

# P R I M A R E

THE SOUND AND VISION OF SCANDINAVIA

## Design Brief – I25 and I25 DAC Stereo Integrated Amplifier



I25 and I25 DAC are the latest iteration of Primare's now iconic integrated amplifiers, and are among the first to use the new UFPD 2 power system, a radical reworking of Primare's award-winning UFPD all-analog Class-D technology. Providing 100 watts at 8 ohms of absolutely linear amplification across the entire audible bandwidth, I25 delivers naturally fast, clean and agile sound with an unprecedented ability to bring music to life. I25 DAC adds an ultra high-resolution state-of-the-art digital to analog conversion allowing for exemplary performance whether the source is analog or digital.

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## Design philosophy

All of Primare designs are a result of our Practical Design Approach, resulting in a focus on two fundamental design elements:

1. Thoroughly implemented power supply designs – so that all elements of any design to operate effortlessly at their fullest effectiveness. Every product and sub-circuit demands unique power supply solutions - a more conventional linear supply or advanced switch mode main supply may work best dependent upon the application, and carefully crafted individual discrete power supplies are strategically inserted into the circuit to deliver power exactly where and how much is needed.
2. Artfully crafted ultra-short signal paths - so that each individual component and sub circuit operates sympathetically to achieve a cohesive whole. Elegant and simple electrical designs are used in even the most complex product, utilizing ultra-short signal paths with all gain in one device whenever possible. Ultimately, this results in fewer, higher quality parts for a reduction in associated distortions and an increase in overall electrical efficiency.

To that end, basic technologies have been selected to realize those benefits:

- 2 and 4-layer double-sided circuit board construction allows for the most direct and efficient layout of circuit components not only for the shortest signal path, but also to more easily achieve a sympathetic layout of circuit and sub-circuit components for best performance.
- Surface mount components are used whenever possible as this allows for direct connection of the circuit device or component to the circuit board trace with the solder being used solely to mechanically hold the part in place. The elimination of the small metal lead or wire at each connection point in a more conventional large scale circuit device or component cumulatively shortens the signal path. Additionally, conventional large scale components demand through hole or “eyelet” construction, limiting direct contact of the component’s lead to the circuit board trace and resulting in the solder providing electrical connection as well as mechanical connection for the device. Neither solder nor the metal used in the leads of most large scale devices provide the best signal transmission, therefore limiting potential performance of even the best designed circuits.
- Class D amplifier technology has many inherent advantages, one of which is the ability to locate the heat sink directly on the circuit board within the amplification module, considerably reducing circuit path length and allowing for the power output devices to be directly connected to the speaker output connection posts.

## Amplifier Technology

### Input section

Carefully crafted input circuitry utilizes relays for input switching providing better isolation and sound than found in more conventional CMOS (Complementary metal-oxide-semiconductor) switches.

Improved 2 x 4 channel balanced mode volume control IC selected for optimal channel balance and low listening level performance.



### Additional Control

- The latest generation OLED display technology used in the I25 was originally developed for the automobile industry to ensure long life in even the most hostile environments, and improved readability due to greater consistency of color value and brightness level.
- Auto sense input circuitry automatically selects any input source as it is activated.
- C25 IR remote control with completely new, proprietary control codes for faster response and reduced interference.
- RS-232 connection, in addition to being used for component quality control testing of each and every product, allows for the use of whole home system control technologies such as Control 4.
- 12V triggers for coordinated system turn on and turn off.

### Control Configuration

Either from the front panel or C25 IR remote control, the I25 can be configured to best suit system needs:

- Input settings
  - Status – enable or disable the input to make it visible or not, so only those you use are visible for easier input selection
  - Alias – edit the alias, or rename, each input to give it a specific name, for easier identification
  - Auto-sense – enable auto-sense to determine which inputs will be automatically selected when a signal is detected
  - Volume – choose between variable or fixed volume, allowing any input to pass through the preamp stage to connect directly to the amplifier for use of within a home theater system configuration.  
Or fixed gain setting allows for any input to be use in a theater or surround sound pass through configuration
  - Input Gain – adjusting the input gain so that all inputs to be at the same relative volume level, and as result the ability to raise or lower overall gain for preferred output volume setting
- Audio Settings
  - Balance – to adjust the output balance between the left and right speaker
  - Startup volume – sets the volume level at a predetermined level upon turn on from standby or at the level when last switched off.
  - Maximum volume – sets the maximum volume
  - Mute volume – sets the output level when muted, from 0 to any preferred setting
  - Digital output – to select between 48kHz and 96kHz settings for the digital output from analog inputs, as some devices in your system might not be compatible with the default 96kHz output.
- General
  - Show inputs – choose between showing all enabled inputs or only those with signal
  - Front panel – to lock the front panel to disable all front panel controls
  - Auto dim – select the amount of time at which the front panel display will dim
  - LED brightness – set the level of display brightness for three specified dim levels
  - Standby settings
    - Standby mode – select



- “normal” standby, which allows any activated input device set to “wake up” enable to wake up the Prisma integrated amp or preamplifier from standby
- or “Eco” in order for the device to consume less than 0.5W in standby mode, disabling auto wake-up
- Auto-standby – sets the amount of time without user interface action or signal from last selected source before the device automatically goes into standby
- Wake up – enables auto-sense to wake up the device from standby upon detecting an input signal source
- Factory reset – allows for the device to be returned to factory default settings

### Amplifier Section

The amplifier section utilizes the new proprietary UFPD 2 power technology, providing immediate and sustained high power output with very low distortion, instantaneous rise time and absolutely linear amplification across the entire bandwidth resulting in a naturally fast, clean and agile sound over an ultra-wide frequency range and with exceptional headroom.

In UFPD 2 a new error amplifier circuit has been developed that does not affect the gain versus frequency curve and thereby the bandwidth does not have to be limited. This gives very low phase shift in the audio band and a larger closed loop bandwidth. Using a custom made output coil in the 2<sup>nd</sup> order filter error amplifier with the same loop gain results in feedback control across the entire audio band. It has been optimized to keep the loop gain constant in the audio band, which means it is actually lower at low frequencies than with UFPD but much higher at high frequencies. The result is even more linear amplification, with lower noise with UFPD 2, providing absolute “black” backgrounds from which music has a more holographic, three-dimensional, life-like character.

### Power Supply Section

Given the speed with which the UFPD 2 amplifier module is able to deliver power to the speaker a switch mode power supply was the only choice in that it allows for rapidly varying demand, providing much more stable voltage, with ancillary capacitive storage to meet peak transient burst requirements.

This newly developed Active Power-Factor Correction (APFC) converter is as much as 5% more efficient than past supplies, and comprises dual PFC converters 180 degrees out of phase from each other. APFC is used to avoid input current harmonics, thereby minimizing interference with other devices being powered from the same source. This reduces the total current ripple and improves EMC (Electromotive Compatibility), while current ripple at the output of the PFC converter is also reduced, which decreases stress within the circuit for prolonged life. Additionally, the supply operates in what is called “transition mode”, minimizing switching losses and improving overall efficiency in delivering power to the UFPD 2 amplification module.

For more details see:

- “UFPD 2 Amplification Technology Design Brief”
- “Performance Benefits of UFPD Amplification”



## Digital to Analog Conversion (DAC) Technology

In order to allow for playback of virtually any digital source with absolute accuracy and musicality, the I35 Prisma's refined DAC stage recreates high-resolution sound that is as close as possible to the original source.

At the heart of this DAC stage is the new flagship of AKM's Verita series, the AK4497EQ chipset, a premium 32-bit stereo DAC, incorporating the companies VELVET SOUND™ technology, and capable of achieving -128dB (stereo) S/N and -116dB THD+N, while supporting up to 768kHz PCM and 22.4MHz DSD. This ability to handle higher resolution file formats will allow for the potential of future software upgrades.

The AK4497EQ integrates a newly developed switched capacitor filter "OSR Doubler" that greatly reduces sound degradation from noise shaping, achieving a flat noise floor up to 200kHz. An innovative design technique utilizing a symmetrical layout for the left and right channels prevents signal quality deterioration, and a 32-bit digital operation block provides full 32-bit processing.

Inputs include, four optical (Toslink), three RCA (SPDF), and one USB-B digital. The USB-B input allows playback of files up to PCM 384kHz 16/24/32bit and DSD256/11.2. One RCA digital output is included, allowing for pass through of digital signals and the option to select 4.8 or 9.6 digital output from analog sources.

## I25 Rear Panel



## I25 DAC Rear Panel



## System Building



The optional configurations offered are examples of Primare's practical design approach extending not only to the individual components we make, but also to the system building options designed into each model. For example, if putting together a full-featured digital and analog system based on the I35 integrated amplifier platform, a number of pairing options. Two possible combinations are detailed below:

### I25 + CD35

Pairing the of I25 and CD35 offers certain advantages for improved performance, in part due to the industry standard ESS Sabre chipset employed in the DAC stage of CD35 being able to provide subtly superior performance over the AKM chipset based DAC stage in I25 DAC. Additionally, the separation of the all-analog amplification circuitry in the I25 from the digital circuitry in the CD35 isolates those sections for lower noise floor and improved power supply delivery.

### I25 DAC + DD35

For those who wish to have a single control and connectivity center, I25 DAC can be paired with the soon to be released DD35 CD disc drive. DD35 is a transport only device, with digital outputs and no DAC stage, and is perfect to provide the best digital signal for conversion by I25 DAC.



## **I25 and I25 DAC Integrated Amplifier Specifications**

### Amplification

Amplifier module: Primare UFPD 2

Power supply: Primare APFC

Output Power: 2x 100W at 8Ω; 2x 200W at 4Ω

Analog Inputs: 5 pair RCA (L & R)

Input Impedance: RCA 15kΩ; XLR 30kΩ

Line Output: 1 pair RCA (L & R)

Pre Out: 1 pair RCA (L & R)

Output Impedance: Line and Pre 100Ω

Frequency Response: 20Hz – 20kHz -0.2dB

THD + N: < 0.01%, 20Hz – 20kHz, 10W at 8Ω

Signal to Noise: >100 dB

### Gain:

- Pre Out: RCA in 16.5dB; XLR in 10.5dB
- Speaker Out: RCA in 42.5dB; XLR in 36.5dB

### Digital to Analog Conversion

Chip set: AKM AK4497

### Inputs

- 4 x Optical/TOSLINK up to 192kHz/24 bit
- 2 x SPDIF/RCA up to 192kHz/24 bit
- 1 x USB-B up to 384kHz/24 bit; DSD 256/11.2

Digital Output: 1 x RCA

- Analog input = selectable 48 kHz or 96kHz out
- Digital input = pass through

Frequency response:

- 44.1kHz 20Hz - 20kHz 44,1 +0,1 / -0,65
- 96/192kHz 20Hz-20kHz +0,1/ -0,2



## General

### Control

- C25 system remote control
- RS232 – Control 4
- IR in/out
- Trigger out

### Power Consumption:

- Standby: <0.5W
- Operate: <32W analog only; <37W DAC

### Dimensions (wxdxh):

- 430 x 420 x 106 mm with knobs and connectors
- 430 x 382 x 106 mm without knobs and connectors

Weight: I25 10.5 kg; I25 DAC 10.75 kg

Color Options: Black and Titanium

