

**FMC ADC32 - 32 Channel ADC 65Msps**

Revision	Drawing #: 1	TRUIMP 4004 Westbrook Mall Vancouver, B.C. Canada V6T 2A3
1.1	Sheet #: 1 of 8	Size: B
	Drawn by: D. Bishop	Date: 9/19/2019

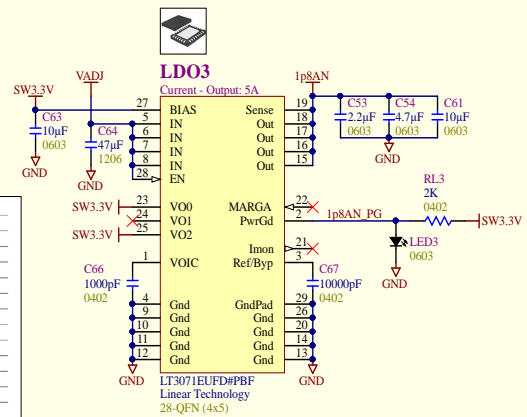
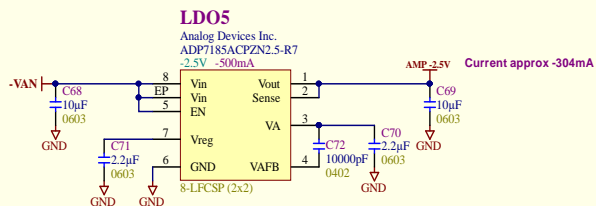
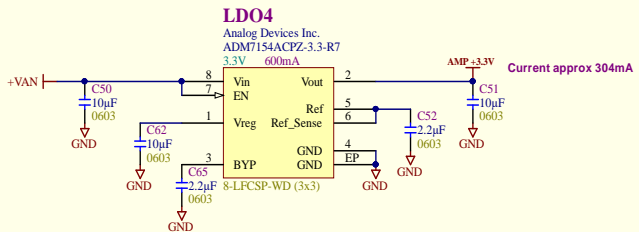
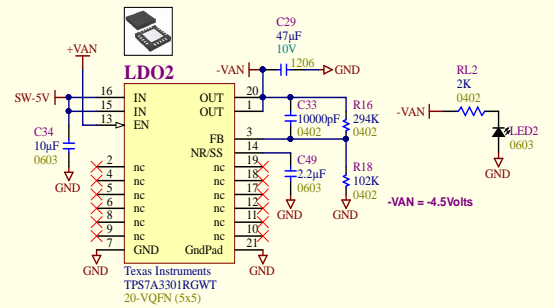
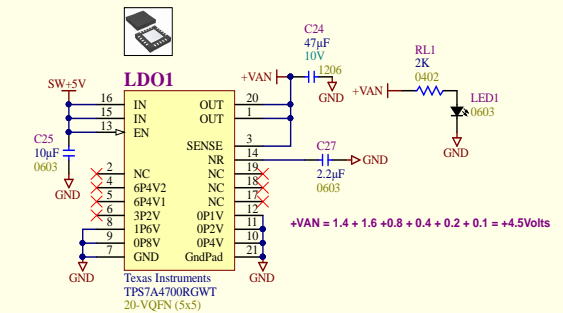
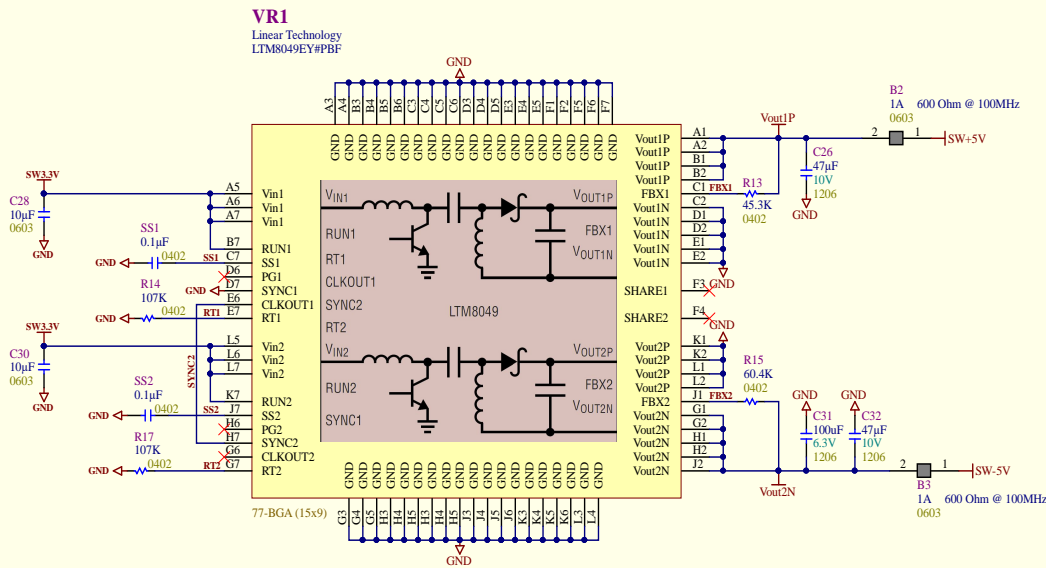


Table 1:  $V_{O2}$  to  $V_{O4}$  Settings vs Output Voltage

$V_{O2}$	$V_{O1}$	$V_{O4}$	$V_{O3nom}$	$V_{O2}$	$V_{O1}$	$V_{O4}$	$V_{O3nom}$
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 *H/Z*-state.

### FMC ADC32 - Power Regulators

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<b>1.1</b>	Sheet #: 2 of 8 Size: B Drawn by: D.Bishop Date: 9/19/2019	

## MPM (Divider)

Vishay Dale Thin Film

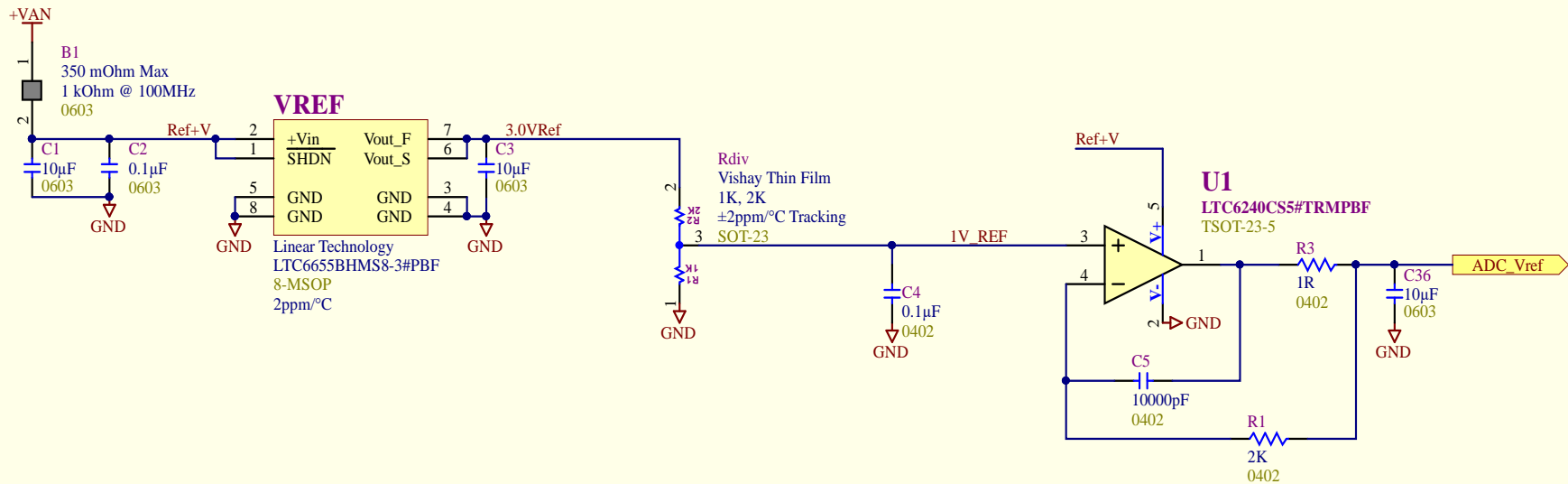
### , Surface Mount Divider Network

#### FEATURES

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

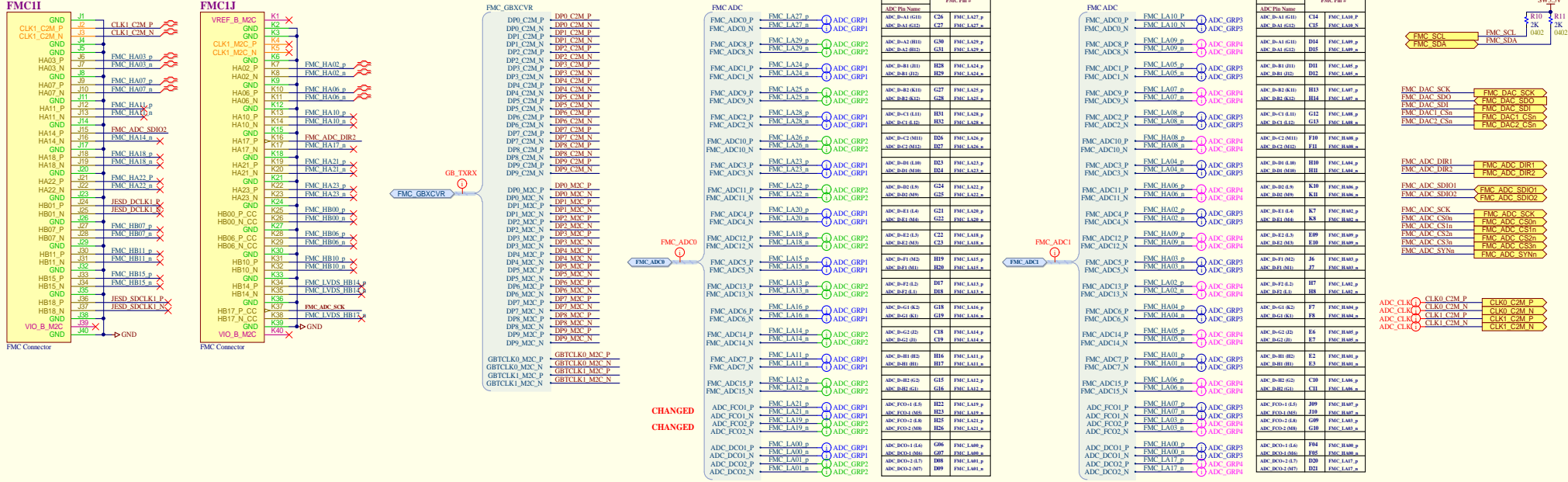
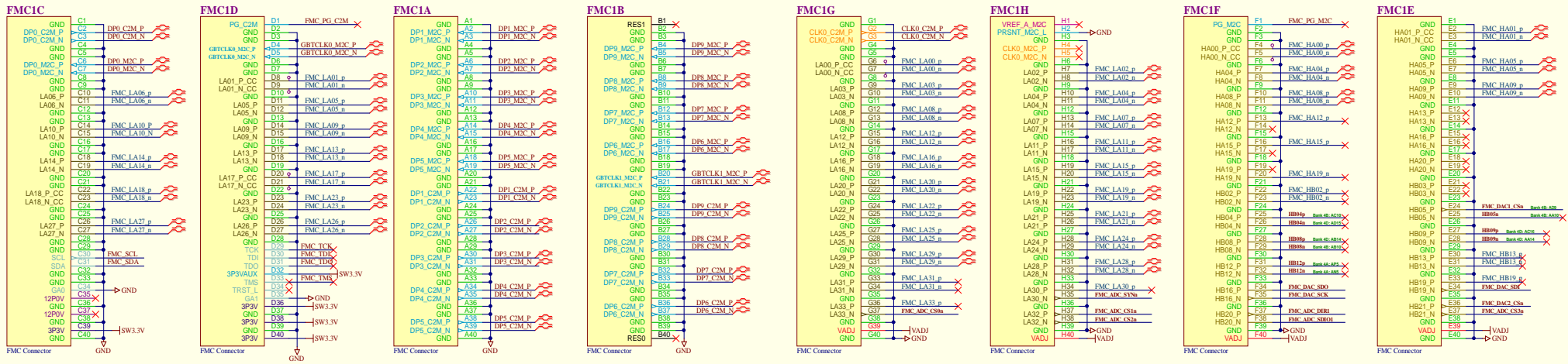


RoHS\*  
Available  
HALOGEN  
FREE



### FMC ADC32 - ADC Voltage Reference

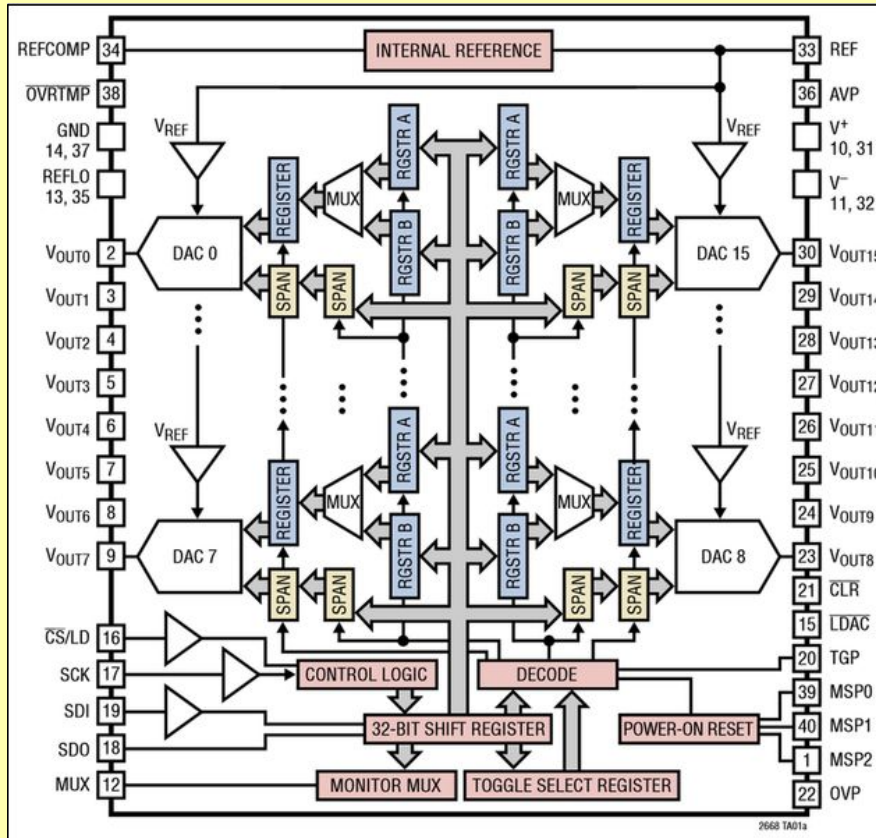
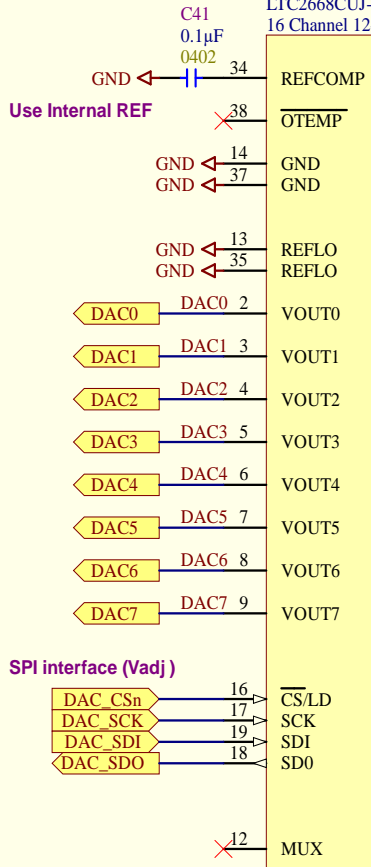
Revision	Drawing #: 3		<b>TRIUMF</b> 4004 Westbrook Mall Vancouver, B.C. Canada V6T 2A3	
<b>1.1</b>	Sheet #: 3 of 8	Size: A		
	Drawn by: D.Bishop	Date: 9/19/2019		



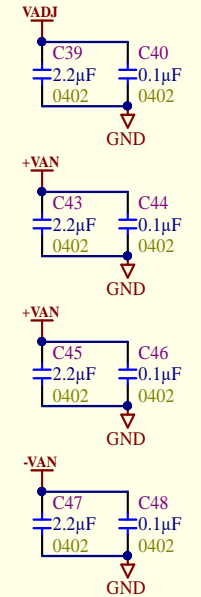
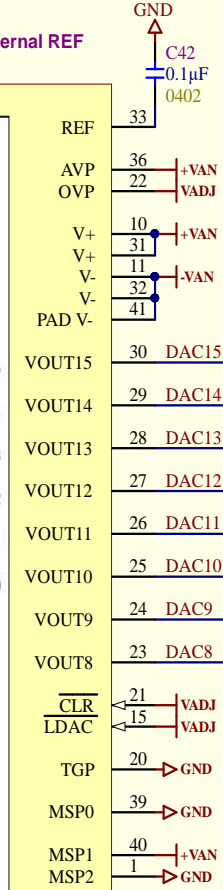
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# DAC

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



Use Internal REF



40-QFN (6x6)

DAC updates via SPI interface

Not using toggle operation

Manual Span +/- 2.5V Mid Scale

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

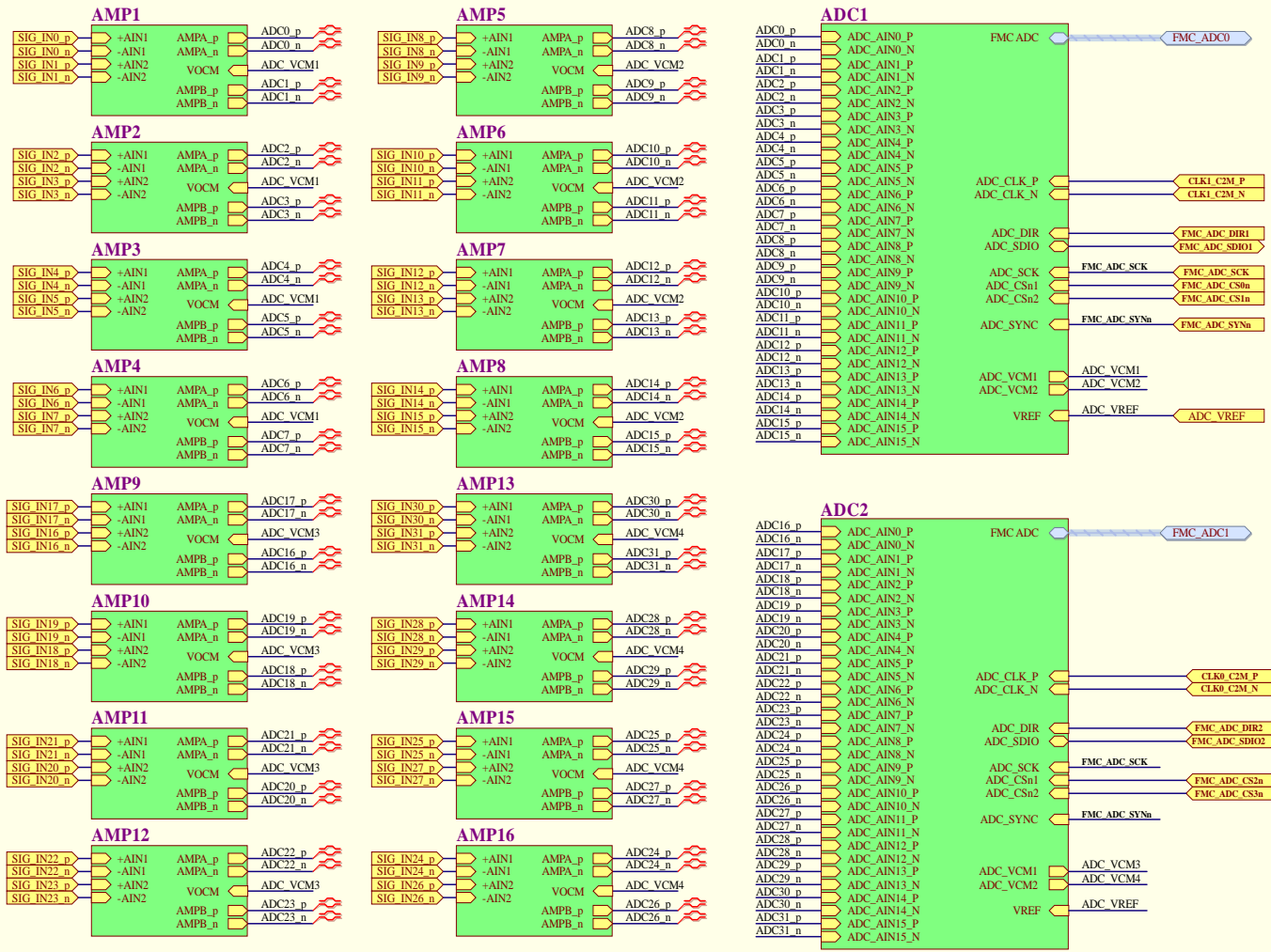
Multiple output ranges are not needed in all applications. By tying the MSPAN pins (MSP2, MSP1 and MSP0) to GND and/or AVP, any output range can be hardware-configured without additional operational overhead. Zero-scale and mid-scale reset options are also available for the unipolar modes (see Table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

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1.1	Sheet #: 5 of 8	Size: A		
	Drawn by: D.Bishop	Date: 9/19/2019		
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4:12:33 PM				

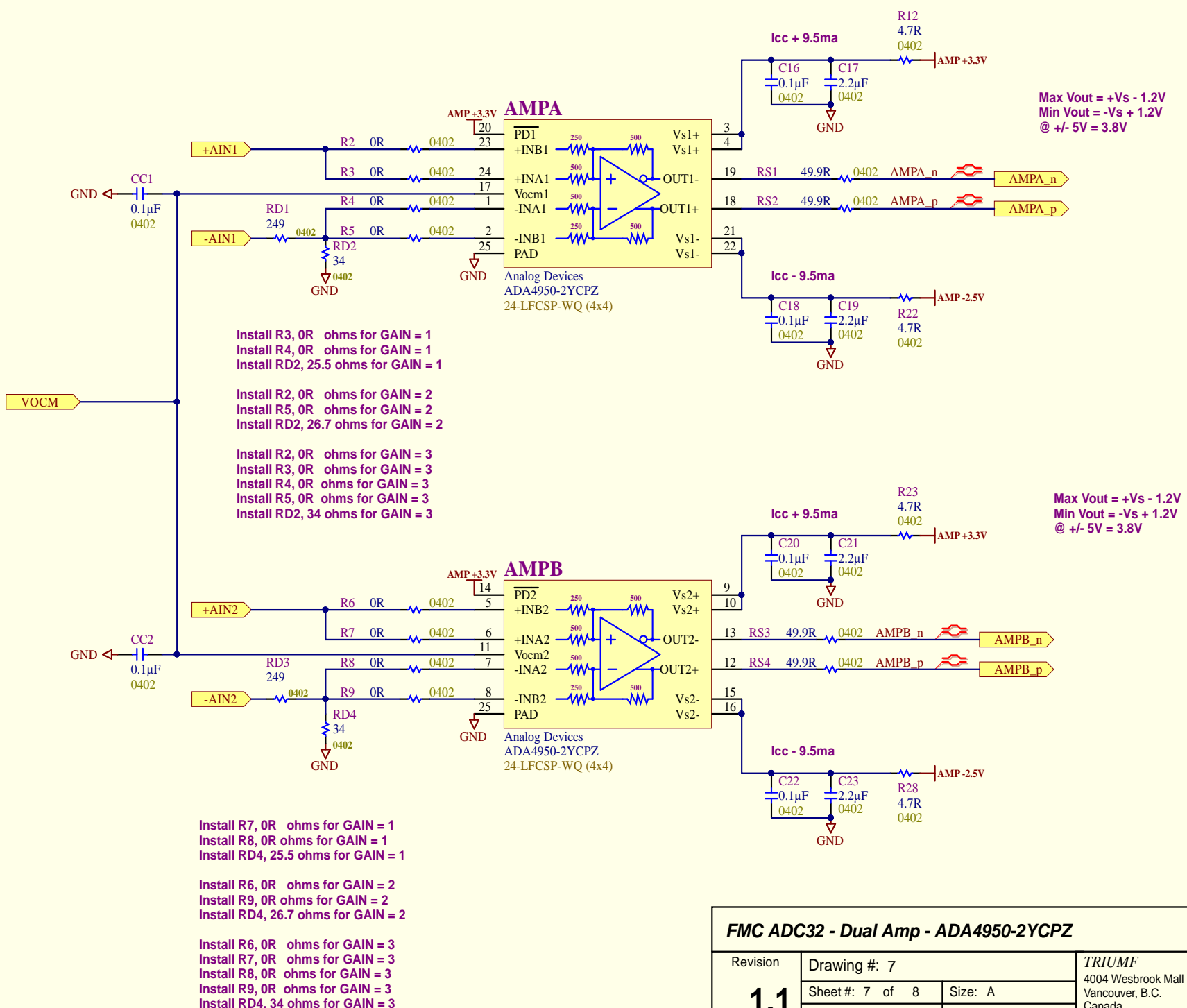


**FMC ADC32 - ADC Front End**

Revision	Drawing #: 6	TRUMF
1.1	Sheet #: 6 of 8	4004 Wesbrook Mall
	Size: B	Vancouver, B.C.
	Drawn by: D.Bishop	Canada
	Date: 9/19/2019	V6T 2A3
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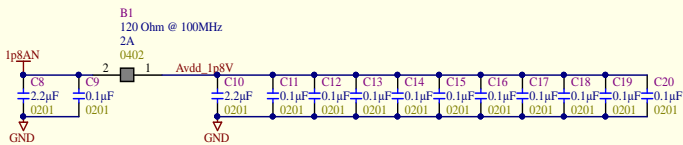
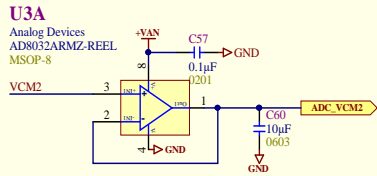
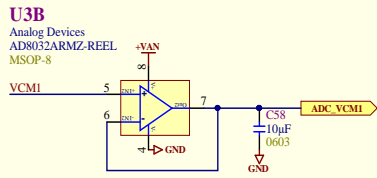
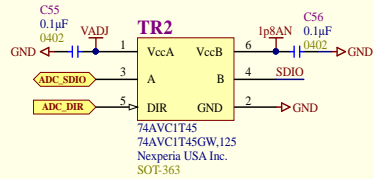
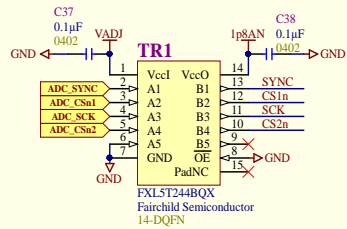
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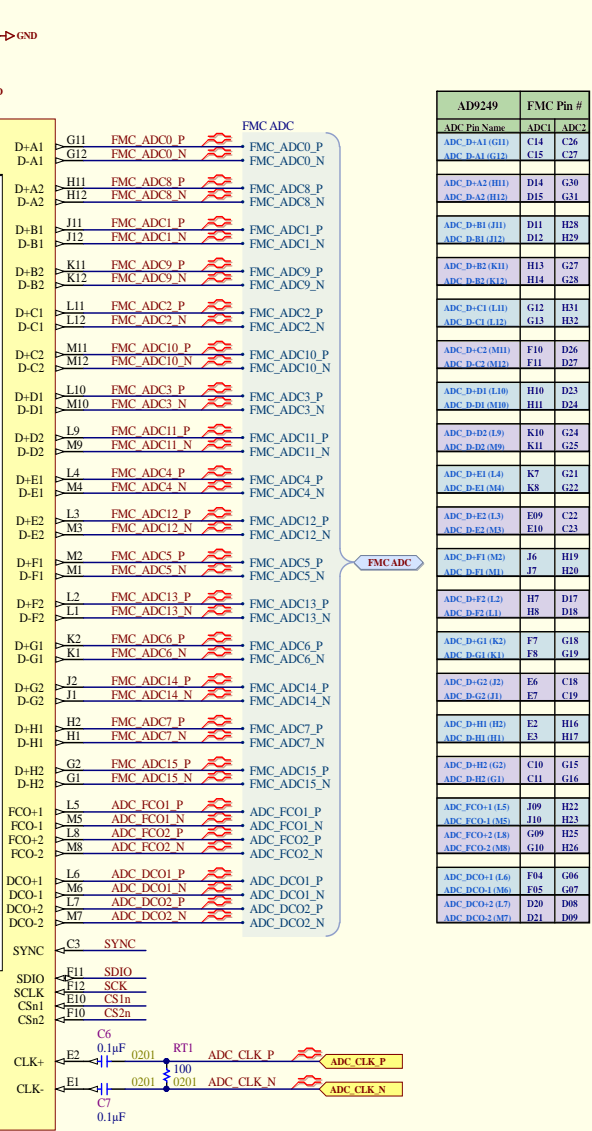
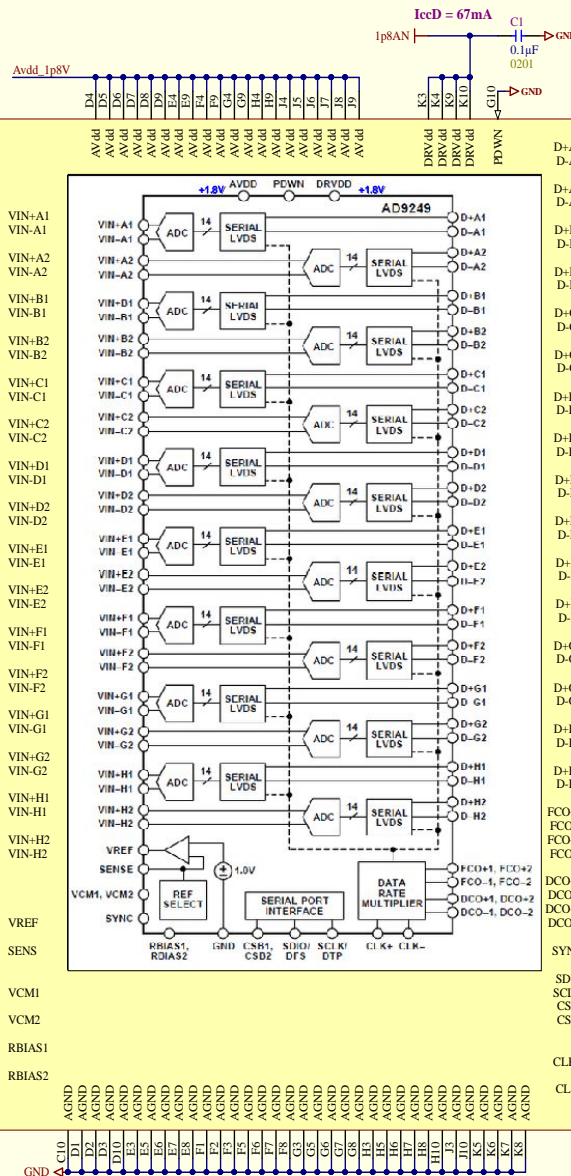
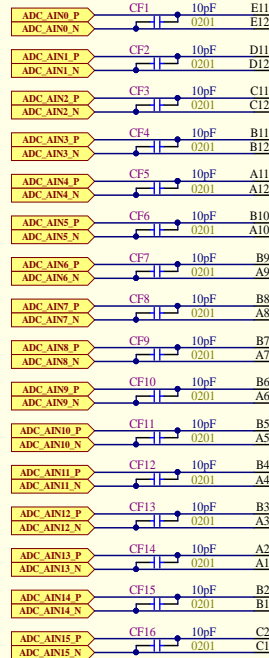
**FMC ADC32 - Dual Amp - ADA4950-2YCPZ**

Revision	Drawing #: 7		TRIUMF 4004 Wesbrook Mall Vancouver, B.C. Canada V6T 2A3	
<b>1.1</b>	Sheet #: 7 of 8	Size: A		
	Drawn by: D.Bishop	Date: 9/19/2019		

File: C:\GitLab\Hardware\FMCFMC - ADC32\rev1\_1\Altium\FMC ADC32 - Dual Amplifier - ADA4950-2 Rev1\_1.SchDoc 4:12:33 PM



**ADC**  
Analog Devices  
AD9249BBCZ-65  
144-CSPBGA (10x10)



AD9249	FMC Pin #
ADC_PlnName	AD9249
ADC_D-A1 (G11)	C14 C26
ADC_D-A1 (G12)	C15 C27
ADC_D-A2 (H11)	D14 G30
ADC_D-A2 (H12)	D15 G31
ADC_D-B1 (J11)	D11 H28
ADC_D-B1 (J12)	D12 H29
ADC_D-B2 (K11)	H13 G27
ADC_D-B2 (K12)	H14 G28
ADC_D-C1 (L11)	G12 H31
ADC_D-C1 (L12)	G13 H32
ADC_D-C2 (M11)	F10 D26
ADC_D-C2 (M12)	F11 D27
ADC_D-C1 (L10)	H10 D23
ADC_D-C1 (L11)	H11 D24
ADC_D-D2 (N1)	K10 G24
ADC_D-D2 (N2)	K11 G25
ADC_D-E1 (L4)	K7 G21
ADC_D-E1 (M4)	K8 G22
ADC_D-E2 (H3)	E99 C22
ADC_D-E2 (M3)	E10 C23
ADC_D-F1 (M2)	J6 H19
ADC_D-F1 (M3)	J7 H20
ADC_D-F2 (L1)	H7 D18
ADC_D-F2 (L2)	H8 D18
ADC_D-G1 (K2)	F7 G18
ADC_D-G1 (K1)	F8 G19
ADC_D-G2 (J2)	E6 C18
ADC_D-G2 (J1)	E7 C19
ADC_D-H1 (H2)	E2 H16
ADC_D-H1 (H3)	E3 H17
ADC_D-H2 (H2 (G2))	C10 H15
ADC_D-H2 (G1)	C11 H16
ADC_FCO-1 (L5)	J09 H22
ADC_FCO-1 (M5)	J10 H23
ADC_FCO-2 (L8)	G09 H25
ADC_FCO-2 (M8)	G10 H26
ADC_DCO-1 (L6)	F04 G06
ADC_DCO-1 (M6)	F05 G07
ADC_DCO-2 (L7)	D20 D08
ADC_DCO-2 (M7)	D21 D09

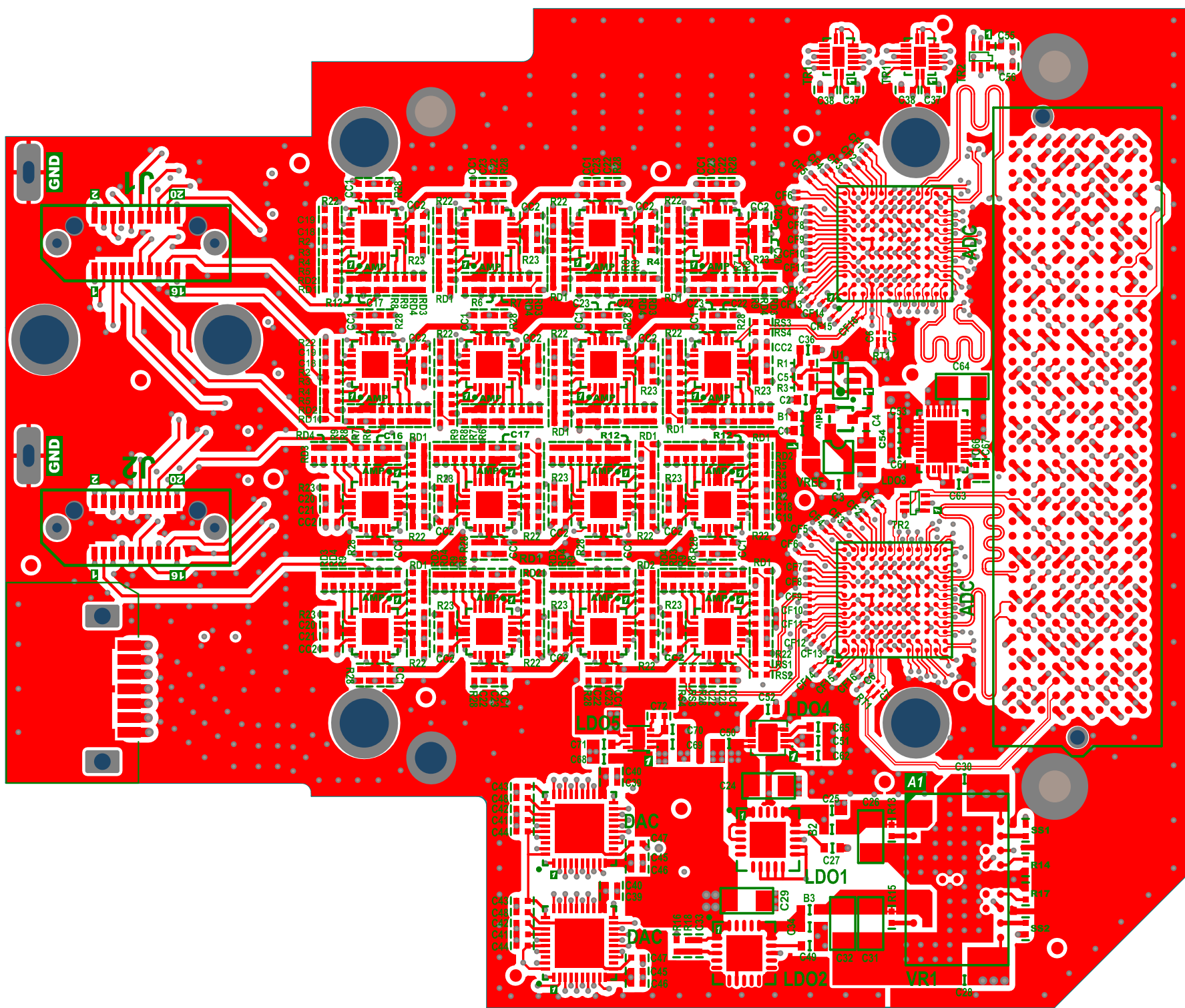
**FMC ADC32 - AD9249 65Mps - 16 Channel ADC**

Revision	Drawing #: 8	TRUMF
1.1	Sheet #: 8 of 8	4004 Westbrook Mall
	Size: B	Vancouver, B.C.
	Drawn by: D.Bishop	Canada
	Date: 9/19/2019	V6T 2A3

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Top Layer (Lyr1)

Top Overlay

Board Outline

# Bill Of Materials

## TRIUMF

Project: FMC ADC32 Rev1\_1.PrjPcb  
 Variant: None

Report Date: 9/19/2019 4:12 PM  
 Print Date: 19-Sep-19 4:12:44 PM

#	Manufacturer	Part Number	Digi-Key	Description	Designator
1	Analog Devices	AD9249BBCZ-65	AD9249BBCZ-65-ND	IC ADC 14BIT 65MSPS 144CSBPBGA	ADC_ADC1_ADC_ADC2
2	Analog Devices	ADA4950-2YCPZ	ADA4950-2YCPZ-R7CTND	IC OPAMP DIFF 750MHZ 24LFCSP	AMP_AMP1_AMP_AMP2_AMP_AMP3_AMP_AMP4
3	Taiyo Yuden	FBMH1608HMT02-1	587-1739-2-ND	FERRITE BEAD 1000 OHM 0603	B1
4	Murata Electronics North America	BLM15PX121SN1D	490-9656-2-ND	FERRITE BEAD 120 OHM 0402 1LN	B1_ADC1_B1_ADC2
5	TDK Corporation	MPZ1608S601ATA00	445-2205-1-ND	FERRITE CHIP BEAD 600 OHM SMD	B2, B3
6	Murata Electronics North America	GRM188R60J106ME47D	587-3238-2-ND	CAP CER 10UF 6.3V 20% X5R 0603	C1, C3, C36, C58_ADC1, C58_ADC2, C60_ADC1
7	Taiyo Yuden	LMK063B1J04K-F	490-5881-2-ND	CAP CER 0.1UF 10V X5R 0201	C1_ADC1, C1_ADC2, C4_ADC1, C4_ADC2, C5
8	Kemet	C0603C104K9RACTU	399-1095-2-ND	CAP CER 0.1UF 10V 10% X7R 0603	C2
9	Murata Electronics North America	GRM033R61A225KE47D	490-13227-2-ND	CAP CER 2.2UF 10V X5R 0201	C3_ADC1, C3_ADC2, C8_ADC1, C8_ADC2, C9
10	Yageo	CC0402KRX7R7BB104	311-1338-2-ND	0.10uF 16V Ceramic Capacitor X7R 0402	C4, C16 AMP1, C16 AMP2, C16 AMP3, C16 AMP4
11	Yageo	CC0402KRX7R9BB103	311-1349-2-ND	CAP CER 10000PF 50V 10% X7R 0402	C5, C33, C67, C72
12	Murata Electronics North America	C1005X5R1A225K050BC	445-7392-2-ND	CAP CER 2.2UF 10V X5R 0402	C17_AMP1, C17_AMP2, C17_AMP3, C17_AMP4
13	Kemet	C1206C476M9PACTU	399-5508-1-ND	CAP CER 47UF 10V 20% X5R 1206	C24, C26, C29, C32, C64
14	Murata Electronics North America	GR1188R61C106KE13D	490-12317-1-ND	CAP CER 10UF 16V X5R 0603	C25, C28, C30, C34, C50, C51, C61, C62, C63
15	Taiyo Yuden	LMK107B725KA-T	587-2983-1-ND	CAP CER 2.2UF 10V 10% X7R 0603	C27, C49, C52, C53, C65, C70, C71
16	Murata Electronics North America	GRM31CR60J107ME39L	490-4539-1-ND	CAP CER 100UF 6.3V X5R 1206	C31
17	Murata Electronics North America	GRM155R61A225ME95D	490-10452-6-ND	CAP CER 2.2UF 10V 20% X5R 0402	C39_DAC1, C39_DAC2, C43_DAC1, C43_DAC2
18	Taiyo Yuden	JMK107BB7475KA-T	587-5870-2-ND	CAP CER 4.7UF 6.3V X7R 0603	C54
19	Kemet	C0402C102J5GACTU	399-10034-1-ND	CAP CER 1000PF 50V 5% NP0 0402	C66
20	Murata Electronics North America	GJM0335C1E100JB01D	490-13312-2-ND	CAP CER 10PF 25V C0G/NP0 0201	CF1_ADC1, CF1_ADC2, CF2_ADC1, CF2_ADC2
21	Linear Technology	LTC2668CUJ-12#PBF	LTC2668CUJ-12#PBF-ND	IC DAC 12BIT 16CH 400FN	DAC_DAC1, DAC_DAC2
22	SAMTEC	ASP-134488-01	ASP-134488-01	FMC Mezzanine connector	FMC
23	Advanced Thermal Solutions Inc.	ATS-CPX005000600-199-C2-R0	ATS1584-ND	HEATSINK 50X50X6MM XOUT CP	HS1
24	Samtec	ERF8-010-05-0-L-DV-L-K-TR	SAMB618CT-ND	CONN RCPT 20POS 0.8MM GOLD SMD	J1, J2
25	Texas Instruments	TPS747A00RGWT	296-34769-1-ND	IC REG LDO ADJ 1A 20VQFN	LD01
26	Texas Instruments	TPS743301RGWT	296-34830-2-ND	IC REG LDO NEG ADJ 1A 20VQFN	LD02
27	Linear Technology	LT3071EUFDP#PBF	LT3071EUFDP#PBF-ND	IC REG LDO ADJ 3A 28QFN	LD03
28	Analog Devices Inc.	ADM7154ACPZ-3.3-R7	ADM7154ACPZ-3.3-R7CTND	IC REG LINEAR 3.3V 600MA 8LFCSP	LD04
29	Analog Devices Inc.	ADP7185ACPZN2.5-R7	ADP7185ACPZN2.5-R7CTND	IC REG LINEAR 500MA 8LFCSP	LD05
30	Panasonic	LNJ231W82RA	LNJ231W82RAC-ND	LED RED HIGH BRIGHT ESS SMD	LED1, LED2, LED3
31	PEM	SMTSOB-M3-4ET	SMTSOB-M3-4ET	Surface mount standoff	PEM1, PEM2, PEM3, PEM4, PEM5, PEM6
32	Yageo	RC11005F202CS	1276-3448-6-ND	RES SMD 2K OHM 1% 1/16W 0402	R1, R10, RL1, RL2, RL3
33	Panasonic Electronic Components	ERJ-2GE0R00X	ERJ-2GE0R00X	RES SMD 0.0 OHM JUMPER 1/10W	R2_AMP1, R2_AMP2, R2_AMP3, R2_AMP4, R2_AMP5
34	Panasonic Electronic Components	ERJ-2GE1J10X	P1 JCTND	RES SMD 1 OHM 5% 1/10W 0402	R3
35	Yageo	1276-3448-6-ND	1276-3448-6-ND	RES SMD 2K OHM 1% 1/16W 0402	R11
36	Stackpole Electronics	RMCF0402F14R70	RMCF0402F14R70DKR-ND	RES SMD 4.7 OHM 1% 1/16W 0402	R12_AMP1, R12_AMP2, R12_AMP3, R12_AMP4