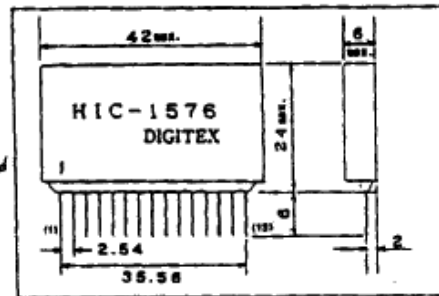


CHARGE SENSITIVE PREAMPLIFIER HIC-1576

HIC-1576はFET入力電荷有感形
超低雑音プリアンプです。

【特徴】

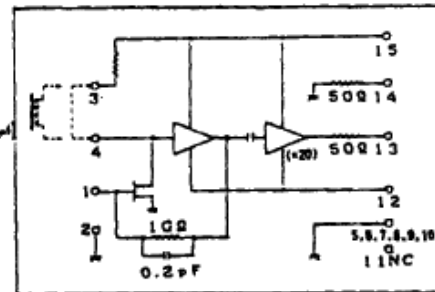
高利得・低雑音です。
シールドケース入りです。3,4 pins are shielded usually
3ピンと4ピンは通常は短絡して使用しますが、ノイズ吸収用のインダクタを挿入することにより、さらに低ノイズ化を期待出来ます。



【外形図】

【仕様】

増幅方式 電荷有感形
利得 (Charge gain) 30^4 /Pico coulomb Typ.
雑音特性 3.50 eV/FWHM
入力インピーダンス $400 \Omega \sim 500 \Omega$
出力インピーダンス 50Ω
最大出力電圧 $+6 \text{ V Typ.}$
外形寸法 15ピン シングレット形 4×6
ケース入り $42 \times 24 \times 6 (\text{max.})$
電源 $+12 \text{ V } 15 \text{ mA}$
 $-12 \text{ V } 5 \text{ mA}$



【等価回路】

DIGITEX LABORATORY CO., LTD.

株式会社 デジテックス研究所

〒181 東京都三鷹市井口3-3-24
TEL. 0422 (31)1111

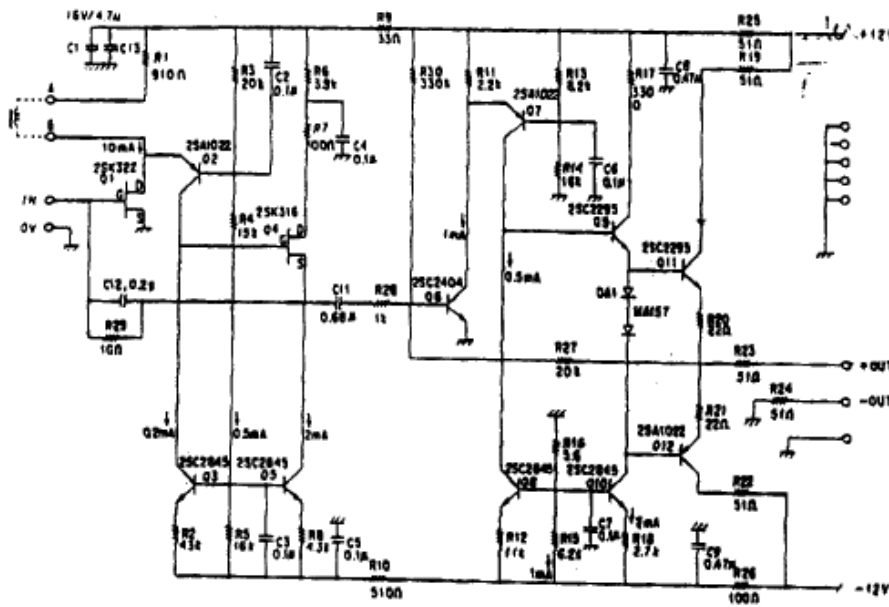


Fig. 1. Circuit diagram of the preamplifier.

They have similar g_m values (30-40mS for $I_D = 10\text{mA}$) and have little difference within their specifications. Hitachi 2SK322 was chosen since a measurement on g_m over a hundred samples were completed and the variation was found to be small³⁾. The drain current of the first stage FET was set to 10 mA for high g_m . Secondly, 1 G Ω thin film metal resistor ($\pm 2\%$ accuracy) was used for the feedback resistor to reduce parallel noise. Thirdly, the charge gain of the first stage was chosen to be very high but the effect of a floating capacitance to the gain stage was still reasonably small. Thus, the feedback capacitor of about 0.2 pF was built as a printed circuit pattern to keep the channel-to-channel variation of the capacitance minimum. Fourthly, the insulator of the PC board is made of glass-reinforced Bismaleimide Triazine resin (called as BT resin; a trade mark of Mitsubishi gas chemical company Co. Ltd.) which has an order of magnitude higher insulation resistance than that of an Epoxy resin (G-10 board) and has a very low dielectric loss at high frequencies. Since the thickness variation is reflected to the capacitance variation and hence the gain of the first stage, the thickness variation was kept within $\pm 5\%$. Fifthly, the second stage is an inverting amplifier with a closed loop gain of 20. The overall gain of the preamplifier was expected to be about 50mV/fC when the output was terminated to 50 Ω . The gain variation of the preamplifier was designed to be less than $\pm 7\%$ including the gain variation of the second stage.

Since the gain of the preamplifier is very high, any mechanical vibration causes microphonic noise.

To minimize the microphonic noise, the preamplifier had to be molded in a metal can.

Fabricated hybrid IC was, first, coated with a silicone resin, (X-35-180, Shinetsu chemical company Co. Ltd.) for high insulation resistance, since a leakage current through epoxy resin was significant. Then it is packed in a copper metal box with an epoxy resin (as shown in Fig. 2).

(b) Shaper amplifier

The pulse shaping stage was built on a mini-card for easy maintenance. A photograph is shown in Fig. 3. The mini-card coupled to the mother PC board with the pins on both sides of the mini PC board. The shaper amplifier

consists of a differential receiver, a pole/zero cancellation amplifier, a fourth-order Gauss integrator and a base-line restorer. The constant of the integration stage was chosen to be 1 μS . A triangular shaping or a truncated cusp shaping was not used because the size of delay lines and prefilters could not match with high density requirement. High speed and low noise operational amplifiers were used for each stage to minimize the size. The circuit diagram is presented in Fig. 4. A new design of a base-line restorer circuit using a pair of transconductance amplifiers was added to

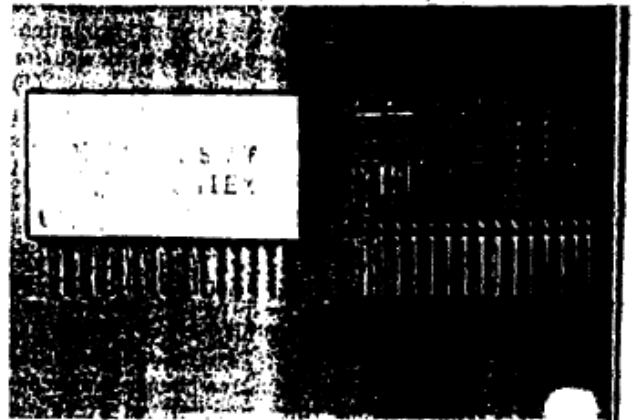


Fig. 2. Photograph of the preamplifier.

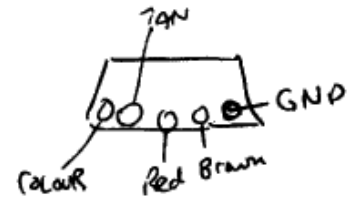
T.F.F. NS-36 (1989)

CONNECTOR PIN-OUT
(TWO CONNECTORS PER BOARD)

Signal Connector

.....
.....
1 COMPONENT SIDE VIEW

CRYSTAL A	1. SIG 1	B	2. RETURN 1	CRYSTAL A
	3. SIG 2	R	4. RETURN 2	
	5. SIG 3	D	6. RETURN 3	
	7. SIG 4	Y	8. RETURN 4	
CRYSTAL B	9. SIG 1	G	10. RETURN 1	CRYSTAL B
	11. SIG 2	Bl	12. RETURN 2	
	13. SIG 3	Br	14. RETURN 3	
	15. SIG 4	Green	16. RETURN 4	
17. GROUND		white	18. GROUND	
19. TEST PULSE RETURN		Black	20. TEST PULSE	
21. +15	-1 - P	+12	tan -	22. GROUND
23. +15	-3 - N	-12		24. +15 -2
25. BIAS				26. +15 -4
27. GROUND				28. GROUND
29. SIG 1			tan -	30. RETURN 1
CRYSTAL C	31. SIG 2		32. RETURN 2	CRYSTAL C
	33. SIG 3		34. RETURN 3	
	35. SIG 4		36. RETURN 4	
	37. SIG 1		38. RETURN 1	
CRYSTAL D	39. SIG 2		40. RETURN 2	CRYSTAL D
	41. SIG 3		42. RETURN 3	
	43. SIG 4		44. RETURN 4	



CONNECTOR	
1	
B	C
4 3 2 1	1 2 3 4
A	D
4 3 2 1	1 2 3 4

COMPONENT SIDE VIEW
PRE-AMP MOTHER BOARD
CORNELL PC BOARD # 6052-202

Lower Back Connector

<u>PIN #</u>		<u>PIN #</u>	
1	NC	2	SELT-
3	NC	4	SELB-
5	NC	6	WRITE
7	NC	8	DATA IN
9	NC	10	DATA OUT
11	NC	12	READ
13	NC	14	SHCLK
15	NC	16	TEST LEVEL
17	SEL	18	NC
19	TEST-	20	NC
21	NC	22	NC
23	NC	24	NC
25	USER JUMPED SUM OUT	26	USER JUMPED SUM OUT
27	USER JUMPED SUM OUT	28	USER JUMPED SUM OUT
29	USER JUMPED SUM OUT	30	USER JUMPED SUM OUT
31	USER JUMPED SUM OUT	32	USER JUMPED SUM OUT
33	USER JUMPED SUM OUT	34	USER JUMPED SUM OUT
35	USER JUMPED SUM OUT	36	USER JUMPED SUM OUT
37	USER JUMPED SUM OUT	38	USER JUMPED SUM OUT
39	USER JUMPED SUM OUT	40	USER JUMPED SUM OUT
41	USER JUMPED SUM OUT	42	USER JUMPED SUM OUT
43	USER JUMPED SUM OUT	44	USER JUMPED SUM OUT
45	USER JUMPED SUM OUT	46	USER JUMPED SUM OUT
47	USER JUMPED SUM OUT	48	USER JUMPED SUM OUT
	PIN 49 THROUGH PIN 72		
	ALL NC.		
73	+5V	74	+15V
75	NC	76	+15V -12
77	NC	78	NC
79	BIAS	80	NC
81	+15-4	82	+15-2
83	+15-1 +12	84	-15V
85	GND.	86	GND

VIEWED FROM FRONT OF CAGE.

Upper Back Connector

PIN #

1 GND
3 GND
5 GND
7 GND
9 GND
11 GND
13 GND
15 GND
17 GND
19 GND

PIN #

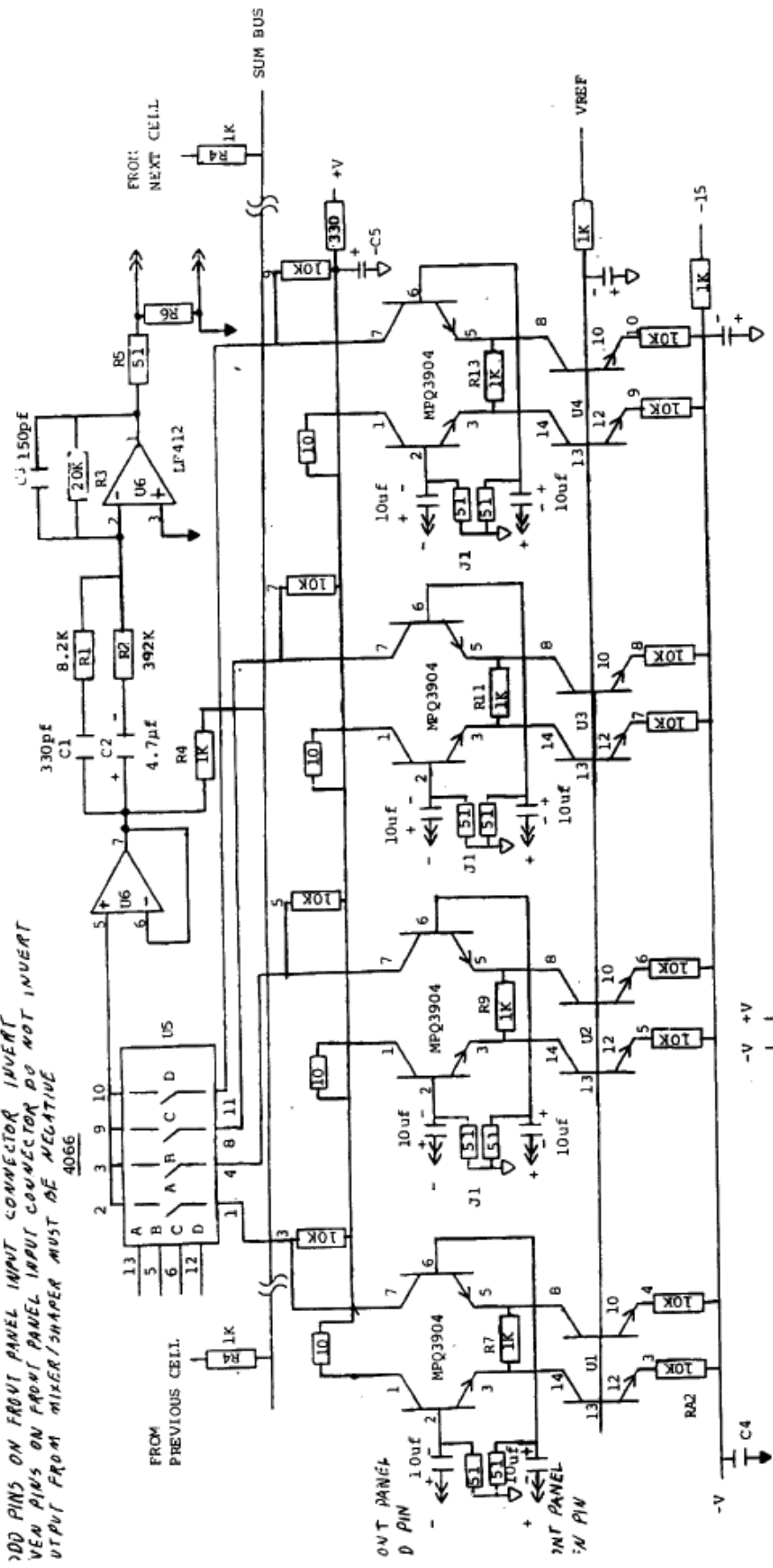
2 NC
4 CRYSTAL A TOP
6 CRYSTAL B TOP
8 CRYSTAL C TOP
10 CRYSTAL D TOP
12 CRYSTAL A BOTTOM
14 CRYSTAL B BOTTOM
16 CRYSTAL C BOTTOM
18 CRYSTAL D BOTTOM
20 NC

VIEWS FROM FRONT OF CAGE.

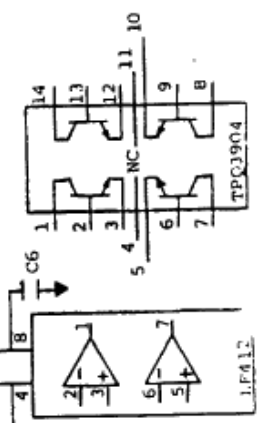
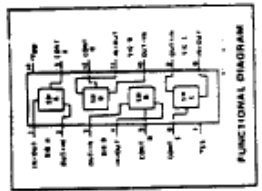
20 PIN SIGNAL OUT CONNECTOR
MIXER/SHAPER
PHYSICS DEPT. OHIO STATE UNIV.
ELECTRONICS LAB. 10/29/85
DRWG.# 475 PAGE 4A

TOTAL P.02

ODD PINS ON FRONT PANEL INPUT CONNECTOR INVERT
 EVEN PINS ON FRONT PANEL INPUT CONNECTOR DO NOT INVERT
 OUTPUT FROM MIXER/SHAPER MUST BE NEGATIVE



NOTE: ALL RESISTORS ARE 1%
 EXCEPT 10,330 WHICH
 CAN BE 5%, ALL 1/8WATT.



MIXER/SHAPER CELL
 EIGHT/BOARD
 PHYSICS DEPT. OHIO STATE UNIV.
 ELECTRONICS LAB 9/16/85
 DRWG.# 475 PAGE 2

