



TA31101 COMPANDER IC FOR CORDLESS TELEPHONE

1. General Description

1.1 Description

The TA31101 is a compander IC for cordless telephone, it is individually composed of the rectification circuit, the gain cell and the operation amplification circuit.

1.2 Features

- Low operation supply voltage and small consumption current make this IC suitable for its application to the sets using the battery such as the cordless telephone set. etc.

$V_{CC}(\text{MIN})=1.8\text{V}(T_a=25^{\circ}\text{C})$

$\text{ICCQ}=2.7\text{mA}(\text{Typ.})(V_{CC}=3\text{V}, T_a=25^{\circ}\text{C})$

- For noise reduction, compressor and expander are incorporated into a package.
- Wide operating supply voltage range:
 $V_{CC}=1.8\text{V}-9\text{V}$
- Recommendable operating supply voltage:
 $V_{CC}=3\text{V}$

1.3 Device Information

PART NUMBER	PACKAGE
TA31101	DIP
	SOP

2. Connection Diagrams and Pin Description

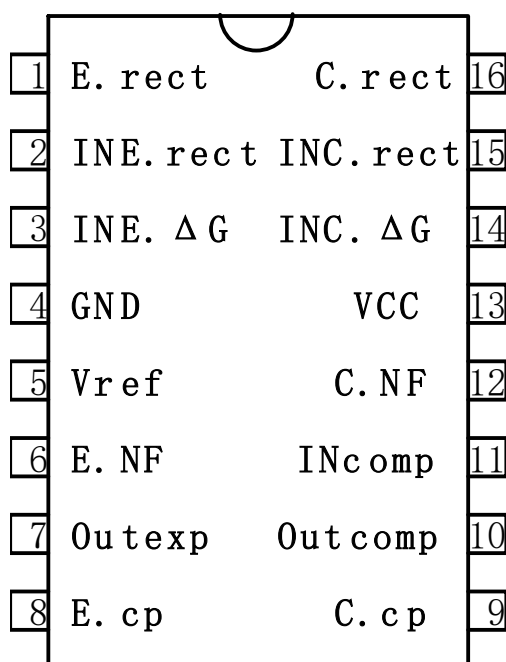


Figure 2.1 Top View

3. System Diagram

3.1 Logic Diagram

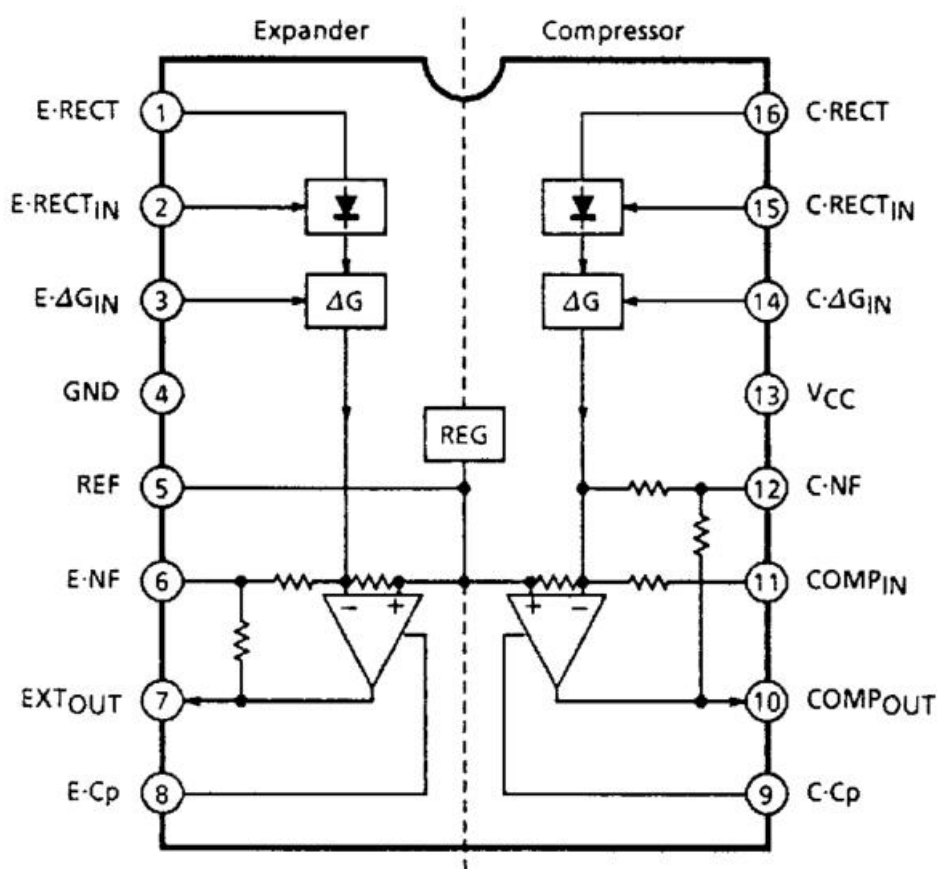


Figure 3.1: TA31101 Logic Diagram

4. Specifications

4.1 Absolute Maximum Ratings

Symbol	Parameter	MIN	MAX	Unit
V _{CC}	Supply Voltage		10	V
T _{stg}	Storage Temperature	-55	150	°C
T _{OP}	Operating Temperature	-25	75	°C

Absolute maximum ratings are those values beyond which the device could be permanently damaged. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions.



4.2 Electrical Characteristics

4.2.1 DC Specifications

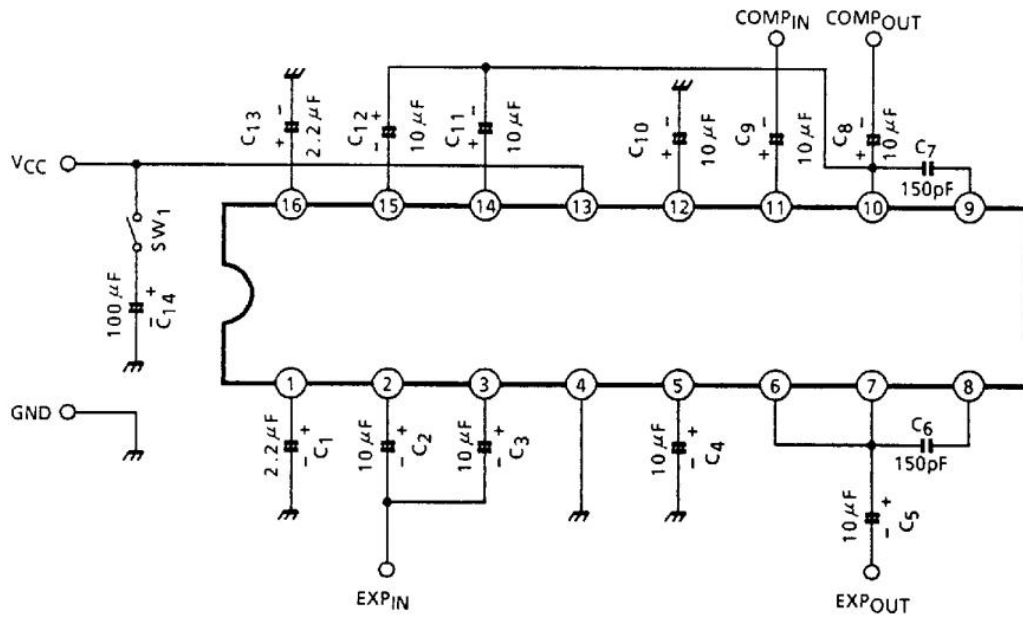
(Vcc=3V, f=1KHZ, Ta = 25°C, 0dB = -20dBV unless otherwise specified)

Characteristic		Symbol	Test Condition	Test Circuit	Min	Tye	Max	Unit
Supply Voltage		Vcc	--		1.8	3.0	9	V
Quiescent Current		IccQ	Vcc=3V	1	--	2.7	5.0	mA
Input Reference Level		Vref	Vin=Vout	2	-21.5	-20.0	-18.5	dBV
Total Harmonic Distortion	COMP	THDC	Vin=0dB	3	--	-55	-46	dB
	EXP	THDE			--	-55	-46	
Output Noise Voltage	COMP	VNOC	Vin= -∞, F=15HZ-20KHZ	4	--	0.5	--	mVrms
	EXP	VNOE			--	15	--	uVrms
Cross Talk		CT(C→E)	Vin=0dBV	5	--	-95	--	dBV
		CT(E→C)	Vin=-12dBV	6	--	-55	--	
Ripple Rejection Ratio		RR _{COMP}	VR=100mVrms, F=1KHZ	7	--	-30	--	dB
		RR _{EXP}			--	-60	--	
Maximum Output Voltage(EXP)		Vom	RL=10KΩ	8	--	800	--	mVrms
Frequency Characteristic		FRCOMP	Vin=0dB,f=200-3500HZ and f=1KHZ are references	10	--	±0.1	--	dB
		FREXP			--	±0.1	--	
Output Deviation(Note 1)		COMP	Voc1	9	-0.4	0.1	0.6	dB
			Vin= 20dB					
			Voc2		-0.5	0	0.5	
		EXP	Vin= -20dB	9	-0.6	-0.1	0.4	
			Voc3		-0.6	-0.1	0.4	
			Vin= -40dB		-0.6	-0.1	0.4	
		EXP	Voe1	9	-1.1	-0.1	0.9	
			Vin= 6.5dB		-1.1	-0.1	0.9	
			Voe2		-0.9	0.1	1.1	
		EXP	Vin= -10dB	9	-0.9	0.1	1.1	
			Vin= -25dB		-1.0	0	1.0	

Note1: Output Deviation = (Vout - Vref) - Vin×αβ ;

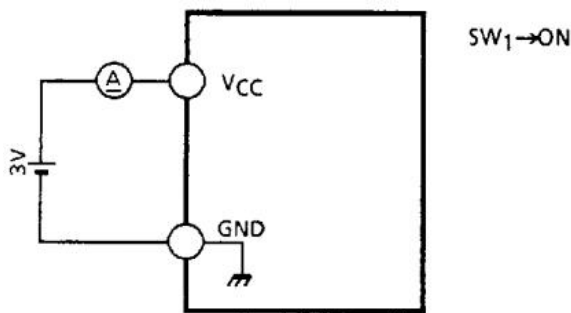
αβ: (COMP=0.5,EXP=2)

4.2.2 Test Circuit

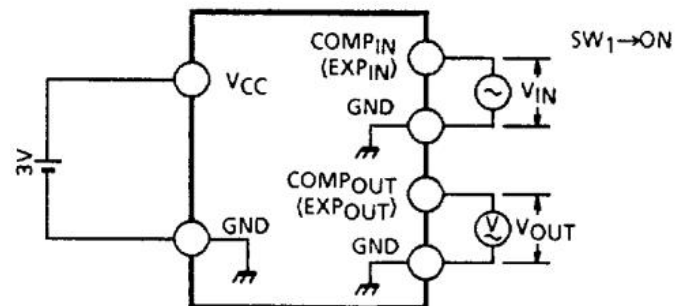


Test Circuit:

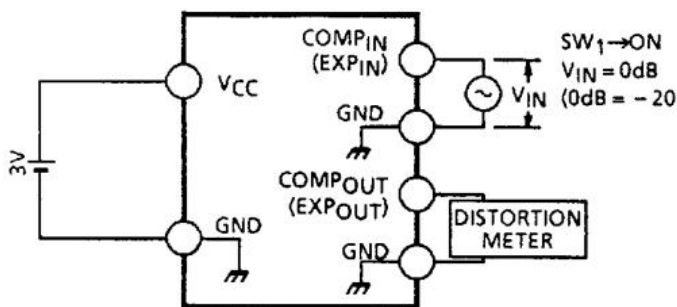
1: I_{CCQ}



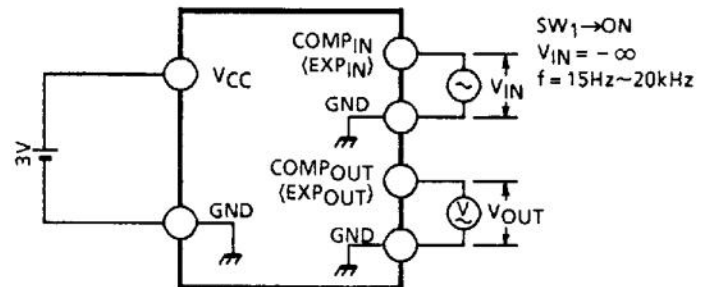
2: V_{REF}



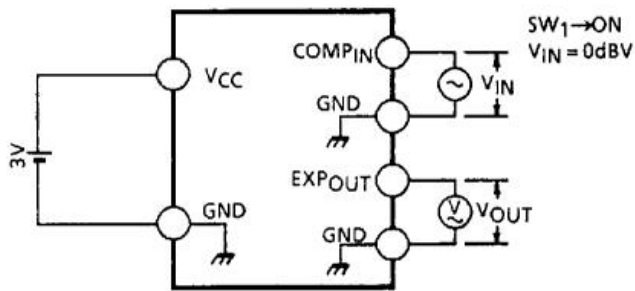
3: THDC, THDE



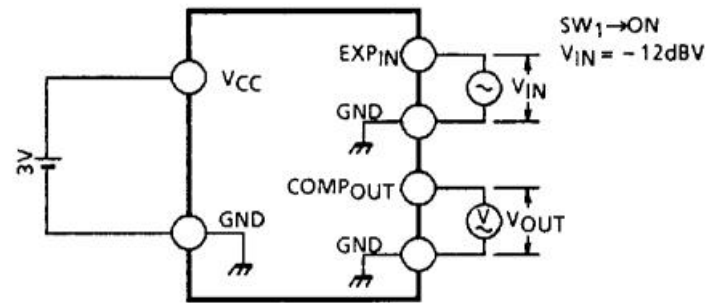
4: V_{NOC} , V_{NOE}



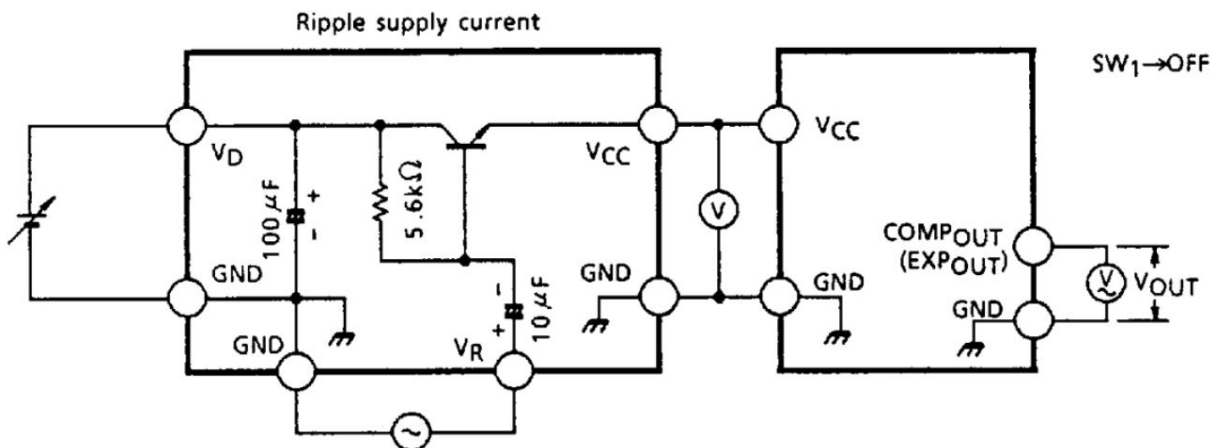
5: CT(C→E)



6: CT(E→C)

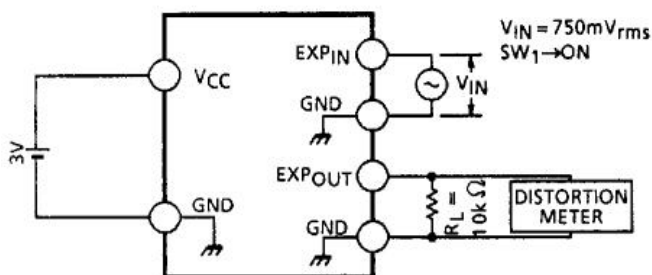


7: RR_{COMP} , RR_{EXP}

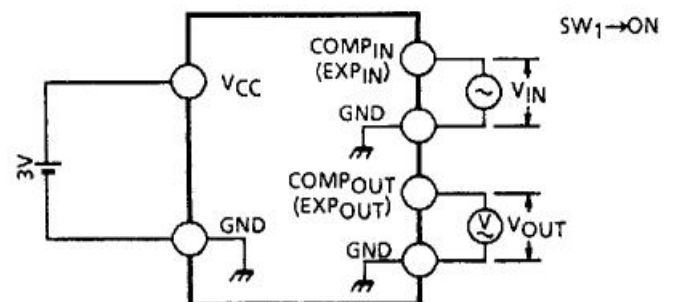


Setting is made so as to make V_{CC} become 3V

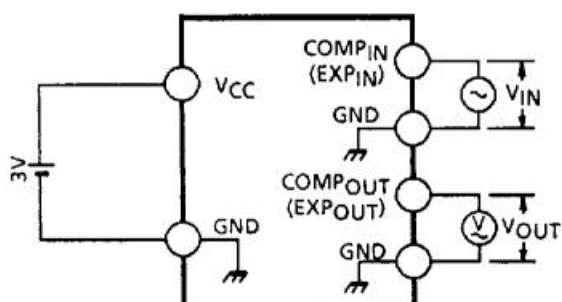
8: Vom



9: $V_{oc1,2,3}$, $V_{oe1,2,3}$



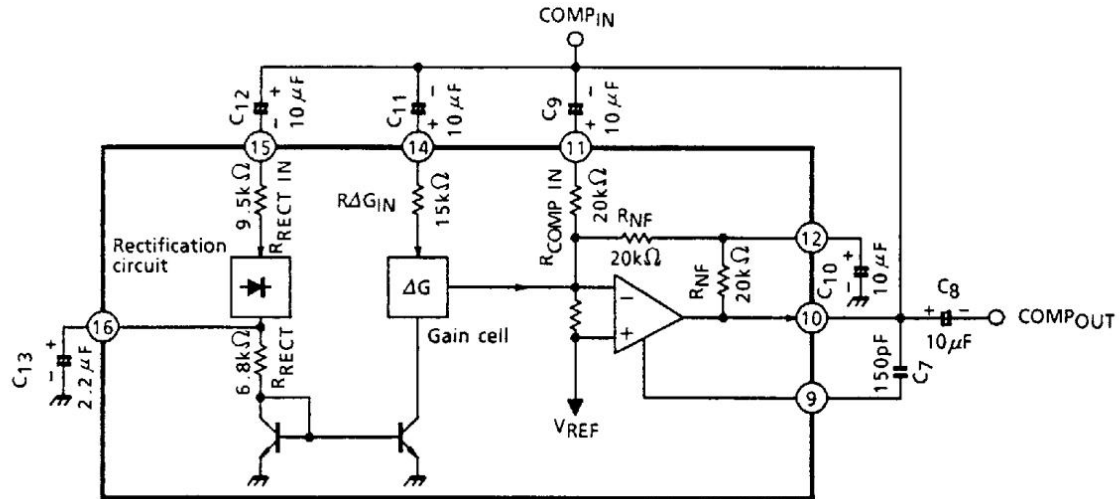
10: FR_{COMP} , FR_{EXP}



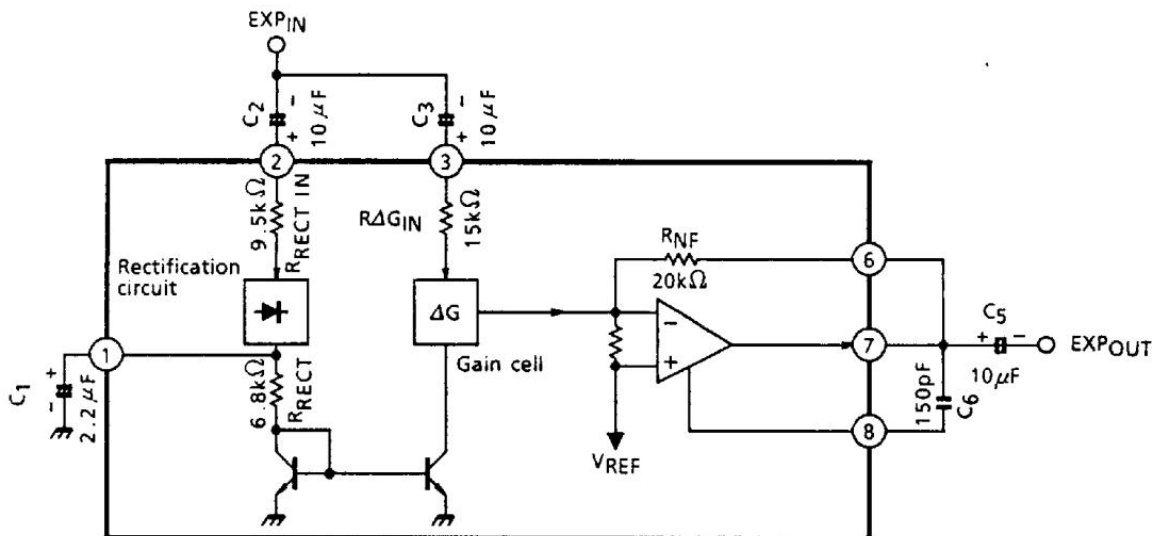
5. Circuit Description

The compressor and the expander of this IC are individually composed of the rectification circuit, the gain cell and the operation amplification circuit as shown in the figure below.

Compressor



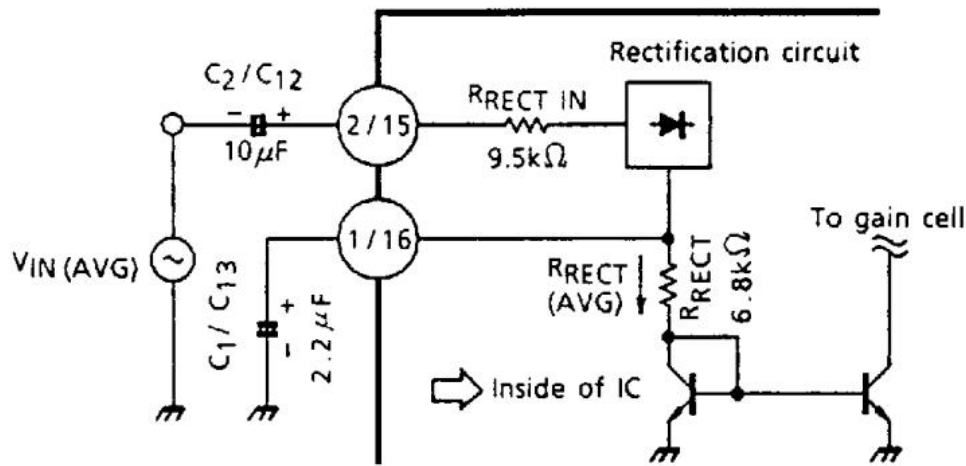
Expander



5.1 Rectification circuit

In this circuit, the feedback-type full-wave rectification circuit is applied for improving the precision of detection, and the response characteristics (attack time, recovery time) are determined by the time constant of the smoothing capacitor of the rectifying output current connected to the E·RECT terminal and the C·RECT terminal (pin 1, pin 16) and by the time constant of the internal resistance of IC.

The internal resistance of E·RECT terminal and C·RECT terminal (pin 1, pin 16) becomes the series resistance of the R·RET 6.8Ω and the emitter resistance r_e in the current miller circuit. The emitter resistance r_e of transistor varies according to the signal level as shown below.



$$3 \cdot \frac{V_{IN(AVG)}}{R_{RECTIN}} = I_{RECT(AVG)}$$

$$r_e = \frac{V_T}{I_{RECT(AVG)}} (\Omega)$$

$V_{IN(AVG)}$: Mean input signal voltage

$I_{RECT(AVG)}$: Mean rectification output2

r_e : Emitter resistance

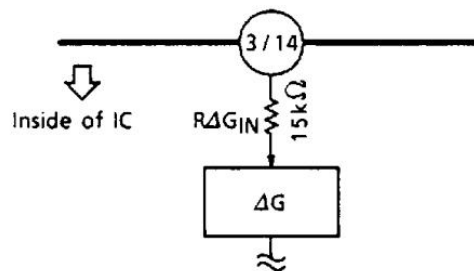
Approx. 26mV (At room temperature)

The input resistance of the input $E \cdot R_{RECTIN}$ terminal and $C \cdot R_{RECTIN}$ terminal (pin 2, pin 15) of the rectification circuit is approximately 9.5kΩ.

5.2 Gain cell(ΔG)

This circuit is a variable gain amplifier for controlling the gain with the rectification output current of the rectification circuit.

The input resistance of the input $E \cdot \Delta G_{IN}$ terminal and $C \cdot \Delta G_{IN}$ terminal of the gain cell (pin 3, pin 14) is approximately 15kΩ.



5.3 Operation amplification circuit

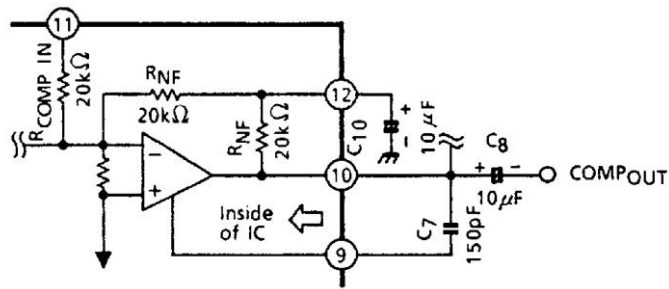
In the compressor, since the variable gain amplifier is involved in the feedback loop of the operation amplification circuit, the oscillation is liable to be generated, however, in this circuit since the $C \cdot CP$ terminal (pin 9) for phase compensation is provided, the countermeasure can be taken against the oscillation through the external capacitor.

In the compressor, for making the current gain maximum, the capacitor for decoupling the current signal is connected to the $C \cdot NF$ terminal (pin 12).

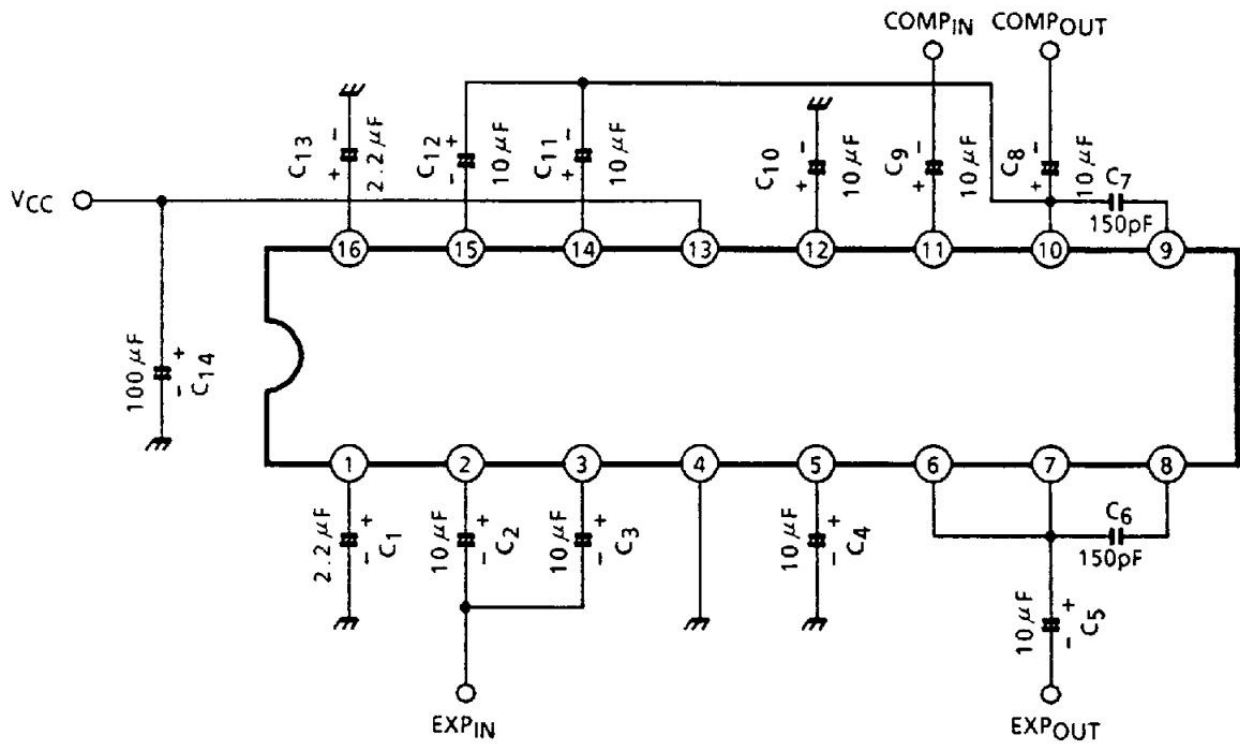
The cut-off frequency of the compressor is determined by the product of the capacitor $C10$ connected to the $C \cdot NF$ terminal multiplied by R_{NF} 20kΩ of the internal resistance.

The cut-off frequency is obtained by the expression below.

$$f_c = \frac{1}{2\pi \cdot C_{10} \cdot R_{NF}}$$



6. Application Circuit





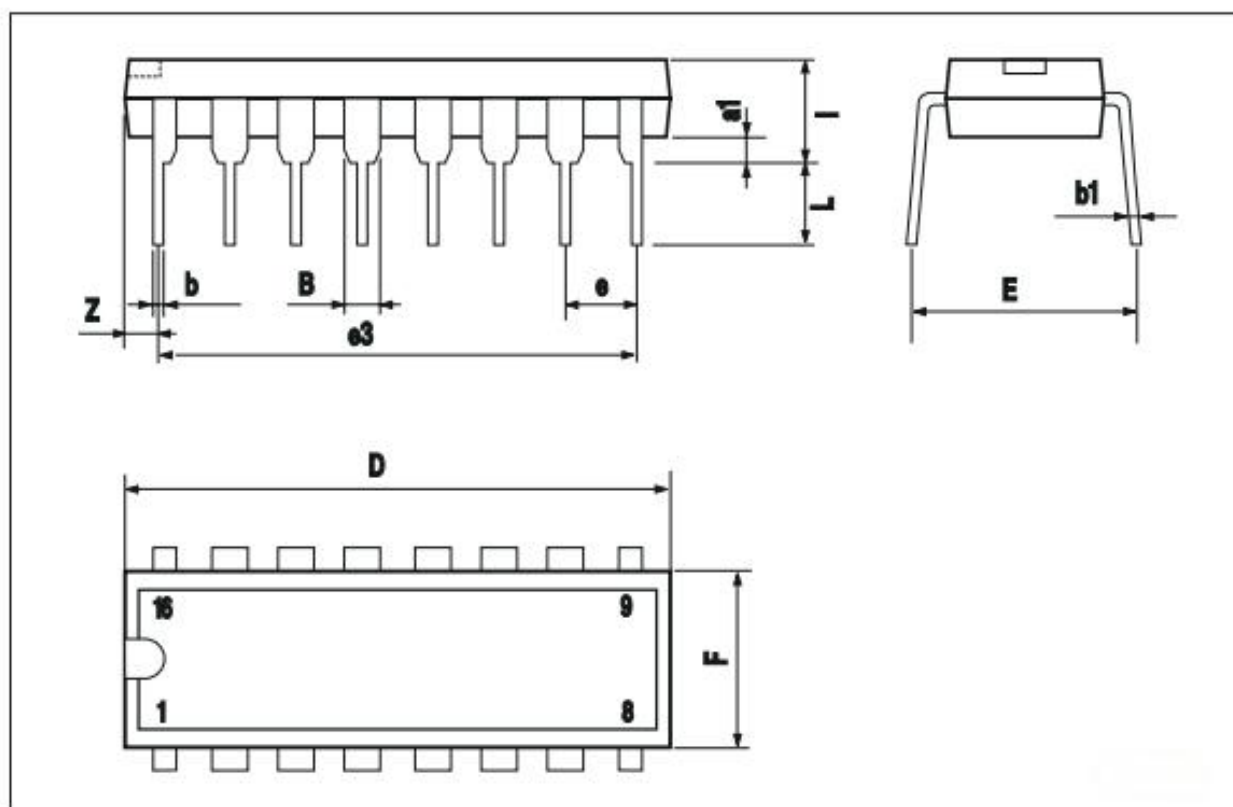
7. Ordering Information

Orderable Device	Package Type	Pins	Packing	Package Qty
TA31101ND16ATBE	DIP	16	Tube	25
TA31101NS16ARDQ	SOP	16	Tape & Reel	4000

8. Package Information

8.1 DIP16

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



8.2 SOP16

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					

