Ordering number : EN660A

Monolithic Linear IC

LA1231N

FM IF System

Overview

Being developed for FM IF System, LA1231 is a highly integrated circuit in which almost all functions are contained concerning the FM tuner IF stage. The block diagram of equivalent circuit is shown below. Usual peripheral circuits are shown also in examples of application circuits.

The IF amplifier and limiter stages are composed of 6-stage double-end type differential amplifier, which is superior on its AMR. The signal meter driving stage which is located in parallel therewith consists of a 3-stage level detector circuit and a drive circuit in order to extend the linear area.

The FM detection stage composed of a double-balance type quadrature detecting circuit is attached with a low frequency preamplifier and muting control circuit.

The muting drive stage is composed of the following 3 circuits.

1) A level detection circuit which detects the S/N ratio of carrier wave when the input is weak.
2) A circuit which detects the dc output of FM detector's 'S' curve when detuning is made.
3) A driving circuit.

Thus, this muting driving stage can reduce foreign factors such as the interstation noises, the shock noise caused from muting when detuning is made, and so forth.

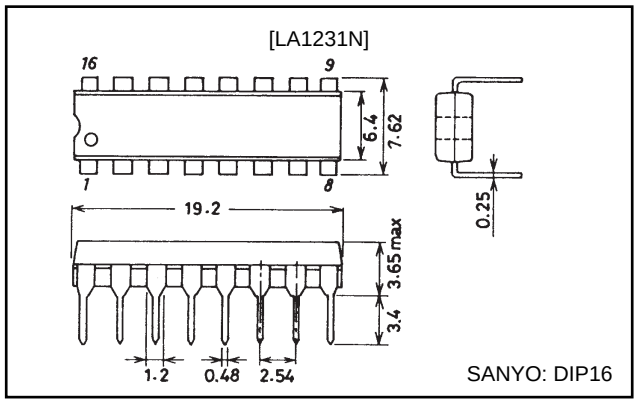
Besides, a voltage-inverting circuit is built in LA1231N so that the muting may be enabled at any appropriate input signal level. The output of this voltage-inverting circuit is connected with the muting drive output terminal. Thus, the muting can be placed to the ON or OFF status when a control voltage is applied from other section to the input terminal of the voltage-inverting circuit. For the control voltage, the output of the signal meter driver is appropriate. Both the AFC output stage and tuning meter driving stage are of the current-driven type. So, not only the sensitivity of AGC but also the muting band (when detuning is made) can be controlled by an outer resistor.

Being utilized for disabling the FM IF amplifier when AM reception is made, the IF amplification/stop circuit can decrease the shock noise caused at the conversion between FM and AM reception modes.

Package Dimensions

unit: mm

3006B-DIP16



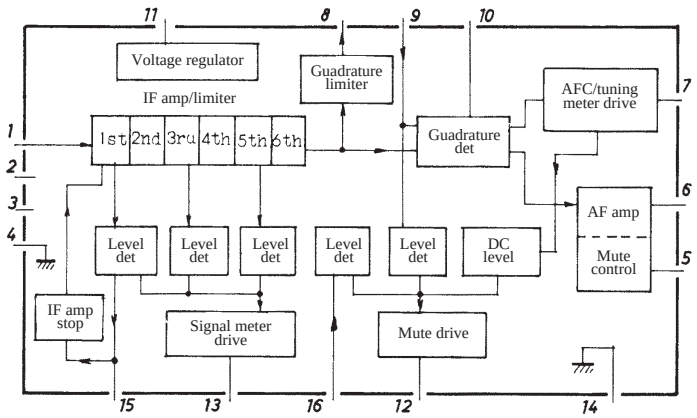
Functions

- IF amplification, Limiter.
- AF preamplifier.
- Muting at the detuning.
- AFC tuning meter drive output.
- Inverting circuit for muting drive voltage.
- Quadrature detection.
- Muting at weak.
- Signal meter drive output.
- Delay AGC output.
- IF amplifier stop circuit.

Features

- High sensitivity on limiting : 18μV typ.
- Low distortion : 0.05% typ. determined by the linearity of phase characteristics in phase shifting circuit.
- High demodulation output : 330 mVrms typ.
- High S/N ratio : 78.5dB typ.
- Muting at detuning with little shock noise.
- Single meter drive output proportional with the input signal level dB.
- Detuning muting band having good symmetrics.
- Tuning meter driving output having wide swing width.
- Delay AGC drive output for front end.
- Constant voltage circuit is built-in : operation voltage=9 to 14V.
- Muting characteristics between adjacent stations are distinguished.

Equivalent Circuit Block Diagram



Specifications

Maximum Ratings at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC}max	Pin 11	16	V
Maximum input voltage	V_{IN}	Pins 1-2	±1	Vp-p
Maximum supply current	I_{CC}	Pin 11	40	mA
Maximum flow-in current	I_{15}	Pin 15	1	mA
	I_{16}	Pin 16	1	mA
Maximum flow-out current	I_{10}	Pin 10	2	mA
	I_{12}	Pin 12	2	mA
	I_{13}	Pin 13	2	mA
	I_{15}	Pin 15	2	mA
Allowable power dissipation	Pd max		650	mA
Operating temperature	Topr		–20 to +70	°C
Storage temperature	Tstg		–40 to +125	°C

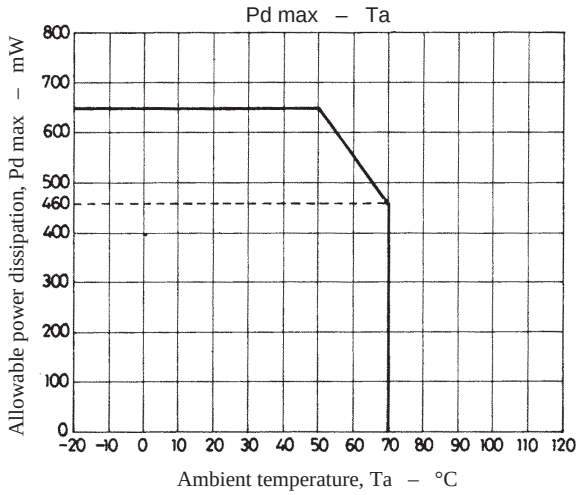
Recommended Operating Conditions at Ta=25°C

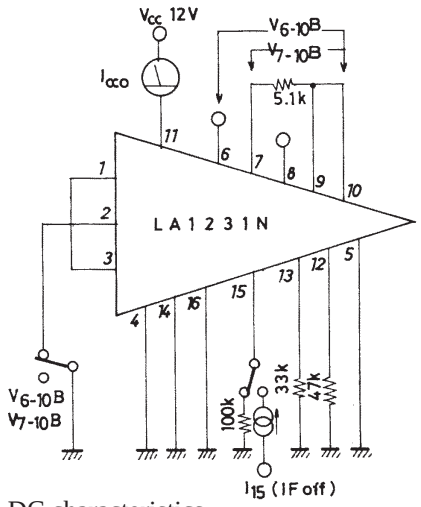
Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V_{CC}		12	V

Operating Characteristics at Ta=25°C, V_{CC}=12V, f=10.7MHz

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	I_{CCO}			22	30	mA
Current drain	I_{CC}	V_{IN}=100dBμ		26.5	33	mA
Demodulated output	Vo	V_{IN}=100dBμ, 400Hz-100% mod	240	330	460	mVrms
S/N		V_{IN}=100dBμ, 400Hz-100% mod	72	78.5		dB
Input limiting voltage	$V_{IN(lim)}$	Vo 3dB down, 400Hz-100% mod		25	31	dBμ
Total harmonic distortion	THD	V_{IN}=100dBμ, 400Hz-100% mod		0.05	0.3	%
Muting sensitivity	$V_{IN(mute)}$	V_{12}=1.4V	23	29	35	dBμ
Muting attenuation	Mute(att)	V_5=2V, V_{IN}=100dBμ, 400Hz-100% mod	60	65		dB
Muting bandwidth	BW(mute)	V_{IN}=100dBμ, V_{12}=1.4V	140	220	370	kHz
AM rejection ratio	AMR	V_{IN}=100dBμ, FM : 400Hz-100% mod AM : 1kHz-30% mod	45	60		dB
Muting driving output	V_{12}	Quiescent	4.0	4.9	6.0	V
		V_{IN}=100dBμ	0	0	0.3	V
Signal meter driving output	V_{13}	Quiescent	0	0	0.1	V
		V_{IN}=70dBμ	1.9	3.0	4.2	V
		V_{IN}=100dBμ	4.5	5.5		V
AGC output	V_{15}	Quiescent	4.2	5.0	5.5	V
		V_{IN}=100dBμ	0	0	0.5	V
IF off current	$I_{15(off)}$	Quiescent, $V_{8\text{-}10}$≤20mV	10	35	60	μA
Voltage of muting operation	V_{16}(mute)	V_{IN}=100dBμ, V_{12}=1.4V	0.7	0.84	1.0	V
Offset voltage	$V_{6\text{-}10\ B}$	Quiescent, pin 6-10	–0.5	0	+0.5	V
	$V_{7\text{-}10\ B}$	Quiescent, pin 7-10, $R_{7\text{-}10}$=5.1kΩ	–0.25	0	+0.25	V
Pin voltage	V_1	Quiescent		2.6		V
	V_2	Quiescent		2.6		V
	V_3	Quiescent		2.6		V
	V_6	Quiescent		5.6		V
	V_7	Quiescent		5.6		V
	V_8	Quiescent		5.4		V
	V_{10}	Quiescent		5.6		V
	V_{12}	Quiescent		4.9		V
	V_{13}	Quiescent		0		V
	V_{15}	Quiescent		5.0		V

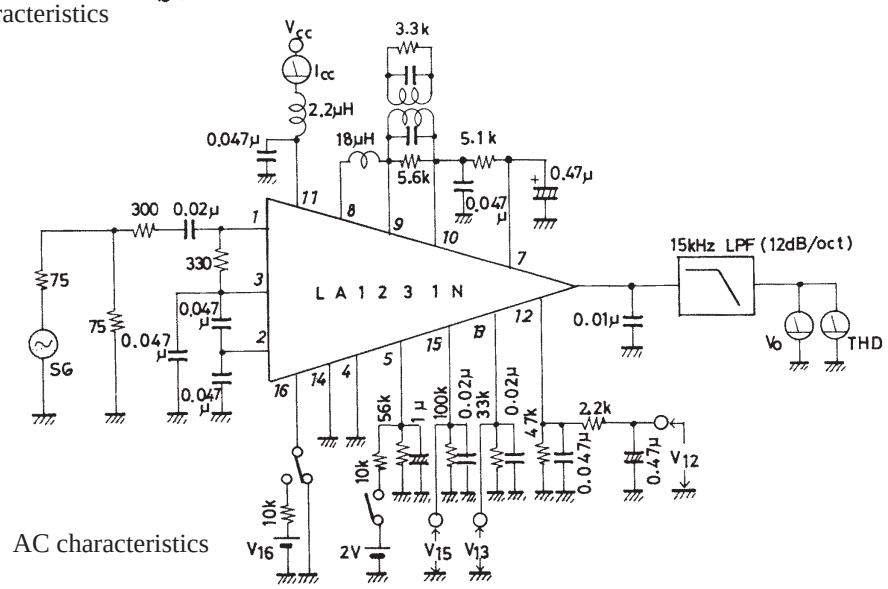
Test Circuit





Unit (resistance : Ω, capacitance : F)

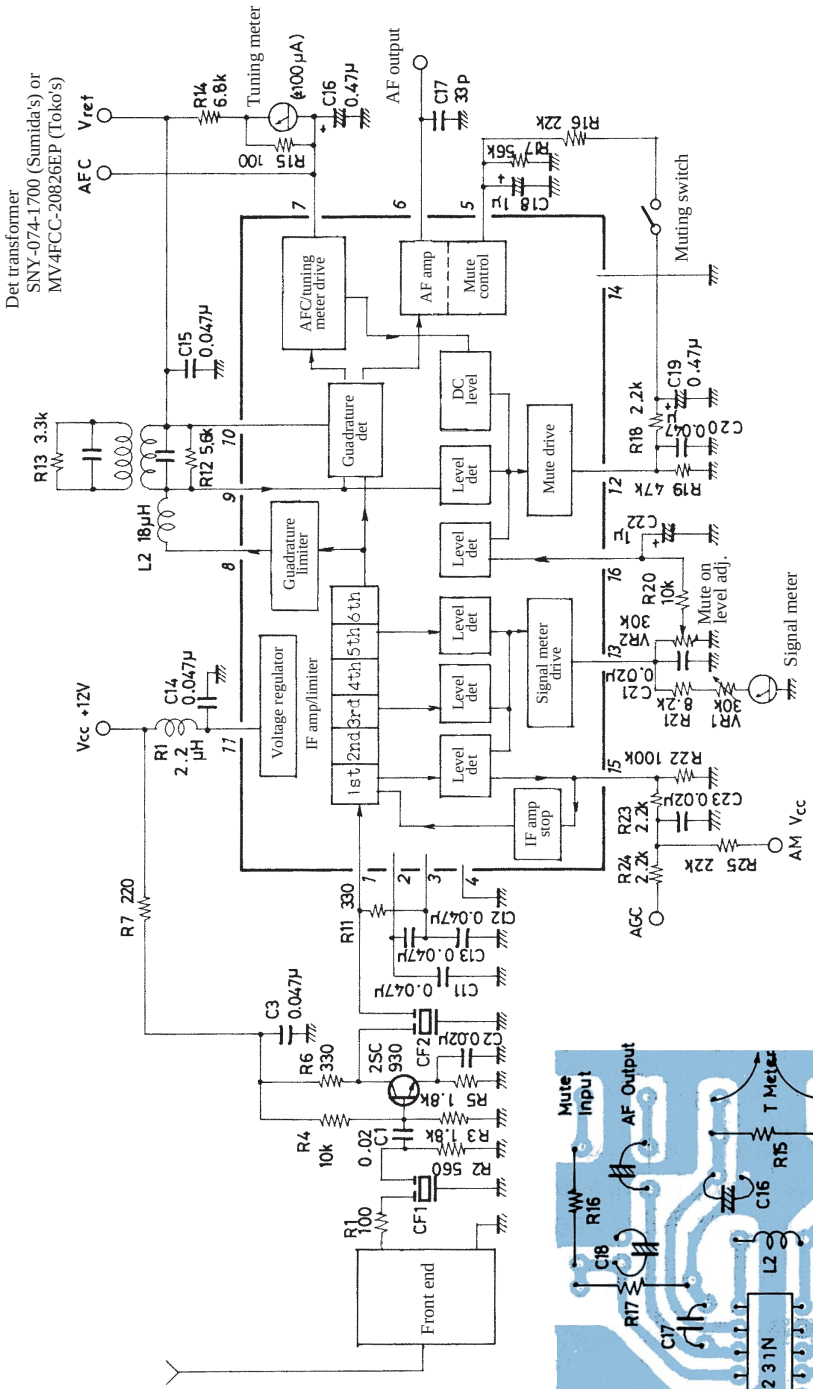
DC characteristics

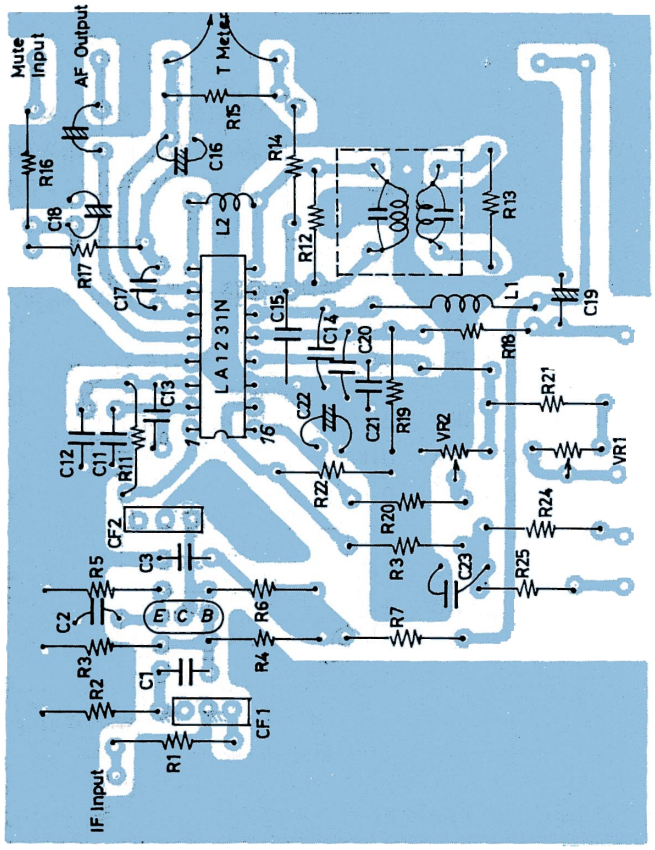


AC characteristics

Unit (resistance : Ω, capacitance : F)

Sample Application Circuit

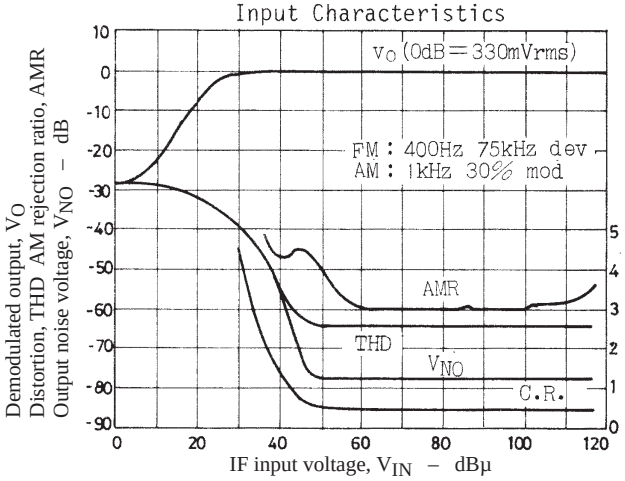




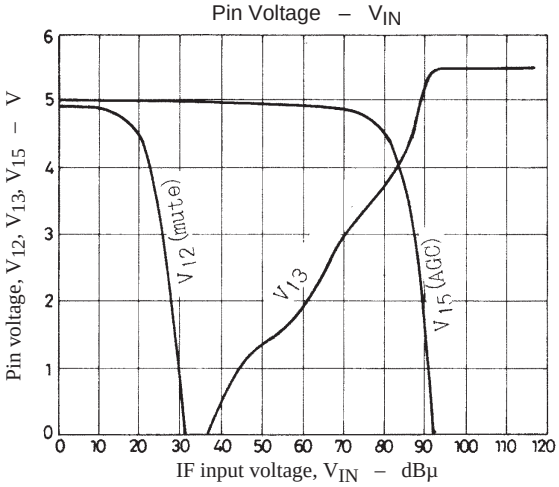
An Example of Printed Pattern Board (70×95mm², bottom view)

Unit (resistance : Ω, capacitance : F)

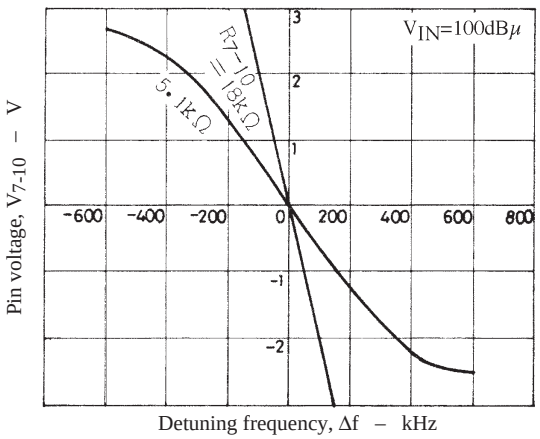
Input Characteristics



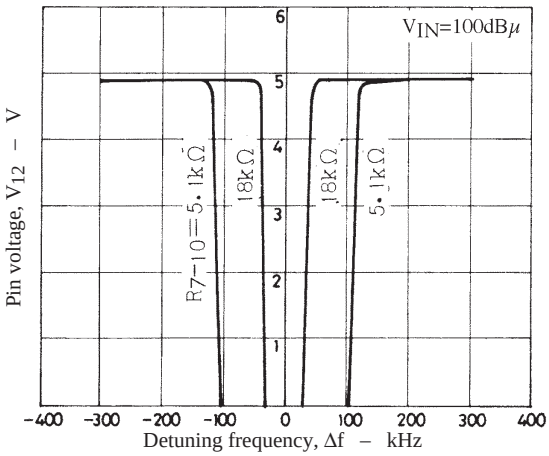
Pin Voltage – V_{IN}



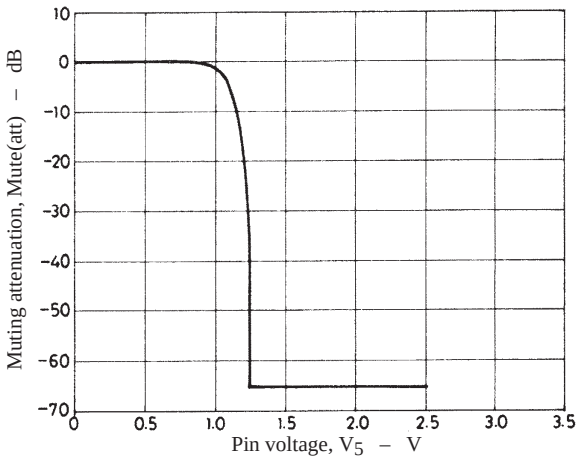
$V_{7\text{-}10}$ – Δf



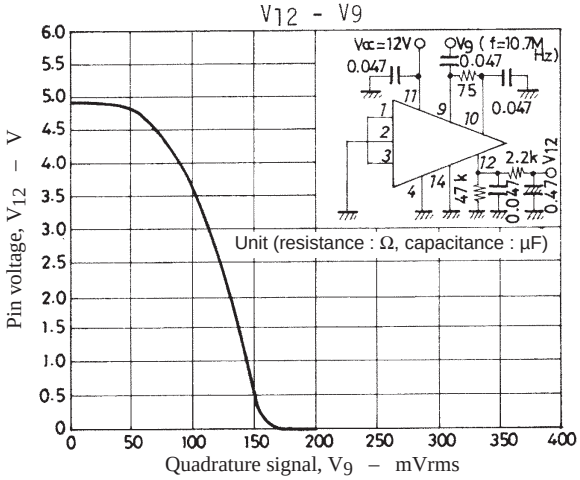
V_{12} – Δf



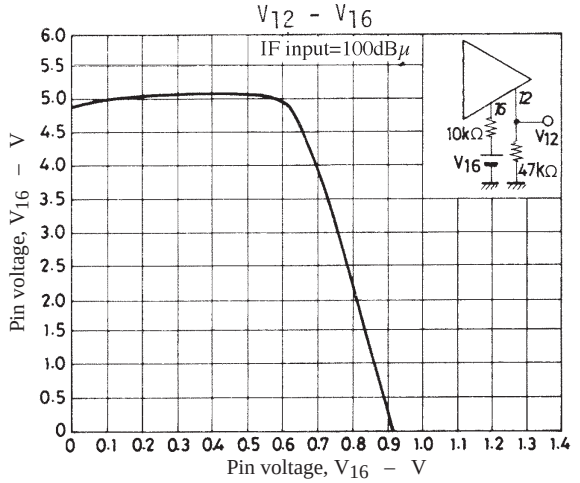
Mute(att) – V_5



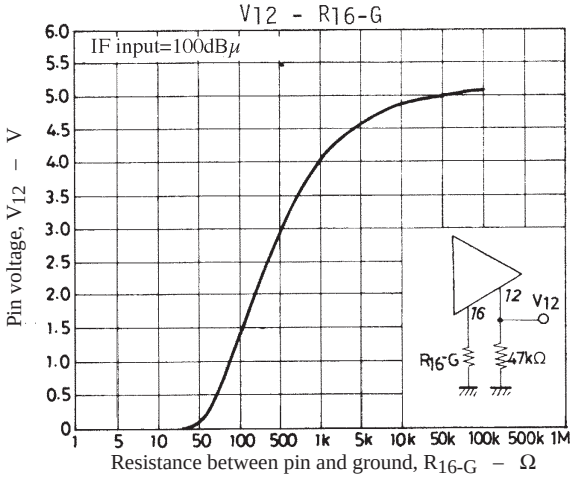
V_{12} - V_9



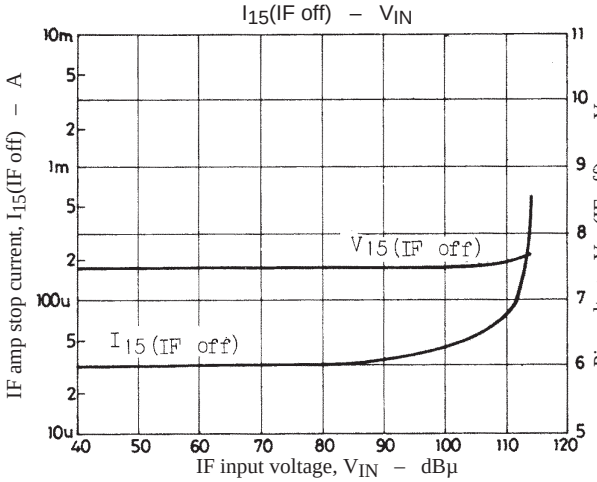
V_{12} - V_{16}



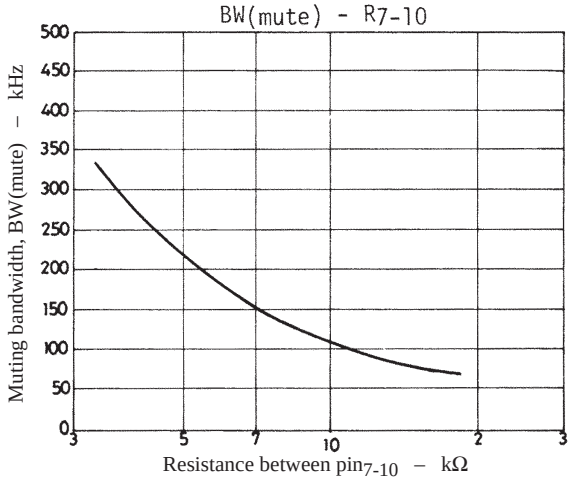
V_{12} - $R_{16\text{-}G}$



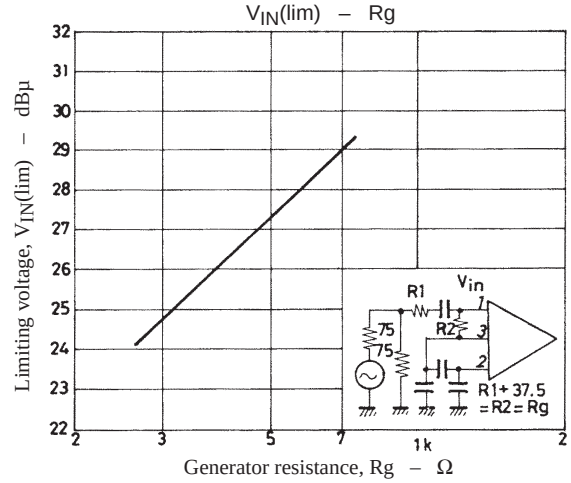
I_{15}(IF off) – V_{IN}



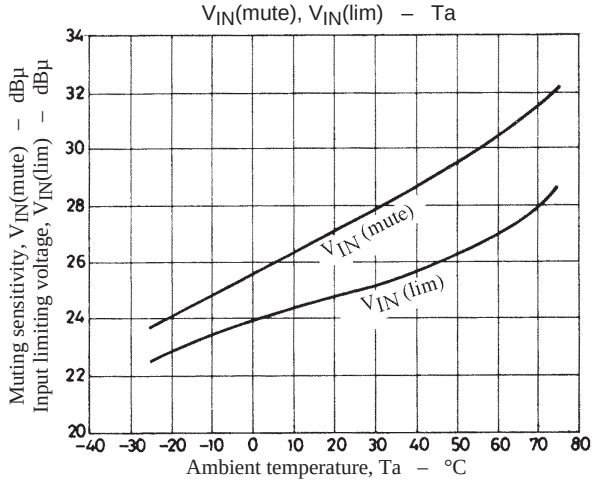
BW(mute) - R7-10



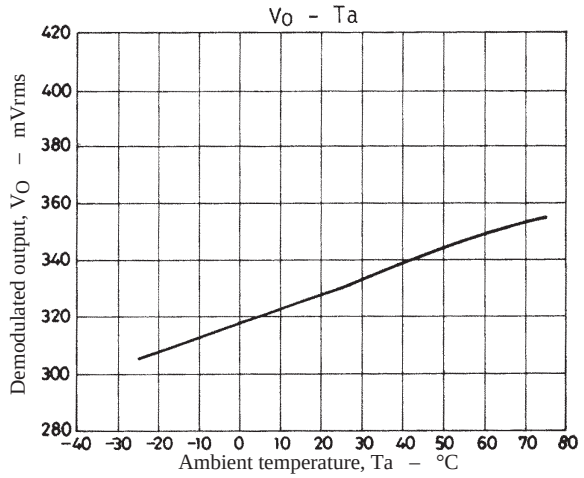
V_{IN}(lim) – Rg



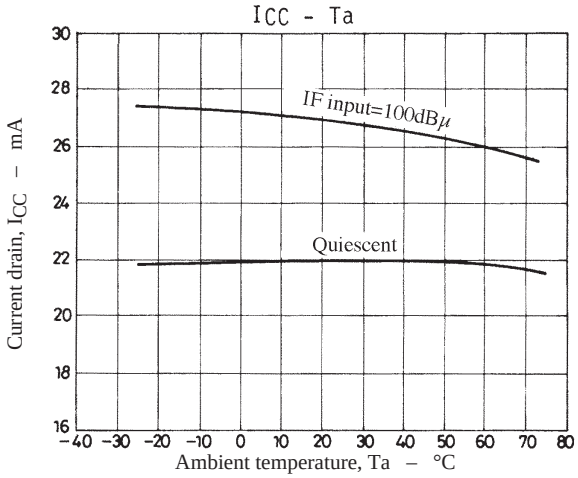
V_{IN}(mute), V_{IN}(lim) – Ta



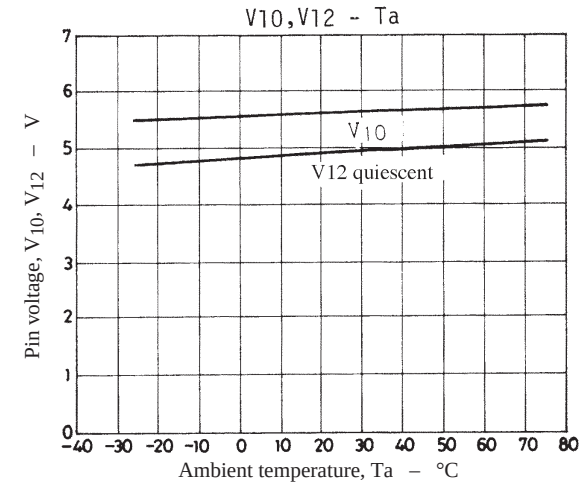
V_O - Ta



ICC - Ta



V10,V12 - Ta



V13 - Ta