# VCR standard audio signal processor
# BA7796FS

The BA7796FS is a standard audio signal processor designed for use in VCRs and tape decks. The circuit is comprised of a playback preamplifier, a line amplifier, a recording amplifier, an ALC circuit, an EQ switch, and high-voltage head switch.
The IC has three input switching systems, and a built-in coil equivalent circuit for recording equalization, which eliminates the need for an external component.

●Applications
Video cassette recorders and tape decks

●Features
1) Three input switching systems built-in (LINE1, LINE2, and TUNER).
2) Built-in coil equivalent circuit for recording equalization.
3) Two-mode EQ switch.
4) High-performance low-noise playback amplifier.
5) Fixed ALC level ( – 7.2dB when $V_{CC}$ = 12V).
6) Phase-inverting recording amplifier.

●Absolute maximum ratings (Ta = 25°C)

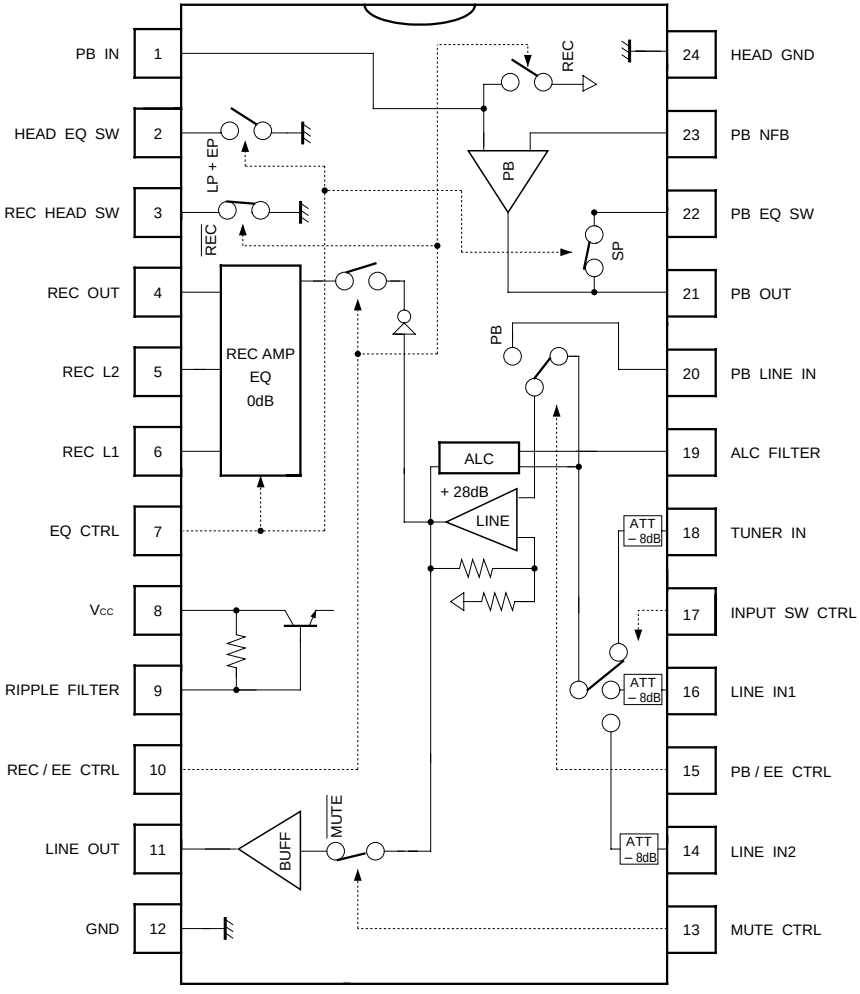
| Parameter | Symbol | Limits | Unit |
|---|---|---|---|
| Power supply voltage | $V_{CC}$ | 13 | V |
| Power dissipation | Pd | 800* | mW |
| Operating temperature | Topr | – 10 ~ + 65 | °C |
| Storage temperature | Tstg | – 55 ~ + 125 | °C |

* When mounted on a 90mm × 50mm × 1.6mm glass epoxy board.
Reduced by 8.0mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Power supply voltage | $V_{CC}$ | 7.5 | — | 12.5 | V |

●Block diagram




Units: R [Ω]
C [F]

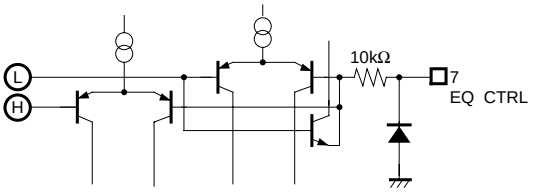
●Pin descriptions

| Pin No. | Pin name | Function | Pin voltage | I / O circuit |
|---|---|---|---|---|
| 1 | PB IN | Playback amplifier input / playback head switch | 2.0V | $\overline{REC}$: 120kΩ<br>REC: 11Ω |
| 2 | HEAD EQ SW | Head resonance capacitor switch | 0.0V | 220kΩ / 20Ω (ON) |
| 3 | REC HEAD SW | High-withstanding voltage recording head switch | 0.0V | $\overline{REC}$: 11Ω (ON)<br>REC: OPEN |
| 4 | REC OUT | Recording amplifier output | 5.7V | EF (P - P) |
| 5 | REC L2 | Recording EQ switch | 5.7V | 19Ω (ON) / OPEN |
| 6 | REC L1 | Recording EQ pin | 5.7V | B (NPN) |
| 7 | EQ CTRL | EQ control | — | See input / output circuit |
| 8 | $V_{CC}$ | $V_{CC}$ | 12.0V | — |
| 9 | RIPPLE FILTER | Ripple filter | 12.0V | 10kΩ ($V_{CC}$) |
| 10 | REC / EE CTRL | REC / EE control | — | See input / output circuit |
| 11 | LINE OUT | Line amplifier output | 5.7V | EF (P - P) |
| 12 | GND | GND | 0.0V | — |
| 13 | MUTE CTRL | Mute control | — | See input / output circuit |
| 14 | LINE IN2 | Line input 2 | 5.6V | 120kΩ |
| 15 | PB / EE CTRL | PB / EE control | — | See input / output circuit |
| 16 | LINE IN1 | Line input 1 | 5.6V | 120kΩ |
| 17 | INPUT SW CTRL | Input switch control | — | See input / output circuit |
| 18 | TUNER IN | Tuner input | 5.6V | 120kΩ |
| 19 | ALC FILTER | For setting the time constant for the ALC filter (attack and recovery times) | PB: 0.0V<br>$\overline{PB}$: not fixed | EF (NPN) ~ 100Ω |
| 20 | PB LINE IN | Line input for playback | 5.6V | 120kΩ |
| 21 | PB OUT | Playback amplifier output | 2.0V | EF (P - P) |
| 22 | PB EQ SW | Playback equalizer switch | 2.0V | 35Ω (ON) / OPEN |
| 23 | PB NFB | Playback amplifier feedback | 2.0V | B (NPN) |
| 24 | HEAD GND | GND for playback amplifier and head switch | 0.0V | — |

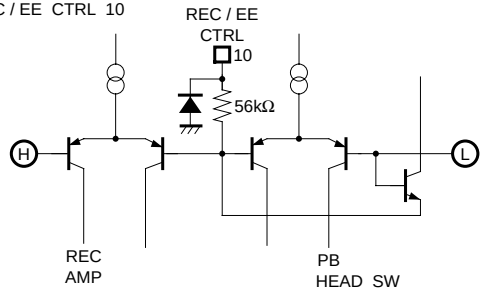
∗ EF: emitter follower, P-P: push pull, B: base, and C: collector.
All measurements made using the measurement circuit (Fig. 1) with $V_{CC}$ = 12V and quiescent circuit conditions.
All numerical values are standardized values.

●Input / output circuits

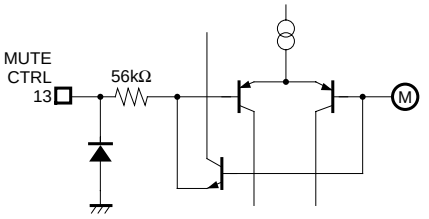
EQ CTRL 7



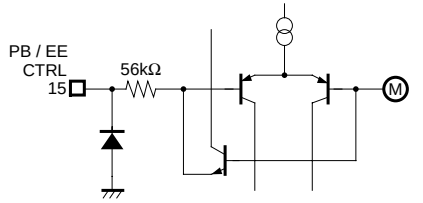

REC / EE CTRL 10



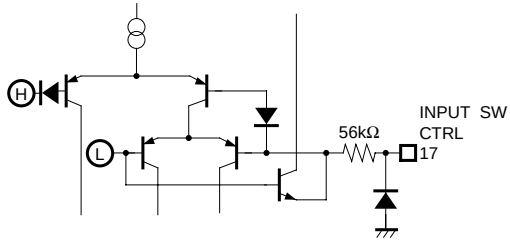

MUTE CTRL 13




PB / EE CTRL 15




INPUT SW CTRL 17




L, M, and H in the above diagrams are 1.7V, 2.5V, and 3.3V respectively.

●Electrical characteristics (unless otherwise noted, Ta = 25°C, $V_{CC}$ = 12V, and f = 1kHz)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions | Measurement circuit |
|---|---|---|---|---|---|---|---|
| Quiescent current EE | $I_{qEE}$ | 7.4 | 9.8 | 13.0 | mA | No signal input | Fig.1 |
| Quiescent current PB | $I_{qPB}$ | 7.4 | 9.8 | 13.0 | mA | No signal input | Fig.1 |
| Quiescent current REC | $I_{qREC}$ | 6.4 | 8.4 | 11.2 | mA | No signal input | Fig.1 |
| ⟨Line amplifier⟩ | | | | | | | |
| Voltage gain (PB input) | $G_{VCLP}$ | 27.0 | 28.0 | 29.0 | dB | $V_O$ = – 8dBV | Fig.1 |
| Voltage gain (LINE1, LINE2, TU inputs) | $G_{VCLT}$ | 19.0 | 20.0 | 21.0 | dB | $V_O$ = – 8dBV | Fig.1 |
| Distortion | $THD_{LT}$ | — | 0.1 | 0.3 | % | $V_O$ = – 8dBV, $R_L$ = 4.7kΩ* | Fig.1 |
| Maximum output level | $V_{OmLT}$ | 7.3 | 10.5 | — | dBV | THD = 1%, $R_L$ = 4.7kΩ* | Fig.1 |
| Output residual noise | $V_{NOLT}$ | — | – 81.5 | – 75 | dBV | $R_g$ = 4.7kΩ, DIN AUDIO | Fig.1 |
| ALC level | $V_{OA}$ | – 8.2 | – 7.2 | – 6.2 | dBV | $V_{IN}$ = – 25dBV | Fig.1 |
| ALC distortion | $THD_A$ | — | 0.1 | 0.5 | % | $V_{IN}$ = – 25dBV, $R_L$ = 4.7kΩ* | Fig.1 |
| Mute attenuation ratio | MT | — | – 82.0 | – 72 | dB | $V_O$ = 0dBV, DIN AUDIO | Fig.1 |
| ⟨Recording amplifier⟩ | | | | | | | |
| Voltage gain | $G_{VCR}$ | 19.0 | 20.0 | 21.0 | dB | LINE1, LINE2, TUNER→REC OUT | Fig.1 |
| Distortion | $THD_R$ | — | 0.13 | 0.4 | % | $V_O$ = – 8dBV | Fig.1 |
| Maximum output level | $V_{OmR}$ | 7.0 | 10.0 | — | dBV | $V_O$ = – 8dBV, $R_L$ = 4.7kΩ* | Fig.1 |
| Openloop gain | $G_{VOR}$ | 60 | 71 | — | dB | THD = 1% , $R_L$ = 4.7kΩ* | Fig.1 |
| ⟨Playback preamplifier⟩ | | | | | | | |
| Openloop gain | $G_{VOP}$ | 61 | 68 | — | dB | — | Fig.1 |
| Input conversion noise | $V_{NINP}$ | — | – 122.5 | – 114 | dBV | $R_g$ = 680Ω, DIN AUDIO | Fig.1 |
| Voltage gain (stand alone, SP mode) | $G_{VCP}$ | 35.0 | 36.0 | 37.0 | dB | PB IN→PB OUT | Fig.1 |
| ⟨Head switch⟩ | | | | | | | |
| PB head switch impedance | $R_{PH}$ | — | 11 | 20 | Ω | — | Fig.1 |
| REC head switch impedance | $R_{RH}$ | — | 11 | 20 | Ω | — | Fig.1 |
| REC head switch DC withstanding voltage | $BV_{RHDC}$ | — | 0 | 10 | μA | $E_3$ = ± 55V | Fig.1 |
| REC head switch AC withstanding voltage | $BV_{RHAC}$ | 80 | 100 | — | $V_{P-P}$ | f = 70kHz, $V_3 \leqq \pm 1.5$V | Fig.2 |

* Measured at BW = 0.4 to 30kHz.

●Measurement circuits

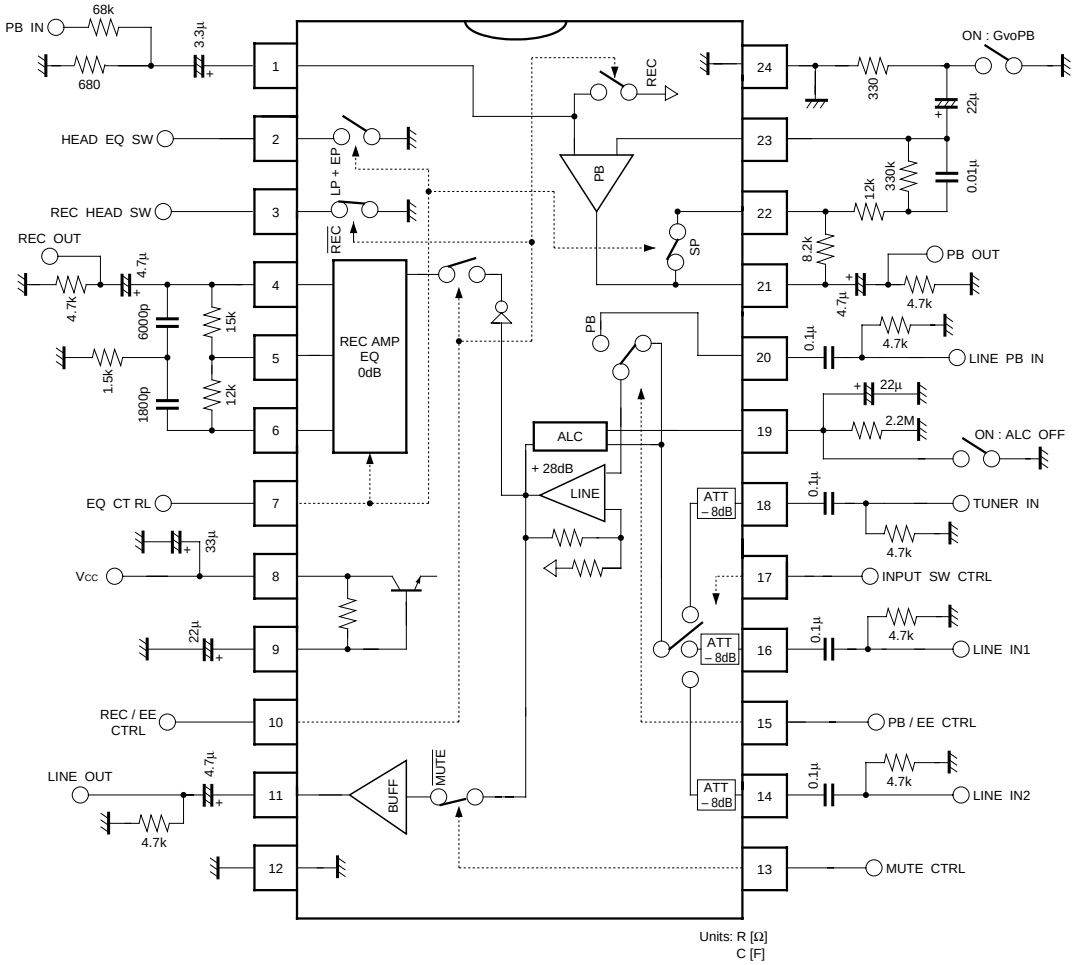



Fig. 1

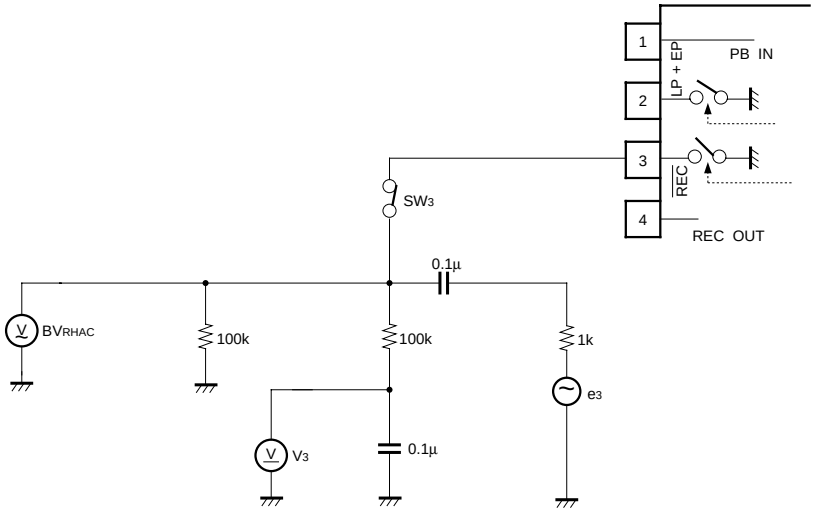



Fig. 2 REC head switch AC withstanding voltage measurement circuit

●Control mode table

(1) REC / EE CTRL, PB / EE CTRL, INPUT SW CTRL

| Control pins | | | Mode | Function | | | |
|---|---|---|---|---|---|---|---|
| REC / EE | PB / EE | INPUT SW | | PB HSW | REC HSW | LINE SW | REC AMP |
| L | L | L | TUNER | OFF | ON | TUNER | OFF |
| L | L | M | LINE2 | OFF | ON | LINE2 | OFF |
| L | L | H | LINE1 | OFF | ON | LINE1 | OFF |
| L | H | — | PB | OFF | ON | PB | OFF |
| H | L | L | TU REC | ON | OFF | TUNER | ON |
| H | L | M | L2 REC | ON | OFF | LINE2 | ON |
| H | L | H | L1 REC | ON | OFF | LINE1 | ON |
| H | H | — | inhibit | — | — | — | — |

If REC / EE CTRL is set to“M”, the REC pause state is possible (REC head switch: open, REC amplifier: off).

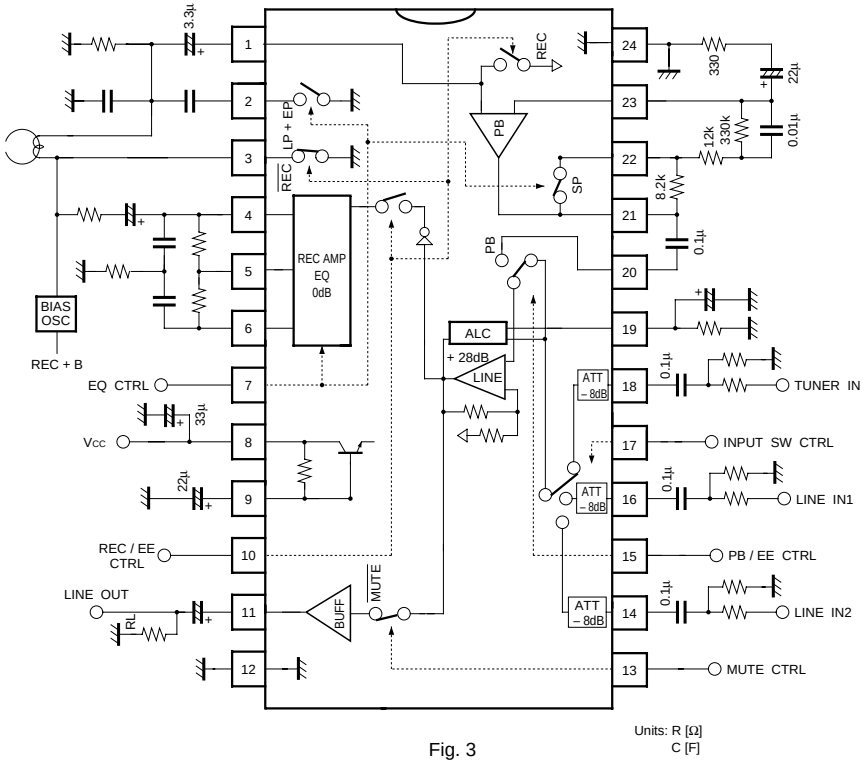
(2) MUTE CTRL

| Control pins | Mode | Function |
|---|---|---|
| MUTE | | LINE SW |
| H | MUTE | OPEN |
| L | $\overline{\text{MUTE}}$ | CLOSE |

(3) EQ CTRL

| Control pins | Mode | | Function | | |
|---|---|---|---|---|---|
| E Q | 2 MODE | 3 MODE | HEAD EQ | PB EQ | REC EQ |
| L | SP | SP | OFF | CLOSE | CLOSE |
| M | — | LP | ON | OPEN | CLOSE |
| H | EP | EP | ON | OPEN | OPEN |

●Application example




Units: R [Ω]
C [F]

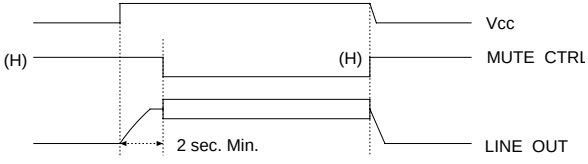
Fig. 3

●Operation notes

(1) Mute signal

Apply the mute signal shown below at power on and off.

If the muting time is short, a “pop” sound will be audible, particularly when the power is switched on.




The mute signal must also be applied when switching PB, LINE1,LINE2 and TUNER.

(2) Recording control

Do not switch the PB and REC modes on together. This will cause erroneous operation.

(3) Line output

The line output can drive a load resistance of up to 2kΩ.

Some types of load can result in local oscillation (eg. large capacitive loads that draw large current), so caution is required. In particular, when there is a possibility that the line output will be connected to a shielded cable, or line cable, connect a resistor of about 1kΩ in series with the output so that the capacitive load is not directly coupled to the IC output terminal.

●Electrical characteristic curves

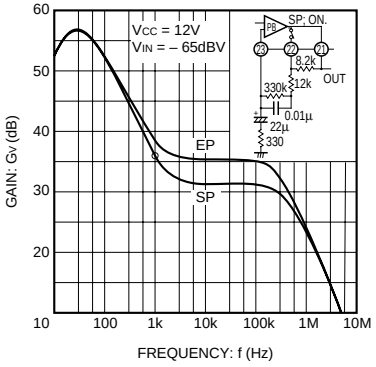



Fig. 4 Gain vs. frequency (PB amplifier)

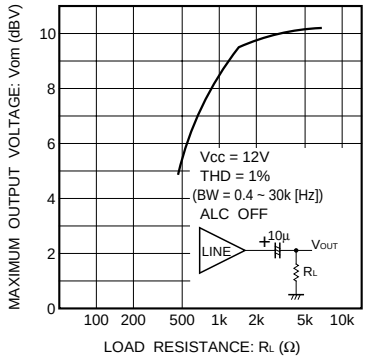



Fig. 5 Line amplifier load drive characteristics

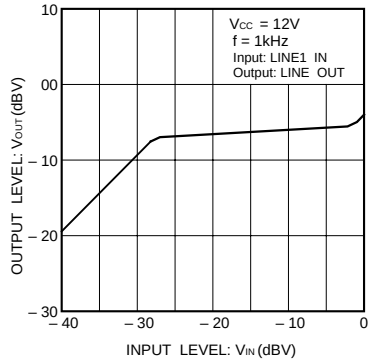



Fig. 6 ALC input / output characteristics

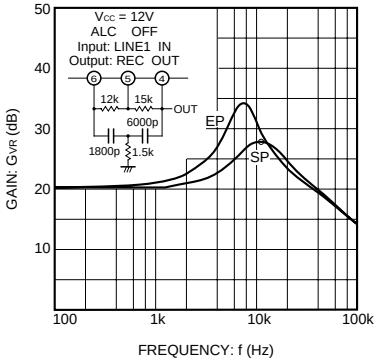
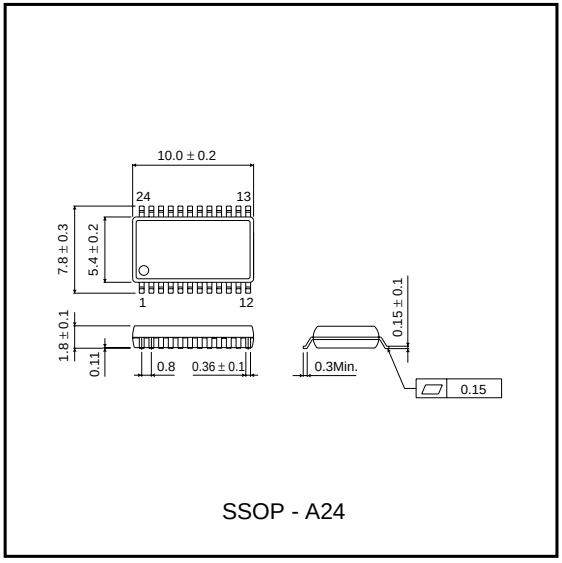



Fig. 7 Gain vs. frequency (REC amplifier)

●External dimensions (Units: mm)

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