GND, R461 0 0603 → U12 M1_0
VCC_1V8, R450 0 0603; GND, R451 DNP 0603 → V12 M0_0

VCCO_0: AD13, AF13 → VCC_1V8; C292 47 UF 0805 6.3V → GND
VCCO_0
D00_MOSI_0 AK12
D01_DIN_0 AJ12
D02_0 AL12
D03_0 AH12
RDWR_FCS_B_0 AG12
CCLK_0 AG13
PROGRAM_B_0 AE12
DONE_0 AC12 → 0603 4.7K R21 → VCC_1V8; V_FPGA_DONE
INIT_B_0 Y12 → 0603 4.7K R453 → VCC_1V8
VBATT AM12 → GND

THIS DESIGN DOES NOT USE ENCRYPTION, SO "VBATT" CAN BE TIED TO "GND"

PULLUPS/PULLDOWNS ON THE BOOT MODE CONFIGURATION INPUTS MUST BE 1K OR LESS.

VCC_1V8: R406 2.2K 0603, R409 4.7K 0603, R407 4.7K 0603

QUAD SPI CONFIG FLASH

CONFIGURATION BITSTREAM LENGTHS
KU15P 290,744,896
VU7P 427,519,232
VU9P 641,272,864

U98 MT25QU01
15 DQ0, 8 DQ1, 9 DQ2, 1 DQ3, 7 S#, 16 CLK
DNU_3 3, DNU_4 4, DNU_5 5, DNU_6 6, DNU_11 11, DNU_12 12, DNU_13 13, DNU_14 14
VCC 2 → VCC_1V8; C729 0.1 UF 0402 → GND
GND 10 → GND

0603 4.7K R713 → VCC_1V8
V_FPGA_PROGRAM PG 11 → Q27 FET_N_1.8V (1, 2, 3); GND
R712 4.7K 0603: GND → V_FPGA_PROGRAM
SW3 SW PUSHBUTTON: 3 → GND; 1 → GND

THE FPGA CAN BE REPROGRAMMED EITHER BY PULSING "V_FPGA_PROGRAM" FROM THE TM4C CONTROLLER, OR BY ACTIVATING THE FRONT PANEL "REPROGRAM" SWITCH.

FRONT PANEL REPROGRAM

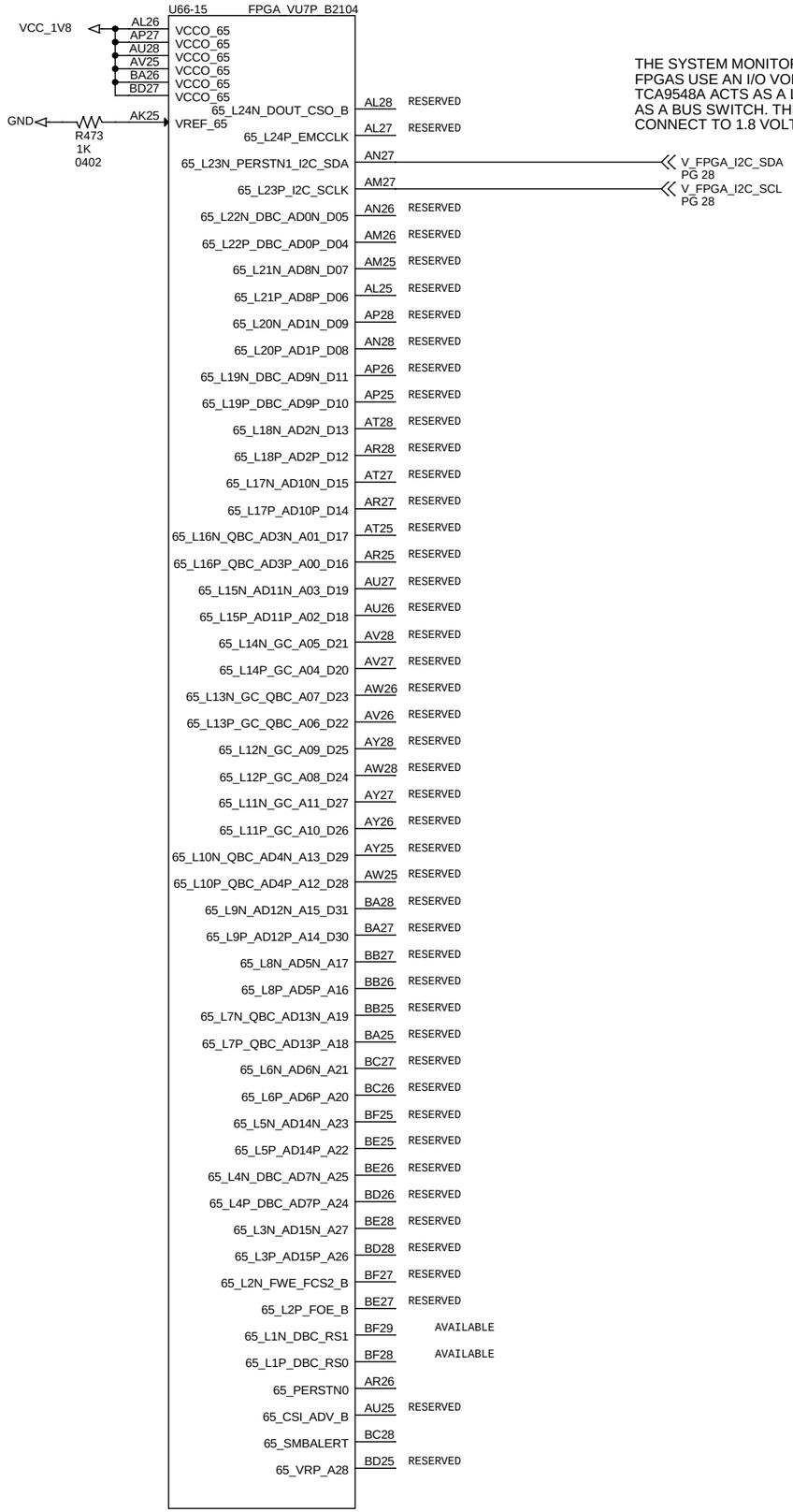
/V_FPGA_DONE
PG 11
0603 4.7K R7
D7 LED GREEN R6 270 → VCC_3V3
V_FPGA_DONE → Q5 FET_N_1.8V (1, 2, 3); GND

VU7P DONE LED

THE PULLUP RESISTOR IN PARALLEL WITH THE LED ENSURES THAT, WHEN THE FET IS OFF, THE "/V_FPGA_DONE" SIGNAL IS AT A HIGH LEVEL FOR FEEDING THE TM4C CONTROLLER.

FOR LED CURRENT OF 5 MA, THE FORWARD VOLTAGE DROP IS 1.95V. USE 270 OHM RESISTOR.

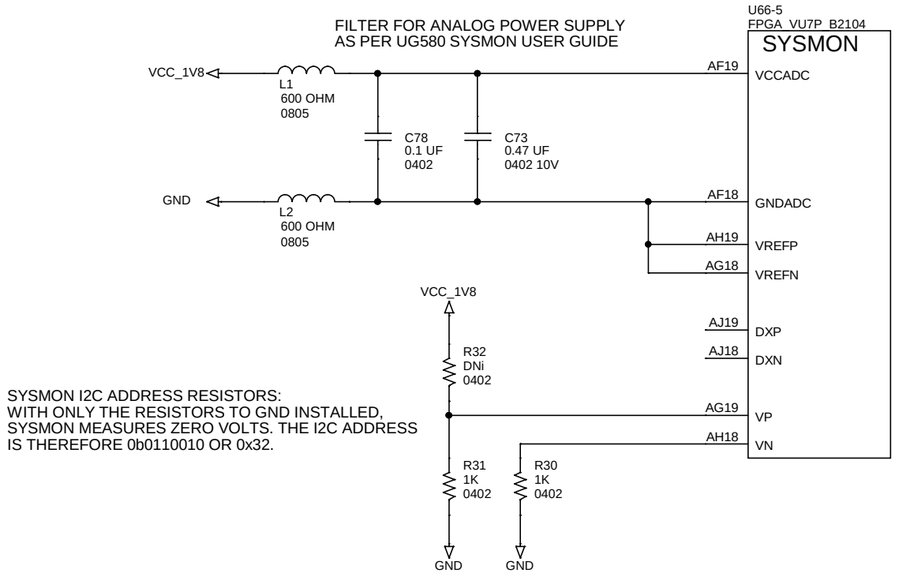
ATCA FPGA BOARD, KU15P AND VU7P, MK1
Title: 6.04: VU7P FPGA CONFIGURATION
Size | Document Number: 6089-103 | Rev: A
Date: Wednesday, March 06, 2019 | Sheet 43 of 74



THE SYSTEM MONITOR I2C PORTS ON THE FPGAS USE AN I/O VOLTAGE OF 1.8 VOLTS. THE TCA9548A ACTS AS A LEVEL SHIFTER AS WELL AS A BUS SWITCH. THE FPGA SIGNAL PULLUPS CONNECT TO 1.8 VOLTS.

BANK 65 CONTAINS MANY DUAL-FUNCTION PINS THAT CAN BE USED DURING CONFIGURATION. THOSE PINS WILL BE MARKED AS "NO CONNECT" AND SHOULD NOT BE USED FOR NORMAL LOGIC.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 6.05: VU7P BANK 65		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 44 of 74	



SYSMON I2C ADDRESS RESISTORS:
WITH ONLY THE RESISTORS TO GND INSTALLED, SYSMON MEASURES ZERO VOLTS. THE I2C ADDRESS IS THEREFORE 0b0110010 OR 0x32.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 6.06: VU7P SYSTEM MONITOR		
Size	Document Number: 6089-103	Rev: A
Date: Wednesday, February 27, 2019	Sheet 45 of 74	

THE UTILITY CLOCK MUST CONNECT TO CLOCK-CAPABLE PINS.

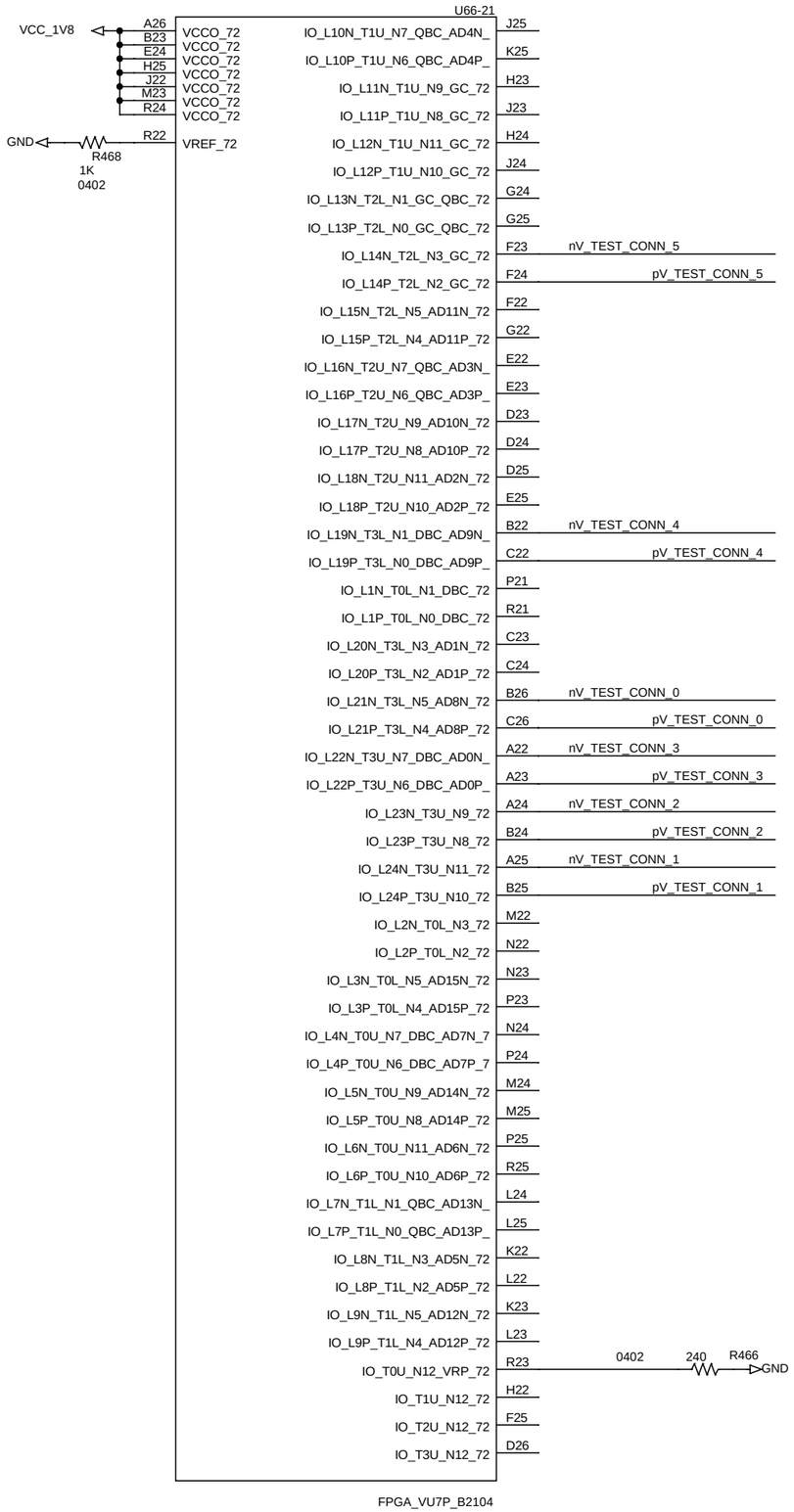
THESE CLOCK SIGNALS CONNECT TO ONE SIDE OF THE "SLR" BOUNDARY.

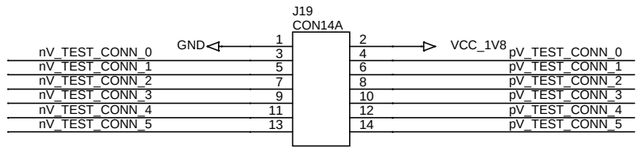
LOGIC FABRIC BOTTOM

THE "KV_SPARE" SIGNALS ARE INTENDED FOR DEBUGGING OR FOR UNFORSEEN I/O NEEDS BETWEEN THE TWO FPGAS. EACH PAIR IS ROUTED AS A 100 OHM DIFFERENTIAL PAIR.

THE "KV_SPARE0" AND "KV_SPARE2" SIGNALS ARE CONNECTED TO CLOCK INPUT PINS ON THE VU7P.

Title	ATCA FPGA BOARD, KU15P AND VU7P, MK1
	6.07 VU7P UTILITY BANKS
Size	Document Number 6089-103 Rev A
Date:	Tuesday, February 26, 2019 Sheet 46 of 74



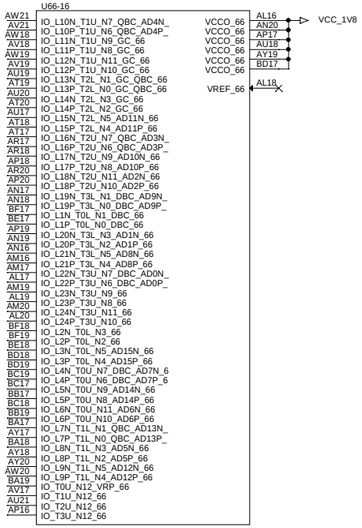


THIS CONNECTOR IS LOCATED ON THE BOTTOM OF THE BOARD. IF THE SITE IS POPULATED, THE CONNECTOR HEIGHT WILL EXCEED THE ATCA DIMENSIONS.

THE CONNECTOR SITE IS INTENDED FOR DEBUGGING OR FOR UNFORSEEN I/O NEEDS. EACH PAIR IS ROUTED AS A 100 OHM DIFFERENTIAL PAIR.

THE "V_TEST_CONN_5" SIGNAL IS CONNECTED TO GLOBAL CLOCK RESOURCES.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 6.08 VU7P TEST CONNECTOR		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 47 of 74	



ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 6.99: VU7P UNUSED BLOCKS

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 48 of 74

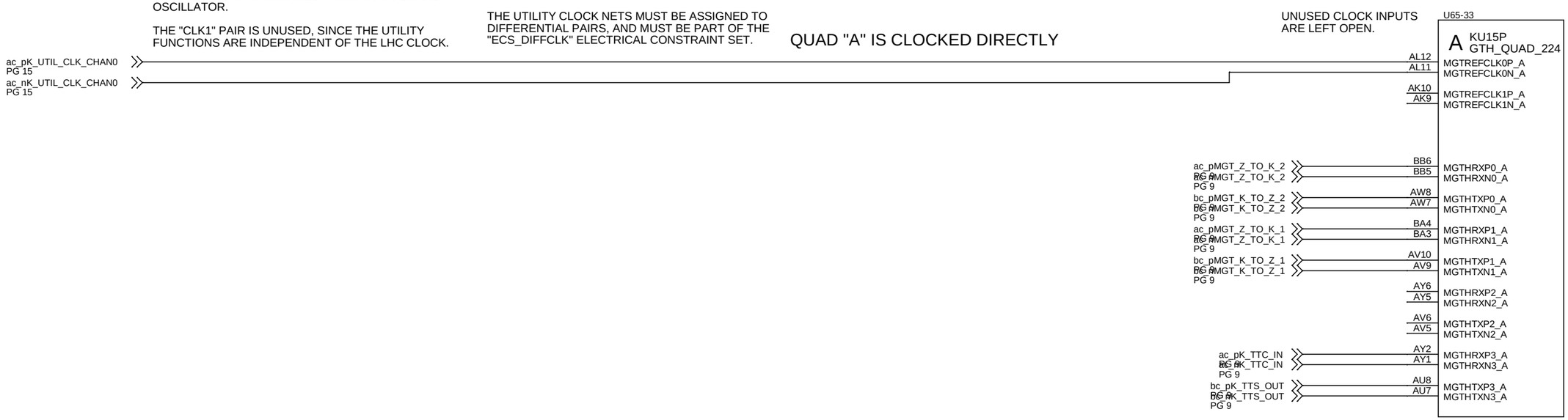
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS UNUSED, SINCE THE UTILITY FUNCTIONS ARE INDEPENDENT OF THE LHC CLOCK.

THE UTILITY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "A" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



UTILITY NETS FROM THE SERVICE BOARD HIGH SPEED CONNECTOR

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.01: KU15P QUAD A UTILITY #1

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 49 of 74

THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

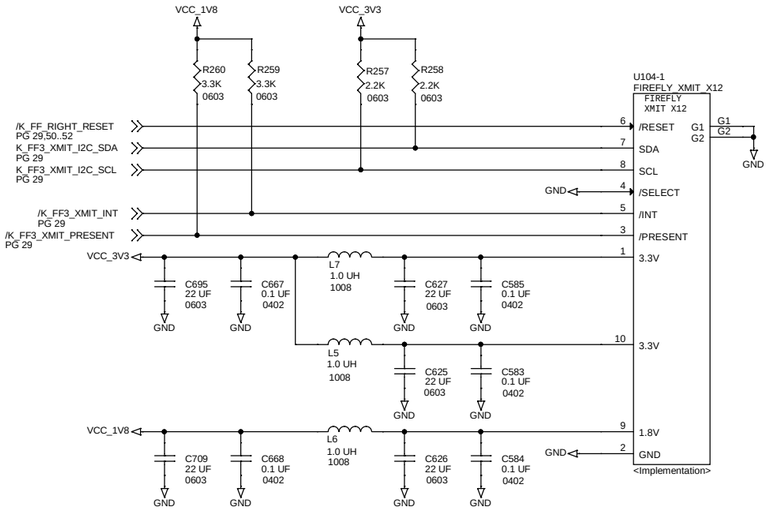
THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

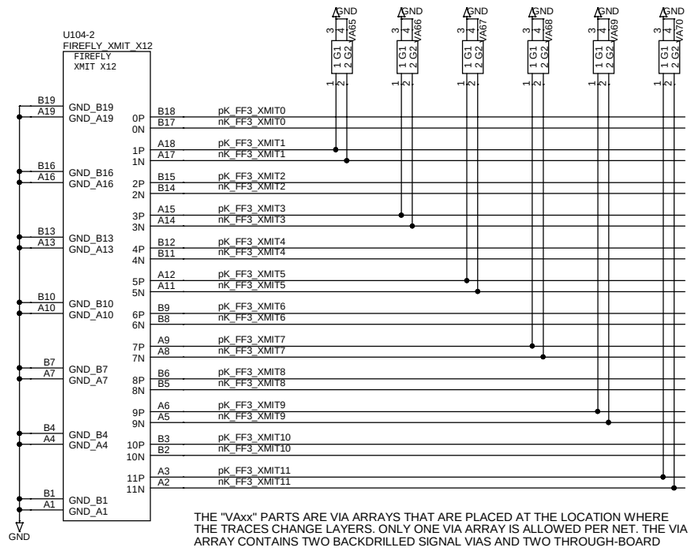
QUADS "B" AND "D" ARE CLOCKED FROM QUAD "C"

UNUSED CLOCK INPUTS ARE LEFT OPEN.

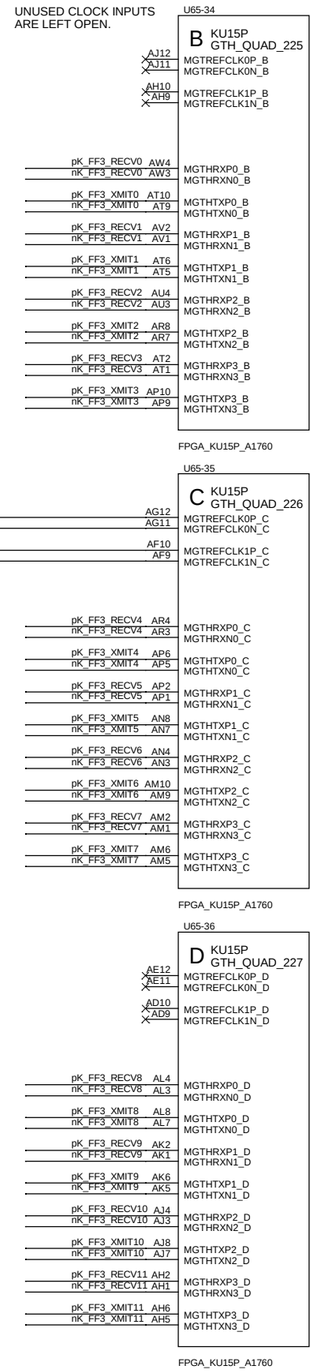
ac_pK_CLK0_CHAN PG 15
ac_nK_CLK0_CHAN PG 15
ac_pK_CLK1_CHAN PG 12
ac_nK_CLK1_CHAN PG 12

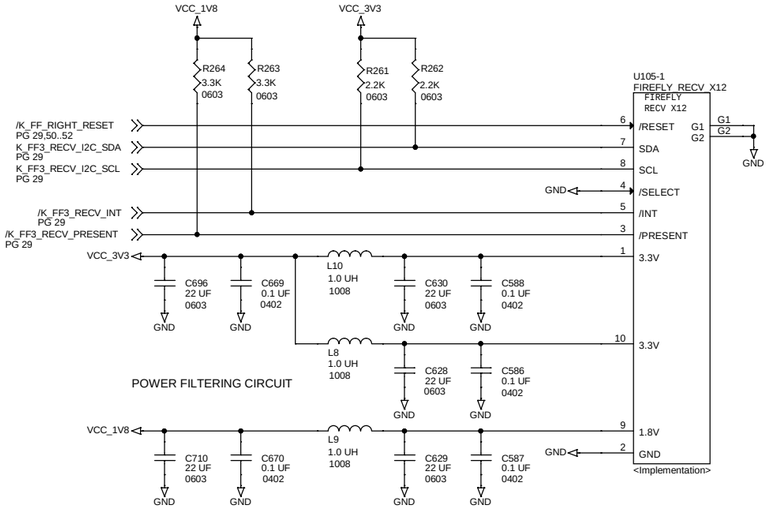


ON THE "X12" FIREFLY DEVICES AT 14G, PIN 9 IS RESERVED. ON THE "X4" FIREFLY DEVICES AT 28G, PIN 9 IS A 1.8 VOLT POWER PIN. THIS DESIGN PROVIDES FILTERING FOR PIN 9. IF IT CAUSES PROBLEMS ON THE "X12" 14G DEVICES, THE PARTS CAN BE OMITTED FROM THE BUILD.



THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.





POWER FILTERING CIRCUIT

ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

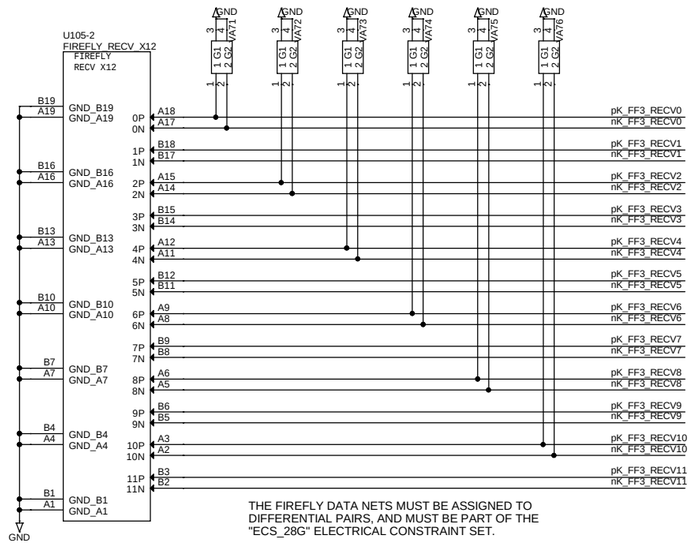
XMIT PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

RECV PORT ADDRESSING
- 0x54 = 7 BIT ADDRESS
- 0xA8 = 8 BIT WRITE ADDRESS
- 0xA9 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.



THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

ATCA FPGA BOARD, KU15P AND VU7P, MK1			
Title: 7.02: KU15P QUADS BCD FIREFLY X12 #3			
Size	Document Number: 6089-103		Rev: A
Date: Tuesday, February 26, 2019	Sheet 50 of 74		

THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUADS "E" AND "G" ARE CLOCKED FROM QUAD "F"

UNUSED CLOCK INPUTS ARE LEFT OPEN.

ac_pK_CLK0_CHAN PG 15
ac_nK_CLK0_CHAN PG 15
ac_pK_CLK1_CHAN PG 12
ac_nK_CLK1_CHAN PG 12

VCC_1V8 VCC_3V3

R268 3.3K 0603 R267 3.3K 0603 R265 2.2K 0603 R266 2.2K 0603

/K_FF_RIGHT_RESET PG 29,50..52
K_FF2_XMIT_I2C_SDA PG 29
K_FF2_XMIT_I2C_SCL PG 29
/K_FF2_XMIT_INT PG 29
/K_FF2_XMIT_PRESENT PG 29

U106-1 FIREFLY_XMIT_X12 FIREFLY XMIT X12

6 /RESET G1 G2 → GND
7 SDA
8 SCL
4 /SELECT ← GND
5 /INT
3 /PRESENT
1 3.3V
10 3.3V
9 1.8V
2 GND

VCC_3V3: L13 1.0 UH 1008; C697 22 UF 0603; C671 0.1 UF 0402; C633 22 UF 0603; C591 0.1 UF 0402
VCC_3V3: L11 1.0 UH 1008; C631 22 UF 0603; C589 0.1 UF 0402
VCC_1V8: L12 1.0 UH 1008; C711 22 UF 0603; C672 0.1 UF 0402; C632 22 UF 0603; C590 0.1 UF 0402

<Implementation>

ON THE "X12" FIREFLY DEVICES AT 14G, PIN 9 IS RESERVED. ON THE "X4" FIREFLY DEVICES AT 28G, PIN 9 IS A 1.8 VOLT POWER PIN. THIS DESIGN PROVIDES FILTERING FOR PIN 9. IF IT CAUSES PROBLEMS ON THE "X12" 14G DEVICES, THE PARTS CAN BE OMITTED FROM THE BUILD.

U106-2 FIREFLY_XMIT_X12 FIREFLY XMIT X12

B19 A19	GND_B19 GND_A19	0P 0N	B18 A18 pK_FF2_XMIT0 nK_FF2_XMIT0
		1P 1N	B17 A17 pK_FF2_XMIT1 nK_FF2_XMIT1
B16 A16	GND_B16 GND_A16	2P 2N	B15 B14 pK_FF2_XMIT2 nK_FF2_XMIT2
		3P 3N	A15 A14 pK_FF2_XMIT3 nK_FF2_XMIT3
B13 A13	GND_B13 GND_A13	4P 4N	B12 B11 pK_FF2_XMIT4 nK_FF2_XMIT4
		5P 5N	A12 A11 pK_FF2_XMIT5 nK_FF2_XMIT5
B10 A10	GND_B10 GND_A10	6P 6N	B9 B8 pK_FF2_XMIT6 nK_FF2_XMIT6
		7P 7N	A9 A8 pK_FF2_XMIT7 nK_FF2_XMIT7
B7 A7	GND_B7 GND_A7	8P 8N	B6 B5 pK_FF2_XMIT8 nK_FF2_XMIT8
		9P 9N	A6 A5 pK_FF2_XMIT9 nK_FF2_XMIT9
B4 A4	GND_B4 GND_A4	10P 10N	B3 B2 pK_FF2_XMIT10 nK_FF2_XMIT10
		11P 11N	A3 A2 pK_FF2_XMIT11 nK_FF2_XMIT11
B1 A1	GND_B1 GND_A1		

GND via 3 4 1 G1 2 G2 /A77 /A78 /A79 /A80 /A81 /A82

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

U65-37 E KU15P GTH_QUAD_228

AC12 AC11	MGTREFCLK0P_E MGTREFCLK0N_E
AB10 AB9	MGTREFCLK1P_E MGTREFCLK1N_E
pK_FF2_RECV0 AG4 nK_FF2_RECV0 AG3	MGTHRXP0_E MGTHRXN0_E
pK_FF2_XMIT0 AG8 nK_FF2_XMIT0 AG7	MGTHTXP0_E MGTHTXN0_E
pK_FF2_RECV1 AF2 nK_FF2_RECV1 AF1	MGTHRXP1_E MGTHRXN1_E
pK_FF2_XMIT1 AF6 nK_FF2_XMIT1 AF5	MGTHTXP1_E MGTHTXN1_E
pK_FF2_RECV2 AE4 nK_FF2_RECV2 AE3	MGTHRXP2_E MGTHRXN2_E
pK_FF2_XMIT2 AE8 nK_FF2_XMIT2 AE7	MGTHTXP2_E MGTHTXN2_E
pK_FF2_RECV3 AD2 nK_FF2_RECV3 AD1	MGTHRXP3_E MGTHRXN3_E
pK_FF2_XMIT3 AD6 nK_FF2_XMIT3 AD5	MGTHTXP3_E MGTHTXN3_E

FPGA_KU15P_A1760

U65-38 F KU15P GTH_QUAD_229

AA12 AA11	MGTREFCLK0P_F MGTREFCLK0N_F
Y10 Y9	MGTREFCLK1P_F MGTREFCLK1N_F
pK_FF2_RECV4 AC4 nK_FF2_RECV4 AC3	MGTHRXP0_F MGTHRXN0_F
pK_FF2_XMIT4 AC8 nK_FF2_XMIT4 AC7	MGTHTXP0_F MGTHTXN0_F
pK_FF2_RECV5 AB2 nK_FF2_RECV5 AB1	MGTHRXP1_F MGTHRXN1_F
pK_FF2_XMIT5 AB6 nK_FF2_XMIT5 AB5	MGTHTXP1_F MGTHTXN1_F
pK_FF2_RECV6 AA4 nK_FF2_RECV6 AA3	MGTHRXP2_F MGTHRXN2_F
pK_FF2_XMIT6 AA8 nK_FF2_XMIT6 AA7	MGTHTXP2_F MGTHTXN2_F
pK_FF2_RECV7 Y2 nK_FF2_RECV7 Y1	MGTHRXP3_F MGTHRXN3_F
pK_FF2_XMIT7 Y6 nK_FF2_XMIT7 Y5	MGTHTXP3_F MGTHTXN3_F

FPGA_KU15P_A1760

VCC_1V8 VCC_3V3

R272 3.3K 0603 R271 3.3K 0603 R269 2.2K 0603 R270 2.2K 0603

/K_FF_RIGHT_RESET PG 29,50..52
K_FF2_RECV_I2C_SDA PG 29
K_FF2_RECV_I2C_SCL PG 29
/K_FF2_RECV_INT PG 29
/K_FF2_RECV_PRESENT PG 29

U107-1 FIREFLY_RECV_X12 FIREFLY RECV X12

6 /RESET G1 G2 → GND
7 SDA
8 SCL
4 /SELECT ← GND
5 /INT
3 /PRESENT
1 3.3V
10 3.3V
9 1.8V
2 GND

VCC_3V3: L16 1.0 UH 1008; C706 22 UF 0603; C673 0.1 UF 0402; C636 22 UF 0603; C594 0.1 UF 0402
VCC_3V3: L14 1.0 UH 1008; C634 22 UF 0603; C592 0.1 UF 0402
VCC_1V8: L15 1.0 UH 1008; C712 22 UF 0603; C674 0.1 UF 0402; C635 22 UF 0603; C593 0.1 UF 0402

<Implementation>

POWER FILTERING CIRCUIT

ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XMIT PORT ADDRESSING
0x50 = 7 BIT ADDRESS
0xA0 = 8 BIT WRITE ADDRESS
0xA1 = 8 BIT READ ADDRESS

RECV PORT ADDRESSING
0x54 = 7 BIT ADDRESS
0xA8 = 8 BIT WRITE ADDRESS
0xA9 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

U107-2 FIREFLY_RECV_X12 FIREFLY RECV X12

B19 A19	GND_B19 GND_A19	0P 0N	A18 A17 pK_FF2_RECV0 nK_FF2_RECV0
		1P 1N	B18 B17 pK_FF2_RECV1 nK_FF2_RECV1
B16 A16	GND_B16 GND_A16	2P 2N	A15 A14 pK_FF2_RECV2 nK_FF2_RECV2
		3P 3N	B15 B14 pK_FF2_RECV3 nK_FF2_RECV3
B13 A13	GND_B13 GND_A13	4P 4N	A12 A11 pK_FF2_RECV4 nK_FF2_RECV4
		5P 5N	B12 B11 pK_FF2_RECV5 nK_FF2_RECV5
B10 A10	GND_B10 GND_A10	6P 6N	A9 A8 pK_FF2_RECV6 nK_FF2_RECV6
		7P 7N	B9 B8 pK_FF2_RECV7 nK_FF2_RECV7
B7 A7	GND_B7 GND_A7	8P 8N	A6 A5 pK_FF2_RECV8 nK_FF2_RECV8
		9P 9N	B6 B5 pK_FF2_RECV9 nK_FF2_RECV9
B4 A4	GND_B4 GND_A4	10P 10N	A3 A2 pK_FF2_RECV10 nK_FF2_RECV10
		11P 11N	B3 B2 pK_FF2_RECV11 nK_FF2_RECV11
B1 A1	GND_B1 GND_A1		

GND via 3 4 1 G1 2 G2 /A83 /A84 /A85 /A86 /A87 /A88

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

U65-39 G KU15P GTH_QUAD_230

W12 W11	MGTREFCLK0P_G MGTREFCLK0N_G
V10 V9	MGTREFCLK1P_G MGTREFCLK1N_G
pK_FF2_RECV8 W4 nK_FF2_RECV8 W3	MGTHRXP0_G MGTHRXN0_G
pK_FF2_XMIT8 W8 nK_FF2_XMIT8 W7	MGTHTXP0_G MGTHTXN0_G
pK_FF2_RECV9 V2 nK_FF2_RECV9 V1	MGTHRXP1_G MGTHRXN1_G
pK_FF2_XMIT9 V6 nK_FF2_XMIT9 V5	MGTHTXP1_G MGTHTXN1_G
pK_FF2_RECV10 U4 nK_FF2_RECV10 U3	MGTHRXP2_G MGTHRXN2_G
pK_FF2_XMIT10 U8 nK_FF2_XMIT10 U7	MGTHTXP2_G MGTHTXN2_G
pK_FF2_RECV11 T2 nK_FF2_RECV11 T1	MGTHRXP3_G MGTHRXN3_G
pK_FF2_XMIT11 T6 nK_FF2_XMIT11 T5	MGTHTXP3_G MGTHTXN3_G

FPGA_KU15P_A1760

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.03: KU15P QUADS EFG FIREFLY X12 #2

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 51 of 74

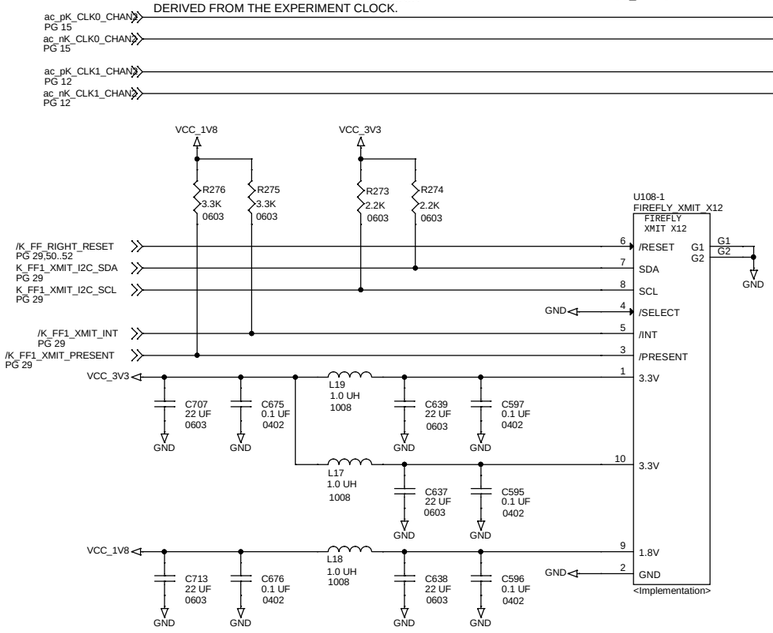
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

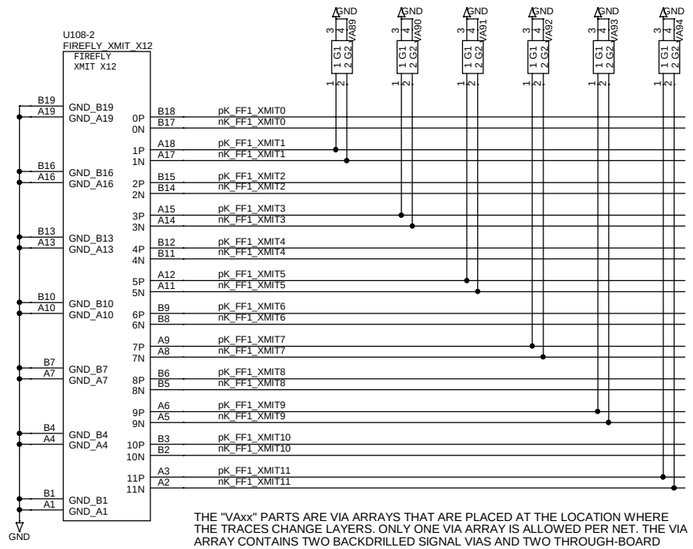
THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUADS "H" AND "J" ARE CLOCKED FROM QUAD "I"

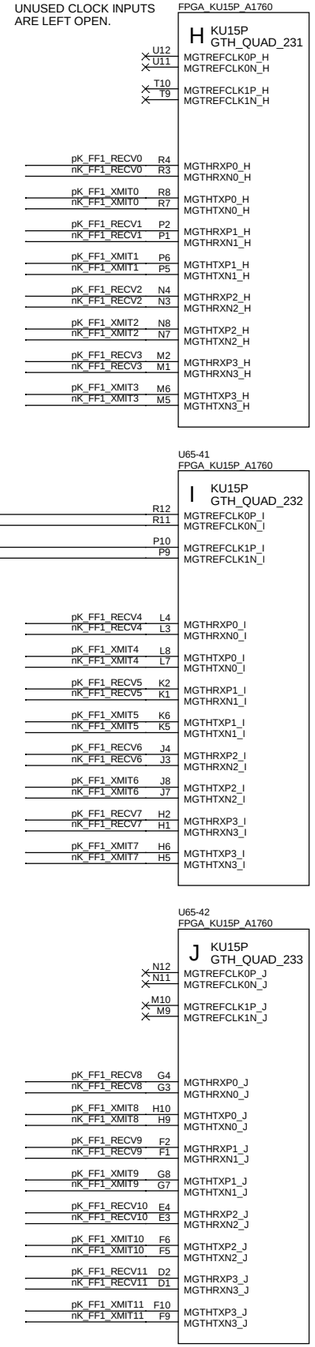
UNUSED CLOCK INPUTS ARE LEFT OPEN.

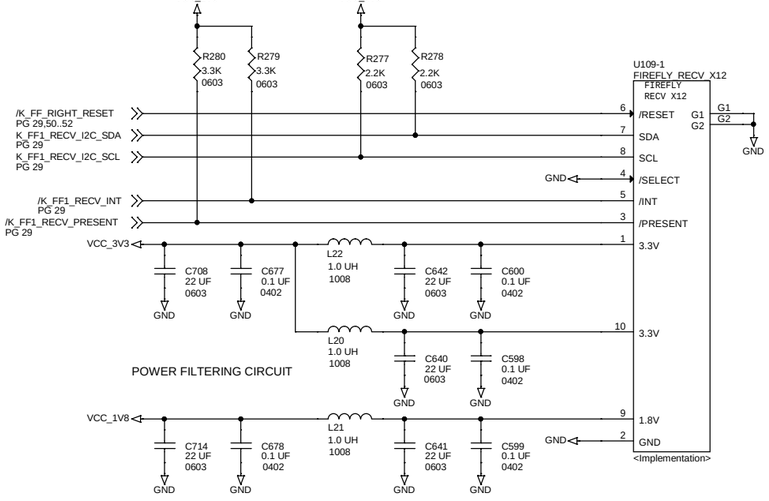


ON THE "X12" FIREFLY DEVICES AT 14G, PIN 9 IS RESERVED. ON THE "X4" FIREFLY DEVICES AT 28G, PIN 9 IS A 1.8 VOLT POWER PIN. THIS DESIGN PROVIDES FILTERING FOR PIN 9. IF IT CAUSES PROBLEMS ON THE "X12" 14G DEVICES, THE PARTS CAN BE OMITTED FROM THE BUILD.

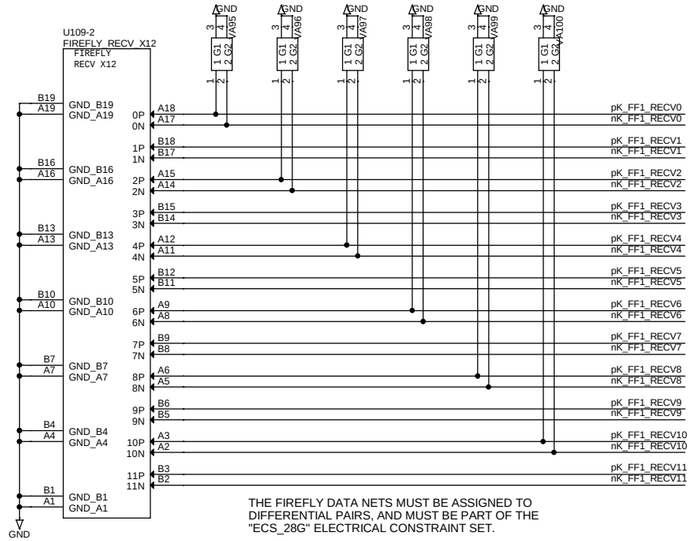


THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.





POWER FILTERING CIRCUIT



THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XMIT PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

RECV PORT ADDRESSING
- 0x54 = 7 BIT ADDRESS
- 0xA8 = 8 BIT WRITE ADDRESS
- 0xA9 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

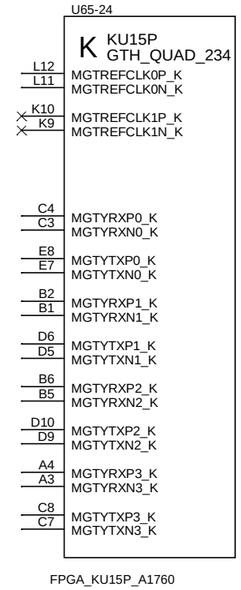
ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.04: KU15P QUADS HIJ FIREFLY X12 #1

Size: | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 52 of 74

QUAD "K" IS UNUSED



FPGA_KU15P_A1760

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.05: KU15P QUAD K UNUSED

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 53 of 74

THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUADS "L" AND "N" ARE CLOCKED FROM QUAD "M"

UNUSED CLOCK INPUTS ARE LEFT OPEN.

ac_pK_CLK0_CHAN4 PG 15
ac_nK_CLK0_CHAN4 PG 15
ac_pK_CLK1_CHAN4 PG 12
ac_nK_CLK1_CHAN4 PG 12

U65-25
L KU15P GTY_QUAD_127
AG30 MGTREFCLK0P_L
AG31 MGTREFCLK0N_L
AE30 MGTREFCLK1P_L
AE31 MGTREFCLK1N_L
pK_FF7_RECV11 AT41 MGTYRXP0_L
nK_FF7_RECV11 AT42 MGTYRXN0_L
pK_FF7_XMIT11 AM36 MGTYTXP0_L
nK_FF7_XMIT11 AM37 MGTYTXN0_L
pK_FF7_RECV10 AR39 MGTYRXP1_L
nK_FF7_RECV10 AR40 MGTYRXN1_L
pK_FF7_XMIT10 AL34 MGTYTXP1_L
nK_FF7_XMIT10 AL35 MGTYTXN1_L
pK_FF7_RECV9 AP41 MGTYRXP2_L
nK_FF7_RECV9 AP42 MGTYRXN2_L
pK_FF7_XMIT9 AK36 MGTYTXP2_L
nK_FF7_XMIT9 AK37 MGTYTXN2_L
pK_FF7_RECV8 AN39 MGTYRXP3_L
nK_FF7_RECV8 AN40 MGTYRXN3_L
pK_FF7_XMIT8 AJ34 MGTYTXP3_L
nK_FF7_XMIT8 AJ35 MGTYTXN3_L
FPGA_KU15P_A1760

U65-26
M KU15P GTY_QUAD_128
AD32 MGTREFCLK0P_M
AD33 MGTREFCLK0N_M
AC30 MGTREFCLK1P_M
AC31 MGTREFCLK1N_M
pK_FF7_RECV7 AM41 MGTYRXP0_M
nK_FF7_RECV7 AM42 MGTYRXN0_M
pK_FF7_XMIT7 AH32 MGTYTXP0_M
nK_FF7_XMIT7 AH33 MGTYTXN0_M
pK_FF7_RECV6 AL39 MGTYRXP1_M
nK_FF7_RECV6 AL40 MGTYRXN1_M
pK_FF7_XMIT6 AH36 MGTYTXP1_M
nK_FF7_XMIT6 AH37 MGTYTXN1_M
pK_FF7_RECV5 AK41 MGTYRXP2_M
nK_FF7_RECV5 AK42 MGTYRXN2_M
pK_FF7_XMIT5 AG34 MGTYTXP2_M
nK_FF7_XMIT5 AG35 MGTYTXN2_M
pK_FF7_RECV4 AJ39 MGTYRXP3_M
nK_FF7_RECV4 AJ40 MGTYRXN3_M
pK_FF7_XMIT4 AF32 MGTYTXP3_M
nK_FF7_XMIT4 AF33 MGTYTXN3_M
FPGA_KU15P_A1760

U65-27
N KU15P GTY_QUAD_129
AB32 MGTREFCLK0P_N
AB33 MGTREFCLK0N_N
AA30 MGTREFCLK1P_N
AA31 MGTREFCLK1N_N
pK_FF7_RECV3 AH41 MGTYRXP0_N
nK_FF7_RECV3 AH42 MGTYRXN0_N
pK_FF7_XMIT3 AF36 MGTYTXP0_N
nK_FF7_XMIT3 AF37 MGTYTXN0_N
pK_FF7_RECV2 AG39 MGTYRXP1_N
nK_FF7_RECV2 AG40 MGTYRXN1_N
pK_FF7_XMIT2 AE34 MGTYTXP1_N
nK_FF7_XMIT2 AE35 MGTYTXN1_N
pK_FF7_RECV1 AF41 MGTYRXP2_N
nK_FF7_RECV1 AF42 MGTYRXN2_N
pK_FF7_XMIT1 AD36 MGTYTXP2_N
nK_FF7_XMIT1 AD37 MGTYTXN2_N
pK_FF7_RECV0 AE39 MGTYRXP3_N
nK_FF7_RECV0 AE40 MGTYRXN3_N
pK_FF7_XMIT0 AC34 MGTYTXP3_N
nK_FF7_XMIT0 AC35 MGTYTXN3_N
FPGA_KU15P_A1760

VCC_1V8 VCC_3V3
R601 3.3K 0603
R602 3.3K 0603
R604 2.2K 0603
R603 2.2K 0603

U20-1 FIREFLY_XMIT_X12 FIREFLY XMIT X12
/K_FF_LEFT_RESET PG 29,54,56..58 → /RESET
K_FF7_XMIT_I2C_SDA PG 29 → SDA
K_FF7_XMIT_I2C_SCL PG 29 → SCL
GND → /SELECT
/K_FF7_XMIT_INT PG 29 → /INT
/K_FF7_XMIT_PRESENT PG 29 → /PRESENT
3.3V
3.3V
1.8V
GND
G1 G2 GND
<Implementation>

L47 1.0 UH 1008
L49 1.0 UH 1008
L48 1.0 UH 1008
C847 22 UF 0603
C860 0.1 UF 0402
C884 22 UF 0603
C920 0.1 UF 0402
C886 22 UF 0603
C922 0.1 UF 0402
C836 22 UF 0603
C859 0.1 UF 0402
C885 22 UF 0603
C921 0.1 UF 0402

ON THE "X12" FIREFLY DEVICES AT 14G, PIN 9 IS RESERVED. ON THE "X4" FIREFLY DEVICES AT 28G, PIN 9 IS A 1.8 VOLT POWER PIN. THIS DESIGN PROVIDES FILTERING FOR PIN 9. IF IT CAUSES PROBLEMS ON THE "X12" 14G DEVICES, THE PARTS CAN BE OMITTED FROM THE BUILD.

U20-2 FIREFLY_XMIT_X12 FIREFLY XMIT X12
GND_B19 A19, GND_B16 A16, GND_B13 A13, GND_B10 A10, GND_B7 A7, GND_B4 A4, GND_B1 A1
0P 0N, 1P 1N, 2P 2N, 3P 3N, 4P 4N, 5P 5N, 6P 6N, 7P 7N, 8P 8N, 9P 9N, 10P 10N, 11P 11N
B18 A18 pK_FF7_XMIT0 / B17 A17 nK_FF7_XMIT0
B15 A15 pK_FF7_XMIT1 / B14 A14 nK_FF7_XMIT1
B12 A12 pK_FF7_XMIT2 / B11 A11 nK_FF7_XMIT2
B9 A9 pK_FF7_XMIT3 / B8 A8 nK_FF7_XMIT3
B6 A6 pK_FF7_XMIT4 / B5 A5 nK_FF7_XMIT4
B3 A3 pK_FF7_XMIT5 / B2 A2 nK_FF7_XMIT5
pK_FF7_XMIT6 / nK_FF7_XMIT6
pK_FF7_XMIT7 / nK_FF7_XMIT7
pK_FF7_XMIT8 / nK_FF7_XMIT8
pK_FF7_XMIT9 / nK_FF7_XMIT9
pK_FF7_XMIT10 / nK_FF7_XMIT10
pK_FF7_XMIT11 / nK_FF7_XMIT11
GND VA4 VA3 VA2 VA1

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

VCC_1V8 VCC_3V3
R605 3.3K 0603
R606 3.3K 0603
R608 2.2K 0603
R607 2.2K 0603

U21-1 FIREFLY_RECV_X12 FIREFLY RECV X12
/K_FF_LEFT_RESET PG 29,54,56..58 → /RESET
K_FF7_RECV_I2C_SDA PG 29 → SDA
K_FF7_RECV_I2C_SCL PG 29 → SCL
GND → /SELECT
/K_FF7_RECV_INT PG 29 → /INT
/K_FF7_RECV_PRESENT PG 29 → /PRESENT
3.3V
3.3V
1.8V
GND
G1 G2 GND
<Implementation>

L50 1.0 UH 1008
L52 1.0 UH 1008
L51 1.0 UH 1008
C848 22 UF 0603
C862 0.1 UF 0402
C887 22 UF 0603
C923 0.1 UF 0402
C889 22 UF 0603
C925 0.1 UF 0402
C837 22 UF 0603
C861 0.1 UF 0402
C888 22 UF 0603
C924 0.1 UF 0402

POWER FILTERING CIRCUIT

ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XMIT PORT ADDRESSING
0x50 = 7 BIT ADDRESS
0xA0 = 8 BIT WRITE ADDRESS
0xA1 = 8 BIT READ ADDRESS

RECV PORT ADDRESSING
0x54 = 7 BIT ADDRESS
0xA8 = 8 BIT WRITE ADDRESS
0xA9 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

U21-2 FIREFLY_RECV_X12 FIREFLY RECV X12
GND_B19 A19, GND_B16 A16, GND_B13 A13, GND_B10 A10, GND_B7 A7, GND_B4 A4, GND_B1 A1
0P 0N, 1P 1N, 2P 2N, 3P 3N, 4P 4N, 5P 5N, 6P 6N, 7P 7N, 8P 8N, 9P 9N, 10P 10N, 11P 11N
A18 A17 pK_FF7_RECV0 / nK_FF7_RECV0
B18 B17 pK_FF7_RECV1 / nK_FF7_RECV1
A15 A14 pK_FF7_RECV2 / nK_FF7_RECV2
B15 B14 pK_FF7_RECV3 / nK_FF7_RECV3
A12 A11 pK_FF7_RECV4 / nK_FF7_RECV4
B12 B11 pK_FF7_RECV5 / nK_FF7_RECV5
A9 A8 pK_FF7_RECV6 / nK_FF7_RECV6
B9 B8 pK_FF7_RECV7 / nK_FF7_RECV7
A6 A5 pK_FF7_RECV8 / nK_FF7_RECV8
B6 B5 pK_FF7_RECV9 / nK_FF7_RECV9
A3 A2 pK_FF7_RECV10 / nK_FF7_RECV10
B3 B2 pK_FF7_RECV11 / nK_FF7_RECV11
GND VA11 VA10 VA9 VA8 VA7

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

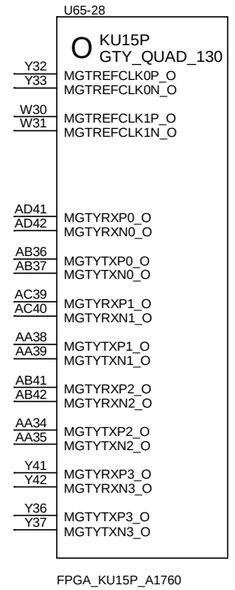
ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.06: KU15P QUADS LMN FIREFLY X12 #7

Size: | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 54 of 74

QUAD "O" IS UNUSED



ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.07: KU15P QUAD O UNUSED

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 55 of 74

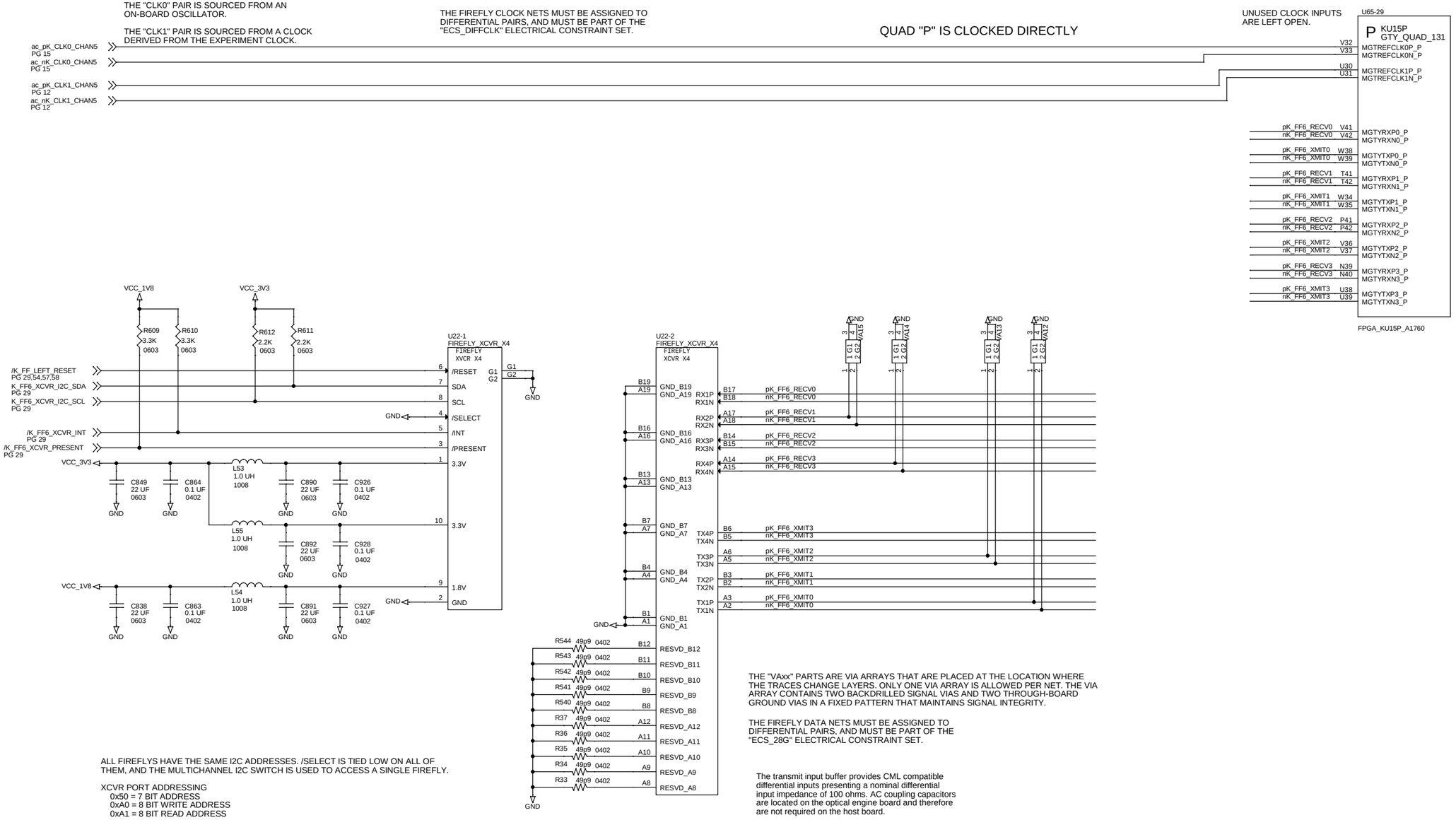
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "P" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

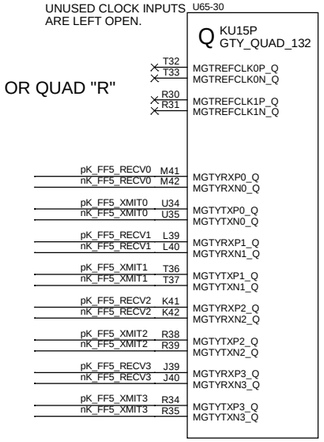
THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

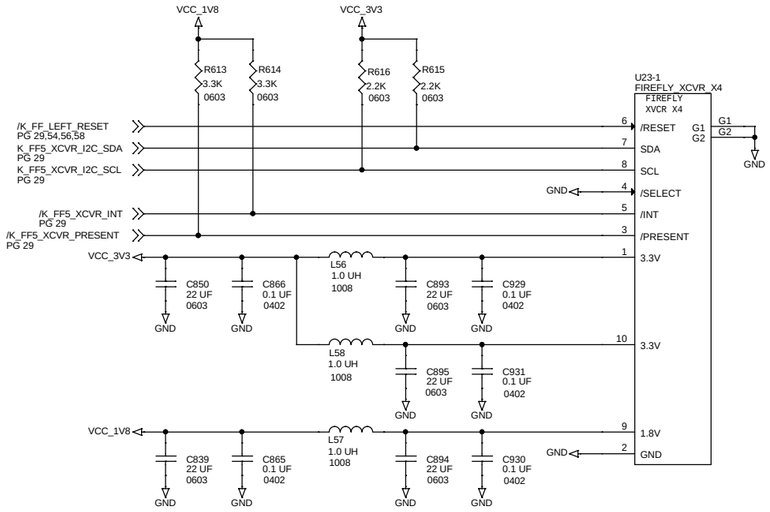
HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

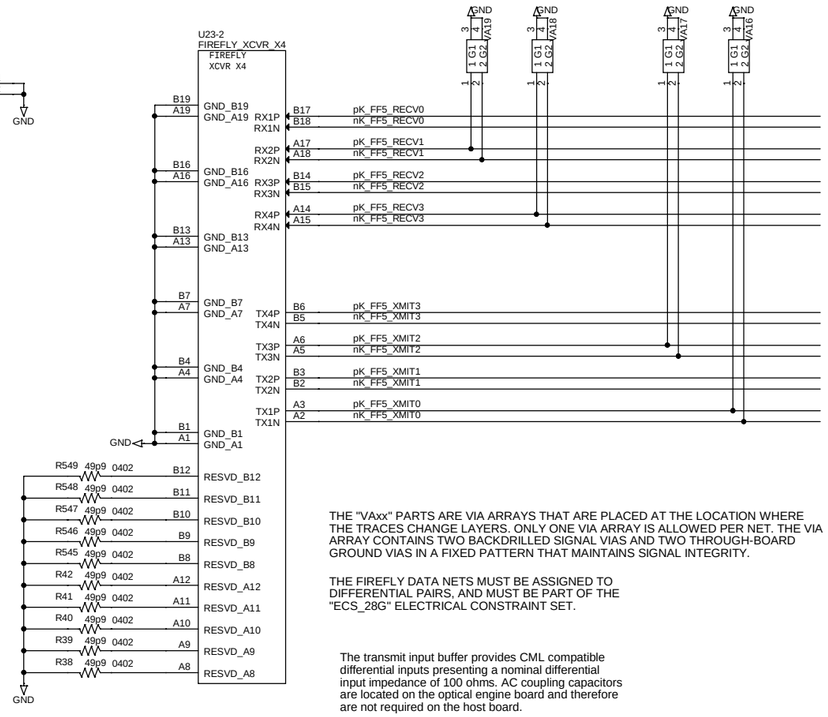
ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 7.08: KU15P QUAD P FIREFLY X4 #6		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 56 of 74	

UNUSED CLOCK INPUTS ARE LEFT OPEN.

QUAD "Q" CAN BE CLOCKED FROM QUAD "P" OR QUAD "R"







ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.09: KU15P QUAD R FIREFLY X4 #5

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 57 of 74

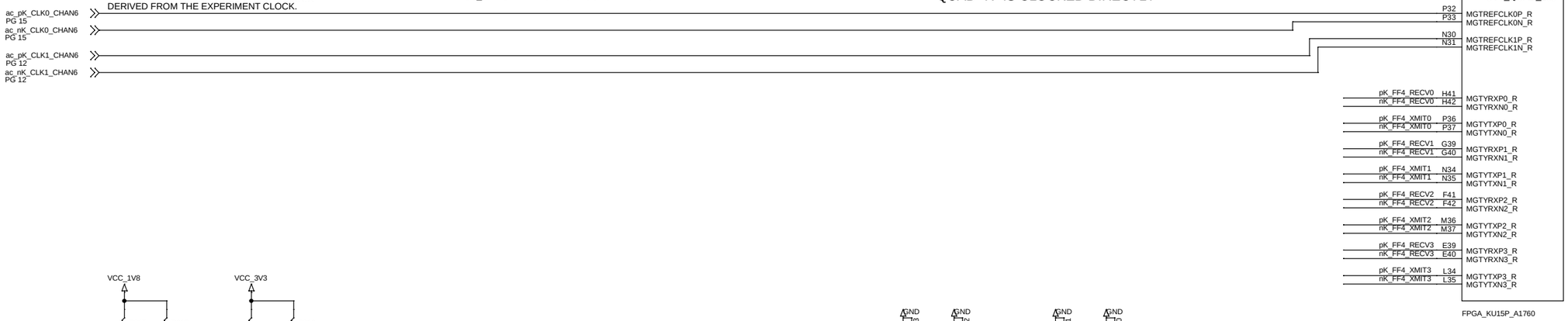
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

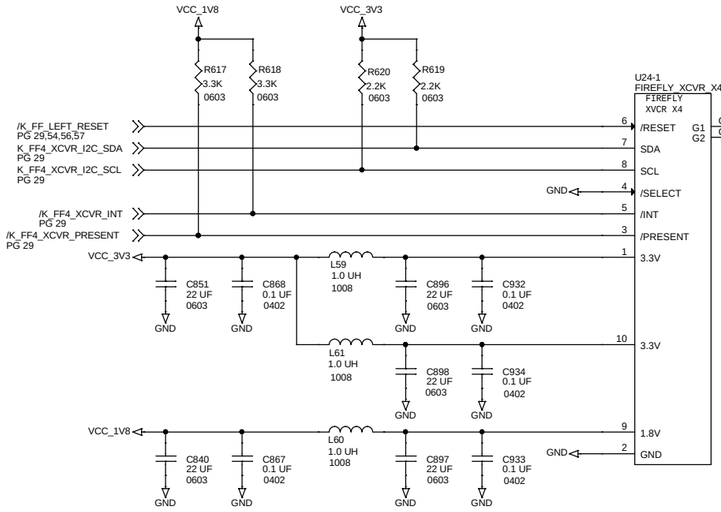
THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

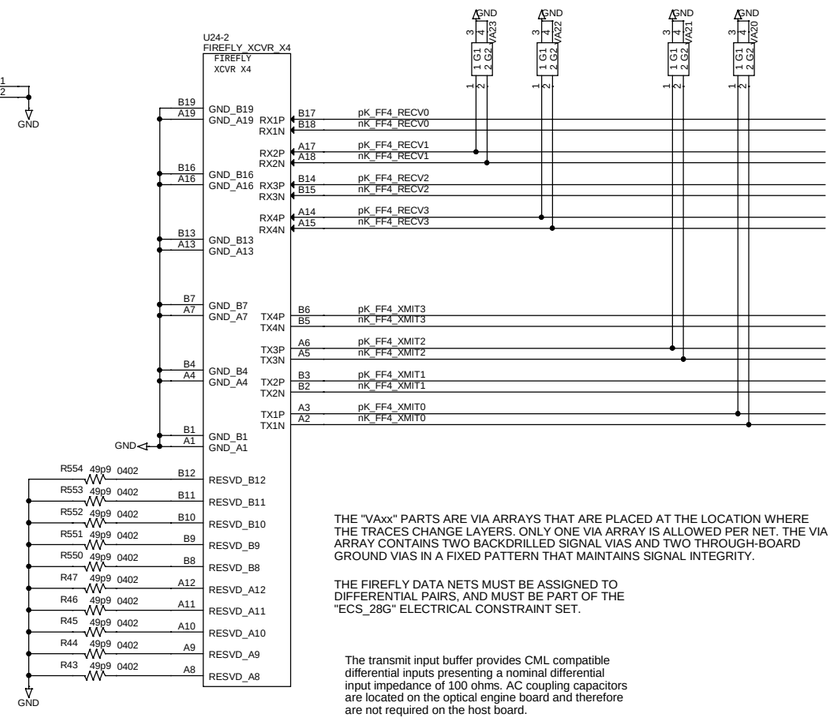
QUAD "R" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



FPGA_KU15P_A1760





ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.10: KU15P QUAD R FIREFLY X4 #4

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 58 of 74

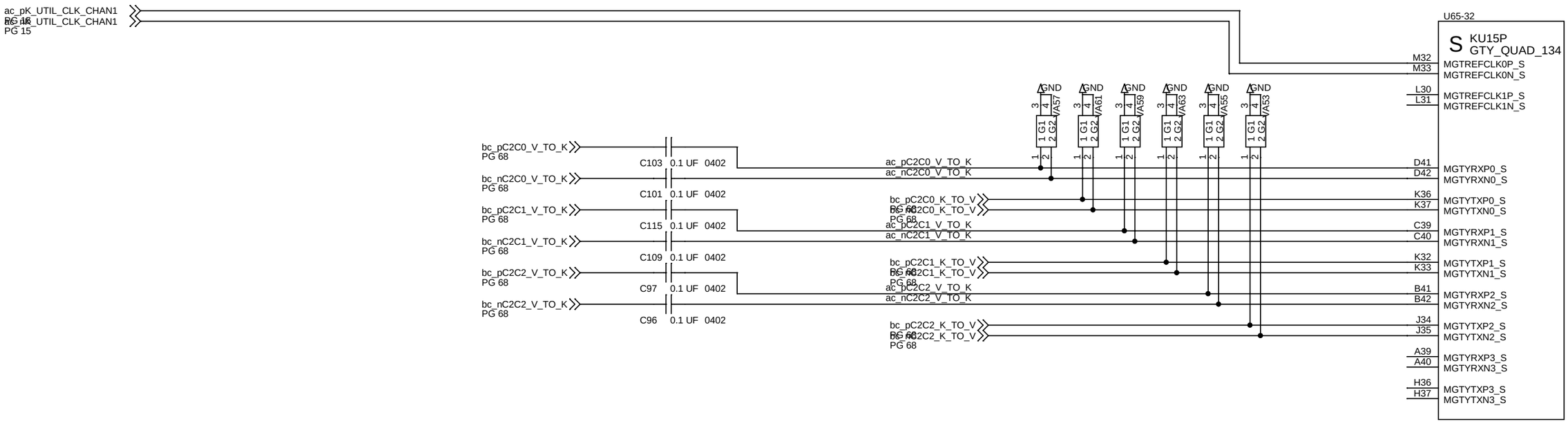
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS UNUSED, SINCE THE UTILITY FUNCTIONS ARE INDEPENDENT OF THE LHC CLOCK.

THE UTILITY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "S" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



THE "C2Cn_V_TO_K" AND "C2Cn_K_TO_V" SIGNALS ARE ROUTED DIRECTLY ON THE PCB. IF ADDITIONAL CHANNELS ARE NEEDED BETWEEN THE TWO FPGAS, USER A FIREFLY LINK.

THE DIRECT SIGNALS ARE AC-COUPLED. SUBSTITUTE A ZERO-OHM RESISTOR IN PLACE OF THE COUPLING CAPACITOR FOR DC-COUPLING.

CONNECT UTILITY NETS HERE

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 7.11: KU15P QUAD S CHIP-TO-CHIP

Size	Document Number	Rev
	6089-103	A

Date: Tuesday, February 26, 2019 Sheet 59 of 74

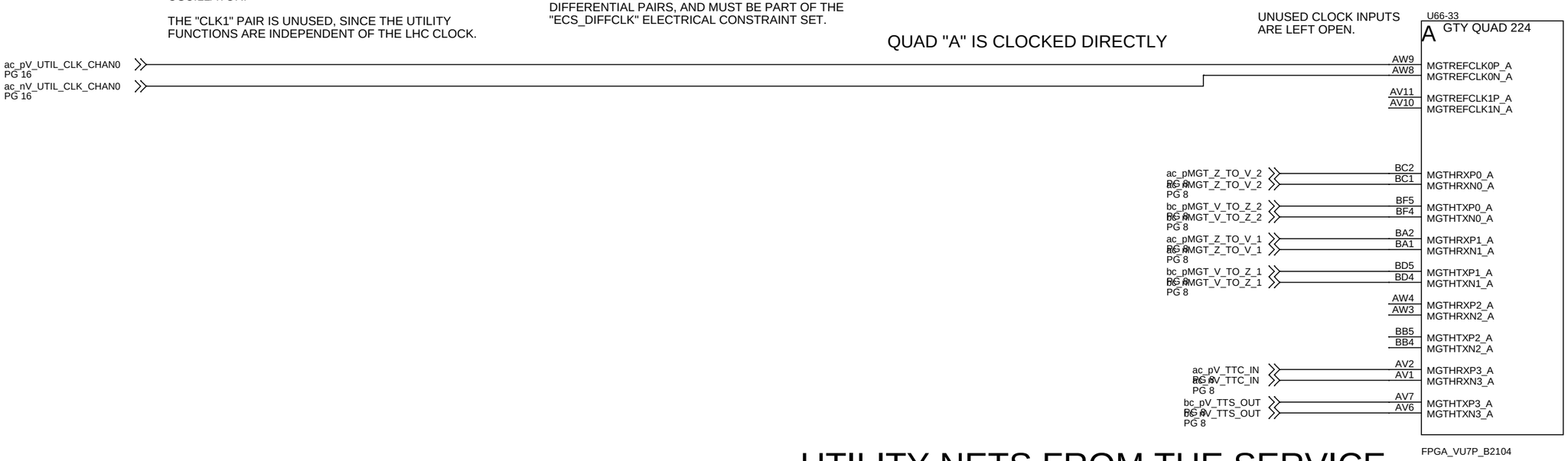
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS UNUSED, SINCE THE UTILITY FUNCTIONS ARE INDEPENDENT OF THE LHC CLOCK.

THE UTILITY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "A" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



UTILITY NETS FROM THE SERVICE BOARD HIGH SPEED CONNECTOR

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.01: VU7P QUAD A UTILITY #1		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 60 of 74	

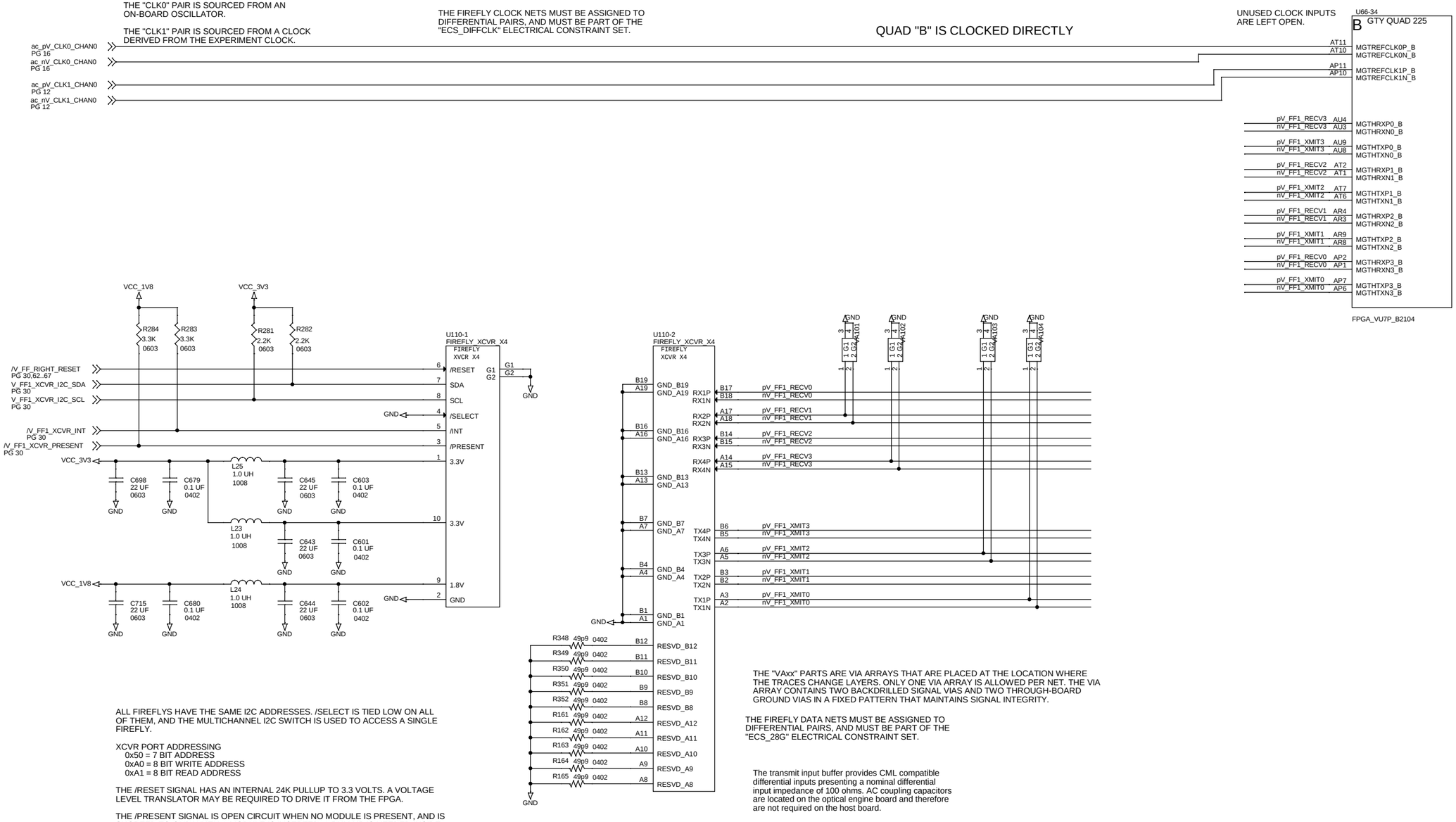
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "B" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

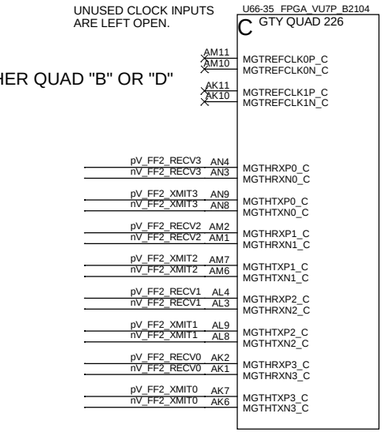
THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

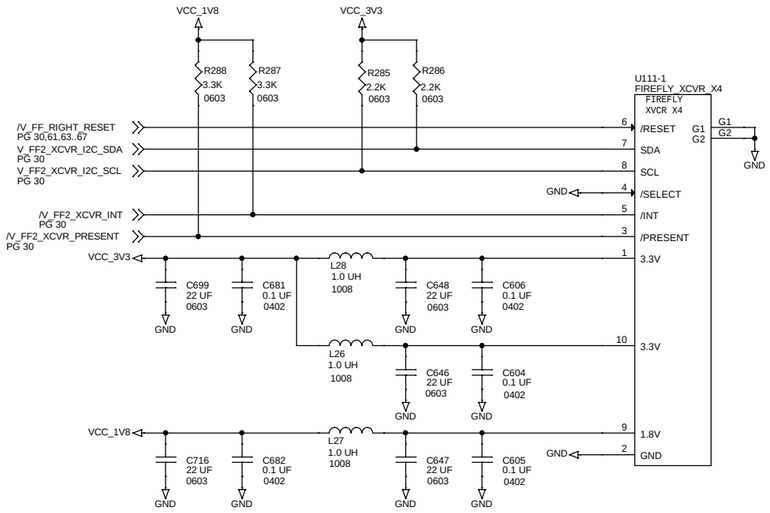
The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

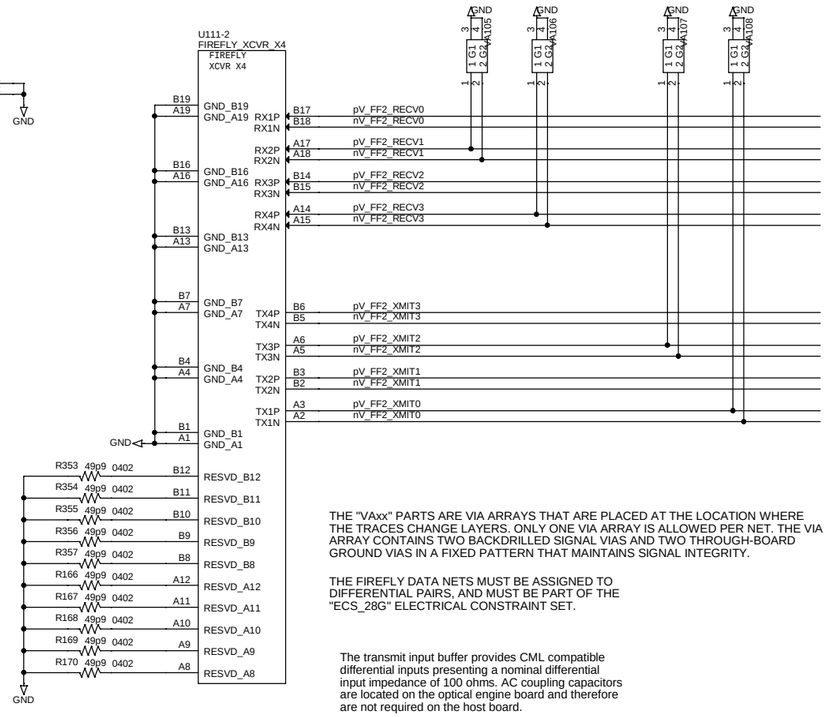
ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.02: VU7P QUAD B FIREFLY X4 #1		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 61 of 74	

UNUSED CLOCK INPUTS
ARE LEFT OPEN.

QUAD "C" IS CLOCKED FROM EITHER QUAD "B" OR "D"







ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
0x50 = 7 BIT ADDRESS
0xA0 = 8 BIT WRITE ADDRESS
0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.03: VU7P QUAD C FIREFLY X4 #2		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 62 of 74	

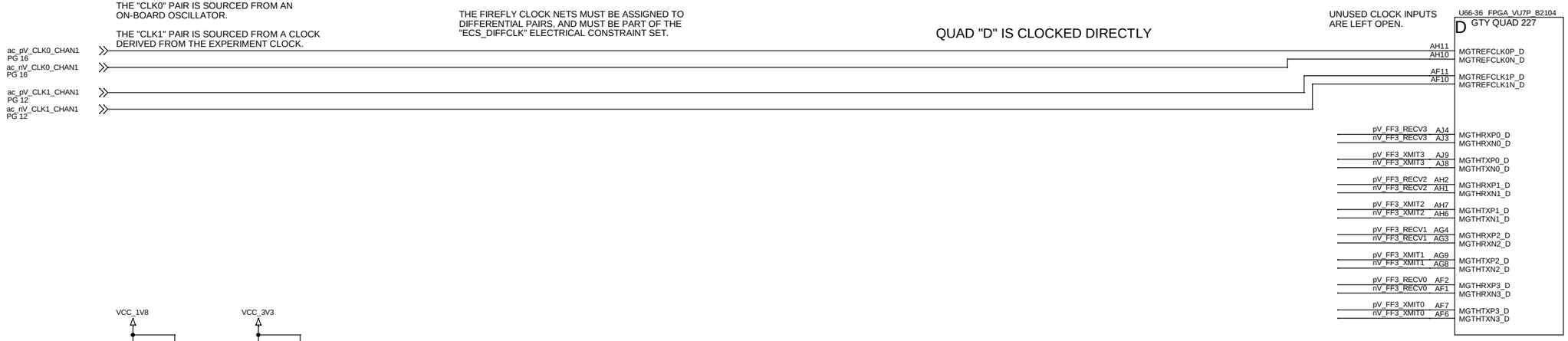
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

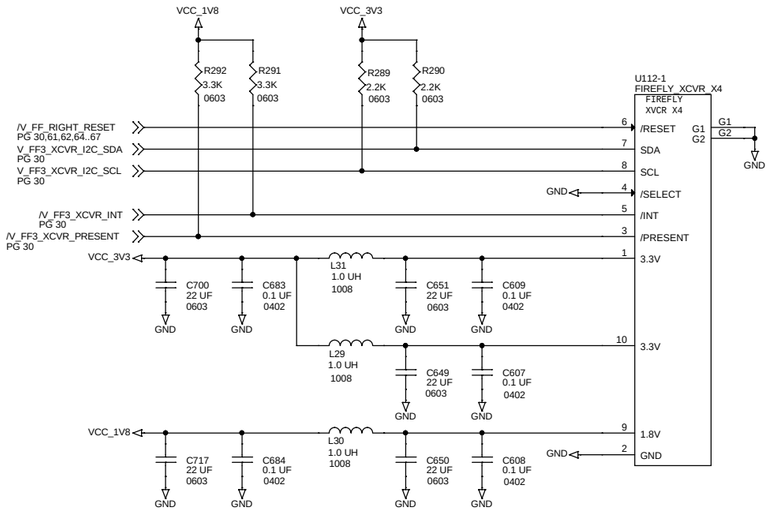
THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

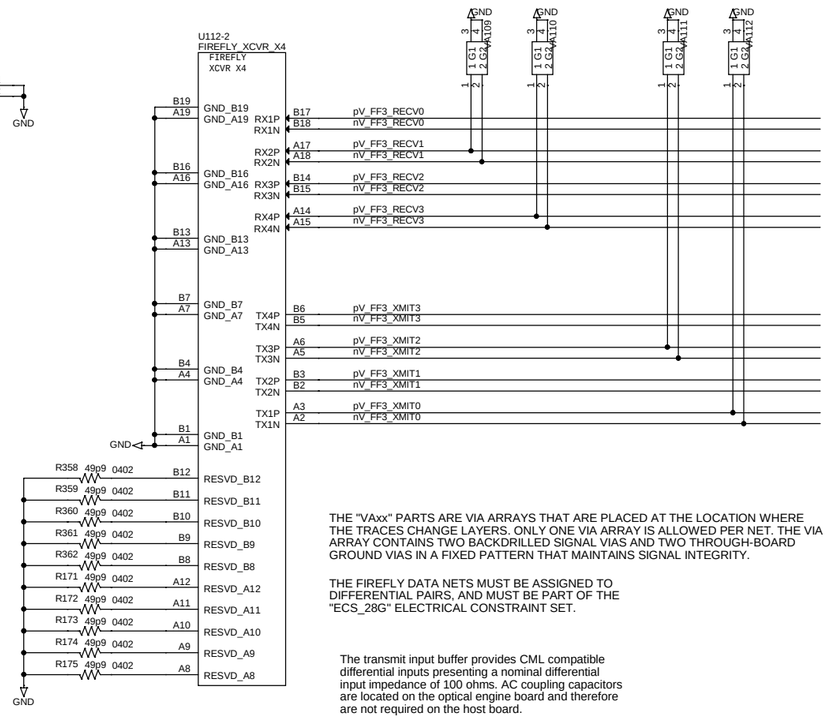
THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "D" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.







ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

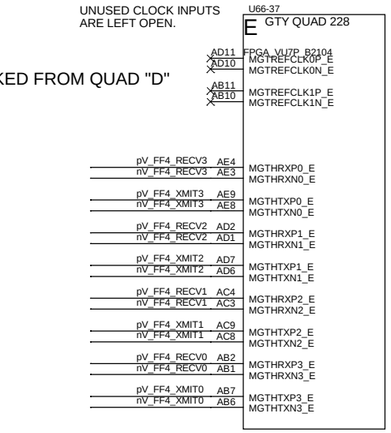
Title: 8.04: VU7P QUAD D FIREFLY X4 #3

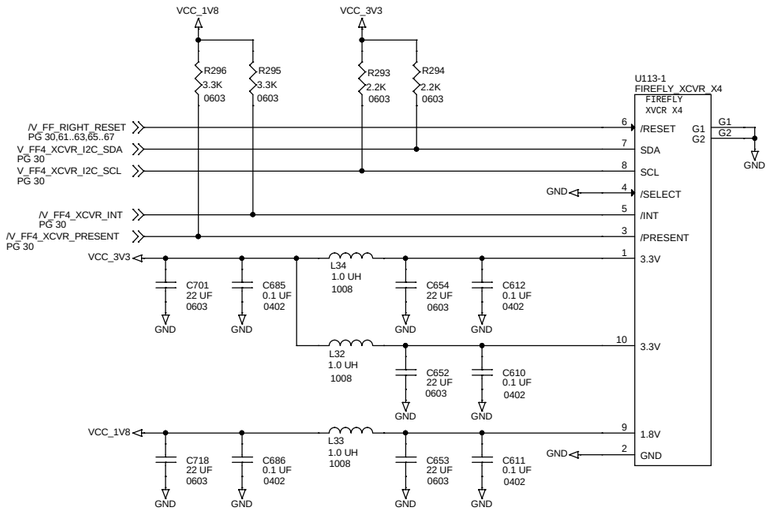
Size | Document Number: 6089-103 | Rev: A

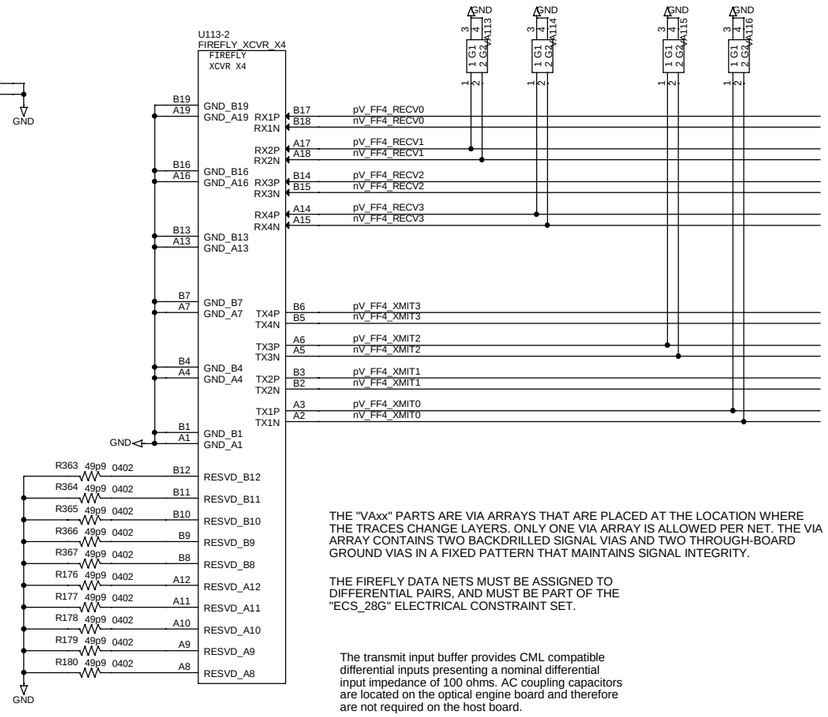
Date: Tuesday, February 26, 2019 | Sheet 63 of 74

UNUSED CLOCK INPUTS
ARE LEFT OPEN.

QUAD "E" IS CLOCKED FROM QUAD "D"







ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
0x50 = 7 BIT ADDRESS
0xA0 = 8 BIT WRITE ADDRESS
0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

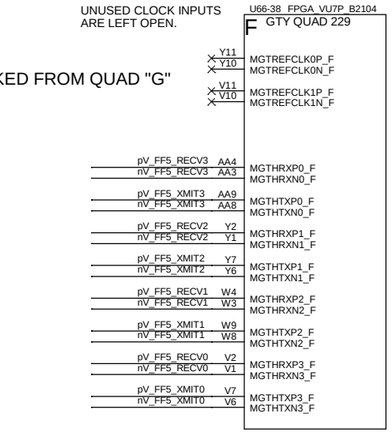
Title: 8.05: VU7P QUAD E FIREFLY X4 #4

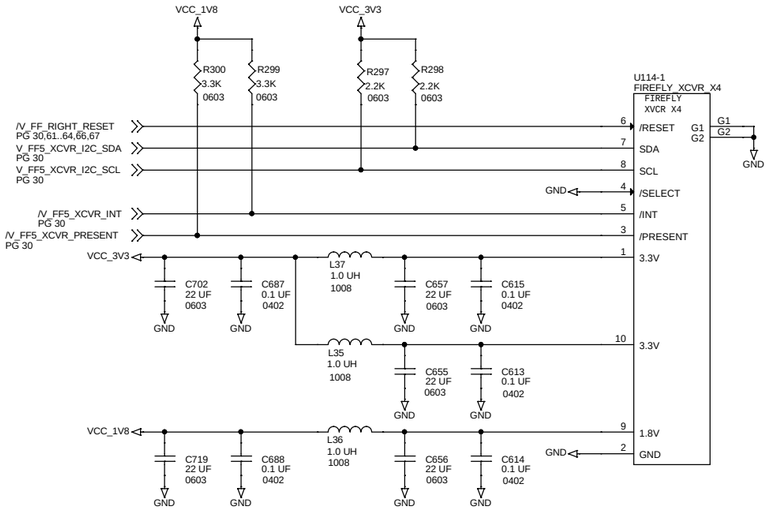
Size	Document Number	Rev
	6089-103	A

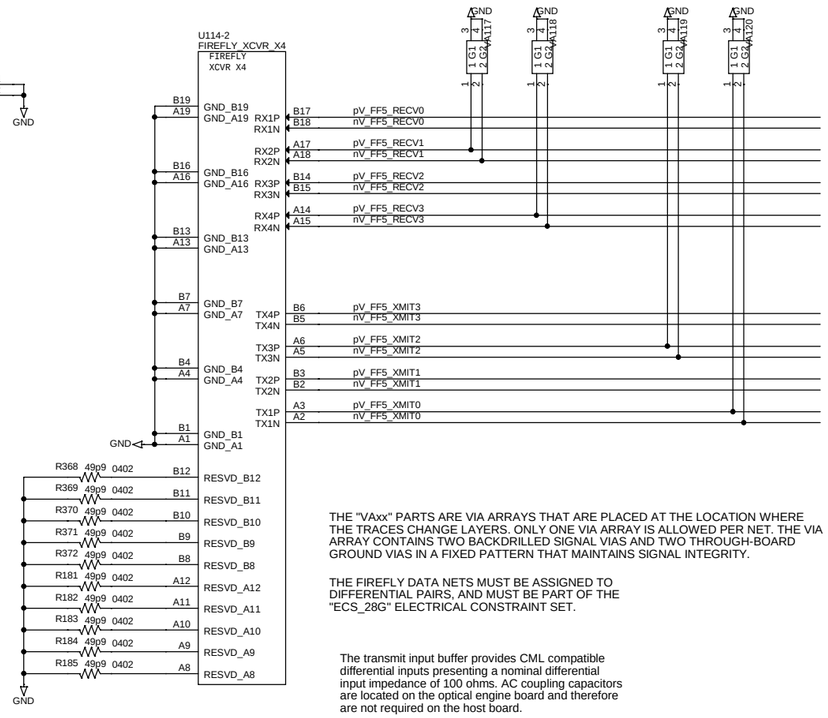
Date: Tuesday, February 26, 2019 Sheet 64 of 74

UNUSED CLOCK INPUTS
ARE LEFT OPEN.

QUAD "F" IS CLOCKED FROM QUAD "G"







ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
0x50 = 7 BIT ADDRESS
0xA0 = 8 BIT WRITE ADDRESS
0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 8.06: VU7P QUAD F FIREFLY X4 #5

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 65 of 74

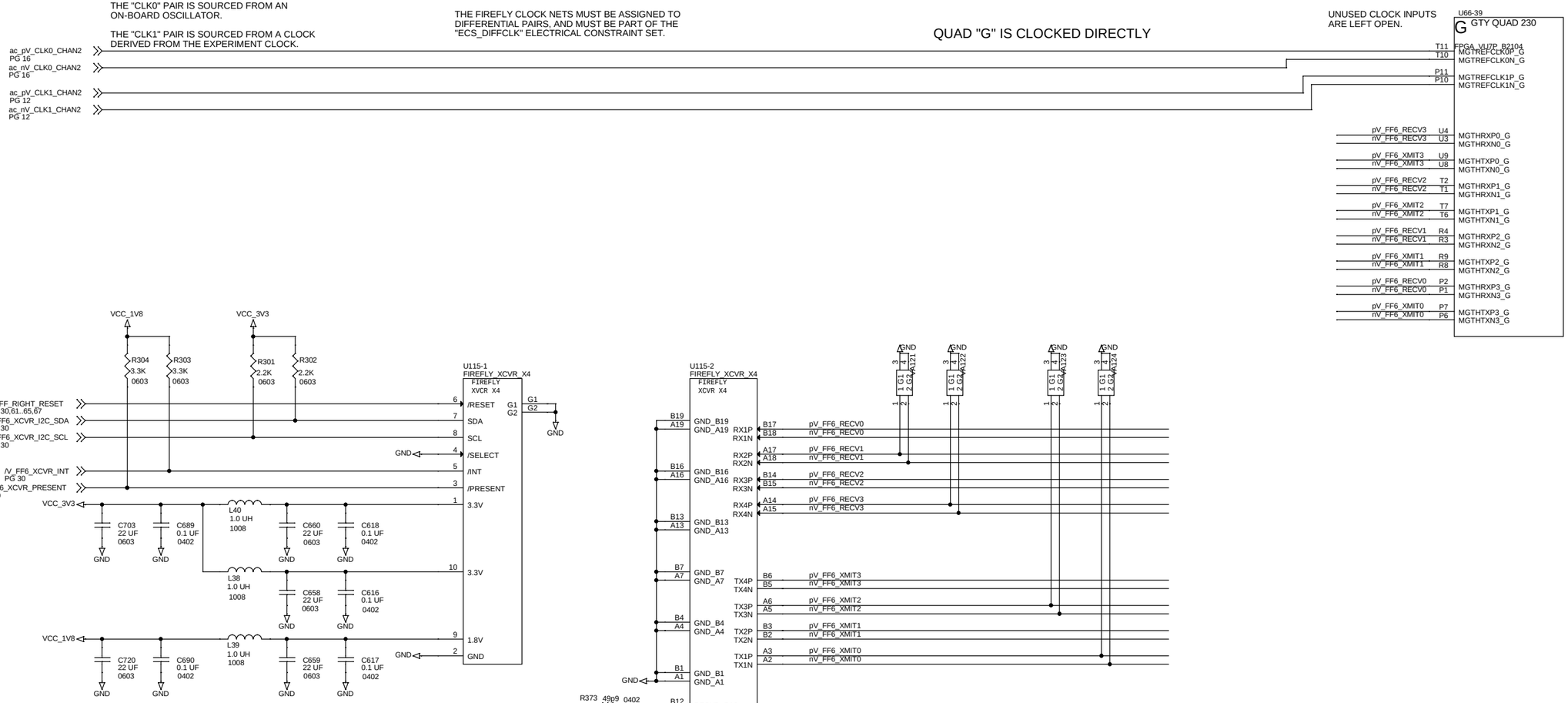
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "G" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 8.07: VU7P QUAD G FIREFLY X4 #6

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 66 of 74

THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

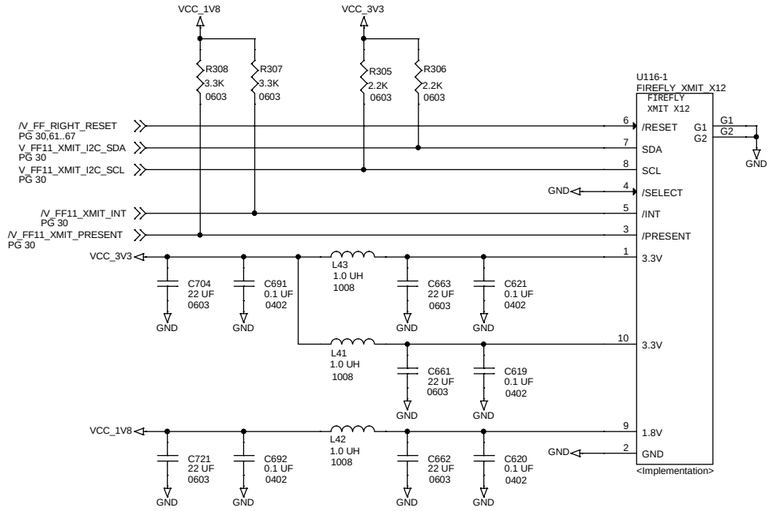
THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

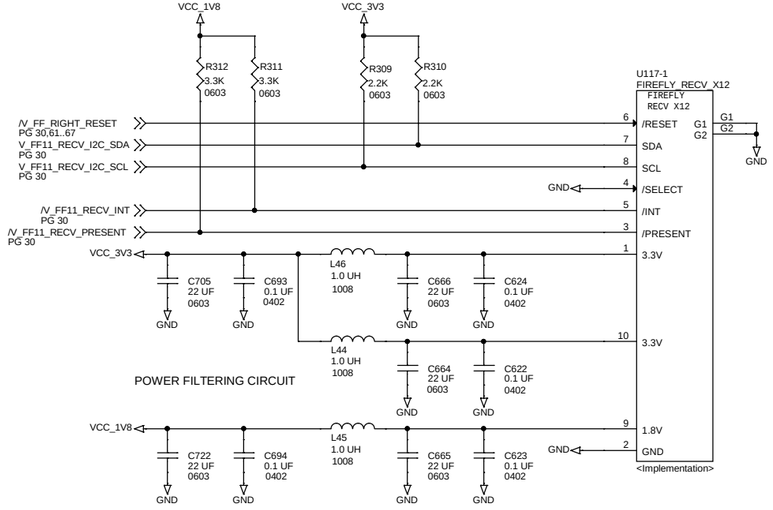
QUADS "H" AND "J" ARE CLOCKED FROM QUAD "I"

UNUSED CLOCK INPUTS ARE LEFT OPEN.

ac_pV_CLK0_CHAN PG 16
ac_nV_CLK0_CHAN PG 16
ac_pV_CLK1_CHAN PG 12
ac_nV_CLK1_CHAN PG 12



ON THE "X12" FIREFLY DEVICES AT 14G, PIN 9 IS RESERVED. ON THE "X4" FIREFLY DEVICES AT 28G, PIN 9 IS A 1.8 VOLT POWER PIN. THIS DESIGN PROVIDES FILTERING FOR PIN 9. IF IT CAUSES PROBLEMS ON THE "X12" 14G DEVICES, THE PARTS CAN BE OMITTED FROM THE BUILD.



POWER FILTERING CIRCUIT

ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

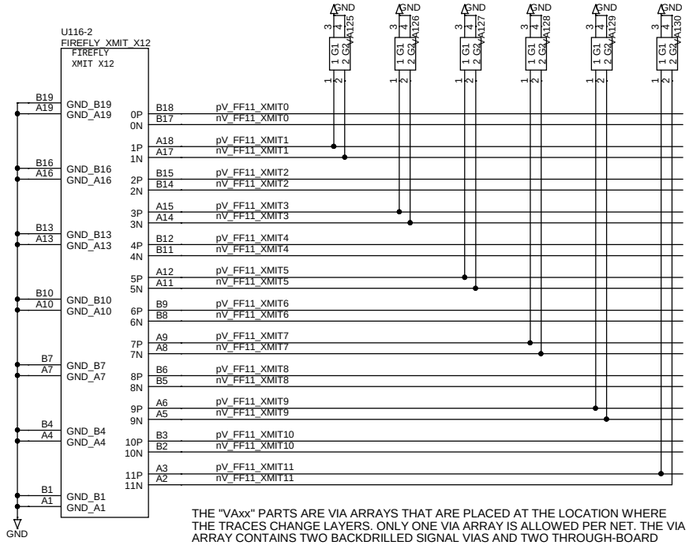
XMIT PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

RECV PORT ADDRESSING
- 0x54 = 7 BIT ADDRESS
- 0xA8 = 8 BIT WRITE ADDRESS
- 0xA9 = 8 BIT READ ADDRESS

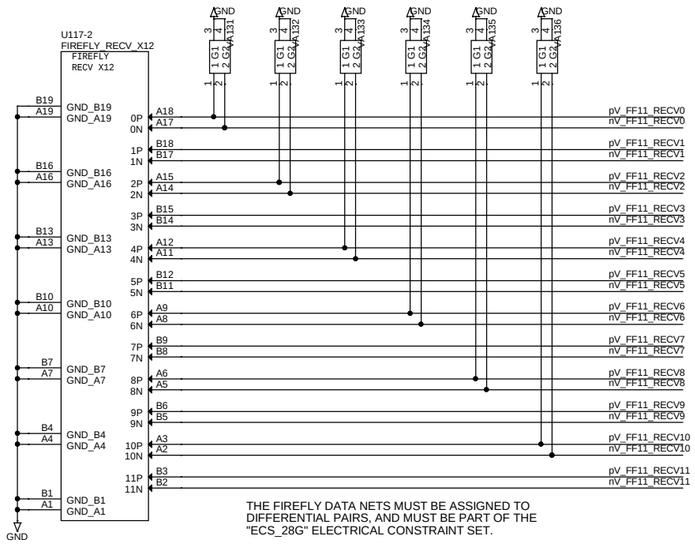
THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

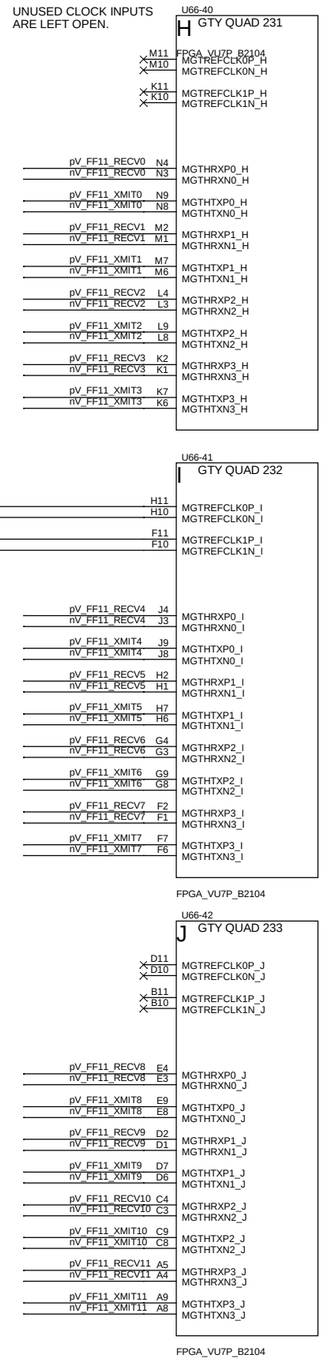


THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.



THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.



ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.08: VU7P QUADS HIJ FIREFLY X12 #11		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 67 of 74	

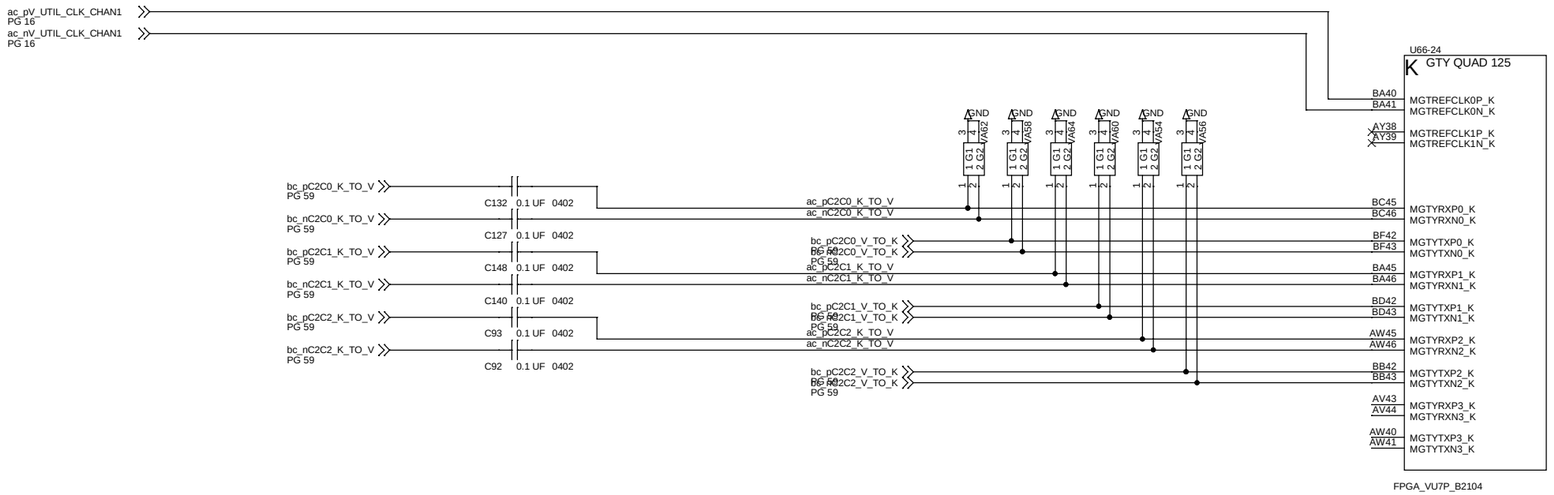
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS UNUSED, SINCE THE UTILITY FUNCTIONS ARE INDEPENDENT OF THE LHC CLOCK.

THE UTILITY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

UNUSED CLOCK INPUTS ARE LEFT OPEN.

QUAD "K" IS CLOCKED DIRECTLY



THE "C2Cn_V_TO_K" AND "C2Cn_K_TO_V" SIGNALS ARE ROUTED DIRECTLY ON THE PCB. IF ADDITIONAL CHANNELS ARE NEEDED BETWEEN THE TWO FPGAS, USER A FIREFLY LINK.

THE DIRECT SIGNALS ARE AC-COUPLED. SUBSTITUTE A ZERO-OHM RESISTOR IN PLACE OF THE COUPLING CAPACITOR FOR DC-COUPLING.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 8.09: VU7P QUAD K CHIP TO CHIP

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 68 of 74

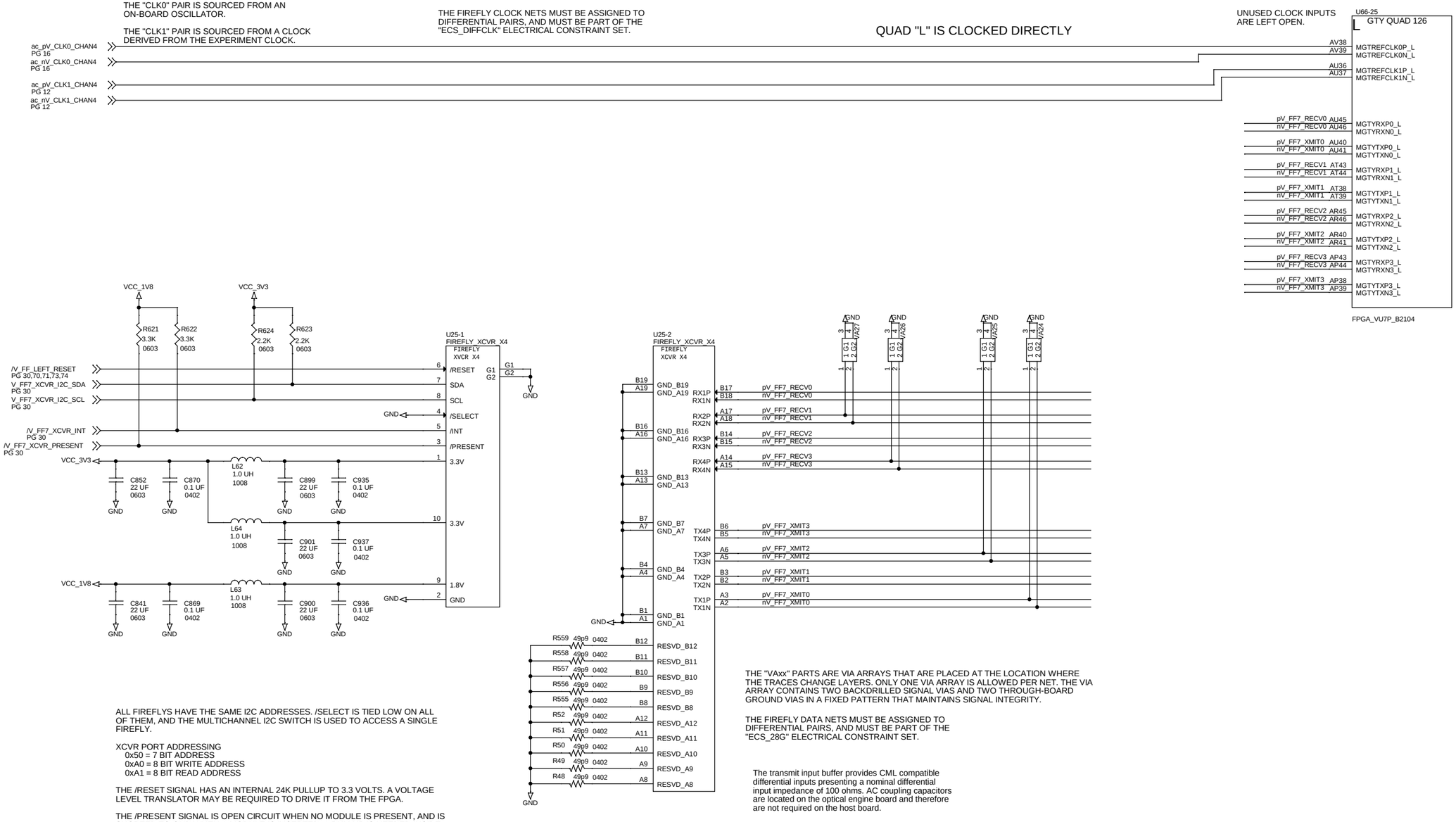
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "L" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

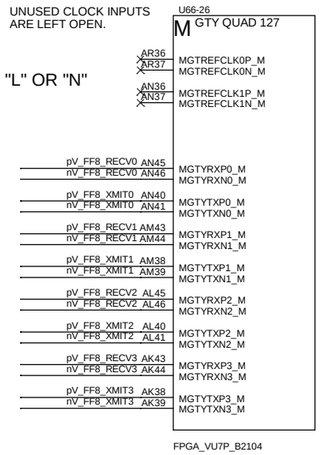
The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

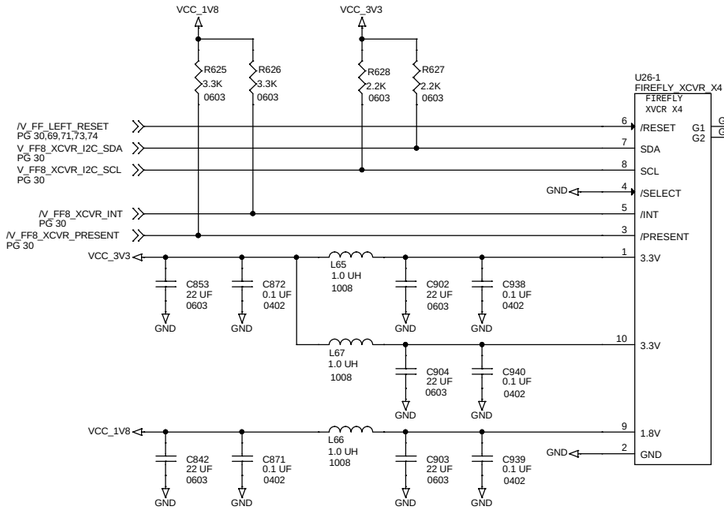
ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.10: VU7P QUAD L FIREFLY X4 #7		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 69 of 74	

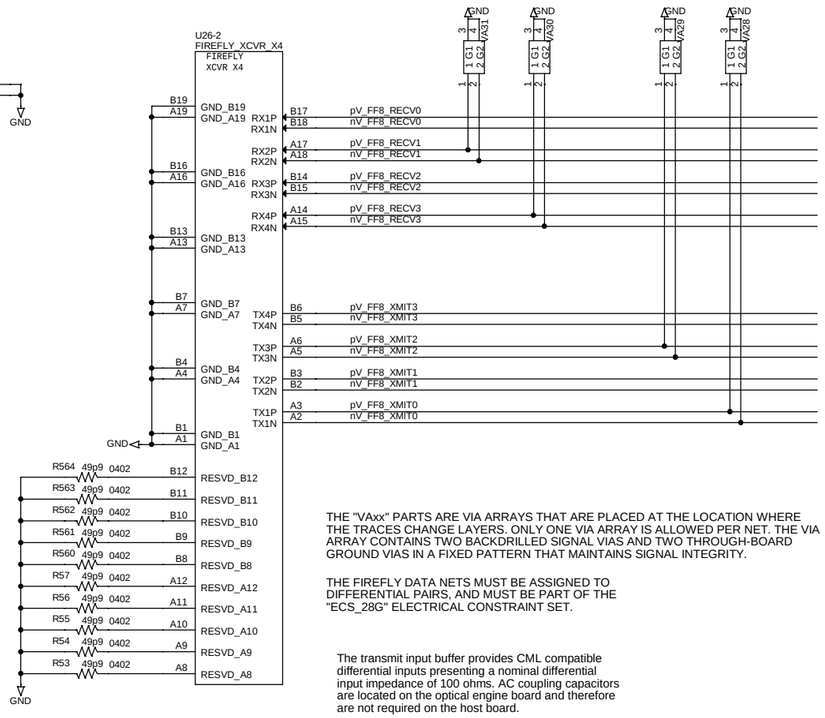
UNUSED CLOCK INPUTS
ARE LEFT OPEN.

QUAD "M" IS CLOCKED FROM EITHER QUAD "L" OR "N"



FPGA_VU7P_B2104





ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
0x50 = 7 BIT ADDRESS
0xA0 = 8 BIT WRITE ADDRESS
0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.11: VU7P QUAD M FIREFLY X4 #8		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 70 of 74	

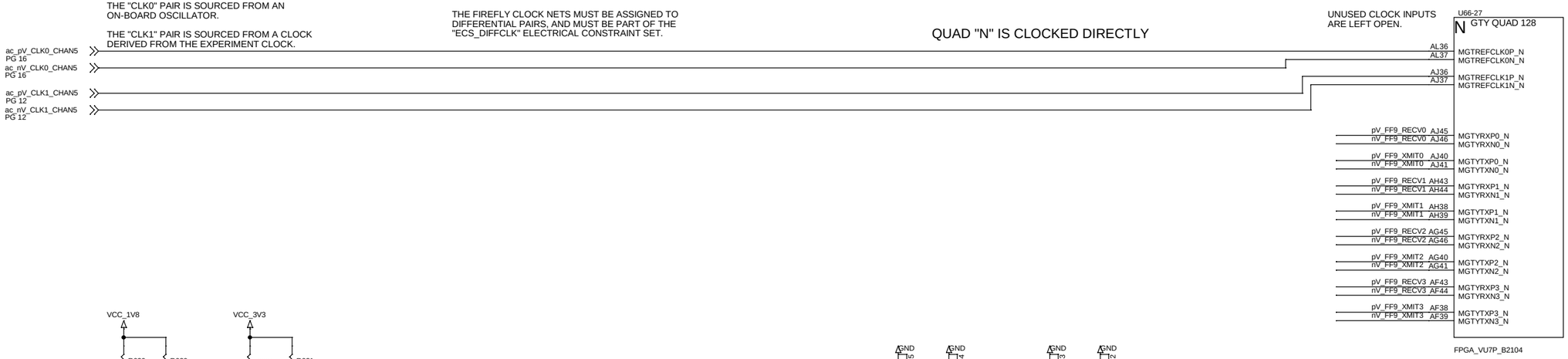
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

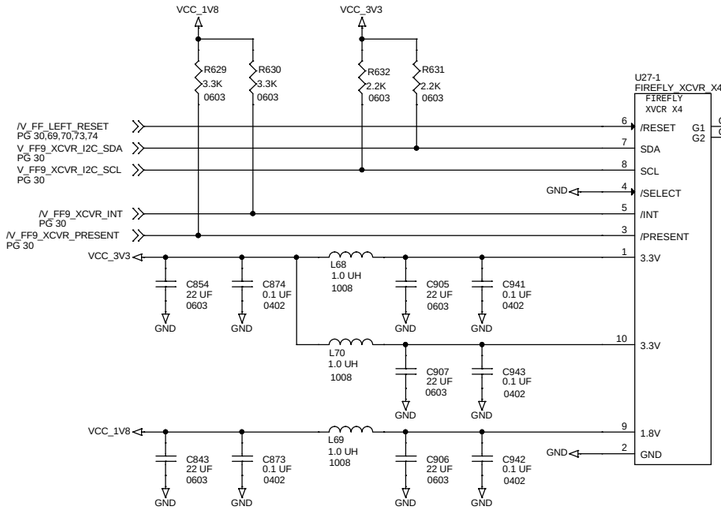
THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

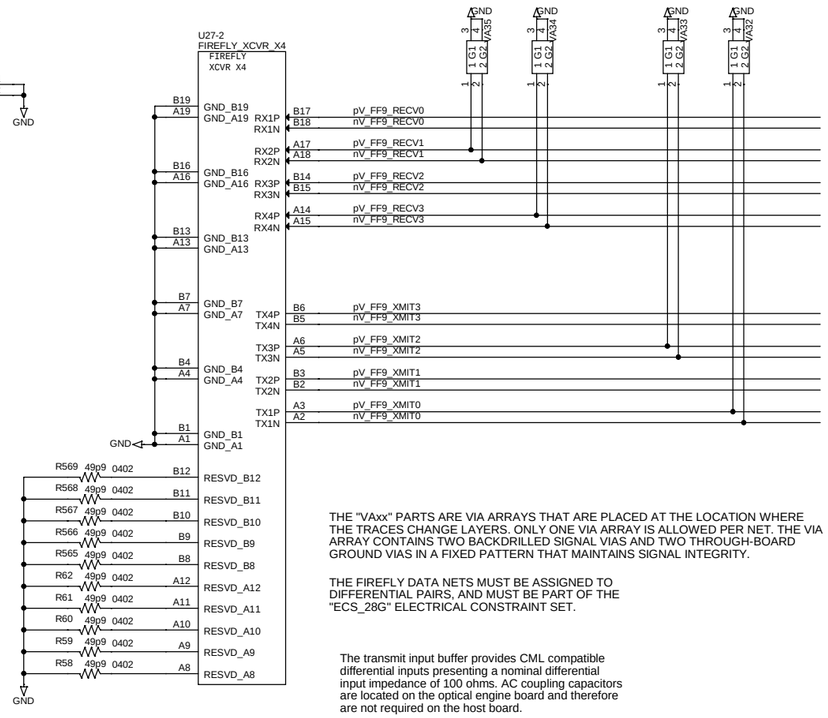
THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "N" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.







ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

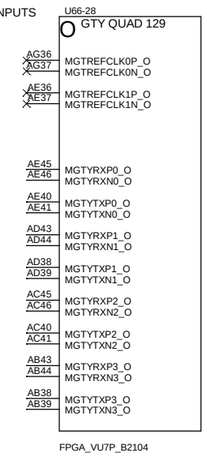
The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.12: VU7P QUAD N FIREFLY X4 #9		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 71 of 74	

UNUSED CLOCK INPUTS
ARE LEFT OPEN.

QUAD "O" IS UNUSED



ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 8.13: VU7P QUAD O UNUSED

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 72 of 74

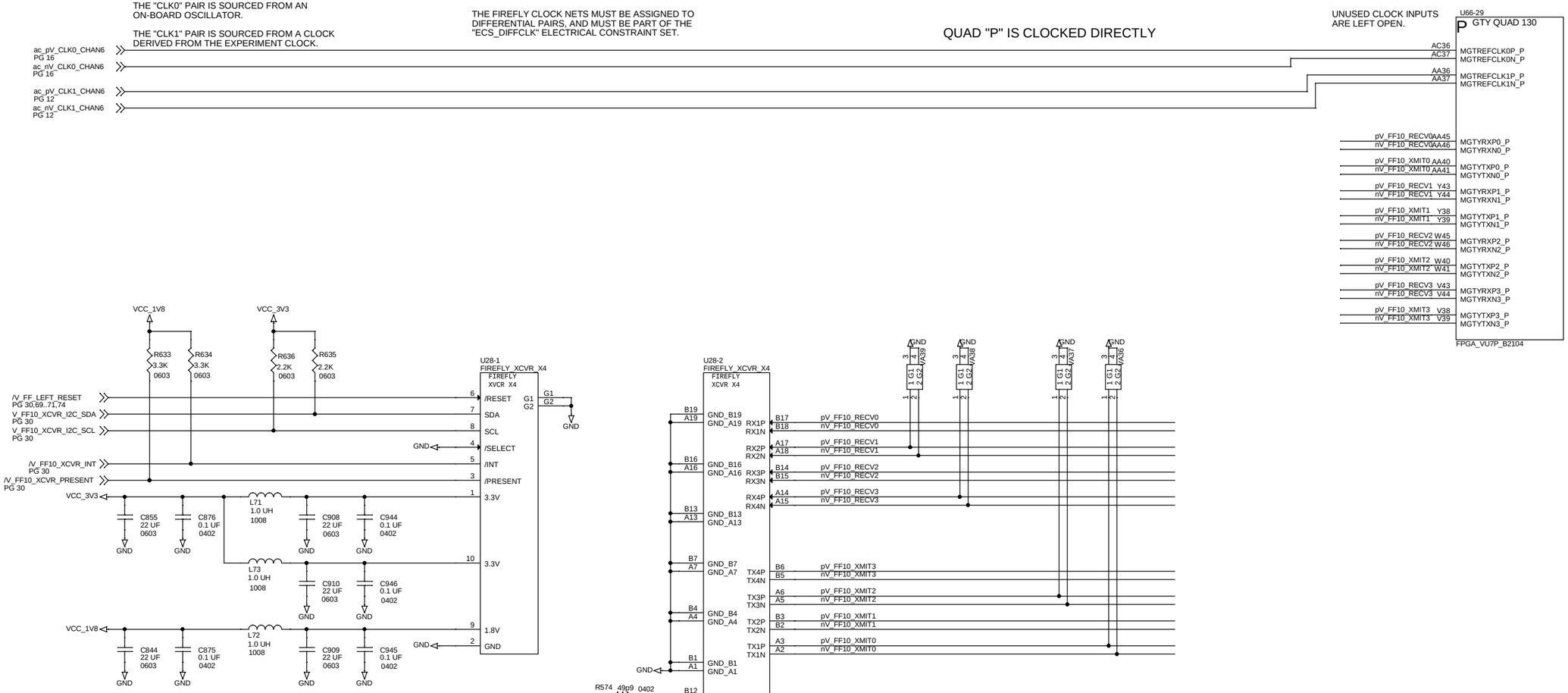
THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

QUAD "P" IS CLOCKED DIRECTLY

UNUSED CLOCK INPUTS ARE LEFT OPEN.



ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XCVR PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. A VOLTAGE LEVEL TRANSLATOR MAY BE REQUIRED TO DRIVE IT FROM THE FPGA.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED INSIDE THE FPGA.

THE /INT SIGNAL IS OPEN-COLLECTOR. THE PULLUP IS TIED TO THE SAME LEVEL AS THE FPGA BANK POWER.

THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.

THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

HANDLING THE RESERVED PINS, ACCORDING TO SAMTEC:
If there is not space for 50 ohm resistors on every lane, it is better to leave those lanes open.
Tying all lanes together to a single resistor will create a current loop that can worsen crosstalk.

ATCA FPGA BOARD, KU15P AND VU7P, MK1		
Title: 8.14: VU7P QUAD P FIREFLY X4 #10		
Size	Document Number: 6089-103	Rev: A
Date: Tuesday, February 26, 2019	Sheet 73 of 74	

THE "CLK0" PAIR IS SOURCED FROM AN ON-BOARD OSCILLATOR.

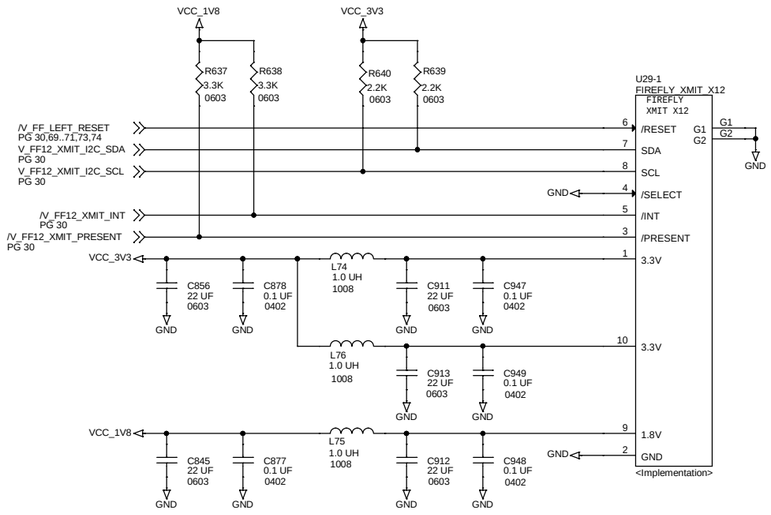
THE "CLK1" PAIR IS SOURCED FROM A CLOCK DERIVED FROM THE EXPERIMENT CLOCK.

THE FIREFLY CLOCK NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_DIFFCLK" ELECTRICAL CONSTRAINT SET.

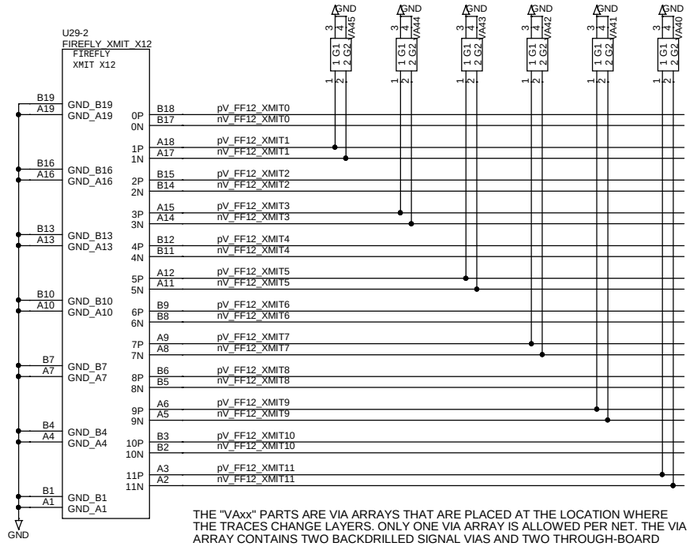
QUADS "Q" AND "S" ARE CLOCKED FROM QUAD "R"

UNUSED CLOCK INPUTS ARE LEFT OPEN.

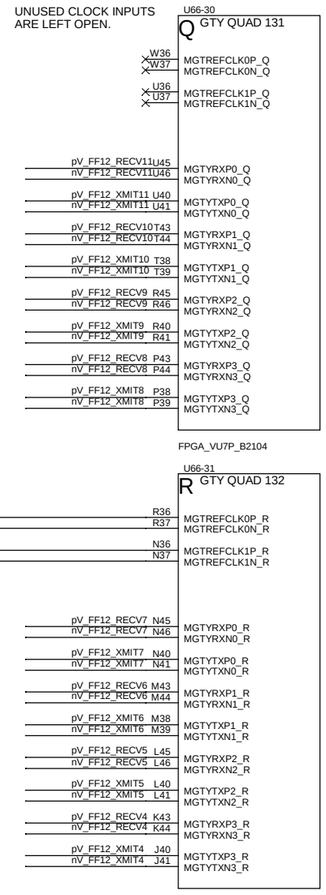
ac_pV_CLK0_CHAN7 PG 16
ac_nV_CLK0_CHAN7 PG 16
ac_pV_CLK1_CHAN7 PG 12
ac_nV_CLK1_CHAN7 PG 12

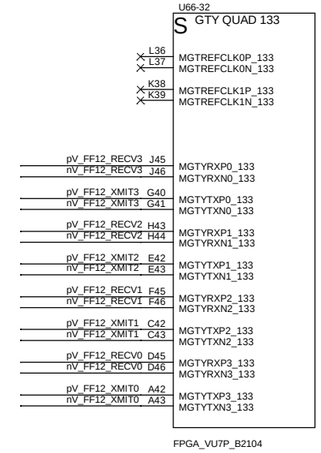


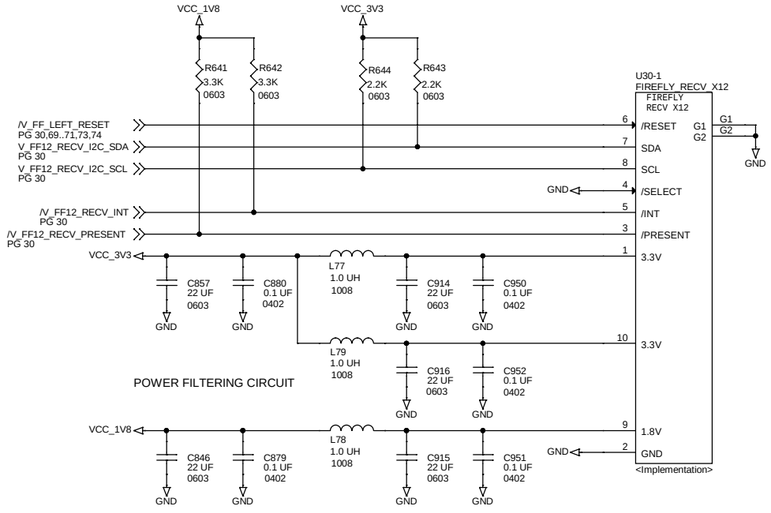
ON THE "X12" FIREFLY DEVICES AT 14G, PIN 9 IS RESERVED. ON THE "X4" FIREFLY DEVICES AT 28G, PIN 9 IS A 1.8 VOLT POWER PIN. THIS DESIGN PROVIDES FILTERING FOR PIN 9. IF IT CAUSES PROBLEMS ON THE "X12" 14G DEVICES, THE PARTS CAN BE OMITTED FROM THE BUILD.



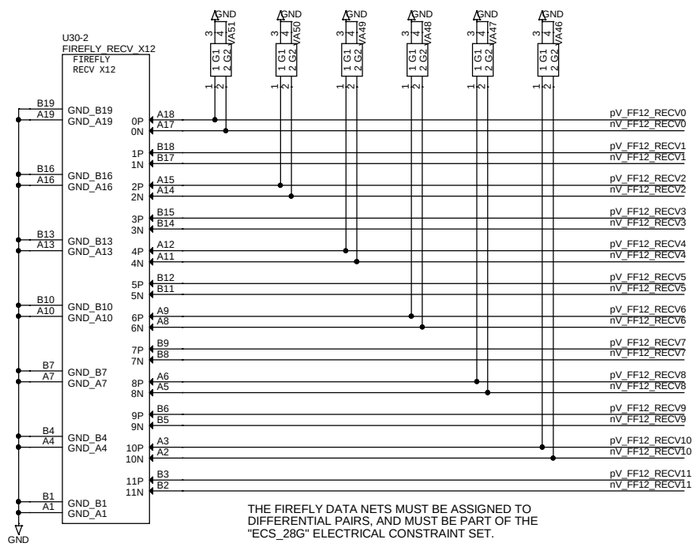
THE "VAxx" PARTS ARE VIA ARRAYS THAT ARE PLACED AT THE LOCATION WHERE THE TRACES CHANGE LAYERS. ONLY ONE VIA ARRAY IS ALLOWED PER NET. THE VIA ARRAY CONTAINS TWO BACKDRILLED SIGNAL VIAS AND TWO THROUGH-BOARD GROUND VIAS IN A FIXED PATTERN THAT MAINTAINS SIGNAL INTEGRITY.







POWER FILTERING CIRCUIT



THE FIREFLY DATA NETS MUST BE ASSIGNED TO DIFFERENTIAL PAIRS, AND MUST BE PART OF THE "ECS_28G" ELECTRICAL CONSTRAINT SET.

The transmit input buffer provides CML compatible differential inputs presenting a nominal differential input impedance of 100 ohms. AC coupling capacitors are located on the optical engine board and therefore are not required on the host board.

ALL FIREFLYS HAVE THE SAME I2C ADDRESSES. /SELECT IS TIED LOW ON ALL OF THEM, AND THE MULTICHANNEL I2C SWITCH IS USED TO ACCESS A SINGLE FIREFLY.

XMIT PORT ADDRESSING
- 0x50 = 7 BIT ADDRESS
- 0xA0 = 8 BIT WRITE ADDRESS
- 0xA1 = 8 BIT READ ADDRESS

RECV PORT ADDRESSING
- 0x54 = 7 BIT ADDRESS
- 0xA8 = 8 BIT WRITE ADDRESS
- 0xA9 = 8 BIT READ ADDRESS

THE /RESET SIGNAL HAS AN INTERNAL 24K PULLUP TO 3.3 VOLTS. ALL FIREFLY MODULES ON THE SAME SIDE OF THE SAME FPGA SHARE A COMMON RESET.

THE /PRESENT SIGNAL IS OPEN CIRCUIT WHEN NO MODULE IS PRESENT, AND IS SHORTED TO GND WHEN A MODULE IS INSERTED. A PULLUP IS NEEDED.

THE /INT SIGNAL IS OPEN-COLLECTOR. A PULLUP IS NEEDED.

ATCA FPGA BOARD, KU15P AND VU7P, MK1

Title: 8.15: VU7P QUADS QRS FIREFLY X12 #12

Size | Document Number: 6089-103 | Rev: A

Date: Tuesday, February 26, 2019 | Sheet 74 of 74