

DD Dolby B Type Noise Reduction System with Playback Equalizer

Description

The CXA1910Q is an IC designed for use in car stereos. Functions include Dolby B type noise reduction, playback equalizer amplifier and Music sensor into a single chip.

Features

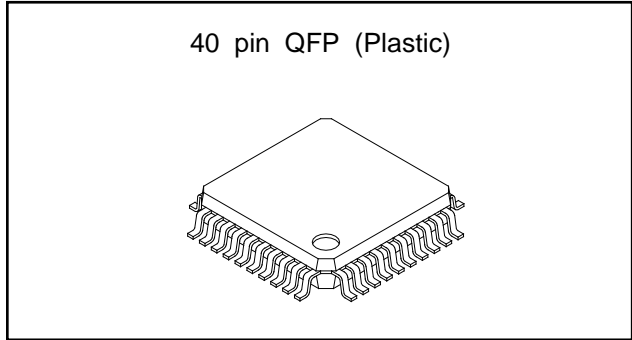
- Few external parts
- Forward/Reverse head switching
- Small package (40-pin QFP)
- Dolby B type noise reduction and playback equalizer into a single chip
- Same pin configuration as Dolby B/C type noise reduction system (CXA1911)
- Music sense level can be set by external resistors/capacitors (2 modes).
- High-band cut filter frequency can be adjusted by the external capacitance.

Applications

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

Structure

Bipolar silicon monolithic IC



Absolute Maximum Ratings (Ta=25°C)

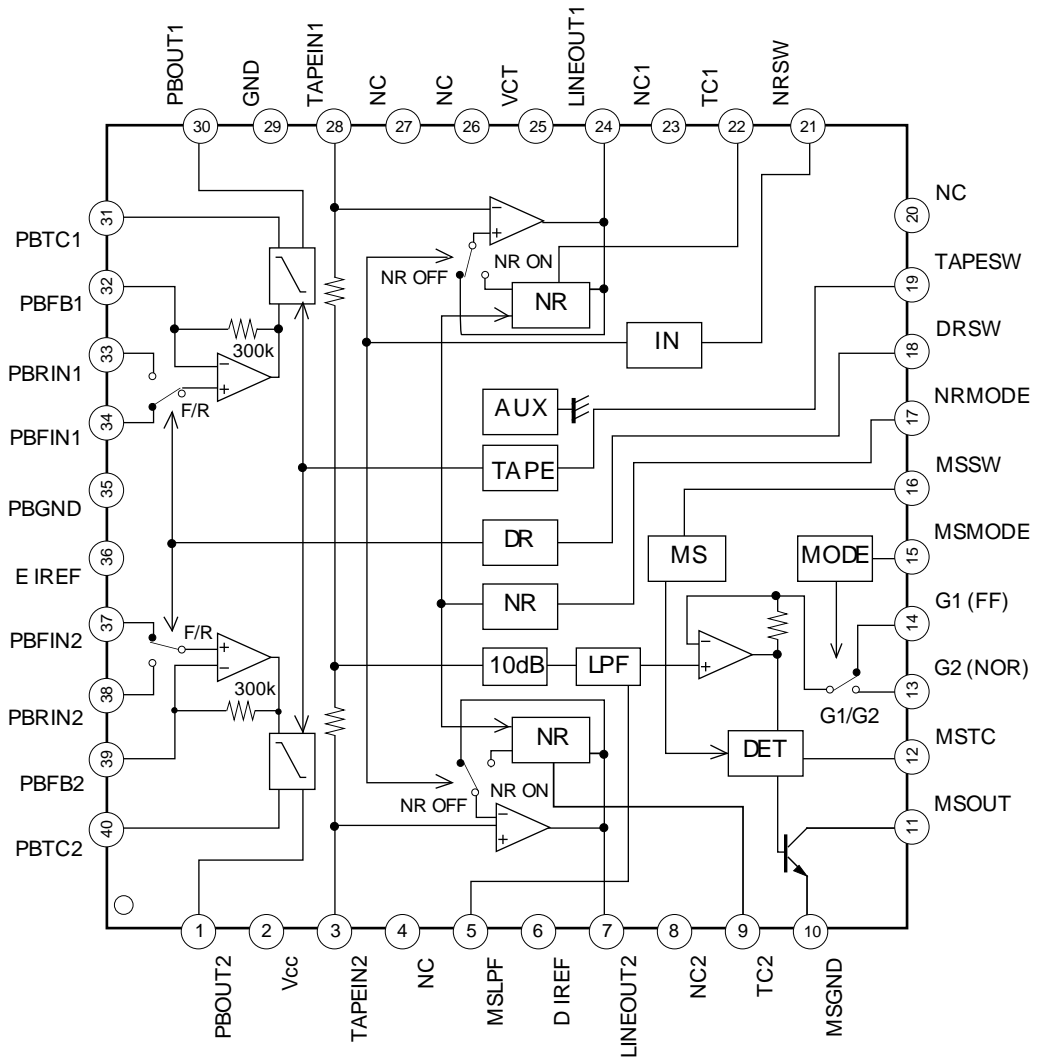
| | | | |
|-------------------------------|------|-------------|----|
| • Supply voltage | VCC | 12 | V |
| • Operating temperature | Topr | -40 to +85 | °C |
| • Storage temperature | Tstg | -65 to +150 | °C |
| • Allowable power dissipation | PD | 430 | mW |

Recommended Operating Condition

| | | | |
|----------------|-----|-----------|---|
| Supply voltage | VCC | 6.5 to 11 | V |
|----------------|-----|-----------|---|

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Block Diagram and Pin Configuration



Pin Description

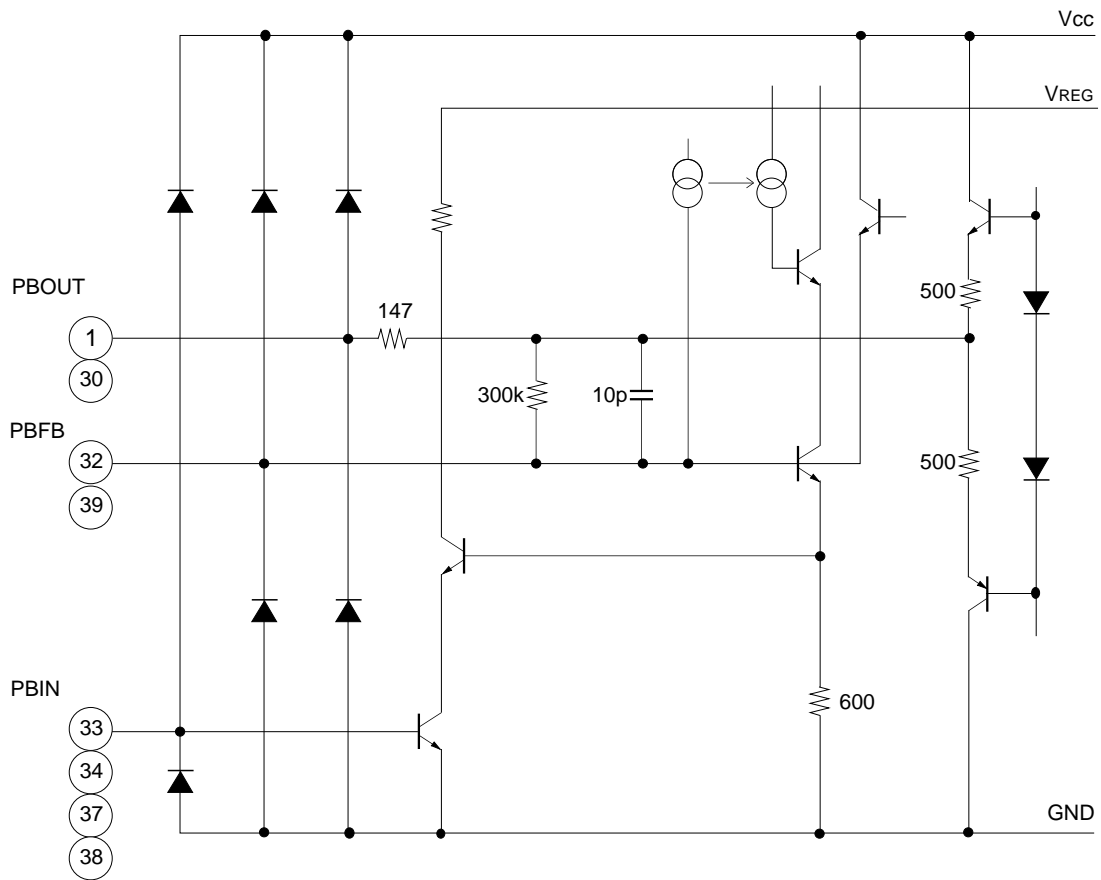
(Ta=25°C, Vcc=8.0V, no signal)

| Pin No. | Symbol | DC value | Z (in) | Equivalent circuit | Description |
|----------------------|-----------------------|--|--------|--------------------|--|
| 1 30 | PBOUT | 2.1V | — | Refer to Page 6. | PBEQ output |
| 32 39 | PBFB | 2.1V | 300kΩ | | PBEQ feedback |
| 33 34 37 38 | PBIN | 0V | — | | PBEQ input |
| 2 | Vcc | 8.0V | — | | Power supply |
| 10 29 35 | MSGND GND PBGND | 0.0V | — | | Ground |
| 31 40 | PBTC | — | — | | PBEQ capacitance |
| 36 | E IREF | 1.25V | — | | Reference current setting resistor pin |
| 11 | MSOUT | 0.0V for signal detection; 5.0V for no signal detection | — | | MS output |

| Pin No. | Symbol | DC value | Z (in) | Equivalent circuit | Description |
|----------|-------------------|---|--------|--------------------|--|
| 12 | MSTC | Approx. 1.4V for signal detection; 5.0V for no signal detection | — | | Connection of MS detection time constant |
| 13 14 | G2(NOR) G1(FF) | 4.0V | — | | MS feedback |
| 3 28 | TAPEIN | 4.0V | 40k | | TAPE input |
| 6 | D IREF | 1.25V | — | | Connection of reference current setting resistor for Dolby block |
| 7 24 | LINEOUT | 4.0V | — | | Line output |

| Pin No. | Symbol | DC value | Z (in) | Equivalent circuit | Description |
|--------------------------------|--|----------|--------|--------------------|--|
| 9 22 | TC | 0.3V | — | | Time Constant pin for the level detector |
| 15 17 18 19 21 | MSMODE NRMODE DRSW TAPESW NRSW | — | — | | Refer to Page 6. |
| 16 | MSSW | — | — | | Refer to Page 6. |
| 25 | VCT | 4.0V | — | | Vcc/2 output |
| 4 8 20 23 26 27 | NC | — | — | | No connection. |
| 5 | MSLPF | 4.0V | 100k | | Capacitance connection for adjusting the MS LPF time constant. |

* PBOUT, PBFB, PBIN equivalent circuit



* Description for SW pins

MSMODE - Switching of MS signal detection/blank detection

High: G1; Low: G2

NRSW - Switching of Dolby B type noise reduction ON/OFF

High: noise reduction ON; Low: noise reduction OFF

DRSW - Switching of tape direction

High: reverse; Low: forward

TAPESW - Switching of HIGH/NORMAL tape

High: NORMAL tape; Low: HIGH tape

NRMODE - Switching of noise reduction modes

High: noise reduction OFF; Low: Dolby B

MSSW - Switching of MS ON/OFF

High: MS ON; Low: MS OFF

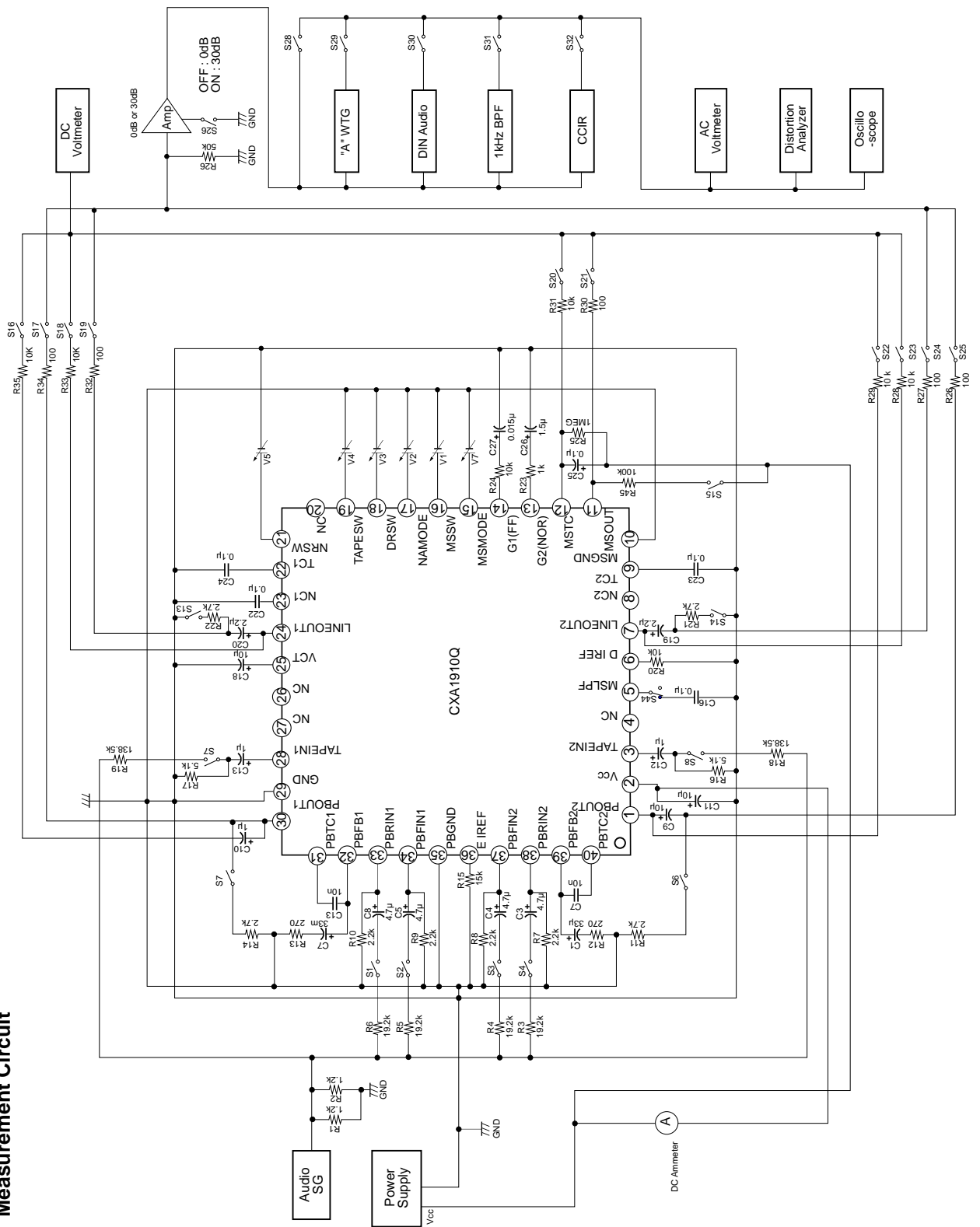
Electrical Characteristics

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

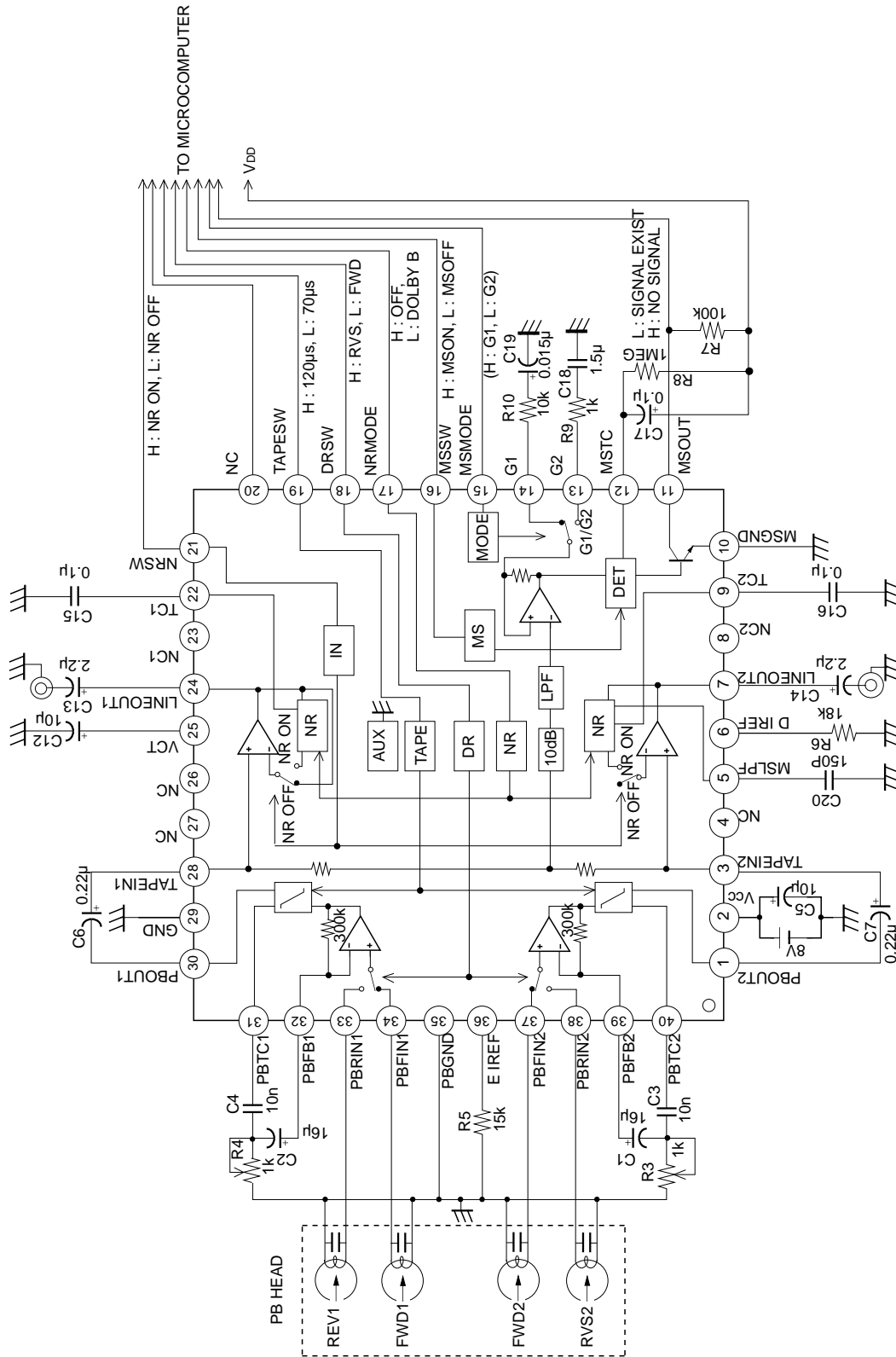
| Item | Symbol | Measurement conditions* (input pin, input level, frequency etc.) | Min. | Typ. | Max. | Unit |
|---|--------|---|-------|-------|-------|------|
| Current consumption | Icc | No signal | 14.5 | 17.9 | 21.5 | mA |
| Dolby block (Dolby level -6dBm=0dB) | | | | | | |
| TAPE IN input sensitivity | 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 | |
| TAPE IN total harmonic distortion 1 | THD1 | TAPE IN -20dBm 1kHz RL=2.7kΩ | — | 0.03 | 0.2 | % |
| TAPE IN 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 | — | dB |
| Cross talk TAPE 1ch→2ch | CT3 | 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 | 0.7 | 1.5 | dB |
| 70μs FWD frequency characteristics | F70F | PB F IN 4.5kHz -53.8dBm for 315Hz | -1.5 | 0.0 | 1.5 | |
| 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 | 57.0 | 60.0 | — | dB |
| Output offset voltage | Vos2 | No signal Rg=2.2kΩ | 1.55 | 1.95 | 2.35 | V |
| Cross talk between channels | CT4 | PB IN 1kHz -42dBm | — | -78 | -70 | dB |
| Cross talk between RVS and FWD | CT5 | | — | -75 | -65 | |
| Interval detection between tracks (MUSIC SENSOR) block | | | | | | |
| Signal detection level 1 | VMS1 | TAPE IN 5kHz MS-ON G1 (10kΩ, 0.015μF) | -43.0 | -39.0 | -35.0 | dBm |
| Signal detection level 2 | VMS2 | TAPE IN 5kHz MS-ON G2 (1kΩ, 1.5μF) | -62.5 | -58.5 | -54.5 | |
| MS output leak current | IoH | | — | 0.0 | 1.0 | μA |
| MS output saturation voltage | VOL | TAPE IN 5kHz -30dBm, 1mA applied to MSOUT AMS ON (G1 mode) | — | 0.28 | 1.0 | V |
| Boost charge circuit block | | | | | | |
| PBFB boost-charge current | ICRG | No signal, 3.4V applied to VCT and 1.8V to PBFB | 1.0 | 3.0 | — | mA |
| Boost charge ON VCT level | VCRG1 | No signal, VCT level when boost charge ON | — | — | 3.4 | V |
| Boost charge OFF VCT level | VCRG2 | No signal, VCT level when boost charge OFF | 3.6 | — | — | |
| Logic voltage | VIL | MSMODE, NRMODE, MSSW, | 0.0 | — | 0.8 | |
| | VIH | TAPESW, NRSW, DRSW | 2.5 | — | Vcc | |

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

**Electrical Characteristics
Measurement Circuit**

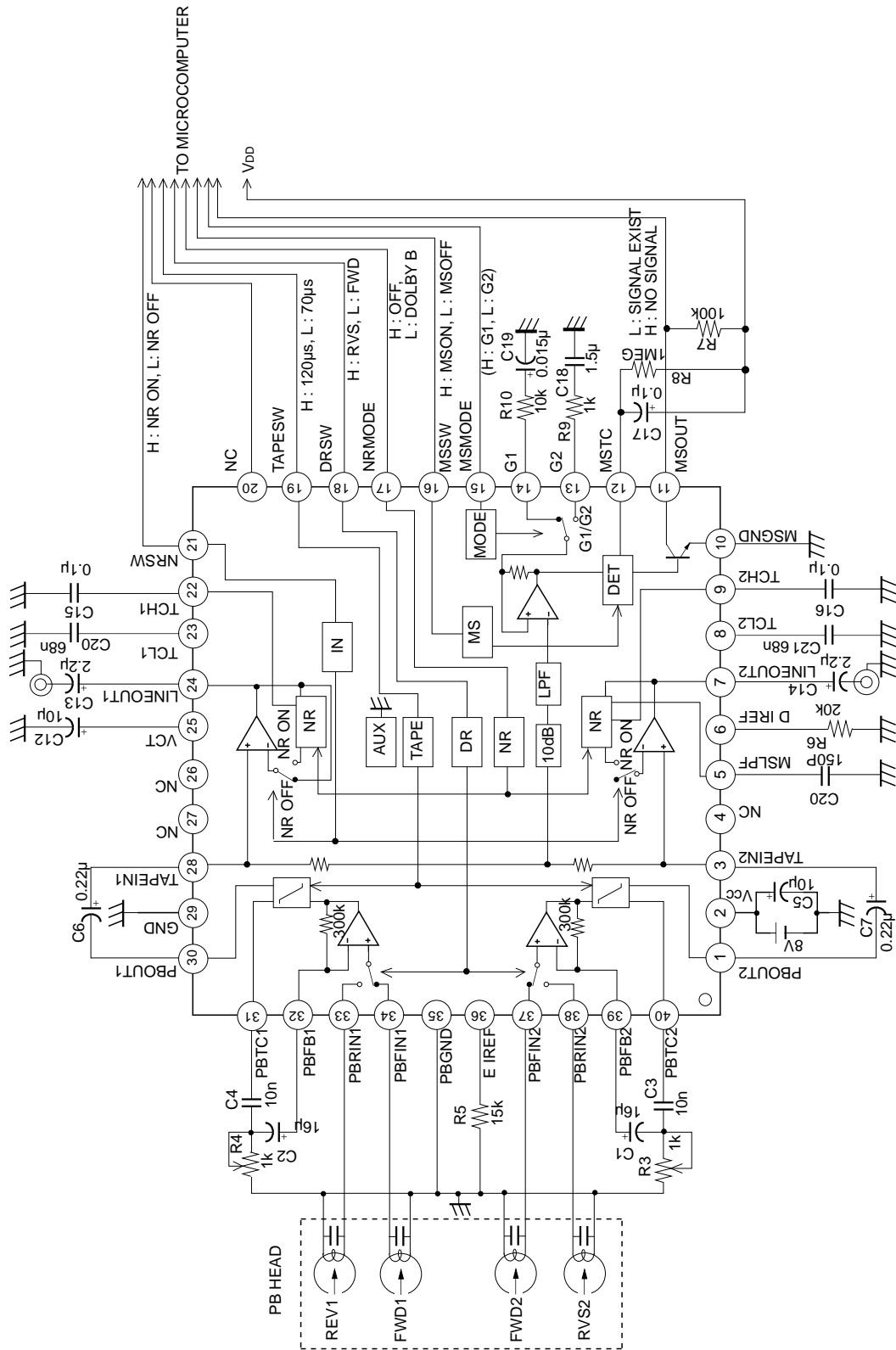


Application Circuit



Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party and other right due to same.

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

The CXA1910Q 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 |
|--------|------------------------|-------------------------|
| NRSW | NR OFF | NR ON |
| TAPESW | 70 μ s | 120 μ s |
| DRSW | PB FWD | PB RVS |
| NRMODE | DOLBY B | NR OFF |
| MSSW | MS OFF | MS ON |
| MSMODE | G2 (NOR) MODE | G1 (FF) MODE |

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

Description of Operation

(1) Signal route

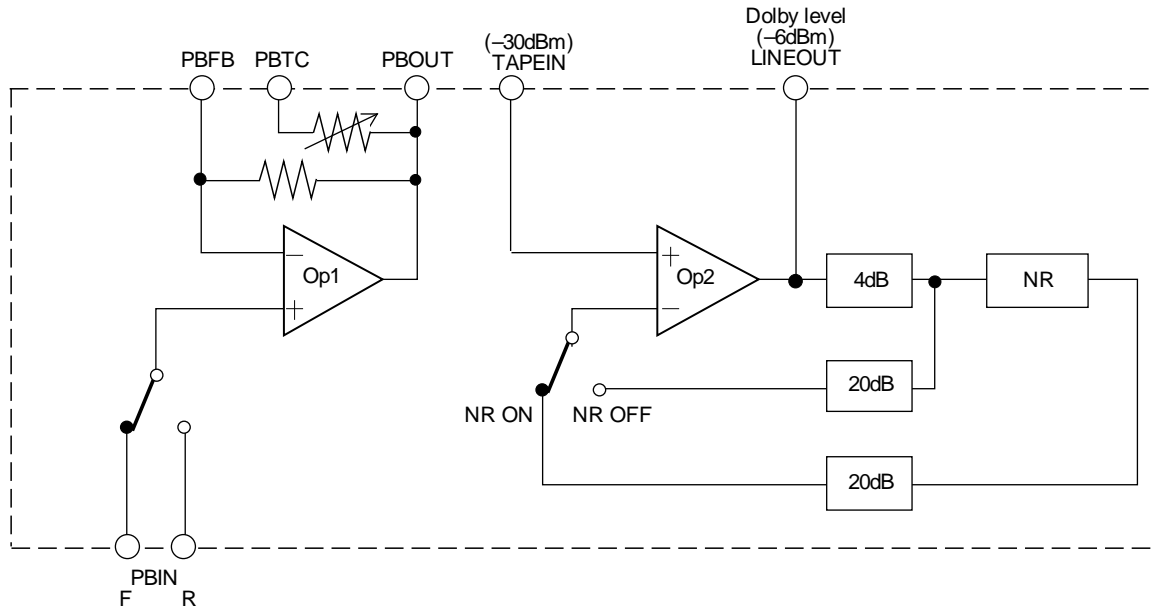


Fig. 1

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 24dB.

Reference input level for Dolby is -30dBm.

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

(2) Level diagram

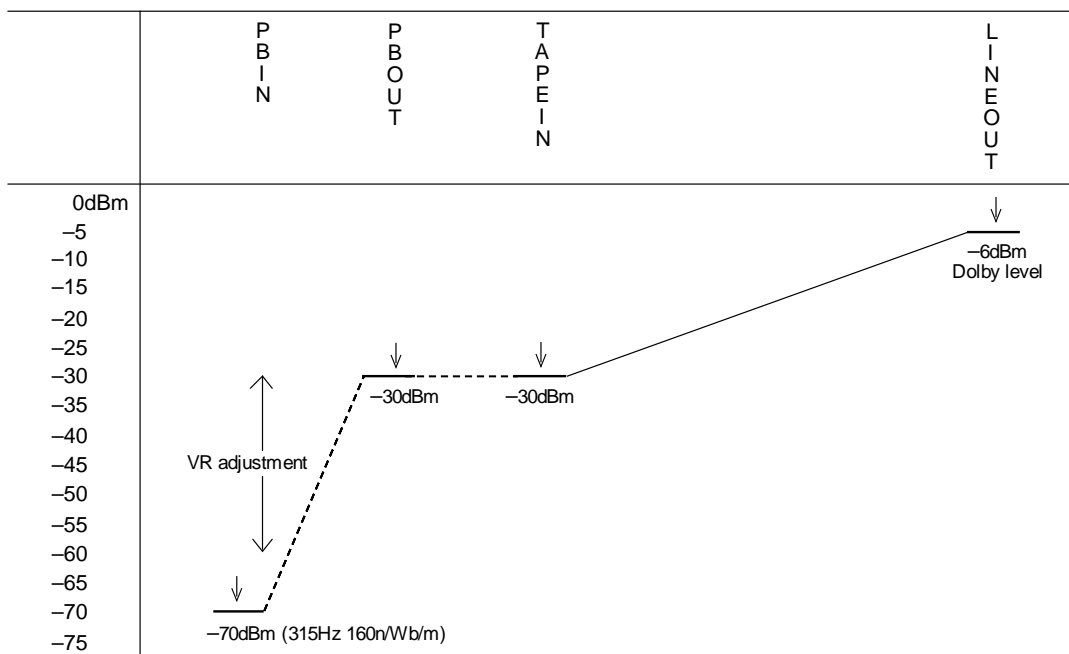


Fig. 2

(3) Adjustment of playback equalizer

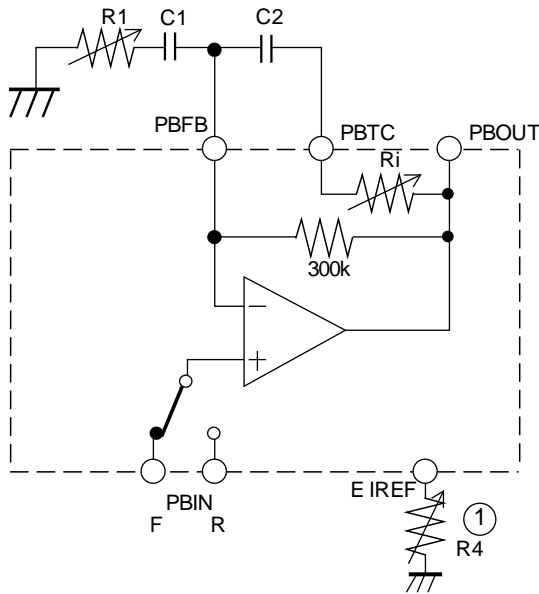


Fig. 3

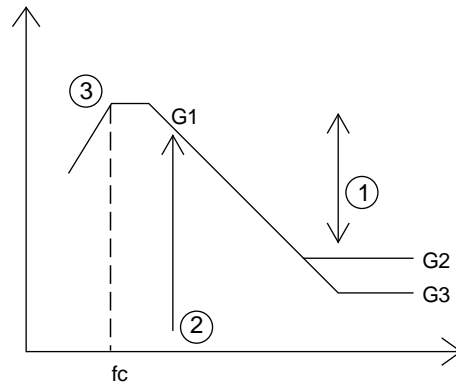


Fig. 4

- 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. G3 are obtained by the following equations.

$$G1=10+20\log\frac{R1+300k}{R1} \text{ (dB)}$$

[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 (internal detection between tracks) adjustment method

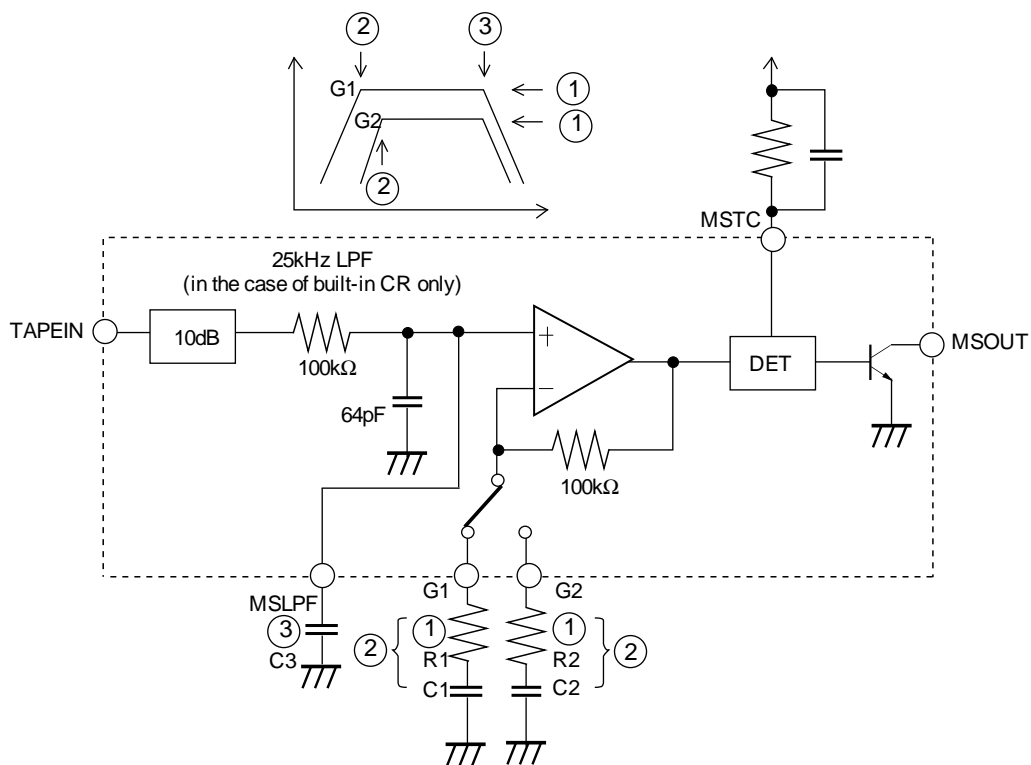


Fig. 5

- 1) MS gain (FF/NOR mode gain) adjustment → External resistors R1 and R2
MS gain is expressed by the following equations.

$$G1 = 10 + 20\log \frac{R1 + 100k}{R1} \text{ [dB]} \qquad G2 = 10 + 20\log \frac{R2 + 100k}{R2} \text{ [dB]}$$

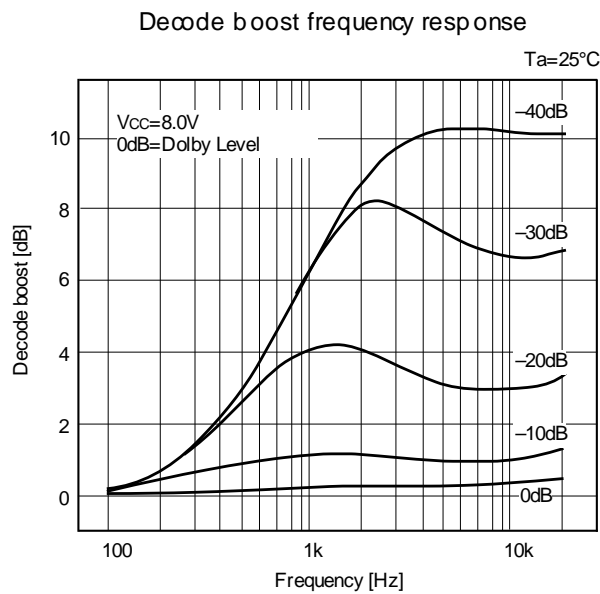
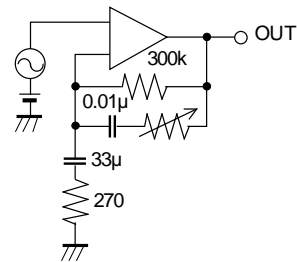
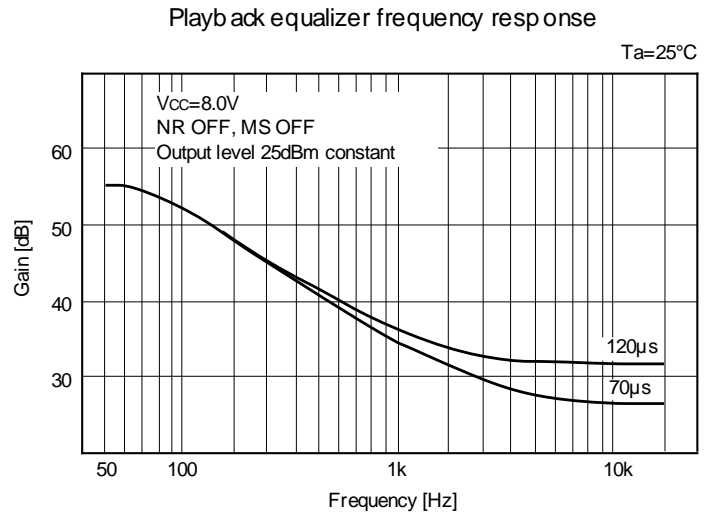
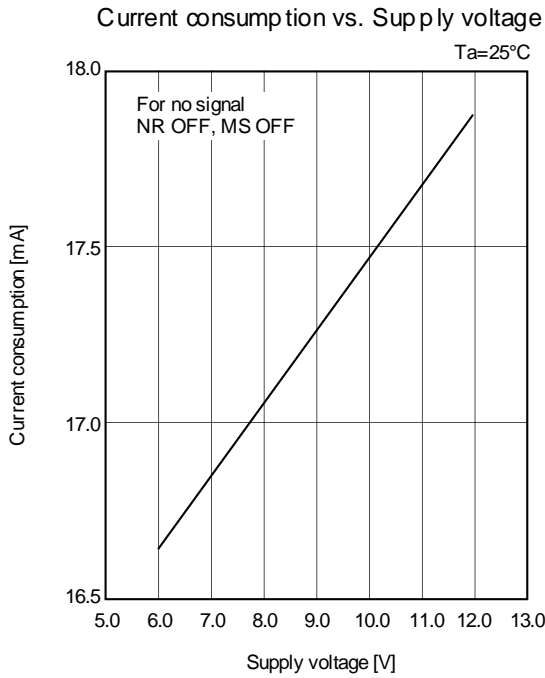
- 2) MS low-band cut-off frequency adjustment → External resistors R1 and R2 and external capacitors C1 and C2

The external resistors R1 and R2 and external capacitors C1 and C2 should be adjusted to adjust the low-band cut-off frequency for the MS frequency response.

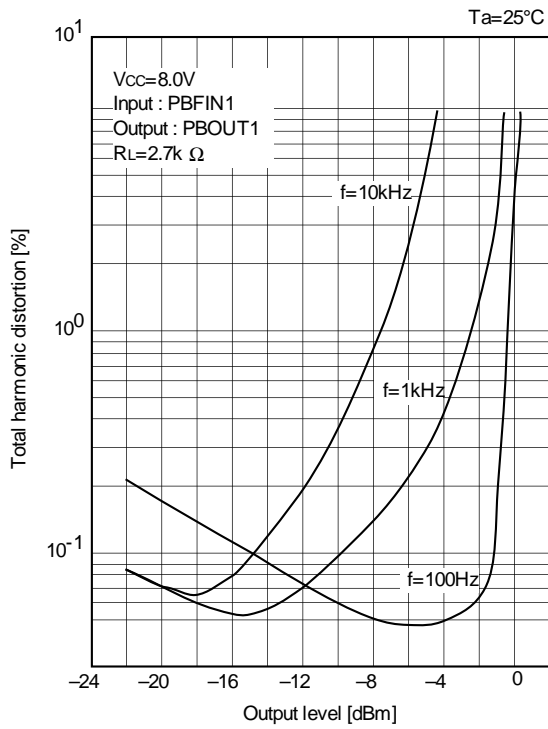
- 3) MS high-band cut-off frequency adjustment → External capacitor C3

The external capacitor C3 should be adjusted to adjust the high-band cut-off frequency for the MS frequency response. (In this case, G1 and G2 have the same cut-off frequency.)

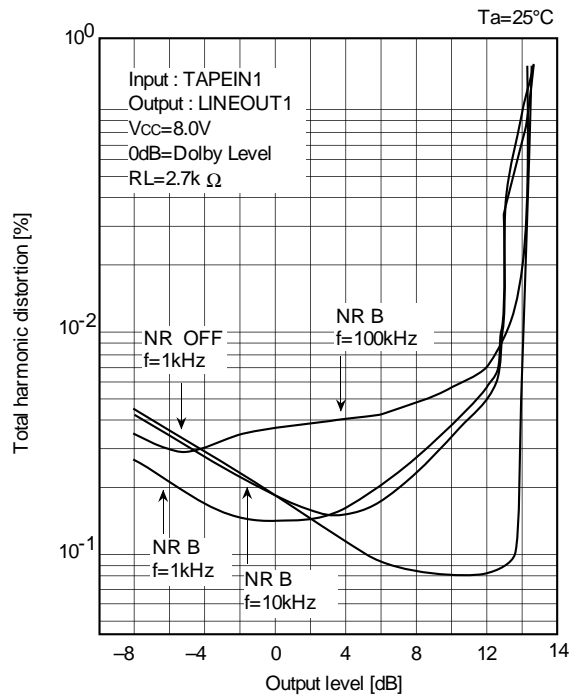
Characteristics Graphs



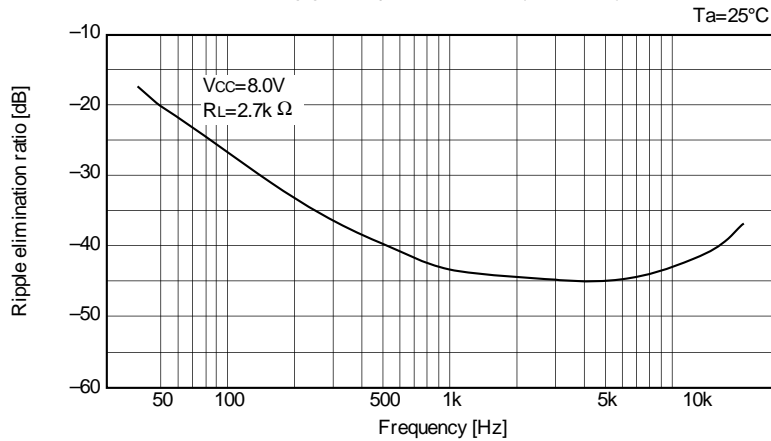
Total harmonic distortion (p re-amplifier block)



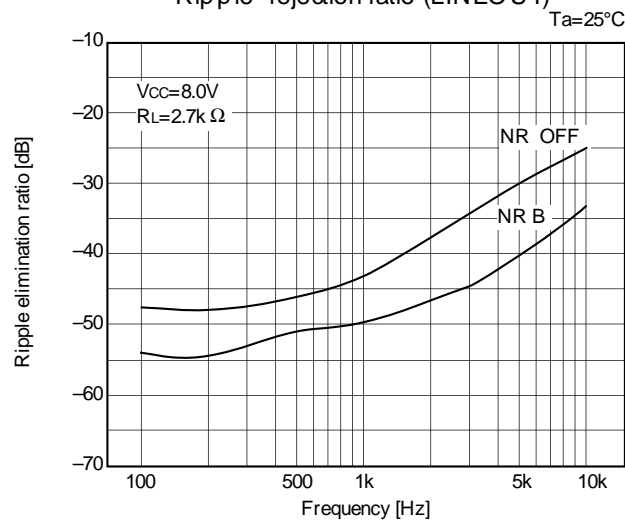
B type total harmonic distortion (Dolby block)



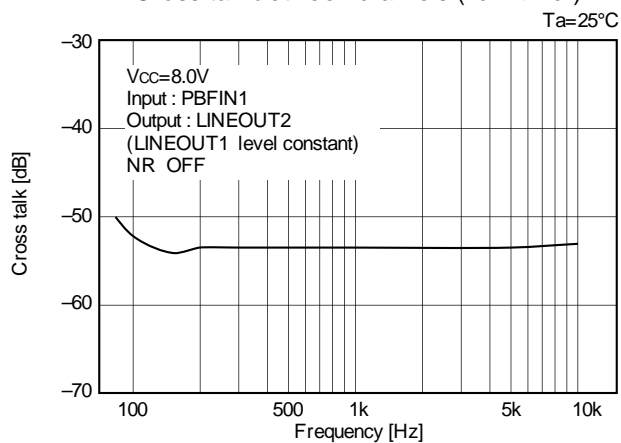
Ripple rejection ratio (PBOUT)



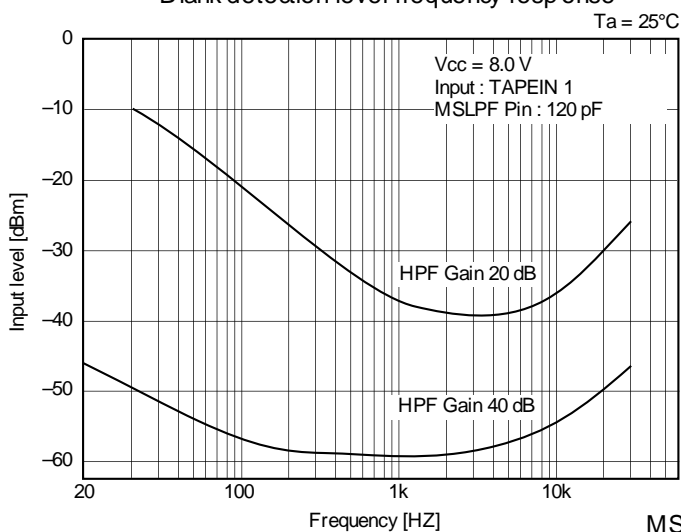
Ripple rejection ratio (LINEOUT)



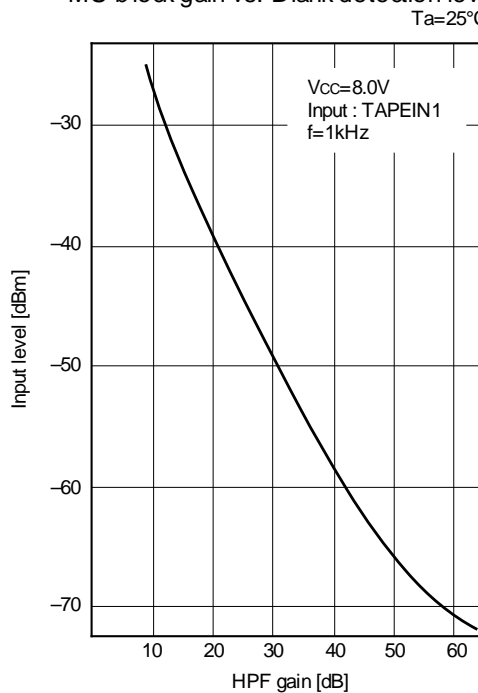
Cross talk between channels (1ch → 2ch)



Blank detection level frequency response

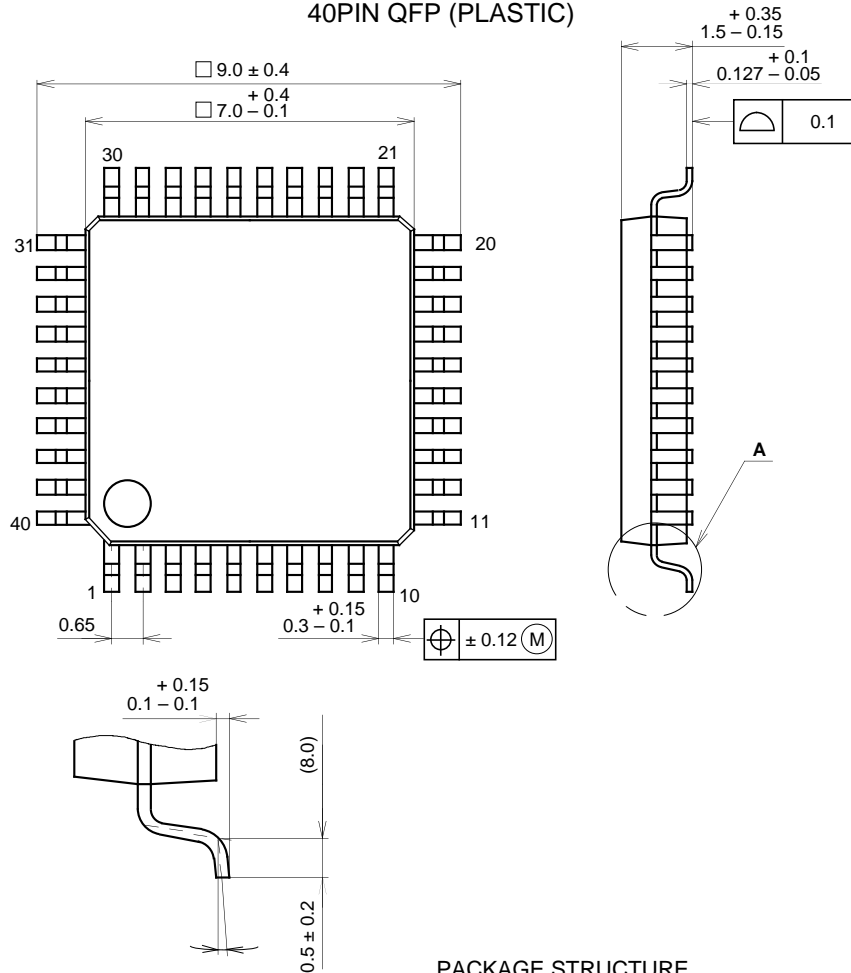


MS block gain vs. Blank detection level



Package Outline Unit : mm

40PIN QFP (PLASTIC)



PACKAGE STRUCTURE

| | |
|------------------|----------------------------|
| PACKAGE MATERIAL | EPOXY RESIN |
| LEAD TREATMENT | SOLDER / PALLADIUM PLATING |
| LEAD MATERIAL | COPPER / 42 ALLOY |
| PACKAGE WEIGHT | 0.2g |

| | |
|------------|----------------|
| SONY CODE | QFP-40P-L01 |
| EIAJ CODE | *QFP040-P-0707 |
| JEDEC CODE | _____ |