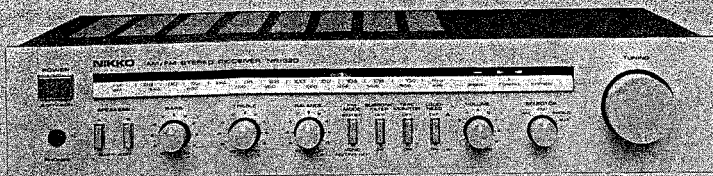


NIKKO

RECEIVER

NR-320 ¹¹⁷

AM/FM STEREO RECEIVER



TYPE AND VOLTAGE

W-TYPE: UL & CSA type

120V AC

SERVICE MANUAL

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SPECIFICATIONS

FM TUNER SECTION

Usable Sensitivity: . . . better than 17.2 dBf/12 dB μ (4 μ V)

50 dB Quieting Sensitivity:

. better than 17.2 dBf/12 dB μ (4 μ V)

Signal to Noise Ratio,

MONO: better than 60 dB

STEREO: better than 50 dB

Total Harmonic Distortion at 1000 Hz,

MONO: no more than 0.3 %

STEREO: no more than 1 %

Alternate Channel Selectivity: better than 45 dB

Spurious Response Rejection: better than 65 dB

Image Frequency Rejection: better than 40 dB

IF Rejection: better than 80 dB

AM Rejection: better than 35 dB

Capture Ratio: better than 3 dB

Stereo Separation,

100 Hz: better than 28 dB

1000 Hz: better than 35 dB

10000 Hz: better than 25 dB

Subcarrier Suppression: better than 30 dB

Muting Sensitivity: 30 dB μ $\pm$ 6 dB

Tuning Frequency Range: 87.4 – 108.25 MHz

Antenna Impedance: 300 Ω balanced &
75 Ω unbalanced

Output Level: 500 mV $\pm$ 3 dB

AM TUNER SECTION

Usable sensitivity with Loop Antenna: . . . better than 40 dB

Signal to Noise Ratio: better than 40 dB

Image Frequency Ratio,

1000 kHz: better than 30 dB

IF Rejection: better than 30 dB

Selectivity ($\pm$ 10 kHz): better than 20 dB

Total Harmonic Distortion: no more than 2 %

Tuning Frequency Range: 520 – 1650 kHz

Output Level: 150 mV $\pm$ 2 dB

AUDIO AMPLIFIER SECTION

Continuous Power Output per channel,

20 – 20000 Hz (8 ohms): more than 25 Watts

1000 Hz (8 ohms): more than 27 Watts

Total Harmonic Distortion, 8 ohms

at Continuous Power Output: . . . no more than 0.08 %

at 1 Watt Power Output: no more than 0.1 %

I. M. Distortion, 8 ohms

at Continuous Power Output: . . . no more than 0.08 %

IHF Power Bandwidth, 8 ohms: 20 – 20000 Hz

Damping Factor at 1000 Hz, 8 ohms: more than 30

Frequency Response,

PHONO to TAPE OUT (RIAA equalization):

. 30 – 15000 Hz $\pm$ 2 dB

AUX, TAPE IN to SPEAKER TERMINAL:

. 20 – 20000 Hz $\pm$ 2 dB

Input Sensitivity for Continuous Power Output,

PHONO: $2.5 \text{ mV} \pm 2 \text{ dB}$ AUX, TAPE IN: $140 \text{ mV} \pm 2 \text{ dB}$

PHONO Maximum Input Capability at 1000 Hz:

..... more than 100 mV

Output Level at Continuous Power Output

TAPE OUT (input: PHONO): $140 \text{ mV} \pm 2 \text{ dB}$

Tone Controls,

BASS (70 Hz) Boost: $+10 \text{ dB} \pm 2 \text{ dB}$ Cut: $-10 \text{ dB} \pm 2 \text{ dB}$ TREBLE (10000 Hz) Boost: $+9 \text{ dB} \pm 2 \text{ dB}$ Cut: $-7 \text{ dB} \pm 2 \text{ dB}$ Loudness Control (Volume Control set at -30 dB position)70 Hz: $+7.5 \text{ dB} \pm 2 \text{ dB}$ Subsonic Filter, at 15 Hz: $-3 \text{ dB} \pm 2 \text{ dB}$

Signal to Noise Ratio with IHF-A Network,

PHONO: better than 70 dB AUX, TAPE IN: better than 95 dB

Residual Hum and Noise, 8 ohms:

..... no more than 1.0 mV Midpoint Voltage: $0 \pm 100 \text{ mV}$

GENERAL

Power Requirement,

U. S. A. & Canada model: AC 120 V/60 Hz

Power Consumption: 140 W (CSA)

Dimensions without knobs and feet,

Width: 440 mm , $17\text{-}1/4''$ Height: 96 mm , $3\text{-}3/4''$ Depth: 300 mm , $11\text{-}3/4''$ Weight without package: 5.8 kg , 12.8 lbs

*Specifications are subject to change without notice.

BLOCK DIAGRAM

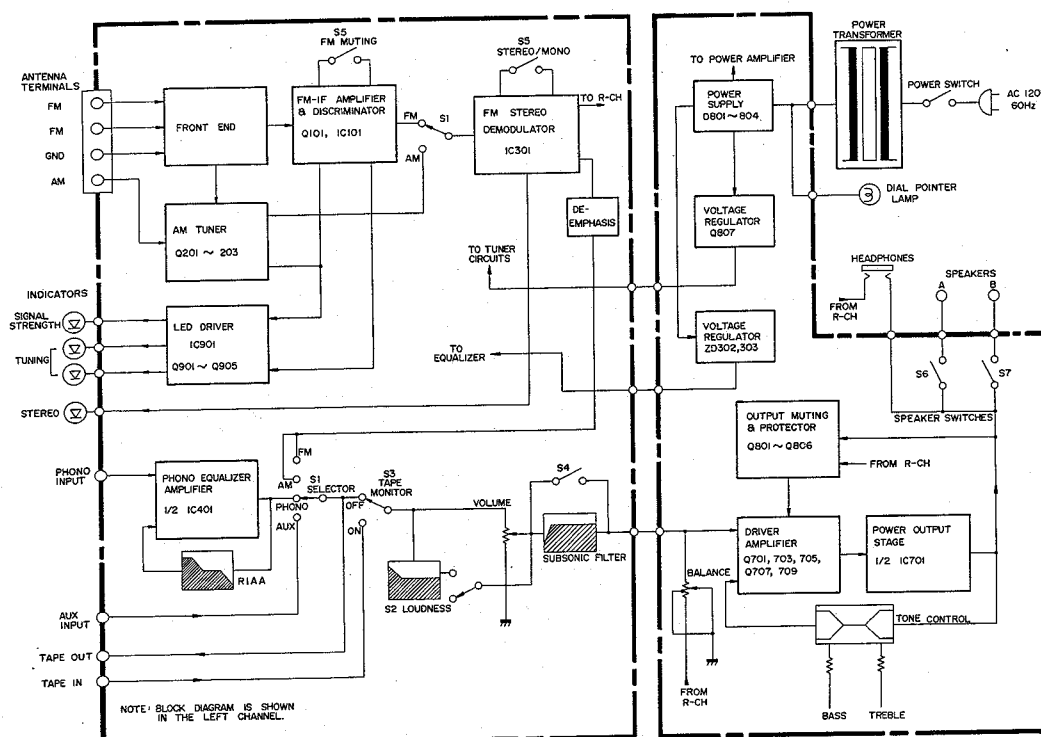


Figure 1

DISASSEMBLY

CABINET COVER REMOVAL

- Remove four screws from both sides of the metal cover.
- Remove two tapping screws from the rear of the metal cover.
- Lift the cover away from the unit.

BOTTOM PLATE REMOVAL

- Remove nine tapping screws (#1 ~ #9) and two transformer screws (#10 and #11) from the bottom of the unit as shown in Photo 1.
- Lift the bottom plate away from the unit.

FRONT PANEL REMOVAL

- Remove the bottom plate.
- Remove the tapping screws (#12 and #13) from the bottom of the unit as shown in Photo 1.
- Remove two tapping screws (#16 and #17) from the top of the unit as shown in Photo 2.
- Remove the front panel away from the unit by pulling it forward.

POWER TRANSFORMER REMOVAL

- Remove the bottom plate.
- Disconnect all the power transformer cables.
- Remove two screws (#14 and #15) from the bottom of the unit as shown in Photo 1.
- Lift the power transformer away from the unit.

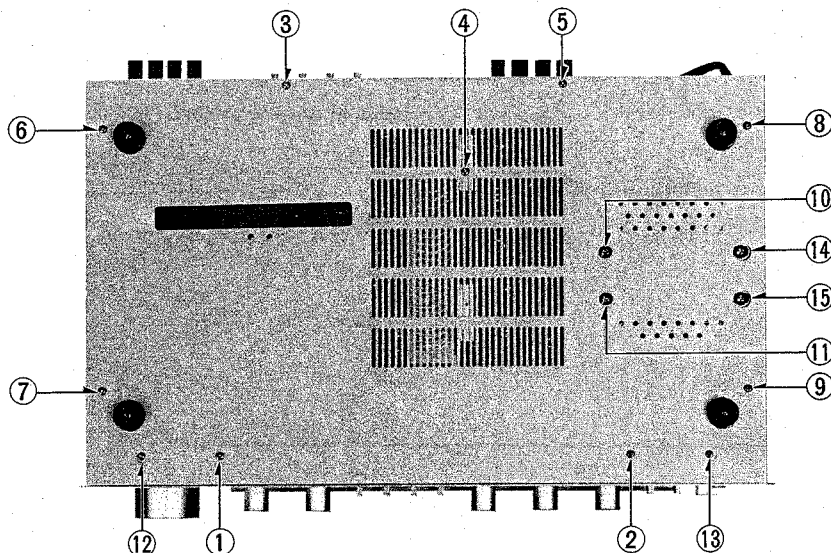


Photo 1

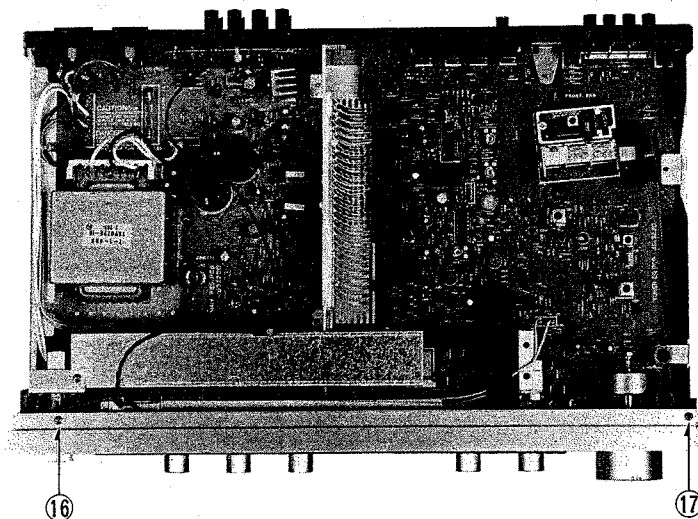


Photo 2

ALIGNMENT

TEST EQUIPMENTS

FM Signal Generator (FM SG)
Oscilloscope
AC Voltmeter
Distortion Meter
MPX Signal Generator (MPX SG)
Frequency Counter
AM Sweep Generator (AM SG)
DC Voltmeter

GENERAL ALIGNMENT INSTRUCTIONS

1. Always observe response curve on oscilloscope during alignment procedure.

2. Do not apply signals from FM or AM broadcast stations. Apply signals from generators only.
3. Use of excessive signal from FM SG or AM SG can cause overloading of the tuner circuits. To properly align the receiver, adjust FM SG or AM SG output level control so that response curve on oscilloscope is not distorted.
4. Input signal levels shown in the tables are measured at the antenna terminals of the receiver.
5. Allow a minimum of 10 minutes warm-up for test equipments and the receiver to be tested.
6. Turn the volume controls down to fully counter clockwise when the dummy load resistors or speakers are not connected to the speaker terminals.

FM SECTION

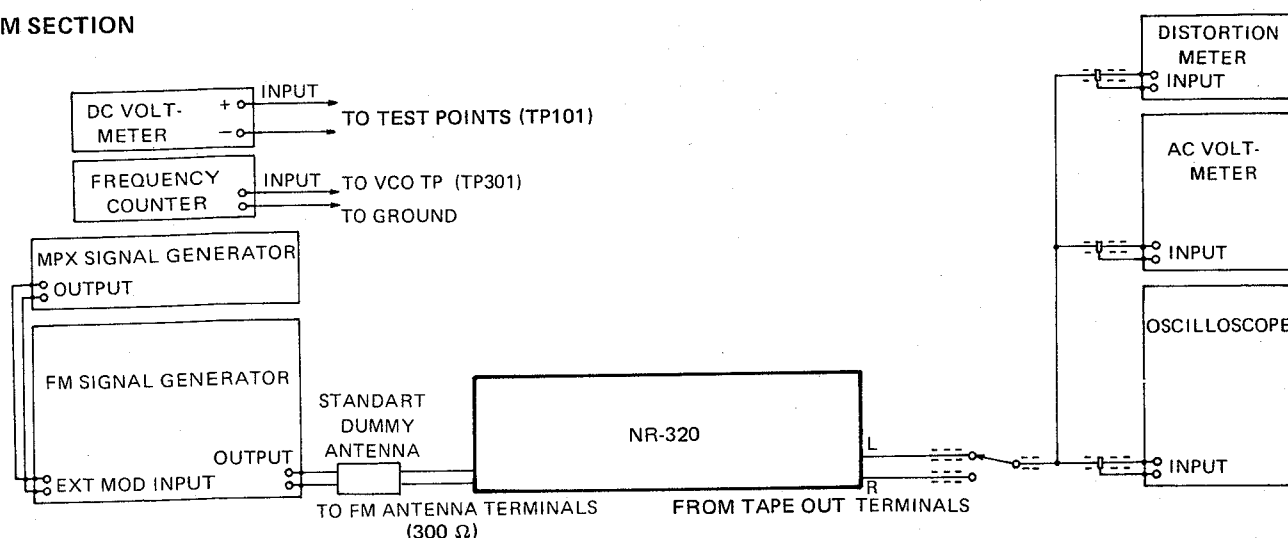


Figure 2. Test Equipment Hook-up

NOTE:

There is no "Tuning Meter" in this receiver. In order to tune fast and accurately, a DC voltmeter is used in place of a "tuning meter". DC voltmeter may have a scale up to 2.5 – 5V, but its accuracy is not important. DC voltmeter is connected to the test points on the P.C. board.

According to characteristic of IC101, voltmeter's needle may swing backward when adjusting. In this case, simply reverse the voltmeter connections. Voltmeter's zero reading corresponds to tuning meter's mid-scale reading.

FM IF Alignment

STEP	FM SG FREQUENCY/ CALIBRATION	MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST- MENT POINT	PROCEDURE	REMARKS
1			A. POWER to "ON". B. SELECTOR to "FM". C. MODE to "MONO".	Where no signal is tuned.	Primary core of T101	Adjust until DC voltmeter indicates zero volt.	Repeat steps 1 and 2 until distortion can no longer be minimized.
2	108 MHz/ 65 dBf (60 dBμ)	400 Hz/mono (± 75 kHz)		108 MHz	Secondary core of T101	Adjust for minimum distortion.	

Table 1 – 1

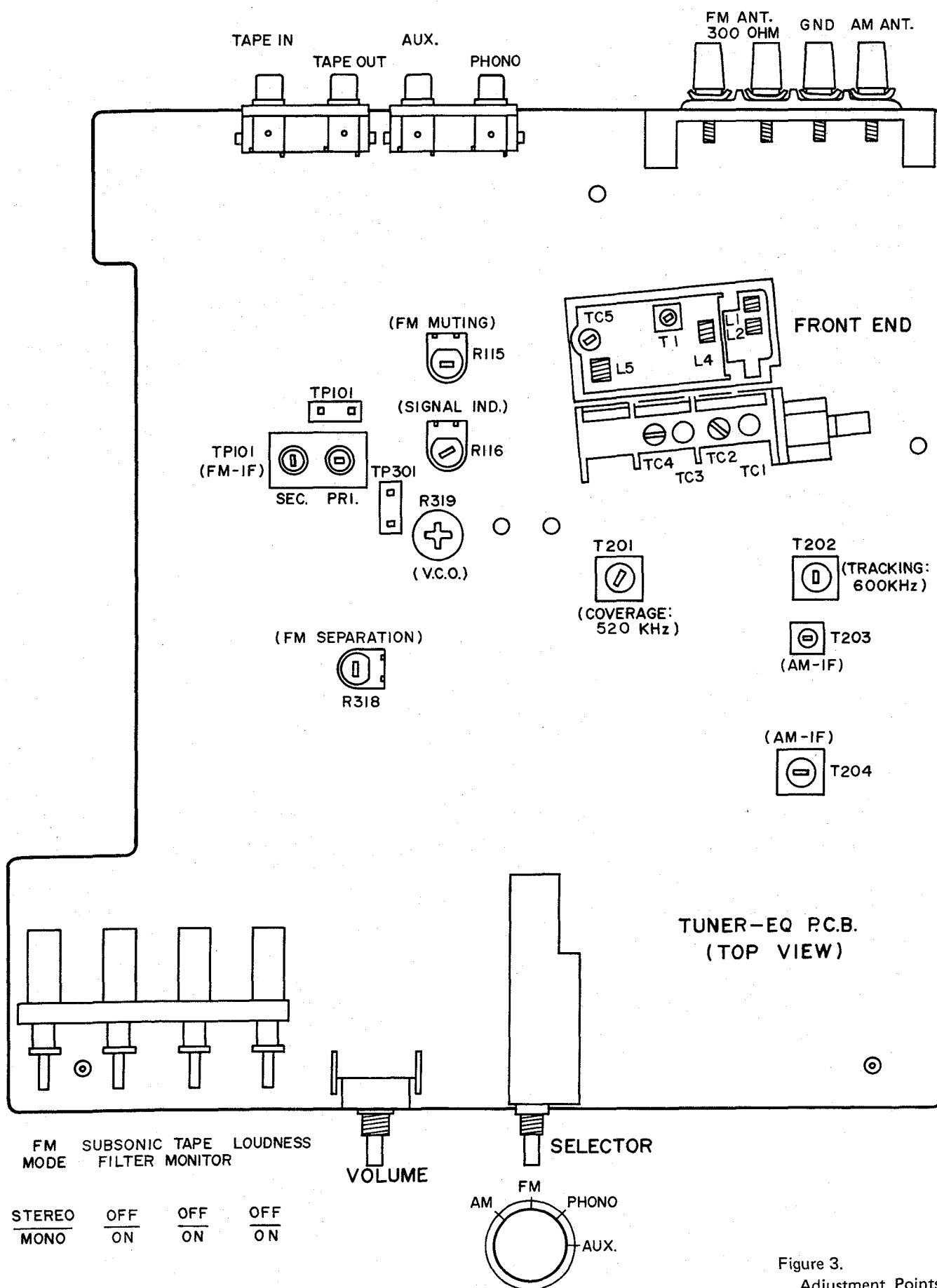


Figure 3.
Adjustment Points

FM Muting Alignment

STEP	FM SG FREQUENCY/ CALIBRATION	MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST- MENT POINT	PROCEDURE	REMARKS
1	98 MHz/ 35 dBf (30 dBμ)	400 Hz/mono (±75 kHz)	A. POWER "ON". B. SELECTOR to "FM". C. MODE to "STEREO"	98 MHz	R115	Adjust until audio output is no longer present on oscillo- scope.	
2	98 MHz/ 65 dBf (60 dBμ)			98 MHz (See PROCE- DURE)		While slightly shifting the frequency in both higher and lower direc- tions from the recep- tion frequency, con- firm that output fades out before wave is distorted.	

Table 1 - 2

FM Frequency Coverage and FM Tracking Alignments

These adjustments are factory preset and normally need no further adjustment.
However, if necessary proceed as follows:

STEP	FM SG FREQUENCY/ CALIBRATION	MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST- MENT POINT	PROCEDURE	REMARKS
1	108 MHz/ 15 dBf (10 dBμ)	1000 Hz/mono (±75 kHz)	A. POWER to "ON". B. SELECTOR to "FM". C. MODE to "MONO".	108 MHz	TC5	Adjust for maxi- mum AC Volt- meter deflection and for zero volt DC voltmeter indication.	
2	88 MHz/ Attenuate for response with 3% distortion.			88 MHz	L2 L4	Adjust for maxi- mum output.	Both the outputs should be equal. Repeat steps 2 and 3 once or twice.
3	108 MHz/ Attenuate for response with 3% distortion.			108 MHz	TC1 TC3		

Table 1 - 3

Signal Strength Indicator Adjustment

1. Apply 35 dBf (30 dB μ) signal from FM SG.
2. Adjust R116 (See Figure 3) until the signal strength indicator on the front panel lights up.
3. Confirm that the indicator goes out when the receiver is detuned.

FM MPX Alignment

STEP	FM SG FREQUENCY/ CALIBRATION	MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST- MENT POINT	PROCEDURE	REMARKS
1	98 MHz/ 65 dBf (60 dB μ)	(Unmodulated carrier)	A. POWER to "ON". B. SELECTOR to "FM". C. MODE to "STEREO".	98 MHz	R319	Adjust for 76 ± 0.1 kHz.	Both the separations (both the outputs of right and left channel) should be equal.
2		1000 Hz/stereo (Main (L) & sub (L): ± 67.5 kHz/ pilot signal: ± 7.5 kHz)			R318	Adjust for maximum separation (or minimum output of right channel).	
3		1000 Hz/stereo (main (R) & sub (-R): ± 67.5 kHz/ pilot signal: ± 7.5 kHz)				Adjust for maximum separation (or minimum output of left channel).	
4		1000 Hz/stereo [sub (L-R)]			T1	Adjust for minimum distortion.	

Table 1 - 4.

AM SECTION

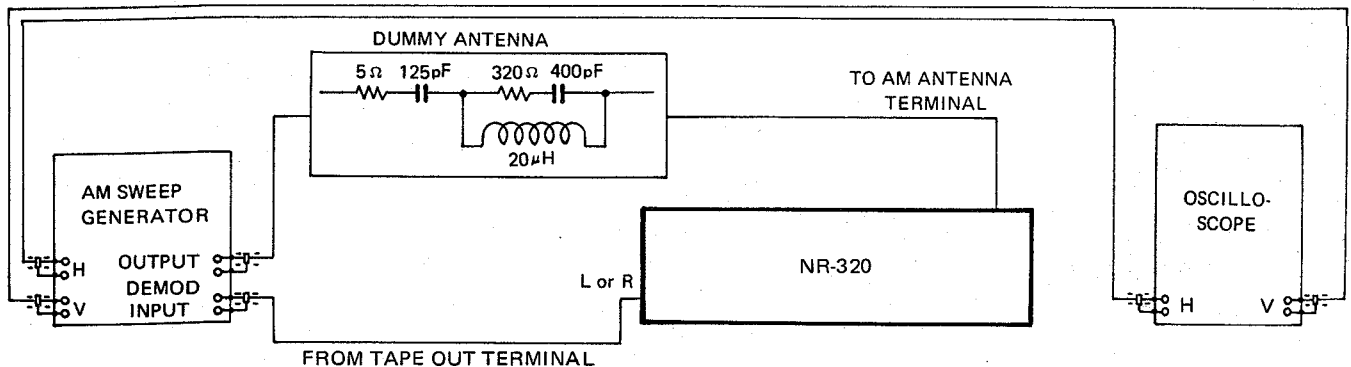


Figure 4-1 Test Equipment Hook-up (1)

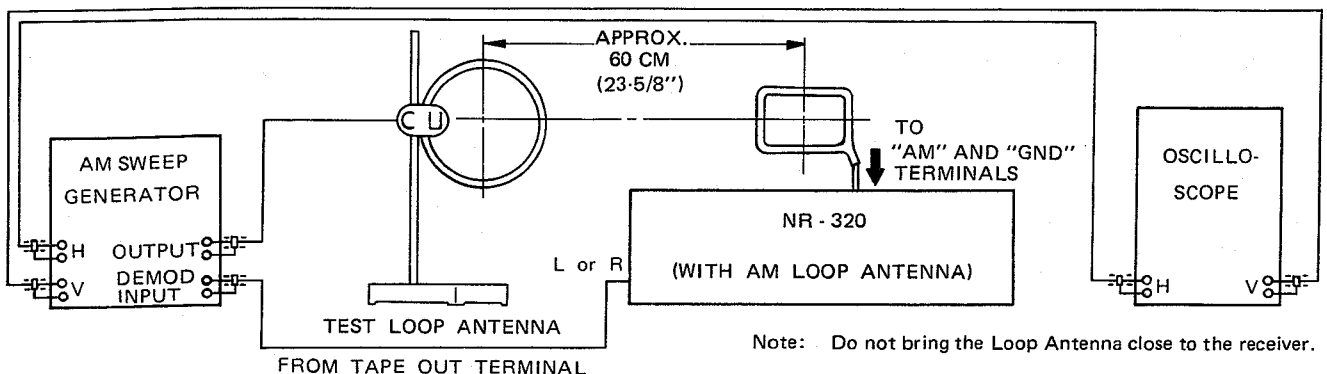


Figure 4-2 Test Equipment Hook-up (2)

AM IF Alignment

STEP	AM SG FREQUENCY/ CALIBRATION		MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST FOR MAX. SCOPE INDICATION	REMARKS
1	450 kHz/ 50 dBμ	Set AM SG IF/ RF switch to "IF" position.	(Unmodulated carrier)	A. POWER to "ON". B. SELECTOR to "AM"	High frequency end of the dial scale.	T203	Repeat steps 1 and 2 until response curve on oscillo- scope indicates maximum waveform. Refer to Figure 5.
2						T204	

Table 2 – 1

AM Frequency Coverage and AM Tracking Alignments

These adjustments are factory preset and normally need no further adjustment. However, if necessary proceed as follows:

STEP	AM SG FREQUENCY/ CALIBRATION		MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST FOR MAX. SCOPE INDICATION	REMARKS
1	520 kHz/ 50 dBμ	Set AM SG IF/ RF switch to "RF" position.	400 Hz/30%	A. POWER to "ON" B. SELECTOR to "AM"	Low frequ- ency end of the dial scale.	T201	Repeat steps 1 and 2 several times. Refer to Figure 6.
2	1650kHz/ 50 dBμ				High fre- quency end of the dial scale	TC4	
3	600 kHz/ 50 dBμ				600 kHz	T202	Repeat steps 3 and 4 once or twice.
4	1400kHz/ 50 dBμ				1400 kHz	TC2	

Table 2 – 2

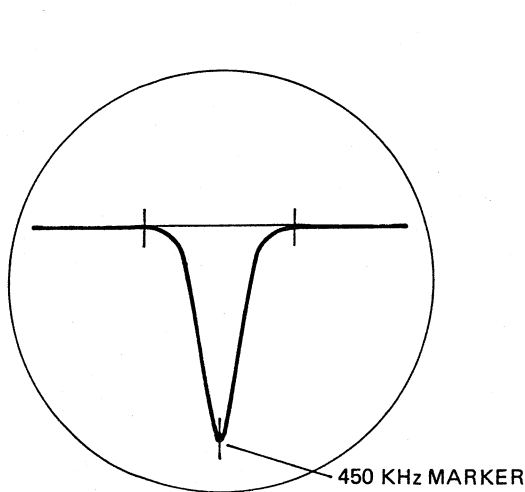


Figure 5. AM IF

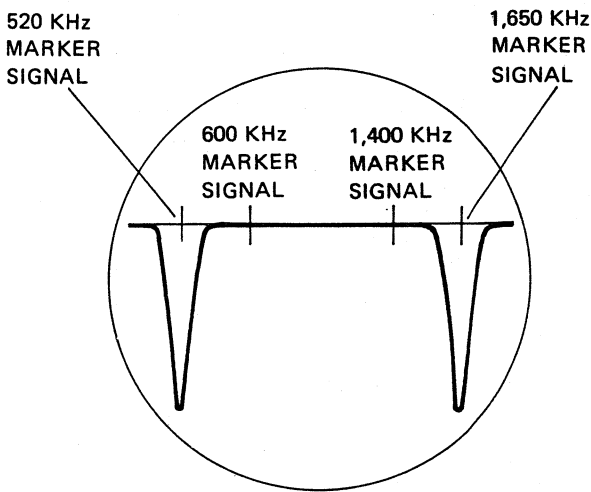


Figure 6. MW Frequency Coverage

DIAL CORD INSTALLATION

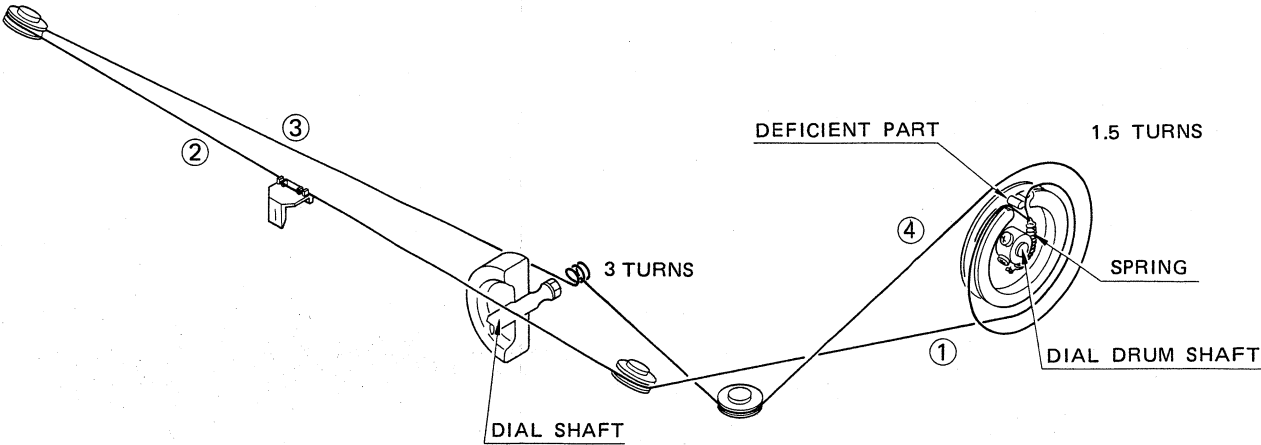


Figure 7

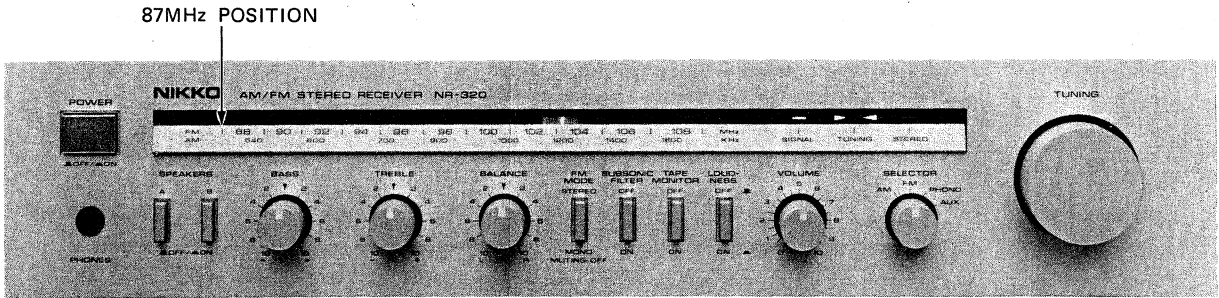


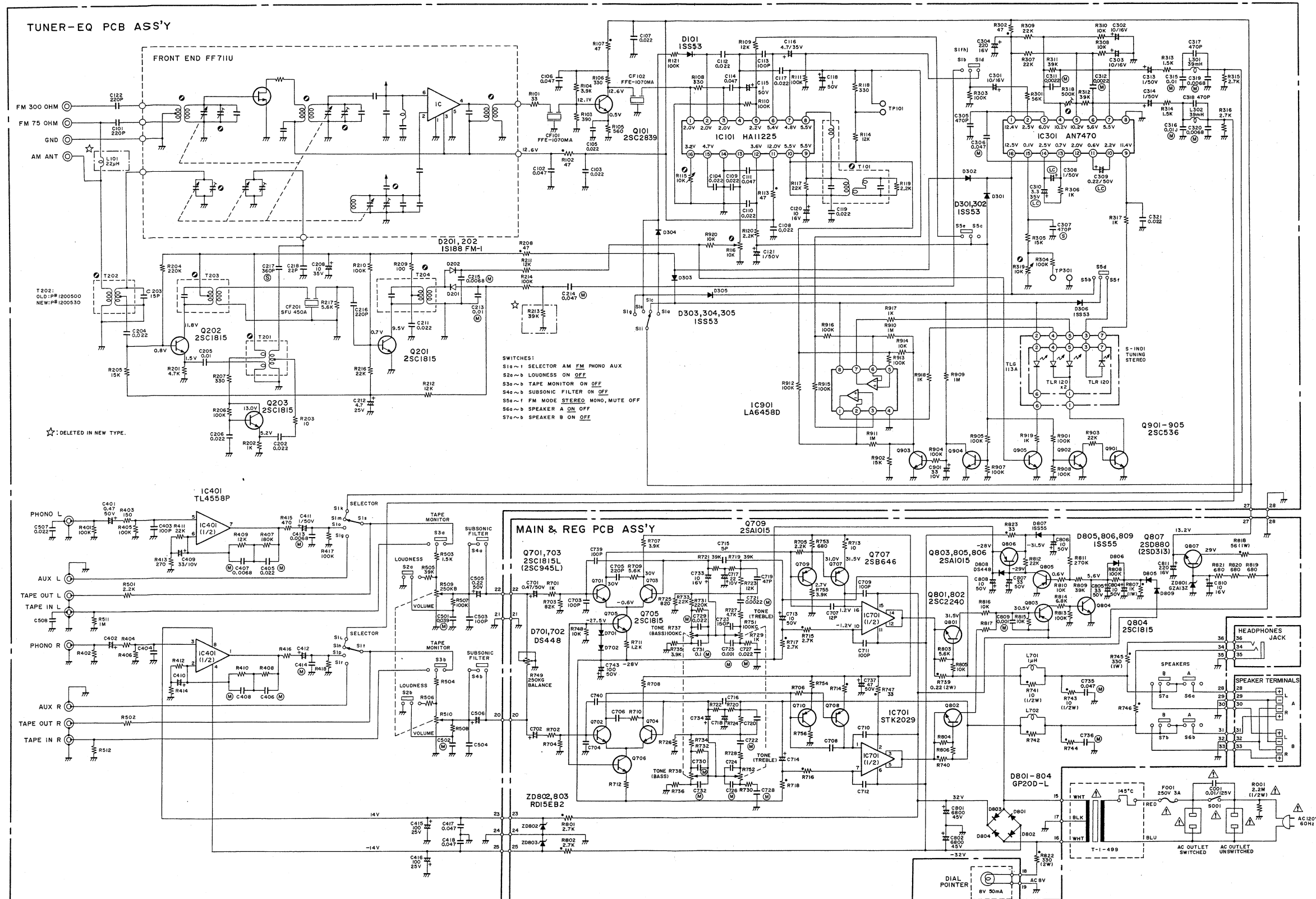
Photo 3

1. Remove an old dial cord.

2. Turn the dial drum shaft counter-clockwise until the rotor of the variable capacitor is completely out of the stator. If the deficient part of the dial drum is not in a straight line with the dial drum shaft (vertically), loosen the dial drum drive screws and adjust the dial drum to be placed on the top portion. Then re-tighten the dial drum screws.
3. String the dial drum and pulleys with a new dial cord as shown in Fig. 7 (in circled numbered order).

4. Turn the dial shaft (Tuning knob) counter-clockwise until the rotor of the variable capacitor is fully rotated in the stator. Then fix the dial pointer to the string at a reading of 87 MHz on the dial scale. (See Photo 3)

SCHEMATIC DIAGRAM Figure 8



SEMICONDUCTORS

	HA11225 AN7470
	LA6458D TL4558P
	STK2029
	2SA1015 2SB646 2SC536 2SC945L 2SC1815 2SC1815L 2SC2240
	2SC2839
	2SD880 (2SD313)
	1S188FM-1 1SS53 1SS55 DS448 GP20D-L
	RD15EB2 GZA13Z
	TLG113A TLR120

NOTES:

1. SCHEMATIC IS SUBJECT TO CHANGE
WITHOUT NOTICE.

UNLESS OTHERWISE SPECIFIED:

2. RESISTANCE VALUES ARE IN OHMS.
K=1,000; M=1,000,000
3. CAPACITANCE VALUES 1.0 AND ABOVE ARE IN pF OR μ F (P=pF, M= μ F), LESS THAN 1.0 ARE IN μ F. (ELECTROLYTIC CAPACITANCE VALUES ARE IN μ F/WV)
4. VOLTAGES ARE MEASURED TO CHASSIS GROUND WITH A "DC VOLTMETER".

SCHEMATIC SYMBOLS:

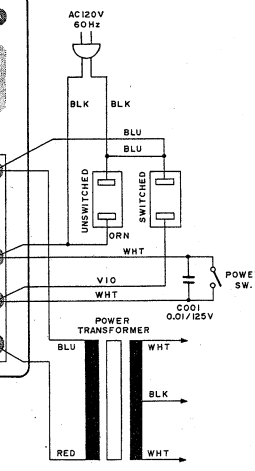
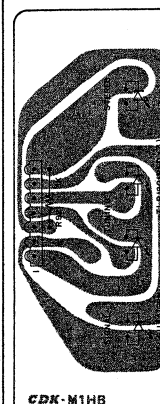
- (M) POLYESTER FILM CAPACITOR
 (P) POLYSTYRENE FILM CAPACITOR
 (LC) LOW CURRENT LEAKAGE ELECTRO-
 LYTIC CAPACITOR
 (NO MARK) CERAMIC CAPACITOR
 • NONFLAMMABLE RESISTOR
 • INTERNAL ADJUSTMENT POINT

WARNING:

- ⚠ INDICATES SAFETY CRITICAL COMPONENTS. FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.**

Note: The screens on the P.C.B. illustrations have the following significance.

 : GND
 : Other



MAIN AMP P.C.B.

PARTS LOCATION

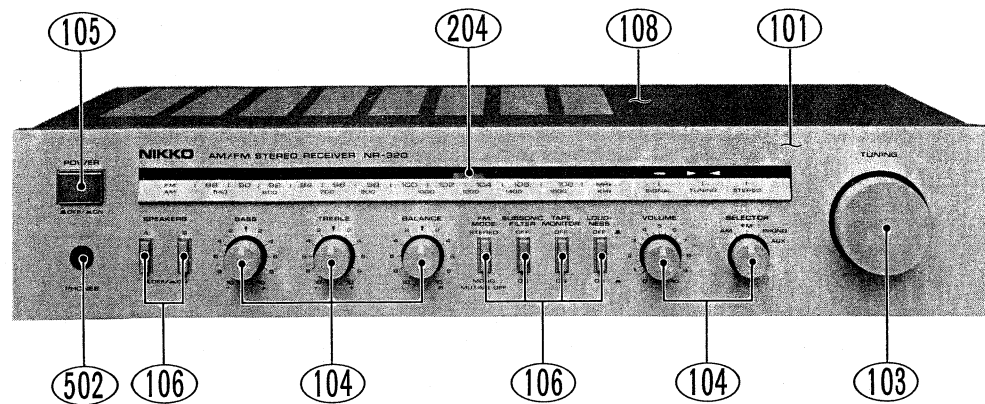


Photo 4

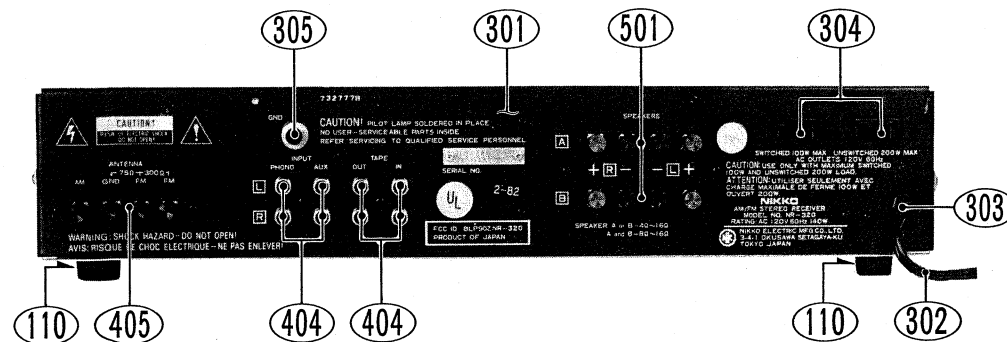


Photo 5

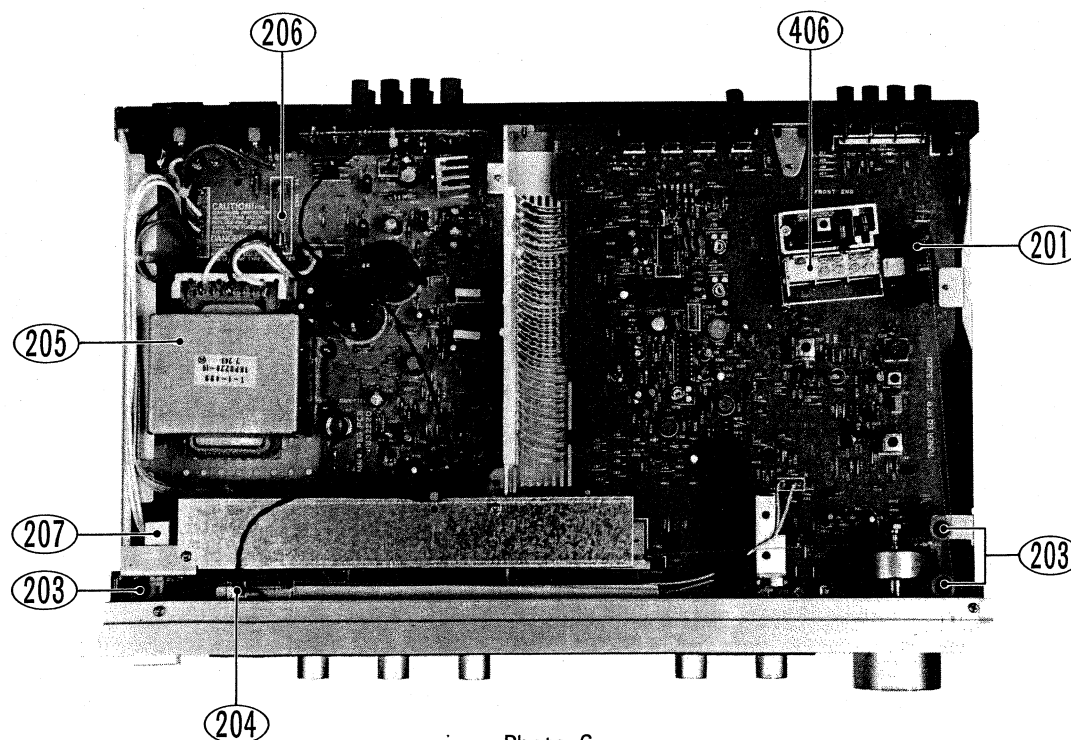


Photo 6

PARTS LIST

NOTES:

1. ★ The REF. NUMBER (#) marked with a (★) on parts list related to number of three digits with a (). (Photo 4 ~ 6)
2. + Numerals in file indicate the quantity of parts used in one type.
W₁ : U.S.A. & Canada model without AM loop antenna.
W₂ : U.S.A. & Canada model with AM loop antenna.
3. ++ TR : Transistor
FET : Field effect transistor
VR : Volume control (Variable resistor)
RES : Carbon film fixed resistor
MO-RES : Metal oxide film fixed resistor
CEM-RES : Cemented wirewound fixed resistor
FP : Flame proof
C-CAP : Ceramic capacitor
E-CAP : Aluminum electrolytic capacitor
M-CAP : Polyester film capacitor
S-CAP : Polystyrene film capacitor
T-CAP : Tantalum electrolytic capacitor

BP-CAP : Bipolar electrolytic capacitor
LC-CAP : Low current leakage electrolytic capacitor

4. Assemblies and parts are subject to change without notice.

5. Parts ordering procedure :

A. DO NOT USE THE "REFERENCE" number and "SYMBOL" number. (these are control # for the factory only)

B. Include in any order

a. Part number, b. Part description, c. Model number.

(any of the above lacking from an order may delay shipment of that order.)

WARNING :

⚠ INDICATES SAFETY CRITICAL COMPONENTS.
FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.

REF. NO.	SYMBOL NO.	TYPE ⁺ W ₁ W ₂	DESCRIPTION ⁺⁺	PART NO.
PACKING MATERIALS & ACCESSORIES				
001		1 1	Carton box	9826450
002		2 2	Pad	9841160
003		1 1	Sack, polyethylen cloth	9640720
004		1 1	Sack, polyethylen cloth — #13	9640320
005		1 —	Manual, instructions — in English and French	960387E
006		— 1	Manual, instructions — in English and French	960413E
007		1 1	Card, warranty — U.S.A.	967046A
008		1 1	Card, warranty — Canada	967044A
009		1 1	List, service stations	9690210
010		1 1	Antenna, FM — Q-MATCH	4581360
011		— 1	Loop antenna, AM	1200550
CABINET ASSEMBLY				
★101		1 1	Panel, front	7886070
102		1 1	Window, panel	7803020
★103		1 1	Knob — 320SL-42R — tuning	7841730
★104		5 5	Knob — 320SL-16DR — others	7841740
★105		1 1	Button, push — P1420SL — power	7852860
★106		6 6	Button, push — P414Z — others	7853160
107		1 1	Shaft, extension — 16.5M	7403140
★108		1 1	Cover, top	7821400
109		1 1	Plate, bottom	7327760
★110		4 4	Foot, plastic	7402640
CHASSIS ASSEMBLY				
★201		1 1	Dial drum — 37φ	740086A
202		1 1	Spring, dial drum	7440380
★203		3 3	Pulley — 10φ	7404570
★204		1 1	Dial pointer assembly	7860680
★205		1 1	Transformer, power — T-1-499 — AC 120V	1104990
★206		1 1	Fuse — 3A 250V	4700630
★207		1 1	Switch, push — SDL-1P — power	4041810
208		1 1	C-CAP 0.01uf AC 125V	239103C
209		1 1	Blind, LED	7003210
BACK PLATE ASSEMBLY				
★301		1 1	Plate, back	732777A

REF. NO.	SYMBOL NO.	TYPE ⁺ W ₁ W ₂	DESCRIPTION ⁺⁺	PART NO.
★302		1 1	Cord, AC line — DP-70	606007A
★303		1 1	Bush, power cord — SR-3P-4	7400620
★304		2 2	Socket, AC outlet	4500150
★305		1 1	Terminal, GND	4450660
TUNER-EQUALIZER P.C. BOARD ASSEMBLY				
401	S1	1 1	Switch, rotary-slide — SRZV044S — selector	4055250
402	S2~S5	1 1	Switch, tetra push — SUN431A — loudness/tape/subsonic filter/FM mode	4042230
403	R509,510	1 1	VR 250kohm (B) x 2 — volume	4321330
★404		2 2	Terminal, RCA phono pin jack — 2P x 2	4444120
★405		1 1	Terminal, antenna — 4P	4450650
★406		1 1	Front end — FF711U	4910340
(FM IF SECTION)				
T101		1 1	Coil, FM discriminator	1240520
L101		1 —	Coil — 22uH	1210990
CF101,102		2 2	Ceramic filter — FFE-1070-MA	1280890
IC101		1 1	IC HA11225	518070S
Q101		1 1	TR 2SC2839 (E)	512134S
D101		1 1	Diode 1SS53	501023S
C101		1 1	C-CAP 220pf 10% 50V SL	232221K
C102,106		2 2	C-CAP 0.047uf +80, -20% 50V YG	231473Z
C103~C110		7 7	C-CAP 0.022uf +80, -20% 50V YG	231223Z
C111,114		2 2	C-CAP 0.047uf +80, -20% 50V YG	231473Z
C112		1 1	C-CAP 0.022uf +80, -20% 50V YG	231223Z
C113		1 1	C-CAP 100pf 10% 50V SL	232101K
C115,118		2 2	E-CAP 1uf 50V	211510S
C116		1 1	E-CAP 4.7uf 35V	211415S
C117,119		2 2	C-CAP 0.022uf +80, -20% 50V YG	231223Z
C120		1 1	E-CAP 10uf 16V	211220S
C121		1 1	E-CAP 1uf 50V	211510S
C122		1 1	C-CAP 220pf 10% 50V SL	232221K
R115,116		2 2	Potentiometer 10kohm	4301580
R101		1 1	RES 33ohm 5% 1/4W	328330J
R102		1 1	FP-RES 47ohm 5% 1/4W	328470L

PART ORDERING PROCEDURE ----- DO NOT USE THE "REFERENCE" number and "SYMBOL" number. (these are control # for the factory only.) Include in any order: a. Part number b. Part description c. Model number. (any of the above lacking from an order may delay shipment of that order.)

REF. NO.	SYMBOL NO.	TYPE ⁺ W ₁ W ₂	DESCRIPTION ⁺⁺	PART NO.
R103	1	1	RES 390ohm 5% ¼W	328391J
R104	1	1	RES 3.9kohm 5% ¼W	328392J
R105	1	1	RES 560ohm 5% ¼W	328561J
R106,108	2	2	RES 330ohm 5% ¼W	328331J
R107	1	1	FP-RES 47ohm 5% ¼W	328470L
R109	1	1	RES 12kohm 5% ¼W	328123J
R110,111	2	2	RES 100kohm 5% ¼W	328104J
R113	1	1	FP-RES 47ohm 5% ¼W	328470L
R114	1	1	RES 12kohm 5% ¼W	328123J
R117	1	1	RES 22kohm 5% ¼W	328223J
R118	1	1	RES 330ohm 5% ¼W	328331J
R119,120	2	2	RES 2.2kohm 5% ¼W	328222J
R121	1	1	RES 100kohm 5% ¼W	328104J
(MPX SECTION)				
L301,302	2	2	Coil - 39mH	1260130
IC301	1	1	IC AN7470	518170S
D301~D306	6	6	Diode 1SS53	501023S
C301~C303	3	3	E-CAP 10uf 16V	211220S
C304	1	1	E-CAP 220uf 16V	211232S
C305	1	1	C-CAP 470pf 5% 50V SL	232471J
C306	1	1	M-CAP 0.047uf 5% 50V	222473J
C307	1	1	S-CAP 470pf 5% 50V	223471V
C308	1	1	LC-CAP 1uf 50V	211510L
C309	1	1	LC-CAP 0.22uf 50V	211502L
C310	1	1	LC-CAP 3.3uf 35V	211413L
C311,312	2	2	M-CAP 0.0022uf 5% 50V	222222J
C313,314	2	2	E-CAP 1uf 50V	211510S
C315,316	2	2	M-CAP 0.01uf 5% 50V	222103J
C317,318	2	2	C-CAP 470pf 5% 50V SL	232471J
C319,320	2	2	M-CAP 0.0068uf 5% 50V	222682J
C321	1	1	C-CAP 0.022uf +80, -20% 50V YG	231223Z
R318	1	1	Potentiometer 500kohm	4301630
R319	1	1	Potentiometer 10kohm	4300510
R301	1	1	RES 56kohm 5% ¼W	328563J
R302	1	1	FP-RES 47ohm 5% ¼W	328470L
R303,304	2	2	RES 100kohm 5% ¼W	328104J
R305	1	1	RES 15kohm 5% ¼W	328153J
R306	1	1	RES 1kohm 5% ¼W	328102J
R307,309	2	2	RES 22kohm 5% ¼W	328223J
R308,310	2	2	RES 10kohm 5% ¼W	328103J
R311,312	2	2	RES 39kohm 5% ¼W	328393J
R313,314	2	2	RES 1.5kohm 5% ¼W	382152J
R315,316	2	2	RES 2.7kohm 5% ¼W	328272J
R317	1	1	RES 1kohm 5% ¼W	328102J
(AM SECTION)				
T201	1	1	Coil, AM oscillator	1220150
T202	1	1	Coil, MW antenna	1200500
T202	1	1	Coil, MW antenna	1200530
T203	1	1	Coil, AM IF	1230160
T204	1	1	Coil, AM discriminator	1230240
CF201	1	1	Ceramic filter, AM - SFU450B	1280910
Q201~Q203	3	3	TR 2SC1815 (Y or GR)	512107S
D201,202	2	2	Diode 1S188FM-1	500019G
C202,204	2	2	C-CAP 0.022uf +80, -20% 50V YG	231223Z
C203	1	1	C-CAP 15pf 10% 50V SL	232150K
C205	1	1	C-CAP 0.01uf +80, -20% 50V YG	231103Z
C206,207	2	2	C-CAP 0.022uf +80, -20% 50V YG	231223Z
C208	1	1	E-CAP 10uf 35V	211420S
C211	1	1	C-CAP 0.022uf +80, -20% 50V YG	231223Z
C212	1	1	E-CAP 4.7uf 35V	211415S
C213	1	1	M-CAP 0.001uf 10% 50V	222102K

REF. NO.	SYMBOL NO.	TYPE ⁺ W ₁ W ₂	DESCRIPTION ⁺⁺	PART NO.
C214	1	1	M-CAP 0.047uf 10% 50V	222473K
C215	1	1	M-CAP 0.0068uf 10% 50V	222682K
C216	1	1	C-CAP 220pf 10% 50V SL	232221K
C217	1	1	S-CAP 360pf 5% 50V	223361V
C218	1	1	C-CAP 22pf 10% 50V SL	232220K
R201	1	1	RES 4.7kohm 5% ¼W	328472J
R202	1	1	RES 1kohm 5% ¼W	328102J
R203	1	1	RES 10ohm 5% ¼W	328100J
R204	1	1	RES 220kohm 5% ¼W	328224J
R205	1	1	RES 15kohm 5% ¼W	328153J
R206	1	1	RES 100kohm 5% ¼W	328104J
R207	1	1	RES 330ohm 5% ¼W	328331J
R208	1	1	FP-RES 47ohm 5% ¼W	328470L
R209	1	1	RES 100ohm 5% ¼W	328101J
R210	1	1	RES 100kohm 5% ¼W	328104J
R211,212	2	2	RES 12kohm 5% ¼W	328123J
R213	1	1	RES 39kohm 5% ¼W	328393J
R214	1	1	RES 100kohm 5% ¼W	328104J
R216	1	1	RES 22kohm 5% ¼W	328223J
R217	1	1	RES 5.6kohm 5% ¼W	328562J
(INDICATOR SECTION)				
LD4	1	1	LED TLG113A - signal strength ind., green	5060470
LD1,2,3	3	3	LED TLR120 - others, red	5060480
IC901	1	1	IC LA6458D	518147S
Q901~Q905	5	5	TR 2SC536 (G or H)	512133S
C901	1	1	E-CAP 33uf 10V	211123S
R902	1	1	RES 15kohm 5% ¼W	328153J
R903,906	2	2	RES 22kohm 5% ¼W	328223J
R909~R911	3	3	RES 1meg-ohm 5% ¼W	328105J
R914,920	2	2	RES 10kohm 5% ¼W	328103J
R917~R919	3	3	RES 1kohm 5% ¼W	328102J
others	9	9	RES 100kohm 5% ¼W	328104J
(EQ AMP SECTION)				
IC401	1	1	IC TL4558P	518129S
C401,402	2	2	E-CAP 0.47uf 50V	211505S
C403,404	2	2	C-CAP 100pf 10% 50V YG	232101K
C405,406	2	2	M-CAP 0.022uf 5% 50V	222223J
C407,408	2	2	M-CAP 0.0068uf 5% 50V	222682J
C409,410	2	2	E-CAP 33uf 10V	211123S
C411,412	2	2	E-CAP 1uf 50V	211510S
C413,414	2	2	M-CAP 0.0068uf 5% 50V	222682J
C415,416	2	2	E-CAP 100uf 25V	211330S
C417,418	2	2	C-CAP 0.047uf +80, -20% 50V YG	231473Z
R401,402	2	2	RES 100kohm 5% ¼W	328104J
R403,404	2	2	RES 150ohm 5% ¼W	328151J
R405,406	2	2	RES 100kohm 5% ¼W	328104J
R407,408	2	2	RES 180kohm 5% ¼W	328184J
R409,410	2	2	RES 12kohm 5% ¼W	328123J
R411,412	2	2	RES 22kohm 5% ¼W	328223J
R413,414	2	2	RES 270ohm 5% ¼W	328271J
R415,416	2	2	RES 470ohm 5% ¼W	328471J
R417,418	2	2	RES 100kohm 5% ¼W	328104J
(OTHER SECTION)				
C501,502	2	2	M-CAP 0.039uf 5% 50V	222393J
C503,504	2	2	C-CAP 100pf 10% 50V YG	232101K
C505,506	2	2	E-CAP 0.22uf 50V	211502S
C507,508	2	2	C-CAP 0.022uf 50V YG	231223M
R501,502	2	2	RES 2.2kohm 5% ¼W	328222J
R503,504	2	2	RES 1.5kohm 5% ¼W	328152J
R505,506	2	2	RES 39kohm 5% ¼W	328393J

PART ORDERING PROCEDURE ----- DO NOT USE THE "REFERENCE" number and "SYMBOL" number. (these are control # for the factory only.) Include in any order: a. Part number b. Part description c. Model number. (any of the above lacking from an order may delay shipment of that order.)

REF.	SYMBOL	TYPE ⁺		DESCRIPTION ⁺⁺				PART
NO.	NO.	W ₁	W ₂					NO.
R507,508	2	2	RES	100kohm	5%	¼W	328104J	
R511,512	2	2	RES	1meg-ohm	5%	¼W	328105J	
MAIN AMP & REGULATOR								
P.C. BOARD ASSEMBLY								
(MAIN AMP SECTION)								
S5, 6	1	1	Switch, twin push — PSC022 — speakers A, B					4042290
R737,738, R751,752 R749	2	2	VR 100kohm (C) x 2 — bass/treble					4321340
	1	1	VR 250kohm (G) — balance					4310700
L701,702	2	2	Coil, choke — 1uH					1210960
IC701	1	1	IC STK2029					518165S
Q701~Q704	4	4	TR 2SC1815L (GR)					512138S
(Q701 ~Q704)	(4	4)	TR 2SC945L (P)					512137S
Q705,706	2	2	TR 2SC1815 (Y or GR)					512107S
Q707,708	2	2	TR 2SB646 (C)					511119S
Q709,710	2	2	TR 2SA1015 (Y)					510102S
D701,702	2	2	Diode DS448					501026S
C701,702	2	2	E-CAP 0.47uf 50V					211505S
C703,704	2	2	C-CAP 100pf 10% 50V SL					232101K
C705,706	2	2	C-CAP 220pf 10% 50V SL					232221K
C707,708	2	2	C-CAP 12pf 10% 50V SL					232120K
C709~C712	4	4	C-CAP 100pf 10% 50V SL					232101K
C713,714	2	2	E-CAP 10uf 50V					211520S
C715,716	2	2	C-CAP 5pf ±0.5pf 50V SL					232509D
C717,718	2	2	E-CAP 22uf 10V					211122S
C719,720	2	2	C-CAP 47pf 10% 50V SL					232470K
C721,722	2	2	M-CAP 0.0022uf 10% 50V					222222K
C723,724	2	2	C-CAP 150pf 10% 50V SL					232151K
C725,726	2	2	M-CAP 0.001uf 10% 50V SL					222102K
C727~C730	4	4	M-CAP 0.022uf 10% 50V					222223K
C731,732	2	2	M-CAP 0.1uf 10% 50V					222104K
C733,734	2	2	E-CAP 10uf 16V					211220S
C735,736	2	2	M-CAP 0.047uf 10% 50V					222473K
C737	1	1	E-CAP 47uf 50V					211525S
C739,740	2	2	C-CAP 100pf 10% 50V SL					232101K
C743	1	1	E-CAP 100uf 50V					211530S
R701,702	2	2	RES 1kohm 5% ¼W					328102J
R703,704	2	2	RES 82kohm 5% ¼W					328823J
R705,706	2	2	RES 2.2kohm 5% ¼W					328222J
R707,708	2	2	RES 3.9kohm 5% ¼W					328392J
R709,710	2	2	RES 5.6kohm 5% ¼W					328562J
R711,712	2	2	RES 1.2kohm 5% ¼W					328122J
R713,714	2	2	FP-RES 10ohm 5% ¼W					328100L
R715~R718	4	4	FP-RES 2.7kohm 5% ¼W					328272L
R719~R722	4	4	RES 39kohm 5% ¼W					328393J
R723,724	2	2	RES 12kohm 5% ¼W					328123J
R725,726	2	2	RES 820ohm 5% ¼W					328821J
R727,728	2	2	RES 4.7kohm 5% ¼W					328472J
R729,730	2	2	RES 1kohm 5% ¼W					328102J
R731,732	2	2	RES 220kohm 5% ¼W					328224J
R733,734	2	2	RES 22kohm 5% ¼W					328223J

REF.	SYMBOL	TYPE ⁺		DESCRIPTION ⁺⁺				PART
NO.	NO.	W ₁	W ₂					NO.
R735,736	2	2	RES	3.9kohm	5%	¼W	328392J	
R739,740	2	2	CEM-RES	0.22ohm	10%	2W	382229W	
R741~R744	4	4	FP-RES	10ohm	5%	¼W	329100L	
R745,746	2	2	FP-MO-RES	330ohm	5%	1W	361331L	
R747	1	1	FP-RES	33ohm	5%	¼W	328330L	
R748	1	1	RES	10kohm	5%	¼W	328103J	
R753,754	2	2	RES	680ohm	5%	¼W	328681J	
R755,756	2	2	RES	3.9kohm	5%	¼W	328392J	
(REGULATOR SECTION)								
Q801,802	2	2	TR	2SC2240	(GR or BL)		512102S	
Q803,805, Q806	3	3	TR	2SA1015	(Y or GR)		510102S	
Q804	1	1	TR	2SC1815	(Y or GR)		512107S	
Q807	1	1	TR	2SD880	(Y or GR)		513106S	
(Q807)	(1)	(1)	TR	2SD313	(E or F)		513127S	
D801~D804	4	4	Diode	GP20D-L			560065S	
D808	1	1	Diode	DS448			501026S	
others	4	4	Diode	1SS55			501024S	
ZD801	1	1	Zener diode	GZA13Z			502095S	
ZD802,803	2	2	Zener diode	RD15EB2			502050S	
C801,802	2	2	E-CAP	6800uf	45V		2100240	
C804,806	2	2	E-CAP	10uf	50V		211520S	
C805,807	2	2	E-CAP	33uf	50V		211523S	
C808	1	1	E-CAP	10uf	50V		211520S	
C809	1	1	M-CAP	0.001uf	10%	50V	222102K	
C810	1	1	E-CAP	10uf	16V		211220S	
C811	1	1	E-CAP	220uf	16V		211232S	
R801,802	2	2	FP-RES	2.7kohm	5%	¼W	328272L	
R803,804	2	2	RES	5.6kohm	5%	¼W	328562J	
R805,806	2	2	RES	10kohm	5%	¼W	328103J	
R807	1	1	FP-MO-RES	1kohm	5%	1W	361102L	
R808	1	1	RES	100kohm	5%	¼W	328104J	
R809	1	1	RES	39kohm	5%	¼W	328393J	
R810	1	1	RES	10kohm	5%	¼W	328103J	
R811	1	1	RES	270kohm	5%	¼W	328274J	
R812	1	1	RES	22kohm	5%	¼W	328223J	
R813	1	1	RES	100kohm	5%	¼W	328104J	
R814	1	1	RES	6.8kohm	5%	¼W	328682J	
R815~R817	3	3	RES	10kohm	5%	¼W	328103J	
R818	1	1	FP-MO-RES	56ohm	5%	1W	361560L	
R819~R821	3	3	RES	680ohm	5%	¼W	328681J	
R822	1	1	FP-MO-RES	330ohm	5%	2W	362331L	
R823	1	1	FP-RES	33ohm	5%	¼W	348330L	
(OUTPUT SECTION)								
*501	1	1	Terminal, speakers	— 8P				4450640
*502	1	1	Jack, headphones					4550390
(PRIMARY SECTION)								
R001	1	1	RES	2.2meg-ohm	5%	¼W	329225J	

SEMICONDUCTOR DATA

TRANSISTORS

† NOTES

Ge: Germanium
Si: Silicon

A: Alloy

B: Base

D: Diffused

Dd: Double-diffused

Df: Drift-field

E: Epitaxial

G: Grown

J: Junction

M: Mesa

P: Planar

Pc: Point-contact

Td: Triple-diffused

DEVICE TYPE	APPLICATIONS	STRUC- TURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T _A = 25° C unless otherwise specified)					ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25° C unless otherwise specified)													MANU- FACTURE
			Collector- to-Base Voltage V _{CB0} (V)	Emitter- to-Base Voltage V _{EB0} (V)	Collector Current I _C (mA)	Collector Dissipa- tion P _C (mW)	Junction Tempera- ture T _J (°C)	Collector Cutoff Current	Static Forward-Current Transfer Ratio			Collector-Emitter Saturation Voltage			Gain-Bandwidth Product			Output Capacitance C _{ob} (pF)	Others		
							I _{CBO} (μA)	V _{CE} (V)	hFE	V _{CE} (V)	I _C (mA)	V _{CE(sat)} (V)	I _C (mA)	I _B (mA)	f _T fob* (MHz)	V _{CE} V _{CB} * (V)	I _E I _C * (mA)				
2SA1015 (Y)	AF, General	PNP Si-E	-50	-5	-150	400	125	-0.1 max.	-50	120 ~ 240	-6	-2	-0.3 max.	-100	-10	80 min.	-10	-1*	7 max.		TOSHIBA
2SB846 (C)	AF, Voltage amp.	PNP Si-E	-120	-5	-50	900	150	-10 max.	-100	100 ~ 200	-5	-10	-2 max.	-30	-3	140	-5	-10*	4		HITACHI
2SC535 (G, H)	AF, General	NPN Si-P	40	5	100	400	125	1 max.	35	280 ~ 950	6	1	0.5 max.	50	5	100	6	1*	3.5		SANYO
2SC945L (P)	AF, General	NPN Si-E	60	5	100	250	125	0.1 max.	60	200 ~ 400	6	1	0.3 max.	100	10	450 max.	6	10	5 max.		N E C
2SC1815 (Y, GR)	AF General	NPN Si-E	60	5	150	400	125	0.1 max.	60	120 ~ 400	6	2	0.25 max.	100	10	80 min.	10	1*	3 max.		TOSHIBA
2SC1815L (GR)	AF, Low noise	NPN Si-E	60	5	150	400	125	0.1 max.	60	200 ~ 400	6	2	0.25 max.	100	10	80 min.	10	1*	3 max.		TOSHIBA
2SC2240 (GR, BL)	AF, Low noise	NPN Si-E	120	5	100	300	125	0.1 max.	120	200 ~ 700	6	2	0.3 max.	10	1	100	6	1*	3		TOSHIBA
2SC2839 (E)	RF amp.	NPN Si-EP	30	5	30	150	125	0.1 max.	10	100 ~ 200	6	1	7 max.	10	1	320	6	1*			TOSHIBA
2SD313 (E, F)	AF, Power amp.	NPN Si-TdP	60	5	3A	30W (T _C =25° C)	150	100 max.	20	100 ~ 320	2	1A	1 max.	2A	200	8	5	500*	65		SANYO
2SD880 (Y, GR)	AF, Power amp.	NPN Si-Td	60	7	3A	30W (T _C =25° C)	150	100 max.	60	100 ~ 300	5	0.5A	1 max.	3A	300	3	5	-500	70		TOSHIBA

DIODES, LEDS

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T _A = 25°C unless otherwise specified)									ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25°C unless otherwise specified)							MANU- FACTURER
			Reverse Surge Voltage	Peak Reverse Voltage	Reverse Voltage	Peak Forward Voltage	Peak Forward Current	Average Rectified Current	Forward Surge Current	Junction Temperature	Total Power Dissipation	Forward Current		Forward Voltage		Reverse Current	Others		
			V _{RSurge} (V)	V _{RM} (V)	V _R (V)	V _{FM} (V)	I _{FM} (mA)	I _O (mA)	I _{F surge} (A)	T _J (°C)	P _D (mW)	I _{Fmin} (mA)	Test Condition V _F (V)	V _{Fmax} (V)	Test Condition I _F (mA)	I _{Rmax} (μA)		Test Condition V _R (V)	
1S188 FM 7	Detector	Ge-Pc		40	35		150	50	0.5	70		4.0	1			13 max.	1		SANYO
ISS53	Medium speed switching	Si-EP		35	30		300	100	2	200	500			0.8	1.0	0.1	30		N E C
ISS55	Medium speed switching	Si-EP		100	75		300	100	2	200	500			0.8	1.0	0.1	75		N E C
DS448	Medium speed switching	Si-P		35	30		360	120	0.5	175	300			1.0	50	1.0	30		SANYO
GP20D-L	Rectifier	Si-DJ			200	200		2.0A	65	150				1.1	2.0A	5			GENERAL INSTRUMENT
TLG113A	Lamp (green)	GaP			4			I _F = 25 mA		75	100			2.8	20	5	4	I _V = 17.0 mcd (I _F = 15 mA)	TOSHIBA
TLR120	Lamp (red)	GaP			4			I _F = 20 mA		75	90			2.8	20	5	4	I _V = 4.0 mcd (I _F = 15 mA)	TOSHIBA

ZENER DIODES

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS			ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25°C unless otherwise specified)													MANU- FACTURER
			Absolute - Maximum Values: (T _A = 25°C unless otherwise specified)																
			Total Power Dissipation	Zener Current	Junction Temperature	Zener Voltage			Test Conditions	Differential Resistance		Temperature Coefficient		Reverse Current		Others			
						V _Z				I _Z	I _Z	γ _Z	γ _Z	I _Z	I _Z				
P _D (mW)	I _Z (A)	T _J (°C)	MIN (V)	TYP (V)	MAX (V)	I _Z (mA)	TYP (Ω)	MAX (Ω)	I _Z (mA)	TYP (%/°C)	MAX (%/°C)	I _Z (mA)	MAX (μA)	V _R (V)					
GZA13Z	Regulator	Si-P	500	34 mA	175	13.4		14.1	5	25	35	5	0.080	0.092	5	0.5	10	SANYO	
RD15-EB2	Regulator	Si-J	400		175	13.89		14.62	10		30	10				2	11	N E C	

INTEGRATED CIRCUITS STK-2029

FUNCTION/MANUFACTURER

■ Dual Audio Power Amplifier Output Stage/Sanyo

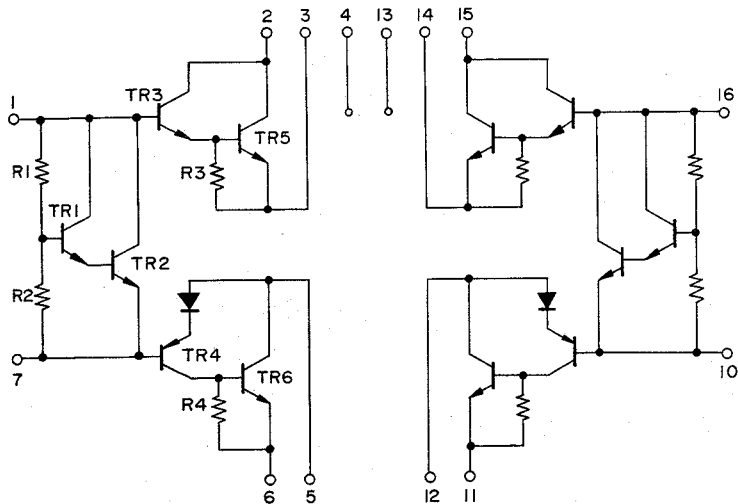
ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

ITEM	SYMBOL	CONDITION	RATING	UNIT
Supply Voltage	Vcc max.		±37	V
Junction Temperature	Tj		150	°C
Storage Temperature	Tstg		-30 ~ +105	°C
Short-Circuit Time Limit	Ts	Vcc=±25.5V, Po=25W, RL=8ohms, f=50Hz	2	sec.

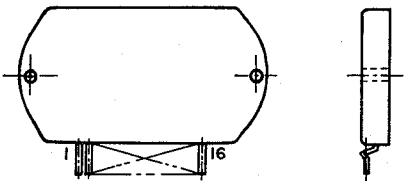
ELECTRICAL CHARACTERISTICS (Ta=25°C, Vcc=±25.5V, RL=8ohms, Rg=600ohms, VG=26.3dB;
unless otherwise noted)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Idling Current	Icco	Vcc=±31V	20	40	80	mA
Output Power	Po (1)	f=20 ~ 20kHz, THD=0.02%	25			W
Total Harmonic Distortion	THD	f=20 ~ 20kHz, Po=1 ~ 25W			0.02	%

EQUIVALENT CIRCUIT



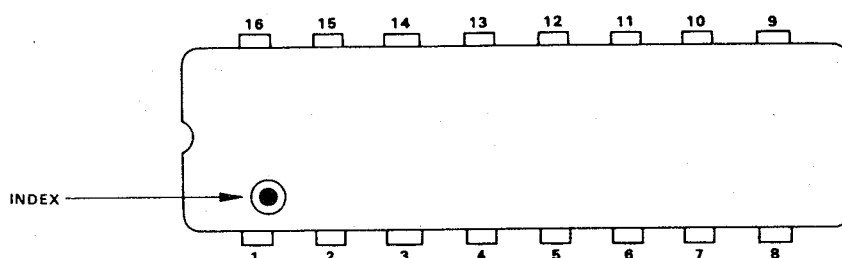
EXTERNAL VIEW



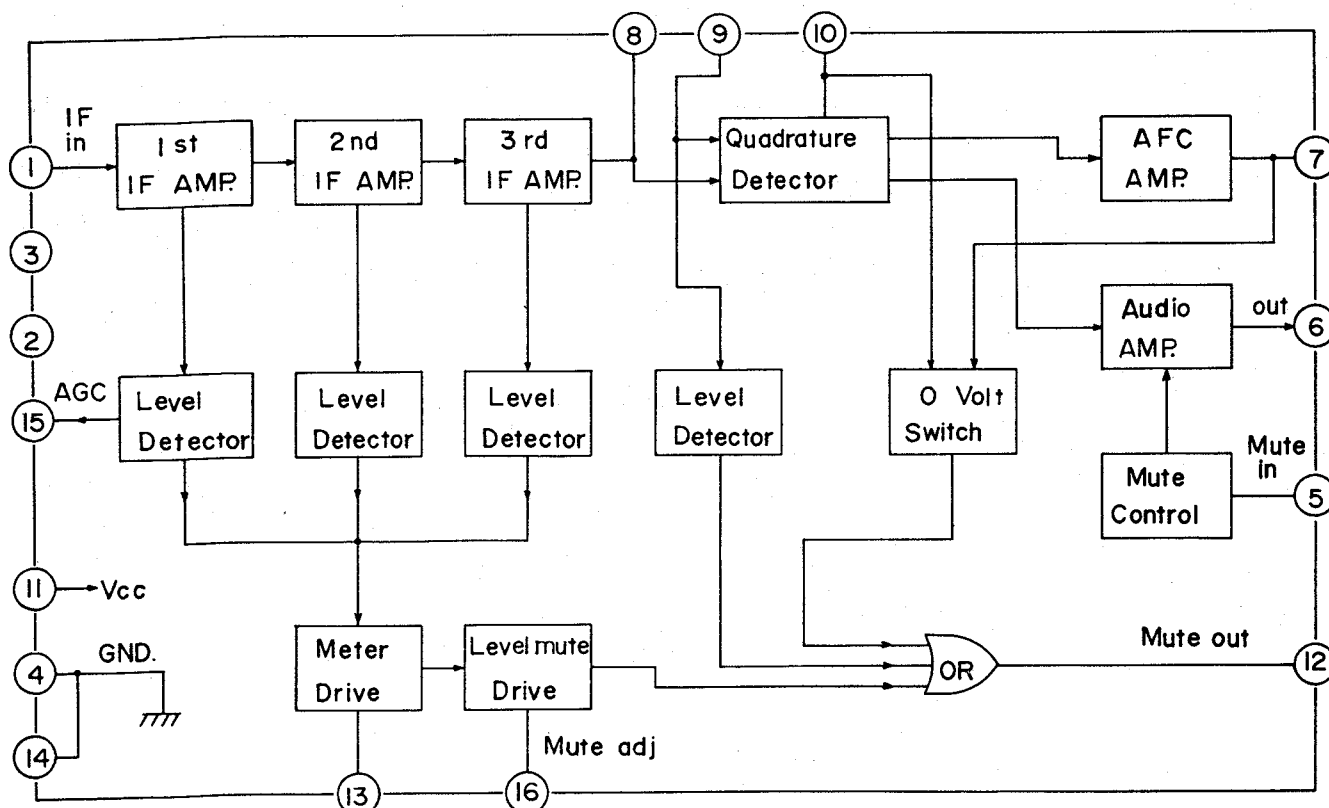
INTEGRATED CIRCUITS HA11225

DEVICE TYPE	APPLICATION	ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)				ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$) Typical Values							MANUFACTURER
		Supply Voltage V_{CC} (V)	Power Dissipation P_T (mW)	Operating Temperature Range T_{opr} ($^\circ\text{C}$)	Storage Temperature Range T_{sig} ($^\circ\text{C}$)	Supply Current (mA)	Input Limiting Sensitivity V_{in} (lim) (μV)	AF Voltage (mVrms)	Total Harmonic Distortion (%)	Signal to Noise Ratio (dB)	AM Rejection (dB)	Muting Sensitivity (μV)	
HA11225	FM IF Amplifier, Quadrature Detector	14	590 ($T_A=60^\circ\text{C}$)	$-20 \sim +70$	$-55 \sim +125$	33 max.	35 (-3dB point)	380	0.1 max.	84	54	158	HITACHI

TERMINAL GUIDE (TOP VIEW)



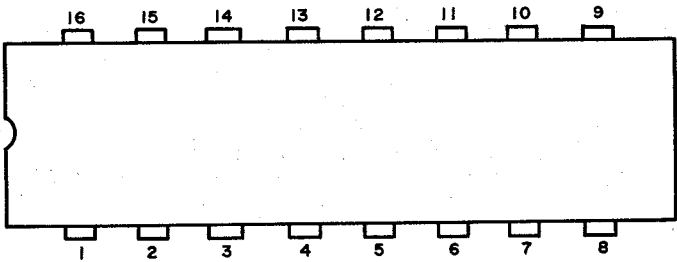
BLOCK DIAGRAM



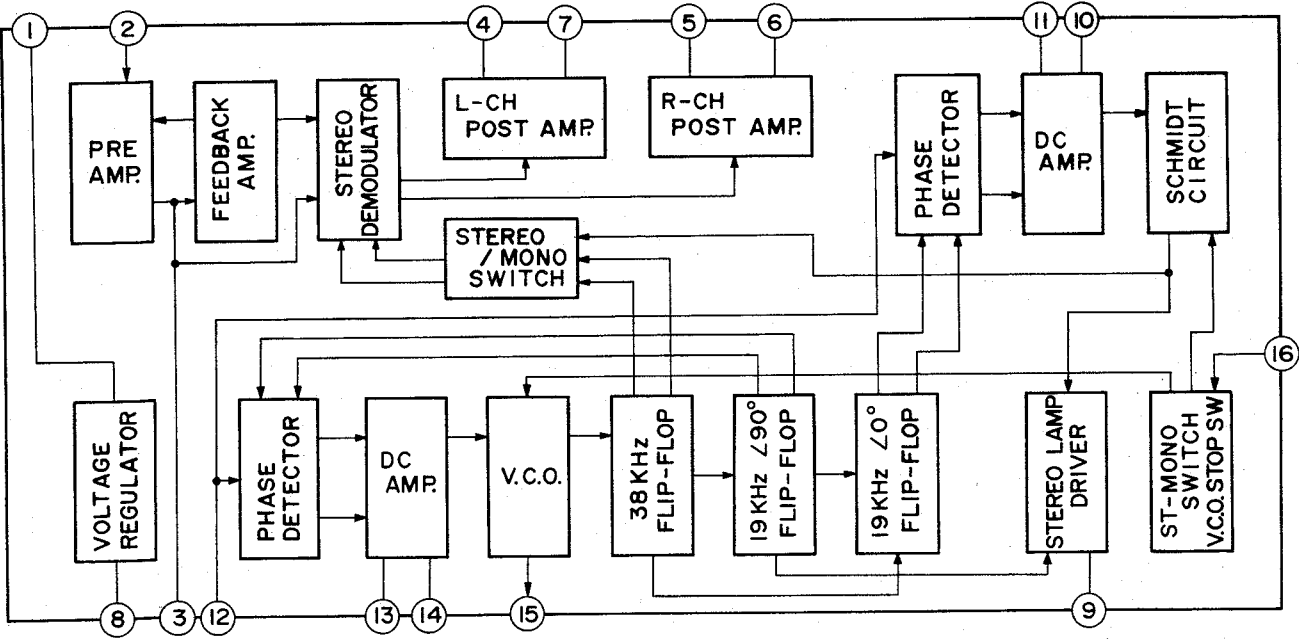
INTEGRATED CIRCUITS AN7470

DEVICE TYPE	APPLICATION	MAXIMUM RATINGS Absolute — Maximum Values: (TA = 25°C)			ELECTRICAL CHARACTERISTICS Typical Values: (TA = 25°C)							MANUFACTURER
		Supply Voltage (V)	Power Dissipation (mW)	Operating Temperature Range (°C)	Supply Current (mA)	Stereo Separation (dB)	Voltage Gain (dB)	Channel Balance (dB)	T. H. D. (mono) (%)	T. H. D. (stereo) (%)	Signal to Noise Ratio (dB)	
AN7470	FM Stereo Demodulator	14.4	430	-20 ~ +75	18	55 (f=1 kHz)	12	0 ± 1.5	0.02	0.04	85	MATSUSHITA

TERMINAL GUIDE (TOP VIEW)



BLOCK DIAGRAM



INTEGRATED CIRCUITS LA6458D/TL4558P

- APPLICATION: DUAL OPERATIONAL AMPLIFIER
- MANUFACTURER: Sanyo (LA6458D)/Texas Instruments (TL4558P)

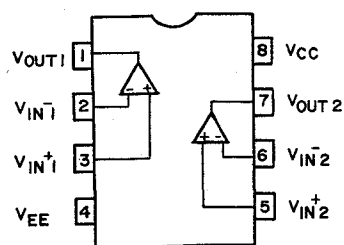
ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	LA6458D	TL4558P	UNITS
Supply Voltage	V _S	±18	±18	V
Total Power Dissipation	P _T	500	680	mW
Differential Input Voltage	V _{ID}	±30	±30	V
Input Voltage	V _{ICM}	±15	±15	V
Storage Temperature	T _{srg}	-40 ~ +125	-65 ~ +150	°C
Operating Temperature	T _{opt}	-20 ~ +75	-20 ~ +70	°C

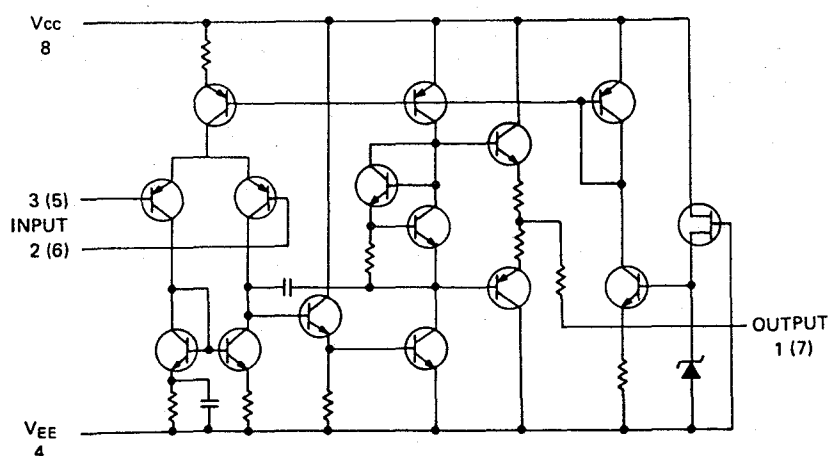
ELECTRICAL CHARACTERISTICS (T_a = 25°C, V_S = ±15V)

ITEM	SYMBOL	CONDITIONS	LA6458D			TL4558P			UNITS
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Input Offset Voltage	V _{IO}	R _S ≤ 10kΩ		0.5	6.0			6.0	mV
Input Offset Current	I _{IO}			5	200		5	200	nA
Input Bias Current	I _B			60	500		40	500	nA
Large-Signal Voltage Gain	A _V	R _L ≥ 2kΩ, V _O = ±10V	86	100		86	110		dB
Output Voltage Swing	V _{om}	R _L ≥ 10kΩ	±12	±14		±12	±14		V
Common Mode Rejection Ratio	CMR	R _S ≤ 10kΩ	70	90		70	90		dB
Supply Voltage Rejection Ratio	SVR	R _S ≤ 10kΩ		30	150		30	150	μV/V
Power Consumption	P _d	both channel		90	180		75	170	mW
Slew Rate	SR	R _L ≥ 2kΩ, V _G = 0dB		1.1			1.9		V/μS

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EQUIVALENT CIRCUIT (1/2 CIRCUIT)



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