ON Semiconductor

Is Now

onsemi™

**To learn more about onsemi™, please visit our website at
www.onsemi.com**

AND9086/D

RHYTHM™ SB3231 Parameters

INTRODUCTION

This application note provides a description for the Rhythm SB3231 product parameters that you can adjust using the Application Resource Kit (ARK) software.

Refer to the *Application Resource Kit User's Guide* for information about using the features of the Application Resource Kit (ARK) software applications with ON Semiconductor pre-configured DSP products.

Settings Parameters

MSPullUpDown (MS2PullUpDown)

Setting this to **Pull Up** means the pads need to be tied to ground to activate the memory select. Setting to Pull Down means the pins should be tied to Vb.

MSSMode

Sets the memory select pads to work with either momentary or static switches.

DOnly

Activates DOnly memory select mode on MS2. When activated, a memory select on MS2 jumps to memory D. See the product−specific datasheet for a complete description of Donly mode.

MemIndicatorEn

Enables or disables the EVOKE™ memory select indicators.

ExtVC

Enables or disables the external volume control. When disabled, the Internal VC slider on the VC tab in IDS is used.

ExtVCRange

Sets the volume control range for the analog external volume control.

RockerSwitchConfig

Sets the behavior to use for the rocker switch. See the product−specific datasheet for a complete description.

AnalogVCMapping

Maps the external volume control look−up table to the type of taper on the potentiometer. If using a linear taper, this setting should be set to "log".

DVC_MS_Behaviour

When VCConfiguration is set as DVC + MMS, this determines how the volume control and memory select behavior works. For example, `Shrt:DVC,Lng:MS` means a quick press of the switch activates the volume control functionality, and a longer press activates the memory select functionality.

DVC_MS_LengthTH

Sets the length of time for a button press to be considered "long".

DigVCThresh

Sets the difference from mid−rail that is used to detect high or low transitions on the analog VC pad while in digital VC mode. Typically, this should be left as the default setting.

DigVCRange

Sets the volume control adjustment range for a digital volume control.

DigVCDefault

Sets the default setting of the digital volume control when the device is powered on.

DigVCStepSize

Sets the gain change (in dB) for each step in the digital volume control.

DVCUpDnIndicatorEn

Enables or disables the Evoke indicators for the volume control increases and decreases.

DVCMinMaxIndicatorEn

Enables or disables the Evoke indicators for when the volume control reaches the minimum or maximum setting.

StartupIndicatorEn

Enables or disables the Evoke indicator heard when the device is powered on.

LowBatMode

Enables or disables the Evoke low battery indicator.

LowBatThresh

Sets the battery level at which the low battery indicator is played.

PowerOnDelay

Sets the delay time from when the device is first powered on until when the audio is turned on.

TcoilDebounce

With Donly mode enabled, it works with a magnetic or reed switch on MS2 to create an automatic telephone detector. This function sets the time to remain in memory D when the magnetic field is removed and the switch is opened.

PartLocked

Used to lock a hybrid to only work with a particular product library. For more information, refer to the section about "Security Features" in the *ARK User's Guide*.

MS2Lock

When set to locked, this disables the MS2 pin when the device is configured with DOnly enabled. This is useful for products that incorporate a magnetic or reed switch that requires the MS2 pin to be disabled.

EvokeTones

Evoke acoustic indicators can be configured to either all be input−referred, or all be output−referred. This corresponds to the injection point at the start of the audio path (before the compressor and pre−emphasis filters), and at the end of the audio path (after the compressor and the post−emphasis filters).

Input/Output Parameters

The Input/Output parameters control the in−channel wide dynamic range compression (WDRC) settings. To ensure that the Input/Output characteristics are continuous, it is necessary to limit adjustment to four of the first five WDRC parameters listed below:

Lower Threshold

Controls the level at which the hearing aid begins to go into compression.

Low Level Gain

Controls how much gain is applied before the lower threshold kneepoint.

Upper Threshold

Controls the level at which the compression region ends.

High Level Gain

Controls how much gain is applied after the upper threshold kneepoint.

Compression Ratio

Within the compression region (defined by the lower threshold and upper threshold), this is the ratio of change in input level to the corresponding change in output level. This control allows you to define this ratio.

Squelch Threshold

Also known as Low Level Squelch Threshold. This parameter defines the kneepoint below which expansion is applied to reduce the gain for softer sounds.

Squelch Ratio

Controls the rate at which the gain is reduced as the input signal continues to drop below the squelch threshold kneepoint.

AGC−O

The automatic gain control−output (AGC−O) parameter performs a wideband output limiting control that prevents the output from going above the specified full scale level. The output is reduced to that level before saturation occurs.

Dynamics Parameters

The Dynamics parameters control the attack and release time constants for each of the channel detectors, the AGC−O detector and the Squelch detectors. Each of the channels has the following detectors available:

- **FA** − Fast Attack
- **FR** − Fast Release
- **SA** − Slow Attack
- **SR** − Slow Release
- **SQA** − Squelch Attack
- **SQR** − Squelch Release

The wideband AGC−O detector has the following parameters associated with it:

- **Slow Attack**
- **Slow Release**

The wideband detector has the following parameters associated with it:

- **WB_Weight** − This parameter specifies the ratio of wideband level detector output and an individual channel level detector output.
- **WB_Attack** − The attack time constant used for the wideband level detector.
- **WB_Release** − The release time constant used for the wideband level detector.

Frequency Shaping Parameters

The Frequency Shaping parameters provide control over the bands in the Graphic EQ and the crossover frequencies for each compression channel. The frequencies, number of bands and number of crossover settings varies across products.

Graphic EQ Band Gains

Each of the Graphic EQ bands is labeled with the frequency at which the gain of the band can be adjusted. The amount of attenuation that can be applied in each band varies across products.

CF1 − CFX

X is the number of channels in the product less 1. The crossover frequencies define the bandwidth of each of the channels. For example, CF1 sets the upper cutoff frequency for channel 1 and the lower cutoff frequency for channel 2; CF2 sets the upper cutoff frequency for channel 2 and the lower cutoff frequency for channel 3.

Filters Parameters

The Filters parameters are used for modifying the lowcut and highcut filters for the product.

LCCentre

Controls the centre frequency of the lowcut filter.

LCOrder

Controls the order of the lowcut filter.

HCCentre

Controls the centre frequency of the highcut filter.

HCOrder

Controls the order of the highcut filter.

Pre−Biquads and Post−Biquads Parameters

The pre−biquads and post−biquads parameters provide the ability to configure the generic biquad filters for the pre−emphasis filters and post−emphasis filters, respectively.

b0,b1,b2,a1,a2

These parameters correspond to the quantized coefficients for the associated biquad. Refer to the *ARK User's Guide* for details of configuring the generic biquad filters.

meta0, meta1

These parameters do not have any effect on the signal processing, but can be used to store additional information related to the associated biquad.

Volume Control Parameters

WidebandGain

The wideband gain parameter adjusts the gain across the entire frequency response.

VC

When the ExtVC (see "Settings Parameters" on page 1) is disabled, this volume control (VC) setting will be applied to the audio path.

PC

The PC (peak clipper) parameter sets a hard limit for the overall output of the system. No time constants are associated with this threshold. If the signal exceeds the threshold, it is clipped.

Front End Parameters

FEMode

The front end mode parameter allows you to select the active input mode.

Beta

The beta parameter is used to adjust the internal time delay when the FEMode is set to directional.

LowFreqEQ

This parameter adjusts the low frequency equalization when in directional mode. The low frequency equalization can be used to compensate for the 6 db/octave roll−off in frequency response that occurs in directional, adaptive directional, or auto ADM front end modes.

TCoilGain

The gain to be applied to the telecoil input. This parameter is only available if you have customized your library using ARKonline® to override the telecoil calibration values with this parameter value.

TcoilNormFreq

This is the frequency at which the telecoil compensation gain is specified when designing the telecoil compensation filter. This parameter value is applied when the front end mode is set to **telecoil** or **mic plus telecoil**.

TcoilCompCF

The corner frequency used to configure the telecoil compensation low pass filter, when the front end mode is set to **telecoil** or **mic plus telecoil**.

MicAtten

This setting indicates how much attenuation to apply to the microphone path when the front end mode is set to **mic plus telecoil** or **mic plus dai** mode.

DAICompGain

The gain to be applied to the DAI input.

DAICompCF

The corner frequency used to configure the DAI compensation low pass filter when the front end mode is set to **dai** or **mic plus dai**.

Utilities Parameters

HRX™

Enable or disable the Head Room Expander (HRX). When enabled, the input dynamic range is increased by adjusting the pre−amplifier's gain and the post−A/D attenuation.

Advanced Features Parameters

FeedBackCanceller

This parameter enables and disables the Feedback Canceller feature.

FBCAcouDelay

The purpose of this parameter is to allow tuning of the Adaptive Feedback Canceller algorithm to different hearing aid designs. We recommend that for a particular hearing aid design, start with the default values and fine tune the Adaptive Feedback Canceller algorithm, if necessary, by making only small changes from these recommended default settings.

Noise Reduction

Adjusts the level of noise reduction to be applied. A value of 0 dB disables the noise reduction feature.

Tinnitus Parameters

Tinnitus treatment is implemented using an internal white noise generator. This white noise can be shaped and adjusted using the parameters below.

Noise LC Order

A lowcut filter is provided with an adjustable slope for shaping the noise.

Noise LC Corner

Adjusts the corner frequency of the lowcut filter.

Noise HC Order

A highcut filter is provided with an adjustable slope for noise shaping.

Noise HC Corner

Adjusts the corner frequency of the highcut filter.

Noise Level

Attenuate the generated white noise to the desired level.

Noise Type

The type of noise that is injected into the system can be set to flat or band−limited using this parameter. If set to flat, the noise biquads are disabled and bypassed. If set to enabled, the noise is passed through the biquads.

Noise Insertion

The point in the audio path where the noise is injected is defined using this parameter.

It can be before the volume control so that changes to the volume control level also change the noise level or after the volume control to keep the noise level unaffected by the current volume level. This parameter also defines whether the device will be a tinnitus masker only, or be a hearing aid plus tinnitus masker.