life.augmented

FFX
Full flexible amplification



Content

Full flexible amplification 4
Key features 4
Key benefits 4
Targeted application 4
Sound Terminal™ FFX 5
Product selection tables 5
Home system, mini/micro hi-fis, docking stations 5
TV 6
Set-top-boxes 6
Portable applications 7
FFX technology 8
F3X technology 10
STSpeakerSafe technology 11
Multiband DRC 12
Limiter (DRC/anti-clipping modes) 12
Dual-band DRC (B²DRC) 13
Equalized DRC (EqDRC) 13
APWorkbench 14
Audio-processor development environment 14
STSpeakerTune 15
Audio optimization technology 15



Full flexible amplification

The world's highest efficiency class-D amplifiers enabling audio application convergencel

STMicroelectronics takes a step forward in the audio digital domain, enlarging the Sound Terminal™ product family already widely successful in all the traditional consumer electronics market segments (LCD and PDP TVs, audio for portable devices, home systems and set-top boxes). The new STA369BWS mainly addresses the emerging LED backlit ultrathin flat panel TVs.

The devices are built around the FFX controller, a powerful and flexible solution capable of handling both analog and digital sources, delivering a very efficient digital stream to the speakers with audiophile quality sound.

FFX, a proprietary technology belonging to STMicroelectronics, uses an all-digital approach that combines an FFX controller and a digitally-controlled power component on a single device. Binary, ternary and phase-shifting
modulation can be set according to each application requirement. The single-package solution allows both cost optimization and design simplification.

KEY FEATURES

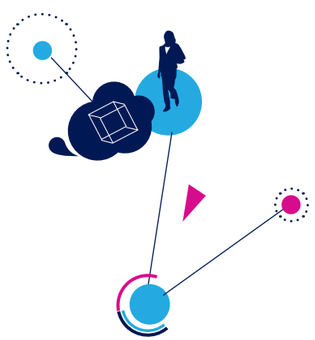
- Up to 94% efficiency (portable applications)
- Fully flexible amplification
  - Binary modulation
  - Phase shift modulation
  - Ternary modulation
  - Binary capacitor-less (portable applications)
- Unrivalled audio quality at maximum dynamic
- Patented digital pop-free start-up
- Analog and digital input
- Microcontroller-less configuration
- Multiband DRC (B²DRC)
- Equalized DRC (EqDRC)

KEY BENEFITS

- Product form factor
- Selectable PWM modulation for configurable products (headphone direct drive, up to 400 W per channel speaker driving)
- Best listening experience
- Seamless connection to any source
- As easy as analog solutions
- BOM reduction

TARGETED APPLICATION

- Portable and personal systems
- Audio home systems
- Set-top boxes
- Flat panel TVs
- Home systems



Sound Terminal™ FFX

PRODUCT SELECTION TABLES

HOME SYSTEM, MINI/MICRO HI-FIS, DOCKING STATIONS

Convergence is a key word for the consumer market.
New systems must be able to handle any source - from analog to digital - and to provide entertainment functions such as karaoke.
ST's FFX technology enables seamless connection to any source and embeds DSP features, delivering the most appealing audio effects.

Part number	Description	Supply voltage (V)	DSP	Input	Microcontroller less	Package
STA323W	2.0/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	8 to 36	4 biquads/channel	Digital	No	PSSO36
STA326	2.0/2.1 2 x 80 W/2 x 40 W + 1 x 80 W	10 to 36	4 biquads/channel	Digital	No	PSO36
STA333IS	2.0, 2 x 10 W	4.5 to 20	Volume control	Digital	No	CSP 5 x 6
STA333W	2.0, 2 x 20 W	4.5 to 20	Volume control, limiter	Digital	No	PSSO36
STA333BW	2.0/2.1 2 x 20 W/2 x 9 W + 1 x 20 W	4.5 to 21.5	5 biquads/channel multiband + DRC	Digital	No	PSSO36
STA333SML	2.0, 2 x 10 W	4.5 to 18	Gain selection	Digital	Yes	CSP 5 x 6
STA339BW	2.0 + headphone out/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	5 to 26	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA339BWS	2.0+headphone out/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	4.5 to 21.5	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA350BW	2.0 /2.1 2 x 50 W/2 x 18 W + 1 x 40 W	5 to 26	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA369BW	2.0+headphone out/2.1 2 x 20 W/2 x 9 W + 1 x 20 W	5 to 26	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA369BWS	2.0+headphone out/2.1 2 x 20 W/2 x 9 W + 1 x 20 W	4.5 to 21.5	8 biquads/channel multiband DRC2.0 + EqDRC, low frequency	Digital	No	PSSO36
STA559BW	2.0 /2.1 2 x 3W + PWM/ternary line out 2 x 1.4 W + 1 x 6 W	4.5 to 16	4 biquads/channel	Digital	No	PSSO36
STA559BWS	2.0 + headphone out /2.1 2 x 10 W/2 x 5 W + 1 x 10 W	4.5 to 16	8 biquads/channel Multiband DRC2.0 + EqDRC,low frequency	Digital	No	PSSO36
STA529	Analog-to-digital converter with headphone output and microphone input	1.8 to 3.6	Analog in and digital in muxing capability	Analog/ digital	Yes	TFBGA48 VFQFPN52



TV

ST has a long tradition of successful products for TV applications, and is now introducing the STA369BWS to meet the challenging demands of ultrathin LED TVs. Integration, audio quality and features are the foundations of ST's market leadership.

Part number	Description	Supply voltage (V)	DSP	Input	Microcontroller less	Package
STA323W	2.0/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	8 to 36	4 biquads/channel	Digital	No	PSSO36
STA333IS	2.0, 2 x 10 W	4.5 to 20	Volume control	Digital	No	CSP 5 x 6
STA333W	2.0, 2 x 20 W	4.5 to 20	Volume control, limiter	Digital	No	PSSO36
STA333BW	2.0/2.1 2 x 20 W/2 x 9 W + 1 x 20 W	4.5 to 21.5	5 biquads/channel multiband + DRC	Digital	No	PSSO36
STA333ML	2.0, 2 x 20 W	4.5 to 20	Gain selection	Digital	Yes	PSSO36
STA333SML	2.0, 2 X 10 W	4.5 to 18	Gain selection	Digital	Yes	CSP 5 x 6
STA335ML	2.0, 2 x 20 W	5 to 26	Gain selection	Digital	Yes	PSSO36
STA339BW	2.0 + headphone out/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	5 to 26	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA339BWS	2.0 + headphone out/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	4.5 to 21.5	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA369BW	2.0 + headphone out/2.1 2 x 20 W/2 x 9 W + 1 x 20 W	5 to 26	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA369BWS	2.0 + headphone out/2.1 2 x 20 W/2 x 9 W + 1 x 20 W	4.5 to 21.5	8 biquads/channel multiband DRC2.0 + EqDRC, low frequency	Digital	No	PSSO36
STA559BW	2.0 /2.1 2 x 3 W + PWM/ternary line out 2 x 1.4 W + 1 x 6 W	4.5 to 16	4 biquads/channel	Digital	No	PSSO36
STA559BWS	2.0 + headphone out/2.1 2 x 10 W/2 x 5 W + 1 x 10 W	4.5 to 16	8 biquads/channel multiband DRC2.0 + EqDRC,low frequency	Digital	No	PSSO36
STA529	Analog-to-digital converter with headphone output and microphone input	1.8 to 3.6	Analog in and digital in muxing capability	Analog/ digital	Yes	TFBGA48 VFQFPN52

SET-TOP-BOXES

ST's home entertainment capabilities span the complete spectrum of software and hardware, from the latest video-processing algorithms to the industry's most advanced SoC devices, embedding best-in-class security and connectivity. In this context, audio and IC connection must be as easy as possible. ST audio ICs are designed to meet the needs for turnkey solutions and format change required by the set-top box market.

Part number	Description	Supply voltage (V)	DSP	Input	Microcontroller less	Package
STA333W	2.0, 2 x 20 W	4.5 to 20	Volume control, limiter	Digital	No	PSSO36
STA333BW	2.0/2.1 2 x 20 W/2 x 9 W + 1 x 20 W	4.5 to 21.5	5 biquads/channel multiband + DRC	Digital	No	PSSO36
STA333SML	2.0, 2 x 10 W	4.5 to 18	Gain selection	Digital	Yes	CSP 5 x 6
STA339BW	2.0 + headphone out/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	5 to 26	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA339BWS	2.0 + headphone out/2.1 2 x 20 W/2 x 10 W + 1 x 20 W	4.5 to 21.5	8 biquads/channel multiband + EqDRC	Digital	No	PSSO36
STA559BW	2.0 /2.1 2 x 3 W + PWM/ternary line out 2 x 1.4 W + 1 x 6 W	4.5 to 16	4 biquads/channel	Digital	No	PSSO36
STA559BWS	2.0 + headphone out /2.1 2 x 10 W/2 x 5 W + 1 x 10 W	4.5 to 16	8 biquads/channel multiband DRC2.0 + EqDRC, low frequency	Digital	No	PSSO36
STA529	Analog-to-digital converter with headphone output and microphone input	1.8 to 3.6	Analog in and digital in muxing capability	Analog/ digital	Yes	TFBGA48 VFQFPN52

PORTABLE APPLICATIONS

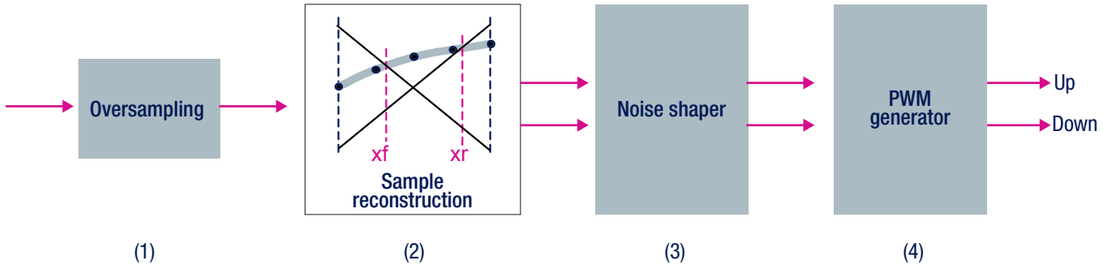
The FFX cell is designed to handle the most demanding portable and personal applications in the consumer and professional audio markets, as well as digital still cameras (DSC).
The FFX portable codec can drive from 100 mW to more than 1 W per channel just by changing the output load from 32 to 4 ohms: the audio quality is kept constant using a dedicated PWM modulation scheme. The FFX filterless application guarantees the best form factor for final products.

Part number	Description	Supply voltage (V)	DSP	Input	Microcontroller less	Package
STA529	Analog-to-digital converter with headphone output and microphone input	1.8 to 3.6	Analog in and digital in muxing capability	Analog/ digital	Yes	TFBGA48 VFQFPN52

For further information on the ST audio product family, please contact:
eur.audio@st.com or visit www.st.com/audio

FFX technology

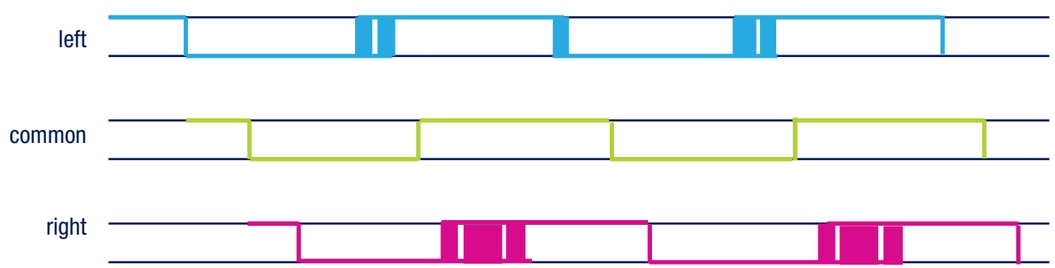
FFX class architecture is a digital low-distortion, low-noise PCM-to-PWM converter, based on a new sample reconstruction approach which converts the digital input signal into a differential pulse-width modulated signal at the frequency of 384 kHz and with a time resolution of 100 MHz.



To avoid distortion and spurious harmonics generation, the audio signal is oversampled (1), and linearized, then an exact calculation of the intersection between the resulting piecewise linear signal and up/down carrier signal is performed (2). FFX contains pop-free start-up, an STMicroelectronics patented fully-digital pop-noise remover (3). The result is obtained gradually, loading the output capacitor from zero to half the supply with the PWM signal, starting from near 0% duty cycle to 50% duty cycle (4).
ST pop-free start-up is thus faster than the traditional resistive partition method.

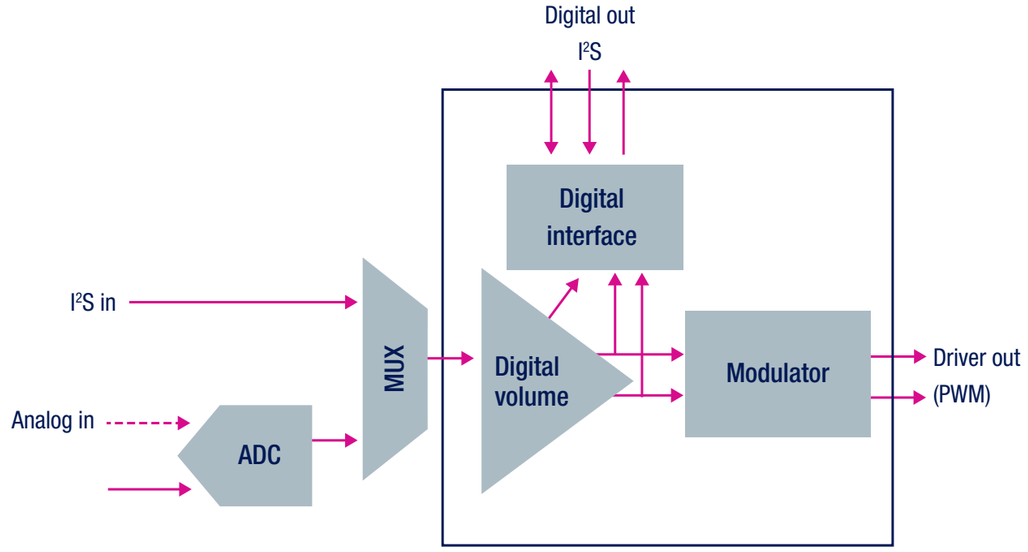
The FFX modulation scheme can be changed with the use of software to match portable or home system applications. For home systems, FFX can release an unrivaled signal-to-noise ratio. FFX for portable applications can work either with an output reconstruction filter or in filter-less mode.

FFX contains specific modulation, called binary headphone, which delivers a headphone capacitor-less solution.

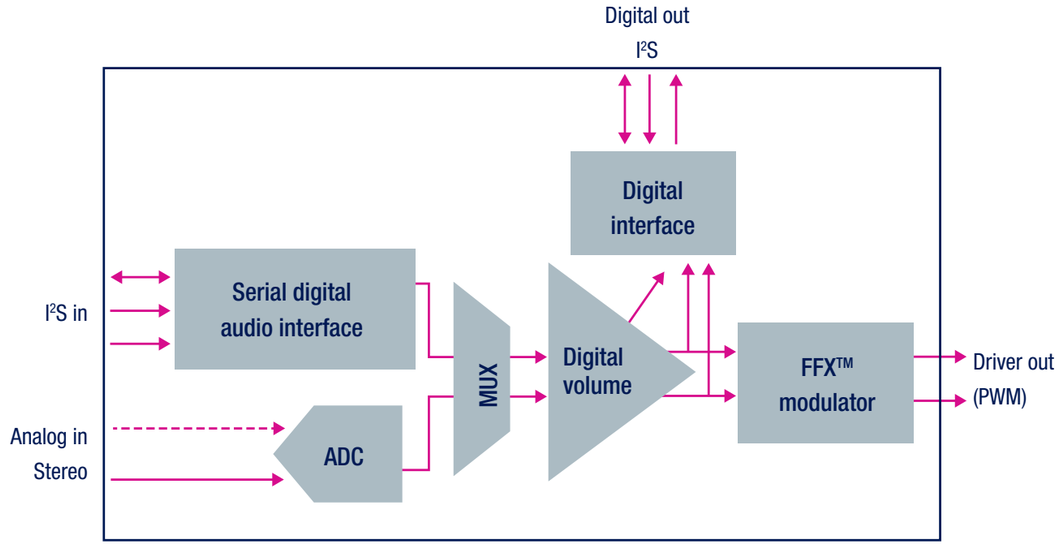


FFX based products contain an analog-to-digital converter and muxing features. The ADC is specifically designed to match the FFX cell and to keep the overall chain quality unchanged. This step of integration allows FFX users to save cost, reduce IC count and design unconstrained form factor products.

Traditional market solution



ST solution

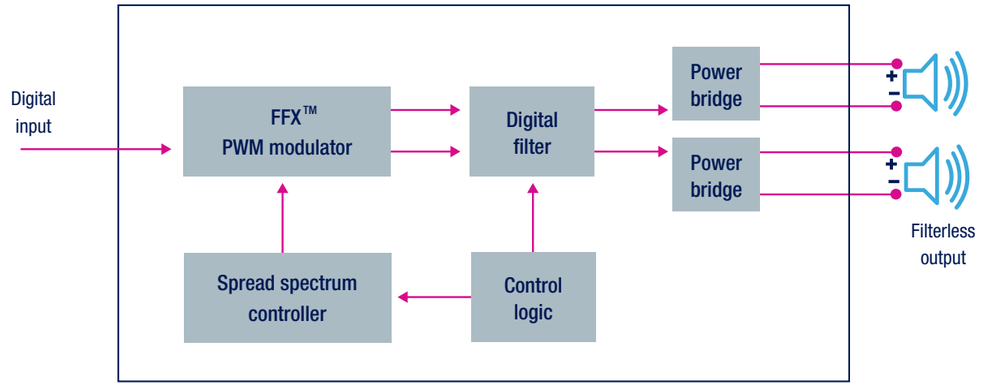


Comparison between traditional implementation and ST enabled implementation

F3X technology

ST's proprietary FFX technology is among the most efficient and successful IPs ever produced for digital audio amplification. Its highly sophisticated and advanced design has now been further improved to reduce the size of the external filtering circuitry (choke and capacitors), resulting in a reduced overall solution size and cost.
In its full-fledged implementation, the company proprietary spread spectrum modulation (SSM) is used. Combined with the unique ternary modulation, this delivers unprecedented efficiency in full filterless configuration, still complying with the most stringent EMI requirements.
A lighter version, already available in the STA369BWS top performance device, is capable of digitally filtering the PWM carrier, thus simplifying external filtering requirements. This solution is specifically designed for applications where a simple op-amp can be used, for instance, to drive an auxiliary headphone line.

Sound Terminal™ : F³ X™ High-efficiency digital class-D modulator

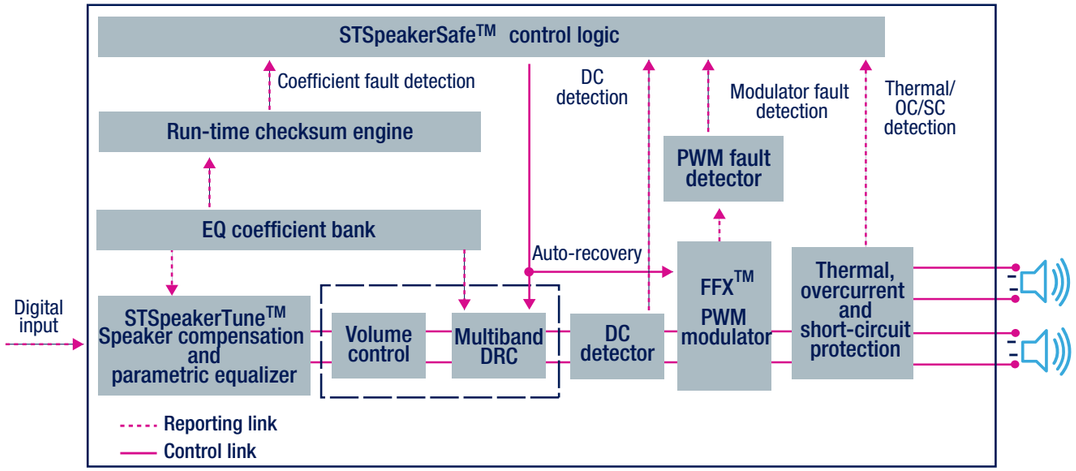


STSpeakerSafe technology

In modern audio systems, the loudspeaker has become the weakest link in the audio amplification chain, both in terms of performances and sound efficiency. This is all the more so in the latest generation of flat-panel TVs with LED backlighting, where the overall thickness is further reduced. Loudspeakers used in such systems, as well as in other miniaturized handheld sound equipment such as PMPs and smartphones, require state-of-the-art protection technology.

This is what STSpeakerSafe is for.
STSpeakerSafe squeezes the best sound quality and power from any loudspeaker under the safest of conditions, thus preventing speaker damage and preserving its original performances over time. STSpeakerSafe includes the latest advanced technology for thermal, overcurrent or overvoltage protection. It can precisely limit the delivered power in the different frequency ranges with a multiband dynamic range compressor. Moreover, self-diagnostic and auto-protection systems prevent any DC signal from damaging the loudspeaker, and immediately warn the host system about any abnormal condition.

Sound Terminal™



Multiband DRC

In some applications, where space, or costing constraints are significant, the loudspeaker systems are often unable to reproduce the whole audio frequency spectrum with good performance. A good example of an application where both speaker size and cost are being squeezed is flat-screen televisions.

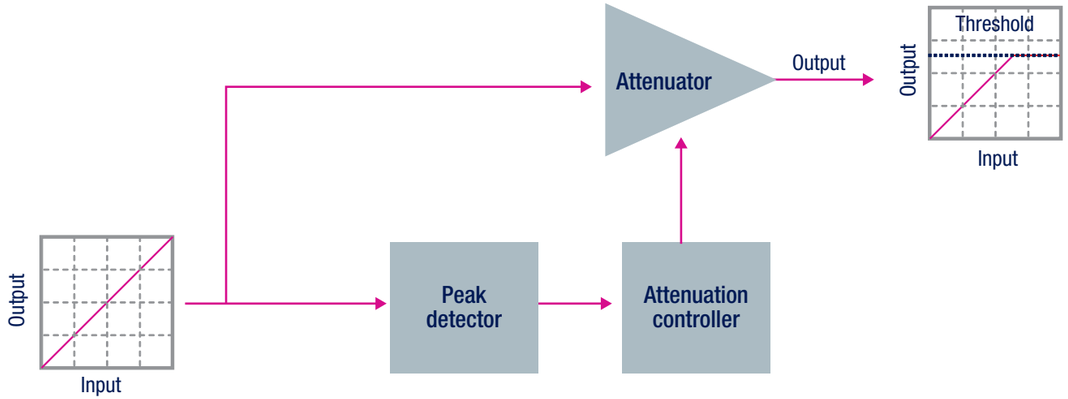
Multiband dynamic range compressor technology, or MDRC, was developed by ST in order to adjust or customize the dynamic range of a signal to a smaller range. This can be accomplished by dynamically controlling a programmable attenuation stage according to the measured average peak level of the signal: the higher the average level, the higher the attenuation. Simply put, this optimizes the audio quality for a given set of speakers, as well as protecting them from output power overstress, which could permanently damage them.

MDRC allows precise control and limiting of the delivered output power. Different parameters for the low and high frequency bands maintain the sound energy within safe boundaries while maximizing loudspeaker performances. The overall audio quality is greatly improved while avoiding unpleasant masking effects, which typically happen when high-energy, low-frequency sounds overwhelm dialog content.

The Sound Terminal™ family offers three different types of limiters and MDRC processing blocks, thus handling most of today's demanding audio applications, described in the following sections.

LIMITER (DRC/ANTI-CLIPPING MODES)

This functional mode allows the signal to be clipped or limited at a programmable threshold, as shown in Figure 1. The attack and release thresholds can be set, as well as the attack and release rates (dB/ms) and the parameter defining the reference values for the thresholds.



DUAL-BAND DRC (B²DRC)

This functional mode allows independent processing of high and low frequency content for each of the two L/R main channels. A single high-pass filter is used to extract the high frequency content. The low frequency part is obtained as a result of the difference between the input signal and its high-pass filtered signal, as shown in Figure 2. There is also a completely independent limiting control on the high and low frequency content.

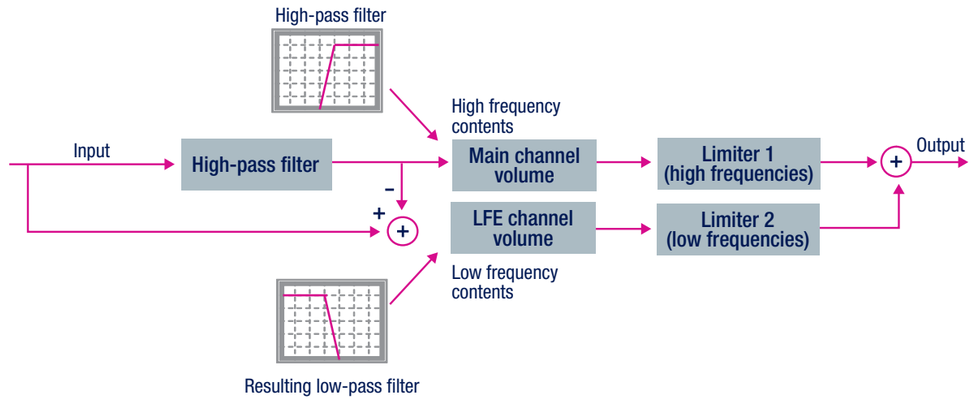


Figure 2: Dual-band DRC (depicted for a single channel only)

EQUALIZED DRC (EQDRC)

This functional mode corresponds to an improved limiter version which adds a pre-filtering of the signal feeding the attenuation controller. In this way, the threshold level can be shaped with respect to the frequency band. Contrary to B²DRC mode, EqDRC does not process the high and low audio frequencies with 2 independent limiters, but instead customizes the shape of the threshold levels applied by a single attenuator across the entire frequency band.

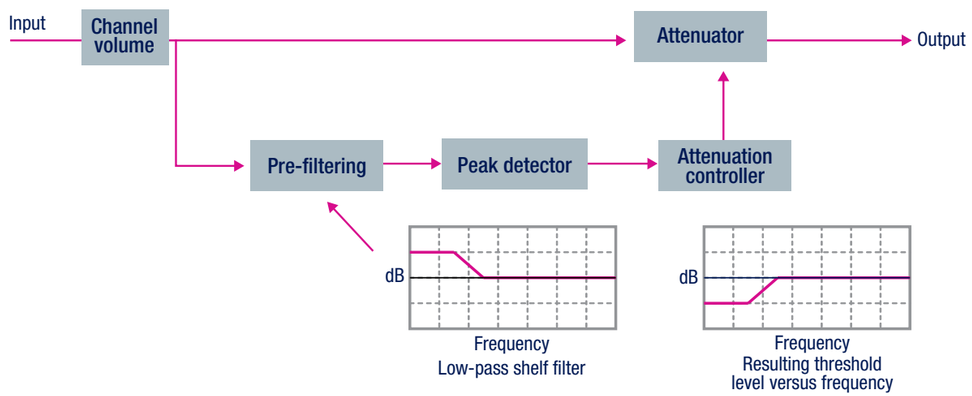


Figure 3: EqDRC block diagram

APWorkbench

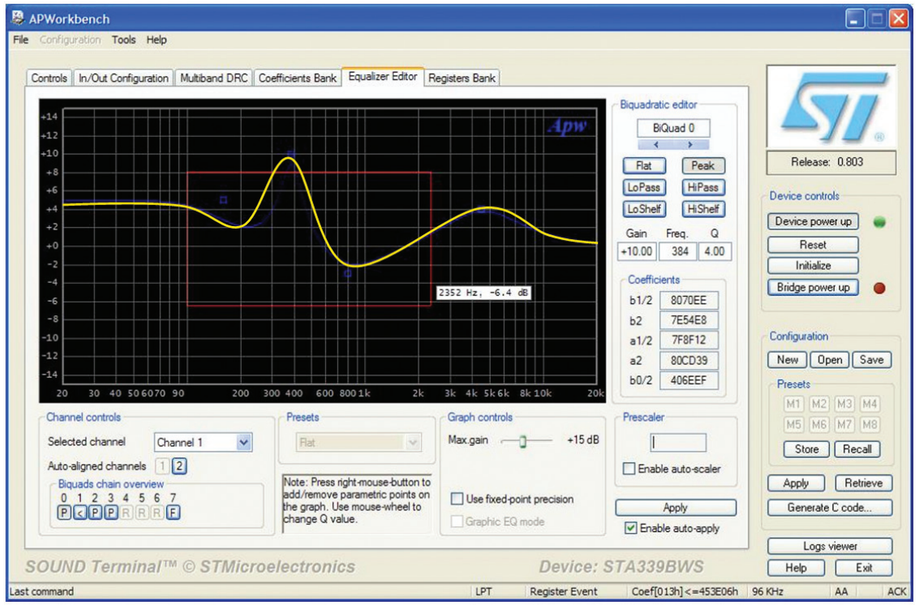
AUDIO-PROCESSOR DEVELOPMENT ENVIRONMENT

ST's Sound Terminal products provide highly-integrated audio amplifiers with utmost audio performances offered in reliable and robust monolithic devices. They are thus ideal for the latest generation of compact home systems, ultrathin flat-panel TVs and miniaturized portable and personal systems.

So as to tune and configure Sound Terminal products in real time, ST proposes a state-of-the-art development environment, APWorkbench, free of charge. APWorkbench is an integrated and easy-to-use professional environment that operates through a dedicated USB interface (APWLink). The highly sophisticated environment offers immediate and intuitive access to the most advanced functionalities of the device, turning complex operations, such as fine tuning of parameters and coefficients, into actions as easy as pressing a button or sketching the desired audio equalization curve on a blackboard.

APWorkbench greatly reduces the learning curve for a new product, so configuring a newly selected device for mass production is just a matter of a few mouse clicks. Listen to the remarkable sound clarity of Sound Terminal devices and change parameters and equalization settings in real time to find your favorite settings.
The tool includes specialized panels and controls to quickly access every single bit of the device: preset memories can be used to store various configurations and retrieve upon request. Configurations can also be exported to ASCII files and relevant C/C++ control code can be generated to ease writing of host microcontroller code.
Support of third-party tools such as Matlab or LinearX allows you to efficiently integrate the Sound Terminal solution into the customer development environment in a seamless scenario. Get the purest natural sound out of every Sound Terminal amplifier and plug it straight away into your audio equipment.

APWorkbench is fully compatible with any PC running Windows® XP, Vista or Windows® 7 OS.



STSpeakerTune

AUDIO OPTIMIZATION TECHNOLOGY

Ongoing technological evolution in the electronics field is allowing increasingly complex functionalities to be built into very small and compact stylish applications. The latest generation of ultrathin flat-panel TVs is a clear illustration of this trend. New kinds of personal handheld devices are now available combining personal media player capabilities with connectivity and cellular phone functionalities. In particular, smartphones are claiming a boosted audio power up to 3 W or even more, and the same is going to happen for laptop or all-in-one PC systems. Clearly, audio is one of the topmost attributes for consumers when deciding which personal or home entertainment system to buy.

These new products are requiring new standards in audio quality and performances, further highlighted by their small form factors and pricing, leading to poor loudspeaker acoustic quality.

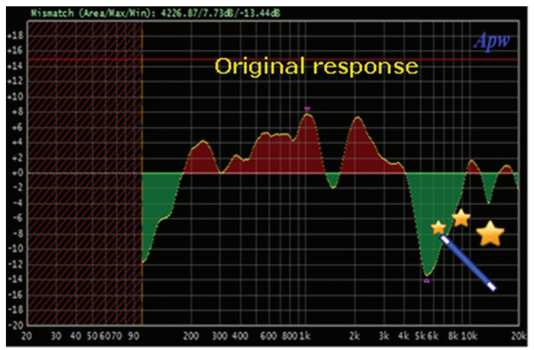
As a result, audio amplifier performance by itself is no longer enough to guarantee a satisfactory listening experience. The overall sound quality is deeply affected by the loudspeaker characteristics, and optimization of the entire audio system (amplifier plus loudspeaker) is what really matters. This is where STSpeakerTune comes in.

ST's unique offer allows you to optimize the overall audio system frequency response through the advanced processing capabilities of Sound Terminal products, together with an intuitive and user-friendly graphical interface for loudspeaker compensation. Sophisticated algorithms and technology running beneath the STSpeakerTune interface boost speaker output quality to unprecedented levels.

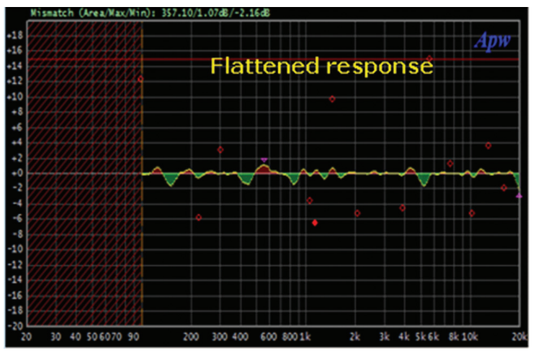
STSpeakerTune is seamlessly integrated into the APWorkbench development environment. Loudspeaker frequency response can be either imported or sketched into the graphical editor. This provides visual information of how the audio is really perceived, on top of the equalization settings applied by the user. Not only the acoustic response can be shaped or adapted to any desired level, but it can also be flattened using a very intuitive tool, a sort of magic wand. In addition, a dedicated wizard provides a fully automatic response compensation through state-of-the-art algorithms.

The resulting acoustic performance is surprisingly sharp, clean and natural, with improved sound clarity for an optimal listening experience. STSpeakerTune maximizes speaker performances at no additional cost.

Speaker frequency response without any compensation



Speaker frequency response with STSpeakerTune™ compensation



life.augmented

MIX
Paper from responsible sources
FSC® C003379

© STMicroelectronics - October 2013 - Printed in United Kingdom - All rights reserved
The STMicroelectronics corporate logo is a registered trademark of the STMicroelectronics group of companies
All other names are the property of their respective owners