Ordering number : EN4931

Monolithic Linear IC

LA8637M

Low-Voltage/Low-Power Compander 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

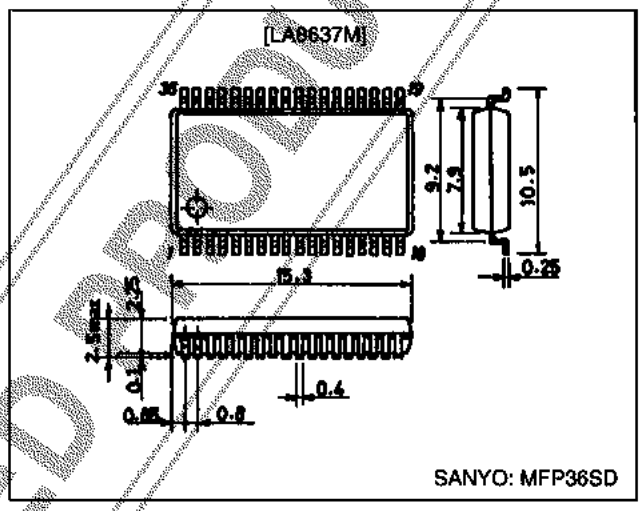
Features

- 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

Package Dimensions

unit: mm

3129-MFP36SD



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		7	V
Allowable power dissipation	Pd max	Ta ≤ 75°C	250	mW
Operating temperature	Topr		−20 to +75	°C
Storage temperature	Tstg		−40 to +125	°C

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Operating Conditions at Ta = 25°C

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

Electrical Characteristics at Ta = 25°C, V_{CC} = 3 V, f = 1 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}	Vi = –60 dBV	37	39	41	dB
Maximum voltage gain	V_{GP} max	Vi = –60 dBV		50		dB
Total harmonic distortion	THD	Vi = –40 dBV, ALC: ON		0.3	1.0	%
Input conversion noise voltage	V_{NI}	Rg = 0 Ω		1.5	5	μVrms
ALC level	V_{ALC}	Vi = –40 dBV, ALC: ON	350	420	490	mVrms
ALC range	ALC	Until the THD from the ALC circuit becomes 1%	35	40		dB
[Compressor] Vinrefc = –20 dBV = 0 dB, output: pin 16						
Input impedance	r_i			30		kΩ
Output voltage	Voc	Vin = Vinrefc = 0 dB	–22	–20	–18	dBV
Gain error (1)	Gec1	Vin = –20 dB	–0.5	0	+0.5	dB
Gain error (2)	Gec2	Vin = –40 dB	–1.0	0	+1.0	dB
Total harmonic distortion	THD	Vin = 0 dB		0.25	1.0	%
Output noise voltage	V_{NOC}	Rg = 620 Ω, f = 20 Hz to 20 kHz		0.15	1.0	mVrms
Crosstalk	CT_C	RX-Vin = –20 dBV, 1 kHz BPF		–75	–60	dB
[Analog Switch]						
Muting attenuation	ATT_C	Vin = –20 dB, 1 kHz BPF	60	75		dB
[Expander] Vinrefe = –20 dBV = 0 dB						
Output voltage	Voe	Vin = Vinrefe = 0 dB	–22	–20	–18	dBV
Gain error (1)	Gee1	Vin = –20 dB	–1.0	0	+1.0	dB
Gain error (2)	Gee2	Vin = –30 dB	–1.5	0	+1.5	dB
Total harmonic distortion	THD	Vin = 0 dB		0.3	1.0	%
Output noise voltage	V_{NOE}	Rg = 620 Ω, f = 20 Hz to 20 kHz		13	80	μVrms
Muting attenuation	ATT_E	Vin = 0 dB, 1 kHz BPF	60	75		dB
Crosstalk	CTe	PRE AMP Vin = –60 dBV, 1 kHz BPF		–95	–80	dB
Maximum output voltage	V_O max	THD = 10%, R_L = 10 kΩ	0.7	1.0		Vrms
[Limiter]						
Limiting voltage	V_L	ΔV = 0.6 V (voltage between pin 9 and pin 10)	0.27	0.3	0.33	Vp-p
[BTL Amplifier] Gain = 30 dB						
Voltage Gain	V_{PWB}	Vin = –40 dBV, R_L = 100 Ω	27.5	29.5	31.5	dB
Total harmonic distortion	THD	Vin = –40 dBV, R_L = 100 Ω		0.5	1.0	%
Maximum output power	P_O max	THD = 10%, R_L = 100 Ω	15	30		mW
Maximum output voltage	V_O max	THD = 10%, R_L = 620 Ω	4.0	5.5		Vp-p
Output noise voltage	V_{NO}	Rg = 0 Ω, R_L = 100 Ω		120	800	μVrms
[Compressor Low-Pass Filter]						
Maximum output voltage	V_O max	THD = 1%, R_L = 10 kΩ	450	550		mVrms
[Expander Low-Pass Filter] V_B = 1.5 V (V_B: low-pass filter bias voltage)						
Maximum output voltage	V_O max	THD = 1%, R_L = 10 kΩ	400	500		mVrms
[Data Shaper]						
Duty	D_{UTY}	Vin = –15 dBV	45	50	55	%
Hysteresis	W_{HYS}		45	70	100	mV
Output high level voltage	V_{OH}	R_L = 100 kΩ	2.8			V
Output low level voltage	V_{OL}	R_L = 100 kΩ			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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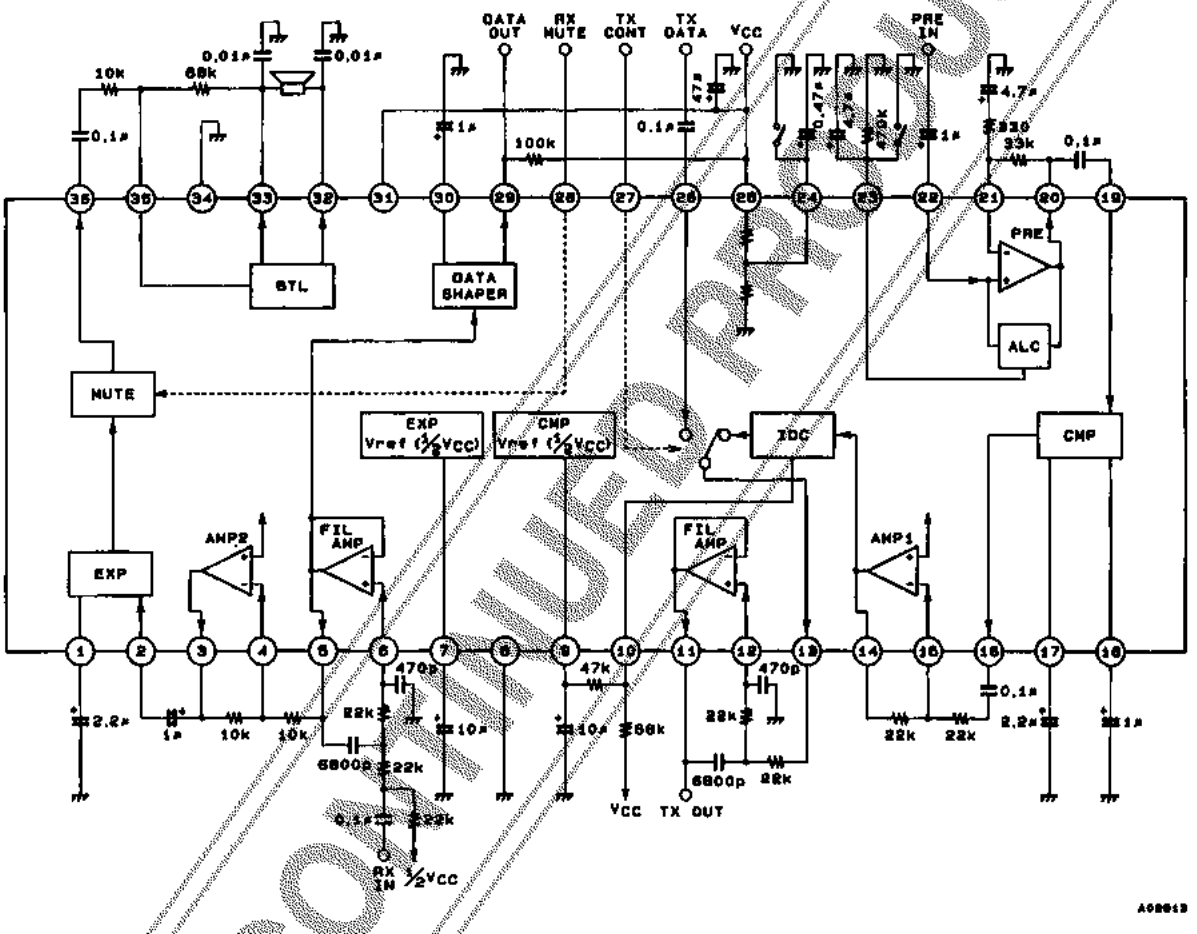
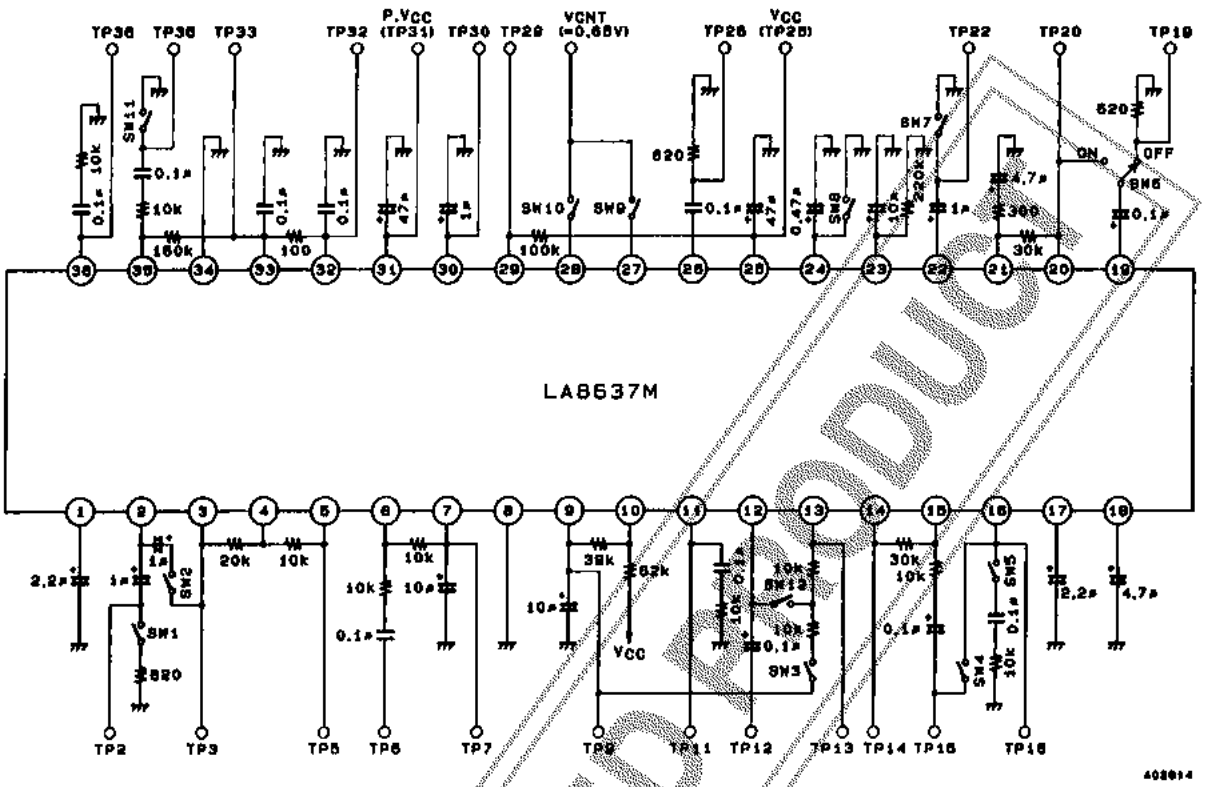
Parameter	Symbol	Conditions	min	typ	max	Unit
[Digital Input Characteristics]						
Input low level voltage	V_{IL}	Pins 27 and 28			0.65	V
Input high level voltage	V_{IH}	Pins 27 and 28	0.6 V_{CC}			V
Input low level current	I_{IL}	Pins 27 and 28, V_I = 0.2 V			100	µA
Input high level current	I_{IH}	Pins 27 and 28, V_I = 2 V			5	µA

Internal Equivalent Circuit Block Diagram



Unit (resistance : Ω, capacitance : F)

AC Test Circuit

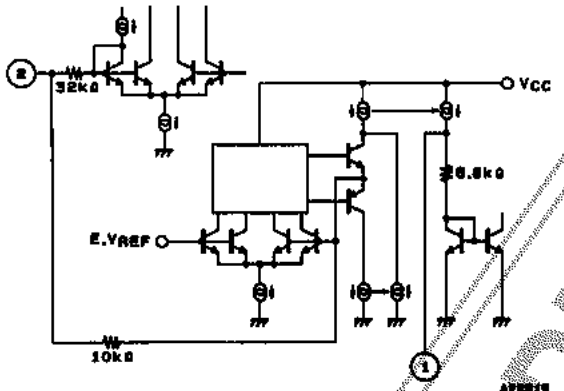
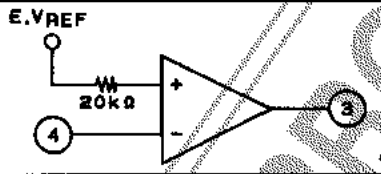
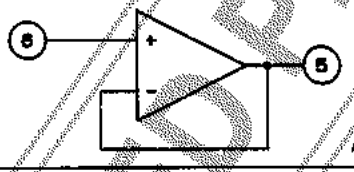
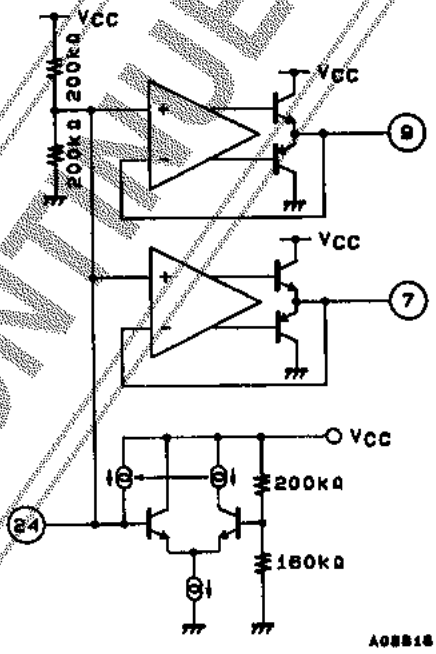
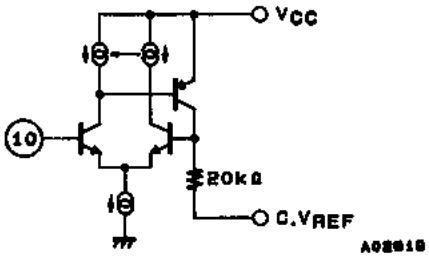


Unit (resistance : Ω, capacitance : F)

Control Mode

Pin No.	Symbol	State	Audio	Data
27	TX CONT	High	○	—
		Low	—	○
28	RX MUTE	High	○	
		Low	Mute	

Pin Functions

Pin No.	Symbol	Internal equivalent circuit	Protective diode	
			V_{CC} side	Ground side
1 2	EXP.V_{REC} EXP.IN		○ ○	○ ○
3 4	OP OUT1 OP IN1		○ ○	○ ○
5 6	FIL.OUT1 FIL.IN1		○ ○	○ ○
7 9 24	EXP.V_{REF} CMP.V_{REF} STAND-BY		○ ○ ○	○ ○ ○
10	IDC.ADJ		○	○

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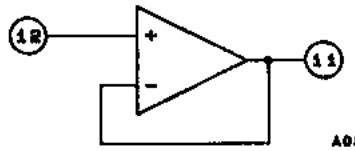
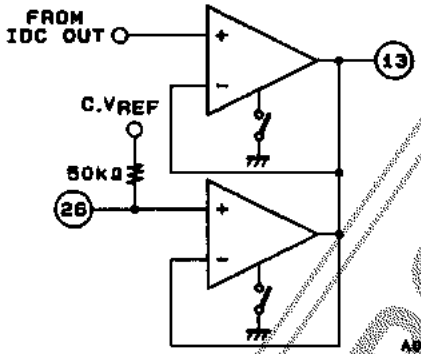
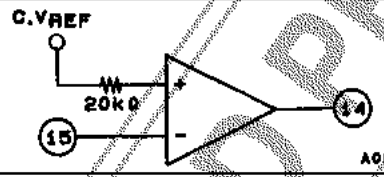
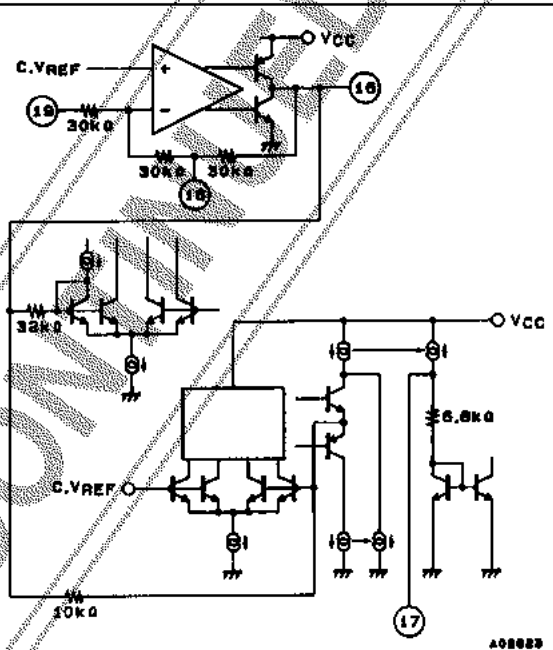
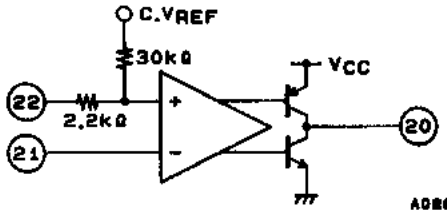
Pin No.	Symbol	Internal equivalent circuit	Protective diode	
			V_{CC} side	Ground side
11 12	FIL.OUT2 FIL.IN2		○ ○	○ ○
13 26	TX.OUT DATA IN		○ ○	○ ○
14 15	OP OUT2 OP IN2		○ ○	○ ○
16 17 18 19	CMP.OUT CMP.V_{REC} CMP.NF CMP.IN		○ ○ ○ ○	○ ○ ○ ○
20 21 22	PRE OUT PRE NF PRE IN		○ — —	○ ○ ○

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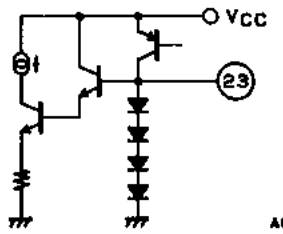
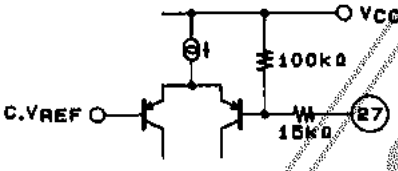
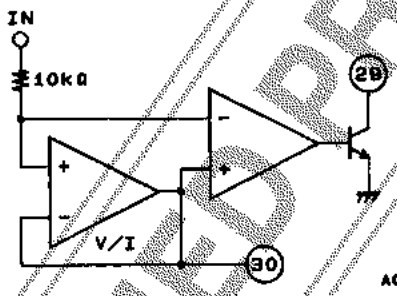
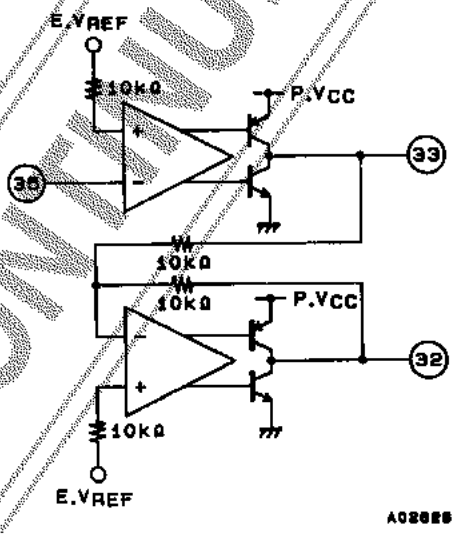
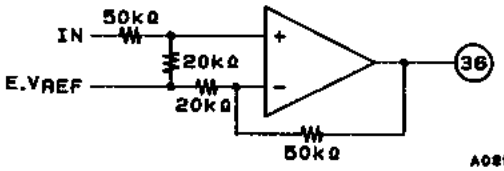
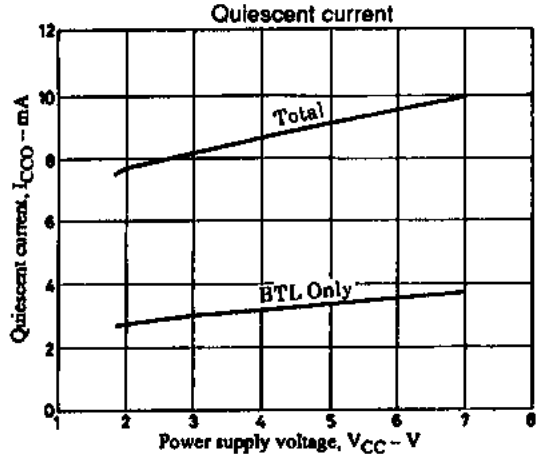
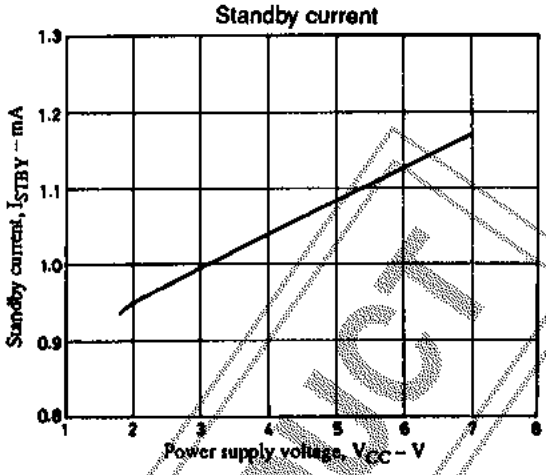
Pin No.	Symbol	Internal equivalent circuit	Protective diode	
			V_{CC} side	Ground side
23	ALC.CT		○	○
27 28	TX.CONT RX.MUTE		○ ○	○ ○
29 30	DATA OUT V.HOLD		— ○	○ ○
32 33 35	BTL OUT2 BTL OUT1 BTL IN		— — —	○ ○ ○
36	EXP.OUT		○	○

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

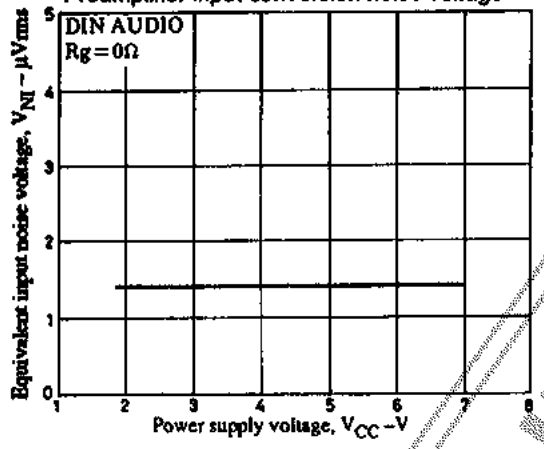
Quiescent current



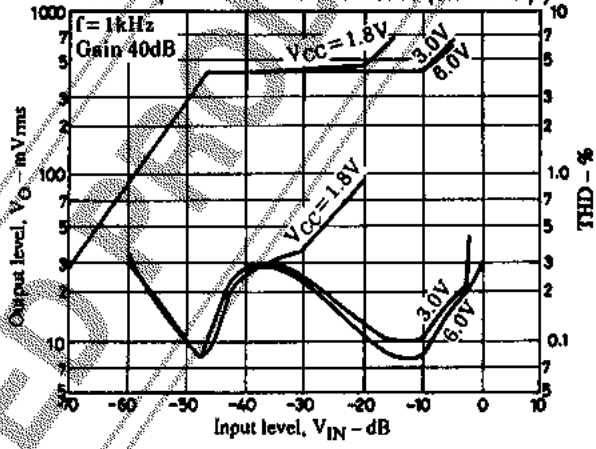
Standby current



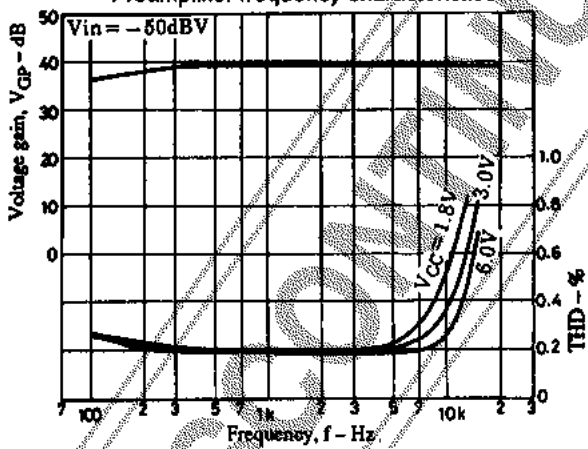
Preamplifier input conversion noise voltage



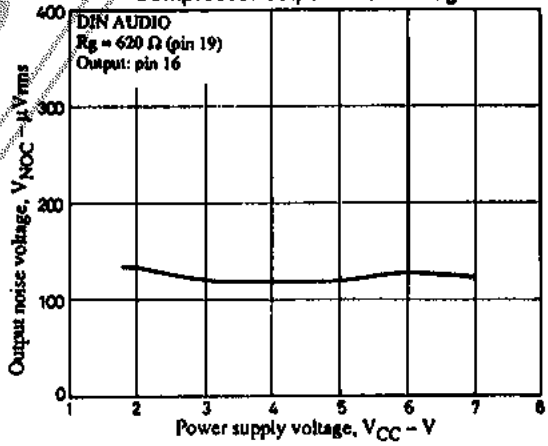
Preamplifier ALC characteristics (220 k/10 μ)



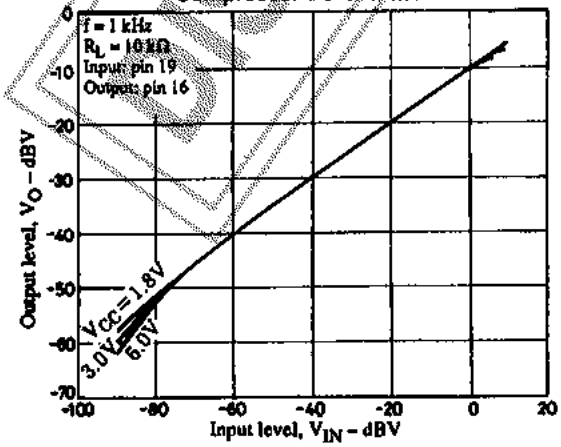
Preamplifier frequency characteristics



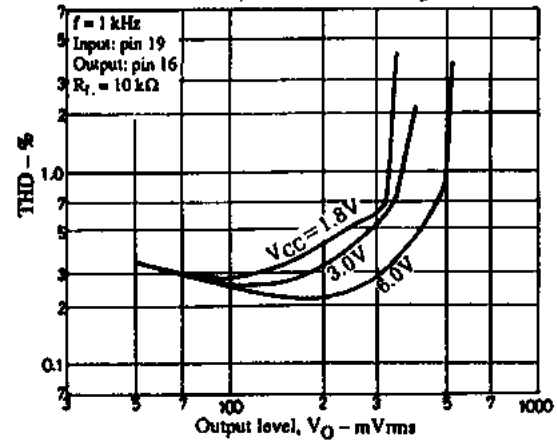
Compressor output noise voltage



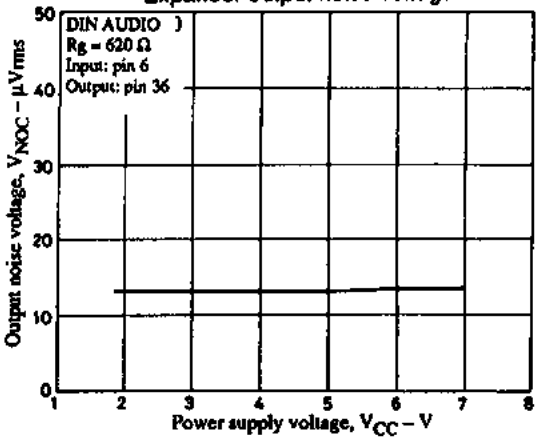
Compressor I/O characteristics



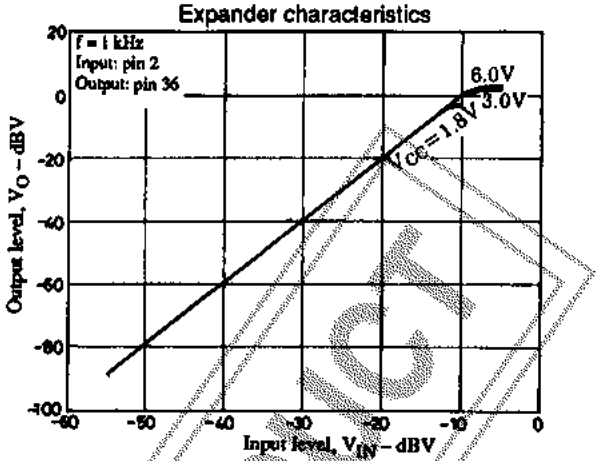
Compressor, THD – V_O



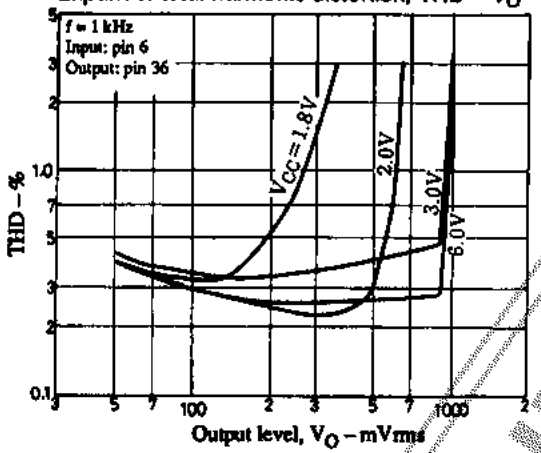
Expander output noise voltage



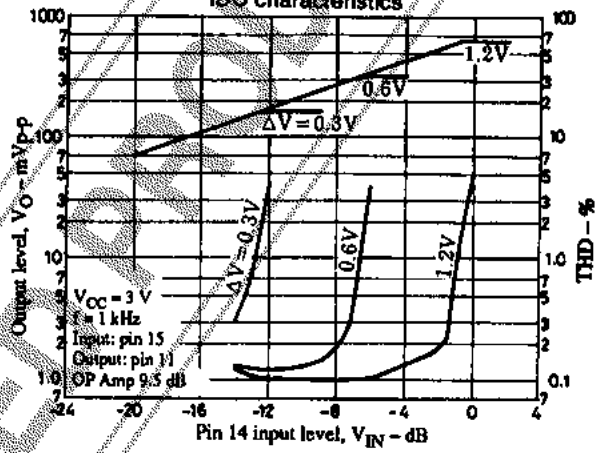
Expander characteristics



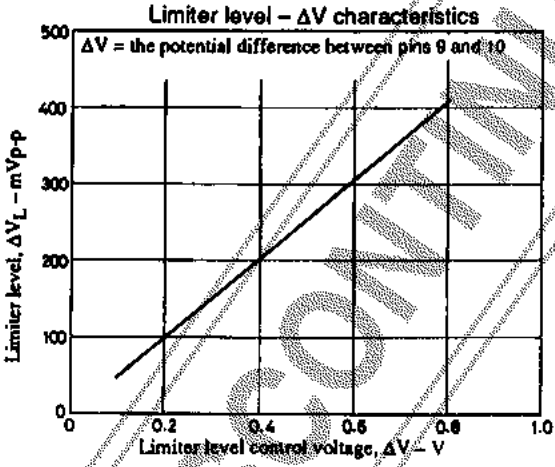
Expander total harmonic distortion, THD – V_O



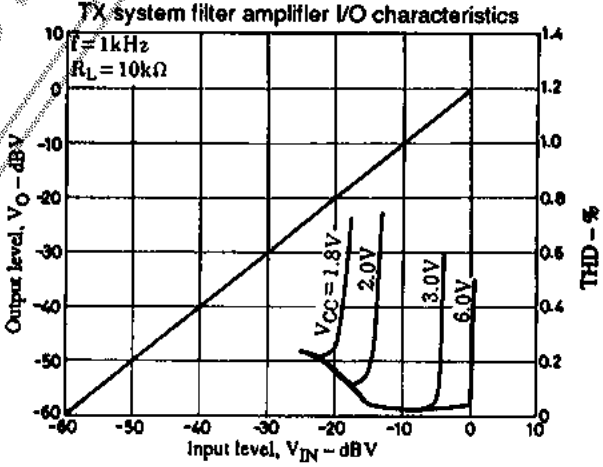
IDC characteristics



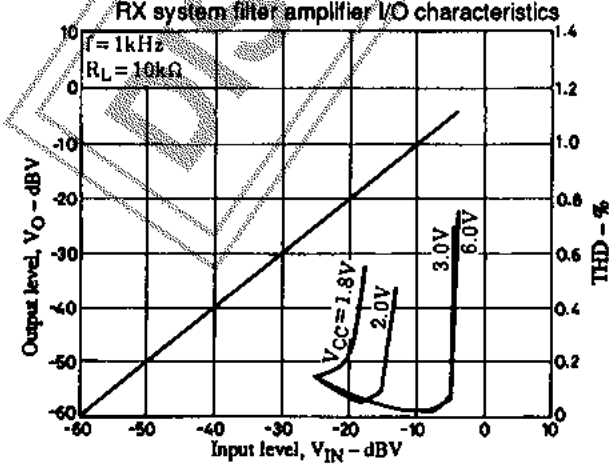
Limiter level – ΔV characteristics



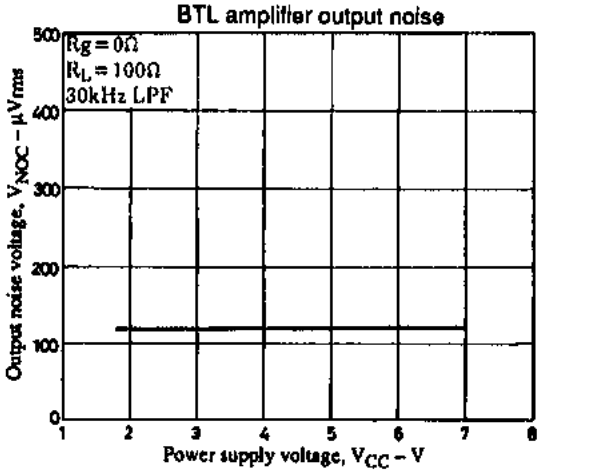
TX system filter amplifier I/O characteristics



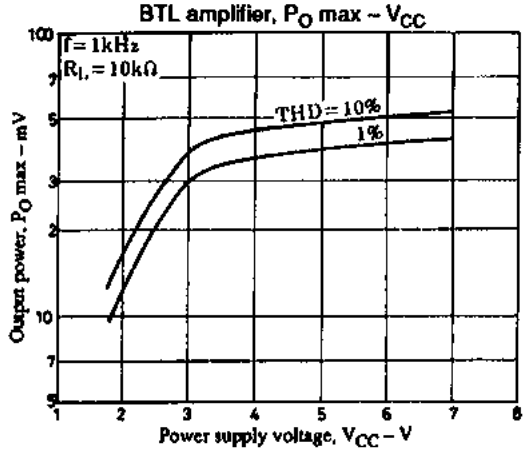
RX system filter amplifier I/O characteristics



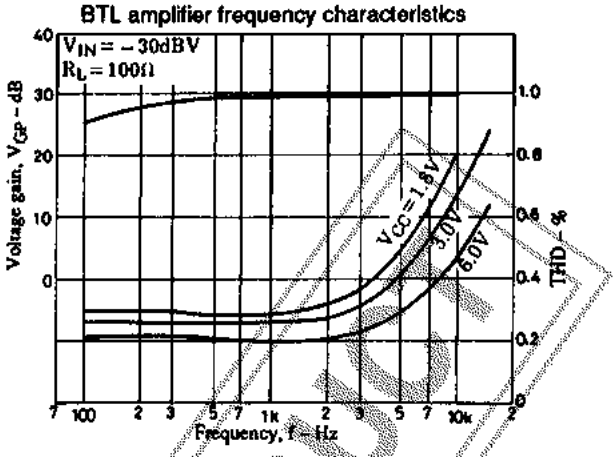
BTL amplifier output noise



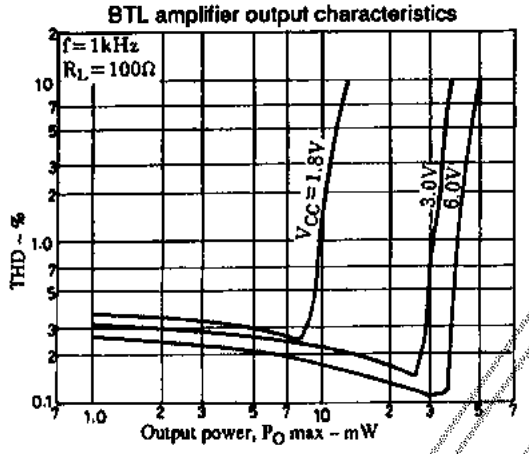
BTL amplifier, P_O max – V_{CC}



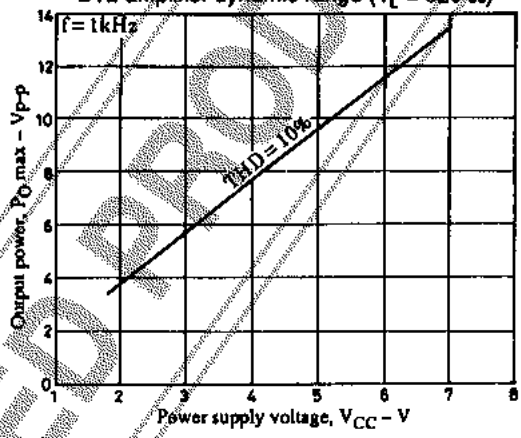
BTL amplifier frequency characteristics



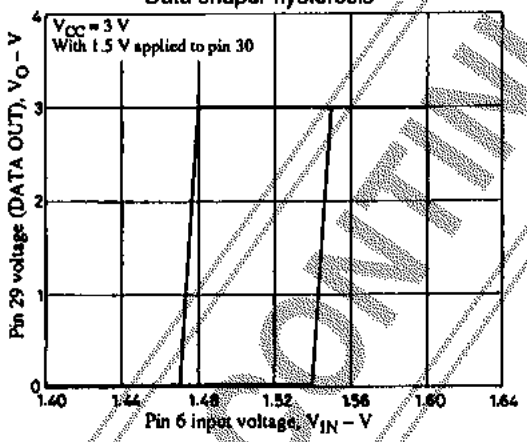
BTL amplifier output characteristics



BTL amplifier dynamic range (T_L = 620Ω)



Data shaper hysteresis



Data shaper duty