Preconfigured DSP System for Hearing Aids

RHYTHM R3920

Description

RHYTHM™ R3920 is a preconfigured hearing health processor based on a DSP platform. Featuring 16 channels of Wide Dynamic Range Compression and Impulse Noise Reduction, R3920 encompasses a rich set of advanced sound processing algorithms and is ideal for high end, full-featured hearing aids. The R3920 hybrid is available in one of the industry's smallest form-factors and is well-suited for all hearing aid types, including those placed deep in the ear canal.

Features and Benefits

Wide Dynamic Range Compression (WDRC) − R3920 contains 16 Channels of Wide Dynamic Range Compression, each with individual settings for Squelch Attentuation and Threshold, Low Level Gain, High Level Gain, Upper and Lower Thresholds, and Compression Ratio. Independent level detectors for both Squelch and WDRC are available with customizable attack and release times set in each channel.

Impulse Noise Reduction (INR) – Loud, impulsive sounds in the environment such as slamming doors, dropped items, or clattering dishes can become uncomfortably or dangerously loud in a traditional hearing aid. The INR algorithm actively monitors and processes the incoming acoustic signal for such sounds. It ensures that the output sound preserves the integrity of the speech signal and is descriptive of the environment, while maintaining an optimal comfort level for the hearing aid user.

Acoustic Environment Classification − iSceneDetect analyzes incoming acoustic signals in order to determine the appropriate classification for a given acoustic environment. Six separate environments are supported by iSceneDetect: quiet, speech in quiet, noise, speech in noise, music, and wind. The feature uses this classification to automatically adjust settings of other features for optimum audio performance.

iLog 4.0 Datalogging − Enables the recording of various hearing aid parameters such as program selection, volume setting and ambient sound levels. The sampling interval can be configured to record from every 4 seconds up to once every 60 minutes. The manufacturer can program the fitting system to retrieve the data for further analysis after an extensive period of wearing the hearing aid. This allows the audiologist to fine tune the hearing aid and further counsel the end-user.

Automatic Adaptive Directionality − The Automatic Adaptive Directional Microphone (ADM) algorithm automatically reduces the level of sound sources that originate from behind or to the side of the hearing aid wearer without affecting sounds from the front. The algorithm can also gather input from the acoustic iSceneDetect environmental classifier algorithm and automatically select whether

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Adaptive Feedback Canceller − Automatically reduces acoustic feedback. It allows for an increase in the stable gain while minimizing artifacts for music and tonal input signals. Additional tuning parameters make for more precise tuning of the algorithm to the hearing aid. The development tools for the R3920 offer a special calibration module to help assess the maximum stable gain in the hearing aid the manufacturer has built to further optimize the Adaptive Feedback Canceller algorithm.

Adaptive Noise Reduction − The Adaptive Noise Reduction algorithm monitors noise levels independently in 128 individual bands and employs advanced psychoacoustic models to reduce noise and provide user comfort. The algorithm can be set for varying levels of aggressiveness from 3 dB up to 12 dB.

Automatic Receiver Detection − For Receiver−in−Canal (RIC) devices with field replaceable receivers, R3920 allows manufacturers to code different receiver types so they are automatically recognizable in software, eliminating potential selection errors.

Tinnitus Masking − R3920 is equipped with a noise source that can be used to mask tinnitus. The noise can be shaped and attenuated and then summed into the audio path either before or after the volume control. A white noise signal is generated and inserted into the audio path either before or after the volume control. Filtering can be performed on the white noise signal in order to shape the noise signal to a desired frequency and bandwidth. The tinnitus masker can be used as a stand alone tinnitus making device or as part of a hearing aid.

EVOKE Advanced Acoustic Indicators − Allows hearing aid manufacturers to provide more pleasing, multi−frequency tones simulating musical notes or chords to indicate events such as program or volume changes.

In−situ Tone Generator − The narrow−band noise stimulus feature can be used for in−situ validation of the hearing aid fitting. The frequency, level and duration of the stimuli are individually adjustable.

Other Key Features − R3920 also supports the following features: Directional processing, built−in feedback path measurement, cross fading between audio paths for click−free program changes, 16−band graphic equalizer, 8 generic biquad filters (configurable as parametric or other filter types), programming speed enhancements, optional peak clipping, flexible compression adjustments, direct interfaces to analog or digital volume control, rocker switch, direct audio input and telecoil. Rhythm R3920 also encompasses industry−leading security features to avoid cloning and software piracy.

Support Tools

- Hybrid Jig
- DSP3 Programming Box
- ARK Software Support

Features

- 16 Channel WDRC
- Advanced Research Algorithms:
  - Impulse Noise Reduction (INR)
  - iSceneDetect Environmental Classification
  - Automatic Adaptive Directional Microphones (ADM)
  - Directional Processing
  - 128−band Adaptive Noise Reduction
  - Next−Generation Adaptive Feedback Cancellation (AFC)
- iLog 4.0 Datalogging
- Tinnitus Masking Noise Generator
- Evoke Acoustic Indicators
- Auto Telecoil with Programmable Delay
- Feedback Path Measurement Tool
- AGC−O with Variable Threshold, Time Constants, and Optional Adaptive Release
- 16−band Graphic Equalizer
- Narrow−Band Noise Stimulus
- SDA or I^2C Programming
- 8 Biquadratic Filters
- 4 Analog Inputs
- 16 kHz or 8 kHz Bandwidth
- 6 Fully Configurable Memories with Audible Memory Change Indicator
- 96 dB Input Dynamic Range with Headroom Extension
- 128−bit Fingerprint Security System and Other Security Features to Protect Against Device Cloning and Software Piracy
- High Fidelity Audio CODEC
- Soft Acoustic Fade between Memory Changes
- Drives Zero−Bias 2−Terminal Receivers
- Internal or External Digital Volume Control with Programmable Range
- Digital Volume Control Level Retention After Power Cycle
- Rocker Switch Support
- Support for Active Hi or Active Lo Switching
- 20−bit Audio Processing
- E1 RoHS Compliant Hybrid
- These Devices are Pb−Free and are RoHS Compliant

Packaging Information

- Hybrid Typical Dimensions:
  0.220 x 0.125 x 0.060 in.
  (5.59 x 3.18 x 1.52 mm)

BLOCK DIAGRAM

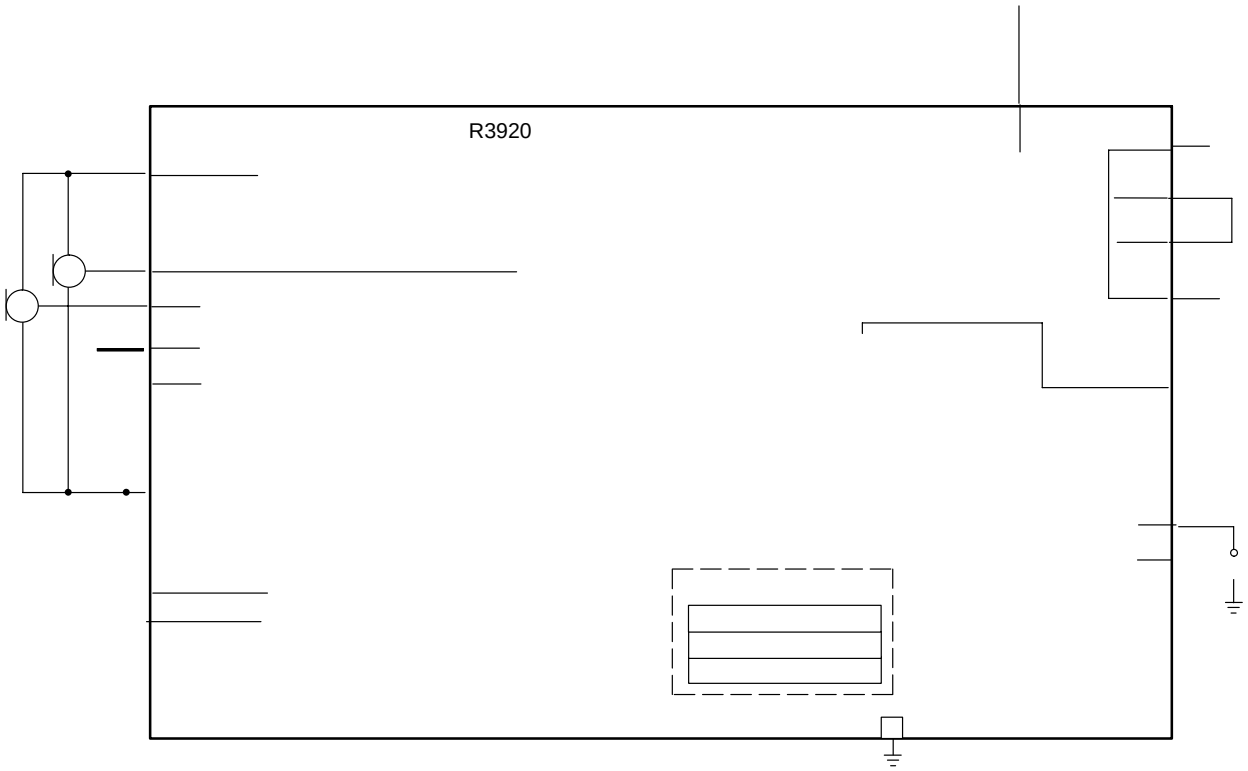


Figure 1. Hybrid Block Diagram

	Units
	°C
	°C
	mW
	VDC
	VDC

ded, device functionality

trolled conditions.

Max	Units
0.97	V
0.83	
1.16	V
1.24	
–	µA
–	
–	cycles
–	Hz
–	kHz
1	%
3	%
4.218	MHz

0.93	V
–	dB

−106	dBV1 0 4 T c T

Table 2. ELECTRICAL CHARACTERISTICS (Supply Voltage V_B = 1.25 V; Temperature = 25°C)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
OUTPUT						

PAD LOCATIONS

Table 4. PAD POSITION AND DIMENSIONS

Pad No.	Pad Position		Pad Dimensions	
	X	Y	Xdim (mil)	Ydim (mil)
1	0	0	20	33
2	−27	0	20	33
3	−54	−5	20	23
4	−81	−5	20	23
5	−108	−5	20	23
6	−135	−5	20	23
7	−162	−5	20	23
8	−189	0	20	33
9	−189	42	20	23
10	−189	85	20	23
11	−162	85	20	23
12	−135	85	20	23
13	−108	85	20	23
14	−81	85	20	23
15	−54	85	20	23
16	−27	85	20	23
17	0	85	20	23
18	0	42	20	23
19	−27	42	20	23
20	−54	42	20	23
21	−81	42	20	23
22	−108	42	20	23
23	−135	42	20	23
24	−162	26.5	18	12
25	−162	53.5	18	12

Table 4. PAD POSITION AND DIMENSIONS

Pad No.	X	Y	Xdim (mm)	Ydim (mm)
1	0	0	0.508	0.838
2	−0.686	0	0.508	0.838
3	−1.372	−0.127	0.508	0.584
4	−2.057	−0.127	0.508	0.584
5	−2.743	−0.127	0.508	0.584
6	−3.429	−0.127	0.508	0.584
7	−4.115	−0.127	0.508	0.584
8	−4.801	0	0.508	0.838
9	−4.801	1.067	0.508	0.584
10	−4.801	2.159	0.508	0.584
11	−4.115	2.159	0.508	0.584
12	−3.429	2.159	0.508	0.584
13	−2.743	2.159	0.508	0.584
14	−2.057	2.159	0.508	0.584
15	−1.372	2.159	0.508	0.584
16	−0.686	2.159	0.508	0.584
17	0	2.159	0.508	0.584
18	0	1.067	0.508	0.584
19	−0.686	1.067	0.508	0.584
20	−1.372	1.067	0.508	0.584
21	−2.057	1.067	0.508	0.584
22	−2.743	1.067	0.508	0.584
23	−3.429	1.067	0.508	0.584
24	−4.115	0.673	0.457	0.305
25	−4.115	1.359	0.457	0.305

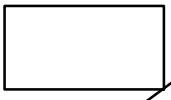
SIP25, 5.59x3.18
CASE 127DN
ISSUE A

DATE 21 JUL 2020

SCALE 2:1

ARITY A

GENERIC



XX = Specific Device Code
ZZ = Lot Traceability

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