To all our customers

Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

M51496P

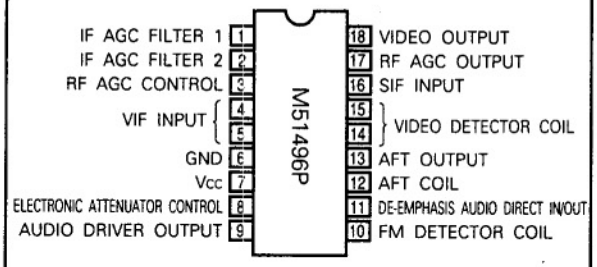
VIF/SIF

DESCRIPTION

The M51496P is a semiconductor integrated circuit which includes Video Intermediate Frequency (VIF) and Sound Intermediate Frequency (SIF) functions for color TV and VCR tuners.

The circuit includes VIF amplifier, video detector, IF AGC, RF AGC, AFT, black noise inverter, SIF limiter amplifier, FM detector, electronic attenuator, and audio driver. The package is of the 18-pin plastic molded DIP.

PIN CONFIGURATION (TOP VIEW)



Outline 18P4

FEATURES

- Compact and low power 18-pin DIP with high performance VIF/SIF functions.
- Preamplifier can be eliminated due to the high gain VIF amplifier.
- Trap between stages is not required even for conventional SAW filter since intermodulation and buzz are improved greatly by adopting a new circuit.
- The AGC works fast because of the 2-stage AGC filter. Cost reduction is possible by using only 1-stage AGC filter.
- AGC noise canceler improves AGC stability against extrinsic noise.
- De-emphasis pin enables input or output of sound signal before the electronic attenuator.
- Video and sound are simultaneously muted by grounding the VCR pin ③ and only sound is muted by grounding pin ⑩.

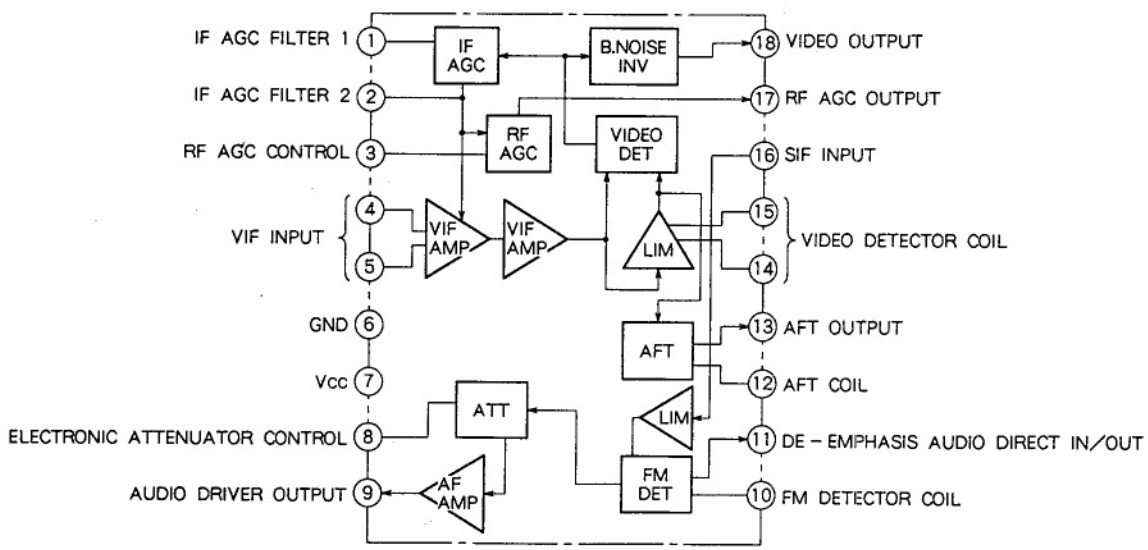
APPLICATIONS

TV sets, VCR tuners

RECOMMENDED OPERATING CONDITIONS

Supply voltage range ..... 7 ~ 10.5V
Rated supply voltage 9V

BLOCK DIAGRAM

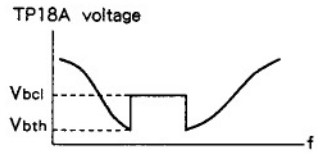
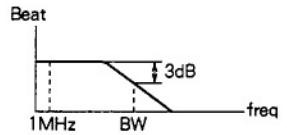


ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
Vcc	Supply voltage	10.5	V
P_d	Power dissipation	1250	mW
K_θ	Thermal derating	12.5	mV/℃
Vsurg	Electrostatic discharge	± 200V or over	V
Topr	Operating temperature	− 20~75	℃
Tstg	Storage temperature	− 40~125	℃

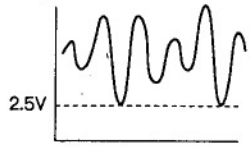
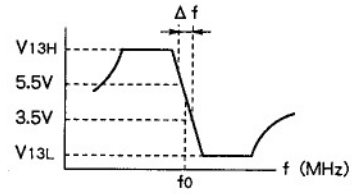
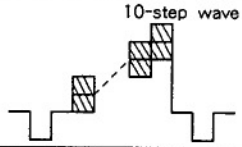
ELECTRICAL CHARACTERISTICS (Ta = 25℃, unless otherwise noted)

VIF SECTION

Symbol	Parameter	Test conditions	No.	Limits Min.	Limits Typ.	Limits Max.	Unit
Icc	Circuit current	Measure current input to pin⑦.	V-1	26	36	45	mA
V_{18}	Video output DC voltage	No input, K1 = 2, V_1 = 0V Measure DC voltage at TP18A	V-2	4.4	4.9	5.4	V
$V_{O\ det}$	Video output signal voltage	VIF IN : f = 58.75MHz, 80dBμ, color bar 87.5%, TV modulation Measure amplitude at TP18A.	V-3	1.65	2.0	2.4	V_{P-P}
V_{sync}	Sync tip voltage	VIF IN : f = 58, 75MHz, 80dBμ, CW Measure DC voltage at TP18A.	V-4	2.25	2.6	2.95	V
$V_{in\ min}$	Input sensitivity	VIF IN : f_i = 58.75MHz, variable level, CW Set the level to 80dB μ and measure at TP18A. Decrease the level and measure the input level at which voltage is 0.6 V larger than that when the level is 80dB μ.	V-5	−	42	46	dBμ
$V_{in\ max}$	Maximum allowable input	VIF IN : f_i = 58.75MHz, variable level, f_m = 10kHz, AM14% Increase the level and measure the level at which amplitude of 10 kHz at TP18A decreases 3dB.	V-6	102	108	−	dBμ
V_{bth}	Black spot noise inverter threshold level	VIF IN : f_1 = 50 to 65MHz, 90dBμ, CW sweep, K1 = 2, V_1 = 0V By adjusting V_1, output the waveform at TP18A as shown in the figure below. 	V-7	1.7	2.05	2.4	V
V_{bcl}	Black spot noise inverter clamp level		V-8	3.4	3.9	4.4	V
BW	Video bandwidth	VIF IN: f_1=58.75MHz, 80dBμ, CW f_2=58.75 to 50MHz, 60dBμ, sweep } mixed signal Adjust V_1 so that the amplitude of beat element of 1 MHz at TP18A will come to 100 dBμ. By sweeping f_2, measure the beat frequency at which the amplitude is 3 dB smaller than that at 1 MHz. 	V-9	5.0	7.5	−	MHz

* : In test circuit 1, K1 = K10 = K12 = 1, V_3 = 2.5V, and V_8 = 7V when not specified otherwise.

VIF SECTION (cont.)

Symbol	Parameter	Test conditions	No.	Limits Min.	Limits Typ.	Limits Max.	Unit
IM	Intermodulation	VIF IN: f_1=58.75MHz, 80dBμ, CW f_2=55.17MHz, 70dBμ, CW } mixed signal f_3=54.25MHz, 70dBμ, CW K1 = 2 Adjust V_1 so that the tip of signal at TP18A will come to 2.5V. Measure difference of amplitude between 1.07kHz and 4.43MHz at TP18A. Output at TP18A  	V-10	34	39	–	dB
S/NP	Video S/N	VIF IN : f_1 = 58.75MHz, 90dB μ, CW, measure noise at TP18B and let it be NP. $S/N_P = 20 \log \left(\frac{V_{o\ det} \times 10^3\ (V_{P-P})}{N_P\ (mVrms)} \right)$	V-11	52	57	–	dB
V_{13}	AFT output DC voltage	No input, K1 = 2, V_1 = 0V, measure at TP13	V-12	3.0	4.0	5.0	V
V_{13H}	AFT output maximum voltage	VIF IN : f_1 = 50 to 65MHz, 90dB μ, CW, sweep Measure the following waveform at TP13. $\mu = \frac{2000\ (mV)}{f\ (kHz)}$  	V-13	8.0	8.8		V
V_{13L}	AFT output minimum voltage		V-14	0	0.15	1	V
μ	AFT detector sensitivity		V-15	45	67	90	mV/kHz
V_{def}	AFT defeat voltage	VIF IN : f_1 = 58.75MHz, 90dBμ, CW K12 = 2, Measure voltage at TP12.	V-16	4.1	4.5	4.9	V
V_{17H}	RF AGC maximum voltage	VIF IN : f_1 = 58.75MHz, 50dBμ, CW Measure at TP17.	V-17	7.5	8.1	–	V
V_{17L}	RF AGC minimum voltage	VIF IN : f_1 = 58.75MHz, 100dBμ, CW Measure at TP17.	V-18	–	0	1.0	V
PS Mute	Video and sound simultaneous muting control voltage	By decreasing V_3, measure V_3 voltage at which TP1 is lower than 0.1 V.	V-19	0.4	0.7	1.2	V
DG	Differential gain	VIF IN : f_1 = 58.75MHz, 90dB μ, 10-step wave, 87.5%, TV modulation Measure at TP18A with vectorscope. 10-step wave 	V-20	–	4	10	%
DP	Differential phase		V-21	–	2.5	8	deg
R_{in} VIF	VIF input resistance	Test circuit 2	V-22		1.07		kΩ
C_{in} VIF	VIF input capacitance	Test circuit 2	V-23		3.3		pF

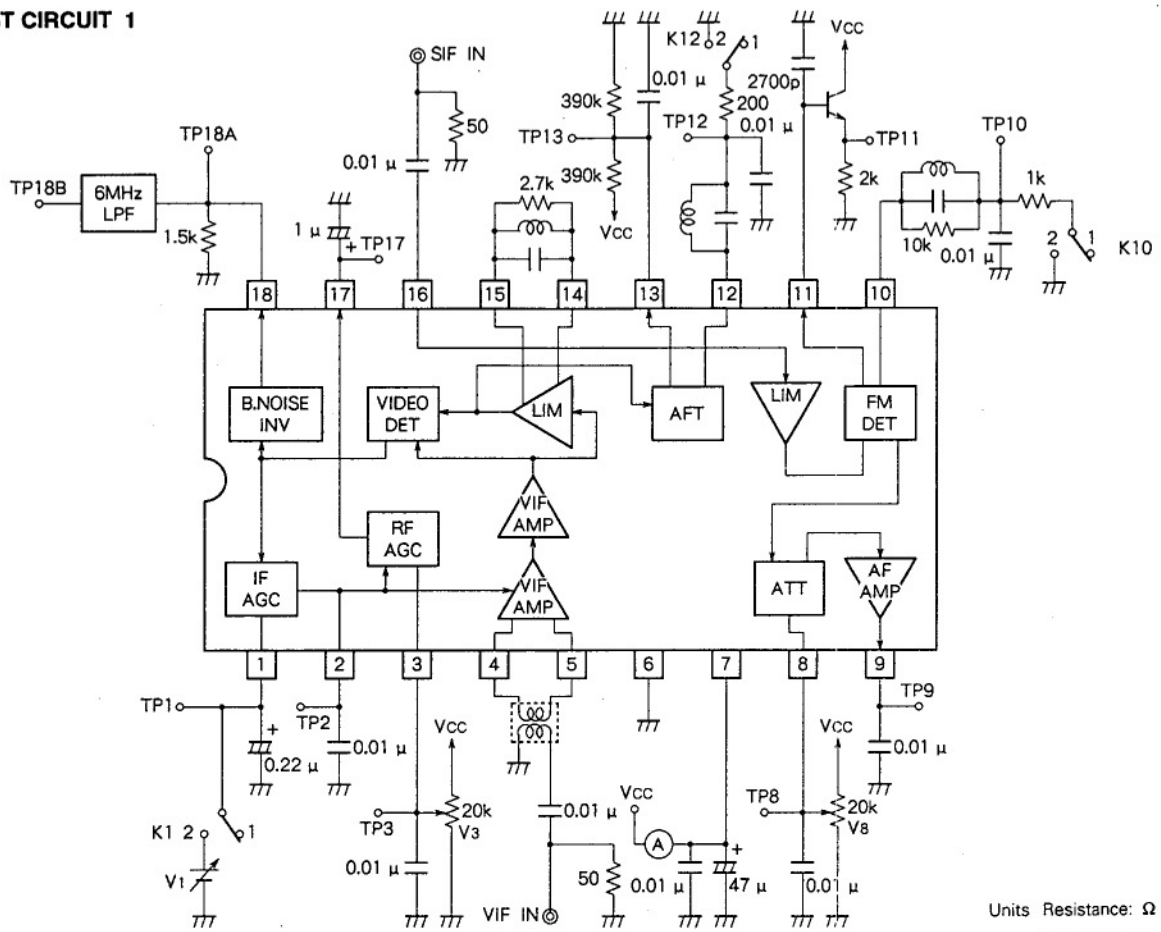
* : In test circuit 1, K1 = K10 = K12 = 1, V_3 = 2.5V, and V_9 = 7V when not specified otherwise.

SIF SECTION (cont.)

Symbol	Parameter	Test conditions	No.	Limits			Unit
				Min.	Typ.	Max.	
V_{11}	AF direct output DC voltage	No input. Measure DC voltage at TP 11.	S-1	3.4	4.0	4.6	V
$V_{O\ AF}$	AF direct detector output	SIF IN : 4.5MHz, 90dBμ, FM400Hz, FM ± 25kHz dev. Measure element of 400Hz at TP11.	S-2	280	410	580	mVrms
LIM	Limiting sensitivity	SIF IN : 4.5MHz, variable level, FM400Hz, FM ± 25kHz dev. Decrease the level and measure element of 400Hz at TP11. Input level at which it is 3dB smaller than $V_{O\ AF}$ is input sensitivity.	S-3		45	50	dB μ
AMR	AM rejection ratio	SIF IN : 4.5MHz, 90dBμ, AM400Hz, 30 $AMR=20\ \log\left(\frac{V_{O\ AF}}{Vam}\right)$ Measure element of 400Hz at TP11 and let it be V_{am}.	S-4	50	62		dB
THD	AF output distortion	SIF IN : 4.5MHz, 90dBμ, FM400Hz, FM ± 25kHz dev. Measure output distortion at TP11.	S-5		0.4	1.0	%
S/N_{af}	Sound S/N	SIF IN : 4.5MHz, 90dBμ, CW Measure noise from 0 to 100 KHz at TP11 and let it be N_{af}. $S/N_{af}=20\ \log\left(\frac{V_{O\ AF}}{N_{af}}\right)$	S-6	58	66		dB
$V_{af\ mute}$	Sound residual at sound mute	SIF IN : 4.5MHz, 90dBμ, FM400Hz, FM ± 25kHz dev. K10 = 2, Measure AC voltage at TP11 and obtain the ratio to $V_{O\ AF}$.	S-7	70	83		dB
$V_{O\ driv\ max}$	AF driver maximum output	SIF IN : 4.5MHz, 90dBμ, FM400Hz, FM ± 25kHz dev.V_8 = 9V Measure element of 400Hz at TP9.	S-8	500	680	1000	mVrms
ATT	Maximum attenuation	SIF IN : 4.5MHz, 90dBμ, FM400Hz, FM ± 25kHz dev.V_8 = 1V Measure element of 400 Hz at TP9 and obtain the ratio to $V_{O\ driv\ max}$.	S-9	70	79		dB
G_{af}	AF driver gain	$Gv=20\ \log\left(\frac{V_{O\ driv\ max}}{V_{O\ AF}}\right)$	S-10	2.8	4.3	5.8	dB
V_9	AF driver output DC voltage	No input, V_8 = 9V Measure DC voltage at TP9.	S-11	3.6	4.2	4.8	V
$V_{O\ driv}$	AF driver output signal voltage	SIF IN : 4.5MHz, 90dBμ, FM400Hz, FM ± 25kHz dev.V_8 = 4.5V Measure element of 400 Hz at TP9.	S-12	20	60	200	mVrms

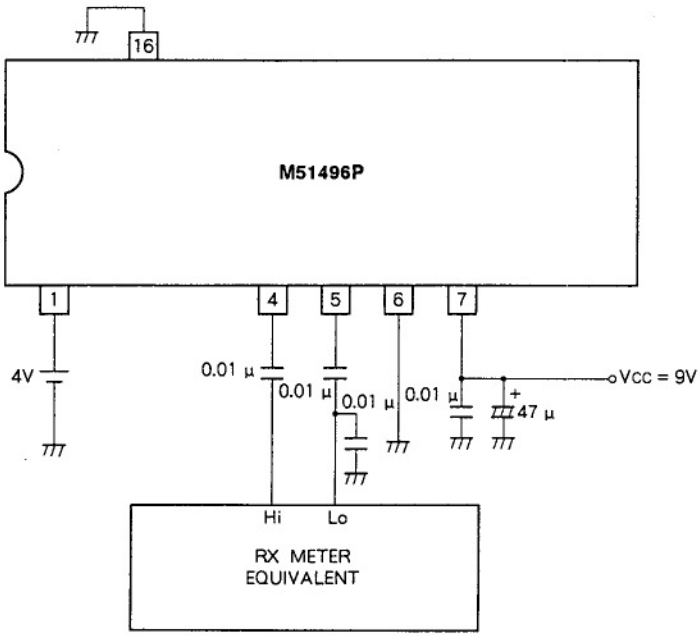
* : In test circuit 1, K1 = Z, K10 = K12 = 1, V_1 = 0V when not specified otherwise.

TEST CIRCUIT 1



Units Resistance: Ω
Capacitance: F

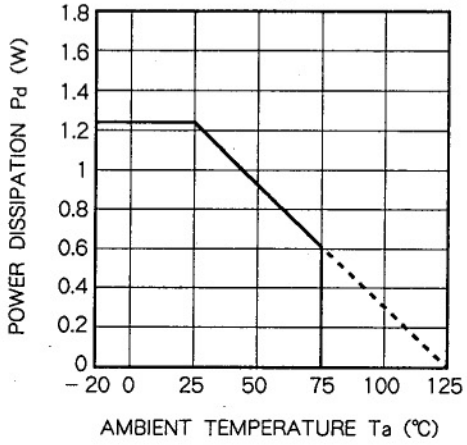
TEST CIRCUIT 2



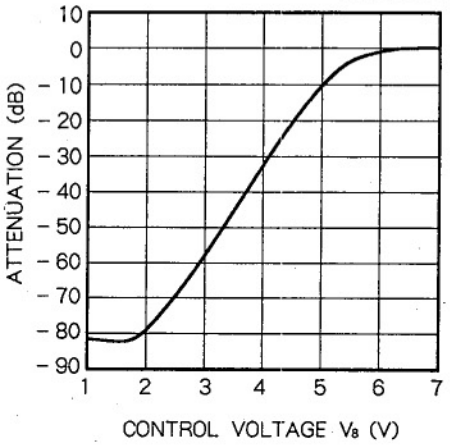
Units Resistance: Ω
Capacitance: F

TYPICAL CHARACTERISTICS

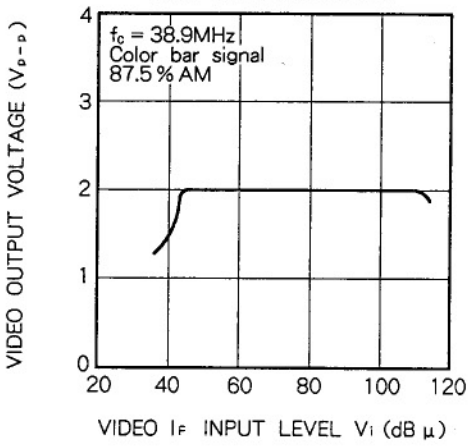
THERMAL DERATING (MAXIMUM RATING)



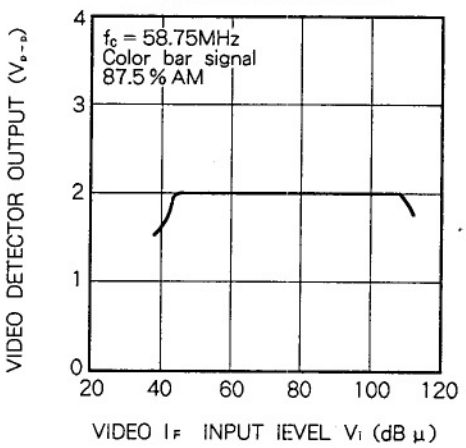
ELECTRONIC VOLUME CONTROL CHARACTERISTICS



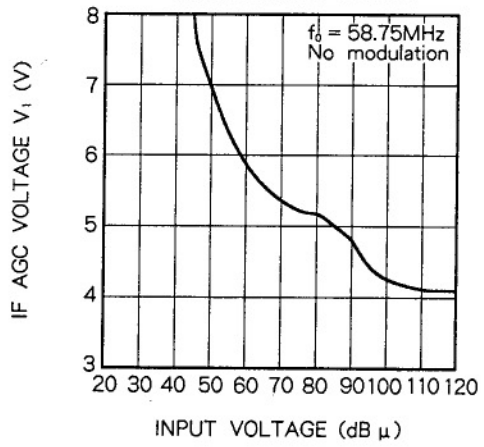
AGC CHARACTERISTICS



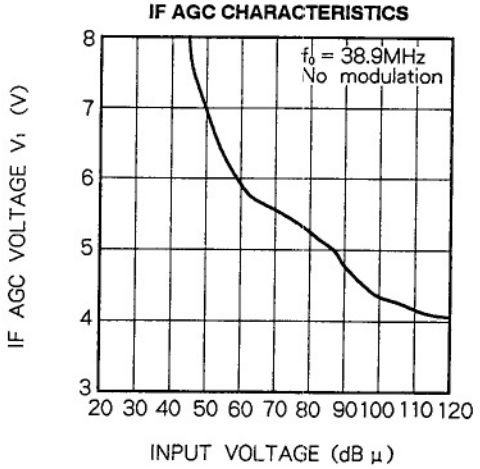
AGC CHARACTERISTICS



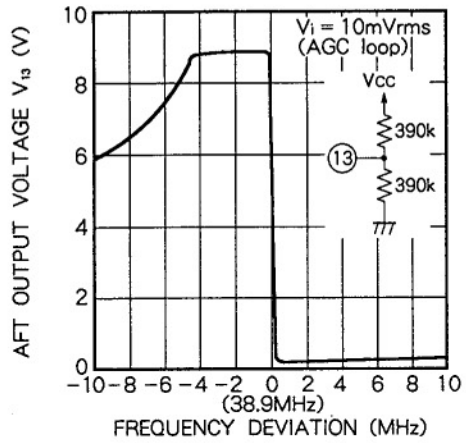
IF AGC CHARACTERISTICS



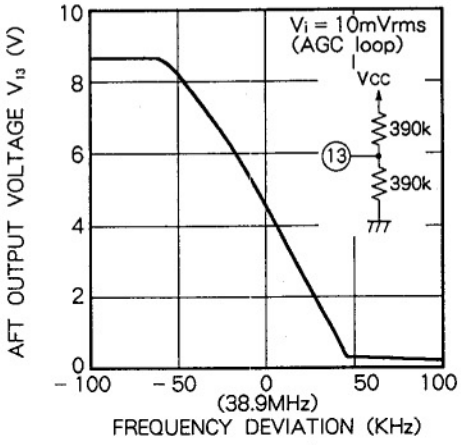
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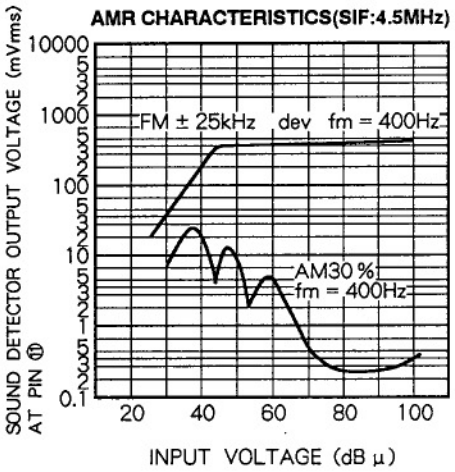
AFT BROADBAND CHARACTERISTICS



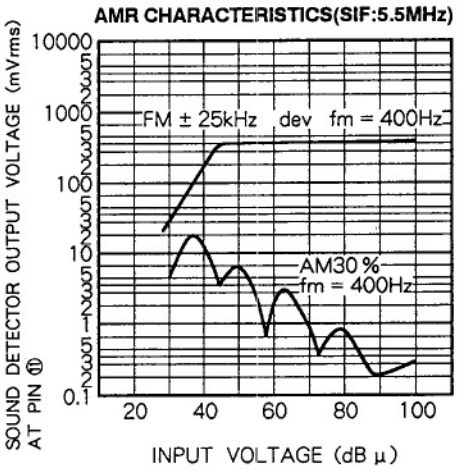
AFT NARROW - BAND CHARACTERISTICS



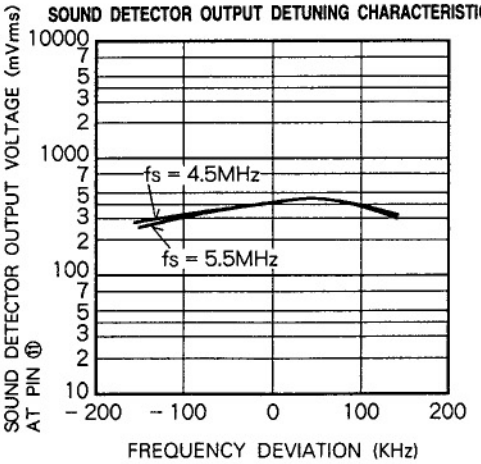
SIF LIMITING CHARACTERISTICS
AMR CHARACTERISTICS(SIF:4.5MHz)



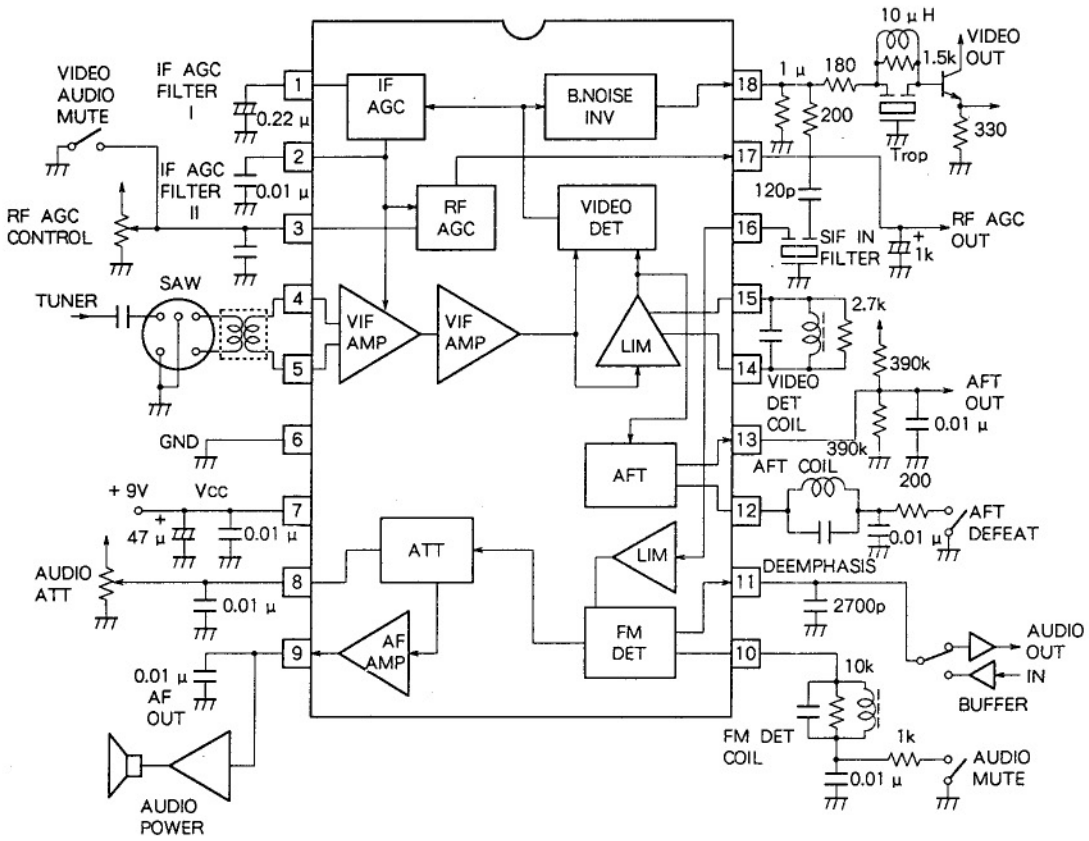
SIF LIMITING CHARACTERISTICS
AMR CHARACTERISTICS(SIF:5.5MHz)



SOUND DETECTOR OUTPUT DETUNING CHARACTERISTICS

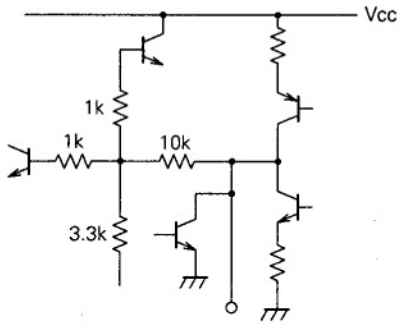
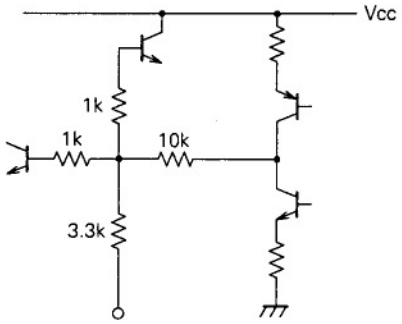
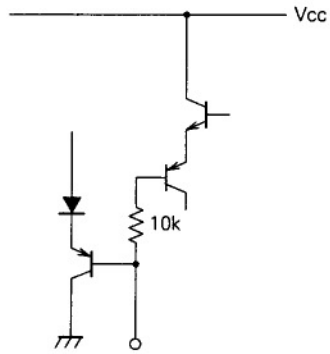
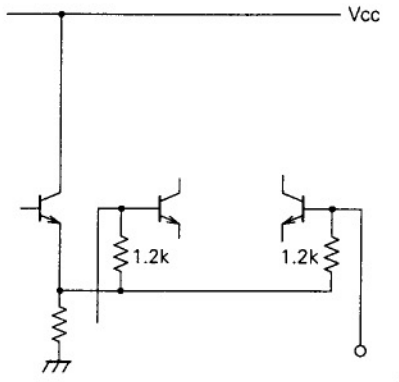


APPLICATION EXAMPLE (f_O = 38.9MHz)

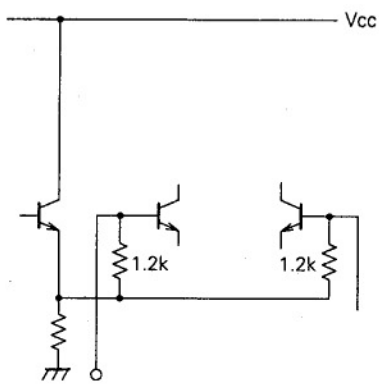
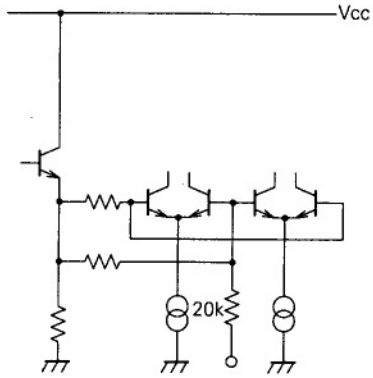
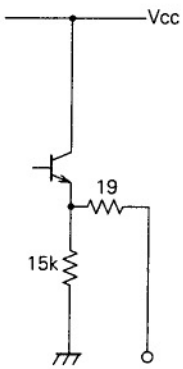


Units Resistance: Ω
Capacitance: F

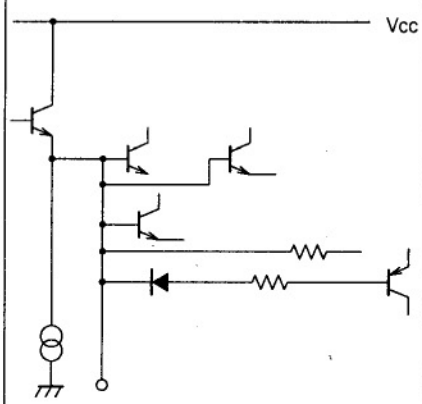
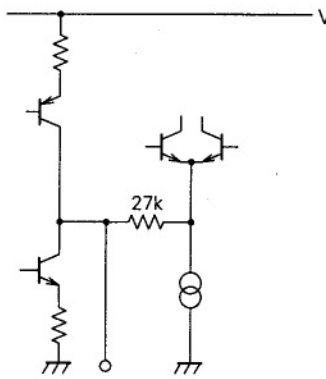
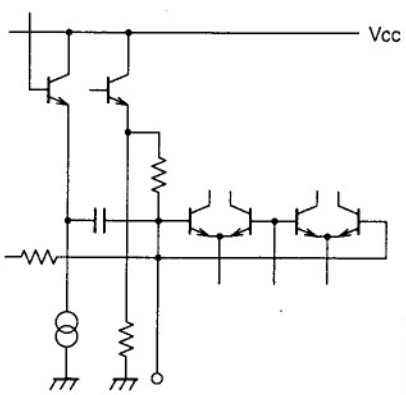
DESCRIPTION OF PIN

Pin No.	Name	Peripheral circuit of pins
①	IF AGC FILTER	
②	IF AGC FILTER	
③	RF AGC FILTER	
④	VIF INPUT	

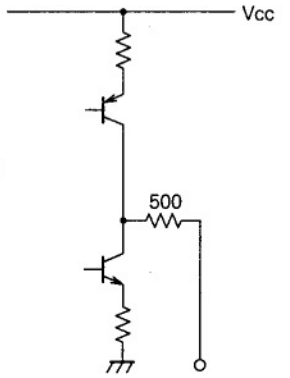
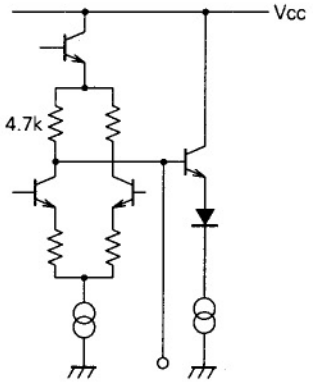
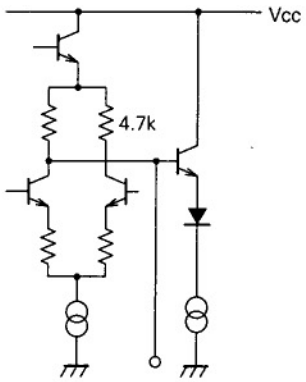
DESCRIPTION OF PIN (cont.)

Pin No.	Name	Peripheral circuit of pins
⑤	VIF INPUT	
⑥	GND	——
⑦	Vcc	——
⑧	ELECTRONIC ATTENUATOR CONTROL	
⑨	AUDIO DRIVER OUTPUT	

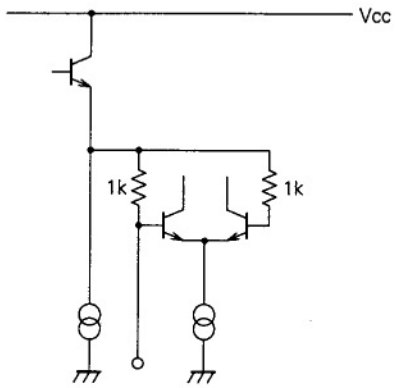
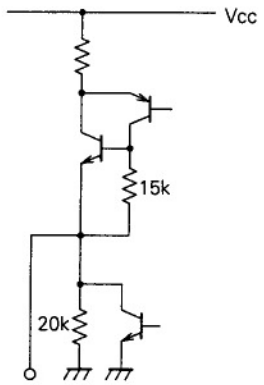
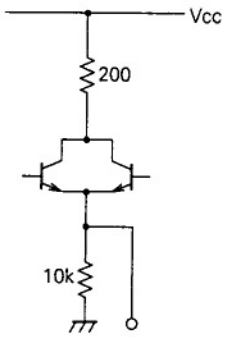
DESCRIPTION OF PIN (cont.)

Pin No.	Name	Peripheral circuit of pins
⑩	FM DETECTOR COIL	
⑪	DE-EMPHASIS/ AUDIO IN/ OUT	
⑫	AFT COIL	

DESCRIPTION OF PIN (cont.)

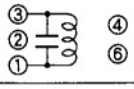
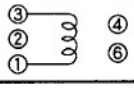
Pin No.	Name	Peripheral circuit of pins
⑬	AFT OUTPUT	
⑭	VIDEO DETECTOR COIL	
⑮	VIDEO DETECTOR COIL	

DESCRIPTION OF PIN (cont.)

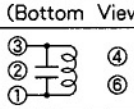
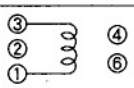
Pin No.	Name	Peripheral circuit of pins
⑯	SIF INPUT	
⑰	RF AGC OUTPUT	
⑱	VIDEO OUTPUT	

SPECIAL PARTS Coil Data (TOKO, INC.) (7mm□)

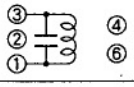
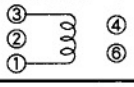
VIF : 58.7MHz

PARTS	IC PIN	NUMBER	FREQUENCY	Qu	Co (pF)	TURNS	BOBBIN	WIRE	CONNECTION (Bottom View)
VIDEO DET COIL	⑭-⑮	292GCS - 5549Z	58.75MHz	112 ± 20%	27 Stray 0	(1-3) 4¾t	7KM	0.12 φ 0UEW	
AFT COIL	⑫	292GNS - 5589Z	58.75MHz	79 ± 20%	56	(1-3) 3t	7KM	0.12 φ 0UEW	

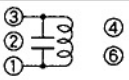
VIF : 45.75MHz

PARTS	IC PIN	NUMBER	FREQUENCY	Qu	Co (pF)	TURNS	BOBBIN	WIRE	CONNECTION (Bottom View)
VIDEO DET COIL	⑭-⑮	292GCS - 5540Z	45.75MHz	110 ± 20%	27 Stray 0	(1-3) 6½t	7KM	0.12 φ 0UEW	
AFT COIL	⑫	292GNS - 5580Z	45.75MHz	76 ± 20%	56	(1-3) 4½t	7KM	0.12 φ 0UEW	

VIF : 38.9MHz

PARTS	IC PIN	NUMBER	FREQUENCY	Qu	Co (pF)	TURNS	BOBBIN	WIRE	CONNECTION (Bottom View)
VIDEO DET COIL	⑭-⑮	292GCS - 5549Z	38.9MHz	113 ± 20%	27 Stray 0	(1-3) 7½t	7KM	0.12 φ 0UEW	
AFT COIL	⑫	292GNS - 5589Z	38.9MHz	84 ± 20%	56	(1-3) 5½t	7KM	0.12 φ 0UEW	

Coil Data of FM Detector

PARTS	IC PIN	NUMBER	FREQUENCY	Qu	Co (pF)	TURNS	BOBBIN	WIRE	CONNECTION (Bottom View)
FM DET COIL	⑩	292BCS - 5923Z	4.5MHz	71 ± 20%	68 Stray 0	(1-3) 45t	7KM	0.07 φ 2UEW	
FM DET COIL	⑩	292BCS - 5924Z	5.5MHz	61 ± 20%	68 Stray 0	(1-3) 35t	7KM	0.08 φ 2UEW	