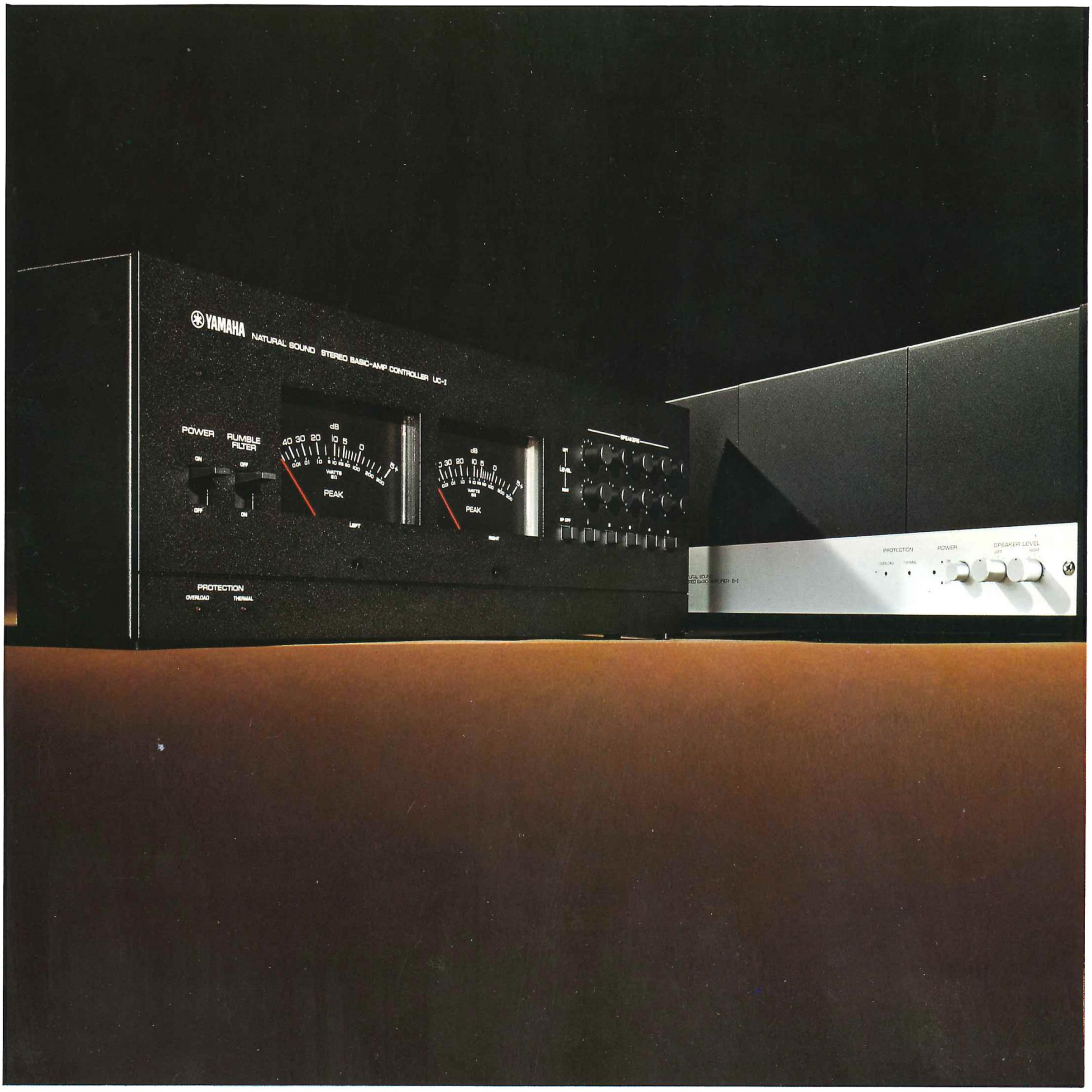
YAMAHA B-I UC-I

Super-power low distortion stereo basic amplifier
with all-stage FET circuitry, revolutionary new Yamaha vertical
power FETs and SEPP OCL design. Complemented by control unit
with dual peak meters, remote control adaptability.
150W/Channel, Both Channels Driven,
20-20,000Hz, 0.1% Total Harmonic Distortion

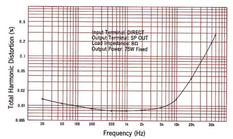


Vertical FET Design: Powerful, Pure Amplifier Response

Incredibly Reduced High-Order Harmonic Distortion for Transparent Tonal Response

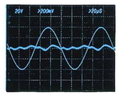
Even after long hours of listening the B-I sound is still fresh and appealing. The Yamaha vertical field effect transistors produce virtually no odd-order harmonics, and even-order harmonics are canceled by a properly designed push-pull circuit. The result is fatigue-free listening with no distortion harshness.
Also gone: the carrier storage effect notch distortion present in bipolar type transistor amps, providing better transient response.

FREQUENCY RESPONSE vs. TOTAL HARMONIC DISTORTION

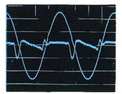


The Yamaha B-I harmonic distortion stays incredibly low up to and beyond the frequency limits perceived by the human ear.

Vertical FET Distortion Element Waveform (0.018%)



Yamaha CA-1000 Bipolar Transistor Distortion Element Waveform(0.028%)



All-FET, SEPP, OCL Circuitry Makes the Most of the Vertical FET

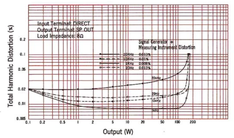
The entire B-I signal route is composed of three types of FETs—a total of 14 for each channel. These are linked in a three-stage direct-coupled system. Since FETs actually reduce current flow at high temperatures, there is no chance of thermal runaway—a major problem with bipolar transistor amps. So no temperature compensation is needed

The single ended push-pull output capacitorless circuitry uses three-stage differential amplification and a source-follower symmetrical drive. Differences in FET characteristics are easily compensated for. This system cancels even-order harmonics for smoother, cleaner tones.
Extra stability, even in case of power supply fluctuations, is assured by a newly developed driver and power stage FET biasing method (pats. pending).
Improved transient response results from greatly reduced bootstrap and electrolytic capacitors.

Tremendous Power: 150W Per Channel, Both Channels Driven Into 8 Ohms, 20-20,000Hz at No More Than 0.1% Total Harmonic Distortion

Vertical power FETs form the B-I drive and output stages. Their immense power handling capacities provide freedom from saturation and total harmonic distortion which is completely negligible at normal listening levels: 0.02% at 100W, 1KHz; under 0.06% at 100W, 20-20,000Hz. This means less negative feedback needed to keep distortion levels down, resulting in superior overall stability.

OUTPUT vs. TOTAL HARMONIC DISTORTION



Independent Power Sources for Left and Right Channels, Dual Transformers

To take full advantage of the dynamic possibilities inherent in the 20-20,000Hz output power range, separate power supplies are provided for each channel. These involve two massive transformers, and guarantee no difference in output during single-channel or stereo drive, or in case of violent dynamic surges. The B-I power transformers work with chemical capacitors to assure ultra-stable power supply.

Perfect Protection

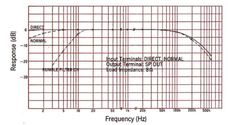
The extreme reliability of FETs—their resistance to thermal runaway and secondary destruction—makes protector circuits almost superfluous. To be perfectly safe, however, the B-I incorporates a speaker protection circuit to sever amp-speaker connection when a ±2V DC potential appears at the speaker terminals. This circuit also cuts shock noise when the power is switched on or off.

In addition, the B-I features all-electronic protection against excessive current. It switches off in case a short, or a load less than 4Ω, is present, to protect the circuitry from excessive current flow. Once the situation is corrected, it automatically switches on again. Finally, a special system senses irregularities in the FET bias current to shut off the circuit before damage can occur, protecting the power FETs.
All of these circuits indicate their operation by the overload indicator incorporating a light emitting diode. The second LED indicator on the B-I panel also lights in case of excessive heat detected by thermal sensors. As in the above cases, return to normal is automatic once the problem is corrected.

Rumble Filter

There are two sets of inputs on the B-I: NORMAL and DIRECT. With the NORMAL input the signal passes via a switchable 10Hz, −12dB/oct. high-efficiency rumble filter. It can be used to cancel the low-frequency noise from defective records, etc., which can damage your woofers during high-power performance.

FREQUENCY RESPONSE CHARACTERISTICS



Professional Control Convenience

The B-I alone will power a single set of speakers. Addition of the UC-I control unit permits pushbutton selection among five pairs of speakers. Selector switches are ultra-reliable reed relays, affording sure, positive touch. Each speaker has its own UC-I level control.
For precision output indication there are dual peak meters, with an extra-wide −50dB (0.001W) to +5dB (300W) range.
These meters offer extremely exact level indication at any frequency, to help guard against clipping. There are also Power and Rumble Filter switches. Use of the RU-I remote control cable kit (adaptor panel for the B-I, five-meter connector cord and UC-I stand) gives instant-action remote control from anywhere in the room. This feature is ideal for comparing speaker systems in an amateur or professional environment.

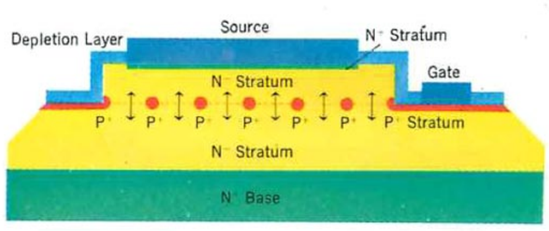
FET VERTICAL FET

The Third Audio Era Opens: Yamaha's New Vertical Field Effect Transistor

The Yamaha B-I incorporates an entirely new type of amplifier element which offers performance characteristics excitingly superior to the bipolar transistor, with all the benefits of the triode vacuum tube. This vertical FET is a voltage-controlled element capable of handling extremely high power without fear of saturation (similar to a triode vacuum tube).

Based on an invention by Prof. J. Nishizawa of Tohoku University and the Semiconductor Research Institute, the vertical FET was developed for audio application through the joint efforts of Prof. Nishizawa's institute and Yamaha (selected by the Japan Technology Development Foundation to refine the device). This cooperation led to a brilliant breakthrough in semiconductor research.

Yamaha Vertical FET Construction

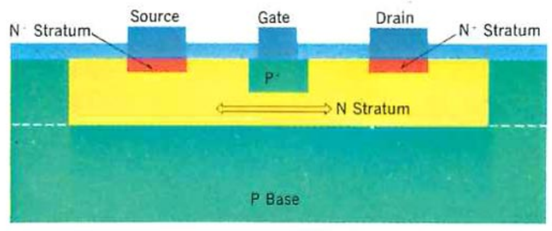


Arrows show current flow

As the illustration shows, the source, gate and drain are aligned vertically, permitting much higher power capacity. Each element of the mesh is, in effect, equivalent to an independent FET; a single Yamaha vertical FET contains tens of thousands of such elements.

The mesh itself measures 5-10μ across. To assure highest possible drain-source and drain-gate breakdown voltage, impurity concentration is reduced to a level far below any previous semiconductors, through a special epitaxial layer formation method.

Conventional FET Construction



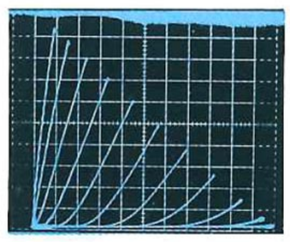
Arrow shows current flow direction

Yamaha Vertical FET Mesh Configuration

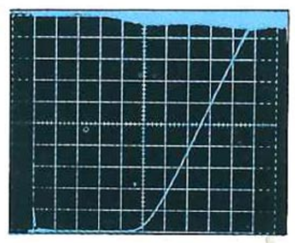
Vertical FET Characteristics

Output and transfer characteristics are shown in the oscilloscope photos.

2SK-77 Output Characteristics



2SK-77 Transfer Characteristics



Note the power handling capacity, which is superior to bipolar transistors. In addition, interior resistance is ten or more times lower than in the vacuum tube. Finally, when compared to the conventional FET, the Yamaha vertical FET gm characteristics (mutual conductance) are extremely high (approximately 1000m℧).

Vertical FET Features

When compared with the bipolar transistors used in today's most advanced audio amplifiers, the Yamaha vertical FET displays these features:

Excellent Pulse Response Characteristics

Carrier storage effect is nil, reducing switching or notch distortion when used in class B or AB operation. Furthermore, rise time and decay time are extremely fast.

Highly Linear Transfer Characteristics

High order harmonic distortion is extremely low when compared with the bipolar transistor (which has an exponential input-output curve) due to the square characteristics.

No High Drive Power Required

The Yamaha vertical FET is a voltage-driven element, so theoretically there is no need for a power drive.

No Secondary Breakdown

Current concentration, which causes secondary breakdown in bipolar transistors, is absent in the Yamaha vertical FET. As long as the gate bias is correct, extreme strength is assured.

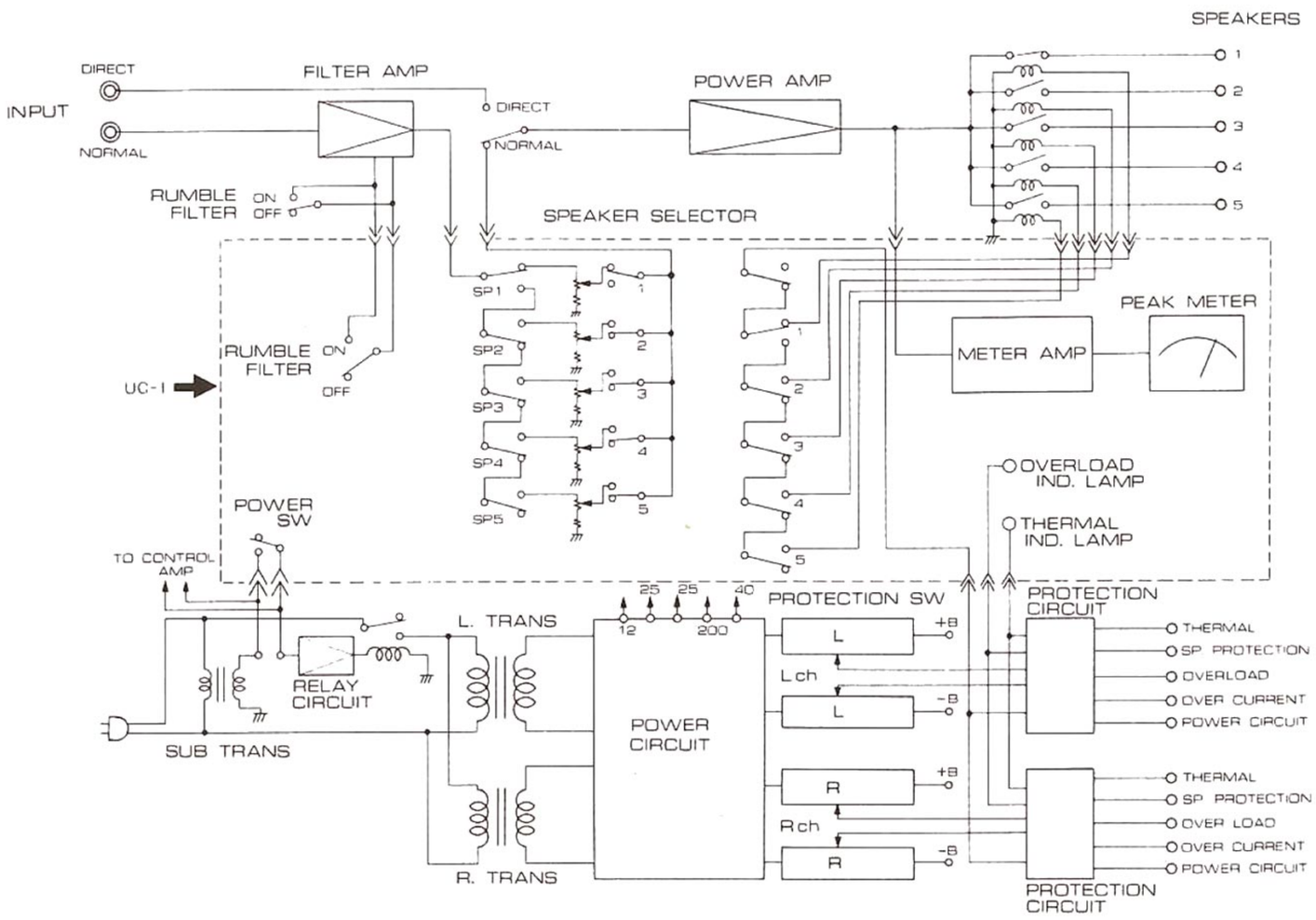
No Thermal Runaway

As the vertical FET temperature rises, current actually decreases, so there is no chance of thermal runaway.

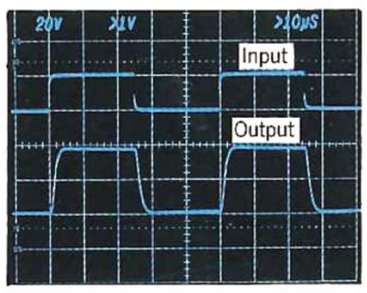
In other words, the Yamaha research team took an idea which was excellent in theory and developed it into a superb audio amplifier element. The Yamaha vertical FET boasts highly linear characteristics, huge power-handling capacity, outstanding thermal stability, low gate leak current and many other performance elements which defy measurement but affect tone quality.

Yamaha Vertical FET 2SK-77 Specifications

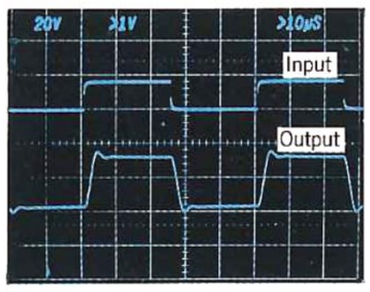
Maximum Drain Loss (W)	300
Drain-Gate Voltage (V)	200-300
ON Resistance (Ω)	1-2
Output Resistance (Ω)	5
Voltage Amplification Factor (μ)	App. 5
Overall Conductance (m℧)	1,000
Maximum Drain Current (mA)	20,000
Cutoff Voltage (V)	14-22



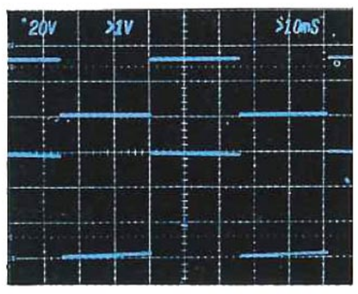
20KHz Waveform Response (8Ω pure resistor load)



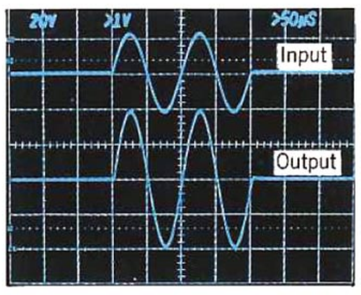
20KHz Waveform Response (0.1μF load)



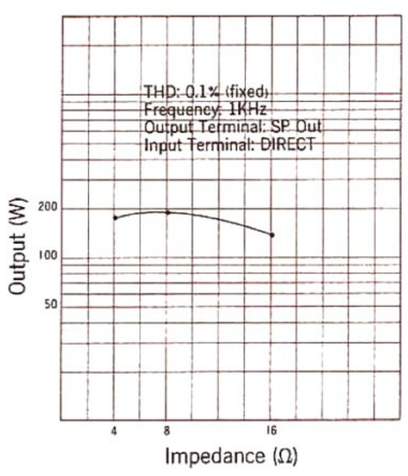
20Hz Waveform Response (8Ω pure resistor load)



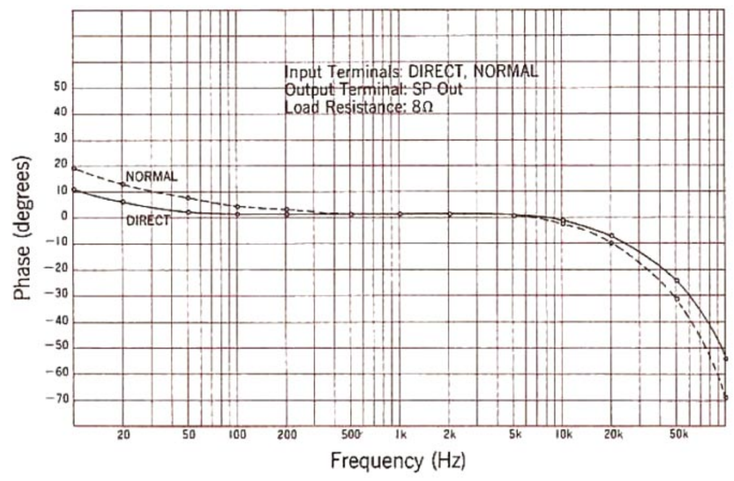
Tone Burst Response (at 10KHz, 100W output)



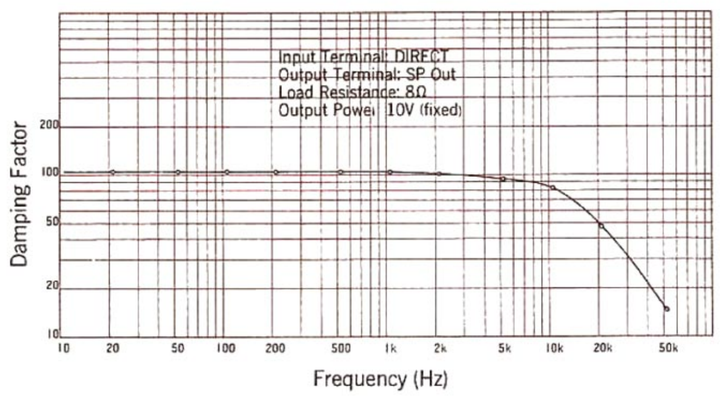
IMPEDANCE vs. OUTPUT CHARACTERISTICS



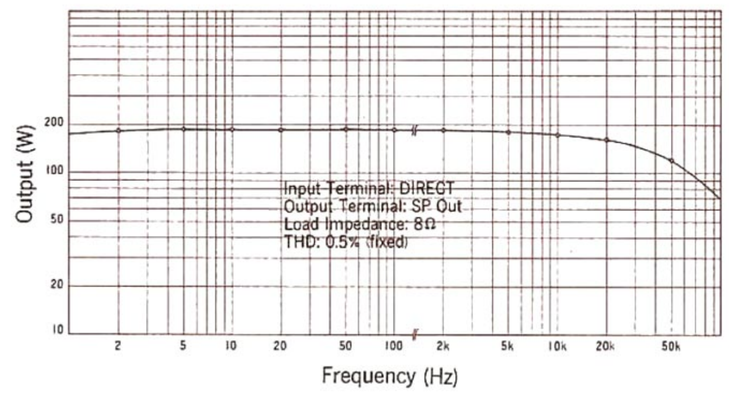
FREQUENCY vs. PHASE CHARACTERISTICS



FREQUENCY vs. DAMPING FACTOR



POWER BANDWIDTH



SPECIFICATIONS

B-I

Min. R.M.S. Output Power per Channel

150 watts (4 or 8 ohms) from 20Hz to 20,000Hz at no more than 0.1% Total Harmonic Distortion

Dynamic Power (IHF)	360W (8Ω)
Continuous RMS Power (both channels driven, 4Ω or 8Ω)	1KHz: 160+160W
Power Bandwidth (8Ω, 0.5% THD)	5-50,000Hz
Input Sensitivity & Impedance	775mV/100KΩ
Total Harmonic Distortion (8Ω)	
At 100W Output	1KHz: 0.02% 20KHz: 0.06%
At 1W Output	1KHz: 0.02% 20KHz: 0.03%
Intermodulation Distortion (70Hz : 7KHz=4 : 1 8Ω,100W Output)	0.04%
Frequency Response (at 1 watt 8Ω)	5-100,000Hz, +0dB, −1dB
Damping Factor	80 at 1KHz/8Ω
Level Control Range	18dB (775mV-6V)
Residual Noise	0.3mV
Signal-Noise Ratio	100dB
Rumble Filter	10Hz (−12dB/oct.)
Output Terminal Sets	1 (B-I only) 5 (with UC-I)

Semiconductors
39 FETs, 113 Transistors, 3 LEDs, 64 Diodes, 7 Zener Diodes

Power Source

U.S.A. & Canada	AC 117V, 60Hz
Other Areas	AC 220/240V 50/60Hz
Power Consumption	440W
Dimensions (WxHxD)	460x150x390mm 18″x 6″x15½″
Weight	37Kg (81.57 lbs.)

UC-I

Meter Range	−50dB (0.001W) to +5dB (300W)
Meter Indication	
at 150W	+2dB (±0.5dB)
at 10W	−10dB (±1dB)
at 1W	−20dB (±1dB)
at 0.1W	−30dB (±4dB)
at 0.01W	−40dB (±5dB)
Dimensions (WxHxD)	460x150x70mm 18″x 6″x 2¾″ Connector protrudes 45mm (1¾″)
Weight	5Kg (11 lbs.)

RU-I

Cord Length	5 meters (16′ 5″)

Specifications subject to change without notice.

For details please contact:

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