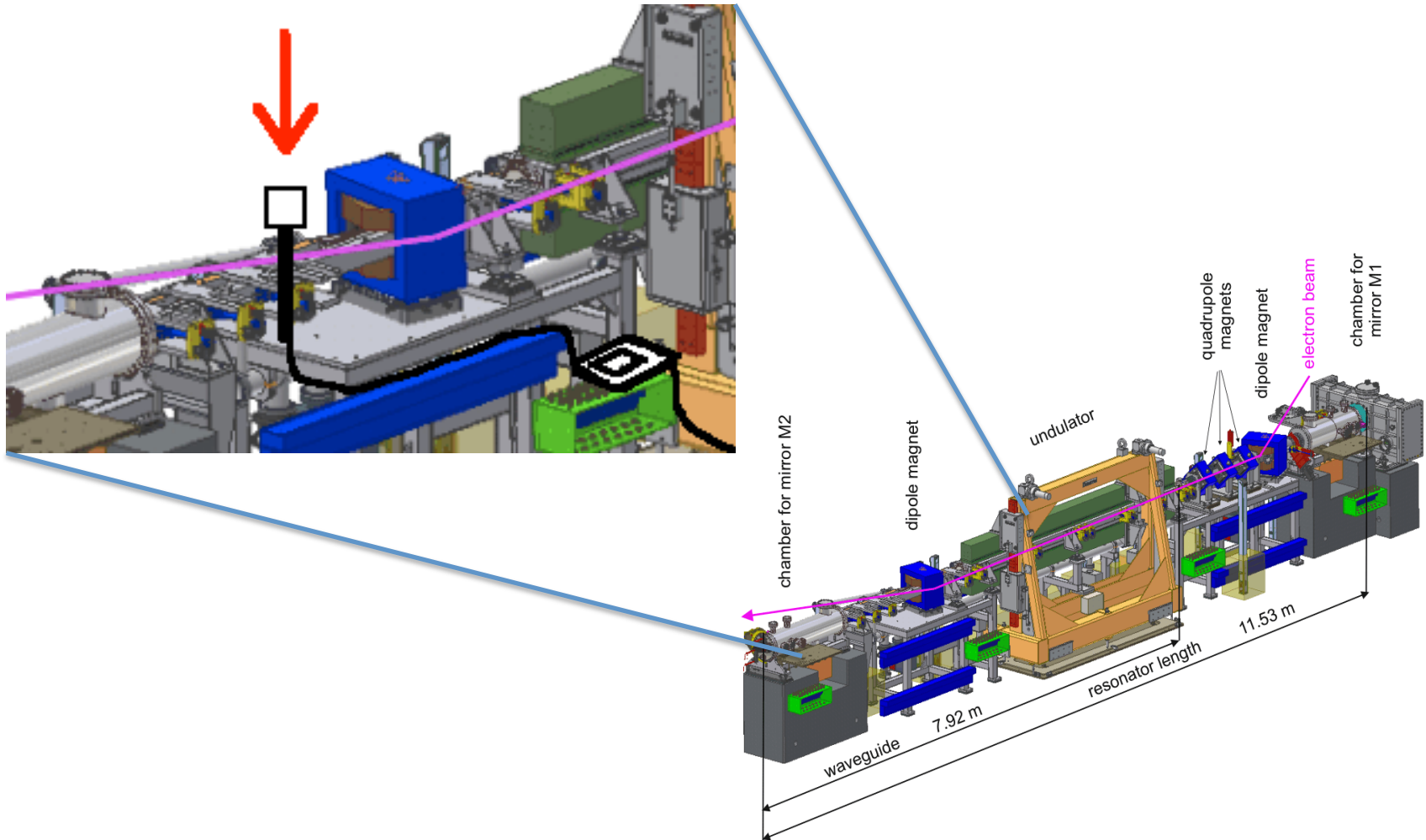


# FEt Diode Diamond X-ray sensor

## PHYS476 Final Presentation



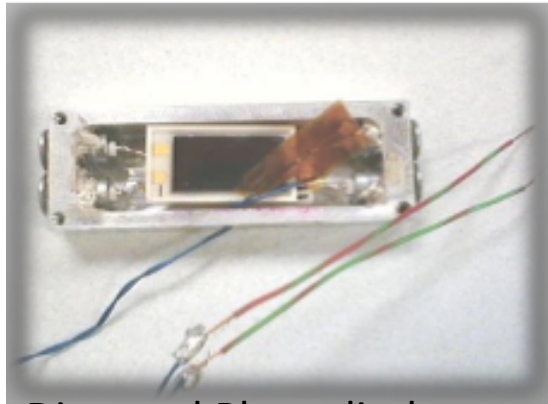
UHM KeitaF 5/8/2012

# Background radiation sensors for FEL

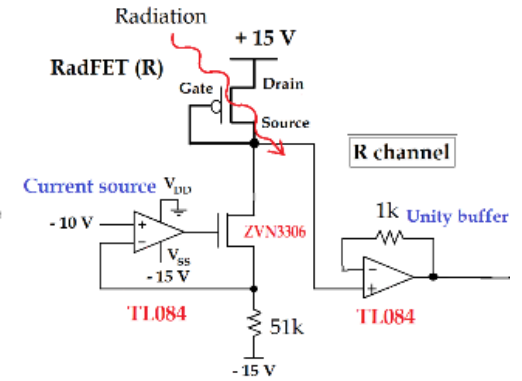
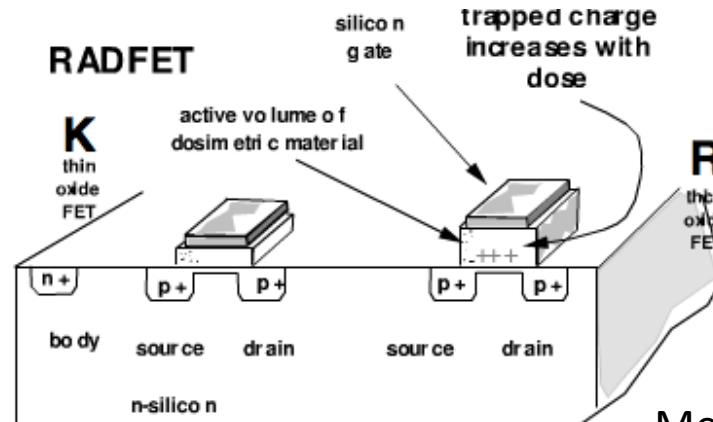
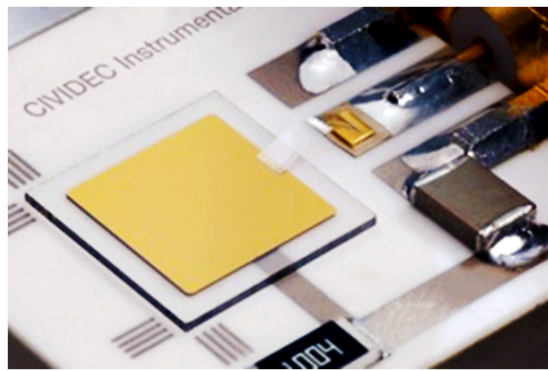
Radiation-sensing FETs



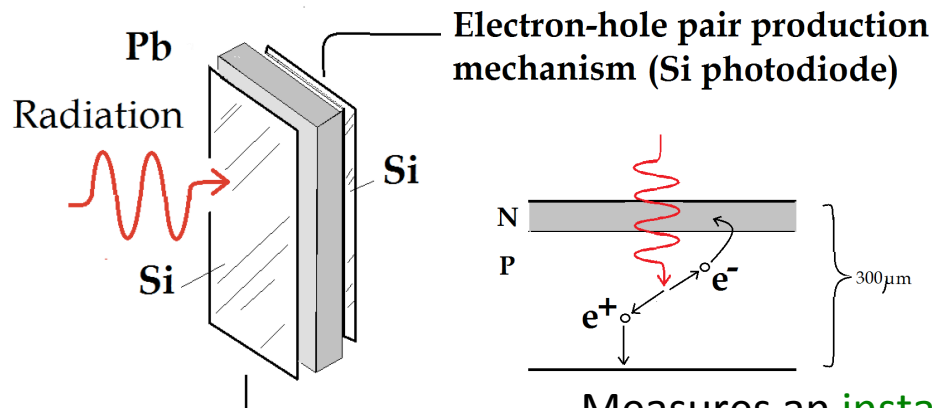
Silicon Photodiodes



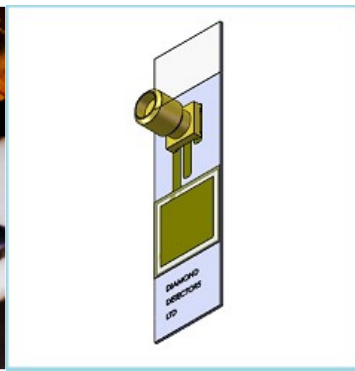
Diamond Photodiode



Measures an **integrated** dose



Measures an **instantaneous** dose



all in one.

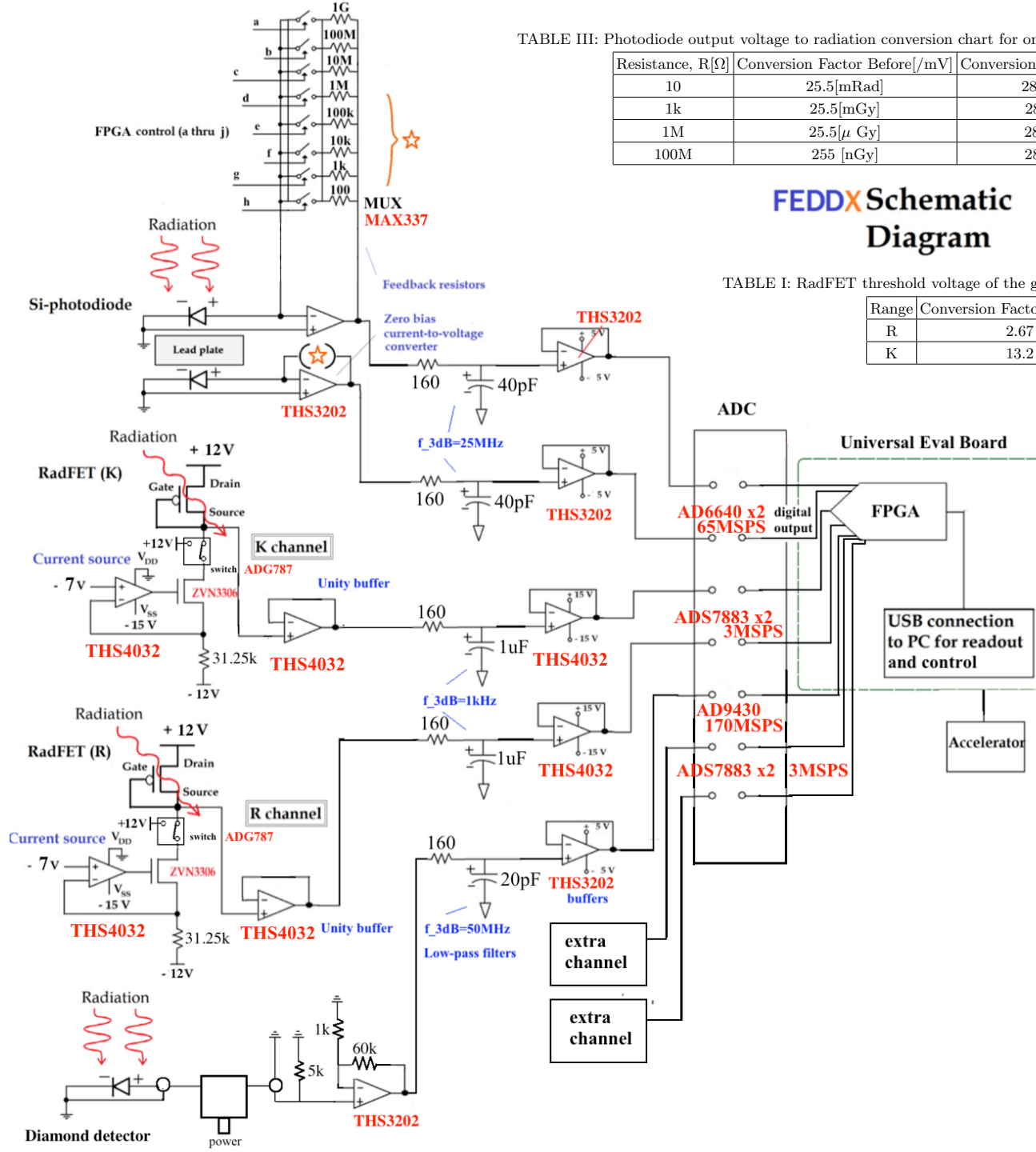
TABLE III: Photodiode output voltage to radiation conversion chart for one before and after the lead shield

Resistance, R[Ω]	Conversion Factor Before[/mV]	Conversion Factor After[/mV]
10	25.5[mRad]	28.56[mRad]
1k	25.5[mGy]	28.56[mGy]
1M	25.5[μ Gy]	28.56[μ Gy]
100M	255 [nGy]	285.6 [nGy]

## FEDDX Schematic Diagram

TABLE I: RadFET threshold voltage of the gate to radiation conversion chart.

Range	Conversion Factor [Rad/mV]
R	2.67
K	13.2



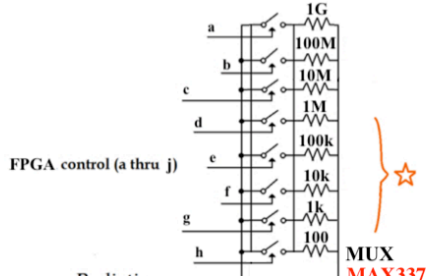


TABLE III: Photodiode output voltage to radiation conversion chart for one before and after the lead shield

Resistance, R[Ω]	Conversion Factor Before[/mV]	Conversion Factor After[/mV]
10	25.5[mRad]	28.56[mRad]
1k	25.5[mGy]	28.56[mGy]
1M	25.5[μ Gy]	28.56[μ Gy]
100M	255 [nGy]	285.6 [nGy]

FEDDX Schematic

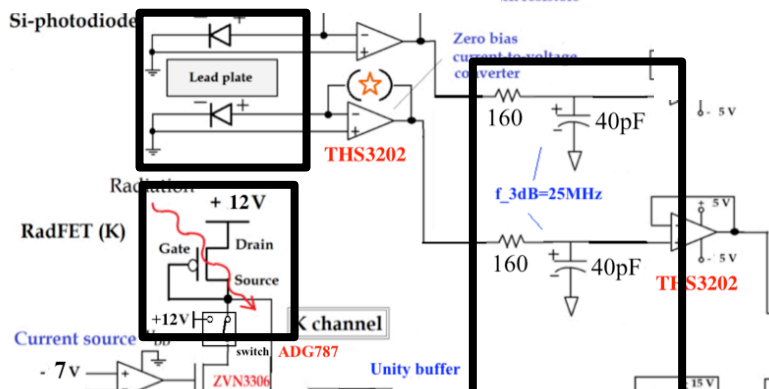
ram

# Silicon Photodiodes

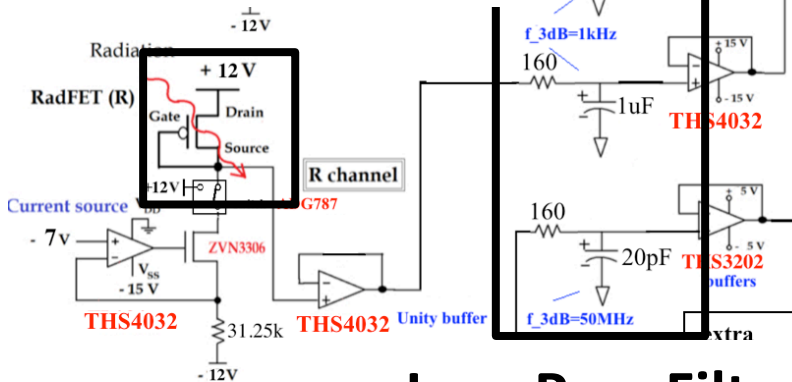
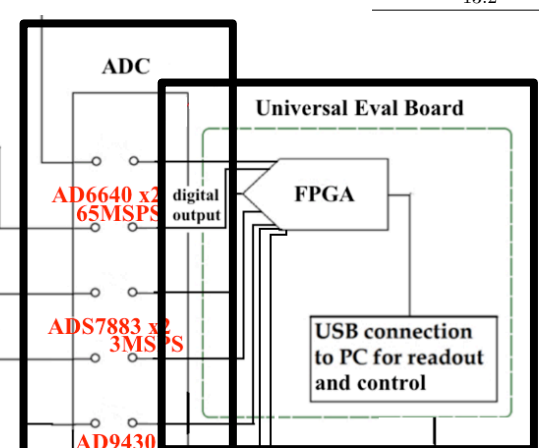
# Analog to Digital Converter

voltage of the gate to radiation conversion chart.

Conversion Factor [Rad/mV]
2.67
13.2



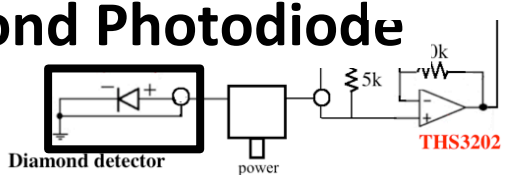
# Radiation-sensing FETs



# Digital to Computer Converter (Mother Board: Universal Eval. Board)

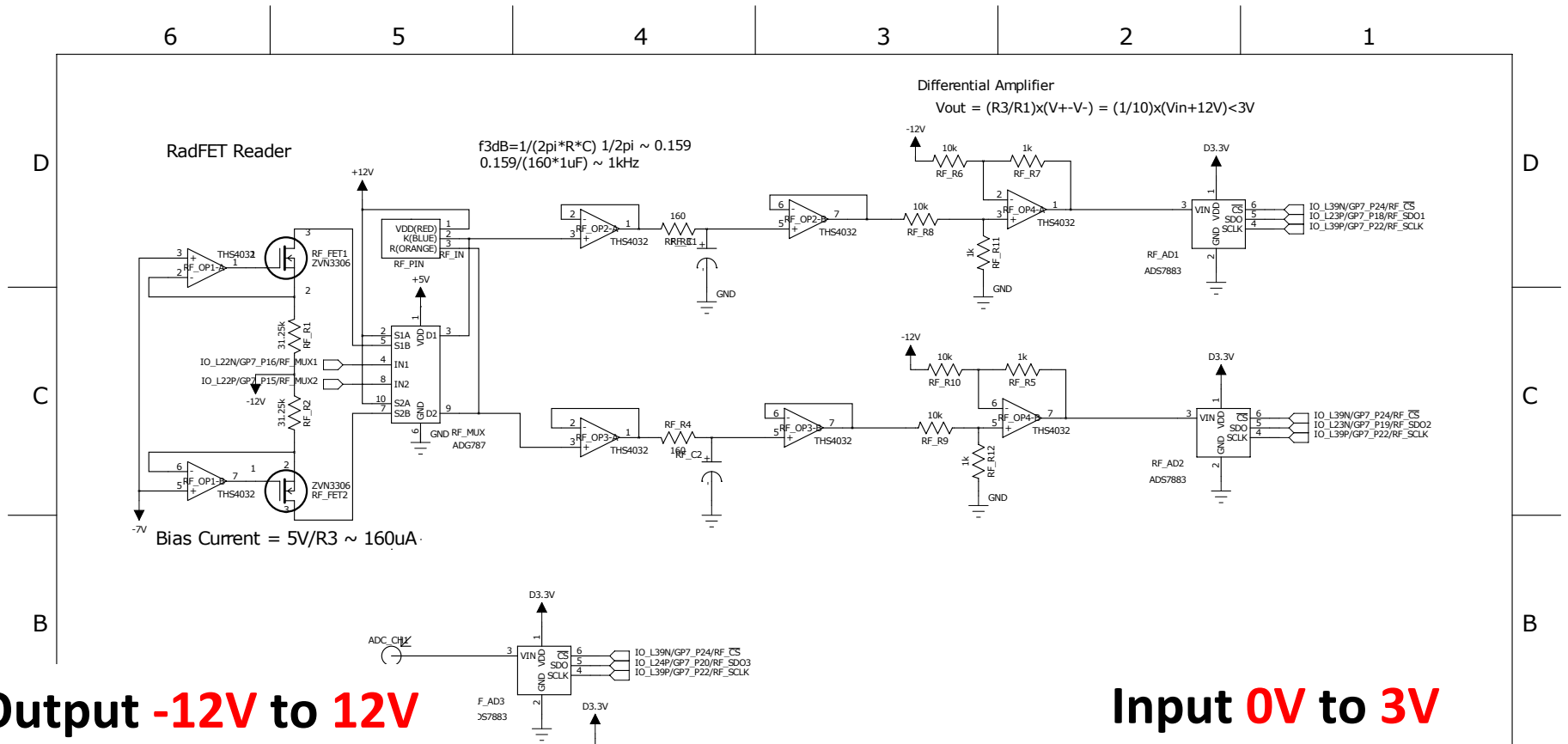
# Low-Pass Filter

# Diamond Photodiode



FEDDX Block Diagram

# RadFET Schematic

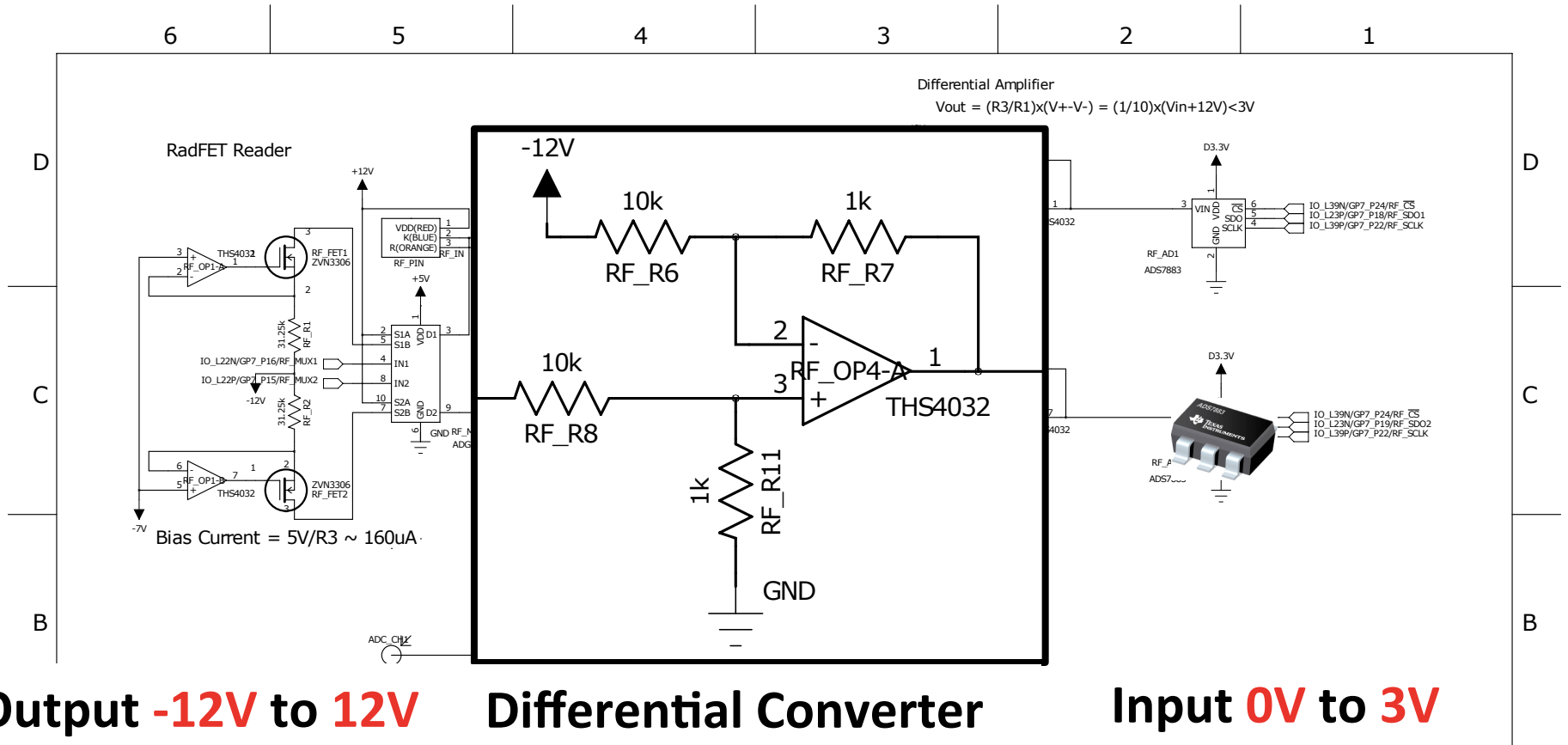


**Output -12V to 12V**

**Input 0V to 3V**



# RadFET Schematic



Output **-12V** to **12V**

Differential Converter

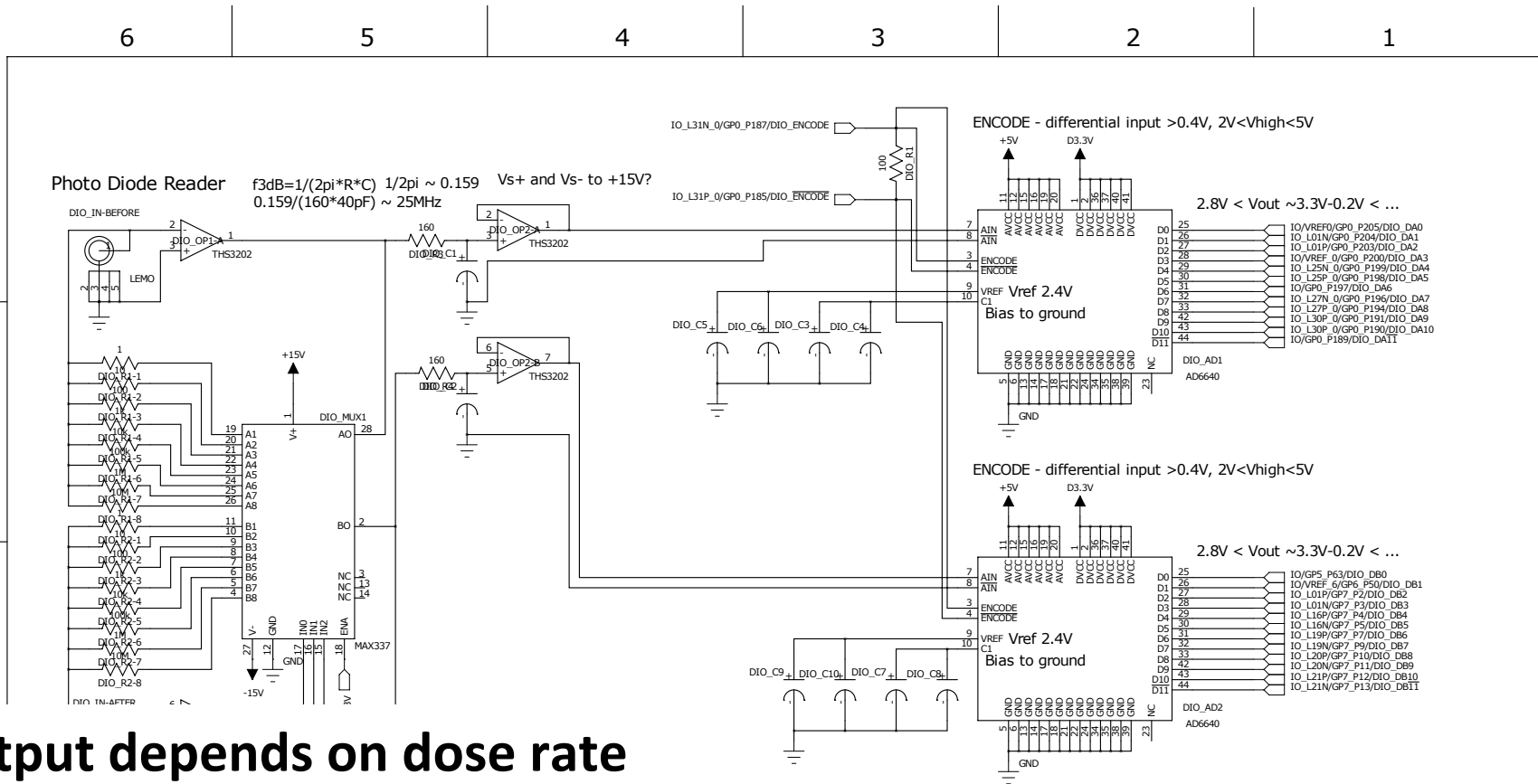
Input **0V** to **3V**

$$V_{out} = (R_3/R_1) \times (V_+ - V_-)$$

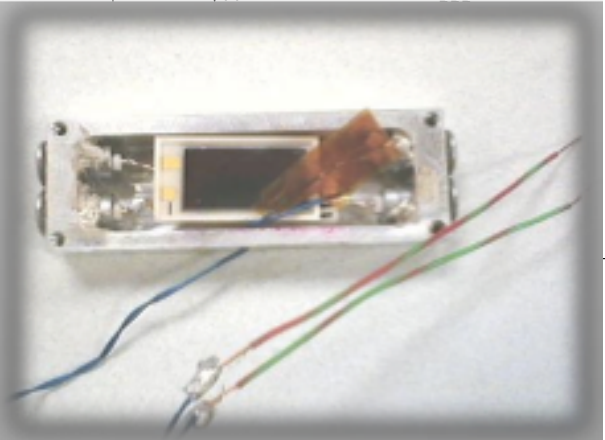
$$(1/10) \times (V_{in} - (-12V)) < 3V$$



# Diode Schematic



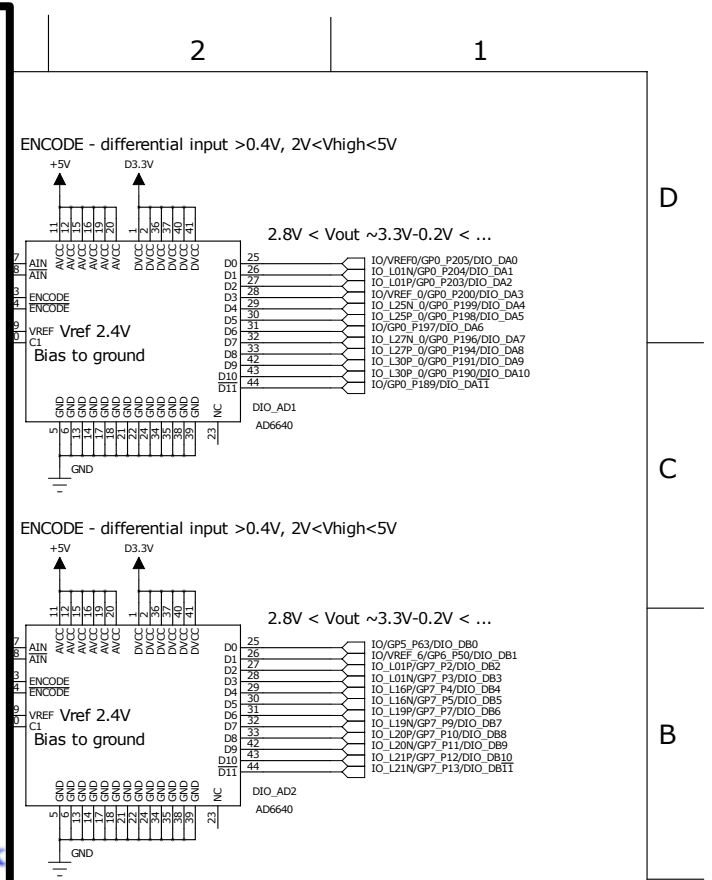
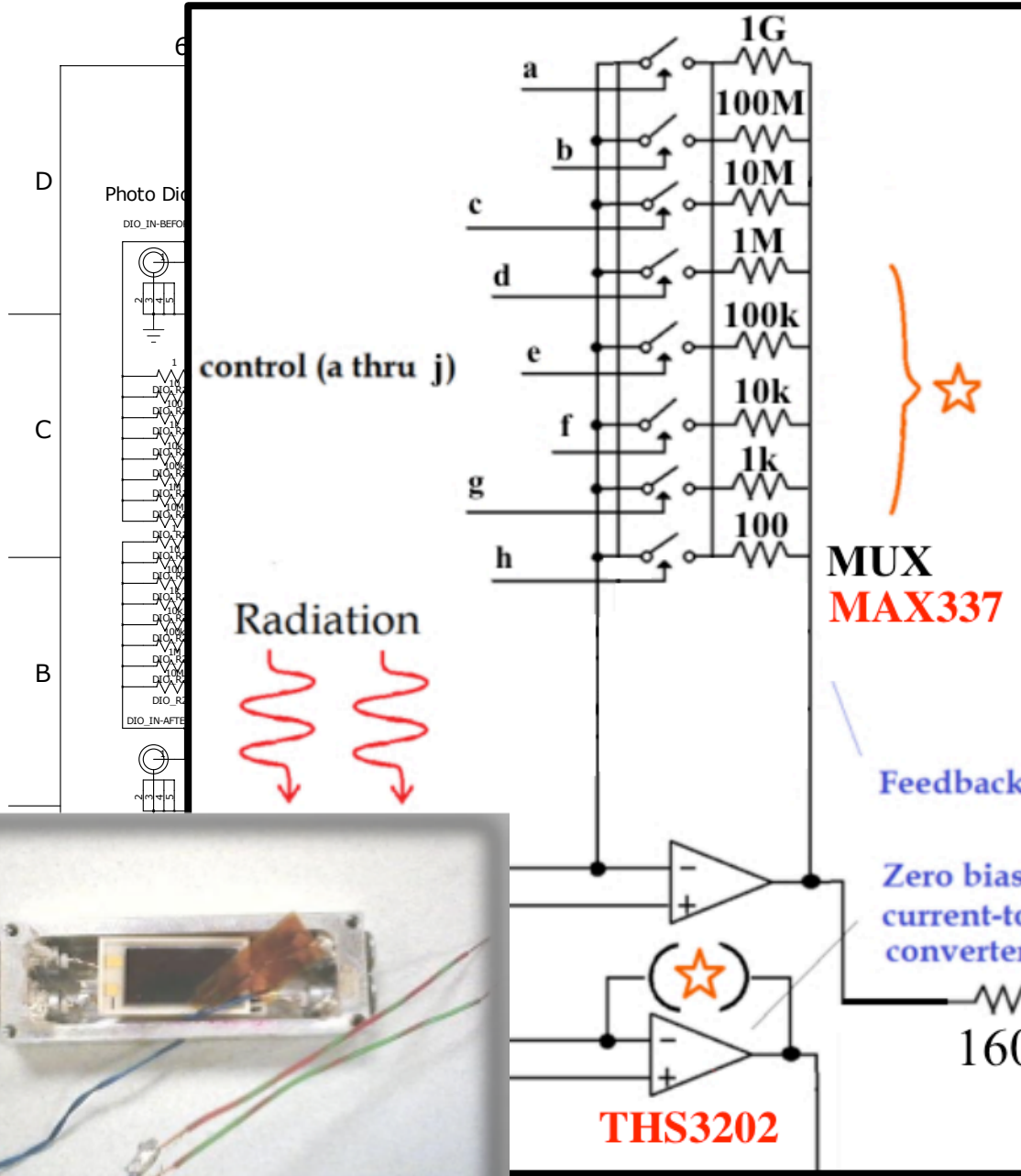
Output depends on dose rate



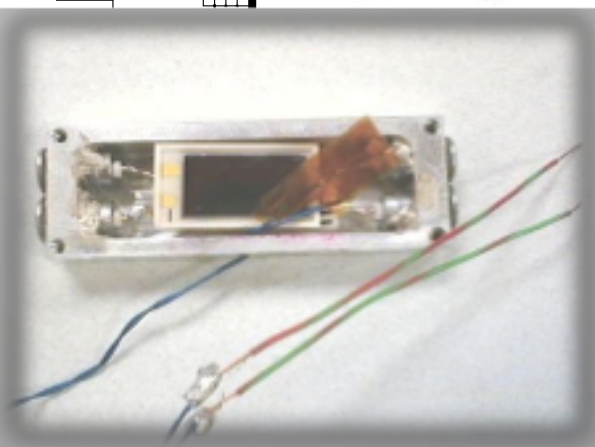
Univ. of Hawai'i -- PHYS476			
TITLE: FET, Diode, and Diamond X-ray sensor (FEDDX)			
Design:	Page Description:	REV:	
KF	Photo Diode Reader	A	
DATED: 4-APR-12	[DIODE]	SHEET: 2 OF 5	

# Current to Voltage Converter

# Diode Schematic

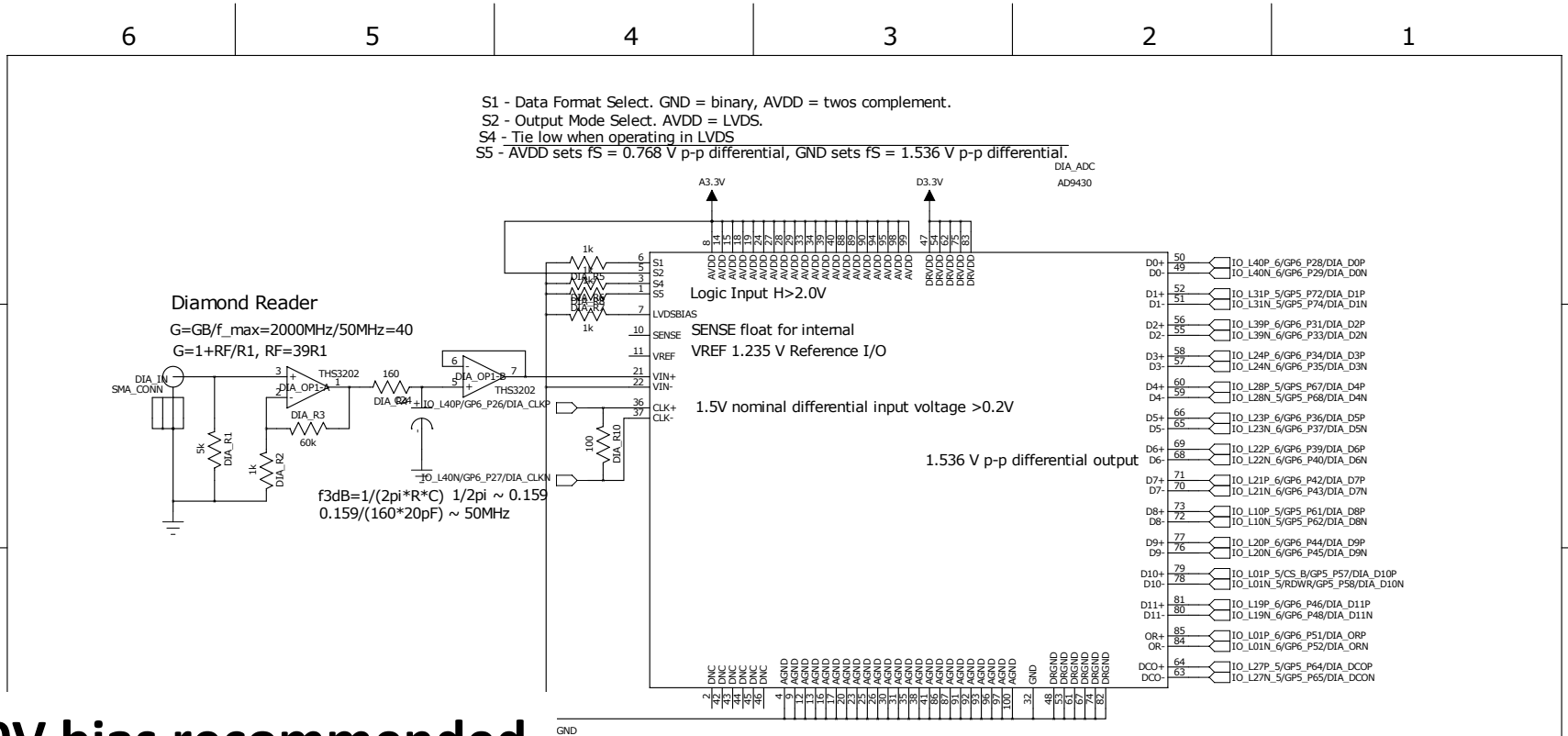


$$V = R \frac{E_x}{E_{PE}} e f$$

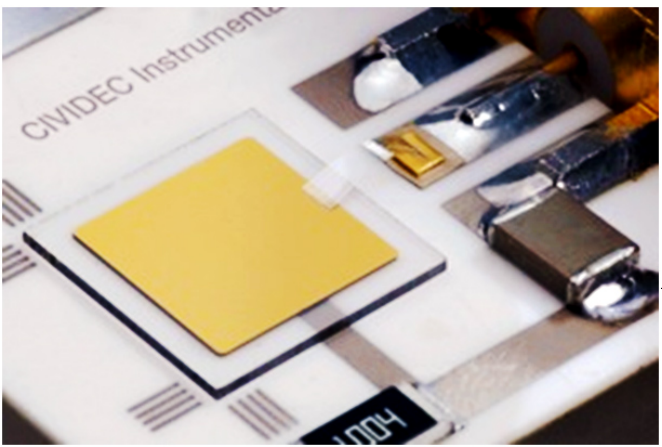




# Diamond Schematic

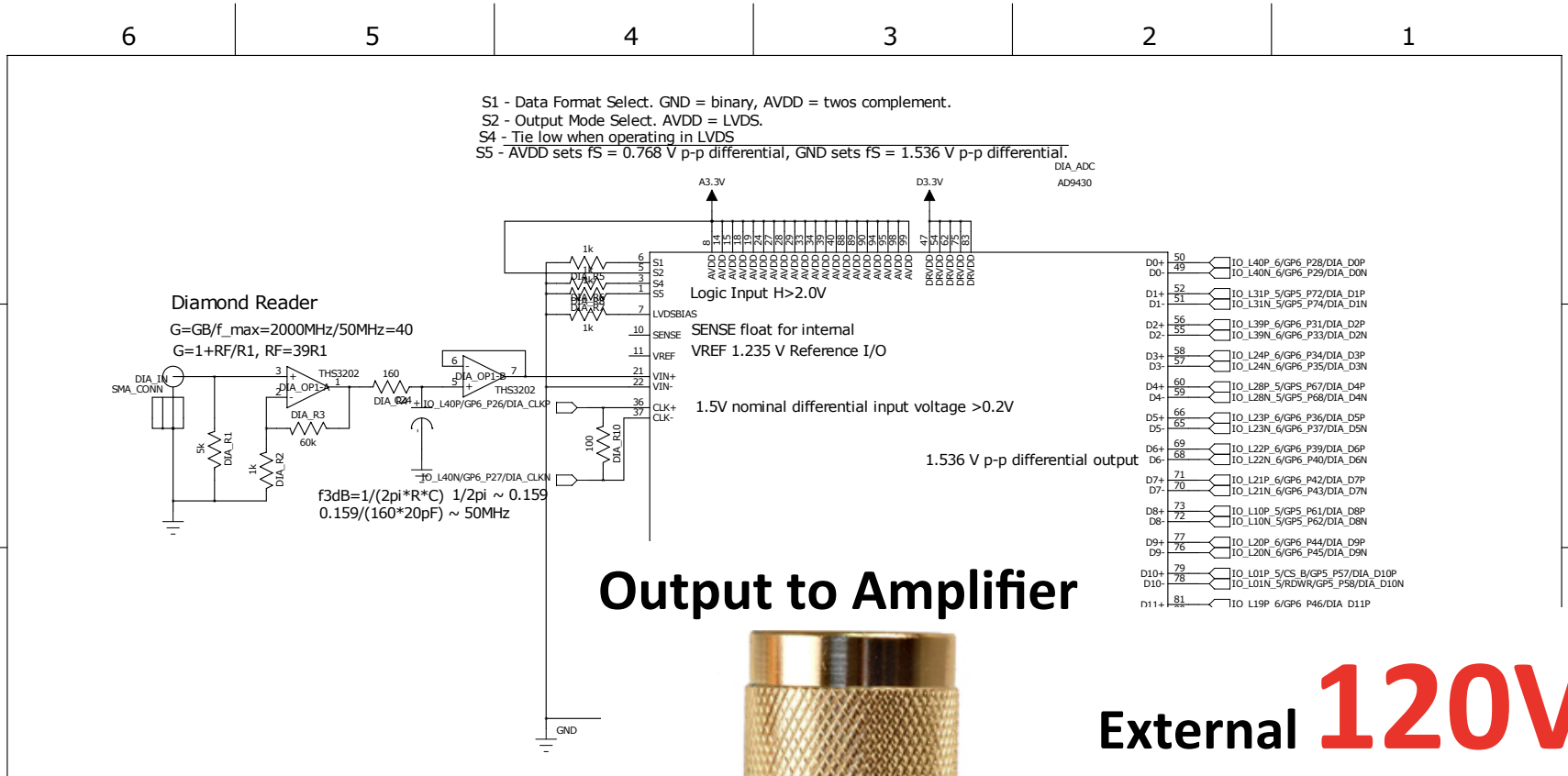


120V bias recommended



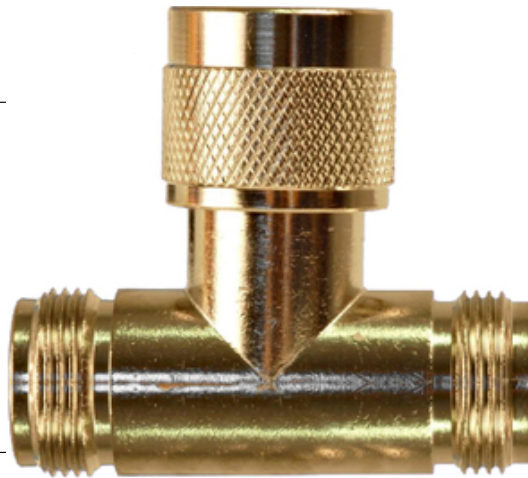
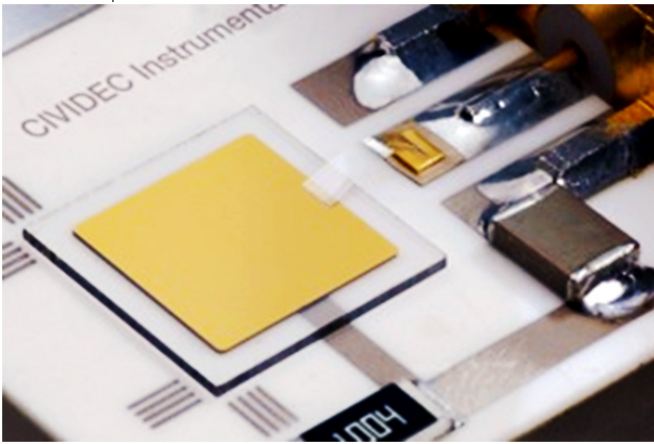
Univ. of Hawai'i -- PHYS476			
TITLE: FET, Diode, and Diamond X-ray sensor (FEDDX)			
Design:	Page Description:	REV:	
KF	Diamond Detector Reader	A	
DATED: 4-APR-12	[DIAMOND]	SHEET: 3 OF 5	

# Diamond Schematic



**Output to Amplifier**

External **120V**



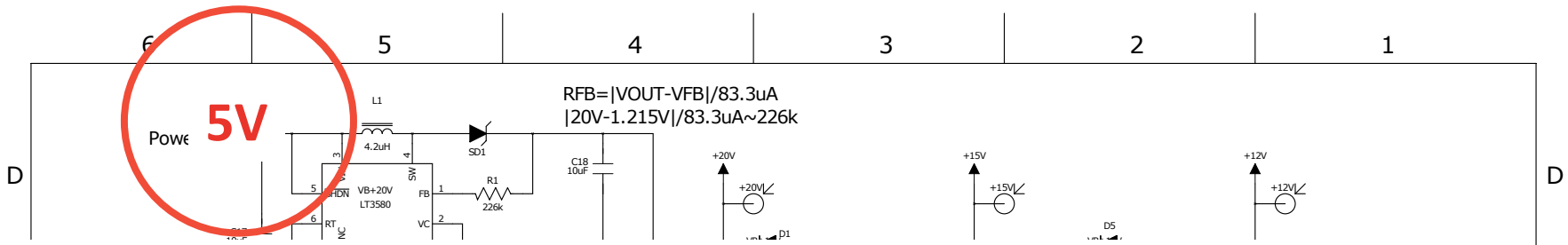
iv. of H  
Fet, Di

4-APR-1

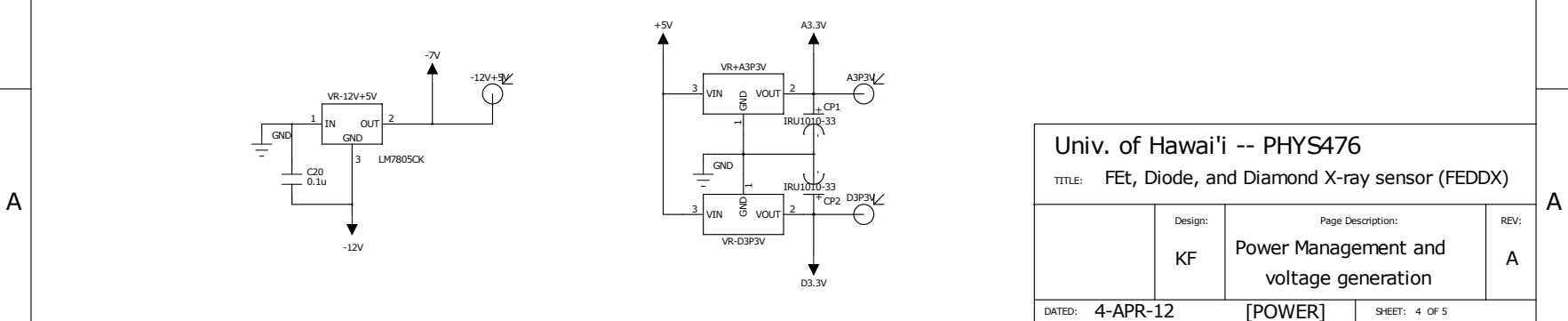
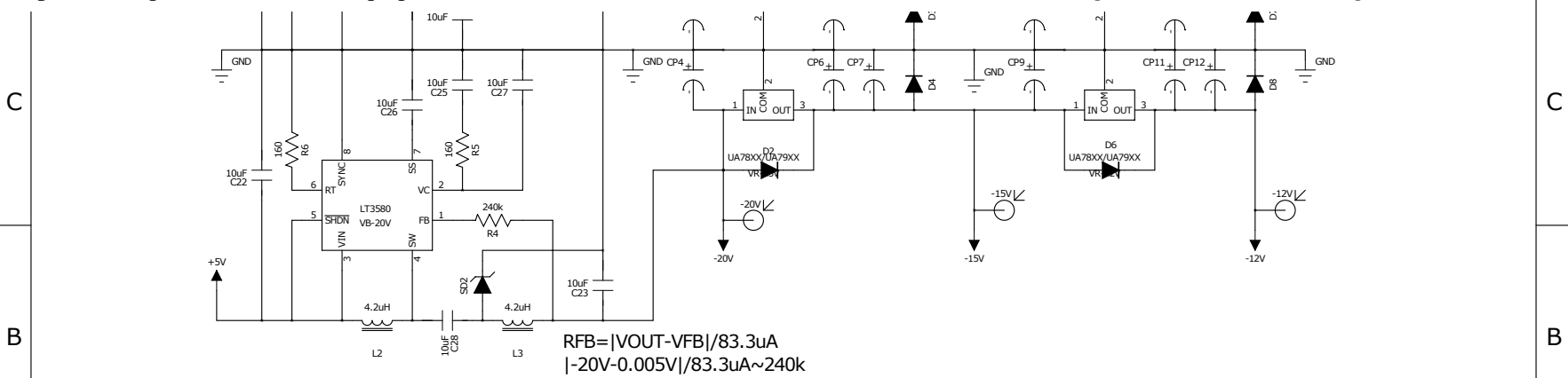


A

# Power Schematic



Only **5V** power supplied from the mother board (Univ. Eval.)



Univ. of Hawai'i -- PHYS476			
TITLE: Fet, Diode, and Diamond X-ray sensor (FEDDX)			
Design:	Page Description:	REV:	
KF	Power Management and voltage generation	A	
DATED: 4-APR-12	[POWER]	SHEET: 4 OF 5	

# Power Schematic

Current **3A**

5V

20V

15V

12V

-20V

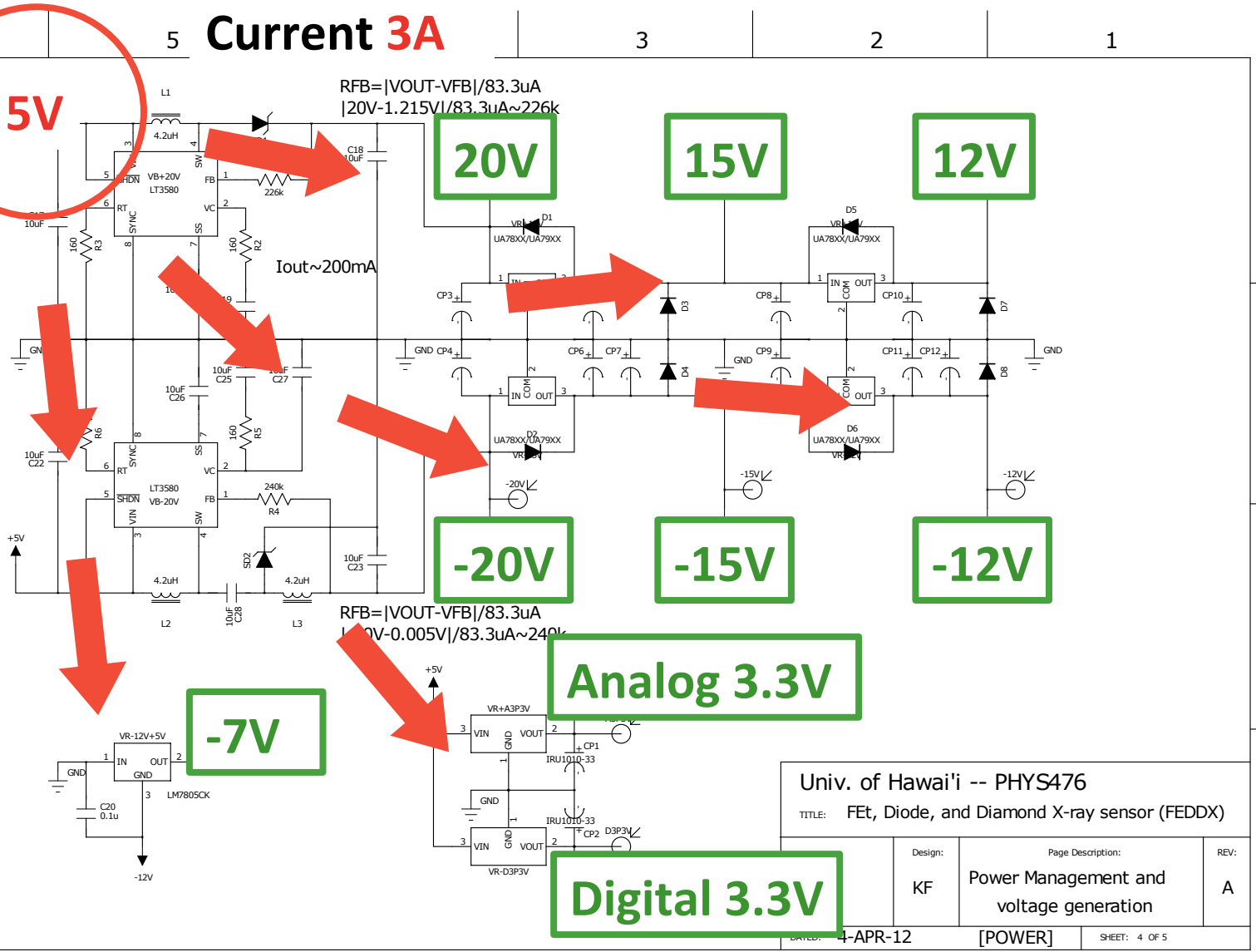
-15V

-12V

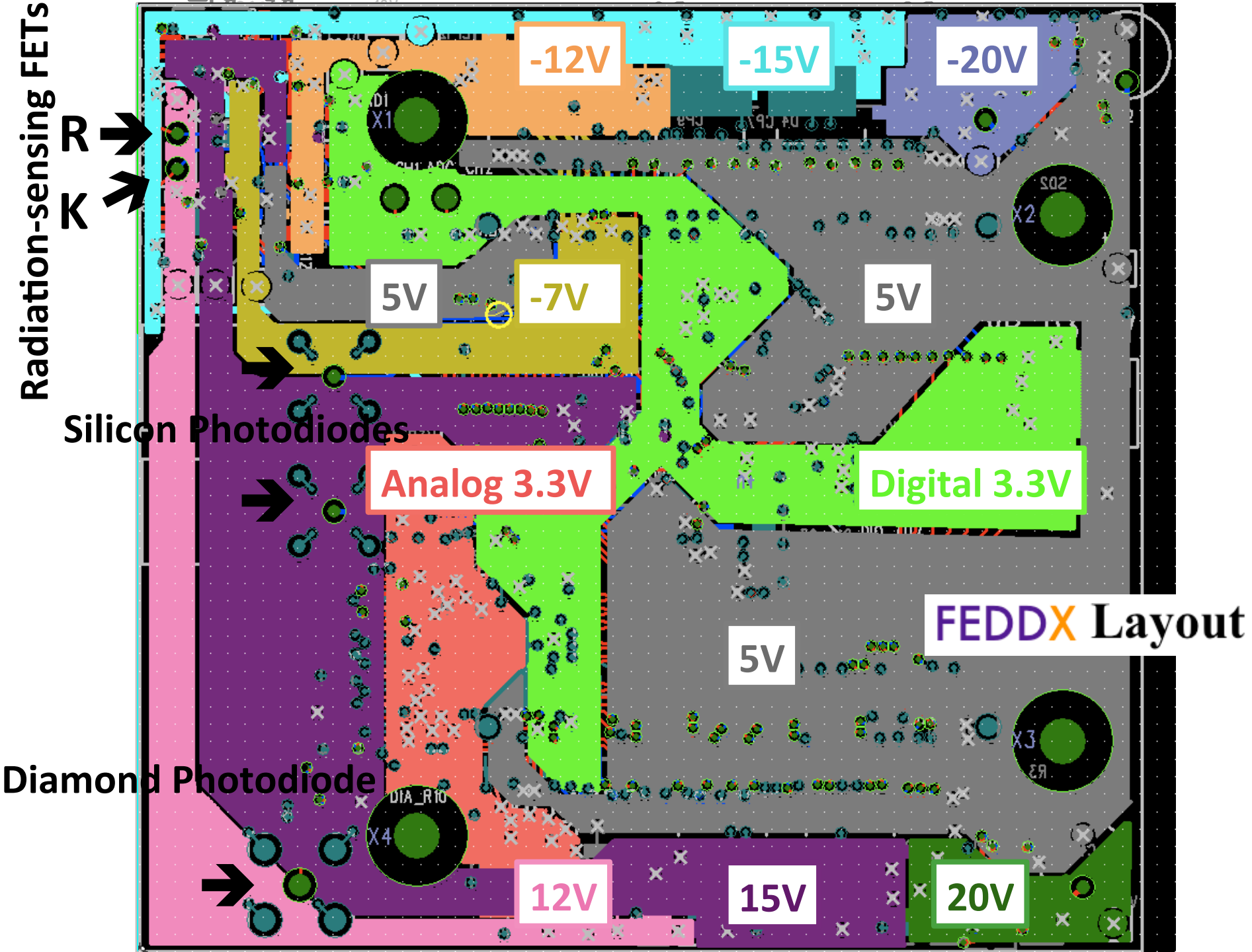
-7V

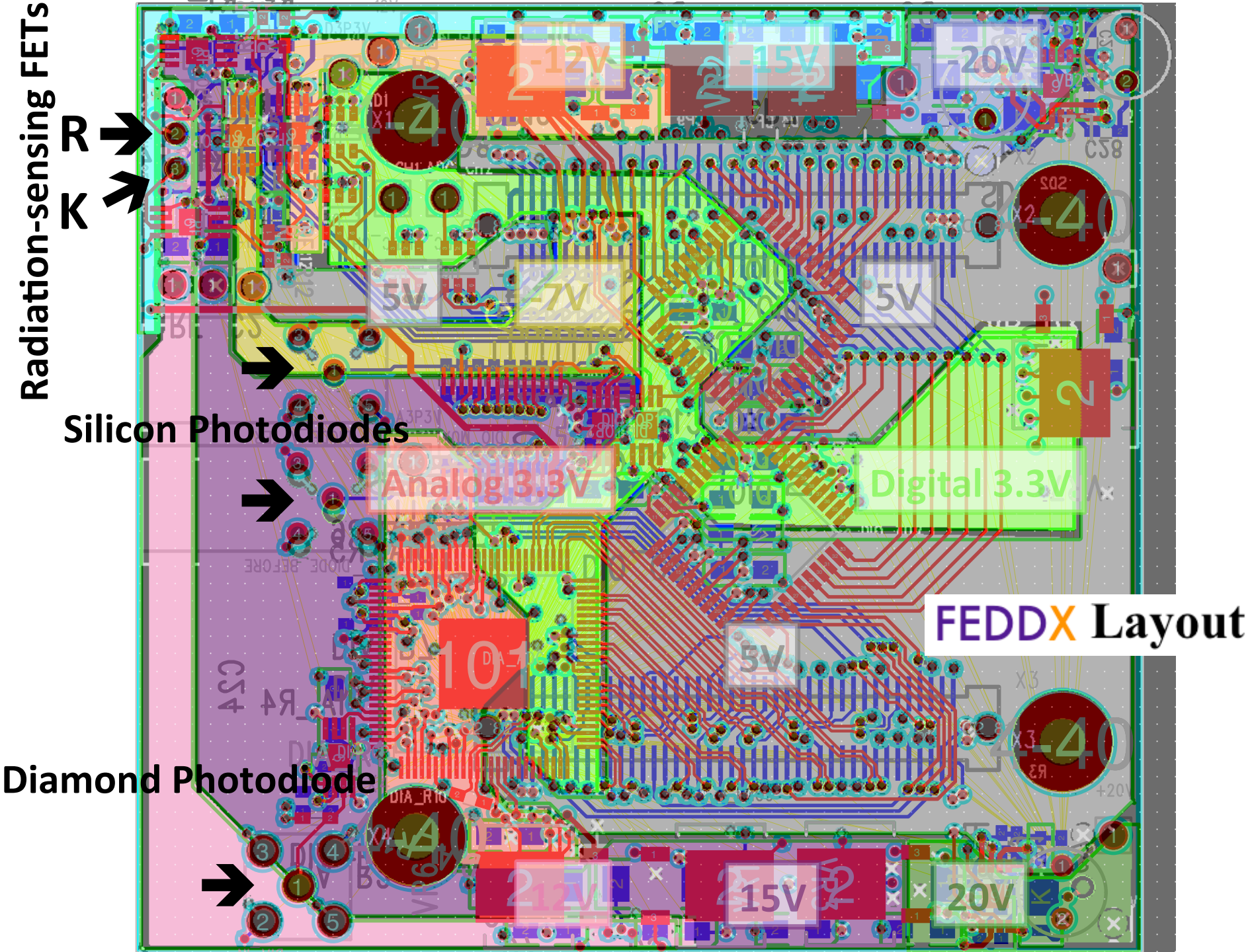
Analog 3.3V

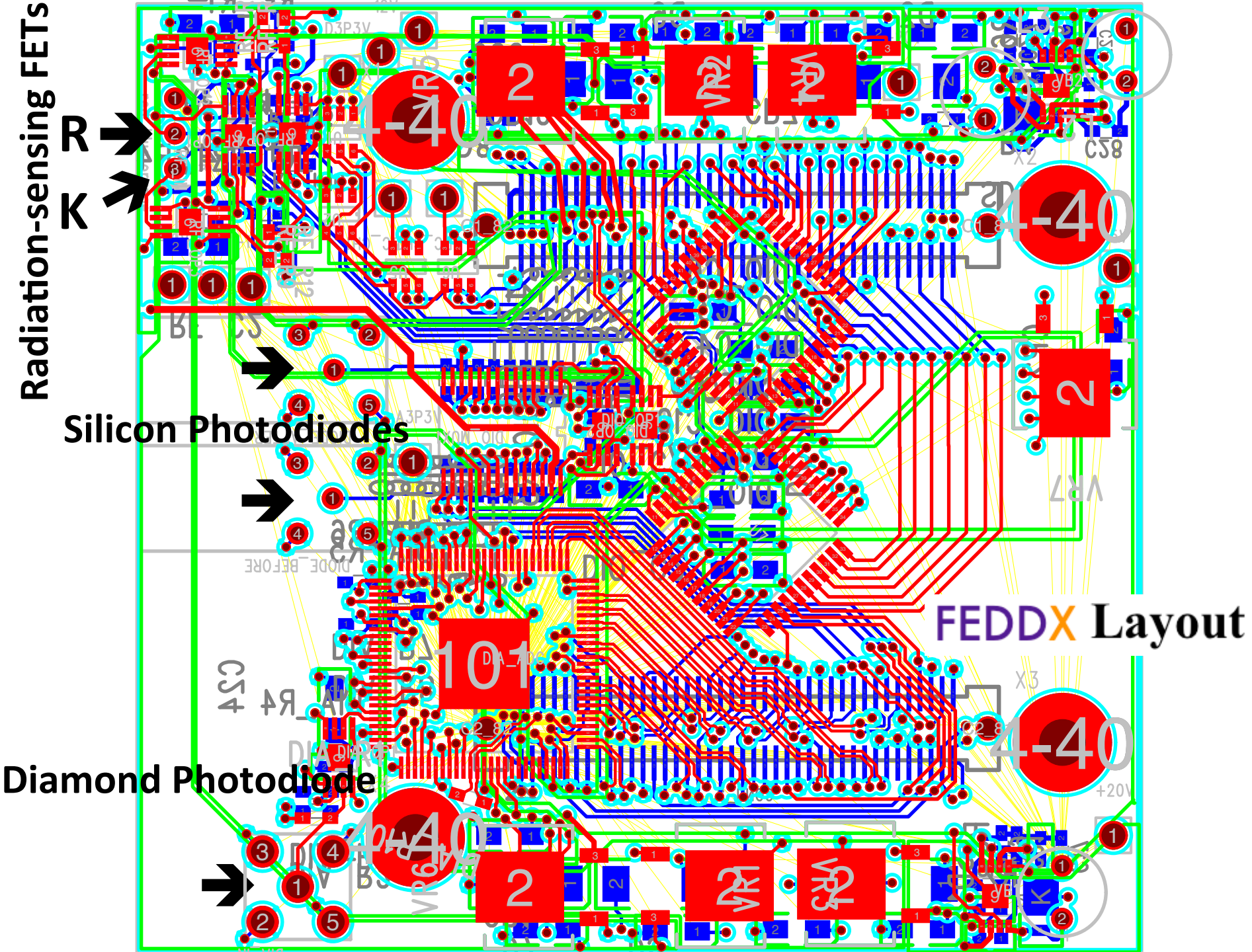
Digital 3.3V



Univ. of Hawai'i -- PHYS476		
TITLE: Fet, Diode, and Diamond X-ray sensor (FEDDX)		
Design: KF	Page Description: Power Management and voltage generation	REV: A
DATE: 4-APR-12	[POWER]	SHEET: 4 OF 5

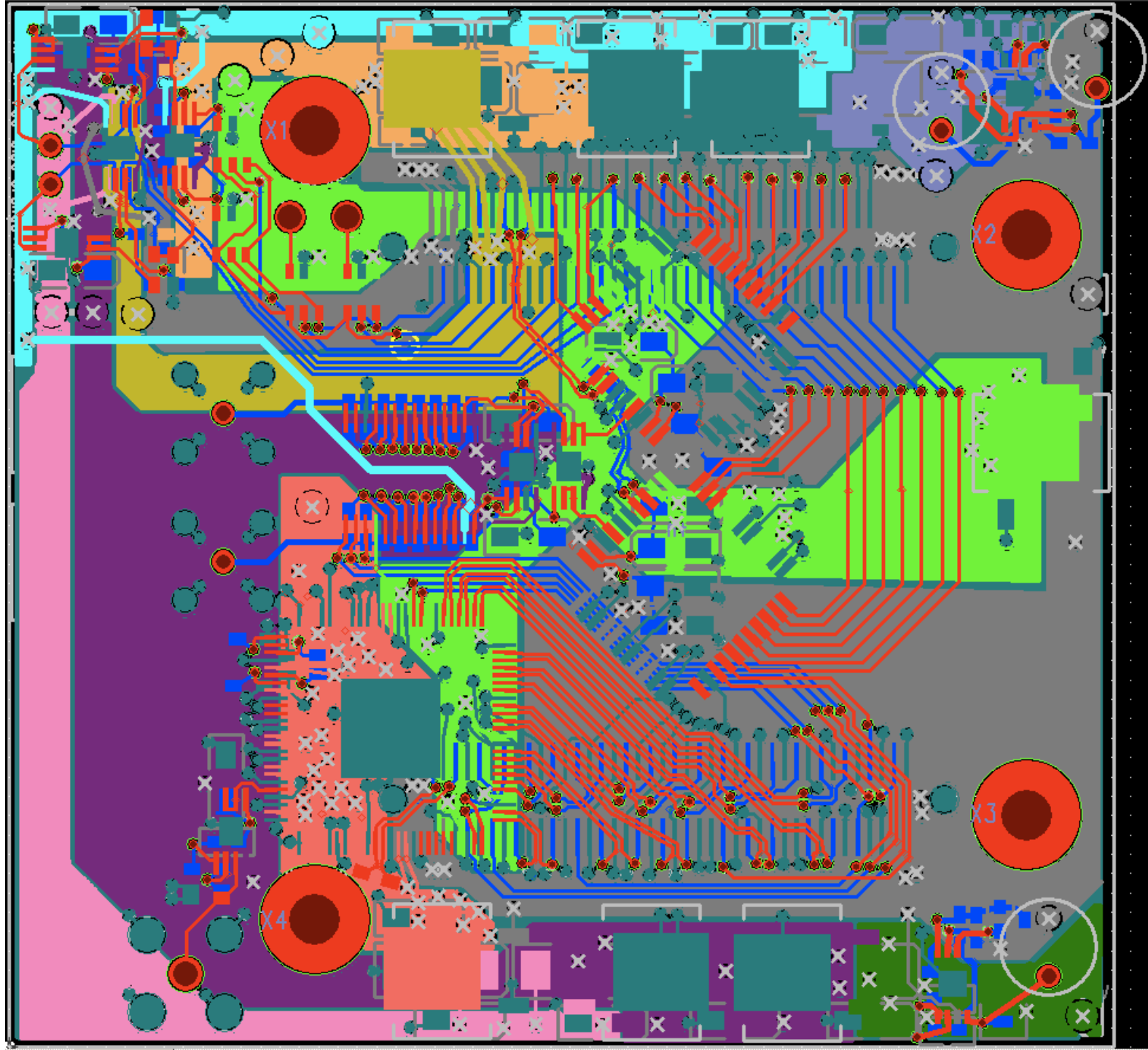


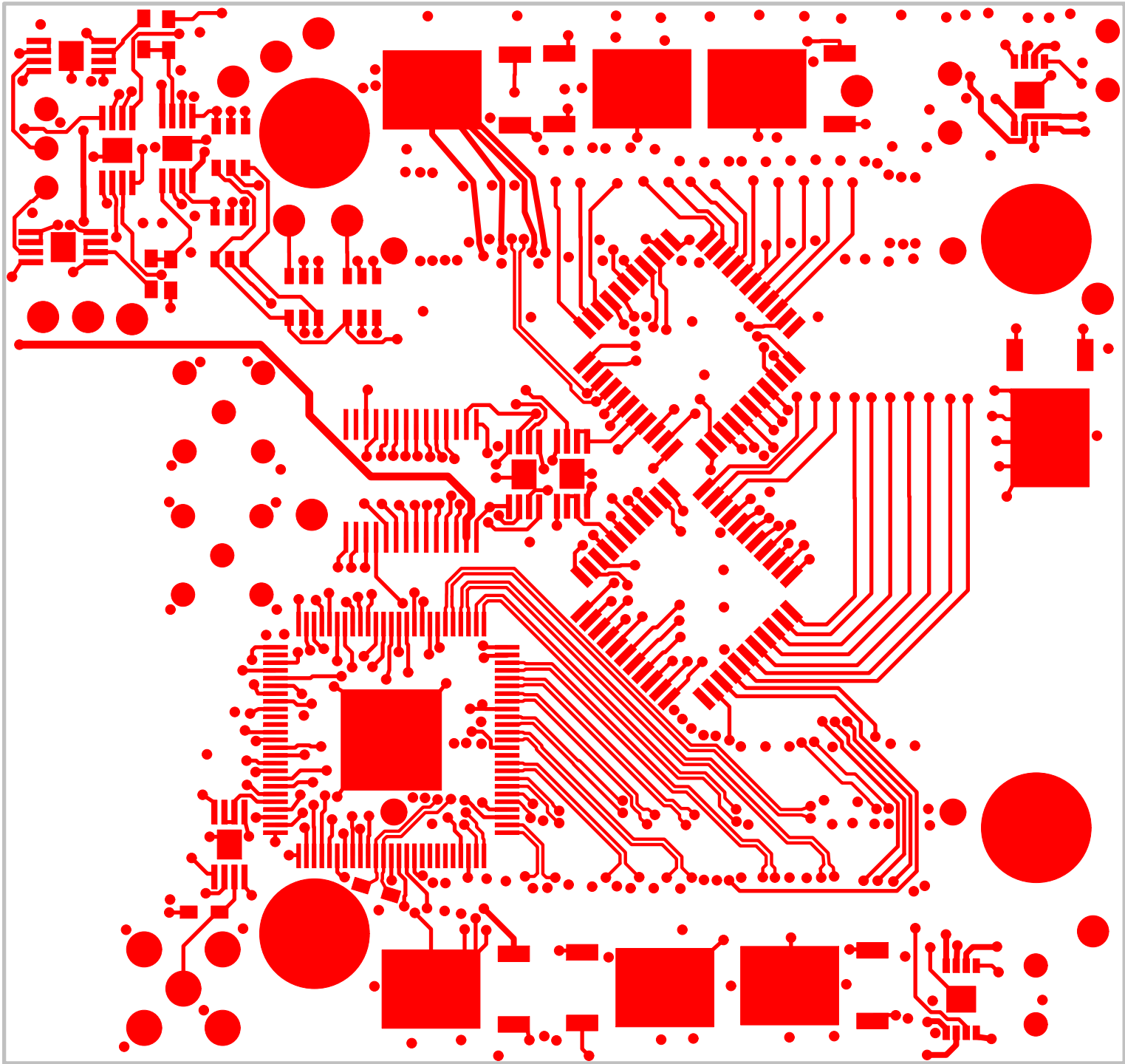


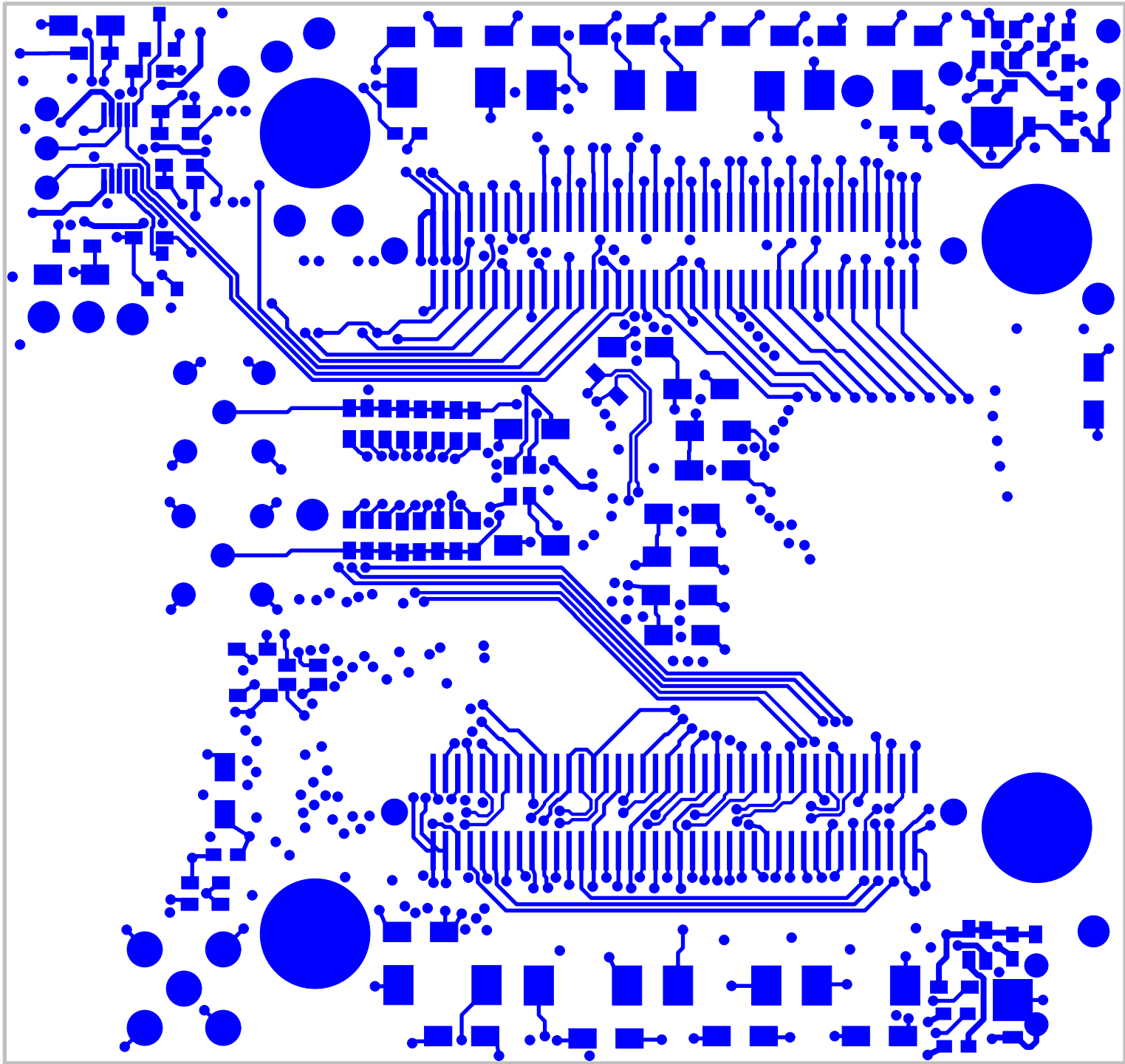


**EXTRA SLIDES**









6

5

4

3

2

1

E

E

D

D

C

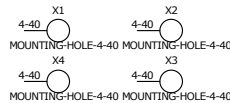
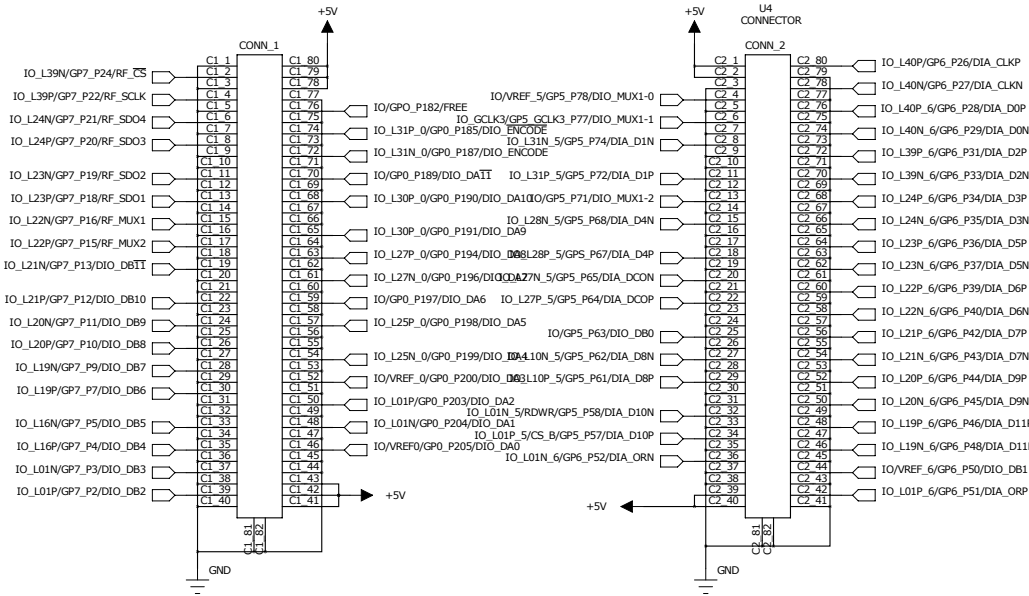
C

B

B

A

A



institution:	University of Hawaii at Manoa High Energy Physics Lab Instrumentation Development Lab
title:	TARGET4 Daughtercard
revision:	A
IDLAB design #:	IDL_12_004
circuit design:	GSV
PCB design:	DMD
sheet #:	2 of 2
sheet description:	TARGET3 input/output
date last modified:	February 14, 2012