

COMPANDER IC FOR CORDLESS TELEPHONE

FEATURES

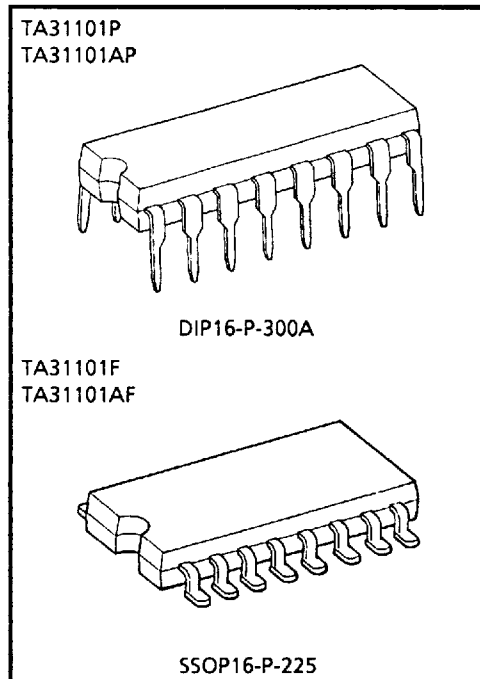
- Low operating supply voltage and small consumption current make this IC suitable for its application to the sets using the battery such as the codeless telephone set, etc.

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

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

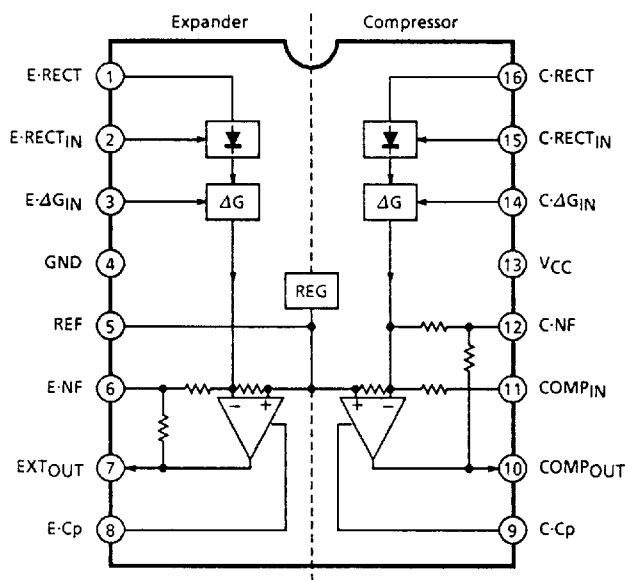
- For noise reduction, compressor and expander are incorporated into a package.
- Wide operating supply voltage range : $V_{CC} = 1.8 \sim 9\text{V}$
- Recommendable operating supply voltage : $V_{CC} = 3\text{V}$
- Difference between TA31101P, TA31101F and TA31101AP, TA31101AF

| NAME OF PRODUCT | INPUT REFERENCE LEVEL (Typ.) |
|----------------------|------------------------------|
| TA31101P, TA31101F | - 18.5dBV |
| TA31101AP, TA31101AF | - 20.0dBV |



Weight DIP16-P-300A : 1.1g (Typ.)
SSOP16-P-225 : 0.14g (Typ.)

BLOCK DIAGRAM



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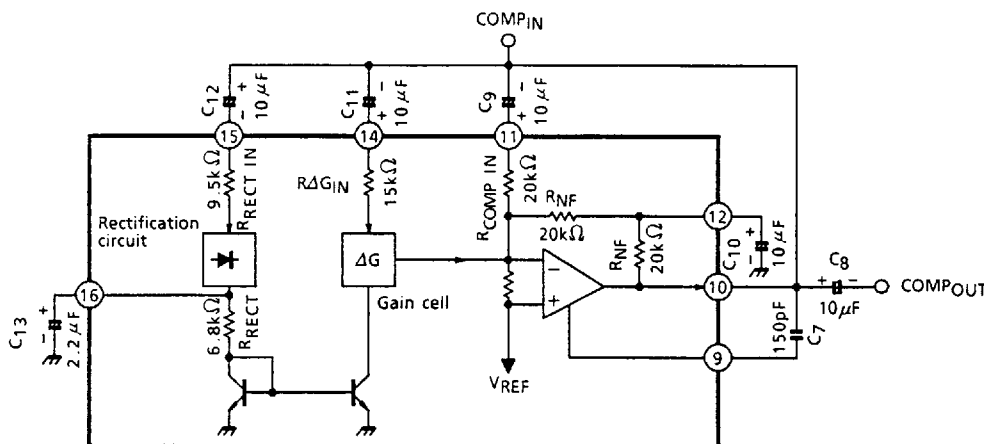
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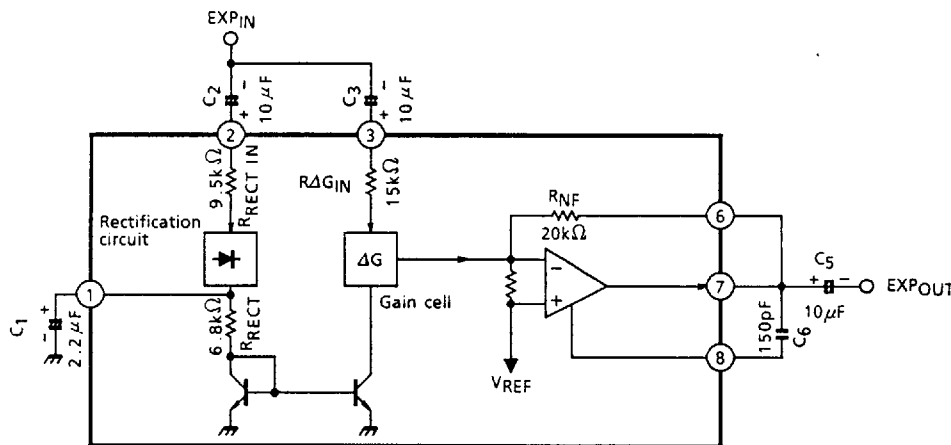
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The compressor and the expander of this IC are individually composed of the rectification circuit, the gain cell and the operation amplification circuit as shown in the figure below.

Compressor



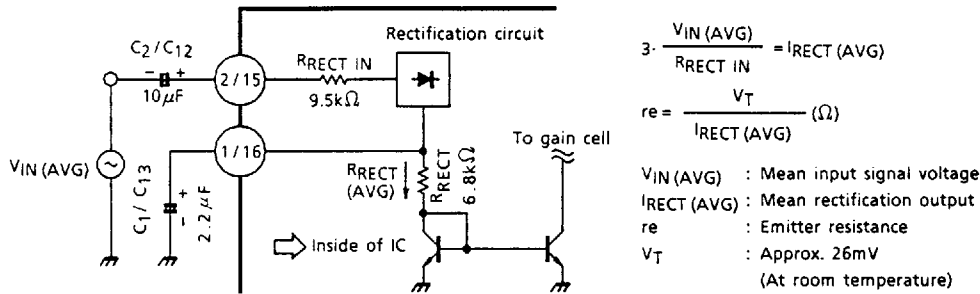
Expander



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-RECT 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.

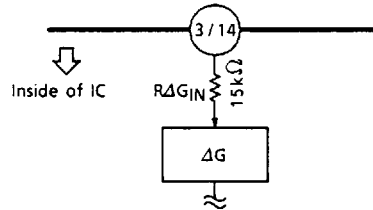


- The input resistance of the input E-RECT_{IN} terminal and C-RECT_{IN} terminal (pin 2, pin 15) of the rectification circuit is approximately 9.5kΩ.

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-ΔG_{IN} terminal and C-ΔG_{IN} terminal of the gain cell (pin 3, pin 14) is approximately 15kΩ.



3. Operation amplification circuit

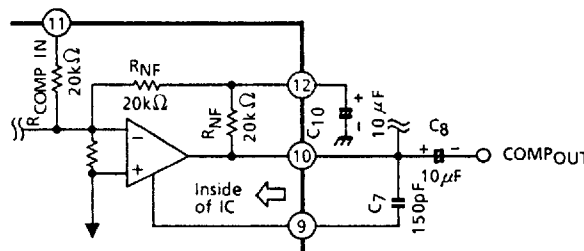
In the compressor, since the variable gain amplifier is involved in the feedback loop of the operation amplification circuit, the oscillation is liable to be generated, however, in this circuit, since the C-Cp terminal (pin 9) for phase compensation is provided, the countermeasure can be taken against 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-NF terminal (pin 12).

The cut-off frequency of the compressor is determined by the product of the capacitor C_{10} connected to the C-NF terminal multiplied by R_{NF} 20kΩ of the internal resistance.

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

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



MAXIMUM RATINGS (Ta = 25°C)

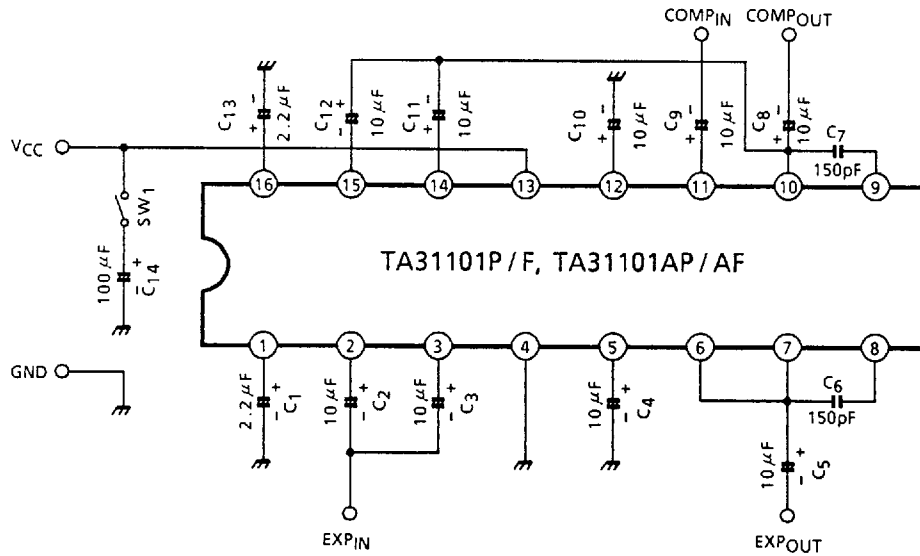
| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|-----------------------|--------|------------------|---------|------|
| Supply Voltage | | V _{CC} | 10 | V |
| Power Dissipation | P type | P _D | 1000 | mW |
| | F type | | 370 | |
| Operating Temperature | | T _{opr} | -25~75 | °C |
| Storage Temperature | | T _{stg} | -55~150 | °C |

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{CC} = 3V, f = 1kHz, Ta = 25°C, 0dB = -20dBV)

| CHARACTERISTIC | | SYMBOL | TEST CIRCUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|------------------------------|-----------|------------------|--------------|--|-------|-------|-------|-------------------|
| Supply Voltage | | V _{CC} | — | — | 1.8 | 3.0 | 9.0 | V |
| Quiescent Current | | I _{CCQ} | 1 | V _{CC} = 3.0V | — | 2.7 | 5.0 | mA |
| Input Reference Level | TA31101P | V _{REF} | 2 | V _{IN} = V _{OUT} | -20.0 | -18.5 | -17.0 | dBV |
| | TA31101F | | | | | | | |
| | TA31101AP | | | | -21.5 | -20.0 | -18.5 | |
| | TA31101AF | | | | | | | |
| Total Harmonic Distortion | COMP | THD _C | 3 | V _{IN} = 0dB | — | -55 | -46 | dB |
| | EXP | THD _E | | | | | | |
| Output Noise Voltage | COMP | V _{NOC} | 4 | V _{IN} = -∞, f = 15Hz~20kHz | — | 0.5 | — | mV _{rms} |
| | EXP | V _{NOE} | | | | | | — |
| Cross Talk | C→E | CT (C→E) | 5 | V _{IN} = 0dBV | — | -95 | — | dBV |
| | E→C | CT (E→C) | 6 | V _{IN} = -12dBV | | | | |
| Ripple Rejection Ratio | COMP | RRC | 7 | V _R = 100mV _{rms} , f = 1kHz | — | -30 | — | dB |
| | EXP | RRE | | | | | | |
| Maximum Output Voltage (EXP) | | V _{OM} | 8 | R _L = 10kΩ | — | 800 | — | mV _{rms} |
| Output Deviation (Note 1) | COMP | V _{OC1} | 9 | V _{IN} = 20dB | -0.4 | 0.1 | 0.6 | dB |
| | | V _{OC2} | | V _{IN} = -20dB | -0.5 | 0 | 0.5 | |
| | | V _{OC3} | | V _{IN} = -40dB | -0.6 | -0.1 | 0.4 | |
| | EXP | V _{OE1} | 9 | V _{IN} = 6.5dB | -1.1 | -0.1 | 0.9 | |
| | | V _{OE2} | | V _{IN} = -10dB | -0.9 | 0.1 | 1.1 | |
| | | V _{OE3} | | V _{IN} = -25dB | -1.0 | 0 | 1.0 | |
| Frequency Characteristic | COMP | FRC | 10 | V _{IN} = 0dB, f = 200~3500Hz and f = 1kHz are references. | — | ±0.1 | — | dB |
| | EXP | FRE | | | | | | |

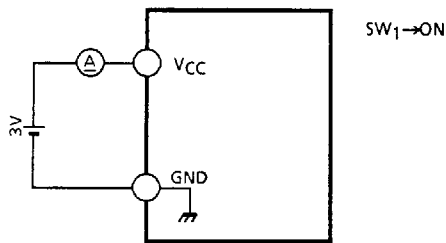
Note 1 : Output deviation = (V_{OUT} - V_{REF}) - V_{IN} × αβ
αβ : (COMP = 0.5, EXP = 2)

TEST CIRCUIT

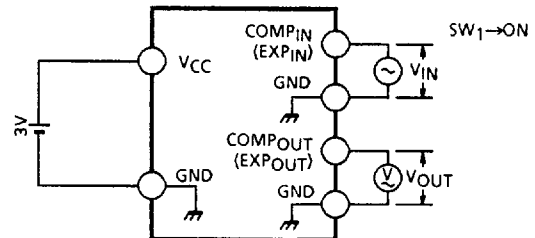


TEST CIRCUIT

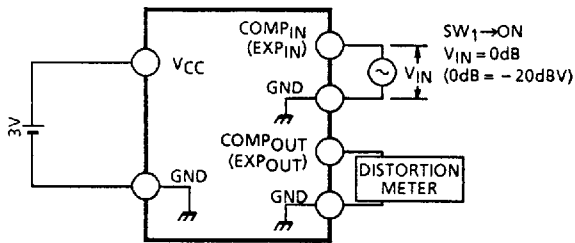
(1) I_{CCQ}



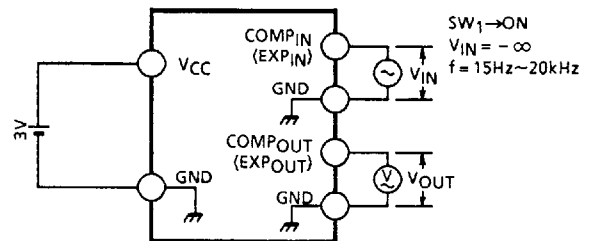
(2) V_{REF}



(3) THD_C, THD_E



(4) V_{NOC}, V_{NOE}

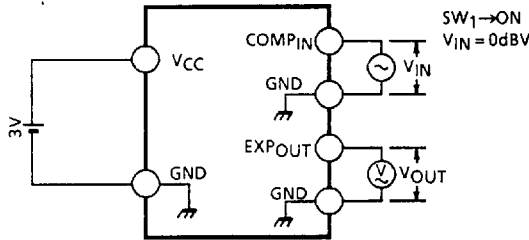


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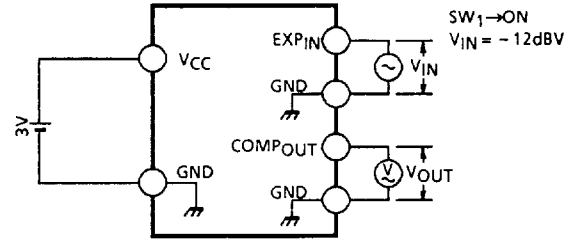
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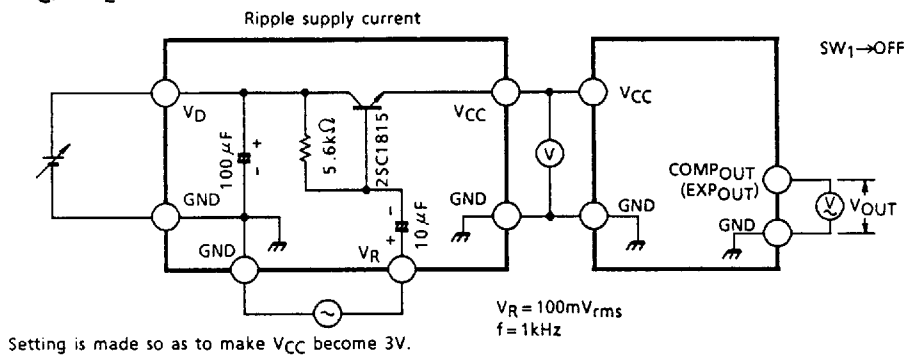
(5) CT (C→E)



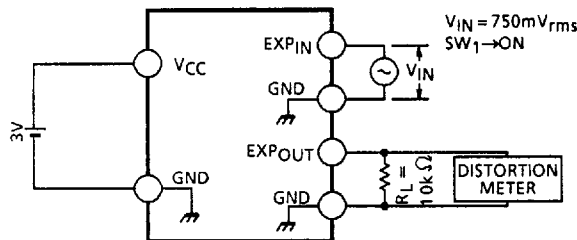
(6) CT (E→C)



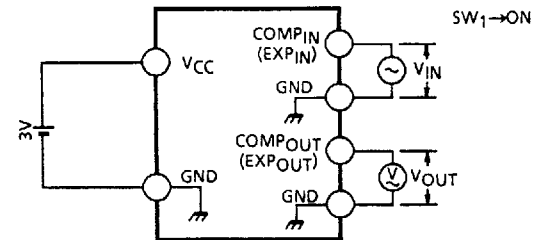
(7) RR_C, RR_E



(8) V_{OM}



(9) V_{OC1, 2, 3}, V_{OE1, 2, 3}



Note : OUTPUT DEVIATION

$$= (V_{OUT} - V_{REF}) - V_{IN} \times \alpha\beta$$

$$\alpha\beta : (\text{COMP} = 0.5, \text{EXP} = 2)$$

$$(\text{0dB} = -20\text{dBV})$$

$$V_{OC1} \rightarrow V_{IN} = +20\text{dB}$$

$$V_{OE1} \rightarrow V_{IN} = +6.5\text{dB}$$

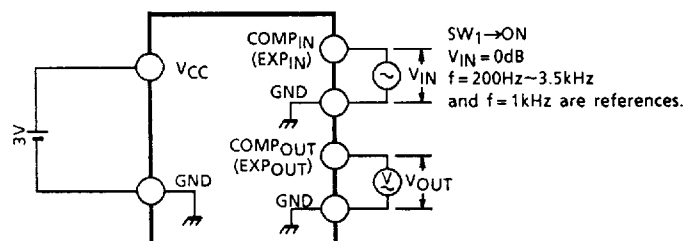
$$V_{OC2} \rightarrow V_{IN} = -20\text{dB}$$

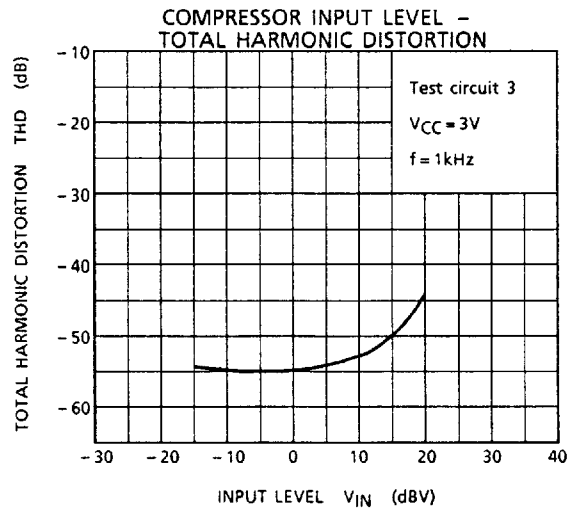
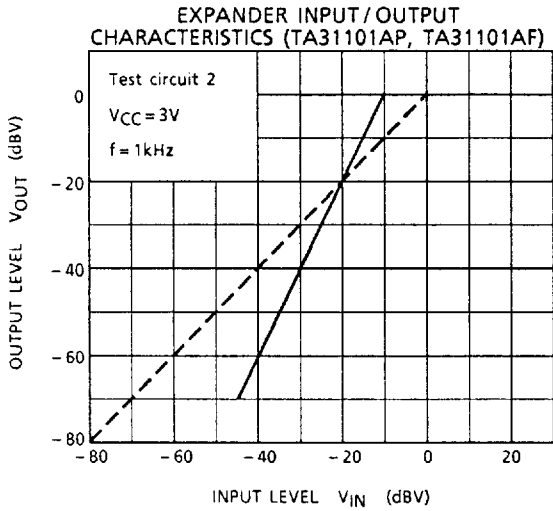
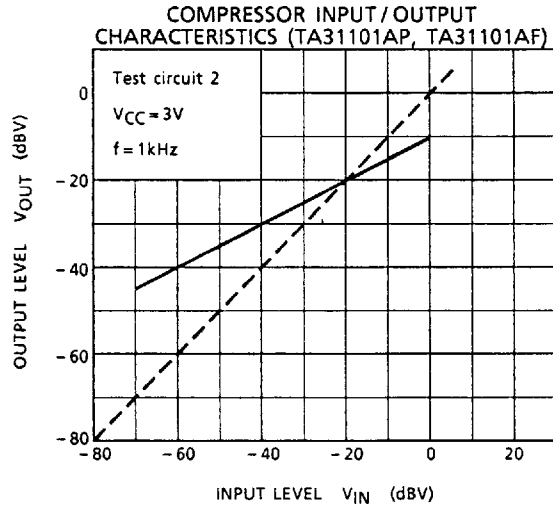
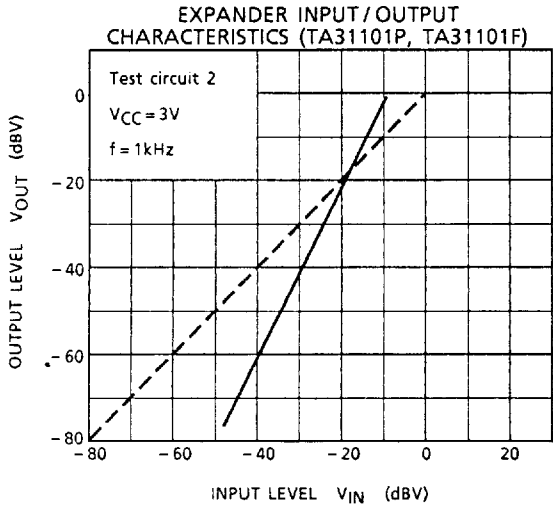
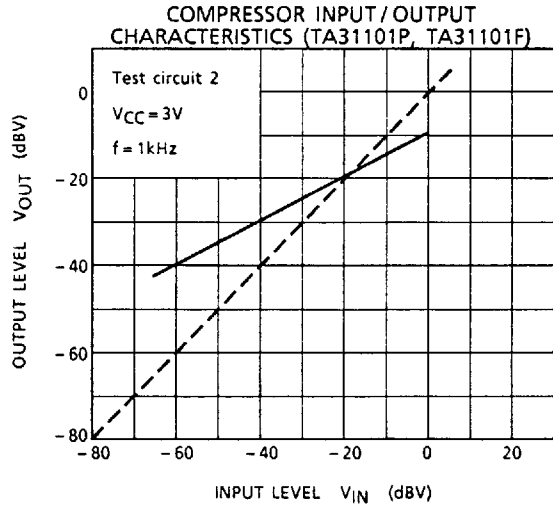
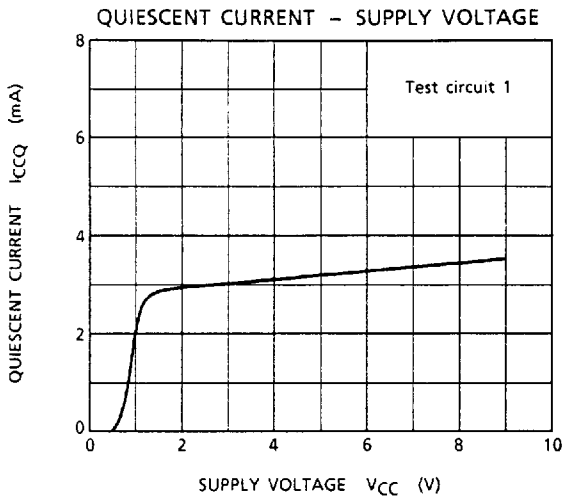
$$V_{OE2} \rightarrow V_{IN} = -10\text{dB}$$

$$V_{OC3} \rightarrow V_{IN} = -40\text{dB}$$

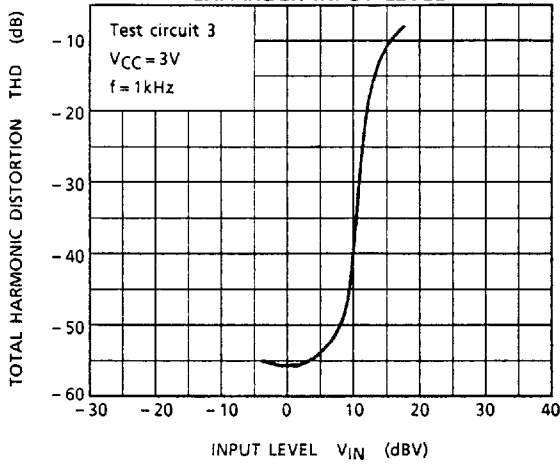
$$V_{OE3} \rightarrow V_{IN} = -25\text{dB}$$

(10) FR_C, FR_E

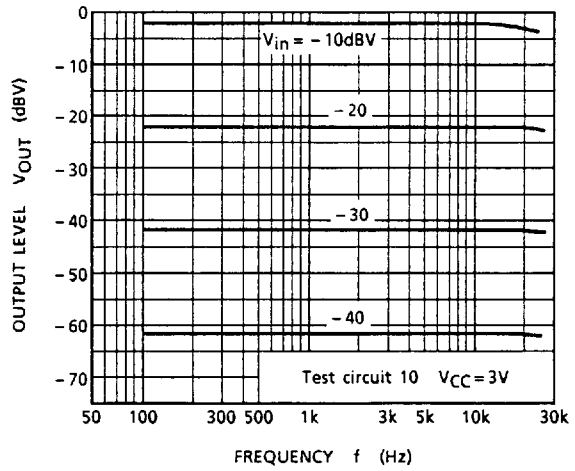




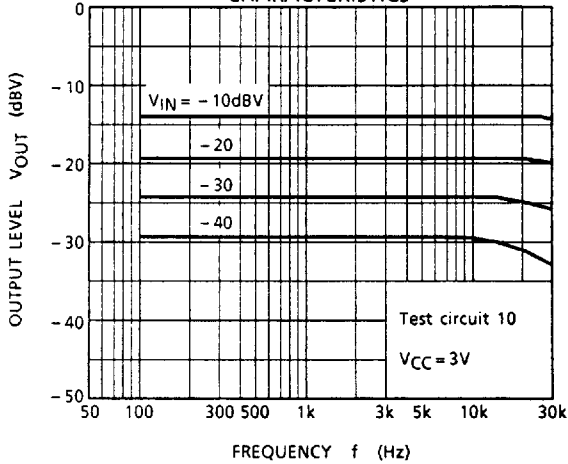
TOTAL HARMONIC DISTORTION -
EXPANDER INPUT LEVEL



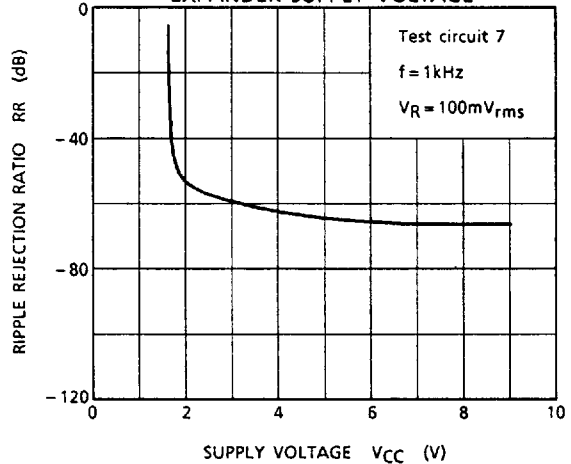
EXPANDER FREQUENCY CHARACTERISTICS



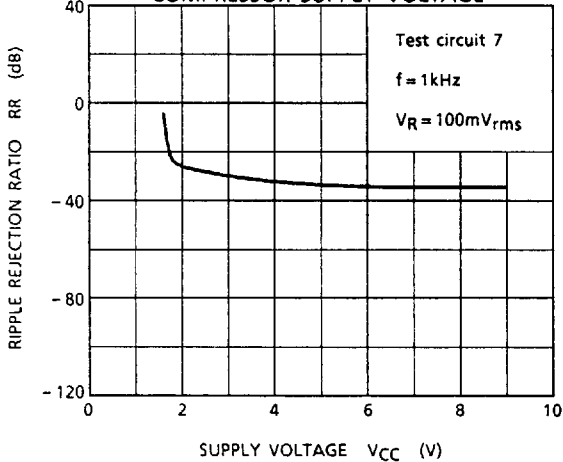
COMPRESSOR FREQUENCY
CHARACTERISTICS



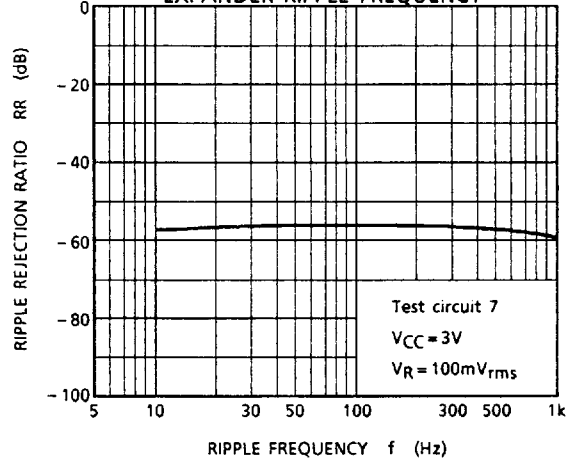
RIPPLE REJECTION RATIO -
EXPANDER SUPPLY VOLTAGE

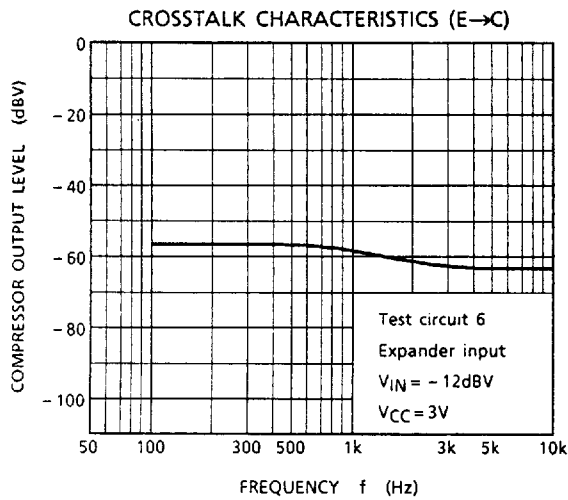
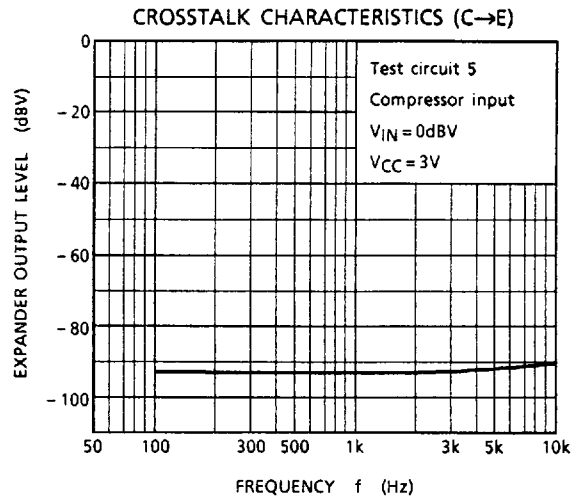
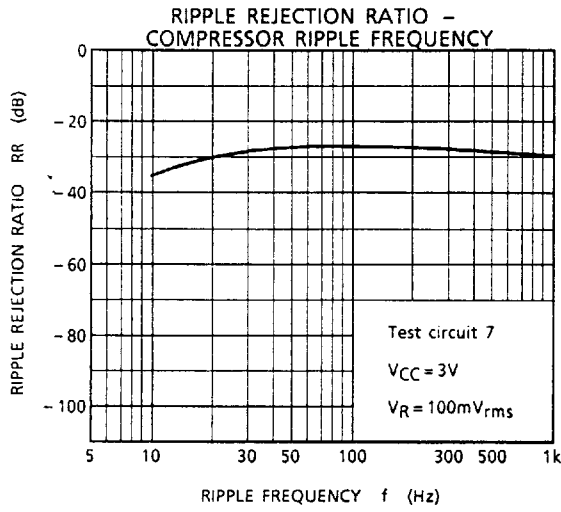


RIPPLE REJECTION RATIO -
COMPRESSOR SUPPLY VOLTAGE

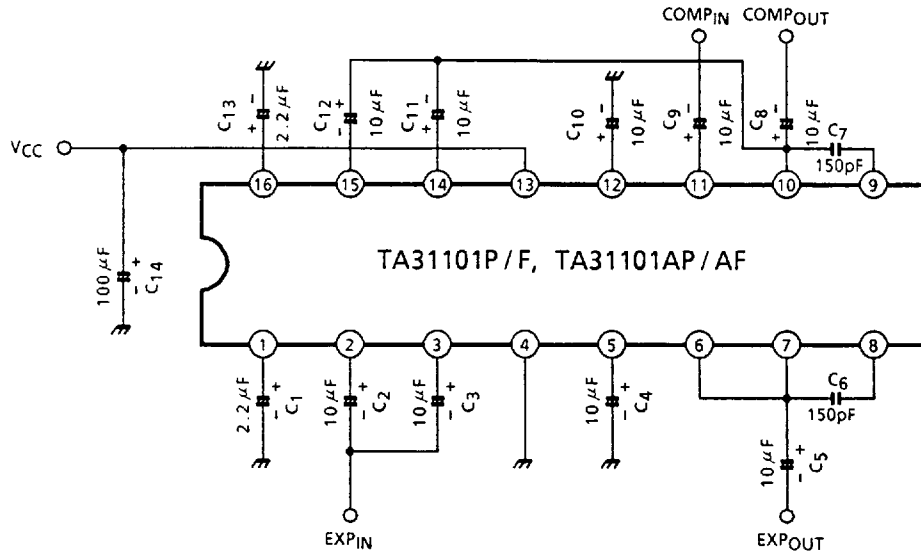


RIPPLE REJECTION RATIO -
EXPANDER RIPPLE FREQUENCY





APPLICATION CIRCUIT



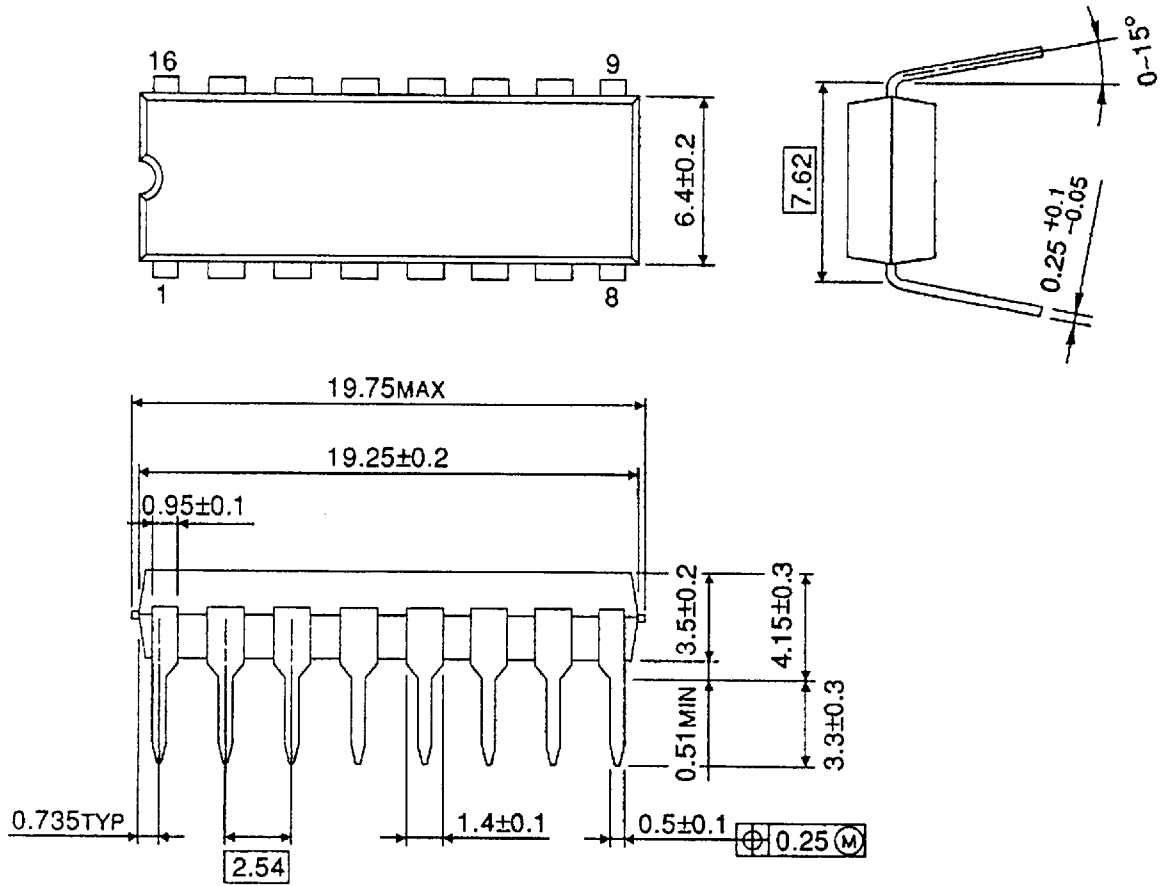
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OUTLINE DRAWING
DIP16-P-300A

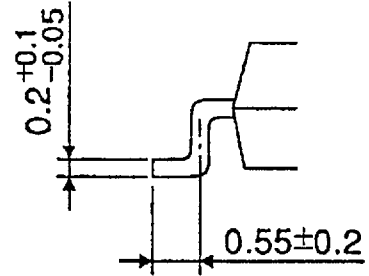
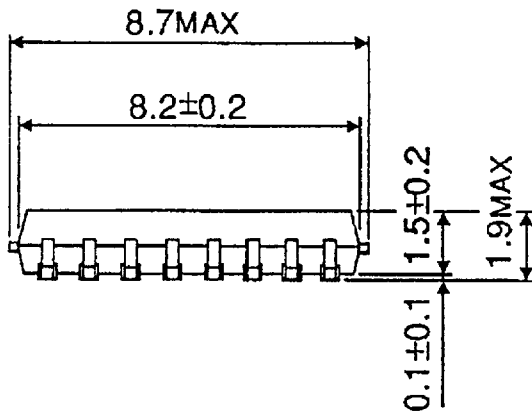
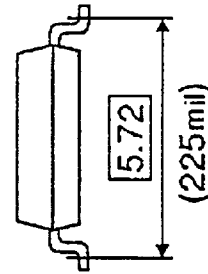
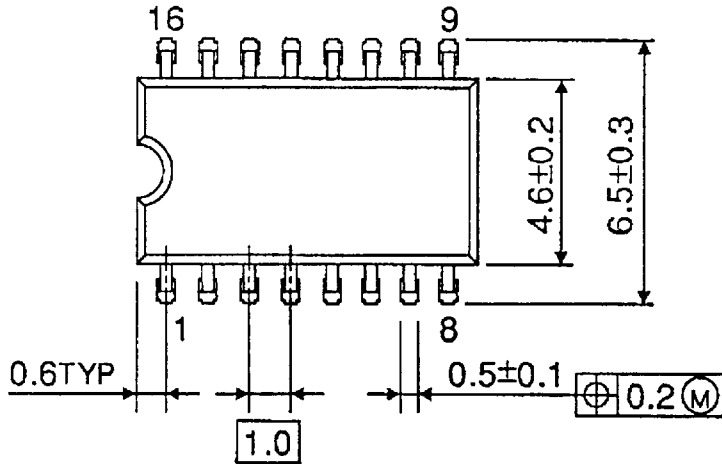
Unit : mm



Weight : 1.1g (Typ.)

OUTLINE DRAWING
SSOP16-P-225

Unit : mm



Weight : 0.14g (Typ.)