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|--------------|--|----------------|
| SANYO | No. 4931 | LA8637M |
| | Low-Voltage/Low-Power Compaander IC | |

Overview

The LA8637M is a compander IC that was developed to improve audio quality in transceiver systems such as cordless telephones by expanding the dynamic range of the audio signal and suppressing noise. In addition to including both a compressor circuit that compresses with a compression ratio of 1/2 (logarithmic) and an expander with an expansion factor of 2 (logarithmic), the LA8637M also integrates the following functions on the same chip: an ALC preamplifier, a BTL amplifier, a data shaper for received data, a muting function and a standby function. Thus the LA8637M is optimal as the compander/system IC in cordless telephone products.

Applications

- Cordless telephones

Functions

- Compressor
ALC preamplifier, preemphasis amplifier, limiter, transmission data input analog switch, filter buffer amplifier
- Expander
Filter buffer amplifier, de-emphasis amplifier, mute, BTL amplifier (100 Ω load)
- Level following data shaper (with hysteresis)
- Standby mode

Features

- Easy implementation of transmission system and reception system base band signal processing
- Built-in BTL amplifier that supports mobile unit handsets
- Standby function to support battery saving
- Low voltage operation: $V_{CC\ OP} = 1.8$ to 6 V

Specifications

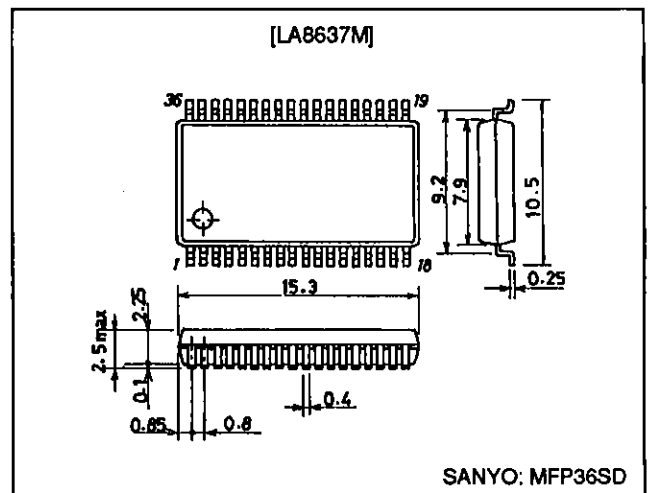
Maximum Ratings at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|---------------|-----------------------------|-------------|------------------|
| Maximum supply voltage | $V_{CC\ max}$ | | 7 | V |
| Allowable power dissipation | $P_d\ max$ | $T_a \leq 75^\circ\text{C}$ | 250 | mW |
| Operating temperature | T_{opr} | | -20 to +75 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | -40 to +125 | $^\circ\text{C}$ |

Package Dimensions

unit: mm

3129-MFP36SD



Operating Conditions at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|----------------------------|--------------------|------------|----------|------|
| Recommended supply voltage | V_{CC} | | 3 | V |
| Operating supply voltage | $V_{CC\text{ OP}}$ | | 1.8 to 6 | V |

Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{ V}$, $f = 1\text{ kHz}$

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---------------------|---|------|------|------|------------------|
| Quiescent current | I_{CCO} | No signal | 5 | 8 | 12 | mA |
| Standby current | I_{STBY} | No signal, standby mode (pin 24: low) | 0.8 | 1 | 1.2 | mA |
| [Preamplifier] | | | | | | |
| Voltage gain | V_{GP} | $V_i = -60\text{ dBV}$ | 37 | 39 | 41 | dB |
| Maximum voltage gain | $V_{GP\text{ max}}$ | $V_i = -60\text{ dBV}$ | | 50 | | dB |
| Total harmonic distortion | THD | $V_i = -40\text{ dBV}$, ALC: ON | | 0.3 | 1.0 | % |
| Input conversion noise voltage | V_{NI} | $R_g = 0\ \Omega$ | | 1.5 | 5 | μVrms |
| ALC level | V_{ALC} | $V_i = -40\text{ dBV}$, ALC: ON | 350 | 420 | 490 | mVrms |
| ALC range | ALC | Until the THD from the ALC circuit becomes 1% | 35 | 40 | | dB |
| [Compressor] $V_{in\text{refc}} = -20\text{ dBV} = 0\text{ dB}$, output: pin 16 | | | | | | |
| Input impedance | r_i | | | 30 | | k Ω |
| Output voltage | V_{oc} | $V_{in} = V_{in\text{refc}} = 0\text{ dB}$ | -22 | -20 | -18 | dBV |
| Gain error (1) | G_{ec1} | $V_{in} = -20\text{ dB}$ | -0.5 | 0 | +0.5 | dB |
| Gain error (2) | G_{ec2} | $V_{in} = -40\text{ dB}$ | -1.0 | 0 | +1.0 | dB |
| Total harmonic distortion | THD | $V_{in} = 0\text{ dB}$ | | 0.25 | 1.0 | % |
| Output noise voltage | V_{NOC} | $R_g = 620\ \Omega$, $f = 20\text{ Hz}$ to 20 kHz | | 0.15 | 1.0 | mVrms |
| Crosstalk | CT_C | $RX-V_{in} = -20\text{ dBV}$, 1 kHz BPF | | -75 | -60 | dB |
| [Analog Switch] | | | | | | |
| Muting attenuation | ATT_C | $V_{in} = -20\text{ dB}$, 1 kHz BPF | 60 | 75 | | dB |
| [Expander] $V_{in\text{refe}} = -20\text{ dBV} = 0\text{ dB}$ | | | | | | |
| Output voltage | V_{oe} | $V_{in} = V_{in\text{refe}} = 0\text{ dB}$ | -22 | -20 | -18 | dBV |
| Gain error (1) | G_{ee1} | $V_{in} = -20\text{ dB}$ | -1.0 | 0 | +1.0 | dB |
| Gain error (2) | G_{ee2} | $V_{in} = -30\text{ dB}$ | -1.5 | 0 | +1.5 | dB |
| Total harmonic distortion | THD | $V_{in} = 0\text{ dB}$ | | 0.3 | 1.0 | % |
| Output noise voltage | V_{NOe} | $R_g = 620\ \Omega$, $f = 20\text{ Hz}$ to 20 kHz | | 13 | 80 | μVrms |
| Muting attenuation | ATT_e | $V_{in} = 0\text{ dB}$, 1 kHz BPF | 60 | 75 | | dB |
| Crosstalk | CT_e | $PRE\text{ AMP-}V_{in} = -60\text{ dBV}$, 1 kHz BPF | | -95 | -80 | dB |
| Maximum output voltage | $V_{O\text{ max}}$ | THD = 10%, $R_L = 10\text{ k}\Omega$ | 0.7 | 1.0 | | Vrms |
| [Limiter] | | | | | | |
| Limiting voltage | V_L | $\Delta V = 0.6\text{ V}$ (voltage between pin 9 and pin 10) | 0.27 | 0.3 | 0.33 | Vp-p |
| [BTL Amplifier] Gain = 30 dB | | | | | | |
| Voltage Gain | V_{PWR} | $V_{in} = -40\text{ dBV}$, $R_L = 100\ \Omega$ | 27.5 | 29.5 | 31.5 | dB |
| Total harmonic distortion | THD | $V_{in} = -40\text{ dBV}$, $R_L = 100\ \Omega$ | | 0.5 | 1.0 | % |
| Maximum output power | $P_{O\text{ max}}$ | THD = 10%, $R_L = 100\ \Omega$ | 15 | 30 | | mW |
| Maximum output voltage | $V_{O\text{ max}}$ | THD = 10%, $R_L = 620\ \Omega$ | 4.0 | 5.5 | | Vp-p |
| Output noise voltage | V_{NO} | $R_g = 0\ \Omega$, $R_L = 100\ \Omega$ | | 120 | 800 | μVrms |
| [Compressor Low-Pass Filter] | | | | | | |
| Maximum output voltage | $V_{O\text{ max}}$ | THD = 1%, $R_L = 10\text{ k}\Omega$ | 450 | 550 | | mVrms |
| [Expander Low-Pass Filter] $V_B = 1.5\text{ V}$ (V_B : low-pass filter bias voltage) | | | | | | |
| Maximum output voltage | $V_{O\text{ max}}$ | THD = 1%, $R_L = 10\text{ k}\Omega$ | 400 | 500 | | mVrms |
| [Data Shaper] | | | | | | |
| Duty | D_{UTY} | $V_{in} = -15\text{ dBV}$ | 45 | 50 | 55 | % |
| Hysteresis | W_{HYS} | | 45 | 70 | 100 | mV |
| Output high level voltage | V_{OH} | $R_L = 100\text{ k}\Omega$ | 2.8 | | | V |
| Output low level voltage | V_{OL} | $R_L = 100\text{ k}\Omega$ | | | 0.3 | V |
| [Standby] | | | | | | |
| Standby voltage | V_{ST} | Pin 24 | | | 0.7 | V |
| Standby current | I_{ST} | Pin 24 outflow current | | | 30 | μA |

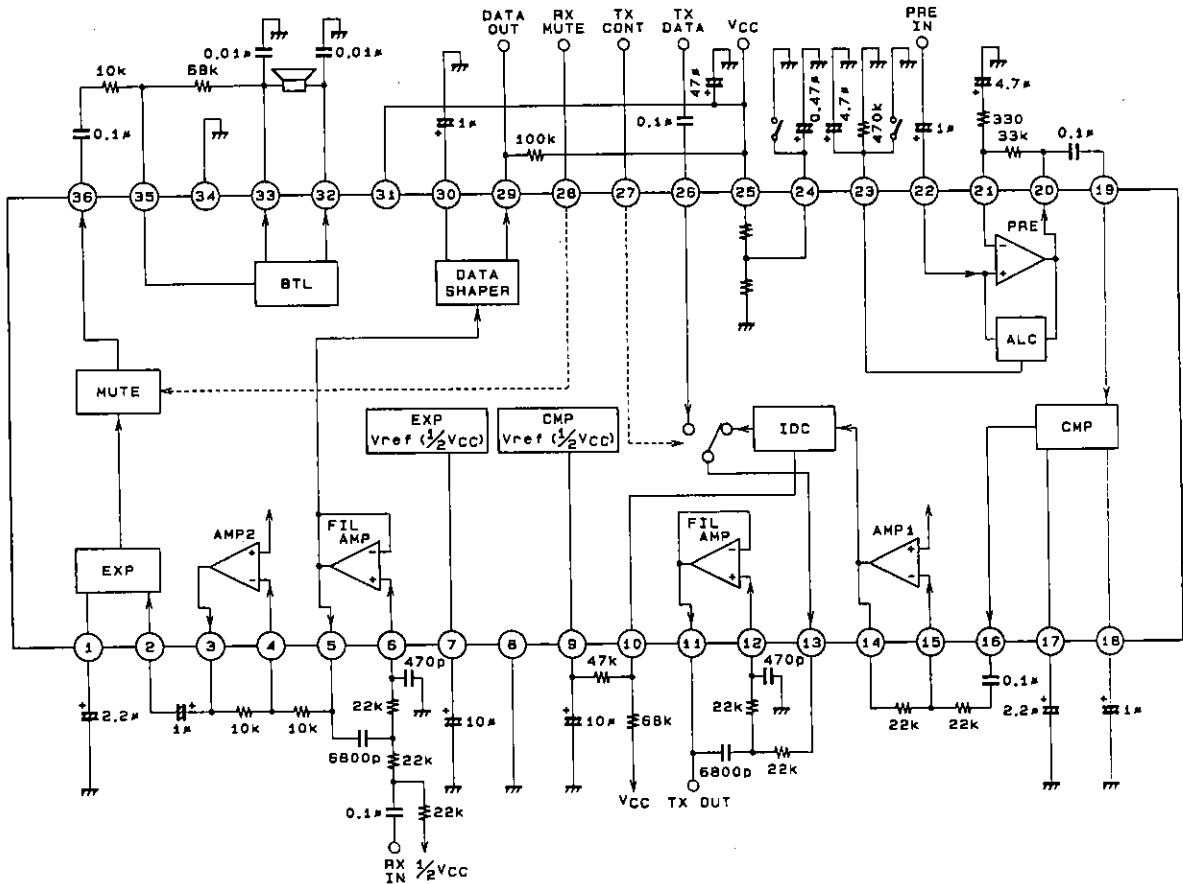
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| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---------------------------------|----------|-------------------------------|--------------|-----|------|---------|
| [Digital Input Characteristics] | | | | | | |
| Input low level voltage | V_{IL} | Pins 27 and 28 | | | 0.65 | V |
| Input high level voltage | V_{IH} | Pins 27 and 28 | $0.6 V_{CC}$ | | | V |
| Input low level current | I_{IL} | Pins 27 and 28, $V_I = 0.2 V$ | | | 100 | μA |
| Input high level current | I_{IH} | Pins 27 and 28, $V_I = 2 V$ | | | 5 | μA |

Internal Equivalent Circuit Block Diagram



402613

Unit (resistance : Ω , capacitance : F)

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Pin Functions

| Pin No. | Symbol | Internal equivalent circuit | Protective diode | |
|--------------|--|--|----------------------|-------------|
| | | | V _{CC} side | Ground side |
| 1 2 | EXP.V _{REC} EXP.IN | <p style="text-align: right;">A02816</p> | ○ ○ | ○ ○ |
| 3 4 | OP.OUT1 OP.IN1 | <p style="text-align: right;">A02816</p> | ○ ○ | ○ ○ |
| 5 6 | FIL.OUT1 FIL.IN1 | <p style="text-align: right;">A02817</p> | ○ ○ | ○ ○ |
| 7 9 24 | EXP.V _{REF} CMP.V _{REF} STAND-BY | <p style="text-align: right;">A02818</p> | ○ ○ ○ | ○ ○ ○ |
| 10 | IDC.ADJ | <p style="text-align: right;">A02819</p> | ○ | ○ |

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| Pin No. | Symbol | Internal equivalent circuit | Protective diode | |
|----------------------|---|--|------------------|------------------|
| | | | Vcc side | Ground side |
| 11 12 | FIL.OUT2 FIL.IN2 | <p style="text-align: right;">A02820</p> | ○ ○ | ○ ○ |
| 13 26 | TX.OUT DATA IN | <p style="text-align: right;">A02821</p> | ○ ○ | ○ ○ |
| 14 15 | OP OUT2 OP IN2 | <p style="text-align: right;">A02822</p> | ○ ○ | ○ ○ |
| 16 17 18 19 | CMP.OUT CMP.VREC CMP.NF CMP.IN | <p style="text-align: right;">A02823</p> | ○ ○ ○ ○ | ○ ○ ○ ○ |
| 20 21 22 | PRE OUT PRE NF PRE IN | <p style="text-align: right;">A02824</p> | ○ — — | ○ ○ ○ |

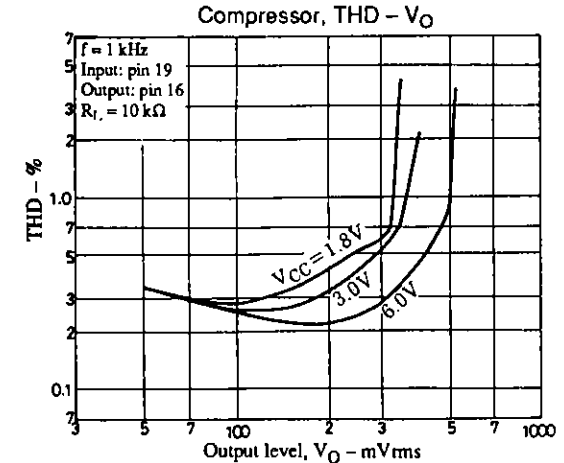
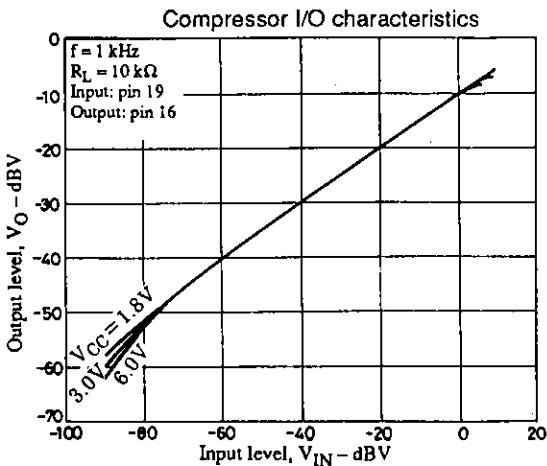
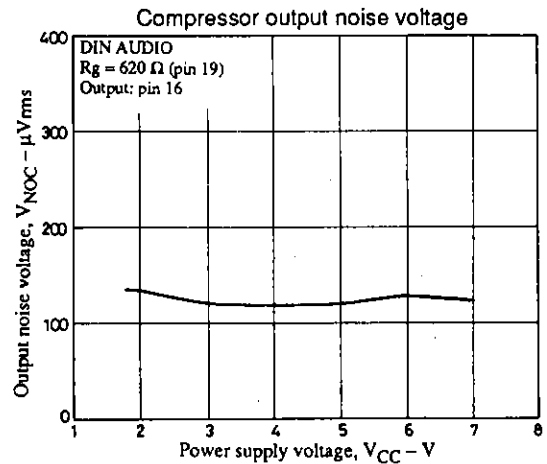
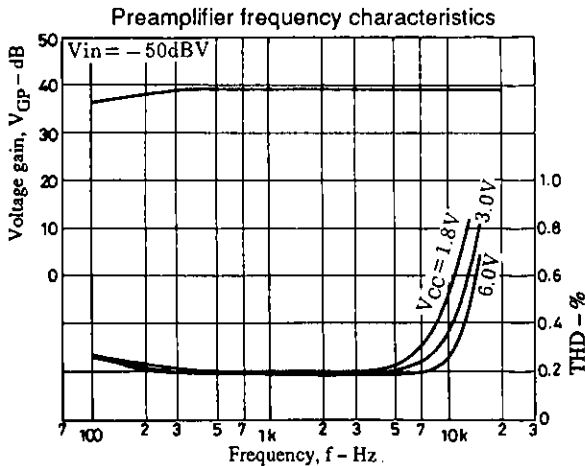
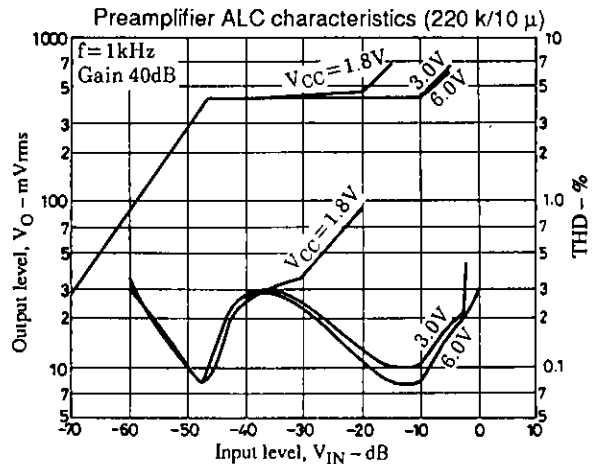
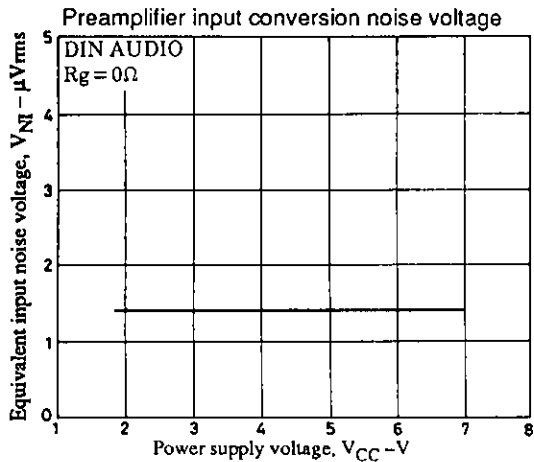
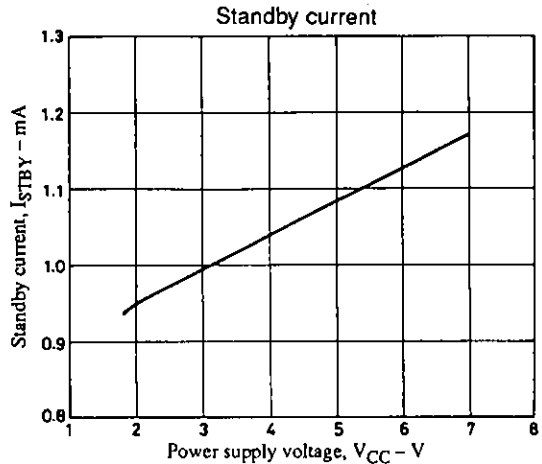
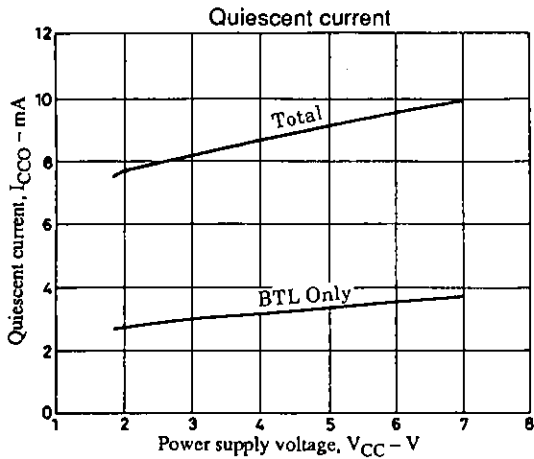
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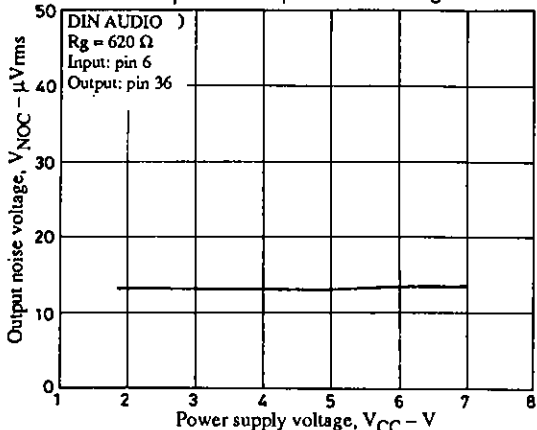
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| Pin No. | Symbol | Internal equivalent circuit | Protective diode | |
|----------------|--------------------------------|--|----------------------|-------------|
| | | | V _{CC} side | Ground side |
| 23 | ALC.CT | <p style="text-align: right;">A02825</p> | ○ | ○ |
| 27 28 | TX.CONT RX.MUTE | <p style="text-align: right;">A02826</p> | ○ ○ | ○ ○ |
| 29 30 | DATA OUT V.HOLD | <p style="text-align: right;">A02827</p> | — ○ | ○ ○ |
| 32 33 35 | BTL OUT2 BTL OUT1 BTL IN | <p style="text-align: right;">A02828</p> | — — — | ○ ○ ○ |
| 36 | EXP.OUT | <p style="text-align: right;">A02829</p> | ○ | ○ |

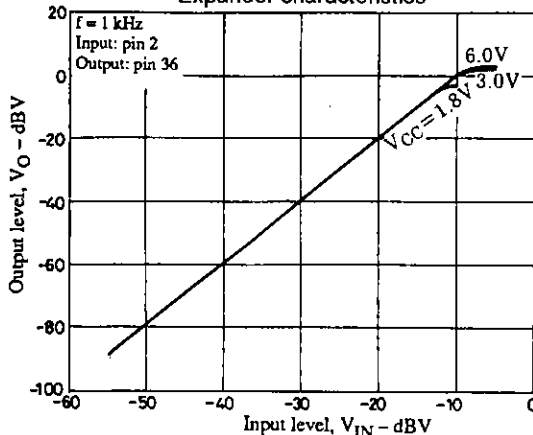
Note: All V_{CC} side diodes are connected to V_{CC} at pin 25.



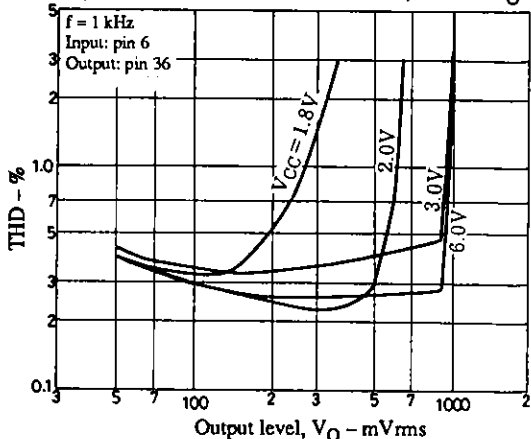
Expander output noise voltage



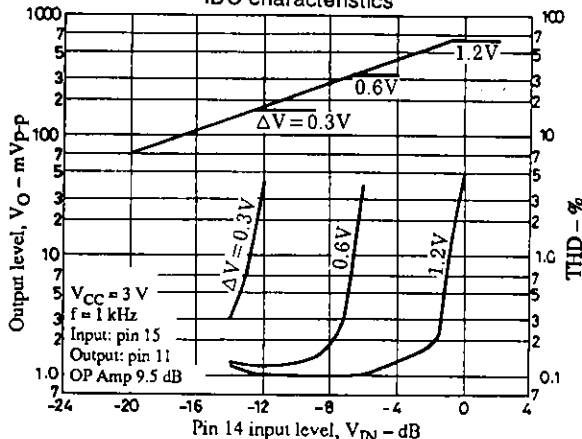
Expander characteristics



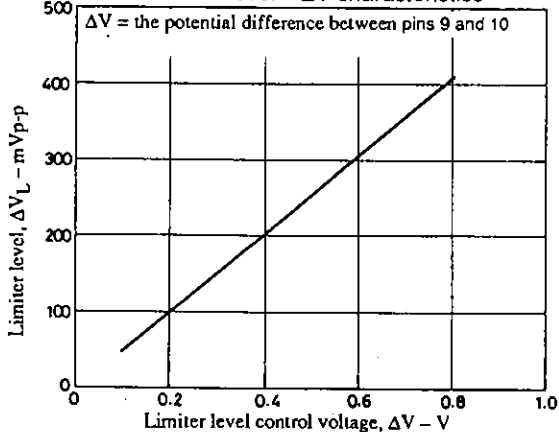
Expander total harmonic distortion, THD - V_O



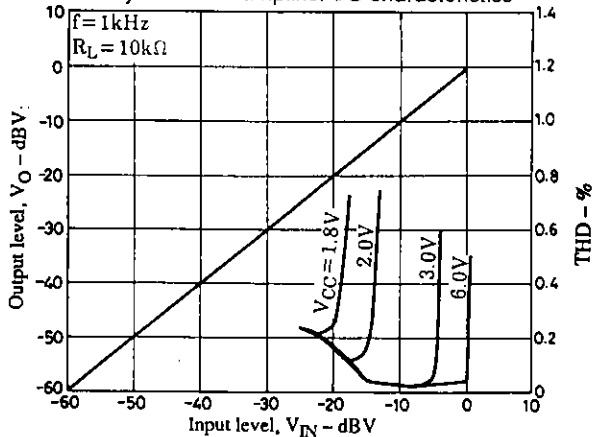
IDC characteristics



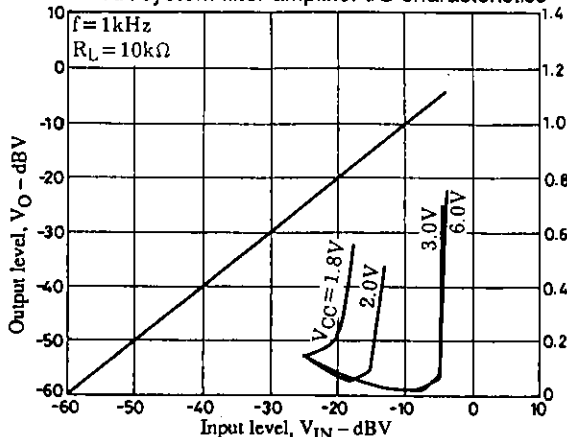
Limiter level - ΔV characteristics



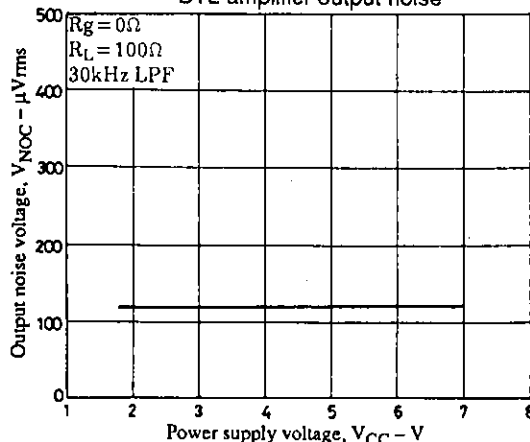
TX system filter amplifier I/O characteristics

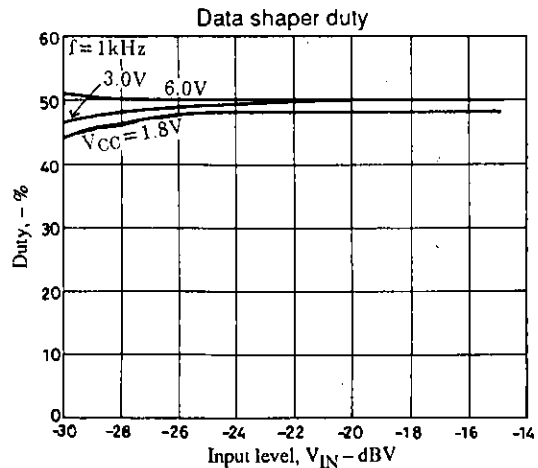
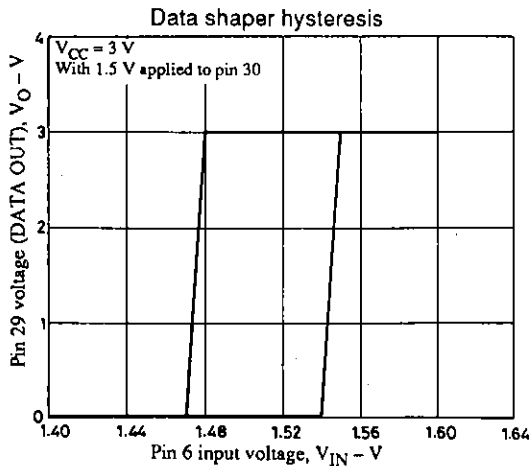
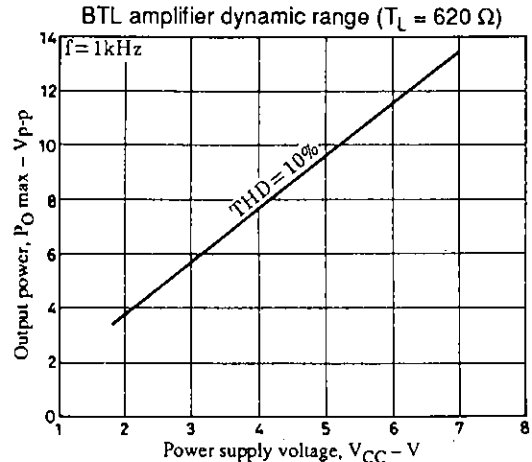
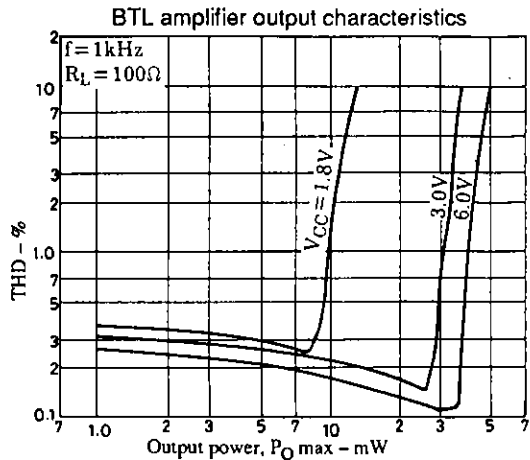
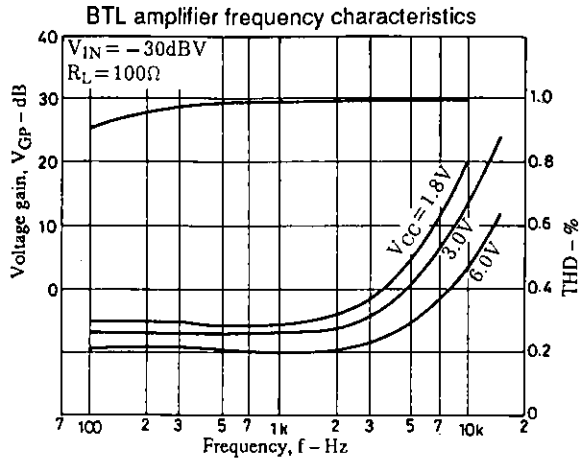
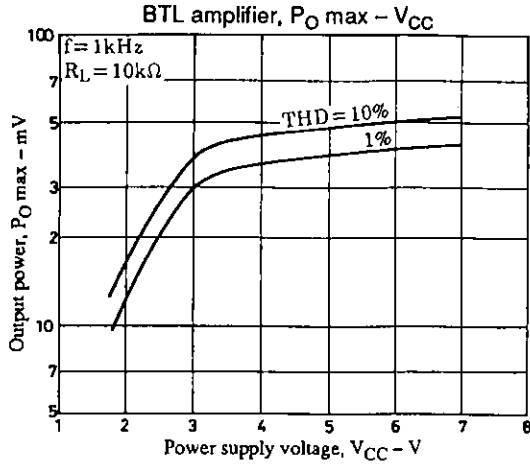


RX system filter amplifier I/O characteristics



BTL amplifier output noise





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