PURE SPEED

SC1000
Multi channel control amplifier

SP2000
ClassA twin monophonic power amplifier

SAYA

Premier Performance with Rich Functionality
PURE SPEED : the dawn of a new-generation audio brand offering a fusion of pure audio and A/V

■ **SC1000**

A multi channel control amplifier that offers not only top performance as a pure audio control amplifier but also the ability to handle surround A/V sources. This is the concept that the development of the SC1000 control amplifier has realized. The SC1000 was designed to be a traditional analogue amplifier, because any bit dropout causes unrecoverable signal degradation that differs from distortion and noise. A well-designed analogue amplifier can achieve ppm linearity, and as such, vanishingly low signal degradation. But an analogue amplifier can only perform as well as the bottleneck in its signal path. This is why no operational amplifiers are used in the SC1000 and its partner, the SP2000 class-A power amplifier. Furthermore, the signals only pass through discrete analogue unit amplifiers, PS-UNIT1 and PS-UNIT2, which provide ppm linearity in order to achieve excellent performance.

■ **SP2000**

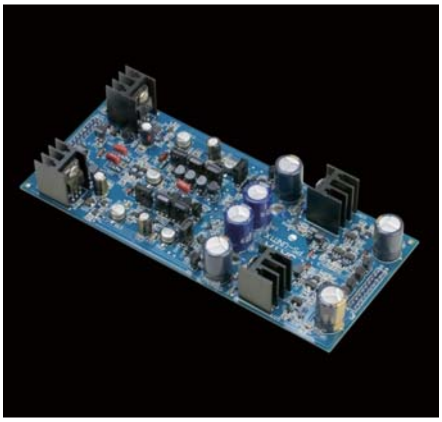
The SP2000 power amplifier, which was designed to be used as a partner to the SC1000 multi channel control amplifier,is a 2 channel amplifier rather than a multi-channel one. Since a power amplifier has no controls, we believe we do not need to cram multiple channels into a single unit and sacrifice performance. Therefore, we assume that, when combined with the SC1000, multiple SP2000 units will be used to drive the loudspeakers. The SP2000 is a pure class-A power amplifier, which in principle does not suffer from either cross-over distortion or switching distortion. In addition, it features a twin monaural construction in order to eliminate any noise caused by ground loop effects. Although the SP2000 is a class-A amplifier, it has a clipping power of 105 W as well as a class A operating range of 76 W, allowing for a generous load driving capacity.

■ **Amplifiers**

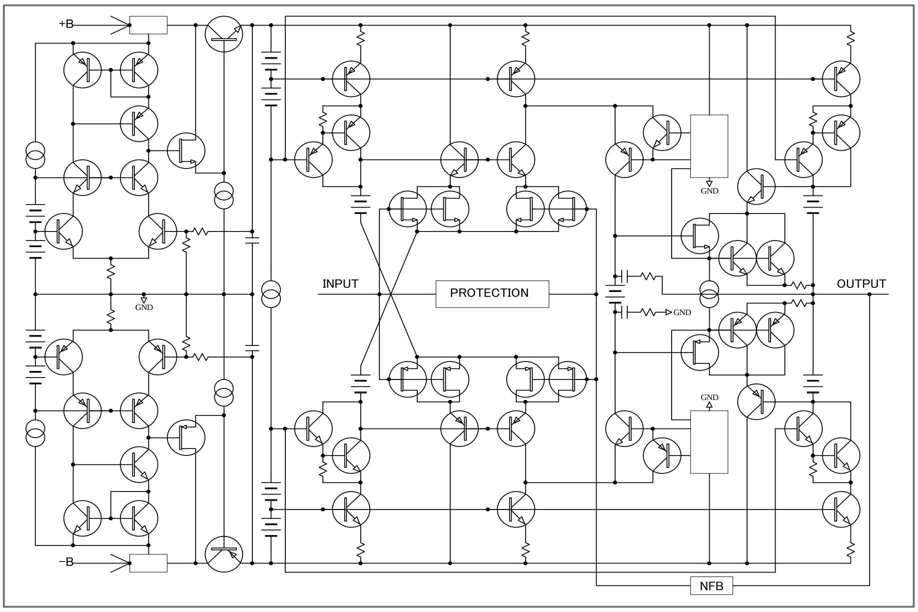
It is known that any bit dropout due to digital signal processing such as multiplication, addition, and so on, can cause unrecoverable signal deterioration that is completely different from that caused by distortion or noise. In particular, this tendency is quite noticeable in the case of control amplifiers, where loss processing is one of their major functions. As such, we believe that audio amplifiers should use analogue signal processing techniques. Based on the understanding that the overall performance of audio amplifiers is determined by any bottleneck part within the overall signal chain, our policy is to avoid using operational amplifier ICs, which are less flexible in terms of freedom of design and to use custom-designed discrete amplifier units instead. Such unit amplifiers have the following features:

■ PS-UNIT1

These unit amplifiers are high-gain, high-speed, and wideband amplifiers with NFB capabilities to use J-FET input operational amplifiers. As voltage feedback is used, any tone control circuitry may be implemented in the feedback loop. As such, various functions may be realized together with the amplification function, making the signal path simpler.



PS-UNIT1 Circuit diagram



（1)Gm stage

The PS_UNIT1 amplifiers use a class-A, fully symm etrical,complementary push-pull configuration for all stages to enable highly symmetrical slew rate characteristics, higher power supply suppression ratio, lower even harmonic distortion, higher net gain, and lower noise characteristics. The input stage employs a differential input, symmetrical circuitry of two FETs connected in parallel to achieve superior noise, distortion, and DC characteristics. In combination with a cascode bootstrap circuitry, any distortion due to modulation by the input capacitance is suppressed. The differential common current, which is also used to provide the bias voltage for the cascode bootstrap circuit, is driven by a constant current source circuit with Darlington cascode to use a precision voltage reference. As a result, a temperature coefficient of 55 ～ 85 ppm/ ℃ and common mode voltage variation of 79 ppm/V are achieved, providing twoto fourfold higher stability than that of Wilson current mirror circuits. This output (signal current) is converted to the signal voltage by the opposite-polarity Darlington, fold back cascade circuitry. Because phase rotation is minimized with the single-stage amplifier configuration, the amplifier can provide a superior gain-bandwidth product and slew rate characteristics. In addition, as the Gm output stage is designed to suppress any capacity modulation, any increase of distortion in higher frequencies is prevented.

(2)Buffer stage

The buffer stage, which is used to isolate the effect of load variation on the Gm stage, is a heterogeneous Darlington complementary class-A SEPP buffer amplifier that uses an FET and two bipolar transistors in parallel. In combination with a cascode bootstrap circuitry, any modulation due to input capacitance is minimized. The high impedance characteristics inherent to the FET reduce the load to the Gm stage and contribute to a higher gain (less current amplitude) and lower distortion. The bipolar transistor stage can provide an output current of up to 2 A, which contributes to making the system impedance lower (which results in lower noise).

(3)Integrated regulator directly coupled to the unit amplifier

In the PS_UNIT1 unit amplifier, the voltage amplifier stage, which uses a differential cascode Wilson mirror circuitry, and the single-stage regulator, which uses a heterogeneous (FET + bipolar) Darlington output stage, are integrated to minimize interference between the circuits. As a ripple filter is implemented with the regulator to stabilize the supply power to the voltage amplification stage, a superior ripple suppression ratio of 106 dB or higher (for 1 kHz and below) and 78.7 dB (@100 kHz) is maintained over the wide bandwidth. The reference voltage source as well as the feedback resistors used are of low drift type (30 ppm/ ℃ to 25 ppm/ ℃), which provide excellent temperature stability.

(4) Low noise bias circuitry and highly stable constant current source of cascode connection

Any bias voltage for use in the cascode bootstrap or constant current circuitry is supplied through a voltage regulator with sufficient filter capacitors to ensure that it does not act as a noise source. Also, any drive current is produced by a cascaded constant current source to provide high stability. This policy is applied to both amplifiers and regulators.

(5) Use of surface-mount components and multi-layer circuit boards

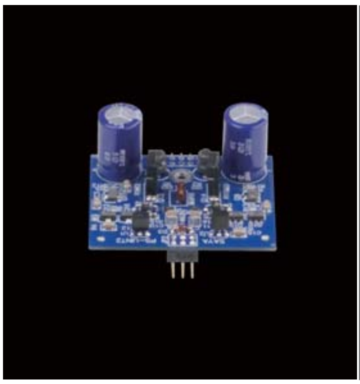
In order to make the circuitry compact to reduce wiring resistance and inductance, surface-mount parts and multi-layer boards (that mount parts on both sides) are used. In regard to the thickness of the copper clad, it is known that thickening it increases the capacitance between lines while thinning it increases the wiring impedance. Accordingly, the thickness of the copper clad of the circuit board is optimized.

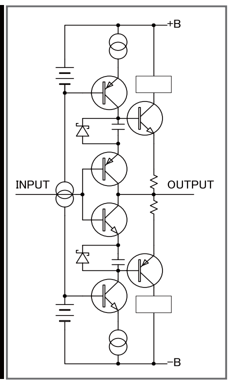
(6) Performance

Our amplifiers feature superb performance characteristics including low noise characteristics that enable sensor amplifiers to handle very low voltages, output current of up to 2 A, withstand voltage of ± 60V, very low distortion of lower than -120 dB for 1 to 20V rms/20 kHz, PSRR of 200 dB or higher, very low bias current, and very high gain of 120 to 150 dB (DC) and 100 to 120 dB (@1kHz). Optimal performance can be obtained by using this unit amplifier in every signal path.

■ PS-UNIT2

While the PS_UNIT1 amplifiers are built as operational amplifiers (i.e., the use of NFB is assumed), the PS_UNIT2 amplifier is a buffer amplifier with no feedback that is suitable for the case where no significant gain is required and the load is light. The circuit configuration is an opposite-polarity Darlington, complementary, symmetrical push-pull, emitter follower with cascode bootstrap connection for the first stage. Although no feedback is employed, low distortion of less than 0.00005% (1 kHz, 1 to 7 Vrms) and 0.00017% (20 kHz, 1 to 7 Vrms) as well as a signal to noise ratio of 136.6 dB (IEC-A) is achieved. Although it is a buffer amplifier with no feedback, output impedance of as low as 8 ohms is realized to enable its use in channel divider applications. The PS_UNIT2 amplifier operates with the stabilized power supplied from





PS-UNIT2

SC1000

Multi channel control amplifier

An ultralow distortion and low noise multi-channel control amplifier using PS-UNIT1 amplifiers throughout its signal path.
Pure audio amplifiers with superb audio performance that provides rich functionality while handling multichannel signals.

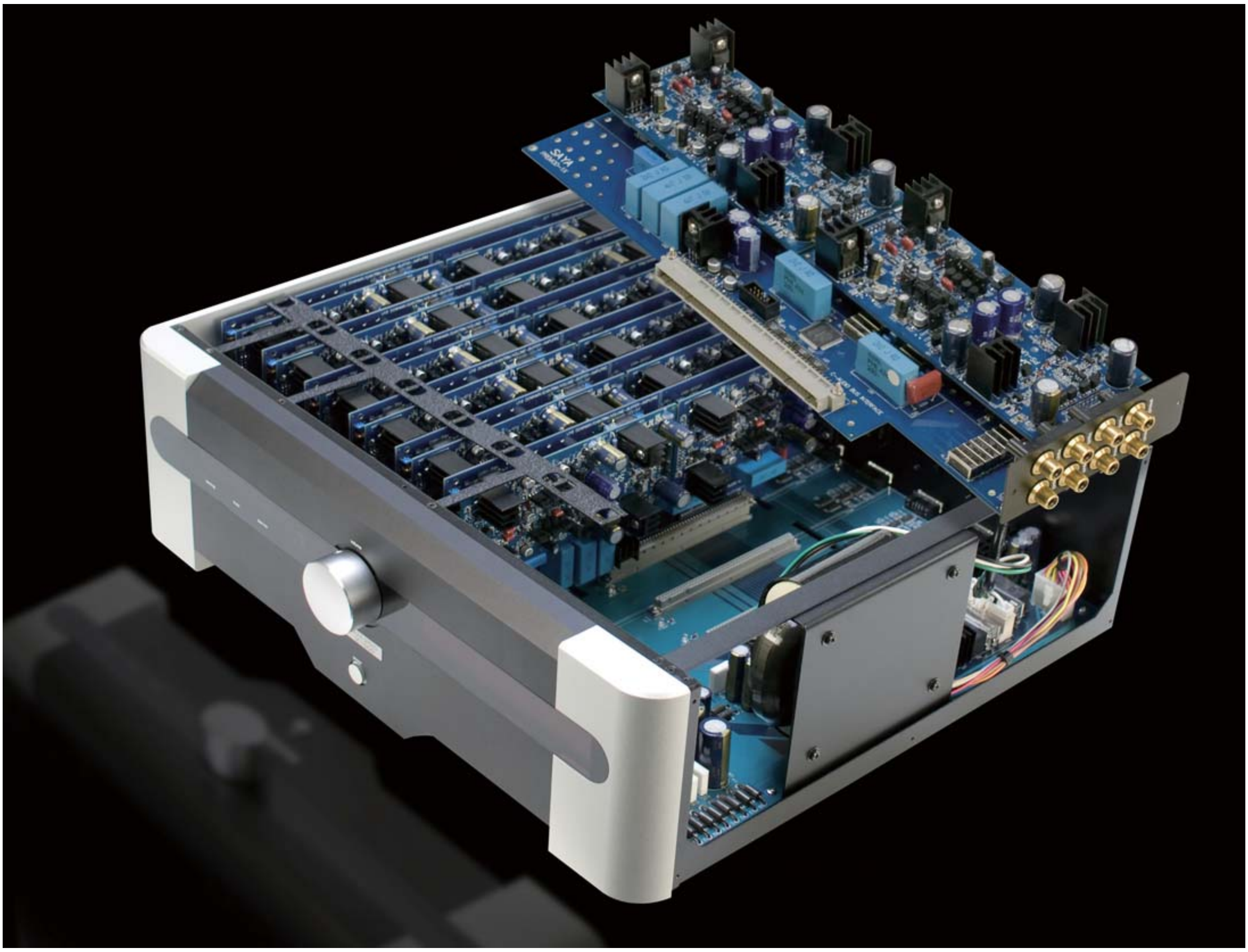
The 2 to 8 channel control amplifiers can be used for a wide range of sources from pure audio to home theatre applications. Every channel is built in the same configuration and there is no performance difference between channels. The system is composed of a variable gain amplifier with NF tone, attenuator, variable gain amplifier (i.e., buffer between volume control and down mix), and passive down mix. It is designed to make the most of the performance of PS_UNIT1 and minimize the number of amplifier stages in the signal chain. Regardless of the function in use, there are only two PS_UNIT1 amplifiers in the signal path, making the system simpler. While any resistor that is inserted in the signal path (e.g., volume attenuator, NFB, down mix circuitry) will generate thermal noise at a level proportional to the resistance value, this control amplifier makes use of the powerful drive capability of PS_UNIT1 to significantly reduce such resistance values to 1/10 to 1/100 of that used in conventional control amplifiers to reduce the thermal noise level.

(1) Variable gain amplifier with NF tone

The input signal is routed via the selector to the variable gain amplifier with NF tone, which uses PS_UNIT1. Using the NF tone configuration, high functionality as well as high performance is realized with no additional amplification path. As the minimum gain (5.6 dB) is maintained unless the volume control is set to 80% or higher, a sufficient feedback is obtained in normal use for minimizing the distortion and maximizing the signal to noise ratio.

(2) Electronically controlled attenuator

After the variable gain amplifier with NF tone, the signal is routed to an electronically controlled attenuator for which source impedance is maintained to be 2.5 k ohms or less to realize lower system impedance and, consequently, low noise. A variable loudness control with eight position selections is included.



(3) Variable gain amplifier

(buffer between volume control and down mix)

The variable gain amplifier of the second stage is also used as the buffer between the electronically controlled attenuator and the down mix. The amplifier uses PS_UNIT1 and the gain is kept sufficiently low (0.4 dB to 5.7 dB) to minimize the distortion and maximize the signal to noise ratio.

(4) Down mix + DC servo

By implementing the down mix, the 4-channel mode operation that enables the use of large loudspeakers becomes easier. In the case of the 5.1 or 7.1 channel mode, it is difficult to arrange pure audio speakers and most speakers for 5.1 or 7.1 are poor compared with those for pure audio. With the down mix, four speakers are sufficient; more speaker selection options are available as consideration need not be given to the center channel. For home use, due to the short distance between the left and right channels, the center speaker may be offset to the left or right without causing any significant problems. As the lower frequency performance of the speakers for pure audio is sufficiently high, there is no need to use a super woofer. As the down-mix matrix only uses resistors, no distortion is generated. Also, while the low impedance of 250 ohms leads to low noise, it also makes the signal path simpler because the subsequent buffer amplifier can be eliminated.

(5) Reed relays to replace semiconductor switches

Every signal route switching function, including the selector, tone switching, variable gain control of amplifiers, attenuator control, loudness control, and down-mix switching, is performed using reed relays. By using reed relays instead of semiconductor switches, distortion generation due to the signal voltage dependence of the on-resistance, off-resistance, and residual capacity in the off-state of semiconductor devices is avoided and the signal path length is minimized.

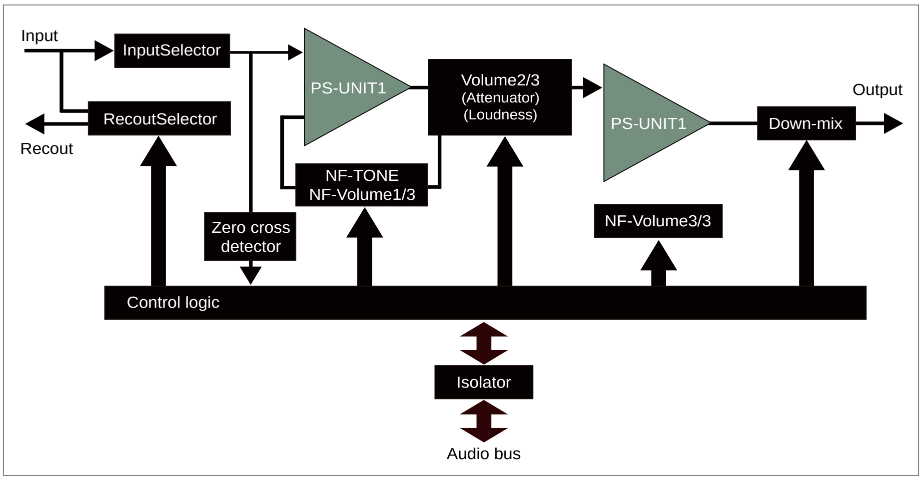
(6) High-performance resistors

For the resistors that determine gain parameters, i.e., the ones used in the feedback circuits, attenuators, and down-mix circuits, ultra-high-precision film resistors of temperature coefficient 2.5 ppm/ ℃ and accuracy of 0.05% and thin-film chip resistors of temperature coefficient 25 ppm/℃ and accuracy of 0.5% are used to reduce thermal modulation distortion and gain errors between channels.

(7) Volume balance

Volume control is performed in 608 steps by adjusting the gains of the two amplifiers and the attenuation of the attenuator. When the volume control is set to a low level, the amplifier gains are lower and the attenuation of the attenuator is lower compared to conventional control amplifiers. In this way, a high signal to noise ratio and low distortion are achieved by optimizing the gains of the two amplifiers and the attenuator to avoid excess gains. Furthermore, through zero-cross switching, no shock noise s generated by the operation. It should be noted that the volume control function is also used for balance control in order to minimize the signal path length. To deal with the relatively large number of volume control steps, an accelerated volume control system is used, i.e., the control rate is switched in three steps for the remote control and in two steps for the rotary encoder of the main unit, to ensure smooth and precise control operation.

SC1000 Block diagram



(8) AV selector function

The AV selector is a 5 to 1 selector and is coupled with the video selector of the D-port. The buffer amplifier for the video system is a direct-coupling current feedback complementary push-pull amplifier with a signal bandwidth of 200 MHz, making it suitable for D1 to D5. Furthermore, an independent set of AV selectors is provided for use in the REC-OUT selector and the bypass selector for subamplifiers.

ORDERING GUIDE	
Model	**Audio channel**
SC1000-8	8
SC1000-6	6
SC1000-2	2

(9) Channel card construction

The entire audio signal path from the input port to the output port of a single channel is integrated in a channel card to minimize the signal path length. As many channel cards as required are installed on the motherboard. In order to prevent any noise injection, the channel cards are isolated from the motherboard, including the power supply connections; the cards are interconnected through a dedicated audio bus. To prevent interference between circuit blocks, the power to the audio control block, audio amplifier block, video circuit block, and digital circuit block is separately supplied by a power supply dedicated to each circuit block that is isolated from the transformer winding level. Each power supply block uses an electrolyte capacitor with a capacity of 65,400 μ F and a 160VA R-core transformer to provide ample capacity comparable to that of pre-main amplifiers.

(8) User interface and functions

This product has a sufficient number of functions including tone control (treble and bass), variable loudness control, two selectors, channel balance control, down mix, automatic dimmer, large VFD display, and remote control for ease of use. Although functions tend to be eliminated in pure audio products, this product is designed to implement useful features without causing performance degradation.

PURE SPEED’ s down mix 4.0ch playback
Little or no degradation of directional reproduction
Large loudspeakers can be for pure audio
More flexibility allowed when configuring the display
Offers the ability to create a sound image vertically localized to a virtual center channel
Ensures uniform sound by using the same type of loudspeakers for both front and surround speakers

Conventional 5.1ch playback
Difficult-to-handle large loudspeakers for pure audio due to the presence of a central speaker
5.1 speakers are typically low-cost; their sound quality will not satisfy audiophiles
Mixed configurations employing various types of speakers leading to inconsistencies
in directivity, frequency response and distortion characteristics
iPower amplification sufficient to drive six to eight channels required

SP2000

ClassA twin monophonic power amplifier

Incorporates a 76 W pure class-A power amplifier and channel divider by means of PS-UNIT1 and PS-UNIT2 amplifiers. A two-stage pi-network power supply filter, an efficient cooling system, and an output stage comprising a parallel configuration of five MOSFETs all add up to a new concept in power amplification.

Although a class-D switching amplifier may be made more compact to include 6 to 8 channels in a system, this product is a pure class-A amplifier for the sake of sound quality. Based on the class-A operation principle, no crossover or switching distortion is generated up to the maximum output power. Even when the amplifier is operated in the class-AB region, such distortion is optimally suppressed thanks to the square-law characteristics of MOSFETs. This amplifier is in dual channel configuration because the output power of 100 W in a class-A operation makes it difficult to accommodate multiple channels in a single unit and it is not inconvenient in the case of power amplifiers even if they cannot accommodate multi-channels.

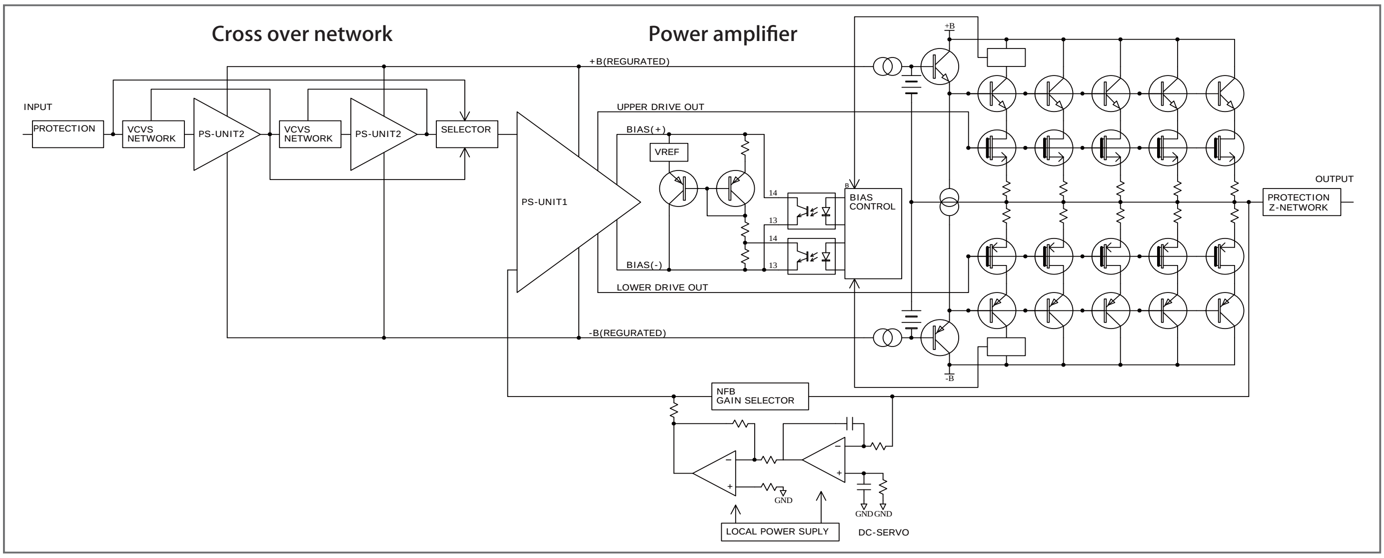
(1) Basic configuration

After the PS_UNIT1 amplifier, a 100W, pure class-A output stage of 5 x MOSFETs in parallel with cascode bootstrap is added as the three-stage Darlington output stage. The cascode bootstrap configuration of the final stage prevents modulation by the input capacity of MOSFETs and reduces the distortion by alleviating the voltage burden of the MOSFETS. In addition, the parallel configuration of the five MOSFETs contributes to lower distortion by reducing the current burden of the MOSFETs and cascode transistors while the increase of input capacity is kept to a reasonable level. The feedback circuit is combined with pole-zero phase compensation to provide sufficient feedback to improve the distortion performance in the higher frequencies. The MOSFET devices used are conventional, high-speed (low capacity), low Gm devices. Thanks to the low input capacity, less phase compensation is required as the low Gm device of less local feedback. Accordingly, a high GB product, high slew rate, and high feedback are achieved and the resulting distortion is extremely low at 0.00028% (@20 kHz) and 0.00008% (@1 kHz, 28W, including the distortion of the measurement systems).

(2) Idle current stabilization circuit

Even with a class-A amplifier, the idle current varies due to the high temperature coefficient of semiconductor devices. It is generally the case that the temperature coefficient is set to a negative value to prevent thermal runaway and it is unavoidable that the area of class-A operation narrows at a higher temperature. As this device includes an idle current stabilization circuit that constantly monitors and adequately controls the bias voltage, a stable class-A operation is provided without the effect of temperature variation or aging. As this idle current stabilization mechanism has a sufficiently large time constant, the idle current is adjusted at a control interval in which frequency is below the audible frequency range. As such, it will not have any adverse effects (i.e., variation of Gm) on the distortion characteristics.

Two stage pi-network power supply filter



(3) Class-A operation range selector and gain selector

As the class-A operation range can be selected to either 100 W or 50 W by the push switch on the front panel, the power consumption may be halved in the case of a typical low-level listening environment. In addition, the NF-type gain switching function can control the gain in 12 steps from 11 to 20 dB. The lower the gain, the more advantageous the signal to noise ratio (S/N) and distortion. Since the recording level is high for recent digital audio sources, the gain of power amplifiers may be set to a low value.

(4) Two stage pi-network power supply filter

Although the power to PS_UNIT1 is internally regulated, it is difficult to supply voltage-regulated power to the output stage because of the high current requirement. Traditionally, this has been considered to be a problem of the supply voltage variation suppression performance of the power amplifier itself, making it a limiting factor in noise reduction. Even if big capacitors are introduced to reduce the power supply noise, the charging current will become higher and this would result in other problems such as larger induced noise, less power factor, and contamination of the power supply by the inrush current and/or the charging current. To resolve this, the supply power to the output stage of this unit is implemented with a two-stage pi network (double LC smoothing) to provide lower ripple, higher power factor, and low charging current. Although it is generally considered difficult to implement smoothing pi networks in the power supply for semiconductor amplifiers because of the possibly enormous size, our technical solution of the two-stage pi network with optimized time constants for the first and second stages as well as the use of a current limiter made it possible to reduce the size of the system. The harmonic levels referenced to the fundamental component of 50 Hz (as 100%) are 68%, 33%, 4.8%, and 17% for the second, third, fourth, and fifth harmonics, respectively, in the case of a capacitor-input smoothing circuit whereas they are significantly reduced to 22%, 12%, 8.3%, and 6.9%, respectively, in the case of the two stage pi-network. This configuration also provides additional advantages in that the peak charging current and inrush current are halved. With the use of the smoothing capacitors with a total capacity of 193,800 μF and an 640 VA R-core right and left, independent transformer with low leakage flux, the powerful power supply system provides eight independent windings to prevent interference between circuit blocks of left/right driver stages, left/right output stages, left/right auxiliary circuits (DC servo), and left/right control circuits.

(5) Cooling

When a number of natural cooling power amplifiers are used together in an application of 5.1ch, 7.1ch, or multiple amplifier systems, there is a risk of insufficient heat dissipation. In addition, as the heat sinks for natural cooling are generally large and heavy, installation of the power amplifiers is troublesome. With high-capacity tunnel-type heat sinks and rear fans, this PA uses a front-in/rear-out forced air cooling system. With the use of various kinds of quieting techniques listed below, a super-quiet system as well as 20% volume reduction from the natural cooling counterpart has been realized; one will almost forget the existence of the forced air cooling. The fans are controlled by linear amplifiers so as not to be noise sources.

- A large-size heat sink of 168 x 84 x 400 (mm) is used for each (L or R) channel to increase the contact area of the cooling air for improved heat dissipation efficiency.
- The heat sinks are directly attached to the enclosure and small additional heat sinks are also placed on top of the device to provide additional natural cooling capability.
- The fan speed is reduced by making the blade area wider and using four 80-mm fans (two per channel), the motor for which is very slim.
- The wind noise is reduced by applying dimples and a urethane finish on the fan blade.
- The fan speed is optimized to provide the minimum required speed based on the temperature detected.
- Silencers are implemented in the inlet and exhaust chambers and the residual noise is further reduced by arranging the inlets at the lower front and lower rear portions.

(6) Channel divider function

The channel divider function is implemented using two PS_UNIT2 no-feedback buffer amplifiers. Various types of filters including low pass, high pass, band pass, and through output can be realized and amplifiers other than those used for the filter function are bypassed. A filter attenuation curve of either –6 dB/octave or –12dB/octave can be selected. The filter attenuation curve and the cut-off frequency are switched in an expansion card. Unlike the case of using a separate (external) channel divider, the input and output buffer amplifiers are unnecessary and the number of stages in the signal path is thus reduced. Most importantly, it becomes easier to implement multiple amplifier systems for better sound quality.

(7) Various safety measures

Safety measures are fully implemented, including a DC servo system with a mirror integrator to use low-noise, high-precision OP amplifiers, DC protection, thermal protection, over current protection, power on mute, and inrush current protection functions.

(8) Printed circuit board

Using six-layer boards with components on both sides, only high-quality parts are used, including long-life electrolyte capacitors and super-precision film resistors of 2.5 ppm/℃ temperature coefficient and 0.05% tolerance for the places where the gain is determined.

SC1000 specifications		
Frequency responce	5Hz ～ 100KHz（-5.8dB）	
	20Hz ～ 20 KHz（-0.5dB）	
Input impedance	33.3K Ω ± 0.5%	
Output impedance	250 Ω ± 0.1% （down-mix enable）	
	240 Ω ± 0.5% （down-mix disable）	
Output load impedance	2k Ω	
Output swing	9.3Vrms（maximum）	
Rated output voltage	6.4Vrms（THD2-5<4ppm ／ 20Hz-20KHz）	
Total harmonic distortion ※ 2nd ～ 5th ※ Volume position -34.6dB	0.5V	0.00005%（1KHz）
		0.00005%（20KHz）
	0.7V	0.00004%（1KHz）
		0.00003%（20KHz）
	1V	0.00004%（1KHz）
		0.00006%（20KHz）
	2V	0.00004%（1KHz）
		0.00012%（20KHz）
	3V	0.00003%（1KHz）
		0.00013%（20KHz）
	5V	0.00010%（1KHz）
		0.00014%（20KHz）
	6.4V	0.00037%（1KHz）
		0.00038%（20KHz）
Signal to-noise ratio ※ A-weighted ※ Volume position -27.31dB	124.6dB(入力 6.4Vrms)	
	116.3dB(入力 2.5Vrms)	
Noise voltage（A-weighted）	18.8uV（Volume position 575/575）	
	7.8uV （Volume position 500/575）	
	5.8uV （Volume position 400/575）	
	2.2uV （Volume position 300/575）	
	2.0uV （Volume position 200/575）	
	1.8uV （Volume position 100/575）	
Voltage gain	21.1dB（down-mix enable）	
	15.1dB（down-mix disable）	
BASS	11step+6.2dB ～ -3.8dB（50Hz）	
TREBLE	11step+6.0dB ～ -3.6dB（10KHz）	
Loudness compensatipn ※ Volume position200/575	7：100Hz/6.6dB、20KHz/7.6dB	
	6：100Hz/6.4dB、20KHz/7.4dB	
	5：100Hz/6.1dB、20KHz/7.2dB	
	4：100Hz/5.8dB、20KHz/6.9dB	
	3：100Hz/5.1dB、20KHz/6.3dB	
	2：100Hz/4.1dB、20KHz/5.5dB	
	1：100Hz/2.4dB、20KHz/4.0dB	
Power requirements	AC120V/230V 50/60Hz	
Power consumption	55 watts	
Overall Dimensions	475.6 × 178 × 414.2mm（WXH × D）	
Weight	19.8Kg	

※ The total harmonic distortion, noise voltage and signal to noise ratio were measured with the down mix and loudness set to off and the BASS/TREBLE set to their flat positions.

SP2000 specifications		
Power output(8 Ω)	76W × 2 （THD2-5<7ppm、20Hz-20KHz）	
	105W × 2（THD2-5<1%、20Hz-20KHz）	
Total harmonic distortion ※ 2nd ～ 5th	0.12W	0.00017%（1KHz）
		0.00015%（20KHz）
	0.28W	0.00014%（1KHz）
		0.00012%（20KHz）
	0.5W	0.00014%（1KHz）
		0.00027%（20KHz）
	1.1W	0.00019%（1KHz）
		0.00022%（20KHz）
	1.7W	0.00019%（1KHz）
		0.00022%（20KHz）
	3.0W	0.00008%（1KHz）
		0.00022%（20KHz）
	6.1W	0.00008%（1KHz）
		0.00018%（20KHz）
	12.5W	0.00007%（1KHz）
		0.00022%（20KHz）
	28W	0.00009%（1KHz）
		0.00028%（20KHz）
	38W	0.00011%（1KHz）
		0.00035%（20KHz）
	50W	0.00013%（1KHz）
		0.00041%（20KHz）
	76W	0.00018%（1KHz）
		0.00062%（20KHz）
	83W	0.00070%（1KHz）
		0.00128%（20KHz）
	100W	0.0075% （1KHz）
		0.0250% （20KHz）
Frequency responce	5Hz ～ 100KHz （-4.6dB、GAIN 20.4dB）	
	20Hz ～ 20 KHz（-0.3dB、GAIN 20.4dB）	
	5Hz ～ 100KHz （-2.0dB、GAIN 11.2dB）	
	20Hz ～ 20 KHz（-0.2dB、GAIN 11.2dB）	
Signal to-noise ratio	105.5dB (A-weighted ,1W,Input open)	
	124.5dB (A-weighted ,76W, Input open)	
	125.9dB (A-weighted ,106W, Input open)	
Voltage gain	20.4dB、19.9dB、19.3dB、18.7dB、18.0dB、17.4dB、16.5dB、15.7dB、14.8dB、13.8dB、12.6dB、11.2dB	
Input impedance	21.1K Ω ± 0.074%	
Output load impedance	4 ～ 16 Ω	
Damping factor	800	
Power requirements	AC120V/230V 50/60Hz	
Overall Dimensions	475.6 × 209 × 513.5（WXH × D）	
Weight	38.3Kg	

※ The total harmonic distortion and noise voltage were measured with the low-power mode set to off and the gain set to 11.2 dB.

Please acknowledge that the specification and externals might change without a previous notice.

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