Ordering number : EN912E

SANYO Semiconductors
DATA SHEET

Monolithic Linear IC

LA3220 — For Radio Cassette Recorders Equalizer Amplifier with ALC

Overview

The LA3220 is a 2ch-low-noise equalizer amplifier with ALC for radio cassette recorders.

Features

- Dual pre-amp with built-in ALC (pre-amp × 2 + ALC × 2).
- Due to high gain, recording amp can be formed separately (variable monitor possible).
- ALC and direct motor drive obtained through SEPP output stage.
- Good ALC response balance between channels.
- Good reduced voltage characteristic.
- Excellent channel separation.
- Quick stabilization during power supply input.

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		14	V
Allowable current in ALC transistor			3.5	mA
Allowable power dissipation	Pd max	Ta ≤ 40°C	600	mW
Operating temperature	Topr		-20 to +75	°C
Storage temperature	Tstg		-40 to +125	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		5 to 13	V
Load resistance	R_L		not less than 680	Ω

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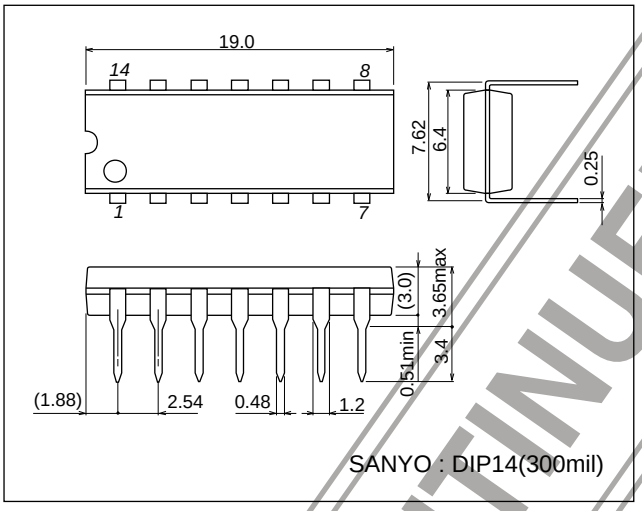
Electrical Characteristics at Ta = 25°C, V_{CC} = 5V, R_L = 10kΩ (PB), Rg = 680Ω (REC), See specified Test Circuit.

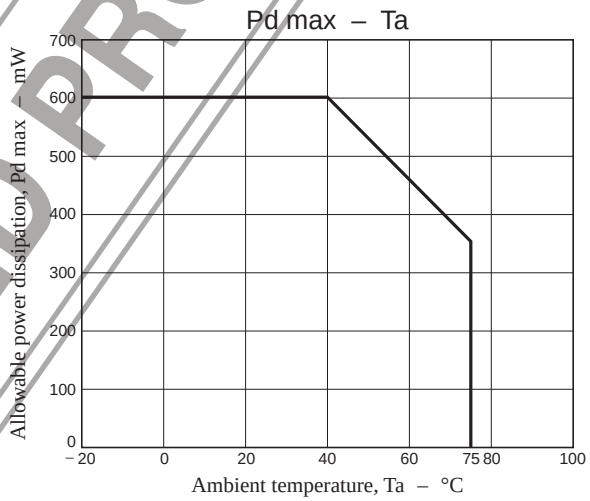
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	I_{CCO}			4.5	10	mA
Open voltage gain	VG_O			85		dB
Voltage gain	V_G	PB		40		dB
		REC		58		dB
Maximum output voltage	V_O max	THD = 1%, PB	0.9	1.2		V
Total harmonic distortion	THD	V_O = 0.5V, PB		0.1	1.0	%
Input resistance	r_i		21	30		kΩ
Channel separation	CHsep	Rg = 2.2kΩ, V_O = 0dBm, PB	40	50		dB
Equivalent input noise voltage	V_{NI}	Rg = 2.2kΩ, B.P.F. = 20Hz to 20kHz, PB		1.0	2.0	μV
ALC width		V_{IN} = -60dBm, REC	35	45		dB
ALC balance		V_{IN} = -20dBm, REC		0	2.0	dB
ALC diatortion		V_{IN} = -20dBm, REC		0.5	2.0	%

Package Dimensions

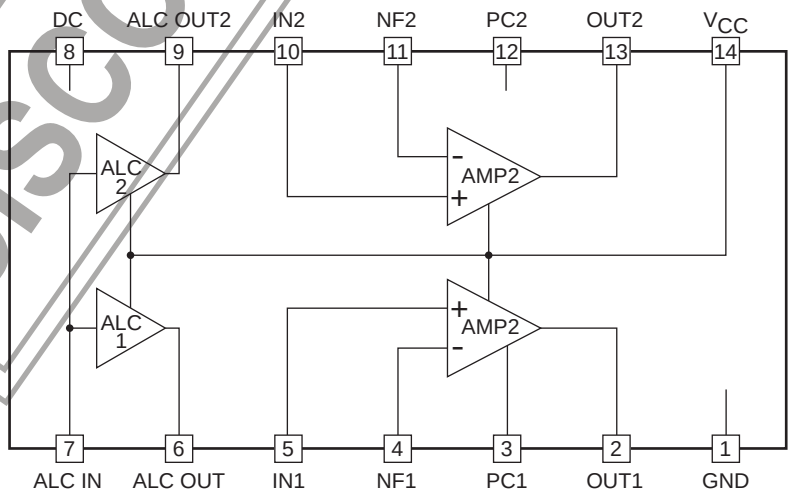
unit : mm (typ)

3003B

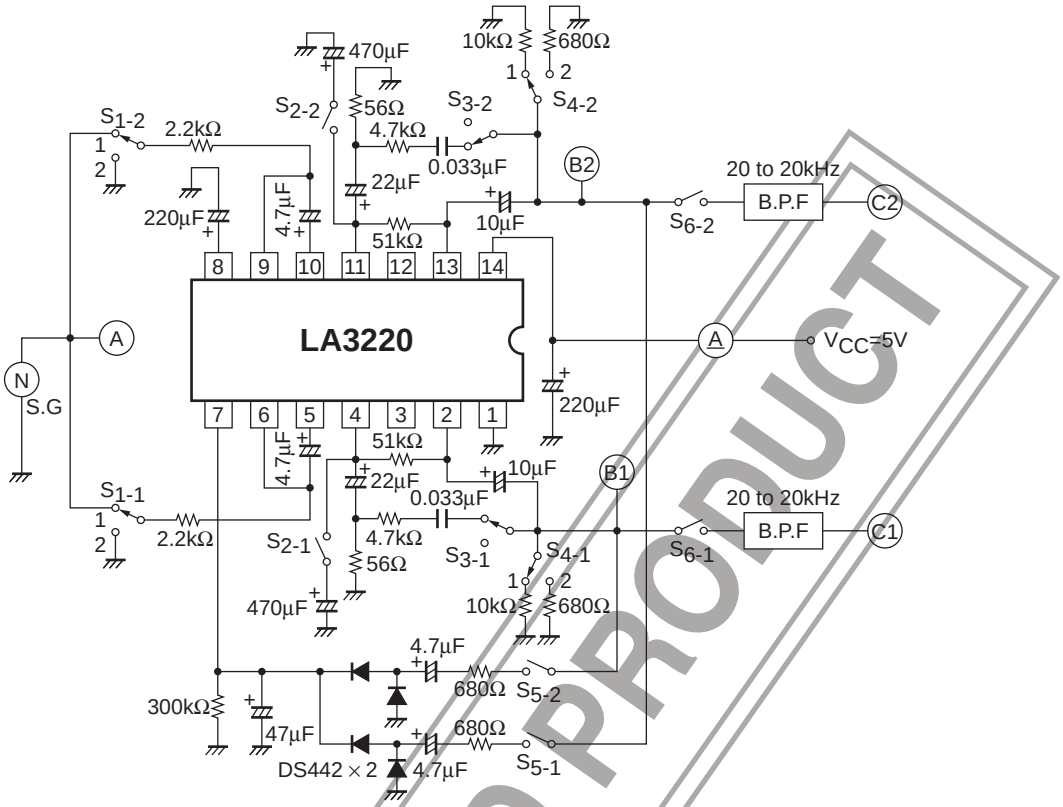




Block Diagram



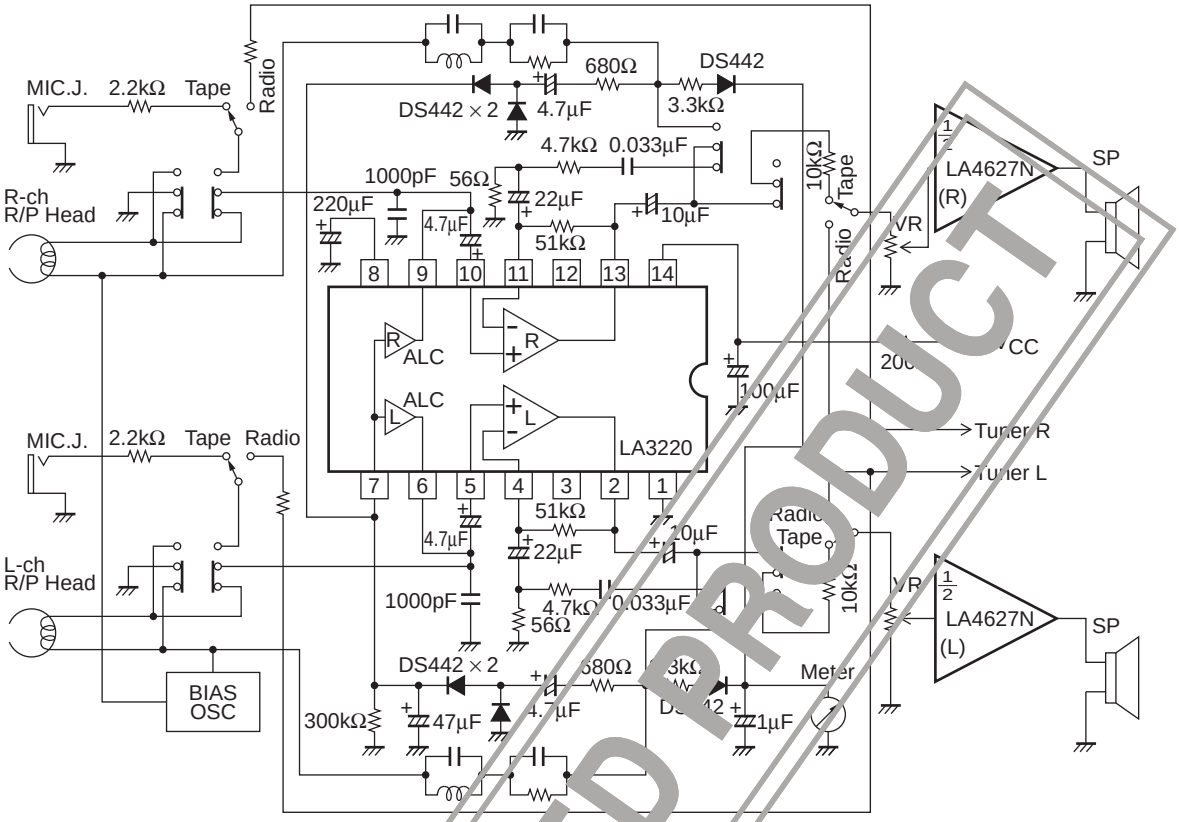
Test Circuit



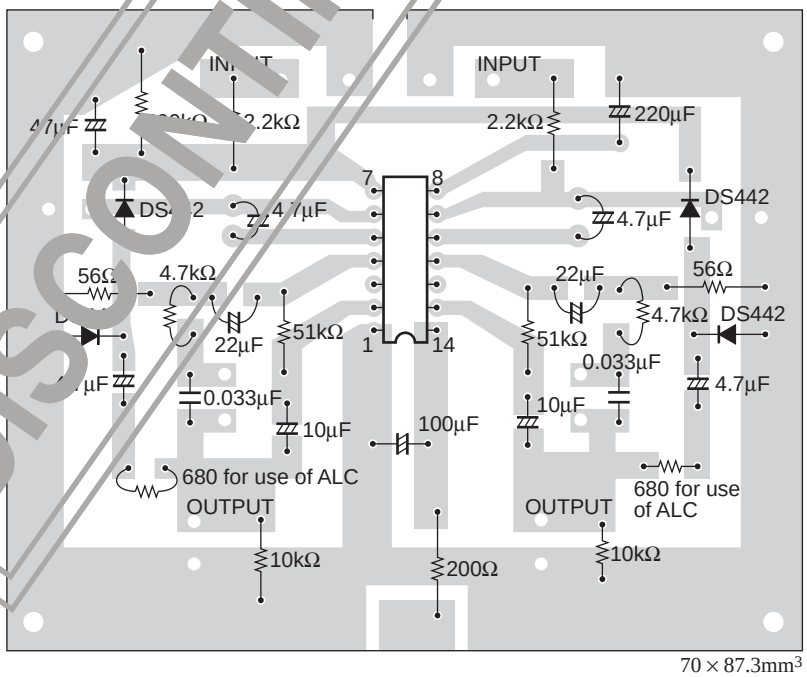
Test Procedure

Item	S1	S2	S3	S4	S5	S6	Measurement location	Procedure
I_{CCO}	2	off	off	1	off	off	-	Read ammeter.
VGo	1	on	off	1	off	off	A, B	Measure at VGo = 20log V_O/V_{IN} (dB) with input voltage at V_{IN} ; output voltage at V_O.
VG	1	off	on	1	off	off	A, B	VG = 20log V_O/V_{IN} (dB)
V_O max	1	off	on	1	off	off	B	Measure output voltage V_O at THD = 1%
THD	1	off	on	1	off	off	B	Measure distortion factor at V_O = 0.5V
CH sep	S_{1-1} S_{1-2} 1 2 2 1	off	on	1	off	off	B	Measure crosstaik of amp 1, 2 at output voltage V_O = 0dBm
V_{NI}	2	off	on	1	off	on	C	Obtain output nois voltage in 1kHz gain equivalent when Rg = 2.2kΩ
ALC width	1	off	off	2	on	off	B	Input voltage renge from when input voltage V_{IN} = -60dBm until output voltage V_O goes up 3dB.
ALC balance	1	off	off	2	on	off	B	Output voltage V_O level differnce between amp 1, 2 when input voltage V_{IN} = -20dBm is applied.
ALC distortion	1	off	off	2	on	off	B	Measure distortion factor when input voltage V_{IN} = -20Bm is applied.

Sample Application Circuit : Variable Moniter System



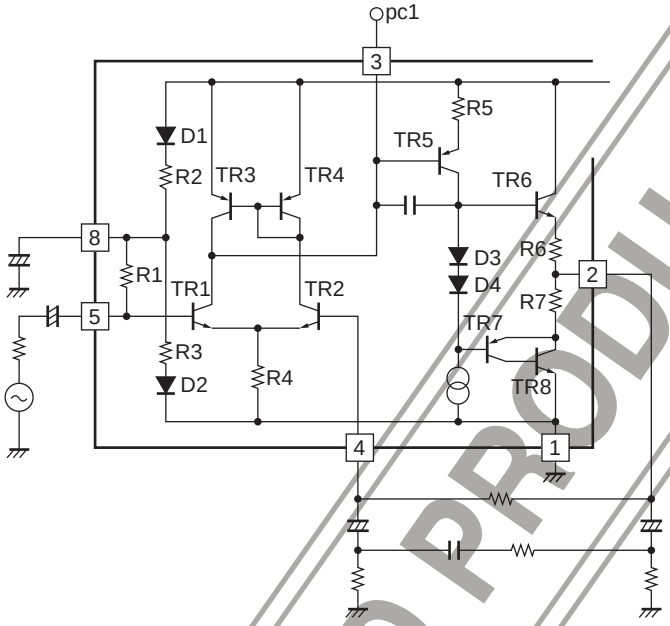
Sample Printed Circuit Pattern (Copper foil side)



70 × 87.3mm³

1. Circuit Construction

1) This is a dual pre-amp composed of AMP × 2, ACL × 2. Input is obtained from NPN differntial TR1, TR2 ; and differntial load uses active element TR3 to obtain high voltage gain. The output stage is push-pull system with drive for low load impedance, and can be directly connected to ALC circuit and meter circuit. Also, because the amp open loop gain is sufficiently high, it can be used for recording amp and variable monitor is possible. Input impedance is determined by built-in resistor R1, and is 30kΩ.



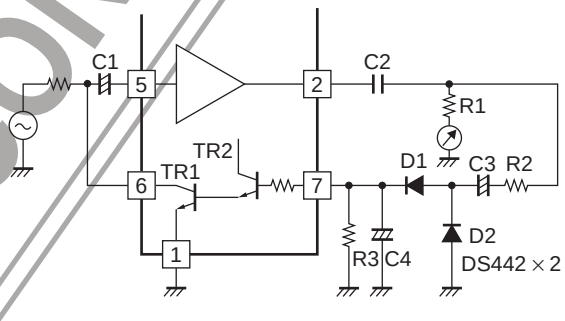
2) ALC Circuit

The ALC circuit is composed of TR1, TR2, and due to DC voltage applied to the 7 control terminals, allows variable impedance between TR1 collector and emitter and controls pre-amp input level.

* Attack Time and Recovery Time

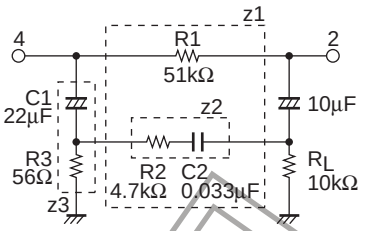
Attack time is between when input signal is applied until ALC begins to operate. Rcover time is between justed by R2, C3 time constant. Recovery time is between when input signal disappears to when amp level returns to the original level. Attack time can be adjusted by C4, R3 time constant.

The rectification circuit, which obtaines ALC control voltage, should be a voltage doubler with superior compression ratio. Also, for low voltage 6V sets, etc., a germanium diode is recommended for D1, D2.



2. Closed loop gain VG (f = 1kHz)

Closed loop voltage gain is gotten at (f = 1kHz) VG ≈ 20log Z1/Z3



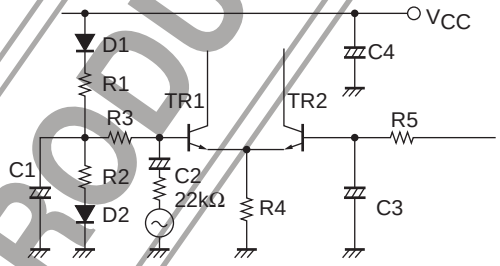
If Z1 = 7.2kΩ
Z3 = 56Ω
VG = 20log $7.2 \times 10^3/56$ becomes = 42dB.

Therefore, equalizer response is determined by these constants.
So, playback amp gain is :
a. 20log R1/R3 in low frequency regions
b. 20log Z2/Z3 in high frequency regions
Recording amp gain is
VG = 20log R1/R3

3. External constants

External constants are related to the operation starting time of the amp.
The operation starting time is designed to be within 0.2s, but in this case it is necessary that the differential TR1 and TR2 is the same in time constant. The condition is :

C1 (R1//R2) = R5 × C3
Example : If C1 = 220μF, R1//R2 = 5kΩ, R5 = 51kΩ
then C3 is 22μF



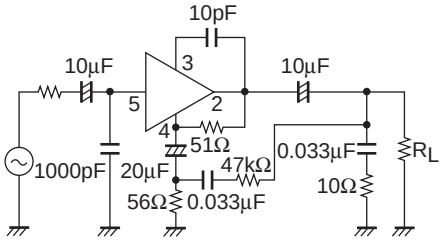
- C1 is a decoupling capacitor, and its capacity changes the ripple rejection rate. (If capacity is large, ripple rejection rate is large.) It is also related to the amp operation starting time, and when R5, C3 time constant is large, C1 must also be made large. The recommended value is 220μF.
- C2 is an input capacitor, and more than 4.7μF is recommended.
- C3 is an NF capacitor, and determines the low region cut-off frequency. If C3 is increased, operation starting time lengthens. 10μF is recommended. The recommended constants therefore are :

R5 (RF)	C1 (CD)	C2 (IN)	C3 (NF)
51k to 100kΩ	220μF	4.7μF	22μF
200kΩ	330μF	10μF	10μF

We do not recommended more than 200kΩ for R5 which lengthens amp operation starting time.

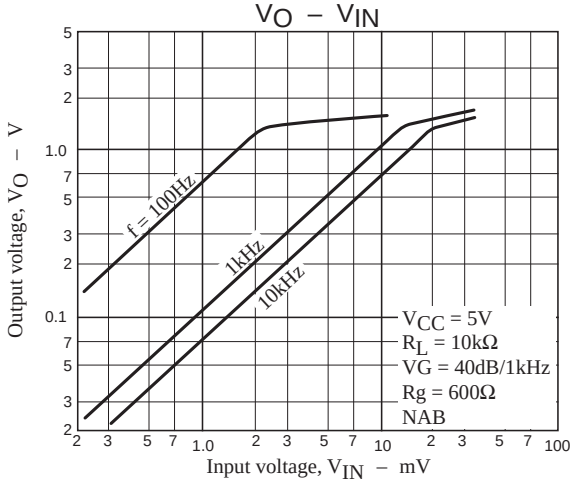
4. Notes on Use

1) Oscillation
When the amp closed loop gain is lowered, oscillation will occur, so when using it with under 40dB gain, connect 10pF between pin 3 and pin 2, and 0.033μF (mylar) + 10Ω to the load end. When closed loop gain is below VG = 30dB, it should not be used.

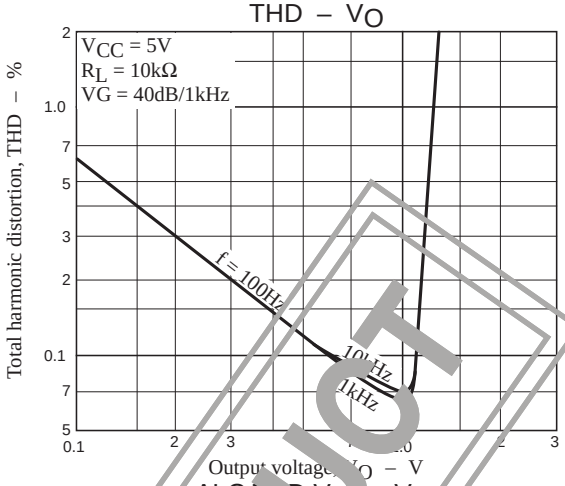


2) Radio Interference Prevention
Connect about 1000pF between input pin (pin 5) and the ground.
3) Maximu Rating
V_{CC} max is V_{CC} = 14V, and it should not go over this. The recommended power supply voltage is 5V to 13V.
4) Load Impedance
The total load impedance as seen from the output terminal should not be less than 680Ω.
5) A shrt between pins will cause breakdown or deterioration.
6) A load short will cause breakdown or deterioration.

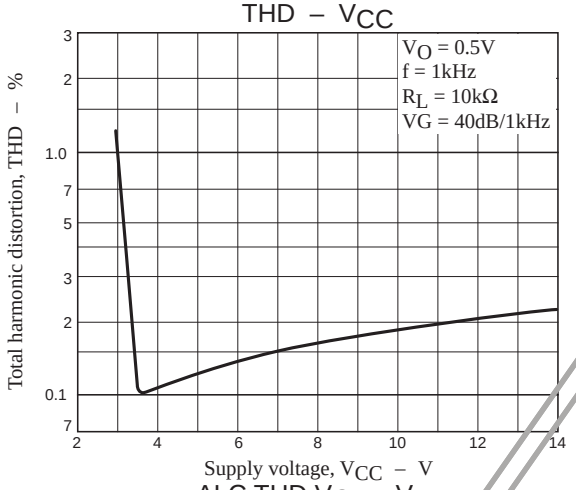
V_O – V_{IN}



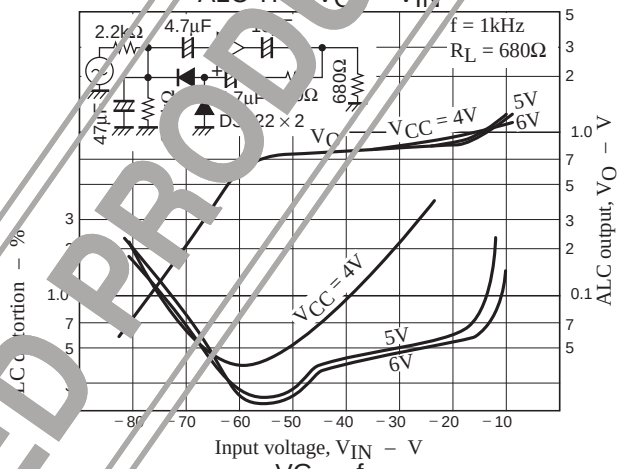
THD – V_O



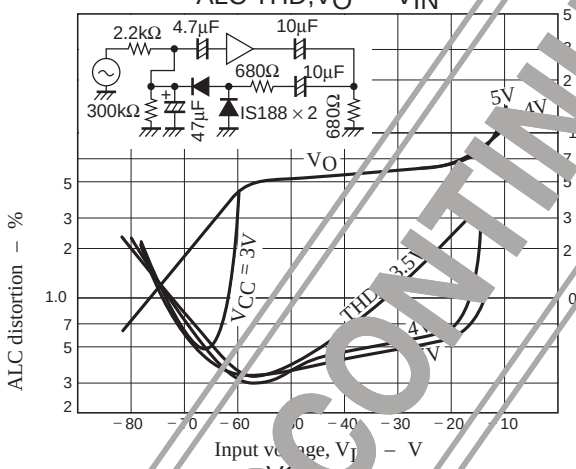
THD – V_{CC}



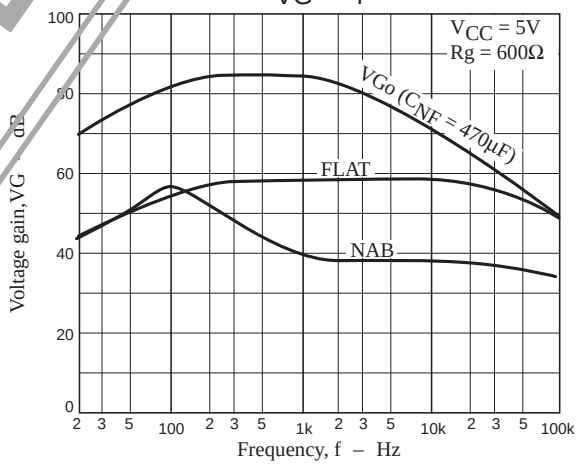
ALC THD,V_O – V_{IN}



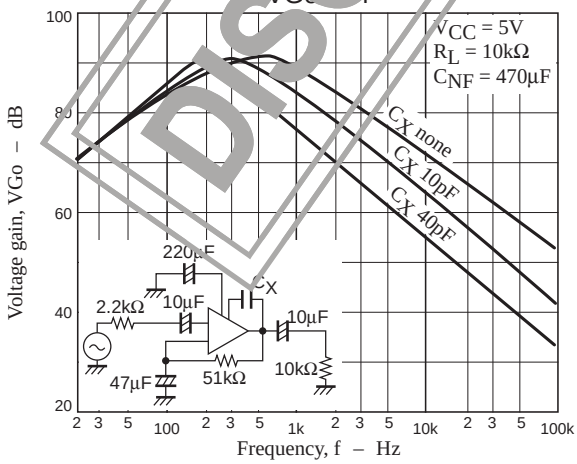
ALC THD,V_O – V_{IN}



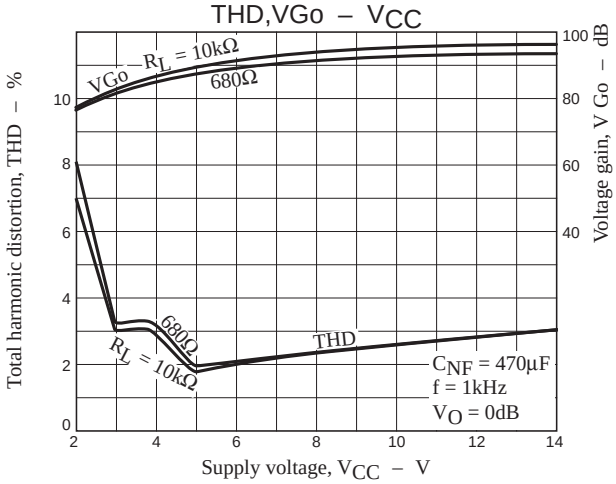
VG – f



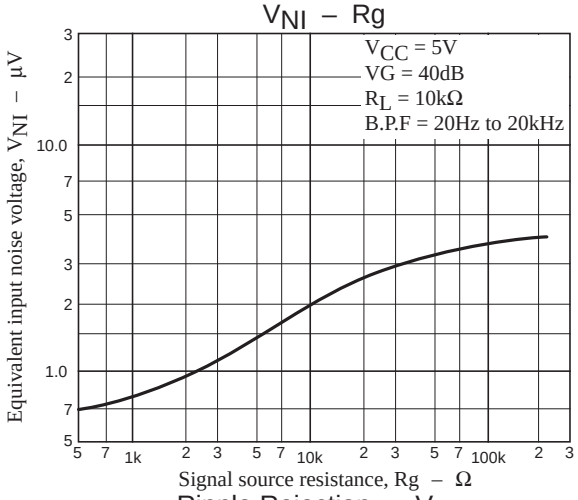
VG – f



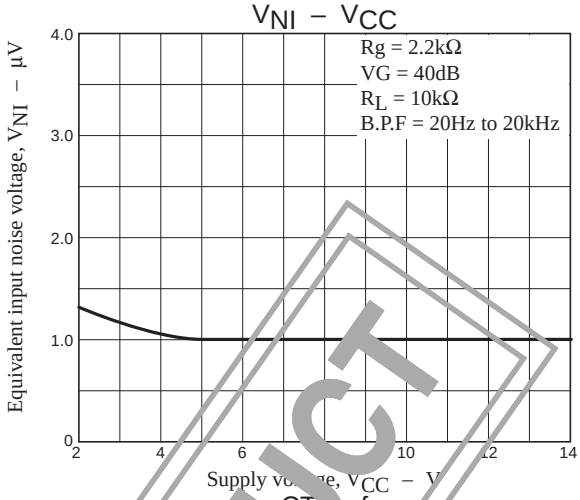
THD,VGo – V_{CC}



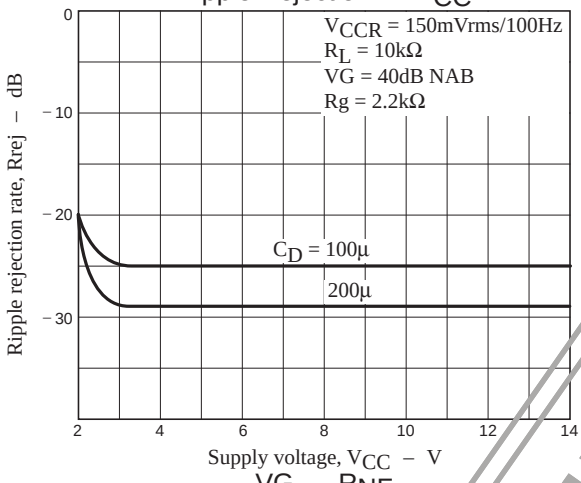
V_{NI} – Rg



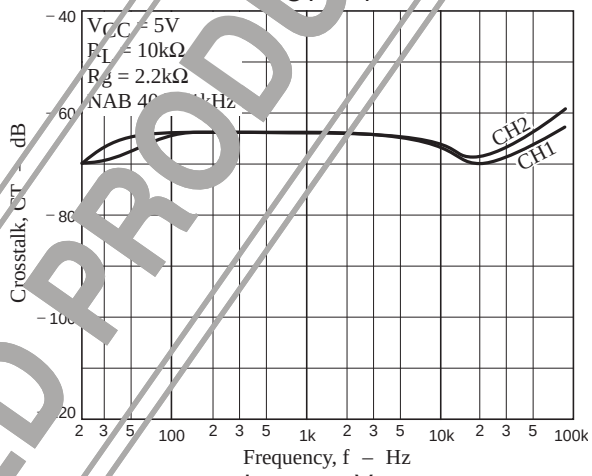
V_{NI} – V_{CC}



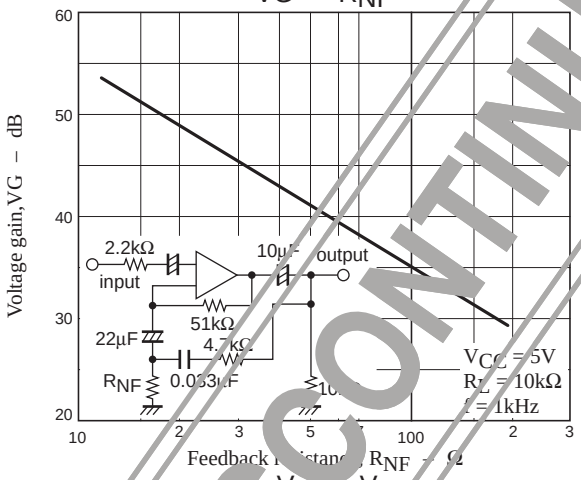
Ripple Rejection – V_{CC}



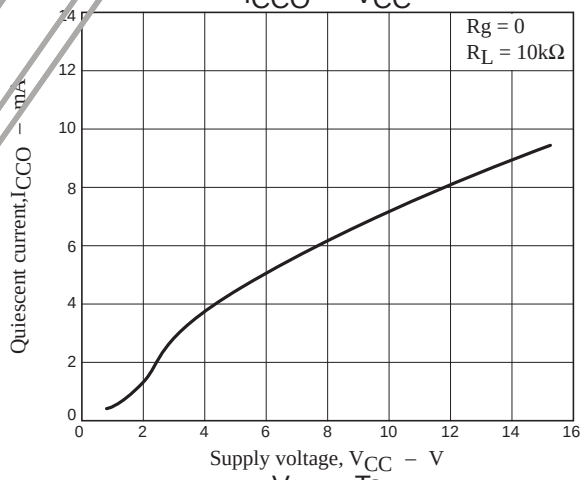
CT – f



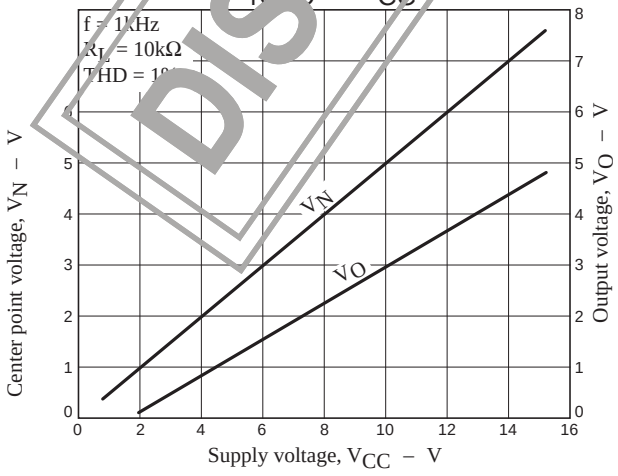
VG – R_{NF}



I_{CCO} – V_{CC}



V_N, V_O – V_{CC}



V_O – Ta