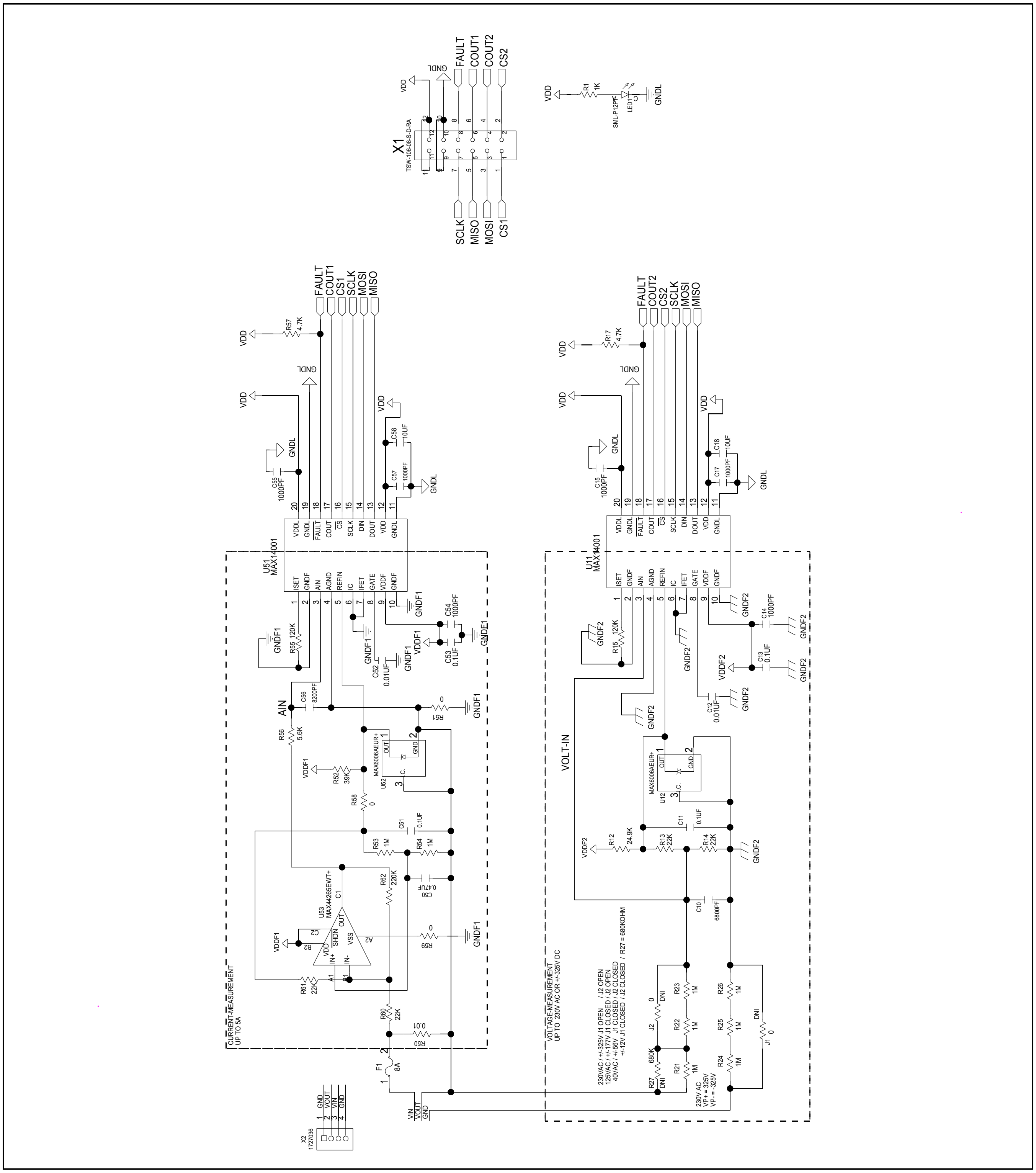


Figure 2. MAX14001PMB Schematic

CURRENT-MEASUREMENT
UP TO 5A
1 GND
2 VOUT
3 VIN
4 GND
VIN
VOUT
GND
F1
8A
R60
22K
R50
0.01
sense resistor
Vin
iB
iA
Vout
R61
22K
VDDF1
B2
C2
U53
MAX44265EWT+
VDD
IN+
SHDN
OUT
IN-
VSS
A1
B1
A2
C1
amp Op gain
Av= 10
$V_{C1} = \pm 5 \cdot 10^{-3}$ V
R62
220K
R59
0
GNDF1
C50
0.47UF
R53
1M
R54
1M
C51
0.1UF
R58
0
R56
5.6K
AIN
C56
8200PF
VDDF1
R52
39K
U52
MAX6006AEUR+
OUT
GND
AGND
Offset
R51
0
U51
MAX1400
R55 120K
ISET
GNDF
AIN
AGND
REFIN
IC
IFET
GATE
VDDF
GNDF
C52
0.01UF
C53
0.1UF
C54
1000PF

I) $V_{in} - V_{out} = R_{50} \cdot i_A$

II) $R_{50} \ll R_{equivalent\ circuit} \longrightarrow i_B \cong 0\,A$

III) $i_A \cong$ circuit measure current

IV) $i_A = \dfrac{V_{in} - V_{out}}{R_{50}}$, $V_{in} - V_{out} = \pm 5 \cdot 10^{-2}\,V$

$$i_A = \frac{\pm 5 \cdot 10^{-2}}{0{,}01} = \pm 5\,A$$

V) $A_{in} \cong V_{C1} + \text{offset}$, $V_{C1} = (V_{in} - V_{out}) \cdot A_v$

$V_{C1} = (V_{in} - V_{out}) \cdot 10$

VI) $A_{in} = (V_{in} - V_{out}) \cdot 10 + \text{Offset}$

$$A_{in} = ((V_{in} - V_{out}) \cdot 10 + 0{,}625$$

$$V_{in} - V_{out} = \frac{A_{in} - 0{,}625}{10}$$

VII) $i_{in} \cong i_A = \dfrac{(V_{in} - V_{out})}{R_{50}} = (V_{in} - V_{out}) \cdot 10^{2}$

VIII) Ain is measure in bits -> apply scale to transfor in Volts

$$A_{in(V)} = A_{in} \times \left(\frac{1250}{1024} \cdot 10^{-3}\right) = A_{in} \times 1{,}220703125 \cdot 10^{-3}$$

IX $A_{in}(V) = A_{in} \times 1{,}220703125 \cdot 10^{-3}$

$$i_{in} = (V_{in} - V_{out}) \cdot 10^{2}$$

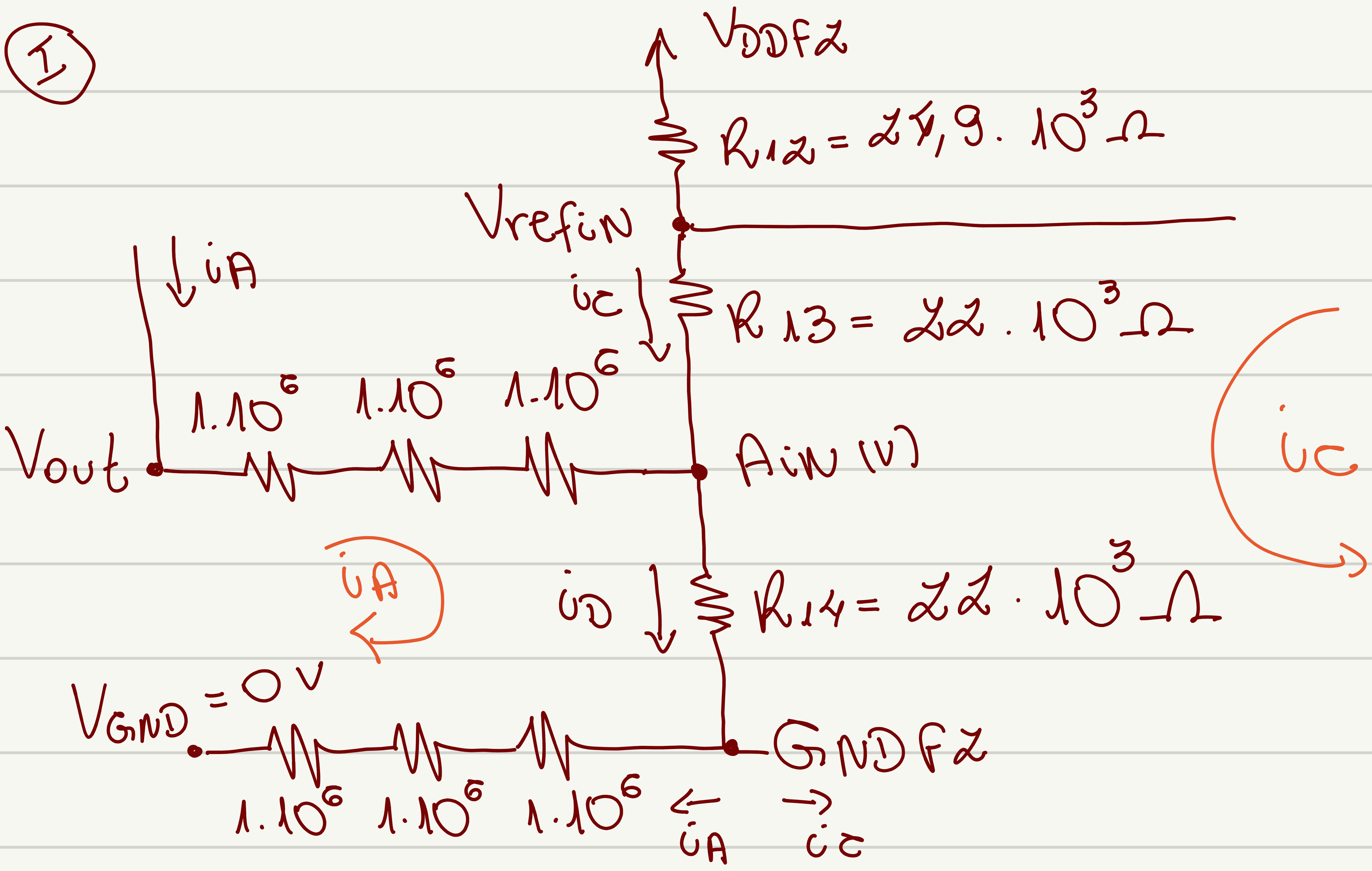
$$V_{in} - V_{out} = \frac{A_{in}(V) - 0{,}625}{10}$$

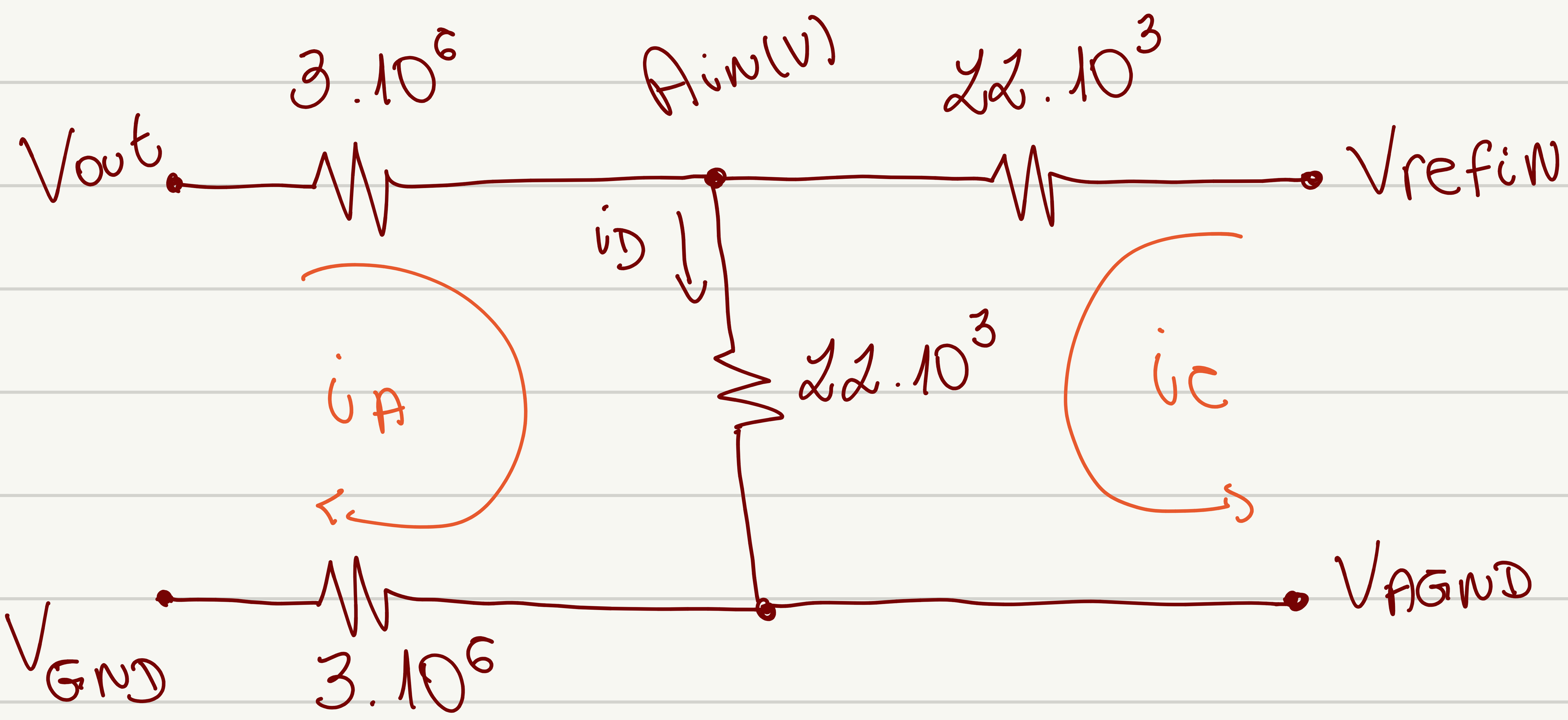
$$i_{in} = \left[\left(A_{in} \times 1{,}220703125 \cdot 10^{-3} \right) - 0{,}625 \right] \times 10$$

$$i_{in} = \left[\left(A_{in} \cdot 0{,}001220703125 \right) - 0{,}625 \right] \times 10 \ (A)$$


VOLTAGE-MEASUREMENT
UP TO 230V AC OR +/-325V DC
VOLT-IN
my configuration
230VAC / +/-325V J1 OPEN / J2 OPEN
125VAC / +/-177V J1 CLOSED / J2 OPEN
40VAC / +/-56V J1 CLOSED / J2 CLOSED
+/-12V J1 CLOSED / J2 CLOSED / R27 = 680KOHM
VDDF2 = 3V
R12
24.9K
Vrefin
iC
R13
22K
iA
Ain(v)
C11
0.1UF
iD
R14
22K
C10
6800PF
Vout
iA
R27
680K
DNI
J2
0
DNI
R21
1M
R22
1M
R23
1M
resistor chain
230V AC
VP+ = 325V
VP- = -325V
VGND
R24
1M
R25
1M
R26
1M
DNI
J1
0
iA
GNDF2
iC
MAX6006AEUR+
U12
OUT
1
3
.C.
GND
2
Vrefin
GNDF2
GNDF2
R15 120K
U11
MAX14
1 ISET
2 GNDF
3 AIN
4 AGND
5 REFIN
6 IC
7 IFET
8 GATE
9 VDDF
10 GNDF
GNDF2
C12
0.01UF
GNDF2
VDDF2
GNDF2
C13
0.1UF
C14
1000PF
GNDF2
GNDF2

I





II $\quad V_{out} - V_{GND} = x$

$x = 3 \cdot 10^6 \cdot i_A + 22 \cdot 10^3 \cdot i_D + 3 \cdot 10^6 \cdot i_A$

$x = 6 \cdot 10^6\, i_A + 22 \cdot 10^3 \cdot i_D$ a

III $\quad V_{refin} - V_{AGND} = 1,25$

$1,25 = i_C \cdot 22 \cdot 10^3 + i_D \cdot 22 \cdot 10^3$ b

IV $\quad A_{in} = i_D \cdot 22 \cdot 10^3$ c

V $\quad i_D = i_A + i_C$ d

VI $\quad V_{refin} - A_{in} = 22 \cdot 10^3 \cdot i_C$

$A_{in} = V_{refin} - 22 \cdot 10^3 \cdot i_C$

$A_{in} = 1,25 - 22 \cdot 10^3\, i_C$

$$A_{in} = 1{,}25 - 22 \cdot 10^3 \cdot i_C$$

$$A_{in} = 1{,}25 - 22 \cdot 10^3 \, (i_D - i_A)$$ using (d)

$$A_{in} = 1{,}25 - 22 \cdot 10^3 \cdot i_D + 22 \cdot 10^3 \cdot i_A$$

$$A_{in} = 1{,}25 - (A_{in}) + 22 \cdot 10^3 \cdot i_A$$ using (c)

$$2 A_{in} = 1{,}25 + 22 \cdot 10^3 \cdot i_A$$

(VII) $$X = 6 \cdot 10^6 \cdot i_A + 22 \cdot 10^3 \cdot i_D$$

$$X = 6 \cdot 10^6 \cdot i_A + (A_{in})$$ using (c)

$$X - A_{in} = 6 \cdot 10^6 \cdot i_A$$

$$i_A = \frac{X - A_{in}}{6 \cdot 10^6}$$

(VIII) $$2 A_{in} = 1{,}25 + 22 \cdot 10^3 \cdot i_A$$

$$2 A_{in} = 1{,}25 + 22 \cdot 10^3 \, \frac{(X - A_{in})}{6 \cdot 10^6}$$

$$2 \cdot A_{in} + \frac{22}{6 \cdot 10^3} A_{in} = 1{,}25 + \frac{22}{6 \cdot 10^3} X$$

using (a)

$$A_{in}\left(2 + \frac{22}{6 \cdot 10^3}\right) = 1{,}25 + \left(\frac{22}{6 \cdot 10^3}\right)(V_{out} - V_{GND})$$

$$A_{in}\left(\frac{2 \cdot 6 \cdot 10^3 + 22}{\cancel{6 \cdot 10^3}}\right) = \frac{1{,}25 \cdot 6 \cdot 10^3 + 22(V_{out} - V_{GND})}{\cancel{6 \cdot 10^3}}$$

$$A_{in}(12\,000 + 22) = 7\,500 + 22\,(V_{out} - V_{GND})$$

$$A_{in} = \frac{7\,500}{12022} + \frac{22}{12022}\,(V_{out} - V_{GND})$$

$$\underbrace{A_{in}}_{\text{voltage}} = 0{,}62385626351688 + 0{,}00182997837298\,(V_{out} - V_{GND})$$

(IX) Ain is measure in bits → apply scale to transfor in Volts

$$A_{in}(V) = A_{in} \times \left(\frac{1250}{1024} \cdot 10^{-3}\right) = A_{in} \times 1{,}220703125 \cdot 10^{-3}$$

(X)

$$A_{in} \cdot 1{,}220703125 \cdot 10^{-3} = 0{,}623856263516888 + 0{,}001829978372\,98\,(V_{out} - V_{GND})$$

$$A_{in} \cong 511{,}06305173 + 1{,}499118283\,(V_{out} - V_{GND})$$

If $V_{GND} = 0\,(V)$

$$A_{in} \cong 511{,}06305173 + 1{,}499118283\, V_{out}$$

$$V_{out} \cong \frac{A_{in} - 511{,}06305173}{1{,}499118283}\ (V)$$