Each variable name is defined as follows.

Front left channel : LF , Right front channel : RF
Left rear channel : LR , Rear right channel : RR
R channel encoded : R , L channel encoded : L
(90 degrees out of phase delay processing) the imaginary unit : i

The following is a method of encoding formula QS. Fig.1 shows a block diagram of this process.

L = 0.92 * LF + 0.38 * RF + 0.92 * LR * i + 0.38 * RR * i
R = 0.38 * LF + 0.92 * RF - 0.38 * LR * i - 0.92 * RR * i

The following is a method of decoding formula QS. Fig.2 shows a block diagram of this process.

LF = L + 0.414 * R
RF = R + 0.414 * L
LR = -L * i + 0.414 * R * i = - (L - 0.414 * R) * i
RR = R * i - 0.414 * L * i = (R - 0.414 * L) * i

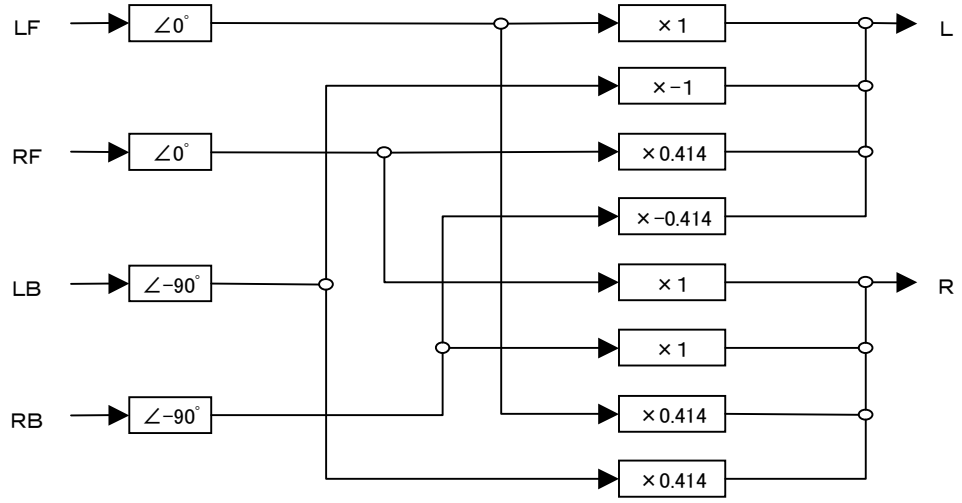


Fig. 1 Encoder block diagram of the QS

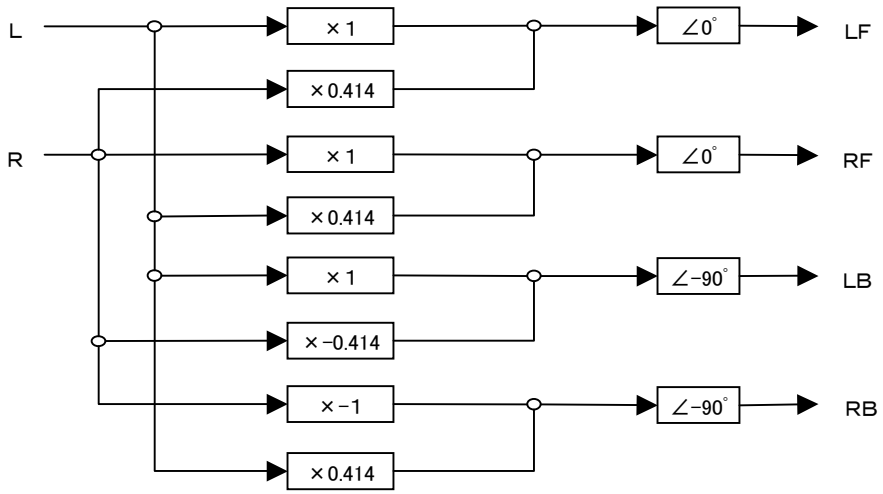


Fig. 2 Decoder block diagram of the QS

In addition, the following is a method of encoding formula SQ. Fig.3 shows a block diagram of this process.

L = LF - 0.707 * LR * i + 0.707 * RR
R = RF - 0.707 * LR + 0.707 * RR * i

The following formula decode (Improvement Scheme symmetric). Fig.4 shows a block diagram of this process.

LF = L
RF = R
LR = -0.5 * L * (1 - i) - 0.5 * R * (1 + i)
RR = 0.5 * L * (1 + i) + 0.5 * R * (1 - i)

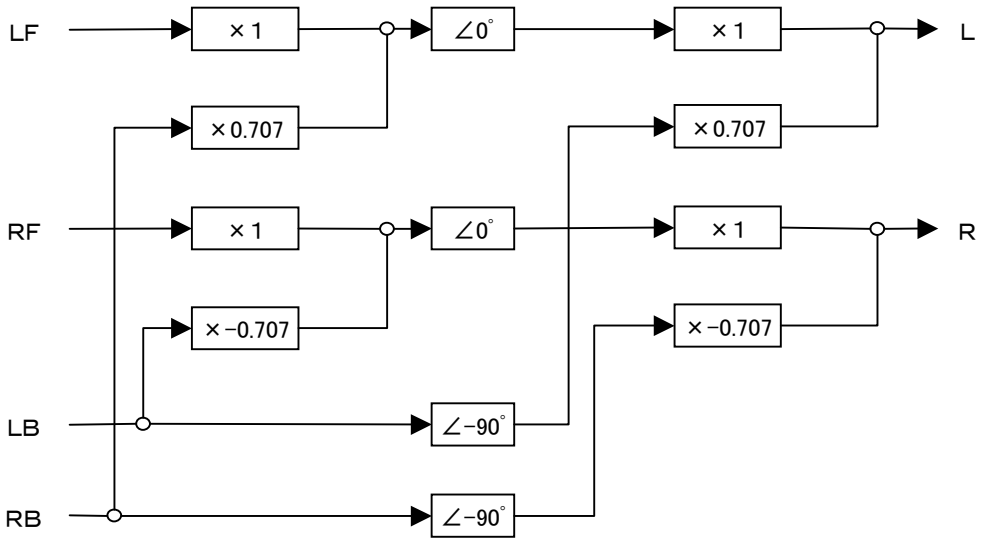


Fig. 3 Block diagram of the SQ encoder

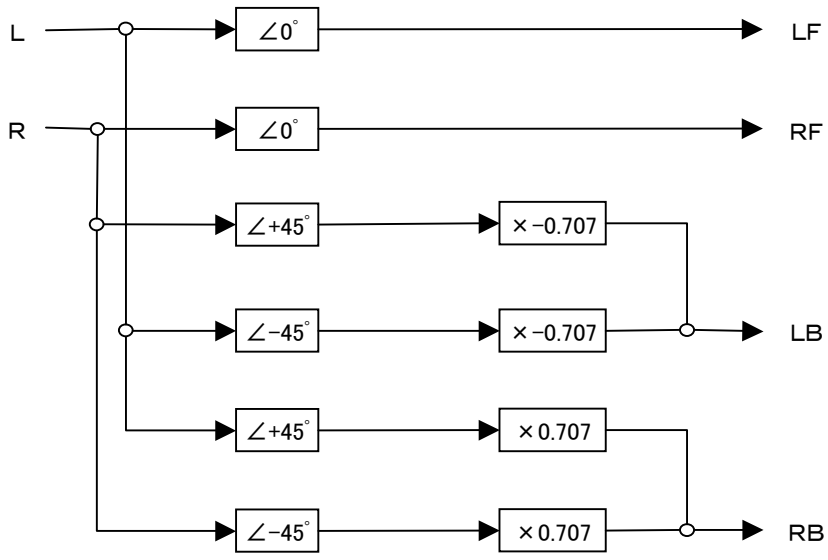


Fig. 4 SQ decoder block diagram of the (symmetric Improvement Scheme)

In addition, the following expression of a standard method method decode SQ. Fig.5 shows a block diagram of this process.
LF = L
RF = R
LR = 0.707 * L * i - 0.707 * R
RR = 0.707 * L - 0.707 * R * i

Therefore, this standard method is as "phase-level" of Fig.6, there is asymmetry, the center is moved to the right front Therefore, this is usually a standard method was not adopted.

In addition, as the "phase-level system" SQ is the same when all channels, signal transmission is not possible, is one of the drawbacks of this method.
In addition, the figure of "phase-level", the dashed line crosstalk, phase is the phase just above 0 degrees, and proceed counter-clockwise.

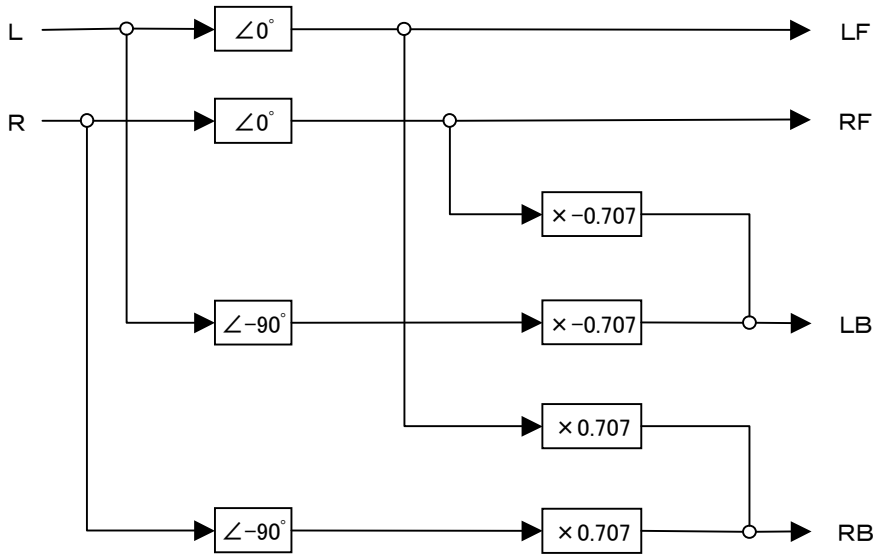


Fig. 5 SQ decoder block diagram of the (standard method)

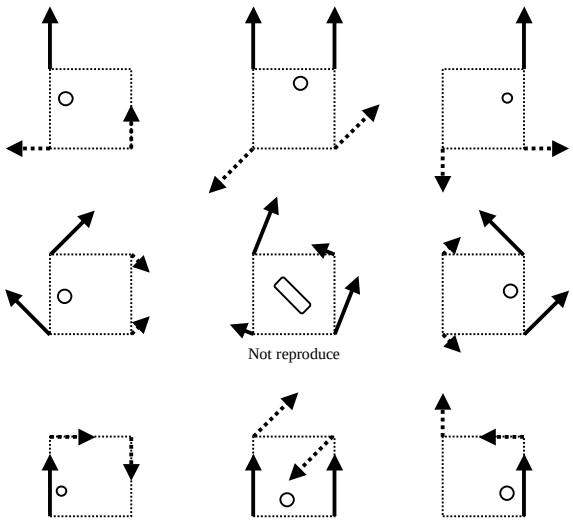


Fig. 6 SQ decoder phase level (standard method)

Is for logic (or later) to reduce crosstalk matrix is a disadvantage, to improve the separation direction emphasizes logic.

This unit, the input switching logic, you can see the (need) that effect.

Cross-talk QS system, the sound source if the center channel, both channels of the opposite side to-7.7dB, the sound source if the corner, on both sides of the channel to-3dB occurs.

QS system logic will detect sound direction in the volume ratio of the channel between each diagonal of the left front and right rear , right front and left rear.

Added in reverse phase to reduce cross-talk channel on both sides of the sound source direction.

Fig.7 shows a block diagram of this process. Phase "level" of the QS system, with no logic in Fig.8, there is logic is shown in Fig.9.

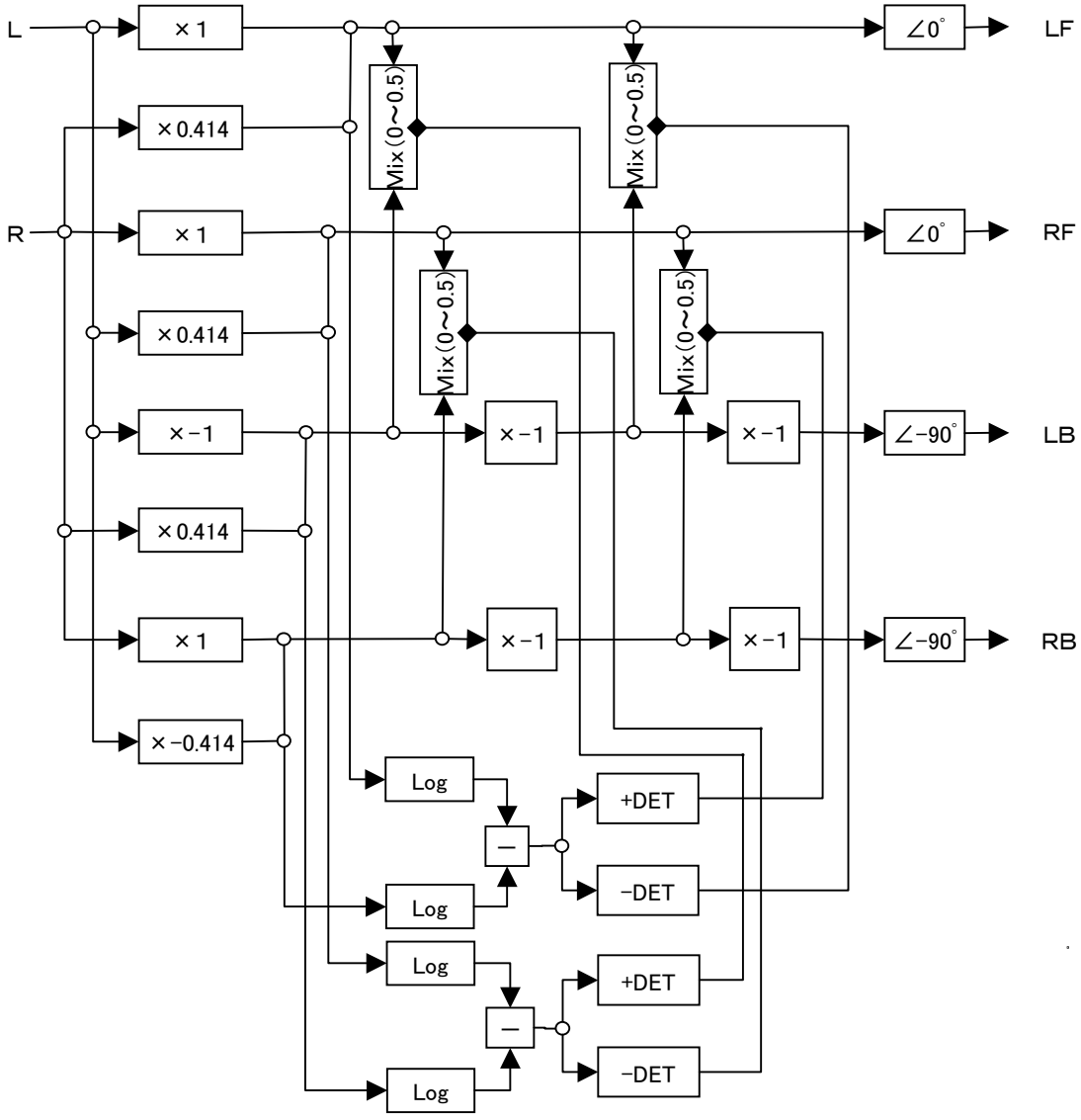


Fig. 7 Full logic decoder block diagram of the QS

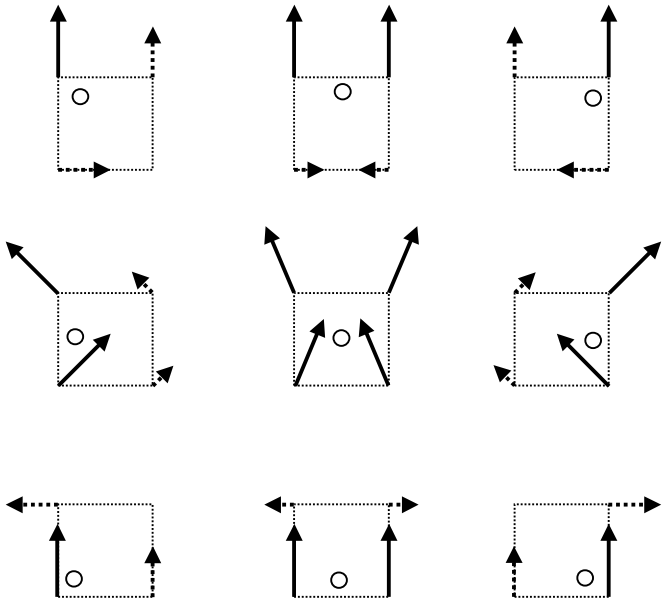


Fig. 8 QS-level phase of the decoder

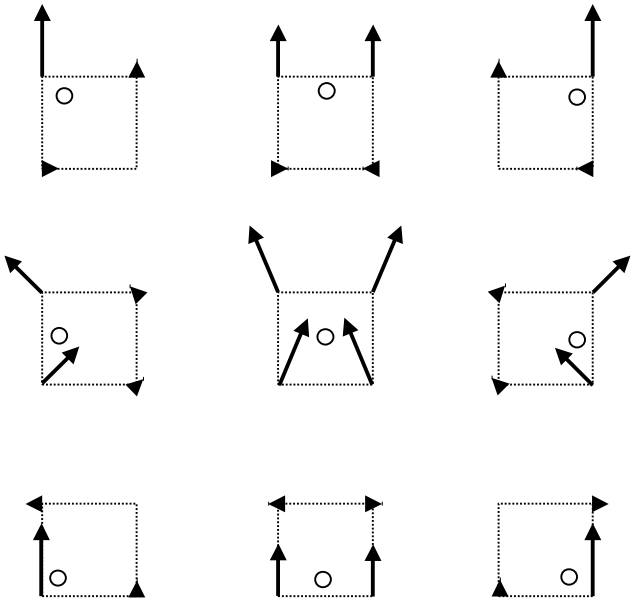


Fig. 9 QS-level phase of full logic decoder

Crosstalk SQ method, in the case of the rear center front and center, occurs 0dB to both channels of the opposite side, in the case of the corner,-3dB to, the channel of the reverse side of the diagonal channel sound source before and after that the sound source -3dB occurs.

SQ scheme logic will detect sound direction and volume ratio of the center of the forward and backward, and volume ratio of the left and right front, left and right volume ratio at the rear.

If the center of the front and rear, is reduced by adding in reverse-phase cross-talk channel on the opposite side, in the case of corners, the phase shifter 90 degrees channel on the diagonal direction, the diagonal and the opposite side of the front and rear sound source sound reduces the sum in the reverse phase of the channel cross-talk.

Fig.10 shows a block diagram of this process. No logic in Fig.11, Fig.12 shows the logic there, the "phase-level" method of SQ.

In addition, the logic of a typical SQ sound system (since it is a simple type) does not perform a reverse phase cancellation of crosstalk in the case of a corner.

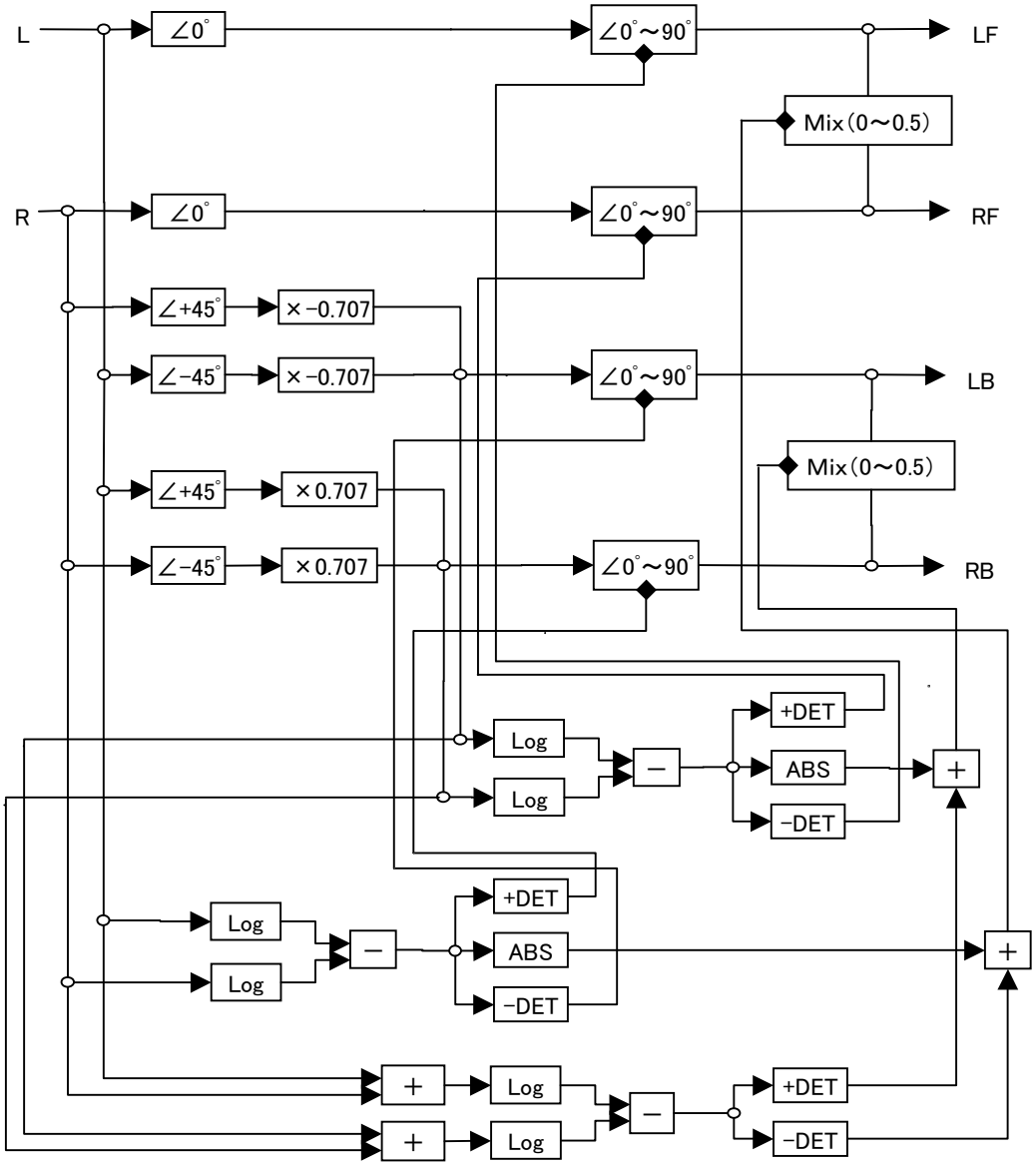


Fig. 10 Full logic SQ decoder block diagram of the (symmetric Improvement Scheme)

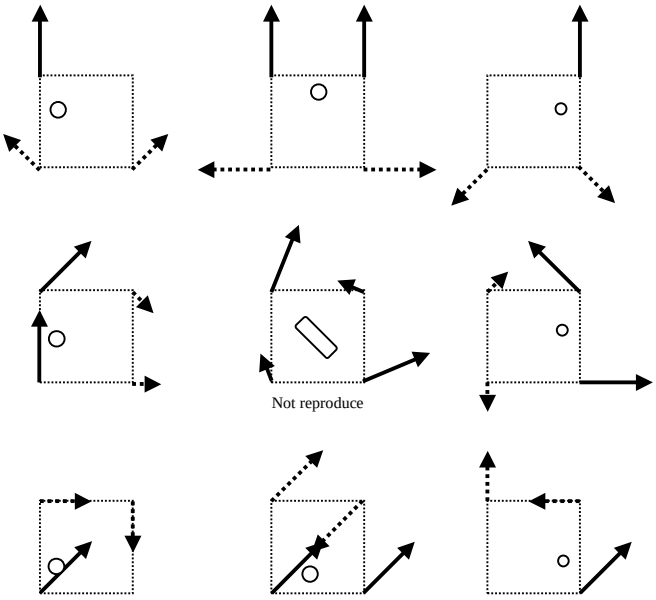


Fig. 11 SQ decoder level phase of (symmetrical Improvement Scheme)

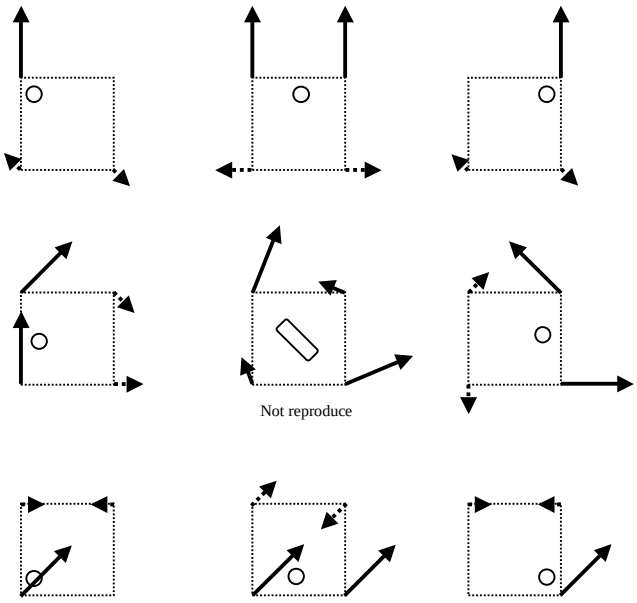


Fig. 12 SQ decoder logic level of the full phase (symmetric Improvement Scheme)

Is shown in Fig.13 (a set of three) the whole circuit diagram of the decoder.

In addition, each output impedance of the substrate is less than a few kΩ so, sliding housing is required other than the VR line is there is no shield.

Shows the schematic of the input and output unit and the mode switching unit to Fig.13-1.

Does not use most, SW of SQ MIX improves the separation of the center of the forward and backward in the no logic of the SQ system.

Shows the schematic of the sound source direction detecting section in Fig.13-2.

Three-stage phase-shift circuit of the detection unit, in the semi-fixed, and then adjusted to 90 ± 5 degree phase difference between the roughly 100Hz ~ 5kHz.

Level of phase-shift circuit, the output, VR15 VR11, when the input 2Vrms, to adjust the maximum amplitude of the output phase-shift circuit.

Each logarithmic conversion circuit for the detection of volume ratio will adjust the DC offset of the op amp is, VR19, VR25 VR27. (Because of the adjustment,, C33 C29 is to the socket)

Balance adjustment of the volume ratio of the QS system, when you left and right signal ratio is 0.414:1 or 1:0.414 VR24, to adjust the output to 0V Log of ratio between the volume of each diagonal.

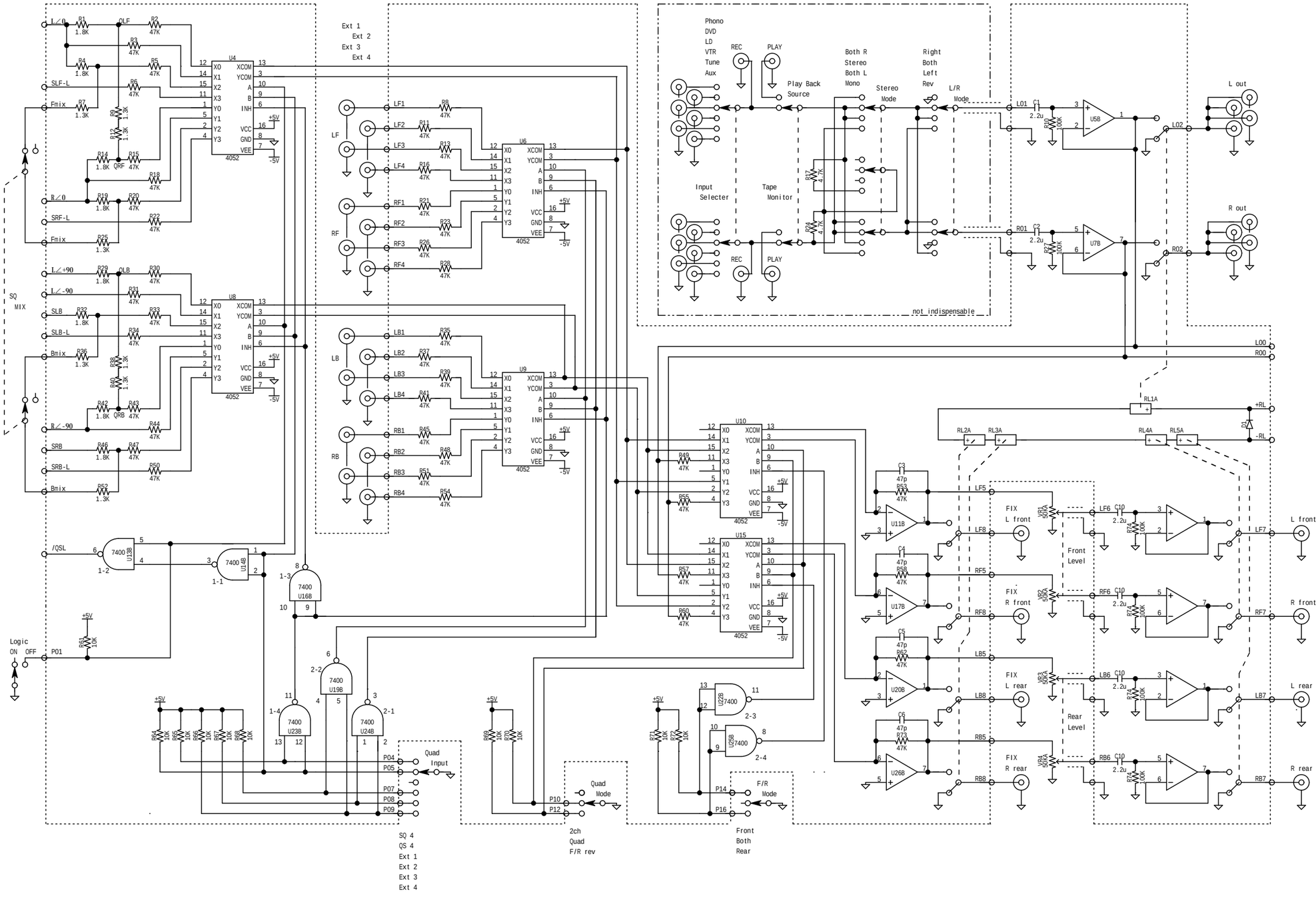
In addition, the balance adjustment of the volume ratio of SQ method, as a mono input is VR24, the volume ratio between the left and right output of Log between the left and right at the front and rear, with the single channel input, adjust the output to 0V Log volume ratio between the before and after you. Gain adjustment is VR22, each logarithmic amplifier and then to adjust the gain and range expansion is VR20, to adjust to the maximum amplitude of ± 5V output Log. (VR20 is about 20kΩ weak) In addition, the noise injection for the dead zone for stabilizing the DC offset and behavior when the level is very small, is, VR21 VR26, and small signal input when the input signal when off, a noise like the noise level and balance of the log output becomes 0V to adjust.

Shows the circuit diagram of the unit and crosstalk cancellation matrix in Fig.13-3.
A four-stage phase-shift circuit of the matrix, in the semi-fixed, and then adjusted to 90 ± 5 degree phase difference between the roughly 20Hz ~ 20kHz. VCR1 QS system for crosstalk cancellation of gain is adjusted in VR52, while taking into account the effect of distortion is canceled and VR48, at the corner - reverse corner sound source, and adjust it to each VC roughly -3.7 ~ 0V.

VCR3 method for crosstalk cancellation of SQ is adjusted in gain, VR64 VR62, to adjust, taking into account the effect of distortion is canceled and VR53. When there is a sound source in front, then a constant voltage of 0V roughly the VC rear. When there is a sound source to the rear, then a constant voltage of 0V roughly the VC front. When the sound source other than the above, the voltage less than-3.7V to roughly each VC.

VCR2 SQ method for phase shift is adjusted in gain, VR58, VR63, VR67 VR57, taking into account the phase shift of 0 to 90 degrees and the distortion is VR56, the sound source at the center of each front corner - (backward), to adjust to each VC roughly -3.7 ~ 0V.

In addition, LED voltage check at the point each, adjustable lighting that becomes a rule of thumb, make it easy to adjust.



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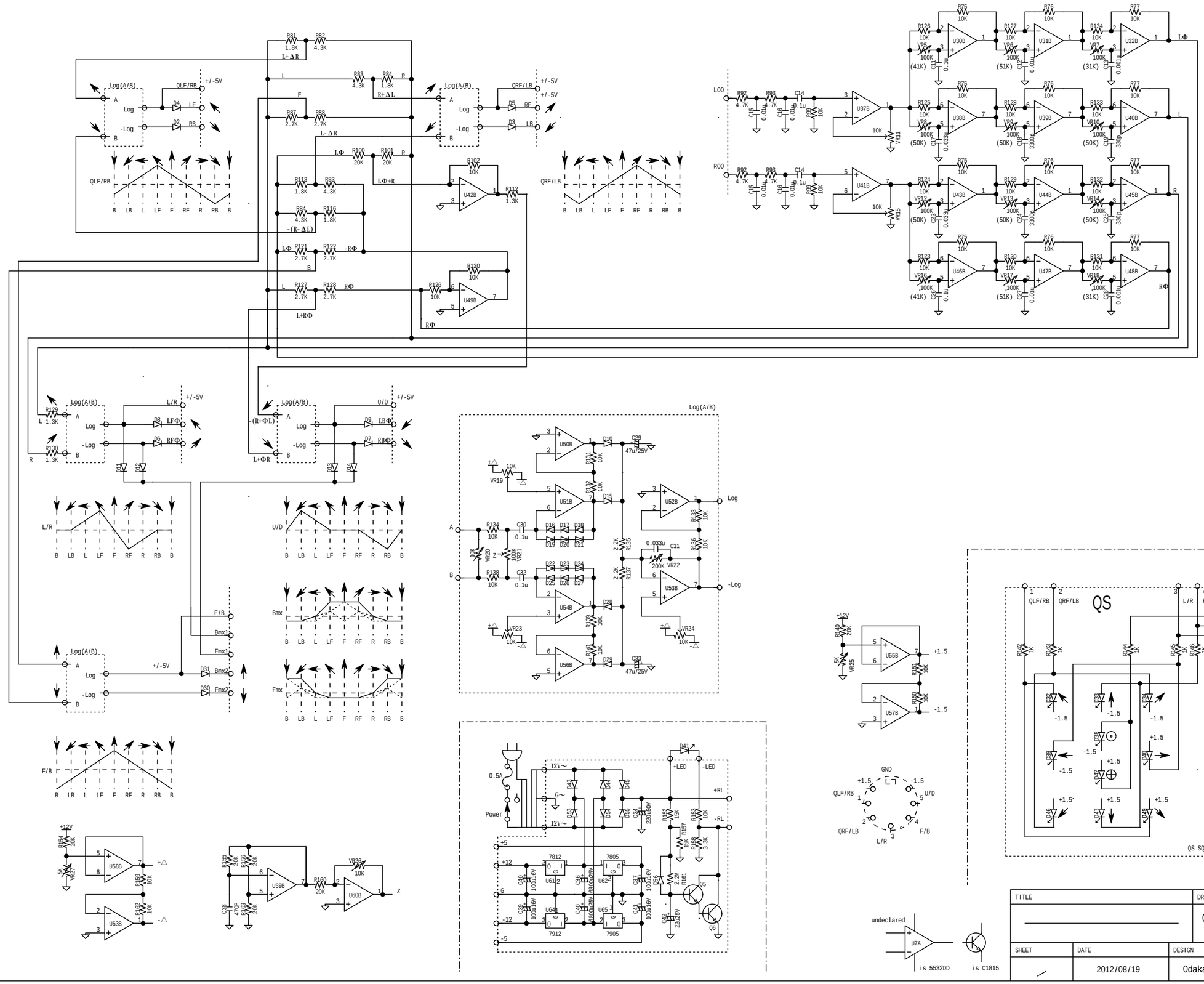
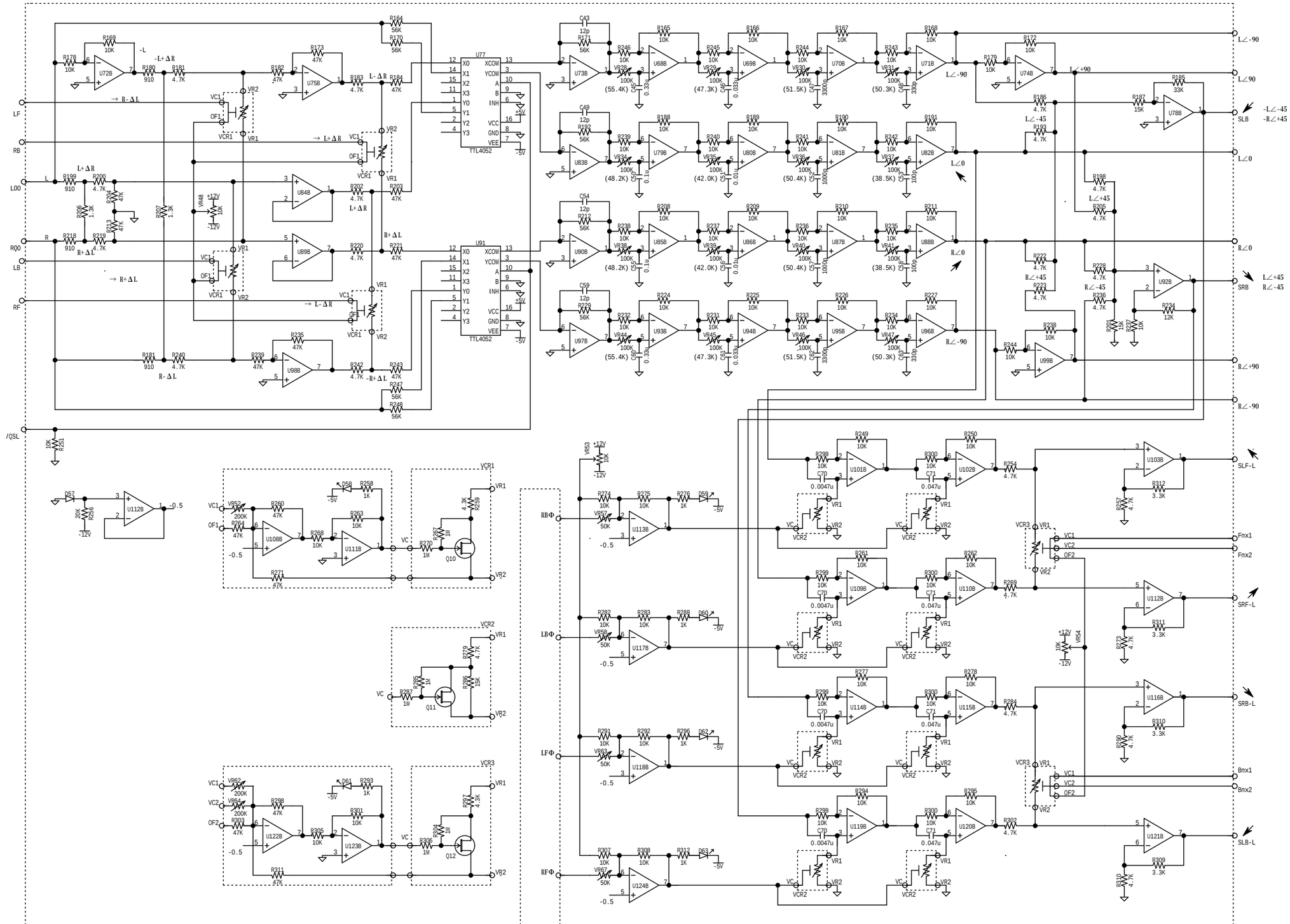
SHEET: /	DATE: 2012/08/19
DESIGN: Odaka Shuichi	Fig. 13-1


Log(A/B)
QLF/RB
QRF/LB
L/R
U/D
F/B
+/-5V
Log
-Log
A
B
D4 LF
D2 RB
D5 RF
D3 LB
D8 LFΦ
D6 RFΦ
D9 LBΦ
D7 RBΦ
D31 Bmx2
D30 Fmx2
B LB L LF F RF R RB B
L+ΔR
R+ΔL
L-ΔR
-(R-ΔL)
L+RΦ
RΦ
-(R+ΦL)
L+ΦR
LΦ
RΦ
LΦ+R
L+RΦ
R81 1.8K
R82 4.3K
R83 4.3K
R84 4.3K
R87 2.7K
R88 2.7K
R93 4.3K
R94 1.8K
R100 20K
R101 20K
R102 10K
R112 1.3K
R113 1.8K
R116 1.8K
R120 10K
R121 2.7K
R122 2.7K
R126 10K
R127 2.7K
R128 2.7K
R130 1.3K
U42B
U49B
U50B
U51B
U52B
U53B
U54B
U56B
U58B
U59B
U60B
U63B
VR19 10K
VR20 10K
VR21 10K
VR22 200K
VR23 10K
VR24 10K
R131 10K
R132 10K
R133 10K
R134 10K
R135 2.2K
R136 10K
R137 2.2K
R138 10K
R139 10K
R140 10K
R141 10K
C30 0.1u
C31 0.033u
C32 0.1u
C33 47u/25V
C29 47u/25V
D10
D15
D16 D17 D18
D19 D20 D21
D22 D23 D24
D25 D26 D27
D28
D29
R154 20K
R155 20K
R156 20K
R157 20K
R158 20K
R159 10K
R160 20K
R161 10K
R162 10K
R163 470P
VR26 10K
VR27 10K
C38 470P
LO0
RO0
U37B
U41B
U57B
VR11 10K
VR15 10K
R92 4.7K
R93 4.7K
C14 0.1u
C15 0.01u
C16 0.01u
R95 10K
R96 10K
U30B
U31B
U32B
U38B
U39B
U40B
U43B
U44B
U45B
U46B
U47B
U48B
R75 10K
R76 10K
R77 10K
R124 10K
R125 10K
R126 10K
R127 10K
R128 10K
R129 10K
R130 10K
R131 10K
R132 10K
R133 10K
R134 10K
VR5 100K
VR6 100K
VR7 100K
VR8 100K
VR9 100K
VR10 100K
VR12 100K
VR13 100K
VR14 100K
VR16 100K
VR17 100K
VR18 100K
(41K)
(51K)
(31K)
(50K)
C1 0.1u
C2 0.033u
C3 0.01u
C4 3300p
C5 330p
C6 0.001u
LΦ
L
R
RΦ
0.5A
Power
12V~
+LED
-LED
+RL
-RL
GND
+5
+12
-12
-5
7812
7805
7912
7905
U61
U62
U64
U65
D41
D43 D44 D45
D54 D55 D56
C34 220u/50V
C35 100u/16V
C36 1000u/25V
C37 100u/16V
C39 100u/16V
C40 100u/16V
C41 100u/16V
C42 220u/25V
R157 1K
R158 3.3K
R159 1K
R160 10K
R161
Q5
Q6
undeclared
U7A
is 5532DD
is C1815
QS
SQ
QLF/RB
QRF/LB
L/R
F/B
U/D
D32 D33 D34 D35 D36 D37
D38 D39 D40
D44 D45 D46 D47 D48 D49 D50 D51 D52
R142 1K
R143 1K
R144 1K
R145 1K
R146 1K
R147 1K
R148 1K
R149 1K
-1.5
+1.5
QS SQ direction detector of a sound source
TITLE
QS Logic / SQ Logic
4channel Decoder (sheet1-2)
DRAWING_No.
SHEET
DATE
2012/08/19
DESIGN
Odaka Shuichi
Fig. 13-2



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is 5532DD

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TITLE		DRAWING_No.
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SHEET	DATE	DESIGN
	2012/08/19	Odaka Shuichi

Fig. 13-3