Ordering number:ENN3516B

Monolithic Linear IC

# LA8630, 8630M

## Low Voltage and Current Dissipation Compandor IC

## Applications

- Cordless telephone.
- FM transceiver.

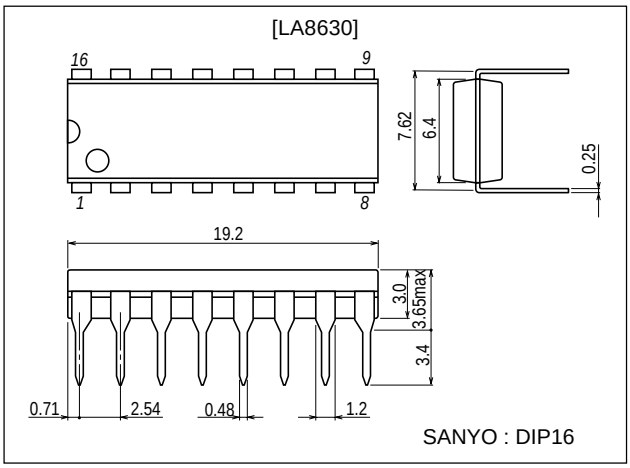
## Functions

- Compressor (VCA circuit, full-wave rectifying circuit, adder amplifier).
- Expandor (VCA circuit, full-wave rectifying circuit, adder amplifier).
- Operational amplifier (in the compressor).
- Operational amplifier with muting function (in the expandor).
- Analog switch for data signal input (in the compressor).
- Regulator.

## Package Dimensions

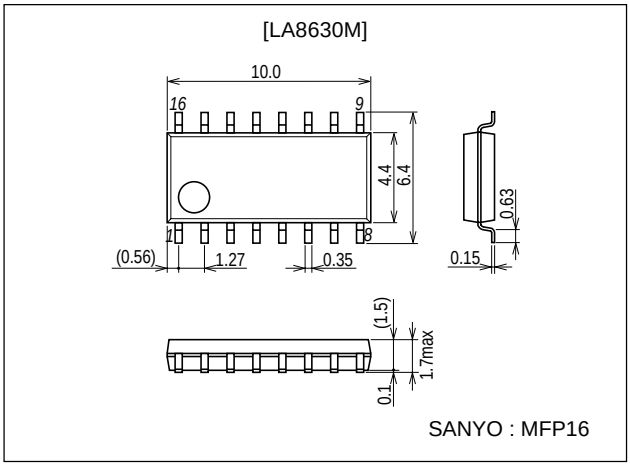
unit:mm

3006B-DIP16




unit:mm

3035B-MFP16







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# Specifications

## Maximum Ratings at Ta = 25˚C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum supply voltage | $V_{CC}$ max | | 8 | V |
| Allowable power dissipation | Pd max | | 300 | 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 | $V_{CC}$ | | 3 | V |
| Operating voltage range | $V_{CC}$ op | | 2.2 to 6 | V |

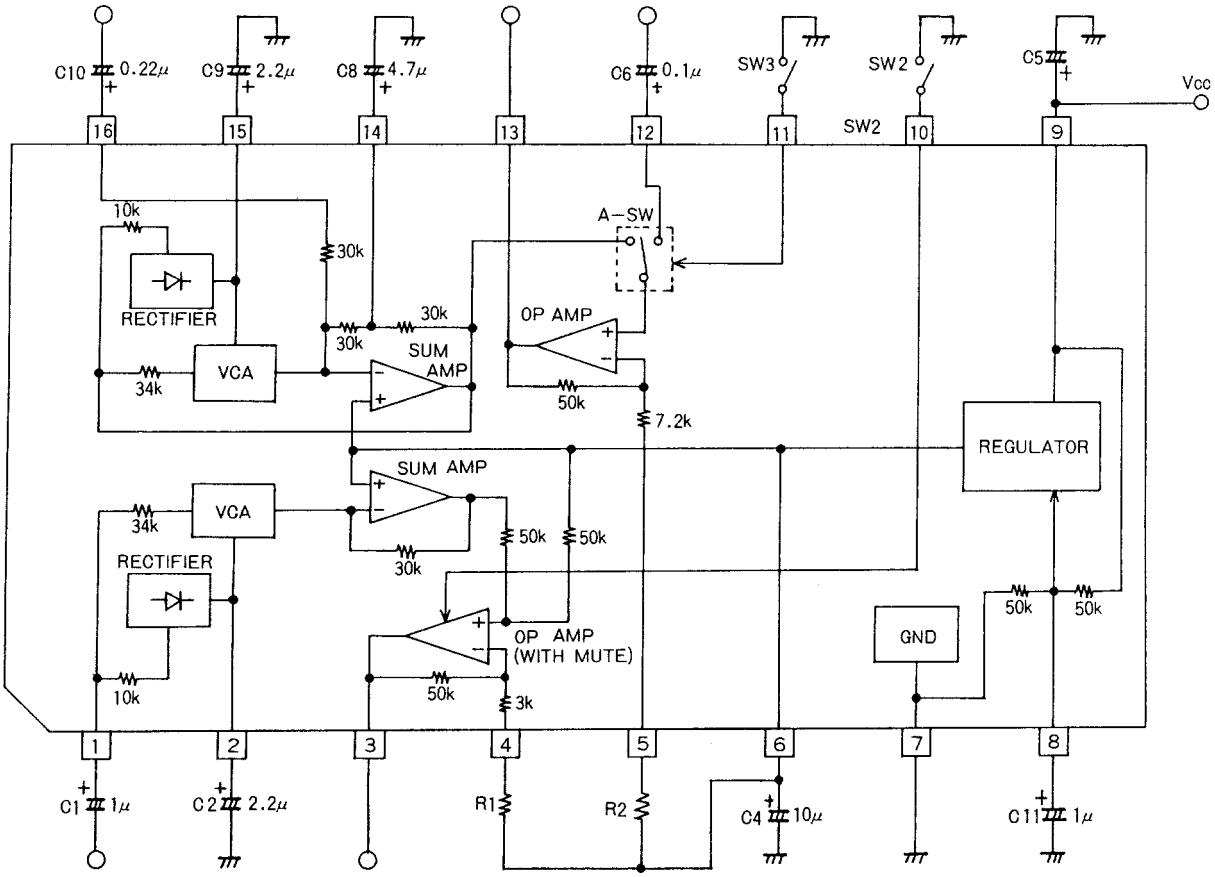
## Operating Characteristics at Ta = 25˚C, $V_{CC}$=3.0V, f=1kHz, Vin=100mVrms (0dB)

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Current drain | $I_{CC}$ | With no signal input | | 2.5 | 3.7 | mA |
| Input reference voltage | Vinref | | | 100 | | mVrms |
| [Expandor] (Operational amplifier gain : 0dB) | | | | | | |
| Output level | Vorefe | Vin=0dB (Operational amplifier gain : –6dB) | –26.5 | –24.5 | –22.5 | dBV |
| Gain error | Vgee1 | Vin=+5dB | –0.5 | 0 | +0.5 | dB |
| | Vgee2 | Vin=–20dB | –1.0 | 0 | +1.0 | dB |
| | Vgee3 | Vin=–30dB | –1.5 | 0 | +2.0 | dB |
| Distortion factor | THDe | Vin=0dB | | 0.35 | 1.0 | % |
| Output noise voltage | $V_{NO}$e | Vin=∞, Rg=620Ω, f=20 to 20000Hz | | 12 | 80 | μVrms |
| Frequency characteristic | f | Vin=0dB, f=200 to 3500Hz | | 0.0 | | dB |
| Maximum output voltage | $V_O$ max | $R_L$=10kΩ, THD=10% | 0.6 | 1.0 | | Vrms |
| [Compressor] (Operational amplifier gain : 0dB) | | | | | | |
| Output level | Vorefc | Vin=0dB | –23 | –21 | –19 | dBV |
| Gain error | Vgec1 | Vin=+20dB | –0.5 | 0 | +0.5 | dB |
| | Vgec2 | Vin=–20dB | –0.5 | 0 | +0.5 | dB |
| | Vgec3 | Vin=–40dB | –1.0 | 0 | +1.0 | dB |
| Distortion factor | THDc | Vin=0dB | | 0.35 | 1.0 | % |
| Output noise voltage | $V_{NO}$c | Vin=∞, Rg=620Ω, f=20 to 20000Hz | | 0.3 | 0.7 | mVrms |
| Frequency characteristic | f | Vin=0dB, f=200 to 3500Hz | | 0.0 | | dB |
| [Muting circuit] (Operational amplifier gain : 0dB) | | | | | | |
| Muting attenuation | CT1 | Vin=0dB, f=1kHz | 60 | 90 | | dB |
| Threshold voltage | Vthm | | 1.25 | 1.35 | 1.45 | V |
| [Analog switch circuit] (operational amplifier gain : 0dB) | | | | | | |
| Crosstalk | CT2 | Vin=0dB, f=1kHz | 40 | 47 | | dB |
| Threshold voltage | Vtha | | 1.25 | 1.35 | 1.45 | V |

* Be careful that the threshold voltage is determined by $V_{CC}$ (Vth=0.45$V_{CC}$).

## Equivalent Circuit Block Diagram/Sample Application Circuit

Unit (resistance: Ω, capacitance: F)

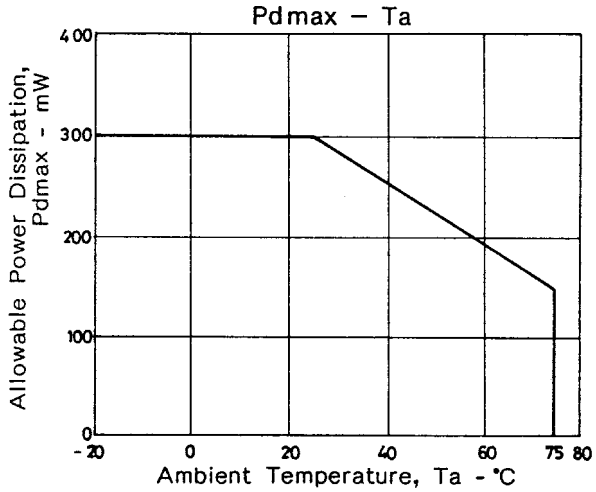



## Pin Name

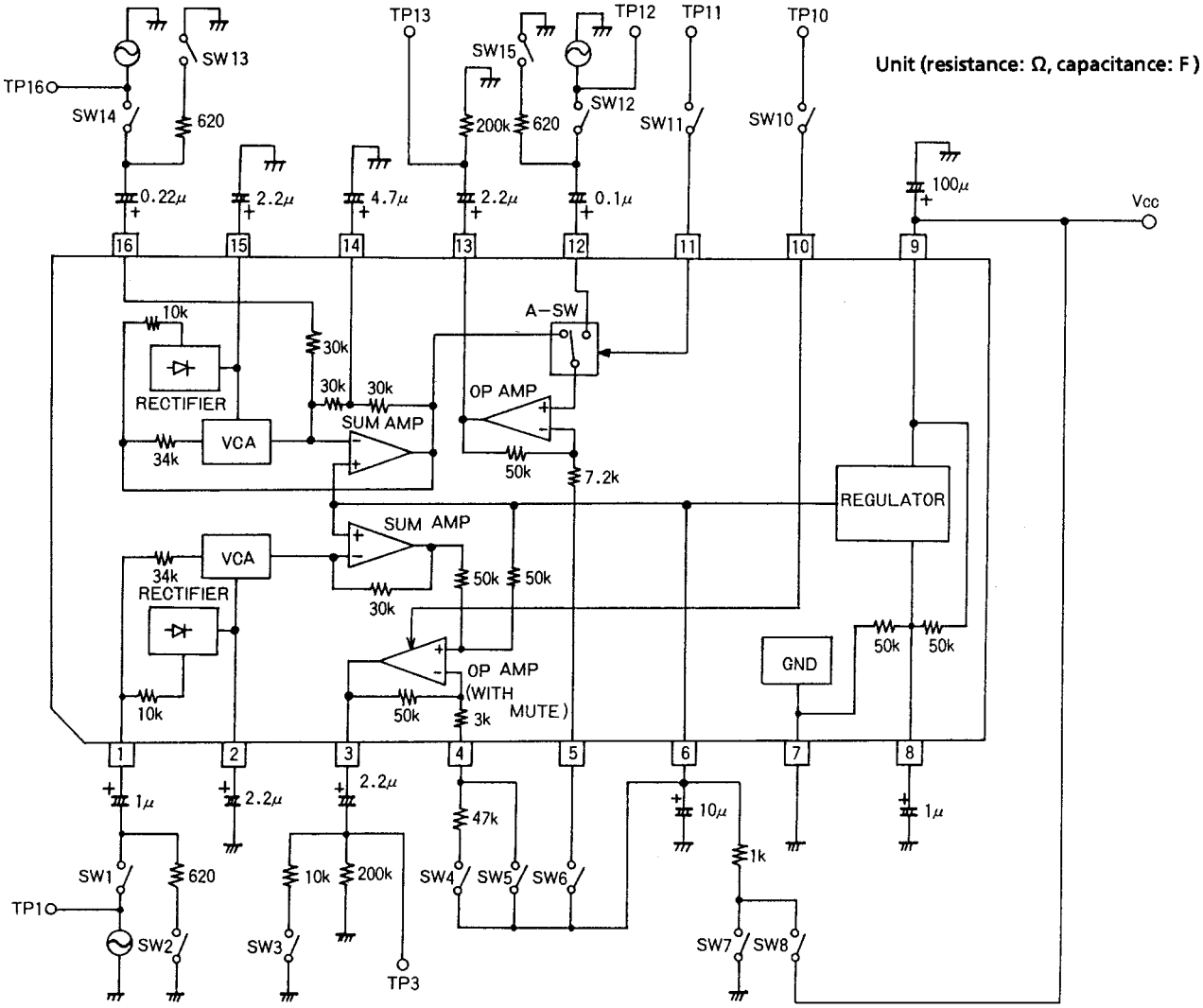
| Pin No. | Name |
|---|---|
| 1 | EXP. VIN |
| 2 | EXP. VREC |
| 3 | EXO. VOUT |
| 4 | OP. AMP NF (EXP) |
| 5 | OP. AMP NF (COMP) |
| 6 | VREF |
| 7 | GND |
| 8 | 1/2VCC |
| 9 | VCC |
| 10 | MUTE CONT |
| 11 | DATA CONT. |
| 12 | DATA IN |
| 13 | COMP. VOUT |
| 14 | COMP. NF |
| 15 | COMP. VREC |
| 16 | COMP. VIN |

## Control Mode

| Mode | | Audio signal | Data |
|---|---|---|---|
| Pin 10 | Open | Output | – |
| | [Low] | Mute | – |
| Pin 11 | Open | Output | Mute |
| | [LOW] | Mute | Output |

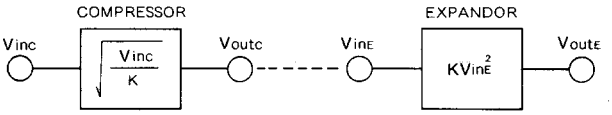


## Test Circuit




## Summary of Compandor

(1) Operation




<for example>

Vref = 100mV

K = 10

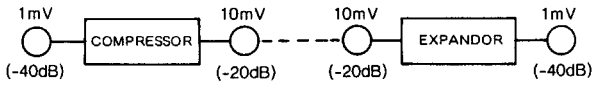
Vinc = 1mV (-40dB) Voutc = $\sqrt{\frac{1}{10}\times 1\times 10^{-3}} \fallingdotseq 10\text{mV} = -20\text{dB}$

VinE = 10mV VoutE = $(10\times 10^{-3})^2\times 10 = 1\text{mV} = -40\text{dB}$

$\text{Voutc} = \sqrt{\text{Vinc}/K}$

$\text{VinE} = \text{Voutc}$

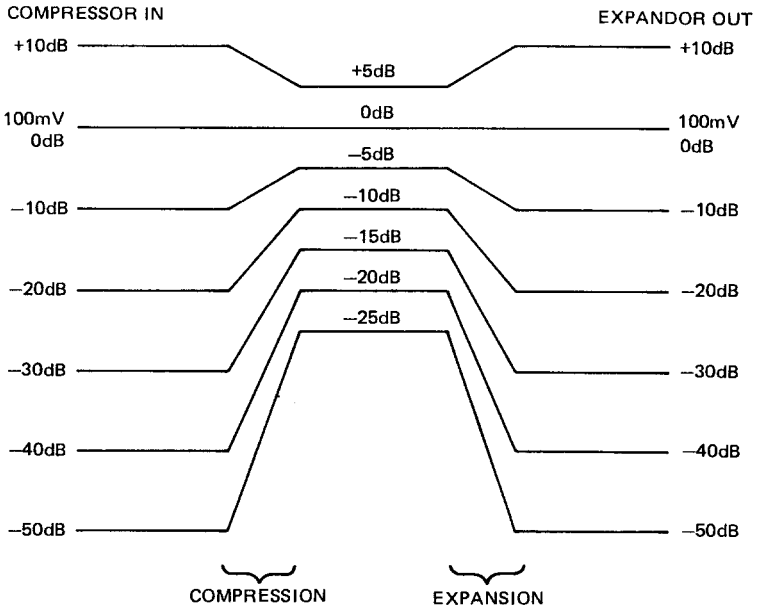
$\text{VoutE} = K\text{VinE}^2 = K\sqrt{\frac{\text{Vinc}}{K}} = \text{Vinc}$




at Reference level (Vref) Vinc = Voutc, VinE = VoutE

| | | |
|---|---|---|
| Vinc<Vref | COMPRESSOR | → Amplifier |
| VinE<Vref | EXPANDOR | → Attenuator |
| Vinc>Vref | COMPRESSOR | → Attenuator |
| VinE>Vref | EXPANDOR | → Amplifier |

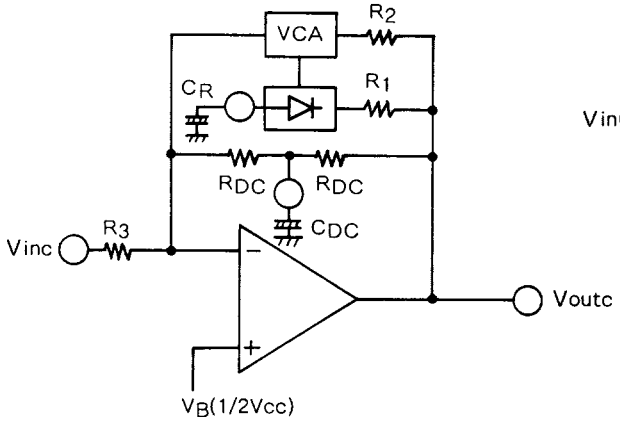
(2) Level Diagram




(3) Block Diagram

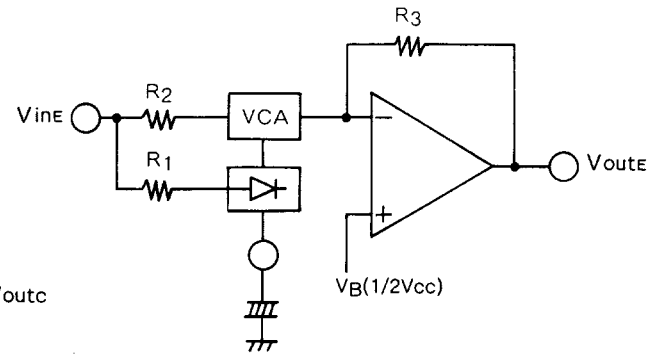
<COMPRESSOR>

$$Voutc = \sqrt{\frac{R_1R_2I_1}{2R_3}\,Vinc} = \sqrt{\frac{1}{10}\,Vin}$$

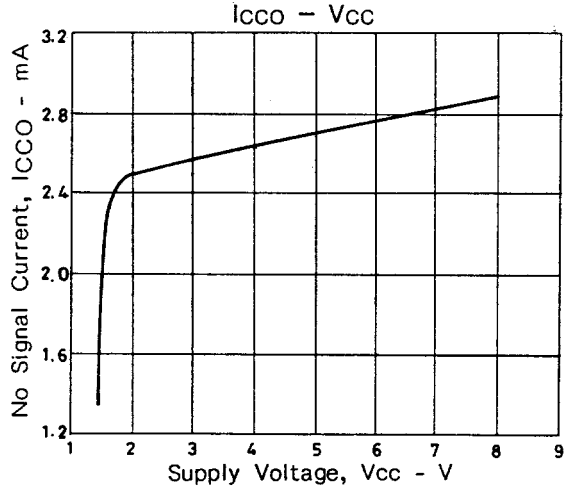



<EXPANDOR>

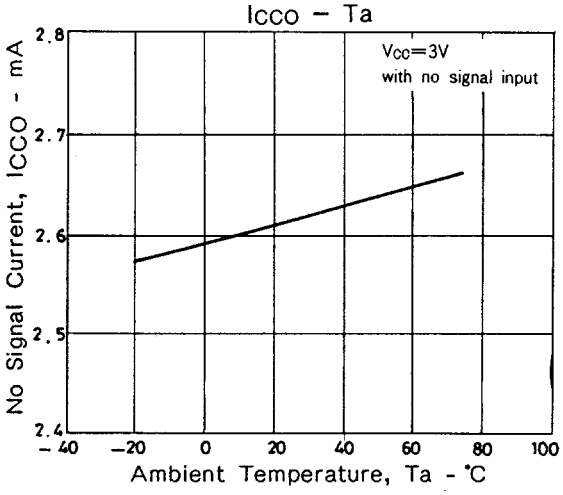
$$Voute = \frac{2R_3}{R_1R_2I_1}\,Vine^2 = 10\,Vine^2$$



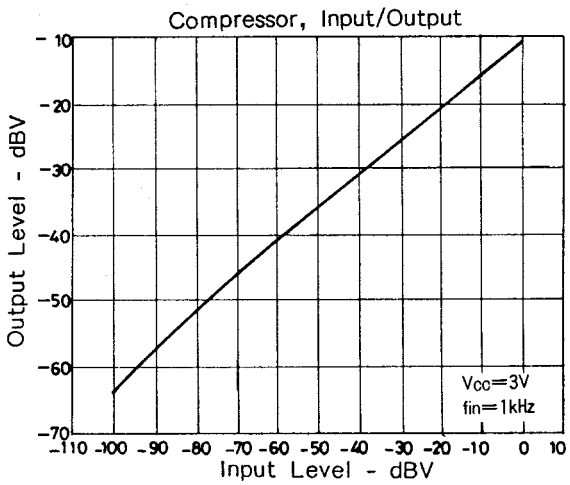
Icco – Vcc



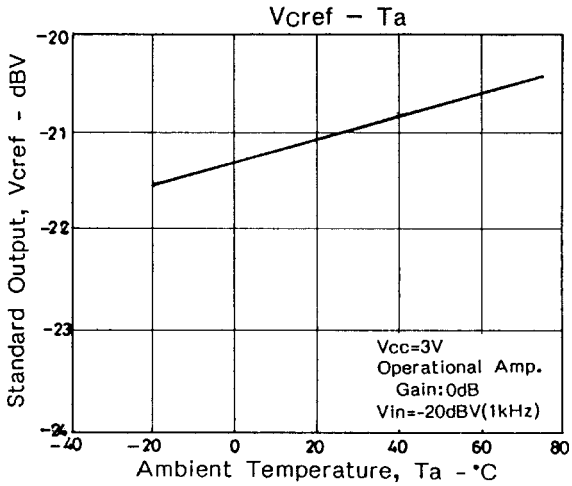

Icco – Ta



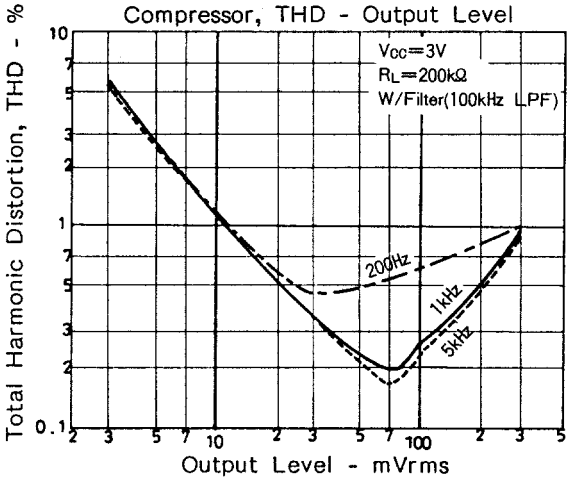

Compressor, Input/Output



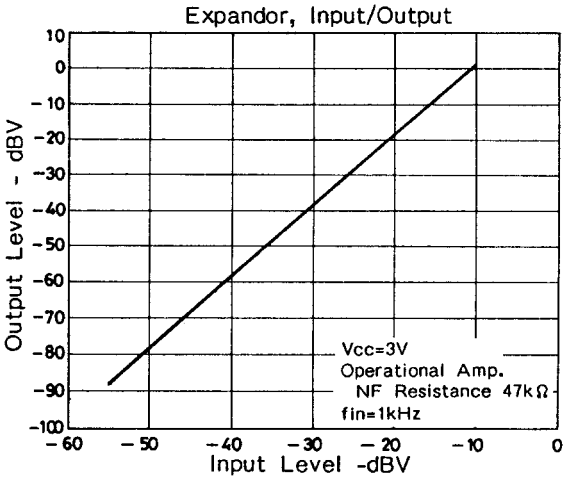

Vcref – Ta



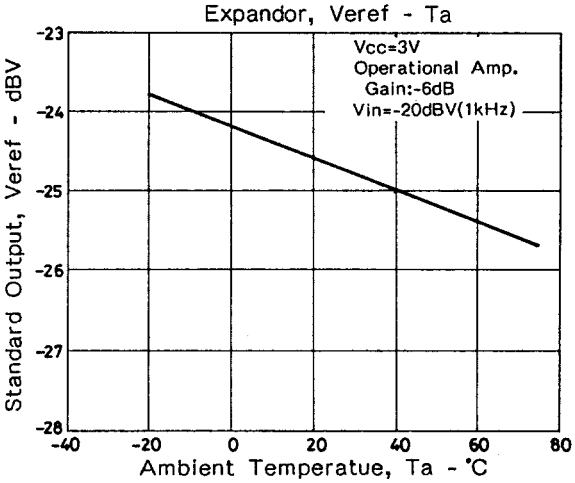

Compressor, THD - Output Level




Expandor, Input/Output




Expandor, Veref - Ta




Expandor, THD - Output Level