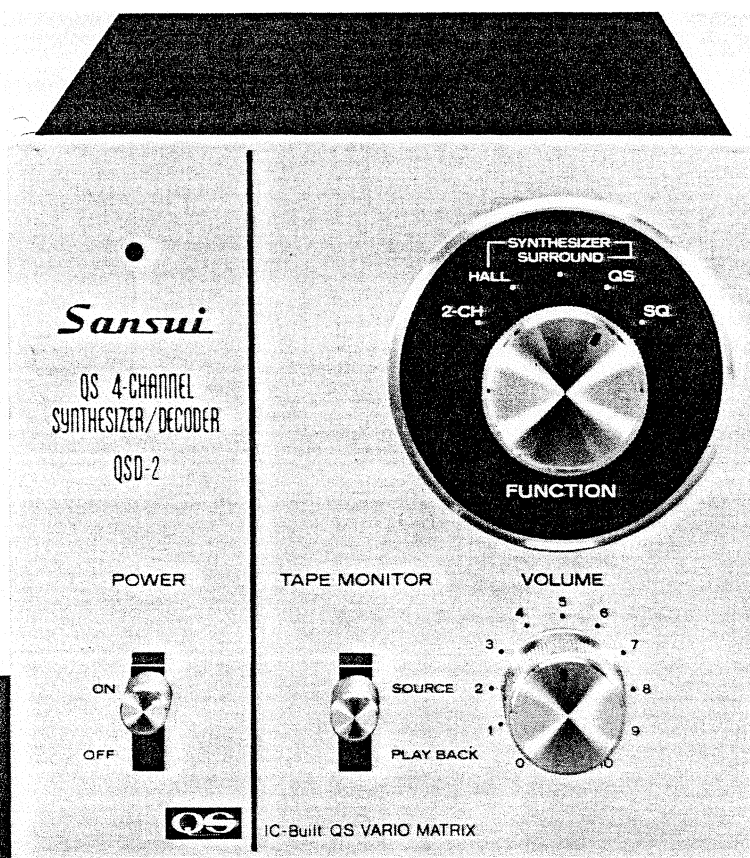


SERVICE MANUAL

4-CHANNEL SYNTHESIZER DECODER

SANSUI QSD-2



SANSUI ELECTRIC CO., LTD.

This service manual is designed for service engineers to repair, adjust, maintain and order the replacement parts of the QSD-2 correctly. When ordering the parts, use the stock number and parts name specifically referring to the Parts Location and Parts Lists. For general usage and maintenance of the unit, please refer to the Operating Instructions attached with the unit.

1. SPECIFICATIONS

4-CHANNEL DECODER SECTION

(TYPE-A QS VARIO-MATRIX)

FREQUENCY RESPONSE ...20 to 30,000Hz

DISTORTIONless than 0.1% (at 1,000Hz)

SEPARATION

QS DECODER.....20dB (adjacent channels)
30dB (diagonal channels)

QS Synthesizerequivalent to QS Decoder

INPUT SENSITIVITY

2-CHANNEL INPUT130mV

TAPE MONITOR(2-CH)...130mV

MAX. INPUT CAPABILITY...3V

OUTPUT LEVEL (at 1,000Hz)

4-CHANNEL OUTPUT

RATED730mV

MAX.....5V (0.5% THD)

TAPE REC.....130mV

GENERAL

SEMICONDUCTORS25 Transistors, 8 Diodes,
1 Zener Diode, 4 ICs, 1 LED

POWER REQUIREMENT

VOLTAGE120V. 50/60Hz

CONSUMPTION4.5 watts

DIMENSIONS126 mm (5") W

120 mm (4¾") H

288 mm (11¾") D

WEIGHT2.5 kg (5.5 lbs.) net

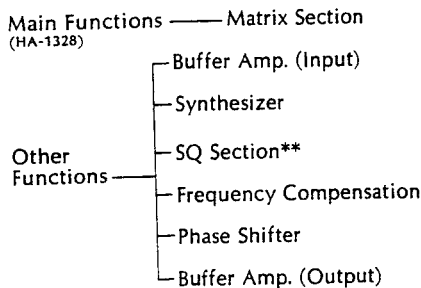
3.3 kg (7.3 lbs.) packed

* Design and specifications subject to change without notice for improvements.

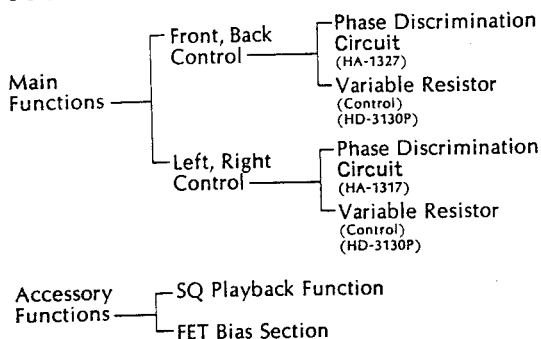
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1) Matrix Section



2) Phase Discriminator Section



2-3. Functions of QS Vario-Matrix Components

1) Matrix Section

◆ Matrix

Computes the input signals in the form of $(L+R)$ and $(L-R)$, then delivers four output signals (LF' , LB' , RF' and RB') according to the matrix coefficients provided by the control section, while creating maximum separation among the four signals.

◆ Synthesizer

Blends L/R audio signals in phase (for QS Synthesizer/Hall function) or in reverse phase (for QS Synthesizer/Surround function) to produce LT/RT composite signals.

◆ Phase Matrix (SQ Section)

A function for decoding SQ encoded signals. It is composed of phase shifters (ϕ_1 , ϕ_1+j) for creating advancing 90-degree phase difference of a LT+RT, over an extended widerange of frequencies, and a gain control section that provides a LT+RT sum signal for separation control of the back channels.

◆ Frequency Compensation

Compensates frequency response to stabilize the localization of reproduced sound images in the low and high frequency ranges:

Low frequency compensation—Designed to improve Front-Back separation in particular

High-frequency compensation—Designed to improve L/R separation in particular

◆ Phase Shifters (ϕ_2 , ϕ_2+j)

There is one (ϕ_2) for the front channels, and another (ϕ_2+j) for the back channels. Together they help to reproduce the QS-encoded signals (LF, LB, RF and RB) in phase one another as they were in the original sound field.

2) Phase Discriminator Section

Detects the location of an input signal by phase-discriminating the phase and level differences between LT/RT QS-encoded signal, converts this information into DC levels, and sends it to the control section.

◆ Front/Back Control

Controls the Front Left/Back left separation, and Front Right/Back right separation according to the phase difference between LT/RT QS-encoded signals.

◆ Left/Right Control

Controls front left/right separation and back left/right separation according to the phase difference between $LT+RT \angle -45^\circ$ and $LT-RT \angle 45^\circ$.

1. Phase Discrimination Circuit

Detects the phase difference between two input signals and delivers a DC output.

2. Variable Resistance Circuit (Control Section)

Changes the bias of the FET array IC (HD-3130P) according to the DC signal from the phase discriminator section. The conductance of the FETs then change continually to alter the matrix coefficients of the matrix section.

Fig. 7

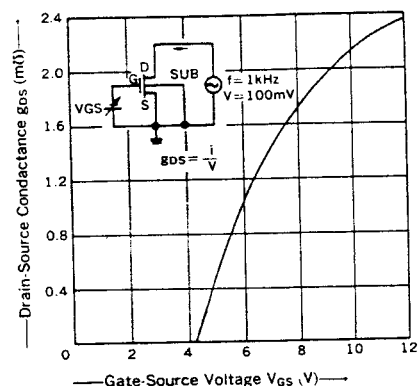


Fig. 7 shows the characteristic of the FETs inside the IC HD-3130P in terms of the gate-source voltage vs. drain-source conductance.

*QS is a trademark of Sansui Electric Co., Ltd.
**SQ is a trademark of CBS Inc.

2. OPERATIONS (Refer to Block Diagram on Page 9)

2-1. Basic Operations of QS Encoder & QS Decoder

1) QS Encoder

While a conventional stereo recording transmits L/R positional information in the form of relative level differences between L/R signals, the QS Encoder additionally transmits front/back positional information in the form of phase differences between L/R signals.

In other words, the QS Encoder is able to transmit signals in full 360-degree directions in an original sound field, by combining LT/RT amplitude differences (for storing left/right information) and LT/RT phase differences (for storing front/back information), and thus offers the advantage of being able to use all existing stereo transmission channels. Consequently, it is highly compatible with mono and stereo playback, yet provides outstanding high-fidelity 4-channel reproduction results. The conceptual diagram of the QS Encoder, and the mathematic equations behind it, are presented below:

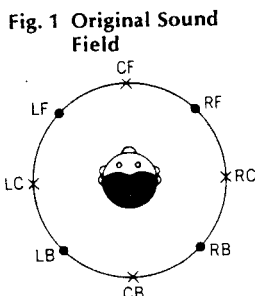


Fig. 2 Conceptual Diagram of QS Encoder

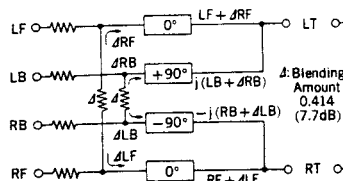
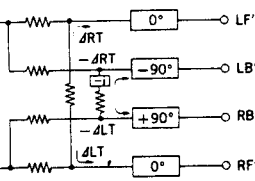


Fig. 3 Conceptual Diagram of QS Decoder



The encoder outputs (decoder inputs), LT and RT, are given by

$$LT = LF + \Delta RF + j(LB + \Delta RB) \quad RT = RF + \Delta LF - j(RB + \Delta LB)$$

The decoder outputs, LF', LB', RB' and RF', are given by

$$LF' = LT + \Delta RT \quad RB' = j(RT - \Delta LT) \\ LB' = -j(LT - \Delta RT) \quad RF' = RT + \Delta LT$$

The QS Encoder provided for aligning the QS Decoder provides the following outputs:

$$\begin{aligned} \textcircled{LF} \quad LT:RT=1:0.414 \quad (7.7\text{dB}) & \quad \textcircled{RF} \quad LT:RT=0.414 \quad (7.7\text{dB}):1 \\ \textcircled{CF} \quad LT:RT=1:1 & \quad \textcircled{CB} \quad LT:RT=1:1 \end{aligned}$$

The $\textcircled{LF}$, $\textcircled{RF}$, $\textcircled{CF}$ and $\textcircled{CB}$ represent sound sources in the original sound field.

2) QS Decoder (Basic Matrix System)

By performing mathematical operations contrary to those accomplished by the QS Encoder, the QS Decoder provides output signals that have the same characteristics (level, phase, directionality) as the signals in the original sound field.

For example, an LF signal in the original sound field, which was encoded by the QS Encoder as $LT=1$, $RT=0.414$, is now reproduced by the QS Decoder in the form of the following four output signals:

$$\begin{aligned} LF' &= LT + \Delta RT = 1 + (0.414)^2 = 1.171 \rightarrow 1.00(0\text{dB}) \\ LB' &= -j(LT - \Delta RT) = -j(1 - 0.414 \times 0.414) = -j0.828 \rightarrow -j0.707(-3\text{dB}) \\ RF' &= RT + \Delta LT = 0.414 + (0.414 \times 1) = 0.828 \rightarrow 0.707(-3\text{dB}) \\ RB' &= j(RT - \Delta LT) = j(0.414 - 0.414 \times 1) = 0 \rightarrow 0(-\infty\text{dB}) \end{aligned}$$

In other words, as Fig. 4 shows, the adjacent channels will have crosstalk of -3dB each, but the diagonally opposite channel will have no crosstalk ($-\infty\text{dB}$).

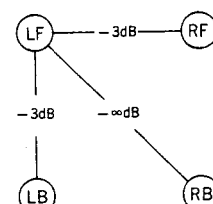


Fig. 4 Separation of QS Decoder

2-2. Basic Operations of QS Vario-Matrix Decoder (QSD-2)

The QS Decoder shown in Fig. 3 provides output signals that closely correspond, in terms of level, phase and directionality, with the signals in the original sound field, but it is the QS Vario-Matrix Decoder that eliminates the crosstalk to the adjacent channels and defines the location of each reproduced signal more clearly.

The QSD-2 QS Vario-Matrix Decoder performs various functions as outlined in the following paragraphs, and faithfully reproduces each and every one of the signals in the original sound field with greatly improved inter-channel separation as Fig. 6 shows.

The improvement in the inter-channel separation is a technical feature of the QS Vario-Matrix Decoder, and is accomplished by scanning and sensing the front/back and R/L direction of the predominant sound source, and varying the matrix coefficients accordingly from moment to moment (hence the name QS vario-matrix). At the same time, it has the advantage that lower-level sounds in all other directions are reproduced in full.

Fig. 5 Block Diagram of QSD-2

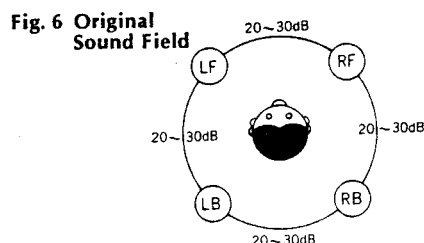
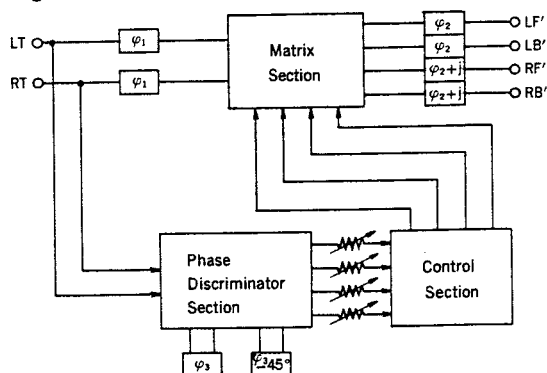
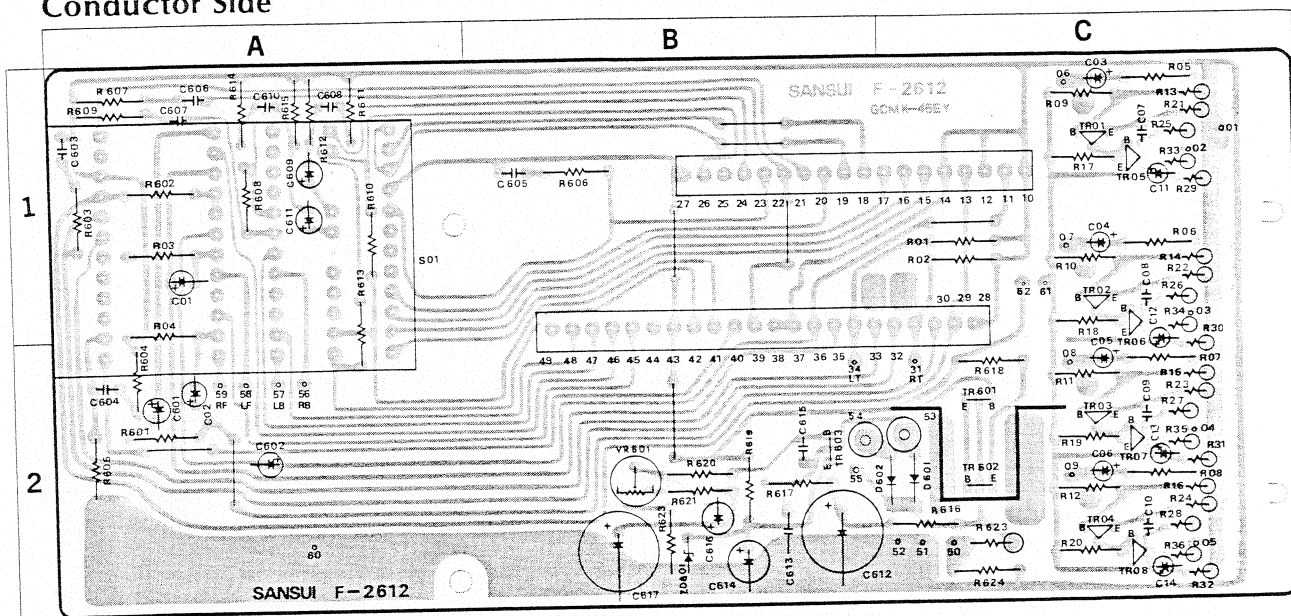


Fig. 6 Original Sound Field

3. PARTS LOCATION AND PARTS LIST

3-1. F-2612 Power Supply Circuit Board (Stock No. 7501651)

Conductor Side

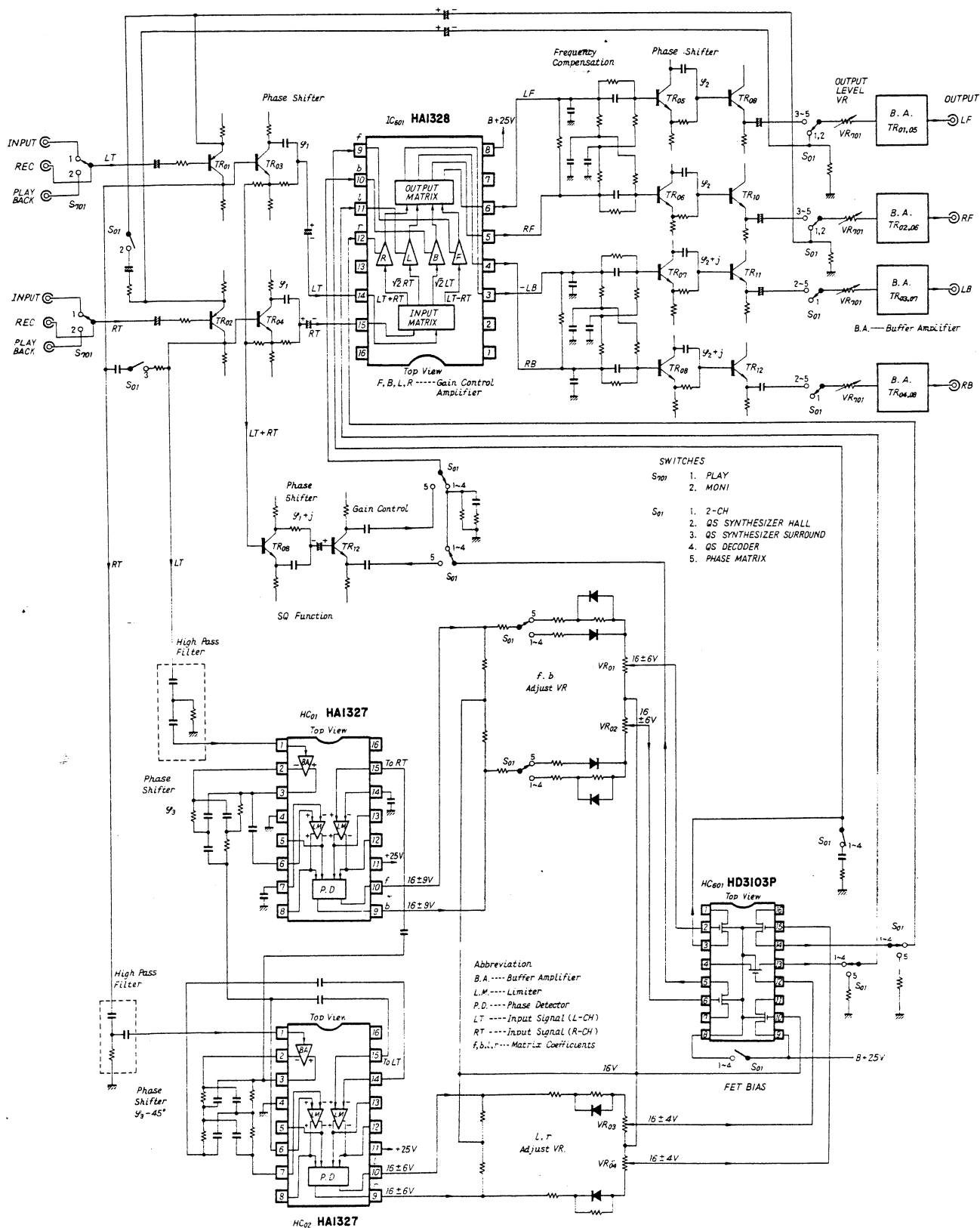


Parts List

Parts No.	Stock No.	Description	Position
TR01-04	0306070, 1	2SC1313 (F, G)	1, 2 C
TR05-08	0300470, 1	2SA726W (F, G)	1, 2 C
TR601	0306130, 1	2SC1364 (5, 6)	2 C
TR602	0308392, 3	2SD313 (E, F)	2 C
TR603	0306130, 1	2SC1364 (5, 6)	2 B
D601	0310880	10D-05	2 C
D602	0310880	10D-05	2 C
ZD601	0315550	RD-6A M Zener Diode	2 B
C01	0519102	3.3μF 50V E.C.	1 A
C02	0519102	3.3μF 50V E.C.	2 A
C03-06	0573228	0.22μF 35WV T.C.	1, 2 C
C07-10	0657470	47 pF 50V C.C.	1, 2 C
C11-14	0515109	1μF 50V E.C.	1, 2 C
C601	0513100	10μF 25V E.C.	2 A
C602	0513100	10μF 25V E.C.	2 A
C603	0600127	0.012μF 50V M.C.	1 A
C604	0600157	0.015μF 50V M.C.	2 A
C605	0600567	0.056μF 50V M.C.	1 B
C606	0600157	0.015μF 50V M.C.	1 A
C607	0600686	0.0068μF 50V M.C.	1 A
C608	0600127	0.012μF 50V M.C.	1 A
C609	0515109	1μF 50V E.C.	1 A
C610	0600127	0.012μF 50V M.C.	1 A
C611	0515109	1μF 50V E.C.	1 A
C612	0514331	330μF 35V E.C.	2 B
C613	0657473	47000 pF 50V C.C.	2 B
C614	0511101	100μF 10V E.C.	2 B
C615	0657221	220 pF 50V C.C.	1 A
C616	0513100	10μF 25V E.C.	2 B
C617	0513102	1000μF 25V E.C.	2 B
R01-02	0107154	150kΩ	2 A
R03	0107563	56kΩ	1 A
R04	0107563	56kΩ	1 A
R05-08	0107222	2.2kΩ	1, 2 C
R09-12	0107824	820kΩ	1, 2 C

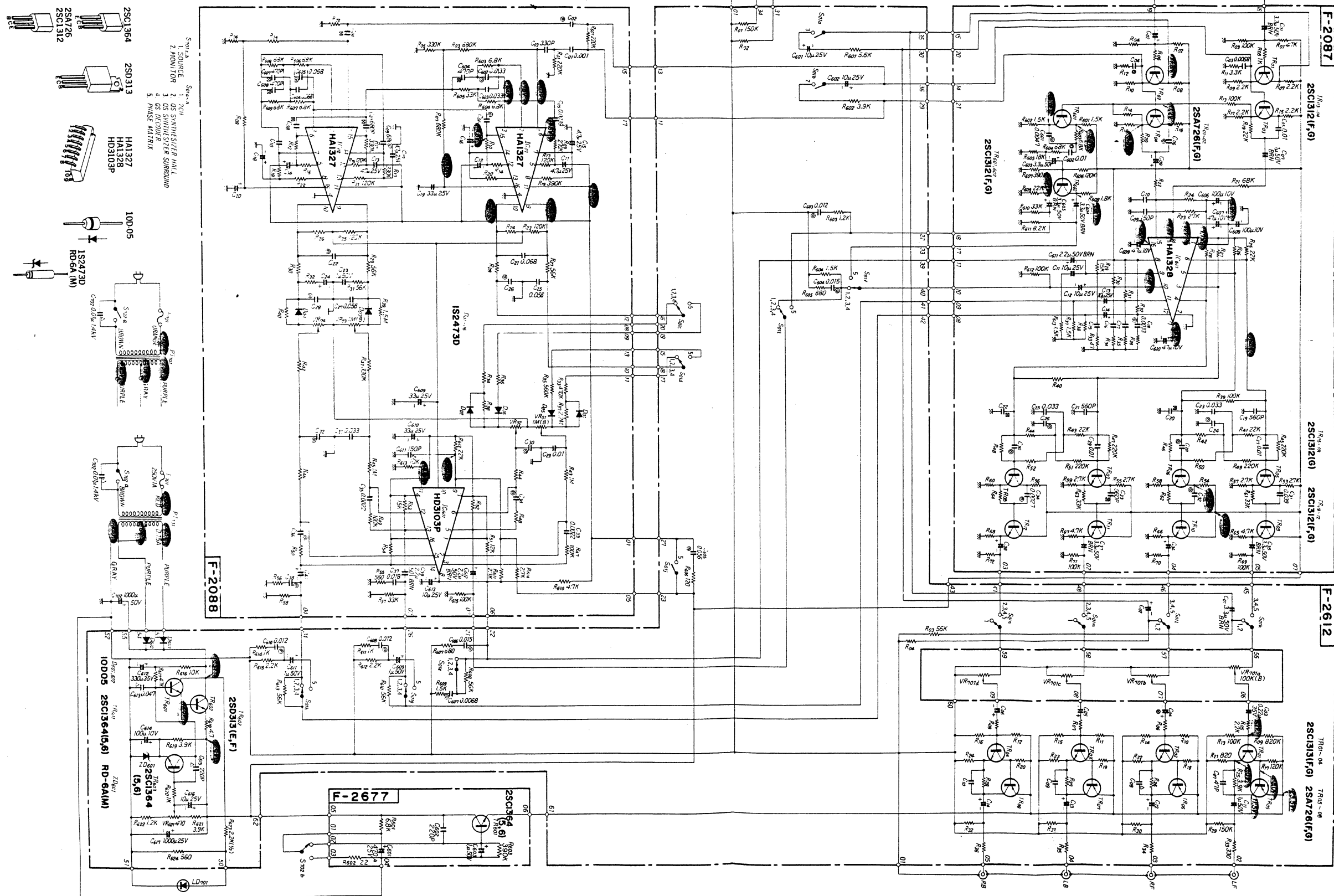
Parts No.	Stock No.	Description	Position
R13-16	0106104	100kΩ	1, 2 C
R17-20	0107124	120kΩ	1, 2 C
R21-24	0106821	820Ω	1, 2 C
R25-28	0106392	3.9kΩ	1, 2 C
R29-32	0106154	150kΩ	1, 2 C
R33-36	0106331	330Ω	1, 2 C
R601	0107562	5.6kΩ	2 A
R602	0107392	3.9kΩ	1 A
R603	0107122	1.2kΩ	1 A
R604	0107152	1.5kΩ	2 A
R605	0107681	680Ω	2 A
R606	0107121	120Ω	1 B
R607	0107681	680Ω	1 A
R608	0107563	56kΩ	1 A
R609	0107152	1.5kΩ	1 A
R610	0107563	56kΩ	1 A
R611	0107102	1kΩ	1 A
R612	0107222	2.2kΩ	1 A
R613	0107563	56kΩ	1, 2 A
R614	0107102	1kΩ	1 A
R615	0107222	2.2kΩ	2 A
R616	0107103	10kΩ	2 C
R617	0107472	4.7kΩ	2 B
R618	0107479	4.7Ω	2 C
R619	0107392	3.9kΩ	2 B
R620	0107102	1kΩ	2 B
R621	0107392	3.9kΩ	2 B
R622	0107122	1.2kΩ	2 B
R623	0103222	2.2kΩ 1/2W C.R.	2 C
R624	0107561	560Ω 1/4W C.R.	2 C
VR601	1035050	470Ω(B) Volume	2 B
S01	1105210	Function Switch	1, 2 A
	2410720	4P Pin Ass'y (Type A)	
	2410740	8P Pin Ass'y (Type A)	
	2410750	10P Pin Ass'y (Type A)	

4. BLOCK DIAGRAM



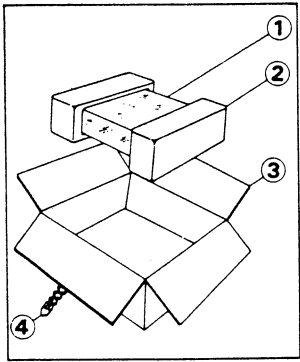
5. SCHEMATIC DIAGRAM

La présentation et les spécifications sont susceptibles d'être modifiées sans préavis par suites d'améliorations éventuelles.
 Änderungen, die dem technischen Fortschritt dienen, bleiben vorbehalten.
 Design and specifications subject to change without notice for improvement.



6. PACKING LIST

Parts No.	Stock No.	Description
1	9116042	Vinyl Cover
2	9027920	Stylofoam Packing
3	9009170	Carton Case
4	5996080	Curl Stopper



7. ACCESSORY PARTS LIST

Stock No.	Description
9209790	Operating Instructions
3810180	Pinplug Cord
9237370	Schematic Diagram

※ Regarding Adjustment methods of QS vario-matrix on QSD-2, refer to Service Bulletin, Ref. AN-087.