ARA2000S12

CATV Reverse Amplifier with Step Attenuator
Advanced Product Information

Rev. 0

FEATURES

- Low cost integrated monolithic GaAs amplifier with step attenuator.
- Attenuation Range: 0 – 56 dB, variable in 1 dB steps via serial input.
- Meets DOCSIS distortion requirements at +60 dBmV
- Low distortion & Low noise figure
- Frequency range: 5 – 100 MHz
- 5 Volt operation

APPLICATIONS

- MCNS/DOCSIS Compliant Cable Modems
- CATV Interactive Set-Top Box
- Telephony over Cable Systems

S12
28 PIN SSOP PACKAGE

DESCRIPTION

The ARA2000S12 is a GaAs IC designed to perform the reverse path amplification and output level control functions in a CATV Set-Top Box or Cable Modem. It incorporates a digitally controlled precision step attenuator that is preceded by an ultra low noise amplifier stage, and followed by an ultra-linear output driver amplifier. It is capable of meeting the MCNS/DOCSIS harmonic distortion specifications while only requiring a single polarity +5V supply. This part is a balanced design that meets or exceeds the MCNS/DOCSIS requirement for harmonic performance @ +60dBmV output levels. Both the input and output are matched to 75 ohms. The precision attenuator provides up to 56 dB of attenuation in 1 dB increments. The ARA2000S12 is supplied in a 28-pin SSOP package featuring a thermal heat slug on the bottom of package. Soldering this heat slug to the ground plane of the PC board ensures the lowest possible thermal resistance for the device resulting in a long MTF.

ABSOLUTE MAXIMUM RATINGS

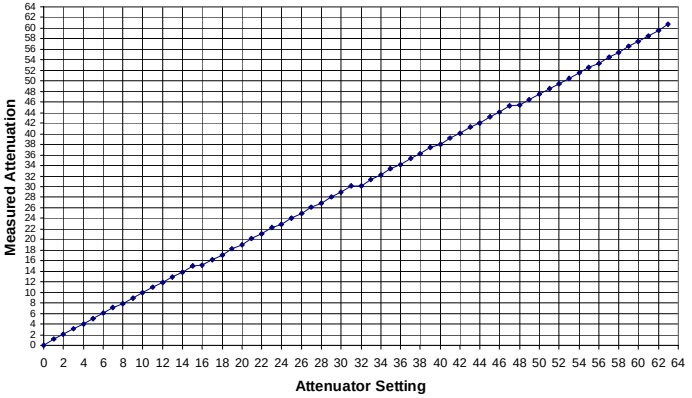
PARAMETER	PARAMETER	
V_{DD} (PINS 2,4,9,21,24)	9	VDC
V_{RFIN} (PINS 5,8)	0 to -3	VDC
ATT_{IN} (3,10) ATT_{OUT} (19,26)V	5	VDC
I_{SET} (PINS 7, 22)	2	VDC
RF Input Voltage (PINS 5,8)*	+ 60	dBmV
Storage Temperature	- 55 to +200	°C
Soldering Temperature	260	°C
Soldering Time	5	Sec
Operating Case Temperature	0 to + 85	°C

ELECTRICAL CHARACTERISTICS (TYPICAL) (V_{DD}=5 V_{DC}, Tc=25 °C)					
PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Gain [1]		29		dB	At 0dB attenuation setting
Gain Flatness [1]	-	0.75	-	dB	5 to 100 MHz
Gain Variation Over Temp	-	-0.006	-	dB/°c	
Attenuation Steps [1] 1 dB 2 dB 4 dB 8 dB 16 dB 32 dB		1 2 3.9 8.0 15.7 31.5		dB	
2nd Harmonic Distortion Level [2] 10 MHz	-	-57		dBc	at +60 dBmV
3rd Harmonic Distortion Level [2] 10 MHz	-	-64		dBc	at +60 dBmV
3rd Order Output Intercept Point	78	-	-	dBmV	
1 dB Gain Compression Point		70	-	dBmV	
Noise Figure	-	1.7	2.5	dB	
Ouput Noise Power Active/No Signal/Min Attn. Setting Active/No Signal/Max Attn. Setting	 - -	 - -	 -24.6 -41.6	dBmV	Any 3200 KHz bandwidth from 5-42 MHz
Switch Isolation at 45 MHz	-	35	30	dB	Difference in output signal level between active and standby
Input Impedance[1]	-	75	-	ohm	
Input Return Loss[1]	-	-20	-15	dB	
Output Impedance[1]	-	75	-	ohm	
Output Return Loss[1]	-	-20	-15	dB	Tx enabled
Output Return Loss[1]	-	-12	-10	dB	Tx disabled
Output Switch Control Logic VIL VIH	0 2.8	- -	1 V_{DD}	V V	
Output Switch Control Impedance	-	10K	-	ohm	
V_{DD1}, V_{DD2}	-	5	7	V	
V_{DD} Digital	-	5	-	V	
V Shutdown	-	0	-	V	
I_{DD1}	-	60	-	mA	
I_{DD2}	-	90	-	mA	
I_{DD} Digital	-	12	20	mA	
Power Consumption	-	0.75	-	W	
Attenuator Control Logic [4] VIL VIH	0 2.7	- -	0.5 6.5	Volts	

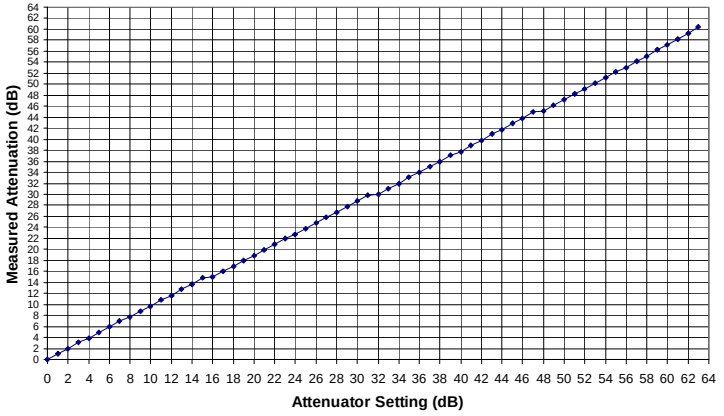
Notes:

1. As measured in ANADIGICS test fixture
2. At +60 dBmV output level into 75 ohm load

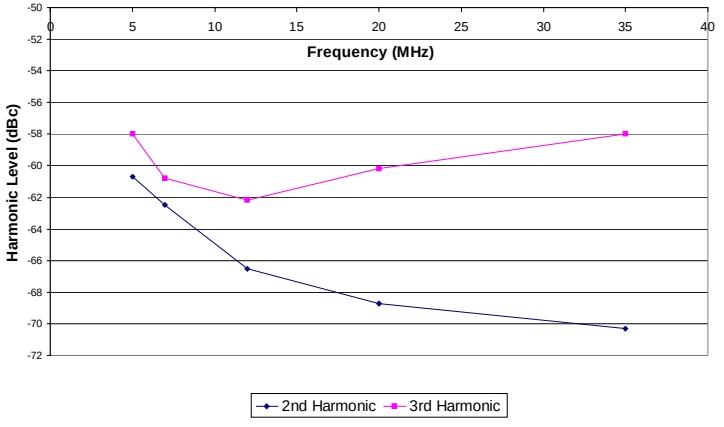
Attenuation @ 20 MHz
Pout = +62 dBmV @ 0 dB Attn. Setting



Attenuation @ 65 MHz
Pout = +62 dBmV @ 0 dB Attn. Setting



ARA2000 Harmonic Performance over Frequency
Pout = +62 dBmV



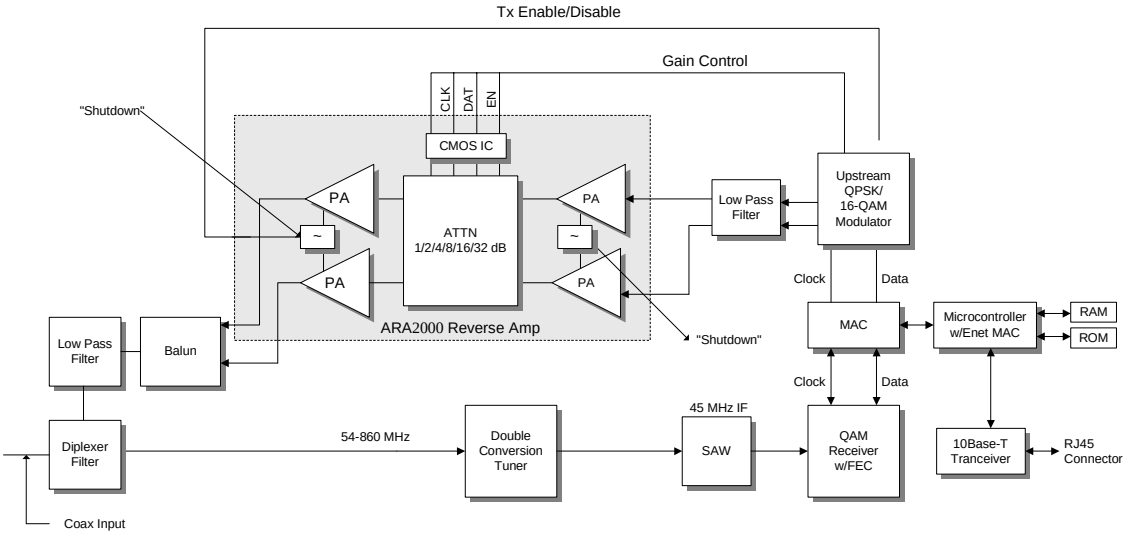


Figure 1: Cable Modem or Interactive Set-Top Box Block Diagram

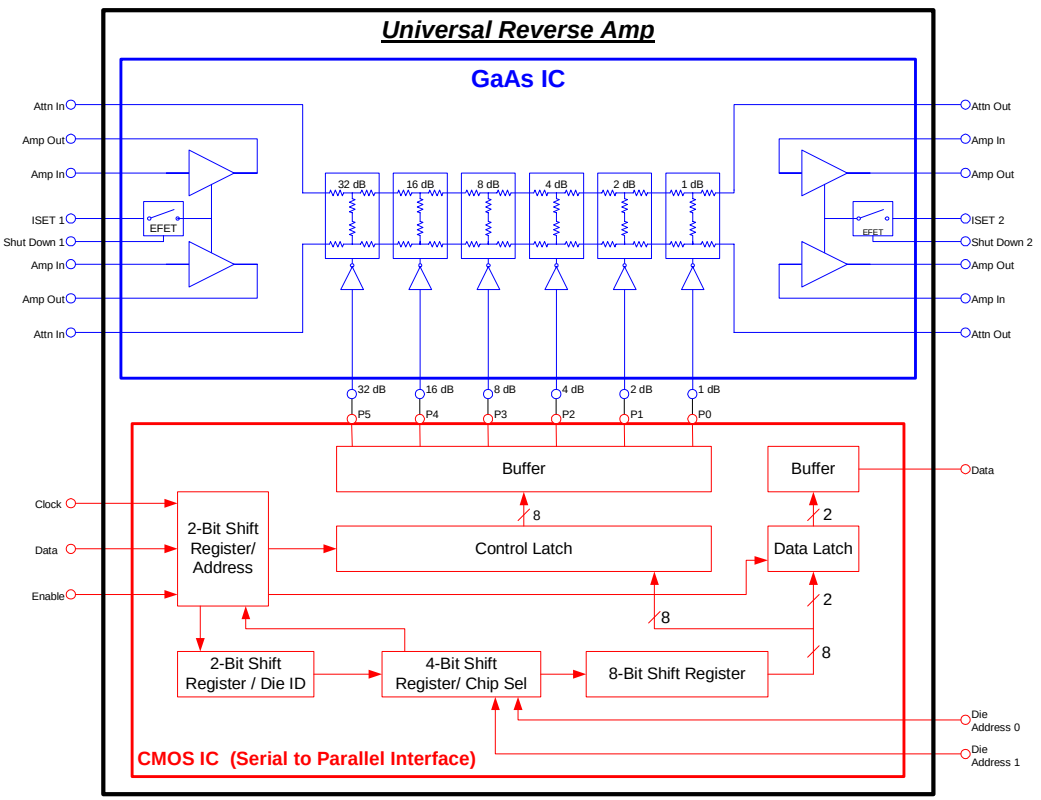
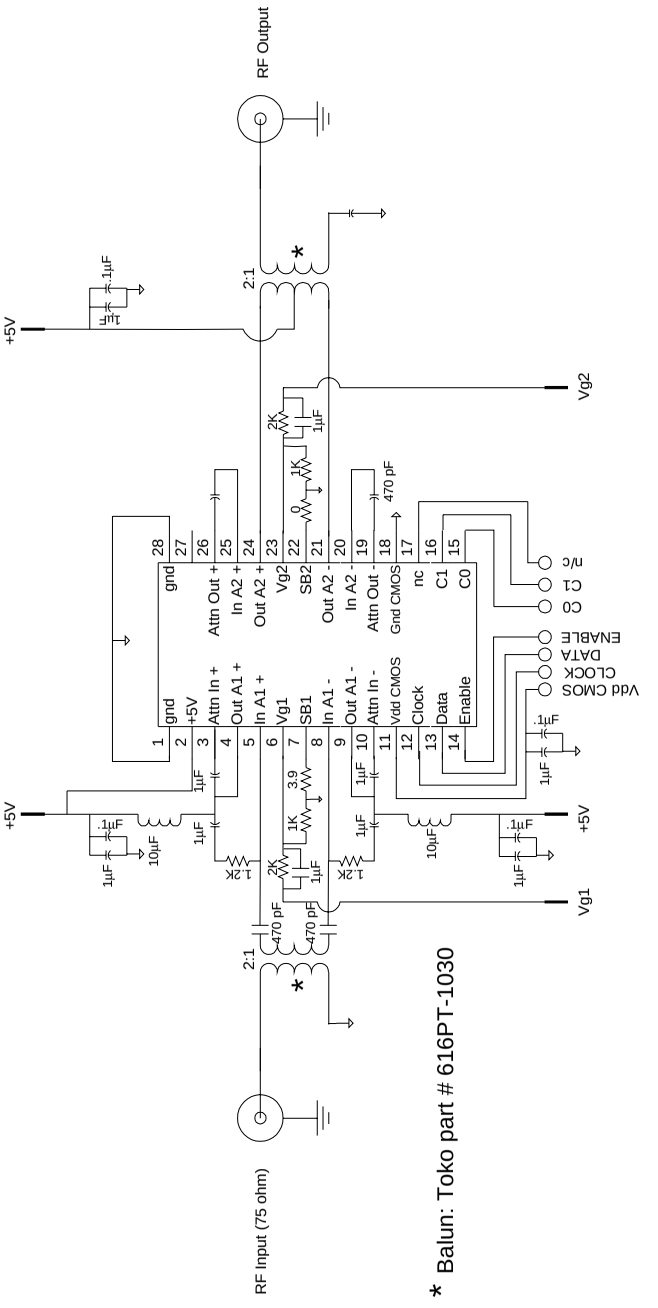


Figure 2

TEST CIRCUIT



Programming Word

D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_{10}	D_{11}	D_{12}	D_{13}	D_{14}	D_{15}
A0	A1	C0	C1	CS0	CS1	CS2	CS3	P0/D0	P1/D1	P2	P3	P4	P5	P6	P7

Register Address

A0	A1	REGISTER
0	0	Data Port
0	1	N/A
1	0	N/A
1	1	Parallel Port

Chip Select

CS0	CS1	CS2	CS3	APPLICATION
1	0	0	0	Serial-Parallel Interface
All Other Combinations				N/A

Die Address

C0 C1		External Die Connection			
		00	01	10	11
Serial Data Input	00	■			
	01		■		
	10			■	
	11				■

■ Indicates Device is Selected

Data Port Description

SERIAL DATA	FUNCTION
P0/D0	1 dB Attenuator Bit / External Data Port 0
P1/D1	2 dB Attenuator Bit / External Data Port 1
P2	4 dB Attenuator Bit
P3	8 dB Attenuator Bit
P4	16 dB Attenuator Bit
P5	32 dB Attenuator Bit
P6	N/A
P7	N/A

Figure 3

SERIAL DATA INPUT TIMING

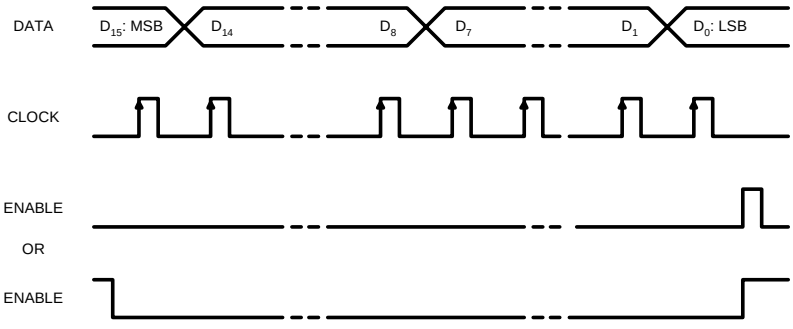
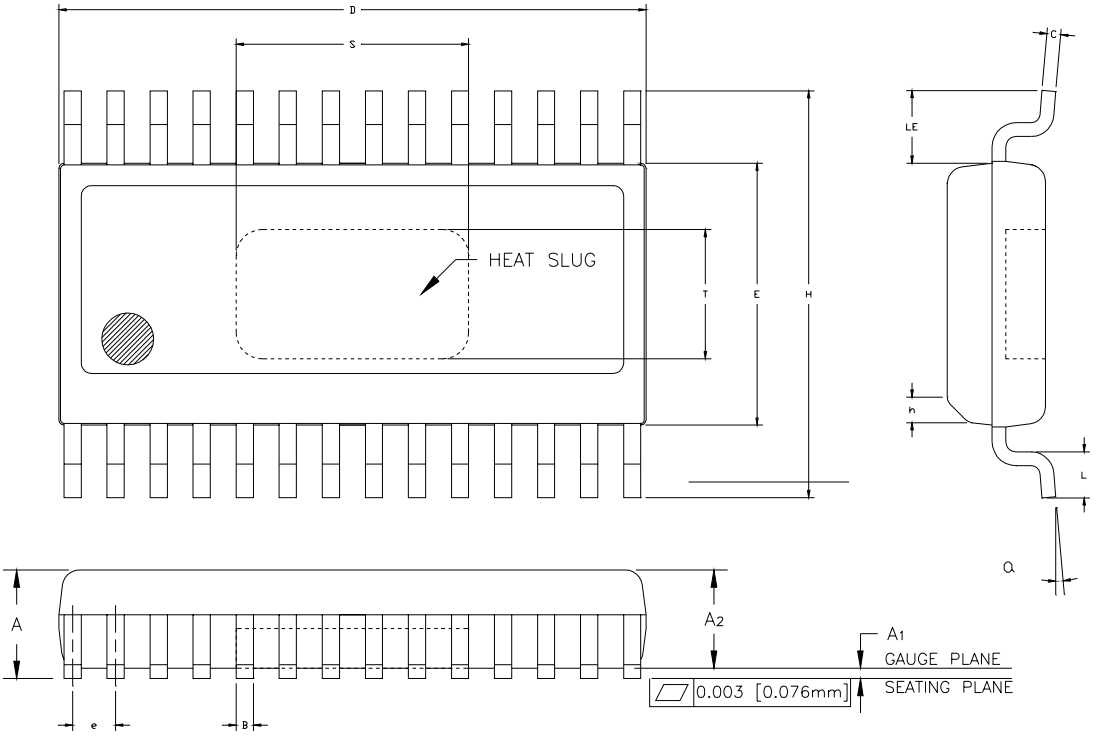


Figure 4

PIN DESCRIPTION		
Pin	**Function**	**Description**
1	Ground	
2	+5 Vdc	
3	ATT_{IN} (+)	Attenuator Input (+)
4	A1 (+) $_{OUT}$	Amplifier 1 (+) Outpout
5	A1 (+) $_{IN}$	Amplifier 1 (+) Input
6	Vg1	Amplifier A1 (+/-) Shutdown
7	I_{SET1}	Amplifier A1 (+/-) Current Adjust
8	A1 $(-)_{IN}$	Amplifier A1 (-) Input
9	A1 (-) $_{OUT}$	Amplifier A1 (-) Output
10	ATT $_{IN\ (-)}$	Attenuator Input (-)
11	VddDigital Supply	Supply For Digital Circuit
12	CLK	Clock
13	DAT	Data
14	En	Enable
15	C0	Die Address (see page 6)
16	C1	Die Address (see page 6)
17	N/C	No connection
18	Dig. gnd	Digital ground
19	$ATT_{OUT(-)}$	Attenuator Output (-)
20	A2 $_{INPUT\ (-)}$	Amplifier A2 (-) Input
21	A2 $_{OUTPUT\ (-)}$	Amplifier A2 (-) Output
22	I_{SET2}	Amplifier A2 (+/-) Current Adjust
23	Vg2	Amplifier A2 (+/-) Shutdown
24	A2 $_{OUTPUT\ (+)}$	Amplifier A2 (+) Output
25	A2 $_{INPUT\ (+)}$	Amplifier A2 (+) Input
26	ATT $_{OUT(+)}$	Attenuator Output (+)
27	N/C	No Connection
28	GND	Ground

PACKAGE DIAGRAM



SYMBOL	INCHES		MILLIMETERS		NOTE
	MIN.	MAX.	MIN.	MAX.	
A	0.058	0.068	1.47	1.73	
A1	0.000	0.004	0.00	0.10	
A2	0.054	0.060	1.37	1.52	
B	0.008	0.012	0.20	0.31	
C	0.007	0.009	0.18	0.23	5
D	0.385	0.393	9.78	9.98	2
E	0.151	0.157	3.84	3.99	3
e	0.025 BSC		0.64 BSC		4
H	0.228	0.244	5.79	6.20	
h	0.015x45°		0.38x45°		
L	0.016	0.032	0.41	0.81	
LE	0.042	—	1.07	—	
α	0°	8°	0°	8°	
S	0.105	0.135	2.67	3.43	6
T	0.045	0.075	1.41	1.91	6

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 0.002 [0.05mm]
5. LEAD THICKNESS AFTER PLATING TO BE 0.012 [0.30mm] MAXIMUM.
6. DIMENSIONS "S" AND "T" INDICATE EXPOSED SLUG AREA.

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