

Dolby B Type Noise Reduction System with Playback Equalizer

Description

The CXA1980Q is an IC designed for use in car stereos. Functions include Dolby B type noise reduction (NR), playback equalizer and interval detection between tracks (Music Sensor) into a single chip.

Features

- Few external parts
- Forward/Reverse head switching
- Small package (32-pin QFP)
- Dolby B type noise reduction and playback equalizer into a single chip
- Interval detection level between tracks can be set by external resistors/capacitors (2 modes).

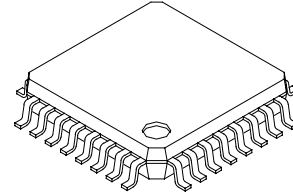
Applications

- Car stereos
- Stereo cassette deck players (playback only)

Structure

Bipolar silicon monolithic IC

32 pin QFP (Plastic)



Absolute Maximum Ratings (Ta=25°C)

• Supply voltage	V _{CC}	12	V
• Operating temperature	T _{opr}	-40 to +85	°C
• Storage temperature	T _{stg}	-65 to +150	°C
• Allowable power dissipation	P _D	430	mW

Recommended Operating Condition

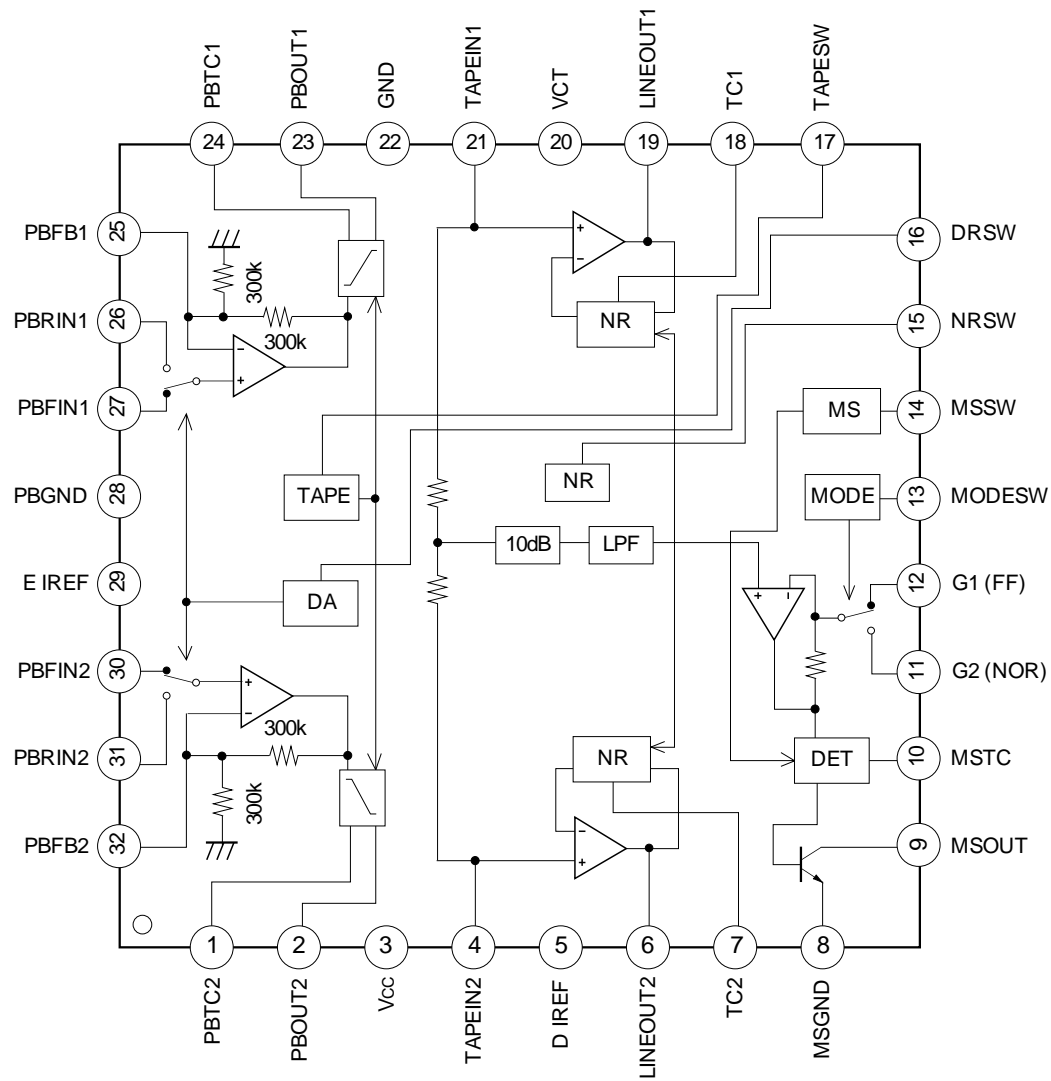
Supply voltage	V _{CC}	6.5 to 11	V
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Block Diagram and Pin Configuration



Pin Description

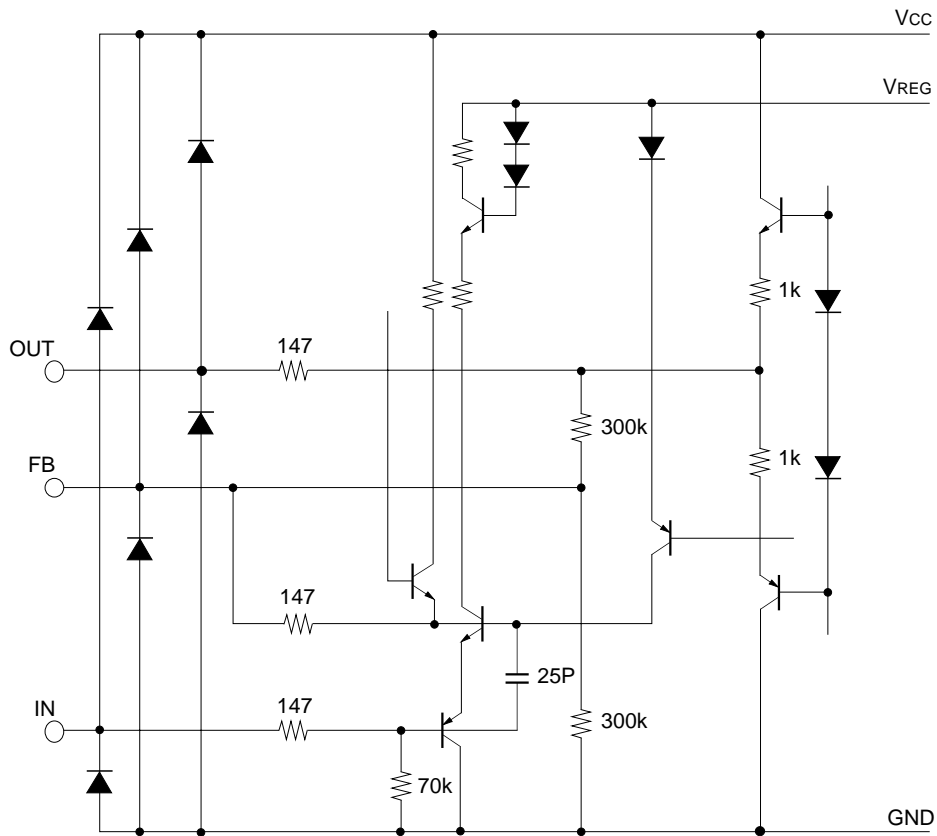
(Ta=25°C, Vcc=8.0V, no signal)

Pin No.	Symbol	DC value	Z (in)	Equivalent circuit	Description
1 24	PBTC	—	—		PBEQ capacitance
2 23	PBOUT	2.8V	—	Refer for page 6	PBEQ output
25 32	PBFB	1.4V	150kΩ		PBEQ feed back
26 27 30 31	PBIN	0V	70kΩ		PBEQ input
3	Vcc	8.0V	—		Power supply
4 21	TAPEIN	4.0V	40kΩ		Tape input
5	D IREF	1.25V	—		Connection of reference current setting resistor for Dolby block

Pin No.	Symbol	DC value	Z (in)	Equivalent circuit	Description
6 19	LINEOUT	4.0V	—		Line output
7 18	TC	0.3V	—		Connection of time constant of level detector
9	MSOUT	0.0V for signal detection; 5.0V for no signal detection	—		MS output
10	MSTC	1.4V for signal detection; 5.0V for no signal detection	—		Connection of MS detection time constant
11 12	G2(NOR) G1(FF)	4.0V	—		MS feed back

Pin No.	Symbol	DC value	Z (in)	Equivalent circuit	Description
13 15 16 17	MODESW NRSW DRSW TAPESW	—	—		Refer to page 6
14	MSSW	—	—		Refer to page 6
20	VCT	4.0V	—		Vcc/2 output
22 8 28	GND MSGND PBGND	0.0V	—		Ground
29	E IREF	1.25V	—		Connection of reference current setting resistor for PBEQ block.

• PBOUT, PBFB, PBIN equivalent circuit



• Description for SW pins

- MODESW — Switching of MS signal detection/blank detection
High: G1 (signal detection); Low: G2 (blank detection)
- NRSW — Switching of Dolby B type noise reduction ON/OFF
High: noise reduction OFF; Low: Dolby B
- DRSW — Switching of tape rotation
High: reverse; Low: forward
- TAPESW — Switching of HIGH/NORMAL tape
High: NORMAL tape; Low: HIGH tape
- MSSW — Switching of MS ON/OFF
High: MS ON; Low: MS OFF

Electrical Characteristics

(Ta=25°C, Vcc=8.0V, RL: output load resistance, Rg: head equivalent impedance)

Item	Symbol	Measurement conditions* (input pin, input level, frequency etc.)	Min.	Typ.	Max.	Unit
Current consumption	Icc	No signal	9.0	12.4	16.0	mA
Dolby block (Dolby level -6dBm=0dB)						
TAPE IN input sensitivity	VTIN	LINEOUT= 0 dB 1kHz	-32.0	-30.0	-28.0	dBm
Decode boost 1	BP1	TAPE IN 500Hz NR-ON Vlo=-25dB	1.4	2.9	4.4	dB
Decode boost 2	BP2	TAPE IN 2kHz NR-ON Vlo=-25dB	5.5	6.4	8.5	
Decode boost 3	BP3	TAPE IN 5kHz NR-ON Vlo=-25dB	3.9	5.2	6.9	
Decode boost 4	BP4	TAPE IN 10kHz NR-ON Vlo=-40dB	9.7	10.4	11.9	
Decode boost 5	BP5	TAPE IN 10kHz NR-ON Vlo=0dB	-1.1	0.4	1.9	
TAPEIN total harmonic distortion 1	THD1	TAPE IN -20dBm 1kHz RL=2.7kΩ	—	0.03	0.2	%
TAPEIN total harmonic distortion 2	THD2	TAPE IN -20dBm 1kHz NR-ON RL=2.7kΩ	—	0.04	0.2	
Decode S/N ratio	SN1	No signal NR-ON CCIR/ARM filter	77.0	82.8	—	dB
Signal handling	VOMAX1	1kHz THD=1% RL=2.7kΩ	13.0	14.4	—	
Cross talk TAPE 1ch→2ch	CT	TAPE IN -24dBm 1kHz	—	-67	-55	
LINEOUT offset voltage	Vos1	No signal	3.9	4.0	4.1	V
Playback equalizer amplifier block						
120μs FWD frequency characteristics	PBREF	PB F IN 315Hz -70dBm VPBO=0dB	-27.0	-25.0	-23.0	dBm
120μs FWD frequency characteristics	F120F	PB F IN 2.7kHz -58.5dBm for 315Hz	-1.5	0.0	1.5	dB
70μs FWD frequency characteristics	F70F	PB F IN 4.5kHz -53.8dBm for 315Hz				
120μs RVS frequency characteristics	F120R	PB R IN 315Hz -70dBm for 315Hz	-1.0	0.0	1.0	
Signal handling	VOMAX2	PB F IN 1kHz THD=1% RL=2.7kΩ	-10.0	-3.0	—	dBm
Total harmonic distortion	THD5	PB F IN 1kHz -52dBm RL=2.7kΩ	—	0.07	0.5	%
S/N ratio	SN2	No signal "A" weighting filter	55.0	58.0	—	dB
Output offset voltage	Vos2	No signal Rg=2.2kΩ	2.4	2.8	3.2	V
Cross talk between channels	CT4	PB IN 1kHz -42dBm		-78	-70	dB
Cross talk between RVS and FWD	CT5			-71	-65	
Interval detection between tracks (MUSIC SENSOR) block						
Signal detection level 1	VMS1	TAPE IN 5kHz MS-ON G1 (10kΩ, 0.015μF)	-44.3	-39.3	-33.0	dBm
Signal detection level 2	VMS2	TAPE IN 5kHz MS ON G2 (1kΩ, 1.5μF)	-63.5	-58.5	-53.5	
MS output leak current	IOH	TAPE IN 5kHz -10dBm, 5V applied to MSOUT	—	0.0	1.0	μA
MS output saturation voltage	VOL	TAPE IN 5kHz -30dBm, 1mA applied to MSOUT	—	0.28	1.0	V
Logic voltage	VIL	AUXSW, MODESW, INSW, MSSW,	0.0	—	0.5	
	VIH	TAPESW, NRSW, DRWSW	2.5	—	Vcc	

*120μs, FWD mode, NR OFF, MS OFF unless otherwise specified.

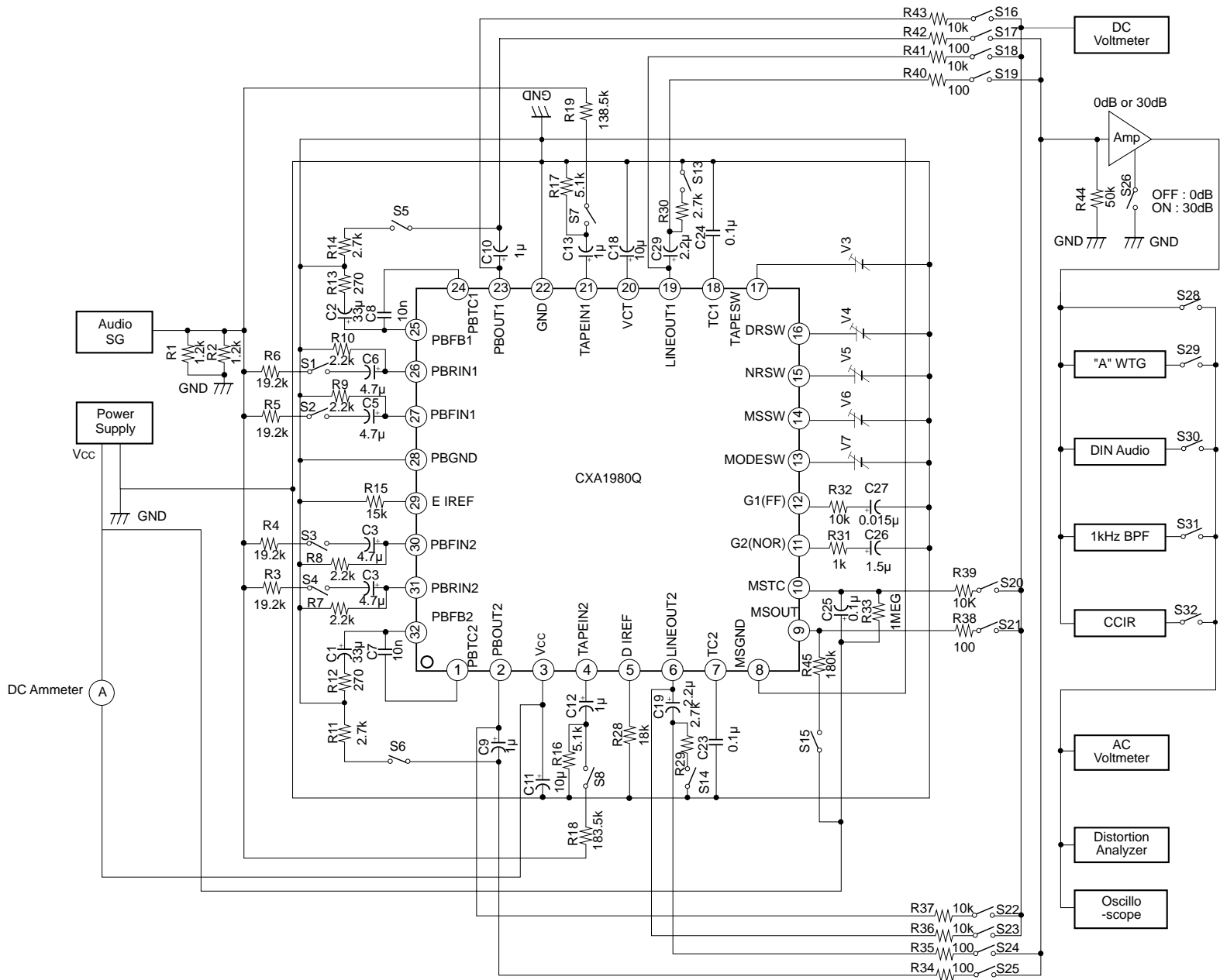
Operation mode control (TAPESW, DRSW, NRSW, MSSW, MODESW)

The CXA1980Q has built in electronic switch circuits and the operations are controlled by the direct current applied to each SW pin. The operation mode state for each switch is shown in the table below.

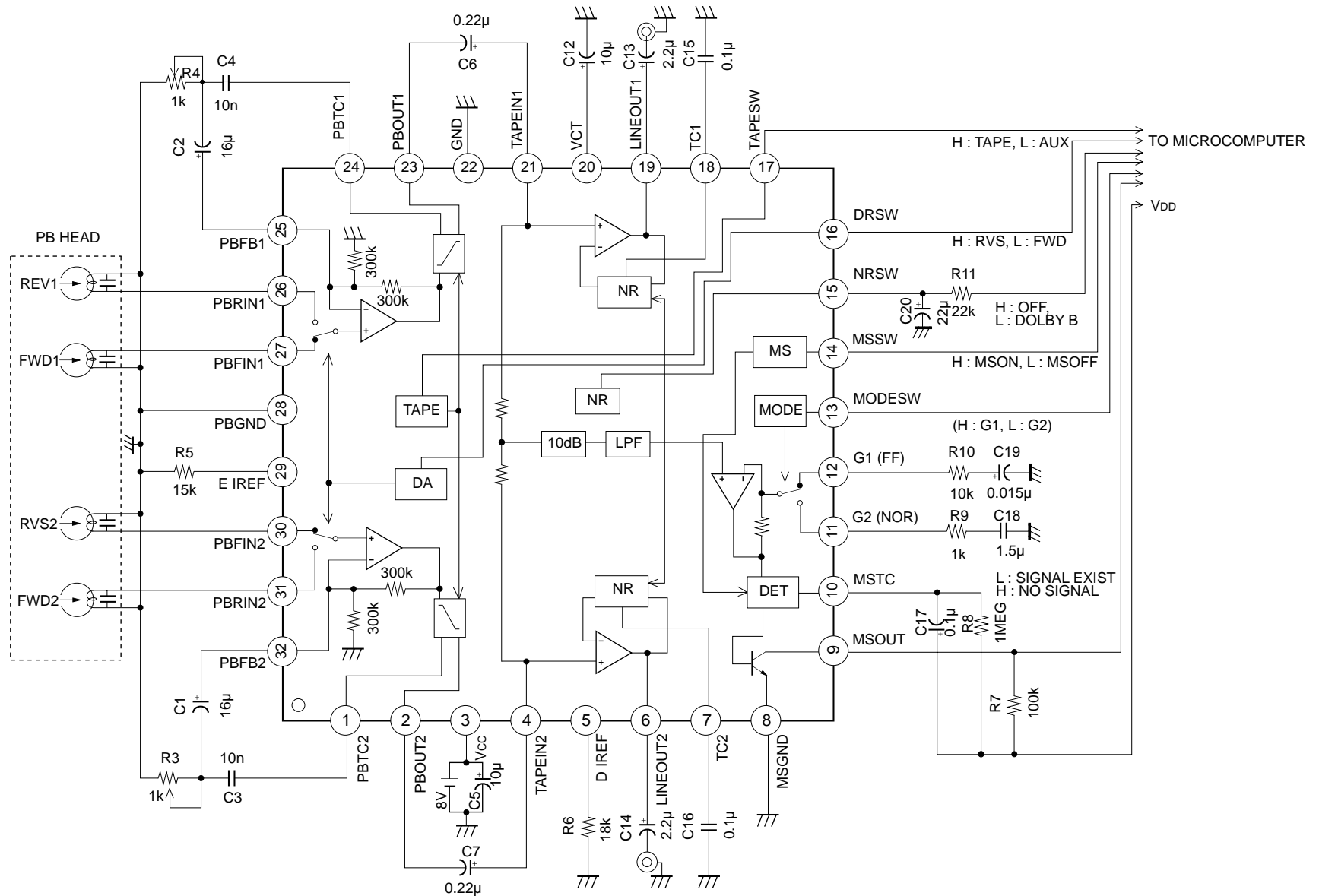
SW	Function for Low input	Function for High input
TAPESW	70 μ S	120 μ s
DRSW	PB FWD	PB RVS
NRSW	DOLBY B NR	NR OFF
MSSW	MS OFF	MS ON
MODESW	G2(NOR) MODE	G1(FF) MODE

Click noise can be reduced by the external CR time constant circuit for NR SW switching.

Electrical Characteristic Measurement Circuit



Application Circuit



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Description of Operation

(1) Signal route

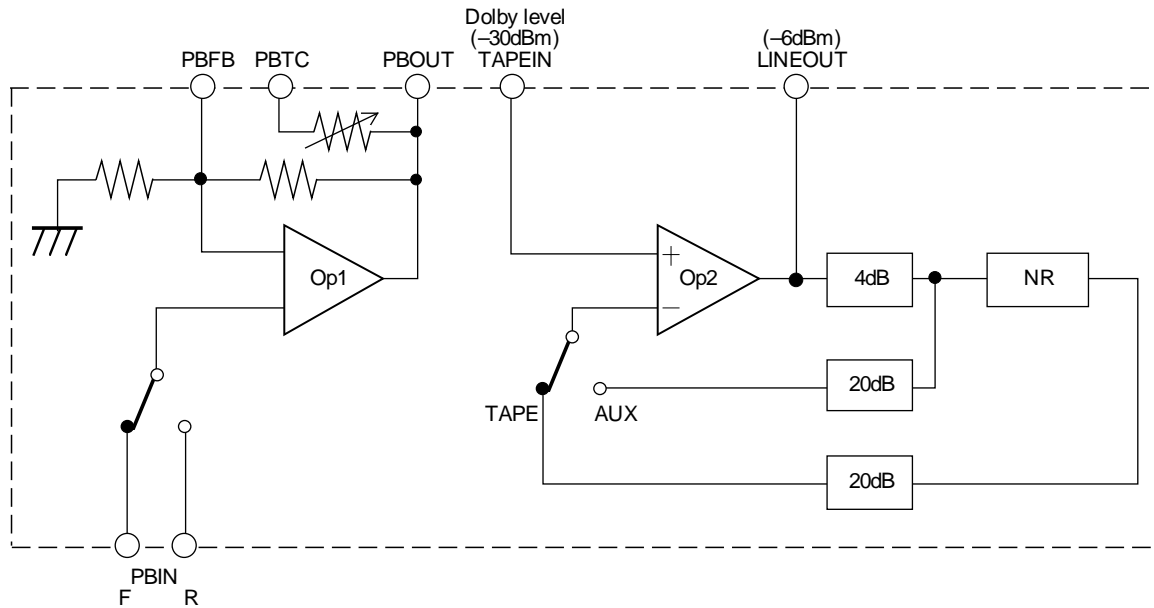


Fig. 1

Op1 and Op2 are operational amplifiers.

Op1 compose the playback equalizer by attaching a resistor and a capacitor to PBFB pin, and a capacitor to PBTC pin.

Op2 is an input selector and a LINEOUT amplifier. The gain of LINEOUT amplifier is 24 dB.

Reference input level for Dolby is -30 dBm.

The adjustment method of playback equalizer is described in the paragraph (3).

(2) Level diagram

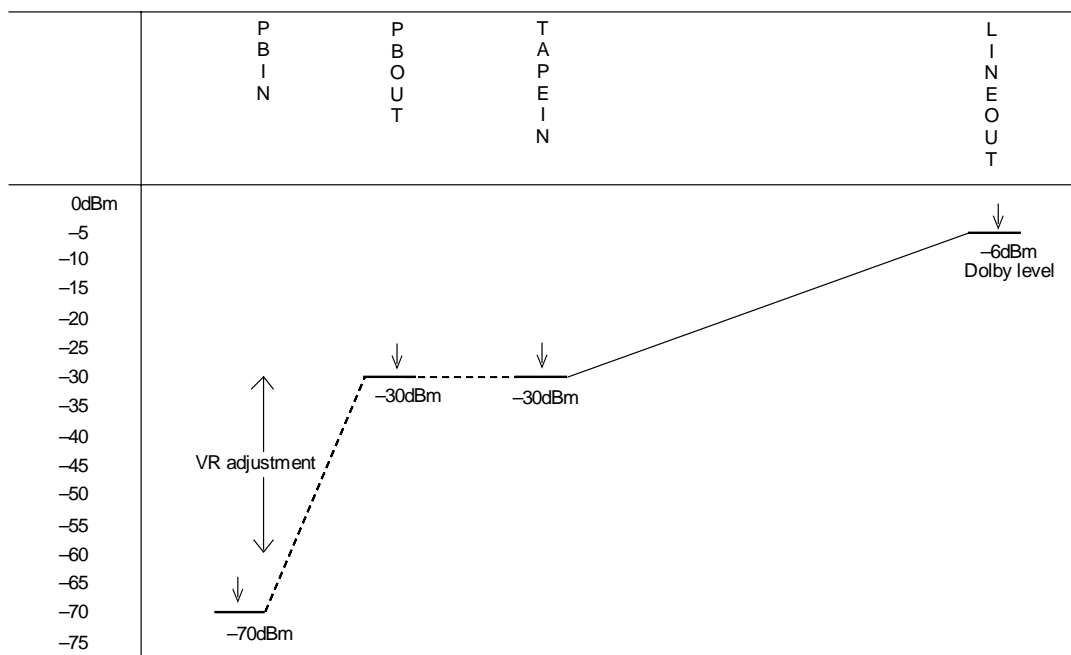


Fig. 2

(3) Adjustment of playback equalizer

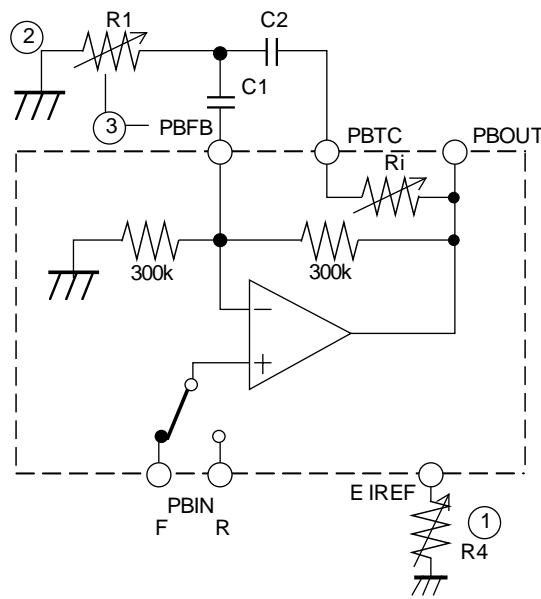


Fig. 3

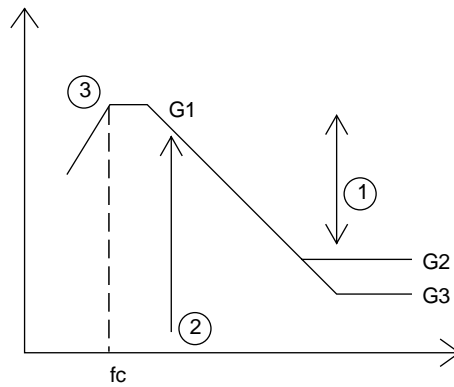


Fig. 4

- ① Adjustment of EQ curve gain difference (= adjustment of internal variable R) → E IREF resistor
The internal variable resistor Ri should be adjusted to adjust the EQ curve gain differences (G1-G2), (G1-G3). Therefore, adjust the external resistor R4 for E IREF pin.
- ② AC gain adjustment → External resistor R1
The external resistor R1 should be adjusted to adjust the AC gain. G1 are obtained by the following equations.

$$G1 = 20 \log \frac{R1 + 300k}{R1} \text{ (dB)}$$

[AC gain can be also adjusted by attaching VR to PBOUT pin, fixing R1. However, the low-band cut-off frequency can be more lowered by R1 adjustment method with the same C1 value used for this method.]
- ③ Low-band cut-off frequency → External resistor R1 and external capacitor C1
The low-band cut-off frequency (fc) can be determined by the external resistor R1 and external capacitor C1.

(4) MS (interval detection between tracks) adjustment method

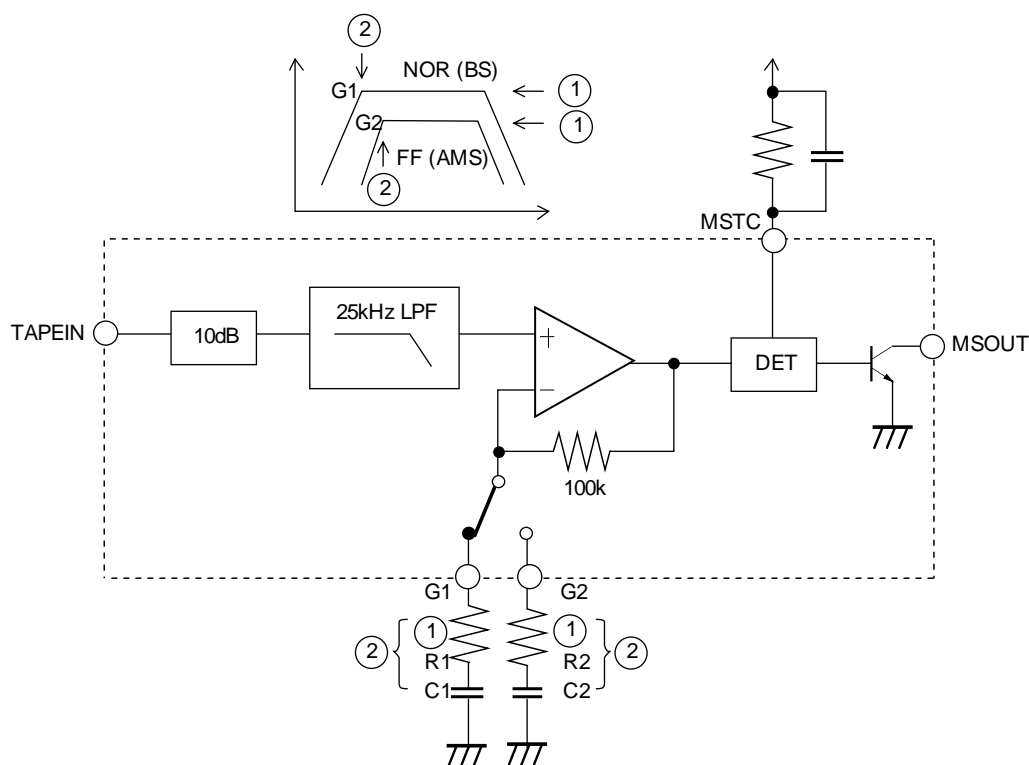


Fig. 5

- ① MS gain (G1/G2 mode gain) adjustment → External resistors R1, R2
MS gain is expressed by the following equations.

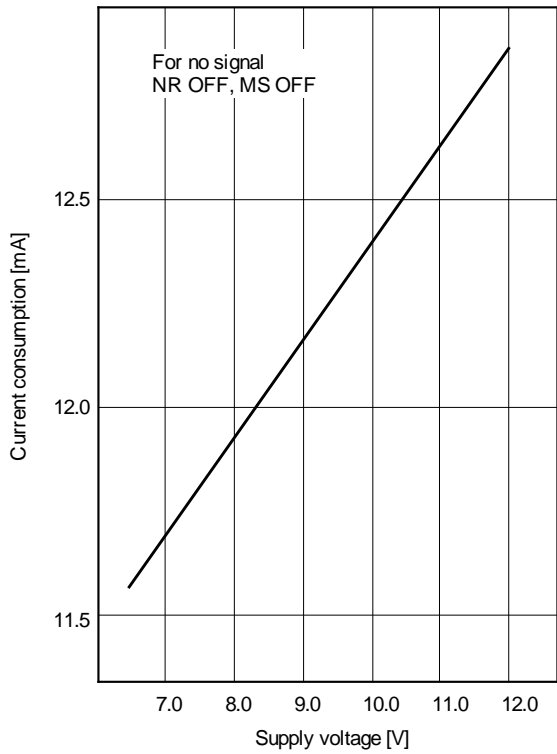
$$G1 = 10 + 20 \log \frac{R1 + 100k}{R1} \text{ (dB)} \quad G2 = 10 + 20 \log \frac{R2 + 100k}{R2} \text{ (dB)}$$

- ② MS cut-off frequency adjustment → External resistors R1, R2 and external capacitors C1, C2
The external resistors R1, R2 and external capacitors C1, C2 should be adjusted to adjust the low-band cut-off frequency of MS frequency characteristics.

Characteristics Graphs

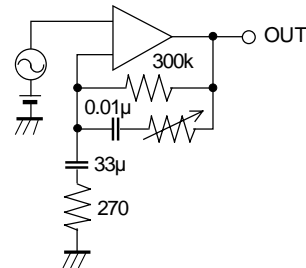
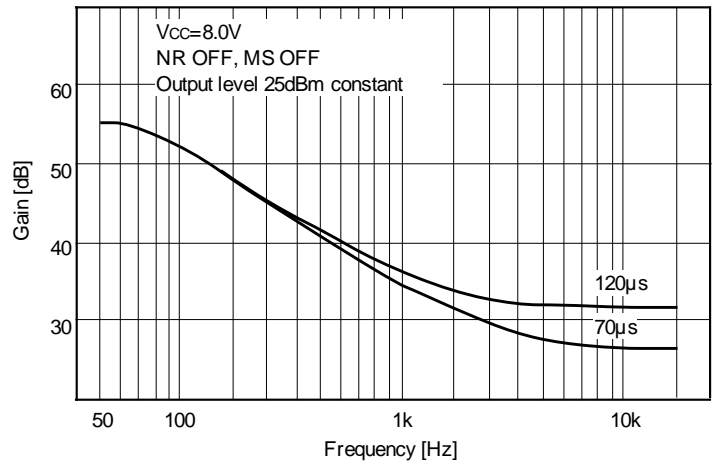
Current consumption vs. Supply voltage

Ta=25°C



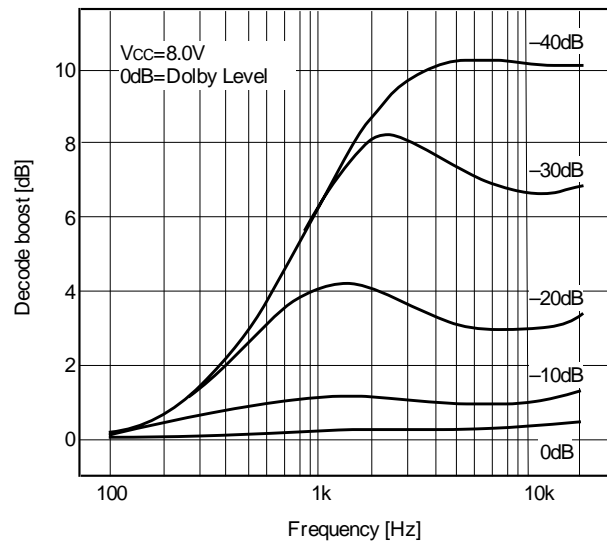
Playback equalizer frequency characteristics

Ta=25°C

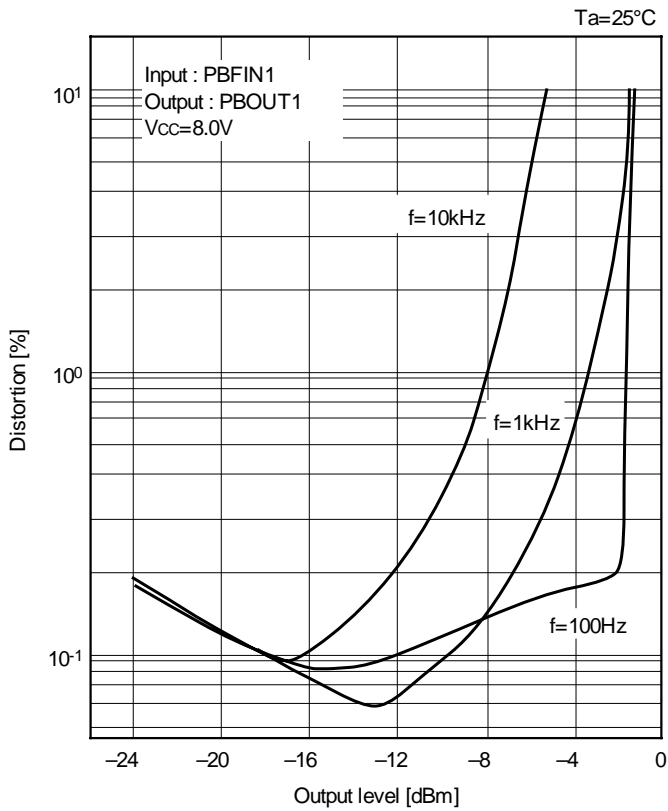


Decode boost frequency characteristics

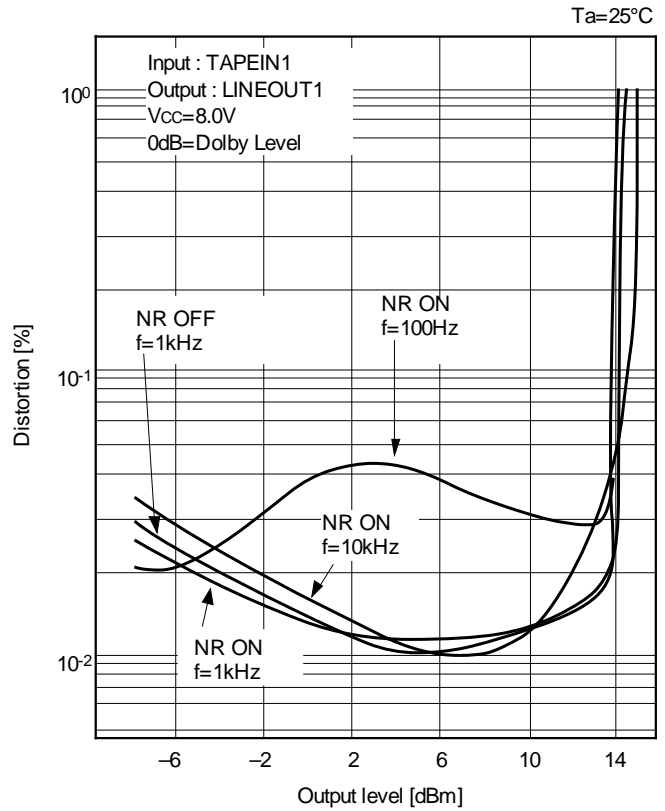
Ta=25°C



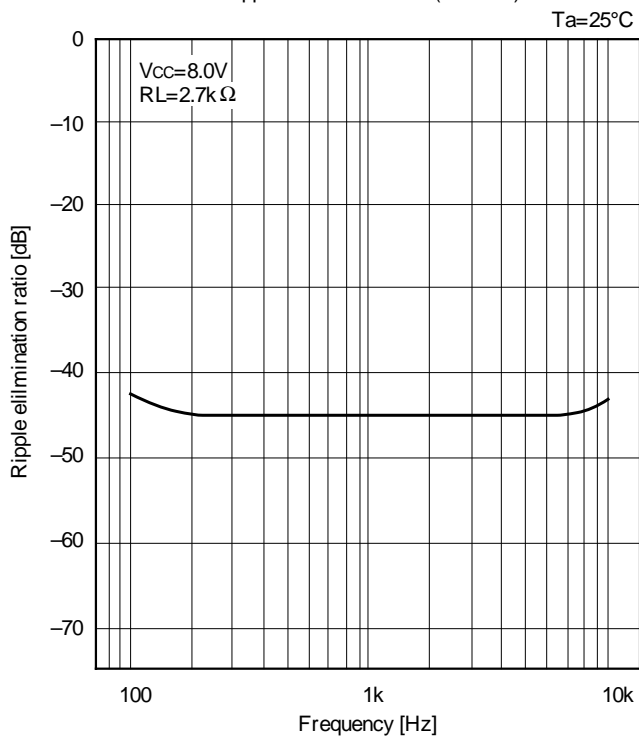
Total harmonic distortion (pre-amplifier block)



Total harmonic distortion (Dolby block)



Ripple elimination ratio (PBOUT)



Ripple elimination ratio (LINEOUT)

