X-Axis

1. Desired Behaviour

-kg to kg → 0 V to V_R

2. Transducer Transfer Equation

$$V_{out\,i} = S \cdot a_i + V_b$$

$$a_i = \frac{V_{out\,i} - V_b}{S}$$

3. SCA Transfer Equation

$$V_{ADC\,i} = mx + b = \frac{V_R - 0\,V}{kg - (-kg)} \cdot a_i + \frac{V_R}{2} = \frac{V_R}{2kg} \cdot a_i + \frac{V_R}{2}$$

$$V_{ADC\,i} = \frac{V_R}{2kg} \cdot \frac{V_{out\,i} - V_b}{S} + \frac{V_R}{2} = \left(\frac{V_R}{2kg \cdot S}\right) \cdot V_{out\,i} + \left(\frac{V_R}{2} - \frac{V_R \cdot V_b}{2kg \cdot S}\right)$$

Where $k = 1, V_R = 2.5\,V, S = 420\,mV/g, V_b = \frac{V_{cc}}{2} = \frac{3.3\,V}{2} = 1.65\,V$

$$V_{ADC\,i} = (2.976190) \cdot V_{out\,i} - 3.660714\,V\ )$$

4. Implementation

$$V_{ADC\,i} = \left(\frac{R_f}{R_i}\right) \cdot V_{out\,i} - \left(\frac{R_f}{R_b}\right) \cdot V_{bias}$$

Choose $V_{bias} = 3.3\,V$ from MSP430

Let $R_f = 100\,k\Omega$

$$\frac{100\,k\Omega}{R_i} = 2.976190 \qquad \therefore R_i = 33.6\,k\Omega$$

$$-\frac{100\,k\Omega}{R_b} \cdot (3.3\,V) = -3.660714\,V \qquad \therefore R_b = 90.146341\,k\Omega$$

Y-Axis

1. Desired Behaviour

0 g to kg → 0 V to V_R

2. Transducer Transfer Equation

$$V_{out\,i} = S \cdot a_i + V_b$$

$$a_i = \frac{V_{out\,i} - V_b}{S}$$

3. SCA Transfer Equation

$$V_{ADC\,i} = mx + b = \frac{V_R - 0\,V}{kg - 0\,g} \cdot a_i + \frac{V_R}{2} = \frac{V_R}{kg} \cdot a_i + \frac{V_R}{2}$$

$$V_{ADC\,i} = \frac{V_R}{kg} \cdot \frac{V_{out\,i} - V_b}{S} + \frac{V_R}{2} = \left(\frac{V_R}{kg \cdot S}\right) \cdot V_{out\,i} + \left(\frac{V_R}{2} - \frac{V_R \cdot V_b}{kg \cdot S}\right)$$

Where $k = 1, V_R = 2.5\,V, S = 420\,mV/g, V_b = \frac{V_{cc}}{2} = \frac{3.3\,V}{2} = 1.65\,V$

$$V_{ADC\,i} = (5.952381) \cdot V_{out\,i} - (8.571429\,V)$$

4. Implementation

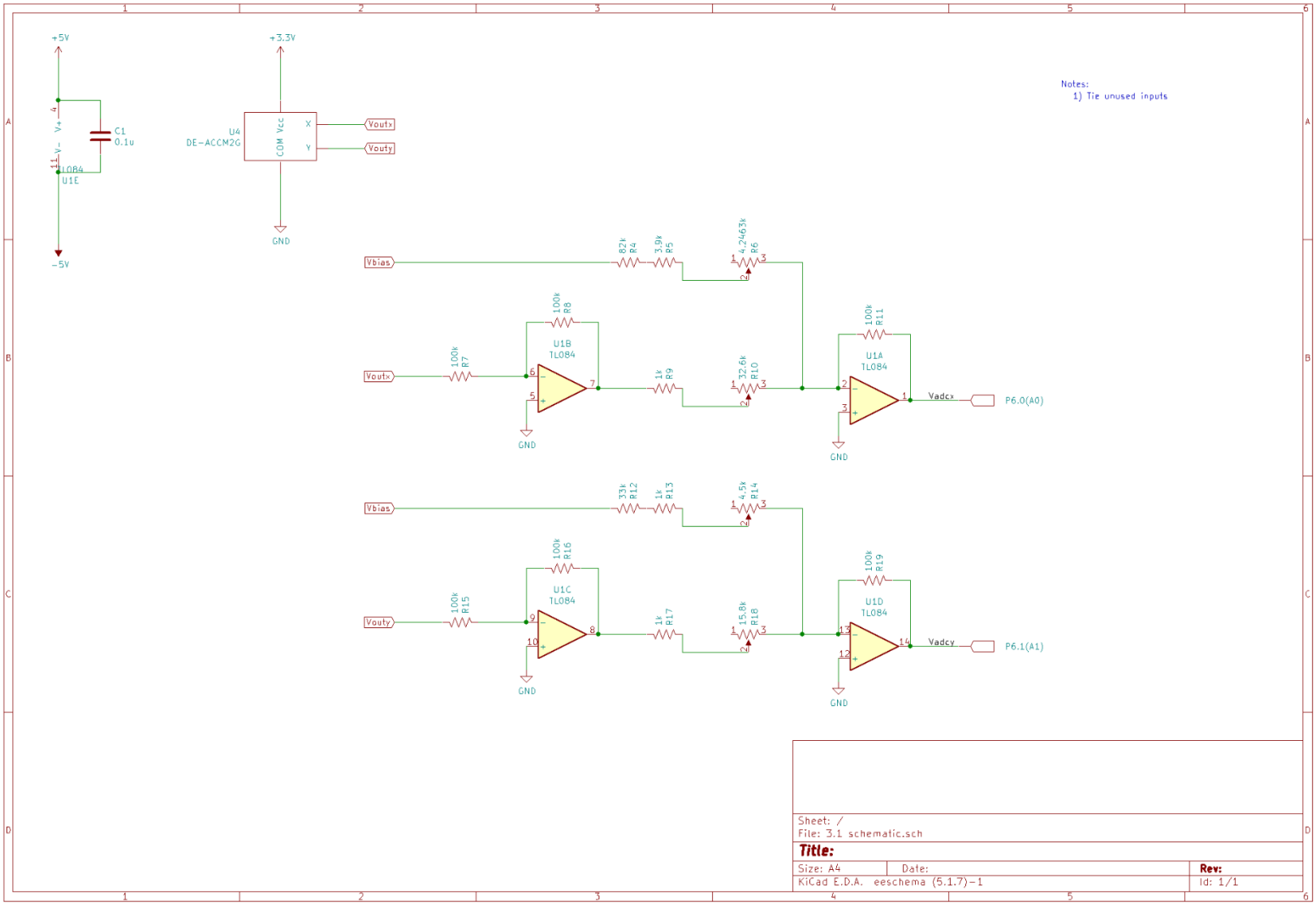
$$V_{ADC\,i} = \left(\frac{R_f}{R_i}\right) \cdot V_{out\,i} - \left(\frac{R_f}{R_b}\right) \cdot V_{bias}$$

Choose $V_{bias} = 3.3\,V$ from MSP430

Let $R_f = 100\,k\Omega$

$$\frac{100\,k\Omega}{R_i} = 5.952381 \qquad \therefore R_i = 16.8\,k\Omega$$

$$-\frac{100\,k\Omega}{R_b} \cdot (3.3\,V) = -8.571429\,V \qquad \therefore R_b = 38.5\,k\Omega$$


+5V
+3.3V
C1
0.1u
TL084
U1E
V+
V-
-5V
U4
DE-ACCM2G
COM
Vcc
X
Y
Voutx
Vouty
GND
Notes:
1) Tie unused inputs
Vbias
82k R4
3.9k R5
4.2463k R6
100k R8
U1B
TL084
Voutx
100k R7
1k R9
32.6k R10
100k R11
U1A
TL084
Vadcx
P6.0(A0)
33k R12
1k R13
4.5k R14
100k R16
U1C
TL084
Vouty
100k R15
1k R17
15.8k R18
100k R19
U1D
TL084
Vadcy
P6.1(A1)
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