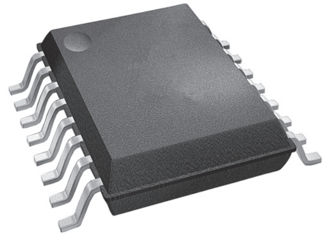
ACA2402

750/870/1000 MHz CATV
Push-Pull Line Amplifier
Data Sheet - Rev 2.2

FEATURES

- 1 GHz Specified Performance
- 22 dB Gain
- Very Low Distortion
- Excellent 75 Ω Input and Output Match
- Stable with High VSWR Load Conditions
- Monolithic Design for Consistent Performance Part-to-Part
- Low DC Power Consumption
- Surface Mount Package Compatible with Automatic Assembly
- Low Cost Alternative to Hybrids
- Meets Cenelec Standards
- Materials set consistent with RoHS Directives.



S7 Package
16 Pin Wide Body SOIC
with Heat Slug

APPLICATIONS

- CATV Line Amplifiers, System Amplifiers, Distribution Nodes

PRODUCT DESCRIPTION

The ACA2402 is a highly linear, monolithic GaAs RF amplifier that has been developed as an alternative to standard CATV hybrid amplifiers. Offered in a convenient surface mount package, the MMIC consists of two pairs of parallel amplifiers that are optimized for exceptionally low distortion and noise figure. A hybrid equivalent that provides flat gain response and excellent input and output return loss over the 40 to 1000 MHz CATV downstream band is formed when one ACA2402 is cascaded between two appropriate transmission line baluns.

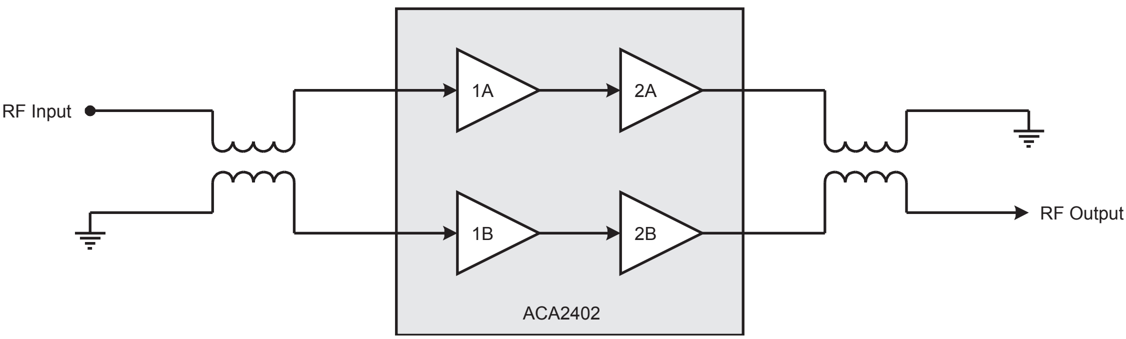


Figure 1: Hybrid Application Diagram

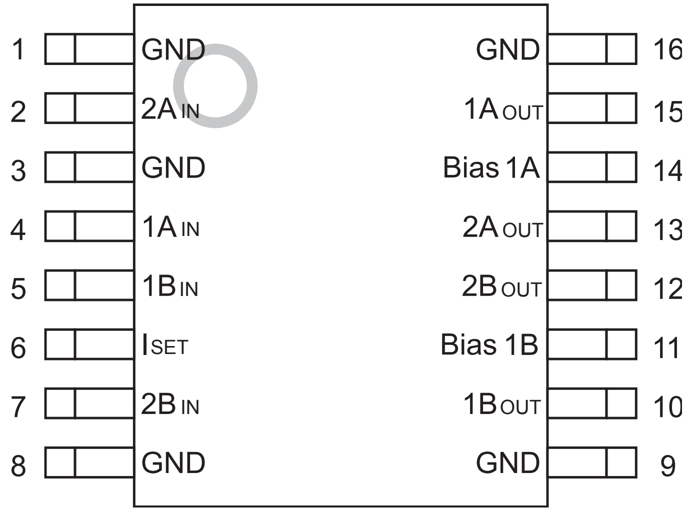


Figure 2: Pin Out

Table 1: Pin Description

PIN	NAME	DESCRIPTION	PIN	NAME	DESCRIPTION
1	GND	Ground	16	GND	Ground
2	$2A_{IN}$	Amplifier 2A Input	15	$1A_{OUT}$	Amplifier 1A Output
3	GND	Ground	14	Bias 1A	Bias for 1A Amplifier
4	$1A_{IN}$	Amplifier 1A Input	13	$2A_{OUT}$	Amplifier 2A Output and Supply
5	$1B_{IN}$	Amplifier 1B Input	12	$2B_{OUT}$	Amplifier 2B Output and Supply
6	1_{SET}	Current Adjust	11	Bias 1B	Bias for 1B Amplifier
7	$2B_{IN}$	Amplifier 2B Input	10	$1B_{OUT}$	Amplifier 1B Output
8	GND	Ground	9	GND	Ground

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Mimimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT
Supply (pins 12, 13)	0	+28	VDC
RF Power at Inputs (pins 4, 5)	-	+75	dBmV
Storage Temperature	-65	+150	°C
Soldering Temperature	-	+260	°C
Soldering Time	-	5.0	Sec

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.

Notes:

1. *Pins 2, 4, 5 and 7 should be AC-coupled. No external DC bias should be applied.*
2. *Pin 6 should be AC-grounded and/or pulled to ground through a resistor for current control. No external DC bias should be applied.*
3. *Pins 11 and 14 are bias feeds for input amplifiers 1A and 1B. No external DC bias should be applied.*
4. *Pins 10 and 15 receive DC bias directly from pins 11 and 14. No other external bias should be applied.*

Table 3: Operating Ranges

PARAMETER	MIN	TYP	MAX	UNIT
Supply: V_{DD} (pins 12, 13)	-	+24	-	VDC
RF Frequency	40	-	1000	MHz
Case Temperature	-40	-	+110	°C

The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

Table 4: AC and DC Electrical Specifications
(T_A = +25 °C, V_{DD} = +24 VDC)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Gain @ 1000 MHz (1)	21.1	21.6	22.1	dB	
Cable Equivalent Slope (1)	-	0	-	dB	
Gain Flatness (1) @ 1000 MHz	-	±0.2	-	dB	
Noise Figure (1)	-	3.5	4.5	dB	
CTB (1) 77 Channels (2) 77 Channels plus QAM to 1 GHz (6) 110 Channels (3) 110 Channels plus QAM to 1 GHz (7) 128 Channels (4)	 - - - - -	 -76 - -73 - -70	 -74 -74 -71 -71 -	dBc	
CSO (1) 77 Channels (2) 77 Channels plus QAM to 1 GHz (6) 110 Channels (3) 110 Channels plus QAM to 1 GHz (7) 128 Channels (4)	 - - - - -	 -72 - -72 - -69	 -70 -70 -70 -68 -	dBc	
XMOD (1) 77 Channels (2) 77 Channels plus QAM to 1 GHz (6) 110 Channels (3) 110 Channels plus QAM to 1 GHz (7) 128 Channels (4)	 - - - - -	 -65 - -65 - -62	 -63 -63 -63 -63 -	dBc	
Return Loss (Input/Output) (1)	18	22	-	dB	75 Ω system
Supply Current (5)	240	250	260	mA	
Thermal Resistance	-	-	3.8	°C/W	

Notes:
(1) Measured with baluns on the input and output of the device.
(2) Parts measured with 77 channels flat output, +42 dBmV per channel.
(3) Parts measured with 110 channels flat output, +40 dBmV per channel.
(4) Parts measured with 128 channels flat output, +40 dBmV per channel.
(5) The supply current may be reduced by decreasing the value of R3 (see Figure 17)
(6) 47.5 dBmV output, 9.5 dB tilt @ 1 GHz
(7) 45.5 dBmV output, 9.5 dB tilt @ 1 GHz
8. All specifications as measured on Evaluation Board (see Figures 16 & 17).

PERFORMANCE DATA

Figure 3: Noise Figure vs Frequency

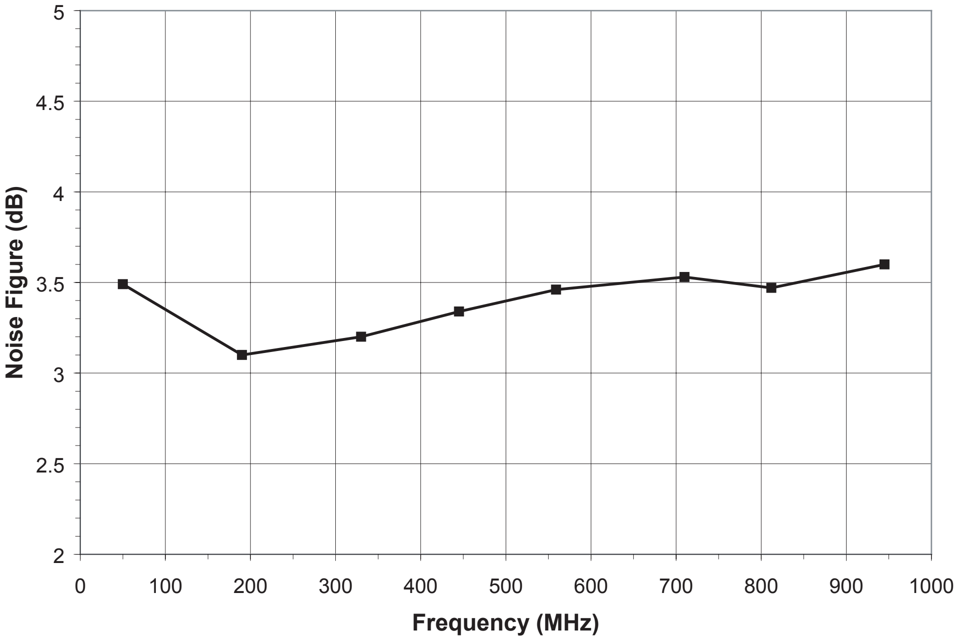


Figure 4: Gain (S21) vs. Frequency

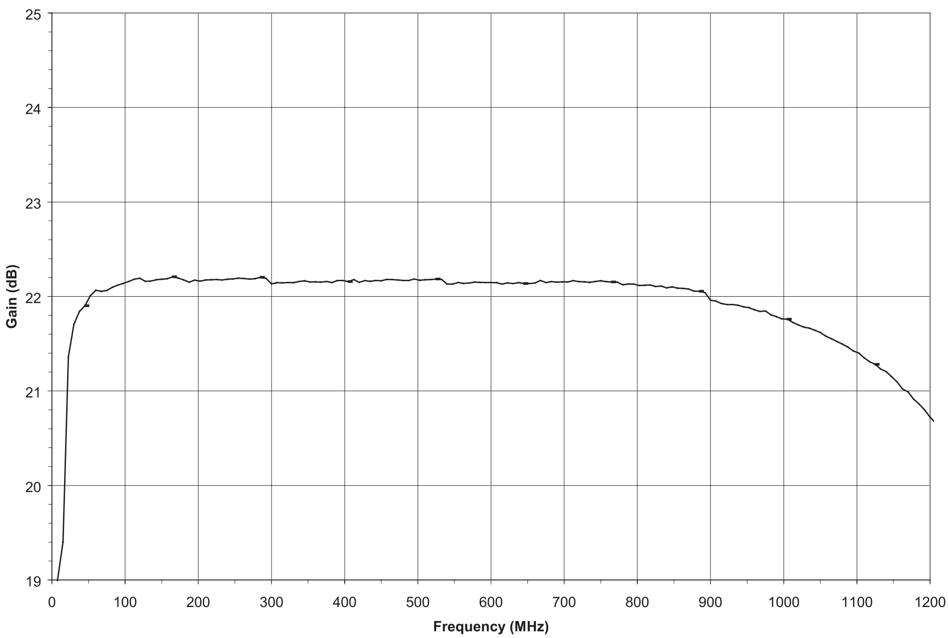


Figure 5: Input and Output Return Loss (S11 and S22) vs. Frequency

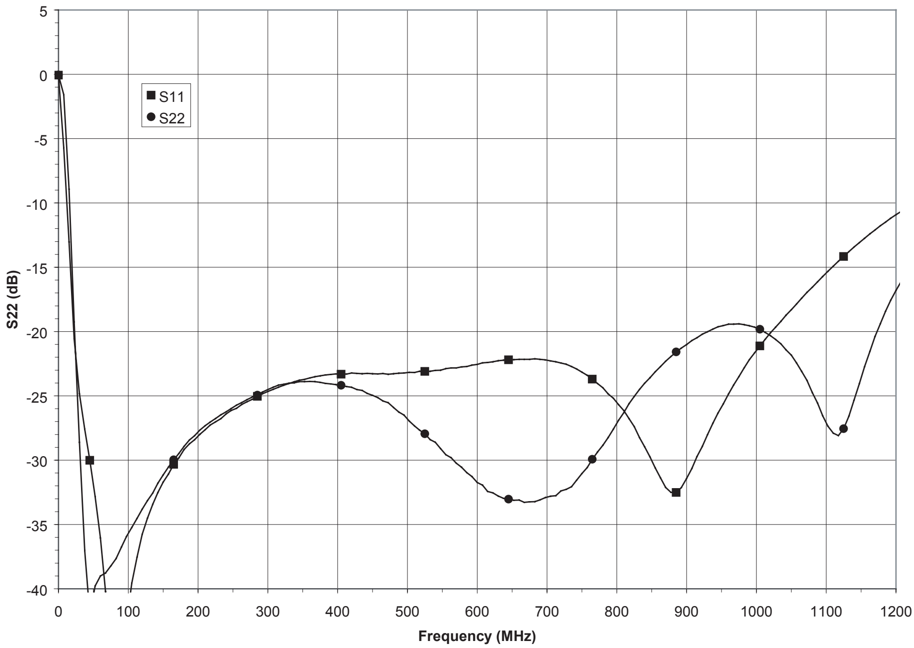


Figure 6: Isolation (S12) vs. Frequency

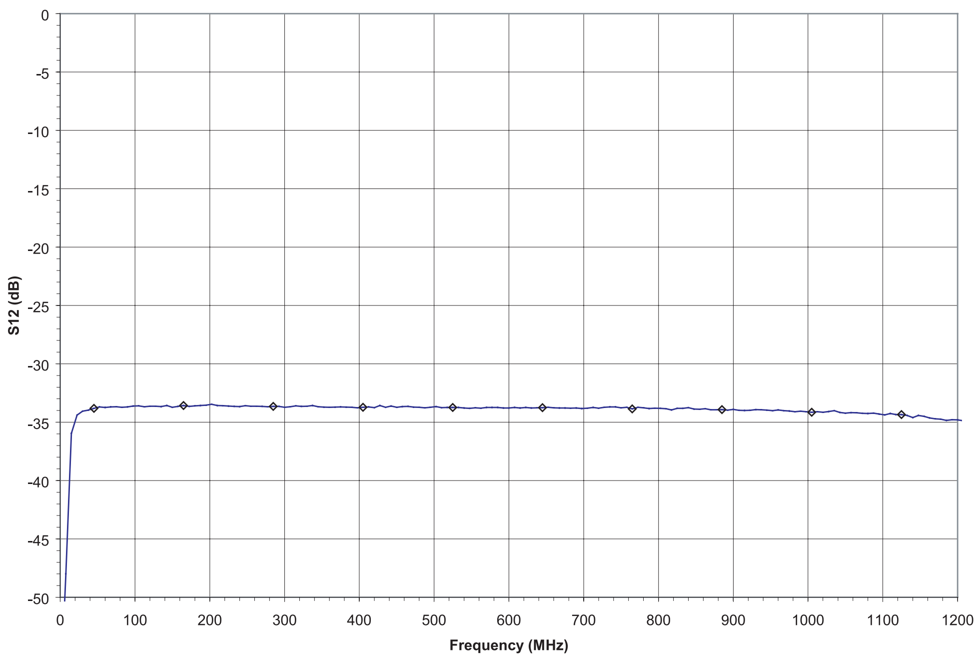


Figure 7: CTB vs. Output Power at Worst-case Channel/Frequency (128 total channels, 110 analog channels, flat output)

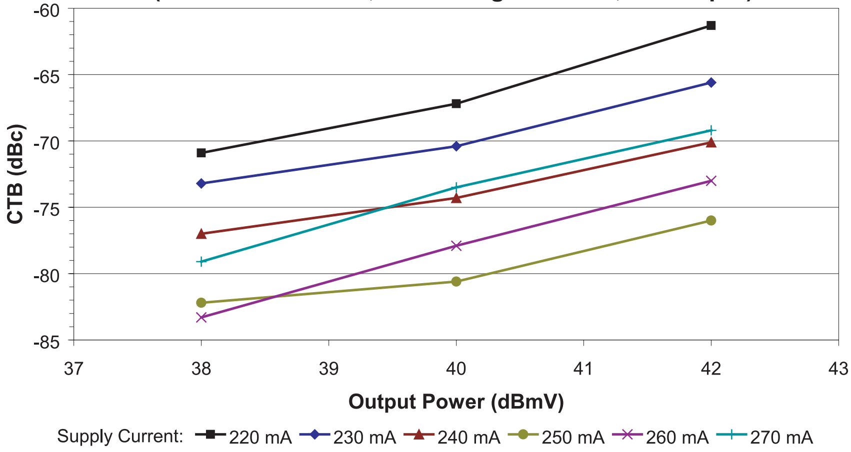


Figure 8: CSO vs. Output Power at Worst-case Channel/Frequency (128 total channels, 110 analog channels, flat output)

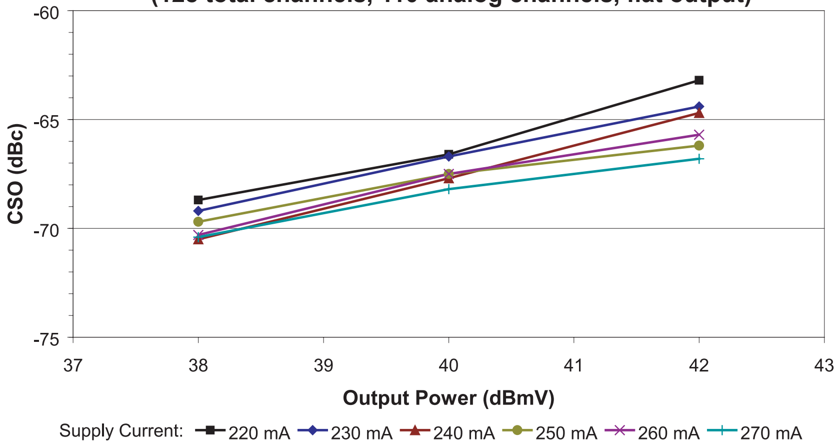


Figure 9: XMOD vs. Output Power at Worst-case Channel/Frequency (128 total channels, 110 analog channels, flat output)

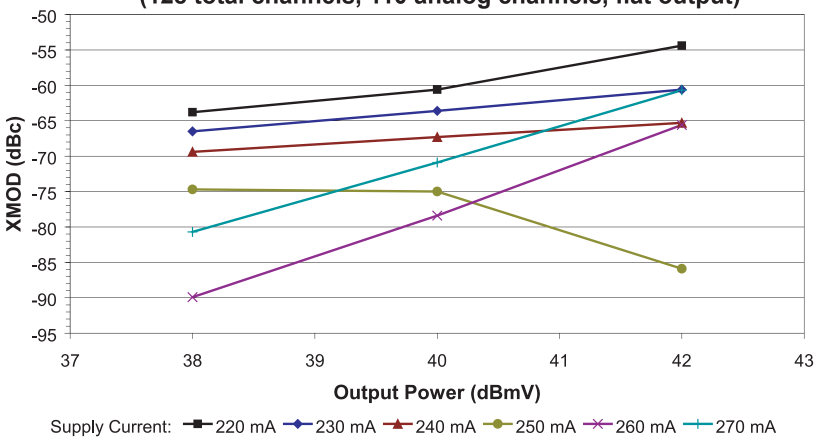


Figure 10: CTB vs. Frequency (110 channels, +40 dBmV power, flat output)

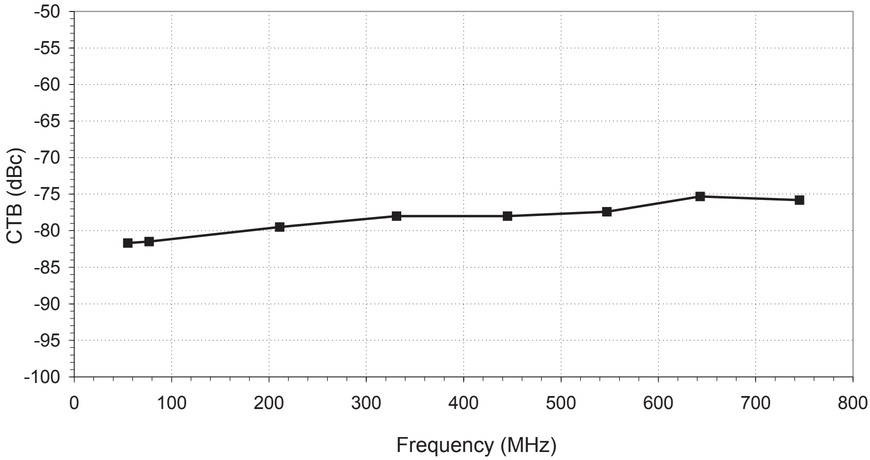


Figure 11: CSO vs. Frequency (110 channels, +40 dBmV power, flat output)

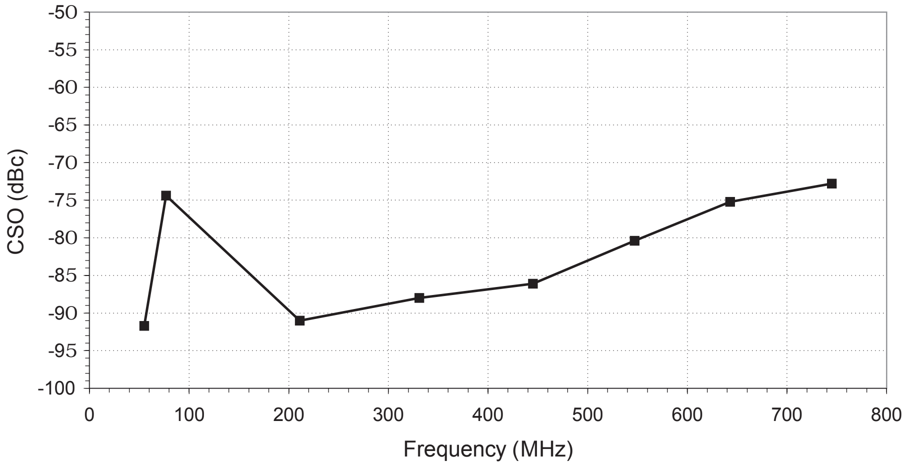


Figure 12: XMOD vs. Frequency (110 channels, +40 dBmV power, flat output)

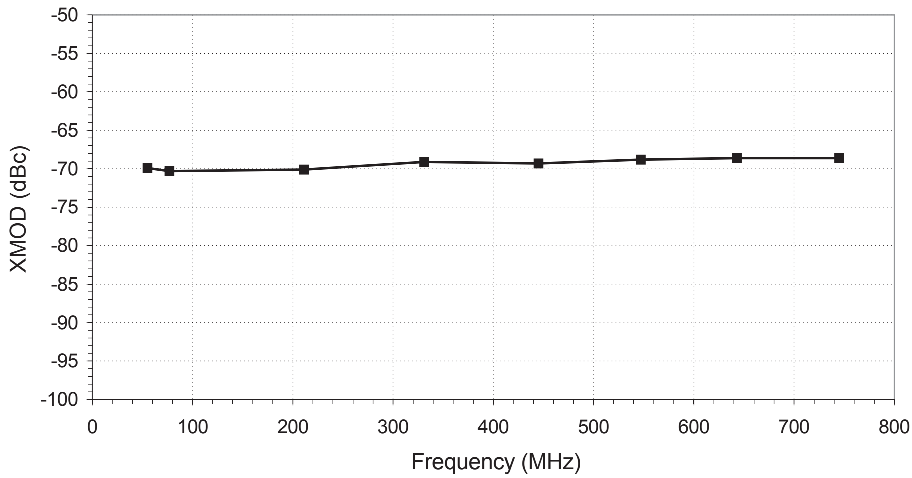


Figure 13: CTB vs. Frequency (77 channels, +42 dBmV power, flat output)

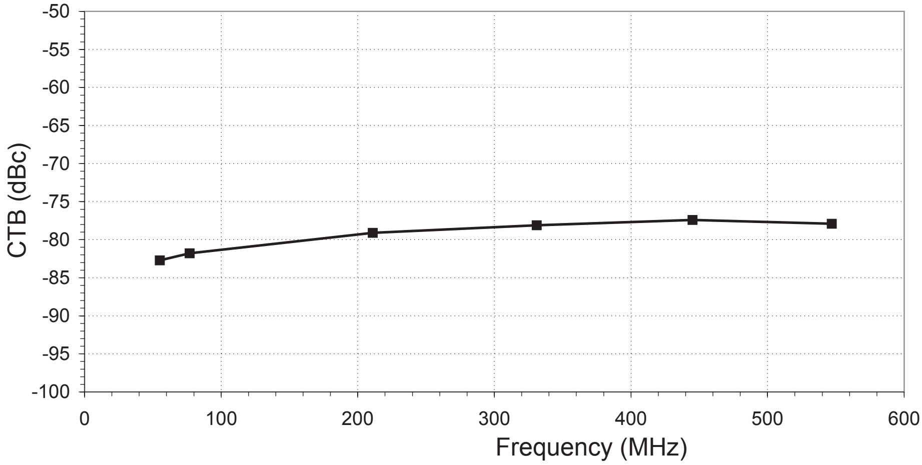


Figure 14: CSO vs. Frequency (77 channels, +42 dBmV power, flat output)

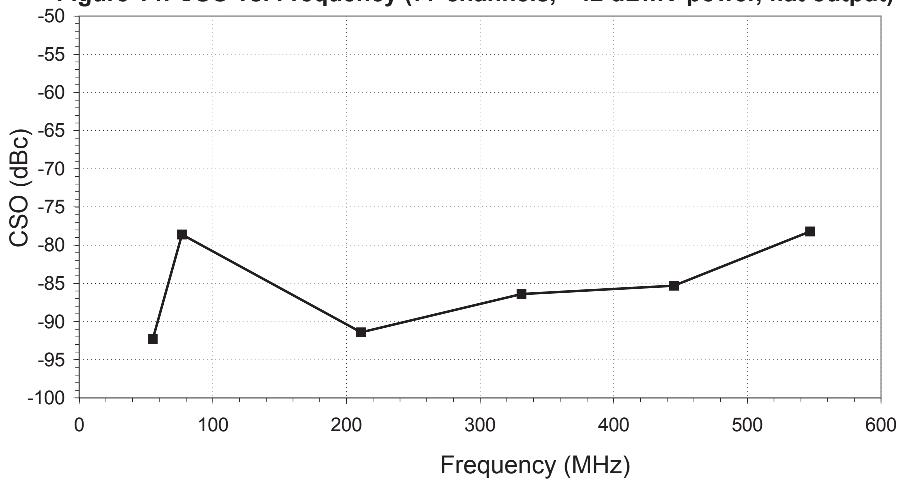
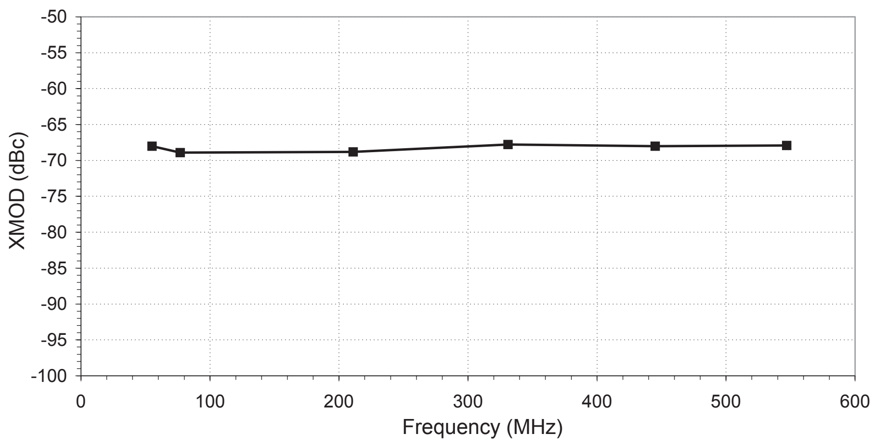


Figure 15: XMOD vs. Frequency (77 channels, +42 dBmV power, flat output)



APPLICATION INFORMATION

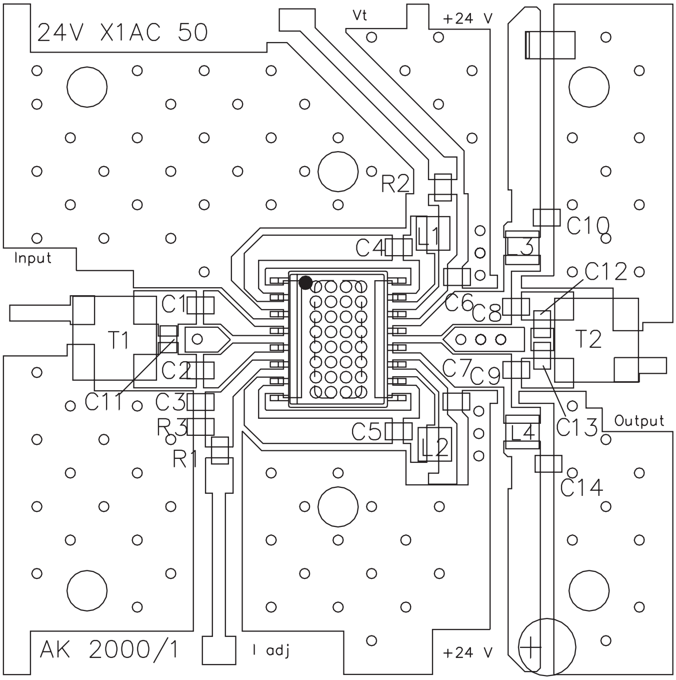


Figure 16: Evaluation Board Layout

Notes:

1. Via holes should be 35 mils (0.89 mm) in diameter, and plated to 1 mil (0.025 mm) thickness. They need not be solder-filled.

2. WARNING: Due to the power dissipation of this device, the printed circuit board should be mounted/attached to a heat sink.

3. More assembly details, such as via hole diameters, via spacing, solder paste application, and soldering recommendations are provided in the application note entitled, "Thermal Management of ANADIGICS' Surface Mounted Amplifiers".

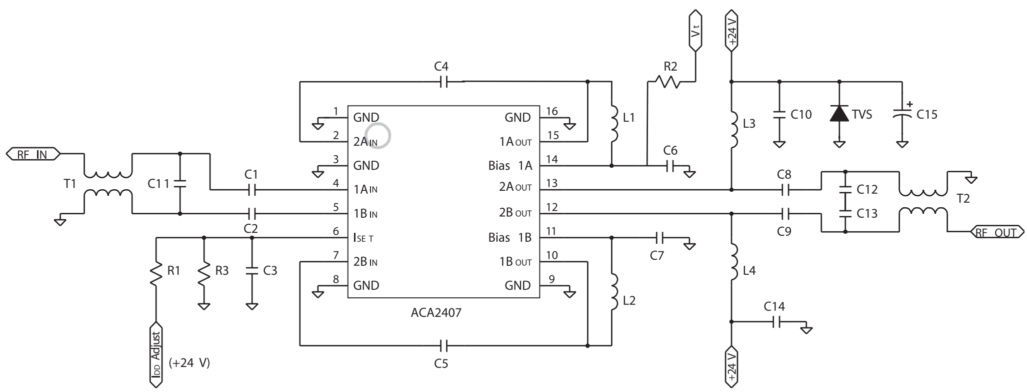


Figure 17: Evaluation Board Schematic

Table 5: Evaluation Board Parts List

REF	DESCRIPTION	QTY	VENDOR	VENDOR P/N
C1, C2, C3, C6, C7, C10, C14	0.01 μF CHIP CAP	7	MURATA	GRM39X7R103K50V
C4, C5, C8, C9	470 pF CHIP CAP	4	MURATA	GRM39X7R471K50V
C12, C13	1.0 pF CHIP CAP	2	MURATA	GRM36COG1R0C50
C15	47 μF ELECT. CAP	1	DIGI-KEY CORP	P5275-ND
R1, R2, C11	NOT USED			
R3	18 kΩ RESISTOR	1	DIGI-KEY CORP	P18KGCT-ND
TVS	TVS 24 VOLT 600 WATT	1	DIGI-KEY CORP	SMBJ24ACCCT-ND
L1, L2, L3, L4 (3)	680 nH INDUCTOR	4	COILCRAFT	1008CS-681XKBC
CONNECTOR (1)	75 Ω N MALE PANEL MOUNT	2	PASTERNACK ENTERPRISES	PE4504
T1, T2 (2) (BALUN)	Ferrite Core	2	FAIR-RITE	2843002702
	Wire		MWS WIRE IND.	T-2361429-20
	Printed Circuit Board	1	STANDARD PRINTED CIRC. INC	24VX1AC50
INDIUM	300 X 160 MILS	1	INDIUM CORP OF AMERICA	14996Y

Notes:
(1) N connector center pin should be approximately 80 mils in length.
(2) T1, T2 balun: 5.5 turns thru, as shown in Figure 18.
(3) 200 mA minimum current rating.

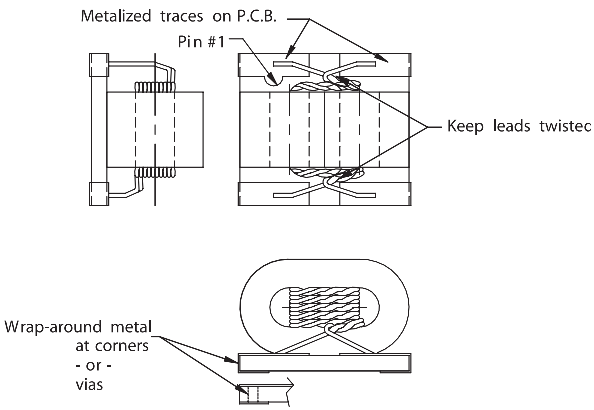
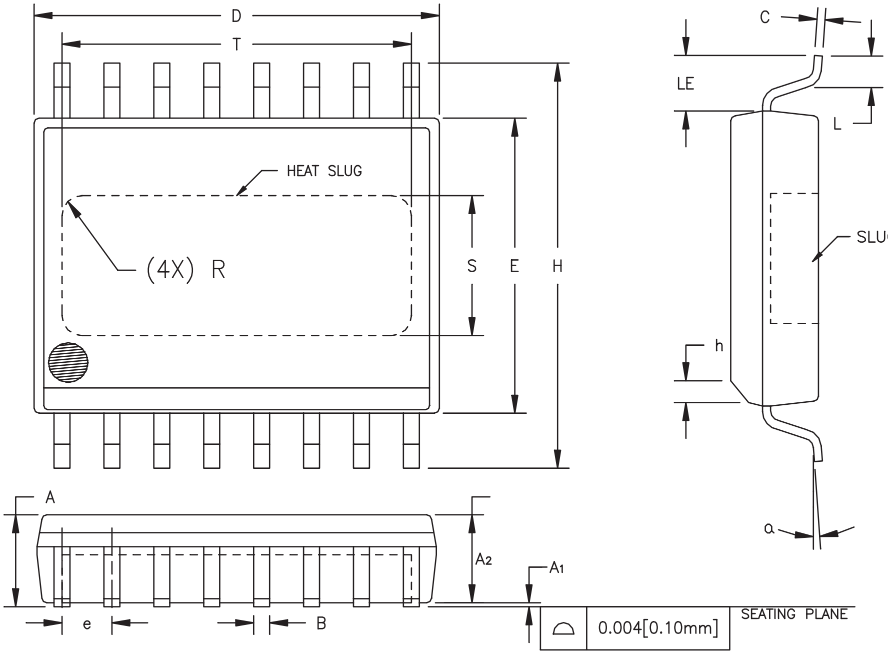


Figure 18: Balun Drawing

PACKAGE OUTLINE



SYMBOL	INCHES		MILLIMETERS		NOTE
	MIN.	MAX.	MIN.	MAX.	
A	0.087	0.098	2.21	2.49	
A_1	0.000	0.004	0.00	0.10	6
A_2	0.087	0.094	2.21	2.39	
B	0.013	0.019	0.33	0.48	
C	0.007	0.009	0.18	0.23	
D	0.398	0.412	10.11	10.46	2
E	0.290	0.300	7.37	7.62	3
e	0.050 BSC		1.27 BSC		4
H	0.394	0.418	10.01	10.62	
h	0.010	0.028	0.25	0.71	
L	0.024	0.040	0.61	1.02	
LE	0.052	—	1.32	—	
α	0°	8°	0°	8°	
S	0.120	0.140	3.05	3.56	5
T	0.330	0.350	8.38	8.89	5
R	REF. 0.015		REF. 0.38		5

NOTES:

1. CONTROLLING DIMENSION: INCHES
2. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.006 [0.15mm] PER SIDE.
3. DIMENSION "E" DOES NOT INCLUDE INTER–LEAD FLASH OR PROTRUSIONS. INTER–LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.010 [0.25mm] PER SIDE.
4. MAXIMUM LEAD TWIST/SKEW TO BE ±0.005 [0.13mm].
5. DIMENSIONS "S", "T" AND "R" INDICATE EXPOSED SLUG AREA.
6. STANDOFF HEIGHT (A_1) MEASURED FROM BOTTOM OF SLUG.

Figure 19: S7 Package Outline - 16 Pin Wide Body SOIC with Heat Slug

ORDERING INFORMATION

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
ACA2402S7TR	-40 to 110 °C	16 Pin Wide Body SOIC with Heat Slug	1,500 piece tape and reel
ACA2402RS7P2	-40 to 110 °C	RoHS-Compliant 16 Pin Wide Body SOIC with Heat Slug	1,500 piece tape and reel
ACA2402S7P0	-40 to 110 °C	16 Pin Wide Body SOIC with Heat Slug	Plastic tubes (50 pieces per tube)
ACA2402RS7P0	-40 to 110 °C	RoHS-Compliant 16 Pin Wide Body SOIC with Heat Slug	Plastic tubes (50 pieces per tube)

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