



# ARA2008

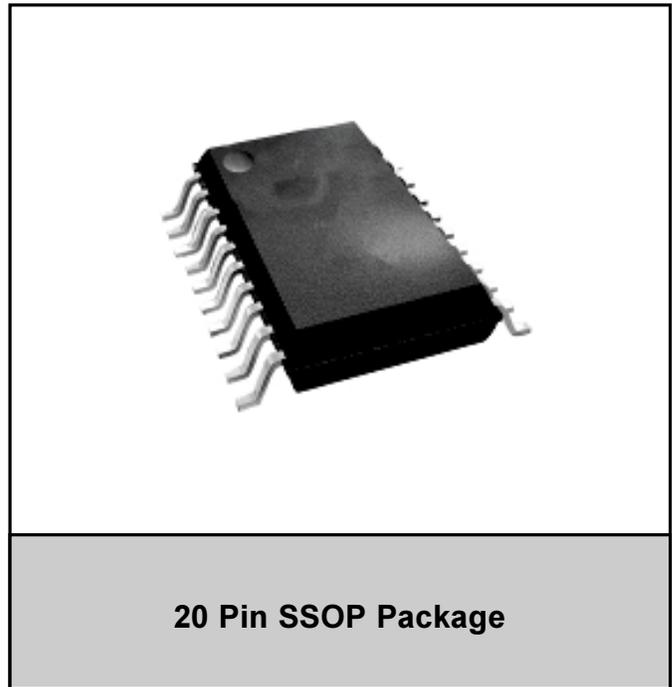
## Reverse Amplifier with Step Attenuator ADVANCED PRODUCT INFORMATION - Rev 0.0

### FEATURES

- Low cost integrated amplifier with step attenuator
- Attenuation Range: 0-58 dB, adjustable in 1dB increments via a 3 wire serial control
- Meets DOCSIS distortion requirements at +60dBmV output signal level
- Low distortion and low noise
- Frequency range: 5-100MHz
- 5 Volt operation
- -40 to +85 °C temperature range

### APPLICATIONS

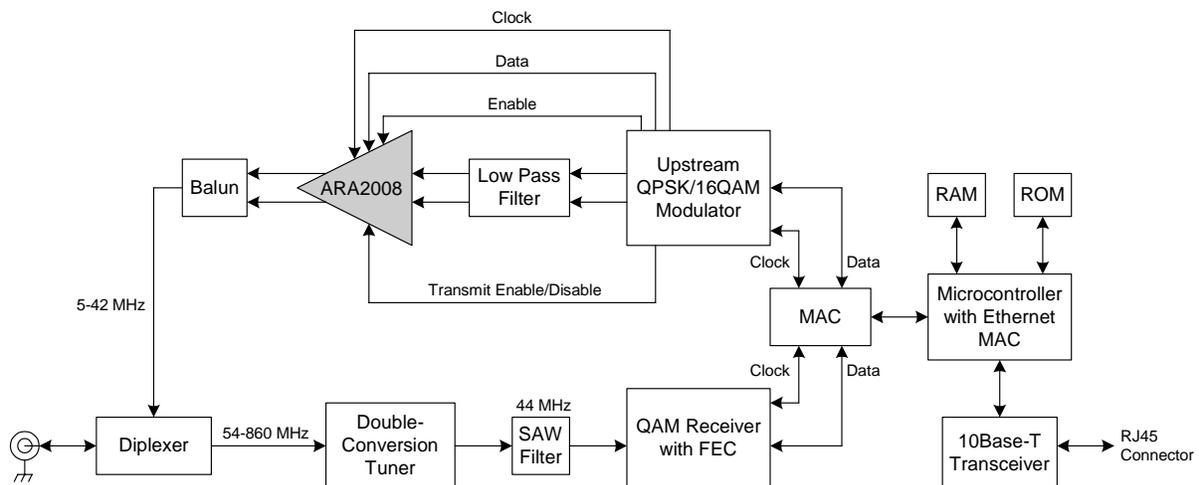
- MCNS/DOCSIS Compliant Cable Modems
- CATV Interactive Set-Top Box
- Telephony over Cable Systems
- OpenCable Set-Top Box
- Residential Gateway



### PRODUCT DESCRIPTION

The ARA2008 is designed to provide 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. This device uses a balanced circuit design that exceeds the MCNS/DOCSIS requirement for harmonic performance at a +60dBmV output level while only

requiring a single polarity +5V supply. Both the input and output are matched to 75 ohms with an appropriate transformer. The precision attenuator provides up to 58 dB of attenuation in 1 dB increments via a three-wire serial interface. With external passive components, this device meets IEC 1000-4-12 and ANSI/IEEE C62.41-1991 100KHz ringwave tests, as well as IEC1000-4-5 1.2/50µS surge tests. The ARA2008 is offered in a 20-pin SSOP package.



**Figure 1. Cable Modem or Set Top Box Application Diagram**

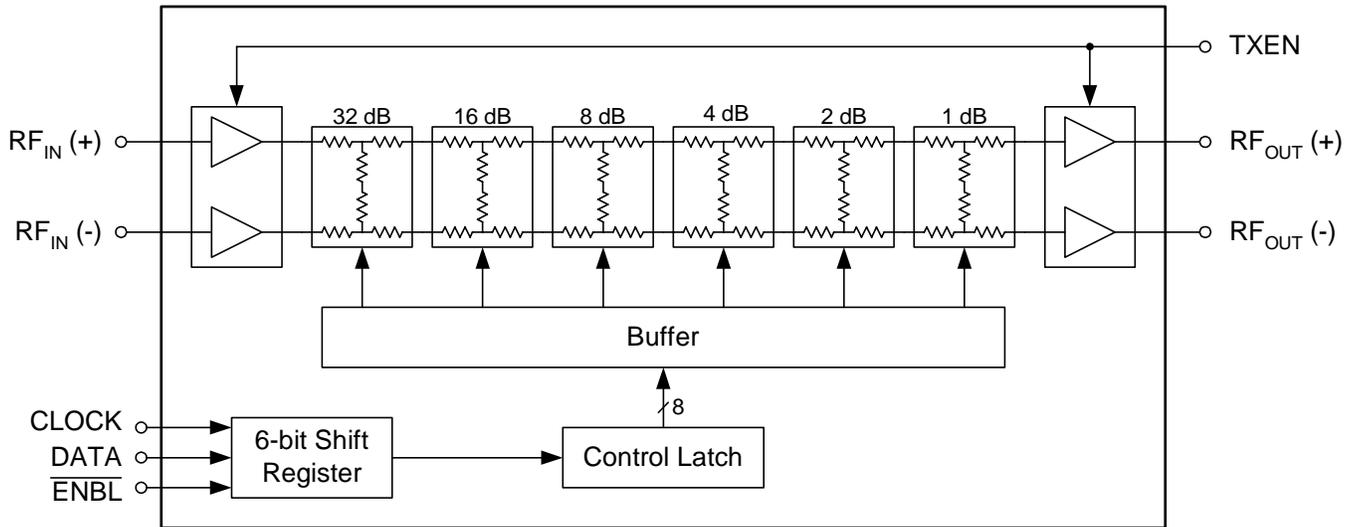


Figure 2: Functional Block Diagram

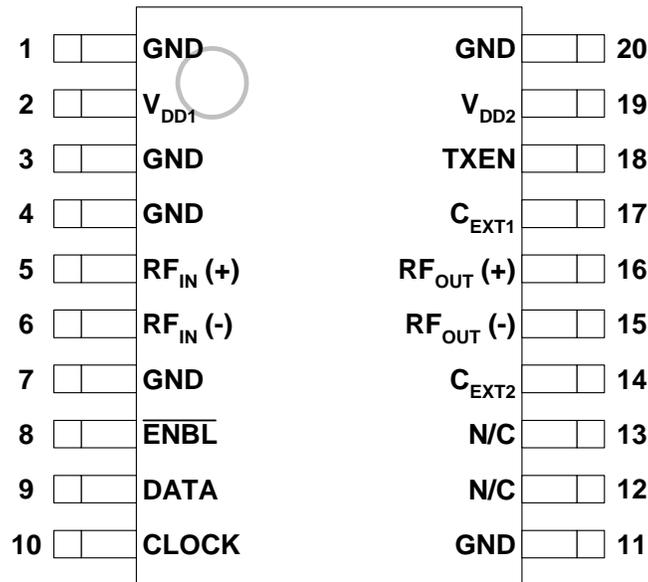


Figure 3: Pin Out - SSOP Package

Table 1: Pin Description - SSOP Package

PIN	NAME	DESCRIPTION	PIN	NAME	DESCRIPTION
1	GND	Ground	11	GND	Ground
2	V <sub>DD1</sub>	Supply	12	N/C	No connection
3	GND	Ground	13	N/C	No connection
4	GND	Ground	14	C <sub>EXT2</sub>	External Capacitor
5	RF <sub>IN</sub> (+)	RF (+) Input	15	RF <sub>OUT</sub> (-)	RF (-) Output
6	RF <sub>IN</sub> (-)	RF (-) Input	16	RF <sub>OUT</sub> (+)	RF (+) Output
7	GND	Ground	17	C <sub>EXT1</sub>	External Capacitor
8	$\overline{\text{ENBL}}$	Enable	18	TXEN	Transmit Enable
9	DATA	Data	19	V <sub>DD2</sub>	Supply
10	CLOCK	Clock	20	GND	Ground

## ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT
Supply: V <sub>DD</sub> (pins 2, 15, 16, 19)	0	9	VDC
RF Power at Inputs (pins 5, 6)	-	+60	dBmV
Digital Interface (pins 8, 9, 10)	-0.5	V <sub>DD</sub> +0.5	V
Storage Temperature	-55	+200	°C
Soldering Temperature	-	260	°C
Soldering Time	-	5	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.

Table 3: Operating Ranges

PARAMETER	MIN	TYP	MAX	UNIT
Supply: V <sub>DD</sub> (pins 2, 15, 16, 19)	4.5	5	7	VDC
Digital Interface (pins 8, 9, 10)	0	-	V <sub>DD</sub>	V
Case Temperature	-40	25	85	°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: DC Electrical Specifications

T<sub>A</sub>=25°C; V<sub>DD</sub> = +5.0 VDC

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Total Supply Current (pins 2, 15, 16, 19)	-	135	-	mA	Tx enabled (TXEN high) Tx disabled (TXEN low)
Total Power Consumption	-	675	-	mW	Tx enabled (TXEN high) Tx disabled (TXEN low)
	-	75	-		

Table 5: Digital Interface Specifications

T<sub>A</sub>=25°C; V<sub>DD</sub> = +5.0 VDC

PARAMETER	MIN	TYP	MAX	UNIT
Logic High Input Voltage: V <sub>IN,HIGH</sub>	2.0	-	V <sub>DD</sub>	V
Logic Low Input Voltage: V <sub>IN,LOW</sub>	0	-	0.8	V

**Table 6: AC Electrical Specifications****T<sub>A</sub>=25°C; V<sub>DD</sub> = +5.0 VDC**

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Gain (10 MHz)	-	29	-	dB	0 dB attenuation setting
Gain Flatness	-	1.5	-	dB	5 to 65 MHz
Gain Variation over Temperature	-	-0.006	-	dB/°C	
Attenuation Step Size	-	1	-	dB	Monotonic
Maximum Attenuation	58	-	-	dB	
2 <sup>nd</sup> Harmonic Distortion Level (10 MHz)	-	-	-53	dBc	+60 dBmV into 75 Ohms
3 <sup>rd</sup> Harmonic Distortion Level (10 MHz)	-	-	-53	dBc	+60 dBmV into 75 Ohms
3 <sup>rd</sup> Order Output Intercept	78	-	-	dBmV	
1 dB Gain Compression Point	-	68.5	-	dBmV	
Noise Figure	-	3.0	-	dB	Includes input balun loss
Output Noise Power Active / No Signal / Min. Atten. Set. Active / No Signal / Max. Atten. Set.	- -	- -	-38.5 -53.8	dBmV	Any 160 kHz bandwidth from 5 to 42 MHz
Isolation (45 MHz) in Tx disable mode	-	60	-	dB	
Differential Input Impedance (Tx enabled)	-	300	-	Ohms	
Input Impedance (Tx enabled)	-	75	-	Ohms	with transformer
Input Return Loss (75 Ohms)	-	-15	-	dB	
Differential Output Impedance	-	300	-	Ohms	
Output Impedance	-	75	-	Ohms	with transformer
Output Return Loss (75 Ohms)	-	-15	-	dB	
Output Voltage Transient Tx enable / Tx disable	- -	- 4	100 7	mVp-p	0 dB attenuator setting 24 dB attenuator setting

## LOGIC PROGRAMMING

### Programming Instructions

The programming word is set through a 6 bit shift register via the data, clock and enable lines. The data is entered in order with the most significant bit (MSB) first and the least significant bit (LSB) last.

The enable line must be low for the duration of the data entry, then set high to latch the shift register. The rising edge of the clock pulse shifts each data value into the register.

Table 7: Programming Word

DATA BIT	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>
Value	P5	P4	P3	P2	P1	P0

Table 8: Data Description

VALUE	FUNCTION (0 = on, 1 = bypass)
P5	32 dB Attenuator Bit
P4	16 dB Attenuator Bit
P3	8 dB Attenuator Bit
P2	4 dB Attenuator Bit
P1	2 dB Attenuator Bit
P0	1 dB Attenuator Bit

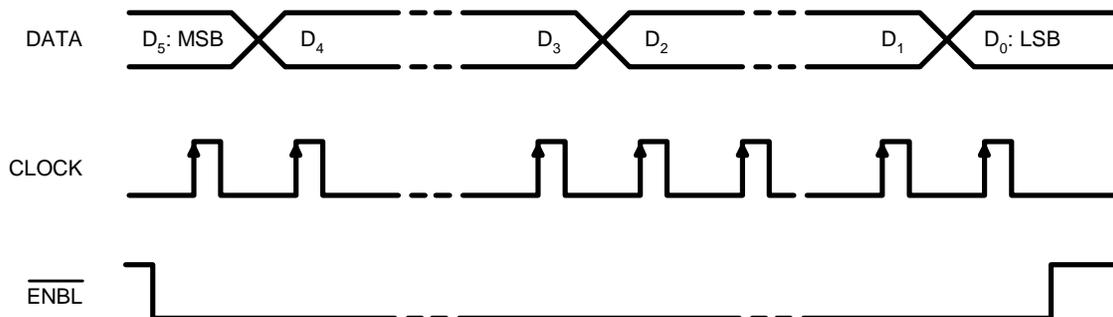


Figure 4: Serial Data Input Timing

## APPLICATION INFORMATION

### Output Transformer

Matching the output of the ARA2008 to a 75 Ohm load is accomplished using a 2:1 turns ratio transformer. In addition to providing an impedance transformation, this transformer provides the bias to the output amplifier stage via the center tap.

The transformer also cancels even mode distortion products and common mode signals, such as the voltage transients that occur while enabling and disabling the amplifiers. As a result, care must be taken when selecting the transformer to be used at the output. It must be capable of handling the RF and DC power requirements without saturating the core, and it must have adequate isolation and good phase and amplitude balance. It also must operate over the desired frequency and temperature range for the intended application.

### ESD Sensitivity

Electrostatic discharges can cause permanent damage to this device. Electrostatic charges accumulate on test equipment and the human body, and can discharge without detection. Although the ARA2008 has some built-in ESD protection, proper precautions and handling are strongly recommended. Refer to the ANADIGICS application note on ESD precautions.

**ANADIGICS, Inc.**

141 Mount Bethel Road  
Warren, New Jersey 07059, U.S.A.  
Tel: +1 (908) 668-5000  
Fax: +1 (908) 668-5132

URL: <http://www.anadigics.com>  
E-mail: [Mktg@anadigics.com](mailto:Mktg@anadigics.com)

**IMPORTANT NOTICE**

ANADIGICS, Inc. reserves the right to make changes to its products or to discontinue any product at any time without notice. The product specifications contained in Advanced Product Information sheets and Preliminary Data Sheets are subject to change prior to a product's formal introduction. Information in Data Sheets have been carefully checked and are assumed to be reliable; however, ANADIGICS assumes no responsibilities for inaccuracies. ANADIGICS strongly urges customers to verify that the information they are using is current before placing orders.

**WARNING**

ANADIGICS products are not intended for use in life support appliances, devices or systems. Use of an ANADIGICS product in any such application without written consent is prohibited.

SUNSTAR 商斯达实业集团是集研发、生产、工程、销售、代理经销、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有 10 多年历史的专业电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一，是一家专业代理和分销世界各大品牌 IC 芯片和电子元器件的连锁经营综合性国际公司，专业经营进口、国产名厂名牌电子元件，型号、种类齐全。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商，已在全国范围内建成强大统一的供货和代理分销网络。我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM 电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA 软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。商斯达实业公司拥有庞大的资料库，有数位毕业于著名高校——有中国电子工业摇篮之称的西安电子科技大学（西军电）并长期从事国防尖端科技研究的高级工程师为您精挑细选、量身订做各种高科技电子元器件，并解决各种技术问题。

微波光电部专业代理经销高频、微波、光纤、光电元器件、组件、部件、模块、整机；电磁兼容元器件、材料、设备；微波 CAD、EDA 软件、开发测试仿真工具；微波、光纤仪器仪表。欢迎国外高科技微波、光纤厂商将优秀产品介绍到中国、共同开拓市场。长期大量现货专业批发高频、微波、卫星、光纤、电视、CATV 器件：晶振、VCO、连接器、PIN 开关、变容二极管、开关二极管、低噪晶体管、功率电阻及电容、放大器、功率管、MMIC、混频器、耦合器、功分器、振荡器、合成器、衰减器、滤波器、隔离器、环行器、移相器、调制解调器；光电子器件和组件：红外发射管、红外接收管、光电开关、光敏管、发光二极管和发光二极管组件、半导体激光二极管和激光器组件、光电探测器和光接收组件、光发射接收模块、光纤激光器和光放大器、光调制器、光开关、DWDM 用光发射和接收器件、用户接入系统光收发器件与模块、光纤连接器、光纤跳线/尾纤、光衰减器、光纤适配器、光隔离器、光耦合器、光环行器、光复用器/转换器；无线收发芯片和模组、蓝牙芯片和模组。

更多产品请看本公司产品专用销售网站：

商斯达中国传感器科技信息网：<http://www.sensor-ic.com/>

商斯达工控安防网：<http://www.pc-ps.net/>

商斯达电子元器件网：<http://www.sunstare.com/>

商斯达微波光电产品网：[HTTP://www.rfoe.net/](http://www.rfoe.net/)

商斯达消费电子产品网：<http://www.icasic.com/>

商斯达实业科技产品网：<http://www.sunstars.cn/> 微波元器件销售热线：

地址：深圳市福田区福华路福庆街鸿图大厦 1602 室

电话：0755-82884100 83397033 83396822 83398585

传真：0755-83376182 (0) 13823648918 MSN: SUNS8888@hotmail.com

邮编：518033 E-mail:szss20@163.com QQ: 195847376

深圳赛格展销部：深圳华强北路赛格电子市场 2583 号 电话：0755-83665529 25059422

技术支持：0755-83394033 13501568376

欢迎索取免费详细资料、设计指南和光盘；产品凡多，未能尽录，欢迎来电查询。

北京分公司：北京海淀区知春路 132 号中发电子大厦 3097 号

TEL: 010-81159046 82615020 13501189838 FAX: 010-62543996

上海分公司：上海市北京东路 668 号上海赛格电子市场 D125 号

TEL: 021-28311762 56703037 13701955389 FAX: 021-56703037

西安分公司：西安高新开发区 20 所(中国电子科技集团导航技术研究所)

西安劳动南路 88 号电子商城二楼 D23 号

TEL: 029-81022619 13072977981 FAX:029-88789382