

## Description

The AMIS-14935 (former MSC-LX1792) offers a patent pending, low-voltage, low-power and high efficiency amplifier for driving a high impedance speaker such as a hearing aid receiver or a headset. The AMIS-14935 consists of a pre-amplifier followed by a fixed gain class D amplifier.

The input resistor and feedback resistor is external in the AMIS-14935 making it possible to set the gain arbitrarily, up to approximately 40dB. The feedback resistor can also be potentiometer to facilitate volume control.

## Key Features

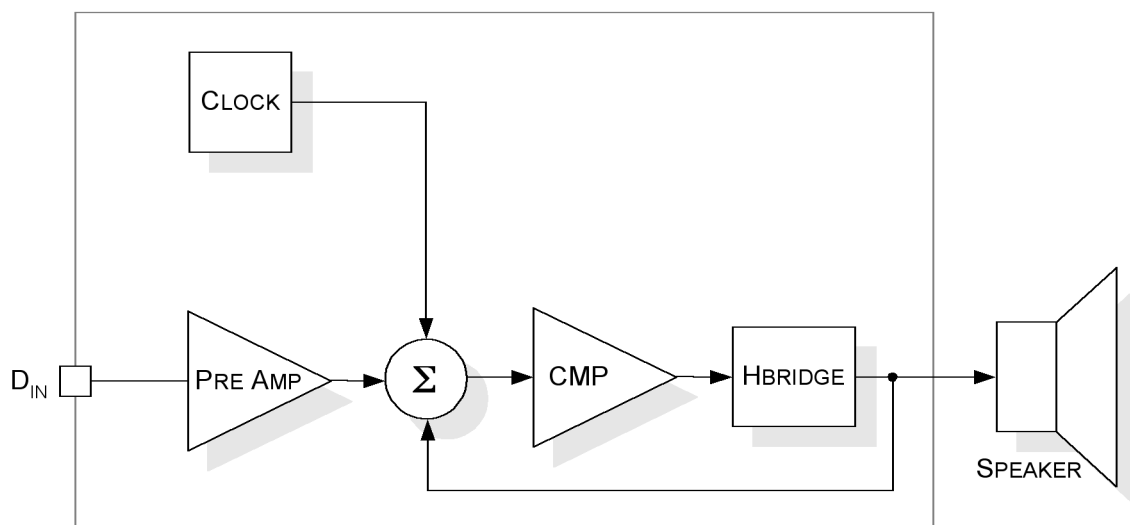
- Low Operating Current: 120 $\mu$ A Typical
- Low Operating Voltage: 0.9V minimum
- Gain Set by External Resistors
- 3 output switch resistance settings: 48, 24 & 16 $\Omega$
- 5 $\mu$ Vrms Input Referred Noise

## Applications

- Hearing aid applications
- High impedance speaker/transducer applications

**Important:** For the most current data, consult AMI Semiconductor's website: <http://www.amis.com>.

## Product Highlight



## Package Order Info

$T_J$  (°C): 10...15  
J: Ceramic Dip 14-Pin  
NQFP: Plastic MLPM 8-Pin  
BD: Bare Die

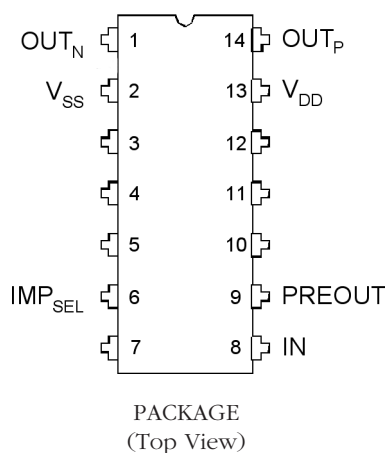
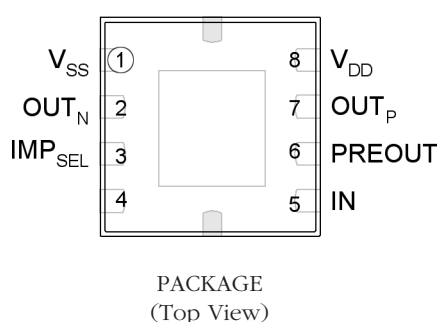
Note for hearing aid applications are covered by Knowles patents numbers US 4,592,087 & 4,689,819: AMI Semiconductor policy is not to sell the AMIS-14935 into hearing aid applications unless a patent license exist between customer and Knowles Corporation. Please contact AMIS for assistance with this.

## Absolute Maximum Ratings

Input Logic Supply Voltage ( $V_{DD}$ ) -0.3V to +3.0V  
 Operating Temperature Range 10°C to 55°C

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

## Package Pin Out



## Settings

Pin	$IMP_{SEL}=V_{SS}$	$IMP_{SEL}=V_{DD}$	$IMP_{SEL}=Floating$
$IMP_{SEL}$	16Ω	24Ω	48Ω

## Functional Pin Description

Pin Name	Pin No 14 Pin J (Evaluation Samples)	Pin No 8 Pin	Description
$V_{DD}$	13	8	Supply Voltage
$V_{SS}$	2	1	Ground
IN	8	5	Analog Audio Input
$OUT_P$	14	7	Positive Output Voltage
$OUT_N$	1	2	Negative Output Voltage
PREOUT	9	6	Pre-Amplifier Output
$IMP_{SEL}$	6	3	Output Resistance Select. See Settings table below for selections.

## Recommended Operating Conditions

Parameter	Symbol	Test Conditions	AMIS-14935			Units
			Min	Typ	Max	
OPERATING CONDITIONS						
Supply Voltage	$V_{DD}$		0.9		1.5	V
Ground	$V_{SS}$			0		V

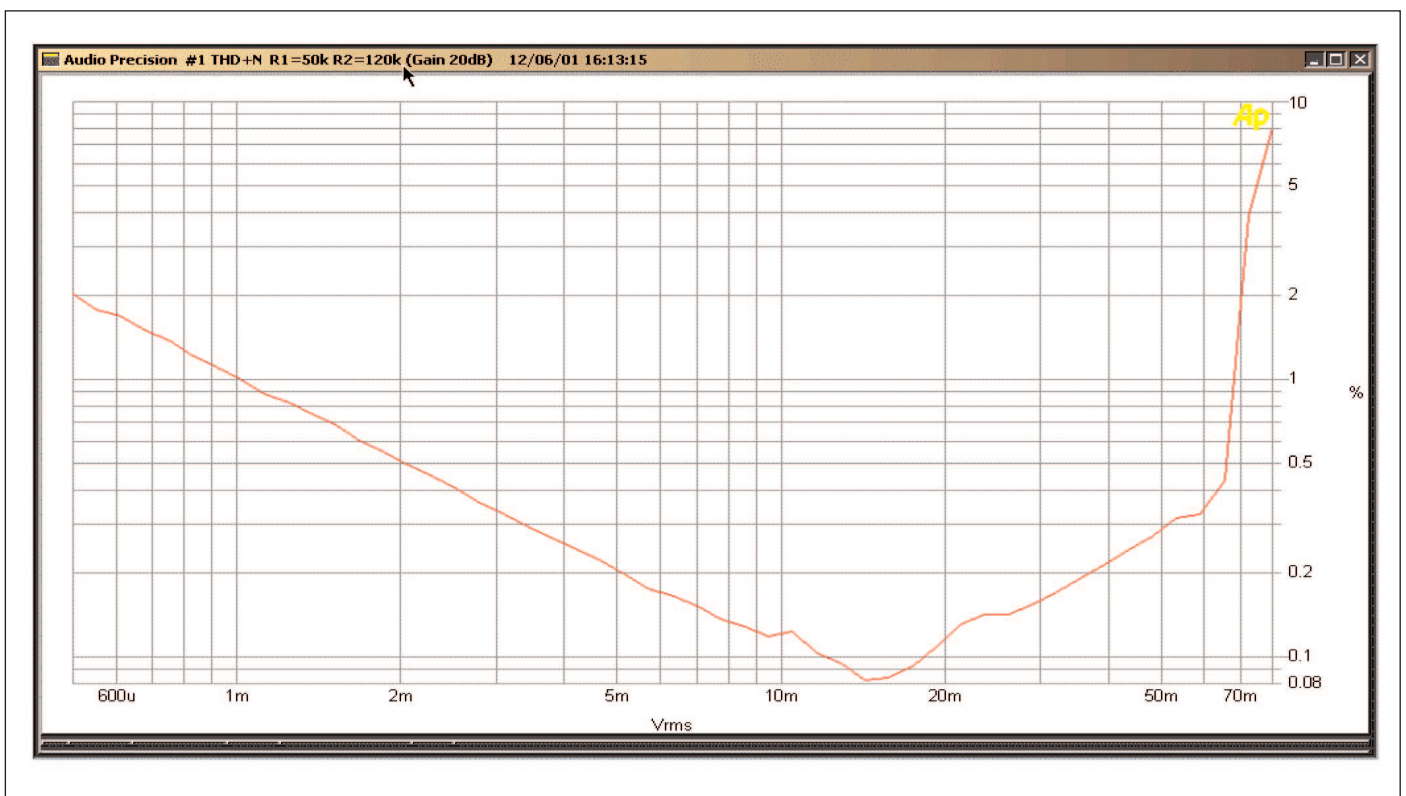
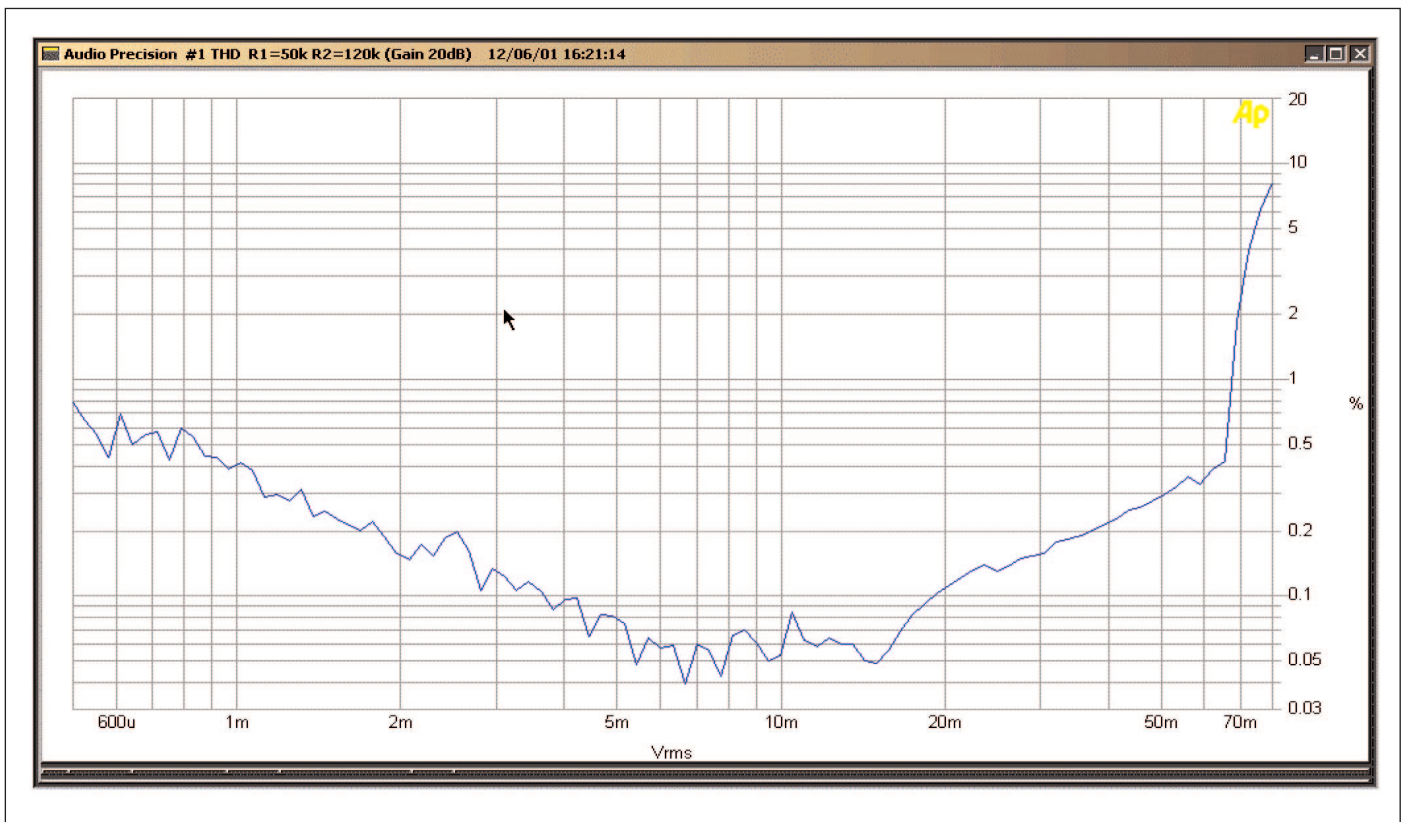
## Electrical Characteristics

Unless otherwise specified, the following specifications apply over the operating ambient temperature  $T_A=25^\circ\text{C}$  except where otherwise noted. Test conditions:  $V_{DD}=1.3\text{V}$ ,

$V_{SS}=0\text{V}$ , Circuit connected as application schematic on page 5, Output loaded with 200Ohm in series with 60mH.

Parameter	Symbol	Test Conditions	AMIS-14935			Units
			Min	Typ	Max	
Switch Output Resistance @ Low Drive	$R_{OUT-L}$			48		
Switch Output Resistance @ Med Drive	$R_{OUT-M}$			24		$\Omega$
Switch Output Resistance @ High Drive	$R_{OUT-HI}$			16	19	
Quiescent Current @ Low Drive	$IDDQ_L$			110		
Quiescent Current @ Med Drive	$IDDQ_M$	No load		120		$\mu\text{A}$
Quiescent Current @ High Drive	$IDDQ_H$			130		
3dB Bandwidth – Min Frequency	$F_{MIN}$	R1=50k, R2=1000k, Fin=1kHz		40	100	Hz
3dB Bandwidth – Max Frequency	$F_{MAX}$		10			kHz
Output Switching Frequency		$F_{CLK}$		200		kHz
Gain1	$A_1$	R1=50k, R2=500k		32		dB
		R1=25k, R2=500k		37		
Power Supply Rejection Ratio	PSRR	Input Reference R1=50k, R2=500k		45		dB
Total Harmonic Distortion	THD1	R1=50k, R2=500k, Vin=5mVrms, Fin=1kHz		0.3		%
		R1=25k, R2=500k, Vin=5mVrms, Fin=1kHz		0.5		
Input Referred Noise	$V_{N-20}$	R1=50k, R2=500k, 100Hz-10kHz, No weighting		4		$\mu\text{Vrms}$
		R1=25k, R2=500k, 100Hz-10kHz, No weighting		3		
Output Clock Frequency	$F_{CLK}$		140	200	300	kHz
Max Absolute DC Offset OutN-OutP	$V_{OFF-NP}$	No input signal	0	0.5	5	mV

## Charts



Note: Graphs show distortion with no load outputs.

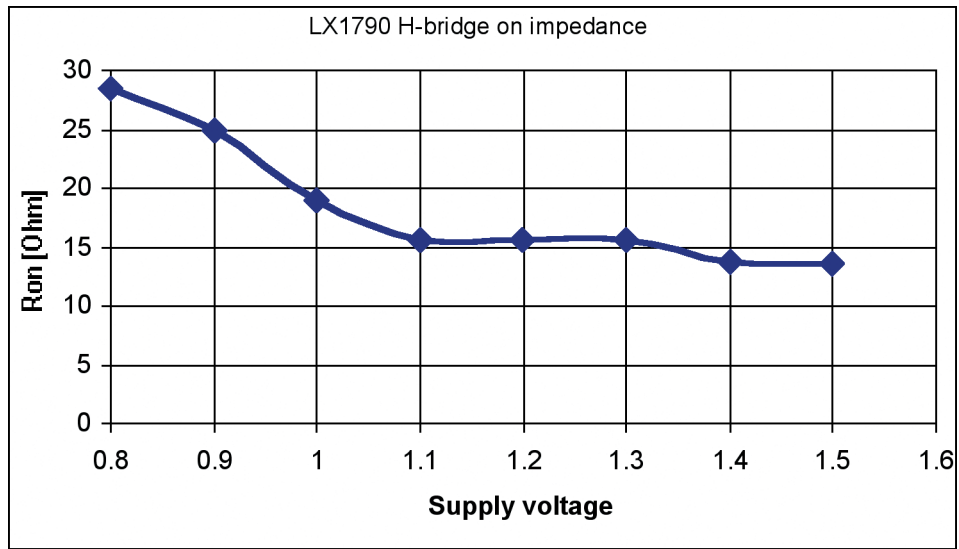
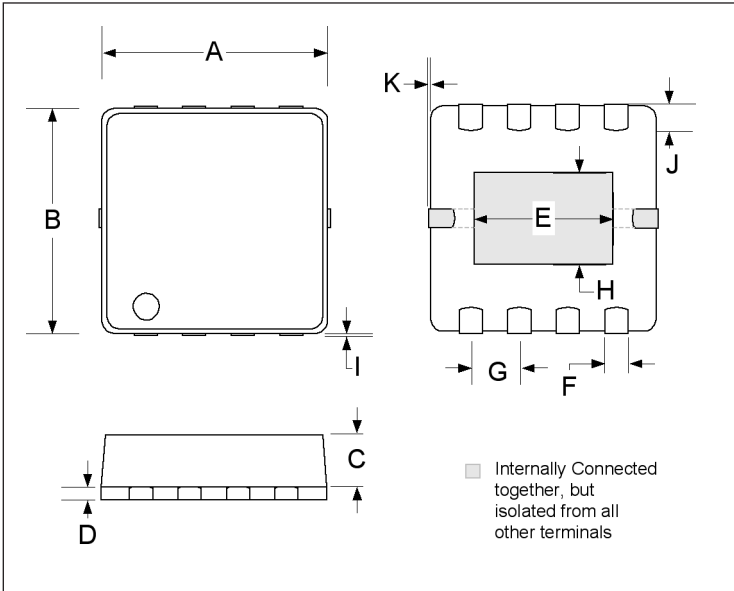


Figure 2 – H-Bridge Impedance vs. Supply Voltage (Lowest Impedance Setting).

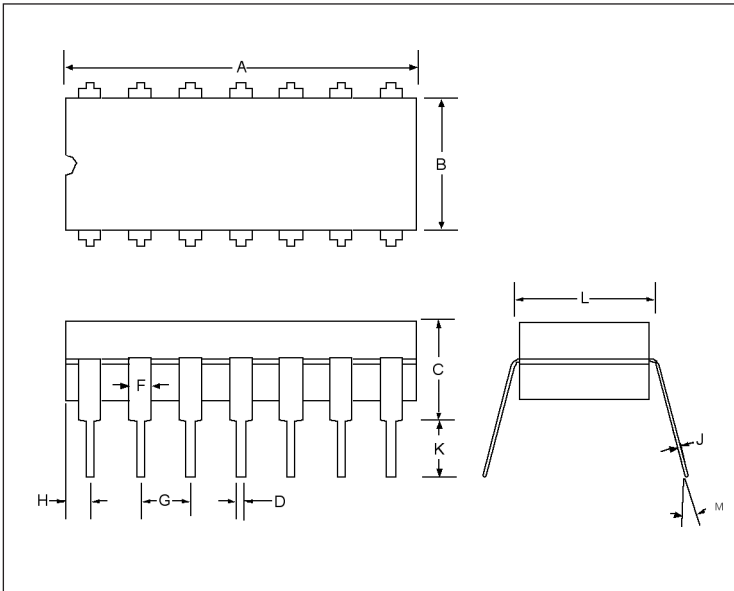
## Mechanicals - 8 Pin MLPQ Package Outline

### LM 8-Pin Plastic MLP-Micro Exposed Pad



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	0.65	0.75	0.025	0.029
D	0.15	0.25	0.005	0.009
E	1.841 BSC		0.075 BSC	
F	0.27	0.43	0.010	0.016
G	0.65 BSC		0.025 BSC	
H	1.22 BSC		0.048 BSC	
I	0	0.10	0	0.003
J	0.21	0.37	0.008	0.014
K	0	0.10	0	0.003

### J 14-Pin Ceramic Dip

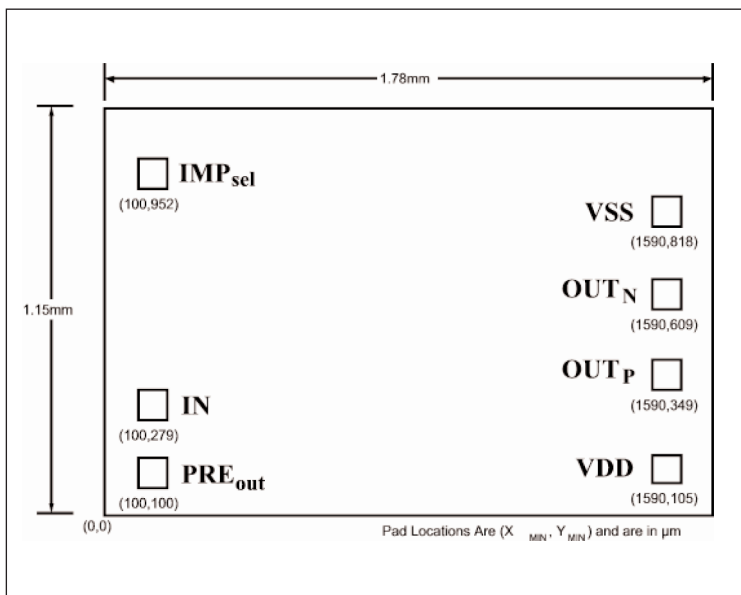


Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	19.30	19.94	0.760	0.785
B	5.59	7.11	0.220	0.280
C	-	5.08	-	0.200
D	0.38	0.51	0.015	0.020
F	1.02	1.77	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	-	2.03	-	0.080
J	0.20	0.38	0.008	0.015
K	3.18	5.08	0.125	0.200
L	7.37	7.87	0.290	0.310
M	-	15°	-	15°

Note:

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

## Mechanicals - 7 Pin Bare Die

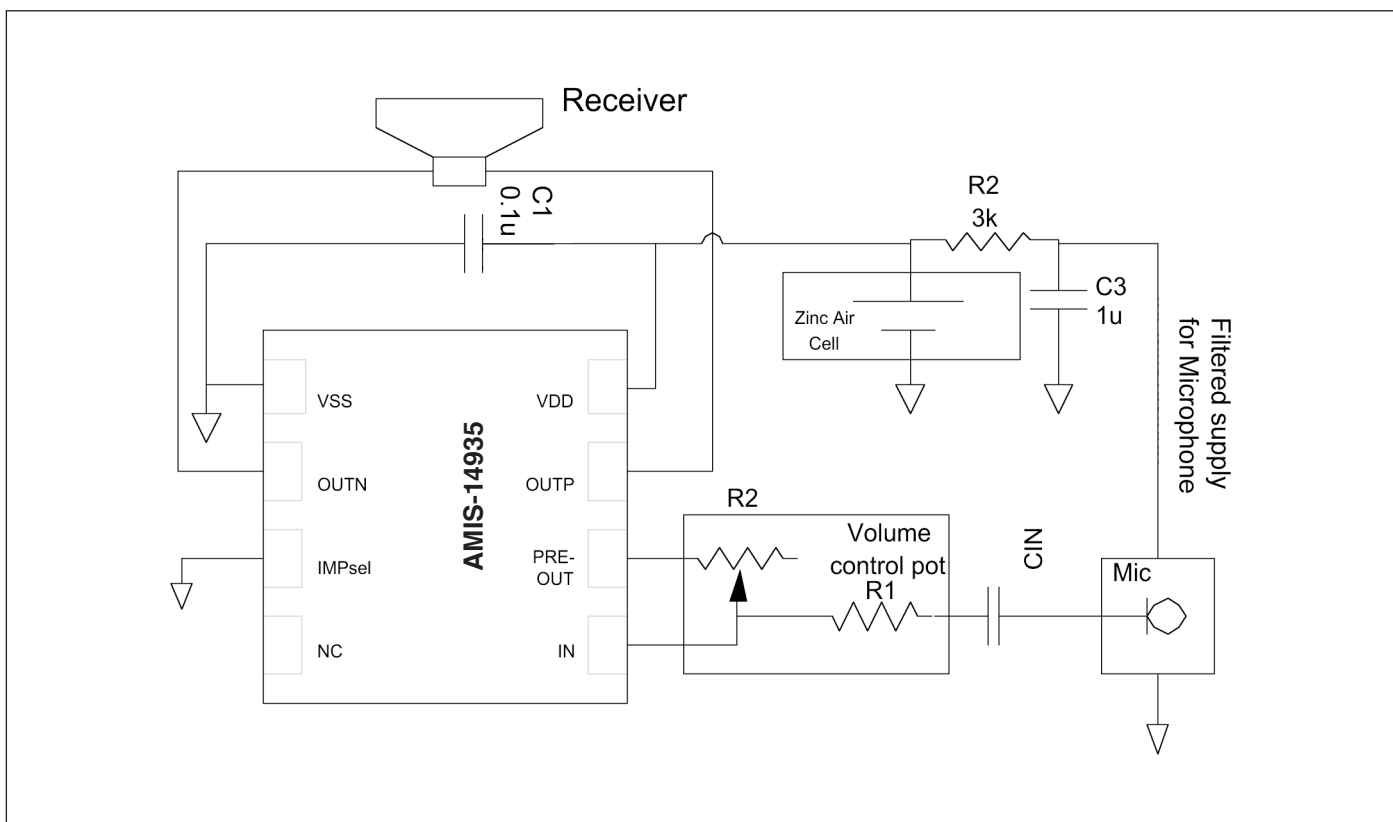


Dim	Millimeters		Inches	
	Min	Max	Min	Max
X		1.15		0.045
Y		1.78		0.070

Note:

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

## Using AMIS-14935 in Hearing Assist Applications



### Notes:

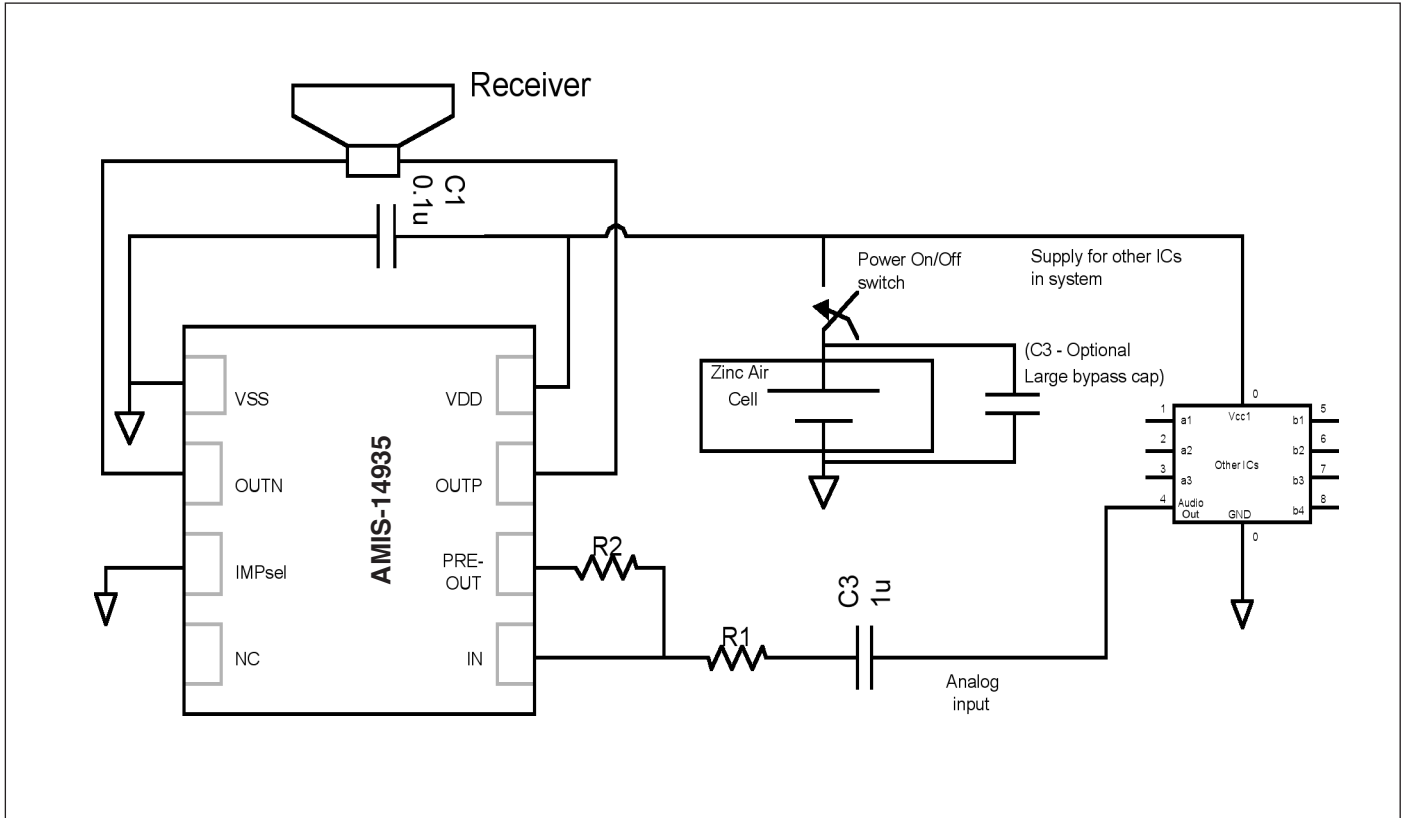
1. When using volume control potentiometer, keep input resistor between 25kOhm to 50kOhm for optimum performance. Using lower than 25k may cause higher distortion and using higher than 50k may cause output noise to increase.
2. Input coupling capacitor (C2) must be present. Forms a high pass filter together with resistor R1 with an approximate corner frequency of  $1/(2\sqrt{3.14}R1C2)$ .
3. R2 and C3 facilitate supply filtering for microphone. The

suggested values are indications only and are dependent on microphone characteristic, quality of supply and supply rejection needed.

4. Bypass capacitor may or may not be needed. Shall be kept low (less than 1µF) since a high value capacitance supply to ground may cause audible noise at power down.
5. IMPsel pin (Impedance select) should generally be tied to ground for minimum switch impedance and maximum drive capability.



## Using AMIS-14935 as Receiver Driver in H-aid Ultra Low Power Audio System



### Notes:

1. For optimum noise and distortion performance a 50k input resistor is recommended.
2. Input coupling capacitor (C2) must be present. Forms a high pass filter together with resistor R1 with an approximate corner frequency of  $1/(2 \times 3.14 \times R1 \times C2)$ .
3. Bypass capacitor (C1) may or may not be needed dependent on the supply quality. This capacitor shall have a

low value (less than 1µF) since a high value capacitance supply to ground may cause audible noise at power down. If other parts of the system requires a higher capacitor value this capacitor can be placed on the battery side of the switch making the total stored charge on the supply line small when system is powered down (switch is opened).