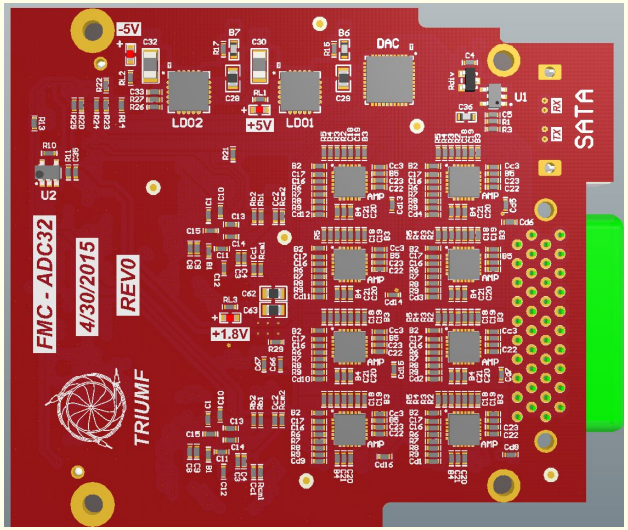
## DAC

FMC ADC32 - Offset DAC.SchDoc

FMC_DAC_CS0n, FMC_SCK, FMC_SDIO, FMC_DAC_SDO

DAC_CSn, DAC_SCK, DAC_SDI, DAC_SDO

DAC0 DAC1 DAC2 DAC3 DAC4 DAC5 DAC6 DAC7 DAC8 DAC9 DAC10 DAC11 DAC12 DAC13 DAC14 DAC15




## J1

Hirose Electric Co Ltd

FX2-40S-1.27DS(71)

MH1 GND

| | | | | |
|---|---|---|---|---|
| SIG_IN2 | a1 | b1 | SIG_IN0 | |
| SIG_IN10 | a2 | b2 | SIG_IN8 | |
| SIG_IN9 | a3 | b3 | SIG_IN3 | |
| SIG_IN12 | a4 | b4 | SIG_IN6 | |
| GND | a5 | b5 | | GND |
| SIG_IN11 | a6 | b6 | SIG_IN1 | |
| SIG_IN13 | a7 | b7 | SIG_IN7 | |
| SIG_IN5 | a8 | b8 | SIG_IN4 | |
| SIG_IN18 | a9 | b9 | SIG_IN24 | |
| GND | a10 | b10 | | GND |
| SIG_IN14 | a11 | b11 | SIG_IN19 | |
| SIG_IN16 | a12 | b12 | SIG_IN15 | |
| SIG_IN26 | a13 | b13 | SIG_IN17 | |
| SIG_IN25 | a14 | b14 | SIG_IN27 | |
| GND | a15 | b15 | | GND |
| SIG_IN20 | a16 | b16 | SIG_IN28 | |
| SIG_IN22 | a17 | b17 | SIG_IN30 | |
| SIG_IN23 | a18 | b18 | SIG_IN21 | |
| SIG_IN29 | a19 | b19 | SIG_IN31 | |
| GND | a20 | b20 | | GND |

MH2 GND

## FRONT END

FMC ADC32 - ADC Front End.SchDoc

SIG_IN0 SIG_IN0_p SIG_IN0_n
DAC12
SIG_IN1 SIG_IN1_p SIG_IN1_n
SIG_IN2 SIG_IN2_p SIG_IN2_n
DAC4
SIG_IN3 SIG_IN3_p SIG_IN3_n
SIG_IN4 SIG_IN4_p SIG_IN4_n
DAC13
SIG_IN5 SIG_IN5_p SIG_IN5_n
SIG_IN6 SIG_IN6_p SIG_IN6_n
DAC5
SIG_IN7 SIG_IN7_p SIG_IN7_n
SIG_IN8 SIG_IN8_p SIG_IN8_n
DAC3
SIG_IN9 SIG_IN9_p SIG_IN9_n
SIG_IN10 SIG_IN10_p SIG_IN10_n
DAC11
SIG_IN11 SIG_IN11_p SIG_IN11_n
SIG_IN12 SIG_IN12_p SIG_IN12_n
DAC2
SIG_IN13 SIG_IN13_p SIG_IN13_n
SIG_IN14 SIG_IN14_p SIG_IN14_n
DAC10
SIG_IN15 SIG_IN15_p SIG_IN15_n
SIG_IN16 SIG_IN16_p SIG_IN16_n
DAC14
SIG_IN17 SIG_IN17_p SIG_IN17_n
SIG_IN18 SIG_IN18_p SIG_IN18_n
DAC6
SIG_IN19 SIG_IN19_p SIG_IN19_n
SIG_IN20 SIG_IN20_p SIG_IN20_n
DAC15
SIG_IN21 SIG_IN21_p SIG_IN21_n
SIG_IN22 SIG_IN22_p SIG_IN22_n
DAC7
SIG_IN23 SIG_IN23_p SIG_IN23_n
SIG_IN24 SIG_IN24_p SIG_IN24_n
DAC1
SIG_IN25 SIG_IN25_p SIG_IN25_n
SIG_IN26 SIG_IN26_p SIG_IN26_n
DAC9
SIG_IN27 SIG_IN27_p SIG_IN27_n
SIG_IN28 SIG_IN28_p SIG_IN28_n
DAC0
SIG_IN29 SIG_IN29_p SIG_IN29_n
SIG_IN30 SIG_IN30_p SIG_IN30_n
DAC8
SIG_IN31 SIG_IN31_p SIG_IN31_n

FMC_ADC0 FMC_ADC1

CLK0_C2M_P CLK0_C2M_N CLK1_C2M_P CLK1_C2M_N

FMC_ADC_SYNn FMC_SCK FMC_SDIO

FMC_ADC_CS0n FMC_ADC_CS1n FMC_ADC_CS2n FMC_ADC_CS3n

ADC_VREF → ADC_Vref

## REGULATORS

FMC ADC32 - Power Supply Rev0.SchDoc

## VREF

FMC ADC32 - ADC Voltage Reference.SchDoc

ADC_Vref → ADC_Vref

## U2

Microchip Technology

24AA02E48T-I/OT

FMC_SCL 1 SCL NC 5
GND 2 Gnd
FMC_SDA 3 SDA Vcc 4
SW3.3V
C35 0.1µF 0402
GND

SOT23-5

**I2C Address 0xA0**

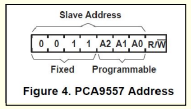



Figure 4. PCA9557 Address

FMC_GBXCVR

DP0_C2M_P DP0_C2M_N DP1_C2M_P DP1_C2M_N DP2_C2M_P DP2_C2M_N DP3_C2M_P DP3_C2M_N DP4_C2M_P DP4_C2M_N DP5_C2M_P DP5_C2M_N DP6_C2M_P DP6_C2M_N DP7_C2M_P DP7_C2M_N DP8_C2M_P DP8_C2M_N DP9_C2M_P DP9_C2M_N

GB_RX_P GB_RX_N

FMC_GBXCVR

DP0_M2C_P DP0_M2C_N DP1_M2C_P DP1_M2C_N DP2_M2C_P DP2_M2C_N DP3_M2C_P DP3_M2C_N DP4_M2C_P DP4_M2C_N DP5_M2C_P DP5_M2C_N DP6_M2C_P DP6_M2C_N DP7_M2C_P DP7_M2C_N DP8_M2C_P DP8_M2C_N DP9_M2C_P DP9_M2C_N

GB_TX_P GB_TX_N

GBTCLK0_M2C_P GBTCLK0_M2C_N GBTCLK1_M2C_P GBTCLK1_M2C_N

## FMC

FMC - ADC32 - FMC Connector.SchDoc

FMC_ADC0 FMC_ADC1 FMC_ADC_SYNn

FMC_SCK FMC_SDIO FMC_DAC_SDO FMC_ADC_CS0n FMC_ADC_CS1n FMC_ADC_CS2n FMC_ADC_CS3n FMC_DAC_CS0n FMC_DAC_CS1n

CLK0_C2M_P CLK0_C2M_N CLK1_C2M_P CLK1_C2M_N CLK0_M2C_P CLK0_M2C_N CLK1_M2C_P CLK1_M2C_N

FMC_GBXCVR

FMC_PG_M2C FMC_PG_C2M

FMC_SCL FMC_SDA

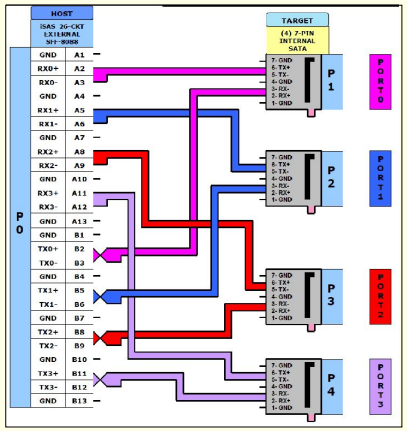
## SATA

| | | | | |
|---|---|---|---|---|
| GND | 1 | eSATA (GND) | NC | MP2 GND |
| GB_RX_P | 2 | eSATA (A+) | | |
| GB_RX_N | 3 | eSATA (A-) | | |
| GND | 4 | eSATA (GND) | | |
| GB_TX_N | 5 | eSATA (B-) | | |
| GB_TX_P | 6 | eSATA (B+) | | |
| GND | 7 | eSATA (GND) | NC | MP1 GND |

SATA - 7-pin SM

0470804005

Molex Inc

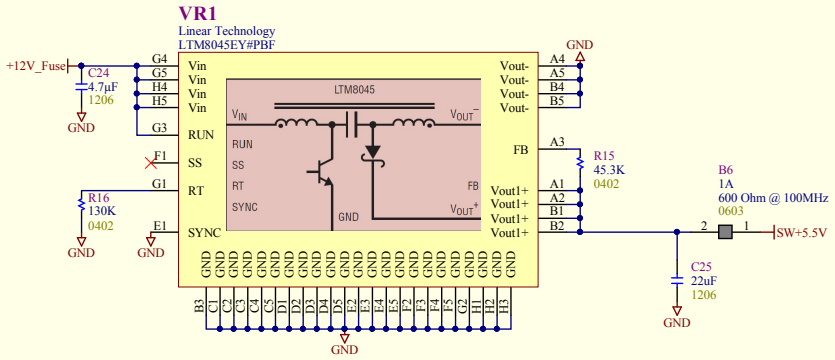


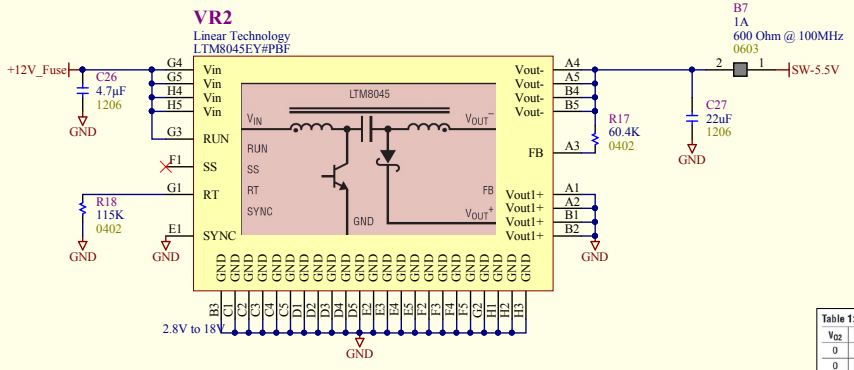

# FMC ADC32 - 32 Channel ADC 65Msps

TRIUMF LOGO

| | | | |
|---|---|---|---|
| Revision 0 | Drawing #: 1 | | TRIUMF 4004 Wesbrook Mall Vancouver, B.C. Canada V6T 2A3 |
| | Sheet #: 1 of 8 | Size: B | |
| | Drawn by:D. Bishop | Date: 7/20/2015 | |
| File: C:\Repositories\GRIF-ADC32\FMC ADC32 Channel ADC Rev0.SchDoc | | | 3:53:52 PM |

GRIFFIN



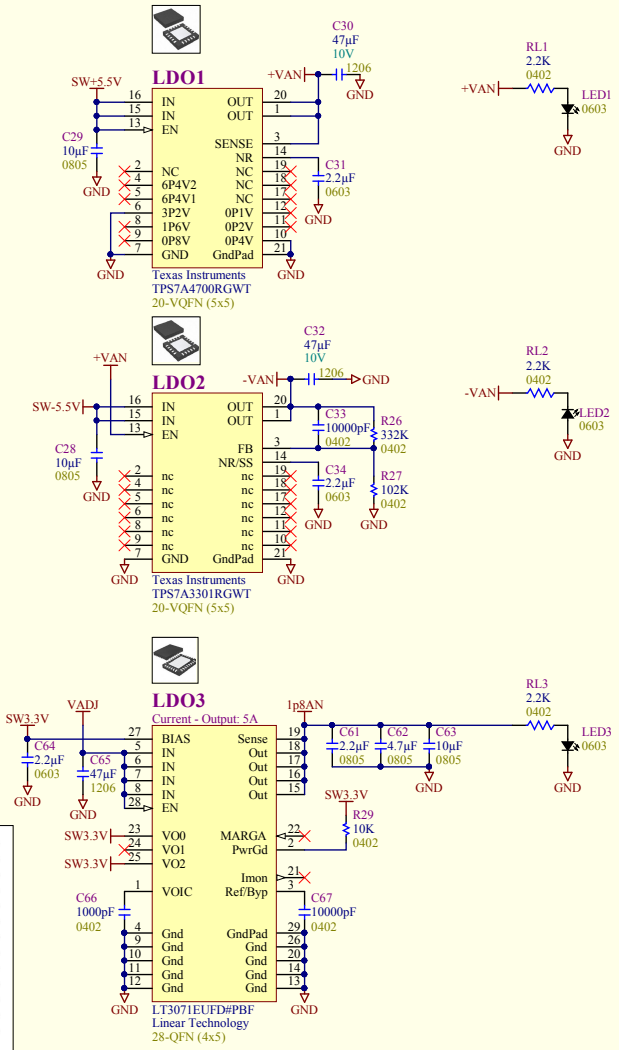




**Table 1: $V_{O2}$ to $V_{O0}$ Settings vs Output Voltage**

| $V_{O2}$ | $V_{O1}$ | $V_{O0}$ | $V_{OUT(NOM)}$ | $V_{O2}$ | $V_{O1}$ | $V_{O0}$ | $V_{OUT(NOM)}$ |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0.80V | Z | 0 | 1 | 1.35V |
| 0 | 0 | Z | 0.85V | Z | Z | 0 | 1.40V |
| 0 | 0 | 1 | 0.90V | Z | Z | Z | 1.45V |
| 0 | Z | 0 | 0.95V | Z | Z | 1 | 1.50V |
| 0 | Z | Z | 1.00V | Z | 1 | 0 | 1.55V |
| 0 | Z | 1 | 1.05V | Z | 1 | Z | 1.60V |
| 0 | 1 | 0 | 1.10V | Z | 1 | 1 | 1.65V |
| 0 | 1 | Z | 1.15V | 1 | X | 0 | 1.70V |
| 0 | 1 | 1 | 1.20V | 1 | X | Z | 1.75V |
| Z | 0 | 0 | 1.25V | 1 | X | 1 | 1.80V |
| Z | 0 | Z | 1.30V | | | | |

X = Don't Care, 0 = Low, Z = Float, 1 = High

The input logic *low* threshold is less than 250mV referenced to GND and the logic *high* threshold is greater than $V_{BIAS}$ – 250mV. The range between these two thresholds as set by a window comparator defines the logic *Hi-Z* state.

## *FMC ADC32 - Power Regulators*

| Revision | Drawing #: 2 | | *TRIUMF* |
|---|---|---|---|
| **0** | Sheet #: 2 of 8 | Size: B | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

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**MPM (Divider)**

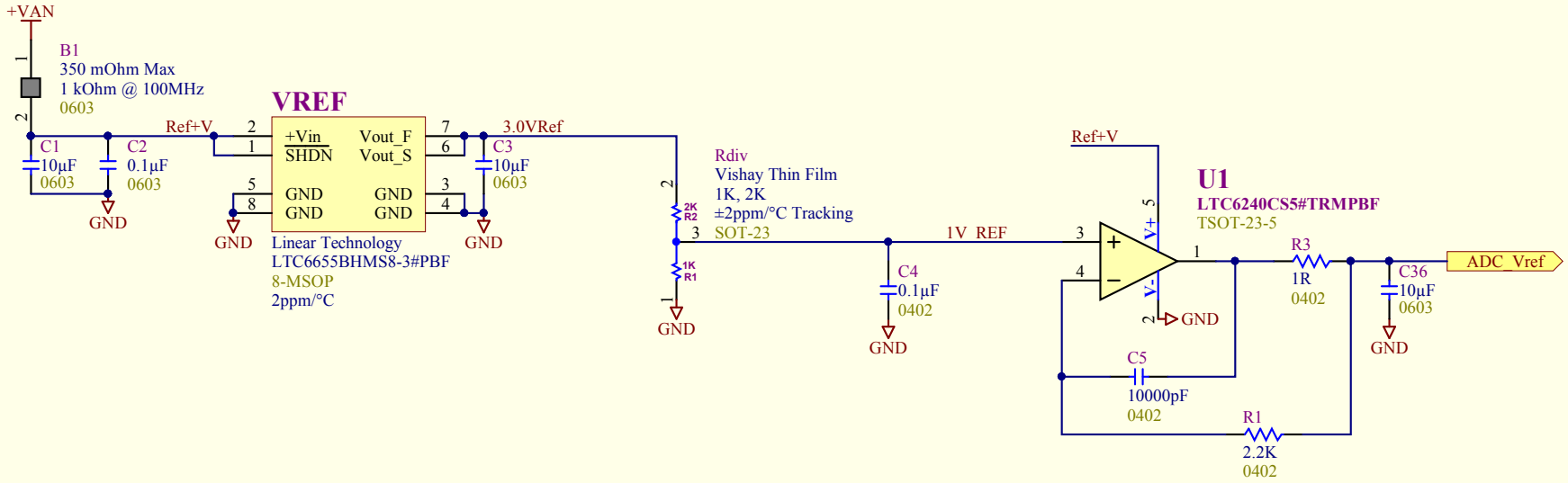
Vishay Dale Thin Film

**, Surface Mount Divider Network**

**FEATURES**

- Excellent long term ratio stability ($\Delta R$ ± 0.015 %, 2000 h, + 70 °C)
- Ratio tolerances to ± 0.01 %
- Low TCR tracking ± 2 ppm
- Standard JEDEC TO-236 package variation AB
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free RoHS* Available HALOGEN FREE




***FMC ADC32 - ADC Voltage Reference***

| Revision | Drawing #: 3 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 3 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

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FMC1C
FMC1D
FMC1A
FMC1B
FMC1G
FMC1H
FMC1F
FMC1E
FMC1I
FMC1J
FMC_GBXCVR
FMC ADC
FMC_ADC0
FMC_ADC1
GB_TXRX
SW3.3V
VADJ
FMC - ADC32 - FMC Connector
TRIUMF
4004 Wesbrook Mall
Vancouver, B.C.
Canada
V6T 2A3
Revision
0
Drawing #:4
Sheet # 4 of 8
Size: C
Drawn by:D.Bishop
Date: 7/20/2015
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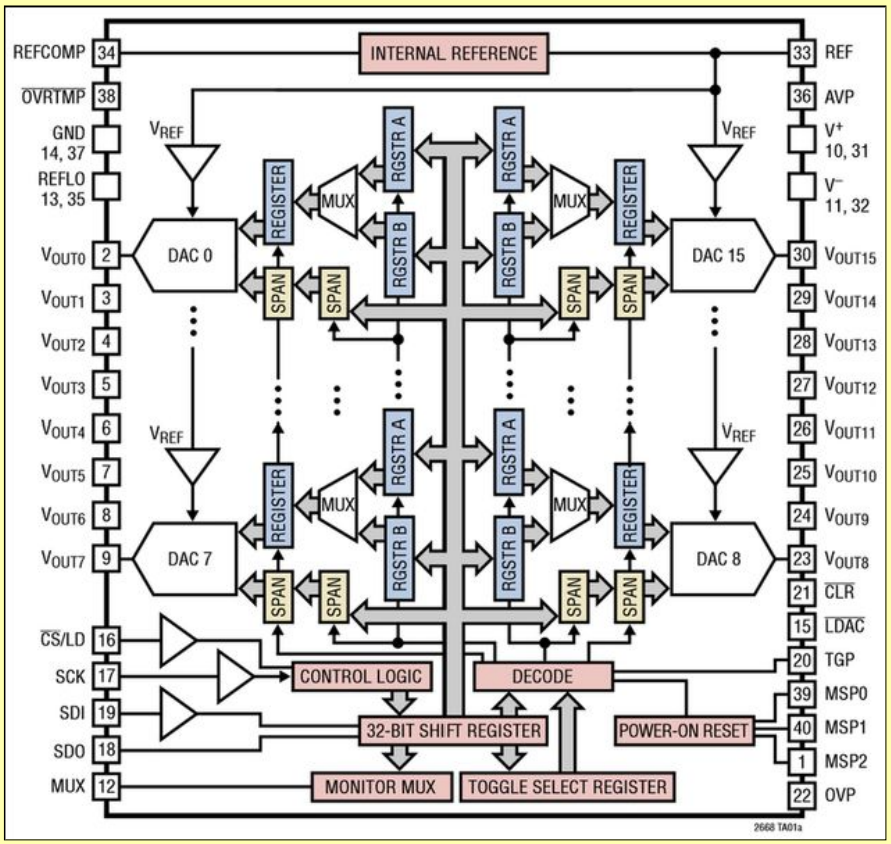
# DAC

Linear Technology
LTC2668CUJ-12#PBF
16 Channel 12-bit bipolar DAC




40-QFN (6x6)

C41 0.1µF 0402
GND — 34 REFCOMP
Use Internal REF
38 OTEMP
GND — 14 GND
GND — 37 GND
GND — 13 REFLO
GND — 35 REFLO

DAC0 — DAC0 2 — VOUT0
DAC1 — DAC1 3 — VOUT1
DAC2 — DAC2 4 — VOUT2
DAC3 — DAC3 5 — VOUT3
DAC4 — DAC4 6 — VOUT4
DAC5 — DAC5 7 — VOUT5
DAC6 — DAC6 8 — VOUT6
DAC7 — DAC7 9 — VOUT7

SPI interface
DAC_CSn — 16 CS/LD
DAC_SCK — 17 SCK
DAC_SDI — 19 SDI
DAC_SDO — 18 SD0

12 MUX

Use Internal REF
GND — C42 0.1µF 0402 — 33 REF

36 AVP — +VAN
22 OVP — VADJ
10 V+ — +VAN
31 V+
11 V- — -VAN
32 V-
41 PAD V-

30 VOUT15 — DAC15
29 VOUT14 — DAC14
28 VOUT13 — DAC13
27 VOUT12 — DAC12
26 VOUT11 — DAC11
25 VOUT10 — DAC10
24 VOUT9 — DAC9
23 VOUT8 — DAC8

21 CLR — VADJ
15 LDAC — VADJ
20 TGP — GND
39 MSP0 — +VAN
40 MSP1 — +VAN
1 MSP2 — +VAN

VADJ
C39 2.2µF 0402 — C40 0.1µF 0402 — GND
+VAN
C43 2.2µF 0402 — C44 0.1µF 0402 — GND
+VAN
C45 2.2µF 0402 — C46 0.1µF 0402 — GND
-VAN
C47 2.2µF 0402 — C48 0.1µF 0402 — GND

DAC updates via SPI interface

Not using toggle operation

Soft Span Operation
Reset = Zero Scale

Cd1 1000pF DAC0 0402 GND
Cd2 1000pF DAC1 0402 GND
Cd3 1000pF DAC2 0402 GND
Cd4 1000pF DAC3 0402 GND
Cd5 1000pF DAC4 0402 GND
Cd6 1000pF DAC5 0402 GND
Cd7 1000pF DAC6 0402 GND
Cd8 1000pF DAC7 0402 GND
Cd9 1000pF DAC8 0402 GND
Cd10 1000pF DAC9 0402 GND
Cd11 1000pF DAC10 0402 GND
Cd12 1000pF DAC11 0402 GND
Cd13 1000pF DAC12 0402 GND
Cd14 1000pF DAC13 0402 GND
Cd15 1000pF DAC14 0402 GND
Cd16 1000pF DAC15 0402 GND

The device has a precision 2.5V integrated reference with a typical temperature drift of 2ppm/°C. To use the internal reference, the REFCOMP pin should be left floating (no DC path to ground). In addition, the RD bit in the config register must have a value of 0. This value is reset to 0 at power-up, or it can be reset using the *Config* command, 0111b. Figure 9 shows the command syntax.

**Manual Span Operation**

Multiple output ranges are not needed in all applications. By tying the MSPAN pins (MSP2, MSP1 and MSP0) to GND and/or AVP, any output range can be hardware-configured without additional operational overhead. Zero-scale and mid-scale reset options are also available for the unipolar modes (see Table 4).

**Table 4. MSPAN Pin Configurations**

| MSP2 | MSP1 | MSP0 | OUTPUT RANGE | RESET CODE | MANUAL SPAN | SOFT-SPAN |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | ±10V | Mid-Scale | X | |
| 0 | 0 | AVP | ±5V | Mid-Scale | X | |
| 0 | AVP | 0 | ±2.5V | Mid-Scale | X | |
| 0 | AVP | AVP | 0V to 10V | Zero-Scale | X | |
| AVP | 0 | 0 | 0V to 10V | Mid-Scale | X | |
| AVP | 0 | AVP | 0V to 5V | Zero-Scale | X | |
| AVP | AVP | 0 | 0V to 5V | Mid-Scale | X | |
| AVP | AVP | AVP | 0V to 5V | Zero-Scale | | X |

## *FMC ADC32 - Offset DAC (LTC2668)*

| Revision | Drawing #: 5 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 5 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

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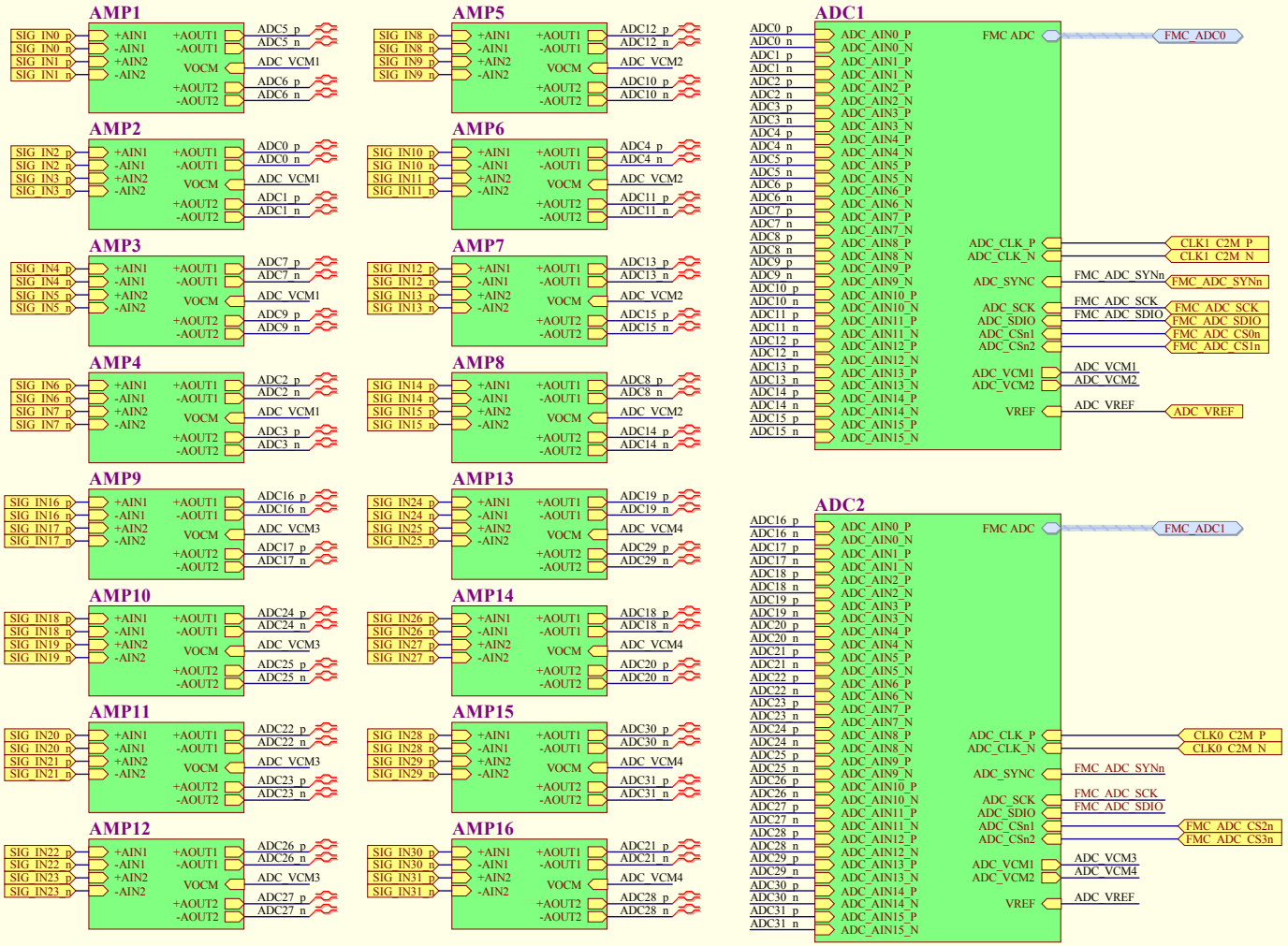
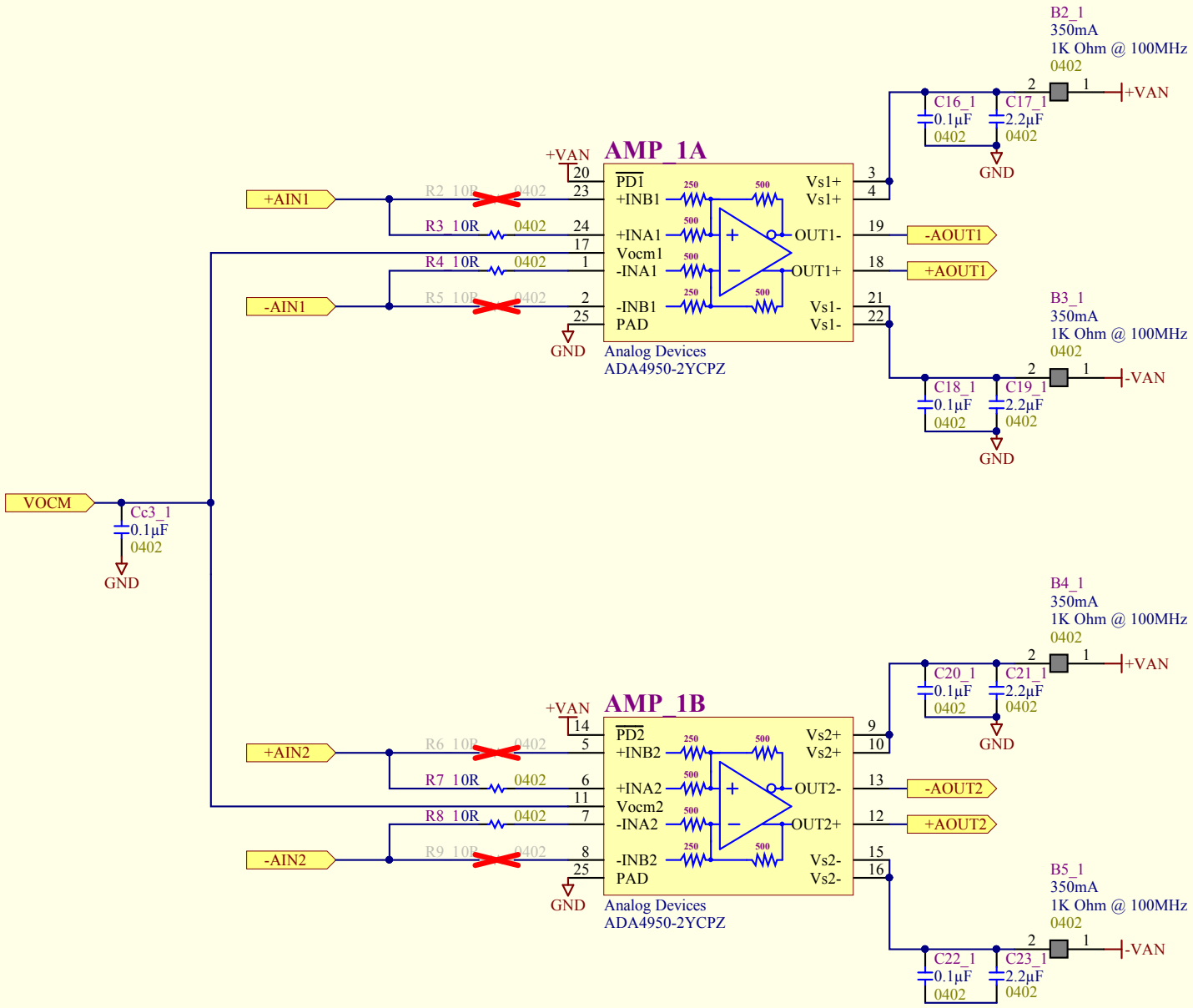
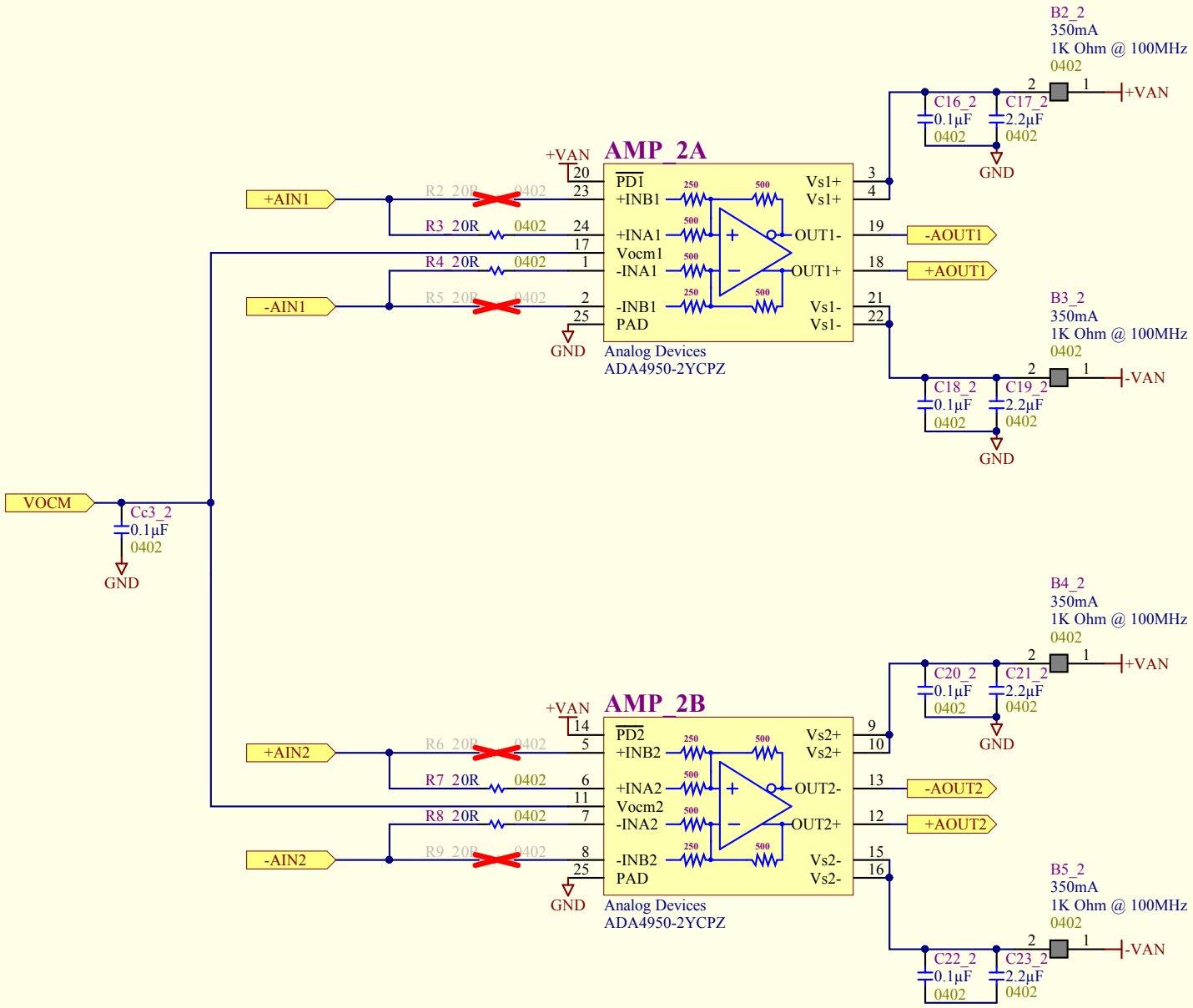

AMP1
SIG_IN0_p
SIG_IN0_n
SIG_IN1_p
SIG_IN1_n
+AIN1
-AIN1
+AIN2
-AIN2
+AOUT1
-AOUT1
VOCM
+AOUT2
-AOUT2
ADC5_p
ADC5_n
ADC_VCM1
ADC6_p
ADC6_n
AMP2
SIG_IN2_p
SIG_IN2_n
SIG_IN3_p
SIG_IN3_n
ADC0_p
ADC0_n
ADC_VCM1
ADC1_p
ADC1_n
AMP3
SIG_IN4_p
SIG_IN4_n
SIG_IN5_p
SIG_IN5_n
ADC7_p
ADC7_n
ADC_VCM1
ADC9_p
ADC9_n
AMP4
SIG_IN6_p
SIG_IN6_n
SIG_IN7_p
SIG_IN7_n
ADC2_p
ADC2_n
ADC_VCM1
ADC3_p
ADC3_n
AMP5
SIG_IN8_p
SIG_IN8_n
SIG_IN9_p
SIG_IN9_n
ADC12_p
ADC12_n
ADC_VCM2
ADC10_p
ADC10_n
AMP6
SIG_IN10_p
SIG_IN10_n
SIG_IN11_p
SIG_IN11_n
ADC4_p
ADC4_n
ADC_VCM2
ADC11_p
ADC11_n
AMP7
SIG_IN12_p
SIG_IN12_n
SIG_IN13_p
SIG_IN13_n
ADC13_p
ADC13_n
ADC_VCM2
ADC15_p
ADC15_n
AMP8
SIG_IN14_p
SIG_IN14_n
SIG_IN15_p
SIG_IN15_n
ADC8_p
ADC8_n
ADC_VCM2
ADC14_p
ADC14_n
AMP9
SIG_IN16_p
SIG_IN16_n
SIG_IN17_p
SIG_IN17_n
ADC16_p
ADC16_n
ADC_VCM3
ADC17_p
ADC17_n
AMP10
SIG_IN18_p
SIG_IN18_n
SIG_IN19_p
SIG_IN19_n
ADC24_p
ADC24_n
ADC_VCM3
ADC25_p
ADC25_n
AMP11
SIG_IN20_p
SIG_IN20_n
SIG_IN21_p
SIG_IN21_n
ADC22_p
ADC22_n
ADC_VCM3
ADC23_p
ADC23_n
AMP12
SIG_IN22_p
SIG_IN22_n
SIG_IN23_p
SIG_IN23_n
ADC26_p
ADC26_n
ADC_VCM3
ADC27_p
ADC27_n
AMP13
SIG_IN24_p
SIG_IN24_n
SIG_IN25_p
SIG_IN25_n
ADC19_p
ADC19_n
ADC_VCM4
ADC29_p
ADC29_n
AMP14
SIG_IN26_p
SIG_IN26_n
SIG_IN27_p
SIG_IN27_n
ADC18_p
ADC18_n
ADC_VCM4
ADC20_p
ADC20_n
AMP15
SIG_IN28_p
SIG_IN28_n
SIG_IN29_p
SIG_IN29_n
ADC30_p
ADC30_n
ADC_VCM4
ADC31_p
ADC31_n
AMP16
SIG_IN30_p
SIG_IN30_n
SIG_IN31_p
SIG_IN31_n
ADC21_p
ADC21_n
ADC_VCM4
ADC28_p
ADC28_n
ADC1
ADC0_p
ADC0_n
ADC1_p
ADC1_n
ADC2_p
ADC2_n
ADC3_p
ADC3_n
ADC4_p
ADC4_n
ADC5_p
ADC5_n
ADC6_p
ADC6_n
ADC7_p
ADC7_n
ADC8_p
ADC8_n
ADC9_p
ADC9_n
ADC10_p
ADC10_n
ADC11_p
ADC11_n
ADC12_p
ADC12_n
ADC13_p
ADC13_n
ADC14_p
ADC14_n
ADC15_p
ADC15_n
ADC_AIN0_P
ADC_AIN0_N
ADC_AIN1_P
ADC_AIN1_N
ADC_AIN2_P
ADC_AIN2_N
ADC_AIN3_P
ADC_AIN3_N
ADC_AIN4_P
ADC_AIN4_N
ADC_AIN5_P
ADC_AIN5_N
ADC_AIN6_P
ADC_AIN6_N
ADC_AIN7_P
ADC_AIN7_N
ADC_AIN8_P
ADC_AIN8_N
ADC_AIN9_P
ADC_AIN9_N
ADC_AIN10_P
ADC_AIN10_N
ADC_AIN11_P
ADC_AIN11_N
ADC_AIN12_P
ADC_AIN12_N
ADC_AIN13_P
ADC_AIN13_N
ADC_AIN14_P
ADC_AIN14_N
ADC_AIN15_P
ADC_AIN15_N
FMC ADC
FMC_ADC0
ADC_CLK_P
ADC_CLK_N
CLK1_C2M_P
CLK1_C2M_N
ADC_SYNC
FMC_ADC_SYNn
ADC_SCK
ADC_SDIO
FMC_ADC_SCK
FMC_ADC_SDIO
ADC_CSn1
ADC_CSn2
FMC_ADC_CS0n
FMC_ADC_CS1n
ADC_VCM1
ADC_VCM2
VREF
ADC_VREF
ADC2
ADC16_p
ADC16_n
ADC17_p
ADC17_n
ADC18_p
ADC18_n
ADC19_p
ADC19_n
ADC20_p
ADC20_n
ADC21_p
ADC21_n
ADC22_p
ADC22_n
ADC23_p
ADC23_n
ADC24_p
ADC24_n
ADC25_p
ADC25_n
ADC26_p
ADC26_n
ADC27_p
ADC27_n
ADC28_p
ADC28_n
ADC29_p
ADC29_n
ADC30_p
ADC30_n
ADC31_p
ADC31_n
ADC_AIN0_P
ADC_AIN0_N
ADC_AIN1_P
ADC_AIN1_N
ADC_AIN2_P
ADC_AIN2_N
ADC_AIN3_P
ADC_AIN3_N
ADC_AIN4_P
ADC_AIN4_N
ADC_AIN5_P
ADC_AIN5_N
ADC_AIN6_P
ADC_AIN6_N
ADC_AIN7_P
ADC_AIN7_N
ADC_AIN8_P
ADC_AIN8_N
ADC_AIN9_P
ADC_AIN9_N
ADC_AIN10_P
ADC_AIN10_N
ADC_AIN11_P
ADC_AIN11_N
ADC_AIN12_P
ADC_AIN12_N
ADC_AIN13_P
ADC_AIN13_N
ADC_AIN14_P
ADC_AIN14_N
ADC_AIN15_P
ADC_AIN15_N
FMC ADC
FMC_ADC1
ADC_CLK_P
ADC_CLK_N
CLK0_C2M_P
CLK0_C2M_N
ADC_SYNC
FMC_ADC_SYNn
ADC_SCK
ADC_SDIO
FMC_ADC_SCK
FMC_ADC_SDIO
ADC_CSn1
ADC_CSn2
FMC_ADC_CS2n
FMC_ADC_CS3n
ADC_VCM1
ADC_VCM2
VREF
ADC_VREF
FMC ADC32 - ADC Front End
Revision
0
Drawing #: 6
Sheet #: 6 of 8
Size: B
Drawn by:D.Bishop
Date: 7/20/2015
TRIUMF
4004 Wesbrook Mall
Vancouver, B.C.
Canada
V6T 2A3
GRIFFIN
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - ADC Front End.SchDoc
3:53:53 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

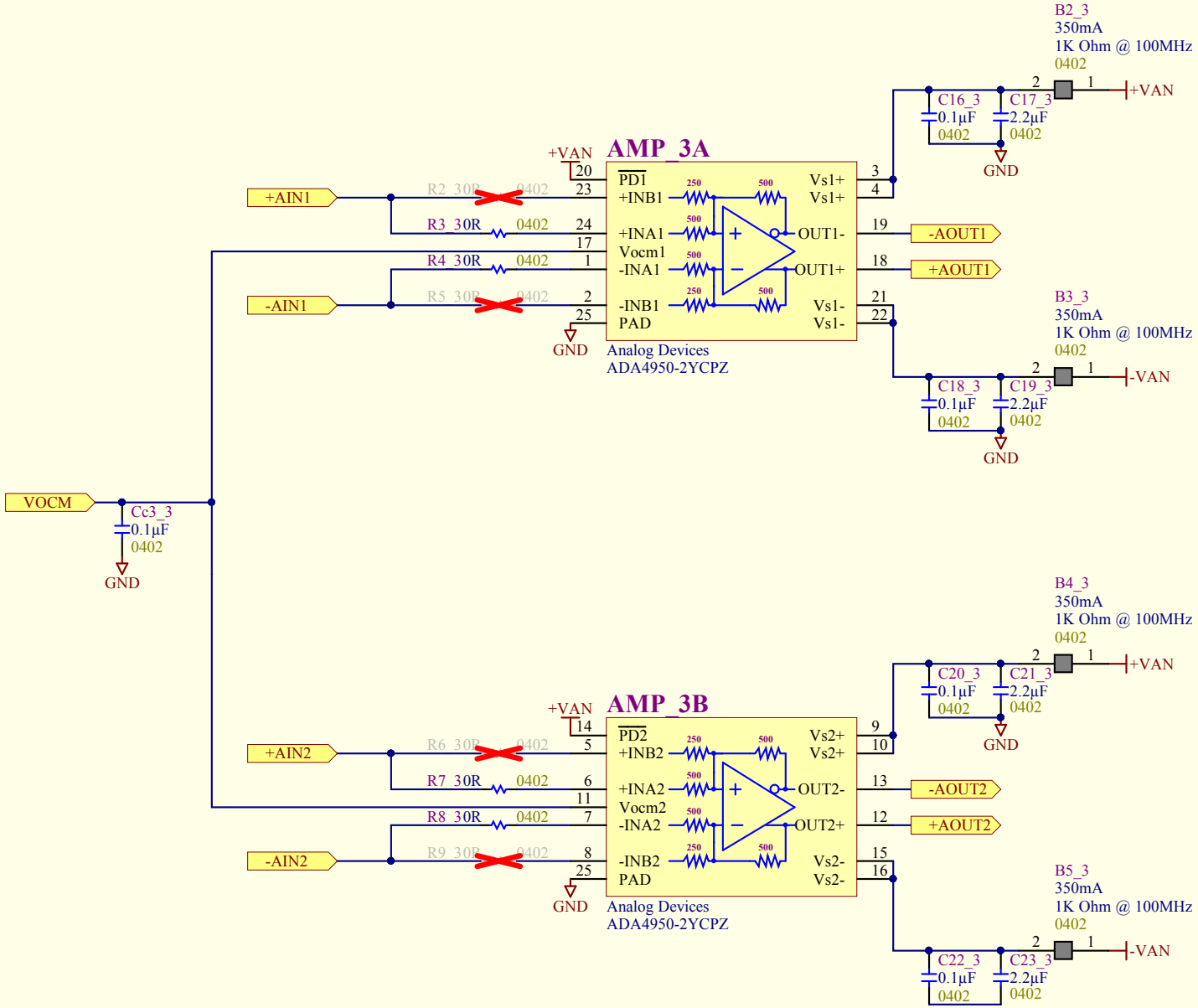
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:54 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

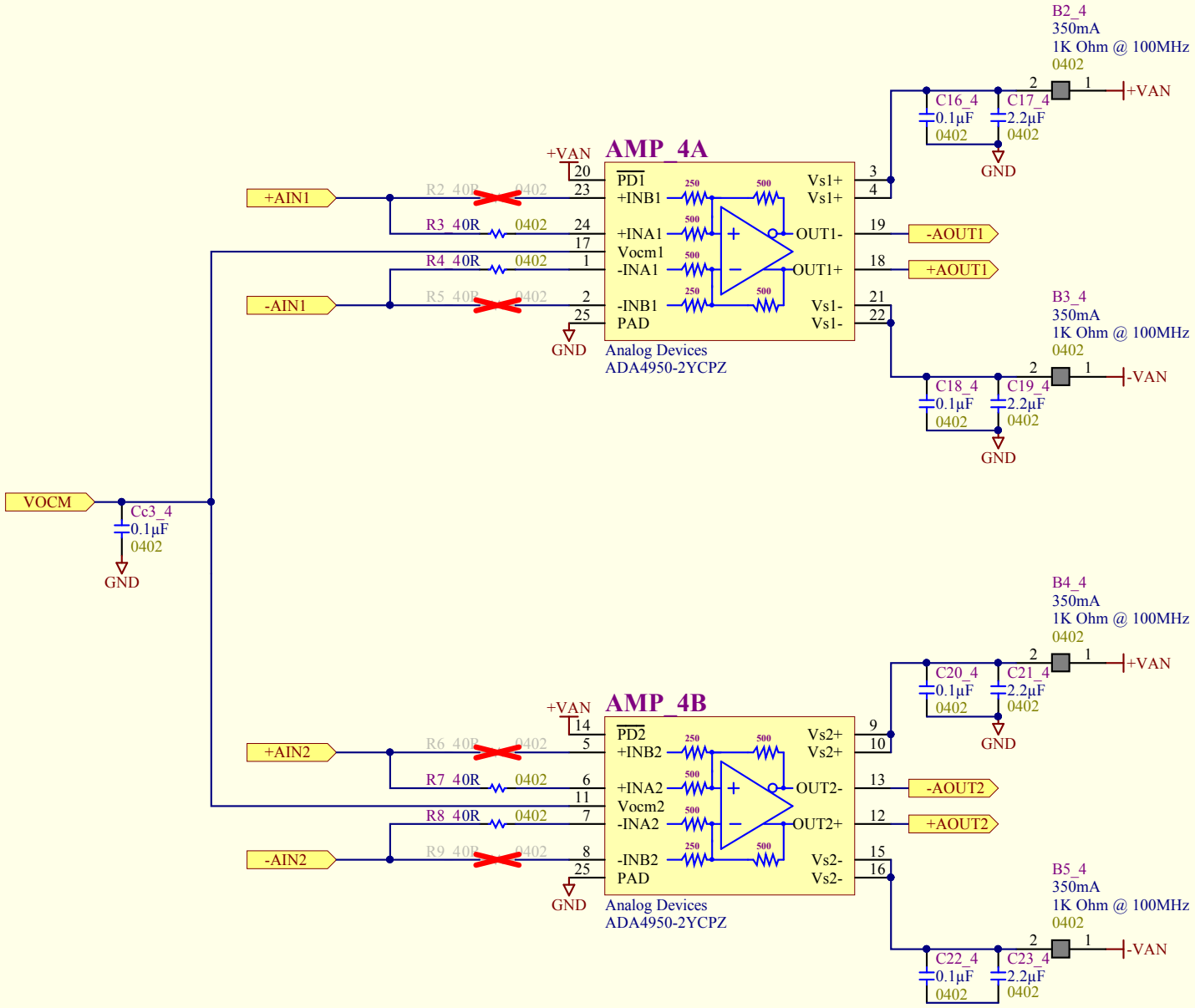
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:54 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

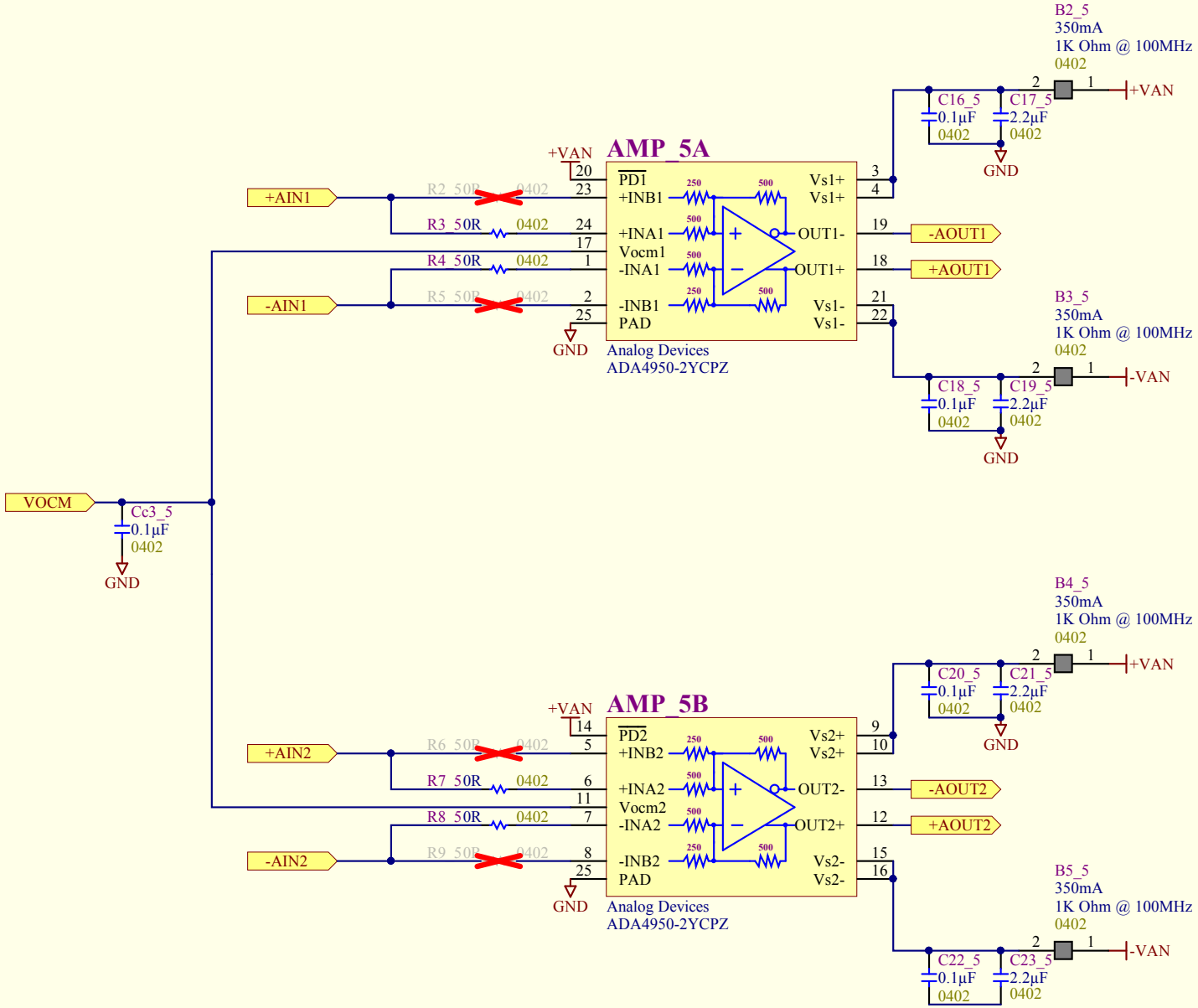
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:54 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

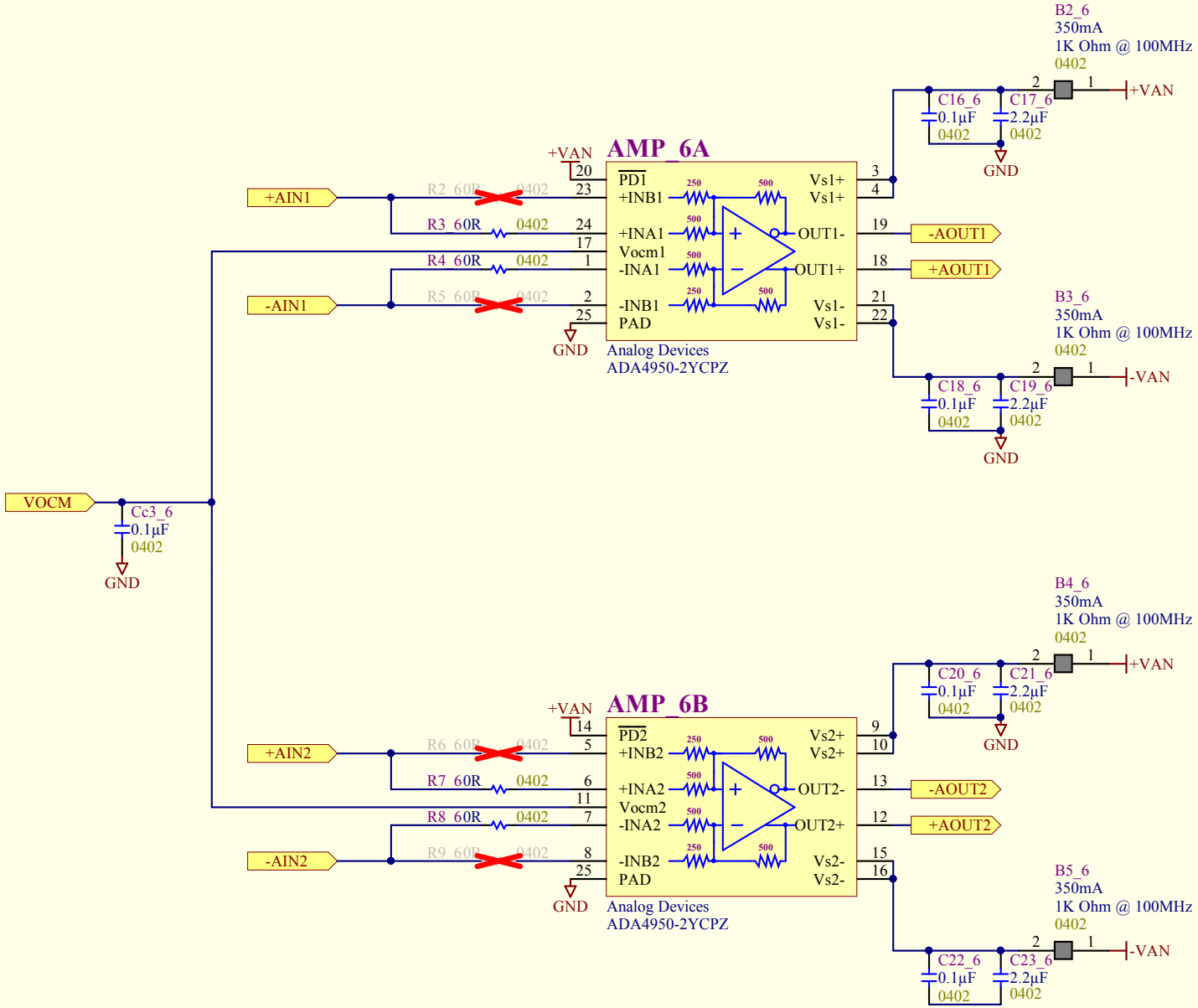
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:54 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

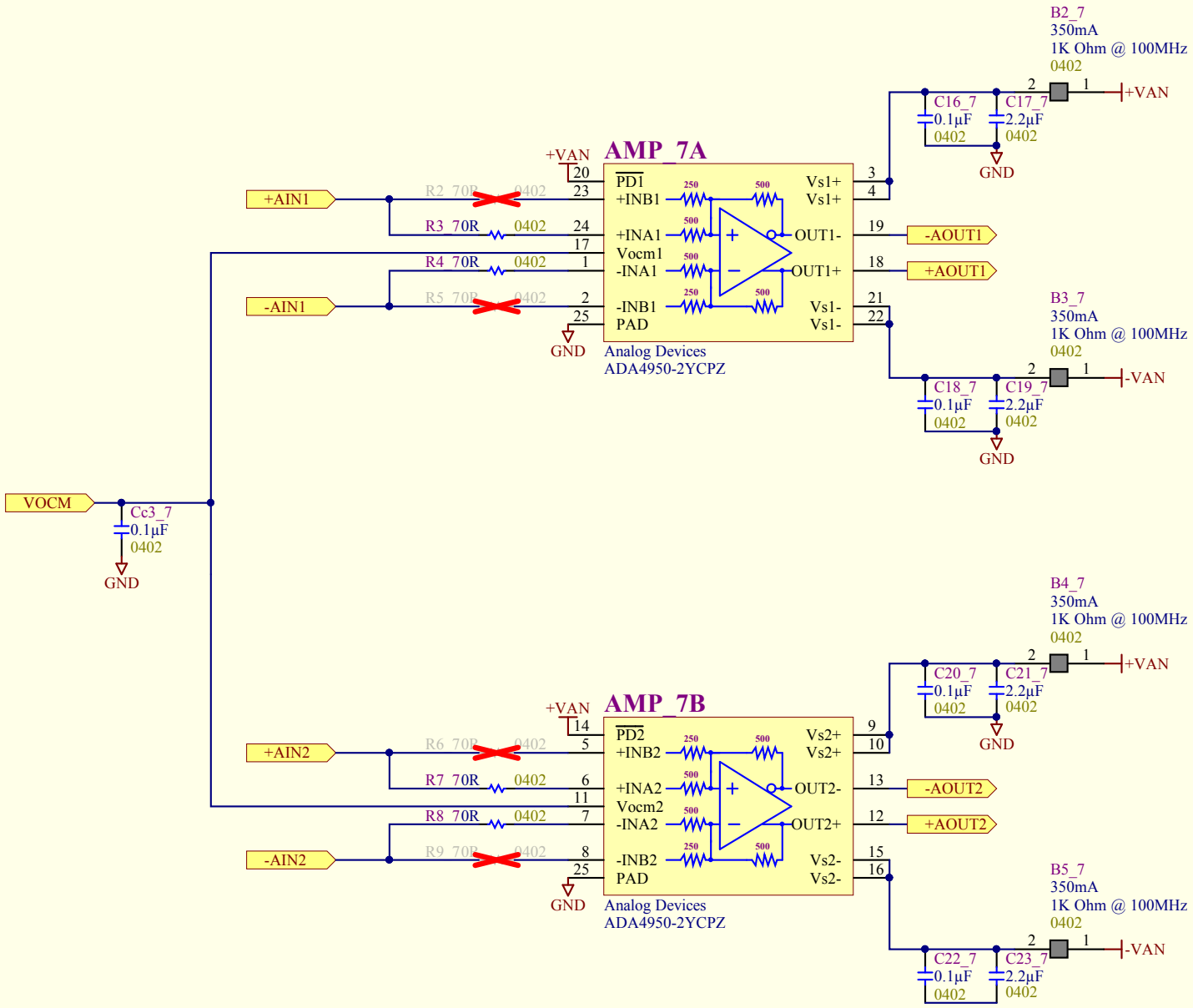
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:54 PM




## *FMC ADC32 - Dual Amp - ADA4950-2YCPZ*

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

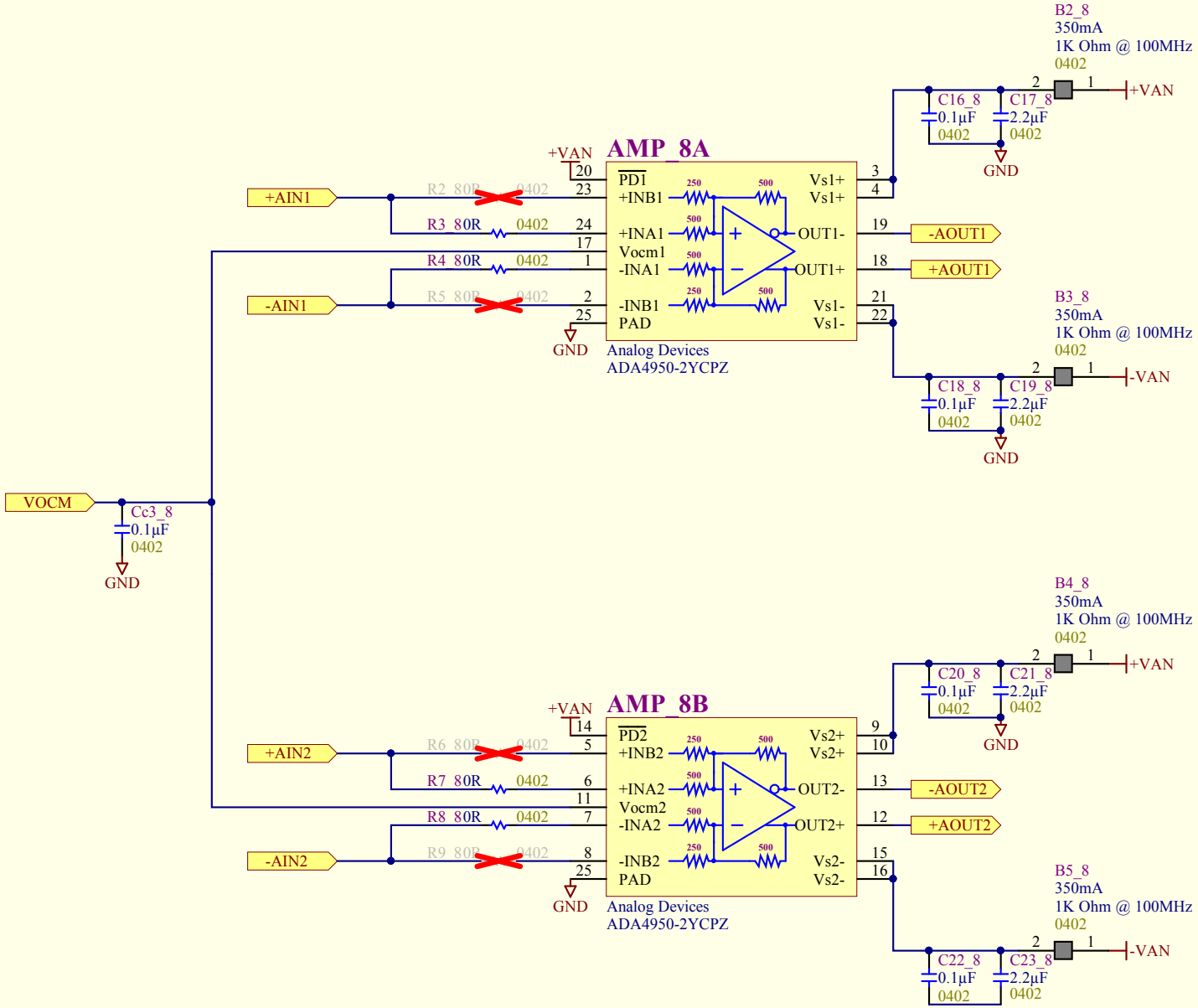
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:55 PM




## *FMC ADC32 - Dual Amp - ADA4950-2YCPZ*

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

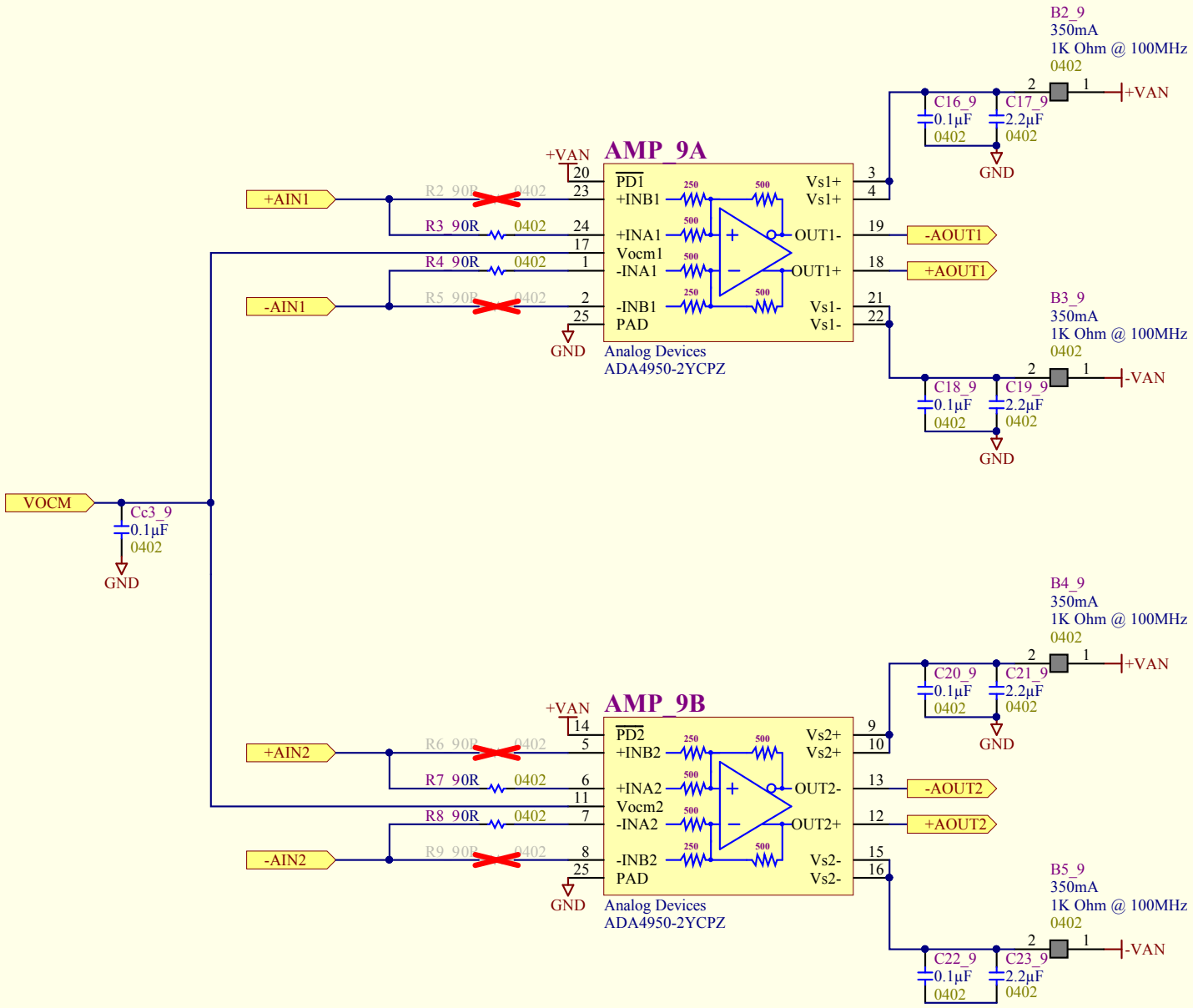
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:55 PM




## *FMC ADC32 - Dual Amp - ADA4950-2YCPZ*

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

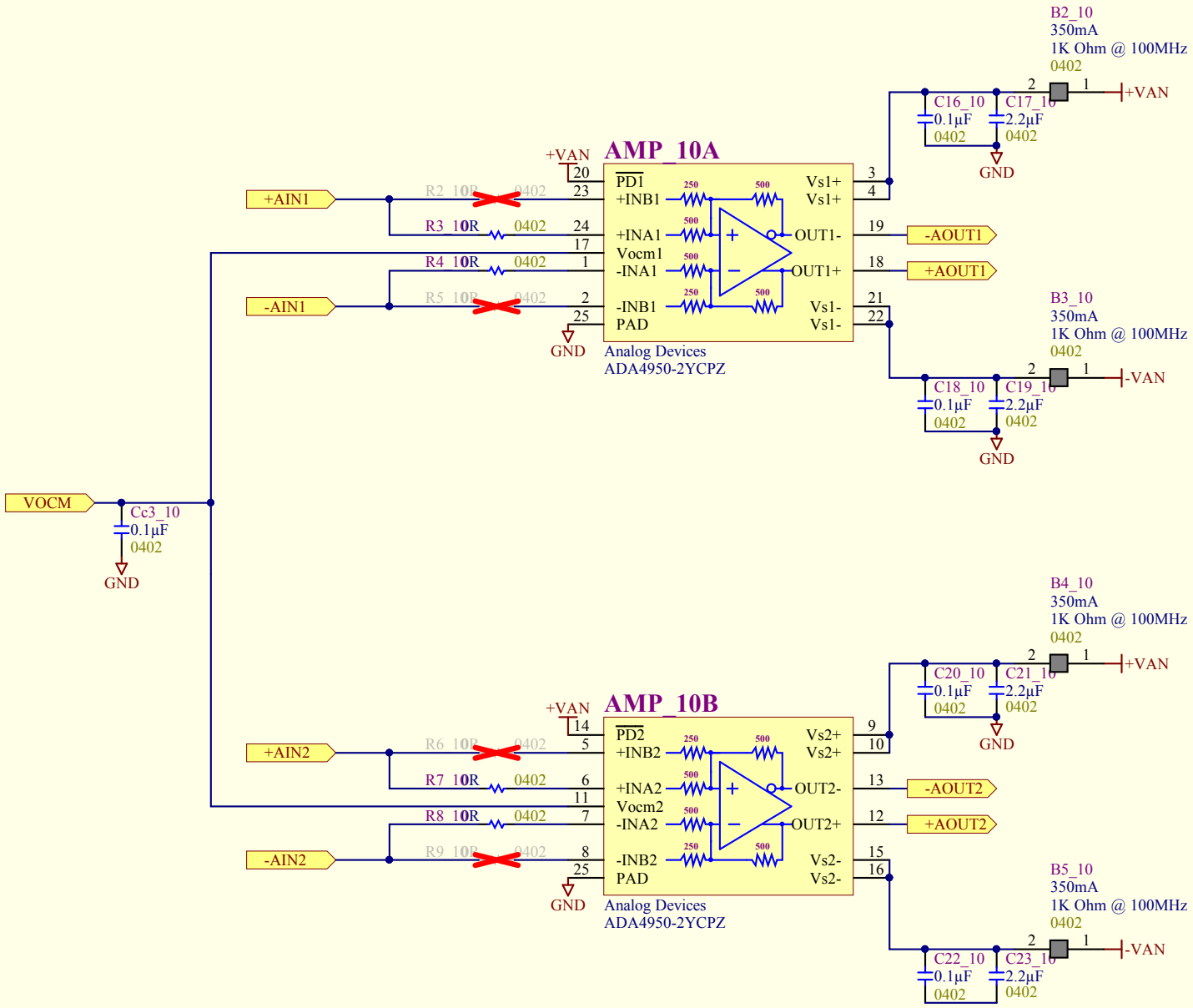
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:55 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

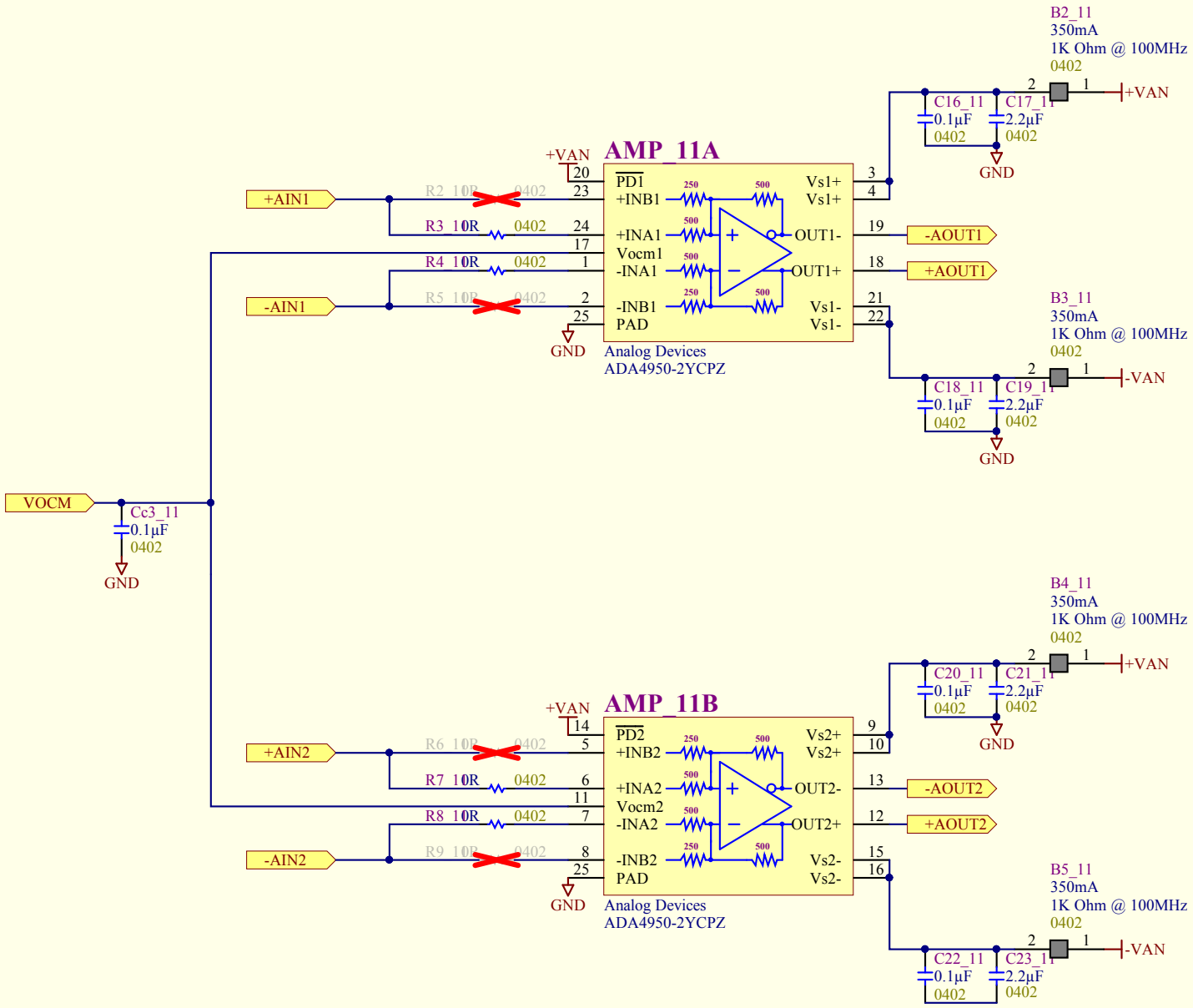
File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:55 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:55 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

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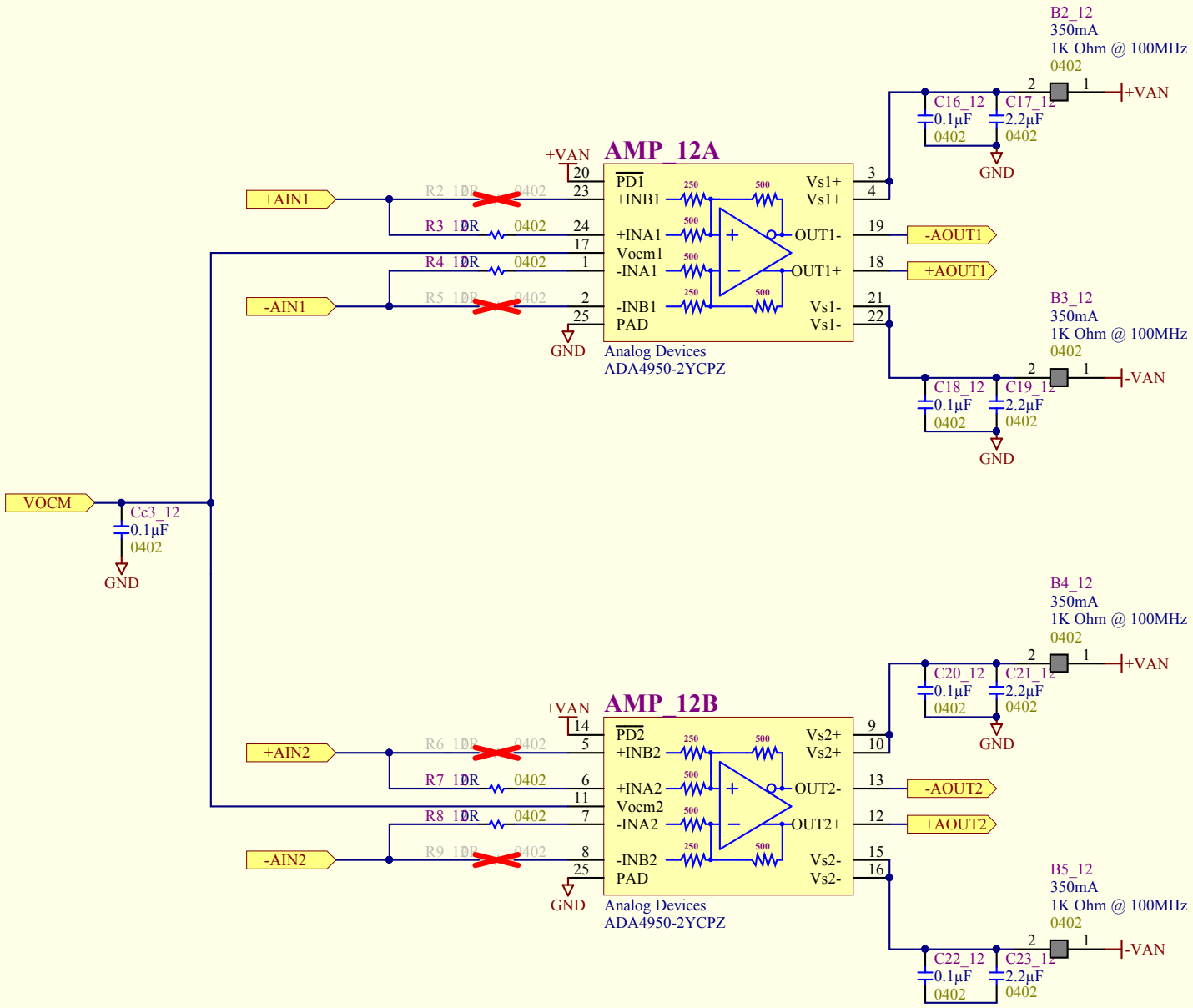
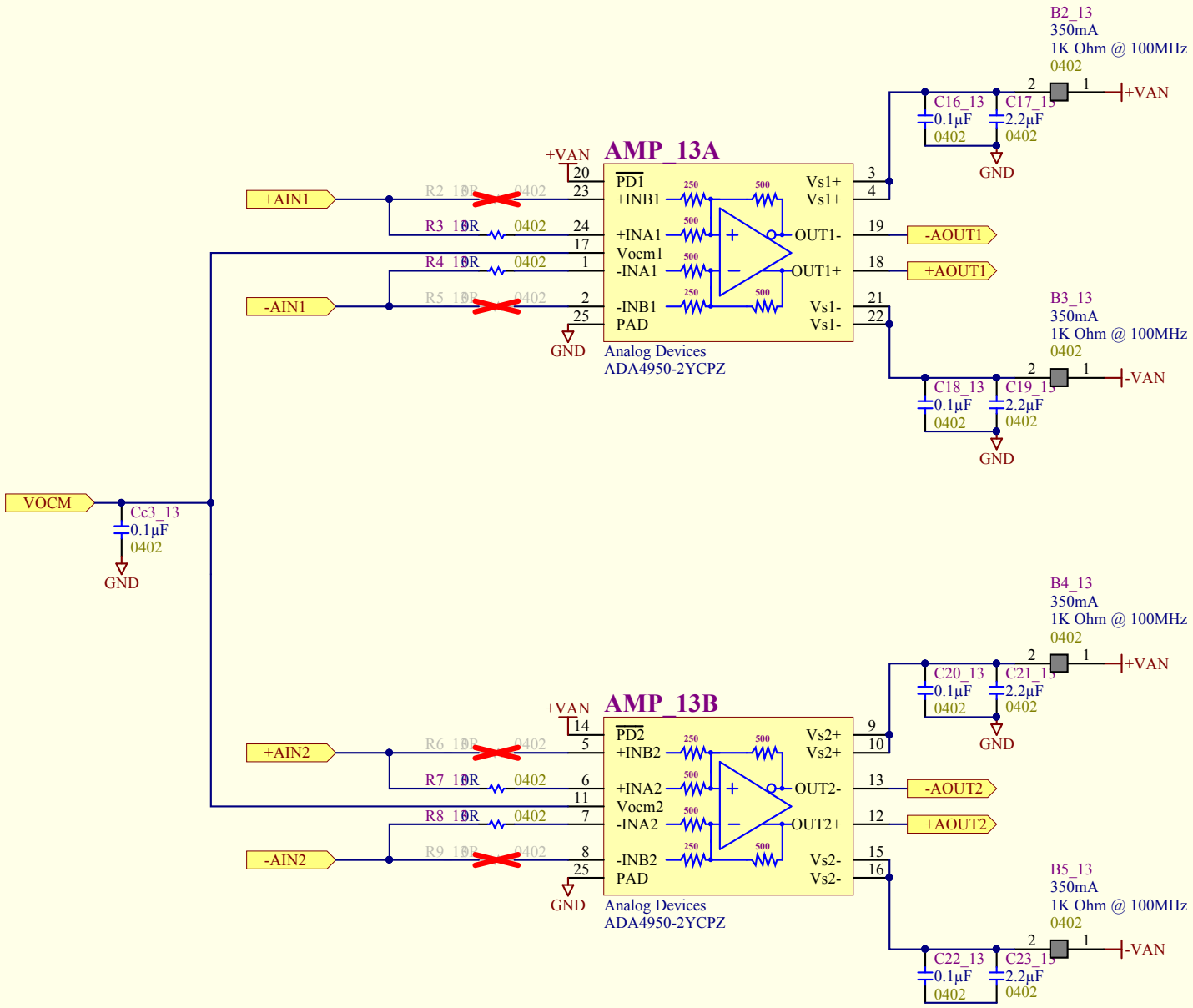



## *FMC ADC32 - Dual Amp - ADA4950-2YCPZ*

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:56 PM




## FMC ADC32 - Dual Amp - ADA4950-2YCPZ

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

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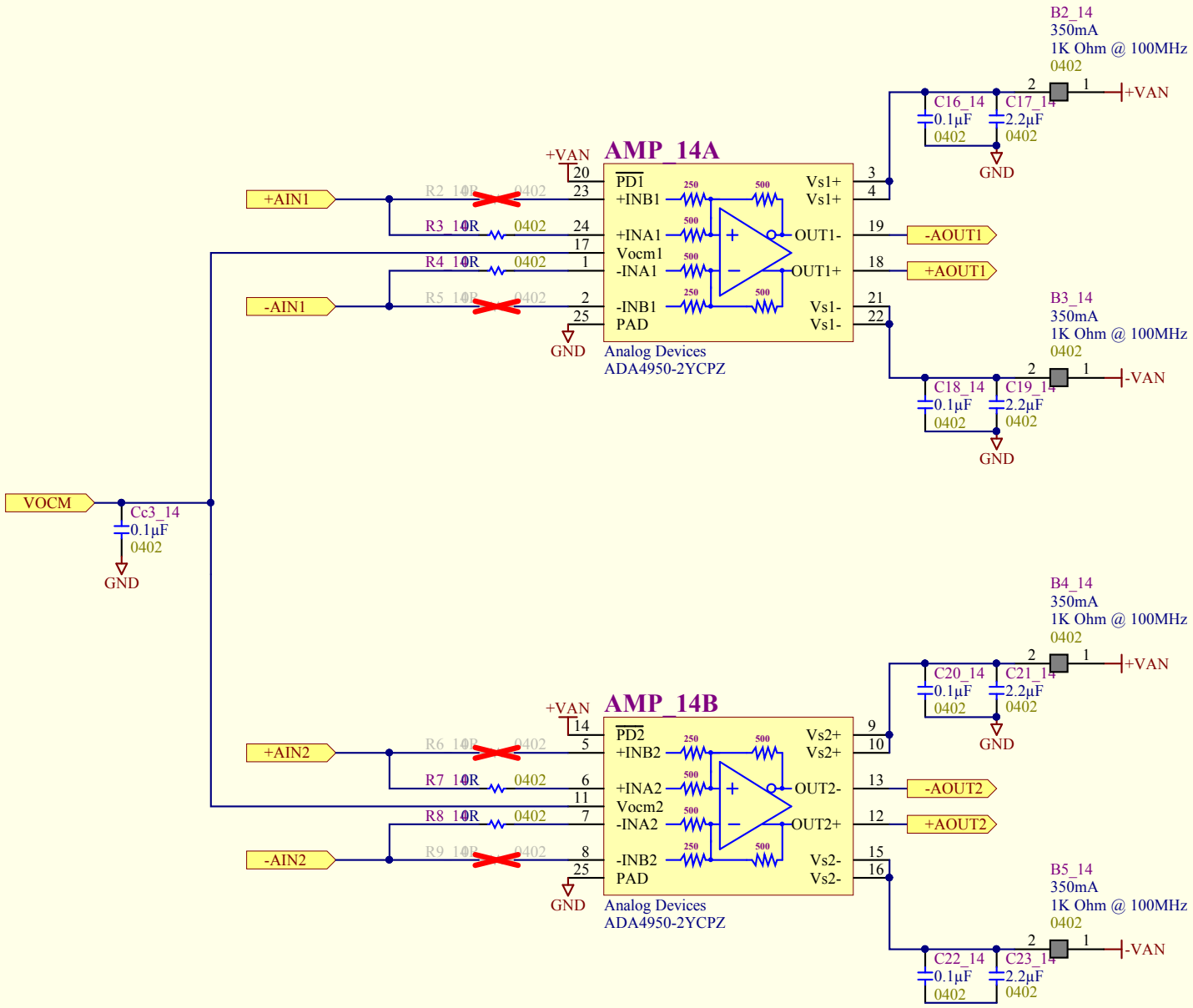
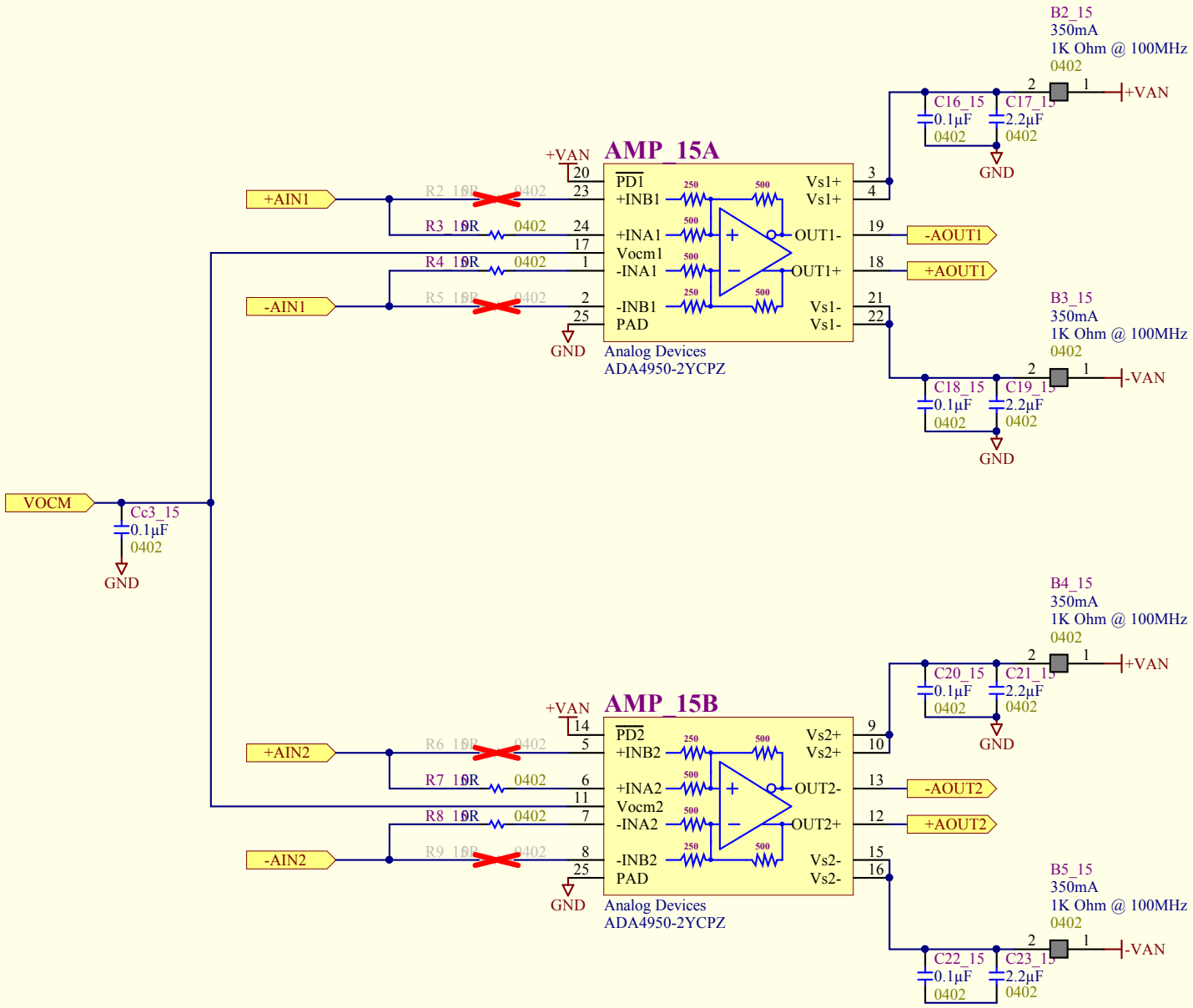



## *FMC ADC32 - Dual Amp - ADA4950-2YCPZ*

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

File: C:\Repositories\GRIF-ADC32\FMC ADC32 - Dual Amplifier - ADA4950-2.SchDoc 3:53:56 PM




## *FMC ADC32 - Dual Amp - ADA4950-2YCPZ*

| Revision | Drawing #: 7 | | *TRIUMF* |
|---|---|---|---|
| **0** | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

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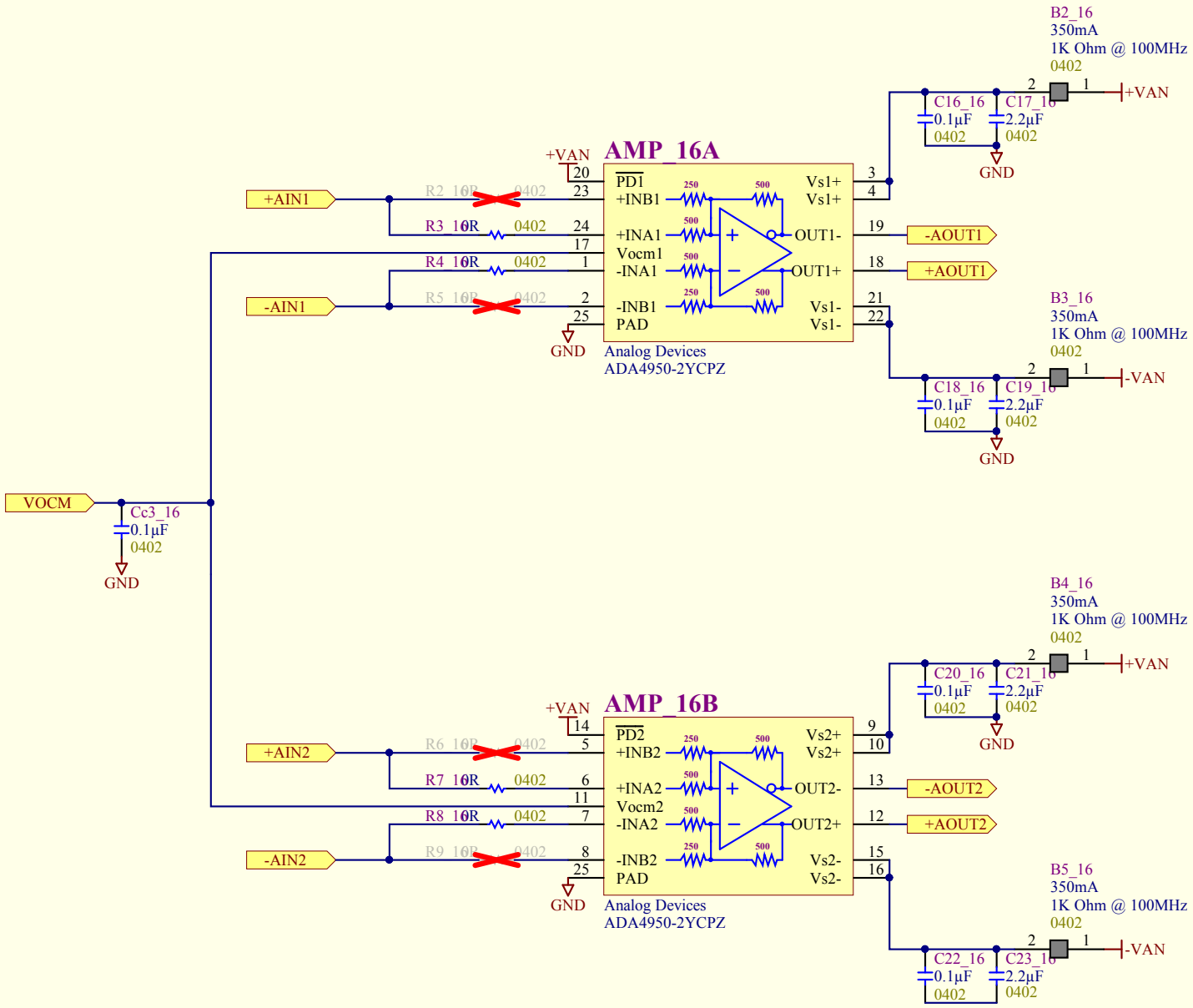


## *FMC ADC32 - Dual Amp - ADA4950-2YCPZ*

| Revision | Drawing #: 7 | | TRIUMF |
|---|---|---|---|
| 0 | Sheet #: 7 of 8 | Size: A | 4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by: D.Bishop | Date: 7/20/2015 | |

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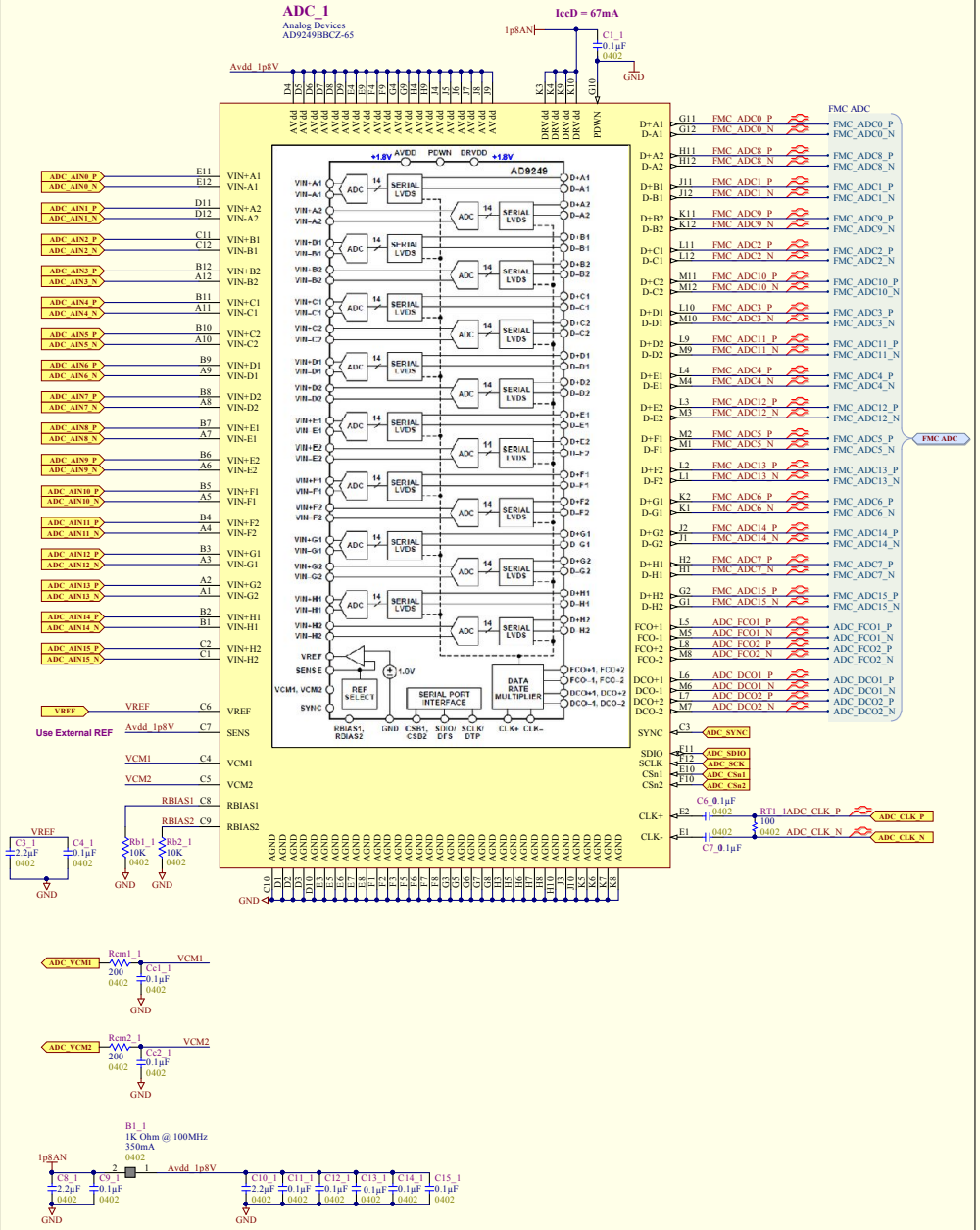


**FMC ADC32 - AD9249 65Msps HEX ADC**

| | | | |
|---|---|---|---|
| Revision 0 | Drawing #: 8 | | TRIUMF 4004 Wesbrook Mall Vancouver, B.C. Canada V6T 2A3 |
| | Sheet #: 8 of 8 | Size: B | |
| | Drawn by:D.Bishop | Date: 7/20/2015 | |

File: C:\Repositories\GRIF-ADC32\FMC ADC32 - AD9249 HEX ADC Rev0.SchDoc

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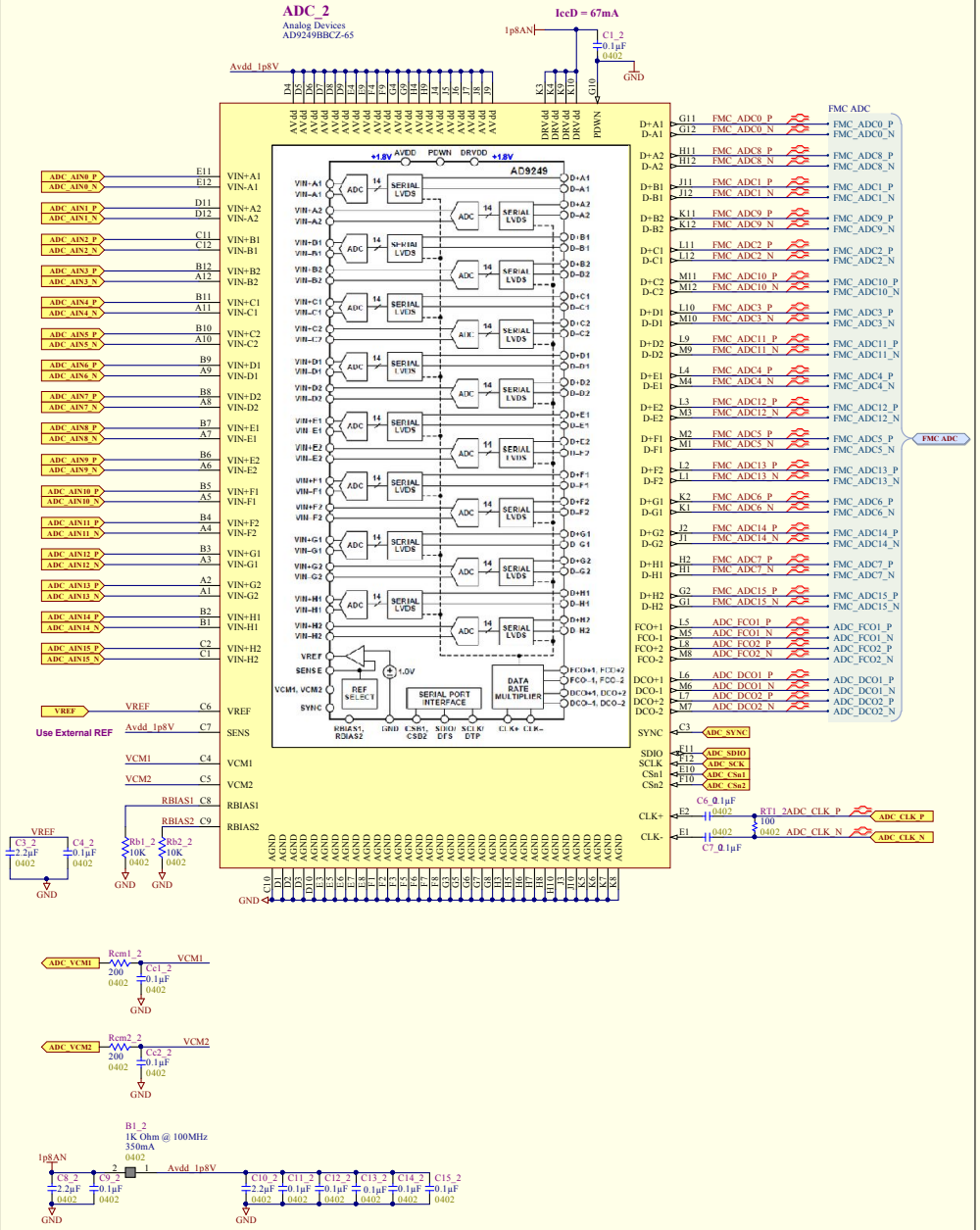


**FMC ADC32 - AD9249 65Msps HEX ADC**

| Revision | Drawing #: 8 | | |
|---|---|---|---|
| 0 | Sheet #: 8 of 8 | Size: B | TRIUMF<br>4004 Wesbrook Mall<br>Vancouver, B.C.<br>Canada<br>V6T 2A3 |
| | Drawn by:D.Bishop | Date: 7/20/2015 | |

File: C:\Repositories\GRIF-ADC32\FMC ADC32 - AD9249 HEX ADC Rev0.SchDoc

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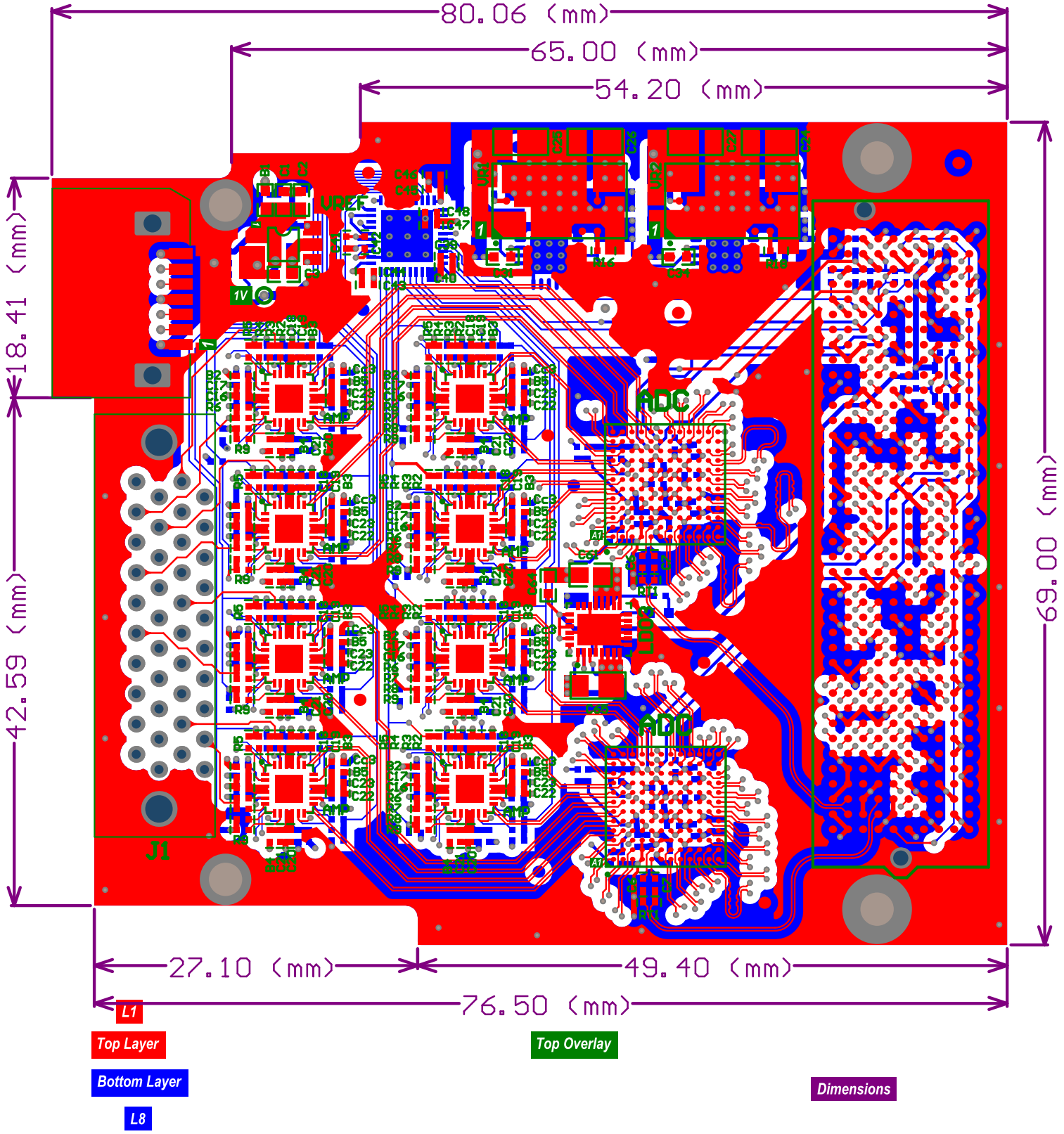
80.06 (mm)
65.00 (mm)
54.20 (mm)
18.41 (mm)
42.59 (mm)
69.00 (mm)
27.10 (mm)
49.40 (mm)
76.50 (mm)
ADC
ADC
J1
L1
Top Layer
Bottom Layer
L8
Top Overlay
Dimensions

# Bill Of Materials

## TRIUMF

*Project:* FMC 32 Channel ADC Rev0.PrjPCB

*Variant:* Variant of FMC 32 Channel ADC Rev0 - GAIN1

**Report Date:** 7/20/2015 3:54:10 PM

**Print Date:** 20-Jul-15 3:54:13 PM

| # | Manufacturer | Part Number | Digi-Key | Description | Designator | Quantity |
|---|---|---|---|---|---|---|
| 1 | Analog Devices | AD9249BBCZ-65 | AD9249BBCZ-65-ND | IC ADC 14BIT 65MSPS 144CSPBGA | ADC_1, ADC_2 | 2 |
| 2 | Analog Devices | ADA4950-2YCPZ | ADA4950-2YCPZ-R7CT-ND | IC OPAMP DIFF 750MHZ 24LFCSP | AMP_1, AMP_2, AMP_3, AMP_4, AMP_5, AMP_6, AMP_7, AMP_8, AMP_9, AMP_10, AMP_11, AMP_12, AMP_13, AMP_14, AMP_15, AMP_16 | 16 |
| 3 | Hirose Electric Co Ltd | FX2-40S-1.27DS(71) | H10639-ND | CONN RECEPT R/A 40POS 1.27MM | J1 | 1 |
| 4 | Linear Technology | LTM8045EY#PBF | LTM8045EY#PBF-ND | DC-DC CONVRT +/-2.5V +/-15V 0.7A | VR1, VR2 | 2 |
| 5 | Linear Technology | LTC2668CUJ-12#PBF | LTC2668CUJ-12#PBF-ND | IC DAC 12BIT 16CH 40QFN | DAC | 1 |
| 6 | Linear Technology | LTC6240CS5#TRMPBF | LTC6240CS5#TRMPBFCT-ND | IC OP AMP SINGLE R-R TSOT23-5 | U1 | 1 |
| 7 | Linear Technology | LT3071EUFD#PBF | LT3071EUFD#PBF-ND | IC REG LDO ADJ 5A 28QFN | LDO3 | 1 |
| 8 | Linear Technology | LTC6655BHMS8-3#PBF | LTC6655BHMS8-3#PBF | IC VREF SERIES 2.5V 8MSOP | VREF | 1 |
| 9 | Microchip Technology | 24AA02E48T-I/OT | 24AA02E48T-I/OTCT-ND | IC EEPROM 2KBIT 400KHZ SOT23-5 | U2 | 1 |
| 10 | Molex Inc | 0470804005 | WM19112CT-ND | CONN PLUG 7POS SERIAL ATA 15GOLD | SATA | 1 |
| 11 | Murata Electronics North America | BLM15AX102SN1D | 490-5442-1-ND | FERRITE CHIP 1000 OHM 0402 | B1_1, B1_2, B2_1, B2_2, B2_3, B2_4, B2_5, B2_6, B2_7, B2_8, B2_9, B2_10, B2_11, B2_12, B2_13, B2_14, B2_15, B2_16, B3_1, B3_2, B3_3, B3_4, B3_5, B3_6, B3_7, B3_8, B3_9, B3_10, B3_11, B3_12, B3_13, B3_14, B3_15, B3_16, B4_1, B4_2, B4_3, B4_4, B4_5, B4_6, B4_7, B4_8, B4_9, B4_10, B4_11, B4_12, B4_13, B4_14, B4_15, B4_16, B5_1, B5_2, B5_3, B5_4, B5_5, B5_6, B5_7, B5_8, B5_9, B5_10, B5_11, B5_12, B5_13, B5_14, B5_15, B5_16 | 66 |
| 12 | Panasonic | LNJ237W82RA | LNJ237W82RACT-ND | LED RED HIGH BRIGHT ESS SMD | LED1, LED2, LED3 | 3 |
| 13 | SAMTEC | ASP-134486-01 | ASP-134486-01 | VITA 57 SEARAY - Female CC-HPC-10 - 10mm | FMC1 | 1 |
| 14 | Taiyo Yuden | FBMH1608HM102-T | 587-1739-2-ND | FERRITE BEAD 1000 OHM 0603 | B1 | 1 |
| 15 | TDK Corporation | MPZ1608S601ATA00 | 445-2205-1-ND | FERRITE CHIP BEAD 600 OHM SMD | B6, B7 | 2 |
| 16 | Texas Instruments | TPS7A4700RGWT | 296-34769-1-ND | IC REG LDO ADJ 1A 20VQFN | LDO1 | 1 |
| 17 | Texas Instruments | TPS7A3301RGWT | 296-34830-2-ND | IC REG LDO NEG ADJ 1A 20VQFN | LDO2 | 1 |
| 18 | Panasonic Electronic Components | ERJ-2GE0R00X | ERJ-2GE0R00X | RES SMD 0.0 OHM JUMPER 1/10W | R3_1, R3_2, R3_3, R3_4, R3_5, R3_6, R3_7, R3_8, R3_9, R3_10, R3_11, R3_12, R3_13, R3_14, R3_15, R3_16, R4_1, R4_2, R4_3, R4_4, R4_5, R4_6, R4_7, R4_8, R4_9, R4_10, R4_11, R4_12, R4_13, R4_14, R4_15, R4_16, R7_1, R7_2, R7_3, R7_4, R7_5, R7_6, R7_7, R7_8, R7_9, R7_10, R7_11, R7_12, R7_13, R7_14, R7_15, R7_16, R8_1, R8_2, R8_3, R8_4, R8_5, R8_6, R8_7, R8_8, R8_9, R8_10, R8_11, R8_12, R8_13, R8_14, R8_15, R8_16 | 64 |
| 19 | Kemet | C0603C104K8RACTU | 399-1095-2-ND | CAP CER 0.1UF 10V 10% X7R 0603 | C2 | 1 |
| 20 | Yageo | CC0402KRX7R7BB104 | 311-1338-2-ND | CAP CER 0.1UF 16V 10% X7R 0402 | C1_1, C1_2, C4, C4_1, C4_2, C6_1, C6_2, C7_1, C7_2, C9_1, C9_2, C11_1, C11_2, C12_1, C12_2, C13_1, C13_2, C14_1, C14_2, C15_1, C15_2, C16_1, C16_2, C16_3, C16_4, C16_5, C16_6, C16_7, C16_8, C16_9, C16_10, C16_11, C16_12, C16_13, C16_14, C16_15, C16_16, C18_1, C18_2, C18_3, C18_4, C18_5, C18_6, C18_7, C18_8, C18_9, C18_10, C18_11, C18_12, C18_13, C18_14, C18_15, C18_16, C20_1, C20_2, C20_3, C20_4, C20_5, C20_6, C20_7, C20_8, C20_9, C20_10, C20_11, C20_12, C20_13, C20_14, C20_15, C20_16, C22_1, C22_2, C22_3, C22_4, C22_5, C22_6, C22_7, C22_8, C22_9, C22_10, C22_11, C22_12, C22_13, C22_14, C22_15, C22_16, C35, C40, C41, C42, C44, C46, C48, Cc1_1, Cc1_2, Cc2_1, Cc2_2, Cc3_1, Cc3_2, Cc3_3, Cc3_4, Cc3_5, Cc3_6, Cc3_7, Cc3_8, Cc3_9, Cc3_10, Cc3_11, Cc3_12, Cc3_13, Cc3_14, Cc3_15, Cc3_16 | 112 |
| 21 | Vishay Thin Film | MPMT10012001AT1 | MPMT-1K/2KCT-ND | RES NET MULT OHM 2 RES TO236-3 | Rdiv | 1 |
| 22 | Panasonic Electronic Components | ERJ-2GEJ1R0X | P1.0JCT-ND | RES SMD 1 OHM 5% 1/10W 0402 | R3 | 1 |
| 23 | Panasonic Electronic Components | ERJ-2RKF2201X | P2.20KLDKR-ND | RES SMD 2.2K OHM 1% 1/10W 0402 | R1, R10, R11, R13, R14, R20, R21, R22, R23, R24, R25, RL1, RL2, RL3 | 14 |
| 24 | Murata Electronics North America | GRM155R61A225ME95D | 490-10452-6-ND | CAP CER 2.2UF 10V 20% X5R 0402 | C3_1, C3_2, C8_1, C8_2, C10_1, C10_2, C17_1, C17_2, C17_3, C17_4, C17_5, C17_6, C17_7, C17_8, C17_9, C17_10, C17_11, C17_12, C17_13, C17_14, C17_15, C17_16, C19_1, C19_2, C19_3, C19_4, C19_5, C19_6, C19_7, C19_8, C19_9, C19_10, C19_11, C19_12, C19_13, C19_14, C19_15, C19_16, C21_1, C21_2, C21_3, C21_4, C21_5, C21_6, C21_7, C21_8, C21_9, C21_10, C21_11, C21_12, C21_13, C21_14, C21_15, C21_16, C23_1, C23_2, C23_3, C23_4, C23_5, C23_6, C23_7, C23_8, C23_9, C23_10, C23_11, C23_12, C23_13, C23_14, C23_15, C23_16, C39, C43, C45, C47 | 74 |
| 25 | Samsung Electro-Mechanics America, Inc | CL21B225KOFNNNE | 1276-1162-2-ND | CAP CER 2.2UF 16V 10% X7R 0805 | C61 | 1 |
| 26 | Taiyo Yuden | LMK107B7225KA-T | 587-2983-1-ND | CAP CER 2.2UF 10V 10% X7R 0603 | C31, C34, C64 | 3 |
| 27 | Murata Electronics North America | GRM21BR61E475KA12L | 490-3335-2-ND | CAP CER 4.7UF 25V 10% X5R 0805 | C62 | 1 |
| 28 | Murata Electronics North America | GRM31CR71E475KA88L | 490-1809-1-ND | CAP CER 4.7UF 25V 10% X7R 1206 | C24, C26 | 2 |
| 29 | Samsung Electro-Mechanics America, Inc | RC1005F103CS | 1276-3431-2-ND | RES 10K OHM 1/16W 1% 0402 | R29, Rb1_1, Rb1_2, Rb2_1, Rb2_2 | 5 |
| 30 | Murata Electronics North America | GRM21BR61A106KE19L | 490-1709-2-ND | CAP CER 10UF 10V 10% X5R 0805 | C28, C29, C63 | 3 |
| 31 | Murata Electronics North America | GRM188R60J106ME47D | 587-3238-2-ND | CAP CER 10UF 6.3V 20% X5R 0603 | C1, C3, C36 | 3 |
| 32 | Murata Electronics North America | GRM31CR71A226ME15L | 490-6516-1-ND | CAP CER 22UF 10V 20% X7R 1206 | C25, C27 | 2 |
| 33 | Panasonic Electronic Components | ERJ-2RKF4532X | P45.3KLCT-ND | RES SMD 45.3K OHM 1% 1/10W 0402 | R15 | 1 |
| 34 | Kemet | C1206C476M8PACTU | 399-5508-1-ND | CAP CER 47UF 10V 20% X5R 1206 | C30, C32, C65 | 3 |
| 35 | Panasonic Electronic Components | ERJ-2RKF6042X | P60.4KLCT-ND | RES SMD 60.4K OHM 1% 1/10W 0402 | R17 | 1 |
| 36 | Panasonic Electronic Components | ERJ-2RKF1000X | P100LCT-ND | RES SMD 100 OHM 1% 1/10W 0402 | RT1_1, RT1_2 | 2 |
| 37 | Samsung | RC1005F1023CS | 1276-4202-6-ND | RES 102K OHM 1/16W 1% 0402 | R27 | 1 |
| 38 | Panasonic Electronic Components | ERJ-2RKF1153X | P115KLCT-ND | RES SMD 115K OHM 1% 1/10W 0402 | R18 | 1 |
| 39 | Panasonic Electronic Components | ERJ-2RKF1303X | P130KLCT-ND | RES SMD 130K OHM 1% 1/10W 0402 | R16 | 1 |
| 40 | Samsung Electro-Mechanics America, Inc | RC1005F201CS | P200LTR-ND | RES 200 OHM 1/16W 1% 0402 | Rcm1_1, Rcm1_2, Rcm2_1, Rcm2_2 | 4 |
| 41 | Samsung | RC1005F3323CS | 1276-4245-2-ND | RES 332K OHM 1/16W 1% 0402 | R26 | 1 |
| 42 | Kemet | C0402C102J5GACTU | 399-10034-1-ND | CAP CER 1000PF 50V 5% NP0 0402 | C66, Cd1, Cd2, Cd3, Cd4, Cd5, Cd6, Cd7, Cd8, Cd9, Cd10, Cd11, Cd12, Cd13, Cd14, Cd15, Cd16 | 17 |
| 43 | Yageo | CC0402KRX7R9BB103 | 311-1349-2-ND | CAP CER 10000PF 50V 10% X7R 0402 | C5, C33, C67 | 3 |
| | | | | | | 424 |